SUSTAINABLE URBAN DEVELOPMENT FRAMEWORK FOR IMT-GT SUBREGION

2019-2036

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The Cooperation of IMT-GT
Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT) was established in year 1993.
The Member States are Indonesia, Malaysia and Thailand.

The IMT-GT Secretariat known as Centre for Indonesia-Malaysia-Thailand Subregional Cooperation (CIMT) is based in Putrajaya, Malaysia.

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This publication was prepared by the Centre for IMT-GT Subregional Cooperation and ICLEI - Local Governments for Sustainability, South Asia to create a comprehensive development framework that intends to foster sustainable, climate resilient growth in the IMT-GT Subregion.

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

One in five people worldwide lives in a city with more than 1 million inhabitants.[1] Between 2016 and 2030, the number of cities with 500,000 inhabitants or more is expected to grow by 30 per cent in Asia.[2] Cities being the economic hotspots, are witnessing an unprecedented demand for urban services. The infrastructure investment gap in the ASEAN region until 2030 is estimated at USD 3 trillion.[3] IMT-GT subregion countries recognize that the pursuit of GDP growth in excess of 5 percent also entails the development of sustainable urban spaces.

Urbanization pressures and the need for immediate provision of urban infrastructure are both a challenge and opportunity to promote GrEEEn[4] growth in the region. Addressing the pressures of urbanization, while ensuring sustainable and environmentally sensitive development, is a daunting challenge that the ASEAN region is contending with. Climate change impacts add to the already complex development challenge. An Asian Development Bank report predicts a 4.8 degrees Celsius rise in mean annual temperature and a 70 centimetres rise in mean sea level by 2100 in Indonesia, the Philippines, Thailand and Vietnam.[5] A rise in sea level would result in major problems for many of ASEAN's largest coastal cities, including Jakarta and Bangkok.

The Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT) is a subregional cooperation agreement between the three country governments, launched in 1993 to accelerate economic transformation of the subregion, focusing on enhancing trade and investment opportunities, tourism, strengthening infrastructure links and institutional arrangements, amongst others. The Centre for IMT-GT Subregional Cooperation (CIMT), based in Malaysia, functions as a central secretariat, coordinating member country activities through national secretariats located in respective countries. The IMT-GT countries now recognize the need to tackle urbanization pressures in the context of prevailing and predicted climate change impacts and have highlighted the need for subsequent action in their Vision 2036.

IMT-GT'S VISION ON CITIES

On 29th April, 2017, the IMT-GT adopted the "Vision 2036" charting out a guiding framework for transforming "middle-weight" cities into more liveable and sustainable urban spaces. IMT-GT intends to achieve this target through the preparation and implementation of Green City Action Plan (GCAP) in 40 cities across the Subregion. Based on the learning from early movers, such as Melaka (Malaysia), Songkhla and Hat Yai (Thailand) and Medan and Batam (Indonesia), which have already prepared their much lauded Green Cities Action Plans (GCAP), the country leaders directed IMT-GT to upscale the successful GCAP models and work towards developing a **Sustainable Urban Development Framework (SUDF)** for the IMT-GT Subregion.

The SUDF, now prepared (core part of this document),not only guides the preparation of 40 GCAPs in the subregion but is also a steering document for identification and implementation of actions, in line with the objectives stated under the environment pillar of the IMT-GT vision.

THE SUSTAINABLE URBAN DEVELOPMENT FRAMEWORK (SUDF)

The Sustainable Urban Development Framework includes and refers to the entire development and monitoring framework that would support the identification of action plans and definition of their scope, mode of implementation and impact. The SUDF will enable the development of a green city network, enabling the implementation of actions which are coherent and in line with local, provincial, national, regional and international priorities.

The SUDF was prepared in a participatory manner, addressing the unique development status of the cities and provinces/states of the IMT-GT. The framework addresses a planning horizon extending from 2019 until 2036, consisting of 3 five year implementation phases (2019-2023, 2024-2028 and 2029-2033) and a final three year implementation phase (2034-2036), during which the next version of the SUDF will be drawn up. Detailed action plans for the first phase (2019-2023), with specific targets and a draft action plan for the entire planning period (2019-2036) are included in the SUDF.

ACTION PLANS AND IMPLEMENTATION STRATEGIES

The prime objective of the action plans (hereafter referred to as 'Plans') is to steer the cities through a progressive journey with an ultimate aim of transforming into green cities, ensuring that sustainability principles are adopted in all development actions. The Plans also address immediate priorities and needs of the cities and provinces/states, while suggesting transformational technologies that would help them leap-frog towards sustainable development.

Interventions included in the plans are clubbed by sector, addressing specific sector-based national targets and policies. Each sectoral intervention may address multiple development objectives, some addressing other sectors as well.

1. United Nations, Department of Economic and Social Affairs, Population Division (2016). The World's Cities in 2016 – Data Booklet (ST/ESA/ SER.A/392)
2. By 2030, Asia will have 6 new mega-cities (population 10 million or more) and 9 new large cities (population 5 – 10 million)
3. Meeting Asia's Infrastructure Needs, Asian Development Bank
4. Considering Economy, Energy and Environment
5. ASEAN Cooperation on Climate Change. Accessed at: https://environment.asean.org/asean-working-group-on-climate-change/

EXECUTIVE SUMMARY

Table 1 delineates all interventions suggested as part of the SUDF action plan. While several measures are to be implemented during the period 2019-2036, some measures are specified only for phase 1 (2019-2023) of the action plan, such as the 'education for sustainable development' measures. Specific targets, until 2036, are specified only for those set of interventions whose implementation is to start in phase 1. For such interventions, phase 1 targets have also been specified separately.

A summary of the estimated investments and GHG emissions reduction potential of the action plans for Indonesia, Malaysia and Thailand for 2019-2036 and 2019- 2023 is given below in table 2.

Table 1: SUDF action plan (2019 – 2036)

Proposed Interventions			
Infrastructure interventions (2019 -2036)	Planning interventions (2019 -2023)	Awareness building measures (2019 -2023)	Suggested infrastructure interventions (to start after 2023 – post phase 1 completion)
• Shift to electric mobility • Installation of solar PV systems • Energy efficient buildings • Implementation of LED street lighting • Solid waste processing facilities (Waste-to-Energy, Composting and Biomethanation) • Increase in tree cover • Restoration of wetlands	• Comprehensive Mobility Plan • GHG emissions inventory • Local Biodiversity Strategy Action Plan	• Education for sustainable development - Eco schools - Eco campuses	• Sanitary/Controlled landfill for solid waste • Solar water heating and cooking • Non-conventional transport system • Public bike sharing • Waste recycling industry • SCADA • Non-revenue water reduction • 24x7 water supply • Introducing compatible agriculture and horticulture species • District cooling systems

Table 2: SUDF action plan - summary of investments and savings

	Total Cost of Investments	Total GHG Emissions Reduction (per annum)	Total Fuel Saved (per annum)	Total Electricity Consumption Reduced (per annum)
	Million USD	Million tonnes of CO_2 equivalent (million tCO_2e)	Million litres	Million units (kWh)
Action Plan 2019 - 2023	5,367	2	42	1,263
Action Plan 2019 - 2036	16,934	6	142	4,757

EXECUTIVE SUMMARY

Sector-wise GHG emissions reductions in tonnes of carbon dioxide equivalent (tCO_2e) are shown in figures 1 and 2.

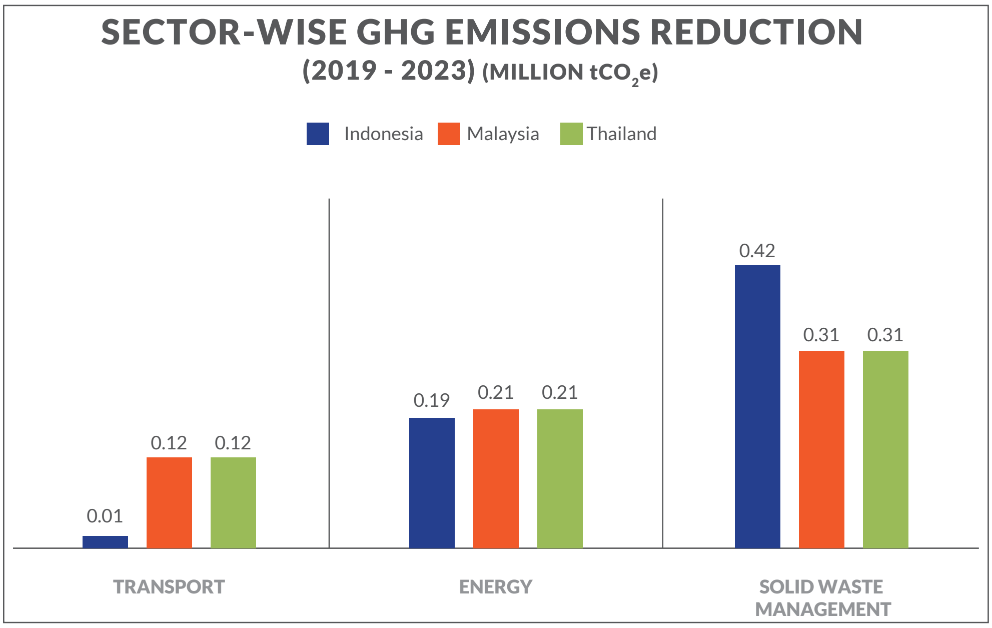

Figure 1: Sector-wise GHG emissions reduction (2019-2023)

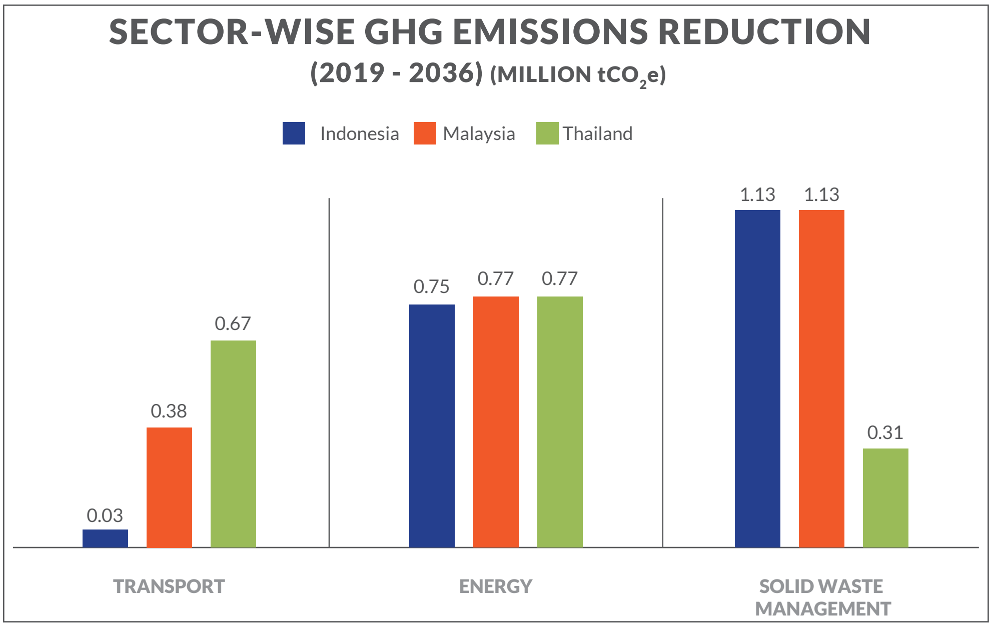

Figure 2: Sector-wise GHG emissions reduction (2019-2036)

For the first phase of the action plan, CIMT will approach the international donor community to generate funds for the preparation of feasibility studies and detailed project reports for specific interventions and action plans, as needed. The national secretariats of the IMT-GT subregional cooperation will also explore avenues for secure national funding for the implementation of the action plans. Cities and provinces/states are also encouraged to co-fund implementation of these actions through own revenues.

The SUDF is to be approved by the leaders of the three countries in 2019 in the 12th Leaders Summit.

INTRODUCTION

INTRODUCTION

Leaders of the Republic of Indonesia, Malaysia and the Kingdom of Thailand launched the Indonesia-Malaysia-Thailand Growth Triangle (hereafter referred to as IMT-GT) subregional cooperation programme in 1993 to accelerate the economic transformation of the subregion. Historically, regional cooperation and integration among these countries has always resulted in fast-tracking economic growth, reducing poverty, and strengthening institutions - both at the individual country level and the region as a whole. Recognizing this potential, IMT-GT is a strategic framework agreement between leaders of the three countries to leverage underlying complementarity and comparative advantages while enhancing the subregion's competitiveness for investment and exports. The subregion includes ten provinces of Sumatra, Indonesia, eight states in Peninsular Malaysia and fourteen provinces in the Southern Region of Thailand. It is home to about 83 million people inhabiting a land area of about 615,208 square kilometres.[6]

As a subregional economic cooperation compact, IMT-GT particularly focuses on enhancing trade and investment opportunities, tourism, strengthening infrastructure links and institutional arrangements, among others. While the agreement binds the three countries to various commitments, around 2007, a need for a central secretariat to coordinate and monitor progress was realised. This led to the establishment of the Centre for IMT-GT subregional cooperation (CIMT) based in Malaysia, with its operations funded equally by all three-member countries.

PROVINCES

10 provinces of Sumatra, Indonesia

8 states in Peninsular Malaysia

14 provinces in the Southern Region of Thailand

POPULATION
83 million people

LAND AREA
615,208 sq. kms

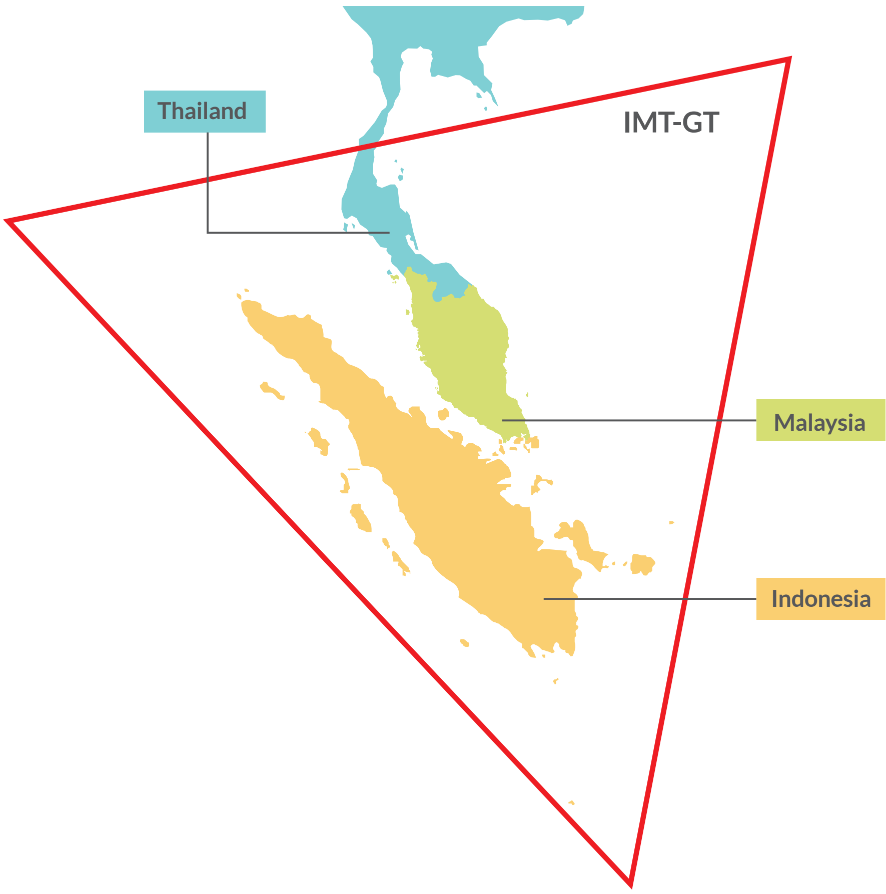

Figure 3: Map of IMT-GT

[6] IMT-GT, Statistical Information Brief, June 2019

INTRODUCTION

ROLE OF CIMT

CIMT acts as a central secretariat coordinating member countries' national secretariats, to achieve the set vision of the IMT-GT. The centre's overarching objective is to accelerate subregional cooperation by providing a cohesive institutional structure by coordinating and facilitating initiatives to further the vision of the IMT-GT. It is also responsible for engaging with potential investors and donors, accelerating project and programme implementation, while also disseminating information on the achievements of IMT-GT within and outside the subregion.

IMT-GT VISION 2036

On 29th April 2017, the IMT-GT adopted the 'Vision 2036', charting out a development framework consisting of goals, objectives and approaches, segregating them under seven strategic pillars. It was decided that agriculture and agro-based industry, tourism, and halal products, and services will spearhead IMT-GT's integration efforts over the next five years and beyond. The three lead focus areas will be supported by four enabling sectors, which are:

- Transport and ICT connectivity
- Trade and investment facilitation
- Environment
- Human resource development, education and culture

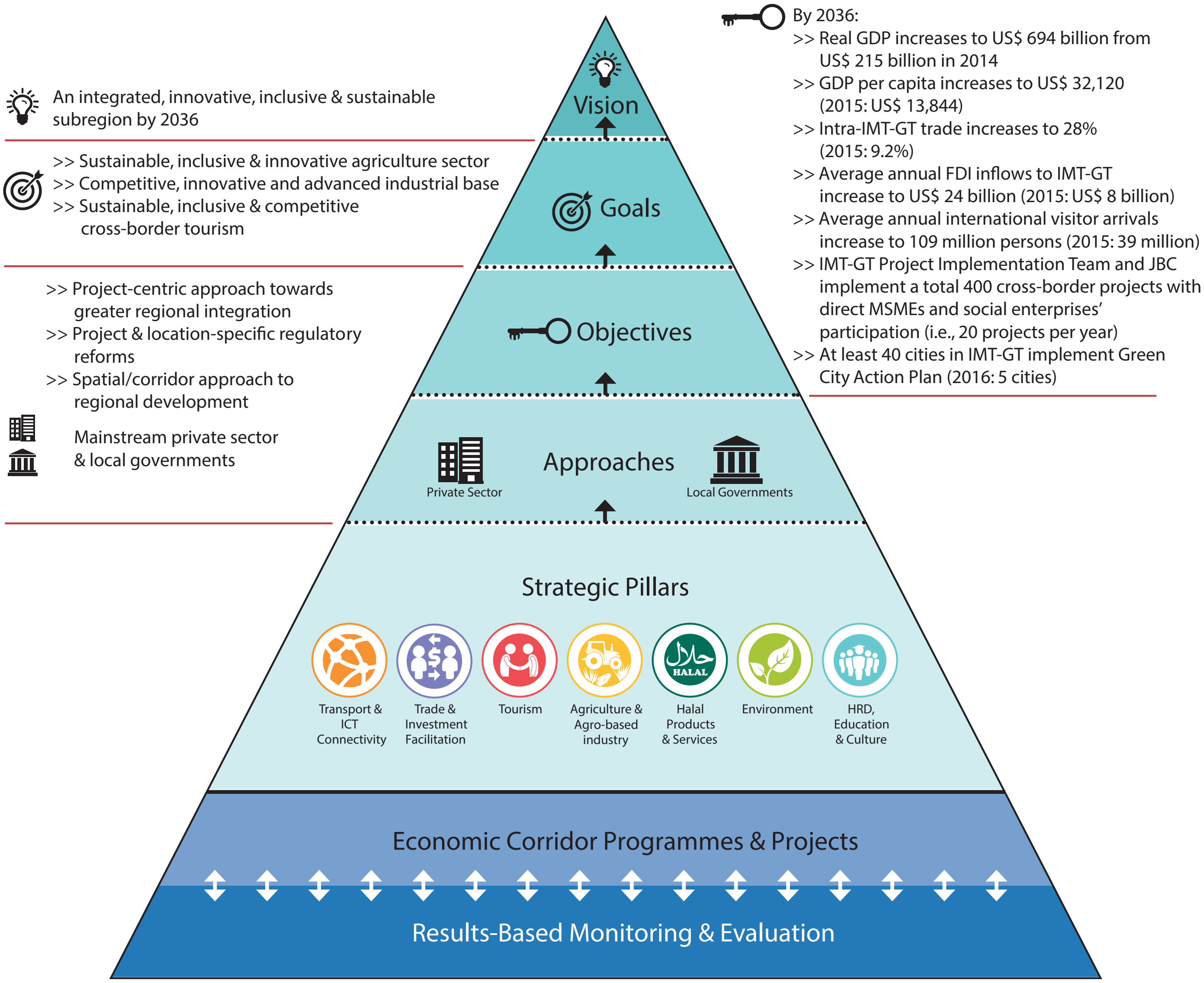

Figure 4: IMT-GT vision 2036

INTRODUCTION

The IMT-GT Subregion is focussing on sustainable economic development. The environment sector is an enabler for sustainble economic growth. Specific objectives are defined in 'IMT-GT's Vision 2036' for achieving this goal. These objectives include:

(1) A network of green cities is established in IMT-GT.
(2) IMT-GT's natural capital such as adjacent national parks, other protected areas and migratory species are effectively managed and conserved under subregional cooperative efforts.

Three priority strategies are to be pursued for achieving these objectives:

(1) Upscaling and replicating the Green City Initiative across the subregion
(2) Undertaking coordinated efforts for the sustainable management of the natural resources in IMT-GT, such as forests, water and wildlife
(3) Enhancing collaboration in the management and restoration of adjacent ecosystems

The Vision 2036 document noted that around 90 million people are estimated to move to cities by 2030, particularly to the smaller 'middle-weight' cities while contributing to about 40 percent of the region's GDP growth. Thus, to make these cities more liveable and sustainable, a target to implement the Green City Action Plan (GCAP) in 40 cities, is defined.

Based on the learning from early movers, such as Melaka (Malaysia), Songkhla (Thailand) and Medan Municipality (Indonesia), which have already prepared their much lauded Green Cities Action Plans (GCAP), the country leaders directed IMT-GT to upscale the successful GCAP models and work towards developing a **Sustainable Urban Development Framework (SUDF)** for the IMT-GT Subregion. The SUDF, now prepared (core part of this document),not only guides the preparation of 40 GCAPs in the subregion but is also a steering document for identification and implementation of actions, in line with the objectives stated under the environment pillar of the IMT-GT vision.

THE SUSTAINABLE URBAN DEVELOPMENT FRAMEWORK (SUDF)

The sustainable urban development framework includes and refers to the entire development and monitoring framework that would support the development of action plans, with well defined scope, mode of implementation and impact. The SUDF will enable the development of a green city network, ensuring the implementation of actions which are coherent and in line with local, provincial, national, regional and international priorities.

The intent of the SUDF is to enable transformative GrEEEn Growth in the region by adopting an integrated approach where the principles of a socially inclusive, economically viable, resilient and environmentally sound growth drive all decisions and actions (governance, policies, strategies, technologies, infrastructure, planning, community involvement etc.), resulting in sustained and resilient economic development in the region.

The framework consists of three operational stages – scoping, planning and implementation.

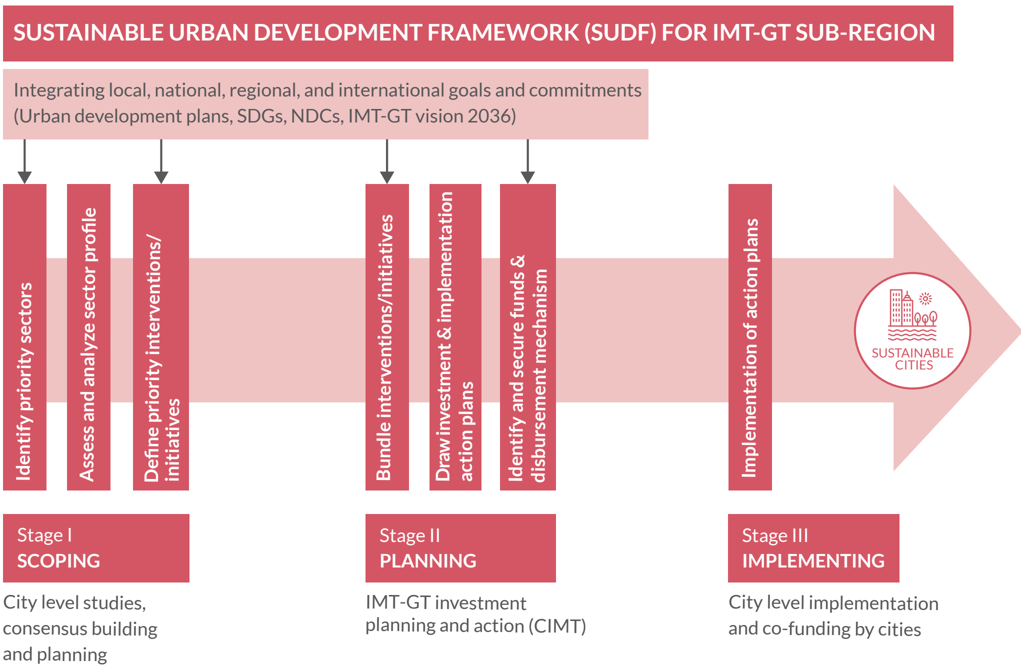

Figure 5: SUDF for the IMT-GT subregion

INTRODUCTION

PREPARATION OF THE SUDF

Assess baseline →	Province/ city workshops →	Priority Sectors
Identify desirable growth path →	Response analysis →	Focus cities/ provinces
Define actions and implementation strategies →	Priority actions →	Financing and implementation
Monitoring and reporting framework →	SUDF implementation monitoring →	Reporting framework to CMGF and Green Council
Final SUDF for adoption →	Workshop with UN agencies and ASEAN Secretariat →	Adoption at 12th IMT-GT Summit – April 2019

Figure 6: SUDF preparation - approach and methodology

The SUDF was prepared in a participatory manner, addressing the unique development status of the cities and provinces of the IMT-GT.

The different stages in the preparation of the SUDF are illustrated in figure 6.

Baseline assessment:
To set the context and identify areas of importance, a series of discussions were conducted with representatives of IMT-GT member cities and provinces in workshops, the national secretariats of each country and CIMT. This led to identification of the following priority sectors – water supply, wastewater management, municipal solid waste management, energy, transport, and biodiversity.

Identification of desirable growth path:
As part of the participatory and comprehensive approach adopted for preparing the SUDF, two sets of questionnaires, one targeting cities and one targeting provinces, were prepared and sent to all member provinces and cities (Refer to data collection toolkit in Annex 1). CIMT and national secretariats coordinated efforts to secure information from all cities and provinces, based on the questionnaires. This information was used to define the baseline scenario and identify city-wise priority interventions, with an aim to enhance service delivery and improve service efficiency, in line with their strategic development plans and future growth potential, while also ensuring low-carbon climate-resilient development.

Additionally, extensive desktop research was carried out to map the mega-trends in urban development in the three countries and understand how they are responding to national development plans, sustainable development plans, Intended/Nationally Determined Commitments (INDC/NDC) as well as other regional collaboration objectives.

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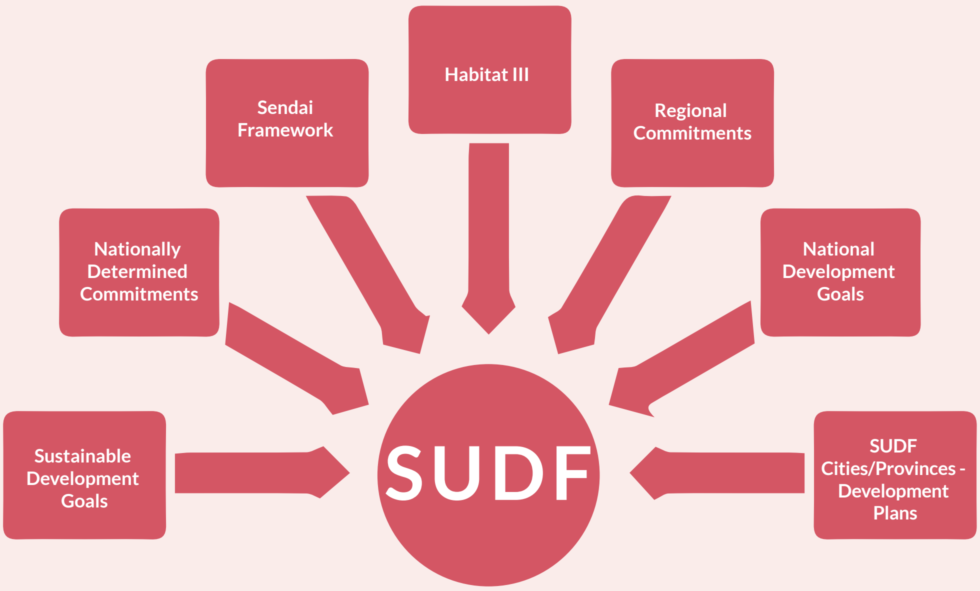
Linking SUDF with international, national and regional goals and commitments
The framework considers the recently adopted Sustainable Development Goals (SDGs) 2030, Nationally Determined Commitments (NDC) under the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement[7] and other international, national and regional goals and commitments.

The framework recognizes and integrates 'Goal 11 – Sustainable cities and communities' of the SDG by including outcome-oriented targets in the sectors of transport, energy, water, waste water, solid waste management and biodiversity. Process oriented targets such as enhancing resilience to climate change by educating the youth on sustainable development (Eco-campus programme), are also included. Further, the framework considers the SDG and NDC targets in each country and identifies relevant interventions that can contribute to their achievement.



[7] The Paris Agreement | UNFCCC - https://unfccc.int/process-and-meetings/...paris-agreement/what-is-the-paris-agreement
[8] Indonesia - Ministry of Environment and Forestry, Malaysia - The Ministry of Natural Resources and Environment (NRE), Thailand - Ministry of Natural Resources and Environmental Policy and Planning

INTRODUCTION

SUDF CITIES PRIORITIZED FOR IMPLEMENTATION OF PHASE 1 ACTIONS

The baseline information and priorities from provinces, regencies and cities, which responded to the request for information, formed the basis of the SUDF and its action plans. These cities are given priority for implementation of actions in phase 1 of the SUDF and are designated as SUDF cities. Table 3 below provides a list of the respondent cities, regencies and provinces.

Table 3: Contributing cities, regencies and provinces

Indonesia	Malaysia	Thailand
Cities		
Jambi City (Jambi Province)	Kangar Municipal Council (Perlis State)	Nakhon Si Thammarat Municipality (Nakhon Si Thammarat Province)
Banda Aceh Municipality (Aceh Province)	Kota Bharu Municipal Council (Kelantan State)	Krabi Municipality (Krabi Province)
Batam Municipality (Riau Island Province)	Teluk Intan Municipal Council (Perak State)	Trang Municipality (Trang Province)
Dumai Municipality (Riau Island Province)	Manjung Municipal Council (Perak State)	Phatthalung Municipality (Phatthalung Province)
Lebong Regency (Bengkulu Province)	Ipoh Municipal Council (Perak State)	Pattani Municipality (Pattani Province)
Medan Municipality (North Sumatra Province)	Taiping Municipal Council (Perak State)	Su-ngai Kolok Municipality (Narathiwat Province)
Muntok Municipality (Bangka-Belitung Province)	Seberang Perai Municipal Council (Penang State)	Ranong Municipality (Ranong Province)
Pekanbaru City (Riau Province)	Kuala Kangsar Municipal Council (Perak State)	Hat Yai Municipality (Songkhla Province)
West Bangka Regency (Bangka-Belitung Province)	Penang Island City Council (Penang State)	
	Alor Setar City Council (Kedah State)	
	Langkawi Municipal Council (Kedah State)	
Provinces		
Aceh Province	Melaka State	Phatthalung Province
Bengkulu Province		Yala Province
Jambi Province		Songkhla Province
Riau Province		Surat Thani Province
		Pattani Province
		Chumphon Province
		Trang Province
		Narathiwat Province
		Satun Province

INTRODUCTION

DEFINE ACTIONS AND IMPLEMENTATION STRATEGIES

Based on an assessment of the feedback and outcomes from the continued dialogue with IMT-GT member cities, national secretariats of each country and CIMT, priority actions were defined for the period 2019 – 2036, the implementation period of the SUDF. This implementation period is consistent with the planning period considered in the IMT-GT Vision document. The implementation of the SUDF is envisaged in 4 phases viz. Phase 1: 2019 – 2023, Phase 2: 2024 – 2028, Phase 3: 2029 – 2033 and Phase 4: 2033 – 2036.

A long list of projects, which are to be implemented over the entire planning period (2019-2036), was defined. Priority actions with targets are also defined for the first phase of implementation (2019-2023). The scale of implementation, cost estimates and indicative implementation mechanisms are also defined. For each proposed intervention, for the entire implementation period, the potential GHG emissions reductions are estimated and adaptation benefits highlighted, thereby indicating the climate benefits of implementing the SUDF.

MONITORING AND REPORTING

The monitoring of the action plan implementation will be overseen by the IMT-GT Green Council. The Green Council consists of a group of Chief Ministers and Governors from the IMT-GT states. The SUDF cities would report to the national secretariats which would then report both to the Green Council and also the Ministries of Environment (the nodal ministries responsible for implementation of the NDCs), enabling them to take cognizance of local actions which contribute to the achievement of national NDC and SDG targets.

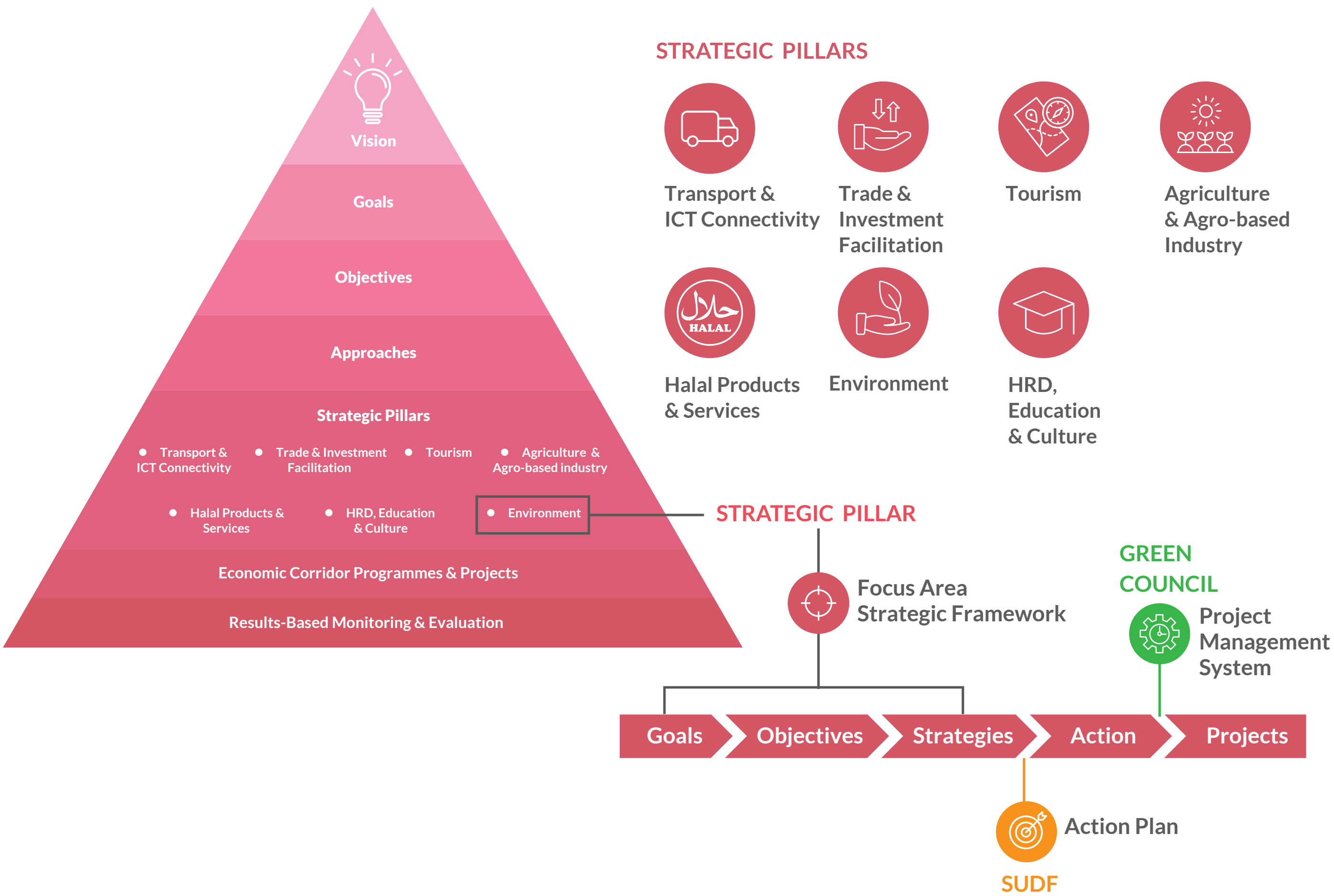


Figure 7: Monitoring and reporting framework for the SUDF

INTRODUCTION

ADOPTION OF THE SUDF

The SUDF, once agreed on by senior officials of the IMT-GT, will be finalized after the scope of the first phase actions is defined in its entirety, including the identification of specific implementation cities and scale of action in each city. This document will be discussed with bilateral and multilateral agencies, UN agencies and the ASEAN Secretariat to explore synergies for implementation. This document will then be presented in the 12th IMT-GT Summit in April 2019, for adoption by the Leaders.

VERSION 2.0 OF THE SUDF

The SUDF is a live document, which is to be updated for beyond 2036. In the 4th year of the first 3 phases (each phase consisting of five years), the specifics of the action plans for the subsequent phase will be defined. The SUDF tool-kit, provided in Annex 1 of this document, will be used as a basis for the preparation of detailed action plans for the subsequent phase.

In the second year of the final phase (consisting of only 3 years), the framework itself will be updated to the second version, spanning the next planning period of the IMT-GT. The framework will be updated in tandem with the vision of the IMT-GT.

STRUCTURE OF THE SUDF DOCUMENT

This document presents the SUDF. The executive summary provides a gist of the process undetaken for the preparation of the SUDF and highlights the provisions of the framework, including the defined action plans and summary of impacts. The 'Introduction' section provides an overview on formation of IMT-GT, role of CIMT, and gives details of the approach and methodology followed in the preparation of the SUDF.

The country profile section, with separate sub-sections for each of the countries – Indonesia, Malaysia and Thailand, provides information on the development context of the country, urbanization scenario, development challenges, GHG emissions and climate change vulnerability scenario, SDG and NDC targets, other sustainable development linked policies and targets and detailed sector profiles. The information provided by respondent cities, regencies and provinces is detailed out in the sector profiles. This information pertains to the baseline sector status and interventions prioritized by the respondents.

Annexes to this document include the SUDF questionnaire tool-kit which was circulated to all IMT-GT members to elicit information for the preparation of the SUDF, detailed response analysis for each country and a technical compendium of interventions that are considered in the SUDF action plans.

COUNTRY PROFILES

INDONESIA

INTRODUCTION

Indonesia is the world's fourth-most populous country. Consisting of over 17,000 islands, it is the world's largest archipelago and has a predominantly mountainous topography. More than half of Indonesia's population is concentrated in the Java province. Indonesia consists of 34 provinces, each with several regencies, cities and villages[1].

Regency and city refer to the second level of government in Indonesia. These are governed by their own legislative bodies. Cities are led by mayors and regencies by regents. Regencies usually have a larger rural/agricultural area and cities are predominantly urban in nature. Cities and regencies accommodate half of Indonesia's population and are responsible for a major share of national GDP.

The sixteenth largest economy in the world and among the largest in Southeast Asia, Indonesia has a GDP of USD 1.015 trillion (2017) with a growth rate of 5.2% (2018)[3]. GDP per capita has steadily risen from $857 in 2000 to $3,876 in 2017.

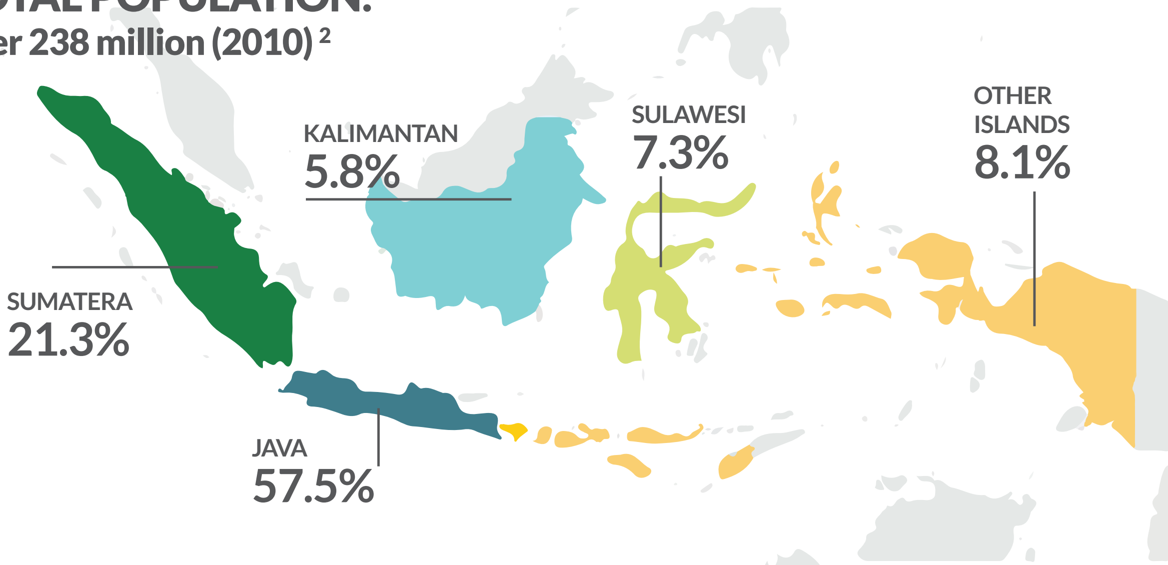
As an emerging middle-income country, Indonesia has made enormous gains in poverty reduction. With the poverty rate has reduced by more than half since 1999 and stands at 10.86 percent in 2016.

Indonesia's economic planning follows a 20-year development plan (2005 to 2025), which is further segmented into 5-year medium-term plans called the RPJMN (Rencana Pembangunan Jangka Menengah Nasional), each with differring development priorities. The current medium-term plan (2015 to 2020) focuses on infrastructure development and social assistance programmes related to education, healthcare and reforms.

URBANIZATION SCENARIO IN INDONESIA

Indonesia is undergoing a historic transformation from a rural to an urban economy with cities growing at a rate of 4.1 percent per year. As per projections, by 2025 the country is expected to have 68% of the country's population would be living in cities[4].

TOTAL POPULATION:
over 238 million (2010) [2]



ADMINISTRATIVE DISTRIBUTION

Provinces – 34 | Regencies- 416 | Municipalities 98 | Districts or Sub-Districts - 6,543 | Villages - 75,244

Figure 8: Indonesia country profile

An increase in rural-urban migration has resulted in rising urban poverty levels. In 2016, 7.8 percent of the urban population was living below the poverty line[5]. By 2020, urban poverty is projected to surpass rural poverty primarily due to the high migration rate and subsequent expansion of cities, without a commensurate increase in employment and social infrastructure.

GDP OF THE COUNTRY (2017) (USD TRILLION)	1.015
PER CAPITA GDP (2017) (USD)	3,876
AVERAGE ANNUAL GROWTH RATE OF GDP (%)	5.2 [6]
POPULATION GROWTH RATE 2017 (%)	1.1 [7]
URBAN POVERTY (% population living below urban poverty line)	7.8

[1] indo.com. (2000). Bali & Indonesia on the net. [online] Available at: http://www.indo.com/indonesia/archipelago.html
[2] Indonesia 2010 Census
[3] countryeconomy.com. (2018). Indonesia GDP - Gross Domestic Product. [online] Available at: https://countryeconomy.com/gdp/indonesia
[4] 2016. Indonesia's Urban Story; World Bank Group. Washington, D.C.: World Bank Group. Available at http://www.worldbank.org/en/news/feature/2016/06/14/indonesia-urban-story
[5] Statistics Indonesia (BPS)
[6] Trading Economics. (2018). Indonesia GDP Annual Growth Rate 2000-2018. [online] Available at https://tradingeconomics.com/indonesia/gdp-growth-annual
[7] Population growth (annual %); World Bank Group (2018)

URBAN PROFILE OF INDONESIA

Table 4: Cities, regencies and provinces participating in the SUDF initiative - Phase 1

PARTICIPATING CITIES, REGENCIES AND PROVINCES	POPULATION (000)
Cities and regencies	
Jambi City, Jambi Province	531 (2010)
Dumai Municipality, Riau Islands Province	292 (2017)
Banda Aceh Municipality, Aceh Province	255 (2016)
Pekanbaru City, Riau Province	1,064 (2016)
Muntok Municipality, Bangka Belitung Province	45 (2015)
Medan Municipality, North Sumatera Province	2,211 (2016)
Batam Municipality, Riau Islands Province	1236
Lebong Regency, Bengkulu Province	114 (2017)
Batam Municipality, Riau Islands Province	274
West Bangka Regency, Bangka Belitung Province	46 (2015)
Provinces	
Bengkulu Province	1,875 (2015)
Jambi Province	3,402 (2015)
Riau Province	6,501 (2016)
Aceh Province	5,096 (2015)

DEVELOPMENT CHALLENGES IN CITIES

Rapid urbanization, high population density and continued rural-urban migration, have all resulted in exerting undue pressure on existing urban insfrastructure. Enhancement of service coverage and performance is unable to keep pace with the rising urban population. Additionally, the impacts of climate change have become a major threat. In 2016, 95 percent disasters in Indonesia were influenced by hydro-meteorological phenomena, causing floods, landslides, tornadoes and forest fires[8]. Some of these impacts are irreversible.

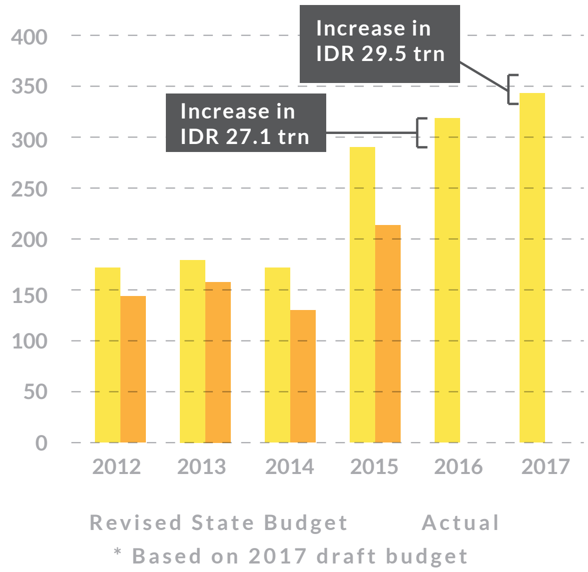
ANNUAL FLOODING OF JAKARTA

Indonesia's predictable but devastating annual floods inundate the city of Jakarta every rainy season from December to February. Tens of kilometres of residential city area are flooded, with up to four metres of sewage mixed flood waters for several days, according to the UN Office for the Coordination of Humanitarian Affairs (OCHA) in Indonesia. Bound by the Java Sea to the north and with thirteen rivers flowing through the city from the mountains in the north to the south, the city is now threatened by climate change impacts in the form of increasingly heavy monsoon rains and rising seas (PRI.org).

In 2007, the worst floods in the history of Jakarta inundated about 70 percent of the city, killing at least 80 people and causing about 340,000 to flee their homes. Moreover, the estimated annual damage due to flooding in Jakarta is approximately USD 400 million. Deficient infrastructure, such as an inadequate drainage system, makes matters worse.

Rising sea level and changing weather patterns also cause increased uncertainty in water availability and food production, and disrupt transport and commerce in cities.

Rural-urban migration has also resulted in urban housing challenges. Due to low and varying income, majority of the urban poor cannot afford housing provided by either the state housing provider agency (PERUMNAS) or private developers. This results in a proliferation of squatter communities[9]. Marginalized urban residents also occupy state owned land such as disposal sites, riverbanks, railway tracks and private unoccupied land where lack of access to urban services results in environmental degradation and unsanitary surroundings.



Source: Ministry of Finance, Government of Indonesia

Figure 9: Government spending on infrastructure (in trillion IDR)

The World Economic Forum's (WEF) Global Competitiveness Report 2016-2017 ranked Indonesia at 60th place among 138 economies in terms of infrastructure development. Inadequate infrastructure implies insufficient utility service coverage as well as poor service levels.

This partially explains the challenges faced by Indonesian cities, as cited below:

- **Constraints in budgetary provision**
- **Inadequate piped water supply and at times, poor water quality**
- **Mixed sewer overflows and inadequate waste water treatment**
- **Open and unscientific solid waste dump yards**
- **Traffic congestion issues**
- **Long duration power outages**
- **Deforestation**

[8] Agency of Meteorology, Climatology, and Geophysics, Indonesia, 2016
[9] Sudarmo 1997; Tunas and Peresthu 2010

CLIMATE CHANGE
GHG EMISSIONS AND VULNERABILITY

With annual GHG emissions of 789.48 million tCO_2e (2014)[10], Indonesia is among the largest GHG emitters globally, contributing to almost 5 percent of the total global emissions.[11]

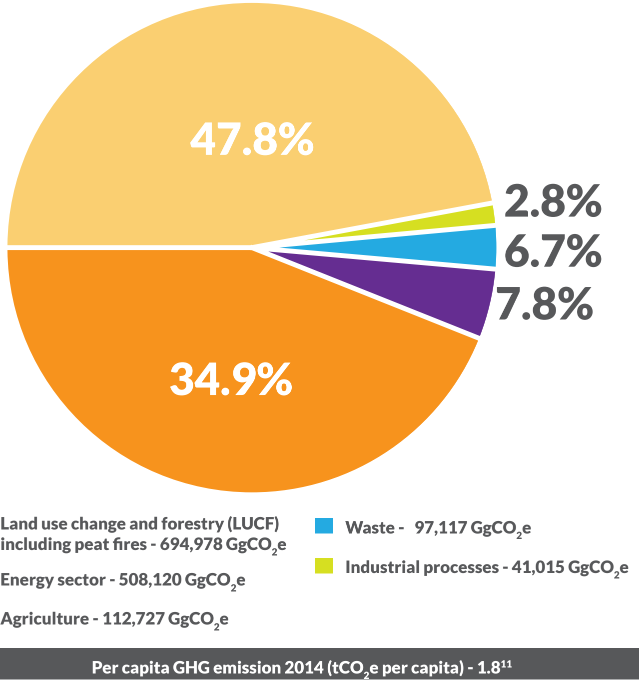


Figure 10: Indonesia GHG emissions profile 2014

According to the World Bank (2010), deforestation, forest fires and degradation of peat land have caused Indonesia to become the third largest GHG emitter globally. Key issues that contribute to Indonesia's deforestation includes weak regulatory accountability, policies favouring large-scale commercial businesses over small and medium size, distorted incentives for timber transport and prices, ineffective legal foundation for protecting the poor land users, undervaluation of forest assets, and corruption (World Bank 2007).

Economy wide activities in cities also significantly contribute to the country's GHG emissions. For example, in 2005 Jakarta city alone was responsible for 35 million tonnes of CO_2e emissions i.e. 1.6 percent of the country's total emissions. GHG emissions in Jakarta are projected to increase to 113.94 million tCO_2e by 2030, as reported by the Jakarta Environmental Agency 2005. Increasing health impacts of poor air quality, such as respiratory problems and visibility issues, are also evident in cities.

VULNERABILITY AND RISK

With a long coastline of 4,675 km, Indonesia is highly vulnerable to rise in sea level. Forty two million Indonesians live less than 10 m above sea level. A one-meter rise in sea level could inundate 405 thousand hectares of land and reduce Indonesia's territory by flooding low-lying islands. Sea level rise and coastal erosion are the most common climate change impacts that the country contends with. Studies have illustrated that the economically productive areas of Bali, Java and Sumatra are particularly vulnerable to impacts of climate change (World Bank 2009).

The National Platform for Disaster Risk Reduction in Indonesia oversees all disaster management related activities and helps synchronize various policies, programs and activities for disaster risk reduction at the national level, in line with the Hyogo Framework for Action (endorsed by UN General Assembly). The Yogyakarta Disaster Risk Management (DRM) Forum rand the East Nusa Tenggara DRM Forum manage regional level disaster risk reduction activities. Disaster management agencies were created in all 34 provinces between the years 2010-2013. At present, local disaster management agencies (BPBDs) exist in more than 90 percent of Indonesian districts and cities.

IMPACTS OF CLIMATE CHANGE

- INCREASED FLOODING
- PERIODIC DROUGHTS
- SEA-LEVEL RISE
- LANDSLIDES
- FREQUENT AND INTENSE TROPICAL STORMS

JAKARTA – THE FASTEST SINKING BIG CITY IN THE WORLD:

Jakarta, the Indonesian capital is sinking up to 17 cm per annum and is sinking so surreally fast that rivers sometimes flow upstream, ordinary rains regularly swamp neighbourhoods and buildings slowly disappear underground. Coastal districts like Muara Baru have sunk as much as 14 feet in recent years. The reason for sinking is a mix of man-made problems like unplanned development, illegal digging of deep bore-wells, polluted web of canals and global warming[13]. Jakarta airport which serves the capital and is about five kilometres from the seafront, will be under water by 2030, primarily due to land subsidence and coastal abrasion from rising sea level (Maplecroft 2014). As per hydrologists, the city has only a decade within which to take measures to halt its subsidence.

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10. CO_2 emissions (metric tons per capita); World Bank Group (2018)
11. climatelinks. (2017). Greenhouse Gas Emissions Factsheet: Indonesia. [online] Available at https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-indonesia
12. CO_2 emissions (metric tons per capita); World Bank Group (2018)
13. Kimmelman, Michael. (2017). 'Jakarta Is Sinking So Fast, It Could End Up Underwater'. The New York Times. Available at https://www.nytimes.com/interactive/2017/12/21/world/asia/jakarta-sinking-climate.html

SDGs, NDCs AND RESILIENCE

SUSTAINABLE DEVELOPMENT GOALS (SDGs) 2030

Indonesia is pursuing all 17 SDGs and categorizes them under 4 pillars- social, economic, environment, and law and governance.

4 PILLARS OF INDONESIAN SDGs

SDGs

17 Goals
169 Targets
241 Indicators

SOCIAL PILLAR 5 Goals 47 Targets 77 Indicators	GOALS 1: No Poverty 2: Zero Hunger 3: Good Health & Well Being 4: Quality Education 5: Gender Equality	**LAW & GOVERNANCE PILLAR** 1 Goal 12 Targets 23 Indicators	GOAL 16: Peace, Justice & Strong Institutions
ENVIRONMENT PILLAR 6 Goals 56 Targets 69 Indicators	GOALS 6: Clean Water & Sanitation 11: Sustainable Cities & Communities 12: Responsible Consumption & Production 13: Climate Action 14: Life Below Water 15: Life on Land	**ECONOMIC PILLAR** 5 Goals 54 Targets 72 Indicators	GOALS 7: Affordable & Clean Energy 8: Decent Work & Economic Growth 9: Industry, Innovation & Infrastructure 10: Reduced Inequalites 17: Partnerships for the Goals

Figure 11: 4 pillars of Indonesian SDGs

The table below gives details of specific goals that are pertinent to the SUDF priority sectors:

Table 5: Goals and priority sectors for SUDF implementation

SDG GOAL	TARGET 2020 [14]	ACHIEVEMENTS (2016)	CHALLENGES/OPPORTUNITIES
Goal 11 – Sustainable cities and communities	Make cities and human settlement inclusive, safe, resilient and sustainable.	Number of people living in slums declined by 1.2% between 2009 and 2014.	There exists high migration from rural areas to cities for access to improved facilities and employment opportunities. It is expected that by 2025, 68% of the country's population will be living in cities.
Goal 7 – Affordable and clean energy	Ensure affordable, reliable, sustainable, and modern energy for all.	Renewable energy constitutes 4% of the total energy mix.	Large percentage of households do not have access to electricity. Since the majority have incomes below the poverty line, provision of subsidized services will impact the exchequer.
Goal 9 – Industry, innovation and infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.	53% of the population has access to piped water.	–
Goal 6 – Clean water and sanitation	Ensure availability and sustainable management of water and sanitation for all.	–	–
Goal 13 – Climate action	Take urgent target action to combat climate change and its impact.	–	The government has committed to reduce emissions by 29% from the 2010 baseline scenario by 2030 in the target areas of LULUCF, waste, energy, industry and agriculture.

[14] 2017. United Nations in Indonesia. Available at http://www.un.or.id/component/content/article/19-sdg/101-goal-11-sustainable-cities-and-communities?Itemid=437

SDGs, NDCs AND RESILIENCE

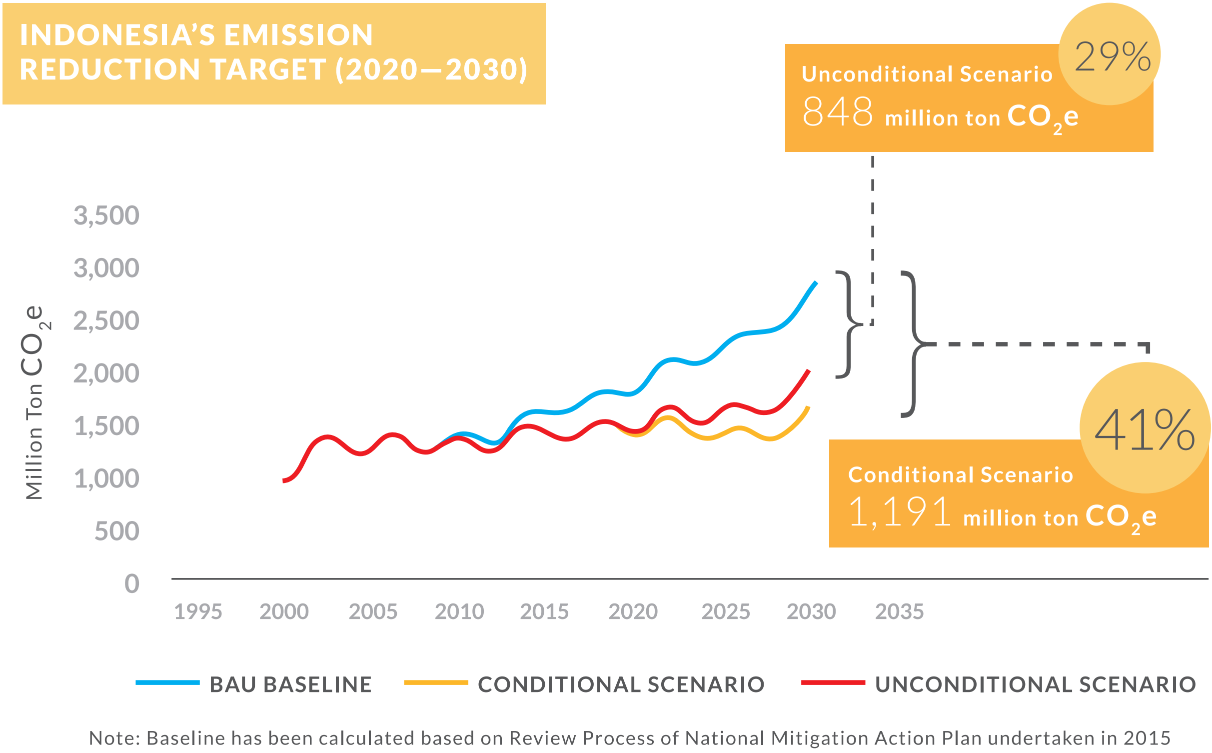

Figure 12: Indonesia's emission reduction targets (2020 - 2030)

NATIONALLY DETERMINED CONTRIBUTION (NDC)

Indonesia's Nationally Determined Contribution (NDC) prioritizes five sectors: energy (including transportation), industrial processes and product use, agriculture, land-use, land-use change and forestry and waste, focusing on three GHGs - Carbon dioxide (CO_2), Methane (CH_4) and Nitrous Oxide (N_2O)[15]. As per the 1st NDC submitted by Indonesia in November 2017, the country has committed to unconditionally reduce 29 percent of its GHG emissions against the Business As Usual (BAU) scenario by 2030. Indonesia could reduce upto to 41 percent of its GHG emissions by 2030, subject to availability of international support for finance, technology transfer and development, and capacity building[16].

Table 6: Indonesia's emissions reduction target based on the NDC pledge

COUNTRY	GHG EMISSIONS IN 2005 (Million tCO_2e)	GHG EMISSIONS WITHOUT CHECK IN 2030 (Million tCO_2e)	GHG EMISSIONS REDUCTION COMMITTED	GHG EMISSIONS REDUCTION WITH INTERNATIONAL SUPPORT
Indonesia	699	2,869	29%	41%

[15] INDC Republic of Indonesia. Available at http://www4.unfccc.int/submissions/INDC/Published%20Documents/Indonesia/1/INDC_REPUBLIC%20OF%20INDONESIA.pdf
[16] First NDC Republic pf Indonesia. Available at http://www4.unfccc.int/ndcregistry/PublishedDocuments/Indonesia%20First/First%20NDC%20Indonesia_submitted%20to%20UNFCCC%20Set_November%20%202016.pdf

POLICIES AND NATIONAL DEVELOPMENT PLANS SUPPORTING SUDF PRIORITY SECTORS

Table 7: Policies and national development plans supporting SUDF priority sectors

POLICY	PRIORITY SECTOR	DETAILS
National Urban Development Policy and Strategy 2016	All sectors of the SUDF	Provides a guiding framework for developing a sustainable urban transport, water supply sanitation and drainage, and solid waste management systems, among priority sectors
National Energy Conservation Policy and Regulation	Energy	Government regulation focusing on greening the energy mix by increasing renewable energy from 4% to 31% in 2050
Master plan of National Tourism Development 2010-2025	Biodiversity and transport	• Introduces elements of green jobs and sustainable tourism standards • Addresses the need for large investments in the green tourism sector
Kampung Improvement Program (KIP), Community-based Housing Development (P2BPK) and Self-help Housing Assistance (BSPS)	Water, sewerage, energy	Three affordable housing policies for urban poor targeting provision of clean water, sewerage connection and energy for all

SECTOR PROFILES

The SUDF addresses the implementation of actions for sustainable development in Indonesian cities and provinces. Proposed actions are primarily focused on water, waste water management, solid waste management, transport, energy and biodiversity sectors. The prioritisation of these sectors is a result of discussions with the constituencies of the IMT-GT subregion. This section discusses the baseline status of development in each of the priority sectors based on secondary research and feedback collected from participating cities. It also captures specific actions/projects identified by the cities under each sector, for implementation under the SUDF initiative.

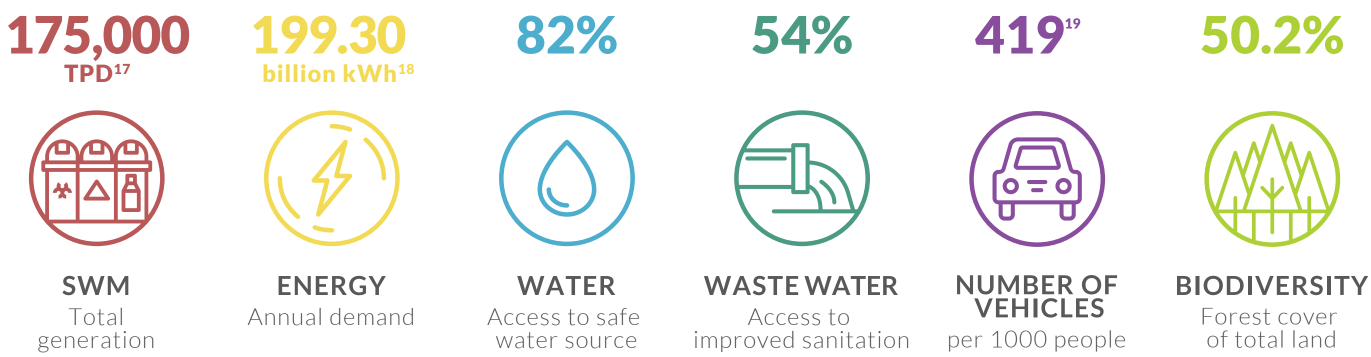

Figure 13: Indonesia Urban Profile

17. https://www.adb.org/sites/default/files/linked-documents/50102-002-sd-05.pdf
18. 2018. Technical Feasibility Studies. Available at https://www.worlddata.info/asia/indonesia/energy-consumption.php
19. WHO 2016

SECTOR PROFILES

WATER SUPPLY

COUNTRY SCENARIO

The total water availability in Indonesia is 690 billion cubic meters per year[20]. 'Improved' water sources commonly used by urban households are borewells (32.9 percent) and water supplied by the water utility - Perusahaan Daerah Air Minum (PDAM) (28.6 percent). The proportion of households that has access to improved drinking water source in the cities and regencies is 64.3% (2013)[21]. The federal government has set a target to provide 100% access to safe drinking water and sanitation facilities, which is estimated to require USD 42 billion in investment by 2019[22].

Despite abundant availability of water resources, many regions in Indonesia experience water shortages due to improper water resource management. PDAMs/PDPALs (Indonesian regional water utility companies) regulate the supply of water through private contractors in the cities. Many of the local water and sewerage utilities (PDAMs/PDPALs) have insufficient cash flow for investing in new water supply infrastructure due to low water tariffs and revenue collection. Additionally, water quality of rivers and lakes is also poor. Monitoring results show that over 50% of the parameters, such as Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), fecal coliform and total coliform, do not meet the norms set by the national government[23]. The Ministry of Mines and Energy (MoM&E) is responsible for monitoring both the quantity and quality of groundwater. The Jawa Water Resources Strategic Study (JWRSS) reports that shallow groundwater is polluted in all large cities of Java. In Jakarta, 45% of groundwater is contaminated by fecal coliform and 80% by Escherichia coli.

CURRENT STATUS OF SERVICE PROVISION IN SUDF CITIES

- Water supply coverage ranges from 3% (Dumai Municipality) to 86% (Banda Aceh Municipality).
- The average water demand per city is 472 MLD.
- Average per capita consumption of water is 268 litres per capita per day.
- Water quality is tested in many cities by health and environment agencies.

Increased budgetary allocations for enhancing water supply coverage are planned for. However, many studies suggest that this may not be sufficient to achieve 100% supply by 2019.

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

Local governments are inclined to engage with the private sector for constructing and operating the water supply infrastructure, either through Public Private Partnerships (PPP) or through privatization. This is expected to resolve both the challenges of non-availability of federal funding as well as improve service and resource quality through healthy competition between private suppliers. Some cities also plan to use state-of-the-art technologies such as Supervisory Control and Data Acquisition (SCADA) for improving water supply monitoring and revenue collection.

IDENTIFICATION OF PRIORITY PROJECTS

- To increase water supply coverage through engagement of private sector.
- To implement SCADA system for monitoring and improving the operation of water supply infrastructure.

WASTE WATER MANAGEMENT

COUNTRY SCENARIO

As per the World Bank 'Urban Story on Indonesia' (June 2016), sewerage network coverage exists in only 12 of the country's 98 municipalities and only 2 percent of city residents have access to centralized sanitation systems[24]. About 75 percent homes have on-site waste treatment systems that are not monitored. Only 170 of 517 cities/regencies owned sewage treatment plants (STP) in 2016[25]. Focus is on providing access to central sewage network and improving the quality of on-site sewage treatment systems[25].

CURRENT STATUS OF SERVICE PROVISION IN SUDF CITIES

- Sewage collection efficiency: The efficiency varies between 3 percent in Medan Municipality and 84 percent in Banda Aceh Municipality which suggests that while a few provinces have adequate sewerage network coverage, majority of the cities have inadequate or no coverage.
- Only Banda Aceh Municipality and Medan Municipality treat the collected waste water before discharging into natural water sources.
- The treatment efficiency of the collected waste water, among the participating member cities/regencies/provinces is well within the 80-100 percent performance level.

Thus, the main concern is improving collection efficiency and avoiding contamination of natural water sources.

IDENTIFIED PRIORITY PROJECTS

In addition to supply of water, Indonesia targets 100% waste water treatment by 2019. Hence, implementation of a centralized collection and treatment system with fewer septic tanks assumes priority. On the other hand, where septic tanks are more in density, checking for leak detection, monitoring and implementation of stringent quality standards for on-site processing of sewerage must be prioritized. Urgent maintenance is required for reviving the built but non-operational processing facilities.

[20] Indonesia Country Water Assessment, ADB, 2016
[21] Indonesia Country Water Assessment, ADB, 2016
[22] Indonesian infrastructure stable foundations for growth, Second edition, PwC, 2017
[23] Indonesia Country Water Assessment, ADB, 2016
[24] 2013. Urban Sanitation Review: Indonesia Country Study: The World Bank. Available at http://www.worldbank.org/content/dam/Worldbank/document/EAP/Indonesia/indonesia_sanitation_report.pdf
[25] Sewerage development in Indonesia: Ministry of Public Works and Housing. Available at http://www.wepa-db.net/activities/2016/20160728/PDF/S2_Indonesia_MPWH.pdf

SECTOR PROFILES

SOLID WASTE MANAGEMENT

COUNTRY SCENARIO

On an average, per capita generation of municipal solid waste is 0.76kg/day, leading to 175 thousand tonnes of waste generation daily (2015). Most of this waste is dumped at open dump sites. A number of research studies suggest that only 10 percent of the waste is disposed in municipal sanitary landfills. 7.5 percent of waste generated in metropolitan cities is recycled but the figure dips to 1.9 percent across all of Indonesia. Indonesia has two main regulations relating to waste management, the Solid Waste Management Act No.18/2008 and the MSW Government Regulation No.12/2012. While the central government is actively enabling scientific waste management, cities and regencies are struggling to achieve targets due to inadequate finances and limited know-how. While there are several pilot initiatives focused on waste collection and recycling, at-scale waste processing facilities and sanitary/controlled landfills are yet to be established in most cities.

CURRENT STATUS IN SUDF CITIES

- Per capita MSW generation: Ranges between 0.41 to 0.95 kg/per capita/day, with an average generation of 0.68 kg/per capita/day
- Collection efficiency: Ranges from 4-80 percent
- While composting facilities are present in many cities, only 4-7 percent of waste is reportedly composted. There is an immediate need for waste processing facilities and sanitary landfills.
- Biodegradable waste is the predominant MSW component in Indonesia. Therefore, compost facilities and biomethanation facilities would be appropriate technologies for immediate adoption.

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

A number of cities/regencies/provinces have implemented initiatives for waste processing and creating awareness to promote 3R management of waste. Composting is practiced in Banda Aceh Municipality (2 percent), Medan Municipality (51 percent), Pekanbaru City (2 percent) and Muntok Municipality (2 percent), whereas recycling activities are reported by Medan Municipality (7 percent), Pekanbaru City (1 percent) and Muntok Municipality (1 percent). Recycling is practiced at the dumping ground in Medan Municipality and at the sanitary landfill in Pekanbaru City. A number of training programs for at-source waste management are implemented in Muntok Municipality and West Bangka Regency.

IDENTIFIED PRIORITY PROJECTS

Solid Waste Management is a priority area for intervention in most cities.

- Sanitary landfills
- Recycling
- Compost facilities
- Waste-to-energy plants
- Biomethanation facilities

TRANSPORT

COUNTRY SCENARIO

Of all cities in Indonesia, Jakarta, Medan Municipality, Bandung, Surabaya, Makassar and Denpasar are most affected by traffic congestion and other transport related issues[26]. Inadequate public transport services, very low modal share of public transit systems, no urban rail systems (except some commuter train services) and sub-optimal bus rapid transit (BRT) systems characterize the transport related issues in these cities. Air quality is severely impacted by increasing numbers of private vehicles. Several cities rely on para-transit services for commuting.

Currently, the transport sector accounts for 70%-80% of all outdoor air pollution in Indonesia (including particulate matter) and 23% of GHG emissions. There is an urgent need to develop an urban transport policy and set urban transport pollution reduction targets.

CURRENT STATUS IN SUDF CITIES

- On an average, 20% of the urban population uses public transport facilities.
- Bus based transport services exist in 4 cities and are used by an average of 29% of the citizens in Lebong Regency and Medan Municipality. Jambi City has developed a new BRT master plan.
- Bike share programmes and cycle tracks are proposed in West Bangka Regency.
- Intermediate public transport is being promoted in Banda Aceh Municipality, Rejang Lebong Regency and Medan Municipality.

SECTOR PROFILES

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES:

Sustainable Urban Transport Programme in Indonesia (SUTRI NAMA) is a national level programme that promotes the use of public transport. Many cities are also promoting non-motorised transport initiatives such as bicycle sharing programmes. An ongoing BRT programme in Banda Aceh Municipality is pending completion (BRTS, 2015-2020).

IDENTIFIED PRIORITY PROJECTS

Transport is a priority sector for 90% of the SUDF cities. Following are the areas of intervention prioritized by these cities:

- Enhancing public transport and bike share programmes
- Setting up mass public transit systems including mono rail in large cities
- Enabling a shift to alternate fuel-based transport

ENERGY

COUNTRY PROFILE

Indonesia has a total installed capacity of 60GW producing 290TWh of electricity, which exceeds the country's energy requirement. Surplus energy is exported to neighbouring countries[27]. However, the energy mix predominantly consists of non-renewable energy sources such as crude oil, coal and natural gas and only 12% (2014) of power production is from RE sources[28].

The government of Indonesia has set an ambitious target of adding 35 GW of capacity before 2019. However, implementation has been slow and based on the 2018-2027 Rencana Usaha Penyediaan Tenaga Listrik (RUPTL), the government intends to achieve this target by 2024-2025. Despite challenges, the renewables sector, in particular, appears to be moving forward. Within the next two years, based on the 2018 RUPTL, approximately 1,300 MW of renewable power projects are expected to be developed.

CURRENT STATUS IN SUDF CITIES

- All cities depend on thermal and/or hydroelectric power. The city of Medan Municipality has deployed pilot scale solar PV systems.
- Power demand in cities varies significantly: Pemerintah Kota Batam Municipality (6,379 MWh), Banda Aceh Municipality (60 MWh), Kota Dumai Municipality(976 MWh), Pemerintah Medan Municipality (80 MWh)
- Conventional street lighting predominates, with pilot initiatives of LED street lights underway. The reported status is given below:

Table 8: Current status of street lighting (2017)

CITY	REPORTED NUMBER OF CONVENTIONAL STREET LIGHTS	REPORTED NUMBER OF LED STREET LIGHTS
Jambi City	15,535	2,899
Banda Aceh Municipality	6,566	87
Batam Municipality	9,423	-
Medan Municipality	83,254	2,800

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

Several energy efficiency and RE initiatives are being implemented and planned in SUDF cities:

- LED street lighting initiatives: Being implemented on a pilot scale in Aceh province, West Bangka Regency, Muntok Municipality, Banda Aceh Municipality, Jambi City and Medan Municipality
- Solar photovoltaic street lighting: Implemented in Muntok and Banda Aceh Municipality
- Construction of a new sub-station: Planned in Muntok district
- An undersea cable for power transmission to Muntok Municipality is under construction
- Wind power: Tested at Belolaut district of Muntok Municipality and to be installed in Banda Aceh Municipality
- Solar farm: Planned at Gampong Jawa Landfill in Banda Aceh Municipality
- GHG emissions inventory: Prepared for Banda Aceh Municipality and Bangka Belitung

IDENTIFIED PRIORITY PROJECTS

Energy is considered a priority sector by all SUDF cities. More than 70% of the cities consider LED street lighting, energy efficient buildings, solar heating and use of alternate fuel for transport as priority solutions. There is a need to develop GHG emissions inventories in order to identify priority sectors, which when addressed, would have the largest GHG emissions reduction impact.

26. 2015. Transport Assessment Report, Indonesia: Asian Development Bank

27. Energy consumption in Indonesia. Available at https://www.worlddata.info/asia/indonesia/energy-consumption.php

28. 2017. Country Report, Electricity Sector in Indonesia: Ministry of Energy and Mineral Resources, GoI. Available at https://eneken.ieej.or.jp/data/7390.pdf

SECTOR PROFILES

BIODIVERSITY

COUNTRY PROFILE

Indonesia has rich coastal and marine biodiversity, with more than 600 known coral species and 2,228 (37%) of the world's 6,000 coral reef fish species. A national level blueprint, The Indonesia Biodiversity Strategy and Action Plan (IBSAP) has been developed to plan for biodiversity management. Focus activities of the short-term plan - IBSAP 2015-2020, include establishment of city level Pay Research Bureaus (PRB), provincial biodiversity inventories and conservation of specific bio-regions.

The national targets for biodiversity management for the period of 2015-2020 were prepared in line with the Aichi (Biodiversity) Targets (AT). The targets as per IBSAP are given in Table 9, corresponding related Aichi targets are also indicated.

Table 9: IBSAP Targets

Corresponding Aichi Target	IBSAP Target
AT-1	Awareness and participation of various parties established through formal and informal educational programs
AT-2	Implementation of sustainable management of biodiversity resources in the planning and implementation of national and regional development to improve community economies
AT-3	Realization of an incentives and disincentives system in business and the sustainable management of biodiversity
AT-4	Establishment of increased availability and implementation of policies supporting sustainable production and consumption (SCP) in the utilization of biodiversity resources
AT-5	Development of ex-situ conservation areas to protect local ecosystems
AT-6	Implementation of a policy for sustainable management and harvesting
AT-7	Realization of improved land for sustainably managed agriculture, plantations and animal husbandry
AT-8	Reduction of pollution that damages biodiverse ecosystems
AT-9	Implementation of prevention and eradication programs for invasive alien species (JAI)
AT-10	Reduced level of anthropogenic pressure on coral reefs and other vulnerable ecosystems affected by climate change
AT-11	Realization of sustainable maintenance and improvement of conservation areas
AT-12	Realization of efforts to maintain the population of endangered species as a national conservation priority
AT-13	Implementation of system development in nurseries, genetic breeding and domestication of wildlife as well as breeding of wild animals
AT-14	Improved functionality of integrated ecosystems to ensure the improvement of essential services (water, health, livelihoods, tourism)
AT-15	Realization of conservation and restoration of degraded ecosystems in the region
AT-16	Implementation of the Nagoya Protocol and its derivative instruments through legislation and the formation of implementation organizations at central and local levels
AT-17	Implementation of the new IBSAP at various levels
AT-18	Development of local wisdom and innovations as well as bio-prospecting capacity building for the conservation and sustainable utilization of biodiversity
AT-19	Implementation of science and technology capacity building for the sustainable management of biodiversity
AT-20	Identification of resources and budget effectiveness in the implementation of sustainable management of biodiversity
–	Implementation of comprehensive and integrated data gathering and information mapping on biodiversity
–	Implementation of various conflict settlement processes related to biodiversity

SECTOR PROFILES

CURRENT STATUS IN SUDF CITIES

Multiple programs have been implemented in the cities for biodiversity conservation:

- An arboretum is maintained in Tibang forest and Tahura biodiversity park exist in West Bangka Regency
- Multiple biodiversity conservation projects in Aceh including Cagar Alam Jantho, Cagar Alam Serbojadi, Taman Wisata Alam, Taman Wisata Alam Jantho, Taman Wisata Alam and Aceh Besar
- Ongoing natural resources conservation and protection programs and wetland conservation programs in Muntok Municipality and West Bangka Regency

IDENTIFIED PRIORITY PROJECTS

- At least 50 percent of SUDF cities consider ecosystem conservation, development of open spaces and development of biodiversity conservation areas as priority
- Few SUDF cities consider compatible agriculture and wetland development as priority solutions
- Many on-going activities focus on earmarking areas for conservation, but there exists a gap in data availability. Hence, the development of documentation on biodiversity needs more attention.

MALAYSIA

INTRODUCTION

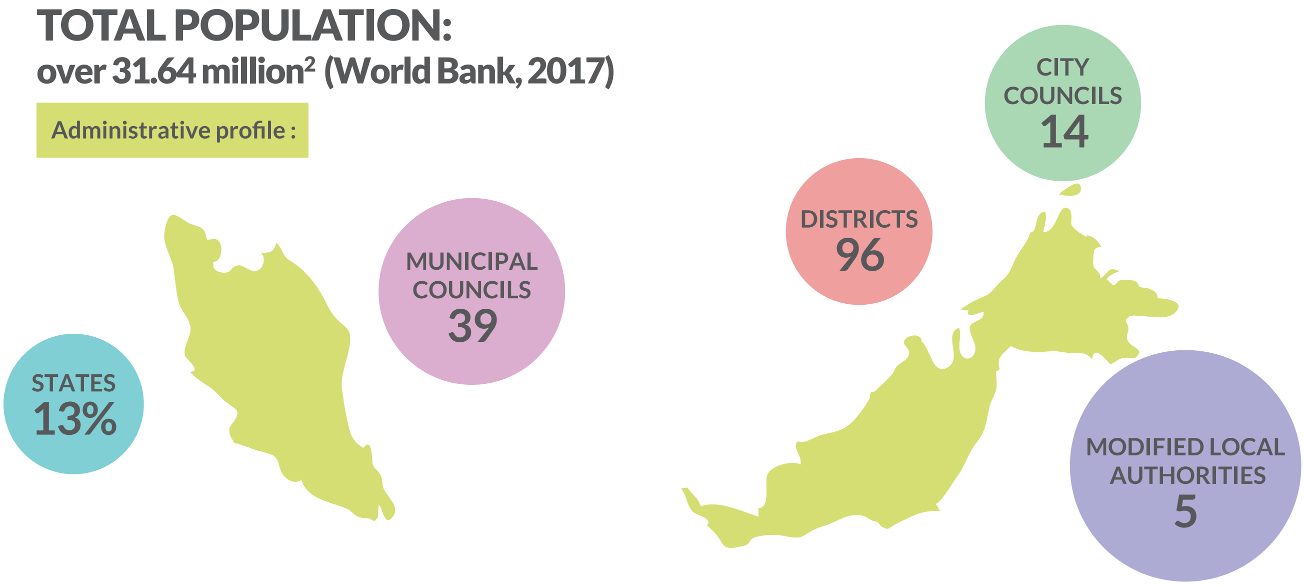

Figure 14: Malaysia country profile

Malaysia consists of Peninsular Malaysia (West Malaysia), which is part of mainland Southeast Asia, and the states of Sabah and Sarawak (East Malaysia) on the northern edges of the island of Borneo. The coastal plains rise gently into hills and mountains covered by dense rain forests, covering 67.55 percent[1] of the country's total area.

Malaysia has transformed into an upper middle-income, multi-sector economy since the 1970s from one that was initially agriculture and commodity-based. Only 0.36 percent of population reported incomes that are under the national poverty line (2015). Malaysia's near-term economic outlook remains favourable with well-functioning and regulated financial systems and ongoing efforts to push structural reforms to enhance public sector performance while boosting productivity of public spending.

City Councils and municipal councils are local governments with their own legislative bodies and financial budgets. Generally, city councils have a larger population and annual budget than municipal councils.

GDP OF THE COUNTRY (2017) (BILLION USD)	**314.5**
PER CAPITA GDP (2017) (USD)	**29,431**
AVERAGE ANNUAL GROWTH RATE OF GDP (%)	**5.9**
POPULATION GROWTH RATE 2017 (%)	**1.4**
URBAN POVERTY (% living below urban poverty line)	**0.3**

[1] Forest area (% of land area), 2015, World Bank; Available at https://data.worldbank.org/indicator/AG.LND.FRST.ZS
[2] All population and economic growth related data has been referred from https://data.worldbank.org

URBAN PROFILE OF MALAYSIA

About 76 percent of the country's population lives in cities, predominantly in the coastal areas. This implies that cities have better economic opportunities and living conditions compared to rural areas in the country. The annual growth rate of urban population is about 2.2%.

Malaysia is currently one of the most urbanized countries of Southeast Asia, and also one of the most rapidly urbanizing regions around the world. The urban population in Malaysia has increased from around 66 percent in 2004 to 74 percent in 2014. This growth is expected to continue, as people from rural areas migrate to urban areas with the economy and employment continuing to shift from agriculture to industry and services. The urban population of Malaysia's three largest cities - Kuala Lumpur, George Town and Johor Bahru, account for 70 percent of the total national population.[3]

At present, the largest city in terms of population is Kuala Lumpur, which is home to around 1.31 million inhabitants - which is still relatively small, considering that the entire population of Malaysia amounts to around 31 million. Malaysia is also home to a number of smaller urban areas. There are three other urban areas with more than 500,000 inhabitants - Johor Bahru, Klang and Ipoh Municipal Council.

Urban areas in Malaysia, notably Kuala Lumpur, are less dense than is common for similar urban areas in Southeast Asia. This means that dealing with and limiting sprawl will be a challenge. As the urban transformation continues, there is still a chance to find a balance between urban and rural settlements in an equitable, compact and sustainable manner.

Table 10: Participating cities and provinces implementing the SUDF initiative

PARTICIPATING CITIES AND PROVINCES	POPULATION (000)
Kota Bharu Municipal Council, Kelantan State	417
Kangar Municipal Council, Perlis State	246 (2016)
Manjung Municipal Council, Perak State	256
Teluk Intan Municipal Council, Perak State	110 (2000)
Penang Island City Council, Penang State	770
Seberang Perai Municipal Council, Penang State	1062
Taiping Municipal Council, Perak State	245
Ipoh City Municipal Council, Perak State	720
Kuala Kangsar Municipal Council, Perak State	159
Melaka State	873 (2015)

3. Baker, Judy L.; Lee, Marcus. 2015. Achieving a system of competitive cities in Malaysia : Main report (English). Washington, D.C.: World Bank Group.

DEVELOPMENT CHALLENGES IN CITIES

Malaysia is the fifth-most urbanized economy in Southeast Asia. However, the spatial density of Malaysian cities[4] is relatively low compared to other large cities in East and Southeast Asia. The relatively low spatial density has led to higher transport costs as well as negative environmental impacts such as high vehicular emissions. The share of transport costs in an urban household income is approximately 50 percent. Studies by Smart Cities Asia[5] suggest that up to 500 million hours of people time is spent in traffic jams leading to a loss in productivity equivalent to USD 1.4 billion.

DROUGHT AND FLOODING – 2014 WAS THE WORSE YEAR FOR MALAYSIA.

From long periods of drought, intense rainfall to muddy landslides, Malaysia struggled with the consequences of climate change in 2014.

During summer, the water level in the Sungai Selangor dam which supplies water to the State of Selangor, fell to critical levels due to reduced rainfall for two-three consecutive years. The state enforced a water rationing policy between March and July, 2014. However, the situation continued to deteriorate compelling the federal government to consider cloud seeding. It proved to be an expensive measure, implemented at the cost of development.

While Selangor didn't get enough rain, State of Sabah's west coast was flooded in early October due to persistent rains for a month. The district of Penampang was most impacted as a result of flood waters released from the Babagon dam. Residential areas were flooded and inundated for several days.

Barely a month after the floods in Sabah, torrential rain let loose flash floods and mudslides upon residents of Ringlet and surrounding villages in the state of Perak, leaving the country devastated in the face of climate induced crises.

In recent years, many studies on Malaysian cities have reported increasing urban heat island impact due to high traffic congestion and increasing vehicular emissions, consequently increasing energy demand for cooling and water needs in the cities. This condition is further accentuated by increasing global temperatures.

Rural to urban migration is another cause for increasing urban sprawl. In the last five years, about 2.5 percent of households moved from rural to urban areas.

Many functions related to the delivery of core urban services such as public transport, roads, water supply, sewerage, solid waste management, drainage, public health, police and emergency services, and education are provided through federal/national-level government agencies. Local authorities in Malaysia are responsible for delivering relatively few services. The challenges identified in the delivery of urban services suggest that the high degree of centralization has not always had the intended benefits of increasing efficiency and effectiveness.[6]

MAJOR CHALLENGES IN THE CITIES[7]

- **Increasing urban poverty**
- **Inadequate affordable housing**
- **Overburdened public amenities**
- **Traffic congestion**
- **Shrinking green areas**
- **Declining health condition and well being**
- **Increasing environmental pollution**

[4] Economic density is measured by jobs per km2 or GDP per km2 ; World Bank Group (2017)
[5] 2016, ' Smart Cities in Malaysia: Part One ', Smart Cities Asia, Available at http://www.techcurator.asia/smart-cities-in-malaysia-part-one/
[6] Baker, Judy L.; Lee, Marcus. 2015. Achieving a system of competitive cities in Malaysia: Main report (English). Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/709061475743434007/Main-report
[7] Paduka, Datin; Rosly, Dr. Dahlia. 2015. Planning For The Future Cities In Malaysia. Malaysia.: World Bank Group. Federal Department of Town and Country Planning Peninsular Malaysia, Ministry of Urban Wellbeing, Housing and Local Government Malaysia

CLIMATE CHANGE
GHG EMISSIONS AND VULNERABILITY

GHG EMISSIONS

In 2011, Malaysia's total Greenhouse Gas (GHG) emissions were 290.23 million tCO_2e,[8] making it the world's 26^{th} emitter of greenhouse gases. Per capita GHG emissions in 2014 were reported at 8 tCO_2e per person.[9]

Table 11: National GHG emissions profile - Malaysia (2011)

Sector	Emission (Mt CO_2eq)	Sink (Mt CO_2eq)
Energy	218.914	
Industrial processes	18.166	
Agriculture	15.775	
Land use, Land-use change and forestry (LULUCF)	2.490	-262.946
Waste	34.885	
Total	290.230	-262.946
Net total (after subtracting sink)	27.284	

As per the Biennial Update Report, 2014 to the United Nations Framework Convention on Climate Change (UNFCCC), Malaysia has already achieved about 33 percent reduction of carbon emissions intensity per unit of GDP (baseline year 2005) by considering the LULUCF approach in terms of both emissions and sinks. Major mitigation actions include implementing renewable energy (RE) and energy efficiency (EE)measures, green technologies, sustainable forest management and sustainable waste management through recycling and effluent treatment.

VULNERABILITY AND RISK

Malaysia has a long coastline of 4,675 km making it vulnerable to rising sea levels. Malaysia's coastal regions are low-lying areas that are less than 0.5m above the highest tide level, thus exposing about 60 percent of its population to submergence in the near future.[10] It is estimated that because of the rising sea level, by the year 2100 many islands in Asia Pacific region will be submerged, including Kedah, Kelantan and Sabah and Sarawak of Malaysia.[11]

Malaysia's mean surface temperatures have increased from 0.6°C to 1.2°C over the past 50 years (1969-2009) and are projected to increase by 1.5-2°C by 2050.[12] The rainfall intensity is also projected to change in both Peninsular Malaysia and Sabah and Sarawak. Based on these projections, key economic sectors such as agriculture, water resources, energy and transport will be significantly affected.

A number of policies and programs have been initiated with a focus on conducting vulnerability assessments and adapting to the adverse impacts of climate change. The National Policy on Climate Change (NPCC) was introduced in 2009 and serves as a framework to mobilize and guide government agencies, businesses and communities in addressing challenges of climate change in an integrated manner. In addition to NPCC, the National Policy on the Environment (NPE), National Green Technology Policy (NGTP), National Renewable Energy Policy and Action Plan (NREPAP), Renewable Energy Act 2011 (RE Act 2011) etc., support mitigation of climate change by promoting use of RE sources for electricity generation. The National Disaster Management Agency (NADMA) and Ministry of Energy, Technology, Science, Climate Change and Environment (MESTECC) are together responsible for implementing multiple programs on climate mitigation, resilience building and disaster risk reduction.

IMPACTS OF CLIMATE CHANGE

- INCREASED FLOODING
- PERIODIC DROUGHTS
- SEA LEVEL RISE
- LANDSLIDES
- FREQUENT & INTENSE TROPICAL STORMS

8. Ministry Of Natural Resources and Environment Malaysia. 2015. Biennial Update Report To The UNFCCC. Malaysia.
9. CO_2 emissions (metric tons per capita) 2014, World Bank; Available at https://data.worldbank.org/indicator/EN.ATM.CO2E.PC
10. Ong, J.Vulnerability of Malaysia to Sea-Level Change. Centre for Marine and Coastal Studies.
11. Hafizz Dzulkifli, M. (2016). Kedah may be largely underwater by 2100 due to climate change. malaysiakini, [online]. Available at: https://www.malaysiakini.com/letters/353315.
12. Siwar, C, Ahmed, F & Begum, RA 2013, 'Climate change, agriculture and food security issues: Malaysian perspective' Journal of Food, Agriculture and Environment.

SDGs, NDCs AND RESILIENCE

SUSTAINABLE DEVELOPMENT GOALS (SDGS) 2030

Malaysia is the fifth most urbanized economy in Southeast Asia. However, the spatial density of Malaysian cities is relatively low compared to other large cities in East and Southeast Asia. The relatively low spatial density has led to higher transport costs as well as negative environmental impacts such as high vehicular emissions. The share of transport costs in an urban household income is approximately 50 percent. Studies by Smart Cities Asia suggest that up to 500 million hours of people time is spent in traffic jams leading to a loss in productivity equivalent to USD 1.4 billion.

Funds are channeled through the programmes and projects under the 11th Malaysia Plan strategic thrusts that fit the SDGs.

Figure 15: Funding Malaysia's SDGs

SDGs, NDCs AND RESILIENCE

Table 12: SDGs related to SUDF priority sectors - voluntary national review 2017*

SDG's	Key success factors	Major achievements	Remaining priorities
SDG 4 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	–	• 97.2% enrollment rates for primary and 90% for secondary school for both boys and girls in 2016 and 48% enrollment for higher education in 2012(70% higher than in 2002)	–
SDG 6 - Ensure availability and sustainable management of water and sanitation for all	–	• Over 95% coverage for treated water and sanitation facilities, and 98.2% coverage of 24-hour electricity supply at national level in 2015 • A 1.5 times increase in RE installed capacity (2016)	–
SDG 9 - Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation	• Investing in economic and social infrastructure to attract private investment and generate economic growth • Focusing infrastructure investment on meeting demand and improving connectivity • Transforming industry and expanding trade opportunities • Developing an innovative ecosystem to support new start-ups, scale up enterprises and attract investment • Underscoring strong public-private partnerships	• 81.5% national broadband penetration (2016) with 91.2% coverage in populated areas (2016) • 58% growth in road networks with improved connectivity across the country between 2010 and 2015	• Embedding elements of sustainability in the development of infrastructure and industry in pursuit of green growth • Gearing up for the 'Industrial Revolution 4.0' and cutting-edge technologies • Strengthening human capital development for economic transformation • Promoting sustainable consumption and production
SDG 13 - Take urgent action to combat climate change and its impact	–	• RM429 million of green government procurement since 2013 • Carbon intensity of economy reduced by 33% since 2009.	–
SDG 14 - Conserve and sustainably use the oceans, seas,and marine resources for sustainable development	• Implementing policies and enforcing regulations that support sustainable management of marine and coastal ecosystems • Partnering with NGOs in advocating sustainable use of marine and coastal resources • Establishing marine protected areas	• Maintained 55.2% forest cover, 12.1% as terrestrial protected areas and 3.36% as marine protected areas • Malaysia participates in international transboundary conservation efforts, namely Heart of Borneo initiatives for forests and Coral Triangle initiatives for marine areas. • 2,711 hectares of mangroves planted from 2005 to 2016 during Mangrove Planting Programme • 53.8% live coral cover in Peninsular Malaysia (2016)	• Achieving holistic marine and coastal management at both federal and state levels • Strengthening monitoring, surveillance and enforcement capacities • Enhancing knowledge on marine resources • Minimising impact of climate change on the marine and coastal ecosystem

*as reported by the Economic Planning Unit, Government of Malaysia (https://sustainabledevelopment.un.org/content/documents/15881Malaysia.pdf)

SDG's	Key success factors	Major achievements	Remaining priorities
SDG 15-Protect, restore and promote sustainable use of territorial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	• Increasing the gazetting of terrestrial protected areas • Implementing sustainable forest management and the Malaysian Timber Certification Scheme • Enforcing legislation to combat poaching, illegal wildlife trade, encroachment and illegal logging	• 1640 ha. covered for forest reforestation project under the 11th Malaysia Plan with RM100 million allocated • 55.2% of total land area remains as natural forest (2015) with a network of protected areas in national and state parks and Ramsar sites. Most are under various forms of protective status, e.g. forest reserves • The second National Policy for Biological Diversity (2016–2025) has been launched. • 12.1% of total land area protected (2015), an increase from 10.76% in 2013	• Strengthening institutional and regulatory framework for forest management • Increasing capacity of related agencies • Strengthening monitoring, surveillance and enforcement capacities • Intensifying reforestation efforts nationwide • Strengthening partnerships with indigenous and local communities

NATIONALLY DETERMINED CONTRIBUTION (NDC)

Malaysia has committed to an unconditional target of 35 percent reduction in its emissions intensity of GDP by 2030, relative to the emissions intensity in 2005. In addition, Malaysia has also proposed a conditional target of 10 percent upon receipt of climate finance, technology transfer and capacity building from developed countries. Sectors included in the mitigation component of NDCs are energy, industrial processes, waste, agriculture, land use, and LULUCF.

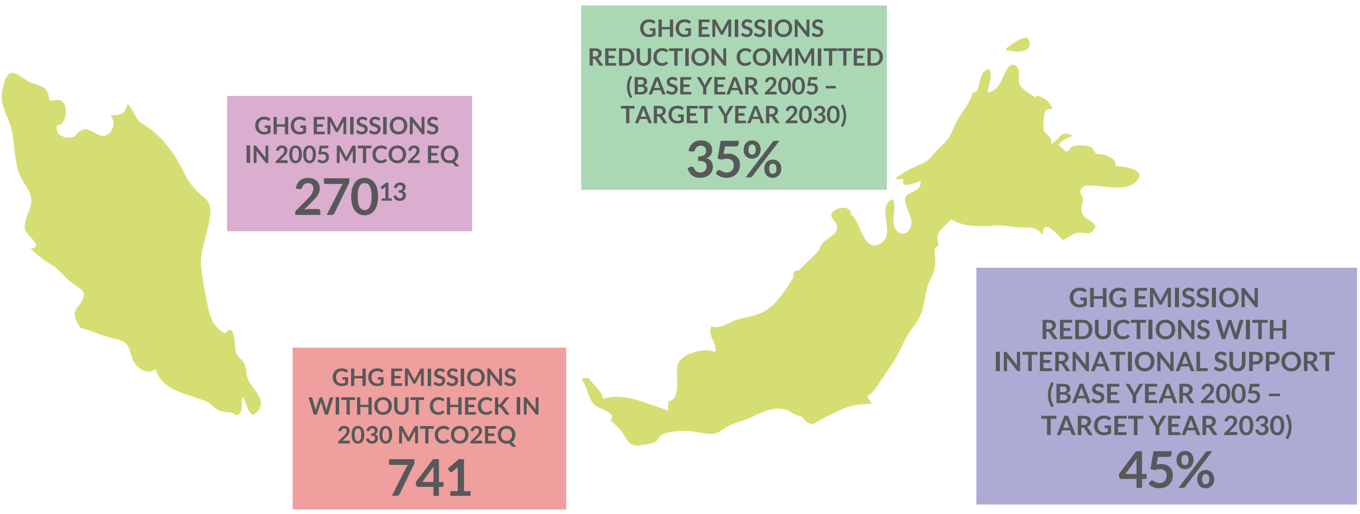

Figure 16: Malaysia's emissions reduction target based on NDC pledge

[13] Low Carbon Society Scenarios Malaysia 2030. Malaysia. Available at http://2050.nies.go.jp/report/file/lcs_asia/Malaysia.pdf

POLICIES AND NATIONAL DEVELOPMENT PLANS SUPPORTING SUDF PRIORITY SECTORS

Table 13: Policies and national development plans supporting SUDF priority sectors

Policy	Priority sectors addressed	Policy provisions that support SUDF framework actions
The National Urbanization Policy, 2006	Transport, Solid Waste Management (SWM)	• Emphasis on development of a high-capacity public transport system • Implementation of sustainable solid waste management system
Low Carbon Cities Framework (LCCF), 2011	Transport, Building Energy Efficiency	• Support decrease in energy consumption and promote use of green technologies in building construction sector • Special emphasis on projects to develop energy efficient buildings, low carbon infrastructure and low carbon public transport
Malaysia's Second National Physical Plan (2010 - 2020)	Biodiversity, Transport	• Emphasis on biodiversity conservation programs, tourism and efficient transportation network
Malaysian Water Vision, 2020	Water	• Support to conserve and manage water resources to ensure adequate and safe water for all
The 11th Malaysian Development Plan (2016-2020)	Water, Biodiversity	• Focus on activities to encourage sustainable energy • Focus on activities to protect water resources • Position eco-tourism as a premier segment of tourism industry • Protect biodiversity by supporting reforestation and forest enrichment efforts
National Policy on Biodiversity (2016-2025)	Biodiversity	• Support conservation of biodiversity
National Biofuels Policy, 2006	Energy	• Promotion of palm oil biofuel and partial substitution by eco-friendly biofuel

SECTOR PROFILES

This section discusses the baseline status of development in each of the priority sectors based on secondary research and feedback collected from SUDF cities. Specific actions/projects identified by the cities under each sector, for implementation under the SUDF initiative are also presented.

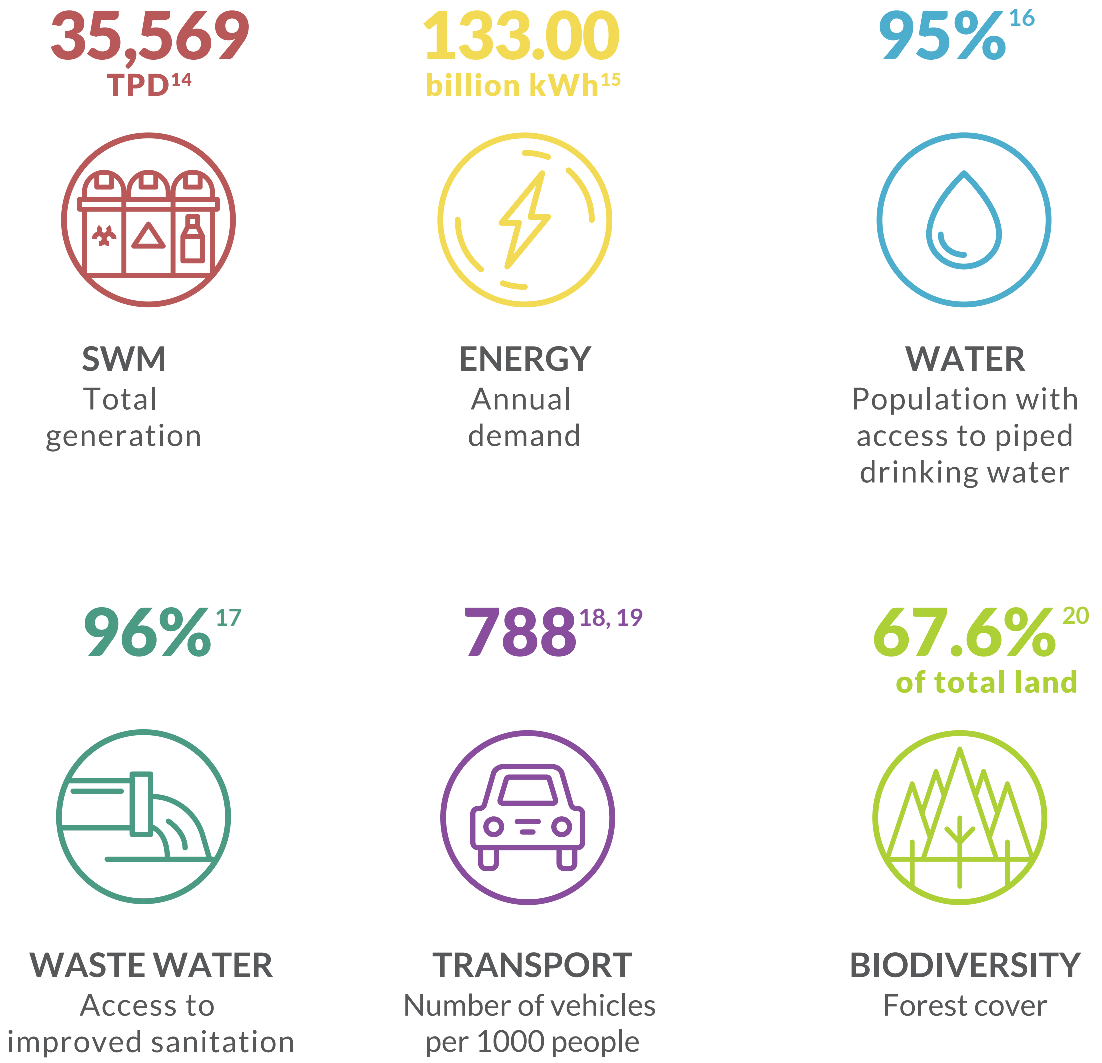

Figure 17: Malaysia urban profile

[14] Pariatamby, Agamuthu. 2017. State of the 3Rs in Asia and the Pacific - Malaysia. Japan: UNCRD. Available athttp://www.uncrd.or.jp/content/documents/5691[Nov%202017]%20 Malaysia.pdf
[15] https://www.worlddata.info/asia/malaysia/energy-consumption.php
[16] 2013. Malaysia 2013 Report (Water Supply Management). ASEAN. Available at https://aseaniwrm.water.gov.my/wp-content/uploads/2015/06/Malaysia-2013-Report-Water-Supply-Management.pdf
[17] 2011. Country Sanitation Assessment in Malaysia. JSC. Available athttp://jsanic.org/publications/Country_Survey_Reports/Malaysia/JSC_Malaysia_Sanitation_Assessment_Report.pdf
[18] http://apps.who.int/gho/data/node.main.A995
[19] Population of Malaysia in 2013. Available athttps://countryeconomy.com/demography/population/malaysia?year=2013
[20] 2018 The World Bank Group. Available at https://data.worldbank.org/indicator/AG.LND.FRST.ZS

SECTOR PROFILES

WATER SUPPLY

COUNTRY SCENARIO

On an average, Malaysia's per capita per day consumption of water is 210 litres of water. This is 27 percent higher than the recommended level of 165 litre per capita per day by World Health Organization (WHO). Although Malaysia is a water rich nation, many states face water shortage as a result of rapid urbanization. As per secondary information from public domain, it is understood that 35.6 percent of processed water does not reach end users due to poor management of supply network.[21]

According to the Ministry of Energy, Green Technology and Water, as of 2017 performance records,nationwide water supply coverage is at 96.4 percent and non-revenue water is at 34.6 percent. The Water Vision of Malaysia, under the 11th Malaysian Development Plans, focuses on achieving 99 percent of water supply coverage and 31 percent reduction in non-revenue water by 2020.

The sector is governed by different levels of governments. The federal government is responsible for providing overall policy guidance for the sector, whereas the National Water Service Commission regulates the sector in terms of water tariff and operational disputes. Pengurusan Aset Air Berhador (PAAB) serves as the custodian of national water assets and state utility companies manage supply provisions.

CURRENT STATUS IN SUDF CITIES

- Piped water supply coverage is 100 percent (except in TelukIntan Municipal Council, which has 15 percent coverage)
- Average water demand: 732 million litres per day (MLD)
- 46% of cities indicated a shortage in supply with respect to demand, which means although most cities are equipped with infrastructure to supply water, some areas may not have 24X7 continued supply.

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

In order to improve the status of non-revenue water and cost recovery, the state utilities are transferring assets to PAAB for better asset management.

IDENTIFICATION OF PRIORITY PROJECTS

All cities prioritised the following actions:

- Ensuring 24X7 water supply through engagement with private sector
- Deployment of Supervisory Control and Data Acquisition (SCADA) systems to monitor service provision

WASTE WATER MANAGEMENT

COUNTRY SCENARIO

99.8 percent of Malaysian cities have access to 'improved sanitation'; sewerage network coverage in urban areas stands at 70 percent of the population as of 2015. Indah Water Konsortium (IWK) is entrusted with wastewater management, sludge collection and treatment. Currently, the sector is operated under heavy losses with huge cross-subsidy and no change in tariff since 1994.[22] Non-compliance or limited compliance with treated wastewater standards are mainly caused by high influent of oil and grease (O&G) discharged into STPs serving industrial, commercial areas and food related business premises.[23]

CURRENT STATUS IN SUDF CITIES

- Majority of cities reported high coverage of sewerage collection system(64% to 98%) except Teluk Intan Municipal Council (26%).
- 77% to 100% treatment of collected sewerage (except in Kangar Municipal Council (21%) and Teluk Intan Municipal Council (26%)

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

Development plans are in place for centralized waste water treatment systems, where required.

IDENTIFICATION OF PRIORITY PROJECTS

Most Malaysian cities suggested that as an immediate action, waste water treatment efficiency and coverage need to be improved, and tariffs must be revisited and revised to cover O&M costs. Intensive communication and awareness programs should be organized to increase the willingness to pay for services.

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21. Editorial (2018). The link between smart cities and Malaysia's economic growth. ASEAN Today, [online]. Available athttps://www.aseantoday.com/2018/03/the-link-between-smart-cities-and-malaysias-economic-growth/
22. Lee, Cassey. 2005. Water Tariff and Development: The Case of Malaysia. ISEAS - YusofIshak Institute. Accessed from Research Gate.
23. Engku Azman Tuan Mat. 2012. Report: Wastewater Production, Treatment, and Use in Malaysia

SECTOR PROFILES

SOLID WASTE MANAGEMENT

COUNTRY SCENARIO

Malaysia generates about 38,000 tonnes of municipal solid waste every day, of which 17.5 percent is recycled. Predominantly, waste is disposed in open dump sites in a majority of cities. According to the Solid Waste Management and Public Cleansing Corporation (SWCorp Malaysia), there are only 14 sanitary landfills across the country. 161 dumpsites are operational and 141 old dumpsites are closed for operation. Several incinerators (incineration without energy recovery) with a total capacity of 75 tonnes/day are operational[24] and the first waste-to-energy facility is expected to be operational by 2019 at Taman Beringin in the capital city Kuala Lumpur,with an estimated capacity of 1,000 tonnes/day.[25]

The Solid Waste Management and Public Cleansing Corporation (SWCorp Malaysia) was established under the Solid Waste Management and Public Cleansing Corporation Act 2007 (Act 673) under the purview of the Ministry of Housing and Local Government (MHLG)[26] with the mandate to complement and ensure the successful implementation of the National Solid Waste Management Policy.

CURRENT STATUS IN SUDF CITIES

Average per capita generation of waste: 0.74 kg/day
Average waste collection efficiency: 53%
Disposal of waste: In open dump sites (sanitary landfill in Kangar Municipal Council)

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

The city of Kota Bharu Municipal Council works with selected schools to promote composting through the Bank Kitar Semula programme. Manjung Municipal Council has proposed a solid waste processing facility.

IDENTIFICATION OF PRIORITY PROJECTS

Most of the participants have identified SWM as a priority area for intervention. All SUDF cities considered composting and biomethanation as measures to be undertaken on priority basis. Where sanitary landfills are available, recycling and waste-to-energy projects are considered as priority.

TRANSPORT

COUNTRY SCENARIO

The transport sector contributes to 40% of Malaysia's total GHG emissions. Vehicles are predominantly fossil fuel based but initiatives have already been undertaken to introduce e-vehicles and reduce CO_2 emissions as part of the country's 2020 goals. The national government has also committed to enhance use of public transport to 40% by 2020.

As part of the low carbon development measures between 2005 and 2013, CO_2 emissions reduction have been achieved by introducing energy-efficient vehicles (EEVs), use of compressed natural gas (CNG) in public vehicles and use of rail-based public transport, as shown below:

Table 14: Impact of low carbon transport measure (2005-2013)

Intervention	Emission reduction
Energy efficient vehicles	40.96 kt CO_2e
Use of CNG in public vehicles	154.62 kt CO_2e
Use of rail-based public transport	214.93 kt CO_2e

CURRENT STATUS IN SUDF CITIES

Kota Bharu Municipal Council indicated that 25 percent of the city's population use public transport and 10 percent of the public transportation runs on CNG and other non-conventional fuel.

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

With an aim to improve public transport amenities, most of the cities have prioritized improvements in basic facilities.

24. Malaysia: Toward A Sustainable Waste Management. (2018). Global Recycling. [online] Available at: http://global-recycling.info/archives/1451.
25. Review of municipal solid waste management options in Malaysia, with an emphasis on sustainable waste-to-energy options. (2013). Journal of Material Cycles and Waste Management.
26. Malaysia: Toward A Sustainable Waste Management. (2018). Global Recycling. [online] Available at: http://global-recycling.info/archives/1451.

SECTOR PROFILES

Table 15: Ongoing / planned initiatives in transport sector

CITY	ONGOING/PLANNED INITIATIVES
Manjung Municipal Council	• Pulau Pangkor Green Transport Project (2018-25) • Electric public motorcycle for tourist locations in Pulau Pangkor (2018-25)
Teluk Intan Municipal Council	• Construction of secondary public transport terminal
Penang Island City Council	• E-rickshaws operational • 'Green Road Sharing' route for cyclists operational in heritage area of George Town • Link Bike has been launched in Penang Island • Bridge Express Shuttle Transit (BEST) operational • Central Area Transit (CAT) operational • Congestion Alleviation Transport (CAT) operational • Bayan Lepas Light Rail Transit (LRT) planned • Air Itam Monorail planned • Tanjung Tokong Monorail planned • George Town Tram Loop planned
Seberang Perai Municipal Council	• Cycle lane planned in 3 districts • BEST project implemented • Congestion Alleviation Transport (CAT) project implemented • Raja Uda – Bukit Mertajam Monorail project planned • Permatang Tinggi – Batu Kawan BRT project planned
Ipoh Municipal Council	• My bus programme – To promote public green transport • RKK Ipoh 2020 (IPOH Green network) - To promote green transport in Heritage areas

IDENTIFICATION OF PRIORITY PROJECTS

Transport interventions suggested by SUDF cities from Malaysia include:

- Enhancing public transport
- Implementation of public bike sharing programme
- Implementation of mass public transport systems including monorail systems in large cities
- Shift to alternate fuel

SECTOR PROFILES

ENERGY

COUNTRY SCENARIO

Malaysia is an industrial nation and oil export is one of the major economic activities. The power generation mix in 2016 included coal (44.9 percent), natural gas (40.7 percent), hydro (13.3 percent), diesel and fuel oil (0.7 percent) and renewables (0.4 percent) with a total installed capacity of 33,090 MW. Over the past few years, several transformative initiatives are being implemented to reduce oil dependency by shifting towards RE. The response analysis of the questionnaires suggests that most of the SUDF cities have implemented a number of projects and initiatives to promote RE use and support sustainable power consumption.

CURRENT STATUS IN SUDF CITIES

The average daily energy demand in Manjung Municipal Council and Penang is 255MW and 1,306MW respectively. Additionally, Penang reported average daily peak demand of 1,622MW and 5 percent distribution loss.

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

There are a number of on-going and planned initiatives in the cities:

IDENTIFICATION OF PRIORITY PROJECTS

All the SUDF cities consider energy as a priority sector and more than 70 percent consider LED street lighting and energy efficient buildings are priority solutions. There is potential for replacing the existing 4,790 mercury streetlights in the participant cities with LED lights.

Table 16: Ongoing and/or planned initiatives in energy sector

CITY	ONGOING/PLANNED INITIATIVES
Manjung Municipal Council	• Solar PV target of 15MW o Teluk Mengkudu 2.6 MW o Solar Farm 500 kw
Kangar Municipal Council	• Implementation of energy audit and retrofittingat the Perlis State SUK Building under Malaysia Green Technology Corporation (MGTC)
Teluk Intan Municipal Council	• LED lighting provided in River Front BaganDatuk (8 units), government buildings (48 units) and for street lighting (55 units) • Hutan Melintang Solar Farm implemented • Solar PV target of 38.57 MW by 2020 • BaganDatok Solar Farm Project implemented
Penang Island City Council	• RE target of 21.5 MW (from biogas) • 7135 LED street lights installed
Seberang Perai Municipal Council	• RE target of 21.5 MW till 2023 (Solar PV- 20MW, biogas – 1.5MW) • 20 MW plant being planned at Pulau Burung • Installed 29 LED streetlights and 1,013LED streetlights to be installed in 2018 • Energy conservation building code developed for Ecocity Batu Kawan • GHG emission inventory developed • Seberang Perai Strategic Plan developed for implementing RE projects in the city
Ipoh Municipal Council	• Replacing damaged High Pressure Sodium Vapour (HPSV) street lights and lights in government buildings with LED
Taiping Municipal Council	• Taman Botani – Using LED and solar lighting • Jejak Warisan - Using LED sign boards

SECTOR PROFILES

BIODIVERSITY

COUNTRY SCENARIO

During the period of the tenth five-year plan (2011-2015), forest area totaling 23,264 hectares in the states of Pahang, Perak and Selangor were gazetted as Permanent Reserved Forest under the Central Forest Spine and this resulted in GHG emissions avoidance of 11.8 $MtCO_2eq$. In total, forest cover increased from 56.4% to 61% from 2010 to 2013.

Malaysia is committed to conserve their biological diversity, promote its sustainable use and ensure fair and equitable sharing of the benefits arising from the use of biological resources. Hence, as per the National Policy on Biological Diversity 2016 – 2025, five overarching goals on biodiversity, and their corresponding targets, have been set for the year 2025:

Table 17: Malaysia biodiversity targets

Goal	Target
Goal 1: We have em-powered and harnessed the commitment of all stakeholders to conserve biodiversity.	Target 1: By 2025, more Malaysians are aware of the values of biodiversity and they can take steps to conserve and use it sustainably. Target 2: By 2025, the contributions of indigenous people and local communities, civil society and private sector to the conservation and sustainable utilization of biodiversity have increased significantly.
Goal 2: We have significantly reduced the direct and indirect pressures on biodiversity.	Target 3: By 2025, biodiversity conservation has been mainstreamed into national development planning and sectorial policies and plans. Target 4: By 2025, our production forests, agriculture production and fisheries are managed and harvested sustainably. Target 5: By 2025, tourism is sustainably managed and promotes biodiversity conservation.
Goal 3: We have safeguarded all our key ecosystems, species and genetic biodiversity.	Target 6: By 2025, at least 20 percent of terrestrial areas and inland waters, and 10 percentof coastal and marine areas, are conserved through a representative system of protected areas and other effective area-based conservation measures. Target 7: By 2025, vulnerable ecosystems and habitats, particularly limestone hills, wetlands, coral reefs and seagrass beds are adequately protected and restored. Target 8: By 2025, important terrestrial and marine ecological corridors have been identified, restored and protected. Target 9: By 2025, the extinction of known threatened species has been prevented and their conservation status has been improved and sustained. Target 10: By 2025, poaching, illegal harvesting and illegal trade of wildlife, fish and plants are under control and significantly reduced. Target 11: By 2025, invasive alien species and pathways are identified, priority species controlled, and measures are in place to prevent their introduction and establishment. Target 12: By 2025, a comprehensive biosafety system inclusive of liability and redress regime is operational to manage potential adverse impacts of modern biotechnology on biodiversity and human health. Target 13: By 2025, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives is adequately conserved.
Goal 4: We have ensured that the benefits from the utilization of biodiversity are shared equitably.	Target 14: By 2025, Malaysia has an operational Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (ABS) framework that is consistent with the Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from utilization.
Goal 5: We have improved the capacity, knowledge and skills of all stakeholders to conserve biodiversity.	Target 15: By 2025, capacity for implementation of the national and subnational biodiversity strategies, the Convention on Biological Diversity (CBD) and other related Maritime Enforcement Agencies(MEAs) has significantly increased. Target 16: By 2025, knowledge and the science base relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are significantly improved and applied. Target 17: By 2025, there is a significant increase in funds and resources mobilized for the conservation of biodiversity from both government and non-government sources.

CURRENT STATUS IN SUDF CITIES

Manjung Municipal Council, Penang Island City Council and Seberang Perai Municipal Council have documented the biodiversity in their region and have prepared a city biodiversity index, and conducted a tree census and bird census. Several programs enhancing ecosystem services and biodiversity conservation are being implemented in Krabi Mueang Municipality. Similar programs are being implemented in other cities and states as well, as a part of the reforestation and forest enrichment commitment laid down in the 11th Malaysia Plan.

IDENTIFICATION OF PRIORITY PROJECTS

With over 67 percent forest cover in the country, it is essential that the cities have proper documentation of the biodiversity and its natural habitat. Local Biodiversity Strategy Action Plan (LBSAP) can be developed along with generating awareness among the people, to encourage activities like urban farming. Further, as wetlands are lifelines for the cities and provide several essential ecosystem services, conservation and restoration of wetlands requires immediate attention.

THAILAND

INTRODUCTION

TOTAL POPULATION:
over 69 million (2017)[1]

Administrative distribution :

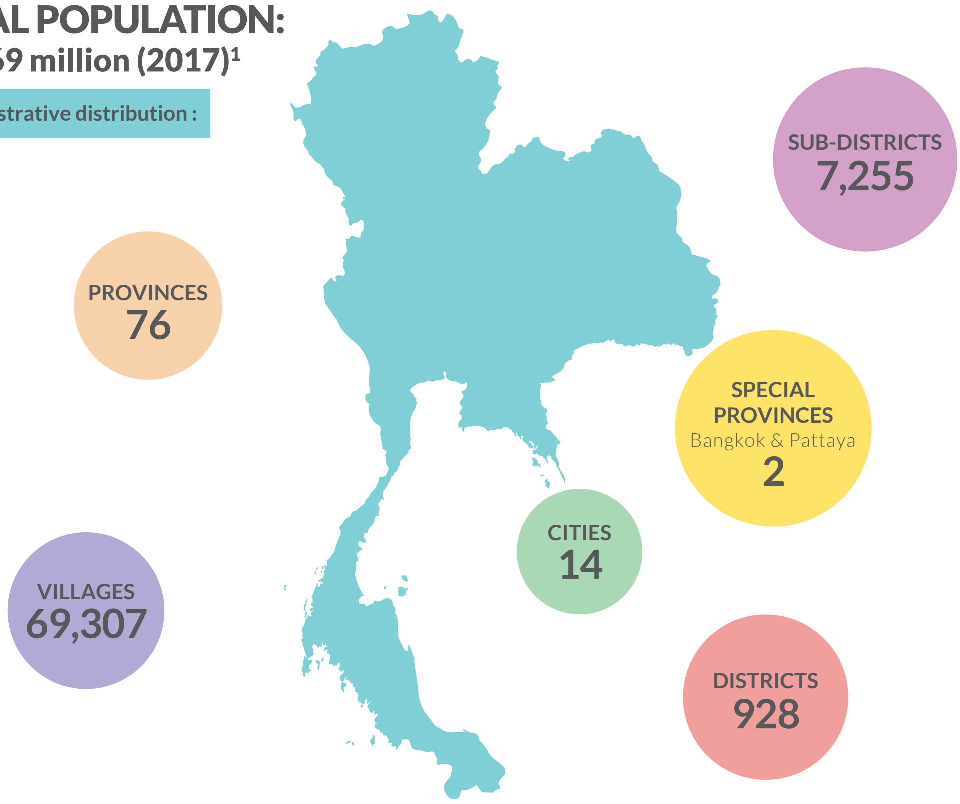

Figure 18: Thailand country profile

The Kingdom of Thailand is a unitary state located at the centre of the Southeast Asian Indo-Chinese Peninsula. Thailand encompasses diverse ecosystems, including hilly forests at the northern frontier, fertile rice fields in the central plains, broad plateau in the northeast, and rugged coasts along the narrow southern peninsula.

Thailand has made significant progress in social and economic development over the last four decades, with robust growth and impressive poverty reduction. Thailand's economy grew at an average annual rate of 7.5 percent in the boom years of 1960 to 1996, creating millions of jobs and liberating millions from poverty. However, the rates dipped later due to financial crisis in Asia during 1999-2005. Thailand is now on the path to recovery with economy growth rate touching 3.9 percent in 2017.

Poverty also declined substantially from 67 percent in 1986 to 8.61 percent in 2015 during the period of high growth. However, an ongoing drought situation, inequality and social inclusion issues continue to pose significant challenges. Agricultural prices are also decreasing, thus impacting the economy.

To overcome these challenges and attain a developed country status, Thailand is implementing the 20-Year National Strategy (2017 – 2036) with proposed reforms addressing economic stability, skill development, equal economic opportunities, environmental sustainability, competitiveness, and effective governance. Recent reforms also include implementation of large multi-year public infrastructure projects, such as implementation of dual railway lines.

Five sub-national administration jurisdictions are defined in Thailand. These are provincial governments, municipalities, sanitary districts, and the two special provinces - the Bangkok Metropolitan Administration (BMA) and the City of Pattaya. The Ministry of Interior determines the administrative status of sub-national governments.[2]

GDP OF THE COUNTRY (2017) (BILLION USD)	**445**
PER CAPITA GDP (2017) (USD)	**6,594**
AVERAGE ANNUAL GROWTH RATE OF GDP (%)	**3.9**
POPULATION GROWTH RATE 2017 (%)	**0.25**
URBAN POVERTY (% living below urban poverty line)	**7.7**

[1] All population and economic growth related data has been referred from https://data.worldbank.org
[2] 2008. Decentralization and local democracy in the world, Global Report: United Cities and Local Governments.

URBAN PROFILE OF THAILAND

A little more than half (52.37 percent as of 2017) the country's population lives in cities. The UNDP estimates that by 2050, nearly 70 percent of Thailand's population will reside in urban areas. The annual growth rate of urban population is about 2.4 percent.[3]

Thailand is in the midst of transforming itself from a predominantly rural to an increasingly urban country. There is a significant shift in the population concentration, with migration from rural to urban areas. With urban population increasing from 36 to 50 percent over the last ten years, cities are the centres of economic activity in Thailand. Consequently, existing urban utilities and systems are rendered inadequate. There is an immediate need to enhance these systems.

Urbanization in the country is dominated by the Bangkok urban area; with 9.6 million people in 2010, it joined the ranks of other mega cities of the region. The population remains concentrated in few other large cities, mainly Chiang Mai, Phuket, Nakhon Ratchasima and Khon Kaen. Secondary cities are now on the government's radar for development. A recent programme promoted tourism in 55 secondary cities by granting tax breaks to domestic tourists, for traveling expenses incurred in those cities.

Table 18: Participating cities, regencies and provinces

PARTICIPATING CITIES, REGENCIES AND PROVINCES	POPULATION (000)
Cities and regencies	
Ranong Municipality	13 (2016)
Trang Municipality	60 (2016)
Pattani Municipality	45 (2017)
Krabi Municipality	32
Nakhon Si Thammarat Municipality	105
Phatthalung Municipality	38
Provinces	
Chumphon	506 (2015)
Narathiwat	783 (2015)
Pattani	686
Songkhla	1400
Surat Thani	1040
Phatthalung	523 (2015)
Satun	313 (2015)
Trang	641 (2015)
Yala	519 (2010)

[3] 2016, Asian Cities Climate Resilience. Working Paper Series 30, Available at http://pubs.iied.org/pdfs/10770IIED.pdf

DEVELOPMENT CHALLENGES IN CITIES

Thailand contends with a diverse set of issues in its mega/large cities and small cities. Connectivity is the main challenge in the mega cities. With businesses located in the city centre, people spend long hours commuting to work. Mega cities also lack affordable facilities for urban poor, specifically healthcare and education.

Smaller cities are grappling with high costs of public service provision owing to the limited scale required. Local governments are constantly under financial stress.

Cities in Thailand are also impacted by an aging population, as in European cities. About 11 percent of the country's population is over 65 years in age, which is higher than the world average of 8 percent.

BANGKOK – CHALLENGES

Bangkok, the commercial hub of Thailand, contributes to 30 percent of the country's GDP. Rapid economic development has resulted in an increase in population density. Unplanned growth of the city; air and noise pollution, primarily due to heavy traffic congestion; water pollution from uncontrolled disposal of sewerage; unscientific disposal of municipal solid waste; annual flooding due to rise in sea level and subsequent land subsidence are some of the problems that Bangkok has been grappling with for several decades.

The city lies 5 feet above the mean sea level. Studies project that by 2100, impacted by rising sea levels due to climate change, the entire city may be submerged. To counter this threat, disaster prevention experts are now advocating the construction of a flood prevention wall, rising three meters above the mean sea level, to be built 300 meters offshore. Experts have also recommended preservation and development of mangrove forests which serve as a natural barrier against coastal erosion.

Rural-urban migration is a cause for increasing urban sprawl. Internal migrants in Thailand constitute a substantial population. According to the 2010 Thailand Population and Housing Census, 8.3 percent of the Thai population had migrated internally during the preceding five years and an overall 21.8% of the population did not live in their home town (National Statistical Office 2010).

Another critical problem faced by Thai cities is water pollution, due to unregulated industrial development and inadequate treatment of domestic sewerage. The depletion of the water table in cities such as Bangkok has led to land subsidence which has exacerbated flooding. The drinking water crisis in Thailand is caused by the depletion and contamination of the water table, which is expected to worsen in the near future.

Thailand's dependence on a fossil fuel economy is evident from an expanding petrochemical industry, increasing coal-fired power production, and an urban architecture that relies on privatized transport.

MAJOR CHALLENGES IN CITIES[4]

- Lack of effective land use planning and zoning
- Traffic congestion
- Inadequate affordable housing for urban poor
- Rural-to-urban migration
- Increasing number of urban poor
- Flooding and drought cycle
- Sea level rise

[4] Paduka, Datin; Rosly, Dr. Dahlia. 2015. Planning for the Future Cities In Malaysia. Malaysia: Federal Department of Town and Country Planning Peninsular Malaysia, Ministry of Urban Wellbeing, Housing and Local Government Malaysia

CLIMATE CHANGE
GHG EMISSIONS AND VULNERABILITY

GHG EMISSIONS

Thailand's per capita GHG emissions in 2012 were 5.63 tCO_2e and emissions per million USD of GDP were 409.54 tCO_2e, which are lower than the world average[5]. In 2014, Thailand accounted for approximately 337 million tCO_2e GHG emissions. The figure below shows Thailand's sector-wise GHG emissions profile, as reported by the country in its second national Biennial Update Report submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2016.[6]

Table 19: National GHG emissions profile - Thailand (2014)

Sector	Emission ($GgCO_2e$)	Emission Share
Waste	11,829.56	3.71%
Energy	236,936.48	74.35%
Industrial process	18,976.79	5.96%
Agriculture	50,919.34	15.98%

Natural gas is the main source of energy for electricity and heat generation. This contributes to high GHG emission levels, to reduce which Thailand's Ministry of Energy introduced the Power Development Plan which aims to achieve a 20 percent share of renewable energy based power generation by 2036. The Ministry also introduced the Alternative Energy Development Plan (AEDP) and the Energy Efficiency Plan (EEP). The AEDP aims to achieve a 30 percent share of renewable energy (RE) in the total final energy consumption in 2036. The EEP plans to reduce Thailand's energy intensity by 30 percent below the 2010 level, by 2036. Additionally, to make renewables more attractive, Thailand has launched support mechanisms like feed-in tariffs, tax incentives and access to investment grants and venture capital for the RE developers.

VULNERABILITY AND RISK

Climate change threatens all three important sectors of Thailand's economy: agriculture, tourism, and trade. Studies in the public domain suggest that the sea level in the Gulf of Thailand is rising 3-5 mm per year compared to a global average of 1.7 (±0.5) mm per year. This implies that the coastline of the country, housing many cities such as Bangkok face a constant threat of flooding. Tourism and fisheries abound on Thailand's 3,200 kilometre long coastline and play an important role in the economy, contributing to 6 percent of GDP and providing livelihood to 10 percent of the population.

After the high impact 2011 flood, official responses have focused around constructing physical infrastructure for flood protection, while also opening floodways to facilitate drainage. Despite the influence of urbanization patterns on flood-prone areas, there has been no policy response to address gaps in land use planning and zoning.[8]

IMPACTS OF CLIMATE CHANGE

- HIGHER SURFACE TEMPERA-TURES
- FLOODS
- DROUGHTS
- SEVERE STORMS
- SEA LEVEL RISE

At the community level, a study supported by Asian Cities Climate Resilience Network (ACCCRN) highlights that there is a widespread sense that flooding is a seasonal problem and a natural phenomenon. Most strategies to deal with shocks are short-term, recovery oriented i.e. taking loans from relatives or relocating temporarily.

Current national policies of the National Economic and Social Development Board (NESDB) such as 'The Twelfth National Economic and Social Development Plan (2017-2021)' present a sustainable vision for an urban future in which cities are compact, environment friendly and provide public green spaces to enhance livability. Thai cities are also envisioned to be energy efficient with improved public transport options, bringing together cultural, social and ecological dimensions of urban life. However, conditions on ground are far removed from this vision.

[5] 2018. Thailand Emission Reduction Challenges. Available at https://www.climatescorecard.org/2016/08/thailand-emission-reduction-challenges/
[6] Ministry of Natural Resources and Environment Thailand. 2016. Biennial Update Report to the UNFCCC. Thailand.
[7] One giga gram is equal to a thousand tonnes
[8] Friend, R., et al. 2018. Urbanising Thailand: Implications for climate vulnerability assessment. London: ACCCRN

SDGs, NDCs AND RESILIENCE

SUSTAINABLE DEVELOPMENT GOALS (SDGs) 2030

Thailand aims to achieve equitable and sustainable development by focusing on 17 goals and 169 targets, addressing poverty, hunger, health, gender, industry, innovation, and infrastructure, life below water, and partnerships. SDGs relevant to interventions proposed in the SUDF are highlighted in this section.[9]

Table 20: SDGs related to SUDF priority sectors

SDG	No. of targets in National Economic and Social Development Plan (2017-2021)		Major achievements
	Number of targets	Highlighted targets	
Goal 4: Quality education	10	Equitable and quality primary and secondary education leading to relevant and effective learning outcomes; Quality early childhood development, care and pre-primary education; Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all	• More than 90 per cent of school children are getting subsidized 15-year basic education. • Promotion of vocational study, in particular dual education, with an aim of increasing the quality workforce in real sectors
Goal 6: Ensure availability and sustainable management of water and sanitation for all	54	Achieve universal and equitable access to safe and affordable drinking water for all; Achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	• Almost 100 per cent households have access to safe and affordable drinking water.
Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all	56	Ensure universal access to affordable, reliable and modern energy services; Increase substantially the share of RE in the global energy mix; Double the global rate of improvement in energy efficiency (EE)	• 30 per cent of energy use to be fulfilled by alternative energy sources by 2036
Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable	12	Ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums; Provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety	• 22,434 million THB preferential housing loan provided to the population in the low and middle classes • 972 communities trained in 2016;Community based disaster risk management programme based on the Sendai framework for disaster risk reduction will be further expanded to local communities nationwide.
Goal 12: Ensure sustainable consumption and production patterns	11	Implement the 10-year framework of programmes on sustainable consumption and production; All countries taking action with developed countries taking the lead taking into account the development and capabilities of developing countries	• 'Sustainable Consumption and Production (SCP) Roadmap 2017- 2036' has been developed to further promote the SCP concept in different sectors • Various medium and long-term plans and strategies on green industry, chemical and waste management, environmental management, green procurement as well as various green labelling schemes have been implemented.

Continued...

[9] 2017. Thailand's Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development. Available at http://www.mfa.go.th/sep4sdgs/contents/filemanager/images/sep/VNR%20English.pdf

SDGs, NDCs AND RESILIENCE

SDG	No. of targets in National Economic and Social Development Plan (2017-2021)		Major achievements
	Number of targets	Highlighted targets	
Goal 13: Take urgent action to combat climate change and its impact	10	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries; Integrate climate change measures into national policies, strategies and planning; Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	• 17 provinces and 32 municipalities have been trained and climate action plan developed for their respective constituencies, complementing their provincial disaster risk reduction plans.
Goal 14: Conserve and sustainably use oceans, seas and marine resources for sustainable development	54	Prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution; Conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	• National Plan of Action to prevent, eliminate and deter illegal unreported and unregulated (IUU) fishing has been developed.
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	56	Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	• Elephant Ivory Act has been developed to combat wildlife trafficking.

NATIONALLY DETERMINED CONTRIBUTION (NDC)

Thailand intends to reduce its GHG emissions by 20 percent from the projected Business-As-Usual (BAU) level in 2030. The level of contribution could increase up to 25 per cent, subject to adequate and enhanced access to technology development and transfer, financial resources and capacity building support through a balanced and ambitious global agreement under UNFCCC. In addition to the priority actions included in the Nationally Determined Contribution (NDC) commitments, water security, sustainable agriculture and plantation, and ecosystem conservation and restoration (under ecosystem and landscape resilience) are among the main thematic areas of the SUDF framework. Hence, the outcomes and goals of activities of the framework will directly contribute to achieving the NDC commitment. Scaling-up of priority actions is being planned to achieve the emissions reduction target of 20% by 2030.

SDGs, NDCs AND RESILIENCE

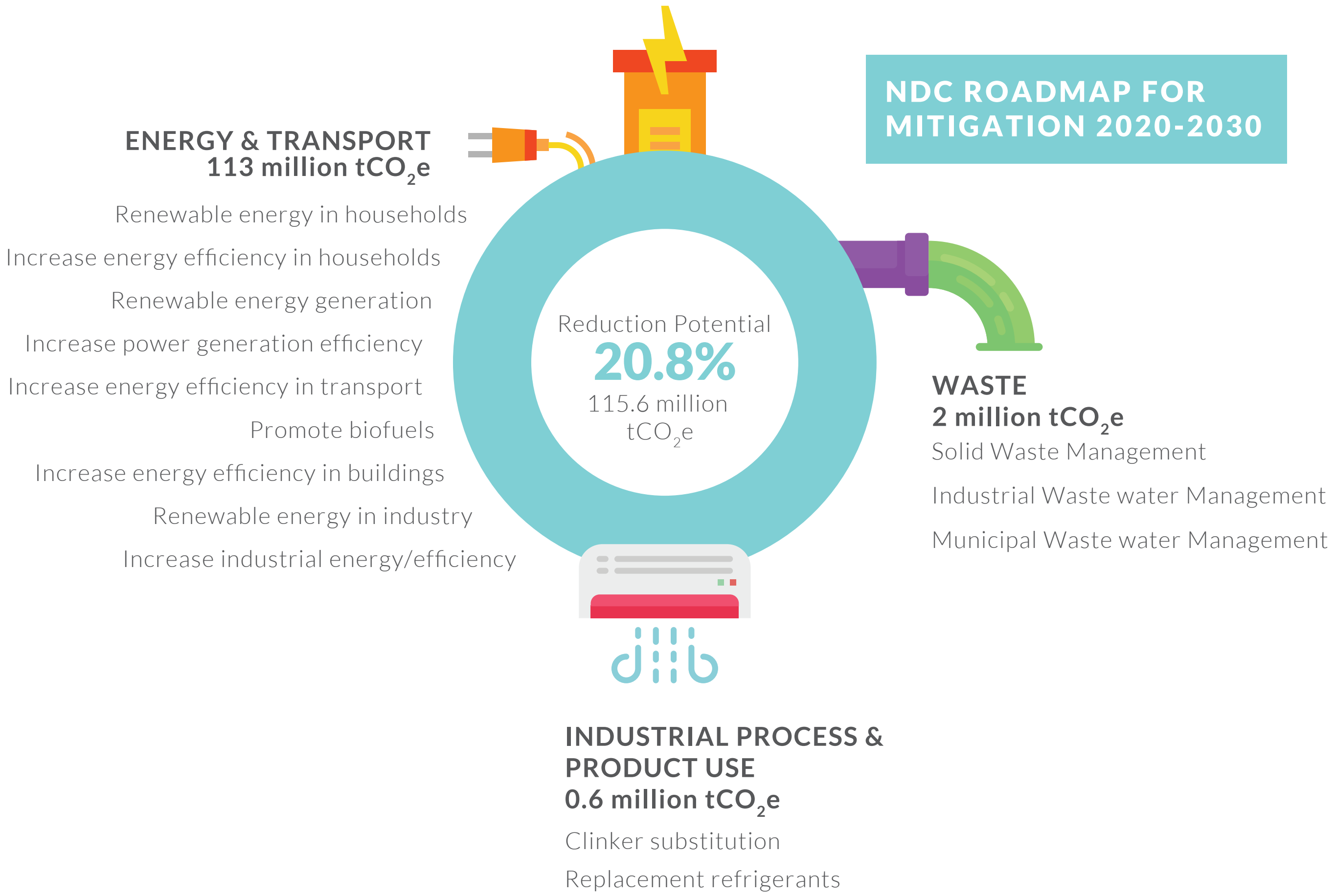

Figure 19: NDC roadmap for mitigation 2020-2030[10]

[10] Saiyasitpanich, Dr. Phirun (2018). Achieving Thailand's Nationally Determined Contributions: National Perspective, By Dr. PhirunSaiyasitpanich Director of Climate Change Management Coordination Division Office of Natural Resources and Environmental Policy and Planning Thailand.

POLICIES AND NATIONAL DEVELOPMENT PLANS SUPPORTING SUDF PRIORITY SECTORS

Table 21: Policies and national development plans supporting SUDF priority sectors

Policy	Policy attributes related to SUDF priority actions
Climate Change Master Plan (2015-2050)	• Comprehensive and flexible framework with a roadmap of short, medium and long-term goals • Low carbon development, mainstreaming climate adaptation, building capacities
The Water Resource Management Strategic Plan 2015 – 2026	• Developing water supply in urban areas • Ensuring quality and affordable consumption of water throughout the country • Alleviating flood damage in urban and major economic areas by enhancing water drainage capacity • Ensuring satisfactory water quality level • Developing a waste water management system
National Master Plan on Waste Management (2016-2021)	• Reducing the generation of solid and hazardous waste at source • Supporting the management of solid and hazardous waste
Waste Management Roadmap	• Promoting sustainable management of upstream, mid-stream and down-stream waste, and waste-to-energy technologies
Power Development Plan (2015-2036)	• Achieving the target of 20% share of power generation from RE sources by 2036
Energy Efficiency Development Plan (2011-2036)	• Reducing energy intensity by 25% over 20 years
Alternate Energy Development Plan (2015-2036)	• Increasing alternative energy production to meet 30% of domestic consumption needs by 2036
Transportation Development Strategy (2017-2036)	• Increasing the proportion of passengers using public transportation systems in urban areas • Promoting road-to-rail modal shift for passenger and freight vehicles
Policy and Plan for Enhancement and Conservation of National Environmental Quality (2017 – 2036)	• Improving measurements for natural resources and environmental management and green growth for sustainability

SECTOR PROFILES

The SUDF addresses the implementation of actions for promoting sustainable development in Thai cities and provinces. Proposed activities are primarily focused on water, waste water management, solid waste management, transport, energy and biodiversity sectors. The prioritisation of these sectors is a result of discussions with the constituencies of the IMT-GT subregion. This section discusses the baseline status of development in each of the priority sectors. The baseline is based on secondary research and feedback from SUDF cities, which also identified potential actions/projects for implementation under the SUDF initiative.

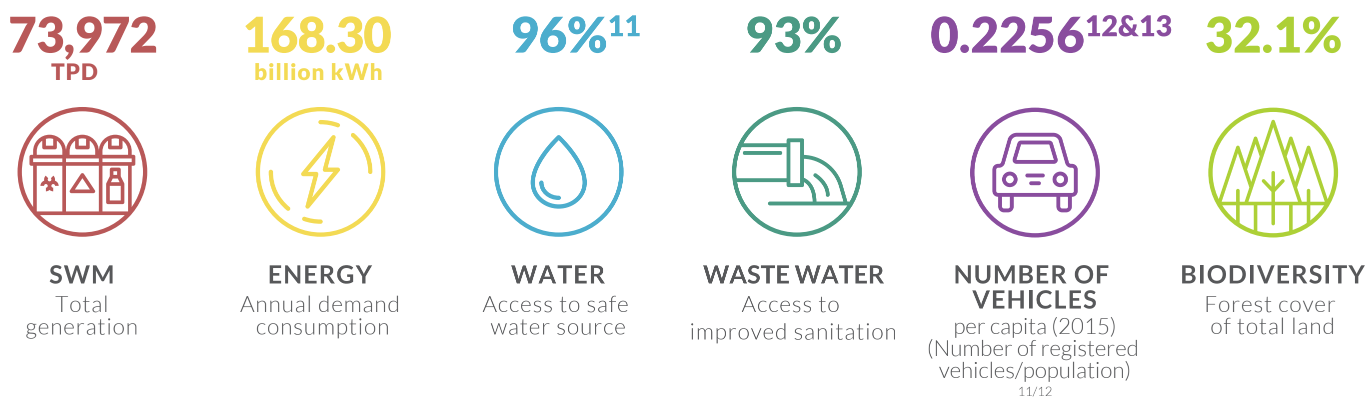

Figure 20: Sector profile - Thailand

WATER SUPPLY

COUNTRY SCENARIO

Thailand depends on surface water sources for use in agriculture, industry and in homes (rural and urban). About 96% of the population has access to improved sources of water. Two main agencies are responsible for providing piped water supply including sourcing, production and distribution of water. These are the Metropolitan Waterworks Authority (MWA) and the Provincial Waterworks Authority (PWA).

The available water resources are severely impacted by floods, droughts, water pollution, and degradation of other related resources. Droughts lead to higher extraction of ground water, often beyond replenishable levels.

Water infrastructure is generally outdated and was considerably damaged during the 2011 floods. It is estimated that water loss from the supply network amounts to more than a quarter of the total extracted water volume.[14] The recently introduced 'Water Loss Improvement Project' aims to strengthen and renovate existing infrastructure, to reduce water losses.

Demand for water in the country's main economic sectors such as tourism, industry and agriculture continues to rise, severely impacting the fragile water infrastructure and resources.

CURRENT STATUS IN SUDF CITIES

- Coverage of piped water supply to households:
  - 100% in Krabi Municipality and Pattani Municipality
  - 81% in Phatthalung Municipality
  - 75%-100% in cities of Satun and Phattalung provinces
- Chumphon Province faces acute water shortage, especially in districts of Amphoe Thasae and Amphoe Lamae. 8 districts in this province including Amphoe Chumphon, Amphoe Sawi, Amphoe Thasae, Amphoe Pathio, Amphoe Lang Suan, Amphoe Thung Tako, Amphoe Phato and Amphoe Lamae require additional water sources and infrastructure development in the water supply sector.

11. 2015 World Health Organisation. Available at http://www.who.int/water_sanitation_health/monitoring/investments/thailand-10-nov-2.pdf
12. 2018 CEIC. Available at https://www.ceicdata.com/en/indicator/thailand/motor-vehicles-sales
13. 2018 The World Bank Group. Available at https://www.google.com/publicdata/explore?ds=d5bncppjof8f9_&met_y=sp_pop_totl&hl=en&dl=en#!ctype=l&strail=false&bcs=d&nselm=h&met_y=sp_pop_totl&scale_y=lin&ind_y=false&rdim=country&idim=country:THA&ifdim=country:region:EAS&hl=en_US&dl=en&ind=false
14. 2016 The Netherlands Embassy in Thailand. Available at: https://www.netherlandsworldwide.nl/binaries/en-nederlandwereldwijd/documents/publications/2016/05/18/factsheet-water-sector-in-thailand/factsheet-the-water-sector-in-thailand-3.pdf

SECTOR PROFILES

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

- Nakhon Municipality: Construction of water storage tanks, expansion of water mains, conservation and sustainable use of natural water sources
- Chumphon Province: Eight projects for water resource management, 16 basic operation plans to be developed for water resource management, 2 disaster prevention and mitigation projects
- Narathiwat Province: Water quality monitoring project and water distribution pipeline project
- Trang Province: Expansion of waterworks system

IDENTIFICATION OF PRIORITY PROJECTS

- Water supply is considered a high priority sector by 63% of the cities.
- Most of the cities and provinces have good coverage of household water supply connections but are grappling with shortage in water supply.

In order to overcome this problem, cities and provinces have suggested the following action points:

- Implementing SCADA systems for monitoring and reducing losses (suggested by 4 participants)
- Implementing rainwater harvesting systems and ground water recharge systems
- Reduction in non-revenue water
- Privatization of water supply system

WASTE WATER MANAGEMENT

COUNTRY SCENARIO

93 percent of the population has access to 'improved sanitation' in cities (2012). 70 percent of the urban population is served by a functional sewerage network (2016). Although there is a well established sewerage collection system, Thailand experiences major challenges with regard to water pollution and the treatment of wastewater. Untreated waste water is discharged into rivers in populated areas. The Thai government has acknowledged the problem in its 11th National Economic and Social Development Plan (2012-2016). Currently, there are over 86 waste water treatment plants (WWTP) across the cities, eight of which the Bangkok Metropolitan Area alone. These WWTPs are operated by local authorities such as municipalities under the Ministry of Interior. However, many the existing plants are not operated efficiently owing to dearth of skilled resources or discontinuation of budget allocation.

CURRENT STATUS IN SUDF CITIES

- 77% of sewage generated is collected.
- An average of 65% of sewage generated is treated.
- 35% raw sewage is discharged directly into nearby rivers, lakes and coastal areas owing to inefficient waste water management or waste water infrastructure.
- On an average, 12.5% of treated sewage is currently being recycled on a regularly basis.

ONGOING AND/OR PLANNED INITIATIVES TO IMPROVE SERVICES

Majority of the cities and provinces have taken up projects to expand the sewage network and efficiency of sewage treatment plants (STP).

Projects undertaken by SUDF cities/provinces:

- Krabi Municipality: Extension of sewage collection system in the next five years
- Trang Municipality: Waste water treatment project
- Songkhla Province: Domestic waste water collection and treatment system construction project

IDENTIFICATION OF PRIORITY PROJECTS

In order to improve waste water management facilities, the participating cities of Thailand have prioritized the following actions:

- Expansion of sewage collection system
- Implementation of new STPs
- Improving treatment quality and adequacy of existing STPs
- Implementing SCADA system for monitoring

SECTOR PROFILES

SOLID WASTE MANAGEMENT

COUNTRY SCENARIO

Cities in Thailand generate about 15.11 million tonnes of municipal solid waste (MSW) (2009) annually. Of the total waste generated, about 84% is collected, only 47% of which is disposed properly at the sanitary landfills;the rest is dumped in open dump sites. Only 20% of MSW is recycled, while the Pollution Control Department estimates a recycling potential of 26%.

There are about 107 sanitary landfill sites, of which only 93 are currently operational. Only the city of Phuket has an operational incineration facility with a 250 tonnes/day installed capacity.

The MSW management issues include:

- Illegal/Open dumping
- Co-disposal of hazardous waste and MSW
- Inadequate processing facilities
- Inadequately enforced environment controls

Cities are adopting the following innovative policies to efficiently manage MSW:

- Forming clusters between adjacent cities to ensure effective long-term solutions for waste management
- Applying the 3R principles for achieving waste reduction and utilization
- Promoting the integrated waste management system to reduce landfill area and generate RE through waste-to-energy plants
- Encouraging both public and private sectors to participate in waste management projects

CURRENT STATUS IN SUDF CITIES

The average per capita waste generation in cities and provinces of Thailand is 1.20 and 0.62 kilo grams per day respectively; however, it varies between different income groups.

The average annual waste generation in Thailand cities and provinces is 13,555 and 168,647 tonnes.

40%-50% of the total waste generated is disposed in open dump sites.

Table 22: Ongoing and/or planned initiatives in the solid waste management sector

Respondent	Ongoing and/or planned initiatives
Krabi Municipality	• Construction and management of 100 TPD community solid waste disposal plant (waste-to-energy plant) • Waste Management Improvement Program
Phatthalung Municipality	• Waste-to-energy plant is operational • Biomethanation plant of 0.5 TPD is operational • Composting plant of 0.8 TPD
Trang Municipality	• Compost plant: 7 TPD • 3R initiative: 10 TPD • Sanitary landfill of 33 TPD is operational • Construction of waste-to-energy plant of 350 TPD
Chumphon Province	• Province has planned for 60 TPD waste segregation system • 5 TPD composting system (under construction)
Narathiwat Province	• Recyclable waste market project to promote waste separation • Community waste management campaign to build awareness about waste segregation is conducted
Pattani Province	• Encourage reduction of solid waste at source • Improve efficiency and collection of solid waste
Phatthalung Province	• Biomethanation plant in Phatthalung Municipality is operational
Songkhla Province	• Promotion of social enterprises to advocate for reduced consumption, reusing waste and creating value-added products from recyclable waste. • Plan for solid waste reduction at source • Plan for solid waste management capability improvement • Solid waste management promotion plan

SECTOR PROFILES

Respondent	Ongoing and/or planned initiatives
Surat Thani Province	• Construction of integrated waste management facility, Phase 2 (Don Sak Municipality)
Trang Province	• Programme to monitor and evaluate the performance of government agencies, schools, universities, religious places, private sector and establishments which organize activities aiming at waste reduction, separation and reuse

IDENTIFICATION OF PRIORITY PROJECTS

Priority initiatives suggested by the cities of Krabi Municipality, Nakhon, Ranong Municipality, Pattani Municipality, and Trang Municipality include:

- Formalizing recycling industries
- Identifying and establishing more waste-to-energy, composting and biomethanation projects
- Converting open dumping areas into sanitary landfills

TRANSPORT

COUNTRY SCENARIO

85% of transport in Thailand is road based. Between 1995 and 2009, vehicle-kilometres travelled has grown by 74%. Inadequate public transport systems and significant dependence on private vehicles characterize urban transit. Urban commute times from business centres to residential areas tend to be extreme, even up to 5 hours each way.

Thailand's 20 Year Transportation Development Strategy (2017-2036) proposes ambitious actions to promote road-to-rail modal shift for both freight and passenger transport, which include extension of mass rapid transit lines, construction of double-track railways and improvement of bus transit in the Bangkok Metro areas. A vehicle tax scheme based on CO2 emissions was also approved in 2016. Urban transport is managed by local agencies.

CURRENT STATUS IN SUDF CITIES

- Percentage of population utilizing public transport for daily commute:
  - o 60 percent in Nakhon Municipality
  - o 30 percent in Tarang Province
  - o 20 percent in Chumphon Province
- Coverage of public transport is as low as 7 percent in Narathiwat province

Table 23: Ongoing and/or planned initiatives in the transport sector

Respondent	Ongoing and/or planned initiatives
Krabi Municipality	• Public transport service (Songthaew) operational • Shutter bus operational from Airport–Mueang Krabi–Ao Nang
Nakhon Si Thammarat Municipality	• 60% of the population uses public transport • 87% of public roads are provided with street lights
Chumphon Province	• Campaign programme for prevention and reduction of road accidents in the province
Songkhla Province	• The province plans to utilize 100% of public buses making use of the central bus terminal so as to have traffic ply in an orderly manner (Bus terminal construction project in Songkhla Province)
Trang Province	• Public transport reorganizing project to support city development

SECTOR PROFILES

IDENTIFICATION OF PRIORITY PROJECTS

- Enhancing public transport and bike sharing are two high priority initiatives identified by the cities.
- Focus on investing in mass public transport systems including mono rail in large cities and vehicles running on alternate fuel

ENERGY

COUNTRY SCENARIO

Thailand's energy consumption still depends mostly on conventional energy sources such as crude oil, coal and natural gas. The country produces roughly one-third of the crude oil it uses and is the second largest importer of crude oil in Southeast Asia. Thailand is also the second largest producer of coal after Indonesia, but needs to import additional coal to meet its domestic demand. Thailand's Renewable Energy (RE) sector is still developing and currently has an installed capacity of 7,901 MW. The nation is blessed with great potential for RE such as solar, hydro and biomass.

Thailand has adopted three national development plans, namely Power Development Plan (2015-2036)[15], Energy Efficiency (EE) Development Plan (2011-2036) and Alternate Energy Development Plan (2015-2036) to promote RE and EE strategies. According to Thailand's Power Development Plan for 2015-2036, the country intends to build 14,684 MW of RE. Additionally, there are plans to set up transmission system development projects for hydro power purchase from neighbouring countries like Laos or Myanmar. Two nuclear plants are also planned. Solar energy is targeted to reach 6,000 MW and biomass 5,570 MW.

CURRENT STATUS IN SUDF CITIES

- Number of households with electricity:
  - o Nakhon Municipality - 46,114 households
  - o Sungai municipality - 12,294 households
  - o Trang Municipality - 23,216 households
- Annual electricity generation in cities:
  - o Chumphon - 271,646 MWh
  - o Narathiwat - 2,044 MWh
  - o Songkhla - 1,583 MWh
  - o Trang Municipality - 14,210 MWh
- Krabi Municipality has developed a GHG emissions inventory.

Table 24: Ongoing and/or planned initiatives in the energy sector

SUDF city/province	Ongoing and/or planned initiatives
Krabi Municipality	• The city plans to replace fluorescent bulbs in offices with LEDs.
Chumphon Province	• Small hydropower projects at the community level • Solar cell pumping system for agriculture • Biomass-to-energy projects • Household level waste-to-energy (biogas) project • Solar cell for village street lighting project • Energy awareness raising programme in schools • The use of LEDs in 23 government agencies, with 1,628 light bulbs, has been encouraged.
Narathiwat Province	• RE technologies in community enterprise project • 100kW solar power project for TakBai Hospital • Solar dryers project for OTOP enterprises[16] and agricultural products of ChangwatNarathiwat • Programme to build public awareness on energy conservation and promoting low-energy light bulb (LED) • Alternative energy project in supporting sufficiency economy village and OTOP development (requesting for budget)

15. Energy Policy and Planning Office, Ministry of Energy. 2015. Thailand Power Development Plan 2015-2036. Thailand. Available at https://www.egat.co.th/en/images/about-egat/PDP2015_Eng.pdf
16. A local entrepreneurship programme called One Tambon One Product (OTOP)

SECTOR PROFILES

IDENTIFICATION OF PRIORITY PROJECTS

- All participants consider energy as a priority sector.
- More than 70 percent of the participants consider LED street lighting and energy efficient buildings as priority solutions.
- The table below demonstrates the huge potential for replacing conventional street lighting with LEDs:

Table 25: Planned LED street lighting projects

SUDF city/province	Ongoing and/or planned initiatives
Songkhla Province	• Plans to promote LED bulb replacement in tourism areas and main roads (Energy Promotion Office, Songkhla province), Songkhla City Hall project, Hat Yai Municipality buildings) • Future projects: o Installing biogas production facilities using rubber industrial waste water o Constructing solar drying systems for product processing o Installing rooftop solar panels o Installing solar pumping system for agriculture
Trang Province	• 200 government agencies are keen to have light bulbs in their buildings replaced by LED bulbs. • Energy reduction project in government buildings

BIODIVERSITY

COUNTRY PROFILE

The principal biological diversity plan of Thailand, 'The Master Plan for Integrated Biodiversity Management (2015-2021)', focuses on biological diversity and sustainable use of related resources, and mentions the country's national biodiversity targets.

Table 26: Ongoing and/or planned initiatives in the biodiversity sector

Action	National biodiversity targets	
	By 2020	By 2021
Awareness raising and education	All sectors, especially people and local communities, have basic knowledge on biodiversity, understand and are aware of importance of conservation and sustainable utilization of biodiversity.	Biodiversity issues are incorporated into curricula of schools and academic institutes at all levels.
Integration and promotion of participation in biodiversity management	Biodiversity issues are incorporated into relevant policies and plans at all levels.	Biodiversity management is implemented with participation at all levels.
	Financial mechanisms for protection, conservation, restoration and sustainable utilization of biodiversity are in place.	–
	Regulations and legislations hindering participatory biodiversity management are amended.	–

SECTOR PROFILES

Action	National biodiversity targets	
	By 2020	By 2021
Conservation, restoration and protection of biodiversity	Rate of habitat loss, including forests and coastal ecosystems is reduced by 50%.	Protected area networks and ecologically significant zones are connected, and management measures for biodiversity and ecosystem services are in place.
	Conservation status of rare, threatened and endemic species is improved, and measures for protection of their habitats are in place.	Management, policy and legislative mechanisms and measures for conservation and protection of genetic diversity are in place.
Threat reduction and sustainable utilization	Reduce pollution inorder to ensure lesser impacts on biodiversity and ecosystem services	–
	Tools/mechanisms/guidelines for sustainable utilization of biodiversity are developed and applied in all relevant sectors.	–
Wetland management	–	Maintenance of ecosystem services provided by wetlands
Alien species management	Measures for controlling invasive alien species are in place.	–
Biosafety management	–	Regulations in accordance with precautionary approach to governing biosafety are in place, in accordance with the obligations of the Cartagena Protocol.
Protection of genetic resources	Central agency for managing access and benefit sharing and monitoring utilization of genetic resources is established.	Local communities derive benefits from institutionalised Access and Benefit Sharing (ABS) mechanisms
Research and development on bio economy	–	Measures and mechanisms are in place for channelizing economic benefits from biological products back to their origins, with an aim to support their conservation and sustainable utilization.
Knowledge and database management	Mechanisms for enabling science based formulation of policies and plans on biodiversity.	Databases on biodiversity wealth are in place.
	–	Inter-departmental linkage of the biodiversity clearing house mechanism.
	–	Municipalities collect and update information relevant to city biodiversity in a systematic manner.
Preservation of traditional knowledge related to biodiversity	–	Biodiversity-related traditional knowledge is documented and given legal protection.

SECTOR PROFILES

CURRENT STATUS IN SUDF CITIES/ PROVINCES

Some SUDF cities and provinces have extensively implemented biodiversity projects:

- **Krabi Municipality:**
  - Tree planting programs, community forestation programs, green area development programs and several other programs on environment conservation
  - Ecosystem based programmes such as green office training programme, Ban Hin Khong community forestation campaign, green area development project (Panurat Temple), environmental volunteer training programme, community maintenance project, organic vegetable programme, youth anti-drug campaign to protect the environment, workshop on development of a sustainable city model, campaign for sustainable community environmental conservation and Beautiful Khlong Project
- **Trang Province:** Biodiversity surveys and documentation, 3 national parks, 2 non-hunting areas, 2 wildlife sanctuaries, 2 botanical gardens, 2 forest reserves
- **Narathiwat Province:** Documentation of local biodiversity, reforestation project at national forest reserve, the Kok Mai Rae Forest
- **Chumphon Province:** Reforestation projects

IDENTIFICATION OF PRIORITY PROJECTS

The initiatives identified by cities for priority intervention are:

- Habitat development programs
- Development of biodiversity parks
- Promotion of compatible agriculture
- Creation of biodiversity conservation areas
- Wetland conservation programs

SUDF ACTION PLAN 2019 – 2036

SUDF ACTION PLAN 2019 – 2036

The SUDF would guide the development of green cities and help achieve the objectives of the environment pillar of the IMT-GT Vision 2036. A set of actions are identified, based on an analysis of country development contexts, national policy targets and city and province specific development status and priorities, which would accelerate the development of green and sustainable cities in the subregion.

The prime objective of the action plan (hereafter referred to as 'Plan') is to steer the cities through a progressive journey with the ultimate aim of transforming into GrEEEn cities, ensuring that sustainability principles are adopted in all development actions.

The Plan also addresses immediate priorities and needs of the cities/provinces, while suggesting transformational technologies that would help them leap-frog towards sustainable development. The Plan is coterminous with the implementation blueprint of IMT-GT Vision 2036 i.e. from 2019 to 2036. The Plan is defined in four phases. The first three phases are five years each and the fourth is three years. Phase 1 of the Plan is also coterminous with the medium term of the IMT-GT implementation blueprint.

While the SUDF cities, which provided inputs to the SUDF and the phase 1 action plan, will be given priority for implementation, other cities would also be invited to implement the action plan and/or learn from the SUDF cities.

SELECTION OF THE INTERVENTIONS

Interventions included in the Plan are based on several criteria including national and regional level goals, targets and commitments towards building 'low-carbon, green growth, resilient cities' and the needs, priorities and targets of SUDF cities and respondent provinces.

While interventions are clubbed by sector, addressing specific sector-based national targets and policies, it must be noted that each intervention may address multiple development objectives, some addressing other sectors as well.

As a case in point, electric mobility with solar PV systems for charging batteries, not only addresses the need to enhance public mobility services and related infrastructure in the cities but also results in reducing the carbon footprint of the transport sector through the adoption of renewable energy. Similarly, in the solid waste management sector, it has been proposed to implement waste-to-energy projects. While the primary objective of such an intervention is to ensure scientific waste processing, the co-benefit is the production of clean energy as opposed to predominant coal-based power production. Figure 21 illustrates the concept further.

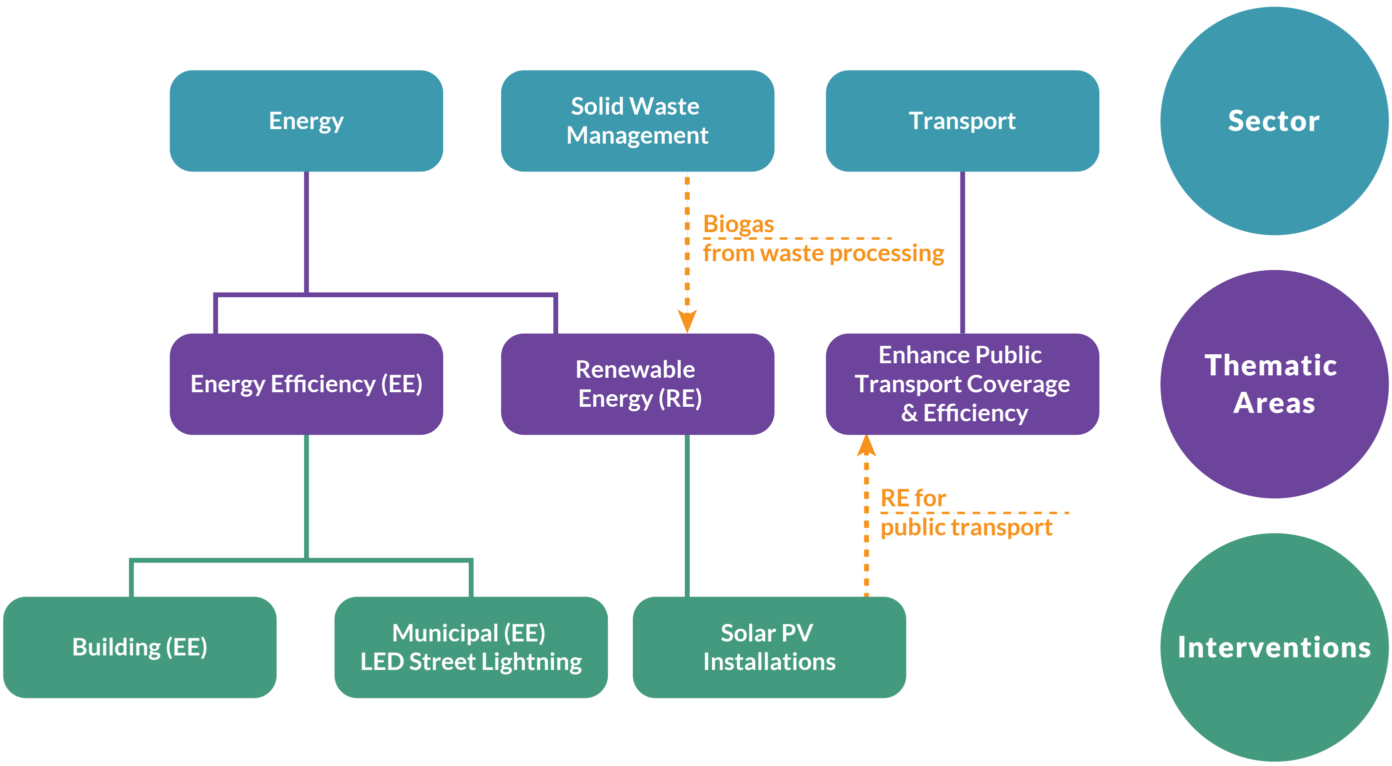

Figure 21: SUDF interventions - indication of multi-sector benefits

SUDF ACTION PLAN 2019 – 2036

THE ACTION PLAN 2019 - 2036

Table 27 delineates all interventions suggested as part of the SUDF action plan. While several measures are to be implemented during the period 2019-2036, some measures are specified only for phase 1 of the action plan, such as the 'Education for sustainable development' measures. Specific targets, until 2036, are specified only for those set of interventions whose implementation is to start in phase 1. For such interventions, phase 1 targets have also been specified separately.

There are a larger set of interventions that are to be implemented in phases 2, 3 and 4 of the action plan, in addition to those implemented in phase 1. These are listed separately. For these interventions, targets have not yet been specified. Targets for subsequent phases will be defined by the national secretariats of the IMT-GT, in consultation with CIMT and approved by the Green Council, in the fourth year of the running phase.

The interventions are classified as infrastructure interventions, planning interventions and awareness building measures.

For each such intervention, cost implications, estimated energy and/or GHG emissions reduction impacts, additional generation of electricity and overall impact on adaptive capacities are also defined, as applicable.

Planning measures are to be completed in phase 1, so the outputs may be used to define specific projects in subsequent action plan phases.

Table 27: Proposed Interventions

Infrastructure interventions (2019 -2036)	Planning interventions (2019 -2023)	Awareness building measures (2019 -2023)	Suggested infrastructure interventions (to start after 2023 – post phase 1 completion)
• Shift to electric mobility • Installation of solar PV systems • Energy efficient buildings • Implementation of LED street lighting • Solid waste processing facilities (Waste-to-Energy) • Solid waste processing facilities (Composting) • Solid waste processing facilities (Biomethanation) • Increase in tree cover • Restoration of wetlands	• Comprehensive Mobility Plan • GHG emissions inventory • Local Biodiversity Strategy Action Plan	• Education for sustainable development o Eco schools o Eco campuses	• Sanitary/Controlled landfill for solid waste • Solar water heating and cooking • Non-conventional transport system • Public bike sharing • Waste recycling industry • SCADA • Non-revenue water reduction • 24x7 water supply • Introducing compatible agriculture and horticulture species • District cooling systems

These interventions are also grouped by sector as illustrated in Figure 22.

For each of the interventions to be implemented in phase 1, targets for the first phase and for the entire duration of the SUDF are proposed, as indicated in Table 28.

SUDF ACTION PLAN 2019 – 2036

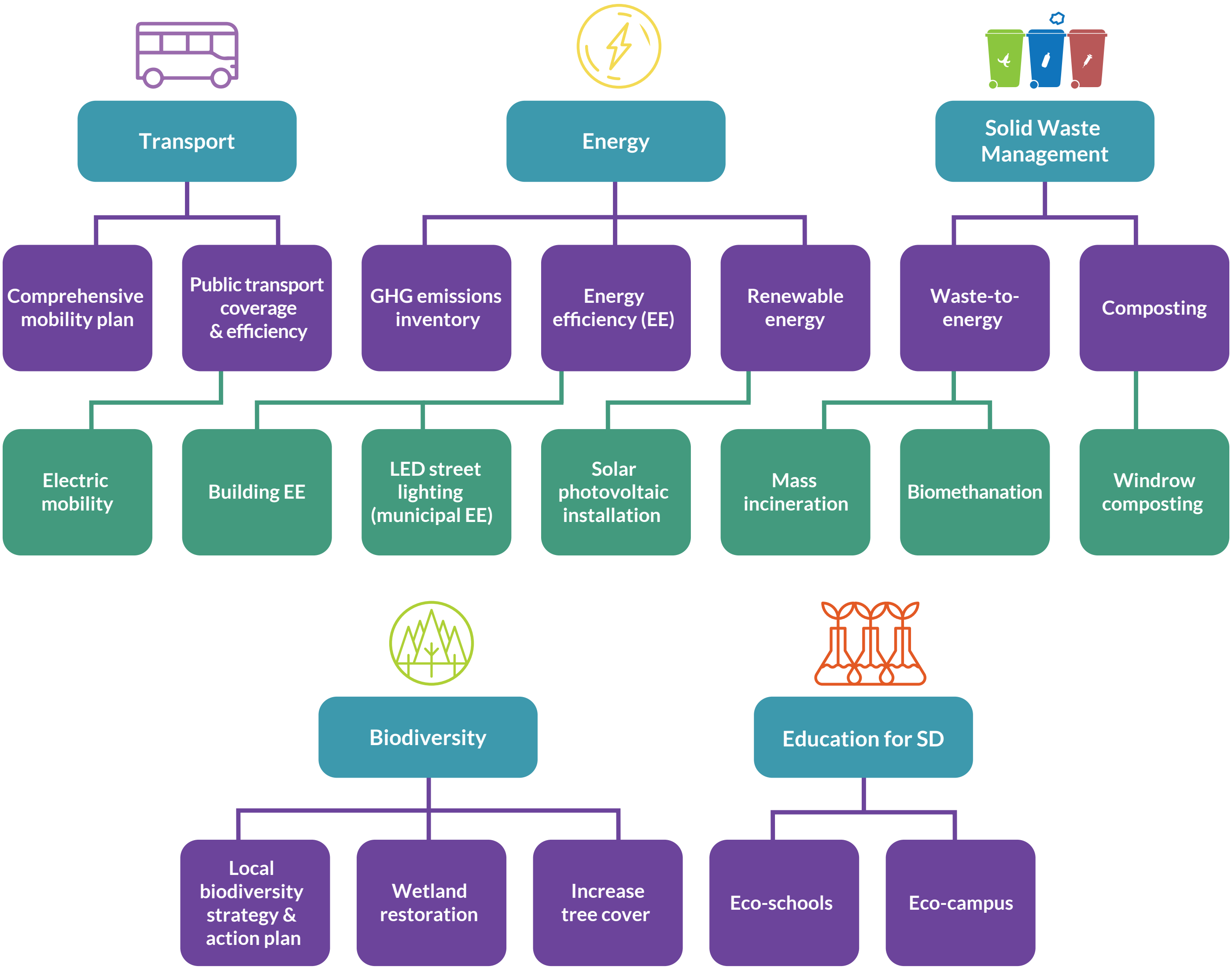

Figure 22: SUDF interventions

National SDG targets, NDC commitments and national level policies guide the selection of SUDF interventions, in addition to specific priorities of cities and provinces. Table 28 gives details of the national level policies and their targets addressed by each of the prioritized interventions that are to be implemented in phase 1.

Table 28: Country policy linkages with SUDF interventions and targets

Country	Related national policy/ directive	Relevant policy clause	SUDF target 2019 – 2036	SUDF target 2019 – 2023
INFRASTRUCTURE INTERVENTIONS - TRANSPORT				
Promoting electric mobility (cars and buses) Replacing inefficient and aging fleet of the city bus service and passenger/government cars with non-polluting electric buses and cars with charging facility electrified by solar photovoltaic (SPV) installations				
Indonesia	Low carbon emission vehicle programme	• 1/5 of all vehicles to be low carbon emission vehicles by 2035 • i.e. 1,200,000 cars out of total 2,800,000 cars by 2035, • of which 400,000 of the 1,600,000 cars by 2025	Total 12,000 cars	2,000 cars
	Nationally determined commitment (NDC targets)	Biofuels should constitute 90% of all fuel used for transport by 2030		
Malaysia	National green technology master plan and Electric Mobility Blueprint (EMB)	• 20% public transport modal share in cities • National electric vehicle targets by 2020 - 2,000 electric buses, 100,000 electric cars, 100,000 electric motorcycles, 125,000 charging stations	Total 6,000 electric cars	1,000 cars
			Total 6,000 electric buses	2,000 buses
Thailand	Electric vehicle promotion plan under Alternative Energy Development Plan (AEDP) 2012-2021	No specific targets	Total 6,000 electric cars	1,000 cars
			Total 6,000 electric buses	2,000 buses
INFRASTRUCTURE INTERVENTIONS - ENERGY				
Solar photovoltaic installations Solar photovoltaic (PV) systems convert solar energy to electrical energy; the energy generated can be put to captive use, through an inverter system or can be fed to the grid, adding renewables to the energy source mix. Multiple energy storage solutions are possible and may be used in conjunction with the PV system, to enhance the availability of power even when electricity is not being generated by the PV system. Use of solar PV systems for electric mobility is a preferred option as against grid connected power, owing to the fact that most conventional power is coal based.				
Indonesia	Nationally determined commitment (NDC targets)	• RE in energy production to be 19.6% (7.4 GW) based on RUPTL – the electricity supply business plan 2018-2027 • Currently installed 80 MWp solar · Expectation of 6500MW by 2025	Total 1 GW of solar PV installation	250 MW
	Indonesian Solar PV Rooftop Program (ISPRP)	• By 2025: Around 92.2 million tonnes of oil equivalent (Mtoe) of Total Primary Energy Supply (TPES) • By 2025: 23% RE share of TPES • By 2050: 31% RE share of TPES (~61 GW) • By 2025: 69,2 Mtoe (45.2 GW) electricity • By 2025: 23 Mtoe for non-electricity		
Malaysia	As reported in ASEAN FiT Report	By 2020: 2,080 MW RE installed capacity (exclude large hydro >30 MW), including: • 800 MW biomass; • 240 MW biogas; • 490 MW mini-hydro; • 455 MW solar PV; • 380 MW municipal solid waste	Total 1 GW of solar PV installation	250 MW
	National Renewable Energy Policy and Action Plan 2010.	By 2050 RE constitutes 24% of the total energy mix from 1% in 2011 and 9% in 2020. • Totalling to 21,370 MW of which Solar Energy is 18,700 MW • Deployed 6286 MW by 2014		
	National Renewable Energy Policy and Action Plan 2010	National target of 175 MW by 2020 (already achieved in 2017)		

Country	Related national policy/ directive	Relevant policy clause	SUDF target 2019 – 2036	SUDF target 2019 – 2023
Thailand	AEDP 2015 -2036	6.65% Renewable energy (RE) in total energy consumption in transport sector by 2036	Total 1 GW of solar PV installation	250 MW
	Renewable Energy Plan 2015 - 2036	Biofuels should constitute 25% of all fuel used for transport by 2036. This is 34,798 Kt of oil equivalent in Thailand.		
	ASEAN feed in tariff study	By 2036: 30% RE share in Total Final Energy Consumption (TFEC), in form of: • Electricity (20.11% in generation, approximately 19,684 MW) • Heat (36.67% of heat production, approximately 25,088 ktOile) • Biofuels (25.04% in transportation sector, approximately 8,712 ktOile)		
Energy efficient buildings Energy efficiency in a building is the extent to which the energy consumption per square metre of floor area of the building measures up to established benchmarks of that particular building. A building energy efficiency programme aims to reduce the energy consumption of a set of identified buildings, often through a contracting process called energy performance contracting.				
Indonesia	Adopted by National Energy Council 2009	Energy intensity reduction of 1% per year	Total 400 buildings	100 buildings
	Energy Vision 25/25, 2011	The policy vision calls for 25% new RE in primary energy supply in 2025		
Malaysia	National Energy Efficiency Action Plan 2016	The Action Plan aims to reduce energy consumption by 52,233 gigawatt-hours over the next ten years by strengthening institutional frameworks, developing skilled capacity, establishing sustainable funding mechanics, promoting investment and integrating energy efficient initiatives.	Total 400 buildings	100 buildings
Thailand	Thailand Energy Efficiency Development Plan 2015 - 2036	Compulsory measures • Enforcement of energy conservation standards in designated factories • and buildings • Building Energy Code (BEC) on the new buildings • Energy labelling on equipment/appliances (HEPS & MEPS) • Enforcing of Energy Efficiency Resource Standard	Total 400 buildings	100 buildings
LED street lighting Replacement of existing conventional streetlights with Light Emitting Diode (LED) street lights due to their energy efficiency LED lights are up to 40-80 percent more efficient than conventional lamps.				
Indonesia	Nationally determined commitment (NDC Targets)	GHG emissions from energy use to reduce by 2030 to 1,335 MtCO2eq (CM1) or 1,271 MtCO2eq (CM2) from an estimated BAU of 1,669 MtCO2eq in 2030	300,000 street lights converted to LED	100,000 street lights converted to LED
Malaysia	National Energy Efficiency Action Plan 2016	The Action Plan aims to reduce energy consumption by 52,233 Giga watt-hours over the next ten years by strengthening institutional frameworks, developing skilled capacity, establishing sustainable funding mechanics, promoting investment and integrating energy efficient initiatives.	400,000 street lights converted to LED	200,000 street lights converted to LED

Country	Related national policy/ directive	Relevant policy clause	SUDF target 2019 – 2036	SUDF target 2019 – 2023
Thailand	Thailand Energy Efficiency Development Plan 2015 - 2036	Energy intensity reduction by 30% by 2036 (A suggested intervention is to promote greater use of LED by price mechanism)	400,000 street lights converted to LED	200,000 street lights converted to LED
INFRASTRUCTURE INTERVENTIONS - SOLID WASTE MANAGEMENT				
Solid waste management initiative – waste-to-energy (mass incineration) When high calorific value fractions of MSW are incinerated (thermal process), the resultant energy, is heat (incineration) which can be reused either directly or converted to electricity using appropriate generators. Sale of this energy results in the financial viability of waste to energy systems.				
Indonesia	Nationally determined Commitment (NDC Targets)	Emissions from waste sector to reduce by 2030 to 285 MtCO2eq (CM1) or 270 MtCO2eq (CM2) from an estimated BAU of 296 MtCO2eq in 2030	Total 2000 TPD	1000 TPD
Malaysia	National Strategic Plan for Solid Waste Management - 2005	• 6 thermal treatment plants to be installed by 2020 • 7 MRF facilities • 100% source segregation of waste	Total 2000 TPD	1000 TPD
Thailand	Alternate Energy Development Plan 2015 - 2036	Biogas from MSW should account for 495 kilo tonnes of oil equivalent in 2036. • In 2015 the biogas from MSW accounts for 98 kilo tonnes of oil equivalent • Target for electricity from MSW is 500 MW by 2036.	Total 2000 TPD	1000 TPD
Solid waste management initiative - biomethanation It is considered one of the most technically viable options for biodegradable municipal solid waste (MSW). Biomethanation plants can be operated at decentralised level (from 1 to 5 TPD) or centralised level depending on the waste inflow. Segregated biodegradable MSW (e.g. hotel and restaurant waste, market waste) is required for optimal plant performance.				
Indonesia	Nationally determined commitment (NDC Targets)	Emissions from waste sector to reduce by 2030 to 285 $MtCO_2eq$ (CM1) or 270 $MtCO_2eq$ (CM2) from an estimated BAU of 296 MtCO2eq in 2030	Total installation of 10 plants	3 plants
Malaysia	NA	NA	Total installation of 10 plants	3 plants
Thailand	AEDP 2015 - 2036	Biogas from MSW should account for 495 kilo tonnes of oil equivalent in 2036. • In 2015 the biogas from MSW accounts for kilo tonnes of oil equivalent. • Target for electricity from MSW is 500 MW by 2036.	Total installation of 10 plants	3 plants
Solid waste management initiative - composting (windrow) This type of composting involves forming organic waste into rows of long piles called 'windrows'. It is suited for large volumes of waste. This technology yields significant amounts of compost, which requires assistance to market the end-product.				
Indonesia	Nationally Determined Commitment (NDC Targets)	Emissions from Waste sector to reduce by 2030 to 285$MTCO_2e$ (CM1) or 270$MTCO_2e$ (CM2) from an estimated BAU of 296MTCO2e in 2030	Total installation of 10 plants	3 plants
Malaysia	NA	NA	Total installation of 10 plants	3 plants
Thailand	Alternate Energy Development Plan 2015 - 2036	Biogas from MSW should account for 495 kilo tonnes of oil equivalent in 2036. In 2015 the biogas from MSW accounts for 98 kilo tonnes of oil equivalent. Target for electricity from MSW is 500 MW by 2036.	Total installation of 10 plants	3 plants
INFRASTRUCTURE INTERVENTIONS - BIODIVERSITY				
Restoration of wetlands Conservation and restoration of mangroves, peat-lands and marshes, rivers and lakes, deltas, floodplains and flooded forests, rice-fields, and even coral reefs				
Indonesia	Indonesian Biodiversity Strategy and Action Plan (IBSAP) 2015-2020	Realization of conservation and restoration of degraded ecosystems in the region	8 wetlands restored	2 wetlands restored
	Biodiversity Utilisation Action Plan 2015-2020	Ecosystem conservation recovery with total area of 250,000 ha		

Country	Related national policy/ directive	Relevant policy clause	SUDF target 2019 – 2036	SUDF target 2019 – 2023
Malaysia	Target 6 of 'National Policy on Biological Diversity 2016-2025'	By 2025, at least 20% of terrestrial area and inland waters and 10% of coastal and marine areas are conserved through a representative system of protected areas and other effective area-based conservation measures.	8 wetlands restored	2 wetlands restored
	Target 8 of 'National Policy on Biological Diversity 2016-2025'	By 2025, important terrestrial and marine ecological corridors have been identified, restored and protected.		
Thailand	Master Plan for Integrated Biodiversity Management (2015-2021)	Significantly reduce wetland ecosystem loss so as to maintain the use of ecosystem service and support climate change adaptation.	8 wetlands restored	2 wetlands restored
Tree cover to be increased to 30% to 40% Action for conservation and protection of trees in forests, urban areas and rural areas resulting in improved tree cover				
Indonesia	Indonesian Biodiversity Strategy and Action Plan (IBSAP) 2015-2020	Realization of conservation and restoration of degraded ecosystems in the region	30 cities have a tree cover of 30% of total land use	8 cities have a tree cover of 30% of total land use
	Biodiversity Utilisation Action Plan 2015-2020	Ecosystem conservation recovery with total area of 250,000 ha		
Malaysia	Target 6 of 'National Policy on Biological Diversity 2016-2025'	By 2025, at least 20% of terrestrial area and inland waters and 10% of coastal and marine areas are conserved through a representative system of protected areas and other effective area-based conservation measures.	30 cities have a tree cover of 30% of total land use	8 cities have a tree cover of 30% of total land use
	Target 8 of 'National Policy on Biological Diversity 2016-2025'	By 2025, important terrestrial and marine ecological corridors have been identified, restored and protected.		
Thailand	Master Plan for Integrated Biodiversity Management (2015-2021)	40% of land use should be tree cover by 2021	30 cities have a tree cover of 30% of total land use	8 cities have a tree cover of 30% of total land use
	Master Plan for Integrated Biodiversity Management (2015-2021)	Significantly reduce wetland ecosystem loss so as to maintain the use of ecosystem service and support climate change adaptation.		
PLANNING INTERVENTIONS				
Comprehensive Mobility Plan A Comprehensive Mobility Plan (CMP) of a city presents a strategy for short, medium, and long-term investments and interventions to improve accessibility and mobility for its residents.				
Indonesia	NA	NA	Developed for 4 cities	-
Malaysia	NA	NA	Developed for 3 cities	-
Thailand	NA	NA	Developed for 3 cities	-
GHG Emissions Inventory The GHG emission inventory report provides a comprehensive accounting of total greenhouse gas emissions for all man-made sources from the cities				
Indonesia	NA	NA	Developed for 5 cities	-
Malaysia	NA	NA	Developed for 5 cities	-
Thailand	NA	NA	Developed for 5 cities	-

Country	Related national policy/ directive	Relevant policy clause	SUDF target 2019 – 2036	SUDF target 2019 – 2023
Local Biodiversity Strategy and Action Plan A Local Biodiversity Strategy and Action Plan (LBSAP) is a guiding strategy, complemented by specific actions and adopted by local governments to achieve optimal and realistic governance and management of biodiversity and ecosystem services.				
Indonesia	Indonesian Biodiversity Strategy and Action Plan (IBSAP) 2015-2020	Target 17 - Implementation of the new IBSAP at various levels	Developed for 10 cities	Developed for 40 cities
Malaysia	National Policy on Biological Biodiversity 2016-2025	By 2025, biodiversity conservation has been mainstreamed into national development planning and sectoral policies and plans	Developed for 10 cities	Developed for 40 cities
Thailand	Master Plan for Integrated Biodiversity Management (2015-2021)	By 2021, to implement the management of biodiversity through participation at all levels	Developed for 10 cities	Developed for 40 cities
AWARENESS BUILDING MEASURES				
Education for Sustainable Development - Eco schools Includes awareness building programs and activities for promoting and incubating knowledge on sustainable development among school children				
Indonesia	Sustainable Development Goals	SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Implemented in 2000 schools	Implemented in 1000 schools
Malaysia	NA	NA	Implemented in 2000 schools	Implemented in 1000 schools
Thailand	NA	NA	Implemented in 2000 schools	Implemented in 1000 schools
Education for Sustainable Development - Eco campus Includes awareness building programs and activities for promoting and incubating knowledge on sustainable development among youth				
Indonesia	Sustainable Development Goals	SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Implemented in 50 universities	Implemented in 20 universities
Malaysia	NA	NA	Implemented in 50 universities	Implemented in 20 universities
Thailand	NA	NA	Implemented in 50 universities	Implemented in 20 universities

Note: NA - Not available

IMPACT SUMMARY OF INTERVENTIONS 2019-2036

TOTAL COST OF INTERVENTIONS: 16,934 MILLION USD

TOTAL FUEL SAVED ANNUALLY: 141.5 MILLION LITRES

TOTAL ELECTRICITY CONSUMPTION REDUCED ANNUALLY: 4,757 MILLION UNITS

TOTAL GHG EMISSIONS REDUCTION: 5.65 MILLION TONNES OF CO_2E

TRANSPORT

Table 29: SUDF Interventions impact summary - transport sector (2019-2036)

SUDF target 2019-2036	Impact for the period 2019-2036			Cost of implementation 2019-2036 (USD)
	Annual potential fuel saving (Kilo litres/year)	Annual potential GHG emissions reduction (tCO_2e)	Mitigation impacts	
Promoting Electric Mobility (EM)				
Indonesia: 12,000 Electric cars on road	16,000	26,900	Reduce GHG emission from transport sector	866,716,800
Malaysia: 6,000 electric cars on road	8,000	13,450		260,015,040
Malaysia: 6,000 electric buses on road	54,750	-35,281	Though using conventional electricity for electric buses may increase GHG emissions as compared to use of diesel buses, it will reduce the levels of air pollution and related health impacts. It is also possible to utilize RE in place of conventional energy by installing a total of 270 MWp solar PV, which will fulfill electricity requirements for all buses and also reduce ~347,355 tCO_2e GHG emissions.	2,205,882,353
Thailand: 6,000 electric cars on road	8,000	13,450	Reduce GHG emissions from transport sector	2 60,015,040
Thailand: 6,000 electric buses on road	54,750	-35,281	Though using conventional electricity for electric bus may increase total tCO2e GHG emissions as compared to diesel buses, it will reduce the levels of air pollution and related health impact. It is also possible to utilize RE in place of conventional energy by installing a total of 270 MWp solar PV, which will not only fulfill electricity requirements for all buses, but will also reduce ~347,355 tCO_2e GHG emissions.	2,205,882,353
Comprehensive Mobility Plan				
Indonesia: Developed for 4 cities			Strategy developed to reduce GHG emissions from transport sector	400,000
Malaysia: Developed for 3 cities			Strategy developed to reduce GHG emissions from transport sector	300,000
Thailand: Developed for 3 cities			Strategy developed to reduce GHG emissions from transport sector	300,000

ENERGY

Table 30: SUDF Interventions impact summary - energy sector (2019-2036)

SUDF target 2019-2036	Impact for the period 2019-2036			Cost of implementation 2019-2036 (USD)
	Annual potential energy saving (Million kWh/year)	Annual potential GHG emissions reduction 2036 (tCO_2e)	Mitigation impact	
Solar Photovoltaic System Installations				
Indonesia: PV system of 1 GW capacity installed	1,301	710,346	Reduce GHG emissions from energy sector	2,134,000,000
Malaysia: PV system of 1 GW capacity installed	1,301	710,346		2,134,000,000
Thailand: PV system of 1 GW capacity installed	1,301	710,346		2,134,000,000
Energy Efficiency in Buildings				
Indonesia: Energy efficiency in 400 buildings	20	10,833	Reduce GHG emissions from energy sector	8,000,000
Malaysia: Efficiency in 400 buildings	20	10,833		8,000,000
Thailand: Energy efficiency in 400 buildings	20	10,833		8,000,000
Replacement of Existing Street Lights with LED Lights				
Indonesia: 300,000 street lights converted to led lights by 2023	48	25,868	Reduce GHG emissions from energy sector	225,000,000
Malaysia: 600,000 street lights converted to led lights by 2023	95	51,736		450,000,000
Thailand: 600,000 street lights converted to led lights by 2023	95	51,736		450,000,000
GHG Emissions Inventory				
Indonesia: Developed for 5 cities			Calculation of GHG emissions at the city level	400,000
Malaysia: Developed for 5 cities				400,000
Thailand: Developed for 5 cities				400,000

SOLID WASTE MANAGEMENT

Table 31: SUDF Interventions impact summary - solid waste management sector (2019-2036)

SUDF target 2019-2036	Impacts for the period 2019-2036			Cost of implementation 2019-2036 (USD)
	Annual potential energy saving (Million kWh/ year)	Annual potential GHG emissions reduction 2036 (tCO_2e)	Mitigation impact	
Waste-to-Energy				
Indonesia: 2,000 TPD processing facility	117	456,346	This intervention has the potential to treat a total of 730,000 metric tonnes of mixed waste per year, which will generate ~117 million kWh of electricity and reduce ~456,346 tCO_2e GHG emissions.	130,220,588
Malaysia: 2,000 TPD processing facility	117	456,346		130,220,588
Thailand: 2,000 TPD processing facility	117	456,346		130,220,588
Composting (Windrow)				
Indonesia: 10 compost plants of 200 TPD processing facility		335,213	This intervention has the potential to compost 730,000 metric tonnes of biodegradable waste per year. This will avoid disposal of biodegradable waste in dump sites and resultant GHG emissions.	67,647,059
Malaysia: 10 compost plants of 200 TPD processing facility		335,213		67,647,059
Thailand: 10 compost plants of 200 TPD processing facility		335,213		67,647,059
Biomethanation				
Indonesia: 10 plants of 100 TPD processing facility	68	334,249	This intervention has the potential to treat 365,000 metric tonnes of food waste per year. This has a potential to reduce ~334,249 tCO_2e GHG emissions. This emissions reduction is from avoidance of disposal of biodegradable waste in dump sites and utilization of biogas for electricity generation. ~68.4 million kWh of electricity can be generated in total.	84,558,824
Malaysia: 10 plants of 100 TPD processing facility	68	334,249		84,558,824
Thailand: 10 plants of 100 TPD processing facility	68	334,249		84,558,824

BIODIVERSITY

Table 32: SUDF Interventions impact summary - biodiversity sector (2019-2036)

SUDF target 2019-2036	Impact for the period 2019-2036 Adaptation impact	Cost of implementation 2019-2036 (USD)
Develop Local Biodiversity Strategy and Action Plan		
Indonesia: Implemented in 40 cites	This intervention will enhance the adaptive capacity and ensure benefits to society; restore, maintain and secure important ecological infrastructure in a way that contributes to sustainable development, long-term job creation and livelihoods; and manage species of special concern, expand biodiversity economy. Biodiversity conservation supports the land reform agenda and socio-economic opportunities for communal land holders and allocates the appropriate resources and benefits for all.	3,400,000
Malaysia: Implemented in 40 cites		3,400,000
Thailand: Implemented in 40 cites		3,400,000
Restoration of Wetlands		
Indonesia: 8 wetlands restored	Restoration of wetlands will help improve adaptive capacity and reduce vulnerability and risk due to flooding. Wetlands will provide a number of important ecosystem services including water quality and climate regulation, accumulation sites for sediments, contaminants, carbon and nutrients. Wetlands also provide vital breeding and nursery ground for a variety of birds, fish, shellfish and mammals. Wetlands are a good sustainable source of timber, fuel and fibre.	600,000
Malaysia: 8 wetlands restored		600,000
Thailand: 8 wetlands restored		600,000
Tree Cover to be Increased to 30% to 40%		
Indonesia: 30 cities have a tree cover of 30% of total land use.	Green cover can reduce temperatures, work as carbon sink, reduce the urban 'heat island' effect and help urban communities to adapt to the effects of climate change, filter the urban air pollutants, regulate water flow and play a key role in preventing floods and reducing the risk of natural disasters. Improvement in green cover will improve ecosystem services including better health and wellbeing for urban-dwellers and will also improve overall biodiversity.	1,500,000
Malaysia: 30 cities have a tree cover of 30% of total land use.		1,500,000
Thailand: 30 cities have a tree cover of 30% of total land use.		1,500,000

EDUCATION FOR SUSTAINABLE DEVELOPMENT

Table 33: SUDF Interventions impact summary - education for sustainable development (2019-2036)

SUDF target 2019-2036	Impact for the period 2019-2036 Impact	Cost of implementation 2019-2036 (USD)
Eco-Schools		
Indonesia: Implemented in 2000 schools	This intervention will ensure that all school children acquire the knowledge and skills needed to promote sustainable development	1,000,000,000
Malaysia: Implemented in 2000 schools		1,000,000,000
Thailand: Implemented in 2000 schools		1,000,000,000
Eco-Campus		
Indonesia: Implemented in 50 Universities	This intervention will ensure that all youth acquire the knowledge and skills needed to promote sustainable development	31,250,000
Malaysia: Implemented in 50 Universities		USD 31,250,000
Thailand: Implemented in 50 Universities		USD 31,250,000

IMPACT SUMMARY OF INTERVENTIONS 2019-2023

TOTAL COST OF INTERVENTIONS: 5367MILLION USD

TOTAL GHG EMISSIONS REDUCTION ANNUALLY: 1.64 MILLION TONNES OF CO_2E

TOTAL FUEL SAVED ANNUALLY: 42 MILLION LITRES

TOTAL ELECTRICITY CONSUMPTION REDUCED ANNUALLY: 1263 MILLION UNITS

TRANSPORT

Table 34: SUDF Interventions impact summary - transport sector (2019-2023)

SUDF target 2019-2023	Impacts for the period 2019-2023			Cost of implementation (USD)
	Annual potential fuel saving (Kilo litres/ year)	Annual potential GHG emissions reduction (tCO_2e)	Mitigation impact	
Promoting Electric Mobility (EM)				
Indonesia: 2,000 Electric cars on road	2,667	4,483	Reduce GHG emissions from transport sector	52,003,008
Malaysia: 1,000 electric cars on road	1,333	2,242		26,001,500
Malaysia: 2,000 electric buses on road	18,250	-11,760	Though using conventional electricity for electric buses may increase GHG emissions as compared to use of diesel buses, it will reduce the levels of air pollution and related health impacts. It is also possible to utilize RE in place of conventional energy by installing a total of 90 MWp solar PV, which will fulfill electricity requirements for all buses and also reduce ~115,785 tCO_2e GHG emissions.	735,294,118
Thailand: 1,000 electric cars on road	1,333	2,242	Reduce GHG emissions from transport sector	26,001,500
Thailand: 2,000 electric busses on road	18,250	-11,760	Though using conventional electricity for electric buses may increase GHG emissions as compared to use of diesel buses, it will reduce the levels of air pollution and related health impacts. It is also possible to utilize RE in place of conventional energy by installing a total of 90 MWp solar PV, which will fulfill electricity requirements for all buses and also reduce ~115,785 tCO_2e GHG emissions.	735,294,118
Comprehensive Mobility Plan				
Indonesia: Developed for 4 cities			Strategy developed to reduce GHG emissions from transport sector	400,000
Malaysia: Developed for 3 cities				300,000
Thailand: Developed for 3 cities				300,000

ENERGY

Table 35: SUDF Interventions impact summary - energy sector (2019-2023)

SUDF target 2019-2023	Impacts for the period 2019-2023			Cost of implementation (USD)
	Annual potential energy saving (Million kWh/year)	Annual potential GHG emissions reduction (tCO_2e)	Mitigation impact	
Solar Photovoltaic System Installations				
Indonesia: PV system of 250 MW capacity installed	325	177,450		533,500,000
Malaysia: PV system of 250 MW capacity installed	325	177,450	Reduce GHG emissions from energy sector	533,500,000
Thailand: PV system of 250 MW capacity installed	325	177,450		533,500,000
Energy Efficiency in Buildings				
Indonesia: Energy efficiency in 100 buildings	5	2,457		2,000,000
Malaysia: Energy efficiency in 100 buildings	5	2,457	Reduce GHG emissions from energy sector	2,000,000
Thailand: Energy efficiency in 100 buildings	5	2,457		2,000,000
Replacement of Existing Street Lights with LED Lights				
Indonesia: 100,000 street lights converted to LED lights by 2023	24	13,153		75,000,000
Malaysia: 200,000 street lights converted to LED lights by 2023	48	26,306	Reduce GHG emissions from energy sector	150,000,000
Thailand: 200,000 street lights converted to LED lights by 2023	48	26,306		150,000,000
GHG Emissions Inventory				
Indonesia: Developed for 5 cities				400,000
Malaysia: Developed for 5 cities			Calculation of GHG emission on a city level	400,000
Thailand: Developed for 5 cities				400,000

SOLID WASTE MANAGEMENT

Table 36: SUDF Interventions impact summary - solid waste management sector (2019-2023)

SUDF target 2019-2023	Impacts for the period 2019-2023			Cost of implementation (USD)
	Annual potential energy saving (Million kWh/ year)	Annual potential GHG emissions reduction (tCO_2e)	Mitigation impact	
Waste-to-Energy				
Indonesia: 1,000 TPD processing facility	59	228,173	This intervention has potential to treat a total of 365,000 metric tonnes of mixed waste per year. This will avoid disposal of biodegradable waste in dump sites and resultant GHG emissions.	65,110,294
Malaysia: 500 TPD processing facility	30	114,087	This intervention has potential to treat total 182,500 metric tonnes of mixed waste per year, which will reduce GHG emissions from waste being dumped in landfill sites.	32,555,147
Thailand: 500 TPD processing facility	30	114,087		
Composting (Windrow)				
Indonesia: 3 compost plants of 200 TPD processing facility		100,564	This intervention has the potential to compost 219,000 meric tonnes of biodegradable waste per year, which would result in reducing ~100,564 tCO_2e GHG emissions from avoided disposal of biodegradable waste in dump sites. Also, generated compost can be utilised in public gardens or can be sold by the local authority to generate revenue.	20,294,118
Malaysia: 3 compost plants of 200 TPD processing facility		100,564		20,294,118
Thailand: 3 compost plants of 200 TPD processing facility		100,564		20,294,118
Biomethanation				
Indonesia: 3 plants of 100 TPD processing facility	12	95,774	This intervention has the potential to treat 109,500 metric tonnes of food waste per year. This has a potential to reduce ~95,774 tCO_2e GHG emissions. This emissions reduction is from avoidance of disposal of biodegradable waste in dump sites and utilization of biogas for electricity generation. ~12.3 million kWh of electricity can be generated in total.	25,367,647
Malaysia: 3 plants of 100 TPD processing facility	68	334,249		25,367,647
Thailand: 3 plants of 100 TPD processing facility	68	334,249		25,367,647

BIODIVERSITY

Table 37: SUDF Interventions impact summary - biodiversity sector (2019-2023)

SUDF target 2019-2023	Impact for the period 2019-2023	Cost of implementation (USD)
	Adaptation impact	
Develop Local Biodiversity Strategy Action Plan		
Indonesia: Implemented in 10 cites	This intervention will enhance the adaptive capacity and ensure benefits to society; restore, maintain and secure important ecological infrastructure in a way that contributes to sustainable development, long-term job creation and livelihoods; and manage species of special concern, expand biodiversity economy. Biodiversity conservation supports the land reform agenda and socio-economic opportunities for communal land holders and allocates the appropriate resources and benefits for all.	850,000
Malaysia: Implemented in 10 cites		850,000
Thailand: Implemented in 10 cites		850,000
Restoration of Wetlands		
Indonesia: 2 wetlands restored	Restoration of wetlands will help improve adaptive capacity and reduce vulnerability and risk due to flooding. Wetlands will provide a number of important ecosystem services including water quality and climate regulation, accumulation sites for sediments, contaminants, carbon and nutrients. Wetlands also provide vital breeding and nursery ground for a variety of birds, fish, shellfish and mammals. Wetlands are a good sustainable source of timber, fuel and fibre.	150,000
Malaysia: 2 wetlands restored		150,000
Thailand: 2 wetlands restored		150,000
Tree Cover to be Increased to 30% to 40%		
Indonesia: 8 cities have a tree cover of 30% of total land use.	Green cover can reduce temperatures, work as carbon sink, reduce the urban 'heat island' effect and help urban communities to adapt to the effects of climate change, filter the urban air pollutants, regulate water flow and play a key role in preventing floods and reducing the risk of natural disasters. Improvement in green cover will improve ecosystem services including better health and wellbeing for urban-dwellers and will also improve overall biodiversity.	400,000
Malaysia: 8 cities have a tree cover of 30% of total land use.		400,000
Thailand: 8 cities have a tree cover of 30% of total land use.		400,000

EDUCATION FOR SUSTAINABLE DEVELOPMENT

Table 38: SUDF Interventions impact summary - education for sustainable development (2019-2023)

SUDF target 2019-2023	Impact for the period 2019-2023	Cost of implementation (USD)
Eco-Schools		
Indonesia: Implemented in 1000 schools	This intervention will ensure that all school children acquire the knowledge and skills needed to promote sustainable development	500,000,000
Malaysia: Implemented in 1000 schools		500,000,000
Thailand: Implemented in 1000 schools		500,000,000
Eco-Campus		
Indonesia: Implemented in 20 Universities	This intervention will ensure that all youth acquire the knowledge and skills needed to promote sustainable development	12,500,000
Malaysia: Implemented in 20 Universities		12,500,000
Thailand: Implemented in 20 Universities		12,500,000

The technical details of all interventions are provided in Annex 3.

SELECTION OF CITIES/PROVINCES FOR IMPLEMENTATION

For implementation of identified interventions, CIMT will reach out to all cities and provinces that are shortlisted. Based on specific inputs from them CIMT will define the specific scope and scale of implementation for each city/province by April 2019.

FACILITATING IMPLEMENTATION OF THE ACTION PLAN

For the first phase of the action plan, CIMT will approach the international donor community to generate funds for the preparation of feasibility studies, detailed project reports for specific interventions and action plans, as needed. The national secretariats of the IMT-GT subregional cooperation will also explore avenues for secure national funding for the implementation of the action plans. Cities and provinces are also encouraged to co-fund implementation of these actions through own revenues.

PLAN OF ACTION 2024-2036

The SUDF toolkit will be deployed in the first quarter of year four (2022) of phase 1 (i.e. during first quarter of 2022). A tentative list of interventions to be considered is provided in Table 1. However, with changing priorities and new policy direction or other developments, the proposed list of interventions will need to be reviewed.