SINGAPORE AND RENEWABLE ENERGIES: CARVING ITS UNIQUE ROLE

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SUMMARY: I. *Introduction.* II. *Singapore's Energy Profile.* III. *Recent Surge of Interest in Renewable Energies.* IV. *The Kyoto Protocol.* V. *Conclusion.*

I. INTRODUCTION

A small city-state with a total landmass of approximately 682.7 square kilometers,[1] Singapore does not enjoy an abundance of natural resources and faces many physical or geographical limitations. It is therefore generally recognized that Singapore is not in a position to harness renewable sources such as wind and water to meet its energy needs and Singapore

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1 Reclamation works carried out over the last thirty years have enabled Singapore to increase its land area from 580 to 680 square kilometres (58 000 ha to 68 000 ha). Source: párrafo 30, *Response of Singapore,* International Tribunal of the Law of the Sea, Malaysia v. Singapore ("Response of Singapore), International Tribunal for the Law of the Sea, 20 de septiembre de 2003, *http://www.itlos.org/start2_en.html*

is likely to remain dependent on fossil fuels to meet the bulk of its energy needs.[2]

Given its limited energy options, Singapore's approach towards renewable energies is necessarily different from that of most other countries. Countries which are keen to increase their use of renewable energies focus their attention on developing institutional frameworks and policies (on both the demand and supply side) to encourage or facilitate the same. Such countries will be exploring issues such as the introduction of incentive schemes to render investment in renewable energies more attractive, domestic energy policies such as legal guarantees for access to the electricity distribution grids, guaranteed feed-in tariffs and renewable energy quotas and portfolio standards. Some countries such as China have introduced renewable energy legislation with the aim of accelerating market growth. Singapore, however, views renewable energy not as a potential direct user (at least not on a significant scale). The attention of Singapore's policymakers is therefore not likely to be on policy tools and regulatory measures to encourage the development of a domestic market in renewable energies. Instead, it appears that Singapore envisages itself playing a "middleman" role in providing ancillary support, such as access to capital markets and financing, for the development of renewable energies in the Southeast Asian region. Leveraging on its existing research and development (R&D) capabilities, Singapore also appears to have identified R&D in renewable energies as a way to contribute to the global effort to promote renewable energies. It is, at the same time, an economic opportunity. Singapore has identified environmental and water technologies as a key strategic research sector and has set aside some 330 million Singapore dollars to fund research and development in environmental technologies, which

2 Minister for the Environment and Water Resources Yaacob Ibrahim was quoted as saying "Singapore has limited options to change energy sources. We have to rely on fossil fuel, and if the phase of environmental demands following the Kyoto Protocol are too strict, our businesses will be affected." Source: Matthew Phan, "Singapore Launches Energy Association, Other Measures", 13 de julio de 2006 (The Business Times, Singapore). In "Singapore's National Climate Change Strategy", a consultation paper by the Ministry of Environment and Water Resources, it is stated that "We are heavily dependent on imported fossil fuels and have limited scope to explore renewable energy sources to meet our domestic energy needs", párrafo 1.8, *http://www.mewr.gov.sg/nccs/index.htm*

would include renewable energies.[3] Finally, the Kyoto Protocol came into force in Singapore on 11 July 2006.[4] The Protocol's mechanisms offer significant opportunities to advance renewable energies. Conversely, renewable energy projects present opportunities for Singapore investors who wish to take advantage of the Protocol mechanisms such as the Clean Development Mechanism (CDM). Each of these factors will be explored in detail below. However, an understanding of Singapore's energy scenario is necessary before we can analyse Singapore's position in relation to renewable energies.

II. Singapore's Energy Profile

Singapore is heavily dependent on fossil fuels to meet its energy needs. In 2003, 60.8% of electricity generation in Singapore was fuelled by piped natural gas while 34.6% was fuelled by oil.[5] Soaring oil prices and the significant knock-on effects on the economy, amongst other factors, have pushed Singapore towards reducing its reliance on oil. The electricity generation sector was encouraged to convert to greater use of natural gas in the production of electricity. Another factor pushing towards greater use of natural gas in power generation is the on-going deregulation or liberalization of the energy sector in Singapore.[6] The libe-

3 See Press Release, 7 July 2006, "Research, Innovation and Enterprise Council Approved Plans for Three Strategic Research Sectors and a Campus for Top R&D Talent", Research Innovation Enterprise Council, Prime Minister's Office.

4 Singapore deposited its instruments of accession with the Secretary-General of the United Nations in New York on 12 April 2006 (*morning of 13 April, Singapore time*). See "Singapore Accedes to the Kyoto Protocol", Ministry of Environment and Water Resources, *http://app.sprinter.gov.sg/data/pr/20060413999.htm* The Protocol came into force for Singapore on the 90th day after the date of deposit of the instruments.

5 *Singapore–Electricity Generation by Fuel*, International Energy Agency (IEA) Statistics, (2003) online: *http://www.iea.org/statistics*

6 Singapore restructured its electricity industry with the introduction of a New Electricity Market (NEM) for the generation and sale of power on 1 January 2003. The Energy Market Authority, established under the Energy Market Authority of Singapore Act 2001, is responsible for regulating the electricity sector. For a useful overview of the measures that have been taken to liberalise the electricity sector in Singapore, see the chapter on Singapore in the "APEC Energy Overview" (December 2005), Asia Pacific Energy Research Centre (APERC) of the Institute of Energy Economics, Japan, prepared for the Asia Pacific Economic Cooperation (APEC) Secretariat.

ralization efforts have introduced competition amongst the electricity generation companies ("gencos"). In order to stay competitive in the face of high oil prices, the gencos turned to natural gas as an oil substitute. By late 2005, about 80% of Singapore's energy is produced from piped natural gas from Malaysia and Indonesia.

Singapore's government has recently announced its decision to import liquefied natural gas (LNG) from 2012 onwards. This would make it the first country in Southeast Asia to do so. This measure is being taken to cut Singapore's over-reliance on piped natural gas from Malaysia and Indonesia and to meet the rising domestic demand for electricity.[7]

Renewable energy, in contrast, currently plays a very minor role in meeting Singapore's energy needs. In 2003, renewable energy comprised 0.6% of Singapore's Total Primary Energy Supply (TPES).[8] As will be discussed in more detail below, initiatives are underway to increase Singapore's use of renewable energy. Being in the equatorial belt, solar energy might hold the most potential for Singapore amongst the various renewable energy sources.

III. Recent Surge of Interest in Renewable Energies

Recent months have witnessed a surge of interest in renewable energies in Singapore. This surge of interest in renewable energies coincides with the coming into force of the Kyoto Protocol in Singapore. As Singa-

7 See Erica Tay, "S'pore Opts for LNG to Diversify Power Sources", 8 de agosto de 2006 (The Straits Times, Singapore). Two years ago, an imperative to consider the possibility of importing LNG into Singapore was given when the gas supply from the Natuna gas fields failed. A technical malfunction at the Jurong (Singapore) receiving point of the piped gas resulted in a serious power blackout throughout the country. In the wake of this, the Singapore government commissioned a Japanese utility, Tokyo Gas, one of the world's largest LNG importers, to conduct a feasibility study on the import of LNG into Singapore. It is arguable that shipping in LNG, and then regasifying it for power generation and other uses, would diversify and thereby strengthen Singapore's energy supply chain. North-western Australia and the Middle East gulf are likely LNG supply sources. In contrast, regional LNG producers such as Indsonesia, Malaysia and Brunei face difficulties expanding beyond existing output in terms of available reserves. See Andrew Symon, "Singapore stands to gain as regional import hub for LNG", 5 de agosto de 2006 (The Straits Times (Singapore)).

8 Singapore – Shares of TPES (2003), International Energy Agency (IEA) Statistics, *http://www.iea.org/statistics*

pore is now formally a participant in the key multilateral regime to tackle climate change, it has to concertedly address climate change issues such as energy efficiency, reducing its carbon dioxide emissions (amongst the other greenhouse gases)[9], etc. Renewable energies present energy efficiency and carbon mitigation opportunities and therefore, are naturally considered an essential component of a country's climate change strategy. In Singapore's case, given its limited capacity to harness renewable energies, it appears that the policy direction is not towards developing a domestic renewable energy market *per se* but towards aiding the development of renewable energies elsewhere in the region. In this regard, Singapore has plans to make itself a regional centre for backing renewable energy projects and to become an environmental financing hub for the Asian region in general.[10] The recent launch of the Renewable Energy Exchange in Singapore by the Austrian-based non-governmental organization, the Renewable Energy and Energy Efficiency Partnership (REEEP) and Singapore's signing up to membership of this organization are steps in this direction.[11]

1. *Renewable Energy Exchange*

The Renewable Energy Exchange is the first such initiative by the REEEP. The REEEP traditionally provides assistance to governments in reviewing and analyzing policy measures and renewable energy legislation, amongst its other areas of work. It also receives proposals for potential renewable energy projects and a select few would receive direct funding by the organization itself. However, it was soon realized that the REEEP could play a more strategic role by acting as an intermediary. Rather than financing projects directly, which the REEEP could only do on a limited basis given funding limitations and other donor considerations, the REEEP was well placed to play the "matchmaker" between potential investors and potential project developers. Potential investors are

9 Note, however, that as Singapore is not an Annex I party, it does not face mandatory and legally binding emission reduction targets for the first commitment period (2008-2012).

10 Meng-Yew Choong, "Singapore chosen as Base for Renewable Energy Projects", 23 June 2006 (the Straits Times (Singapore)).

11 "Singapore Joins International Energy Partnership", Press Release (Singapore, 21 June 2006), REEEP.

often on the lookout for profitable and viable investment opportunities. However, apart from the specialized few with a specific interest in socially responsible investment or sustainable development/ "green" investment, the majority of potential investors tend to shy away from renewable energy projects which are perceived to be riskier and to have less predictable revenue returns. The REEEP seeks to address this concern by conducting basic due diligence on potential projects so that, at least on a preliminary basis, the projects that are introduced to potential investors have investment potential. On the other hand, project developers are often in search for equity investors and joint venture partners. The REEEP plays the "matchmaker" by introducing potential investors to these project developers.[12]

Singapore was chosen as the base for the Renewable Energy Exchange for the following reasons: the country's stable political climate, the presence of large financial institutions and potential investors in Singapore, the country's linkages to the rest of the Southeast Asian region, amongst other factors. Singapore's location vis-à-vis the Southeast Asian region was a relatively significant factor as the REEEP had identified Southeast Asia as the focus of its attention.[13] It was identified that India and China are relatively more mature renewable energy markets and therefore are also better served. Similarly, the South American countries have also benefited from the presence of relatively more comprehensive institutional infrastructure, including private sector investors, non-governmental organizations which are involved in renewable energies, inter-governmental funding agencies, etc. In comparison, there is still much untapped potential for renewable energies as well as a lack of institutional infrastructure in the Southeast Asian countries. There is also growing interest in Southeast Asian countries to tap the potential of renewable energies in light of soaring oil prices.[14] Against this background, the Renewable Energy Exchange seeks to promote potential renewable energy projects in Southeast Asia. It appears that Singapore companies have expressed interest in investing in such projects and have welcomed

12 Interview with dr. Mike Allen, Director, the Renewable Energy Exchange (Asia) Private Ltd (on file with author).

13 *Idem.*

14 "ASEAN calls for more renewable energy use amid high oil prices", AFX News, 27 July 2006, *http://www.forbes.com/home/feeds/afx/2006/07/27/afx2908185.html*

the establishment of the Renewable Energy Exchange. Further, there are some small-scale renewable energy project developers in Singapore which are keen to tap on the Exchange's expertise.

2. *Singapore as an Environmental Financing Hub*

Another aspect of Singapore's interest in renewable energies is in the provision of financing services for renewable energy projects. In this regard, Singapore has plans to develop itself as an environmental financial hub in general.

As was recently expressed by Dr Yaacob Ibrahim, Minister for the Environment and Water Resources, "Singapore, with its inherent expertise in financial services, is well positioned as a hub for environmental financing".[15] Singapore has long been a key financial centre in the Asian region. There are more than 500 local and foreign financial institutions offering a wide array of financial products and services.[16] The local equity and debt capital markets are fairly mature and many global companies have operations in Singapore to take advantage of the depth and liquidity that these markets offer. Singapore is the fourth largest foreign exchange trading centre in the world. The Singapore Exchange (SGX) is Asia-Pacific's first de-mutualised and integrated securities and derivatives exchange and many of Asia's largest companies are listed on the SGX. The Monetary Authority of Singapore (MAS) is the regulatory authority that has oversight of all aspects of monetary, banking and financial activities in Singapore and is reputed for its prudential supervision which has, amongst other things, been credited as one of the reasons behind Singapore's ability to weather the Asian economic crisis in the 1990s.[17] Singapore is therefore well-placed to provide financial support services for renewable energy projects. It is also a natural candidate as a source of equity and debt financing for projects in the region. Singapo-

15 Speech by dr. Yaacob Ibrahim, Minister for the Environment and Water Resources, at "Emissions Trading - Economic Opportunities in Asia" Seminar and Launch of the Sustainable Energy Association of Singapore, 12 de julio de 2006.

16 A complete list of financial institutions with presence in Singapore is available on the Monetary Authority of Singapore website *www.mas.gov.sg*

17 See "Singapore as a Regional Financial Centre", Denis Hew, Institute of Southeast Asian Studies, presented at "The Role of Capital Markets in Asian Economic Development", 7 y 8 de marzo de 2002, organized by the Tokyo Club Foundation for Global Studies.

re's potential as an environmental financing hub has already attracted companies such as Asia Carbon to set up their regional headquarters in Singapore. Of interest would be the Asia Carbon Fund, an equity fund that is primarily focused on funding power generation projects using renewable energy technologies in the Asian region which have the capacity to generate carbon credits under the Kyoto Protocol and the European Union Emissions Trading Scheme (EU ETS).[18] The presence of such entities in Singapore bodes well for the development of renewable energy financing and renewable energy technologies in general.

However, it should be noted that renewable energy financing is a relatively specialized area of project financing, which itself is a specialized field. One concern is the relative lack of experience and knowledge about renewable energy financing in Singapore. For example, it is likely that in assessing the financial viability of a renewable energy project, conventional financing models and accounting treatment would be used. This usually results in renewable energy projects being deemed riskier because of its less predictable revenue returns, the high cost of technology, and the absence of economies of scale, amongst other factors. However, the balance is shifted in favour of renewable energy projects when full-cost accounting is adopted. Full-cost accounting would incorporate factors such as the projected costs of climate change, the costs of fuel imports and fuel price volatility, and other environmental, social, economic and security impacts of various technology options on a life-cycle basis. The concern is that the lack of knowledge in this field would hamper Singapore's efforts to develop as an environmental financing hub as well as prove detrimental to the development of renewable energies in the region. In this regard, the REEEP and the Exchange have identified capacity building as an important component of its work in Singapore and the Southeast Asian regions. Efforts are underway to conduct training and information exchange sessions for the financial sector in Singapore.[19] It can be argued that the present lack of know-how in re-

18 More information on Asia Carbon is available on their website *www.asiacarbon.com*

19 Dr. Mike Allen has shared that the Renewable Energy Exchange has plans to organize workshops and seminars in Singapore for financing experts from neighbouring countries such as to share their knowledge and experience; Interview with Dr. Mike Allen (on file with author).

lation to environmental financing can be easily remedied. The more crucial factor may be the interest of the financial services industry in investing time and resources to develop environmental financing services to support renewable energy projects. At present, banks and other lending institutions may not see the benefits of extending lending facilities to renewable energy projects which tend to be small in scale. Syndicated loans and other financing arrangements also require projects to be of certain value so as to be viable. In some countries, this difficulty with limited financing options is alleviated by the presence of micro-credit schemes, public-private partnerships, funds set up by the government to extend low interest rate lending to renewable energy project developers as a form of indirect assistance, etc. Presently, such options are limited in Singapore. Policy makers ought to consider such possibilities to attract private sector capital to renewable investments.

Synergy between the promotion of renewable energy financing (and environmental financing in general) and other niche financial services may also be pursued in Singapore. Islamic or shari'ah financing is a case in point.[20] Alongside private wealth management, Islamic banking has been identified as a potential growth area for the financial services industry in Singapore.[21] The provision of shari'ah- compliant financial instruments is viewed as one way of attracting fund flows from the Middle East, which has seen surplus savings partly due to soaring oil prices. Renewable energy projects, like most infrastructure projects, lend themselves readily to Islamic financing arrangements. The possibilities of tapping into Islamic financial products as a source of financing for renewable projects ought to be explored.

20 The principal difference between Islamic commercial activities and conventional commercial activities is that Islam expressly forbids the giving or receiving of interest as it is viewed as tantamount to usury (*riba*). There is a wider variety of Islamic financial products that have been developed to meet various needs. The specific ones which the author has in mind include the ones that are similar to a "buy and lease back" in conventional banking terms and those which are akin to joint ventures. For an introduction to Islamic banking, see "Islamic banking and finance in South East Asia: Its Developments and Future", Angelo M Vernardos, World Scientific Press, 2005.

21 The MAS, for example, sees "explosive growth ahead for Islamic financing"; "Singapore to promote Islamic banking using existing Regulatory Framework", *Channel-News Asia*, 29 de septiembre de 2005.

3. *Research and Development*

The promotion of R&D is always crucial for the advancement of the technologies themselves and for determining the optimal application of the technologies in market environments. In Singapore, research into renewable energy technologies has been undertaken jointly between the National Environmental Agency and tertiary institutions since the early 1990s.[22] In 2001 and 2003 respectively, two new schemes were introduced to provide capital grants to private sector companies which wish to undertake pilot projects. Interestingly, while these projects may be for the promotion of renewable energies, the criteria employed in assessing whether the projects ought to receive funding is "environmental sustainability". Thus, these two schemes cannot be said to be introduced solely to promote renewable energies.

Recently, in July 2006, the government announced that it would be setting aside some 330 million Singapore dollars to fund R&D in environmental technologies. This is in tandem with the efforts of investment/trade agencies such as International Enterprise Singapore (formerly the Singapore Trade Development Board) and the Economic Development Board to boost Singapore's private sector capabilities on energy efficiency and renewable energy. One such initiative is the launch of the iPartners Consortium on Solar Energy by IE Singapore.[23] Growing interest in solar technologies has led to the formation of this consortium of Singapore companies to band together to venture abroad to serve the solar photovoltaic markets in Asia and the Middle East. The consortium's present capabilities include solar system integration, the supply of raw materials, cables manufacture and legal services. The consortium has also signed a Memorandum of Understanding with REEEP to cooperate in the promotion of various energy systems, sharing of best practices, and raising the profile of local and regional projects, etc. Another private sector initiative that was recently launched in July 2006 is the Sustainable Energy Association of Singapore (SEAS). SEAS will serve as the lead industry association of Singapore companies in relation to issues of cli-

22 Source: International Energy Association, *Global Renewable Energy Policies and Measures Database*, *http://www.iea.org/textbase/pamsdb/grcountry.aspx?country=Singapore*

23 Information available on the International Enterprise Singapore website: *www.iesingapore.gov.sg*

mate change, renewable energies and sustainable development.[24] It will also serve as a platform for dialogue and cooperation with the public sector, academia and similar associations abroad.

4. *Solar energy*

Located in the equatorial belt, solar energy is widely available in Singapore. Solar thermal energy appears to be rather cost effective and its use is being encouraged both in public buildings and private residences. There has been a resurgence of interest in solar photovoltaic technologies in recent years but the main issue remains cost (both in the short term and long term), rather than availability. Hopes are being placed on nanotechnologies and non- or low- silicon technologies to provide longer term viability and sustainability. A number of test beds for solar photo voltaics can be found in Singapore, largely in public buildings.

5. *Biomass/Bio energy*

Presently, all incinerable waste that is not recovered, reused or recycled is sent to large scale waste-to-energy incineration plants operated by the National Environmental Agency. The biomass in Singapore's municipal waste consists mainly of wood waste, horticultural waste, food waste and waste paper. Two companies in Singapore, M/s ECO-IEE Pte Ltd and M/s Bee Joo Industries Pte Ltd have biomass cogeneration plants. The ECO cogeneration plant has a turbine capacity of 0.53 MW and uses wood waste as fuel. The Bee Joo cogeneration plant has a turbine capacity of 1.0 MW and uses wood waste and horticulture waste as fuel.

By 2007, the first bio-methanisation and renewable energy plant will be established in Singapore.[25] It will also be the first of its kind in Asia. The 60 million Singapore dollars facility, IUT Global, will specialise in recovering and converting food and other organic waste into biogas and compost materials. The biogas, which will include methane, will be used to generate electricity. The plant will initially have a treatment capacity

24 Véase nota 15.

25 "Waste treatment plant in Tuas to turn food waste into power and money", 15 de septiembre de 2005, *Channel News* Asia.

of 300 tonnes per day, with a possible future expansion to a capacity of up to 800 tonnes per day. According to an estimate by the National Environment Agency, IUT Global's plant has the potential to increase Singapore's food waste recycling rate from the current 6% to about 25%.[26] This means that, potentially, the facility may also help Singapore achieve its food waste recycling target of 30% by 2012. Presently, out of the 13 000 tons of waste per day, food waste amount to some 1500 tons per day. The amount of food waste is expected to rise in the future as the food and beverage industry as well as domestic population are growing. The tertiary institutions in Singapore are also conducting R&D in this area as it is believed that there is large potential in this region as there are many bio-resources for both bio-ethanol production (the above being an example of such) and bio-diesel production (from palm oil).[27]

IV. The Kyoto Protocol

1. *Introduction to the Kyoto Protocol*

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) is the key multilateral environmental agreement in relation to climate change. While the UNFCCC places broad obligations (which are largely non-legally binding) on signatories to tackle climate change, the Kyoto Protocol goes further and gives "teeth" to the climate change regime by committing Annex I parties[28] to legally binding quantified green house gas (GHG)[29] emission reduction targets and a timetable for their achievement.

26 Speech by Dr Yaacob Ibrahim, Minister for the Environment and Water Resources, at the Ground Breaking Ceremony of IUT Global Pte Ltd's Bio-Methanisation and Renewable Energy Plant, 15 September 2005; online: National Climate Change Committee *www.nccc.gov.sg*

27 Email interview with Associate Professor Ho Hiang Kwee, Director of Energy Systems Laboratory and Associate Professor, School of Mechanical & Aerospace Engineering, Nanyang Technological University (on file with author).

28 These are mostly developed countries, so known as "Annex I parties" because they are listed in Annex I to the Kyoto Protocol.

29 The six gases covered by the emission reduction commitments of the Annex I Parties as set out in Annex A of the Kyoto Protocol are carbon dioxide, methane, nitrous oxide, hydroflurocarbons, perflurocarbons and sulphur hexafluoride.

Article 3(1) sets out the basic obligation accepted by Annex I parties. It states that Annex I parties "shall, individually or jointly, ensure that their anthropogenic carbon dioxide equivalent emissions of the GHGs listed in Annex A do not exceed their assigned amounts". The commitments under the Protocol vary from nation to nation as set out in Annex B of the Protocol. The overall 5 per cent target for developed countries is to be met through cuts (from 1990 levels) of 8% in the European Union[30], Switzerland, and most Central and East European states; 6% in Canada; 6% in Hungary, Japan, and Poland; while New Zealand, Russia, and Ukraine are to stabilize their emissions.

To compensate for the sting of these "binding targets", as they are called, the so-called "flexible mechanisms" were introduced to assist parties to achieve these targets in a flexible and cost-efficient manner. These flexible mechanisms are joint implementation, emissions trading and the Clean Development Mechanism (CDM). The rationale underpinning these three mechanisms is the same: Due to the unlocalised nature of carbon dioxide (which is the most prevalent GHG), it does not matter for the environment where reduction of emissions occur. At the same time, the cost of reducing emissions in developing countries is significantly lower than that in industralised countries. Therefore, there is a strong market incentive to abate emissions where it is cheaper. Credits will be issued to reflect the emission reductions, which can then be used by parties to meet their emission targets.

2. *The Clean Development Mechanism*

The objective of the CDM is "to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their… commitments under Article 3".

In simplified terms, the CDM works in the following way: Annex I countries invest in projects (directly or indirectly) that cut or avoid emissions in non-Annex I countries and are awarded credits that can be ap-

30 The European Union has made its own internal agreement to meet its 8% target by distributing different rates to its member states. These targets range from a 28% reduction by Luxembourg and 21% cuts by Denmark and Germany to a 25% increase by Greece and a 27% increase by Portugal.

plied to meeting their own emissions targets. The non-Annex I countries benefit from free infusion or transfer of advanced (and environmentally sound) technology and investment that promotes sustainable development. The CDM has drawn extensive interest and steps have been taken to put it into operation even before the Protocol takes effect. In particular, it is a cost-effective and flexible means for industrialized countries to meet their targets as well as presents investment opportunities for developing countries. Ultimately, the global environment also benefits.

Renewable energy projects lend themselves well to being approved as CDM projects because they *prima facie* meet the key criteria of additionality and sustainable development. In relation to additionality, CDM project activities must result in reducing or absorbing (sequestering) GHGs that are *real and measurable* and *would not have occurred in the absence of the proposed project activity*. In other words, to qualify for credits, a project activity must demonstrate that GHG emissions were reduced against the "baseline scenario," a representation of GHG emissions under normal circumstances. As for the sustainable development criterion, proposed CDM project activities must demonstrate their contributions to environmental integrity and the host country's sustainable development goals.

On 11 July 2006, the Kyoto Protocol came into force in Singapore. This means that Singapore (both the government and private sector companies) is now in a position to participate in the CDM. The interest in the CDM is two-fold. Renewable energy project developers in Singapore are keen to qualify as CDM projects as the sale of carbon credits will be an additional potential revenue stream. It is also "strategic marketing" for renewable energy project developers to be able to promote the CDM potential of their projects. On the other hand, financiers are keen to invest in CDM projects in Singapore and beyond. To the extent that these CDM projects are renewable energy projects, renewable energies are receiving a boost with the interest to invest in CDM projects. It can be argued that Singapore's participation in the Kyoto Protocol opens up another frontier for the development of renewable energy projects/technologies as well as in renewable energy financing.

V. Conclusion

Singapore is unlikely to become a major user of renewable energy technologies. It is certainly looking into increasing its use of, for exam-

ple, solar energy (thermal and photovoltaic) and biomass for electricity generation. However, this is likely to remain a minor component of Singapore's energy profile and Singapore will continue to rely on fossil fuels to meet its energy demands.

Instead, Singapore has identified that it can contribute to the global effort to increase renewable energy use by promoting its financial (and other ancillary) services as well as investing in and supporting R&D. The presence of both public and private organizations in Singapore that are committed to promoting renewable energies is heartening and certainly will boost the interest (and confidence) of the various stakeholders, including project developers, investors, non-governmental organizations, etc.

Finally, it can be said that we are witnessing the setting-up of infrastructure to support the growth of renewable energy use in the Southeast Asian region. As these foundations are being laid, we can look forward to a future of more wide-spread employment of renewable energy in Southeast Asia.