



Ministry of Foreign Affairs

Sector scan of the fundamentals for developing the WTE market in Thailand and Malaysia

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- DRAFT -

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developing the WTE market in Thailand
and Malaysia



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Executive summary

The Dutch regional development center ASEAN in Singapore and the Embassies of the Netherlands in Thailand and Malaysia focus on developing opportunities for Dutch Corporates and Institutions. Important themes are i.a., the development of Smart Cities and Waste-to-Energy (WTE) issues, whereby bridging the gap between finance supply and project realization is a critical point of focus to enable Dutch consortia to be successful. The Regional Business Development (RBD) team of the Netherlands and the two embassies of interest also note a general shift in conscience and greater awareness among the broader population regarding the impact on untreated waste streams.

Since the 1960s the Netherlands has implemented a circular WTE strategy, which has resulted in many Dutch corporates acquiring vast experience in developing, constructing and operating waste separation, recycling, processing, gasification and incineration plants. Consequently, the Netherlands has developed a large waste-development services and knowledge industry, ranging from engineering services to logistical support and handling management. This is a comparative advantage for the Dutch within a global setting.

Given the above, the following question arises: how can Dutch expertise benefit the Thai and Malaysian WTE market? To answer this question, a sector-wide analysis of market fundamentals for developing the WTE market in Thailand and Malaysia has been conducted, focusing on:

1. What are the sector-wide fundamentals in the Thai and Malaysian WTE markets?
2. Which Dutch corporates are active and how will they benefit from sector-wide development?
3. Can the Dutch Government pave the way for companies & projects?

For this assignment the theory of Lansink's Ladder has been operationalized. This theory implies that "the waste management hierarchy indicates an order of preference for action to reduce and manage waste from most favorable to least favorable actions"¹.

Thailand

As economic growth continues, Thailand is facing interesting opportunities in its energy sector. Thailand's energy demand will rise by 70%+ in the next two decades based on population growth, economic growth and improved consumer access to energy. This creates sizeable opportunities for a country that currently relies on energy imports for more than half of its supply. Therefore, Thailand needs to create energy supply security and meet long-term social and economic goals through improved efficiency and greater reliance on renewables.

General observations:

- The municipal solid waste (MSW) generated is currently about 71,700 tons a day.
- MSW generation has continuously increased over the years and in 2016, the total amount of MSW in the country was 26.2 million tons which represented an increase of 0.2 million tons since 2015.
- The efficiency of waste collection is about 80% countrywide but only 36% of the total generated waste is disposed of using acceptable processes such as incineration, composting or landfilling.
- Thailand aims to move away from (and prohibit) open dumping and to more effectively treat residual waste, including urgently removing it from landfills and to renovate existing landfills to render them sanitary.
- WTE is touted as a viable means to dispose MSW, produce energy, recover materials, and free up scarce land that would otherwise have been used for landfill.
- In general, the waste owned by a central/local governmental authority and service providers (concessionaires) are contracted to process the waste. The most common manner of processing is landfilling or large-scale incineration (without sophisticated separation or recycling). Contracts are underwritten by long-term supply contracts and power purchase agreements, FiT or tipping fees.
- Landfills are full and small-scale incineration on landfills are being considered.
- At the level of the central government, Thai authorities are faced with the challenge of policy implementation at the local and municipal level, in a market where waste separation, recycling and upcycling is not commonly practiced.
- The access point for Dutch companies are therefore the current concessionaires.

Malaysia

The energy situation in Malaysia has experienced significant changes over the last three decades. In particular, the nation has managed to transform its energy mix from being almost totally oil dependent to a more diversified mix of oil, gas, coal and hydro. Today, an increasing share of renewable energy constitutes the mix.

¹ Ad Lansink, 'Challenging Changes – Connecting Waste Hierarchy and Circular Economy', *Waste Management and Research*. (2018), pp.872.

Between 2005 and 2015, generation of municipal solid wastes (MSW) in Malaysia has increased more than 60%. In 2015, 23,000 tonnes of waste was produced each day in Malaysia. This amount is expected to rise to 30,000 tonnes by the year 2020. The amount of waste generated continues to increase due to the increasing population and economic development – with national recycling estimates ranging from 10% to 17.5% as opposed to instances of 80% in the Netherlands. Therefore, MSW management in Malaysia can be interpreted as lacking sufficient integration in all aspects of the waste management chain. For this reason, the most preferred disposal method of MSW in Malaysia is landfilling.

General observations:

- The execution of commercial waste processing is under central government legislation in 7 states including the city of Kuala Lumpur. The other regions/states fall under the regional/local authority.
- For the last 10 years commercial parties (concessionaires) have been tasked with sanitating the local authorities owned waste against commercial fees – predominantly by landfilling. Concessions are long-term contracts (22 years) underwritten by long-term supply and power purchase agreements (PPAs). The first 7-year cycle is currently being evaluated.
- Landfills are completely full, illegal dumping is at the centre of attention so the time to act is now.
- The Malaysian authorities at both the central and local level are faced with the challenge of policy implementation on local and municipal level – in a market where waste separation, recycling and upcycling is not commonly practiced.
- Currently separation, recycling and upcycling are not part of the concession contract where the sales of outputs does fall under the FIT;
- Therefore, the primary access point for Dutch companies are the current concessionaires.
- Focus is on mid-size assets: recycling, digestion and small scale decentralized MSW incineration.

Thai and Malaysian Market:

For both countries, it is observed that the national market is well developed in relation to:

- Waste collection, landfilling and waste incineration (though the latter point refers specifically to Thailand)
- High-level Policy development (meaning policy development at the highest level i.e., at the level of the Central Government)
- Availability of policy/government driven FIT tariffs

Dutch supply against Thailand & Malaysian WTE demand

Despite the markets' development in those areas, there are ample supply opportunities for Dutch Companies/SMEs in those areas where a similar level of development has not been achieved, thus resulting in domestic supply failing to satisfy demand..

These opportunities include:

- Waste recycling
- Engineering
- Construction management
- Operational policy development and implementation (that is, the regional and municipal implementation of government agendas and policy objectives and decentralised policy development)

In more specific terms, Dutch supply products (based on experience and expertise) include:

1. Waste treatment, recycling & upcycling equipment supply:
 - Municipal solid waste pre-treatment, recycling & upcycling equipment supply
 - WTE E&A equipment supply (Electrical, Instrumentation & Automation)
 - Biogas & Liquid waste to biogas process equipment supply
2. Knowledge Development:
 - Capacity building in energy efficiency, infrastructure development, waste pre-treatment, recycling & upcycling, policy implementation
3. Engineering/Consultancy Services:
 - Engineering services for waste pre-treatment, recycling & upcycling projects
 - Construction management services for pre-treatment, recycling & upcycling projects
 - Integrated Waste management services (adequate waste handling, separation, landfilling, recycling)

Demand for coordinated development approach

From desk and field research, based on integration with Dutch companies, the following is observed relating to the demand for a coordinated market development approach:

- In general, Dutch companies/SMEs do not have extensive international development budgets/resources and have the need to develop international markets with other players or in a centralized approach.
- Before committing to a development effort, companies need to see/be assured that a positive business case is formed, risks of doing business are acceptable, and a local "anchor" is available.

- Therefore, a coordinated development approach is needed, and Companies/SMEs welcome the Dutch Government as an enabler and facilitator.
- The willingness to invest in a coordinated development effort is high since Companies/SMEs recognize that:
 - by working with other Companies/SMEs and the Government the cooperation value is larger than individual efforts
 - Dutch government involvement is seen as critical since the Dutch Government brings:
 - Access to network (public and private)
 - (Institutional) G-to-G Knowledge & Embassy support – creating stability and continuity

Available finance for project development

Project finance markets in Thailand and Malaysia are extremely liquid, non-volatile and relatively cheap (compared to Europe); there is no shortage of funding.

Investor confidence is returning to the clean energy sector in the Asia-Pacific after a lull in investment prior to 2015. This is in tandem with independent and synchronised pushes for hastening the conversion to renewable energies by governments across the region. Coupled with rapid urbanization in the region and exponential increases in municipal waste, an acute interest in WTE solutions is developing and funding streams for them are becoming increasingly diversified.

Project bidding

Malaysia

The government of Malaysia identifies opportunities and invites public participants to bid for the project. The government invites expressions of interest from the international market for the design, construction, operation and financing of a facility. Developing projects under the Government-Bidding process requires thorough institutional knowledge combined with a large and deeply rooted network. Incumbent companies possess both of those, demonstrating that connection to/forming a consortium with a Dutch affiliated company is crucial. Consortia formation is the sensible approach, combining international engineering power, equipment knowledge, project development knowledge with national/local network and institutional experience.

Thailand

In Thailand, the market works with a government bidding process out of which several rounds have been undertaken. There is a quick-win bidding list available to the market, comprising 11 projects.

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1 Introduction

1.1 General Introduction

This assignment executes a sector-wide analysis of market fundamentals for developing the WTE market in Thailand and Malaysia, to the mutual benefit of those countries and Dutch companies/SMEs. The motivation for this analysis is based on current developments of the SE Asian WTE market and the expertise Dutch Companies have in this segment.

Given the above, the following questions arise:

- 1 - What are the sector-wide fundamentals in the Thai and Malaysian WTE markets?
- 2 - Which Dutch corporates are active and how will they benefit from a sector-wide development effort?
- 3 - Can the Dutch Government pave the way for companies to develop projects in Thailand and Malaysia?

To answer some of these questions, a high-level sector-wide analysis has been conducted to investigate the market drivers and establish the current opportunities in the WTE Sector in Thailand and Malaysia, focusing on who is active in this market and if a sector-wide development effort makes sense for Dutch Corporates.

1.2 How to use this report

This report is written for a wide audience with the intention to provide general information leading to the engagement of opportunities in the Thai and Malaysian WTE markets. The report is intended to support development efforts for all relevant stakeholders. Any lists or references do not exhaust all potential avenues or sources but provide a sense of direction or variety.

The analysis and report do not constitute development and/or investment advice and is composed and presented to the best efforts of The Dutch Ministry of Foreign Affairs and Everest Energy.

2 Assignment Scope

2.1 General Assignment Scope

The Dutch regional development center ASEAN in Singapore focuses on developing opportunities for Dutch corporates & institutions and supporting Embassies in the region. Focus themes are i.a., Development of Smart Cities & smart mobility and Solid Waste-to-Energy, whereby bridging the gap between finance supply and project realization is a critical focus point to enable Dutch consortia to be successful.

Assumptions for this Assignment – The Waste Management Sector in The Netherlands:

Because the Netherlands has started implementing the Circular Waste-to-Energy policy as of the 1960's, many Dutch corporates have vast experience in developing, constructing and operating waste separation, recycling, processing, gasifying and incineration plants. Dutch policymakers and implementation agencies also have thorough experience in creating socially accepted policy, executing implementation measures and constantly developing policy for a circular economy future. Consequently, the Netherlands has developed a large waste-development services & knowledge industry, ranging from engineering services to logistical support and handling management. This is a unique advantage for the Dutch within a global setting.

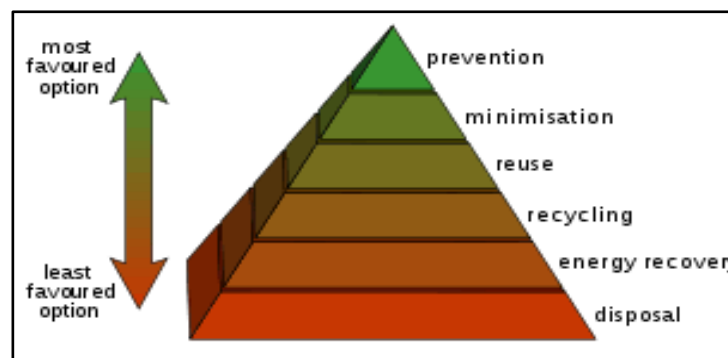
The ladder of Lansink

For this assignment the theory of Lansink's Ladder is used as a basic working-theory. This theory is presented as "The waste management hierarchy indicates an order of preference for action to reduce and manage waste from most favorable to least favorable actions"².

Mr. Ad Lansink (senior scientific staff member University of Nijmegen and Member of Dutch Parliament) is internationally recognized for making the original waste hierarchy or 'Lansink's Ladder' and is often dubbed the 'Father of waste hierarchy'. The theory is that only the highest value of waste processing is to be used³.

A proper application of the hierarchy can help prevent greenhouse-gas emissions, reduce pollutants, save energy, conserve resources, create jobs and stimulate the development of green technologies.

Visualization of Lansink's Ladder



1 - Challenging Changes

Assignment Assumptions

- Therefore, in order to be complete and service the entire Dutch Waste Industry this assignment scope will not exclude any technology or input feedstock, and it will incorporate all elements in the waste processing cycle - not only waste incineration. This includes (but is not limited to): liquid, solid and agro-waste. The term "Waste-to-Energy" in this assignment applies to all of the above. The term "Energy" refers to all forms of energy – not only electrical energy (power).
- This sector analysis is for the benefit of all the Dutch companies active in the entire WTE sector. This includes all products producers AND services providers.
- That there is a positive business case for SE Asian urban WTE project is assumed to start with.
- There are clusters of Dutch corporates active on the global WTE sector looking to the Thai and Malaysian WTE sector for expansion opportunities.

² Ad Lansink, 'Challenging Changes – Connecting Waste Hierarchy and Circular Economy', *Waste Management and Research*. (2018), pp.872.

³ 'Ad Lansink at Global Dialogue on Waste 2018'. (2018). Available at: <https://www.challengingchanges.org/>

- The Dutch regional development centre as the Embassies of Thailand & Malaysia are keen to contribute to solving SE Asian Urban waste problems AND wish to support Dutch Companies in developing this sector.
- The general approach of this assignment and its execution allows for other regional Embassies and other Dutch Companies to join this coordinated development effort, either now or in the near future.

Scoping of the assignment

The assignment scope focusses on the following:

1. Describing the sector-wide market fundamentals for developing the WTE market in Thailand and Malaysia to meet local demand and elucidate supply opportunities for Dutch Companies and Projects
2. Assignment execution is based on Desk and Field research. The field research incorporates interaction with key national and international players in NL, Thailand & Malaysia.
3. Establishing the Dutch company appetite for development of the WTE sector in Thailand & Malaysia.
4. Develop a generic sector-wide business case per country based on;
 - a. Future demand &
 - b. Added value of Dutch companies

A coordinated effort to develop the sector should lead directly to the potential realisation of flagship projects for Dutch Corporates & Institutions.

2.2 Geographical focus

This assignment will focus on two geographical areas in Asia, being Thailand and Malaysia.

a) Thailand (The greater Urban area of Bangkok) focus themes:

- Waste theme with emphasis on WTE
- Financing of large WTE projects.
The Thai prefer to keep attracting project debt to a minimum and Governmental support is needed.

Based on these focus points, the field research interviews are conducted within the following sector-categories:

1. International Financial Institutions
2. Governmental Policymakers
3. Large City Project officials
4. Engineering firms
5. Business community (developing Industrials)

b) Malaysia (The greater Urban area of the Klang Valley) focus themes:

- Waste theme with emphasis on Landfilling based challenges, combined with the new policy of closing illegal landfills
- Financing large WTE projects - noting that the Asian Development bank (ADB) does not finance Malaysian projects.

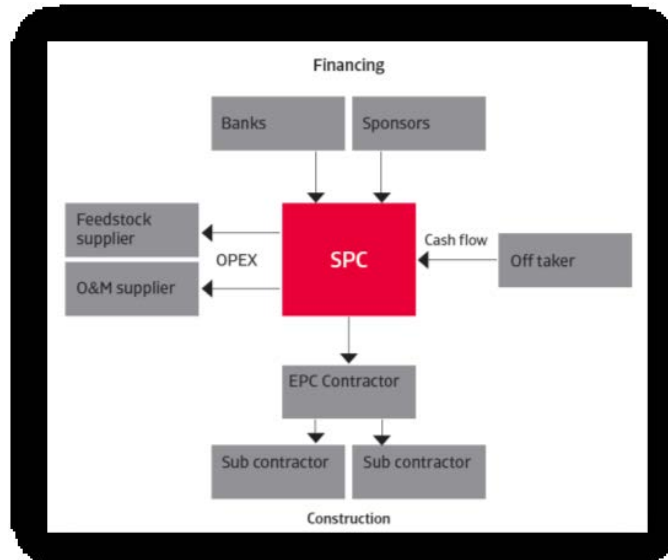
Based on these focus points, the field research interviews are conducted within the following sector-categories:

1. International Financial Institutions
2. Governmental Policy Makers
3. Large City Project officials
4. Engineering firms / Waste processors
5. Business Community (Developing Industrials)

2.3 Project Finance scope

Project finance is defined as a form of debt financing where financiers rely on the cash flow of the project for the repayment of the loan. The projects assets and potential contracts can be used as securities.

Project finance definition



2 - Atradius Dutch State Bank

3 Methodology

3.1 General Assignment Methodology

The assignment will:

1. Execute field & desk research in two SE Asian Cities (Kuala Lumpur and Bangkok) and The Netherlands – interacting with specific key players and sector clusters. Key players are identified to be (without being complete):
 - a. Ministry of Energy, Ministry of Housing, Local government; governmental policymakers, permit authorities, subsidy-providing institutions
 - b. Logistics experts & sector associations, sustainability policy makers and enforcement authorities
 - c. National & International development financiers, commercial financiers and governmental funders
 - d. Dutch Embassy, prominent development companies and/or tech providers
2. Assume that other regional Embassies and other Dutch corporates can join this sector analysis at a later stage.
3. The results of the assignment can be used “all-round”, meaning that the reports can be used for other cities when adjusting the input/output variables.

The Thai and Malaysian WTE sector is comprised of MSW processing, Agro waste processing and Industrial Waste processing. The reader of this report should note that the “total” market is comprised by MSW processing + Agro waste processing + Industrial Waste processing – generally referred to as “waste”. Furthermore, some sources mention different output producing technologies (biogas, incineration or recycling). This report does not discriminate between these technologies since waste is the input stream for all the mentioned technologies.

3.2 Desk & Field research

The research activities are split into field and desk research.

Desk research:

During the preparation phase, desk research will be done in order to gather, investigate, analyse and select relevant sector and institutional information. Public and other available sources will be used.

Field research

The field research comprises of interview preparation, planning and carrying out the field research (interviews on location and/or via teleconferencing) in Malaysia, Kuala Lumpur and Thailand, Bangkok. Cooperation and interaction with the relevant Embassies and ASEAN Business Developers is crucial for success since they have in-depth connections with relevant stakeholders.

Reporting:

In the reporting phase the final report will be produced and presented. The information obtained by desk and field research will be analysed (cross-checked with interviewees where necessary) and, together with the information gathered, processed into a draft final report, which is to be discussed.

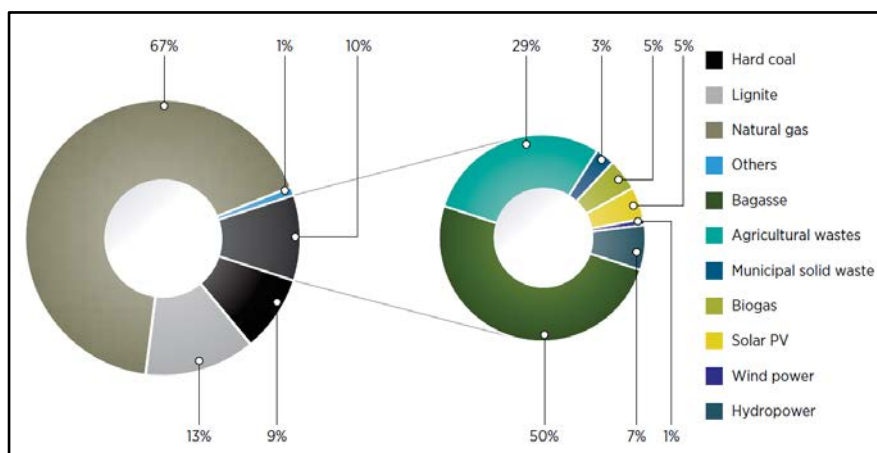
No *fundamental* research will be executed; available sources, insights, observations and interview inputs are used and interpreted. International market standards are used for modelling and base-data references.

4 Sector Analysis Thailand

4.1 Basic Analysis of WTE market in Thailand

As economic growth continues, Thailand is faced with interesting opportunities in its energy sector. Thailand's energy demand will rise by 70%+ in the next two decades based on population growth, continued economic growth and improved accessibility of energy to consumers. This creates significant opportunities for a country that now relies heavily on energy imports for more than half of its energy supply. Therefore, Thailand needs to create energy supply-security and meet long-term social and economic goals through improved efficiency and greater reliance on renewables⁴.

To elucidate, Thailand's electricity generation is fuelled primarily by hard coal, lignite and natural gas, which together make up almost 90% of total output (as of 2016). Renewables only contributed roughly to 10% (or 15% of total power consumption) with bioenergy comprising roughly 75% (15TWh) of renewable energy generation, demonstrating its proportional significance to the sector⁵.



3 - Irena Renewable Energy Outlook Thailand 2017

Generally, the following characteristics are applicable for the Thai energy market:

- More than half the energy supply relies on imported energy, a proportion that is likely to increase further when proven National reserves of oil and gas are depleted as anticipated in less than a decade, unless other indigenous energy sources are exploited.
- A growing availability of Hydropower –with a 1000 MW installed capacity in 2036, including pumped storage facilities.
- Thailand has a large and active Agro industrial thermal (process) energy market – where industrial facilities use biomass for energy production in large-scale, centralised plants operating at economies of scale.
- The Thai WTE sector is comprised of MSW processing, Agro waste processing and Industrial Waste processing.
- Thailand has a stable and creditworthy renewable energy pricing system (backed by Governmental subsidies) which allows for cashflow-stable project development.
- The Thai financial markets are characterised as stable and supply-deep, leading to low (compared with Europe) cost of funding.
- As of the end of 2017, Thailand's existing generation capacity was 49,047.54MW, with a total generating capacity of renewable projects of 10,237.93 MW.

⁴ 'Thailand Energy Situation', Energypedia. (2018). Available at: <https://energypedia.info/wiki/ThailandEnergySituation>.

⁵ 'Renewable Energy Outlook, Thailand', IRENA. (2017). Available at: <https://www.irena.org/publications/2017/Nov/Renewable-Energy-Outlook-Thailand>.

Thailand has different Energy cost tariffs for the residential, commercial and industrial sectors:

Electricity tariff (per kWh)					
Residential		Commercial		Industrial	
Minimum	1.80 THB (5.8 cent USD)	Minimum	1.67 THB (5.4 cent USD)	Minimum	1.17 THB (3.9 cent USD)
Maximum	2.98 THB (9.6 cent USD)	Maximum	1.73 THB (5.6 cent USD)	Maximum	2.84 THB (9.2 cent USD)
The electricity tariffs for residential sector are according to the consumption level [kWh]. Consumer with higher consumption level has to pay more expensive tariff.		The electricity tariffs for commercial sector are according to voltage level. The user that connected to higher voltage level is subjected to cheaper electricity tariff.		The electricity tariff for industrial sector depends on the connecting voltage level and time of use. Peak-time usage is subjected to more expensive tariff.	

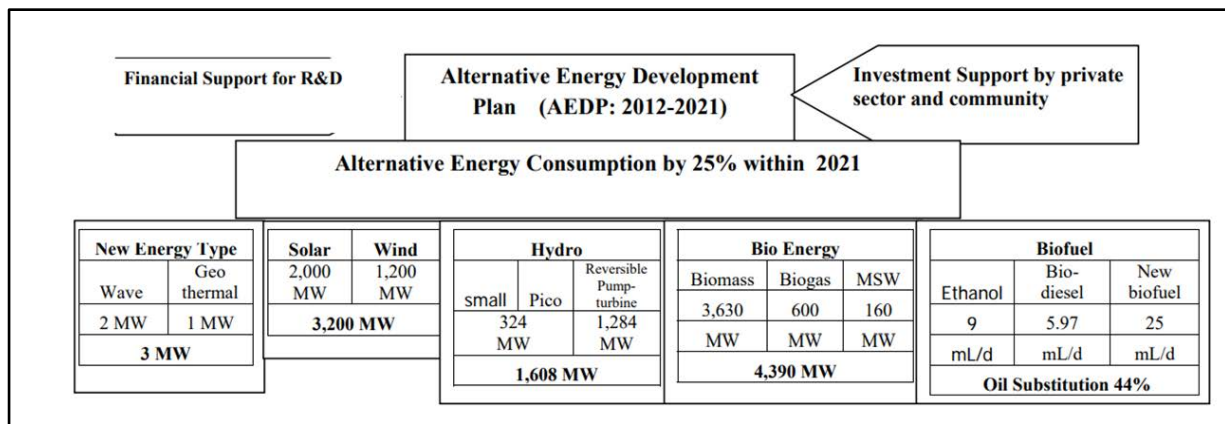
4 - Energypedia – Thailand Energy Situation, Bath-USD conversion rate Feb. 2019

Waste to Energy

With the Paris Agreement entering into force in Thailand in November 2016, Thailand must fulfil its commitments stipulated by the Nationally Determined Contributions (NDC) by reducing carbon emissions from its energy, industrial, agricultural and waste sectors by 20-25% from the business-as-usual scenario by 2030.

A further priority under bioelectricity is MSW. MSW is a national priority while bioenergy is often viewed as a by-product. The volume of MSW has been increasing (by at least 9% between 2012 and 2015) due to the growing population, improved living standards and the expanding tourism industry.

Thailand has developed an Alternative Energy Development Plan, outlining the structure of implementing fee structures for the production of renewable energy. The table below indicates the composition of energy consumption by 2021 and the proportion each renewable energy type will generate:



5 - Alternative Energy Development Plan (AEDP:2015-2036)

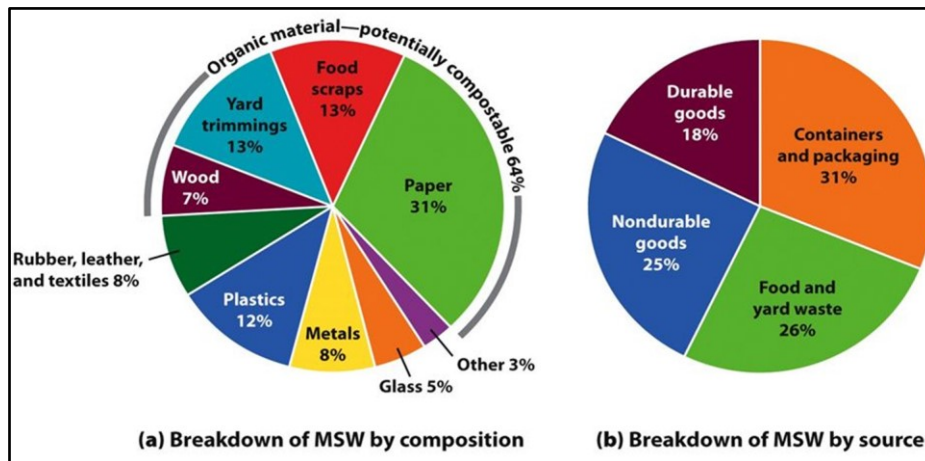
Relating to the WTE market in Thailand following characteristics are applicable:

- The municipal solid waste (MSW) generated is currently about 71,700 tons a day.
- The increases in the generation of municipal solid waste caused by population growth and increasing economic development in developing countries has become one of the most serious environmental issues.
- MSW generation has continuously increased over the years and in 2016, the total amount of MSW in the country was 27.06 million tons which represented an increase of 0.2 million tons since 2015.
- The efficiency of waste collection is about 80% countrywide but only 36% of the total generated waste is disposed of using acceptable processes such as incineration, composting or landfilling.
- Prohibitions against dumping are becoming more stringent; and residual waste must be properly treated including urgently removing it from landfills and existing ones must be rendered sanitary
- WTE is perceived as a means to dispose MSW, produce energy, recover materials, and free up scarce land that would otherwise have been used for landfill.
- Thailand considers WTE to consist of the following renewable technologies:
 - incineration
 - refuse derived fuel (RDF) utilization

- anaerobic digestion
- pyrolysis
- gasification
- landfill gas recovery

In Thailand, the composition of waste is dominated by organic waste followed by paper, plastic, glass, and metal. No single method of MSW disposal can deal with all materials in an environmentally sustainable way. Therefore, a suitable approach in MSW management should be an integrated approach in which complementarities between different parts of the waste management chain are utilised to ensure the maximisation of value. For example, better material recovery practices will improve the quality of the residual organic fraction, enabling more efficient utilisation for energy generation. This is particularly important aspect of knowledge transfer that can be supplied by both public and private Dutch institutions to Thai counterparts, especially at the municipal level.

Waste Composition Thailand 2016



6 - Waste Generation and Waste Disposal Thailand, Isabella Gibbs 2016

Thailand has a clear and stable Feed-in tariff rate of renewable energy for very small power producers (VSP)- including WTE. As the table below demonstrates, tariff rates are variable depending on the size of the project, the amount of electricity it will generate, and the type of input processed to create the energy.

Capacity (MW)	FiT (Bht/kWhr)			Support duration (Years)	FiT premium (Bht/kWhr)	
	FiT _F	FiT _V 2017	FiT ⁽¹⁾		Bio-fuel projects (First 8 years)	Projects in border area ⁽²⁾ (Entire project lifetime)
1. Waste (Integrated waste management)						
Installed capacity >1 MW	3.13	3.21	6.34	20	0.70	0.50
Installed capacity >1-3 MW	2.61	3.21	5.82	20	0.70	0.50
Installed capacity >3 MW	2.39	2.69	5.08	20	0.70	0.50
2. Waste (Landfill)	5.60	—	5.60	10	—	0.50
3. Biomass						
Installed capacity >1 MW	3.13	2.21	5.34	20	0.50	0.50
Installed capacity >1-3 MW	2.61	2.21	4.82	20	0.40	0.50
Installed capacity >3 MW	2.39	1.85	4.24	20	0.30	0.50
4. Biogas (Wastewater/Manure/Solid waste)	3.76	—	3.76	20	0.50	0.50
5. Biogas (Energy crop)	2.79	2.55	5.34	20	0.50	0.50
6. Hydropower						
Installed capacity >200 kW	4.90	—	4.90	20	—	0.50
7. Wind	6.06	—	6.06	20	—	0.50

⁽¹⁾Remark: This FiT rate applies to projects that supply power into the grid system in the year 2017. After 2017, FiT_V will be continually increased depending on the core inflation rate. This rate applies to waste fuel (integrated waste management), biomass, and biogas (energy crop) projects only [36].

7 - IEA Thailand 2015

Future demand WTE sector:

Thailand’s overall energy demand is expected to increase by 78% by 2036. Supply by renewables will play an important role in meeting this increased demand. Thailand has set a renewable energy target of 30% of total final energy consumption by 2036 in its Alternative Energy Development Plan (AEDP) 2015⁶.

Therefore, it is planned that total installed renewable electricity capacity will triple over the following 20 years, if AEDP 2015 were implemented as per the policy planning and if project finance is consistently available to the market. To meet the target, total additional capacity of 11 721 MW would be required and be expected to deliver 46 902 GWh annually, assuming an overall capacity factor of 45.7%⁷.

As bioenergy includes solid biomass combustion, municipal waste and industrial waste, as well as biogas for electricity generation; these inputs will account for generating the lion’s share of electricity output, while their corresponding aggregated generating capacity would represent less than one-third of the total additional capacity. Provided feedstock sourcing is possible; biomass-based electricity generating facilities could generally provide a baseload with a relatively high capacity factor⁸.

Capacity additions and electricity generated by technology – per policy directive

Energy plans	Overall target	Sector breakdown		
		Power sector	Heating	Transport
EEP	Energy intensity reduction of 30% by 2036 from the 2010 level	Expected saving of 90 865 GWh/7 813 ktoe accounting for 15% of the total savings	Expected saving of 13 673 ktoe, accounting for 26% of the total savings	Expected saving of 30 213 ktoe, accounting for 58% of the total savings
PDP	Fuel/generation capacity mix (2015-36): <ul style="list-style-type: none"> Gas: 64% - 37% Coal: 20% - 23% Nuclear: 0% - 5% (2035) Imported hydropower: 7% - 15% Renewable energy: 8% - 20% 		<ul style="list-style-type: none"> Heat from co-generation with efficiency not lower than 45% should account for 10% 	
AEDP	<ul style="list-style-type: none"> Renewables (final energy consumption): 39 389 ktoe, or 30% of TFEC in 2036, i.e. 131 000 ktoe 	<ul style="list-style-type: none"> 19 684 MW (installed capacity): Solar PV: 6 000 MW Wind: 3 002 MW Large hydro: 2 906 MW Small hydro: 376 MW Biomass: 5 570 MW Biogas: 600 MW WTE: 550 MW Energy crops: 680 MW 	<ul style="list-style-type: none"> 25 088 ktoe (final energy consumption): MSW: 495 ktoe Biomass: 22 100 ktoe Biogas: 1 283 ktoe Solar heating: 1 200 ktoe Others*: 10 ktoe 	<ul style="list-style-type: none"> Bioethanol: 11.3 million litres/day Biodiesel: 14 million litres/day Pyrolysis: 0.53 million litres/day Compressed biogas: 4 800 tonnes/day Others**: 10 ktoe

8 - Key Targets in Energy Plans, 2015-2036 – DEDE Alternative Energy Development Plan 2015

For the renewable energy policy framework and especially the waste-to-energy market the AEDP policy is applicable, whereby a 20-fold capacity growth is envisioned and supported by subsidy regimes.

⁶ 'Alternative Energy Development Plan', Ministry of Energy. (2015). Available at: <http://www.eppo.go.th/images/POLICY/ENG/AEDP2015ENG.pdf>.

⁷ Ibid

⁸ 'Renewable Energy Outlook, Thailand', IRENA. (2017).

Capacity additions and electricity generated by 2036 - Renewable Energy use AEDP policy targets

Energy type	Reference (2015)*	Target in 2021	Target in 2036	Reference (2015)	Target in 2021	Target in 2036
Power	Final energy consumption (ktoe)	Capacity (MW)	No. of power plants	Capacity (MW)	Capacity (MW)	Capacity (MW)
Municipal waste	44	214	261	131	410	500
Industrial waste	-	26	26	-	50	50
Solid biomass	1 104	2 059	2 910	2 726	3 940	5 570
Biogas	92	234	313	372	448	600
Biogas (energy crop)	-	225	395	-	387	680
Small hydropower	24	79	115	172	259	376
Wind	28	64	403	233	475	3 002
Solar	202	358	716	1 419	2 993	6 000
Large hydropower	290****	446	446	2 906	2 906	2 906
Sub-total	1 786	3 706	5 588	7 962	11 871	19 684
Thermal	ktoe	ktoe	ktoe			
MSW	88	178	495	-	-	-
Biomass	5 990	8 649	22 100	-	-	-
Biogas	495	716	1 283	-	-	-
Solar	5	43	1 200	-	-	-
Other alternative energy**	-	0.35	10	-	-	-
Sub-total	6 578	9 586	25 088	-	-	-

9 - key Targets in Energy Plans, 2015-2036 – DEDE Alternative Energy Development Plan 2015

These figures testify to the Thai governments ambitions and recapitulates the supply opportunities for Dutch Companies/SMEs with regard to both the provision of expertise (i.e., how to efficiently integrate waste management and WTE practices) and technology, which would help satisfy these targets.

4.2 Regulatory context for developing WTE projects

Thai regulatory bodies:

National Energy Policy Council (NEPC)

has authority to set a policy and a strategy for energy management and development, including an energy price; authority to assign other relevant authorities/entities to put such policy into practice and to follow up on the progress made by such authorities/entities; the leader of the National Council for Peace and Order (the Prime Minister) as its chairman; and the Office of Energy Policy and Plan which acts as the NEPC's secretary office.

The Ministry of Energy (MOE)

has authority over the procurement, development and management of energy; has state sectors, such as Office of the Minister, Office of the Permanent Secretary, Department of Mineral Fuels, Department of Energy Business, Department of Alternative Energy Development and Efficiency, Energy Policy and Planning Office; and supervises certain state enterprises, such as EGAT and PTT Public Company Limited.

The Energy Regulatory Commission (ERC)

was established by the Energy Industry Act B.E. 2550 (2007) as an independent regulatory agency. It has authority to, regulate the energy industry in accordance with government policy (e.g. policy from the "NEPC"); prescribe the size/type of energy business in which an energy business licence is required or exempted; prescribe steps and procedures for the purchase from/selection of the seller (e.g. the bidding process); and can issue permits/licences required for energy business, including those pursuant to regulations under the responsibility of other governmental agencies (with such governmental agencies' recommendation) such as factory licences and building construction permits.

Ministry of Interiors (MOI)

The MOI exercises various functions and responsibilities, namely local administration, internal security, land management and public works. Thereby, it is the owner of municipal waste.

Ministry of Industry (M-Industry)

WTE plants must have factory approval from the department of industrial works (DIW) prior to construction.

Legislative and permitting policy is structured along the following focus AEDP guidelines:

- Promoting and supporting WTE in the Small and Medium Local Administrations
- Speeding up the amendment/improvement of Private Participation in State Undertaking Act 1992 (B.E. 2535) to allow private sectors to jointly invest with the Local Administrations
- Creating participation of the targeted areas in installing waste-to-energy production system, and knowledge campaigns
- Research and study on RDF management, incinerator and small-scale RDF production systems to produce in the country and the development on standard and equipment relating to plastic waste-to-fuel production

Legislation affecting waste management:

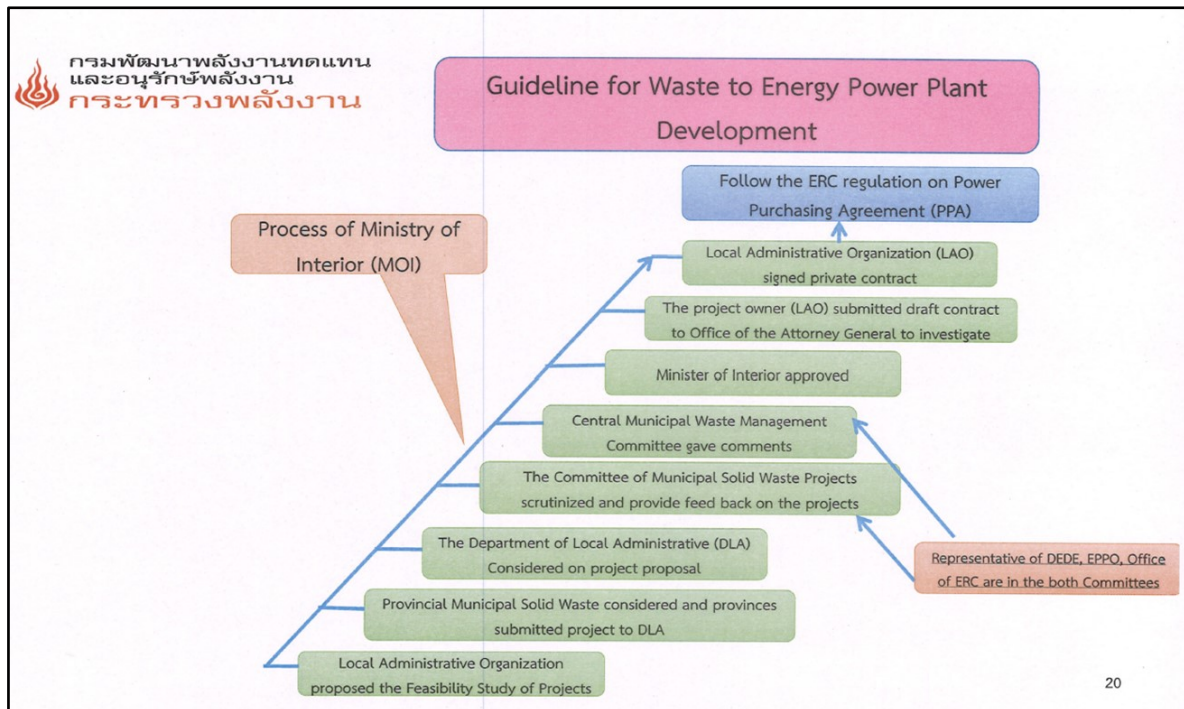
Generally, local authorities in Thailand are responsible for MSW on their administrative zones and the collection, treatment, and disposal of municipal, industrial and infectious waste is under the control of those local authorities. As part of this policy, the government has directed that each province should identify locations for the construction of waste facilities including proper landfill disposal sites and facilities to convert waste into renewable energy. This national strategy was incorporated into a solid and hazardous waste management roadmap which was drafted by the MNRE and represents a significant step in defining the national agenda relating to the solid waste issue.

The legal structure of the national roadmap for solid and hazardous waste management is divided into four focus categories:

1. Residual waste
 - a. There will be no more open dumping and residual waste must be properly treated including urgently removing it from landfills
 - b. Survey and improve all illegal and improper landfills including sites within local administrative control and private sites
2. Emerging waste
 - a. Reduce and separate waste at household sources
 - b. Apply a clustering waste management system using combination technologies with the emphasis on waste to energy (WTE) and maximizing waste recovery
 - c. Reinforce the role of the private sector in waste management and increase investment especially in waste incinerators
3. Waste management measures and policy
 - a. governors are the provincial regulatory waste management administrators
 - b. Legislation to introduce and standardize procedures including waste reduction, separation, collection and transportation, and, to standardize waste disposal fees for solid, hazardous and infectious waste
4. Encouraging civil discipline, public education, and enactments for sustainability

Permitting:

The legal framework for permitting—especially with respect to the use of land— is not coordinated. Different authorities sometimes do not follow the same standards or set of rules in issuing permits and licenses.



10 - Source: field research – ministry provided

Project bidding:

Developing projects is done by a bidding process. The Government of Thailand identifies opportunities and invites public participants to bid for the project. The government invites expressions of interest from the international market for the design, construction, operation and financing of a facility.

Restrictions on Foreign Investment

Generally, there is no restriction on the number of shares or percentage of shares to be held by a foreign entity, as the power generation business is not a restricted business activity under the Foreign Business Act B.E. 2542 (1999) (FBA). However, under the Land Code of Thailand ("Land Code"), a company in which more than 49% of the total shares are held by foreigners or where foreign shareholders make up more than half of the total number of shareholders, shall be considered a foreigner and shall not be permitted to own land. However, given that the renewable energy projects are types of businesses which are eligible for Board of Investment promotion, certain privileges are granted, and one of the key privileges (other than tax holidays and custom duty exceptions) is the ability of the project company to have ownership over the land in which the project will be located, despite the restriction under the Land Code.

The Thailand Board of Investment:

The Thailand Board of Investment (BOI) is an institution established half a century ago with a mandate to promote investment and was known as the Board of Industrial Investment until 1972. Since 2004 it has provided alternative energy projects with support, mostly in the form of tax exemptions. Examples include the following:

- Projects using waste, including refuse-derived fuel, to produce electricity or steam are eligible for eight-year corporate income tax exemption without an exemption cap, as well as exemption from import duty on machinery, and other non-tax incentives.
- Other renewable energy projects that have an eight-year corporate income tax holiday, import duty exemption on machinery and non-tax incentives, include the manufacture of solar cells and/or raw materials for solar cells, as well as power produced from renewable energy sources, e.g. solar energy, wind energy, biomass or biogas.
- Projects that target biofuel production from agricultural products and by-products, for example biomass to liquid (BTL) or biogas from wastewater, are given an eight-year corporate income tax holiday, import duty exemption on machinery and raw or essential materials used in manufacturing export products, as well as other non-tax incentives.
- Projects aimed at biomass briquettes and pellets are exempt for five years from corporate income tax and import duty on machinery and other nontax incentives.

5 Sector Analysis Malaysia

5.1 The Malaysian WTE Market

The energy situation in Malaysia has experienced significant changes over the last three decades. In particular, the nation has managed to transform its energy mix from being almost totally oil dependent to a more diversified mix of oil, gas, coal and hydro, with renewables constituting an increasing share of the energy mix⁹.

Malaysia is an industrialized market economy. About 40% of the country's revenue is generated from oil and gas exports. Therefore, fossil fuel is the primary source for electricity generation, +/- 50% of electricity generation is using natural gas as input fuel and +/- 40% of electricity generation is using coal as input fuel.

In order to move towards a more sustainable energy mix, the Ministry of Energy, Science, Technology, Environment and Climate Change has identified three principal energy objectives that would be instrumental in guiding the development of the energy sector.

1. Supply

To ensure the provision of adequate, secure and cost-effective energy supplies through developing indigenous energy resources including both non-renewable and renewable energy, using the latest cost options (meaning the latest relevant prices) and diversification of supply sources both from within and outside the country.

2. Utilisation




To promote the efficient utilisation of energy and discourage wasteful and non-productive patterns of energy consumption. Government initiatives to encourage cogeneration are also aimed at promoting an efficient method for generating heat energy and electricity from a single energy source.

3. Environmental

To minimise the negative impacts of energy production, transportation, conversion, utilisation and consumption on the environment. All major energy development projects are subjected to the mandatory environmental impact assessment requirement. Environmental consequences, such as emissions, discharges and noise are subjected to the environmental quality standards like air quality and emission standards.

Electricity tariff description:

Malaysia has in total 16 electricity tariffs, the table below provides the electricity tariff in three main sectors: being residential, commercial and industrial.

Electricity tariff (per kWh)					
	Residential		Commercial		Industrial
Minimum	0.218 RM (7.0 cent USD)	Minimum	0.192 RM (6.2 cent USD)	Minimum	0.147 RM (4.7 cent USD)
Maximum	0.454 RM (14.6 cent USD)	Maximum	0.430 RM (13.9 cent USD)	Maximum	0.377 RM (12.1 cent USD)
<p>The electricity tariff for residential sector consists of 9 steps. Consumer who has higher consumption level has to pay higher tariff. Above the monthly consumption of 900 kWh, the tariff remains constant at 14.5 cent USD/kWh. This is the highest tariff among all sectors.</p>		<p>The electricity tariff for commercial sector depends on the voltage level (low or medium-voltage). Connection to higher voltage level is charged with lower tariff.</p> <p>There are two tariffs for the connection to medium voltage level. One is the time-of-use system, taking into account peak/off-peak. Another one is without this consideration.</p>		<p>The electricity tariff for industrial sector depends on the voltage level (low, medium, or high voltage). Two systems apply for connection to medium voltage level: general tariff and time-of-use (peak/off-peak) tariff. For high voltage level, only time-of-use system applies. Typically, connection to high voltage level allows consumer to pay lower tariff. There is also a possibility to request a special reduced tariff from TRB. Special criteria applies in such case.</p>	





12 - Energypedia – Malaysian Electricity tariff 2016

The Renewable Energy Sector

⁹ 'Renewable Energy Market Analysis, South-East Asia'. IRENA. (2018). Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_Market_Southeast_Asia_2018.pdf

In terms of installed capacity of renewable energy in Malaysia, biomass is the highest with about 48%. This high number comes from the fact that Malaysia is the largest palm oil producer and has abundant biomass. Solar occupies the second position with about 19% of the total installed capacity, followed by hydro with 17%.

Feed-in Tariff for renewable energy

Source	Feed-in tariff (per kWh)			
	2013		2014	
	minimum	maximum	minimum	maximum
 Biomass	0.268 RM (8.6 cent USD)	0.309 RM (9.9 cent USD)	0.257 RM (8.3 cent USD)	0.307 RM (9.9 cent USD)
 Biogas	0.279 RM (8.9 cent USD)	0.318 RM (10.2 cent USD)	0.277 RM (8.9 cent USD)	0.317 RM (10.2 cent USD)
 Mini-hydro	0.230 RM (7.4 cent USD)	0.240 RM (7.7 cent USD)	Same as 2013	Same as 2013
 Solar	0.782 RM (25.1 cent USD)	1.131 RM (36.3 cent USD)	0.719 RM (23.1 cent USD)	1.041 RM (33.4 cent USD)

13 - Energypedia FIT 2016

These tariffs vary depending on (1) the size of the installation (2) the attribution of bonus criteria¹⁰.

Waste to Energy

Between 2005 and 2015, generation of municipal solid wastes (MSW) in Malaysia has increased by more than 60%. In 2015, 23,000 tonnes of waste was produced each day. This amount is expected to rise to 30,000 tonnes by the year 2020 due to population increases and continuing economic development. However, less than 20% of the waste is being recycled and landfilling remains the preferred method of disposal. Therefore, despite its sophistication in some respects, Malaysia's overarching waste management methodology is insufficiently integrated and currently fails to capture latent value.

The sources of MSW in Malaysia vary for each local authority area depending on city size and economic standards. In central and southern regions of Malaysia, 36.73% of wastes are household waste, 28.34% industrial and construction wastes, and 34.93% of waste comes from other sources. Malaysian MSW contains high volume of organic matters and is therefore highly biodegradable and easily converted into bioenergy¹¹.

Development and operationalization of WTE projects lies in the hands of the Ministry of Housing, Communities and Local Government (MHLG), who will remain central in terms of enforcing laws and regulations and ensuring that private sector meets required standards and quality. However, the fees for the waste management services are no longer the responsibility of the local authorities but must be managed privately by the waste management company.

Recycling:

In Malaysia, there are three *main* types of recyclables; Paper, plastics and bottles. However, very little of the waste is actually being recycled. Although national recycling rates have improved from roughly 5% in 2005 to estimates of 10% to 17.5% today (notwithstanding variation between municipalities). However, this still falls radically short of instances of 80% found in the Netherlands¹².

¹⁰ See <http://www3.seda.gov.my/#tab-A> for further details.

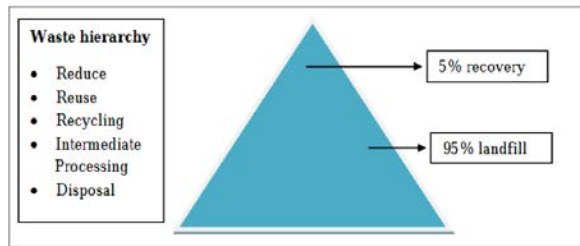
¹¹ Ibid.

¹² Ilham., & Esa. (2017). Composting as a sustainable method to Minimise Waste at Source in Malaysia. *International Conference on Environmental research and technology (ICERT)*. Available at:

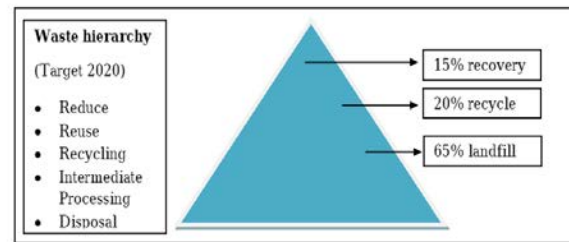
<https://icert.usm.my/index.php/ms/articles/articles-icert-2017?download=66:40> See also: Rodzi et al. (2019). Environmental Awareness and Attitudes Towards Solid Waste Management Among TVET Students in Malaysia. *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, 8(7). Available at: <https://www.ijitee.org/wp-content/uploads/papers/v8i7/G5375058719.pdf>.

Take, for example, the targets for the Bukit Tagar sanitary landfill in Ulu Selangor by the Ministry of Housing and Local Government¹³.

Targets for 2003 in 2003



Targets for 2020 in 2015



14 - Ministry of Housing and Local Government

5.2 Regulatory context for developing WTE projects

The energy policy of Malaysia is determined by the Malaysian Government, which address issues of energy production, distribution, and consumption.

The Policy Vision

Enhancing the utilisation of indigenous renewable energy (RE) resources to contribute towards national electricity supply security and sustainable socioeconomic development. In pursuance of this vision, the incumbent government is targeting 20% of the country's total electricity supply to be generated from Renewables by 2030, though this Renewable Energy Transition Roadmap (RETP) is still in a formulative stage.

The Objectives

- To increase RE contribution in the national power generation mix;
- To facilitate the growth of the RE industry;
- To ensure reasonable RE generation costs;
- To conserve the environment for future generations; and
- To enhance awareness on the role and importance of renewable energies¹⁴

The Department of Electricity and Gas Supply acts as the regulator. Governmental agencies that contribute to the policy are the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC), the Energy Commission (Suruhanjaya Tenaga), and the Malaysia Energy Centre (Pusat Tenaga Malaysia). Among the documents that the policy is based on are the 1974 Petroleum Development Act, 1975 National Petroleum Policy, 1980 National Depletion Policy, 1990 Electricity Supply Act, 1993 Gas Supply Acts, 1994 Electricity Regulations, 1997 Gas Supply Regulation and the 2001 Energy Commission Act.

The Malaysian government is seeking to intensify the development of renewable energy, particularly biomass, as the 'fifth fuel' resource under the country's Fuel Diversification Policy. The policy has been reinforced by fiscal incentives, such as investment tax allowances and the Small Renewable Energy Programme (SREP), which encourages the connection of small renewable power generation plants to the national grid.

The Small Renewable Energy Program allows renewable projects with up to 10 MW of capacity to sell their electricity output to TNB, under 21-year licence agreements. Numerous applications for the program have been received, mainly involving biomass.

SEDA Malaysia is a statutory body formed under the Sustainable Energy Development Authority Act of 2011. One of the key roles of the SEDA is to administer and manage the implementation of the Feed-in Tariff (FIT) mechanism, including a Renewable Energy fund mandated under the Renewable Energy Act of 2011. The Renewable Energy fund was created to support the FIT scheme¹⁵.

Project bidding:

Developing projects is done by a bidding process. The Government of Malaysia identifies opportunities and invites public participants to bid for the project. The government invites expressions of interest from the international market for the design, construction, operation and financing of a facility.

¹³ Currently the Ministry of Housing and Local Government (KPKT) is evaluating existing sanitary landfills as suitable sites to develop waste to energy (WTE) plants.

¹⁴ SEDA (2019). Available at: <http://www.seda.gov.my/>.

¹⁵ Darshan Joshi, 'Evaluating the Performance of the Sustainable Energy Development Authority (SEDA) and Renewable Energy Policy in Malaysia'. (2018). Penang Institute. Available at: https://penanginstitute.org/wp-content/uploads/2018/06/Evaluating-the-Performance-of-SEDA-and-RE-Policy-in-Malaysia_PI_Darshan_5-June-2018.pdf.

Projects are being offered to as a public private partnership (PPP), secured under a long-term concession agreement. Bidding consortia can, for example, be technology providers, civil engineering contractors and waste management companies- or other combinations.

The Facility provider will be appointed under a procurement process involving pre-qualification with outline proposals, request for proposals and final tenders. The price and quality selection criteria for choice of provider will be set out in the tender documents to be issued to the bidders selected from the pre-qualification stage. This Pre-Qualification is offered to companies registered in Malaysia or a joint venture/consortium with at least one incorporated company in Malaysia with 51% of its shareholdings to be held by Malaysian controlled entities.

Note:

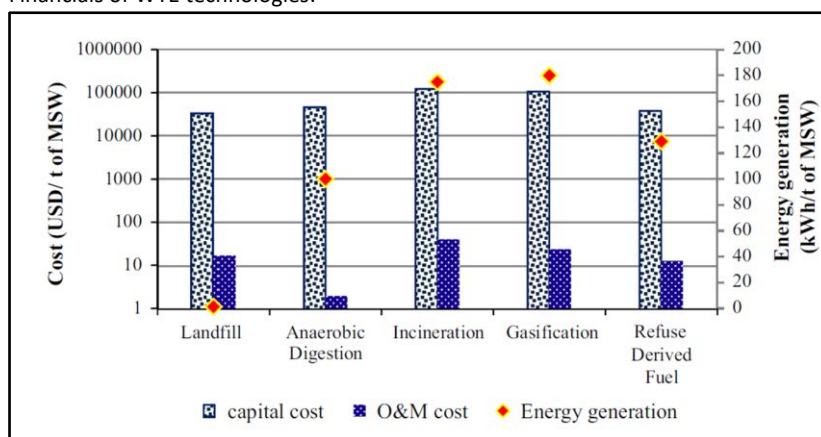
In March 2019 The government announced that it will hold an open tender exercise for companies interested in developing a waste-to-energy (WTE) management system for safer waste disposal. Malaysia is seen to modernise its waste management system and shift from landfills to a better disposal solution.

6 General Sector Analysis

6.1 Available Funding for WTE projects

The cost price per WTE project per output capacity unit differs greatly depending on the choice of technology, operations, maintenance desires and expected residual value of the asset. Therefore, funding options vary and depend on the composition of the aforementioned factors.

Financials of WTE technologies:



15 - Valorization of MSW-to-Energy in Thailand Publication, Rotchana Intharathirat & P. Abdul Sal

Available finance for project development

Investor confidence is returning to the clean energy sector in the Asia-Pacific after a lull in investment prior to 2015. This is in tandem with independent and synchronised pushes for hastening the conversion to renewable energies by governments across the region. Coupled with rapid urbanization in the region and exponential increases in municipal waste, an acute interest in WTE solutions is developing and funding streams for them are becoming increasingly diversified. Part of this diversification is due to the high risk associated with renewable energy projects as a consequence of the intermittent nature of some forms of energy production and accused low rates of return, which tends to ward off players in capital markets, especially venture capitalists. However, with the establishment of private-public equity partnerships, the development of new non-bank (or non-traditional) financial instruments to funding deficits (some of which are discussed below, such as green bonds) and increasing capitalisation of bilateral and multilateral investors is steadily fertilising the Asia-Pacific market for renewable energy projects¹⁶.

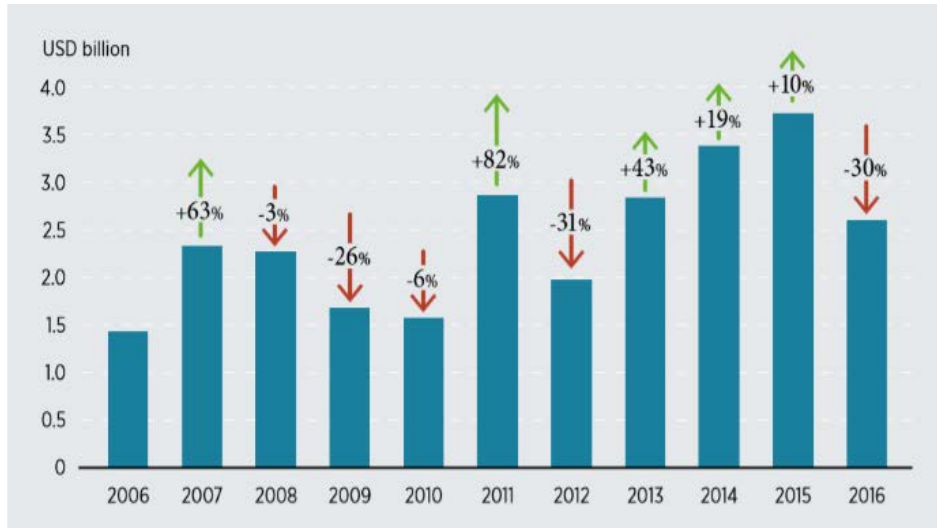
Market trends and capitalisation

Nearly USD 27 billion was cumulatively invested between 2006 and 2016 in renewable energy projects in the Asia-Pacific region. Thailand attracted the bulk of cumulative financing, with over USD 10 billion invested, followed by Singapore and Indonesia. However, a decline in investment over the past decade was recorded in Malaysia, due to a reduction in activities in the bioenergy sector¹⁷.

Investment in Asian Renewable Finance sector

¹⁶ 'Renewable Energy Market Analysis, South-East Asia'. IRENA. (2018). Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_Market_Southeast_Asia_2018.pdf

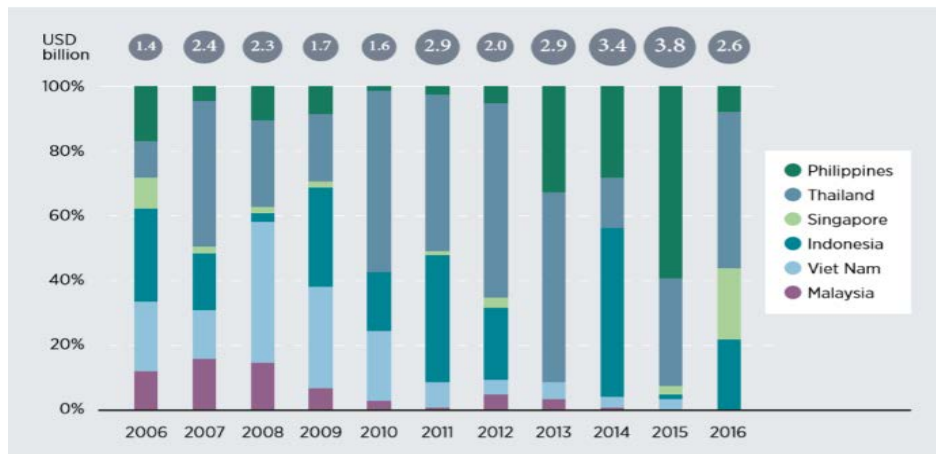
¹⁷ Ibid, pp.109



16 - Investment in Renewable Energy Sector 2006-16 in USD, IRENA (2018)

In terms of technology investment, its composition has changed over time. Before 2008, bioenergy and small hydropower consumed a greater proportion of investment whereas more recently, and as a consequence of augmented funding availability, investment has started flowing towards geothermal, solar PV and wind. Widening interest in alternative clean energy infrastructure and technology indicates that the pool of capital is expanding (see graphs 17&18).

Investment in Renewable Energy in the Power Sector by Country 2006-2016

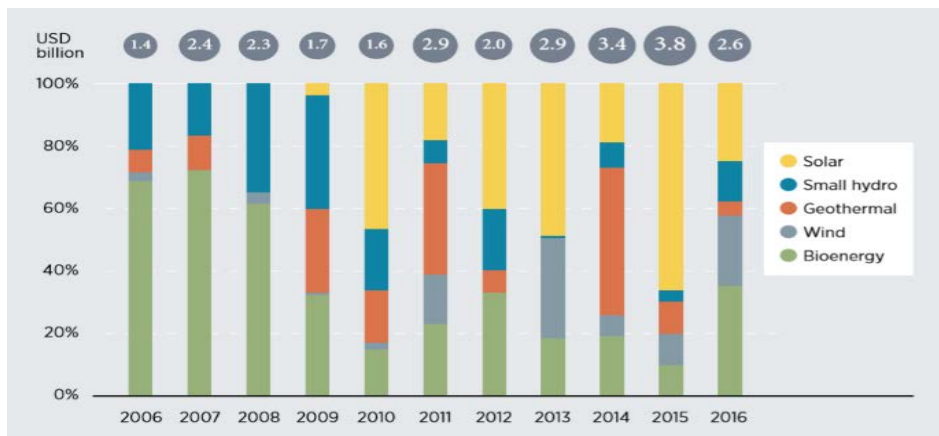


17 - Investment in Renewable Energy Sector 2006-16 in USD, IRENA (2018)

This deepening is also necessitated by the regions target of securing 23% of primary energy from renewable sources by 2025. In order for that target to be met, renewable energy investment would have to be scaled by another USD 27 billion. No one development agency, public body or private equity holder possesses the capital for such an upscaling, and it is unlikely to come solely from one domain. The capital mix will therefore be diverse, with projects likely to be comprised by hybrid funding streams¹⁸

Investment in Renewable Energy in the Power Sector by Technology 2006-2016

¹⁸ Ibid, pp.110.



18 - Investment in Renewable Energy Sector 2006-16 in USD, IRENA (2018)

6.2 Funding options for Low Carbon WTE projects

This section presents an assimilation (although not entirely exhaustive) of relevant available funding options acquired through desk research¹⁹:

Asian Development Bank (ADB) Initiatives

- (a) The Climate Change Fund
- (b) The Future Carbon Fund (FCF)
- (c) Japan Fund for the Joint Crediting Mechanism (JFJCM)

International Finance Corporation (IFC)

The IFC works with both public and private sources of financing for climate-smart investments in emerging markets, using multiple channels including direct funding and funder-funds. Example of IFC funder funds are Armstrong Capital in Singapore and IFC Global Emerging Markets Fund of Funds in Washington and Singapore.

- (a) Green Bonds
- (b) Catalyst Fund

Climate Investment Funds (CIF)

The CIF investment fund is highly capitalised, with funds standing at around \$8 billion. The fund accelerates climate action by empowering transformations in clean technology, energy access, climate resilience, and sustainable forests in developing and middle-income countries.

Global Environment Facility (GEF)

The GEF has provided over \$17.9 billion in grants and mobilized an additional \$93.2 billion in co-financing for projects that address environmental issues worldwide. GEF funds are available to developing countries and countries with economies in transition to meet the objectives of the international environmental conventions and agreements.

Asia-Pacific Economic Cooperation (APEC)

- (a) Sub-Fund on Energy Efficiency and Low-Carbon Measures.

Netherlands Development Finance Cooperation (FMO)

Regarding energy-related sectors specifically, the FMO offers a range of financing solutions including syndicated loans and equity investments for projects pertaining to energy generation and distribution, off-grid solutions, refurbishments and efficiency improvements.

ESCO Fund (Department of Alternative Energy Development and Efficiency)

Created by Thailand's Department of Alternative Energy Development and Efficiency under the Ministry of Energy, the ESCO fund promotes energy conservation and alternative energy investment by providing investment assistance to potential SME operators who lack the necessary capital.

Dutch Good Growth Fund (DGGF)

By providing finance and insurance through the DGGF-programme, the Dutch Ministry of Foreign Affairs creates the conditions to development related trade and investment in 68 countries.

¹⁹ See the websites of these institutions for a more comprehensive overview of the funding opportunities offered and for more information regarding tender / project initiation processes.

ASEAN – German Energy Program (AGEP) – ASEAN Centre for Energy and GIZ

In contribution to the ASEAN Plan of Action for Energy Cooperation 2016 – 2025, the overall objective of AGEP is the improvement of regional coordination for the promotion of renewable energy and energy efficiency towards sustainable energy for all ASEAN Member States.

The Energy and Environment Partnership Mekong

Thirty-nine projects have been supported by providing partial grant based funding to project developers for feasibility studies and pilot and demonstration projects in Cambodia, Lao PDR, Myanmar, Thailand and Vietnam.

Clean Power Asia

USAID CPA is expected to mobilise at least USD 750 million in clean energy investments over the next five years in the region. It will also support installing at least 500 megawatts (MW) of grid-tied renewable energy generation and help implement laws, policies, strategies, plans or regulations that contribute to reducing greenhouse gas emissions.

Country programmes – Global Green Growth Institute (GGGI)

GGGI supports countries in developing their green growth plans. It also develops finance mechanisms and investment instruments in its member countries. It has active renewable energy programmes in Indonesia, Vietnam, Cambodia, Thailand, Lao PDR and Myanmar.

InfraCo Asia

InfraCo Asia funds pre-financial close, early stage, high-risk infrastructure development activities by taking an equity stake with a focus on socially responsible and commercially viable infrastructure projects that contribute to economic growth, social development and poverty reduction. By mitigating early stage development risks, InfraCo Asia facilitates private sector participation.

7 Dutch focus on Thailand & Malaysia WTE sector

7.1 Value chain description of Dutch WTE sector

In this section, relevant general WTE (related) capabilities available from the Netherlands are presented. Then, the most applicable opportunities are summarized from the desk research findings.

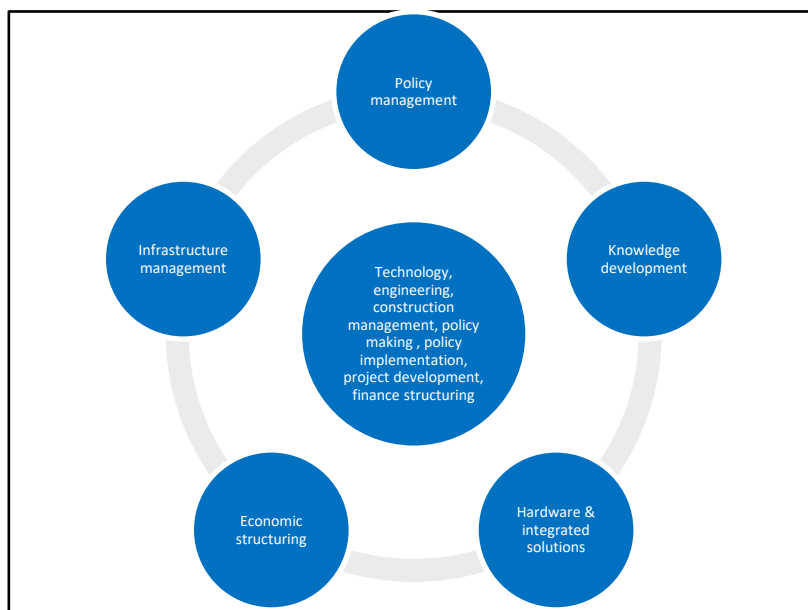
Available expertise and technologies within the Netherlands:

Energy expertise within the Netherlands is found in a diverse array of areas of expertise and technologies:

- MSW incineration technology
- Biogas processing technology
- Liquid waste processing technology
- Policy Implementation expertise
- Project Finance structuring & Funding
- Waste recycling technology
- Waste processing engineering
- Construction Management
- Policy implementation expertise

These areas of expertise available from corporates and institutions apply to the domains of:

- Policy Management
- Knowledge Development (R&D – fundamental and applied)
- Infrastructure Management
- Economic structuring
- Hardware & integrated solutions



19 - Relevant energy areas of expertise and technologies in the Netherlands (Source: Everest Energy)

Opportunities for companies and institutions from the Kingdom of the Netherlands

Given the relevant knowledge and implementation experiences the Netherlands has gained in the past several decades with regards to waste recycling and upcycling, engineering, construction management and, there is an abundant pool of readily available services and equipment provision that can be exported to meet supply opportunities. The type of services can range from technology specific issues and construction experiences, general energy project advice, awareness creation campaigns, to sustainable energy policy making and implementation.

In the following paragraphs the main opportunities will be presented, from both technological and knowledge/engineering perspectives, which are mapped against the aforementioned areas of expertise. Given the specific (enabling) nature of policy making for the adoption and deployment of WTE, the opportunities in this area are presented separately.

1. Opportunities for technology providers

- Proven technologies:
 - Municipal solid waste pre-treatment, recycling & upcycling equipment supply
 - MSW incineration boiler & turbine (total plant) equipment supply
 - WTE EI&A equipment supply (Electrical, Instrumentation & Automation)
 - Biogas & Liquid waste to biogas process equipment supply
 - Energy efficiency measurement, programming and management equipment supply

Servicing expertise areas:



2. Opportunities for knowledge transfer and engineering providers

- Knowledge Institutions (R&D)
 - Capacity building in energy efficiency, infrastructure development, waste pre-treatment, recycling & upcycling, policy implementation development
 - Support with methods and tooling / hardware for laboratories and testing facilities in the fields of (smart) energy systems, waste recycling & processing

Servicing expertise areas:



- Other Engineering/Consultancy firms
 - Engineering services for waste pre-treatment, recycling & upcycling projects
 - Construction management services for pre-treatment, recycling & upcycling projects
 - Operations & Maintenance services in all domains.
 - Integrated Waste management services (adequate waste handling, separation, landfilling, recycling)
 - (Economic) project structuring, Technical Assistance (TA) program for developing economic structuring/risk analysis (credit assessment) capabilities relating to renewable energy projects
 - Sustainability certification

Servicing expertise areas:



Opportunities for policy making

In case there is willingness in the target region for co-operation, the following opportunities could be taken advantage of:

- Operational policy development/writing and anchoring within the national and regional governmental agencies
- Policy Implementation support in all areas of capabilities, especially in renewable energy (broad)
- Governmental Technical Assistance (TA) program for developing economic structuring/risk analysis (credit assessment) capabilities relating to sustainable energy initiatives.
- Technical Assistance (TA) for institutional capacity building
- Awareness raising, especially on need for improved waste management and benefits of sustainable energy and energy efficiency increase.

Servicing expertise areas:



7.2 Dutch supply against Thailand & Malaysian WTE demand

It has been observed from desk and field research that the Thailand & Malaysian WTE markets are well developed in relation to:

- Waste collection & landfilling
- High-level Policy development
- Waste incineration (specific to Thailand)
- Availability of policy/government driven FIT tariffs

However, supply opportunities for Dutch companies/SMEs are promising in the areas of WTE that have been observed to be less developed, but which are characterised by high demand.

Naming specific Dutch supply products, originating from experience and expertise are:

Waste Treatment, recycling & Upcycling equipment supply:

- Municipal solid waste pre-treatment, recycling & upcycling equipment supply
- WTE EI&A equipment supply (Electrical, Instrumentation & Automation)
- Biogas & Liquid waste to biogas process equipment supply

Knowledge Development:

- Capacity building in energy efficiency, infrastructure development, waste pre-treatment, recycling & upcycling, policy implementation and operational development

Engineering/Consultancy services:

- Engineering services for waste pre-treatment, recycling & upcycling projects
- Construction management services for pre-treatment, recycling & upcycling projects
- Integrated Waste management services (adequate waste handling, separation, landfilling, recycling)

Policy development:

- Operational policy development/writing and anchoring within regional & local governmental agencies
- Policy Implementation support in all areas of capabilities, especially in renewable energy (broad)

7.3 Demand for coordinated development approach

From desk and field research, based on integration with Dutch companies, the following is observed relating to the demand for a coordinated market development approach:

- Companies see Asean-5 and South East Asia as 1 development target region. There is little country distinction when allocating development efforts. Therefore, Myanmar and The Philippines are perceived as equally interesting to target.
- Many companies know each other or have done projects together in the past, so working together again or forming consortia is “easier”.
- Companies/SMEs generally do not have extensive international development budgets/resources and have the need to develop international markets with other players or in a centralized approach.
- Before committing to a development effort, companies need to see/be assured that a positive business case is available, risks of doing business are acceptable and a local “anchor” is needed.
- Therefore, a coordinated development approach is needed, and Companies/SMEs welcome the Dutch Government as an enabler and facilitator.
- The Companies/SMEs will require a better understanding of the facilitating tools.
- Dutch Companies/SMEs have limited familiarity with the Dutch Government as an enabler. Given the limited international development budget (as opposed to the need for short-cycled results) Companies/SMEs focus on development efficiency, limited bureaucracy and a high result-versus-cost ratio.
- The willingness to invest in a coordinated development effort is high since Companies/SMEs recognize that:
 - the future growth potential in SE Asia is high
 - the quality of Dutch products & services is export worthy
 - by working with other Companies/SMEs and the Government the cooperation value is larger than individual efforts
 - Dutch government involvement is seen as critical since the Dutch Government brings:
 - Access to network (public and private)
 - (Institutional) Knowledge
 - Embassy support – creating stability and continuity

- In order to create sustainable consortia, the economic upside needs to be presented and the Companies/SMEs require business-oriented support to set up, cement and roll-out consortia and development programmes.

8 Conclusion

The following conclusion have been drawn relating to the research question: “How can Dutch expertise benefit the Thai and Malaysian WTE market?”

1. Energy demand and MSW output will rise significantly in the next two decades based on population growth, continued economic growth and improved accessibility of energy to consumers. Landfilling is prohibited and residual waste must be properly treated including urgently removing it from landfills. In addition, existing landfills must be renovated to render them sanitary. Therefore, demand for MSW and consequently hygiene solutions will be high on the development agenda.
2. For both countries, it has been observed that the national market is very well developed relating to:
 - Waste collection, Landfilling and Waste incineration (specific to Thailand)
 - High-level Policy development
 - Availability of policy/government driven FiT tariffs

Therefore, Supply opportunities are evidently promising in the areas of waste recycling, engineering, construction management and operational policy development/implementation, as it is in these areas that lesser levels of development have been observed.

3. As to the availability of finance for project development, it is observed that both the global as the local investment in renewable energy is fast growing. Project finance markets in Thailand and Malaysia are extremely liquid, non-volatile and relatively cheap (compared to Europe); there is no shortage of funding.
4. The willingness to invest in a coordinated development effort is high since Companies/SMEs recognize that:
 - a. Working with other companies/SMEs and cooperation with government is more valuable and less costly than individual efforts.
 - b. The Dutch government’s involvement is seen as critical since the Dutch Government brings:
 - i. Access to network (public and private)
 - ii. (Institutional) G-to-G Knowledge & Embassy support – creating stability and continuity
5. The markets are well serviced relating to large-scale landfilling, large-scale incineration (specific to Thailand). However, focus area’s where Dutch involvement can be complementary to the current market are:
 - a. Municipal solid waste pre-treatment, recycling & upcycling equipment supply
 - b. WTE EI&A equipment supply (Electrical, Instrumentation & Automation)
 - c. Biogas & Liquid waste to biogas process equipment supply
 - d. Engineering services for waste pre-treatment, recycling & upcycling projects
 - e. Construction management services for pre-treatment, recycling & upcycling projects
 - f. Integrated Waste management services (adequate waste handling, separation, landfilling, recycling)

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