WORKING PAPER

Withering before full bloom?

Bioenergy in Southeast Asia

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Cover photo by Yayan Indriatmoko
Oil palm seedling, West Kalimantan, Indonesia.

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1. Introduction

Southeast Asia is experiencing rapid economic growth. In 2010, the region's economies expanded at an average rate of 8.4% (World Bank 2011). Another important characteristic of Southeast Asia is that it is densely populated. In 2010, there were 591 million people – 8.7% of the world's population – living in the region and the population is growing at 1.3% a year (World Bank 2011). The strong economic growth and expanding population mean that there is a need in nearly all Southeast Asian countries to secure long-term energy supplies (Fesharaki *et al.* 1995, Nidlom and Chantanakome 2008).

In principle, the region is rich in energy resources. However, these resources are not evenly distributed and their level of use varies. Oil and gas are produced in all countries except Laos. Coal is produced in Indonesia, Malaysia, the Philippines, Thailand and Vietnam. Vietnam produces biomass-based energy, particularly ethanol. There are two main sources of energy for electricity in the region – hydropower and geothermal. However, in aggregate terms the contribution of hydropower to the overall energy mix is low, while the use of geothermal energy is still in its infancy. Hydropower is produced in Cambodia, Indonesia, Laos, Myanmar, the Philippines and Vietnam. Indonesia and the Philippines produce energy from geothermal sources (Nidlom and Chantanakome 2008). The newest country in the region, Timor Leste, possesses the most oil and gas discoveries.

There are discernible patterns in the production and consumption of energy in Southeast Asia. These have significant implications for the energy balance and the sourcing of energy in the future.

- The gap between oil production and oil consumption in the region is growing. Oil consumption is driven primarily by the expanding economies in China and India, but also by the second-tier economies, such as Indonesia, Malaysia and Thailand. Most oil consumption is satisfied from imported end-products rather than locally produced oil derivatives. This is illustrated by the fact that in 2008 only about half of the refining capacity in Southeast Asia was being used. This further indicates significant expenditure on oil imports (BP 2009).
- Southeast Asian countries are taking steps to close the energy gap by boosting the production and use of natural gas. Indonesia is one of the leading producers and exporters of natural gas, producing 82 billion m^3 and exporting about 41.25 billion m^3 in 2010 (BP 2011).
- Coal is the main energy resource offsetting the decline in the oil sector. Indonesia is the main producer and exporter of coal in Southeast Asia (BP 2011) and is poised to increase consumption of coal over the next few years with the construction of new coal-fired power plants for a 20,000 MW electricity programme. Approximately 66% of Indonesian coal has medium calorific values of 5,100 to 6,100 kcal/kg. The highest quality coal has a low ash and sulphur content and is among the cleanest in the world. The high quality coal is prioritised for export, while domestic markets absorb the lower quality coal (Petromindo 2011, Emerging Markets Direct 2011). The Indonesian government envisages that, by 2025, coal will provide about 33% of Indonesia's energy needs, 17% will be provided by 'renewable' energy[1], and the rest will come from oil and gas (MEMR 2006).

The projected increase in the production and consumption of coal over the coming years presents an opportunity to reduce the regional dependence on oil, but it also raises environmental concerns. An increase in coal consumption inevitably means carbon emissions will increase. While prospects are improving for 'clean coal energy' and some companies are exploring the potential for carbon capture and storage in Indonesia, carbon capture and storage technologies are still in the experimental stages (Neal *et al.* 2010, Anonymous 2008a). In this context, the current interest in the development of first and second generation biofuels is likely to continue, in addition to interest in hydroelectricity, solar and wind energy. Nuclear energy is unlikely to be significant in Southeast Asia because of the

1 It is important to note that of the 17% 'renewable' energy, 5% is targeted from biofuels, 5% from geothermal, 5% from biomass, nuclear, hydro and solar, and the remaining 2% from coal liquefaction (Hartoyo 2007, MEMR 2006). Traditional wood fuels are probably included as part of 'biomass'.

construction and maintenance costs, and security concerns. Concerns heightened after an earthquake destroyed the Fukushima nuclear installation in Japan and when, as a consequence, the Japanese government closed all nuclear reactors in May 2012 (Batty and Agencies 2012).

While most countries in the region plan to use a portfolio of the resources available, increasing attention has been paid to renewable energy since 2005. The technologies for renewable energy from solar cells and the wind are still relatively expensive, especially on a large scale (German Aerospace Center 2012, Anonymous 2011a, Ölz and Beerepoot 2010, True Wind Solutions 2001). In addition, most of the countries have well-established plantations with ready-to-use feedstocks. As a result, crop-based bioenergy, such as biodiesel and bioethanol, is widely seen as the main direction for developing renewable energy in the region.

Biofuels in Southeast Asia are seen not only as a solution to domestic energy security, but also as an important opportunity for developing plantations and biofuel industries to capitalise on the growing demand for renewable fuels in Europe and North America[2]. In December 2008, the European Union (EU) adopted the Renewable Energy Directive (RED), which created a binding target of 10% biofuel in transport fuels by 2020. The Directive also set basic sustainability criteria, including a greenhouse gas (GHG) balance, measures to protect biodiversity and carbon storage. Europe is a potential market for biofuel producers in Southeast Asia; they anticipate filling the demand created by enforcement of RED blending targets.

This paper reviews the bioenergy sector in Southeast Asia in order to assess its development during the boom in 2005 and immediately after. It takes stock of the current situation, and indicates possible directions for the near future. The paper focuses primarily on Indonesia, Malaysia, the Philippines and Thailand. Indonesia and Malaysia are world leaders in oil palm production and exports. The Philippines is the only country in the region which has developed biodiesel from coconut. Thailand leads in producing bioethanol.

We start with a review of government motivations and government planners' visions of the potential for bioenergy, and the policies they have developed as a result. Next we describe how the sector has performed over the last few years. We then discuss the factors that support or hinder the development of bioenergy. The final section explores what may lie ahead and what steps are necessary for biofuels to achieve their potential.

2. Bioenergy policies in Southeast Asia

2.1. Motivations and visions

Most countries in Southeast Asia are facing challenges in securing energy resources. There are two main reasons – population growth and growing economic expansion – both of which lead to a need for more energy. In the mid-2000s, biofuels emerged as the most important way to address energy needs. The countries in the region began to plan strategies to develop the bioenergy sector in order to become energy-secure and less dependent on imports of fossil fuels.

In Indonesia, the need to 'ensure the security of domestic energy supply and to support sustainable development' led to the drafting, in 2006, of a national energy policy. A significant part of the policy is dedicated to the development of bioenergy[3]. From 2004 the country has been a net oil importer (ADB 2009a). Indonesia's imports of oil increased from 296,000 barrels per day in 2009 to 450,000 barrels per day in 2011. In terms of gas, Indonesia is a net exporter; approximately 30 billion m^3 of gas were exported annually 2009-11 (BMI 2012a).

The Malaysian government's first steps in biofuel planning date back to 1982, but significant practical steps have been taken only since 2006 through the National Biofuel Policy (Abdullah *et al.* 2009). This policy promotes the 'use of environmentally friendly, sustainable and viable sources of energy to reduce the dependency on depleting fossil fuels; and enhanced prosperity and well-being of all the stakeholders in the agriculture and commodity based industries

2 In 2003, the European Union adopted the directive EC2003/30, which specifies that 5.75% of transport fuel consumption should be met from biofuels by 2010.

3 Indonesia's Presidential Regulation 1/2006 on National Energy Policy.

through stable and remunerative prices…'[4]. Malaysia is still a net oil exporter. However, exports are declining. In 2009, Malaysia exported 155,000 barrels per day; this decreased to 94,000 barrels per day in 2011. Malaysia is also a net gas exporter, annually exporting 29 billion m^3 2009-11 (BMI 2012b). The National Biofuel Policy is directed primarily at reducing the country's dependence on depleting fossil fuels, promoting the demand for palm oil and stabilising palm oil prices at a profitable level. The key goal of this policy was for Malaysia to become the world's top biodiesel producer by 2008 (Anonymous 2006). However, as discussed in subsequent sections of this paper, as of 2012 this has not been achieved and it is unlikely that it will be realised in the near future.

The Philippines have been using biofuels since the 1970s, but suffered a setback as a result of limited technology, the lack of a government mandate and fluctuating oil prices (Poblete 2006). As in Indonesia and Malaysia, in 2006 the Philippines government issued a biofuel policy motivated by the need to reduce its dependence on oil imports (Morgera *et al.* 2009). The Philippines produce less oil than the other three countries, and has relied heavily on imports to meet domestic oil demand. In 2009, the country imported 289,000 barrels per day and this increased to 293,000 barrels per day in 2011. Similarly, the country consumes all its gas production domestically (BMI 2012c). The policy prescribed developing biofuels from renewable, sustainable and clean energy sources as a measure to mitigate emissions of GHG, increase rural employment and incomes, and ensure the availability of alternative clean energy[5].

In Thailand, the demand for energy has increased significantly in recent decades. Despite efforts over the past few years to shift to alternative energy sources, the country remains dependent on imports to fuel its growing manufacturing-based economy (Morgera *et al.* 2009). In 2009, the country's oil imports reached 526,000 barrels per day, increasing to 654,000 barrels per day in 2012. Similarly, the country's imports of gas reached about 9 billion m^3 a year from 2009-11 (BMI 2012d). The government has initiated a renewable energy policy to investigate alternative sources of energy, such as solar, wind, water and biofuel energy (Gonsalves 2006). In 2008, the Ministry of Energy issued its Alternative Energy Development Plan 2008-22. The objective of the plan was to increase the share of alternative energy to 20% of the country's total energy use by 2022. All policies and development programmes thus far have been developed based on the first National Alternative Energy Development Plan 2004-11 and the second Alternative Energy Development Plan 2008-22 (Preechajarn and Prasertsri 2010).

2.2. Policies

The key policies that encourage the development of bioenergy in Southeast Asia are those that set fuel blending targets – targets for bioenergy as a certain per cent of total energy, particularly in the transport sector. In order to achieve these targets, government authorities in the region have put supporting policies in place, as discussed below.

Table 1. Main feedstocks for biofuels in Southeast Asia

Country	Biodiesel	Bioethanol
Indonesia	Oil palm	Sugarcane
Malaysia	Oil palm	
Philippines	Coconut	Sugarcane
Thailand	Oil palm	Sugarcane, molasses, cassava

Source: FAO (2008)

Blending targets

Most bioenergy-related policies in countries in the region set blending targets but the blending rates and timelines vary. For example, in Indonesia, the government set a target of 2% biofuel in national energy consumption by 2010 and 5% by 2025[6]. At the same time, the Ministry of Energy and Mineral Resources (MEMR) issued regulations stipulating a phased mandatory use of biofuels in various industrial sectors. The heavy industries, for example, were required to use at least 5% biodiesel by 2010, 10% by 2015 and 15% by 2020[7]. The country failed to achieve the 2010 target. In 2010, Indonesia

4 Malaysia's National Biofuel Policy 2006.

5 Philippines' Biofuels Act of 2006 (Republic Act 9367).

6 Indonesia's Presidential Regulation No. 1/2006 on the National Energy Policy.

7 Indonesia's Ministry of Energy and Mineral Resources No. 32/2008.

produced only 21% of the 2010 target for biodiesel. Subsidised fossil fuels and the rise in CPO prices have made biodiesel uncompetitive (Notonegoro 2012).

In Malaysia, the National Biofuel Policy sought to achieve 5% biofuel in the transport and industrial sectors (Lopez and Laan 2008). This blending target was to be compulsory by 2010 (Abdullah *et al.* 2009). Malaysia has developed a biofuel standard which complies with the European and American standard specifications for biodiesel (Abdullah *et al.* 2009). The government did not set a particular target for bioethanol blending mainly because of the lack of raw materials for first-generation bioethanol. However, several projects are developing second generation bioethanol, although they have not reached the production stage (Asahi Shimbun 2012, Asia in Focus 2011).

In the Philippines in 2007, the government issued the Energy Independence Agenda policy. The policy set a target of 60% energy self-sufficiency by 2010 and mandated the use of 1% coconut-based biodiesel in all government diesel-fuelled vehicles (National Economic Development Authority 2005). The country has achieved the target for energy self-sufficiency – 59.2% in 2009 and 59.6% in 2010 (Reyes 2011, Department of Energy 2010). The Biofuels Act of 2006 mandates the use of biofuels for blending with gasoline. In 2009, this required a 5% blend of bioethanol in gasoline and this was to be increased to 10% by 2011. In 2009, in parallel with developments in bioethanol, a 1% blending target for biodiesel was implemented as well. Following an evaluation and feasibility assessment, this blending target was to be increased to 2% within two years (Yu 2007). The market analysts believe the Philippines have the potential to meet the biodiesel blending target. However, it is falling far behind on the bioethanol blending target, where, so far, only approximately 20% of the original target has been achieved. The main challenges are a lack of investment and poor logistics, which negatively affect the distribution system. In addition, the profit margins from using sugarcane to produce sugar are higher than those from producing ethanol (BMI 2011, Corpuz 2011).

The Thai government planned to increase national renewable energy use from 0.5% in 2002 to 8% by 2011 (Pleanjai and Gheewala 2009). As part of the implementation of the policy, the government announced that B2 biodiesel – a mixture of 2% biofuel and 98% diesel fuel – would become mandatory by early 2008 (Anonymous 2008b, Knight Ridder/Tribune Business News 2007). In 2008, the Thai government planned to ask all oil companies to switch all diesel to B2 (Preechajarn 2010, Biopact 2007). By 2011, all diesel should have been B5 biodiesel. Both have not been achieved. Blending would subsequently increase to B10 by 2012 (Preechajarn 2010). Despite the growing production of biodiesel and bioethanol, the country has fallen short of these targets. In 2010, the production of gasohol – Thailand's name for bioethanol-based gasoline – was 1.2 million L/day, or approximately 40% of the target of 3 million L/day. Similarly, the production of biodiesel in 2010 reached approximately 2 million L/day, or 67% of the target 3 million L/day (Preechajarn and Prasertsri 2011).

Supporting policies

In order to implement the blending targets, the countries developed policies to provide incentives for investment in the bioenergy sector. In Indonesia,

Table 2. Biofuel targets in four countries in Southeast Asia

Country	Biodiesel	Bioethanol
Indonesia	For transportation*	For transportation
	2009: 1%	2009: 1-5%
	2010: 2.5-3%	2010: 3-7%
	2015: 5-7%	2015: 5-10%
	2020: 10%	2020: 10-12%
	2025: 20%	2025: 15%
Malaysia	2010: 5%	
Philippines	2007: 1%	2009: 5%
	2009: 2%	2011: 10%
	2011: 5%	
Thailand	2008: 2%	2008: 20%
	2011: 5%	2008: 85%
	2012: 10%	

* Indonesia has set targets for the household, transportation, industry and electricity sectors. The ranges are for the transport sector with and without public service obligation (PSO). The lower ranges are for PSO transportation.

Source: Indonesia: adapted from Dillon *et al.* 2008; Malaysia: Abdullah *et al.* 2009; Philippines: Republic Act 9367 (signed 12 January 2007); Thailand: Preechajarn 2010, 2008

the President has instructed 13 ministries, provincial governors and district heads across the country to accelerate the production and use of biofuels[8]. In addition to promoting biofuel use, the government has provided other incentives in the form of a corporate income tax reduction of 5% of the total investment annually for six years, accelerated depreciation and amortisation, a compensation against operational losses from five to 10 years and exemption from the value added tax for 15 industrial categories, including bioenergy (Slette and Wiyono 2010)[9]. Subsidies to encourage the use of biofuels have also been increased from year to year. In 2009, the subsidy was set at IDR 1,000 (USD 0.11) per litre of biofuels. It subsequently increased to IDR 2,000 (USD 0.22) per litre in 2010 and IDR 2,500 (USD 0.27) per litre in 2011 (Anonymous 2010a). The Indonesia Parliament House of Representatives has agreed to further increase the subsidy to IDR 2,500- 3,000 (USD 0.27-0.32) per litre for biodiesel and IDR 3,000-3,500 (USD 0.32-0.37) per litre for bioethanol in 2012 (EBTKE 2011)[10].

The Government of Indonesia's National Team on Renewable Energy also planned to develop special biofuel zones to simplify the requirements for biofuel investment. Four main feedstocks are targeted – cassava (mostly in Java), jatropha (mostly in eastern Indonesia), oil palm (in Sumatra, Kalimantan and Papua) and sugarcane (in Sumatra and Sulawesi). While there are several companies investing in cassava and jatropha, the proportion of these feedstocks in the overall portfolio of biofuel investments is small. Furthermore, the actual use of these feedstocks for bioenergy, rather than for food, is very small (Anonymous 2011b).

The Government of the Philippines issued a regulation regarding the guidelines governing the production of biofuel feedstocks and the production, distribution, and sale of biofuels and biofuel blends[11]. While ensuring the stability of the domestic supply of feedstocks, biofuel and biofuel blends, the guidelines seek to ensure that the development of renewable energy is not environmentally detrimental and that lands devoted to food crops shall not be used for biofuel feedstock production. The Philippines Department of Agriculture seeks to avert food-fuel competition by checking that land planted with biofuel feedstocks does not encroach on land intended for food crops. Only then does the government issue a certificate allowing the feedstocks be used for biofuels. The Department of Agriculture is responsible for this part of the certification process. In November 2008, the government issued an act, which established the framework for accelerating development and increasing the use of renewable energy resources[12].

In the Philippines, in order to encourage investments in the biofuel industry and guarantee the market for locally produced biofuel, the Biofuels Act of 2006[13] provides incentives. These include no tax on local and imported biofuel components, exemption from value added tax on the sale of raw materials used in the production of biofuels, exemption from wastewater charges on all water effluents and high priority access to financial assistance. These incentives were further strengthened by the Renewable Energy Act of 2008, which includes, among other things, a seven-year income tax holiday for renewable energy developers, after which they will be charged a lower corporate income tax. Other incentives include a 1.5% royalty tax cap on the original cost of equipment and facilities used for renewable energy production, duty-free imports of equipment and materials for 10 years, and an exemption from all taxes of carbon credits generated from the renewable energy sector.

Like other countries in the region, the Government of Thailand has been promoting bioethanol and biodiesel for renewable energy. Bioethanol and biodiesel are the priority alternative energy sources in the national plan. The government monitors and regulates the price of biofuels, supports research and development, and conducts public awareness campaigns. The government also has price incentives to encourage consumers to use biofuels. Through the Ayeyawady – Chao Phraya-Mekong Economic Cooperation Strategy (ACMECS), economic cooperation between Cambodia, Laos, Myanmar and Thailand was established in 2003. The Government of Thailand established contract

8 Indonesia's Presidential Instruction No. 1/2006.

9 Indonesia's Government Regulation No. 1/2007.

10 Assumes an exchange rate of IDR 9,000 = USD 1.

11 Philippines Government Joint Administrative Order No. 2008-1, Series of 2008, issued in September 2008.

12 Philippines Government Republic Act 9513 or the Renewable Energy Act of 2008.

13 Philippines Government Republic Act 9367 or the Biofuels Act of 2006.

farming with the governments of Laos, Cambodia and Myanmar to supply palm oil and jatropha for biodiesel production (ACMECS 2009, Preechajarn and Prasertsri 2007). The latest ACMEC document shows these discussions are still taking place between Thailand and the other countries on how contract farming would operate, as well as how the logistics will be managed. In March 2008, a new policy framework was issued to promote the use of biofuels. The measures included maintaining sufficient raw materials for biofuels, developing logistics systems, stabilising supplies and prices, carrying out public awareness and outreach, and increasing the number of bioethanol-based petrol stations. The framework emphasises coordination across the ministries (Preechajarn 2008).

3. The performance of the bioenergy industry in Southeast Asia

This section discusses the performance of biofuel industries in Indonesia, Malaysia, the Philippines and Thailand. It is important to note, however, that the development of biofuel industries is also taking place in other countries in the region.

3.1. Development of the biodiesel industry

The amount of biodiesel produced in Indonesia has increased significantly from a mere 24 million liters in 2006 to approximately 650 million liters in 2011. Because of low domestic absorption, Pertamina, the Indonesian state-owned oil company which is mandated to manage the biofuel programme in the country, has allowed biofuel producers to export (Slette and Wiyono 2011). The number of mills also increased from two in 2006 to 22 in 2011a. The use of CPO was relatively low. In 2011, the amount of CPO used for biodiesel was 715,000 tonne, or just 2.8% of Indonesia's total CPO production of 25.2 million tonne (Anonymous 2011c). However, these figures do not imply that biofuel production is booming, since the use of biorefinery capacity remains low. In 2011, it was estimated that capacity use was about 17%, leaving most of the biofuel refineries idle (Slette and Wiyono 2011a). Some companies prioritize the CPO for food. In addition, with an increasing CPO price, producing biofuels becomes non-competitive. The low use of refining capacity is partly the result of a decision by some companies to produce palm oil for food rather than for fuel. For example, Sinar Mas, a company that has the largest oil palm land bank, has prioritised CPO production for food instead of biodiesel (Habib 2011). Increasing CPO prices also makes biodiesel production uncompetitive. In addition, low domestic consumption of biofuel has led the Indonesian government to allow biodiesel producers to export (Slette and Wiyono 2011a). Given the sustainability standards imposed by buyer countries on biodiesel produced in Indonesia, and Indonesia's responses to these standards, it remains to be seen how the biodiesel sector will develop in the country.

The development of biodiesel in Malaysia is also not going well. As fossil fuels are heavily subsidised, the incentives for biodiesel development in the country are poor (Hoh 2011). The production of biodiesel is declining, from 325 million liters in 2006 to a mere 13 million liters in 2011 (Hoh 2008, Hoh 2011). Production is negligible despite an increase in the number of mills, which means that use of refining capacity is very low (Lim 2012a).

As Malaysia is the second largest palm oil producer in the world, the availability of feedstocks is not the main issue. The high subsidy makes the production of biodiesel uncompetitive.

Coconut methyl ester (CME) is the major feedstock for biodiesel production in the Philippines. Production of biodiesel increased from 2 million liters in 2006 to 144 million liters in 2010. The use of CME also increased from 1,000 tonne in 2006 to 144,000 tonne in 2011. There are no imports, and the entire production is consumed domestically. The number of processing facilities increased from 10 in 2006 to 12 in 2007. Although the installed capacity is increasing, capacity has never been fully used. Capacity use increased from just 1% in 2006 to 36% in 2011.

Thailand, another major oil palm growing country, has also been experiencing a significant growth in biodiesel production, from 2 million liters in 2006 to approximately 680 million liters in 2011. The entire production is consumed domestically. The country does not import biodiesel, although it has been importing palm oil to produce biodiesel. The number of processing facilities increased from three units in

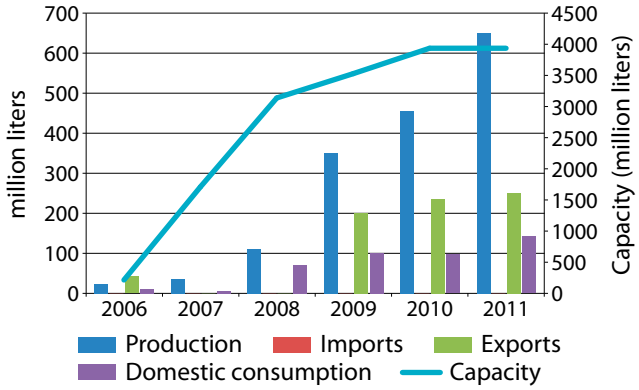

Figure 1. Biodiesel indicators in Indonesia 2006-2011

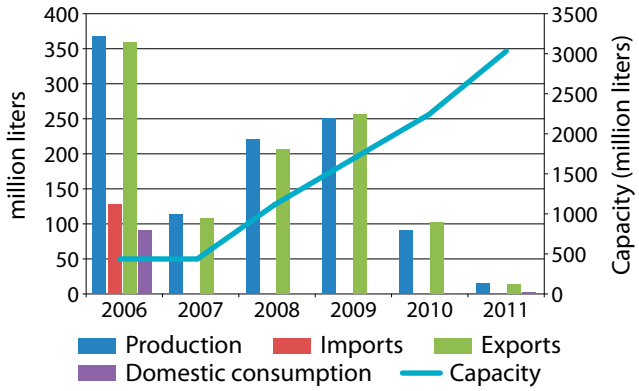

Figure 2. Malaysia biodiesel indicators 2006-2011

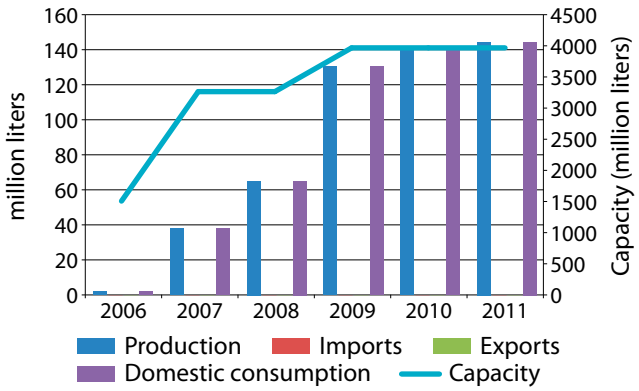

Figure 3. Philippines biodiesel indicators 2006-2011

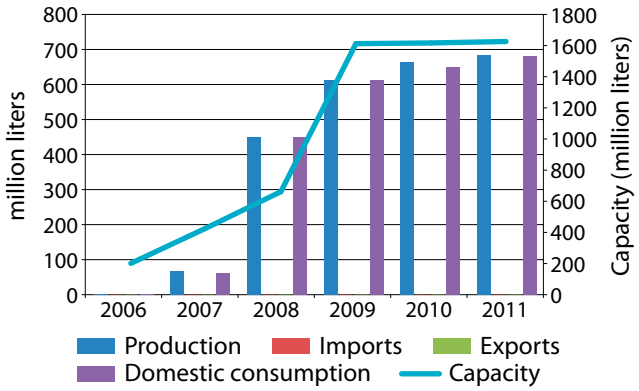

Figure 4. Thailand biodiesel indicators 2006-2011

2006 to 13 in 2011. The use of installed capacity increased from 1% in 2006 to 42% in 2011.

In summary, the data show that the biodiesel industry and biodiesel production is growing relatively well in Thailand and the Philippines, while in Indonesia and Malaysia they are either stagnating or contracting. The performance of the biodiesel sector in Thailand is not problem-free as the country lacks adequate supplies of CPO and needs to import them from neighbouring countries. The fact that biodiesel is not developing well in Indonesia and Malaysia is interesting since Indonesia and Malaysia are the world's two largest oil palm producers and, at least in theory, should not face problems with supplies of CPO to produce biofuel. While demand for biodiesel in international markets is increasing, producers still use feedstocks for food rather than fuel, because biodiesel is not competitive with fossil fuels. This will continue as long as governments subsidise fossil fuel. In the Philippines, about three-quarters of coconut production has been exported as copra in the last decade (Philippines Coconut Authority 2012). This means that biodiesel competes with food for the remainder of the domestically available coconut.

3.2. Development of the bioethanol industry

In Indonesia, molasses from sugarcane is the main feedstock for bioethanol. Production is small, but is growing. MEMR designated Pertamina, the state-owned oil company, to manage the provision and distribution of biofuels. However, there has been no production since 2010. In January 2010, MEMR decreed that the prices of ethanol supplied to Pertamina would follow Thailand's monthly average ethanol prices, which are released by Argus Media[14]. Indonesian ethanol producers found that production costs are higher than the Thai market

14 Indonesian Minister of Energy and Mineral Resources Decree No. 0219K/12/MEM/2010.

price index. They have been pushing MEMR to revise the formula and adopt the domestic price as a benchmark, rather than rely on Thai prices.

The disagreement over price between the ethanol producers and Pertamina, (the only buyer of bioethanol in Indonesia) is one of the main reasons for the halt in production (Slette and Wiyono 2011a). The government is reported to have planned a revision to the regulation (Indonesia Finance Today 2011). As of April 2012, however, there has been no revision of the market price index (Sianipar 2012). This is deplorable since, as of 2011, Indonesia has the installed capacity to produce 273 million liters of bioethanol (Slette and Wiyono 2011a).

In the Philippines, development of bioethanol lags significantly behind that of biodiesel. This is understandable since the feedstock for biodiesel is more widely available than feedstock for bioethanol. Production of bioethanol started in 2009, when the country produced 25 million L. This is not enough to meet domestic demand and the rest is imported – 9 million liters in 2008 and 236 million liters in 2011. Currently, there are three mills in the country with a total capacity of 75 million L. The mills are operating at 39% capacity.

There are three domestic bioethanol plants – San Carlos Bioenergy, Leyte Agri Corp and Roxol Bioenergy – all of which have reportedly halted operations since the beginning of 2011. This has happened because of fluctuation in sugar production in the Philippines, largely because of extremely variable weather. The Philippines turned from a net sugar exporter to a net importer in 2009/10, shipping in a record 250,000 tonne. Therefore, the country's bioethanol requirements have been met mostly with imports (BMI 2011).

Thailand has produced bioethanol since the late 1990s and is a well-established producer. Currently the country produces 528 million L, almost four times the production in 2006. Thailand has increased bioethanol exports, from 15 million liters in 2007 to 70 million liters in 2011. Nevertheless, processing facilities have been operating at about half capacity since 2006, meaning that there are further opportunities to increase production. Thailand has ample feedstock to produce bioethanol, including molasses (both from sugarcane and tapioca), sugarcane and cassava.

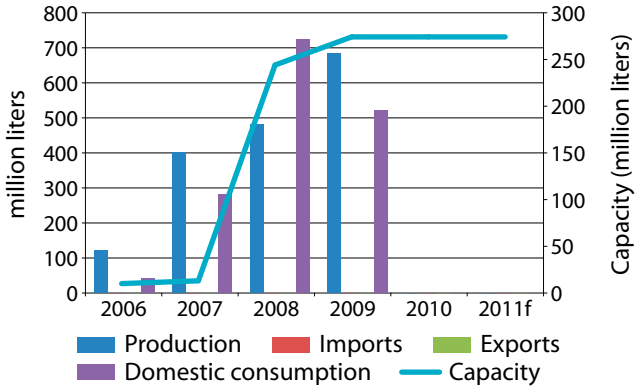

Figure 5. Indonesian bioethanol indicators 2006-2011

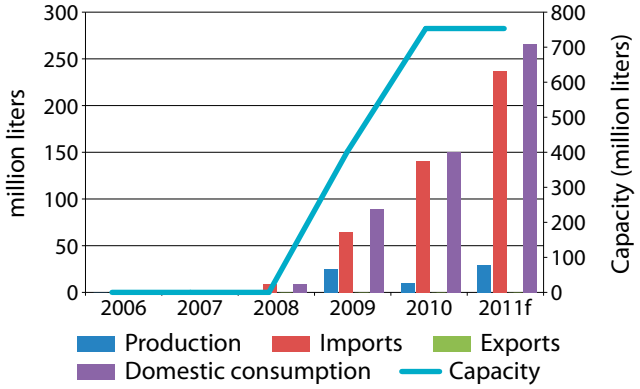

Figure 6. Philippines bioethanol indicators 2006-2011

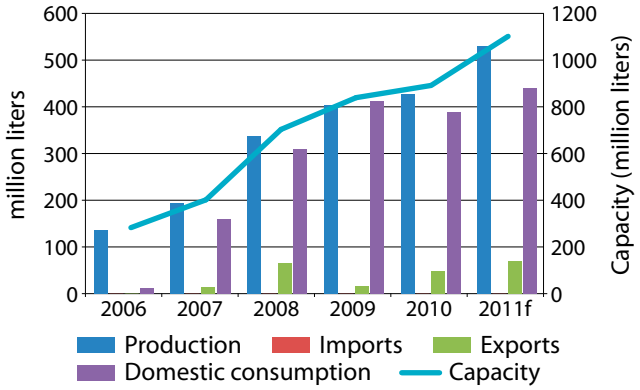

Figure 7. Thailand bioethanol indicators 2006-2011

Thailand is a clear leader in bioethanol production in Southeast Asia. At the other end of the spectrum, Malaysia has not produced any first-generation bioethanol on a significant scale, mainly because the amount of sugarcane available in the country that could be used as feedstock is very small (BMI 2011,

Hoh 2011). Although there are plans to develop second-generation bioethanol using glycerin and oil palm waste (Asahi Shimbun 2012, Asia in Focus 2011), the development of bioethanol for domestic markets could be hampered by high subsidies for gasoline. This is because there are limited feedstocks available, and a high subsidy for gasoline.

Indonesia and the Philippines have established processing facilities, but both countries are producing only small amounts of bioethanol and are far behind Thailand in this regard. A policy obstacle in the form of a market price index is the key disincentive for bioethanol production in Indonesia. The Philippines is making some progress in increasing its production, although the main challenge is to ensure availability of feedstocks.

4. Discussion

Section 3 suggests that bioenergy production in Southeast Asia is not developing as originally expected (Goh and Lee 2010). Even in Thailand, where biodiesel and bioethanol production seem to be growing, use of production capacity is low. In the four countries under consideration, capacity use for biodiesel is below 50%. Only Thailand, at 42% capacity use, and the Philippines, at 36% capacity use, are performing relatively well. In the bioethanol sector, Thailand uses up to 50% of its capacity, while in Indonesia there has been no bioethanol production since 2010. As a result, none of these countries were able to comply with national fuel blending targets set in their respective bioenergy policies. The development of biodiesel and bioethanol in the region faces several challenges.

4.1. Divert feedstocks from food to fuel, or vice versa?

With the emergence of biofuel feedstock plantations and the development of biofuel industries in Southeast Asia, concerns emerged over the security of food supplies in the region. These concerns were based on the assumption that productive land and/or existing agricultural production may be diverted away from food to biofuel. Of particular concern was the potential pressure on the supplies of palm oil and sugarcane (FAO 2008). Palm oil is an important commodity for Indonesia and Malaysia as exporters and particularly for India and China as consumers. For example, China and India absorb approximately half Malaysia's palm oil exports. Also, about 60% of Indian edible oil imports in 2012 come from Indonesia (Petrosil 2012). The increasing demand for CPO, particularly in China and India (with less strict enforcement of sustainability standards), has opened opportunities for palm oil producers to export palm oil rather than processing it further or converting it to biodiesel.

Indonesia is perhaps the country in the region where these concerns have manifested themselves most strongly. However, so far the negative consequences have been limited and they are unlikely to become a factor in the near future. This is because the diversion of agricultural production to biofuels is more than offset by the aggressive expansion of both biofuel feedstocks and food production.

Over the last decade, Indonesia's oil palm sector has experienced tremendous growth. Between 1990 and 2010, the area of plantations increased seven-fold from 1.1 million ha to 7.8 million ha (Direktorat Jenderal Perkebunan 2011, Sheil *et al.* 2009).The growth of the oil palm sector is largely directed to meeting demand in major emerging economies, such as China and India, as well as in Indonesia. Approximately half Indonesia's CPO production is exported unprocessed. Most of the remaining CPO is processed into cooking oil and about half of this is exported as well (Boucher *et al.* 2011). The rest is consumed locally.

The biofuel sector has been slow to develop, as indicated by the modest growth rates from 2006 and the projections through 2011 (Slette and Wiyono 2011b). Recently, the sector has shown signs of growth (Yulisman 2011). However, in aggregate terms, less than 5% of total CPO production is being used for biodiesel. Therefore, biofuels are unlikely to pose a threat to the production of food from CPO in the foreseeable future. The issue of diverting CPO away from food production is rendered even less significant by plans to expand plantations and production of palm oil on Indonesia's frontiers. Over the next decade, Indonesia government plans to double CPO production and expand oil palm plantations by at least 4 million ha (Bahroeny 2009, Suparno and Afrida 2009).

It appears that the main concern of Indonesian policy makers in relation to national food security has to do

with the dwindling area of prime agricultural land in Java which can be harnessed to produce food. According to government statistics, each year about 110,000 ha of arable land is lost in Java, mainly as a result of urban sprawl and soil degradation (Anonymous 2010a, DeFries and Rosenzweig 2010, DeFries *et al.* 2010). As a result, Indonesia increasingly relies on imports to meet domestic demands for rice, sugar, soy beans and other foods (Basuno and Weinberger 2011, Rusastra *et al.* 2008). Government planners estimate that over the next two decades at least 2 million ha of new land will be needed to grow food crops (Anonymous 2010a). Of these 2 million ha, 1 million ha is to be devoted to rice fields, 500,000 ha to sugar cane and 500,000 ha to soybeans (Bisnis Indonesia 2011a, 2011b, Anonymous 2010a).

Integrated, large-scale food estates are the preferred means for stimulating mass food production. One of the largest such estates is the Merauke Integrated Food and Energy Estate (MIFEE), which will extend to 1.2 million ha in Papua by 2030 (Ministry of Public Works 2010, Anonymous 2010b, RAPERDA Merauke 2010). Other food estates are being planned for East Kalimantan, Sulawesi, Maluku and Sumatra (Bisnis Indonesia 2011b).

It is also noteworthy that Indonesia is taking steps to diversify biofuel feedstock options. Spurred by the interest of South Korean companies, which so far have pledged USD 600 million in investment projects, Indonesian authorities have to date released about 500,000 ha for timber plantations to support wood pellet production (Anonymous 2012). About half of this is in Papua, 200,000 ha in Sulawesi, and the rest in Java and Kalimantan (Bisnis Indonesia. 2011b, Wright 2009, Cr-44/Papos 2009, Anonymous 2009).

A possible exception to countries experiencing competition between food and biofuels is Thailand. Despite being the world's third largest palm oil producer after Indonesia and Malaysia, Thailand cannot meet the demand for biodiesel as much of the domestic production is destined for food. Efforts to extend plantations and increase productivity have been difficult because farmers are reluctant to diversify away from rubber (which is more profitable) and because of the difficulty of finding suitable land to expand oil palm plantations. As a result, Thailand has been importing palm oil from neighbouring countries to supply its biodiesel industries. In the aftermath of the severe flooding in late 2011, the Thai government reassigned all CPO previously reserved for biofuel to producing cooking oil (Asia Pulse 2011).

4.2. Dynamics of crude oil and biofuel feedstock prices

The viability of biofuel production depends on the relative prices of CPO or sugarcane and crude oil, the product for which biofuels are a substitute. With the exception of the bioethanol sector in Thailand, which has been growing since the early 2000s, most of the initiatives in the region to develop the bioenergy sector have been responses to increasing crude oil prices and ballooning domestic fuel subsidies.

The increasing price of crude oil has put pressure on economic development in Southeast Asian countries. Most countries in the region have heavily subsidised fuel prices. Thailand's imports of crude oil and its derivatives cost almost 10% of the country's gross domestic product (GDP) and pose a challenge to economic growth (Anonymous 2011d, Bell *et al.* 2011). Indonesia regularly allocates a large part of its budget to fuel subsidies. In 2008, when the oil price exceeded USD 130 per barrel, the government allocated IDR 223 trillion (nearly USD 25 billion) for fuel subsidies. In 2012, the subsidy for fuel reached nearly USD 14 billion, about 1.5% of Indonesia's GDP.[15]

The subsidies for fossil fuels in Indonesia mean that the policy to develop biofuels has fallen short of its target. Caroko *et al.* (2011), METI (2011) and Soerawidjaja (2011) show that the failure to achieve the target results from relatively high and fluctuating prices for the raw material (CPO) and the inability of biofuels to compete with subsidised fossil fuels. Policies to promote the development of biofuels are in place and, at least initially, there was enthusiasm in the private sector. The lack of progress has much to do with how effectively presidential instructions have been implemented by relevant ministries, heads

15 The Government of Indonesia planned to reduce fuel subsidies and increase the price of petrol by 1 April 2012. However, this plan was not approved by parliament and was put on hold. With the allocation for subsidised fuel almost exhausted, the pressure on the government to fund fuel subsidies is getting stronger. It is possible that removal of the subsidy will be enacted in late 2012.

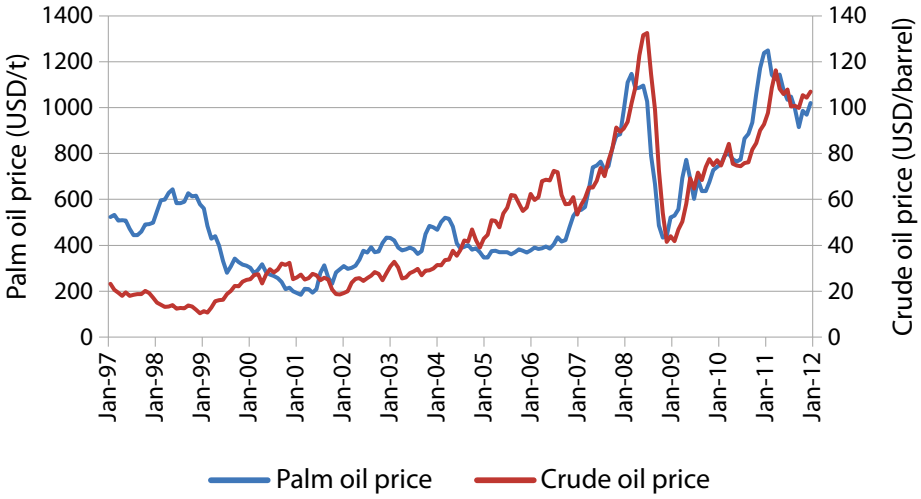

Figure 8. Crude oil and crude palm oil prices 1997-2012

Source: Index Mundi 2012

Table 3. Fuel subsidies in Indonesia 2005-2012

Year	Amount (IDR trillion)	Amount (USD billion)	Proportion of GDP (%)
2005	104.4	11.6	3.4
2006	94.6	10.5	1.9
2007	116.9	13.0	2.1
2008	223.0	24.8	2.8
2009	45.0	5.0	0.8
2010	82.4	9.2	1.3
2011	129.7	14.4	1.8
2012	123.6	13.7	1.5

Source: Republika Indonesia 2012, 2011, 2010

Exchange rate is assumed at IDR 9,000 = USD 1

of governors and districts. Some ministries, such as mining, agriculture and forestry, have structured their master plans to develop biofuels in their respective sectors, although there has been concern about the lack of coherence among the plans.[16] In terms of targets for increasing the area of plantations, for example, achievements are difficult to verify. This is because feedstocks, such as oil palm, sugarcane and cassava, are grown for various purposes, not only for biofuel. While plantations for biofuel feedstocks have expanded in most provinces, little information is available about the commitment of specific areas to biofuel production, or the proportion of the existing feedstock plantations that is devoted to supplying the biofuel industry. There has also been a lack of coordination among agencies (METI 2011, Soerawidjaja 2011, Caroko *et al.* 2011).

Malaysia faces a similar dilemma. When the price of crude petroleum oil is around USD 115 per barrel and CPO prices are USD 1,000 per tonne, the cost of production of petroleum diesel in Malaysia is estimated to be around USD 0.93 per L, while the cost of producing biodiesel is USD 1.15 per L. The government would have to provide subsidies to cover the difference. At these crude oil and CPO prices, replacing 500,000 tonne of petroleum diesel with biodiesel would cost the Malaysian government around USD 122 million in fuel subsidies per year (Hoh 2011).

Given rising crude oil prices and fluctuating biofuel feedstock prices, biofuel blending targets across the countries have become a moving target, confusing and discouraging the private sector (Anonymous 2011e). In Malaysia, where the cost of producing petroleum fuel is less than the cost of producing biofuels, the government has not yet decided whether to pass the extra cost of producing B5 biodiesel on to consumers or to petroleum companies, or whether to absorb it as a government subsidy. Because of high palm oil prices, the government failed to meet the B5 target for 2010. In 2011, the government sought to reduce the B5 blend to a B3 blend in order to

16 An interview with Director of Bioenergy, Indonesian Ministry of Energy and Mineral Resources, April 2012

reduce the subsidy (Chin 2011). The private sector in Malaysia is still optimistic that the Malaysian government is determined to further develop the palm oil industry by promoting the production and use of CPO biodiesel. However, the private sector raises concerns about the lack of clear direction in implementing the mandatory blend of B5 in the domestic market.

In Thailand, an increase in feedstock prices has made it difficult for the government to meet biofuel targets. An increase in the price of biofuels has encouraged consumers to switch to subsidised fossil fuels. This, combined with shortages of feedstock because of unfavourable weather, and concerns over food supplies, prompted the government to change the target from B5 to B2 and B3 in 2010. In 2011, as economic conditions improved, the government planned a return to B5 (Preechajarn and Prasetsri 2010). Similarly, the blending target for ethanol in the Philippines was not achieved. The government postponed implementation of the 10% bioethanol blend indefinitely. According to industry sources, a lack of clarity in the government's operational plan to implement the bioethanol target is one of the reasons (Corpuz 2011).

The fuel markets in Southeast Asian countries are dominated by state-owned companies. In Indonesia, Pertamina processes and sells transport fuels; it is the only buyer of biodiesel and fuel ethanol, which it processes further. The same company retails biodiesel and bioethanol-based fuels. The Indonesian Bioethanol Program was ended in 2010 because of a disagreement between the MEMR and fuel ethanol producers over the market price index formulation (Slette and Wiyono 2011). The Ministerial regulation stipulates that the fuel ethanol market price index is based monthly ethanol prices in Thailand. However, the fuel ethanol producers in Indonesia have proposed that a domestic fuel ethanol price index would be more realistic since it would include transport costs from producers to blending plants, and better reflect domestic costs of production.

4.3. Pressure from international buyers on sustainability issues

Biofuels produced by Southeast Asian countries also face challenges from emerging sustainability standards. The development of biofuels in Southeast Asian countries has significant economic potential, as yet mainly unfulfilled because of structural economic barriers. Even if it were possible to implement development fully, the expansion of biofuels entails numerous trade-offs and risks. These stem from the negative environmental and social effects of the main biofuel feedstocks, such as oil palm, which have been observed in Indonesia and Malaysia.

Biofuels produced, transported and processed by Southeast Asian countries may have to meet sustainability standards or guidelines designed to ensure the environmental and social integrity of plantation feedstock development and management. Currently, a number of standards are in force or are being developed at international or national levels. Some of the better known sustainability standards include the Indonesian Roundtable on Sustainable Palm Oil (RSPO), the Roundtable on Sustainable Biofuels (RSB), the US Environmental Protection Agency (EPA) Renewable Fuel Standard, Better

Box 1. Neste Oil strives for sustainable biofuels

Neste Oil is an example of a company which meets the requirements for producing sustainable biofuel. In late November 2007, Neste Oil, a Finnish refining and marketing company that produces advanced traffic fuels, announced plans to construct the largest biodiesel plant in the world. The feedstock would be palm oil certified by the RSPO. The main market for the biodiesel is likely to be Europe, although there has been interest in Singapore, Korea, Japan and the United States.

The plant would run using Neste's proprietary NExBTL technology, a next-generation renewable diesel production process that can use any vegetable oil or animal fat as input. The site has been strategically selected to be close to Malaysia and Indonesia, where the Neste group expects to secure 200,000 ha of palm oil plantations for feedstock.

The plant started operating in November 2010, and has 800,w t of installed capacity. In early 2012, the plant was certified by the US EPA, allowing the company to export to the American market.

Sources: Ngo 2007, Lim 2012b.

Sugarcane Initiative and seven EU sustainability schemes. In addition to these, another notable initiative is the effort by a Finnish company, Neste Oil, to set up its own system to ensure that only RSPO certified palm oil is used for biodiesel production[17].

Roundtable on Sustainable Palm Oil (RSPO)

RSPO is a global, multi-stakeholder initiative that promotes the production and use of sustainable palm oil products. It comprises oil palm growers, banks and investors, manufacturers of consumer goods, social and environmental NGOs, palm oil processors and retailers. The RSPO principles and criteria were adopted at the end of 2007 and focus primarily on the development of plantations and CPO production. By February 2012, RSPO had 599 ordinary members, 100 affiliate members and 97 supply chain associates.

As of March 2012, RSPO had certified around 5.7 million tonne of palm oil and 1.15 million ha of oil palm plantations. Indonesia has 42% of this certified CPO and Malaysia 47% – 73 companies in Indonesia and 83 companies in Malaysia, comprising various plantation units and palm oil mills. In December 2011, RSPO and four Thai associations – the Thai Oil Palm and Palm Oil Association', the Palm Oil Crushing Mill Association, the Thai Biodiesel Producer Association and the Palm Oil Refinery Association – approved the National Interpretation of the RSPO in Thailand. The Thai palm oil industry and the RSPO are, therefore, ready for sustainable palm oil production in Thailand. The first Thai palm oil mill will most likely be certified in 2012.

Despite the increasing area of RSPO certified CPO plantations, there is growing concern among some private sector actors and policy makers, particularly in Indonesia and Malaysia, about the inability of RSPO to reassure the international market that Indonesia and Malaysia are committed to sustainability (Paoli *et al.* 2010). There is increasing criticism by international environmental NGOs concerning violations of RSPO certification standards by several major oil palm producers (RSPO members). For example, the Rainforest Action Network alleges that Cargill Incorporated has violated a number of RSPO criteria, such as:

- Operating outside Indonesian law
- Failing to disclose ownership of palm oil plantations
- Clearing rainforests without permits
- Failing to resolve ongoing and large-scale land conflicts
- Destroying watersheds (Rainforest Action Network 2011).

Similarly, Oxfam reported that PT Menara Alfa Semesta, a subsidiary of the Malaysian palm oil giant Sime Darby, obtained land from rural households in 11 villages in Sanggau, West Kalimantan, Indonesia. Reportedly, each household 'released' approximately 7.5 ha of land voluntarily through a 'letter of release'. Under the agreement, the company was to lease 5.5 ha of the land for 35 years, and to plant and return 2 ha to the households. Oxfam research shows that 15 years after the 'letter of release', the households, on average, received only 1.2 ha of the 2 ha promised by the company (Oxfam 2011).

RSPO certification is often considered costly, especially for smallholders and small- and medium-size companies (Anonymous 2010b). Since RSPO is mostly driven by buyers, there is also concern over the inability of producers in Southeast Asia to obtain better prices in global markets for RSPO certified palm oil (Anonymous 2011f) than for uncertified palm oil. These concerns among other have led policy makers, especially in Indonesia, to establish their own certification schemes, for example the Indonesian Sustainable Palm Oil (ISPO) scheme.

Indonesian Roundtable on Sustainable Palm Oil (ISPO)

The ISPO standard was officially launched in March 2011; it is a standard based on the Ministry of Agriculture Decree No. 19/Permentan/OT.140/3/2011. The standard seeks to ensure that palm oil production meets the sustainability criteria specified in a number of Indonesian laws and regulations. The standard has been implemented since 2011 on a trial basis and will become mandatory – in contrast to the RSPO standard which is voluntary – for all oil palm plantation companies in Indonesia by December 2014. The ISPO standard will include seven principles, 39

17 Interviews with Adrian Suharto, Sustainability Manager, Neste Oil Ltd. March 2010

criteria and 128 indicators covering licensing and plantation management, cultivation and processing, environmental monitoring and management, labour, social and economic empowerment, and business development (Dirjenbun 2011b). As an incentive, the government has indicated that ISPO certified companies will be eligible for a reduction in the export tax on CPO.

Questions, however, remain as to whether ISPO will be credible in the international arena, which is dominated by its rival, RSPO. The trade in RSPO certified palm oil continues to increase, indicating international acceptance of the standard. This is not yet the case with ISPO, which is perceived to be inferior as a certification standard and is thus likely to face obstacles in gaining international acceptance. The main issues are the extent to which ISPO can provide credible solutions to key problems, such as reducing GHG emissions, reducing the conversion of peat lands to plantations and setting aside high-conservation value forests. The extent to which third party auditing is implemented in accordance with internationally accepted standards is also an issue (Caroko *et al.* 2011).

Roundtable on Sustainable Biofuels (RSB)

The RSB is an international initiative that brings together farmers, companies, NGOs, experts, governments and inter-governmental agencies concerned with ensuring the sustainability of biofuel production and processing. The roundtable was established in 2007 to provide and promote a global standard and certification scheme for socially, environmentally and economically sustainable production of biomass and biofuels. RSB embraces 10 principles which cover:

- Legality, planning, monitoring and continuous improvement of operations
- GHG emissions
- Human and labour rights
- Rural and social development
- Local food security
- Conservation
- Soil, water and air quality.

RSB is applicable to all regions and all biofuel feedstocks and covers the entire supply chain from production to the end-user.

In July 2011, the European Commission recognised RSB as an effective means for demonstrating the sustainability of biofuels as required by the EU under the RED. RSB was also recognised by the German Federal Agency for Agriculture and Food (Bundesanstalt für Landwirtschaft und Ernährung). The RSB provides yet another means for prospective biofuel exporters in Southeast Asia to ensure that their products meet required specifications.

The US Environmental Protection Agency Renewable Fuel Standard

Another standard likely to affect biofuels produced in Southeast Asian countries, particularly in Indonesia and Malaysia, is that of the United States EPA. In December 2011, the EPA issued a Notice of Data Availability concerning a life-cycle analysis of greenhouse gas (GHG) emissions associated with palm oil used as a feedstock for biodiesel under the Renewable Fuel Standard programme. The EPA undertook a detailed assessment of palm oil biofuel produced in Malaysia and Indonesia, including the scale of the palm oil industry, data on palm oil land use and future oil palm expansion.

Based on this analysis, the US EPA concluded that the estimated life cycle reduction of GHG emissions from biodiesel produced from palm oil would be 17% as compared with the GHG emissions from the baseline petroleum diesel fuel they replace. Therefore, biofuels produced from palm oil in Indonesia and Malaysia fail to meet the minimum 20% reduction threshold in GHG emissions required by the US Clean Air Act for renewable fuel made in facilities that commenced construction after 19 December 2007. The EPA set a deadline of 28 March 2012 for the relevant parties to submit grievances. It was reported that Indonesia and Malaysia launched a protest against the notice and considered the scientific basis for the EPA assessment to be flawed. They argue that the reduction in GHG emissions of biodiesel from Indonesia is more than 40%.

Better Sugarcane Initiative (BSI)

The Better Sugarcane Initiative (BSI), or Bonsucro sustainability framework, includes principles and criteria for sustainable sugarcane production and the Chain of Custody Standard. The BSI standard includes technical and administrative

requirements for tracking the entire supply chain for all sugarcane products. It seeks to improve the social, environmental and economic sustainability of sugarcane by promoting the use of a global metric standard to continuously improve sugarcane production and downstream processing and promote more sustainable practices. The standard has some implications for bioethanol production and trade in the region. Approximately 63% of the sugarcane production in Indonesia is in Java. Additionally, Indonesia has not produced bioethanol since 2010 because of the government policy on the market price index. Indonesia is also striving to reach sugar self-sufficiency by 2014 and is currently opening 215,000 ha in Riau, Lampung, Central Java, East Java and South Sulawesi, and planning to release 'degraded land' in Papua for this purpose (see Section 4.1). This could pose a serious threat to the success of the moratorium on issuing permits for conversion of primary forests and peatlands.

Seven EU sustainability schemes

In July 2011, as a commitment to sustainability, the European Commission approved seven voluntary schemes to ensure that biofuel feedstocks are produced, processed and traded in a way that minimises adverse environmental and social impacts. While some may not be directly relevant to biofuels produced in Southeast Asia, fulfilling the requirements of the schemes would enable producers to gain access to the European market. In addition to the RSB and Bonsucro EU Production Standard, the other five schemes are Abengoa RED Bioenergy Sustainability Assurance, Biomass Biofuels Sustainability Voluntary Scheme, Greenenergy, International Sustainability and Carbon Certification (ISCC), and the Round Table for Responsible Soy EU RED. While the mandated sustainability criteria of the EU RED have a strong environmental focus, German and Schoneveld (2011) noted that other schemes have a significant social component and sustainability requirements as well.

5. Conclusions

This review of biofuel developments in Southeast Asia presents a mixed picture. Initially, government agencies across the region in charge of investment and development in energy established a relatively comprehensive set of biofuel policies. In time, however, structural market conditions, the unpredictability of buyer markets for renewable energy, concerns over competition with food production and misaligned policies have limited development of biofuels.

One of the main drivers behind the high hopes and early excitement associated with biofuels across Southeast Asia was the potential for biofuels to make significant contributions to national energy objectives. Almost all countries in the region saw biofuel as a means to strengthen energy security. Most Southeast Asian countries are net oil/gas importers. The ability to substitute some of these imports with domestically produced biofuels was seen as politically strategic. Economically, the potential lay in the ability of biofuels to reduce national budgets for fossil fuel subsidies. Most countries in Southeast Asia have long-standing fuel subsidy schemes which cost them tens of billions of US dollars each year. While for the most part these have been manageable, economic problems and the spectre of political instability surfaced when oil prices rose in 2008 and subsidies began to strain national budgets. In this respect, biofuels are also seen as having the potential to support political stability in the region.

Most countries adopted policies that set targets for blending biofuel with fossil fuel. In some countries, heavy industries and transport have been obliged to use a specified proportion of biofuel in their energy mix. Among other supporting policies have been subsidies for fuels containing biofuel. Proposals for biofuel mills and supporting infrastructure have been offered a range of important export duty exceptions. Simplified application and land acquisition processes have assisted investors seeking to establish biofuel feedstock plantations (oil palm, sugar cane and jatropha).

Given the expectations and measures undertaken to stimulate the development of biofuels across Southeast Asia, the outcomes so far are limited at best. Since 2005, production of the two main biofuels in the region, biodiesel and bioethanol, has grown, but is far below original expectations. Key underlying market forces and policy conditions are barriers which, so far, have proved difficult to overcome.

First, market demand and prices for crude oil and CPO 'conspire' against the development and use

of biofuel. One of the prevailing perceptions about the economic viability of biodiesel or bioethanol is that crude oil prices must consistently be well above USD 100 per barrel. During the past four years this has been the case, but still biofuels have not been able to make the expected advances. This is because, in parallel with the increases in crude oil prices, the prices for biofuel feedstocks (e.g. CPO) have risen dramatically as well, essentially negating the potential opportunities created by high crude oil prices.

Second, rising crude oil prices have prompted most of the countries in the region to maintain or increase subsidies for fossil fuel for political and social stability reasons. This has compounded the problem of making biofuels economically viable.

Third, the expansion of biofuel in Southeast Asia created a perception among civil society groups – and to an extent among policy makers as well – that the production of biofuels may threaten national food security. In most countries in the region, such fears turned out to be unfounded. The expansion of plantations that could provide either biofuel feedstocks or produce food far outpaced the demand for raw material from a handful of struggling biodiesel and bioethanol mills.

Fourth, biofuel production in Southeast Asia increasingly became the target of criticism by international civil society groups concerned about the environmental consequences of expanding oil palm plantations, especially the accompanying deforestation and loss of biodiversity. As a result, key biofuel buyer markets, such as the EU and the USA, are implementing regulatory safeguards for the import of biofuels which are linked to either their own sustainability criteria (e.g. EU RED) or international standards (e.g. RSPO, RSB). This has placed pressure on the production and export of biofuels as well.

Biofuels have the potential to form a small but important element of Southeast Asia's energy mix in the near future. There are clear economic benefits to be gained, employment opportunities to be developed, national energy security strengthened and greater economic efficiencies to be realised. However, in order for this to happen, a number of important factors need to be considered. First, national governments in Southeast Asia need to find ways to reduce fossil fuel subsidies and to align policies. While politically unpopular, this is necessary if biofuels are ever to compete on comparatively level terms. Governments will also likely need to implement temporary subsidies for biofuels on a consistent basis to ensure wider acceptance. Eventually, such subsidies could be reduced or withdrawn. Second, government planners need to ensure that any current or future expansion of plantations for biofuel feedstocks is on barren land. This will help alleviate environmental concerns in key buyer markets and will loosen the restrictions which are increasingly being imposed in the form of environmental safeguards. This is particularly important since land available for expansion is limited in some countries, Indonesia being an exception. Since the land allocation process involves different levels of government, a common understanding about areas where expansion can occur and where it cannot, is important. In this case, the moratorium existing in Indonesia, where there is an effort to integrate maps from various agencies, would hopefully play a role in building a common understanding about land allocation. Third, while the threat from biofuels to food security has so far not materialised, governments need to ensure that if fossil fuel prices continue to increase this does not trigger a rush to develop biofuel plantations which could compromise land allocated for the production of food.

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Government of Viet Nam Decision No. 177 of 2007, Approval of the scheme on development of biofuel up to 2012, with a vision to 2025.

Annex 1. Bioenergy policies in other countries in Southeast Asia

In addition to ASEAN-4, other countries are involved and are at different stages in the development of a bio-energy sector.

The Government of Viet Nam issued a regulation which presents the blueprint for Viet Nam's national energy development up to 2020[18]. In 2008, the government approved a programme of research, development and use of jatropha in the country[19]. In 2009, the government issued regulations setting E5 and B5 standards (ADB 2009b). In the same year, the government reiterated its commitment to the biofuel target and intensified efforts to promote biofuel production. In order to advance the implementation of this vision, the Government of Viet Nam issued a decree to attract investment, encourage production on an industrial scale and raise public awareness about the use of biofuels[20]. This decree provides incentives to the private sector and international companies to invest in the biofuel industry and it also gives biofuel enterprises long-term concessions for land leases of at least 20 years at low rents. Tax holidays during the initial period and low taxation rates in subsequent years are also included.

In Laos, the Ministry of Energy and Mines is supporting business actors to grow coconut, jatropha and soybean feedstocks for biodiesel (Japan Bio-Energy Development Corporation 2008, Sengmany 2007). In 2008, the Government of Laos established an *ad hoc* committee to facilitate the development and formulation of a national strategy and policy on biofuels. Approximately 10,000 ha of jatropha have been planted. However, it is not clear how the jatropha is to be used, who made the investment and where the products are to be sold.

In Myanmar, the national agricultural policy formulated by the government authorities in 1992 sought to improve the agriculture sector and uplift the national economy. The three major goals of the policy are food security, export promotion and enhancing the income and welfare of farmers. The policy, for instance, allows the cultivation of biofuel crops without restriction on new agricultural land, promotes the introduction of modern biofuel processing technology and permits the production of industrial crops on a commercial scale (ADB 2009a). In 2005, the government ordered a nation-wide campaign to plant jatropha for biodiesel production. The plan called for plantations to cover up to 3.2 million ha. The vast size of the plantations was deemed critical by Myanmar government authorities to achieve self-sufficiency in fuel and energy needs. However, there are concerns that biofuel development policies in Myanmar are ill-informed and production targets unrealistic (ECDF 2008). In 2006, Myanmar was reported to be planning to replace its entire daily consumption of 40,000 barrels of crude oil with jatropha oil. The plan envisioned developing 200,000 ha of jatropha plantations in the first three years, growing jatropha on all major military sites for biodiesel that would be used by the army and encouraging villages in rural areas to create protective jatropha hedges around their fields.

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18 Government of Viet Nam's Decision No. 1855 of 2007, Approval of Viet Nam's national energy development strategy up to 2020, with 2050 vision.

19 Government of Viet Nam's Decision No. 1842 of 2008, Approval of the scheme 'research, development and usage products of *Jatropha curcas* L. in VietNam in the period 2008-2015 and with a vision to 2025'.

20 Government of Viet Nam's Decision No. 177 of 2007, Approval of the scheme on development of biofuel up to 2012, with a vision to 2025.

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Countries in Southeast Asia have been producing bioenergy since 2005. With the exception of bioethanol production in Thailand, most initiatives responded to rising crude oil prices and the increasing domestic fuel subsidies. This paper reviews the development of the bioenergy sector in Indonesia, Malaysia, the Philippines and Thailand. The paper finds that targets set by the four countries have not been met, although in Thailand and the Philippines the use of biofuels has been growing steadily. In Indonesia, production has increased, but the use of biodiesel is low. In Malaysia, both production and use of biodiesel have declined. Thailand leads the region in bioethanol production. The Philippines relies on imports to provide feedstock to produce bioethanol. Indonesia did not produce bioethanol after 2010. Malaysia produces no first-generation bioethanol, although there are plans to develop second-generation bioethanol. There are at least two reasons for low domestic consumption of biofuels. First, the rise in feedstock prices means production of biofuels is less competitive. Second, rising crude oil prices prompted most countries to maintain or increase fossil fuel subsidies to preserve political and social stability. While there is concern that production of biofuels may threaten food security, this does not seem to be a major issue, at least in the near future. However, international civil society groups are concerned with the environmental and social impacts of expanding oil palm plantations and are increasingly critical of biofuel production in Southeast Asia.

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