PROMOTING URBAN SUSTAINABILITY THROUGH GREEN TECHNOLOGY IN MALAYSIA

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Abstract

This paper provides an evaluation of Malaysia's green technology stimulus policy and actions for industrial firms. We used interviews and a questionnaire to assess if responses from local authorities and industrial firms are in accordance with the targets and objectives of the Green Technology Policy. Following a performance evaluation, we concluded that the involvement of local authorities and industrial firms is limited, due to a disconnect in implementation between federal, state, and local authorities, even though the policy strongly encourages the use of green technology to increase economic growth and reduce carbon dioxide emissions. The lack of ongoing evaluation after six years of the Green Technology Policy initiative needs to be urgently addressed. Timely policy evaluation is required to increase public support, and ensure the most cost-effective use of resources. Toward those ends, policy prescriptions—aimed at promoting green technology to accelerate economic growth and sustainable industrial transformation—will be put forward.

Introduction

Malaysia began promoting green technology (GT) in 2009, as economic growth slowed and it became evident that, when compared with other developing countries, the country was producing high levels of carbon emissions. The GT concept was far from new; in fact, its history can be traced back more than 4,000 years, when the ancient Egyptians

first began designing buildings with passive air conditioning.[i] Current GT trends were initiated around 2001, with a number of events happening almost simultaneously, including the setting up of the Green Hall of Fame, the investment by Cypress Semiconductor's CEO T. J. Rodgers in Sunpower, and the establishment of Bloom Energy.[ii] Against this backdrop, and in light of Malaysia's perceived need to speed up economic growth, a wave of GT started in the country after the 2000s, fueled both by private sector investment and intervention by, and incentives from, the national government in the solar power industry.

In April 2009, Malaysia formally established the Ministry of Energy, Green Technology, and Water (called KeTTHA in Malay) with the mandate of increasing GT development. As defined by that ministry, GT is "the development and application of products, equipment and systems to conserve the natural environment and resources, minimizing and reducing the negative impact of human activities." GT therefore includes products people have been using for some time—such as solar panels and wind turbines—and also newer technologies, such as the electric car. These technologies are referred to as "green" because they help to minimize environmental impact.

Also in 2009, a National Green Technology Policy was first promulgated. The policy had multiple interrelated goals, including spurring economic development, making the country a leading player in the southeast Asia region, and promoting long-term sustainable development. In 2012, a group of urban planners and researchers at Universiti Teknologi Malaysia (UTM) cooperated with the Iskandar Regional Development Authority—an important economic corridor in southern Malaysia—to develop the country's first Low Carbon Society Blueprint, incorporating GT into local development planning.

Most innovation in GT takes place in industrial countries, but a number of large companies in the major developing countries—including Brazil, China, and India—are also engaged in the development of new technologies. Due to restrictions in technology and funding in developing countries, government support is sometimes needed to help companies use, adapt, and diffuse GT into the domestic economy—and eventually, to design new technologies (Ocampo 2011). An analysis of Malaysia's efforts in this area, and in the larger GT arena, should help us to understand the challenges, efforts, and obstacles facing GT in developing countries.

Research questions

This paper evaluates the outcomes of the National Green Technology Policy and actions to promote GT in Malaysia. It seeks to provide insights into how to more effectively promote GT in the future, build a sustainable society in Malaysia, and give guidance to other developing countries. Specifically, the paper seeks to answer the following questions:

- Against what backdrop did Malaysia initiate GT?

- What are the main strategies and measures to facilitate GT?
- Who are the stakeholders in GT policy?
- What successes and failures of policy implementation can we point to?

The paper is structured as follows: Section 1 outlines the methodology, including the background of our case study. Section 2 presents the history of Malaysia's GT initiative and context. Section 3 provides a literature review. Section 4 illustrates the main findings. In Section 5, we discuss key findings. Finally, in Section 6, we draw some conclusions and make several policy prescriptions.

Methodology

One goal of this study was to assess the characteristics of beneficiaries of Malaysia's GT Policy. This includes, in the industrial subsector, the location and size of firms, and the category of GT that they operate in. We also analyzed responses from stakeholders, especially industrial firms and local authorities, in terms of their attitude, knowledge about GT, implementation process, and future expectations.

A qualitative methodology was used for this research. Based on public data from 2009 to November 2014, available online, we analyzed the characteristics of major industrial firms. Although our fieldwork in Malaysia was necessarily restricted, we nevertheless conducted 15 surveys and nine interviews, aimed at assessing the responses and perspectives of key stakeholders.

The data associated with projects approved under the GT policy were analyzed. Each project was identified for information on project location, subsector, and category of GT, to help us understand the general background of the beneficiaries. This analysis was also used to identify firms for further interviews and surveys.

Surveys were administered to selected industrial companies to obtain data on the category, scale, and type of GT, as well as the attitudes and expectations of individuals within those companies. Focusing on the goals of the National Technology Policy 2009, a first-round survey of major industrial companies was carried out in November 2014. This first round, focused on the Iskandar area, was conducted by phone. During this survey, most of the industrial firms replied that either they had not heard of the GT Policy, or were not clear about its scope, focus, or criteria for awarding incentives and grants. Clearly, the dissemination of GT knowledge was not as widespread as government officials had hoped and expected. With support from the local government of Pasai Gudan, a second-round survey was conducted during a meeting organized by a local authority about low carbon development, with 15 companies responding to the questionnaire.

Meanwhile, interviews were being conducted with federal and local government officials, researchers, and industrial firms to gain an objective and comprehensive understanding from various perspectives. These included individuals within the Ministry of Water, Green Technology, and Waste; the Malaysian Green Technology Corporation; the Iskandar Regional Development Authority; the Pasai Gudan Municipal Council; the Jahor Bahru Chinese Chamber of Commerce and Industry; the Small and Medium Enterprises (SME) Association of Malaysia; HQ Tool Industries Sdn. Bhd.; the University Teknologi Malaysia (UTM) Low Carbon Centre; and the Universiti Kebangsaan Malaysia (UKM) Institute of Malaysia International Studies.

History

Economic slowdown during the past decade compared with 1990s

After strong growth in the 1990s, Malaysia experienced considerably slower economic growth. From 2001–2009, for example, growth averaged 4.3 percent (Government of Malaysia 2012), which was about half of the average growth rate of 9.2 percent in the previous decade. A World Bank Report in 1993 had highlighted weaknesses in Malaysia's economic structure, which might lead to what is sometimes called a "middle-income trap."[iii] In fact, Malaysia's economic development model typified the larger East Asian model, focusing on manufacturing and oriented toward exports. Although previous governments pursued a variety of strategies and policies, encouraging foreign investment and promoting exports have been the consistent policy trends since the 1990s (see Table 1).

After many years of economic development, labor productivity in the manufacturing sector is already high, which means that further growth in manufacturing productivity is likely to be limited. Growth is further constrained by factors such as high labor costs compared with other Asian countries, and high numbers of qualified personnel flowing out to Singapore. As a result, Malaysia is unlikely to remain competitive as a high volume, low-cost producer; likewise, it is incapable of ascending the value chain into the fast-growing markets for knowledge and innovation-based products and services. Therefore, during the Ninth Plan period, Malaysia government began investing more in new growth areas—for instance, renewable energy, high-end electronic products, machinery and equipment, and medical devices—to strengthen its industrial base (Government of Malaysia 2012).

Period	Trade policies	FDI policies	Motivations
1957-1967	Import substitution in manufacturing	FDI for import-substituting industries	Produce previously imported goods
1968-1980	Export promotion in manufacturing	Free trade zones	Generate employment
1980-1985	Import substitution in manufacturing	Joint venture projects between state-owned enterprises for selected heavy industries such as automotive, motorcycle assembly, steel, cement, fertilizers, etc.	Employment, linkages, develop heavy industries, nurturing indigenous enterprises
1986-2005	Export promotion in manufacturing	Relaxation of equity constraints for manufacturing	Employment; technology transfer and moving up the value chain of production through cluster development
2006-2020	Export promotion of manufacturing and selected services as new sources of growth	Relaxation of equity constraints for selected services	Continuation of knowledge-based industrial growth based on cluster development; export of selected services as new sources of growth

Table 1. Phases of industrialization and policies, 1957-2010[iv]

High carbon emissions compared with other developing countries

In March 1997, Malaysia signed the Kyoto Protocol, thereby becoming one of the first countries to embrace the concept of global warming. Notably, however, it was *not* among the first 35 nations that agreed to reduce their carbon emissions.

With an average CO^2 emission of 7.8 metric tons per capita in 2008, Malaysian CO^2 emission levels are higher than the world average, and also high among the newly developing nations (see Figure 1 and Figure 2) (World Bank Data). The transportation sector is the largest consumer of energy in Malaysia, generally accounting for more than 40 percent during the period of 2000 to 2005, with the other three sectors—including industrial, commercial, and residential—comprising about 51 percent together (Ho and Fong 2007). Malaysia's government has committed to reduce the country's emission intensity by 40 percent by 2020, based on the 2005 baseline (Low Carbon Blueprint Malaysia). In

recent years, the government has implemented policies strategies and otherwise initiated actions to promote the use of renewable energy, and make progress toward the objective of energy efficiency.

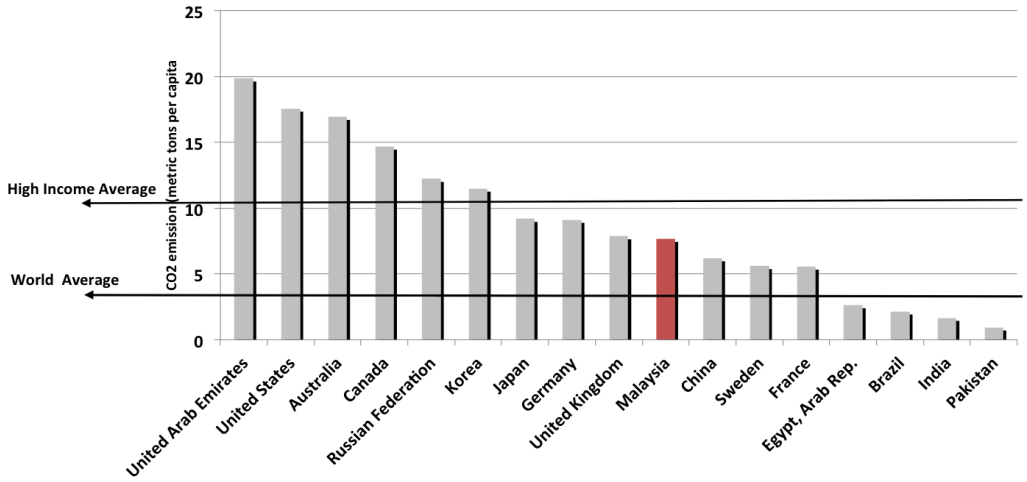

Figure 1. Comparison of Malaysia and other countries in terms of CO2 emission per capita in 2008[v]

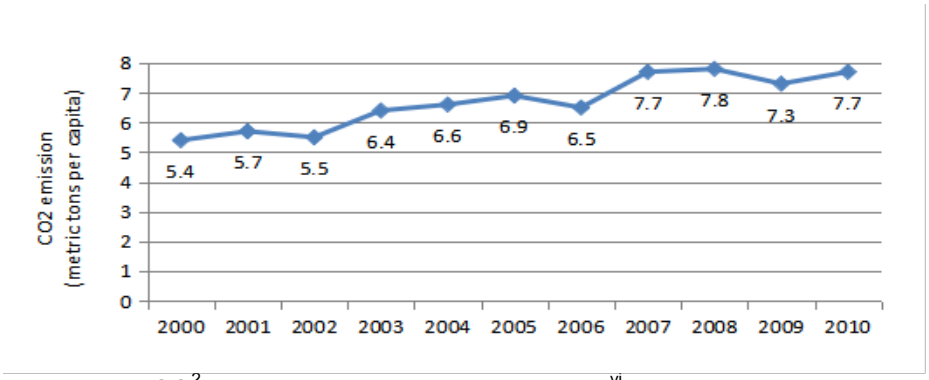

Figure 2. CO^2 emissions in Malaysia, 2000-2010[vi]

Green technology as one of the instruments of urban sustainability and industrial transformation

In July 2009, the Malaysian government launched the "the National Green Technology Policy," aimed at accelerating the national economy and promoting sustainable development. The policy had four major emphases. The first was achieving energy independence, in part through more efficient use of existing resources. The second focus was the environment, largely through conservation. The third involved enhancing and promoting national economic development, with an emphasis on green technology (and the expectation of associated innovation). The fourth goal of the policy had a societal emphasis: improving the quality of

life for Malaysia's citizens.[vii] Table 2 summarizes the four emphases and the sectors in which they were likely to be pursued.

Key areas	Objectives
Energy Sector	• Application of Green Technology in power generation and in the energy supply side management, including co-generation by the industrial and commercial sectors • Energy Utilization Sector: Application of Green Technology in all energy utilization sectors and in demand side management programs
Buildings Sector	• Adoption of Green Technology in the construction, management, maintenance and demolition of buildings
Water and Waste Water Management Sector	• Adoption of Green Technology in the management and utilization of water resources, waste water treatment, solid waste and sanitary landfill
Transportation Sector	• Incorporation of Green Technology in the transportation infrastructure and vehicles, in particular, biofuels and public road transport

Table 2. Pillars and objectives of National Green Technology 2009[viii]

Literature review

The adoption of a set of policy instruments to stimulate green technology has been embraced by countries around the world. According to their nature, those policies might be classified as (Crespi et al. 2015): "market and incentive-based instruments; command and control regulation instruments; voluntary (also called negotiated) agreements; information and education-based instruments."

The first category—market and incentive-based instruments—is the most diversified group, comprising "emissions trading, environmental taxes and charges, deposit-refund systems, subsidies and compensation mechanisms, and green purchasing" (EEA, 2006). The second category, command and control regulation instruments, are non market-based instruments, normally imposing standard or obligations directly on firms, individuals, and local governments—for instance, by limiting the amount of emission per unit of output. The third, voluntary agreements, are based on voluntarily coordination for the adoption of pollution reduction strategies among institutions and firms. The Czech Republic's Eco-Labeling system

is a case in point. In this paper, reflecting the realities of Malaysia and our analysis on the GT policy, the focus will be on the first group: incentives aimed at supporting government policies.

National policy instruments

Certainly, the embrace of green technology can present many benefits to developing countries. But when compared with other alternatives, green technology tends to be more expensive, and private investors are unlikely to invest in those more expensive technologies without government support. In many cases, government intervention through targeted technology policies proves to be a critically important factor in offsetting the lack of sufficient investment from private enterprises (Jordan, Wurzel, and Zito 2003). Such intervention can be made in either of two ways: as a "push" or a "pull." In other words, by implementing measures to reduce the cost of technologies and products to firms, and by decreasing the risks of technology innovation, government acts as a pushing force. At the same time, the government can increase the market demand for green technology products by increasing benefits to the end-users—i.e., as a pulling force.

It is worth noting that very similar policy instruments may bring about different outcomes in different countries. Those outcomes depend in part on the respective levels of development, country by country, and also on institutional capabilities—for example, how governments choose to address market failures. The design and implementation of these policies, therefore, may raise governance issues, which may in turn affect the overall efficiency of the initiative. For instance, although intergenerational transfers are generally intended to improve the well-being of both current and future generations, without well-developed financial markets, they may well fall short of their goals (De Serres, Murtin, and Nicoletti 2010).

Urban planning integration with green growth

Through the promulgation and implementation of urban development plans, land use planning can play an important role in promoting low-carbon cities. Spatial strategies in development plans comprise a variety of sustainable development principles, such as compact cities, eco-cities, Transit Oriented Development (TOD), and other tools. Some of these concepts rely (at least in part) on renewable energy sources, and are currently gaining increased attention in Malaysia. They have been incorporated in development plans of many newly planned cities—for example, in the South Johor Economic Region (SJER), which also known as the Iskandar Development Region (IDR) (Ho and Fong 2007).

In Asia, the "Eco-town" planning model that has been embraced by Japanese planners seeks to achieve economic stimulation through waste reduction and recycling, with increased use of renewable energy resources. The impetus for this model can be traced back to the 1990s,

when Japan was facing a shortage of landfills and a lagging local economy. The cities of Kawasaki, Lida (Nagano prefecture), and Kitakyushu were approved as Eco-towns in 1997 in part to address these problems. One of the key targets for the Japanese Eco-town initiative has been the efficient use of land. This begins with an economic calculation—that is, making efficient and productive use of the land—and extends to a broader scope, including reducing the region's carbon footprint. To summarize, the standard for "efficient" land use in urban area includes, for example, minimizing the amount of land needed, reducing carbon dioxide emissions, reducing waste and effluent emissions, optimizing the use of existing infrastructure, and the circular usage of waste between industrial firms.

Monitoring green technology policy

Effective monitoring and evaluation of green technology policies are key to ensuring an efficient implementation of a country's green growth strategy. Monitoring should be carried out on an ongoing basis during the implementation phase of a project, to ensure that the program is moving toward its original objectives. In addition, regular evaluations should be undertaken to examine the overall implementation process; to assess whether the priorities of green technology policies are in accordance with national low-carbon, green growth, and environmental policies; and to adjust plans and activities if necessary. Such evaluations can be considered in two categories: *process* evaluation and *performance* evaluation. In the process-focused approach, agency efficiency is determined "by the number of inspections, the number of fines, the number of 'beans'" (Metzenbaum 1998). In contrast, in a performance-focused system, agencies are judged by the "effect of their activities on the ultimate policy outcomes of interest"(Lori S. Bennear and Dickinson 2015).

With that background in mind, let's now explore Malaysia's green technology policy. Did that policy lead to the intended results? Were there unforeseen or unintended consequences? In retrospect, how well did the policy perform? As Bennear and Coglianese (2004) point out, such assessment can serve as critical inputs into future learning and decision-making.

Main findings

As noted above, the Ministry of Energy, Green Technology, and Water (KeTTHA) was established In April 2009 during a national cabinet reshuffle. In July of that year, the National Green Technology Policy was launched by the Prime Minister of Malaysia, Najib Razak. KeTTHA adopted the National Green Technology Policy, among other programs, thus cementing its role as the most important entity promoting green technology.

On January 26, 2010, the first GT Council (Green Technology and Climate Change Council) meeting was held. This was a coordination forum, chaired by the prime minister and organized for the benefit of government ministries, agencies, private sectors and key stakeholders. More on these two government bodies, and their interactions, follows.

Federal level took initiative as the main support and driving force

KeTTHA, as noted, is the main Malaysian institution responsible for promulgating green technology policies and coordinating with other ministries to integrate relevant action in pursuit of specific outcomes. The main goal of KeTTHA is "to innovate and manage resources strategically, thereby ensuring availability, reliability and affordability of energy and water services and to champion the application of green technology to Promote Green Economy and Green Living" ("Laman Web Rasmi Kementerian Tenaga, Teknologi Hijau Dan Air" 2015).

Because green technology comprises a wide variety of fields, the GT Council was established as a high-level coordinating and decision-making body. The council oversees the overall implementation of green technology in Malaysia. It serves as the umbrella organization for a total eight working groups, including groups focused on industry research and innovation, human capital promotion, public awareness, transportation, adaptation, green tech, food remains, and a "green group," which meet once or twice a year.

In addition to KeTHA and the GT Council, a third federal entity—the Green Technology Corporation (GTC)—works with a network of some 20 commercial and Islamic banks to provide loans and grants to appropriate applicants. The GTC also focuses on education and implementation. Many educational activities are held annually to enhance people's awareness of new technologies and sustainable lifestyles. For example, the International Greentech & Eco Products Exhibition & Conference (IGEM), organized by KeTTHA, acts as the prime mover for government initiatives in green growth, providing exhibition and conference platforms for industry professionals. The exhibition provided a platform to increase people's awareness of sustainable development, through showing the importance and opportunities brought by green technology. It also helped to put Malaysia on the map as the regional hub for green technology, with total business transactions reported during this exhibition in 2011 and 2012 totaling some 1.3 billion RM.

Federal government used incentive policies to attract engagement from entrepreneurs

The "Green Technology Finance Scheme" is the incentive policy promulgated by KeTTHA to stimulate green technology utilization in energy, building, transportation, water, and waste management through interest subsidies and grants. This program is aimed at both the producers and users of green technology. The scheme offers a 2 percent interest

subsidy, with 60 percent of the loan being guaranteed by the government. It was launched with a 1.5 billion RM soft loan, which has since been increased to 3.5 billion RM. Between 2009 and November 2014, 351 projects were covered by this scheme, including 243 energy efficiency projects, 17 green building projects, and 91 waste and water projects. The majority of projects are located in Kuala Lumpur, Selangor, and Johor Bahru.

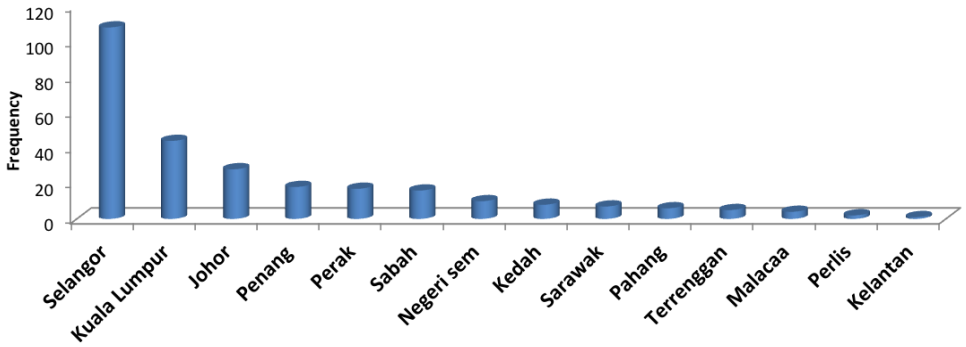

Figure 3. Location of projects approved by GTFS, 2009-2014

The energy-sector projects command the largest share, at 69 percent (see Figure 4), with most energy projects going toward the solar power industry. In terms of industrial sector, electrical, electronic, and biotechnology have the highest percentages, comprising 52 percent of all projects (see Figure 5).

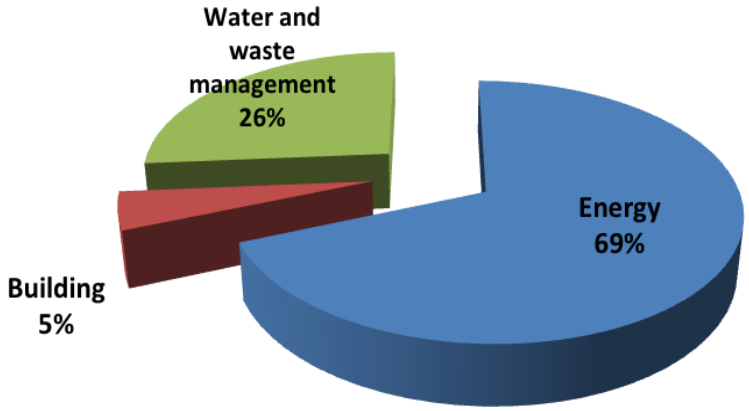

Figure 4. Subsector of green technology projects approved by GTFS, 2009-2014

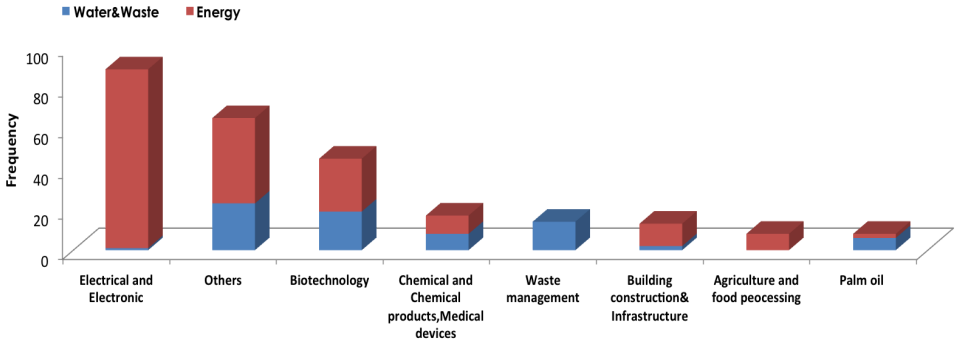

Figure 5. Subsector of green technology projects approved by GTFS, 2009-2014

Little knowledge of green technology on the level of industrial firms due to limited knowledge dissemination

The main questions covered in our company-directed questionnaire included: the energy saving measures being taken by the company; the needs and issues surrounding environmental management; and the obstacles, incentives, and preferences involved when companies choose to take action (or not take action) on using green technology, either as providers or customers. The survey results show that the five biggest challenges for companies in green technology action, in terms of frequency, are: financing, information, operating cost, work force ability, economic risks, and technology (see Figure 6).

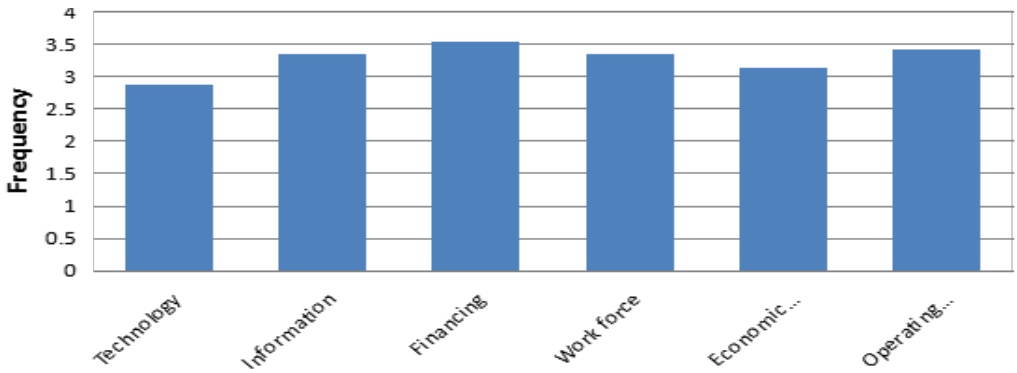

Figure 6. Obstacles for industrial firms to take actions on green technology

Under pressure from the national level to promote GT, experimental regional institutions are exploring how to incorporate green technology strategies into urban planning

Engagement from regional and local governments with the implementation of the National Green Technology Policy is another useful metric for measuring the influence of that policy. In line with the national and regional governments' aspirations for green economic growth and greater sustainability, Iskandar Malaysia (IM) is set to be the first region in Malaysia for initiating its own climate change action plan, named the "Low

Carbon Society Blueprint for Iskandar Malaysia 2025." Urban planners from both academia and the public sector helped draft this blueprint, which also serves as the roadmap for a collaborative research program. That program brings together both international and local experts and scientists to provide scientific findings and quantitative modeling of carbon dioxide emissions for the Iskandar Regional Development Authority (IRDA), which is the regional policy maker.

Another unique feature of the blueprint is that it comprises 12 proposed actions, based on consensus building among major stakeholders who have been involved in the program from formulation to implementation in Islander Malaysia (see Table 3). From these twelve actions, two inferences can be drawn. First, as stated, this is a blueprint stemming from traditional urban planning; but it focuses on how to make a sustainable and resilient urban area in the future. Second, it assumes that the "green" concept is fundamental to future implementation, including green growth, green community, and green environment. As Table 3 indicates, green technology is closely related with the implementation of green transportation, green industry, green building and construction, green energy systems, renewable energy, and sustainable waste management.

Mitigation Options	Reduction (ktCO2eq)	Percentage (%)
Green economy	**6937**	**54%**
Action 1: Integrated green transportation	1916	15%
Action 2: Green industry	1094	9%
Action 3: Low-carbon urban governance	-	-
Action 4: Green building and construction	1203	9%
Action 5: Green energy system and renewable energy	2725	21%
Green community	**2727**	**21%**
Action 6: Low carbon lifestyle	2727	21%
Action 7: Community engagement and consensus building	-	-
Green environment	**3094**	**25%**
Action 8: Walkable, safe, and livable city design	263	2%
Action 9: Smart urban growth	1214	10%
Action 10: Green and blue infrastructure	392	3%
Action 11: Sustainable waste management	1224	10%
Action 12: Clean air environment	-	-
Total	**12758**	**100%**

Table 3. Carbon reduction contribution of 12 mitigation options for low-carbon Iskandar Malaysia

Analysis of the findings

Lack of access to information is the main barrier to industrial companies taking action on green technology

If industrial companies are going to take proactive steps toward embracing green technology, those companies must first be aware of relevant green technology and incentive policies. Our survey of industrial firms revealed that the distribution of companies receiving "green" policy support is very much concentrated in and around the capital and the southern economic corridor. Even in Iskandar—the important southern economic corridor connecting Malaysia with Singapore—many industrial firms do not have a clear concept of what green technology is, what the criteria are for a green technology project to receive support from the government, or even what defines them as a "green industry."

As a representative of one of the surveyed companies responded, "I myself I like all these things (green technology), now we use more solar energy, green energy. These are the two things we are using now. [I am] now using it as a hobby, later on, when I know about it, maybe I will use it, partially to replace [my] electricity supply, to cut down the cost."

This lack of awareness manifests itself on multiple levels. The Small and Medium Enterprises Association, for example, told us that most SMEs don't know how to demonstrate that they are, in fact, in a green industry. Lack of knowledge at "ground level," due mainly to a lack of information-distribution channels, is a continuing problem.

GT policy cannot get to ground level because local authorities are not involved

The separation among government agencies on various levels is a serious issue in policy implementation in Malaysia. So far, design and implementation of the Green Technology Policy have all been driven by entities on the federal level, with no involvement at either the state or local levels. Without the involvement of local authorities between the federal level and individual firms, any policy aimed at promoting green technology will continue to be difficult to implement. As mentioned above, most local firms don't understand the policy clearly, or even understand what "green technology" is. Given that the majority of the firms getting grants from the National Green Technology Policy are concentrated in Kuala Lumpur and Selangor—a city close to the capital—it seems fair to assume that the subsidized firms are getting their information about the policy from the (nearby) national authorities, rather than through the local authorities.

The same could be said of the low-carbon blueprints that are promulgated at the regional level, which don't connect to any planning to the local level. The Iskandar Low-Carbon Society Blueprint 2025, for example, is mainly initiated by the regional IRDA. Therefore, its

effectiveness mainly lies in whether it can be incorporated into local land-use planning. However, policies and guidelines regarding to reducing the energy and carbon emissions intensity of rapid growth have yet to "find their way into the lower-level development policies, plans, and guidelines that are more effective and detailed in guiding and regulating physical-spatial development."[ix]

Incentive policies go to the business side

Green technologies are relatively expensive at the beginning, but become more reasonable if their associated costs are calculated across the relatively long lifespans of those technologies. Therefore, government support and incentives are critical for stimulating nascent green investments. However, Malaysia has not yet fully embraced the concept of stimulating demand on the part of end users—a policy for which there is ample precedent. For example, in order to support the domestic electric car market, U.S., Holland, Iceland, and some other countries have provided tax incentives to consumers. "People say that developing countries concentrate too much on subsidies and incentives, but actually, it's a worldwide scenario," a KeTTHA official told us. "The lifestyle of consumers is very much related to incentives and subsidies. So the same thing is going to happen in Malaysia. That is why we have to come up with something more sustainable kind of approach."

Evaluations are necessary for future policies to build on six years of implementation experience

So far, even after six years of implementation of its Green Technology Policy and the launch of more than 300 projects under its auspices, KeTTHA has not launched any evaluation of its efforts. Because of the lack of monitoring of project outcomes, it is difficult to know if the implementation of the policy has achieved its desired ends: promoting economic growth and protecting the environment. To be fair, planning for such an evaluation is underway as of this writing. Having its results in hand is a critical prerequisite to mapping out future policies on all levels of government.

Conclusion and policy prescriptions

Moving downward within the government hierarchy, promoting far more engagement from local governments and providing easier access to companies

As noted, engagement with state and local governments is an urgent need for future implementation and dissemination of green technology. In Malaysia, some local governments have already begun planning for implementation. They have come up with their own initiatives, such as joint ventures with foreign institutions. For example, the Petaling Jaya city council and Subang Jaya city council have partnered with the UK carbon trust and the University of Leeds to develop a smart city

framework. Both of these city councils are comparatively wealthy, and have the funding to implement projects. This is not true in other parts of the country, where most states lack the financial capacity. This demonstrates the importance of the federal government supporting local governments to promote green technology.

Enhancing and expanding the relevant information channels

Currently, information is mainly being disseminated though three channels: KeTTHA at the federal level, Green Tech Corporation-Public corporation from the federal level, and the commercial banks. All evidence suggests that this is insufficient. Getting attention from industrial firms and the public should be the next step. Local governments, associations, universities, and schools can have more influence on disseminating information about green technology.

Urgent need to evaluate project outcomes

We've already referred to the need for an overall policy evaluation. On the ground level, too, evaluations should be performed on the costs and benefits of each project carried out under the auspices of the national policy. What is the cost of the project? What is the percentage of grants that the project can receive from the incentive policies? What were the incentives used? Do the entrepreneurs continue the projects after the incentives have finished? What are main areas of support that firms need from the governments? How do they think green technology will benefit industrial firms? What was the impact on emissions and energy use?

Reconsidering the policy targets based on the evaluation and responses from various entities

Clearly, Malaysia enjoys good conditions for the exploitation of solar energy. The risk, though, is that the government will overinvest in that one sector. It should also look to other areas of green technology—for example, biomass—which if successful might position Malaysis to become a sectoral hub in that field across Southeast Asia.

Acknowledgements

The authors are grateful to MIT-UTM Malaysia Sustainable Development Program (MSCP) for financial support. We would also like to thank the stakeholders who provided various resources and otherwise made themselves available to participate in our research.

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Notes

[i] *When Green Tech Was Born*, Greentech Media 2015
[ii] *When Green Tech Was Born*, Greentech Media 2015
[iii] Simply stated, this is the circumstance in which a country that—thanks to inherent advantages—achieves a certain income level, but then gets stuck at that level.
[iv] Source: Tham and Loke 2011
[v] Source*:* World Bank data
[vi] Source: World Bank data
[vii] Source: www.kettha.gov.cn
[viii] Source: www.kettha.gov.my
[ix] Iskandar Low-Carbon Society Blueprint 2025