Evaluating the Performance of the Sustainable Energy Development Authority (SEDA) and Renewable Energy Policy in Malaysia

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Abstract

Conceived in 2011, the Sustainable Energy Development Authority (SEDA) holds the mandate of boosting the share of renewable energy (RE) in national electricity generation. Seven years since its conception, this report serves as an evaluation and critique of the performances of both the Authority, and the RE policies enacted in Malaysia. Two of the key policy measures implemented and administered by SEDA – the feed-in tariff (FiT), and net energy metering (NEM) – have both fallen short of achieving the targets for RE power generation set within the National Renewable Energy Policy and Action Plan (NREPAP).

This is particularly discouraging, given that the NREPAP indicated a strong understanding of the issues facing the RE sector in Malaysia, and provided a holistic framework that, if adhered to, would have culminated in a substantial increase in the deployment of the nation's vast RE resources. A factor that has played a major role in contributing to this failure relates to the design of policy frameworks that have led to a severe lack of financial sustainability, and, further, seem to be beholden to the interests of Malaysia's powerful distribution licensees (DLs). In addition, issues of corruption and cronyism have consistently plagued the awarding of contracts for RE power generation – a feature that extends beyond the FiT and NEM mechanisms.

SEDA must remain true to its ambitions, and steadfast in its pursuits, moving forward. Should the progress of RE deployment persist at its current trajectory, there is little hope of Malaysia achieving the national RE targets set within the NREPAP in the foreseeable future. There would be even less hope of Malaysia honouring the international pledges it has made with regard to the climate change mitigation. Recent changes in federal governance, however, offer a tremendous opportunity for the review and revamp of current RE policy frameworks in place. It is hoped that the recommendations presented in this paper are taken into consideration as Malaysia launches a fresh push towards the implementation of climate-friendly measures and policies.

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1.0 Introduction

The creation of the Sustainable Energy Development Authority (SEDA) was originally mooted in the National Renewable Energy Policy and Action Plan (NREPAP)[1], designed in 2009. The NREPAP is a well thought-out, forward-looking plan aimed at stimulating the development and deployment of renewable energy (RE) technology across Malaysia, so as to achieve goals of energy security and sustainability, while boosting a nascent industry that, over the coming decades, will play an important role in the mitigation of climate change.

This paper serves as a review, analysis, and critique of SEDA's achievements in its seven-year existence thus far. Section 2 sets the stage with a brief history of the events leading to the conception of SEDA, by focusing on developments within Malaysia's RE landscape between 2001 and 2009. The lessons learned from three RE policies enacted in this time set the stage for the NREPAP, as well as the RE and SEDA Acts, which were passed into law in 2011. The RE Act introduced the feed-in tariff (FiT) and renewable energy fund (REF) mechanisms, and the concurrent SEDA Act established SEDA itself, as the agency tasked with the implementation and management of the FiT policy and its related mechanisms.

Section 3 details the mechanics of a FiT and the theory that underlies this policy, as well as providing a quantitative analysis of the progress made in proliferating the deployment of RE technology in Malaysia under the FiT framework. Section 4 takes a step back from the numbers and analyses a variety of challenges faced by SEDA during the course of the FiT programme. Many of these challenges have influenced Malaysia's failure to achieve its RE targets. Section 5 describes two of the more recent policy measures aimed at increasing the national deployment of RE technology; net energy metering (NEM), and large-scale solar (LSS). Particular attention is paid to the former, which has been active since late-2016, and this section provides an analysis of the progress made as a result of the NEM thus far. Section 6 provides an overview of the roles that SEDA should look to

[1] Ministry of Energy, Green Technology and Water (2009), *National Renewable Energy Policy and Action Plan*.

play in the future, given the conclusions of the preceding four sections, while Section 7 concludes with the overarching lessons learned from this paper.

2.0 The History Behind the Establishment of SEDA

The necessity of the establishment of SEDA, as a proposed 'implementing agency' focused on spurring the development and deployment of RE in Malaysia, is first highlighted in the NREPAP. This document, alongside outlining strategies aimed at encouraging the widespread adoption of renewable energy in Malaysia, lists a host of functions that would fall under the purview of such an 'implementing agency'. This list is reproduced in Table 1.

Table 1: Functions of the Renewable Energy 'Implementing Agency'[2]	
1	Management and approval of FiT applications
2	Determining the applicable FiT based on commercial operation data for REPPs
3	Evaluating the technical competency of REPPs for license recommendations to ST
4	Evaluating the technical competency of RE equipment for fiscal incentive recommendations to MIDA
5	Providing the facilities for the SME-RE Centre
6	Providing the facilities for the RE Fund
7	RE data collection
8	RE reporting
9	RE advocacy

The NREPAP stressed the need for an overhaul of Malaysia's RE policies, in order to stimulate "sustainable and forward-looking renewable energy development in the country […] in a systematic and aggressive manner". It recognises the importance of the role that the 'implementing agency', or SEDA, would play in order to achieve these goals, with particular emphasis placed on its implementation, management, and administration of the FiT and related REF mechanism. The FiT was designed to address two common pitfalls which typically hinder the progressive deployment of RE technology; the inherent market failures in electricity generation, and the absence of long-run price (and, consequently, revenue) certainty to RE project investors.

[2] Tables 1, 2, and 3 are adapted from the National Renewable Energy Policy and Action Plan (NREPAP), 2009.

2.1 Renewable Energy Policy Programs in the pre-SEDA Era

The NREPAP acted as an informed response to three RE policy programs in place between 2001 and 2009; the Small Renewable Energy Power Programme (SREP); the Biogen Full Scale Model Demonstration Project (Biogen FSM); and the Malaysia Building Integrated Photovoltaic Project (MBIPV).

2.1.1 The 'Small Renewable Energy Power' Programme

Implemented in 2001, the SREP allowed RE power producers (REPPs) with a generation capacity of under 10 megawatts (MW) to "export electricity to the utility company through the distribution grid system". Particularly popular RE technologies under this program included biogas, biomass, small-hydro, and solid waste. Energy prices were proposed to be negotiated between REPPs and the relevant distribution licensee (DL; Tenaga Nasional Berhad, or TNB, on the Peninsular, and Sabah Electricity Sdn Bhd, or SESB, in Sabah), with payments to be made on a 'take-and-pay' basis. This means the REPPs were only compensated if the DLs 'took' the electricity generated over a particular period. By 2009, 53MW of RE generation capacity was connected to the electricity grid through this program. This figure represented 0.2% of Peninsular Malaysia's total installed electricity generation capacity of 21,817MW that same year.

Several issues plagued the SREP throughout the duration of its existence. The first of these related to financing; REPPs were required to meet their upfront funding needs through either internally-generated funds, or the acquisition of loans from commercial financial institutions. They were also required to bear the cost burden of grid interconnections. These issues imposed financial constraints on approved REPPs even before the commencement of commercial operations. At the same time, returns on investments for these REPPs was not guaranteed given the existence of the 'take-and-pay' mechanism. In most cases, these returns were anyway insufficient. REPPs were compensated at a rate of RM0.17/kWh, which rose to RM0.21/kWh in 2007 for biomass and biogas producers. While these rates were mandated by SREP guidelines to be discussed between the relevant parties, they were instead 'declared' by the then-Ministry

of Energy, Water, and Communications (later restructured as the Ministry of Energy, Green Technology and Water). In any case, the existence of a single buyer (in the form of the relevant DL) would have created an unequal bargaining position between the DL and REPPs, with the former theoretically able to exercise its monopsony power to squeeze the latter into accepting prices too low to ensure sufficient returns on investment.

Further, issues pertaining to RE fuel supply were particularly apparent for biomass and biogas power producers. These producers, reliant on fuel sources such as palm oil empty fruit bunches (EFB), palm oil mills effluent (POME), rice husk, and wood residue, often faced difficulties in obtaining long-term fuel supply agreements at attractive rates, with suppliers of these fuel sources also exerting their market power and imposing onerous economic terms and conditions on REPPs. This had the knock-on effect of diminishing the viability of RE projects, as the DLs could not be guaranteed a consistent, long-run RE supply from these power producers.

This confluence of factors drastically hindered the success of the SREP program. Sovacool and Drupady (2011) provide a thorough analysis of the shortcomings, and subsequent takeaways, of the SREP program[3].

2.1.2 The 'Biogen Full Scale Model' Demonstration Project

The Biogen FSM project, which commenced in 2002, aimed to "catalyse the development of RE projects through […] biomass and biogas grid connected power generation projects", and represented a cooperative effort between the Malaysian Government, and the United Nations Development Programme's Global Environmental Facility (UNDP-GEF). Despite strong initial participant interest, only two FSM projects were commissioned as of 2010: a 13MW biomass power plant operated by MHES Asia, using EFB as a fuel source, and a 500kW biogas power plant operated by FELDA, using POME as a fuel source. Financial issues were, again, apparent with the Biogen FSM project. Many initially-interested

[3] Sovacool, B.K and Drupady, I.M (2011), *Examining the small renewable energy power (SREP) program in Malaysia.* Energy Policy, 39 (11). pp. 7244-7256.

parties, put off by the "lack of adequate or sufficient returns on investment", withdrew from the application process. MHES Asia, too, faced numerous fiscal issues during the implementation process, including delays in obtaining loan approvals from local financial institutions. More emphasis should be placed on the development of a comprehensive financing framework for RE investments.

2.1.3 The 'Malaysia Building Integrated Photovoltaic' Project

Launched in July 2005 and co-financed by the Malaysian Government, UNDP-GEF, and private sector players, the MBIPV project set out to achieve two tangible objectives: a 20% reduction in the unit cost of solar PV installations, and a 330% increase in solar PV capacity, relative to 2005 baseline levels. Through this, the ambition was to develop a sustainable solar PV market through long-run reductions in the cost of the technology. Of all the pre-SEDA energy policies adopted in Malaysia, the MBIPV was the most successful in terms of meeting its objectives.

Part of the success of the MBPIV program was due to the efforts of the local solar PV industry umbrella organisation, the Malaysian Photovoltaic Industry Association (MPIA). Designed to resemble the European Photovoltaic Industry Association (EPIA) in terms of structure and functionality, the MPIA has been responsible for the conduct of conferences, events, and training programs concerning the solar industry in Malaysia. Its efforts have contributed to increases in the quality, and reductions in the cost, of solar PV installations. The MPIA, consequently, plays a critical role in the approval and certification of local BIPV service providers[4].

By the time the program was phased out in 2010, the aforementioned targets had been exceeded; PV installations had seen a 39% reduction in price between 2005 and 2010, aided in part by the swift global decline in the cost of solar PV technology, and PV capacity had achieved an increase of 439%, from 470kWp to 2,054 kWp. Further, foreign direct investment (FDI) in the photovoltaic sector reached US$4bn, and the industry saw the creation of over 5,000 jobs across the nation, according to a report co-published by the

Government of Malaysia and UNDP-GEF[4]. Malaysia now stands as the world's third-largest producer of solar PV cells and modules[5], though the majority of local production is currently exported. More emphasis should be placed on policies that encourage and stimulate the domestic consumption of locally-produced solar PV technology.

2.2 The *Renewable Energy Act* of 2011

The lessons derived from the successes and failures of the three major RE policy programs described in Section 2.1 are summarised in Table 2, and the subsequent action items deemed necessary to achieve successful and sustainable RE development are summarised in Table 3.

These set the stage for the *Renewable Energy Act 2011* (RE Act), which strives to ramp up the generation of electricity from renewable energy sources (particularly solar PV, biogas, biomass, and small-hydro), through the establishment of the FiT and REF mechanisms. It highlights the importance of an 'implementing agency' tasked with the implementation, management, and administration of both the FiT and REF. This is where SEDA, as the 'implementing agency', comes into the picture, with the introduction of the *Sustainable Energy Development Authority Act 2011* (SEDA Act).

Table 2: Lessons Learned from pre-SEDA RE Policies	
1	Market forces are insufficient in the pursuit of desired outcomes, in the presence of financial and technological constraints.
2	There is a need for the introduction of an informed, efficient RE price setting mechanism that takes into account financial implications for power producers, the purchasing utility, and consumers.
3	There is a need for the societal sharing of the cost burden of RE; electricity tariffs need to be revised upwards to prevent a 'regulatory squeeze' being imposed on the utility company.
4	There is a need for a proper regulatory framework that addresses specific market failures and constraints, and signals the Government's commitment towards increasing the deployment of RE technology.
5	Strong governance is required to positively influence the participation of stakeholders, and the legitimacy of RE policies.
6	Regulatory oversight, and policy implementation, need to be under the purview of separate, transparent, and accountable organisations. This would allow for efficient monitoring of progress and rectification of problems.
7	Information asymmetries must be addressed in order to minimise the impact of market failures
8	Access to accurate information is necessary to assist the RE investment decisions of private actors.

[4] Government of Malaysia, UNDP-GEF (2011), *Final Evaluation Report: Malaysian Building Integrated Photovoltaic Project (MBIPV).*
[5] http://www.mida.gov.my/home/3052/news/pvcelltech-2016-reaffirms-malaysia's-position-as-leader-for-new-cell-fabrications-in-asean/

Table 3: Actions Required for Sustainable RE Development	
1	The introduction of a regulatory framework that: a) addresses issues of market failure pertaining to RE power producers and investors, including information asymmetries, financial and technological constraints, and long-run price certainty; b) minimises regulatory and political capture by interested parties; c) sets RE prices based on concrete and clear economic principles, that allows financiers in RE technology to recoup investment costs; d) establishes an effective 'implementing agency' for RE development; e) provides a mechanism through which society-at-large progressively contributes to financing the development and deployment of RE technology; f) creates a fund into which societal contributions are paid, and determines the manner in which these funds are utilised.
2	Development of a cost-sharing mechanism, in the form of an RE Fund, that determines societal payment obligations, and identifies the terms of operation and use of the Fund.
3	Introduces the clarity of roles between the 'implementing agency' and the 'oversight agency', to ensure full accountability.
4	Dissemination of relevant and pertinent information to firms intending to participate in the RE industry, so as to minimise instances of information asymmetries.

2.3 The *Sustainable Energy Development Authority Act* of 2011

Both the NREPAP and RE Act introduced the role of SEDA as an 'implementing agency' tasked with the implementation, management, and administration of the FiT and REF. A select but comprehensive list of the functions assigned to SEDA, reproduced from the SEDA Act, is provided in Table 4.

Table 4: Functions of SEDA[6]	
1	Provide advice to Ministers and Ministries on matters relating to RE, including recommendations on policies, laws, and actions in promoting the use of RE.
2	Promote and implement national policy objectives for RE, as well as promote, stimulate, and facilitate RE use.
3	Implement, manage, monitor, and review the FiT mechanism, and maintain thorough data pertaining to the performance of this policy mechanism. This includes administration and control of the RE Fund, from which feed-in approval holders are paid tariffs based on FiT rates declared by the Authority.
4	Implement sustainable energy laws and recommend reforms to such laws to the Federal Government.
5	Conduct, or organise the carrying out, of research, and provide information pertaining to RE, to Government entities, investors or potential investors in RE, and the public.
6	Conduct, promote, and support research and innovation efforts in the field of RE.
7	Conduct, promote, and support programs aiding the development of human resources and capacity building in the RE sector.
8	Implement measures aimed at promoting public awareness and participation on matters pertaining to RE.

Given the lessons learned from pre-SEDA RE policies (Table 2), the understanding of the action necessary to achieve sustainable RE development (Table 3) and following an assessment of the potential electricity generation capacity of RE resources indigenous to

[6] Table 4 is adapted from the Sustainable Energy Development Authority Act (SEDA Act), 2011.

Malaysia, the NREPAP laid out targets pertaining to the utilisation of RE resources in Malaysia, up to 2050. These targets are reproduced in Table 5.

Table 5: Renewable Energy Targets[7]

Year	Cumulative Total RE Capacity (MW)	RE Share of Electricity Capacity
2011	217	1%
2015	975	6%
2020	2,065	10%
2025	2,809	12%
2030	3,484	13%
2035	4,317	15%
2040	5,729	19%
2045	8,034	25%
2050	11,544	34%

In 2015, however, RE capacity in Malaysia totalled a mere 446MW, just over 45% of the aim of 975MW, for an electricity capacity share of under 3%[8]. This stands out as a striking failure of policy execution, particularly given the comprehensive planning involved in the conception of the NREPAP, and the consequent RE and SEDA Acts. It is precisely this failure which sets the stage for Section 3 of this paper, which analyses the FiT and REF mechanisms that represent a crucial component of SEDA's responsibilities

[7] Table 5 is adapted from the NREPAP, 2009.
[8] Suruhanjaya Tenaga (2017) *Peninsular Malaysia Electricity Supply Industry Outlook 2017*, pp. 29.

3.0 The Feed-in Tariff Experience under SEDA

As described in Section 2, the FiT, and related REF mechanism, represented a critical component of the NREPAP, which itself set the tone for the subsequent RE and SEDA Acts. Theoretically, these mechanisms have the potential to address many of the common pitfalls that hinder the progressive deployment of RE technology. These pitfalls, made apparent through the successes and failures of the pre-existing RE policies summarised in Section 2.1, include inherent market failures in electricity generation, and the absence of long-run price certainty to investors in RE projects. The FiT mechanism sought to alleviate these burdens. This section of the paper will first provide a theoretical overview of FiTs and how they assist in spurring the adoption of RE technology, before analysing from a quantitative perspective the impact that the FiT mechanism has had on RE power generation in Malaysia since the gazetting of the relevant Acts of Parliament in 2011.

3.1 The Theoretical Basis of Feed-in Tariffs

Feed-in tariffs represent an attempt to address the risks, or pitfalls, inherent in RE markets. Within the Malaysian context, FiTs are comprised of long-term supply contracts between REPPs and DLs; TNB and SESB. Under these contracts, REPPs receive per-kWh payments for selling electricity to the utilities at guaranteed – and favourable – predetermined rates, allowing REPPs to make healthy returns on their investments. This is an especially critical aspect of the FiT mechanism, given the evidence of troublesome financial experiences faced by RE investors during the course of the SREP and Biogen FSM policies. The length of these contracts is fixed at 16 years for biomass and biogas power producers, and 21 years for small-hydro and solar PV power producers. This assists REPPs by providing them sustainable, long-term certainty over the returns on their high upfront-cost investments.

In order to mitigate the financial burden imposed on the utilities themselves through the FiT mechanism, the Renewable Energy Fund (REF) was concurrently introduced. While partially funded by the Federal Government, the majority of the REF is financed through surcharges on electricity bills paid by domestic electricity consumers. Households consuming more than 300kWh each month are liable to pay for this surcharge, which

started out at a rate of 1% during the first two years of the existence of the FiT, and rose to 1.6% at the start of 2014. In a sense, this represents the imposition of a progressive burden on electricity consumers; households with the largest electricity consumption are those contributing the most to the REF, and thus towards RE power generation. It is worth noting that only 25% of domestic electricity consumers fall into this bracket.

3.2 A Quantitative Review of the FiT Experience in Malaysia

Due to concerns over the ability to finance the FiT mechanism, given that a significant proportion of the financing for REF is derived from the fixed-percentage RE surcharge on domestic electricity consumption, SEDA imposed caps, or quotas, on the installed capacities of REPPs eligible for FiTs. These 'FiT quotas', by year and RE source, are reproduced in Table 6.

Quotas are postulated to act as a barrier towards the full development of national RE markets by limiting the quantity of newly installed RE capacity. Mendonca et al (2009) provide a thorough examination of the effects of the inclusion of capacity quotas, or caps, in any FiT mechanism[9]. An analysis of capacity caps suggests that they are burdensome when it comes to the development of necessarily consistent and sustainable RE markets. Past experience, in nations such as Germany and Spain, suggests that the imposition of such caps propagates 'stop-and-go' cycles, where markets tend to heat up prior to the attainment of a particular quota, but come to a halt once that quota is reached. This tends to lead to a temporary collapse of the market, which bounces back only when a fresh quota is introduced. A key issue that arises from such a situation is that the creation of a national market for RE requires sustainable, and predictable market growth, as well as stable supply chains. Capacity caps, or quotas, inhibit this from happening.

It is therefore crucial to consider measures that circumvent the need to impose capacity quotas on the FiT. Given that the shift towards RE across the country is a national need, the federal government has a responsibility to partially fund the mechanisms put in place to achieve this need. Malaysia's annual budgets should include contributions to the REF,

[9] Mendonça, M; Jacobs, D; Sovacool, B.K (2009), *Powering the Green Economy: The Feed-in Tariff Handbook*, Earthscan: London.

for a start. Additional funding could also arrive in the form of proceeds from carbon, or emissions, taxes. A discussion of such a proposal is beyond the scope of this paper, but the imposition of a tax on heavy emitters of greenhouse gases is widely considered by economists to be the optimal response to the issue of climate change[10,11] – the very issue that is spurring the shift towards RE at the expense of fossil fuel energy sources. Revenue raised through this tax should be channelled towards policies implemented to increase the deployment of RE in Malaysia, and this includes the FiT.

Table 6: FiT Quotas, by Year and RE Source[12]

Year	RE Source, *MW*						
	Biogas	Biomass	Small Hydro	Solar PV (Individual)	Solar PV (Non-Individual)	Solar PV (Community)	Totals
2012	30	60	30	5	45	0	170
2013	30	50	30	11	45	0	166
2014	25	50	45	13	51	5	189
2015	31	18	0	26	54	7	136
2016	25	20	50	15	53	7	170
2017	15	30	100	15	24	7	191
Totals	156	228	255	85	272	26	**1,022**

Another explanation for the existence of capacity quotas for RE power generation through the FiT scheme is the exertion of the influence held by the DLs themselves. As the amount of energy produced by independent REPPs increases, the electricity market share of TNB on the Peninsula, and SESB in Sabah, will decrease. In the context of the Malaysian electricity market, the enormous weight held by TNB, particularly, opens the door to potential conflicts-of-interest between SEDA, tasked with boosting the share of RE generation across the nation, and TNB, tasked with protecting its market share and maximising profits. Thus, the possibility that the imposition of these restrictions was in some capacity influenced by TNB cannot be discounted.

Tables 7 and 8 highlight the cumulative number, and capacities, of approved FiT projects, and FiT projects achieving commercial operations, respectively. Table 9 calculates the share of these approved FiT projects that achieve commercial operations as of a particular

[10] https://www.nytimes.com/2015/06/07/opinion/the-case-for-a-carbon-tax.html
[11] https://www.brookings.edu/opinions/the-tax-favored-by-most-economists/
[12] Tables 6 through 12 are derived from data available within SEDA's Annual Reports between 2011 and 2016.

year. By the end of 2016, the cumulative FiT quota released for biogas, biomass, small hydro, and solar PV technologies was 831MW. At that point, nearly 1350MW worth of RE projects utilising these technologies were approved, yet only 420.94MW, or 31.1%, of this electricity generation capacity was commercially operational.

Table 7: Approved FiT Projects

RE Source	2012		2013		2014		2015		2016	
	No.	*Capacity (MW)*	*No.*	*Capacity (MW)*	*No.*	*Capacity (MW)*	*No.*	*Capacity (MW)*	*No.*	*Capacity (MW)*
Biogas	13	20.53	20	29.53	68	111.69	92	164.02	112	197.37
Biomass	15	146.29	18	166.49	31	303.79	37	348.79	41	372.28
Small Hydro	18	115.05	22	130.99	34	264.84	36	279.64	45	353.29
Solar PV (Individual)	781	12.33	2,448	26.28	4,065	40.15	6,545	60.54	9,994	92.67
Solar PV (Non-Individual)	133	156.65	252	182.70	342	210.41	449	258.01	668	324.10
Solar PV (Community)	0	0.00	0	0.00	91	1.72	277	6.26	403	9.65
Cumulative Approved Applications	**960**	**450.85**	**2,760**	**535.99**	**4,631**	**932.60**	**7,436**	**1,117.26**	**11,263**	**1,349.36**

Table 8: FiT Projects Achieving Commercial Operations

RE Source	2012		2013		2014		2015		2016	
	No.	*Capacity (MW)*	*No.*	*Capacity (MW)*	*No.*	*Capacity (MW)*	*No.*	*Capacity (MW)*	*No.*	*Capacity (MW)*
Biogas	5	7.41	5	8.53	6	11.73	11	20.23	18	30.89
Biomass	5	50.40	5	50.40	5	55.90	6	68.40	7	75.40
Small Hydro	5	15.70	5	15.70	5	15.70	5	18.30	6	30.30
Solar PV (Individual)	111	2.21	1,326	15.54	2,773	29.00	5,418	50.79	6,289	58.56
Solar PV (Non-Individual)	29	22.81	86	57.76	195	131.03	308	178.01	382	222.32
Solar PV (Community)	0	0.00	0	0.00	0	0.00	102	1.68	183	3.47
Cumulative Commercial Operations	**155**	**98.53**	**1,427**	**147.93**	**2,984**	**243.36**	**5,850**	**337.41**	**6,885**	**420.94**

It is worth noting the disparities, by RE source, in the shares of approved applications achieving commercial operations. Much of this comes down to the heterogeneity in installation times for each of these technologies; solar PV achieves the quickest turnaround in this regard, while the relatively high operationalisation rates seen for biogas and biomass installations in 2012 and 2013 were driven largely by these REPPs migrating from the SREP to FiT programs. In any case, the fact that only under 421MW of RE

electricity generation capacity was added through the FiT mechanism, given the set RE targets, is grounds for disappointment.

Table 9: Share of Approved Applications Achieving Commercial Operations					
Source / Year	**As of 2012**	**As of 2013**	**As of 2014**	**As of 2015**	**As of 2016**
Biogas	38.46%	25.00%	8.82%	11.96%	16.07%
Biomass	33.33%	27.78%	16.13%	16.22%	17.07%
Small Hydro	27.78%	22.73%	14.71%	13.89%	13.33%
Solar PV (Individual)	14.21%	54.17%	68.22%	82.78%	62.93%
Solar PV (Non-Individual)	21.80%	34.13%	57.02%	68.60%	57.19%
Solar PV (Community)	N/A	N/A	0.00%	36.82%	45.41%

Figure 1: Capacity Targets vs. Approved, and Commercially Operational FiT Projects

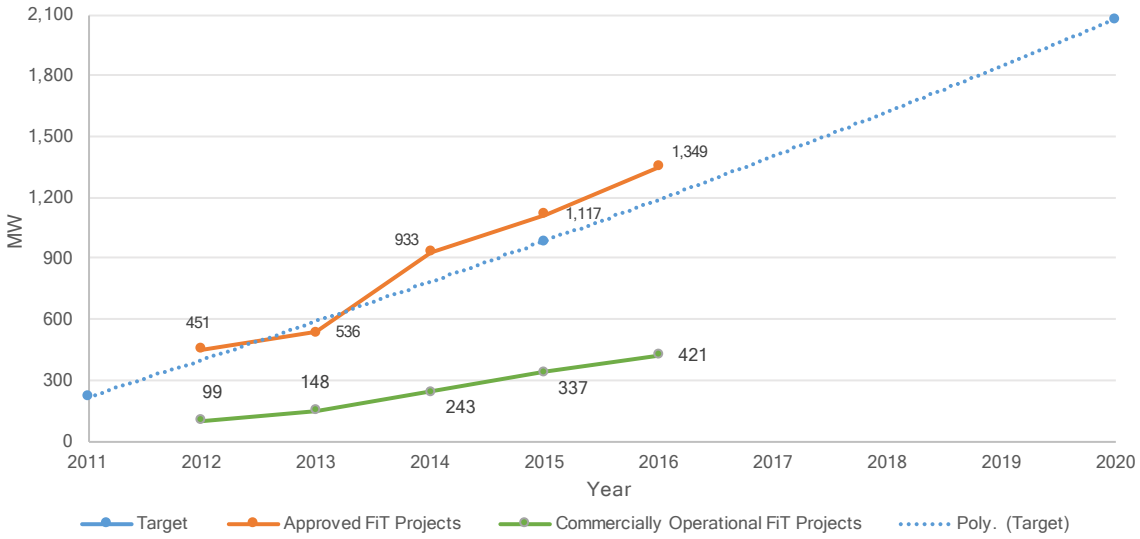


Figure 1, meanwhile, is an illustrative exercise that highlights the fact that had all approved FiT projects achieved commercial operations the same year they were approved, Malaysia would exceed its official RE goals. While this represents an impossible target – even in fast-track mode, construction of an average power plant takes at least 18 to 24 months – any reductions in the turnaround time between project approval and operationalisation would increase RE generation capacity in every given year. Meeting set deadlines should be a contractual obligation, with levels of stringency varying by RE source. Missing them should result in a review of contractual terms.

Table 10 highlights annual contributions towards the REF. These contributions, as mentioned in Section 3.1, are derived from surcharges imposed on domestic electricity consumers. The distinctions in REF collections are apparent between the periods of 2012-2013, when the RE surcharge rate was 1%, and 2014-2016, when the RE surcharge rate rose to 1.6%. During the initial period, the average collection was RM308.7 million, compared to RM674.9 million following the surcharge hike. It is questionable, however, if this surcharge hike had much of an effect on successfully increasing the deployment of RE technologies as a result of the FiT mechanism, based on the data presented in Tables 7 and 8. It is also unclear if this surcharge rate was in any case high enough to ensure the financial sustainability of the FiT; for comparison, equivalent rates in China, Japan (both 3%), the United Kingdom (2 to 3%) and Germany (18%) are all higher. SEDA, for its part, has raised concerns about the relatively low RE surcharge rate in the past[13].

Table 10: Renewable Energy Fund					
Collections (in RM)	**2012**	**2013**	**2014**	**2015**	**2016**
Annually	219,241,907	398,212,980	612,793,682	657,881,185	753,972,002
Total Balance	510,614,959	844,968,896	1,301,688,742	1,749,252,425	2,236,153,690
RE Surcharge Rate	1%		1.6%		
Average Collection by Period	**308,727,444**		**674,882,290**		

[13] http://www.seda.gov.my/?omaneg=000101000000010101010001000010000000000000000000000&y=45&s=3254

4.0 Challenges Faced by SEDA

This section will elaborate on some of the political, economic, and energy-related challenges faced by SEDA during the course of its existence thus far. Particular issues that will be examined in detail are:

i. The lack of transparency in the allocation of FiT solar PV quotas, including allegations of these quotas being 'rigged' to benefit connected companies and individuals;
ii. Difficulties faced by potential REPPs in obtaining the requisite financing to invest in RE technology;
iii. The incidence of cost burdens associated with grid connections;
iv. A sudden and unnecessary diversification towards geothermal energy;
v. The increasing reliance on coal-powered electricity generation, whose share of the electricity generation mix is projected by the EC to rise to two-thirds within the next decade;
vi. The reclassification of large-hydro power as a renewable energy source, despite such a classification being heavily-contested worldwide; and,
vii. Funding constraints, which have led SEDA to put an end to new applications for the FiT program for solar PV, in favour of Net Energy Metering (NEM).

4.1 The Lack of Transparency in Solar PV FiT Quota Allocations

An alleged issue of preferential treatment towards certain applicants was first raised by Members of Parliament Nurul Izzah Anwar and Tony Pua with regard to the allocation of solar PV quotas. They found that almost a third of the 1MW to 5MW quota in 2012 was awarded to 12 companies owned by the relative of a well-connected, retired civil servant[14]. While this claim of preferential treatment was disputed by SEDA, it shed light on an allocation process deeply lacking in transparency. SEDA's computerised 'first-come-first-served' application system, criticised by lawmakers and RE industry players, consisted of loopholes that allowed for the devising of application strategies designed to manipulate the system, and thus allow certain parties to obtain large shares of the quota.

[14] http://tonypua.blogspot.my/2012/07/tan-sri-sidek-hassans-daughter-won.html

Further, the application system often crashed, leading to chaotic and dissatisfactory outcomes for the majority of applicants[15,16]. Combined, these issues painted a picture of an unprofessional application procedure deeply lacking in transparency. Quotas should instead be allocated openly, and awarded to companies and individuals based on merit, technical competency, and competitive pricing. They should not be awarded to those with strong political and business connections, nor those most capable of gaming the application system for their own benefit.

It wasn't until June 2014 that SEDA finally conducted their first open-ballot session for the allocation of solar PV quotas[17]. This is what should have been done from the start of the FiT mechanism, in order to maximise fairness and transparency, and inspire confidence in the process. Even then, this open-ballot session pertained only to non-individual applicants for 10MW worth of solar PV quotas falling into the 'under-425kWh' category, and not the larger 425kWh to 1MW category.

While a step in the right direction, this did not represent the holistic overhaul of the application process that was necessary to ensure full transparency, and to mitigate instances of potential corruption and cronyism. The FIT quotas for applications 1MW and above were not awarded via open tender, but decided by KeTTHA, presumably with the approval of the Minister. This is especially concerning given that funding for the FiT mechanism comes from the pockets of citizens; Malaysians have a right to know where, or to whom, the surcharges on their electricity bills are going, and why. To echo recent comments by the Minister of Economic Affairs, Azmin Ali, it is imperative that the habit of engaging in direct negotiations comes to a halt, in favour of an era of fairness and transparency.

[15] http://www.seda.gov.my/?omaneg=000101000000010101010001000010000000000000000000000&y=45&s=3922
[16] https://dev.seda.gov.my/seda_prelaunch/?omaneg=000101000000010101010001000010000000000000000000000&y=45&s=3870
[17] http://www.seda.gov.my/?omaneg=000101000000010101010001000010000000000000000000000&y=45&s=3922

4.2 Financial Difficulties Faced by Potential RE Investors

As of the end of 2016, a cumulative total of 480MW of FiT RE applications had been refused or revoked[18], a total greater than the cumulative RE capacity that had achieved commercial operations by that time. Part of the struggles faced by applicants falling into these categories arose from inadequate or insufficient upfront financing, and in turn, the inability of prospective REPPs to obtain bank loans to support their investments.

More effort should be placed on the development of a 'green financing framework', including provisions for green bonds, green loans, and green sukuk, amongst other financing options. These would play an important role in alleviating the heavy fiscal burdens imposed on prospective REPPs. SEDA, with first-hand knowledge of the struggles faced by program participants, would be well-placed to assist in the development of such a framework. Dialogue should commence between KeTTHA and local financial institutions, private equity funds, and angel investors, seeking comprehensive solutions that would bridge the funding gaps in RE project development.

While the FiT mechanism allows RE investors to recoup their investment costs throughout the duration of their contracts, it does not do enough to assist individuals and smaller companies during the installation process. This is typically the most financially onerous part of the commissioning of new power-generation plants. If RE deployment is to take off at a quicker and more sustainable rate, suitable financing models need to be developed and put into practice moving forward. Hussain et al (2012), of the World Bank, provide an in-depth look into the development of financing instruments aimed at supporting the scaling-up of the deployment of RE technologies[19].

4.3 Cost Burdens of Grid Interconnections

Another issue adding to the financial difficulties faced by REPPs under the FiT program relates to the fact that these producers are held responsible for the cost of grid interconnections – provided that these RE power plants are accessing the grid via the

[18] Sustainable Energy Development Authority (2016) *Annual Report 2016*, pp. 50.
[19] Hussain, M.Z et al (2013). *Financing Renewable Energy: Options for Developing Financing Instruments Using Public Funds*. Washington DC: World Bank

closest connection point[20]. This is a particularly pertinent issue for non-individual REPPs whose power plants are located in off-grid areas; with the required upfront investment costs already high, having to bear the added financial burden of connecting their power plants to the grid in order to export their energy production to the DLs can act as a further deterrent to the deployment of RE technology. This is but another factor that has served to hinder the desired increase in RE power generation in Malaysia.

SEDA, acting on the ambition to increase the use of RE across the nation, should make more of an effort to further its agenda by assisting in the alleviation of the financial burdens faced by REPPs on this front – even if this means tackling the nation's energy sector behemoths. A cost-sharing mechanism between approved REPPs and the DLs for grid interconnections should therefore be proposed and enforced.

4.4 A Sudden and Unnecessary Diversification into Geothermal Energy

In November 2013, it was revealed that a 30MW geothermal energy contract was allocated by SEDA to Tawau Green Energy (TGE), via the opaque procedure of direct negotiation. Geothermal energy, however, was only entered as a category within the RE Act in December 2013, more than a month after this allocation announcement was made public. As mentioned in Section 4.1, it is imperative that the disbursement of quota allocations be conducted in an open and transparent fashion, and not done to benefit well-connected businesspeople and politicians. It is therefore greatly concerning that this 30MW contract was allocated to a company whose majority owner at the time was the son of the former Sabah Chief Minister Musa Aman[21].

It was also revealed that this project received RM35 million in public funding[22], with total project costs expected to ultimately exceed RM670 million. Further darkening the cloud over this project, slated to be housed in the middle of a protected forest reserve in Tawau, Sabah, is the fact that its completion date has been pushed back repeatedly, from 2015[22],

[20] Government of Malaysia (2011), *Renewable Energy (Technical and Operational Requirements) Rules 2011*.
[21] https://ongkianming.com/2014/05/02/media-statement-why-was-30mw-of-geothermal-fit-quota-allocated-via-direct-negotiation-to-tawau-green-energy-tge-which-is-majority-owned-by-sabah-umno-leaders/
[22] http://www.theborneopost.com/2012/05/10/rm419-mln-tawau-geothermal-power-plant-ready-by-2015/

to May 2016[23], to June 2018[24], and most recently to May 2019[25]. The TGE website, meanwhile, has not been updated since 2016[26]. In October 2017, it was announced that Ranhill Holdings Bhd, part-owned by the Employees Provident Fund (EPF), would be acquiring a 26.7% stake in TGE[27]. A site visit by Sabah DAP assemblyman Chan Foong Hin last year revealed that no work has begun on this project, aside from land-clearing. No news has since surfaced about TGE, or this proposed 30MW geothermal energy 'project'.

Given that the full potential of the other RE sources included in the FiT plans is far from exhausted (as is clear from Section 3); the fact that the NREPAP describes geothermal energy as a source whose potential in Malaysia is yet to be fully examined and verified; and the questionable nature of many aspects of this particular contract award, SEDA and KeTTHA should launch a full review of the contract, and if warranted, revoke the approval of TGE's FiT license.

4.5 The Projected Increase in Malaysia's Use of Imported Coal

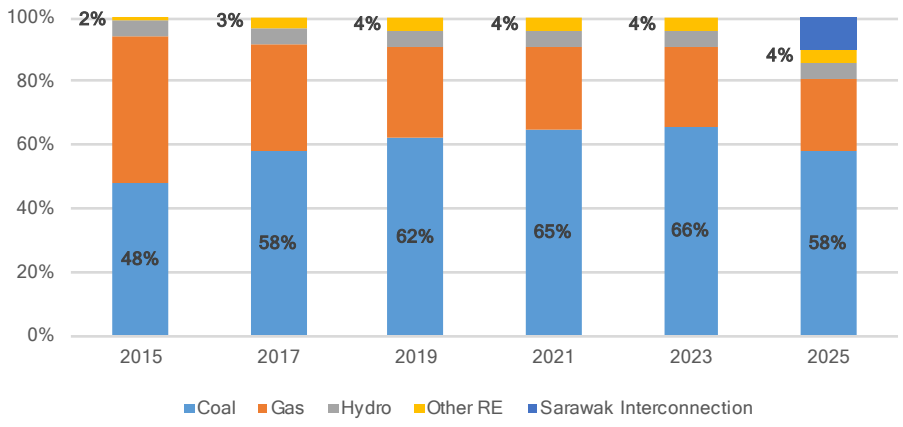
Rapid technological advancements in both the natural gas and renewable energy sectors are driving a swift decline in the costs of production for these energy sources. Coal, whose biggest asset relative to other energy sources is its price, is a major pollutant. Concerns over pollution and air quality, as well as the need for climate change mitigation action, have compelled many nations across the world to reduce their reliance on coal, in favour of cleaner sources of energy production.

As a result, it is highly disconcerting that between the start of the SREP program in 2001, and 2015, the quantity of electricity generated from coal has increased by over 850%, from 6,238GWh to 59,335GWh. The subsequent share of coal in electricity generation has risen from under 12.5% in 2001, to 46.7% in 2015[28]. The Energy Commission projects that coal use will continue to increase in Malaysia well into the 2020s, with its share

[23] http://www.theborneopost.com/2014/03/01/tawau-geothermal-power-plant-ready-by-may-2016/
[24] http://www.themalaymailonline.com/malaysia/article/minister-malaysias-first-geothermal-plant-to-be-operational-by-2018
[25] http://www.thinkgeoenergy.com/30-mw-apas-kiri-geothermal-project-in-malaysia-on-track-to-operate-in-2019/
[26] http://www.tgepower.com/
[27] https://www.thestar.com.my/business/business-news/2017/10/02/ranhill-acquires-26pc-stake-in-tawau-green-energy-for-rm18mil/
[28] Suruhanjaya Tenaga (2015) *Peninsular Malaysia Electricity Supply Industry Outlook 2015*, pp. 56.

forecasted to reach 62% by 2019, and peaking at 66% in 2023[29]. Figure 2 illustrates the projections for the electricity generation mix in Malaysia through to 2025, with a particular emphasis on the electricity generation shares of coal, and other RE (which includes biogas, biomass, solar PV, and small-hydro). Attention should be paid to the rates at which the share of coal increases, contrasted against the almost-negligible growth in the share of renewable energy to Malaysia's electricity generation mix.

Figure 2: Electricity Generation Mix, 2015 to 2025



Further, two new coal-fuelled power plants, contributing an additional 3GW to Malaysia's electricity generation capacity, are expected to come online by the end of 2019[30]. This raises strong questions about just how dedicated the EC and KeTTHA are to increasing RE deployment in the country, and whether they stand in the way of SEDA meeting its targets. Section 3.2 revealed that the FiT mechanism added under 421MW of RE generation capacity to the mix; this figure is almost six times less than the planned additions to Malaysia's coal capacity between 2017 and 2019.

This increasing reliance on coal acts directly against the overarching ambition of reducing greenhouse gas (GHG) emissions, and in the context of this report, casts an enormous shadow over the work that SEDA purports to do. Malaysia is already well behind its targets for RE generation capacity, and the emphasis placed on coal as an important energy

[29] Suruhanjaya Tenaga (2016) *Peninsular Malaysia Electricity Supply Industry Outlook 2016*, pp. 34.
[30] Suruhanjaya Tenaga (2017) *Peninsular Malaysia Electricity Supply Industry Outlook 2017*, pp. 27.

source will not help this situation. Moving forward, KeTTHA should revisit these plans to increase the use of coal across Malaysia, phase out old coal plants, and put an end to approvals of new coal-fuelled power plant projects.

4.6 The Reclassification of Large Hydro as a Renewable Energy Source

The classification of large hydroelectric power generators as an RE source is widely contested. Even the definition of what constitutes large-hydro itself is heavily debated, with numerous international agencies offering varying power-generation capacity ranges for the term.

For instance, in two separate publications, the International Renewable Energy Agency (IRENA) defines large-hydro as generators with a capacity of over 10MW[31], and 100MW[32]. The United Nations Industrial Development Organization (UNIDO) defines small-hydro plants as those with a capacity not exceeding 10MW[33], while the World Bank's International Finance Corporation (IFC) describes large-hydro power generators as those with a capacity of at least 100MW[34]. The International Energy Agency (IEA) refers to large-hydro power generators as those with a capacity exceeding 300MW[35], and the Intergovernmental Panel on Climate Change (IPCC) considers large-hydro plants to be those with a capacity exceeding 500MW[36]. There is therefore no strict global consensus on the definition of large-hydro, in the context of power-generating capacity.

Contention persists, too, with regard to whether large-hydro should fall under the category of RE in the first place. It should be noted that hydropower-at-large is considered a RE source, since it satisfies two key elements of the definition of RE: it is derived from natural process, and is replenished at a faster rate than it is consumed. Certain international organisations (such as the United Nations, the IEA, British Petroleum (BP), and the World Wildlife Fund (WWF)), as well as many civil society and environmental advocacy groups,

[31] International Renewable Energy Agency (2015), *Hydropower Technology Brief*
[32] International Renewable Energy Agency (2012), *Renewable Energy Technologies: Cost Analysis Series, Vol 1: Power Sector, Issue 3/5, Hydropower*
[33] United Nations Industrial Development Organization (2016), *World Small Hydropower Development Report 2016.*
[34] International Finance Corporation – World Bank Group (2015), *Hydroelectric Power: A Guide for Developers and Investors*.
[35] International Energy Agency (2010), *Renewable Energy Essentials: Hydropower*.
[36] Intergovernmental Panel on Climate Change (2009), *Special Report on Renewable Energy Sources and Climate Change Mitigation*.

contest the idea of large-hydro falling into this category, however. Even within the United States, there is state-by-state variation in the acceptance of large-hydro as a RE source. A major criticism of large-hydro relates to the fact that these plants have negative impacts on local environments, particularly through its effects on local biodiversity and ecology, relative to small-hydro alternatives[37].

It is against this contentious backdrop that large-hydro projects have been considered by the former KeTTHA Minister Maximus Ongkili to be a crucial component of Malaysia's total RE capacity. In January 2018, Ongkili claimed that 7,272MW, or 22% of Malaysia's total electricity generation, is derived from RE sources[38]. Included in this figure are the contributions of large-hydro projects. This is an unprecedented step for Malaysia; never before has large-hydro been included in calculations of the nation's RE capacity. Confusing matters further is the fact that a mere three years prior to this claim, Ongkili is quoted as questioning the classification of large-hydro as a truly renewable source of energy[39]: "Big dams […] would have a great impact on the environment. A vast area of rich ecosystem (sic) would be submerged and can only be recovered or replaced after 30 years or more. RE should not adversely affect the environment […]". What brought on this sudden shift in Ongkili's position on large-hydro?

It should be noted that large-hydro projects had been left out of calculations of Malaysia's existing and projected RE capacity in all the major RE policy plans, and Acts, quoted in this paper. The NREPAP, and the RE and SEDA Acts do not consider large-hydro projects as a part of their focus on the push towards enhancing the contributions of RE to national electricity generation. Malaysia's Biennial Update Report (BUR) to the UNFCCC, too, excludes the specific mention of large-hydro power generation as a measure towards mitigating national greenhouse gas emissions.

It is reasonable to attribute the sudden inclusion of large-hydro as a RE source as a tactic designed not only to overstate the contributions of RE towards power generation in

[37] https://waterkeeper.org/un-excludes-large-dams-from-renewables/
[38] http://www.bernama.com/en/general/news.php?id=1430801
[39] https://www.pressreader.com/malaysia/the-borneo-post-sabah/20150529/281745562987016

Malaysia, but also to mask the fact that policymakers have routinely failed to design appropriate measures that might aid in successfully meeting the targets set for RE power generation since the passage of the NREPAP, and the RE and SEDA Acts. Under the new Pakatan Harapan government, it is important that this consideration of large-hydro as a renewable source of energy is rescinded, due to concerns over ecology and biodiversity, and honest efforts are made to increase the deployment of biogas, biomass, small-hydro, and solar energy.

4.7 Funding Constraints and the Shift to Net Energy Metering for Solar PV

In November 2016, the Net Energy Metering (NEM) scheme for solar PV was announced by the former Prime Minister, Najib Razak, as a complement to the FiT mechanism. The driving force behind this policy shift relate to the financial constraints imposed upon the REF throughout the duration of the FiT program. Oversubscription of solar PV quotas, particularly, led to a situation where, according to Ongkili, "the RE Fund can no longer support additional RE projects without a corresponding increase in (the) FiT contribution from consumers"[40].

The NEM scheme involves an annual solar PV capacity quota of 100MW for Peninsular Malaysia and Sabah between 2016 and 2020, for a total of 500MW across the five-year period. The scheme is executed by the Ministry of Energy, Green Technology, and Water and regulated by the Energy Commission. SEDA's official role is to act as the 'implementing agency', the same role it holds with regard to the FiT mechanism. In reality, however, it is unclear if SEDA plays a much of a role in the implementation of this policy.

As Section 5 of this paper will highlight, the NEM scheme has been an abject failure thus far. It is deeply concerning that the two major RE policies of the past decade have thus far been severely unsuccessful in meeting their goals. Botched policy execution, weak-minded governance, and the unhindered influence of special and connected interests should shoulder a large part of the blame for this situation.

[40] Refer to Ongkili's keynote speech at the 3rd International Sustainable Energy Summit (ISES), on 5 April 2016.

5.0 Other Renewable Energy Initiatives and Challenges

This section analyses major RE initiatives embarked upon in Malaysia, in addition to the FiT mechanism. Section 4.6 introduced Net Energy Metering (NEM), and Section 5.1 provides further details regarding the theory that underlies this policy, as well as an analysis of the factors that have contributed to its failure thus far. Section 5.2 evaluates the state of large-scale solar (LSS) in the country, and pinpoints certain pitfalls that the Energy Commission should have avoided, and would be wise to watch out for as the implementation of this program progresses. Section 5.3 concludes this section by assessing the possibility of, and whether there is a need for, exploring RE sources beyond those that have been analysed in this paper thus far.

5.1 Net Energy Metering

The NEM scheme, which commenced in November 2016, covers solar PV installations, and aims to act as a complement to the FiT mechanism. Financial constraints relating to the REF, and consequently the FiT, formed the basis of this policy shift.

5.1.1 The Theoretical Basis of Net Energy Metering

NEM policies are widely used globally to foster private investment in RE technology. These schemes, when appropriately implemented, serve to boost the contribution of RE sources to domestic electricity grids. NEM allows for two critical mechanisms: the self-consumption of electricity generated by solar PV system users, and the selling of excess energy production to the DLs, at a prevailing 'displaced cost'. This policy provides two major avenues through which domestic electricity consumers can benefit; first, a degree of self-sufficiency in electricity generation leads to a reduced reliance on importing electricity from the DLs, and thus savings on utility bills; and second, consumers are able to sell their excess energy to the DLs, and in doing so claim 'electricity credits' on current and future electricity bills.

An immediate advantage of NEM over the FiT mechanism relates to the fact that prospective RE investors are able to circumvent the numerous hassles associated with obtaining FiT approval, in order to sell excess self-generated electricity back to the grid.

Due to the generous terms offered for solar PV electricity generation as part of the FiT, quotas were routinely oversubscribed. This has been highlighted in Section 4.7. This, in turn, imposed financial constraints on the REF, whereas NEM allows these funding issues to be avoided as it does not require public funding. Other benefits derived from NEM include its intrinsic ability to smooth out electricity demand, particularly during peak periods. It helps that the power-generation potential of solar energy also peaks during these high-demand periods, which typically occur during the middle of the day, with factories running and air-conditioners on. As more individual solar PV electricity generators connect to the grid, the burden imposed on existing power plants decreases. Finally, having a larger proportion of electricity generation come from a clean energy source, rather than coal or natural gas, introduces numerous environmental- and health-related benefits.

Two factors in particular are critical in dictating the success or failure of any NEM policy. The first of these pertains to the 'displaced cost', or the rate at which exporters of solar-generated electricity are compensated. Rates too low provide an insufficient incentive to encourage private investment in solar PV panels, and consequently renders it unlikely that RE targets will be met. At rates too high, as was the case with the FiT mechanism, oversubscription would become an issue, and given the lack of a NEM-equivalent to the REF, too large a financial burden would be imposed on the DLs who purchase the excess electricity generated by program participants.

The second factor relates to the length of rollover period, and the potential uses of the credits that private participants receive as a result of selling excess electricity to the grid. The imposition of short rollover period combined with expiring credits, for instance, may act as a deterrent towards would-be solar investors – unless the displaced cost is high enough to ensure these investors are able to make a return on their investment within the specified time period. This, however, is inefficient. Numerous U.S. states include indefinite rollover periods as part of their NEM policies, with electricity generation credits rolling over from month-to-month, in perpetuity. Some allow for the conversion of these credits into monetary compensation at the end of a pre-determined rollover period. With

others, credits expire at the end of the rollover period and are forfeited to the benefit of the DL, or utility company.

Ultimately, not all NEM policies are created equally, and there exists considerable variation in the design of such policies within and across nations. Both intuitive reasoning, and results-driven analysis, however, can serve to highlight conditions under which NEM policies are more likely to be successful, or unsuccessful, in achieving their goals. With this in mind, the next two subsections of this paper will detail, and evaluate the success of, the net energy metering policy as implemented in Malaysia.

5.1.2 Outlining NEM in Malaysia

Table 11: Net Energy Metering in Malaysia[41]	
Duration	November 2016, through (November) 2020.
Total Capacity Limits	500MW through 2020, with annual capacities capped at • 90MW for Peninsula Malaysia; • 10MW for Sabah. Within this, limits of: • 24MW/year for residential consumers; • 39MW/year for commercial consumers; • 37MW/year for industrial consumers.
Individual Capacity Limits	For residential consumers: • 12kWp for a single-phase system; • 72kWp for a three-phase system. For commercial and industrial consumers: • 75% of the consumers' average maximum electricity demand over the prior year.
Eligibility	Registered customers of DLs.
Metering Costs	To be borne by consumers, through processes of initial installation, upgrading, and replacement of meters.
Displaced Costs	• For low-voltages (<1kV), RM0.31/kWh for Peninsula Malaysia, RM0.30/kWh for Sabah; • For medium-voltages (1kV to 50kV), RM0.238/kWh for Peninsula Malaysia, RM0.22/kWh for Sabah.
Net Billing	The following formula dictates the net bill to consumers under the NEM scheme: • Net Billing = [Energy Consumed from DL (kWh) x Gazetted Tariff (RM)] - [Energy Exported to DL (kWh) x Displaced Cost (RM)]
Electricity Credits and Rollover Period	• Credits allowed to roll over for a maximum of 24 months (or two years); • Any credits amassed by the end of this period to be *forfeited* to the DL.

[41] Suruhanjaya Tenaga (2016), Guidelines for Solar Photovoltaic Installation on Net Energy Metering Scheme

The key details of the NEM scheme as implemented in Malaysia are summarised in Table 11. The policy, which commenced in late 2016, is slated to run for five years through 2020. Capacity limits for net electricity exports have been imposed, to the tune of 90MW in Peninsula Malaysia, and 10MW in Sabah, annually. Within this, there are limits for residential (24MW per year), commercial (39MW), and industrial (37MW) consumers.

Displaced costs, or the rate of compensation offered to NEM participants, differ across low- and medium-voltage exports to the grid; for the former, the rate is RM0.31 per kWh exported to the grid in Peninsula Malaysia and RM0.30/kWh in Sabah, while for the latter the rate is RM0.238/kWh in Peninsula Malaysia and RM0.22/kWh in Sabah. The final critical detail of the NEM policy in Malaysia relates to the electricity credits obtained by solar PV electricity exporters and the rollover period. Credits are allowed to roll over for up to 24 months, at which point any leftover credits cannot be converted into cash payments to the NEM participants, nor can they continue to be rolled over into the next 24-month cycle; they are instead forfeited to the relevant DL.

5.1.3 Malaysia's NEM Experience to Date

Uptake of Malaysia's NEM scheme to date is summarised in Table 12. Given the targets set forth in terms of added solar-powered capacity to the electricity grid, the policy thus far has been a major disappointment. This is not due to any fault with the concept of, or the theory behind, NEM itself; after all, such policies have been executed with great success in other nations. Once again, specific details of Malaysia's version of NEM, and, consequently, poor policy execution, are to blame.

Table 12: Uptake of NEM in Malaysia, as of 4 June 2018[42]

Region	*Peninsular Malaysia*			*Sabah*		
Year	2016	2017	2018	2016	2017	2018
Domestic (MW)	0.021	0.5441	0.6653	0	0.0215	0.0031
Commercial (MW)	0.0064	2.0147	3.1368	0	0	0
Industrial (MW)	0	2.6304	4.5131	0	0	0
Total (MW)	**0.0274**	**5.1892**	**8.3152**	**0**	**0.0215**	**0.0031**

[42] This table is adapted from information published on SEDA's NEM webpage.

Of the available 300MW of capacity for the NEM scheme between 2016 and 2018, only 4.5% of the total, or 13.56MW, has been taken up. Table 12 provides the breakdown of this 13.56MW by consumer type. How can such a well-meaning policy perform as abjectly as it has in Malaysia?

Several factors explain this policy failure succinctly. The first of these relates to the fact that the financial incentives offered to NEM participants, or would-be participants, are severely inadequate. Compensation rates do not exceed RM0.31/kWh, compared to RM0.67/kWh for <4kWh installations as per the oversubscribed FiT scheme. To put this into greater perspective, the average TNB electricity tariff rate is RM0.38/kWh[43]. This means that as long as households consume more than 300kWh per month, they will end up having to pay TNB, rather than be paid by TNB, for the generation of electricity through the NEM scheme. Instead of encouraging the uptake of NEM, this arrangement disincentivises it.

The second factor contributing to the failure of Malaysia's NEM policy pertains to the mechanics of the rollover period and the stipulation of expiring electricity credits. Energy efficient households consistently amassing credits each month during the rollover period are forced into the forfeiture of these credits, to their respective DLs, after 24 months. This weak incentivization structure fails to encourage investment in solar PV installations, and further, can even deter households from being energy efficient. Another hindrance to NEM includes the imposition of cost burdens of meter installations, upgrades, and replacements on NEM participants, rather than these burdens being absorbed by the Federal Government, through the relevant agencies in SEDA and the EC, or by TNB itself.

These issues that have contributed to the failure of the NEM policy in Malaysia thus far have one factor in common: they serve to protect the DLs, particularly TNB. It was raised in Section 3.2 that as the quantity of self-generated electricity increases, the market share and profitability of utility companies decreases. This should be seen as a positive, as it represents a step towards the liberalisation of Malaysia's electricity markets. Yet, SEDA

[43] The current, tiered electricity tariff is RM0.218/kWh for the first 200kWh; RM0.334/kWh between 200 and 300kWh; RM0.516/kWh between 300 and 600kWh; RM0.546/kWh between 600 and 900kWh; and RM0.571/kWh above 900kWh.

itself has officially stated that certain restrictions imposed on the NEM scheme were designed to protect TNB's revenue[44]. Such an admission indicates that the NEM scheme is operating under the regulatory capture of TNB.

The imposition of financial incentives too low to encourage uptake of solar energy investments through the NEM strengthens the notion that TNB is afforded protection from technological disruption at the expense of consumers (or, at least, participants in the NEM scheme). The fact that amassed credits are forfeited to TNB at the end of the rollover period, instead of allowing efficient households to cash these credits in, serves the same purpose of protecting TNB, as do limits on the self-generation of electricity, which ensures that consumers maintain a reliance on the DLs. Finally, forcing NEM participants to bear the cost burdens associated with metering acts as a final blow to the success of the policy itself; there is no reason why the DLs cannot afford to at least partially absorb these costs.

This confluence of factors plays a large role in explaining why NEM in Malaysia has, to-date, failed. Without changes to the policy that address the overarching issue of insufficient financial incentivization for program participants, NEM will likely continue to fall short of realising its full potential. Consequently, the contribution of RE – and particularly solar energy – to Malaysia's electricity generation mix, will continue to fail to reach the targets outlined in the NREPAP.

5.2 Large Scale Solar

The first move towards the implementation of large-scale solar power plants (LSS) in Malaysia was announced in March 2014, with KeTTHA awarding 1MDB Sdn Bhd the right to develop multiple LSS power plants, with an aggregate capacity of 500MW. One of these solar plants, announced in April 2014, was slated be a 50MW project located in Kuala Ketil, Kedah, with a 1MDB subsidiary, 1MDB Solar, entering into a power-purchasing agreement with TNB. It must be highlighted these development rights were awarded without an open-tender process, but through direct negotiations between KeTTHA and 1MDB. The dangers associated with the use of direct negotiations to award contracts

[44] https://www.tnb.com.my/assets/newsclip/24082015a.pdf

have been highlighted in Sections 4.1 and 4.4; such negotiations are lacking heavily in transparency, and open the door to the possibilities of preferential treatment, corruption and cronyism.

Given that open balloting sessions were during the same year being held for the allocation of FiT quotas for small-scale solar installations, following the concerns raised in Section 4.1, such a direct award is highly questionable. The news that has since surfaced about 1MDB, involving but not limited to claims of fraud, money laundering, and the mismanagement and misappropriation of funds, adds further fuel to this fire. To date, no work has started on any of these "multiple LSS plants", including the planned project in Kuala Ketil, Kedah.

The direct contract awards did not stop with 1MDB, however. In January 2016, the KeTTHA secretary-general Loo Took Gee announced the award of a 150MW LSS power plant to "a consortium that is technically and financially strong", but refused to disclose the name or details of the consortium in question. It was only revealed in November 2016, through a TNB bourse filing, that the consortium in question comprised of three companies with no experience in RE, let alone in solar installations - Maltech Pro Sdn Bhd, Cam-Lite Sdn Bhd and ItraMAS Technology. This makes a mockery of Loo's announcement that the consortium was 'technically […] strong'. How can a company, or group of companies, without any experience in the industry in question possibly be considered to be technically adept? In addition, one of these companies, Maltech Pro, lists two UMNO leaders as its shareholders. The possibility that this contract was also awarded to benefit well-connected individuals cannot be discounted, based on existing evidence.

Since this most recent round of directly-awarded contracts, the EC has held two open-ballot events for LSS power plants; one in March 2016, and the next a year later. The first of these awarded 450MW worth of contracts, against a target of 250MW, with approved projects expected to achieve commercial operation between 2017 and 2018. The second LSS tender received bids totalling 1,632MW in capacity, against a target of 460MW, and these projects are expected to achieve commercial operation between 2019 and 2020. In

December 2017, the EC announced the 'winners' from this second round, with the awarding of contracts worth 562MW. Tables 13 and 14 summarise the details of these contract awards, with the former detailing projects slated to achieve commercial operations between 2017 and 2018, and the latter detailing projects slated to achieve commercial operations between 2019 and 2020. It is encouraging that the shift from direct negotiations to open-balloting has occurred. Open-balloting, where contracts are awarded based on merit, technical competency, and competitive pricing, allows for a fair and transparent selection process. It is imperative that the EC continues in this vein moving forward.

Table 13: LSS Projects Commercially Operational in 2017/2018[45]

Location	*Package Type*	*No. of Shortlisted Bidders*	*Total Capacity (MW)*
Peninsula Malaysia	1MW to 5MW	3	10.5
	6MW to 29MW	6	114.5
	30MW to 50MW	7	309
Sabah & Labuan	1MW to 5MW	2	10.9
	6MW to 29MW	1	6
Total		**19**	**450.9**

Table 14: LSS Projects Commercially Operational in 2019/2020[46]

Location	*Package Type*	*No. of Shortlisted Bidders*	*Total Capacity (MW)*
Peninsula Malaysia	1MW to 5.99MW	6	26
	6MW to 9.99MW	11	105.5
	10MW to 30MW	13	374.9
Sabah & Labuan	1MW to 5.99MW	8	27.9
	6MW to 10MW	3	27.7
Total		**41**	**562**

As of April 2018, four LSS projects had commenced operations. The total capacity of these operational projects is 34.5MW, representing 7.65% of the total approved capacity

[45] Suruhanjaya Tenaga (2016), *Announcement of Shortlisted Bidders for the Development of Large Scale Solar Plants […] for Commercial Operation in 2017-2018*

[46] Suruhanjaya Tenaga (2017), *Announcement of Shortlisted Bidders for the Development of Large Scale Solar Plants […] for Commercial Operation in 2019-2020*

required to commence operations by the end of 2018. The details of these projects are presented in Table 15.

Table 15: LSS Projects Commercially Operational as of March 2018[47]

Operational Date	*Location*	*Capacity (MW)*
15-Sep-17	Kudat, Sabah	2
22-Dec-17	Bukit Kayu Hitam, Kedah	10
3-Mar-18	Arau, Perlis	4
23-Mar-18	Kemaman, Terengganu	18.5

With the process of open-balloting in place to determine the dispensation of LSS contracts, the only remaining area of concern pertains to seemingly non-existent role that SEDA – the authority tasked with increasing the deployment of RE energy in Malaysia – plays in the process of LSS deployment. After all, the regulations that shape RE in Malaysia; namely, the NREPAP, and RE and SEDA Acts; empower SEDA, and not KeTTHA or the EC, to design, formulate, and implement national RE policies. These Acts of Parliament must be adhered to; moving forward, SEDA must be allowed to carry out its duties without the undue influence of KeTTHA, the EC, and TNB.

5.3 Other Forms of Renewable Energy

Section 4.4 highlighted an attempt to diversify into geothermal energy in Malaysia; the sanctioned project, however, has been saddled with controversy since it was announced in 2013, and plans to achieve commercial operationalisation by 2016 have failed to come to fruition. Even today, no progress has been made on the proposed 30MW geothermal power plant in Tawau, Sabah. This particular example highlights the dangers associated with sudden diversifications into RE options whose practicality in Malaysia have yet to be fully studied.

A critical point that must be considered before any decision is made to diversify into alternative RE resources is that there remains enormous untapped potential in Malaysia's

[47] The data presented in this table was provided by former KeTTHA Minister, Maximus Ongkili, in a written parliamentary reply on 19 March 2018.

biogas, biomass, small hydro, and solar PV resources. Policy efforts to date with regard to each of these well-studied resources have failed to realise their full potential, or even meet the targets set in the NREPAP. It is almost embarrassing that a nation such as Malaysia, located on the Sun Belt and a beneficiary of high levels of solar irradiation, combined with almost two decades of expensive, pro-RE policy efforts, derives less than 2% of its electricity generation capacity from solar energy.

Instead of diverting our attention towards geothermal, wave, or wind energy, resources whose potential in Malaysia are far from understood, policymakers should focus their efforts on the development of more effective policies that would do a better job in allowing the country to realise the full potential of its biogas, biomass, small hydro, and solar resources. This point has been raised by the former CEO of the Malaysian Green Technology Corporation, Ahmad Hadri Haris, who questioned SEDA's plan to study the potential of wind and geothermal energy in Malaysia: "Earlier studies […] identified biomass, biogas, small hydro and solar […] why would SEDA diversify its resources into geothermal and wind when the immediate potential has not been fully tapped […] instead of focusing on making a success of the identified RE resources?"[48]

These unnecessary diversifications would only serve to distract the EC, KeTTHA, and SEDA from improving the current mix of policies that were designed to enhance the contributions of these well-examined RE resources to electricity generation in Malaysia.

[48] https://www.thestar.com.my/news/environment/2014/02/24/what-ails-the-fit/

6.0 The Future of SEDA

This paper has thus far analysed critical facets of the RE landscape in Malaysia: the legislative statutes in the form of the NREPAP, and RE and SEDA Acts; the policies, including the pre-SEDA efforts, the FiT, NEM, and LSS, amongst others; and the key actors involved, particularly SEDA, the EC, KeTTHA, and TNB. This section looks into the future roles that SEDA is well-placed to carry out, in terms of shaping the development and deployment of RE in Malaysia. This is a particularly pertinent issue given that the NEM scheme seems to be firmly entrenched under the control of TNB, the EC is handling the push towards LSS, and the fact that the REF, and, consequently, the FiT mechanism, will be wound down in the near future. What purpose would SEDA then serve over the coming years?

6.1 Revisiting SEDA's Original Purpose

Table 4 in Section 2.3 highlighted the functions SEDA was slated to carry out following its conception in 2011. Aside from the implementation, management, and monitoring of the FiT mechanism, it was proposed that SEDA would:

1) Advise Ministers and Ministries on matters relating to RE, including recommendations on policies, laws, and actions designed to promote the deployment of RE;
2) Promote and implement national policy objectives for RE, and stimulate and facilitate RE use;
3) Implement sustainable energy laws, and recommend reforms to such laws to the Federal Government;
4) Conduct, or organise the conduct of, and promote research and innovation efforts in the field of RE;
5) Conduct, promote, and support programs aiding the development of human resources and capacity-building in the RE sector;
6) Implement measures aimed at promoting public awareness and participation on matters pertaining to RE.

There is no reason for SEDA not to focus its future efforts on the vast majority of the functions it was proposed to handle at its conception.

6.2 Outlining SEDA's Future Roles

SEDA should first and foremost strive to attain the position of Malaysia's principal expert in RE. This can be achieved through the employment of RE subject-matter experts within the Authority, and through the cultivation of relationships with reputable regional and international organisations focused on topics related to the field. Such an environment would necessitate the gravitation of RE-sector issues towards SEDA itself, even if other Ministries or business entities are to continue their current focus on the implementation of the specific policy mechanisms in place in Malaysia.

Once recognised and respected as the national expert on matters related to RE, SEDA would be in a stronger position to recommend and advocate for policies, laws, and actions designed to boost the deployment and contributions of RE across the nation. It is also imperative that the implementation of any future RE policies be left under the purview of SEDA, without the undue influence of special interests, private-sector entities, KeTTHA, and the EC. SEDA must be afforded independence in performing its functions. In this way, the RE industry in Malaysia would be allowed to take off in an efficient manner, dictated by scientific, economic, and technological reason, rather than by the interests of other major energy-sector regulatory authorities and industry players whose domains of expertise lie beyond RE.

In concert, SEDA should seek to conduct original scientific research and innovation efforts in the field of RE, particularly with regard to studies of suitability and feasibility of specific RE technologies across the nation. Such action would assist in setting the stage for future diversification, bearing in mind the untapped potential of existing RE options. A critical element of the processes of original research and innovation is the development of necessary human capital within the field; the greater the number of local academics, scientists, engineers, and economists specialising in issues related RE, the higher the level of informed, intellectual debate on the topic. This would have positive knock-on effects on the quality and originality of future policy proposals.

Finally, it is important to realise that efforts designed to boost the deployment of RE across the nation – and indeed the world – are driven largely by concerns over greenhouse gas emissions, and subsequently, climate change. SEDA can, and should, play a central role in promoting public awareness of the overarching issue of climate change, in detailing its projected impacts across the nation, and thus the importance of decarbonising the Malaysian economy through an increased emphasis on RE technology. As the public is made more aware of the importance of climate change mitigation, this issue develops into one along which voting lines are drawn. Politicians will, ultimately, have no choice but to work towards implementing pro-RE policies that ultimately serve to benefit Malaysia, Malaysians, and our future generations.

7.0 Concluding Remarks

The targeted increases in the deployment of RE resources in Malaysia, first drawn up in the NREPAP, have not been met. This is a major disappointment, particularly given the displayed understanding of the action items necessary to boost the contribution of RE to Malaysia's electricity generation mix. Key policy measures that have been enacted since the conception of SEDA, including the feed-in tariff and net energy metering, have been implemented in numerous countries across the world, to great effect. Yet, in Malaysia, they have had only a minor influence on the composition of electricity generation across the country.

This failure is largely due to specific details of these policies in the context of their enactment in Malaysia. Firstly, too much emphasis has been placed on protecting the market shares and profitability of the distribution licensees, or utility companies, rather than boldly and solely encouraging the widespread adoption of RE through these policy frameworks. In other words, too much control has been placed on minimising the disruptive impacts of these progressive policy frameworks on the DLs. For instance, the imposition of quotas on RE generation capacity under the FiT mechanism was always bound to restrain the growth of the RE industry, while the low rates of return offered to RE investors has played a major role in the failure of the NEM scheme to date. The major beneficiary of these factors that restrict the growth of independently-generated RE power has been TNB itself.

Secondly, the manner in which many contract awards have been dispersed has, to a large degree, not been fair or transparent; there have been too many instances of servitude towards special or vested interests throughout the course of the FiT program. It is likely that this has eroded the confidence that many would-be investors have in the RE policies enacted by SEDA. This issue has threatened large-scale solar in Malaysia, too.

There remains hope, however. SEDA and the EC have conducted open-ballot sessions for particular contract awards, and this must become the norm with any future policy mechanisms, beginning with LSS. Further, there is still time to revamp the NEM

framework in a manner that increases the financial incentives for individuals and independent power producers to participate in the program, and removes the stipulation of expiring electricity credits that has also served to diminish interest in NEM. To achieve this, SEDA will need to stand up for itself, its principles, and its goals – and not remain subservient to the wishes and demands of KeTTHA, the EC, and TNB.

Renewable energy represents the future. Economic, political, social and technological trends all point towards the increased adoption of sustainable energy over the coming decades, and SEDA should put itself in a position to take full advantage of this situation. This paper has highlighted the factors that have contributed to the Authority's failure to meet its targets thus far, and provided some insight into the steps that need to be taken for SEDA to turn these failures into successes moving forward. It is hoped that the recommendations proposed in this paper are taken into consideration as the new Pakatan Harapan government launches a fresh push towards the implementation of climate-friendly policies. SEDA can, and should, still play an important role in ensuring the long-term sustainability of life in Malaysia.