SDG 7 Localization

AFFORDABLE AND CLEAN ENERGY

in ASEAN cities

UNITED NATIONS ESCAP
Economic and Social Commision for Asia and the Pacific

UN environment programme

The shaded areas of the map indicate ESCAP members and associate members.*

The Economic and Social Commission for Asia and the Pacific (ESCAP) serves as the United Nations' regional hub, promoting cooperation among countries to achieve inclusive and sustainable development.

The largest regional intergovernmental platform with 53 member States and 9 associate members, ESCAP has emerged as a strong regional think-tank offering countries sound analytical products that shed insight into the evolving economic, social and environmental dynamics of the region. The Commission's strategic focus is to deliver on the 2030 Agenda for Sustainable Development, which it does by reinforcing and deepening regional cooperation and integration to advance connectivity, financial cooperation and market integration. The research and analysis undertaken by ESCAP, coupled with its policy advisory services, capacity building and technical assistance to governments aims to support countries' sustainable and inclusive development ambitions.

Information and statistics presented in this publication include only those member and associate member States located in the Asia-Pacific region.

*The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

SDG 7 Localization

AFFORDABLE AND CLEAN ENERGY

in ASEAN cities

United Nations publication

Printed in Bangkok

Photo credits:

Cover shutterstock.com
photo# 1638174760

iStock.com
photo# 851449160

Acknowledgements

This report was developed by the Energy Division of ESCAP under the overall direction and guidance of Hongpeng Liu, Director of the Energy Division, and Michael Williamson, Section Chief of the Energy Division, in collaboration with the project team of United Nations Environment Programme under the leadership of Martina Otto, Head of Cities and Lifestyles.

The principal authors of the report include: Ksenia Petrichenko (ESCAP), Vitaly Bekker (ESCAP), Lily Riahi (UNEP) and Benjamin Hickman (UNEP). The contributing authors include: Kimeang Taing (ESCAP), Syrine El Abed (UNEP) and Maizura Ismail (UCLG ASPAC).

Michael Williamson provided the overall review and guidance in finalizing the report. The peer review and valuable suggestions were provided by Bernadia Irawati Tjandradewi (UCLG ASPAC), Ramona Lissa Villegas (UCLG ASPAC), Hendra Susila Adi (UCLG ASPAC), Nancy Judith Cromar (UCLG ASPAC), David Ferrari (ESCAP), Dominique Ortiz (ICLEI South-East Asia), Phil Reid (Tractebel Engineering), Anil Sardana (Adani Transmission Limited), Darshan Hiranandani (Hiranandani Group).

Support in data collection and communication with cities and local stakeholders was provided by Ramona Lissa Villegas (UCLG ASPAC), Kevin Drouin (CityNet Secretariat), Kok-Chin Tay (Smart Cities Network), Keoduangchai Nouanphanthakoun (ICLEI Southeast Asia), Vic Aquitania (ICLEI Southeast Asia).

The methodology presented in this report was reviewed by the following group of experts: David Ferrari (ESCAP), Md Anisuzzaman (Murdoch University), Kevin Drouin (CityNet Secretariat), Kok-Chin Tay (Smart Cities Network), Ric Marfiga (ICLEI Southeast Asia), Dominique Ortiz (ICLEI Southeast Asia), Ramona Lissa Villegas (UCLG ASPAC), Kanagaraj Ganesan (Integrative Design Solutions Pvt. Ltd.) and Zhuolun Chen (UNEP-DTU Partnership).

Anna Lobanova (ESCAP), Daniel Collins (ESCAP), Mona Eide Onstad (ESCAP), Haoman Zhong (ESCAP) and Ramona Lissa Villegas (UCLG ASPAC) contributed to the research of the case studies featured in this report.

The ESCAP-UNEP-UCLG ASPAC team, who worked on this report, would like to express their appreciation for all the work and cooperation provided by the following local experts and governmental officials in support of this project, despite the exceptionally challenging circumstances caused by the COVID-19 pandemic: Edwin V. de Nicolas (Bago, the Philipinnes), Daniel B. Andea (Borongan, the Philippines), Reina Santos (Cauayan, the Philippines), Nguyen Hong Linh (Da Nang, Viet Nam), Hakimul Batih (Jakarta), Hamizah A Rahman (Iskandar, Malaysia), Jaime B. Antonio Jr. Bong (Munoz, the Philippines), Andrei Argana (Muntinlupa, the Philippines), Joseph Pilapil (Ormoc, the Philippines), Oon Lai Kuan (Penang, Malaysia), Wang Tze Wee (Putrajaya, Malaysia), Vincent Vinarao (Quezon, the Philippines), Anjela Mae D. Era (Santa Rosa, the Philippines), Roxane Villanueva (Vigan, the Philippines), Rodrigo S. Sicat (Zamboanga, the Philippines).

Robert Oliver edited the manuscript. The cover and design layout were created by Lowil Espada. Administrative and secretarial support was provided by Prachakporn Sophon, Nawaporn Sunkpho, Thiraya Tangkawattana and Sarinna Sunkphayung.

About ESCAP

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) serves as the United Nations' regional hub promoting cooperation among countries to achieve inclusive and sustainable development. The largest regional intergovernmental platform with 53 Member States and nine Associate Members, ESCAP has emerged as a strong regional think-tank, offering countries sound analytical products that shed insight into the evolving economic, social and environmental dynamics of the region. The Commission's strategic focus is to deliver on the 2030 Agenda for Sustainable Development, which it does by reinforcing and deepening regional cooperation and integration to advance connectivity, financial cooperation and market integration. ESCAP's research and analysis coupled with its policy advisory services, capacity-building and technical assistance to Governments aims to support countries' sustainable and inclusive development ambitions.

About UNEP

The United Nations Environment Programme (UNEP) is the leading global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system, and serves as an authoritative advocate for the global environment. UNEP's mission is to provide leadership and encourage partnership in caring for the environment by inspiring, informing and enabling nations and peoples to improve their quality of life without compromising that of future generations. UNEP leads the Integrated Urban Systems Partnership, a global public-private partnership launched at the 4th United Nations Environment Assembly in 2019.

About UCLG ASPAC

United Cities and Local Governments Asia-Pacific (UCLG ASPAC) is the largest Regional Section of United Cities and Local Governments (UCLG), the world organization of local government associations, established as an amalgamation of the International Union of Local Authorities, United Towns Organisation (UTO) and World Association of the Major Metropolises (METROPOLIS). UCLG ASPAC connects more than 10,000 cities and local governments in the Asia-Pacific region. UCLG ASPAC promotes and stimulates cooperation between sub-national governments and within the wider international communities in the region. Its work focuses on advocacy, capacity- building, policy and research, programmes and projects, and decentralized cooperation. It is also the key knowledge management hub on local government issues in the Asia-Pacific region.

Abbreviations and acronyms

ASCN	ASEAN Smart Cities Network
ASEAN	Association of Southeast Asian Nations
C40	C40 Cities Network
CDD	Cooling degree days
CityNet	Regional network of local authorities for the management of human settlements
COVID-19	Corona Virus Disease 2019
EMS	energy management systems
ESCAP	(United Nations) Economical and Social Commission for Asia and Pacific
ICLEI	Local Governments for Sustainability global network
MDB	multilateral development banks
MDG	Millennium Development Goals
MLG	multi-level governance
MRV	measuring, reporting and verification
PPA	power purchase agreement
PPP	public-private partnerships
RISE	Regulatory Indicators for Sustainable Energy
SDG 7	Sustainable Development Goal 7 (Energy)
SDGs	Sustainable Development Goals
THB	Thai Baht
UCLG- ASPAC	United Cities and Local Government of Asia Pacific
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP DTU Partnership	Partnership between the United Nations Environment Programme and Technical University of Denmark
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UTO	United Towns Organization
VLR	Voluntary Local Review

Contents

List of Boxes

List of Figures

List of Tables

Executive Summary

Key messages

- The SDG 7 localization process is ongoing in ASEAN cities with varying levels of success across different cities, but overall its impact and scale are limited.
- Common challenges on SDG 7 localization across selected jurisdictions include the use of financial resources, energy data monitoring and implementation activities.
- Horizontal coordination, vertical integration of SDG 7-related efforts as well as a multi-level governance approach are crucial for SDG 7 localization, but the related effective mechanisms are currently absent or missing in most of the analysed cities.
- The lack of robust energy data collection and monitoring systems aggravate the progress of SDG 7 localization and limit the understanding of achieved results and impacts.
- Limited availability of financial recourses to support SDG 7 implementation at the local level poses a risk of blocking out sustainable energy in cities.
- Capacity-building for local government officials and technical staff on sustainable energy solutions, data collection, monitoring and reporting as well as project development and financing is crucial for acceleration SDG 7-related actions.
- Progress on SDG 7 implementation at the local level remains fairly modest:
  - While most jurisdictions report high electrification rates, use of clean cooking technologies shows substantial room for improvement and should be considered critical for urban slums and informal settlements;
  - Use of renewable energy in cities requires further acceleration, which is often curtailed by dependency on the national grid and limited opportunities for diversification of electricity generation;
  - Energy efficiency efforts are lagging behind in a number of cities with a fairly small scale of utilization of energy efficient equipment and technologies across main energy-consuming sectors.

ASEAN cities continue to grow in terms of population and economic output. This has seen a doubling of the rate of carbon dioxide (CO2) emissions over the past 25 years. However, to ensure that the gains of urbanization are captured in order to support the Sustainable Development Goals (SDGs) and other global agendas, transformative changes are needed. The way ASEAN cities are designed, planned and managed must change if we want to ensure that the gains of urbanization in meeting the SDGs and other Global Agendas are retained. However, according to the International Resource Panel's 'The Weight of Cities' report (IRP, 2018), adoption of an integrated approach to urban energy and related investments – as well as building linkages between the urban socio-technological subsystems of energy, transportation, urban greenery, waste management and buildings that lead to synergies and efficiencies – can offer up to 20-fold improvement in resource use and energy efficiency, with a potential for a 35-55 per cent reduction in greenhouse gas emissions.

The increasing decentralization in ASEAN opens up the potential for increased autonomy and freedom in policy and decision-making for cities, including setting their own local agendas and infrastructure investment plans. These changes will provide more opportunities for cities to prioritize an integrated approach to urban energy and to build linkages between the urban subsystems of energy, transportation, urban greenery, waste management and buildings. However, the utilization of these opportunities can only happen if cities and local governments are: (a) able to identify, evaluate and give precedence to sustainable energy solutions; and (b) empowered to coordinate needed efforts within their jurisdiction with national, regional and international collaborators towards achieving SDGs in general, and SDG 7 on affordable and clean energy, in particular.

This report presents the results of the research and analytical work initiated by ESCAP, in collaboration with the United Nations Environment Programme (UNEP) and the United Cities and Local Governments Asia Pacific (UCLG ASPAC), and under the grant support from the Energy Foundation China. The cornerstone of this work is the development of the analytical framework for assessing cities' status on SDG 7 localization across key areas of the SDG localization process and its application to the selected cities and subnational jurisdictions in ASEAN.

Lessons learnt from the global efforts to achieve the Millennium Development Goals (MDGs) have led to greater active involvement of local governments in the subsequent SDGs. The post-2015 Agenda Synthesis Report highlighted the importance of cities and local governments when it stated that "many of the investments to achieve the sustainable development goals will take place at the subnational level and be led by local authorities".

The 2030 Agenda took this further by emphasizing the need for an inclusive and localized approach to the SDGs when it stated that "…governments and public institutions will also work closely on implementation with regional and local authorities, subregional institutions, international institutions, academia, philanthropic organizations, volunteer groups and others". It has been estimated that 65 per cent of the resulting 169 targets and 231 indicators are relevant in the context of cities, requiring actions by the local governments.

SDG localization can be defined as "the process of defining, implementing and monitoring strategies at the local level for achieving global, national, and subnational sustainable development goals." Beyond merely "landing" the internationally-agreed goals at the local level, localization refers to adaptation or translation of

the SDGs' aspirations into objectives that are relevant, applicable and attainable at the local level. Through localization, SDGs can provide a framework, both for local development policies and strategizing local action to support the overall achievement of the SDGs, in addition to ensuring coherence and cohesion between policies at the national and subnational levels.

Successful localization of the SDGs embraces a number of elements, including:

- Horizontal coordination and vertical integration – through adoption of laws and regulations to ensure policy coherence and cohesion, coordination and cooperation among stakeholders, and an inter-level oversight mechanism to monitor implementation and ensure accountability;
- Increased capacity of local governments – stakeholder diversification, decentralized cooperation and direct interaction with Global Agendas demand local governments operate in untraditional areas;
- Mainstreaming of SDGs into local planning – through the review of existing strategies and plans to identify areas for change, setting of locally-relevant targets, and the formulation of new integrating strategy and plans;
- Strong Government commitments – essential for establishing the necessary conditions at all levels of governance for taking action, including integrated approaches, implementation and monitoring mechanisms.

Good governance is the key to SDG localization, the absence of which may become one of the key barriers for a successful localization process. Good governance allows for people-centric policy development, efficient policy implementation, effective and transparent resource usage, more capable and responsive institutions, social inclusion and more.

As the level of government that is closest to the population, local governments are largely responsible for providing and making accessible basic services that underpin the population's quality of life. This includes adequate housing, clean water, sanitation, education, mobility and health. Even when local governments are not directly making decisions and delivering on the basic services – as is often the case with the energy sector – they still have a role to play in establishing the planning, regulatory and enabling environments. Many local governments have sufficient authority to significantly influence local sustainable energy agenda through:

- Setting sustainable energy targets;
- Developing sustainable energy policies;
- Influencing energy mix;
- Engaging various stakeholders;
- Unlocking sustainable energy finance.

A number of challenges hinder the process of SDG 7 localization in many cities around the world. Typical issues include lack of financing as well as limited power and authority to turn ambitious sustainable energy agendas into implemented actions that result in energy saved and greenhouse gas emissions avoided, among other co-benefits.

Greater focus on localizing SDG 7 is key not only for achieving the SDG 7 targets, but also leverage on the other SDGs, such as SDGs on n. Linkages between SDG 7 and other global development agendas are also key. Reliable and affordable energy was determined to be a fundamental prerequisite for achieving the Millennium Development Goals, without which substantial social and economic development cannot occur. Similarly, affordable and clean energy has been deemed as central to the achievement of both the 2030 Agenda and the Paris Agreement on climate change.

To identify areas for action and improvement in order to accelerate and make the SDG 7 localization process more efficient and impactful, it is important to understand the local context of each city and the efforts related to sustainable energy that have already been made. In order to analyse the status of any city on SDG 7 localization, ESCAP developed an analytical framework with several qualitative SDG 7 Localization Indicators covering the main areas of the SDG localization process, such as the policy and institutional environment, capacity, collaboration, resources, implementation efforts and linkages to other SDGs. These indicators do not measure the progress made on the quantitative global SDG 7 targets at the city level. Rather, they focus on qualitative evaluation of the local context based on the self-assessment by city stakeholders of the current situation in the city in relation to the SDG 7 localization through completion of the dedicated questionnaire.

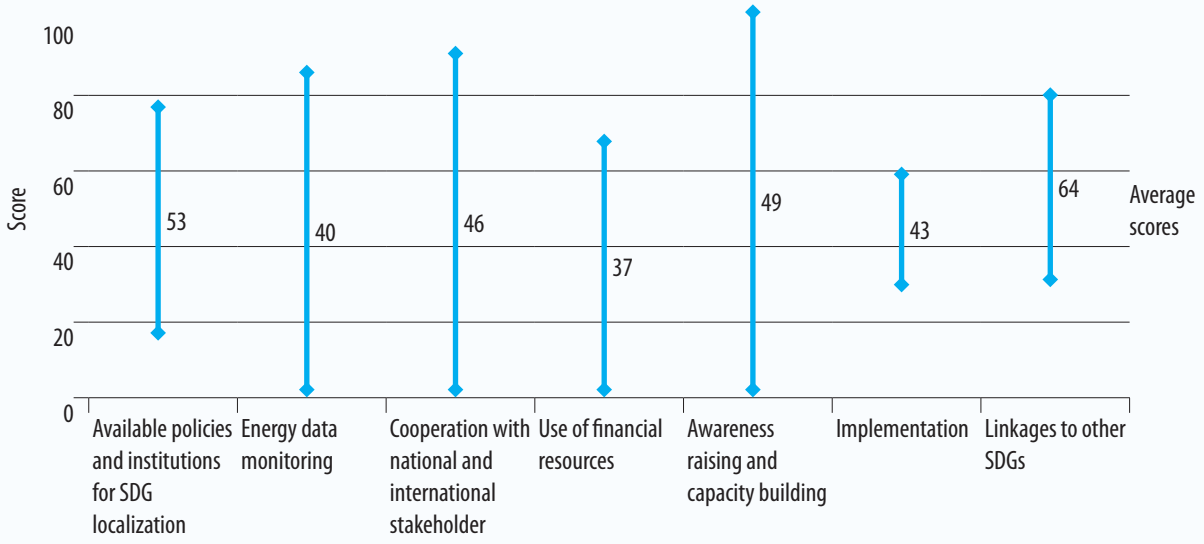
The identified indicators include: available policies and institutions for SDG localization; energy data monitoring; cooperation with national and international stakeholders; use of financial resources; awareness raising and capacity-building; implementation of actions on energy access, renewable energy and energy efficiency; and linkages to other SDGs, i.e., SDG 3 on good health and well-being, SDG 6 on clean water and sanitation, SDG 11 on sustainable cities and communities, SDG 12 on responsible production and consumption, and SDG 13 on climate action. Based on the aggregation of the cities' answers to the questionnaire, a score between 0 and 100 is calculated for each indicator and sub-indicator; this shows the qualitative assessment result of SDG 7 localization efforts in this particular area.

The resulting analytical framework on SDG 7 localization was applied to the data collected from 20 ASEAN cities and subnational jurisdictions selected from those that completed the SDG 7 localization questionnaire with sufficient level of detail. (For simplicity, the term "jurisdiction" is used interchangeably for cities, provinces and other subnational regions throughout this report). These cities include 10 cities in the Philippines (Bago, Borongan, Cauayan, Munoz, Muntinlupa, Ormoc, Quezon, Santa Rosa, Vigan and Zamboanga; four from Malaysia (Iskandar, Penang, Putrajaya and Subang Jaya); three from Indonesia (Balikpapan, Jakarta and Palembang), two from the Lao People's Democratic Republic (Kaysone Phomvihane and Pakse) and one from Viet Nam (Da Nang). This report discusses the results of the data analysis across all 20 cities (SDG7 Snapshots, 2021) and presents selected lessons learnt and good practices from those cities.

The results for all SDG 7 Localization Indicators (figure 1) show the range and average total scores for SDG 7 localization indicators aggregated across all 20 jurisdictions. The average score across all the jurisdictions and the indicators at 47 points out of maximum 100 shows commonly modest progress towards SDG 7 localization. Common challenges in SDG 7 localization across selected jurisdictions, revealed by the lowest average scores, include: the use of financial resources (Indicator 4), energy data monitoring (Indicator 2) and implementation (Indicator 6).

The results show that only five jurisdictions demonstrated significant progress (i.e., a score of 80 and higher out of a possible 100) in certain SDG 7 localization areas – Muntinlupa (Indicator 5 on awareness raising and capacity-building), Iskandar (Indicators 3 and 5 on cooperation with stakeholders, and awareness raising and capacity-building, respectively), Putrajaya (for Indicators 2 and 7 on energy data monitoring and linkages to other SDGs, respectively), Jakarta (Indicators 3 and 5 on cooperation with stakeholders, and awareness

Figure 1 Total scores for primary SDG 7 Localization Indicators aggregated across 20 selected jurisdictions



raising and capacity-building, respectively) and Da Nang (Indicator 5 on awareness raising and capacity-building). The region of Iskandar, Malaysia, is the only jurisdiction that achieved 100 points (Indicator 5 on awareness raising and capacity-building.

Results show that all analysed jurisdictions have started the process of SDG 7 localization, but are currently at different stages, as demonstrated by the total SDG 7 localization scores, with only around 40 pr cent of evaluated jurisdictions (9 out of 20) using a half or more of their existing SDG 7 localization opportunities.

An integrated approach to urban infrastructure development that seeks to optimize the synergies between energy, transport, buildings and other sectors is considered as a way to accelerate the process of SDG 7 localization, leveraging on the fact that around 70 per cent of the infrastructure by 2050 has yet to be built. This is key to the collective global action to mitigate climate change, ensure sustainable resource availability and improve urban services for all.

However, it will require a shift from "siloed thinking to more integrated approaches in spatial planning, infrastructure development and provision of municipal services – particularly as cities face and overcome the economic consequences of COVID-19.

This requires cities to move away from the prevailing fossil fuel-based model to generate energy used in urban centres, towards developing local renewable energy sources, deploying tailored approaches to energy access and building urban resilience. The shift will allow cities and neighborhoods to effectively store, shift, produce and avoid energy use through integrated urban energy systems, significantly reducing dependence on external sources, while delivering a host of social, economic, environmental and resilience benefits.

Such systems include integrating physical infrastructure that offers opportunities for synergies between industrial, residential, commercial, public buildings, transport and municipal services consumers. The integrated systems can also work as catalysts for new business models and market structures as well as

relevant regulating approaches and policies surrounding integration, energy use, urban planning, urban design, public procurement and sustainability strategies.

An ideal city-level energy system contains three overarching objectives – affordability, reliability and sustainability – requiring municipal intervention. If not for the whole city, many municipalities will have at least considered delivering these objectives for their own energy consumption as well as how these apply to critical infrastructure, such as hospitals, and to lower income groups. One clear conclusion is that energy efficiency needs to be prioritized in order to enable an affordable and resilient transition to high shares of renewable energy.

An example of this is given, using the energy transition that is consistent with the Paris Agreement, and which targets an energy system that (a) requires an energy supply by 2050 that is half of that required in 2004, and (b) allows an increase in locally produced energy to 20 per cent by 2050, thereby increasing a city's resilience and wealth retention. Such large-scale efficiency improvements and adoption of renewables requires concerted action by each city's system – public transport, private transport, water, sanitation, power supply and distribution, heating and cooling, building efficiency and industry. Synergies and integration of these systems can realize higher energy efficiency levels that can also bring about cost-savings and resilience benefits. Some of the barriers to this include the requirement for strong coordination between city departments, often higher upfront costs as well as unclear authority for cities to intervene.

Although examples of implementation of integrated urban solutions at the local level have demonstrated efficiencies, greater resilience, more equitable access to energy, low- or zero-carbon operation and large-scale renewable generation, currently progress and expansion is too slow, isolated, irreplicable or unsuited for scaling up, and limited to cities in developed countries.

Further, this report calls for better coordination between the national, subnational and local levels of government in regulating, planning, managing and monitoring implementation of SDG 7-related initiatives and acceleration. The commitment by most of the ASEAN national Governments to achieving SDG 7 are reflected in the availability of regulatory documents on sustainable energy generation and use, energy efficiency projects and renewable energy sources. However, the disconnection between different levels of governments has resulted in miscoordination between national and local-level stakeholders as well as administrative departments within the jurisdictions. More support is needed at the local level for additional capacity-building for technical and administrative professionals to improve the understanding of available regulatory and financing possibilities for actions on sustainable energy.

Feedback from local stakeholders has demonstrated the need to create a specialized on-line platform, offering continuous access to the information and knowledge on various aspects of SDG 7 localization as well as presenting opportunities for collaboration with regional and local level associations such as UCLG ASPAC, CityNet, ICLEI and others in establishing communication and implementing localization actions.

In order to enable and encourage SDG 7 localization, the following recommendations have been developed, based on the results of the research:

- Apply a Multi-Level Governance (MLG) approach to ensure local efforts are aligned with the national commitments and plans, while taking into account the local context and priorities;

- Allocate resources towards capacity-building and professional training for local technical and administrative staff in order to enhance their expertise on sustainable energy issues and solutions,

including the energy management system, local procurement and financing procedures as well as the preparation of action plans and accessing potential financial sources for implementation;

- Ensure that nationally supported policy instruments, monitoring and verification mechanisms are in place and updated regularly, covering the main sectors and/or energy end-users in the jurisdiction;
- Set and regularly increase the minimum energy performance standards and targets, in combination with a mandatory requirement for periodic maintenance and upgrades of energy-consuming technologies and equipment, to be integrated into the local energy management strategy;
- Expand the scope of existing smart metering and energy management systems (or in the case of their absence, establish new ones) to cover a wide range of energy consumers, and establish the opportunity for the continuous analysis of data received from the manual or automated energy metering systems;
- Improve communication and cooperation with national and international stakeholders to promote knowledge-sharing and peer-to-peer learning on sustainable energy;
- Improve the availability of financing mechanisms for local implementation of sustainable energy projects and related policy development, in order to enable access to available extrabudgetary options, including international donors and investors;
- Establish visible SDG tracking and reporting processes such as, for example, Voluntary Local Reviews (VLRs);
- Support local governments in ASEAN during the current COVID-19 pandemic and possible future disasters, by providing additional financial and human capacity possibilities for remote control and operation of sustainable energy development projects and actions.

Introduction

As of 2020, half of the population in the Association of Southeast Asian Nations (ASEAN) region lived in urban areas. By 2025, it is expected that an additional 70 million people will have moved to cities (ASEAN, 2018). Therefore, the way that cities in ASEAN are designed, planned and managed will largely determine whether the region's economies and societies have been transformed to meet the SDGs. Urbanization in the region is being accompanied by economic growth, with the highest growth rates demonstrated by middleweight cities (i.e., with a population between 500,000 and 5 million people). While the urban population in ASEAN grew by around 3 per cent annually between 1990 and 2015, the rate of carbon dioxide (CO_2) emissions has been increasing at more than double that rate (6.1 per cent/year) driven, to a large extent, by the increase in urban energy consumption in transport and buildings (Minh, McKenna and Fichtner, 2017). It is estimated that ASEAN's overall energy demand will increase even further, from 427 to 653 million tonnes of oil equivalent (MTOE) by 2025 (ASEAN, 2017).

At the same time, ASEAN countries demonstrate a trend towards "decentralization" of governance, which refers to the process of conferring a degree of self-government to local authorities to manage the needs of their constituents (ASEAN, 2018). This gives cities more autonomy in decision and policymaking; and more freedom in developing their local action agendas. This, combined with the fact that most of the infrastructure in developing countries has yet to be built, presents an immense opportunity for taking an integrated approach to urban energy and related investments by linking subsystems like energy, transport, urban greenery, waste management and buildings, offering synergies and efficiencies.

According to the International Resource Panel report, *The Weight of Cities* (IRP, 2018), the cumulative benefits of integrated approaches can enable up to 20-fold improvements in resource use and energy efficiency, with a potential for a 35-55% reduction in greenhouse gas emissions. However, the capacity of local governments to identify and prioritize sustainable energy solutions, evaluate how they can be optimized for achievement of SDG 7 and coordinate related efforts with the national government remains limited in ASEAN.

Responding to this identified need, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), in collaboration with the United Nations Environment Programme (UNEP) and the United Cities and Local Governments Asia Pacific (UCLG ASPAC) and with a grant support from the Energy Foundation China, are undertaking a project to increase the capacity of cities in ASEAN to accelerate the development and implementation of SDG 7-related actions. The project is focusing on the following three components:

- Development of the analytical framework for assessing the status of cities on SDG 7 localization;
- The collection of best practices and case studies on sustainable energy urban solutions;
- Development of the e-learning program on SDG 7 localization for cities.

The current report presents the results of the first component, based on the analysis of the data collected from 20 jurisdictions[1] and 5 ASEAN members covering various aspects of SDG 7 localization. Chapter 1 discusses the importance of the process of the SDG 7 localization as a delivery mechanism for Agenda 2030. Chapter 2 presents the methodology developed for qualitative analysis of the SDG 7 localization status, based on the answers to a self-assessment questionnaire completed by local stakeholders. Chapter 3 outlines the key results on SDG 7 localization across 20 ASEAN cities. Chapter 4 focuses on the topic of integrated urban sustainable energy solutions as a way to accelerate the process of SDG 7 localization.

1 For simplicity, throughout this report the term "jurisdiction" will refer to a city or any subnational-level territorial entity – for example, a province or region within a country.

SDG 7 localization as a delivery mechanism for Agenda 2030

CHAPTER 1

From global agenda to local action

Since the Sustainable Development Goals (SDGs) were launched more than five years ago, countries in Asia and the Pacific region have been implementing policies and actions related to all 17 SDGs. Significant progress has been made on some of the goals – SDG 3 on good health and wellbeing, SDG 4 on quality education, SDG 6 on clean water and sanitation and SDG 16 on peace, justice and strong institutions – accounting for more than half of the measurable targets, to which the Asia-Pacific region is on track. The data, however, clearly show that the region cannot expect to achieve all the SDGs by 2030 without accelerated action (ESCAP, 2020a). Moreover, for 20 per cent of the SDG targets the conditions in 2030 are expected to be worse than they were in 2015. Even in areas where the region is making good progress, inequality across the region, and between urban and rural areas, is a concern that calls for more progress in reaching the targets that are coupled with human well-being and a healthy environment.

According to the SDG progress report for Asia and the Pacific in 2020, there is overwhelming evidence that the region is alarmingly underperforming, specifically in the case of the environmental targets, including those on environmental resource depletion and degradation, the share of renewable energy, the proportion of people affected by natural disasters, and greenhouse gas emissions. Therefore, substantial improvements are still needed in the areas of energy efficiency, renewable energy deployment, hazardous waste generation, greenhouse gas emissions, climate-related hazards and impact of natural disasters as well as air quality and waste management in cities.

Early in the efforts to achieve the Millennium Development Goals (MDGs), countries, multilateral agencies and other development actors recognized that involving local government and considering the local development context was vital in achieving the goals. During the discussions leading up to the adoption of Agenda

Box 1 Agenda 2030 for Sustainable Development

The 2030 Agenda for Sustainable Development (Agenda 2030) was adopted by all United Nations member States in 2015 with the aim of providing "a shared blueprint for peace and prosperity for people and the planet, now and into the future".

The 17 SDGs are the central part of Agenda 2030 to provide an urgent call for action by all countries as part of a global partnership. Synergetic achievement of these 17 goals is crucial for addressing pressing global problems, while ensuring sustainable development.

Source: UN, 2020.

Box 2 Leading by example on SDG localization – Cauayan City, the Philippines

Cauayan City took the lead in the SDG implementation process at the local level. In his 2017 State of the City Address, the mayor presented several actions related to all 17 SDGs. To eradicate poverty, for example, the city is providing basic services that address all sectors of society, making sure that "no one is left behind". For SDG 2 on 'zero hunger', supplementary feeding programmes were run in all the *barangays* and in schools, and a local Food Bank was established. Malnutrition decreased to as low as 1.2 per cent. For health, in collaboration with several non-governmental organizations (NGOs), the city initiated new programmes, and managed to successfully reduce maternal and neonatal deaths. The city government supported the so-called "18-day Campaign" to fight violence against women. For access to, and management of water, the city promoted the construction of a deep-well water system, distributed sanitary toilets to the *barangays*, installed 30 units of solar street lighting along the main highway, and promoted major ICT infrastructure in the attempt to transform Cauayan into a 'smart city'.

Source: LGISB, 2018.

2030, which were building on the experiences from implementation of the MDGs, many actors argued for greater active involvement of local governments in working towards the sustainable development agenda.[2]

The important role of subnational and local governments in shaping and achieving the SDGs is highlighted in the United Nations Secretary-General's Synthesis Report on the Post-2015 Agenda (UNGA, 2014), which states that "many of the investments to achieve the sustainable development goals will take place at the subnational level and be led by local authorities". While the 17 SDGs and 169 targets of the Agenda 2030 are global in their coverage, their achievement will depend on the effective retranslation of global goals into national policies, with subsequent enforcement and implementation through concrete actions at the subnational level.

The UNEP Integrated Guidelines for Sustainable Neighbourhood Design (UNEP, 2015b) go even further, making the case for action at the neighbourhood level as "an integrative scale to deliver carbon-neutrality, resource-efficiency, and inclusiveness", and which "can be used as a proof of concept for replication at the city level".

It has been estimated that without the involvement of local tiers of government, approximately 65 per cent of the SDG targets may not be achieved (Misselwitz and Villanueva, 2016). Therefore, local governments, together with local communities and stakeholders, are critical to turning Agenda 2030 from a global vision into a local reality (Steiner, 2017) through the process of SDG localization.

SDG localization has been defined as "the process of defining, implementing and monitoring strategies at the local level for achieving global, national and subnational sustainable development goals" (UNDG, 2014). It encompasses the entire process, from the setting of goals and targets, to determining the means of implementation as well as using indicators to measure and monitor progress. It also involves promoting local ownership, understanding local context and trends, and effectively allocating resources to achieve targeted outcomes at the local level..

2 The Global Taskforce of Local and Regional Governments was set up in 2013 to bring the voices of local leaders and people on to the international stage and influence the global development agenda. The taskforce was a channel for the joint advocacy work of major international networks of local governments.

SDG localization: Success factors and challenges

Important consideration in the localization process should be given to the analysis and understanding of local **subnational** contexts in the achievement of Agenda 2030. While local actions should be in alignment with the national policies through continuous communication and coordination of efforts between nation and local facets, local priorities and needs should inform setting of goals and targets, determining the **means of implementation** and **selecting the indicators** to measure and monitor progress (Local2030, 2017). All relevant actors at all levels of governance must be involved in the decision-making process, through consultative and participative mechanisms, at the local and national levels (figure 2).

Figure 2 SDG localization success factors

To ensure that the process of SDG localization is successful several factors should be put in place in order to increase the effectiveness of the process:

- Better local level coordination of effort is needed within a city at the level of different ministries, institutions and local stakeholders (horizontal coordination) as well as development of coherent institutional and policy frameworks across different levels of governance (vertical integration);
- Increased capacity of local government;
- Mainstreaming of SDGs into local planning;
- Strong commitment by the Government.

Horizontal coordination and vertical integration include the adoption of laws and regulations to ensure policy coherence and cohesion as well as coordination and cooperation among all relevant stakeholders. Policy and the institutional framework also include national and local oversight institutions that monitor the implementation of SDG-related strategies and ensure accountability for the achievement of the SDGs. Multilevel governance (MLG) frameworks defined as "the structural and institutional setting in which different levels of government distribute roles and responsibilities, coordinate and cooperate on climate action" can help to address issues related to implementation, and introduce decentralized administrative elements as an important supportive measure (Fee, 2020).

There are various MLG Instruments such as, among others: climate finance; measuring, reporting and verification (MRV) procedures; engagement of local citizens; capacity-building for professionals; and digitalization of operations. For example, as part of China's SDG localization strategy, the Government of China launched the SDG Pilot Zone Initiative whereby local government can pass new legislation, explore institutional reform, pilot alternative public

Box 3 Strengthening local capacities for implementing the SDG innovation Pilot Zone Initiative, China

To promote local innovation for achieving SDGs, China's State Council issued its "Development Plan of China's Innovation Demonstration Zones for the Implementation of the 2030 Agenda for Sustainable Development" in December 2016. It delegated the Ministry of Science and Technology (MOST) to lead the SDG Innovation Pilot Zone Initiative, an initiative representing the most practical SDG localization strategy thus far. To achieve this, an inter-ministerial meeting was organized and coordinated by MOST, with active participation by the National Development and Reform Committee (NDRC), Ministry of Foreign Affairs (MOFA), Ministry of Environmental Protection (MEP) and other ministries. The Initiative stresses the need to utilize innovative thinking, problem orientation, diversified participation, the process of opening-up, and sharing as a principle in order to build SDG pilot zones within the national agenda for the 2030 Agenda for Sustainable Development.

Many cities welcomed this new initiative as they saw the SDG pilot zones as an opportunity to upgrade their local development efforts. Sixteen cities applied or started the application process to become SDG pilot zones. On the 23 March 2018 the State Council announced the first batch of approved SDG pilot zones:

- Guilin city – focusing on the sustainable use of landscape and tourism resources;
- Shenzhen city – focusing on sustainable development and good mega city governance; and
- Taiyuan city – focusing on the sustainable transformation of resource-based cities.

All the pilot zones will include key features for achieving SDGs. These include developing innovative policies and implementation mechanisms, experimenting with the creation of better opportunities for public participation, and, more importantly, aiming for more seamless vertical coordination among the central Government and provincial and city governments, and horizontal coordination among different departments at both the central and local levels.

Key lessons learnt from SDG pilot zones:

- Awareness raising and capacity development support for SDG-related project design and implementation contributed to wider adoption of SDGs by local governments;
- Support from UNDP also helped selected local governments to implement the SDG innovative pilot zone initiative, a comprehensive SDG localization strategy
- Several SDG-related policies were adopted by the Government of China, thereby creating a strong policy foundation for local cities and governments; coordination mechanisms were also established to facilitate innovative programming for SDGs.

Source: UCLG ASPAC, 2020.

servants' performance evaluation and restructure public expenditure, in line with the SDGs and in partnership with various organizations and experts (Reddy, 2018).

Increased capacity of local governments is crucial in order for the subnational jurisdictions to take the lead and play a more proactive role in the implementation of Agenda 2030. Through decentralized cooperation, local and regional governments are bridging the gap in national support by working together through city-to-city and region-to-region collaboration and learning from each other as well as the international expert community. Residents of the cities are also at the heart of the SDGs' global and universal framework.

Box 4 **SDG mainstreaming at the local level in Indonesia**

Based on the lessons from MDGs, the Government of Indonesia adopted measures to ensure policy and implementation coherence from the national to the local level. Presidential Decree No. 59, 2017 provided the legal basis for mainstreaming SDGs into national and local planning processes. SDG coordination teams were established at the national and subnational levels. At the national level, the coordination team is guided by a steering committee headed by the President.

As a large country, spread out across three time zones, implementing the 17 SDGs brings with it a major challenge. At the national level, the goals intersect with the mandate of nearly all of the country's 30+ ministries/agencies. Yet, most development programmes are implemented at the ground level by 416 autonomous districts and 98 municipalities. Each district and municipality has diverse natural and social characteristics, which define their development potential as well as their needs. The provincial governments have a role in coordinating the efforts of the district/ municipal governments, and cascading down the policies of the national Government. This makes for a complex web of development goals, actors and actions across the country. Learning from the MDG experience, the national Government understood that ensuring implementation of SDGs in this complex web requires a coherent set of policies and directives on one hand and, on the other hand, sensitivity to the diverse aspirations and needs of the regions across the country.

The institutional arrangements towards SDG implementation are further elaborated in the National Planning Ministerial Regulation No. 7, 2018 and the National Planning Ministerial Decision 1 (dated 30 April 2018). The former describes the mechanisms for coordination, planning, monitoring, evaluation and reporting of SDG implementation, while the latter appoints members of the SDG teams and working groups.

The National SDG Coordination Team is guided by the Steering Committee, chaired by the President. The National Planning Minister/Head of the National Development Planning Agency is appointed as the Implementation Coordinator, which among other strategic duties provides guidance and coordinates the Implementation Team. The Implementation Team is headed by a senior official in the National Development Planning Agency. An expert panel provides expert advice, and four Working Groups have been established for each of the four SDG pillars of Indonesia: social, economic, environmental as well as justice and governance. The regulation also established the National SDG Secretariat to support daily functions of the National SDG Coordination Team.

Source: Bappenas, 2020.

Therefore, local government should make efforts to embrace various means of enhancing citizens' awareness and adapt local public services to reflect this aspiration (CEMR, 2019). Additional support for cities, grounded on the continued recognition of decentralized cooperation, is needed from national Governments and international organizations, in the following areas:

- Creating platforms for the exchange of experiences and practices;
- Addressing specific administrative, territorial and urban challenges through training, recruitment or development of streamlined systems;
- Fostering multilevel governance and multi-stakeholder alliances; and
- Creating strong links between the territories.

Mainstreaming of SDGs into local planning should be based on an in-depth understanding of the 2030 Agenda, its integration into the locally relevant policies and their alignment with the national, subnational, and local contexts. Such contexts are unique to each country and each city and cover a wide range of issues – from

key socioeconomic characteristics to specific government policies and management strategies to address the issues covered by respective SDGs (Dickens, Nhlengethwa and Ndhlovu, 2019). Governments at all levels have a variety of existing policy objectives and commitments that are articulated in different national and sectoral strategies, and local policies and plans as well as in commitments to international agreements and ongoing actions and projects. Integration of SDGs at all levels of governance should consider these as part of the mainstreaming process. In this regard, the common steps for SDG mainstreaming may include (UN, 2016):

A review of existing strategies and plans at the national, subnational and local levels, in relation to the global SDGs and targets to identify gaps and areas for change;

The setting of SDG-related targets specific to the level of governance (national, subnational and/or local level), which should be achievable, yet ambitious with the vision for regular updates;

Utilization of the integrated systems' thinking in order to incorporate recommendations and insights from the above steps into local strategies and plans, and to match ambition and commitments with resources and capacities.

Strong commitments by the government at all levels of governance (national, sub-national and local levels) are absolutely essential for creating the necessary conditions for localizing the SDGs, including developing integrated approaches, implementation, and monitoring of the achievement of the SDGs, based on the selected SDG indicators at the local level.

The localization of SDGs faces a number of challenges, especially in terms of serving the surge of population growth in the urban areas. In Asia and the Pacific, the rapid scale and intensity of urbanization have created enormous development challenges in the region's cities to which national and local governments are struggling to respond (Local 2030, 2017). This has resulted in many challenges in developing legal, policy and institutional frameworks for

Box 5 The Philippines' experience: From localizing MDGs to localizing SDGs

The Philippine Development Plan (PDP) 2017-2022 is anchored in the national long-term vision, or AmBisyon Natin 2040, the Duterte Administration's 0-10-point Socioeconomic Agenda, and the Sustainable Development Goals. A total of 63 of the global SDG indicators are reflected in the PDP. Given the fact that the Philippines has a decentralized form of government, the Department of the Interior and Local Government (DILG) is responsible for localizing the envisioned results of the PDP 2017-2022, including integrating the selected SDG indicators of the PDP into provincial plans and budgets. A platform on SDG localization was established in 2015 that brought together national government agencies such as the DILG, Philippine Statistical Authority, National Economic and Development Authority, Commission on Human Rights, League of Provinces, CSOs and Academic Institutions, to design an SDG localization approach for the Philippines.

DILG has extensive experience in localizing the global and national development goals into local plans. The experiences of MDGs have helped DILG to support localization of SDGs in more than 34 cities since 2015. During the MDG era, DILG led the localization of MDGs and prescribed a framework for local governments that focused on the entire policy and implementation cycle – policy support, planning and budgeting, and monitoring and reporting. It also promoted innovations in local programming processes to achieve MDG targets. In collaboration with the Local Government Academy (LGA), the League of Cities of the Philippines, and with technical support from UNDP and UN Habitat, launched and implemented the MDG Family-based Actions for Children and their Environs in the Slums (MDG FACES). Initially implemented in 15 cities in 2008, it had expanded to 127 cities by 2015.

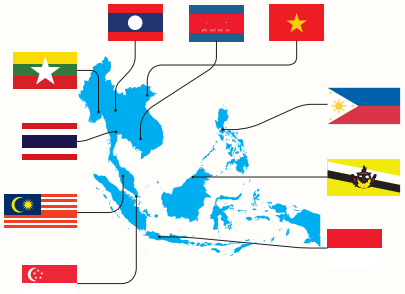
Source: LGA, 2009, and Paloma, 2018.

enabling environments to support the sustainable development of cities.

The most pressing need across the region is to improve local government revenue, which requires much stronger enabling legislation, particularly related to the autonomy of cities in raising their own revenue. This, in turn, requires reviewing the legislative frameworks for vertical fiscal integration as well as the use of tax and other nationally collected revenue. The lack of local financial autonomy to decide on how best to use the resources is hindering sustainable development outcomes at a local level as well as the prospects of achieving the SDGs at the national, regional and global levels.

Other local challenges include the lack of a focus on creating legislation that encourages a collaborative approach that involves metropolitan planning and management, citizen engagement in planning decision-making processes, and enforcement of local-level regulations.

Box 6 Association of Southeast Asian Nations



The Association of Southeast Asian Nations (ASEAN), a regional intergovernmental organization that promotes governmental and economic cooperation, comprises Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam. The institutional framework of ASEAN joins together distinct and diverse national situations in terms of geographic characteristics, socioeconomic development and economic structures.

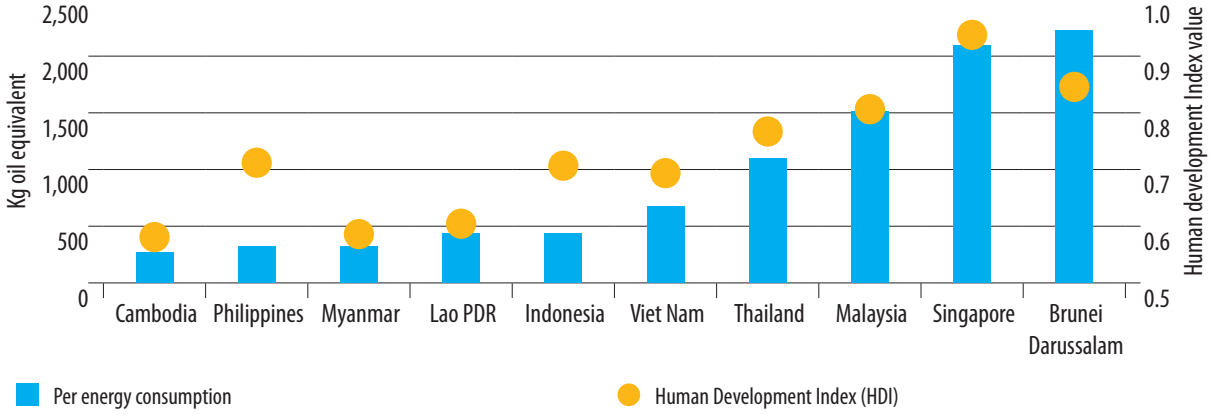
It has a combined population of approximately 667 million people with half of them living in cities and urban areas. The regional economic growth rate has remained consistently above the global average, making ASEAN "an emerging global economic powerhouse" with growing energy consumption (ESCAP, 2020b).

	Population 2020 (million people)	Urban population 2020 (% of total)	GDP PPP 2017 US dollars per capita
Indonesia	273.5	57	4,131
Philippines	109.6	47	2,891
Viet Nam	97.3	37	1,835
Thailand	69.8	51	6,126
Myanmar	54.4	31	1,247
Malaysia	32.4	77	11,528
Cambodia	16.7	24	1,136
Lao PDR	7.3	36	1,773
Singapore	5.9	100	54,301
Brunei Darussalam	0.4	78	31,440

Data Source: APEP, 2020.

Affordable and clean energy at the local level in ASEAN

Figure 3 Energy use and human development are highly coupled in the ASEAN region



Source: ESCAP, 2020b.
Note: HDI is a summary measure of national achievement in the areas of population health, education and standard of living, measured by life expectancy, mean years of schooling and gross national income per capita. Higher rankings suggest a greater level of development progress that benefits national populations.

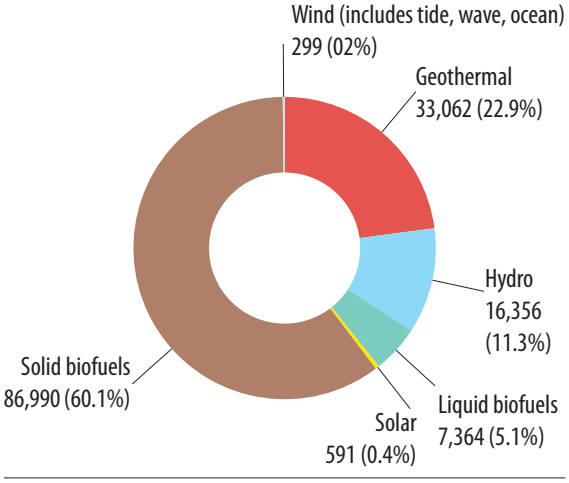
The Association of Southeast Asian Nations (ASEAN) is a dynamic region, the expansive socioeconomic development of which is being supported by continuously growing energy consumption.

The region's energy demand increased by nearly 80 per cent between 2000 and 2017, with fossil fuels (oil, natural gas and coal) shaping its primary energy mix and supplying the main sectors of the economy.

Despite urgent global calls to end coal-fired power generation, driven by growing consensus for the need to limit global warming and to protect human health, new coal-fired power plants in ASEAN are still being built. New coal power capacity has risen in recent years, making coal the fastest growing fossil fuel in the regional energy mix (ESCAP, 2020b).

Indonesia, Viet Nam and the Philippines have the largest coal plant pipelines, with Malaysia and Thailand being not far behind. Investment into coal-based energy infrastructure locks high

Figure 4 Renewable energy production mix in ASEAN, 2018



Source: Asia Pacific Energy Portal, 2020b.

Table 1. Amount of cooling degree days (CDD) experienced by the population

№	Country	Total CDD exposure (in billions)	Global share (%)
1	India	3,728	28
2	China	1,410	10
3	Indonesia	848	6
4	Nigeria	621	5
5	Pakistan	474	4
6	Brazil	434	3
7	Bangladesh	426	3
8	Philippines	332	2
9	United States	277	2
10	Viet Nam	260	2

Source: Biardeau, Davis, Gertler and Wolfarm, 2019.

emissions into the energy system that needs urgent decarbonization.

The largest share (more than 60 per cent) of renewable energy in the region is represented by the use primarily of traditional biomass for heating and cooking (figure 4). Geothermal and hydropower account for notable portions in several countries of the region. Solar and wind power emerged in the region only in the early 2000s and are expanding their capacity, although at the regional level their share accounts for less than 1 per cent.

South-East Asia's electricity consumption has been growing continuously, from 11 Mtoe in 1990 to 82 Mtoe in 2018 (APEP, 2020). About 60 per cent of electricity usage in South-East Asian cities is attributable to the use of air-conditioning, making

Box 7 Sustainable Development Goal 7

Sustainable Development Goal 7 targets universal access to energy, increasing renewable energy's share in the global energy mix, and doubling the rate of energy efficiency improvement. SDG 7 offers a framework for realizing not only a sustainable energy future, but also underpins the achievement of myriad socioeconomic development objectives in areas including poverty, education, sustainable cities and communities, and the fight against climate change (UN, 2015).

Ensure access to affordable, reliable, sustainable and modern energy for all

Target 7.1: By 2030, ensure universal access to affordable, reliable, and modern energy services.	**Indicator 7.1.1:** Proportion of population with access to electricity. **Indicator 7.1.2:** Proportion of population with primary reliance on clean fuels and technology.
Target 7.2: Increase substantially the share of renewable energy in the global energy mix by 2030.	**Indicator 7.2.1:** Renewable energy share in the total final energy consumption.
Target 7.3: Double the global rate of improvement in energy efficiency by 2030.	**Indicator 7.3.1:** Energy intensity measured in terms of primary energy and GDP
Target 7.a: By 2030, enhance international cooperation to facilitate access to clean energy research and technologies – including renewable energy, energy efficiency and advanced and cleaner fossil fuel technologies – and promote investment in energy infrastructure and clean energy technologies.	**Indicator 7.a.1:** Mobilized amount of United States dollars per year, starting in 2020 accountable towards the US$100 billion commitment.
Target 7.b: By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, particularly LDCs and SIDS.	**Indicator 7.b.1:** Investments in energy efficiency as a proportion of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services.

sustainable cooling one of the most important areas of urban policy agenda in the region (Lee, 2018). A hot and humid climate as well as economic growth and urbanization will continue to drive growth in energy use for space cooling in ASEAN cities. Three ASEAN members (Indonesia, the Philippines and Viet Nam) are already among the top 10 countries in the world with "CDD exposure" – the amount of cooling degree days (CDD)[3] experienced by the population – which can be considered as a measure for potential demand for space cooling (table 1). It is estimated that air-conditioning could account for up to 40 per cent of South-East Asia's electricity consumption by 2040 (Lee,2018).

With ongoing reliance on fossil fuels, growing energy demand and a currently limited impact of modern renewables on the region's energy mix, the achievement of SDG 7 on affordable and clean energy by 2030 has become a crucial and challenging task in the ASEAN region.

Access to electricity (SDG 7 Indicator 7.1.1) has been steadily expanding in ASEAN, with 95.5 per cent of the region's population having access to an electrical connection in 2018, up from 79.3 per cent in 2000. Improving access to clean cooking (SDG 7 Indicator 7.1.2) remains relatively slow, with only 66.5 per cent of the region's population in 2018 having access to the respective clean cooking fuels and technologies. Achieving the target for universal access to clean cooking by 2030 will be a major challenge in many areas.

The share of modern renewable energy (use of traditional biomass is excluded) in the final energy consumption (SDG 7 Indicator 7.2.1) was 11.5 per cent in 2017, demonstrating a notable increase from 9.4 per cent in 2000. ASEAN policymakers also established a region-wide target of reaching 23 per cent of modern renewable energy in the primary energy mix by 2025 (in 2018 that share was 21.5 per cent).

3 A cooling degree day is the number of degrees that a day's average temperature is above the base temperature (typically 18o -22o Celsius), which can be used to quantify the demand for energy needed to cool buildings to a certain temperature.

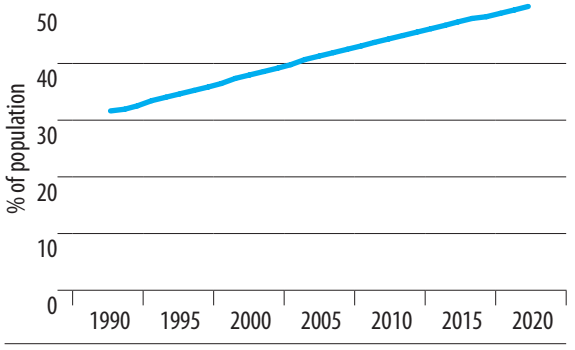
Improvement in the region's levels of energy efficiency, as measured through the primary energy intensity (SDG 7 Indicator 7.3.1), is showing some progress. In 2017, energy intensity was 3.9 megajoules per 2011 PPP $, down from 5.3 in 2000, which is lower than the global average (4.9 MJ per 2011 PPP $ in 2017). However, the compound rate of primary energy intensity (a proxy indicator used for tracking improvements in energy efficiency) in the region has fluctuated significantly during the past decade, and is significantly influenced by various structural factors and the economic situation in different countries, which makes it difficult to arrive at a clear conclusion on energy efficiency progress. However, the regional target to reduce energy intensity by 20 per cent by 2020 in relation to the 2005 level has been achieved and ASEAN is on track towards reaching the regional 30 per cent target by 2025 (APEP, 2020).

While the data on key SDG 7 indicators at the regional level show that the progress is being made in ASEAN across the main areas of SDG 7 – energy access, renewable energy and energy efficiency – there is substantial room for improvement, and further acceleration of efforts is needed at all levels of governance.

The role that cities play in ASEAN's development and energy consumption is increasing rapidly; urban population in the region has been growing continuously, with half of the region's population living in urban areas as of 2020 (figure 5).

The localization of SDGs is crucial for ASEAN (and the Asian and the Pacific region overall) due to the pressure that rapid urbanization, economic growth and impacts of climate change put on the capacity of local communities (Oosterhof, 2018). To enable subnational and local governments to be effective contributors to the implementation of SDGs, there should be an effective coordination and exchange between the global, national and local levels to align local needs with national policy priorities and global goals. This should involve the relevant actors from different levels of governance in decision-making along the whole policy chain (ASEAN, 2018).

Figure 5 Urbanization rate in ASEAN, 1990-2020



Source: APEP, 2020.

In terms of electrification, most cities across ASEAN have achieved close to full coverage of the population. In 2018, 2.7 million city dwellers did not have access to electricity, compared with 26.4 million people living in rural areas (ESCAP, 2020b). In terms of the access of urban population to clean cooking, the results vary significantly among countries, with five countries out of 10 having more than 15 per cent of urban population lacking access to clean cooking fuels and technologies (table 2).

While electrification and access to clean cooking provide a high-level understanding of energy access in urban areas of ASEAN, it is important to note that these indicators do not reflect the quality, reliability and sustainability of energy access for all city dwellers, which might differ significantly based on the living conditions. It is estimated4 that more than 95 million people in the region live in urban slums. Slums and informal settlements across the region take many different forms and are characterized by different levels of poverty, built environments and infrastructure systems. However, urban settlements that lack secure land tenure and access to basic infrastructure, such as modern and reliable energy services, are a common feature in numerous cities in ASEAN members, with the notable exceptions of Brunei Darussalam, Singapore and, to a lesser extent, Malaysia (UNEP, 2018). Demand for energy from cities' dwellers with energy access is only expected to grow driven by increasing incomes, urbanization and standards of living. Demand will rise further as new urban residents are connected to the grid for the first time, and programmes for resettlement or upgrading of existing slums are implemented.

Table 2. Energy access in urban areas of ASEAN members

	Proportion of urban population with access to electricity (2018)	Proportion of urban population with primary reliance on clean fuels and technology (2018)	Proportion of urban population living in slums (2018)
Brunei Darussalam	100	100	no data
Singapore	100	100	no data
Malaysia	100	99	no data
Thailand	100	87	24
Viet Nam	100	82	14
Cambodia	100	65	45
Indonesia	100	91	31
Lao PDR	99	17	21
Philippines	98	67	43
Myanmar	92	70	56
Source	Asia Pacific Energy Portal (APEP)	Asia Pacific Energy Portal	World Development Indicators (World Bank, 2016)

For successful SDG 7 localization it is important to ensure that expanding energy access and enhancing living conditions of people go hand-in-hand with improvements of energy efficiency and renewable energy deployment.

National commitments to, and policies on sustainable energy can substantially support SDG 7 localization in cities. However, local governments can take the lead through a number of actions within their jurisdictions to accelerate the progress on SDG 7 and "avoid locking in dependency on fossil fuels and the associated volatile prices, air pollution and expensive

4 If data on the proportion of urban population living in slums (2018) is applied to urban population data (2020).

infrastructure" (Westphal, Martin Zhouand Satterthwaite, 2017).

Definition of 'slums'

Slums is an urban area which lacks one or more of the following:

1. durable housing of a permanent nature that protects against extreme climate conditions;
2. sufficient living space which means not more than three people sharing the same room;
3. easy access to safe water in sufficient amounts at an affordable price;
4. access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people;
5. security of tenure that prevents forced eviction

Source: UNHABITAT, 2006.

The levels of administrative and regulatory powers of local governments vary significantly across ASEAN members (UNEP, 2019). The scope of legal authority and/or the practical capacity to influence the governance and development trajectories of energy and other linked sectors of a city are important factors for how SDG 7 process can be implemented in a given city and across the region. However, there are certain roles and strategies that are typically common across different cities and in the types of governance that can support the process of SDG 7 localization, such as:

- Setting sustainable energy targets. Most local governments have the power to set sustainable energy targets (e.g., on improving energy access, increasing the share of renewable energy in total energy consumption and improving energy efficiency across various sectors) at the city level and/or at the sectoral level within the city. The target tailored to the local context and level of ambition is an important tool to encourage action and pave the way to sustainable energy transition. A number of cities in ASEAN have already established targets, e.g., for increasing utilization of renewable energy (table 3).

- Developing sustainable energy policies. Achievement of sustainable energy targets is only possible through establishing dedicated institutions responsible for their implementation and enforcement. Local governments play an important role in the design, planning, zoning and permitting of city infrastructure. Many cities have the authority and capacity to: (a) set local sustainable energy targets (table 3); (b) introduce tax incentives for the utilization of energy efficient and/or renewable energy technologies; (c) implement building energy codes with energy efficiency requirements; (d) introduce energy performance labelling and certification schemes for buildings and energy-consuming appliances; (e) adopt programmes for reducing traffic congestion and increasing the use of public transport; and (f) cycling and walking. Cities could also serve as implementers of sustainable energy regulations adopted at the state/provincial and national levels – such as, for example, feed-in tariffs and net metering policies to increase the local deployment of renewables, and energy management systems to improve efficiency of energy use in buildings, industry and transport.

- Influencing energy use mix. Depends on the ownership structure and geographic location of the urban infrastructure (buildings, transport, waste, water supply, electricity generation etc.) and the level of autonomy that cities have to influence their local energy mix to various degrees. When cities own their utilities, energy networks and infrastructure, they often have greater direct control over the types of fuels that can be used within city boundaries. For example, they may decide to accelerate renewable energy deployment and energy efficiency improvement by modifying their investments, operations and planning. Many cities can become energy producers or prosumers, for example, by installing solar systems on public buildings and exploring the potential for waste-to-energy projects. In jurisdictions where the control over urban energy infrastructure lies with national or state/provincial utilities, the decision-making

Table 3. Renewable energy and GHG emissions reduction targets in selected ASEAN cities

Country	City	Scale	Energy types covered by target	Target year	Target	Source
Indonesia	Balikapan	City-wide	GHG emissions reduction	2020	19% of the baseline	City's self-report
Indonesia	Jakarta	Province-wide	Share of renewable energy	2025	6.4%	City's self-report
Indonesia	Jakarta	Province-wide	Share of renewable energy	2050	7.1%	City's self-report
Indonesia	Jakarta	Municipal operations	Share of renewable energy	2030	30%	REN21 2019a
Indonesia	Malang	City-wide	Share of renewable power	2020	20%	REN21 2019a
Malaysia	Alor Gajah	Municipal operations	Share of renewable energy	2020	40%	REN21 2019a
Malaysia	Kota Kinabalu	City-wide	Share of renewable energy	2020	11%	REN21 2019a
Malaysia	Iskandar	Region-wide	Share of renewable energy	2025	12%	Region's self-report
Malaysia	Melaka	City-wide	Share of renewable energy	2020	11%	REN21 2019a
Malaysia	Shah Alam	City-wide	Share of renewable energy	2020	11%	REN21 2019a
Malaysia	Subang Jaya	City-wide	Share of renewable energy	2025	20%	City's self-report
Malaysia	Subang Jaya	City-wide	GHG emissions reduction	2030	45%	City's self-report
Philippines	Pasig	Municipal operations	Share of renewable power	2020	10%	REN21 2019a
Philippines	Mindanao	City-wide	Share of renewable power	n/a	100%	REN21 2019a
Philippines	San Carlos	Municipal transport	Share of renewable energy	2025	15%	REN21 2019a
Philippines	Zamboanga	City-wide	GHG emissions reduction	n/a	5-30%	City's self-report
Singapore	Singapore	City-wide	Share of renewable power	2020	5% (350 MWh)	CDP 2019
Thailand	Hat Yai	Municipal operations	Share of renewable power	2020	10%	REN21 2019
Thailand	Hat Yai	City-wide	Share of renewable power	2030	5%	REN21 2019a
Viet Nam	Da Nang	City-wide	Share of renewable energy	2030	6%	REN21 2019a
Viet Nam	Ho Chi Minh City	City-wide	Total installed capacity of renewable energy	2020	2%	CDP 2019

power of the local government is much more limited, but it can start initiatives to 're-municipalise' this infrastructure and acquire greater local control (REN21, 2019). Some cities have aggregated city-wide electricity use to procure renewable power on behalf of residents and businesses, or have benefited from renewables from outside the city boundaries – for example, by signing power purchase agreements (PPAs) with nearby wind and solar projects (Kelliher, 2018).

- Engaging various stakeholders. Local governments are well-positioned to engage various stakeholders in the process of SDG 7 localization and serve the role of coordinator and facilitator of efforts. Coordination of action vertically (i.e., with national and provincial levels of governance) as well as horizontally (i.e., among various institutions within the city) can increase the effectiveness of work, help to secure additional support, and align local actions with national policies and global goals on sustainable energy. Cities can effectively engage local citizens and communities by: (a) introducing awareness-raising and information campaigns about the benefits of sustainable energy as well as support educational programmes at all levels of education; and (b) provide vocational training for professionals and capacity-building activities for governmental officials. Cities can actively participate in knowledge sharing and peer-to-peer dialogue with other cities in the region and globally, in order to learn about good practices on sustainable

energy, and explore ways for collaboration on specific projects. Engagement of the private sector and international organizations can facilitate the development of sustainable energy projects that are attractive to investors. Local government can establish effective mechanisms for involving representatives from citizens, industry, civil society, national and provincial governments as well as academia in the development of sustainable energy policies and plans in order to ensure the inclusion of these groups from the beginning.

- Unlocking sustainable energy finance. Availability of financing is often considered as one of the key barriers to sustainable energy projects at the city level. Most cities obtain income from a variety of sources – tax collection, municipal bond issuance and a range of fee-for-service charges, among others – which constitute the municipal budget (REN21, 2019). City governments can prioritize sustainable energy actions for their municipal operation during the municipal budget planning and "lead by example" in order to encourage further investments in sustainable energy from residents and businesses. Cities can also unlock additional financial resources through the engagement of the private and non-profit sector in order to advance their sustainable energy agendas, for example, through the mechanism of public-private partnerships (PPPs). Local governments might need to invest in building technical capacity for sustainable energy project development or collaborate with international organizations, which can provide technical assistance for the preparation of a business case that clearly articulates the potential value of the project to private partners (Fishman and Flynn, 2018).

Strong and coherent policy and institutional framework should be established at every level of governance to ensure the achievement of SDG 7. However, a lack of coordination and alignment between actions and resources at the national, provincial and city levels as well as fragmentation of responsibilities and lack of communication between different within the city can significantly aggravate undertaking of SDG 7 localization, and substantially reduce the impact of related efforts. Lack of financing and limited power and authority to turn ambitious sustainable energy plans into implemented actions that result in energy savings and greenhouse gas emission reductions, and other co-benefits, further aggravates the ability of cities to accelerate the process of SDG 7 localization.

COVID-19 has posed further challenges to sustainable energy implementation. Many national and local governments around the world have had to divert funding away from clean energy in response to the COVID-19 crisis, thereby sidelining clean energy legislation, renewable energy reverse auctions and related policy developments. Even though a reduction in energy demand, caused by COVID-19-related restrictions, has boosted the renewable energy share in many countries and cities, it is likely to be a temporary phenomenon and a rebound is expected to take place once the pandemic is over (ESCAP, 2020b).

Governments, with their sustainable energy commitments, policies and resources, play an important role in supporting the process of SDG 7 localization in these challenging circumstances. However, local governments should not rely solely on national-level support and should be pro-active in seeking other opportunities for sustainable energy development.

In order for local governments to identify actions that are needed for effective SDG 7 localization in their respective jurisdictions, it is important to analyse the local context across various dimensions related to sustainable energy, governance and collaboration with various stakeholders. That should serve as a starting point for an in-depth analysis of related policy and technological options tailored to a city's unique situation and development of a roadmap or an action plan to pave the way for sustainable energy actions.

Chapter 2 presents the analytical framework that helps cities to do a self-assessment of their situation regarding SDG 7 localization and identify opportunities for improvement.

Box 8 Local policy actions in selected ASEAN cities

Cauayan City (Philippines) is implementing the Philippine Green Building Code, which was adopted at the country level. However, in practice the regulation has not made a significant impact on city's buildings, as most of them do not meet the minimum total gross floor area of 10,000 sqm prescribed by the Code. Cauayan City is also an active advocate of smarter transportation and it started promoting the use of electric vehicles since 2017. There is a variety of e-vehicles operating on city's streets, including e-tricycles, e-jeepney, e-scooters and the Hybrid Electric Road Train.

Quezon city (Philippines) is currently in the process of updating its Green Building Code to include minimum energy efficiency requirements for new buildings and increase the rate of compliance towards a robust building energy code, under C40's Building Energy 2020 Technical Assistance Programme.

Vigan city (Philippines) is mitigating the problem of urban air pollution through retrofitting of the 3,500 tricycles in the city. Another recent measure is the provision of public access to bicycles, particularly for women to help their mobility and support their families economically in the situation of increased unemployment and increases cost of transportation, aggravated by the COVID 19 pandemic.

Iskandar (Malaysia) has set the following specific targets for renewable energy and energy efficiency at the subnational level:

Key targets for RE	2015	2020	2025
RE savings by sector, MW			
▪ Biomass from EFB (MW)	15	20	25
▪ Biogas from POME (MW)	4.8	5	8
▪ Municipal solid wastes (MW)	25	50	50
▪ Mini hydro (MW)	5	10	15
▪ Shortfall from solar PV (MW)	70	191	361
Total renewable energy target (MW)	120 (6%)	276 (10%)	459 (12%)
EE savings by sector, MW			
▪ Domestic (MW)	29	54	88
▪ Commercial (MW)	93	194	464
▪ Industrial (MW)	106	209	360
Total energy efficiency target (MW)	228 (11%)	457 (17%)	(24%)

Penang (Malaysia) has established local energy efficient guidelines for street lighting, which include compulsory installation of LED street lights by all developers, consultants and other related agencies as well as retrofitting from HPSV street lights to LED street lights belonging to the City Council of Seberang Perai. More than 18,500 street lights have been retrofitted to LED in Seberang Pera.

DKI Jakarta has set the following subnational sectoral targets of GHG emission reduction in its Regional Action Plan (RAD) by 2030:

- Industry – 10.8 million ton CO_2e
- Transportation – 9.8 million ton CO_2e
- Commercial – 5.7 million ton CO_2e
- Residential – 5.2 million ton CO_2e
- Others – 0.07 million ton CO_2e
- Solid waste– 2.6 million ton CO_2e
- Liquid waste – 0.3 million ton CO_2e
- Land use – 0.6 million ton CO_2e

Analytical framework on SDG 7 localization

CHAPTER 2

ESCAP, in collaboration with UNEP, has developed an analytical framework based on a multi-criteria assessment of the status of SDG 7 localization process in any city or sub-national jurisdiction across seven SDG 7 localization Indicators, corresponding to important areas of the city's operation in relation to sustainable energy. This analytical framework allows assessment of the status and progress made in the city on SDG 7 localization and identify areas for improvement tailored to the city's unique context.

This chapter presents the main attributes of the methodology of the analytical framework. It explains how it can be applied in a given city by collecting required information through completion of the questionnaire (Annex 1) by relevant local stakeholders (representatives of local governments, related technical and utilities department experts).

SDG 7 Localization Indicators

As part of the methodology development, the project team conducted a desktop review of multiple existing sources and publications in order to identify important factors that influence SDG 7 localization efforts (some of the related findings were discussed in Chapter 1). Below several important factors from several sources are highlighted, which were taken into account in determining SDG 7 Localization Indicators for the present analytical framework.

According to the Roadmap for localizing SDGs (UNHABITAT, 2016), the achievement of the SDGs depends on 'the ability of local and regional governments to promote integrated, inclusive and sustainable territorial development'. The Roadmap presents the following action areas crucial for ensuring an effective SDG localization process:

- **Awareness raising.** Actions focused on presenting SDGs contexts and specific requirements at the local level, increasing citizens' understanding and ownership of the SDGs as well as presentation of clear guidance on SDGs implementation steps and available supportive measures, both at the national and local levels;
- **Advocacy.** This includes a subnational perspective of national SDG strategies. Establishment and operation support of local level institutional and administrative frameworks aimed at emphasizing the role of local and regional governments in the process of national commitments localization;
- **Implementation.** Support of various SDG-specific action plans development and implementation. The process should start from the conducting needs assessment research aimed at determining the priority spheres for future implementation of the identified actions. At this stage it is important to prioritize those goals and targets that best respond to their specific contexts and needs;
- **Evaluating and learning** from the experiences of implemented projects. Analysis of the available case-studies and lessons learnt from the previously implemented SDG-specific projects could become available part of the localization strategy. Evaluation of the main findings, implementation gaps and barriers that were discovered during the process of case projects execution during the development phase could save a considerable local resources and increase operational effectiveness of the developed action plans.

Analysis of the experiences in SDG localization in ASEAN identified the following areas in which the commitment and actions of the Governments are needed, in order to enable an effective process of SDG localization (UNDP, 2018):

- **Enabling a policy and institutional environment.** SDG localization includes the adoption of laws and regulations that ensure policy coherence, cohesion as well as coordination and cooperation among all relevant stakeholders. This is not only vital for SDG integration into national and local planning and budgeting processes, but for achieving specific targets. Policies may need to be changed or new means of services may need to be developed in order to achieve a specific target. A strong yet flexible and agile enabling policy and institutional framework is required in order to adopt and implement measures for achieving specific targets;

- **Energy data monitoring.** Reliable and disaggregated data are imperative for decision-making processes and for ensuring that no one is left behind. Strong data systems are required at the national and local levels that provide baseline data and track achievement against SDG targets;

- **Cooperation with relevant partners.** One of the core principles that underpin Agenda 2030 is that multi-stakeholder engagement is critical to the achievement of SDGs. It will require the sustained efforts of all stakeholders – civil society, the private sector, academia, individuals, countries and multi-lateral organizations – to work together to develop and implement initiatives for achieving the SDGs;

- **Improved access to financing for the SDGs.** Mobilizing public resources domestically and aligning private sector investment with the SDGs as well as promoting equity, efficiency and effectiveness in the use of resources. With the financing landscape becoming more dynamic, new types of financing mechanisms are available for SDG achievement. Measures need to be put in place to leverage and align not only large-scale investments but also smaller financial initiatives that promote sustainable development;

- **Implementation of new solutions.** Innovation refers to both social innovation that promotes collaborative engagement among all stakeholders to address development challenges, and to the use of new technologies to promote efficiency in SDG implementation strategies. However, more needs to be done to enable innovation within the public sector, including (a) establishing collaborative spaces, and developing public sector capacities to leverage the collaborative spaces, and (b) new technologies to develop new initiatives for achieving the SDGs. The rise of smart cities offers an opportunity to revamp the public sector.

Regulatory Indicators for Sustainable Energy (RISE) (World Bank, 2016) offer snapshots of countries' policies and regulations in the energy sector, structured around the three pillars of sustainable energy – i.e., energy access, energy efficiency and renewable energy. Under each pillar there are different sets of indicators, with the following themes being common among them:

- Legal frameworks;
- Institutions and planning;
- Incentives and financing mechanisms;
- Other policy instruments, including different end-use sectors.

The Asia-Pacific Regional Guidelines on Voluntary Local Reviews (ESCAP, 2020c) emphasize the role of local governments in the SDG localization process, and define the following types of indicators for tracking related progress:

- Context indicators. These indicators describe the context in which subnational governments work. These are situations and developments in which they can only exert a small amount of

Table 4. SDG 7 Localization Indicators

№	SDG 7 Localization Indicators	Description
1.	Available policies and institutions for SDG localization	Availability of specific policies and institutions focused on supporting the SDG 7 implementation.
2.	Energy data monitoring	Accessibility and penetration of energy monitoring and smart metering.
3.	Cooperation with national and international stakeholders	Efficient communication and collaboration between local stakeholders and various stakeholder groups at the national and international levels.
4.	Use of financial resources	Availability of various financial resources and instruments for supporting SDG 7 implementation actions.
5.	Awareness raising and capacity-building	Availability of policies or actions to increase the understanding among citizens and build the capacity of professionals for SDG 7 implementation.
6.	Implementation	Presence of policies and actions to implement SDG 7 targets.
6.1.	Energy access	Policies or actions taken by cities on energy access.
6.2.	Renewable energy	Policies or actions taken by cities on renewable energy.
6.3.	Energy efficiency	Policies or actions taken by cities on energy efficiency.
7.	Linkages to other SDGs	Availability of policies or actions with linkages between SDG 7 and other SDGs.
7.1.	SDG 3. Good health and well-being.	The presence of energy-related activities or measures that support the health sector.
7.2.	SDG 6. Clean water and sanitation.	The presence of energy-related activities or measures that support water and sanitation.
7.3.	SDG 11. Sustainable cities and communities.	The presence of energy-related activities or measures that support development of sustainable cities and communities.
7.4.	SDG 12. Responsible production and consumption.	The presence of energy-related activities or measures that support responsible production and consumption.
7.5.	SDG 13. Climate action.	The presence of energy-related activities or measures that support climate action.

control, e.g., employment rates or number of people living in slums;

- Input indicators. These **indicators** provide information about the people and resources that are used to achieve a certain goal or action, e.g., financial resources used for a certain action or number of employees;

- Process **indicators**. These **indicators** provide information about the organization or the approach of an action or measure, e.g., the turnaround time of a housing permit, or the involvement of citizens in an action;

- Impact **indicators.** These **indicators** measure the impact/result/output of goals/actions, e.g., improvement in citizen health or the number of vaccines delivered.

Based on the synthesis of the information from various sources, followed by several expert discussions, seven primary indicators and eight sub-indicators related to SDG 7 localization were identified to cover important areas of the local context in a city or subnational jurisdiction, such as: policy and institutional environment, capacity, resources, and implementation efforts and linkages to other SDGs. These indicators underwent several rounds of expert reviews to arrive at the final set, which is presented in table 4. It is important to note that these indicators are not for measurement of the level of cities' achievement of the quantitative targets under the SDG 7. These qualitative indicators are based on the cities' self-assessment of their capacity and availability of policies, actions and resources for supporting SDG 7 localization.

The outlined indicators play a central role in this analytical work as they provide a qualitative evaluation of cities' status on SDG 7 localization, offer an evidence base for constructing recommendations tailored to the local context, and serve as baseline results for tracking cities' progress of local SDG 7 localization efforts.

Methodology of SDG 7 localization analytical framework

The developed analytical framework can be applied for the analysis of the local context of any selected jurisdiction through the following steps.

Step 1. Data collection

The SDG 7 Localization Questionnaire (see Annex 1) is aimed at collecting data from a city or subnational jurisdiction (i.e., provinces, municipalities, cities, districts etc.) in order to assess the situation of implementation of different mechanisms and ongoing activities related to SDG 7.

The questions included in the questionnaire were formulated in a way that allows capturing the key information and qualitative data under each of the seven SDG 7 Localization Indicators and related Sub-Indicators, with multiple questions or sometimes different parts of questions contributing to different indicators. The questionnaire was structured in two main parts:

- Part 1. Current status of SDG 7 and other SDG-related indicators the city. Developed to prepare an overview of the local context across various areas related to SDG 7 localization (figure 6), and to "translate" the answers from the jurisdiction into scores (from zero to 100) for each of the SDG 7 Localization Indicators;
- Part 2. Implementation of sector-specific and cross-sectoral integrated urban solutions. Developed as a tracking tool on the implementation of various sector-specific and cross-sectoral energy efficient and renewable energy solutions, covering different energy end-users and energy generation facilities available in the jurisdiction.

These two parts consisted of 45 questions, with three types of questions – simple binary questions, multiple answer question, and open-end questions.

Figure 6 Main areas covered by the SDG 7 Localization Questionnaire

General information	Location, climate, institutional capacity
Sustainable energy	Energy generation and end-use, targets and regulations in the city, sector specific incentives and support
Healthy lives and well-being	Evaluation of healthcare facilities with cooling space
Water management and sanitation	Quality, availability and support measures
Resilient city infrastructure	Living conditions, transport and pedestrian infrastructure availability, air pollution
Climate change and its impacts	Availability of relevant plans and programs

Table 5. Linkages between questions of SDG 7 Localization Questionnaire and SDG 7 Localization Indicators

№	SDG 7 localization Indicators	Questions of SDG 7 Localization Questionnaire
1.	Available policies and institutions for SDG localization	Q1.4, Q2.1, Q2.3, Q2.7, Q2.8
2.	Energy data monitoring	Q1.6, Q1.8, Q2.6
3.	Cooperation with national and international stakeholder	Q1.5, Q2.2, Q2.4
4.	Use of financial resources	Q2.9, Q4.5
5.	Awareness raising and capacity building	Q1.7, Q2.5
6.	Implementation	
6.1.	Energy access	Q1.6, Q2.10, Q2.12, Q2.13
6.2.	Renewable energy	Q1.6, Q2.6, Q2.10
6.3.	Energy efficiency	Q1.6, Q2.6, Q2.10
7.	Linkages to other SDGs	
7.1.	SDG3. Good health and well-being.	Q3.1, Q3.2
7.2.	SDG6. Clean water and sanitation.	Q4.1, Q4.2, Q4.3, Q4.4
7.3.	SDG11. Sustainable cities and communities.	Q1.6, Q5.1, Q5.2, Q5.3, Q5.4
7.4.	SDG12. Responsible production and consumption.	Q5.6
7.5.	SDG13. Climate action.	Q6.1
	Unlinked questions (used for additional information only)	Q2.11, Q5.5, Q5.7

Step 2. Data analysis

Answers that were provided in the questionnaire were decoded into numeric values based on the meaning of the answer for the SDG 7 localization process, which were then aggregated into the overall score (between zero and 100) for each SDG 7 Localization Sub-Indicator and Indicator.

First, the score for each question is calculated, as a difference between the sum of the actual answers (in format of decoded numeric values) and the sum of maximum possible answers (with highest value). Each question has a pre-determined numerical 'weight' or contribution to one or more SDG 7 indicators, measured between 0 and 1 (where '0' indicates that the question is not related to a particular indicator, and '1' means that the question has a maximum direct connection to this indicator, among other questions). The final score for each indicator is calculated as a weighted average between summarized actual scores for questions, related to a selected indicator, and summarized maximum possible scores, related to a selected indicator, multiplied by their respective "weights".[5]

Table 5 shows the linkages between the questions of the SDG 7 Localization Questionnaire and each SDG 7 Localization Indicator and Sub-Indicator. The answers to the questions listed for each indicator or sub-indicator were aggregated to arrive at the final score for that particular indicator or sub-indicator. Some questions (for example Q2.10) were mentioned for more than one indicator, which means that different parts of the same questions were considered under different indicators.

The weight for each question were established in consultation with a group of 10 experts. The Delphi method (Skinner, Nelson, Chin and Land, 2015) was used to collect the expert assessments regarding the importance of each question for

5 This calculation is conducted for all questions in Part 1 of the questionnaire (except for 2.11, 5.5 and 5.7, as they provide additional information not considered in the calculation).

each of the SDG 7 Localization Indicators and Sub-Indicators over the course of two online sessions. During the first session, a group of experts independently and anonymously submitted their own subjective weights for each of the questions in the questionnaire, following the instructions of the session's moderator. After the session, the moderator, who did not take part in the assessment of the weights, aggregated all the answers to arrive at preliminary average weights across all the experts' assessments. These results were shared with the participating experts after the session for the review. During the second session each preliminary average weight was discussed within the group. The experts had the opportunity to provide feedback on the results and propose adjustments. The adjustments were made if the consensus was achieved among the experts. After the session, the moderator made the revisions and shared the updated version with the experts for their final comments – after that the values of the questions' weights were considered final.

It is important to note that the indicators used in this analytical framework are qualitative and should not be used for assessing cities' achievement of quantitative targets under the global SDG 7. The results for these qualitative indicators are based on cities' self-assessment of their current conditions, efforts, resources and capacity in relation to supporting SDG 7 localization process and can serve the role of the evidence base for constructing recommendations tailored to the local context, as well as the baseline results for tracking cities' progress of their SDG 7 localization efforts. The results for each indicator are presented as a nominal score from 0 to 100 (where 100 is the maximum possible score that can be achieved for each indicator or sub-indicator based on the aggregation of all answers of the questionnaire).

Step 3. SDG 7 localization snapshot

The main results of the data analysis for each city are presented in a concise publication – SDG 7 Localization Snapshot (SDG7 Snapshots, 2021). The results are organized around several diagrams to show the selected aspects of the SDG 7 localization status of the city, followed by high-level recommendations tailored to the local context, based on the answers to the questionnaire and the resulting scores for the indicators.

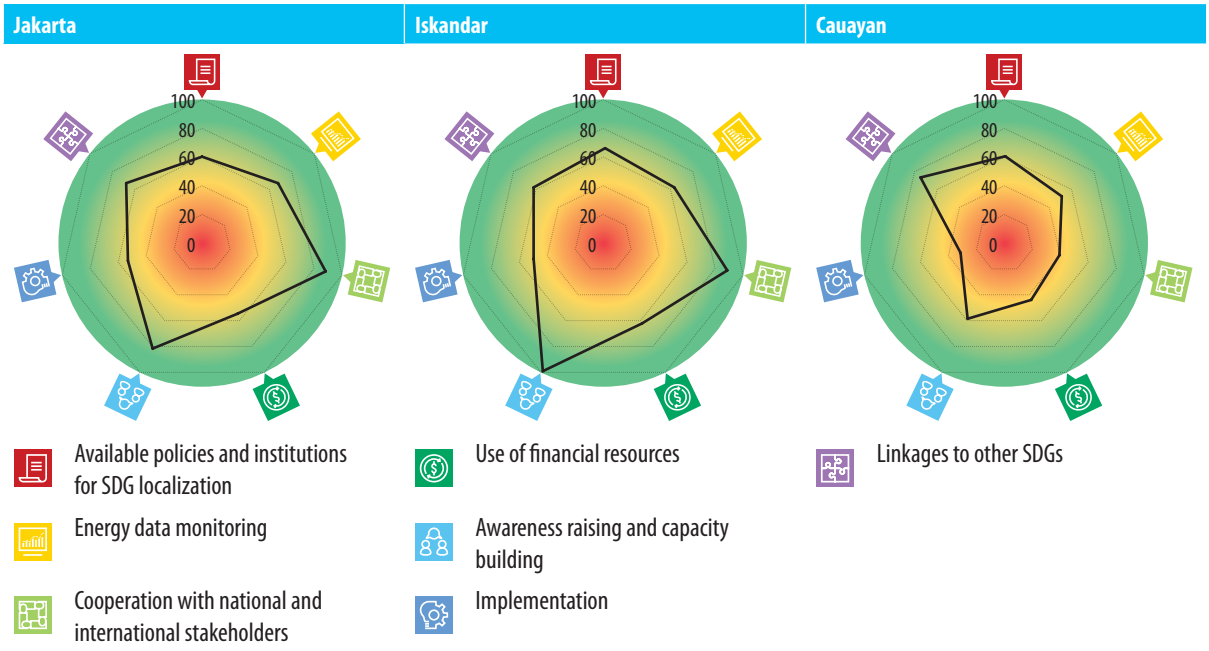
The main spider diagram (Figure 7) presents the results for all seven SDG 7 Localization Indicators at once. The diagram provides a visual picture of how a jurisdiction performs in each of these areas based on the overall nominal score (from zero to 100) calculated for each indicator. The further the score is from the maximum 100 points, the more room there is for improvements in that particular area of the SDG 7 localization process.

The examples in figure 7 show a snapshot of the status on SDG 7 localization in three jurisdictions – Jakarta in Indonesia, the Iskandar region in Malaysia, and Cauayan in the Philippines. All three jurisdictions are taking actions on SDG 7 localization and are working closely with ESCAP on the development of SDG 7 Roadmaps, including technological and policy pathways to contribute to achievement of SDG 7 at the local level.

The results in figure 7 show that Jakarta has already made notable progress on cooperation with stakeholders, and awareness-raising and implementation activities related to SDG 7. Further improvements are required for strengthening necessary policies and institutions, establishing robust data collection and monitoring systems as well as ensuring the availability of various financial resources and instruments to support efforts on achieving sustainable energy.

Iskandar shows a similar picture to the Jakarta configuration of results across the indicators, which can be easily observed from the shape of the line on the spider diagram. Iskandar demonstrates the maximum possible score of 100 points for awareness-raising and capacity-building. As in Jakarta, additional improvements in Iskandar are needed in the areas of financial

Figure 7 Results for SDG 7 Localization indicators in three cities



resources, policy development and energy data monitoring, as the respective indicators show fairly modest scores.

The results for Cauayan show a different picture. Most of the efforts related to SDG 7 are taking place in the areas linked to other SDGs, which corresponds to a relatively high score for the indicator on linkages to other SDGs. That might be an indication that SDG 7 is not high on the list of the city's priorities, which is confirmed by a relatively low result for the indicator on Implementation. This suggests that projects and initiatives directly focused on SDG 7 implementation (i.e., energy efficiency, renewable energy and energy access) are quite limited at the moment, and need additional support and acceleration from the local government. This is especially the case when it comes to disbursement of financial resources, improving energy data collection and monitoring as well as more active collaboration with national and international stakeholders in the field of sustainable energy.

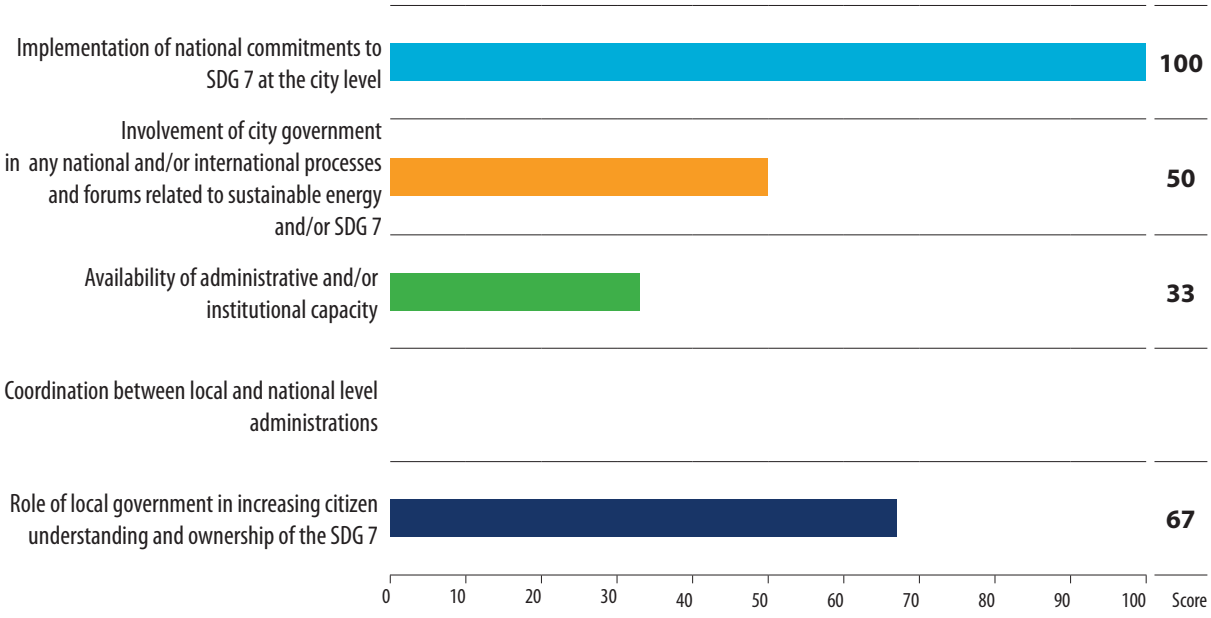
SDG 7 Localization Snapshot also investigates more specific areas of local efforts, crucial for an effective SDG 7 localization process. Based on the desktop review and expert inputs, the following topics were included in the SDG 7 Localization Snapshot to draw the attention of the local stakeholders to the jurisdiction's progress in these important areas:

- SDG 7 commitments and institutional capacity in the jurisdiction;
- Availability and utilization of energy efficient and renewable energy technologies;
- Implementation of SDG 7 support targets and policies.

The results for these areas are presented in figures 8, 9, 10 and 11 based on the assessment for Cauayan City in the Philippines and Jakarta city in Indonesia.

Figure 8 provides an example of the results for SDG 7 commitments and institutional capacity

Figure 8 Assessment results on SDG 7 commitments and institutional capacity



for Cauayan City in the Philippines.[6] The aim of this figure is to assess local government work being carried out in collaboration with the national Government in relation to SDG 7 implementation, the alignment between national and local commitments to SDG 7, and any existing coordination mechanisms between different levels of governance, which are crucial for effective implementation of the actions toward achievement of SDG 7. The city can lead by example and set its own targets and commitments on SDG 7 (which might even more ambitious than the national ones), or implement similar targets to the ones set at the national level. In any case, the effectiveness of SDG localization increases if there are mechanisms for coordination and communication regarding SDG-related efforts at the national and local levels (UCLG ASPAC, 2016).

Local capacity for implementing actions and following through on the commitments is another crucial factor in achieving successful SDG localization (figure 8). Effective SDG 7 localization is not possible without having the general public on board, making choices and adjusting their behaviour in support of sustainable energy. Local governments are well-positioned to play a key role in improving citizens' understanding and knowledge of SDG 7 and the importance of the related actions that can be taken by everyone (figure 8). Awareness-raising campaigns, educational programmes and professional training programmes for different groups of people are important tools that can used by the local government to make improvements in this area.

The example of the results in figure 8 shows that currently there are no existing mechanisms specifically for coordination of efforts on SDG 7 between national and local governments. At the moment, it is not preventing the city from ensuring the implementation of the national commitments on SDG 7 at the local level. However, such results regarding coordination between local and national governments on SDG 7, for the Cauayan city, were received because answers in the questionnaire indicates, that city have no information or not aware of

6 The results shown in figure 8 are aggregated from the answers to the questions 2.1, 2.2, 2.3, 2.4, and 2.5 of the SDG 7 Localization Questionnaire (Annex 1).

Figure 9 Assessement results on energy access

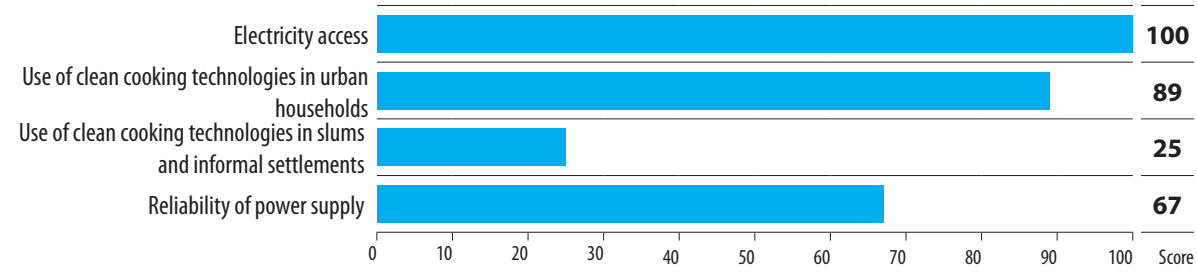
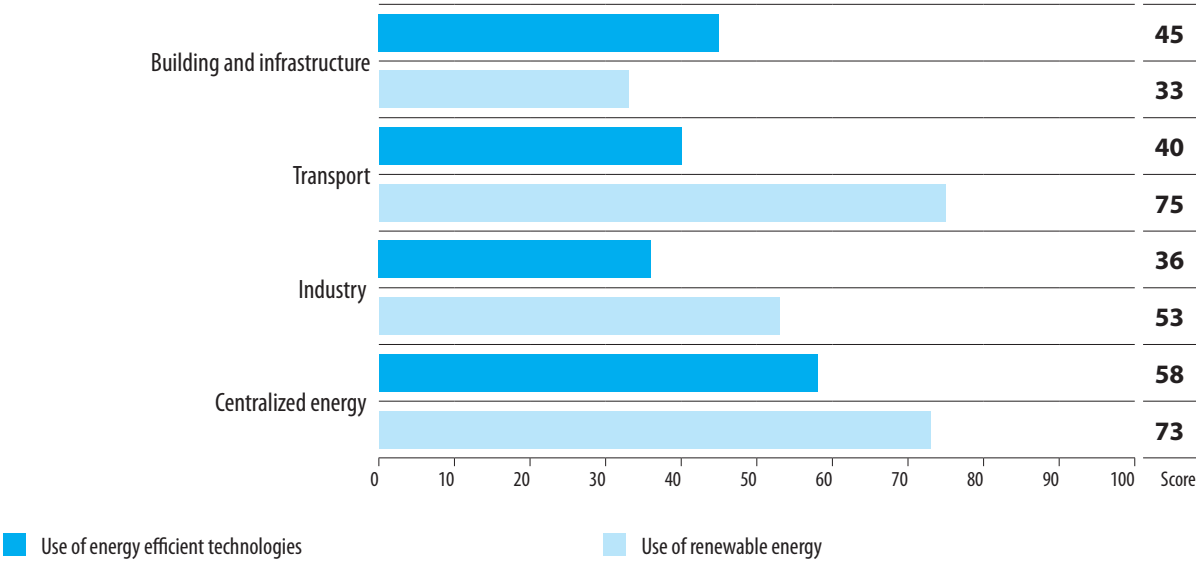


Figure 10 Assessment results on utilization of energy efficient and renewable energy technologies by end-use sector

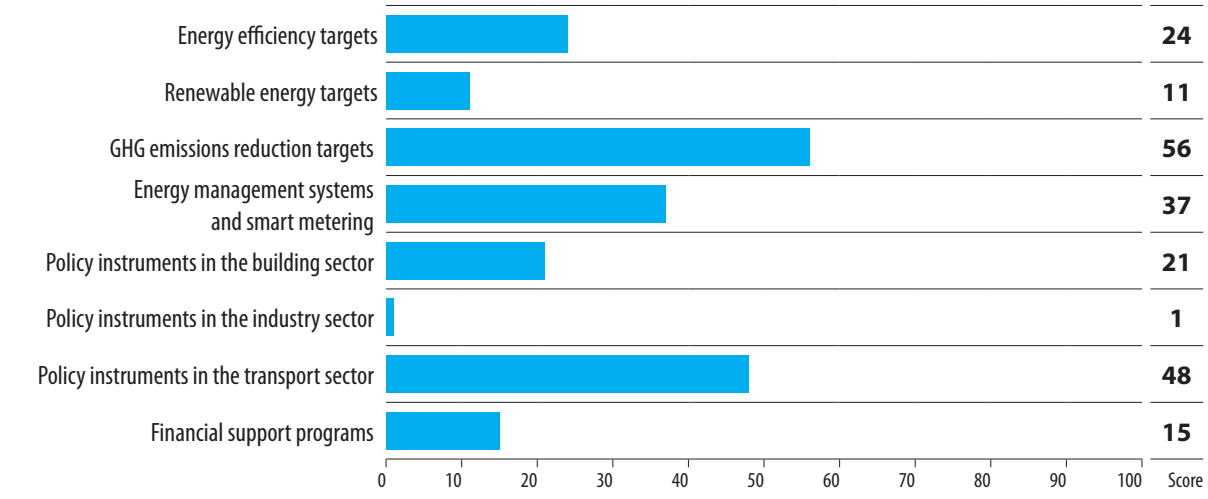


such coordination and suggests that national commitments on SDG 7 are being implemented at the local level without consultation with the Government. It shows that the city acts as an independent leader; on the other hand, the absence of coordination mechanisms might limit national support for the city and create potential misalignments between national and local efforts. Introduction of such mechanisms can unlock further support from the Government, which together with increasing the availability of administrative and institutional capacity are important actions in scaling up efforts on SDG 7.

Figure 9 shows example results of the self-assessment on several aspects of energy access for the Jakarta City in Indonesia,[7] including the scale of electrification of buildings, reliability of power supply, and use of clean cooking technologies for urban households and slums. Figure 9 shows that the city has good electricity access; however, there is room for improvement when it comes to the use of clean cooking technologies in urban households. Moreover, access to clean cooking in slums presents a real challenge, based on the low assessment score (only 25 out of 100), and should be addressed by the local government as part of its efforts to improve energy access and slum upgrade strategies. Energy end-users have

7 The evaluation was conducted based on the answers of the specific Jurisdictions to questions 2.10, 2.12 and 2.13 of the SDG 7 Localization Questionnaire (Annex 1).

Figure 11 Examples of results from implementation of SDG 7 support targets and policies



an established connection to the electrical grid; however, the city reported power supply reliability issues and the occurrence of power outages.

Assessment of the utilization of energy efficiency and renewable energy technologies, for the Jakarta City in Indonesia, presented in figure 10, is conducted for centralized energy, industry, transport, buildings and infrastructure.[8] The results show that renewable energy is widely used in the centralized energy generation and transport sectors, while its use in industry, buildings and infrastructure remains fairly limited.

The results for energy efficiency implementation are very modest across all the analysed sectors, with an average score of 45 points out of a possible 100. The city should accelerate its efforts on energy efficiency improvement to benefit from the cost-effective potential, as such measures can offer to reduce energy demand across all the main energy-consuming sectors.

Figure 11 presents the results for the implementation of SDG 7 support targets, key regulations and policies policies for the Jakarta City in Indonesia. It covers (a) energy-efficiency targets, (b) renewable energy targets, (c) GHG emissions reduction targets, (d) energy management systems and smart metering, (e) policy instruments in the building, industry and transport sectors, and (f) financial support programmes. The results were aggregated from answers to multiple questions in the questionnaire based on cities' assessments of the implementation of various types of policies locally. The results across the presented categories of policy instruments are consistently low except for the transport sector. Additional efforts should be made in the city towards setting sustainable energy targets, establishing energy management systems and developing policy packages for buildings and industry. Particular focus should be placed on unlocking access to finance for implementation of sustainable energy policies and projects.

The SDG 7 Localization Snapshot also includes a set of recommendations for further improvements of each of the SDG 7 Localization Indicators and Sub-Indicators. The recommendations are tailored to the local context of the jurisdiction, based on the answers provided in the SDG 7 Questionnaire and the results of the data analysis. The databases of possible high-level recommendations for different levels of scores for each question in the SDG 7 Localization Questionnaire were prepared and pre-defined by the project team

8 Evaluation was conducted based on the answers of the specific Jurisdictions to the questions 2.10 of the SDG 7 Localization Questionnaire (Annex 1)

and reviewed by a group of experts. Depending on the score assigned for each question, a recommendation was provided from the respective score range. There were three to five pre-defined recommendations for each question, based on ranges of different scoring. Also, the methodology was designed to provide tailor-made or personalized recommendations based on the city's answers in some of the questions.[9]

9 For example, questions 1.4, 2.6.4, 2.7, 2.8, 2.9 and 2.10.

SDG 7 localization in selected ASEAN cities

CHAPTER 3

The SDG 7 Localization Questionnaire (Annex 1) was sent to more than 90 cities and subnational jurisdictions in ASEAN with the help of city networks and associations active in the region (e.g., UCLG ASPAC, CityNet, ICLEI and Smart Cities Network). A total of 26 cities and jurisdictions submitted responses, from which 20 were selected for this study (table 6), as they provided sufficient information for the data analysis.

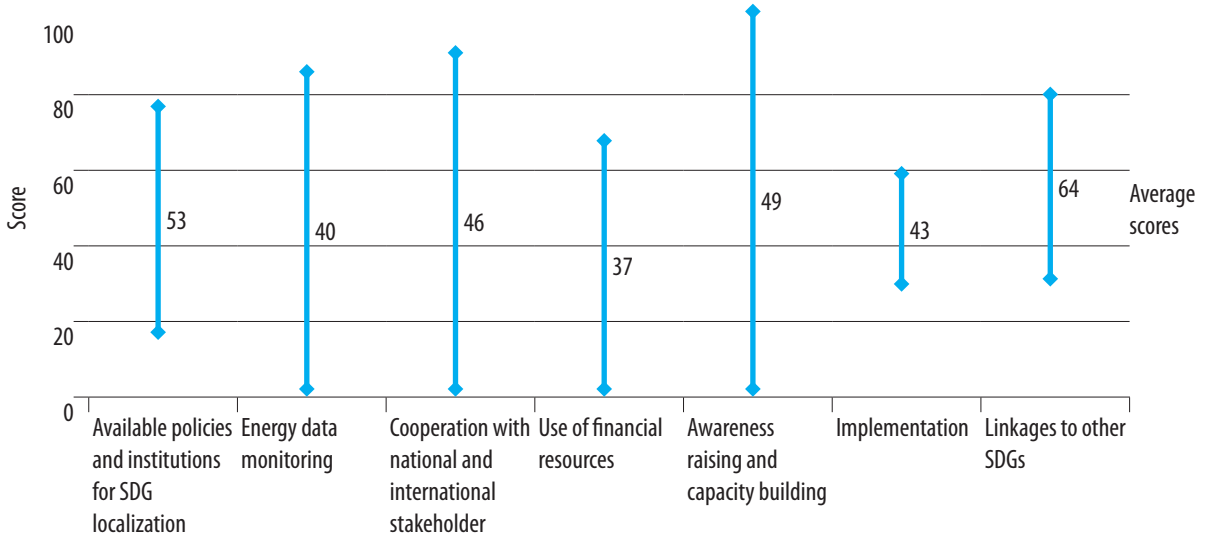
The analytical framework for SDG 7 localization described in the previous chapter was applied to the data collected from these 20 jurisdictions, and this chapter presents selected results and lessons learnt from the data synthesis and analysis across them.

Figure 12 presents the range and average total scores for each SDG 7 Localization Indicator aggregated across all 20 jurisdictions. The average score across all the jurisdictions and the indicators was 47 points out of maximum 100, which shows

Table 6. Selected ASEAN jurisdictions for the analysis

Jurisdiction	Country	Population, million people	Jurisdiction	Country	Population, million people
Bago	Philippines	0.2	Iskandar	Malaysia	2.0
Borongan	Philippines	0.1	Penang	Malaysia	1.8
Cauayan	Philippines	0.1	Putrajaya	Malaysia	0.1
Munoz	Philippines	0.1	Subang Jaya	Malaysia	1.0
Muntinlupa	Philippines	0.5	Balikpapan	Indonesia	0.7
Ormoc	Philippines	0.2	Jakarta	Indonesia	10.6
Quezon	Philippines	3.1	Palembang	Indonesia	1.7
Santa Rosa	Philippines	0.4	Kaysone Phomvihane	Lao PDR	0.1
Vigan	Philippines	0.1	Pakse	Lao PDR	0.1
Zamboanga	Philippines	0.9	Da Nang	Viet Nam	1.1

Figure 12 Total scores for primary SDG 7 Localization Indicators aggregated across 20 selected jurisdictions



modest progress towards SDG 7 localization. Common challenges to SDG 7 localization across selected jurisdictions, revealed by the lowest average scores (figure 12), include the use of financial resources (Indicator 4), energy data monitoring (Indicator 2) and implementation (Indicator 6).

All the selected jurisdictions started the process of SDG 7 localization, but are currently at different stages, as demonstrated by the total city scores, ranging from 13 points in Bago City in the Philippines to 71 points in the Iskandar region in Malaysia (table 7). The results show that only around 40 per cent of evaluated jurisdictions (9 out of 20) are using half or more of their existing SDG 7 localization opportunities.

The results for all SDG 7 Localization Indicators across 20 cities (table 7) show that only five

Table 7. Resulting scores for SDG 7 Localization Indicators and selected jurisdictions in ASEAN

Jurisdiction	SDG 7 Localization Indicator*							Total score
	1	2	3	4	5	6	7	
The Philippines								
Bago	17	0	0	0	0	30	50	14
Borongan	40	11	0	3	18	37	48	22
Cauayan	61	52	39	43	59	32	75	52
Munoz	66	29	33	16	51	30	66	42
Muntinlupa	53	19	28	39	82	46	68	48
Ormoc	48	21	61	22	59	54	61	47
Quezon	77	31	61	45	35	59	76	55
Santa Rosa	46	32	44	6	0	43	69	34
Vigan	51	34	11	16	47	30	65	36
Zamboanga	40	19	39	63	18	41	57	40
Malaysia								
Iskandar	66	63	89	62	100	50	63	70
Penang	54	56	62	59	24	52	77	55
Putrajaya	52	84	50	66	35	57	80	61
Subang Jaya	66	46	77	53	76	41	68	61
Indonesia								
Balikpapan	52	53	39	0	47	40	70	43
Jakarta	61	68	89	55	82	54	68	68
Palembang	67	38	39	63	35	49	62	50
Lao PDR								
Kaysone Phomvihane	29	12	61	32	65	30	31	37
Pakse	39	61	28	36	59	32	65	46
Viet Nam								
Da Nang	65	66	77	57	82	46	57	64

* Indicator description:
Indicator 1 – Available policies and institutions for SDG 7 localization
Indicator 2 – Energy data monitoring
Indicator 3 – Cooperation with national and international stakeholders
Indicator 4 – Use of financial resources
Indicator 5 – Awareness raising and capacity building
Indicator 6 – Implementation Indicator
Indicator 7 – Linkages to other SDGs

jurisdictions demonstrated significant progress (i.e., a score of 80 and higher out of possible 100) across seven SDG 7 Localization Indicators, i.e., Muntinlupa (Indicator 5 on awareness raising and capacity-building), Iskandar (Indicators 3 and 5 on cooperation with stakeholders, and awareness raising and capacity-building, respectively), Putrajaya (Indicators 2 and 7 on energy data monitoring, and linkages to other SDGs, respectively), Jakarta (Indicators 3 and 5 on cooperation with stakeholders, and awareness raising and capacity-building, respectively) and Da Nang (Indicator 5 on awareness raising and capacity-building). The region of Iskandar, Malaysia, is the sole jurisdiction that achieved 100 points for Indicator 5 on awareness raising and capacity-building. More detailed observations and analyses, conducted by specific indicators, are presented below.

Indicator 1 Available policies and institutions for SDG 7 localization

The following topics are covered by this indicator through the respective questions in the questionnaire – multilevel governance approach, level of decentralization, and coordination mechanisms between different levels of governance. Questions were also focused on abilities of the jurisdiction to introduce legislation, enforce legislation or assign tasks of enforcement (monitor, penalize, award and surveillance), apply taxes (fiscal powers to create and collect taxes), subsidize and/or provide grants, and set targets and obligations.

Evaluation of enabling a policy environment for SDG 7 localization (VVSG, 2018) focused on the following: (a) key principles (policy coherence, cohesion, coordination and cooperation) and strategies; (b) the national commitments to SDG 7 and their implementation at the local level through local policies and projects; and (c) availability of administrative and/or institutional capacity responsible for implementation of initiatives related to sustainable energy and/or SDG 7. The following evaluation criteria were selected for analysing the response: (a) the presence of such institutions/appointed specialists in the jurisdiction; (b) availability of guidelines for setting up such an institutional framework; (c) appointment of responsible department/ dedicated specialists; and (d) sufficiency of their capacities to support sustainable energy projects.

The presence of various sustainable energy policy instruments that exist or are planned to be introduced shortly in the jurisdiction buildings sector (the residential sector, public buildings, commercial buildings, slums and informal settlements) and industry, was also evaluated. The following most common policy instruments were included in the cities' self-evaluation:

- Energy efficiency policy for new construction and retrofits;
- Programme to promote utilization of local materials in construction and retrofits;
- Sustainable procurement regulations, energy performance certification and labelling of buildings;
- Smart metering;
- Energy efficiency obligations schemes/white certificates;
- Carbon market project mechanisms/green certificates;

- Awareness raising, education and information campaigns on sustainable energy;
- Net-metering regulations;
- Mandatory requirements for on-site solar generation, use of ecological standards (ISO 14001 or similar);
- Use of energy management standards (ISO 50001 or similar);
- Energy efficiency action plan;
- Mandatory energy auditing;
- Use of renewable energy for hot water;
- Use of renewable energy for cooling or heating;
- On-site water treatment;
- Connection to the district energy source, in cases of availability.

The following policies and regulations for the transport sector (passenger and freight transport) were included in the cities' self-evaluation:

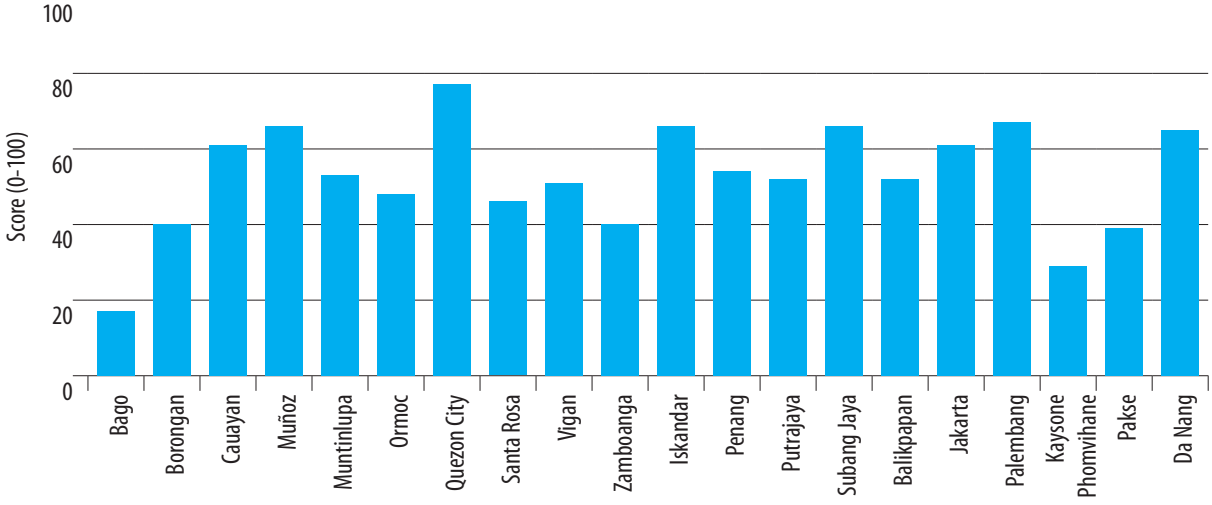
- Regulations on high standard liquid fuel use (petrol and diesel EURO-5 or higher),
- Use of hybrid/electrical engines, LPG or similar gas type,
- Biogas and hydrogen engines,
- Mandatory Eco-drive trainings,
- Policies on integration of transport low emission zones and timing limits,
- Bus rapid transit lines.

The majority of jurisdictions analysed showed scores higher than 50, but lower than 80 (figure 13), indicating that visible, but modest progress on the development of polices and institutions is being made at the local level.

Detailed results of the SDG 7 localization Indicator 1 for selected cities in ASEAN, according to the related questions in the SDG 7 Localization Questionnaire (Annex 1), are presented in table 8.

As stated in the Renewables in Cities Global Status Report (REN21, 2019): "In many parts of the world, city governments still lack the financing, power and legal authority needed to pursue ambitious energy and climate strategies. In Asia,

Figure 13 **Total scores for Indicator 1 scores for 20 selected jurisdictions in ASEAN**



Latin America and sub-Saharan Africa, many cities depend heavily on their national Governments for funding and access to financial markets, and have comparatively little rule-making authority". The results of the research conducted show that most of the analysed jurisdictions in ASEAN, based on their self-assessment, have high availability of power. Such power is focused on the introduction or enforcement of existing legislation, application of taxes, subsidizing and/or providing grants, and setting targets and obligations (except for Kaysone Phomvihane, Pakse and Da Nang) as well as implementation of the national SDG 7 commitments at the local level (except Munoz, Vigan and Zamboanga). In such cases it is important to ensure that local efforts on SDG 7 implementation are in line with the national commitments and plans, or are even more ambitious, so that the cities can lead by example. Exploring the ways to apply a Multi-Level Governance (MLG) approach (Local2030, 2020) to implementing SDG 7 is recommended in order to enhance the efficiency of coordination between national and local levels of governance.

Table 8 shows that a number of jurisdictions consider that they are making significant efforts on implementation of national commitments to

Table 8. Assessment results for the questions related to available policies and institutions for SDG 7 localization

Country	Jurisdiction	SDG 7-related powers of local government	Local implementation of national commitments	Availability of administrative and institutional capacity	Sustainable energy policy instruments in buildings and infra-structure sectors	Sustainable energy policy instruments in the industry sector	Sustainable energy policy instruments in transport sector
The Philippines	Bago	100	0	0	0	0	0
	Borongan	100	100	0	11	14	11
	Cauayan	100	100	33	33	33	63
	Munoz	100	33	67	62	62	73
	Muntinlupa	100	100	0	34	58	24
	Ormoc	100	100	0	29	29	25
	Quezon	100	100	100	57	57	51
	Santa Rosa	100	100	33	20	23	3
	Vigan	100	67	0	41	51	47
	Zamboanga	100	33	0	35	35	33
Indonesia	Iskandar	80	100	100	37	55	28
	Penang	100	100	67	29	30	0
	Putrajaya	100	100	67	33	0*	12
	Subang Jaya	100	100	67	41	42	49
Malaysia	Balikpapan	100	100	67	10	30	8
	Jakarta	100	100	100	21	1	48
	Palembang	100	100	67	17	72	45
Lao PDR	Kaysone Phomvihane	40	100	0	1	1	33
	Pakse	60	100	33	1	9	33
Viet Nam	Da Nang	60	100	100	45	67	20

*Area is an industry free zone.

Box 9 Regulation of Green Buildings in Jakarta. Indonesia

The Governor Regulation of DKI Jakarta No. 38/2012 on Green Buildings regulates the planning, construction, utilization, maintenance and deconstruction of buildings in Jakarta. It focuses on energy efficiency, water efficiency, indoor air quality, waste and soil treatment, and construction activities.

The regulations apply to specific building sizes and types: apartment buildings, office buildings, trade buildings, and buildings that have more than one function within one building, with floor space larger than 50,000 m^2; buildings for businesses, hotels, social and cultural functions, and health-care buildings with floor size greater than 20,000 m^2; and buildings for social and cultural functions, educational service buildings, with floor size greater than 10,000 m^2.

Requirements for new construction

Energy efficiency. This covers efficiency of the building envelope, ventilation systems, air systems, lighting systems, building transportation systems and electrical systems. Water efficiency: planning of water-saving sanitary equipment and planning of the use of water.

Indoor air quality. Land and waste management: requirements regarding spatial landscape planning on the inside and outside the buildings, and planning of rainwater reservoir systems, supporting facilities, and solid and liquid waste management.

Implementation of construction activities. This includes safety, work health and environment, water conservation when conducting construction activities, and the management of hazardous and toxic waste in construction activities.

Requirements for existing buildings

Existing buildings (buildings under construction and/or already for use) must consider: conservation and energy efficiency; conservation and water efficiency; indoor air quality and thermal comfort; and operational management/maintenance.

Source: IEA, 2017.

SDG 7 at the local level (except for Bago, Munoz, Zamboanga and, to some extent, Vigan), while the level of implementation of the sectoral policies for buildings, transport and industry remains relatively low. This result means that the national commitments are not effectively translated into sectoral policies, and/or that the national commitments might not be clear enough in relation to the requirements for how they should be implemented at the local level as well as through which policy instruments. As detailed in box 9, this conclusion is also supported by relatively low assessment scores regarding the coordination between national and local levels of governance.

Policy implementation processes at the local level may start with existing national policy instruments, and/or cover specific sectors or energy end-users in the jurisdiction. Monitoring and verification of the results, achieved after "pilot" implementation of selected policy instruments, are needed for possible fine-tuning and adaptation to the local conditions and requirements. An exemplary practice would be to work towards expanding and refining the policy framework in order to arrive at an effective mix of regulatory measures, incentives and information instruments. It is crucial for local governments to allocate budgetary resources for appointing special staff to be responsible for the efforts on sustainable energy and to widen their capacity through professional training to ensure they have

sufficient knowledge of SDG 7-related issues and solutions is to support effective SDG 7 localization process. Cities can explore how their intervention in the energy sector, e.g., investing in specific projects with returns, can build dedicated revenue streams that support more staff dedicated to SDG 7 with greater capacity.

Indicator 2 Energy data monitoring

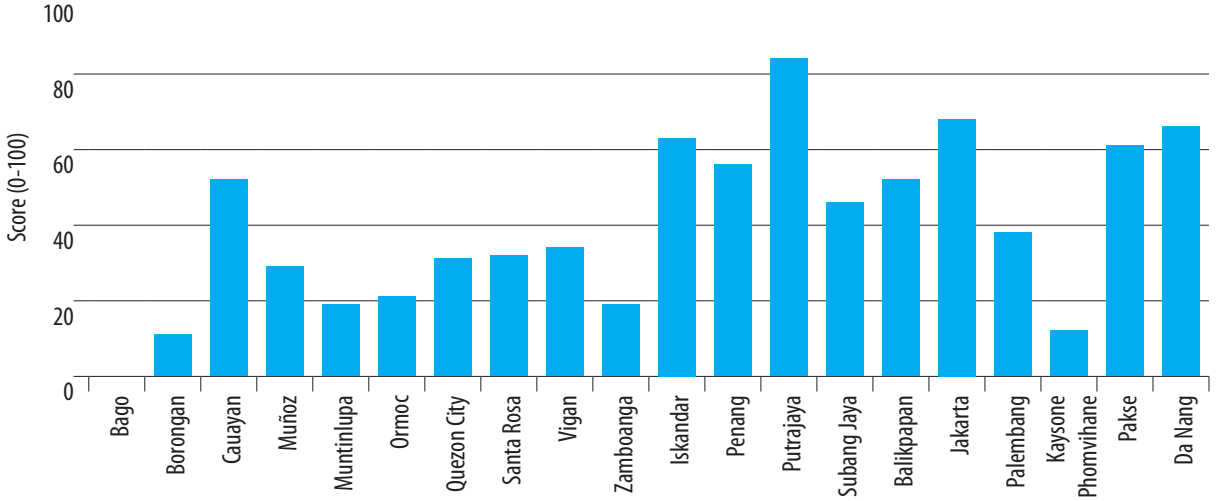
The SDG 7 Localization Indicator 2 focuses on evaluation of the availability and level of implementation of energy data collection as well as energy monitoring and smart metering systems.

As can be seen in figure 14, the overall results on energy data monitoring vary significantly across analysed jurisdictions (from zero in Bago to 84 in Putrajaya) with a median score of 36 across 20 jurisdictions. Most of the jurisdictions demonstrated a significant need for improvement in their data collection and monitoring efforts, and a number of them indicated the need for the related capacity-building activities to be delivered by international experts to capitalize on existing good practices.

Evaluation of jurisdiction-wide data collection efforts and existing monitoring systems was conducted for the following areas: energy efficiency; renewable energy; energy access; sustainable energy; different SDGs; and energy supply and demand. In addition, the presence of specific targets and regulations focused on promotion and support of energy management and smart metering systems implementation in the jurisdiction was evaluated. Assessment was made from the perspective of whether such systems are defined at the national level and implemented at the local level for the following sectors and relevant subsectors: buildings; industry; centralized energy generation; transport; waste management; street lighting; and the water sector.

The results for the availability and level of implementation of energy data collection, energy monitoring and smart metering for the selected cities of ASEAN are presented in table 9.

Figure 14 Total scores for Indicator 2 for 20 selected jurisdictions in ASEAN



The results confirmed the importance of existing data collection efforts for the implementation of energy management and smart metering practices. It is difficult to implement energy management systems (EMS) and smart metering without a properly established and detailed jurisdiction-wide energy data collection system and priorities for specific energy consumers; similarly, data collection and monitoring systems could not be managed without proper EMS and energy monitoring. It is important to follow a balanced approach between implementation of energy monitoring smart systems as well as making data-collection efforts and conducting relevant support for the operation of energy management and a smart metering system.

For some cities – such as Borongan, Muntinlupa, Santa Rosa and Zamboanga – implementation of energy management and smart metering systems come before energy data collection and monitoring systems development. It is fair to conclude that in such cases there is a big chance of low-quality data collection, which could result in wrong determination of the baseline consumption and poor accuracy in energy planning.

For Ormoc, Subang Jaya, Balikpapan and Pakse available jurisdiction-wide data collection efforts are not supported by implementation of an energy management system, which technically means a lack of analytical possibilities of the collected energy data. Such a situation could result in low quality energy action planning.

The energy data monitoring system is normally supposed to function under the existing energy performance Monitoring, Reporting and Verification (MRV) Protocols. The local/city authorities usually provide general guidance and

Table 9. Assessment results for the questions related to energy data monitoring

Country	Jurisdiction	Projects related to energy data monitoring	Jurisdiction-wide data collection efforts and existing monitoring systems	Energy management systems and smart metering
The Philippines	Bago	No	0	0
	Borongan	No	4	27
	Cauayan	Yes	42	33
	Munoz	No	38	36
	Muntinlupa	No	17	33
	Ormoc	No	46	3
	Quezon	No	46	33
	Santa Rosa	Yes	0	30
	Vigan	No	29	64
	Zamboanga	No	17	33
Malaysia	Iskandar	Yes	54	50
	Penang	Yes	42	46
	Putrajaya	Yes	79	80
	Subang Jaya	Yes	38	21
Indonesia	Balikpapan	Yes	67	2
	Jakarta	Yes	75	37
	Palembang	Yes	8	12
Lao PDR	Kaysone Phomvihane	N/A	0	28
	Pakse	Yes	63	33
Viet Nam	Da Nang	Yes	54	60

strategic indications on the overall sustainable energy development strategy, implementation of the energy data monitoring system and operational support for the MRV protocols; this is done by, interacting with different stakeholders involved at the operational level (both public and private). Together with the national policy level, it will facilitate the implementation of enabling activities, such as the definition of the long-term strategy and effective policy instruments to support SDG 7 implementation.

The data collection process should be focused on the following main activities – identification of main data sources, collaboration with the statistical department and stakeholder consultations to bridge data gaps. At the same time, MRV protocols are aimed at implementation of low-carbon policies and actions at the national and local levels by establishing baselines and helping to identify mitigation potentials and opportunities for improvement (IISD, 2012).

The objective of the MRV framework is to measure and ensure the effectiveness of suggested measures, e.g., meeting the required energy performance standards and technical expectation (also as proof for the stakeholders) as well as providing a credible and transparent approach for quantifying and reporting of energy and GHG emission reductions. Local governments should provide support for the collection of available data and information, for example on electricity and primary fuel source consumption, types and capacity of energy users as well as other SDG indicators, such as air quality. It will enable overall coordination for the implementation of the MRV framework, both for the mitigation outcomes and for the sustainable development impacts. This will require availability of the necessary technical capacity within local governments to perform the tasks required for MRV purposes. Energy data monitoring and integration of MRV procedures should be performed in close cooperation with energy operators, who are responsible for the financial and energy performance of relevant systems. Together with other public entities, the jurisdiction's authorities also need to collect the relevant data for the MRV of the sustainable development progress. Hence, the local governments should ensure the exchange of information and data with relevant public entities and with the national level for official communication with UNFCCC and other national and international stakeholders.

Box 10 Installation of 1,000 smart meters in residential buildings in Malaysia

A smart meter pilot project run by the Malaysian state utility *Tenaga Nasional Bhd* between 2014 and 2016 saw the installation of 1,000 smart meters in residential dwellings, and resulted in a reduction of energy consumption by engaging the smart meter recipients in energy efficiency.

Following the success of the pilot project, *Tenaga Nasional Bhd* announced that it planned to install 8.5 million smart meters covering every residential dwelling, commercial business and light industrial premises throughout the country to ensure more efficient use of energy in Malaysia.

The project is being undertaken in three phases, with Phase 1 focusing on the tech-savvy areas of Malacca and the Klang Valley as they have high Internet penetration and usage demands, and which was scheduled for completion in 2020. Phase 2 will see the remainder of the Klang Valley installations, as well as Johore and Penang between 2021 and 2023. Phase 3, running from 2024 to 2026, will see the installation of smart meters in the rest of Malaysia.

Source: Energy Malaysia, 2019.

Indicator 3 Cooperation with stakeholders

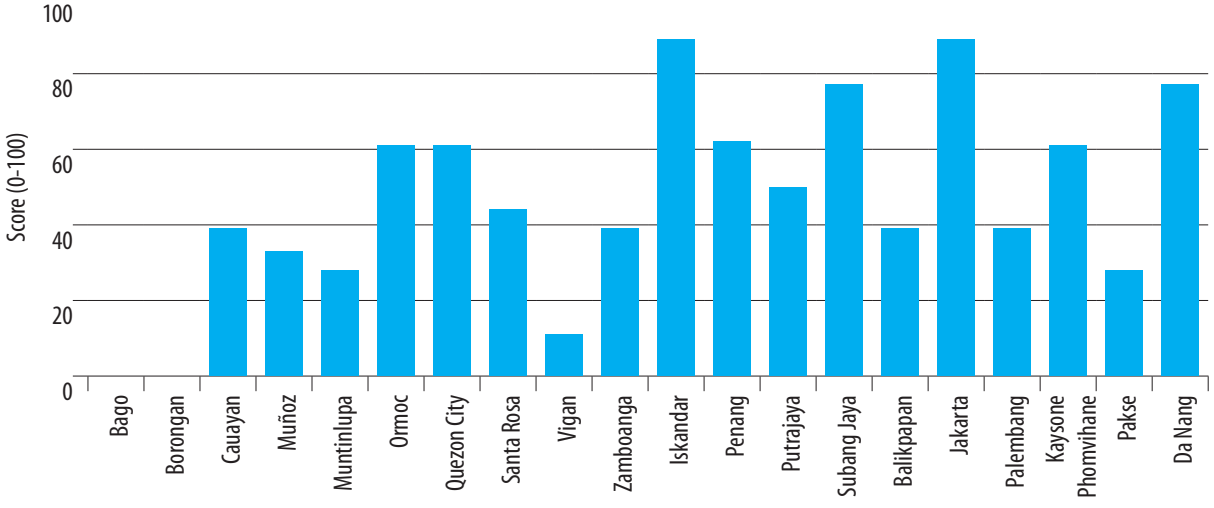
The SDG 7 Localization Indicator 3 aims at assessing the level and effectiveness of established communication between local government and relevant national/international stakeholders involved in the process of SDG 7 implementation and localization. It is important to emphasize the high relevance of such cooperation in securing potential financing for sustainable energy project implementation. Evaluation of communication and interaction between local government and various stakeholders as well as involvement of the local government in the national and international collaborative processes are considered under this indicator.

The total scores for Indicator 3 for the 20 ASEAN jurisdictions discussed in this report are presented in figure 15. Only a few jurisdictions (such as Iskandar, Jakarta, Subang Jaya and Da Nang) show quite high self-assessment results under this indicator (more than 75 points out of 100), while the median score across all 20 jurisdictions is very modest at 42, which suggests fairly limited efforts in cooperating with stakeholders.

One important aspect of stakeholder cooperation is the membership of the jurisdiction in various multi-stakeholder city initiatives, networks and alliances. The following stakeholder initiatives were identified as relevant to supporting SDG 7 localization in ASEAN: ICLEI, CityNet, United Cities and Local Governments Asia-Pacific (UCLG ASPAC), Global Covenant of Mayors, C40, UN Local 2030 Network, ASEAN Smart Cities Network (ASCN), UN-HABITAT's City Prosperity Initiative (CPI) among others. The level and nature of local government involvement in national and/or international processes and forums related to sustainable energy and/or SDG 7 were also assessed as part of this indicator.

Coordination between local, subnational and national level administrations regarding sustainable energy issues and/or implementation of SDG 7 was assessed by jurisdictions from the perspective of availability of coordination mechanisms (for example, steering committees/councils/other institutions that include representatives from both national, subnational and local levels of governance). In some cases,

Figure 15 Total scores for Indicator 3 for 20 selected jurisdictions in ASEAN



there is a lack or even absence of a dialogue between relevant national agencies and subnational and/or local administrations. Where coordination mechanisms exist, but cannot be supported by the relevant national regulatory and budgetary frameworks, causes additional barriers to implementation in the jurisdiction.

Detailed results of SDG 7 Localization Indicator 3 for selected jurisdictions of ASEAN, according to the related questions of the SDG 7 Localization Questionnaire (Annex 1), are presented in table 10.

Table 10 shows that there is a significant potential for local administrations to develop specific stakeholder engagement activities in most of the shortlisted jurisdictions. For the members of local engineering societies, energy experts and operation professionals it is important to promote knowledge sharing and peer-to-peer learning with other jurisdictions across the region. Examples of possible stakeholders engaging in steps with stakeholders, such as audience identification, building a group profile, prioritization, planning and events conduction, are presented in the report prepared by the Carbon Trust (2016). I More proactive participation in different thematic forums, events and training, supported by local government, facilitates capacity-building and participation in knowledge sharing of relevant technical staff of the city as part of their professional duties.

Table 10. Assessment results for the questions related to stakeholder cooperation activities

Country	Jurisdiction	Membership in multi-stakeholder initiatives, networks and alliances	Involvement of local government involved in national and international processes and forums related to SDG 7	Level of coordination between city, sub-national and national level administrations, regarding implementation of SDG 7
The Philippines	Bago	0	0	0
	Borongan	0**	0	N/A*
	Cauayan	67	50	0**
	Munoz	33	0	67
	Muntinlupa	33	50	0
	Ormoc	33	50	100
	Quezon	67	50	67
	Santa Rosa	33	100	0**
	Vigan	33	0**	0
	Zamboanga	33	50	33
Indonesia	Iskandar	67	100	100
	Penang	100	50	33
	Putrajaya	67	50	33
	Subang Jaya	33	100	100
Malaysia	Balikpapan	33	50	33
	Jakarta	67	100	100
	Palembang	33	50	33
Lao PDR	Kaysone Phomvihane	33	50	100
	Pakse	33	50	0
Viet Nam	Da Nang	33	100	100

* The jurisdiction did not provide an answer.
** The jurisdiction had no information or were unaware of such information.

Engagement of the private sector, public-private consultations, youth engagement mechanisms, and on-line and in-person conferences and webinars on various topics related to SDG 7 are among the important strategies that can be used by cities for effective stakeholder engagement.

Additional evaluation was conducted from the perspective of vertical integration of the stakeholder engagement actions into the local context, based on existing coordination mechanisms related to sustainable energy/SDG 7 implementation in the country of the jurisdiction and the level of involvement or reasons for non-involvement. Jurisdictions such as Ormoc, Jakarta, Iskandar, Subang Jaya and Da Nang reported having effective mechanisms in place for coordination of SDG 7-related efforts across different levels of governance. Other jurisdictions (with the exception of Munoz and Quezon, which show moderate scores) indicated the lack of such coordination mechanisms.

In order to achieve coordination between different levels of governance more effective, it is recommended that the policy, institutional and budgetary frameworks for SDG 7 localization and respective project implementation be developed in consultation with the Government. The jurisdictions could initiate a dialogue with the Government to demonstrate the importance of such coordination mechanisms, and to provide suggestions on how such collaboration could encourage the progress of SDG 7 implementation.

The impact and facilitation of this process can be achieved through a collective action, for example via city associations or groups like the League of Provinces of the Philippines, and the Philippine League of Local Environment and Natural Resources Officers. International city networks can also serve as a bridge between different levels of governance. It gives more weight to the concerns of the jurisdiction or the cities, and grants them more bargaining power in the SDG localization process.

Box 11 Philippine League of Local Environment and Natural Resources Officers

The Philippine League of Local Environment and Natural Resources Officers (PLLENRO), is a non-profit environmental organization composed of 352 environment officers of cities, municipalities and provinces all over the country. Its aim is to help local government units to protect, care for and preserve the country's environment. It was founded to help strengthen the environment advocacy and facilitate capacity-building and development of all local ENROs to address complex environmental laws and concerns.

The key functioning aspects are focused on providing advisory support, capacity-building for local professionals and serve as a platform for communication between specialist, local and national level governmental representatives.

Batangas City, as a member of PLLENRO, aims to be the first totally carbon-neutral city in the country by 2030. Through the leadership of the city government and PLLENRO expert support, the city has implemented a number of sustainable and environment-friendly projects. One example is the installation of solar panels and energy-efficient LEDs for street lights throughout the city, which has become a norm and not just a mere trend. Initiatives such as collecting rainwater and constructing sea walls are next in line to be implemented in order to make Batangas City more liveable, sustainable, energy-efficient and globally competitive.

Source: PLLENRO,2020.

Indicator 4 Use of financial resources

The SDG 7 Localization Indicator 4 aims at evaluating the availability of resources for financing sustainable energy policies and projects at the local level, with particular focus on national support programmes and their level of implementation at the local level.

Different types of financial resources in support of SDG 7 localization (UNEP, 2017) are already available in selected jurisdictions of ASEAN as well as across the whole region, such as: national level instruments, municipal bonds, private sector financing, mobilizing private investment to align with SDG 7, international donors and financial institutions' support, including dynamic and new types of financing.

Information was collected and analysed on: (a) available financial support for projects related to electrification, clean fuels, cooking, energy efficiency, renewable energy and overall implementation of SDG 7 (e.g., subsidies, grants, soft loans and tax reductions); and (b) sectoral instruments for buildings and infrastructure, industry, transport, waste management and energy generation. The evaluation was conducted from the perspective of the availability of supporting measures at the national level and their implementation at the local level. An additional question was asked regarding accessibility of financing resources for water management projects that can be focused on rainwater harvesting, desalination, water efficiency, wastewater treatment, and technologies for water recycling and reuse.

The results for Indicator 4 across the analysed jurisdictions (Bago, Borongan, Munoz, Santa Rosa, Vigan and Balikpapan) (figure 16) are quite modest, with a median score of only 41, with six jurisdictions showing very low results (i.e., lower than 20 points out of 100). This raises significant concerns regarding lock-in effect of sustainable energy potential due to the lack of financing, which aggravates the implementation of necessary actions in this area.

Moreover, the detailed results in table 11 show lower scores for financing energy-related initiatives in comparison to water management activities in a number of jurisdictions, which suggests that financing of sustainable energy projects might be under-prioritized.

The availability of financial resources is of critical importance to the process of sustainable energy development at the local level. In addition, relevant guidance for financial access should be available at the local level and presented to relevant responsible departments. Disbursement of the resources should be conducted in accordance with an approved internal procedure, with transparent monitoring of achieved project results. In the case of non-compliance, additional corrective measures should be taken in order to ensure the planned results are achieved.

In order to support the attraction of additional financial resources for sustainable energy projects, it is important to consider various strategies. There should be a focus on further strengthening the local level implementation of national mechanisms to enable access to available extrabudgetary options that could be used to support implementation of local level projects. However, a city should not rely solely on budgetary resources and national support, but should also be pro-active in exploring and attempting to access other types of financial instruments. Some of the common avenues in accessing sustainable energy finance are summarized below:

- Public private partnerships (PPP) are defined as "*public* sector's investment with the *private* sector, in any form or

Figure 16 Total scores for Indicator 4 in 20 selected jurisdictions in ASEAN

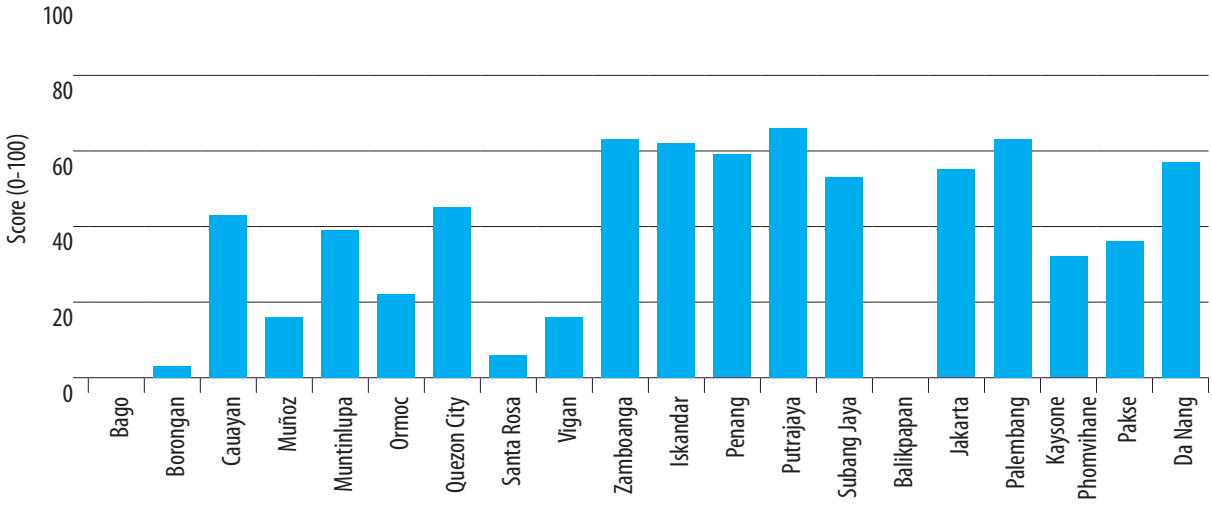


Table 11. Assessment results for the questions related to the use of financial resources

Country	Jurisdiction	Availability of financial support for energy related sectors	Access to the international financial support in water management processes
The Philippines	Bago	0	0
	Borongan	6	0
	Cauayan	11	80
	Munoz	30	0
	Muntinlupa	4	80
	Ormoc	6	40
	Quezon	15	80
	Santa Rosa	11	0*
	Vigan	30	0
	Zamboanga	100	20
Indonesia	Iskandar	64	60
	Penang	57	60
	Putrajaya	55	80
	Subang Jaya	82	20
Malaysia	Balikpapan	0	0
	Jakarta	15	100
	Palembang	83	40
Lao PDR	Kaysone Phomvihane	43	20
	Pakse	51	20
Viet Nam	Da Nang	38	80

* City has no information or is not aware of such information.

allowing *private* sector investment, by issuing permits, granting of concessions. or of any form of right" (MOF Thailand, 2016). Currently, PPP is a well-known alternative source for infrastructure investment; however, using PPP may be restricted in certain subsectors in which the Government allows private sectors to participate via a PPP contract (MOF Thailand, 2018);

- Blended finance is used to combine the power of development finance and private capital, in order to reduce risks and increase opportunities for private investors. Such models should be used to scale-up financing of new technologies in energy assess, energy efficiency, renewable energy, urban transport and other related fields. According to the research done by the GEF (GEF, 2020), in this case opportunities for private sector investors could be really extended, as countries put in place enabling policy environments (e.g., feed-in-tariffs and power purchase agreements) and sustainable energy technologies begin achieving significant cost reduction;
- Institutional investors are companies or organizations that invest money on behalf of clients or members (such as hedge funds, mutual funds and trust funds). Sustainable energy projects for institutional investors can present a good economic opportunity to diversify assets and benefit from strong, stable, long-term cashflows that match their liabilities, while minimizing the risk of stranded assets (IRENA, 2020);
- Energy projects aggregation is a method in which a group of companies or local institutions partner together to buy energy from a single developer, or multiple developers, in smaller volumes while retaining the economic advantages of a high-volume purchase (Level10 Energy, 2018). For example, such an approach is used to describe bulk purchases of renewables from wind, solar and hydropower projects with subsequent centralized distribution to consumers.
- Multilateral development bank (MDB) financing and grants. MDBs are international

Box 12 Million Green Homes Programme in Viet Nam

The Million Green Homes programme, which was established in Viet Nam, is focused on bringing solar PV and energy efficiency technologies to a million houses and buildings by 2030, thereby helping the country to shift away from its existing fossil fuel dependency.

The Million Green Homes Project connects businesses, citizens, state agencies, NGOs and financiers. For example, through the programme financial institutions and local government investment programmes can be used together in order to create aggregated financial packages aimed at providing financing for scaling up implementation of green energy solutions.

Consumer awareness campaigns run by partner NGOs will help to encourage citizens to visit the Million Green Homes online platform, where they can learn about technological solutions, government incentives for these solutions and the companies offering them.

It is possible to support forecasting of renewable enrgy production capacity and help to manage grid operation through this platform for the state agencies responsible for regulating grid connections and connections of solar PV energy generation companies.

Source: Trieunhaxan, 2020.

government organizations set up by agreement between several countries to fund selected specific and sometimes financially unfeasible development projects aimed at socioeconomic (or sustainable energy) development. Such institutions are able to provide loans, invest equity, guarantee against risk and donate technical cooperation. MDBs represent the priority of capital mobilization over concessional aid. MDBs can take sovereign guarantees that are unavailable to commercial banks, and can offer longer maturities and lower interest rates (Mendez and Houghton, 2020).

Additional capacity-building training for responsible administrative personnel, and the development of guidelines on accessing finance, are important steps towards establishing the framework for local procurement and financing procedures.

Indicator 5 Awareness and capacity-building

The SDG 7 Localization Indicator 5 aims at evaluating the availability of initiatives and actions to increase the understanding among citizens, improve the capacity of professionals for SDG 7 implementation, and the level of local government capacity and involvement in reporting on the progress of achieving various SDG targets.

There are many good practices and possible implementation steps that could be taken to develop effective awareness raising and capacity-building programmes at the local level, such as public campaigns, utilization of various types of communication and social media channels, educational e-learning programs, and vocational training. Figure 17 shows that most of the jurisdictions are pursuing some form of the awareness raising activities on SDG 7 (seven out of 20 jurisdictions have a score higher than 50 for this indicator).

The effectiveness of implementation and the selection of the most applicable method is dependent on the local communication environment, the level of involvement of local government as well as the level of the knowledge of different stakeholders (citizens, professionals, responsible energy management specialists and others).

The following key principles of awareness-raising programmes that are relevant to professionals and citizens engagement could be: strong messaging; alignment with SDG 7 targets and linkages to other SDGs (e.g., gender equality, clean water access, sustainable waste management and others); support by local government; and the use of relevant methods of knowledge dissemination, tailored to the local context.

Local government should play a leading role in increasing citizens' understanding and ownership of the SDG 7 targets. In this report, this issue is evaluated from the perspective of whether awareness raising for SDG 7 is recognized and included in the local government's policy agenda (table 12).

Efforts to increase citizens' understanding and ownership of the SDG 7 targets through awareness-raising campaigns are often not sufficiently covered in the local government policy agenda – for example, in Bago and Borongan the local government policy agenda does not include awareness-raising activities or strategy). It is crucial to design and implement a series of information campaigns and awareness-raising materials to educate citizens on the importance of their actions in line with the different SDGs. It is recommended that local governments also

Figure 17 Total scores for Indicator 5 for 20 selected jurisdictions in ASEAN

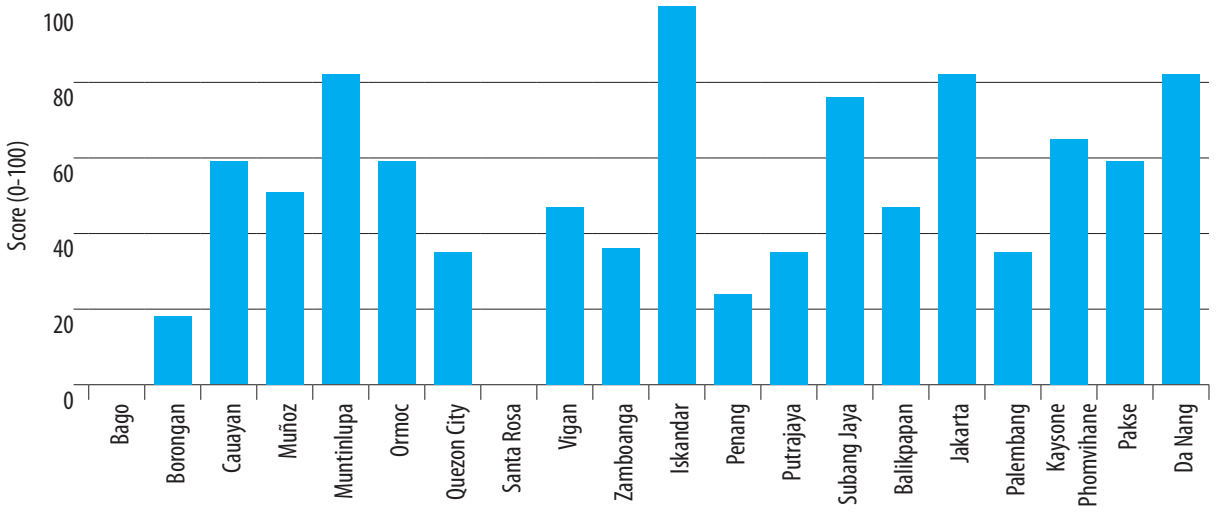


Table 12. Assessment results for questions related to awareness and capacity-building

Country	Jurisdiction	Involvement in preparation of the reports to track the progress on SDG targets	Role of local government in increasing citizen understanding and ownership of the SDG 7
The Philippines	Bago	0	0
	Borongan	0	33
	Cauayan	50	67
	Munoz	33	67
	Muntinlupa	100	67
	Ormoc	50	67
	Quezon	0*	67
	Santa Rosa	0*	0
	Vigan	100	0
	Zamboanga	0	33
Indonesia	Iskandar	100	100
	Penang	50	0
	Putrajaya	0	67
	Subang Jaya	50	100
Malaysia	Balikpapan	100	0
	Jakarta	100	67
	Palembang	0*	67
Lao PDR	Kaysone Phomvihane	100	33
	Pakse	50	67
Viet Nam	Da Nang	100	67

*Jurisdiction has no information or not aware of such information.

conduct outreach activities within their ongoing and planned activities, showcasing how they align with SDGs as well as the potential (or achieved) benefits from their successful implementation. This will help to get additional support from citizens as well as improve their motivation to adjust their behaviour and consumer choices towards more sustainable practices.

It is important that all selected jurisdictions prepare a sustainable long-term plan for awareness-raising activities that cover a wide range of activities for different target groups in order to ensure there is a continuity of effort. Different SDG 7-related issues should be covered for various target groups, such as: educational programmes for schools, colleges and universities; public awareness-raising events and success story promotion for all citizens; capacity-building courses for professionals; and the establishment of proper monitoring and evaluation procedures to raise awareness of the results. Focus should be placed on constantly improving programmes in order to ensure sustained success.

Box 13 National Environment Agency's Save Energy Save Money Initiative, Singapore

To increase public awareness of energy efficient measures, the National Environment Agency (NEA) in Singapore has rolled out the Save Energy Save Money initiative. It encourages households to reduce their energy use by practicing simple energy-saving habits. By doing so, it is possible to save money and help fight climate change.

The platform also provides guidance on how to conduct a simple Home Energy Audit to find out which appliances in the home are greater consumers of energy, and ways to reduce or manage their energy use. If a consumer is shopping for new household appliances, Life Cycle Cost Calculator can help in making well-informed purchasing decisions.

Besides being energy efficient at home, it is proposed to achieve energy efficiency in the workplace by practicing Eco-Office tips or using energy management solutions to transform the workplace into an Eco-Office.

Important information and tips on energy efficiency are consolidated on the Energy Efficient Singapore website, which is run by the Energy Efficiency Programme Office (E2PO), under NEA's leadership, in collaboration with the Energy Market Authority (EMA). The E2PO is a multi-agency committee that jointly promotes and facilitates the adoption of energy efficiency in Singapore.

Source: EE Singapore, 2020.

Indicator 6 Implementation

The SDG 7 Localization Indicator 6 shows the availability and level of implementation of existing policies, initiatives or actions related to SDG 7 targets on energy access, renewable energy and energy efficiency. Figure 18 shows that the assessment results for implementation activities are relatively low (below 60 points out of 100) in all jurisdictions.

For the purpose of making a more detailed assessment, additional sub-indicators were developed for each of the key pillars of SDG 7 Sub-Indicator 6.1: Energy access; Sub-Indicator 6.2: Renewable energy; and Sub-Indicator 6.3: Energy efficiency. The results are discussed in the respective subsections below.

Sub-Indicator 6.1 Energy access

Sub-Indicator 6.1. is designed to evaluate the availability and implementation of technological solutions and good practices for energy access in cities (figure 19). According to the definition of the energy access target of SDG 7, the methodology covers evaluation of the access to electrical energy and clean cooking technologies in selected jurisdictions. The efforts related to energy access show moderate self-assessment results with a median score across the jurisdictions of 58.5; however, for all the jurisdictions the scores are lower than 80.

The primary focus was given to the evaluation of ongoing or previously implemented projects related to energy access, which are producing tangible and visible impacts and benefits. Jurisdictions also provided additional information on existing projects, indicating duration, sources of funding, solutions applied and achieved (or expected).

Evaluation of the various energy sources was conducted based on analysis of the specific answer types for the question that focused on availability of the connection to electricity power supply (question 2.10).

Specific questions addressed the utilization of different cooking methods by households in jurisdictions, both in urban areas and in informal

Figure 18 Total scores for Indicator 6 for 20 selected jurisdictions in ASEAN

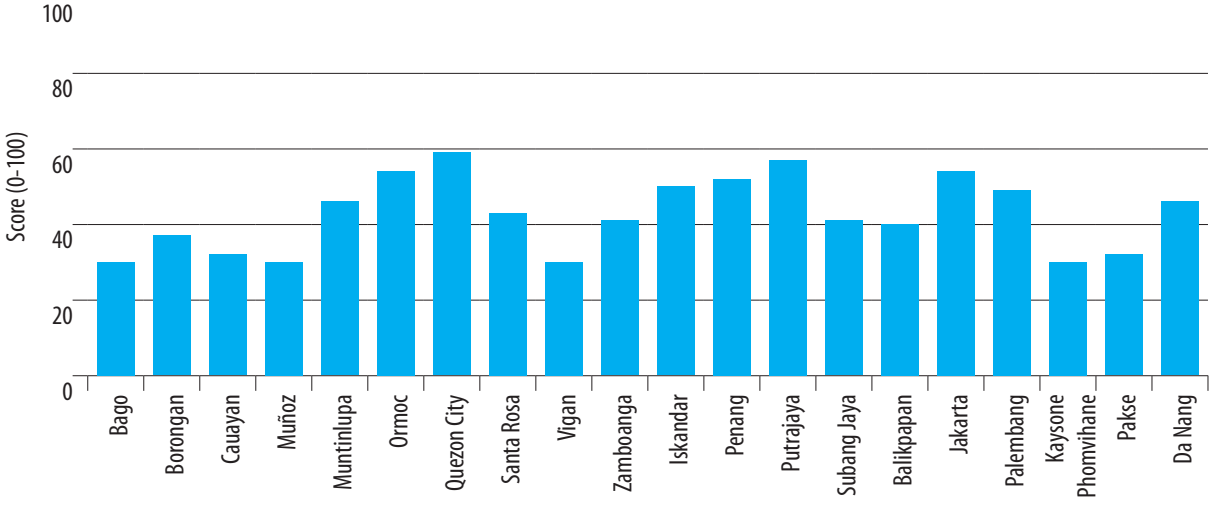


Figure 19 Total scores for Sub-Indicator 6.1 for 20 selected jurisdictions in ASEAN

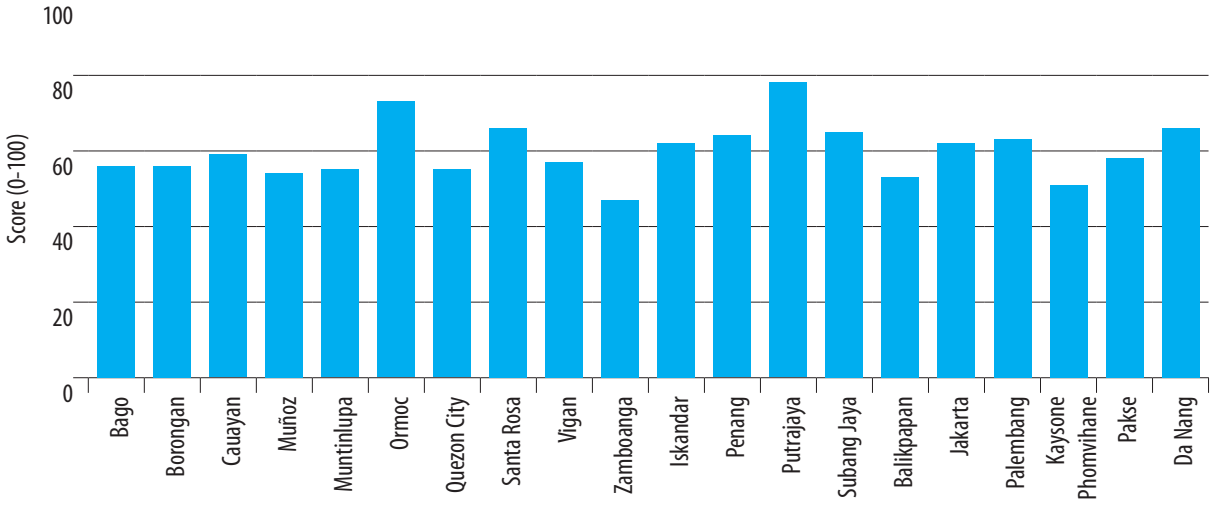


Table 13. Assessment results for the questions related to energy access

Country	Jurisdiction	Ongoing or implemented projects related to energy access	Electricity Access in the buildings and infrastructure sector	Utilization of efficient cooking methods by urban households	Utilization of efficient cooking methods in slums and informal settlements	Power supply reliability
The Philippines	Bago	No	100	80	38	33
	Borongan	No	88	48	33	33
	Cauayan	Yes	100	67	42	0
	Munoz	No	70	67	42	67
	Muntinlupa	No	85	73	21	67
	Ormoc	Yes	100	73	33	67
	Quezon	No	100	100	13	33
	Santa Rosa	No	100	75	25	100
	Vigan	No	100	100	21	33
	Zamboanga	No	100	67	42	0
Malaysia	Iskandar	No	85	92	38	67
	Penang	No	100	80	8	100
	Putrajaya	Yes	100	100	N/A*	100
	Subang Jaya	No	95	100	N/A*	100
Indonesia	Balikpapan	No	100	67	33	33
	Jakarta	No	100	89	25	67
	Palembang	Yes	86	50	25	67
Lao PDR	Kaysone Phomvihane	N/A*	50	60	29	67
	Pakse	No	100	73	21	67
Viet Nam	Da Nang	No	100	100	29	67

*There are no slums in the jurisdiction.

settlements. They were divided based on methods used, such as:

- The basic methods of burning fuels (coal, oil products, wood and raw organic waste), kerosene and ethanol/alcohol; and
- Low-emission cooking methods, such as: improved wood cookstoves, electric cookers, pressure cookers, induction electric stoves, high efficiency natural gas or LPG stoves, low emission stoves (using fossil fuels or pellets/ charcoal briquettes), solar thermal cooking, solar concentrators and landfill or biomass methane gas cooking stoves.

The assessment was carried out based on the specific cooking method and the common practice of the local households in each jurisdiction.

Box 14 LPG mobile retail dealers, Bangladesh

A gas supply company, TOTALGAZ, conducted an extensive market survey in Bangladesh to form a market expansion strategy in areas where piped gas connections were either not available or inadequate. The survey found that a substantial number of small- and medium-sized enterprises (SMEs), including restaurants, bakeries and tea stalls in poor urban areas, were either using firewood or kerosene. Either the owners were unaware of the availability of liquefied petroleum gas (LPG) as an alternative or found carrying LPG refill bottles too difficult. As a result, the sales team devised a way of delivering LPG door-to-door. The SMEs agreed to use LPG if home delivery and reliable supply were ensured. Household LPG supply was a natural addition to their business.

The concept of using mobile retail dealers (MRDs) for the delivery of LPG evolved from the findings of a market survey and was officially launched by MRDs who were perceived to be trustworthy and willing to provide financial support and rickshaw vans or bicycles for carrying the LPG bottles to the consumers. By supplying LPG bottles and accessories, togetherwith providing technical support, an MRD could earn as much as US$ 130 per month. More than 100 jobs were generated within a month for the distribution system, enabling hard-working, but less-educated populations to earn a decent living.

The project demonstrates the successful and effective role of simple, innovative technological solutions. Although an old concept, the application of home service for LPG bottle supply was first used in Bangladesh by TOTALGAZ. The project also empowered poor people with only junior school education to earn a decent living and even become entrepreneurs.

Overcoming barriers to energy access

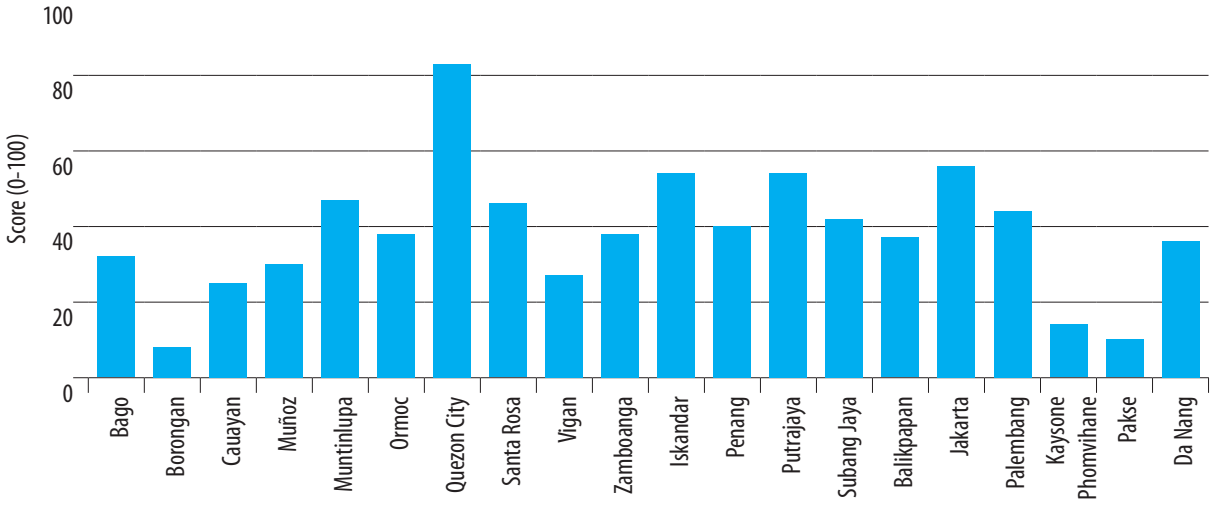
Although the SMEs could afford to pay for LPG, the lack of an efficient distribution system prevented access to LPG. Consumers had difficulty transporting bottles to filling stations that were often a long distance away. Also, many SMEs were not aware of the benefits of using LPG and the availability of LPG in the country. The project achieved the primary objective of expanding the LPG market among urban SMEs that were without a piped gas connection. It also generated employment for the poor. Now the model is being replicated (informally) by other LPG marketing companies.

Best practices

The existing SME operators were using kerosene and biomass stoves and this initiative provided a solution to their needs. In addition, the project was implemented by people who understood the business environment very well. Communication and synergy among the training, marketing, and management departments of the company was important in formulating a winning strategy for the programme.

Source: ESMAP, 2020.

Figure 20 **Total scores for Sub-Indicator 6.2 for 20 selected jurisdictions in ASEAN**



An additional evaluation was conducted of the power outages problem, based on the responses provided by jurisdiction regarding the frequency and duration of electricity blackouts, which greatly affect sustainable energy access and are critically important for normal operation of the local infrastructure.

The results of the scoring for the current status of energy access localization actions for selected jurisdictions of ASEAN, are presented in table 13.

The analysis of data received shows that most of the jurisdictions had made good progress towards SDG 7 localization in relation to electricity access. Most of the jurisdictions, except for Munoz (70) and Kaysone Phomvihane (50), received 80 points and higher on electricity access out of the possible 100. Level of projects implementation, related to energy access, could be assessed as low. Only 4 out of 20 Jurisdictions (Cauayan, Ormoc, Putrajaya and Palembang) highlighted that such projects were implemented or ongoing.

The results on clean cooking for urban households can be considered relatively high – most of the jurisdictions demonstrate scores higher than 60 with five of them claiming 100 points (Quezon, Vigan, Putrajaya, Subang Jaya and Da Nang). Two jurisdictions, however, show quite low availability of clean cooking: Borongan (48) and Palembang (50). For the slums and informal settlements, in those Jurisdictions, results are much less positive – all 20 jurisdictions received scores lower than 50 points (with Penang receiving the score as low as only 8 points out 100), indicating that such cooking methods are still not very common in these disadvantaged urban areas.

It is therefore important for all jurisdictions to develop slums upgrading and rehabilitation programmes that incorporate measures on clean cooking, sustainable electricity access, energy efficiency and renewable energy. If a jurisdiction lacks local capacity and/or resources for project development and implementation, local government should seek technical assistance from the national Government and international organizations, multilateral development banks and city networks. The jurisdiction should also explore opportunities for peer-to-peer cooperation with other cities in the country.

Sub-Indicator 6.2 Renewable energy

Sub-Indicator 6.2. is aimed at evaluating the availability and use of technological solutions and good practices on renewable energy in selected jurisdictions of ASEAN.

Assessment results of the efforts related to renewable energy vary from city to city significantly (from 8 points in Borongan to 83 points in Quezon) with a median score across the jurisdictions at 38 (figure 20).

The specific contribution of each renewable energy type (such as solar and biomass) to the final energy consumption by different end-users was calculated using the following scale – availability of energy source and specific consumer, efficiency of the equipment and the technologies used.

Table 14. **Assessment results for the use of renewable energy**

Country	Jurisdiction	Ongoing or implemented projects related to renewable energy	Availability of renewable energy targets	Availability of GHG emissions/ air pollution reduction targets	Use of renewable energy and related technologies			
					Buildings and infrastructure sectors	Transport sector	Industry sector	Energy generation sector
The Philippines	Bago	No	0	0	0*	0*	100	0*
	Borongan	No	12	35	0	0	3	9
	Cauayan	Yes	33	33	16	0	19	17
	Munoz	No	36	36	33	43	28	19
	Muntinlupa	Yes	29	86	34	33	52	22
	Ormoc	Yes	3	24	28	100	17	15
	Quezon	Yes	100	100	39	100	56	100
	Santa Rosa	Yes	30	100	26	50	6	0
	Vigan	No	44	59	28	25	4	15
	Zamboanga	Yes	41	41	30	58	6	22
Malaysia	Iskandar	Yes	51	70	17	62	55	50
	Penang	Yes	68	55	23	24	6	42
	Putrajaya	Yes	15	79	50	50	N/A**	50
	Subang Jaya	Yes	48	48	63	15	7	44
Indonesia	Balikpapan	Yes	43	54	15	50	33	0
	Jakarta	Yes	11	56	33	75	53	73
	Palembang	Yes	25	33	22	76	8	50
Lao PDR	Kaysone Phomvihane	N/A**	28	27	0	0	0	22
	Pakse	No	33	33	0	0	0	0
Viet Nam	Da Nang	Yes	47	42	18	50	9	22

* Energy consumer not present.
**Jurisdiction is an industry free zone.

The implementation of renewable energy technologies at the local level depends on the availability of the specific source and/or relevant energy user, and should also comply with existing qualifications of local technical specialists as well as the availability of proper maintenance at the potential installation location.

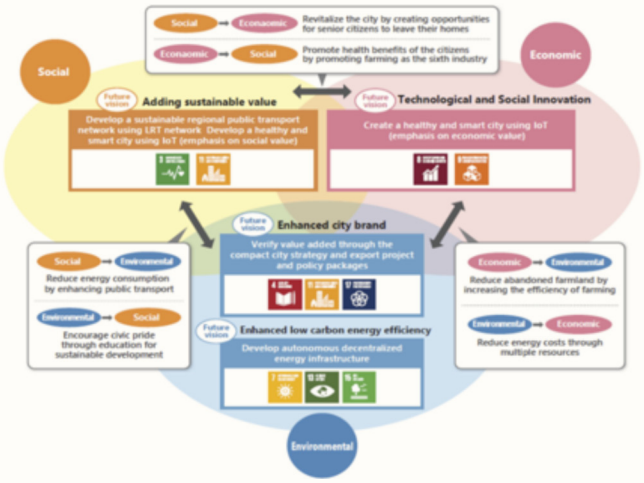
The results of existing renewable energy localization actions in selected jurisdictions of ASEAN are shown in table 14.

The analysis of results shows a relatively low level of renewable energy localization actions across the majority of the selected jurisdictions in ASEAN. Notable progress has been made in this area by Jakarta, Iskandar and Quezon; however, it is important for all jurisdictions to continue energy and financial monitoring of the existing renewable energy projects as well as to increase the number of new RE installments.

To enhance the implementation of renewable energy projects, it is important that local governments to assess the local renewable energy

Box 15 Toyama City Low Carbon Farming Village Model, Japan

Figure 21 Agriculture revitalization project using renewable energy



Source: IGES, 2018.

Toyama City pays attention to maintaining regional characters such as protecting the function of villages in agricultural and mountainous areas (figure 21).

The Toyama City Low- Carbon Farming Model uses renewable energy at a support centre for farmers as an attempt to revitalize farming with crops other than rice, such as vegetables that have a locally low crop acreage.

The facility uses renewable power sources including solar, geothermal heat pumps and small-scale hydroelectric power for agricultural machinery, and air-conditioned green houses for multiple crop vegetables such as *komatsuna* (Japanese mustard spinach), myoga ginger and *egoma*.

The produce is offered to elementary schools, welfare facilities, nursing homes and facilities for the disabled, and conduct hands-on agricultural tours for agricultural high-school students and the public. A project team comprising of academics, agricultural cooperative and private sector businesses, evaluates and disseminates to farms and mountain villages the benefits of renewable energy equipment: energy efficiency; cost reduction and disaster prevention. The following renewable energy equipment was introduced in the project:

- Solar power 30 kW;
- Small hydroelectric 40W;
- Geothermal heat pump 25kW;
- Storage battery 44 kWh.

Source: IGES, 2018.

potential and establish targets tailored to the local context, renewable energy opportunity and needs of different energy consumers. The results of this study and identified targets should be used as a basis for development of the renewable energy action plan for the jurisdictions. A mechanism for tracking progress according to specific key performance indicators will assist implementation of actions in support of target as well as the regular revision to raise the bar higher. Wider utilization of renewable energy will help to address the issue of urban air pollution. GHG inventory and air pollution monitoring systems in the jurisdictions will help the collection of data necessary for determining local targets, including the establishment of relevant performance tracking mechanisms.

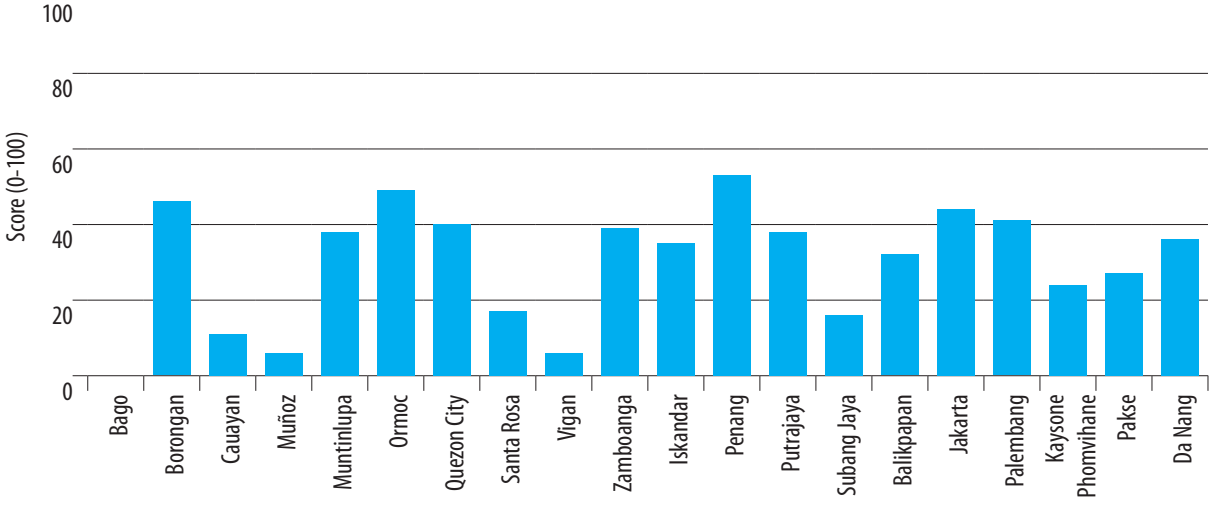
In cases where renewable and non-fossil fuel energy technologies have limited implementation in different energy consuming sectors, further support for the development of the renewable pilot projects accompanied by guidelines for the project development and implementation processes should be provided by the relevant responsible departments of the local government, with the involvement of the private sector. Adjustments could be made to the local investment strategy with the aim to prioritize financing for low-carbon projects and technologies. For the jurisdictions where the implementation of such projects is already taking place, further detailed monitoring and verification is required in order to maintain the quality of suppled energy and to support the jurisdiction's low-carbon transition. The use of additional investment potential created by successfully implemented renewable energy projects should become an important part of future planning of sustainable energy actions and related financial processes.

Capacity-building training for responsible administrative and technical staff working in the area of installation and operation of renewable energy systems is an important part of scaling up the efforts on SDG 7 localization efforts in relation to renewable energy deployment. This could form a strong foundation for the further transition to low emission energy use, as an overall component of the local decarbonization strategy.

Sub-Indicator 6.3 Energy efficiency

Indicator 6.3. is aimed at evaluating availability and implementation of technological solutions and good practices on energy efficiency in selected jurisdictions of ASEAN.

Figure 22 **Total scores for Sub-Indicator 6.3 for 20 selected jurisdictions in ASEAN**



Box 16 Energy efficient renovation of administrative buildings in Bangkok, Thailand

The buildings of the Department of Public Works (DPW) and the Department of Drainage and Sewerage (DDS), located at the Bangkok City Hall 2, are office buildings with approximately 23,135 m2 each. Both of the buildings were operated for more than 30 years, which resulted in low efficiency of their electrical and air conditioning systems as well as a significant increase in the monthly electricity bills. Consequently, the Bangkok Metropolitan Administration (BMA) allocated a budget of US$ 18,051,103 (580,000,000 baht) in the 2017 fiscal year in order to renovate the two buildings. The project took place between 2017 and 2018. The main objective of the renovation was to improve the operational quality of the existing engineering systems (sanitary, electrical and air-conditioning systems) and reduce the cost of the monthly electricity bills.

The energy efficient measures implemented during the renovation included:

- Replacement of 36 W fluorescent bulbs with 18 W LEDs;
- Replacement of a 305-ton refrigeration (TR) chiller and two 335-TR chillers (efficiency of 0.85 kW/TR) with three 370-TR chillers installed in each building with an efficiency of 0.62 kW/TR.
- The renovation resulted in the reduction of total energy consumption in both buildings by 56 per cent (from 7.1 GWh/year before renovation to 3.1 GWh/year), which is estimated to have saved US$ 501,055 (16.1 million baht) in electricity costs and avoided 2,374.66 tCO2-eq. of greenhouse gas emissions.

The GHG emission mitigation target under the Bangkok Master Plan on Climate Change, 2013-2023, is that by 2023 all the BMA buildings will have reduced total GHG emissions by 26,570 tCO2-eq. compared to business as usual (BAU) (based on 2010). Therefore, the renovation project of the DPW and DDS buildings accounted for 8.94 per cent of the overall GHG emission reduction target for 2023.

Source: C40, 2019.

The assessment results on the efforts related to energy efficiency vary from city to city significantly (from zero points in Bago to 53 points in Penang) with a quite low median score of 35.5 across the jurisdictions (figure 22).

A specific assessment of the efficiency of utilization of various energy sources was conducted in buildings, infrastructure and transport sectors of the selected jurisdictions as well as the technologies in electricity consumption. The evaluation was conducted for the main fossil fuel types, including coal, oil products, natural gas and LPG, depending on the availability, and the scale of use and efficiency of the respective equipment and technologies.

The results of existing energy efficiency localization actions in selected jurisdictions of ASEAN are shown in table 15. The results show a relatively low level of implementation of various energy- efficient projects, technologies and solutions across different energy end-uses, for almost all the jurisdictions analysed.

For the building and infrastructure sectors in most of the jurisdictions, development is recommended of specific minimum energy performance standards and targets, in combination with the mandatory requirements for regular maintenance and upgrades of energy-consuming technologies and equipment. Professional training and capacity-building activities are needed for

Table 15. Assessment results for the questions related to energy efficiency

Countries	City/Jurisdiction	On-going or implemented projects related to energy efficiency	Energy intensity reduction/ Energy efficiency target	Use of energy efficient technologies in buildings and infrastructure sectors		
				Fossil fuel	Renewable energy and non-fossil fuels	Electricity consumption
The Philippines	Bago	No	0	0	0*	0
	Borongan	No	16	67	0*	67
	Cauayan	Yes	33	0	0	0
	Munoz	No	36	0	0*	0
	Muntinlupa	Yes	33	43	0	67
	Ormoc	Yes	3	0*	67	67
	Quezon	Yes	33	42	0*	56
	Santa Rosa	Yes	45	5	0*	33
	Vigan	No	53	10	0	0
	Zamboanga	Yes	41	6	0*	67
Malaysia	Iskandar	Yes	73	0	0*	58
	Penang	Yes	83	83	0*	67
	Putrajaya	Yes	37	44	0*	50
	Subang Jaya	Yes	48	0	0	67
Indonesia	Balikpapan	Yes	52	67	0*	67
	Jakarta	Yes	24	29	0*	60
	Palembang	Yes	32	11	0*	27
Lao PDR	Kaysone Phomvihane	N/A**	27	0*	0*	0
	Pakse	No	32	0*	0*	13
Viet Nam	Da Nang	Yes	63	0	0*	52

* Energy consumer is not present.
**The jurisdiction did not provide an answer.

local professionals and relevant technical and administrative staff of the jurisdiction, in order to present possibilities for effective implementation, maintenance and financing of energy efficiency measures. Incentive programmes offered by the local government can further support promotion and utilization of energy efficiency technologies, wherever feasible. These measures, among others, should be integrated into the jurisdiction's energy management and clean energy strategy.

In order to support transport sector efficiency improvements, it is important to prepare relevant decarbonization and low-emissions development strategies as well as conduct additional capacity-building for responsible administrative and technical staff. The focus should be on best practices of low-carbon transportation solutions (such as eco-driving practice, rapid transit bus systems, e-vehicles and a "green wave" for traffic, among others) , coupled with practical studies on lessons learnt after implementation of similar projects in other cities.

Use of energy efficient technologies in transport sector			Use of energy efficient technologies in industry sector			Use of energy efficient technologies in energy generation sector	
Fossil fuel	Renewable energy and non-fossil fuels	Electricity consumption	Fossil fuel	Renewable energy and non-fossil fuels	Electricity consumption	Fossil fuel	Renewable energy and non-fossil fuels
0	0*	0*	0	0	0	0	0*
65	0*	0	67	0*	67	0*	0*
0	0*	0	0*	0*	0	0*	0*
0	0	19	0	0*	0	0	0*
20	67	0	52	0	67	0*	1
67	0	0	67	0*	67	67	67
42	0	0	64	0	67	67	44
2	0*	4	0	0*	0	0*	0*
0	0	0	0	0*	0*	0	0
67	67	0	0	0*	67	0	0*
33	0	0	0*	0	0*	48	67
46	0*	0	61	0*	67	50	0
0	0*	0	N/A**	N/A**	N/A**	67	0*
0	0*	0	0	0*	0	0	0
0	0*	0	0	0	0	67	0*
46	67	7	67	33	7	57	58
67	13	0	56	0*	67	33	67
39	0*	0	0*	0*	67	0*	33
67	0	0	0*	0*	67	0*	0*
68	0*	0*	0	67	67	0*	11

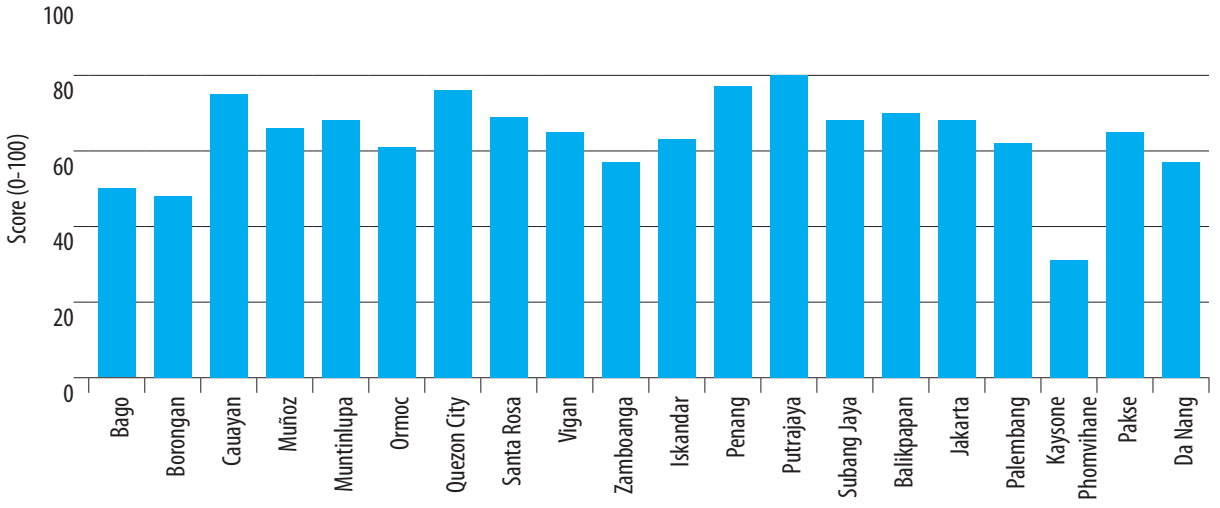
Indicator 7

Linkages between SDG 7 and other SDGs

Sustainable energy issues cut across different SDGs in various direct and indirect ways. For the purpose of this study, linkages to other SDGs were limited to the most direct connections between sustainable energy use and specific SDG targets, localization of which could be assessed at the city level through the developed analytical framework. Assessment results on the efforts linked to other SDGs show relatively high results across the analysed jurisdictions with a median score of 65.5 (figure 23).

The scope of assessing these linkages from the SDG localization point of view was narrowed down to five SDGs, which resulted in the following SDG 7 Localization Sub-Indicators:

Figure 23 **Total scores for Indicator 7 for 20 selected jurisdictions in ASEAN**



- Sub-Indicator 7.1. SDG 3 – Health care and well-being;
- Sub-Indicator 7.2. SDG 6 – Clean water and sanitation;
- Sub-Indicator 7.3. SDG 11 – Sustainable cities and communities;
- Sub-Indicator 7.4. SDG 12 – Responsible production and consumption; and
- Sub-Indicator 7.5. SDG 13 – Climate action.

Sub-Indicator 7.1 SDG 3 – Health care and well-being

SDG 3 aims to ensure healthy lives and promote well-being for all, at all ages

Sub-Indicator 7.1. is designed to assess energy-related activities or those that support sustainable water and sanitation project implementation.

Table 16 shows SDG 3 targets and indicators that were selected as relevant for assessing SDG 7 localization, taking into account the global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development (UN, 2020). These targets and indicators were used to formulate the respective qualitative questions in the SDG 7 Localization Questionnaire to evaluate the linkages between SDG 7 and SDG 3 in the localization process.

An evaluation was carried out taking into account the availability of health-care facilities with space cooling (e.g., hospitals and medical centres) in the jurisdictions. Further assessment was conducted of the availability of mobile vaccine/blood refrigeration facilities in in each jurisdiction and their sufficiency to cover health-care needs of the local population (table 17).

The results show that all of the jurisdictions analysed, except Borongan, have implemented activities aimed at supporting the installation of required cooling capacities for health-care needs. Nevertheless, the level of vaccine/blood refrigeration facilities available in Cauayan, Ormoc, Zamboanga, Subang Jaya, Palembang and Kaysone Phomvihane, still requires improvement. A significant increase of space-cooling capacity should be undertaken in Vigan, Kaysone Phomvihane and Da Nang.

Table 16. Selected SDG 3 targets and indicators linked to SDG 7

Selected SDG 3 targets	Selected SDG 3 Indicators
3.8. Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.	3.8.1 Coverage of essential health services.
3.b Support the research and development of vaccines and medicines for communicable and non-communicable diseases that primarily affect developing countries, and provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property. Rights regarding flexibilities to protect public health and, in particular, provide access to medicines for all.	3.b.1. Proportion of the target population covered by all vaccines included in their national programme. 3.b.2. Total net official development assistance to medical research and basic health sectors. 3.b.3. Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a sustainable basis.

Table 17. Assessment results for the questions related to health care and well-being

Country	Jurisdiction	Availability of health facility related with air cooling	Availability of the mobile vaccine/blood refrigeration facilities
The Philippines	Bago	100	0
	Borongan	0	0
	Cauayan	100	33
	Munoz	67	67
	Muntinlupa	67	67
	Ormoc	67	0
	Quezon	100	67
	Santa Rosa	100	0
	Vigan	0	67
	Zamboanga	67	33
Indonesia	Iskandar	67	67
	Penang	67	100
	Putrajaya	100	67
	Subang Jaya	100	0
Malaysia	Balikpapan	100	100
	Jakarta	100	67
	Palembang	67	33
Lao PDR	Kaysone Phomvihane	0	33
	Pakse	100	100
Viet Nam	Da Nang	0	100

For jurisdictions where existing health-related facilities have sufficient space cooling to ensure people's thermal comfort, and are able to satisfy most of the health-care needs of the local population, it is recommended that consideration be given to further implementation of passive cooling strategies (especially for new buildings) through building design, insulation, shading, white roofs, windows with low-e coating, and natural ventilation, where applicable, to reduce

Box 17 Thai hospitals go solar

In 2019 the Thailand Solar Fund conducted a crowd-funding campaign with the goal of installing solar rooftop panels in seven Thai hospitals by the end of 2019. The installed solar energy generation is by on-grid systems that do not require a battery but are connected directly to the Government's power grid, allowing the hospitals to save about US$ 580,000 per year in energy costs.

The Solar Fund is a resource mobilization platform for installation of solar energy equipment and collaboration with civil society networks. The activity involved consumers at the household level, local administrative institutions and various business sectors in order to create participation by people in sustainable development by action.

Source: Thai Solar Fund, 2020.

the cooling load. Energy efficiency improvements of active cooling systems (i.e., air-conditioning, refrigeration and ventilation), including integration of renewable energy solutions, are also recommended.

The availability of mobile vaccine/blood refrigeration facilities is crucial for people's well-being and for providing an adequate response to health crises (such as the one caused by the COVID-19 pandemic). A local sustainable health-care strategy should be prepared in consultation with the national level stakeholders and in cooperation with international organizations, in order to find possibilities for financing the purchase and maintenance of related supply chains and their readiness for emergency response. Large-scale deployment of such facilities and equipment will increase energy use and the need for a reliable electricity supply. Therefore, consideration should be given to existing energy-efficient solutions available for the health cold chain and 'green' vaccine supply (e.g., energy-efficient cooling and refrigeration technologies with better insulation, off-grid direct current-based refrigerators, solar cooling or solar direct drive vaccine refrigerators).

Table 18. Selected SDG 6 targets and indicators linked to SDG 7

Selected SDG 6 targets	Selected SDG 6 Indicators
6.1. By 2030, achieve universal and equitable access to safe and affordable drinking water for all.	6.1.1. Proportion of population using safely managed drinking water services.
6.2. By 2030, 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.	6.2.1. Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water.
6.3. By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.	6.3.1. Proportion of domestic and industrial wastewater flows safely treated 6.3.2 Proportion of bodies of water with good ambient water quality.
6.4. By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.	6.4.1. Change in water-use efficiency over time.
6.5. By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.	6.5.1. Degree of integrated water resources management.

Sub-Indicator 7.2 SDG 6 – Clean water and sanitation

SDG 6 aims to make cities and human settlements inclusive, safe, resilient and sustainable

Sub-Indicator 7.2. is designed for the assessment of energy-related activities or measures that support sustainable water and sanitation project implementation.

The following SDG 6 targets were selected as relevant to assessing SDG 7 Localization, taking into account the global indicator framework for the SDSGs and targets of the 2030 Agenda for Sustainable Development (UN, 2020) These targets and indicators were used to formulate the respective qualitative questions in the SDG 7 Localization Questionnaire to evaluate the linkages between SDG 7 and SDG 6 in the localization process.

The quality of existing wastewater treatment practices in the jurisdictions was evaluated based on the availability of wastewater treatment facilities and practices as well as energy efficiency of equipment in water management and sanitation facilities.

Evaluation also included the responses regarding the level of implementation of Water Resource Management (IWRM), which is a process that promotes the coordinated development and management of water, land and related resources. The objective is to maximize

Table 19. **Assessment results for the questions related to clean water and sanitation**

Country	Jurisdiction	Quality of existing wastewater treatment	Efficiency of water management and sanitation equipment	Level of implementation of Integrated Water Resource Management (IWRM)	Energy efficient technologies are commonly used as part of the IWRM
The Philippines	Bago	0	0	0	0
	Borongan	0	33	0	0
	Cauayan	0	0	33	50
	Munoz	0	33	67	17
	Muntinlupa	100	67	67	33
	Ormoc	33	33	0	0
	Quezon	67	100	100	50
	Santa Rosa	67	67	67	14
	Vigan	67	33	67	17
	Zamboanga	0	67	33	33
Indonesia	Iskandar	67	67	100	67
	Penang	100	100	33	33
	Putrajaya	100	67	67	14
	Subang Jaya	100	67	100	17
Malaysia	Balikpapan	67	67	67	33
	Jakarta	33	67	67	17
	Palembang	33	33	33	17
Lao PDR	Kaysone Phomvihane	0	33	0	17
	Pakse	0	33	33	17
Viet Nam	Da Nang	67	67	67	33

Box 18 Septage treatment and wastewater energy project, Naga, the Philippines

Naga City in the Philippines (population 196,003 in 2015) is an actively developing hub of economic activities. Responding to the growing demand for new residential areas as the population continues to increase, the city government took action on planning and implementation of cost-efficient housing schemes that, among others, included the development of roads, energy systems, water systems, wastewater treatment, storm water drainage and solid waste management

A public housing project that was commissioned by the city government included an innovative wastewater treatment plant, which works to convert wastewater (black water) into biogas and organic fertilizer production. Wastewater supplied from the slaughterhouse, district jail, housing estate and a high school is provided to the plant for treatment. Such an approach has shown the possibilities of an integrated resource management and use of a closed-loop system, which is environmentally friendly and resource efficient. The central septic tank was upgraded through installation of more earthquake-resistant foundations as well as removal of unnecessary structural elements and adding reinforcements to protect the roof during the typhoon season.

The wastewater treatment system proved to yield technical and economic benefits from producing energy from wastewater (using biogas) and reusing treated wastewater for irrigation and soil fertilization. The project resulted in a 20 per cent reduction in consumption of fossil fuel for energy generation and a decrease in occurrences of water-borne diseases in the city.

Photo source: SunStar CEBU,2018.

Source: SunStar CEBU, 2018.

economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment. Answers were collected depending on the scale of the implementation of IWRM and utilization of energy efficient technologies commonly used as part of the IWRM – for example, water pumps with VSD drive, smart process control systems, automated demand-side water supply regulation, solar energy for water supply and treatment, heat pumps, and the implementation of waste-to-energy technologies to utilize the liquid organic waste from the sanitation system.

The results of the assessment for related questions under this sub-indicator for selected jurisdictions of ASEAN are shown in table 19.

Analysis of the responses show a low availability of good-quality wastewater treatment facilities in Bago, Borongan, Cauayan, Munoz, Kaysone Phomvihane and Pakse. Some jurisdictions, such as Muntinlupa, Penang, Putrajaya and Subang Jaya, show a relatively high level of availability of wastewater treatment facilities. Nevertheless, for most of the jurisdictions, including those mentioned above, the implementation of specific energy efficient technologies that are commonly used as part of IWRM is relatively low. Most of the jurisdictions, apart from Bago, Borongan and Ormoc, undertook actions towards the implementation of Water Resource Management Plans and associated activities.

Adequate expansion, sufficient maintenance and upgrading of existing wastewater treatment facilities is needed for most of the jurisdictions analysed, including the integration of energy-efficient and renewable energy technologies into wastewater treatment and water management practices. Additional capacity-building training is required for personnel to build their skillset to operate new and more energy efficient equipment. In order to ensure the development of an adequate wastewater treatment system, consultation should be undertaken with relevant national level stakeholders, international development organizations working in the area and the private sector. In cases of low levels of energy efficiency or significant energy losses, conducting relevant energy audits and feasibility studies is recommended in order to identify applicable strategies and technologies for improving wastewater treatment systems.

Exploring additional opportunities for integration of energy-efficient and renewable energy technologies into the existing or developed IWRM is recommended (e.g., smart process control systems, automated demand-side water supply regulation, solar energy for water supply and treatment etc.). This should be supported by building the relevant technical capacity of local specialists.

Sub-Indicator 7.3 SDG 11 – Sustainable cities and communities

SDG 11 aims to make cities and human settlements inclusive, safe, resilient and sustainable.

Sub-Indicator 7.3. is designed for the assessment of energy-related activities or measures that support the development of sustainable cities and communities. The following SDG 11 targets were selected as relevant for assessing SDG 7 localization, taking into account the global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development (UN, 2020). These targets and indicators were used to formulate the respective qualitative questions in the SDG 7 Localization Questionnaire to evaluate the linkages between SDG 7 and SDG11 in the localization process.

Jurisdictions were asked to assess the proportion of the population living in slums, informal settlements or inadequate housing, and the proportion of the population with access to public or shared transport. In addition to this, questions about the level of walkability of the jurisdiction and the availability of pedestrian paths as well as their location and walking convenience. The evaluation of the significance of air pollution in the jurisdiction was also carried out, using the average assessed measurement in parts per million (ppm) by volume.

The results of the assessment of related questions under this sub-indicator for selected jurisdictions of ASEAN is shown in table 21.

The analysis of these results shows that the issue with slums and informal settlements or inadequate housing prevails in most of the jurisdictions analysed. Some of the selected jurisdictions reported on the significance of this problem, particularly Bago, Quezon and Pakse. Deployment of energy-efficient

Table 20. Selected SDG 11 targets and indicators linked to SDG 7

Selected SDG 11 targets	Selected SDG 11 Indicators
11.1. By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.	11.1.1. Proportion of urban population living in slums, informal settlements or inadequate housing.
11.2. By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.	11.2.1. Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities.
11.6. By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.	11.6.1. Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities. 11.6.2. Annual mean levels of fine particulate matter (e.g., PM 2.5 and PM 10) in cities (population weighted).
11.7. By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.	11.7.1. Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities.

Table 21. Assessment results for the questions related to sustainable cities and communities

Country	Cities/ jurisdiction	On-going or implemented projects related to sustainable neighbourhoods/ eco-districts	Existing problems with slums, informal settlements or inadequate housing	Access to public or shared transport in the jurisdiction	Level of walkability	Air quality of air in the jurisdiction (no air pollution problem)
The Philippines	Bago	No	33	100	67	100
	Borongan	No	67	100	33	100
	Cauayan	Yes	67	100	100	67
	Munoz	No	67	67	67	100
	Muntinlupa	No	67	100	67	100
	Ormoc	Yes	67	100	67	100
	Quezon	No	33	100	67	33
	Santa Rosa	Yes	67	100	33	67
	Vigan	No	67	100	100	100
	Zamboanga	No	67	100	33	100
Indonesia	Iskandar	Yes	67	67	67	67
	Penang	Yes	67	33	67	80
	Putrajaya	Yes	100	100	67	67
	Subang Jaya	Yes	100	100	67	67
Malaysia	Balikpapan	Yes	67	100	100	100
	Jakarta	Yes	67	100	67	67
	Palembang	Yes	100	100	33	60
Lao PDR	Kaysone Phomvihane	N/A*	67	67	33	67
	Pakse	Yes	33	100	67	67
Viet Nam	Da Nang	No	67	67	33	33

* Jurisdiction did not provide an answer.

Box 19 Integrated "city-within-a-city" approach, Bangkok, Thailand

Bangkok, Thailand's capital and largest city, has substantial potential for implementation of an integrated sustainable development and smart city approach.

According to the 20-Year Energy Efficiency Development Plan (2011-2030) (MOE, 2011), Thailand aims to reduce energy consumption by 20 per cent by 2030. This would require companies to adopt more stringent steps to reduce energy use in buildings and in other sectors. Thailand's Energy Policy Administration Committee has approved a new building energy code (BEC), applicable to buildings with an area greater than 10,000 m^2. The regulations, which govern power usage of air-conditioning systems, lighting and hot water, are expected to reduce electricity consumption by 10 per cent. The city also plans to improve the network of public transportation so that 60 per cent of the population can rely on public transport for their daily commute as opposed to the current 40 per cent. It is planned to expand the rapid rail network in greater Bangkok area to more than 500 kilometres by 2029.

As part of its vision to become a smart and sustainable city, Bangkok is piloting an integrated citizen-centric approach in the development of a district that is being described as "a city within a city". The district will incorporate various elements of the Internet of Things (IoT) and will cover 16.7 ha, of which 8 ha will be dedicated to greenery and open spaces. The built-up area of the district, with a gross floor area of 1.83 million m^2, will comprise (by 2025) five office towers built to LEED and WELL standards, five hotels, three ultra-luxury residential towers, a comprehensive array of retail buildings as well as a variety of civic, art and culture areas.

To move 'smart' efforts beyond pilot projects, the Thai Board of Investment (BOI) has rolled out a smart city promotion scheme to attract investors in potential smart city projects in the country. This includes an eight-year corporate income tax exemption for the projects that focus on development of smart city infrastructure systems (e.g., telecommunication networks and Open Data Platforms) or on providing support for intelligent network developers who design IT systems for smart cities.

Source: The ASEAN Post, 2018.

and renewable energy technologies in these jurisdictions is aggravated by the lack of basic infrastructure. The integration of upgraded strategies for informal settlements into local housing policies is recommended in order to ensure the improvement of living conditions as well as the access to modern and sustainable energy services. As urban areas are expected to continuously attract migrants and workers, it is also important to improve public transportation and connectivity; this especially relevant in highly dense metropolitan areas where building social housing near commercial centres might be impossible due to the lack of land or prohibitively high levels of rent.

Development of policies on clean cooking and electricity access in these areas should be conducted in combination with support programmes for slum dwellers to use more energy-efficient and renewable energy technologies, such as solar LED lighting, solar mini-grids and efficient cooking stoves. Awareness-raising on the benefits of sustainable energy technologies as well as professional training for their proper installation and maintenance are crucial for ensuring effective adoption and long-term use.

All jurisdictions, except Penang, showed that a major portion of the population has access to public or shared transport. It is recommended that further improvement of the system is undertaken, with the introduction of energy-efficient transport solutions, increased utilization of renewable energy as well as expansion of the supporting infrastructure (e.g., charging stations for e-vehicles).

Most of the jurisdictions show the need for the improvement in the pedestrian infrastructure to increase the level of walkability in cities. Cauayan, Vigan and Balikpapan confirmed that pedestrian lanes are common everywhere in those cities and are convenient to walk on. Improvement of the situation is recommended by expanding existing territorial planning solutions or by introducing additional pedestrian areas (e.g., dedicated lanes for pedestrians and cyclists, restricted pedestrian area etc.) aimed at developing effective walkable neighbourhoods as well as ensuring proper maintenance of existing pedestrian areas. Such measures can reduce transportation energy use significantly as well as improve air quality and people's well-being.

The level of air quality was assessed as good or moderate (below 100 ppm) in all jurisdictions except Palembang, which reported an unhealthy level for sensitive groups (up to 150 ppm). Continuation of low-emission development strategy implementation is recommended, which should include an improvement of energy efficiency and increased utilization of renewable energy sources, especially in the main air-polluting sectors.

Sub-Indicator 7.4

SDG 12 – Responsible production and consumption

SDG 12 aims to ensure sustainable consumption and production patterns.

Sub-Indicator 7.4. is designed for the assessment of energy-related activities or measures that support responsible production and consumption, with a particular focus on waste management.

Table 23. Assessment results for the questions related to responsible production and consumption

Country	Jurisdiction	Status of urban solid waste treatment system in your jurisdiction
The Philippines	Bago	67
	Borongan	67
	Cauayan	100
	Munoz	67
	Muntinlupa	67
	Ormoc	67
	Quezon	67
	Santa Rosa	67
	Vigan	67
	Zamboanga	67
Indonesia	Iskandar	33
	Penang	67
	Putrajaya	100
	Subang Jaya	67
Malaysia	Balikpapan	67
	Jakarta	67
	Palembang	67
Lao PDR	Kaysone Phomvihane	33
	Pakse	67
Viet Nam	Da Nang	67

Table 22. Table 22. Selected SDG 12 targets and indicators linked to SDG 7

Selected SDG 12 targets	Selected SDG 12 Indicators
12.4. By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.	12.4.2. (a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment.
12.5. By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.	12.5.1. National recycling rate, tons of material recycled.

The following SDG 12 targets were selected as relevant for assessing SDG 7 Localization, taking into account the global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development (UN, 2020). These targets and indicators were used to formulate the respective qualitative questions in the SDG 7 Localization Questionnaire to evaluate the linkages between SDG 7 and SDG12 in the localization process.

Box 20 Optimizing the utilization of municipal waste and energy generation, Jakarta, Indonesia

Pilot Project Bantargebang Waste to Energy Plant was built by the Center for Environmental Technology (PTL), and the Agency for the Assessment and Application of Technology (BPPT) in collaboration with the Provincial Government of DKI Jakarta.

This facility is designed to be able to reduce the volume of waste quickly and significantly, and to be environmentally friendly and produce electricity as a by-product.

This pilot project is part of National Strategic Projects conducted under the 2017 Presidential Regulation on National Strategic Infrastructure Project. The implementation is regulated under the 2017 Presidential Regulation on National Strategy Policy and the 2018 Presidential Regulation on Environmentally Friendly-based Waste-To-Energy Installation Acceleration, which prioritize 12 major cities in Indonesia, one of which is DKI Jakarta.

This pilot project is in line with Governor Regulation Number 156 of 2018 concerning Regional Action Plans for the Implementation of Achievement of Sustainable Development Goals for 2017-2022.

The following key partners and institutions were involved in the implementation of the project:

- Agency for the Assessment and Application of Technology (BPPT) – design, R&D;
- Local EPC (PT. Indo Marine dan PT. Indah Karya) – construction;
- External contractors for Imported Components – reciprocating grate, steam turbine;
- Air Pollution Control (APC) DKI Jakarta Government Office – operational control.

Technical details of the pilot project:

- Capacity – 100 tons/day;
    - Raw material – waste with a maximum calorific value of 1,500 kcal/kg;
    - Electricity output – maximum of 731.3 kW;.
    - Internal electricity consumption – 350 kW;
    - Availability – 250-300 days/year.

Waste to Energy (WTE) Facility been operating continuously and producing electricity. This WTE facility using waste as raw materials with a maximum calorific value of 1500 kcal / kg without additional fuel. This WTE is able to reduce waste of 100 ton/day. In Its full capacity, this WTE could produce 731.3 kW with internal consumption of about 350 kW. In parallel with the main operation cycle, this facility is used for the purpose of capacity building for local specialists in waste management topic by operating the thermal WTE method before implementing the similar processing systems at a larger scale in the future for other cities.

Source: *Greeners*, 2019.

The evaluation focused on the existing solid waste treatment and management practices, including collection of solid waste, availability of transportation, recycling, re-using and waste-to-energy solutions with relevant infrastructure at special facilities or landfills. Additional comments and project implementation case-studies related to urban waste management infrastructure were provided by the representatives from the jurisdictions.

Existing national policies and strategies on Waste-to-Energy (WTE) projects should be evaluated in order to inform the public and industry about feasible WTE technologies without violating any national policies, and ensure buy-in from multiple stakeholders such the host community and environmental groups that might be opposed to establishing a WTE.

Results of the assessment for related questions under this sub-indicator for selected jurisdictions of ASEAN is presented in table 23.

Table 23 shows that most of the jurisdictions are taking steps on sustainable waste management implementation with some of the landfills already implementing pilot waste treatment and recycling practices. Conducting capacity-building training for local professionals, focused on existing best practices for sustainable solid waste treatment systems, and consideration of possible financing mechanisms can further improve urban waste management. Cooperation with relevant national and international stakeholders is required at this stage in order to prepare feasibility studies for large-scale development and implementation of green urban solid waste treatment projects.

In Iskandar and Kaysone Phomvihane solid waste is mainly collected and transported to open landfills without treatment or sorting. Open landfill storage of waste has a strong negative impact on the environment within the jurisdiction as well as in neighbouring territories. It is recommended that an analysis be undertaken of relevant national and international practices for solid waste storage, disposal and treatment technologies. In addition, assessing the potential for waste-to-energy projects is recommended in order to utilize the synergies between waste management and sustainable energy use. The possibility of attracting extrabudgetary financing should be examined for pilot projects to implement suitable solutions as well as conducting capacity-building training of local professionals focused on introducing and operating low-emissions solid waste treatment systems. These activities should be consolidated into the local waste management strategy.

Cauayan and Putrajaya reported that they had modern and efficient waste management systems in place including sorting, recycling, re-use and waste-to-energy solutions. It is important to support the proper continuous maintenance of urban solid waste treatment systems and the development of its various supporting components. A benchmarking and performance efficiency analysis should be conducted to identify the opportunities for further development and replication in other facilities in the jurisdiction. In addition, the lessons learnt at the national and international levels should be shared.

Sub-Indicator 7.5 SDG 13 – Climate action

SDG 13 aims to take urgent action to combat climate change and its impacts.

Sub-Indicator 7.5. is designed for assessing energy-related activities or measures that support climate action.

The SDG 13 targets (table 24) were selected as being relevant for assessing SDG 7 localization, taking into account the global indicator framework for the SDGs and targets of the 2030 Agenda for Sustainable Development (UN, 2020). These targets and indicators were used to formulate the respective qualitative questions in the SDG 7 Localization Questionnaire to evaluate the linkages between SDG 7 and SDG 13 in the localization process.

Table 24. Selected SDG 13 targets and indicators linked to SDG 7

Selected SDG 13 targets	Selected SDG 13 Indicators
13.1. Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.	13.1.2. The number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030. 13.1.3. Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies.
13.3. Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.	13.3.1. Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment.

Table 25. Assessment results for the questions related to climate action

Country	Jurisdiction	Development and implementation of local disaster risk reduction strategies in the jurisdiction
The Philippines	Bago	67
	Borongan	100
	Cauayan	100
	Munoz	100
	Muntinlupa	67
	Ormoc	100
	Quezon	100
	Santa Rosa	100
	Vigan	100
	Zamboanga	67
Indonesia	Iskandar	67
	Penang	100
	Putrajaya	67
	Subang Jaya	67
Malaysia	Balikpapan	33
	Jakarta	67
	Palembang	100
Lao PDR	Kaysone Phomvihane	33
	Pakse	67
Viet Nam	Da Nang	67

Jurisdictions provided information related to the development and implementation of local disaster risk reduction strategies at the national level, and implementation at the local level (table 25).

The majority of jurisdictions have disaster reduction strategies that are being developed and/or are under implementation at the local level in line with relevant national strategies, with the exception of Balikpapan and Kaysone

Box 21 Low carbon development and climate action. Shenzhen, Guangdong, China

Shenzhen, a big city in China's Pearl River delta in Guangdong province, grew rapidly from an agricultural city of 58,000 people in the 1980s to the nearly 15 million persons metropolis it is today.

The city, as one of 36 low-carbon pilot cities and provinces in China, joined the national pilot programme during the 12th Five-Year Plan (2011-2015) period. In 2015, Shenzhen also joined the Alliance of Peaking Pioneer Cities (APPC) of China.

Shenzhen and other cities are developing their peaking pathways (climate action or mitigation plans), which include investment in low-carbon urban infrastructure (e.g., public transit and non-motorized transport infrastructure), pursuing greater improvement in industrial energy efficiency, enhancing energy efficiency in buildings and de-carbonizing energy supply. Shenzhen was the first Chinese city to pilot a municipal carbon trading programme beginning in 2013, which led to the formation of a national carbon trading system starting in 2017.

Shenzhen and other cities of the Pearl River delta face multiple threats from climate change, including: intensified storms from in- land areas and typhoons; resultant flooding and coastal storm surge; severe heat waves (which will likely have the largest public health impact); saltwater intrusion; worsening problems with urban drainage (storm water management); and inundation of important infrastructure (docks, embankments, power plants and industrial facilities).

After a flood in 2008, Shenzhen turned the square surrounding its Mass Sports Centre into a showcase for resilient urban infrastructure, with permeable pavements, rain gardens and a large rainwater cistern that stores the storm water for later use.

Source: Ohshita and Jonson,2017.

Phomvihane, where some disaster reduction strategies and specific actions have been developed at the national level, but their implementation in the city is currently limited at the local level. Review of these strategies is recommended in order to evaluate whether the synergies between disaster reduction, GHG reduction targets and sustainable energy solutions are being considered.

Examples of such synergies may include, but are not limited to, materials and technologies that enhance a building's energy efficiency and the building's durability and resilience to threats posed by natural disasters. A sustainable energy supply, co-generation systems, distributed generation and micro-grids can support the recovery process from natural disasters etc. Where such synergies are not considered in the existing disaster reduction strategies it is recommended that relevant adjustments be made based on existing international best-practices. Implementing a public awareness campaign on these synergies is recommended in order to influence the adoption and implementation of energy-efficient and resilient designs.

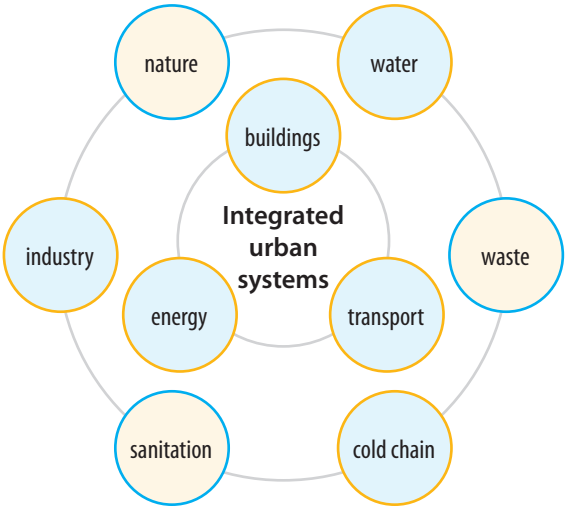
Integrated urban energy

CHAPTER 4

Introduction to integrated urban energy

With a majority of the infrastructure needed in 2050 yet to be built, there are opportunities to reduce environmental impacts and cities' resource and energy use, all while ensuring a reliable energy supply, better transport and economic growth. An integrated approach to urban infrastructure development – one that seeks to optimize the synergies between energy, transport, buildings and other city systems – is key to mitigating climate change, ensuring sustainable resource availability, and improving urban services for all. According to the International Resource Panel Report, "The Weight of Cities," (IRP, 2018) the cumulative benefits of integrated approaches can enable up to 20-fold improvements in resource and energy efficiency in cities. Compact, energy-efficient cities with strong public transport links could reduce resource consumption by 36 to 54 per cent as well as associated emissions and other environmental impacts on land, water and air. UNEP's Integrated Neighbourhood Approach for Energy and Resource Efficiency (UNEP, 2021) shows the increased success of integrated approaches and a greater role of local communities when working at the neighbourhood scale. Such integrated approaches are crucial for successful implementation of the 2030 Agenda for Sustainable Development and should be intrinsic to efforts to localize the SDGs.

Figure 24 **SDG localization success factors**



A shift from siloed to integrated approaches in spatial planning, infrastructure development and provision of municipal services can be timed to empower cities and neighbourhoods – particularly now, as they face the economic consequences of COVID-19. Applied in a developing country context and to high growth cities, the resource efficiencies, circularity and decentralization achieved can translate into much-needed local wealth retention and jobs, reduced strain on municipal services and utilities, and the realization of more liveable and resilient cities.

The multitude of systems in a city provide diverse opportunities for integration in planning, promotion, financing and technical operation. Figure 24 shows these critical systems, all of which can be integrated and designed with any other, from nature-based solutions to flooding, to reuse of solid waste in industry, or smart management of energy demand and supply from transport and buildings. Energy, buildings and transport are particularly critical to integration, given that they are the major sources of greenhouse gas emissions in cities; their integration is also key to tackling the energy transition.

Integration of different urban systems is complex. It requires strong local coordination, sufficient time and resources in city governments and planning departments, pioneering city leaders, regulatory frameworks that empower cities, access to patient capital/long-term investment to tackle the often-higher upfront development and capital costs and pricing mechanisms that encourage resource and energy efficiency. As has been described in the preceding chapters, the role of cities in the energy sector is vastly underdeveloped globally, despite energy being

Table 26. Role of cities in the energy sector and as an integrator of city systems

Local government as planner and regulator	Local governments can effectively catalyze integrated energy deployment first and foremost in their role as planner and regulator. They can set energy policy objectives, strategy and targets; undertake energy mapping and holistic and integrated energy planning (integrating energy infrastructure and land-use planning). They can also set policies that support integrated energy approaches (e.g., connection policies for district energy; local building codes; emissions standards etc.)
Local government as a facilitator: enabling actions to leverage finance	Municipal governments have played a central role in addressing the risks (actual and perceived) and costs associated with investing in more integrated energy systems. There are numerous ways they can do this, such as: (a) financing and fiscal incentives; (b) leveraging city assets to derisk or provide a minor equity stake into projects; (c) undertake demonstration projects to de-risk a technology or approach;(d) tendering projects including to the private sector where public investment isn't viable; (e) direct municipal investment; and (f) exerting control and derisking energy systems through concession contracts
Local government as provider and consumer	As a provider of infrastructure and services (energy, transport, housing, wastewater treatment etc.), a city can shape the low-carbon pathways of these services, capture synergies across the different business segments, and direct the local energy strategy towards social energy (in public buildings, social housing, hospitals, leisure centres, transport etc.). Cities are ideally placed to demand the energy services that they deem optimal and have the ability to facilitate a project's conception through the provision of a reliable 'anchor load' and connection certainty.
Local government as a coordinator and advocate	Implementing integrated urban energy systems requires a new level of planning and coordination capacity as well as significant time, expertise and resources from local governments. Developing such systems also requires a strong champion or series of advocates committed to coordinating agencies and processes; developing a customer base; securing permits, approvals, and regulatory requirements; and driving the overall process. In some cities, the local public utility may be instrumental in steering the energy system towards city objectives. In others, the driver may be an institutional structure created to help develop and implement the energy vision. Regardless of the form, local governments have a vital role to play in advocacy and coordination.

Adapted from UNEP, 2015a, Martinot, 2011 and Sims, 2009.

a critical requirement for city development and resilience as well as a major financial burden on cities' budgets and responsible for some of the largest urban environmental impacts. As such, it is pertinent to examine the role of cities in the energy sector – and, crucially, through their role as planner, coordinator, finance facilitator and advocate (table 26) how cities can integrate energy with other city systems that are historically more under a local government's mandate. To enable the energy transition, cities' ambition and intervention on energy needs to increase significantly.

The prevailing model for energy used in cities is linear and built on a flow of fossil fuels and electricity from external sources to different energy consumers, be that homes, vehicles, offices or industry. Efforts on energy efficiency, led predominantly by national Governments, have mostly focused on each stage in this linear chain from production, distribution and consumption. This linear, centralized model has not been conducive to encouraging exchange and balancing of energy between different urban systems, developing local renewable energy sources, deploying tailored approaches to energy access and building urban resilience. However, cities and neighbourhoods that can effectively store, shift, produce and avoid energy use through integrated urban energy systems, are able to significantly reduce dependence on external sources, delivering a host of social, economic, environmental and resilience benefits.

Such systems include physical infrastructure that fosters integration, such as district energy systems, smart grids, mini-grids and trigeneration, thermal storage, waste-to-energy, local renewables, e-mobility and chargers, hydrogen networks and waste heat capture. These systems share energy and capture synergies between consumers such as industry, residential, commercial, public buildings, and transport as well as critical

municipal services described in SDG11 such as waste, water, sanitation and transport. Detailed examples of these are given later in this chapter.

Beyond physical infrastructure, integrated urban energy systems can be catalyzed by new business models and market structures, such as district energy, city multi-utilities, local energy cooperatives, net-metering and smart grid, including energy management and smart metering. Cities use of urban design and planning policies to deliver compact urban form, mixed use developments and bioclimatic and efficient buildings delivers significant reductions in energy and resource use and fosters more integrated, local urban energy systems, such as district energy

Box 22 Integrated utilities infrastructure, Hiranandani Fortune City, Panvel Estate, Mumbai, India

Integrated utilities infrastructure, Hiranandani Fortune City, Panvel Estate, Mumbai, India

Hiranandani Group is building a smart, integrated and self-sufficient township "Hiranandani Fortune City" in Panvel, India. The company serves not only as real estate developer but also utility service provider. This 600 acre project in the Metropolitan Region of Mumbai area provides integrated utility services including electricity, water, sewage, waste management, gas and internet.

Hiranandani Fortune City has already developed 23 residential buildings and Asia's largest Tier 4 data centres developed by Yotta, Hiranandani Group company. Future residential, commercial and IT development is planned over the remaining land area.

Nidar Utilities ("TUCO") - the utilities arm of the Hiranandani Group, provides an integrated utility services to the residential buildings and the data centre. This includes reliable power as the licensed power distributor; water supply and management; facilities management; security services; sewage and sanitation; smart streetlighting; fibre-optic internet provider; HVAC operation and maintenance; and solid waste collection, treatment and disposal. In addition to TUCO, gas supply will be provided by Mahanagar Gas Limited although Hiranandani Group plans to also develop biogas projects and other waste-to-energy projects to reuse waste and sewage from the development and be a zero-discharge development.

Potable water supply is being guaranteed 24-7 with real-time water quality monitoring – often a rarity for developments in India which often require buildings to have individual water storages on the roof to maintain supply and water purifiers at the apartment level which waste significant amounts of water (often 20-30%). Strong planning of the water system in-step with the real estate development makes the water supply reliable, higher quality and importantly affordable and there is no price increase relative to other water suppliers' tariffs.

To maintain power stability of the expected 200-250 MW of demand, redundancy is designed into the power transmission and distribution system with multiple feeders for the data centre and buildings. The roadmap is to supply daytime power from renewable power and they are working towards 100% renewable power by 2030. The development has 770kW of solar power on commercial buildings and Hiranandani Group is developing a 40MW off-site solar park. Khopoli Hydro Station is providing power to the project through TUCO. The township also has smart meters for power, water and gas in each building and a SCADA system to manage the power system. Hiranandani Group is considering development of a district cooling system, potentially linked to a trigeneration system, as well as smart EV charging system.

Hiranandani Group shows the strength of integrating utility planning and real estate planning. Their ability to own and operate different utilities does enable the needed coordination and integration but it is ultimately the overall vision of high-quality, green, affordable township that is driving the project and it is a lighthouse project for public and private developments in India to show what is possible and affordable.

Box 23 Case studies on integrated urban solutions

Springfield, Australia

Springfield City Group (SCG) are a private developer with plans to build, Brisbane's second central business district (CBD), Greater Springfield, 30 minutes west of Brisbane. SCG and ENGIE have formed a 50-year strategic alliance to achieve the following outcomes: in Greater Springfield:

- Zero net energy by 2038;
- Energy secure;
- Powered by green energy;
- Embrace hydrogen as part of its energy solution;
- Become a world leader in innovative and smart city solutions, and a leading regional demonstration of the implementation of ENGIE Group's Better Cities Today.

Tractebel Engineering performed a 360o City Scan of Greater Springfield in order to identify future development needs while balancing and achieving different goals including circularity, resilience, productivity and connectivity. The net-zero energy target is particularly ambitious and Springfield will be one of the first cities in the world to set such a target, meaning the city will generate more renewable energy than it consumes. In addition to being energy neutral, Greater Springfield will be generating and storing this energy by using leading green technology solutions. Key elements of this solution are expected to be integrated applications of hydrogen as an energy storage medium, 100% renewable energy, district cooling, smart buildings, and electric and hydrogen transport. All available rooftops will have solar and 30% of the city will be dedicated to green space. The rollout of EV charging stations has begun with electric and hydrogen public transport planned aiming to reduce car ownershipfrom 1.98 to 0.8 cars per household. Particularly interesting is the integrated nature of the alliance – one service provider (ENGIE) is able to successfully integrate across numerous aspects of the city design and energy system.

Tokyo: Integrating land use, buildings and district energy

Under its District Energy Planning System for Effective Energy Utilization, the city of Tokyo has implemented several policies to promote district energy. For example, new developments above 50,000 m^2 of floor area are required to provide an Energy Plan for Effective Utilization in order to obtain a building permit. The Plan submission requires setting targets for energy-saving performance in newly constructed buildings as well as studying the introduction of unused energy, renewable energy, and district heating and cooling.

For buildings that exceed 10,000 m^2 or residential developments that exceed 20,000 m2 in total floor area, developers are also required to submit documentation showing evidence of an economic and technical assessment of district energy and consultation with district energy suppliers. Where the barrier is economic, the city will consider on a case-by-case basis if it can address this with remedial policies. A similar approach has been taken in Seattle and Vancouver (UNEP, 2015c).

Helsinki energy challenge

Helsinki is one of the leading cities in the fight against climate change, with the goal of becoming carbon neutral by 2035. The heating system is at the heart of the battle, as its emissions account for more than half of Helsinki's total emissions. The City of Helsinki arranged the year-long international Helsinki Energy Challenge to find future-proof solutions to heat the city during decades to come; an international jury has selected four winners from the 10 finalists in the Helsinki Energy Challenge.

HIVE, an ENGIE Consortium, formulated a flexible plan based on proven technologies and solutions, such as seawater heat pumps, electrical boilers, solar thermal fields and demand side management measures. The plan is capable of integrating new technologies if and when they emerge.

Beyond fossils, an energy transition model based on open and technology neutral clean heating auctions, is paving the path to carbon neutral Helsinki in a flexible and innovation enabling way.

systems and mini-grids, that benefit from density and load diversity.

Integrating energy into urban planning is a key for identifying and creating enabling conditions for integrated urban infrastructure solutions. It is particularly important that urban planning accounts for changing electricity use. For example, in a typical high-density emerging city of 7 million people it is estimated that 11GWh of electricity will be required for transportation per day spread across chargers along the streets, at homes at offices and highly concentrated at bus depots (Siemens, 2018). The speed with which vehicles will need to charge will also require planning for powerful, high-capacity electricity distribution.

Municipal investment and public procurement can often catalyze and demonstrate how integrated urban energy systems, supportive policies and financial mechanisms can lead to them being sustained, expanded and improved. National policy and regulatory frameworks are crucial for unlocking such systems, letting cities and the private sector produce, store and sell energy, mandate local climate and energy planning, provide financial incentives and capital support, and design building codes that prioritize primary energy efficiency and local renewable energy. This is seen in many countries with strong municipal leadership on integrated urban systems, such as those in Europe, Canada, the United States, the United Kingdom, Japan and the Republic of Korea among others.

Integrated urban energy can primarily be considered on the neighbourhood scale in an integrated approach that combines urban planning and infrastructure design. Cities often have an upcoming redevelopment or greenfield area for which an integrated urban energy approach can be developed as a demonstration. The UNEP (2021) report Integrated Neighbourhood Approach for Energy and Resource Efficiency explains the benefits of such a neighbourhood approach, both in reducing energy demand through urban form, bioclimatic design and nature, and by the local infrastructure that is best delivered on the scale of a neighbourhood such as district energy and smart grid, and the local community-led initiatives and business models. Real estate companies in many developing countries are also focused on the township level design that develops a community – bringing energy and other utility infrastructure into this design in an integrated, sustainable manner is a key role that leading real estate companies are taking (see the case study on Hiranandani Estate in box 22).

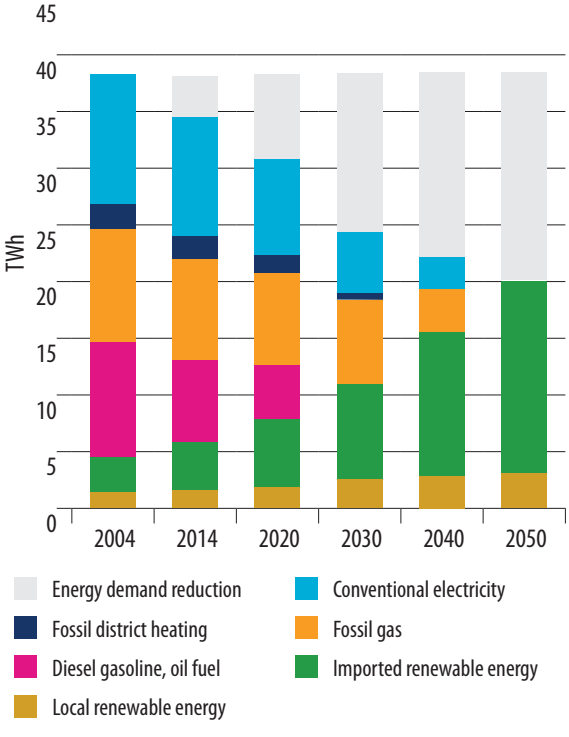
Several visionary local governments and communities are demonstrating that integrated approaches to energy can lead to even higher efficiencies, greater resilience and equitable access to energy and delivery of low- or zero-carbon operation, and close to 100 per cent renewable generation (box 23). However, the pace of progress in expanding integrated approaches is currently too slow; implemented examples remain largely as isolated demonstrations that are not replicated or scaled up. In addition, city-wide implementation that provides considerable benefits from economies of scale is largely limited to cities in developed countries.

Delivering energy efficiency and local renewable energy

An ideal energy system for a city has three overarching objectives – affordability, reliability and sustainability. Leading city governments are taking a very active role in delivering these objectives, as they recognize that without municipal intervention achieving all three objectives will be difficult. Many municipalities will have at least considered delivering these objectives for their own energy consumption. Many will also have considered how these apply to critical infrastructure like hospitals and to lower income groups. Cities at the fore of sustainability are intervening to deliver these objectives for the whole city. At whichever level these are being considered, there is always one clear conclusion: energy efficiency needs to be prioritized in order to maximize the share of renewable integration, while reducing cost/improving affordability, resilience and local economy. This emphasis can be seen very clearly in the energy transition that the city of Paris is leading – figure 25 shows the city is reducing energy demand and increasing renewables simultaneously – resulting in an energy system that will require only half the energy supply by 2050 when compared with 2004. Noticeably, such energy efficiency efforts will allow the city to increase the proportion of locally produced energy to 20 per cent by 2050 – increasing resilience and wealth retention.

Delivering such large-scale efficiency improvements and adoption of renewables requires concerted action on each city system, i.e., public transport, private transport, water supply, sanitation, power supply and distribution, heating and cooling, building efficiency and industry. Cities can achieve a lot through focusing on each of these systems. However, higher energy efficiency levels can be achieved by realizing synergies and integration with other systems – stepping out of a siloed approach; this integration also brings cost savings and resilience benefits. The barriers to this are not insignificant – such integrated solutions require strong coordination between city departments, often with higher upfront costs, in addition to potential regulatory changes regarding the existing utility infrastructure companies with relation to connection, export and storage. Cities may have unclear authority to intervene. However, if cities are to meet carbon neutral or 100 per cent renewable energy goals by mid-century it is crucial that such solutions and approaches are demonstrated now so that they can be expanded and replicated over the next 30 years.

Figure 25 Evolution of the energy supply of Paris



Source: Paris Climate Action Plan, 2020.

Piloting approaches to integrated urban energy

This section presents a high-level methodology for a city to take forward integrated urban energy solutions and effectively integrate energy into urban planning.

- **Baseline and high-level SDG 7 scenario modelling.** This first step assesses the current situation for energy in the city and the degree to which the city is engaged in the energy sector. This can be done using the City Snapshot prepared under the SDG 7 Localization Project (see chapter 2), ensuring that all sectors are considered, including industry. As well as current energy use, this step should look ahead to energy demand and use scenarios for the city to develop a realistic baseline and high-level scenarios on city aspirations for improving energy efficiency, renewables share, energy access and major expected societal shifts in energy consumption. For example, this should cover: a shift from fossil fuel to electric mobility or cooking; larger homes; reduction in industry; and elimination of slums. This could draw upon the methodology and tool of the SDG 7 roadmaps being prepared for Jakarta (Indonesia), Iskandar Region (Malaysia) and Cauayan City (the Philippines). This will build on the drivers and priorities for the city in engaging in the energy sector, particularly with regard to energy access, self-reliance, resilience, quality housing, improved transportation and clean air as well as the various strategies and plans a city has prepared for these priorities.

- **Assess existing energy and climate policy objectives, strategies and targets.** Cities want to engage in the energy sector for a variety of overlapping reasons. They may have a local energy strategy linking the benefits of sustainable energy and broad policy targets, such as targets related to CO2 and greenhouse gas emissions, energy intensity, fossil fuel consumption, energy efficiency and renewable energy, air quality and energy poverty. They may even have specific targets for different energy systems. Understanding these objectives and existing strategies is crucial for developing projects and plans that align with a wider vision of the city. Such strategies are maintained or improved with new administrations helping to secure projects and remove political risk. If an energy strategy does not exist, or needs updating, this is an important process that can be supported to ensure work aligns with city objectives.

- **Assessment of existing planning norms and authority.** This consists of understanding the existing planning norms and practices that are driving energy consumption in a city and also the norms used in infrastructure and utility planning (e.g., standard assumptions for kW of consumption/apartment etc.). Analysis should be undertaken on:

  - The current planning process and enforcement in greenfield and redevelopment areas, and process and level of coordination in infrastructure planning can perhaps best be done focusing on a few recent area developments;

  - The impact of improved urban and building design in greenfield and redevelopment areas from reducing energy use (heating, cooling, transport etc.) and other co-benefits; and

  - Expected shifts in energy consumption patterns (e.g., e-mobility, cooling and cooking) and needed adjustments in infrastructure planning.

This step should also evaluate the degree to which the city can directly or indirectly influence the energy sector under current national, subnational and local regulatory and planning authorities as well as the capacity within the local government, local utilities, real estate sector and industry.

- Identification of champion and stakeholder coordination model. It is important that a strong and local champion can push through reform, innovative ideas, bring together utilities and departments working in siloes, and advocate for increased support for the city. At the same time, integrated urban energy will require strong coordination between different stakeholders such as local power, water and sanitation utilities, real estate developers and different city departments. A clear structure for how different stakeholders coordinate is needed.

- **Identification of a catalyst and the entry point.** Integrated urban energy can be tackled from many different starting points, based on the priority of the city (examined under step 2). For example, the driver can be tackling extreme heat, mitigating air pollution from transport or improving power resilience to weather events. It is important to identify the target/vision to which urban integrated energy solutions respond. Often a catalyst – a particular event – can spur cross-sectoral stakeholders' collaboration and willingness to act. Unique business models or specific local conditions, such as the build-out or renewal of infrastructure, can provide the impetus needed for integrated urban energy projects. For example, the development of Toronto's Deep Lake Water District Cooling System was catalysed by the need for the city to have an improved freshwater supply – this catalyst spurred a decades-old idea into fruition by bringing together necessary stakeholders.

- **Dedicated capacity and policy support.** Cities need to have dedicated energy officials who have training and support to realize integrated urban energy projects and can work with different departments of the city, in particular the planning department and local power utility. National Governments can provide and fund dedicated training with recognized qualifications to increase the energy capacity of cities. Models for cities to ringfence funds for such officials could be considered – city involvement in the energy sector represents a possible new revenue stream (e.g., through concession payments from district energy utilities, returns on investment from municipal renewables or energy efficiency savings). This could be used for expanded capacity in the relevant city departments. The existing capacity of different departments in a city needs to be assessed, both in advancing new and sustainable ideas and in ensuring basic provision of services and enforcement in planning. Cities could advocate for increased capacity support from national Governments and connect with city networks to build capacity on key sustainability topics.

- **City-wide integrated energy plan and mapping.** This should model energy demand, supply and infrastructure into the future. It should use GIS energy mapping and spatial analysis to identify opportunities for integrated energy systems, identify future impacts on the energy system and its resilience, evaluate potential for use of local resources and renewables, opportunity zones for demonstration of new technologies and required shifts in energy and planning policies. The plan should be successfully integrated under a wider Development Plan of Climate Action of the city. It should consider the different systems and energy vectors in a city, including buildings, transport, waste, industrial processes and power, their spatial linkages and opportunities for local, integrated approaches to these that maximize resilience, energy efficiency, reuse of energy and renewables. It should help the city realize its role in the energy sector to help its businesses, industry and citizens go beyond national energy policies.

- The energy mapping undertaken as part of this step should be continuously updated and used by the city, integrated into planning process and become a key communication tool for the city in its efforts on sustainable energy.

- **Neighbourhood-level integrated energy planning.** The development of detailed integrated energy plans at the neighbourhood level is a crucial step in delivering integrated urban energy. At the neighbourhood level, technical integration of energy systems becomes more viable, local resources and circumstances may be different to other areas of the city, local governance structures can be mobilized and local stakeholder engagement will be more focused. Neighbourhood-level is a scale at which urban design, redevelopment, campus and township projects often take place. The UNEP (2021) Neighbourhood Design Guideline goes into detail about planning on the neighbourhood scale. Local energy systems such as district energy,[10] mini-grids, hydrogen networks or community-led projects are more easily conceivable at this scale; while electricity and gas grids are likely to be larger than the neighbourhood-scale they may have low voltage or low-capacity local distribution networks at this scale.

  Energy planning at this local level has been done successfully in many countries for decades although it has not been the norm globally – but it is a vital best practice to delivering a decentralized energy system. It is recommended that detailed spatial mapping of current and future developments, current and future energy demands (buildings, industry, transport etc.), energy supply options (e.g., waste heat, urban renewables and tri-generation) and existing and planned networks (power, heating, cooling, gas) is undertaken. Technical analyses should then be undertaken to identify the least cost, highest efficiency solutions that maximize renewables and circularity, and integrate stand-alone solutions, such as building design, with energy infrastructure that connect buildings and supply and share energy. It should also identify high-priority demonstration projects that can be expanded and replicated across the neighbourhood (e.g., identifying an ideal 'starter network' in a cluster of buildings for district cooling, which would then expand to cover the whole neighbourhood). The Local Area Energy Planning (LAEP) method,[11] developed by the Centre for Sustainable Energy and Energy Systems Catapult in the United Kingdom gives a good introduction to the topic. Selection of such neighbourhoods does not necessarily need to have a residential focus and could also include central business districts, industrial zones, ports and transport hubs.

Neighbourhoods are windows for immediate action

"Acting as innovation labs, neighbourhoods are able to pursue activities on a smaller scale that can then be used as a proof of concept for replication at the city level. Neighbourhoods are big enough to aggregate the interrelated components and give way to a coherent urban fragment, yet small enough to reduce some of the complexities of system integration and to see results in a shorter time period" (UNEP, 2021).

- **Diverse, integrated demonstration projects (city, community, private etc.).** Building upon neighbourhood energy planning, it is critical that cities consider initial pilots at the building cluster or up to neighbourhood level of integrated urban energy systems. Cities should take the lead to catalyze such projects and remove barriers to their development. Upfront development costs for such projects may be high, given that it may be a novel

10 More information about UNEP's work to support district energy is available at www.districtenergyinitiative.org

11 See Centre for Sustainable Energy and Energy Catapult Systems,(CSE), 2020. Prepared for Ofgem. Available at https://www.cse.org.uk/downloads/file/LAEP-method-final-review-draft-30-July-2020.pdf

solution in the city. The city could consider seeking support for early-stage design, project coordination, but also advocate such projects to be picked up and tested by local real estate developers and utilities. Neighbourhood-level projects should also consider the wider geographical picture in terms of energy consumed or waste energy produced from adjacent areas.

- **Procurement support including integrated tenders.** Taking demonstration projects from feasibility study and through tendering can be a costly exercise as newer solutions such as district cooling, mini-grids or integrated tenders (e.g., including buildings, cooling, smart grids etc.) in many countries are likely to have few templates and standard tender documents. Standardization of such templates that are agreed with international financial institutions would speed up this process. Cities can consider approaching development banks or national Governments for support in delivering such tenders if the projects are within the city remit.

- **Link to Urban Climate Action Plan.** It is crucial that the work on energy planning and development of integrated urban energy systems is incorporated into Urban Climate Action Plans and resilience plans, and linked to potential roadmaps to zero emissions as well as other circular economy targets. This is a key recognition of the city's role in tackling impacts from energy use, and cities can also consider targets for energy sector under these plans.

- **Advocacy (policy and regulation).** Ultimately, many cities are unlikely to have the capacity and authority to act on the energy sector as they would desire. However, regulations, particularly in the power sector, can take time to catch up with the pace of decentralization being seen in the energy sector. Cities can advocate to test new regulations or policies in pilot city areas or zones for national consideration. More support needs to be given to cities in organizing and jointly advocatingfor the authority to engage meaningfully on the energy sector and demonstrate the crucial role of cities in delivering on SDG 7.

Key messages and recommendations

Key messages

- SDG 7 localization process is ongoing in ASEAN cities with varying level of success across different cities, but overall, its impact and scale are limited.

- Common challenges on SDG 7 localization across selected jurisdictions include the use of financial resources, energy data monitoring and implementation activities.

- Horizontal coordination, vertical integration of SDG 7-related effort as well a multi-level governance approach are crucial for SDG 7 localization, but the related effective mechanisms are currently absent or missing in most of the analysed cities.

- Lack of robust energy data collection and monitoring systems aggravate the progress of SDG 7 localization and limit understanding of achieved results and impacts.

- Limited availability of financial recourses to support SDG 7 implementation at the local level poses a risk of locking in sustainable energy in cities.
- Capacity-building for local government officials and technical staff on sustainable energy solutions, data collection, monitoring and reporting as well as project development and financing is crucial for acceleration of SDG 7-related actions.
- Progress on SDG 7 implementation at the local level remains fairly modest:
    1. While most of the jurisdictions reported high electrification rates, use of clean cooking technologies shows substantial room for improvement and should be considered critical for urban slums and informal settlements;
    2. Use of renewable energy in cities requires further acceleration, which is often obstructed by dependency on the national grid and limited opportunities for diversification of electricity generation;
    3. Energy efficiency efforts are lagging behind in a number of cities with a fairly small scale of utilization of energy efficient equipment and technologies across main energy-consuming sectors.
- Cities can play a larger role in the energy transition by integrating different urban systems and using their roles as planner, facilitator, coordinator and advocate. A shift from siloed thinking to a more integrated approaches in spatial planning, infrastructure development and provision of municipal services will allow cities and neighborhoods to effectively store, produce and avoid energy use.
- Cities can develop Neighborhood-level Energy Masterplans and City-wide Integrated Energy Plans that identify opportunities for integrated urban energy systems that are well-linked to the wider energy system. National governments can undertake Energy Planning that evaluates the role of cities and local integration and provide support for new policies and interventions.

The evaluation of SDG 7 localization status presented in this report covered 20 jurisdictions from five countries of ASEAN, based on their responses to the provided SDG 7 Localization Questionnaire, which were then analysed and aggregated into qualitative scores for seven SDG 7 Localization Indicators. Twenty analysed jurisdictions were of different sizes and geographical locations, including different national level requites and regulations available to support the implementation of SDG 7.

The analysed indicators covered all major types of SDG 7 localization and implementation activities. Calculation results were reported to the selected jurisdictions and reviewed by relevant local experts. Additional evaluation of the proposed methodology and received results were conducted in close cooperation with relevant technical experts across related United Nations agencies, partner stakeholders and organizations that are actively working in the sustainable development sphere in South-East Asia. Major

support was received from the side of regional and local level associations (UCLG ASPAC, ICLEI, CityNet and Smart Cities Network among others) in the establishment of communication with relevant jurisdictions of ASEAN and further data collection.

The overall SDG 7 localization scoring, as an average for all evaluated jurisdictions, showed slightly better status of actions aimed at supporting the operation of policies and institutions for SDG localization (Indicator 1), implementation of SDG 7 at the local level (Indicator 6) and linkages to other SDGs (Indicator 7). National-level commitments taken by the Governments of the ASEAN members are reflected, in most cases, in the relevant regulatory documents related to implementation of sustainable energy generation and use, energy efficiency projects and renewable energy sources at the local level.

Lower results were received for the activities related to energy data monitoring (Indicator 2) and use of financial recourses to support SDG 7 implementation (Indicator 4). There are a number of short-term and long-term targets determined by each jurisdiction, in order to support implementation of relevant sustainable energy actions. Nevertheless, sometimes they are not very well coordinated and reported, which results in sub-optimal coordination between national and local level stakeholders as well as administrative departments within the jurisdiction. Many recommendations, across almost all selected jurisdictions, have a component related to additional capacity-building required for the engineering professionals and administrative personnel, in order to improve understanding of the available regulatory and financing possibilities for SDG 7 oriented projects.

For local governments and administrations, it is important to ensure that efforts on SDG 7 implementation consider national commitments, policies and plans. Practical implementation of the Multi-Level Governance (MLG) approach in relation to SDG 7 localization is crucial to enhancing the efficiency of coordination of efforts between national and local levels of governance and ensuring policy coherence. Consideration be given to allocating some resources towards capacity-building and professional training of appointed staff to ensure that they have sufficient knowledge of SDG 7-related issues and solutions. In order to improve local level implementation of nationally adopted SDG 7 actions, it is recommended starting with national supported policy instruments and cover specific sectors or energy end-users in the jurisdiction. Monitoring and verification of the results, achieved after this 'pilot' implementation of selected policy instruments, are needed for possible fine-tuning and adaptation of the policies to the local conditions and requirements. Improved communication and cooperation with national and international stakeholders are required in order to promote knowledge sharing and peer-to-peer learning with other jurisdictions across the region. It is recommended that more opportunities for participation in such forums be identified, and more proactive assigning of relevant technical staff to participate and share knowledge.

In order to ensure efficient work of executive technical specialists, professionals and operators in jurisdictions, the scope of smart metering and energy management systems should be extended to a wide range of energy consumers. Focus should be placed on the continuous analysis of data received from the established manual or automated energy metering system, in order to set performance targets for energy end-users and their continuous monitoring.

Additional capacity-building training focused on practical guidance for use of the analytical possibilities of the energy management system as well as the preparation of action plans and accessing potential financial sources for implementation of identified actions, are recommended for local specialists. It is advised that a mechanism be initiated for tracking

progress on specific key energy performance indicators and revising them regularly (e.g., every five years).

For local policymakers it is important to elaborate baseline as well as regular requirements for increasing the minimum energy performance standards and targets, in combination with the mandatory requirement for periodic maintenance and upgrades of energy-consuming technologies and equipment. Incentive programmes could be provided to (a) encourage manufacturers and developers to exceed these targets and integrate opportunities for higher utilization of renewable energy through research and development activities, and (b) identify suitable best practices from other countries and cities. These measures, among others, should be integrated into the local energy management strategy. It will help to evaluate progress on, and contribution to the achievement of the SDGs, including SDG 7, and to identify needs for improvement, evaluate strategic opportunities, seek access to sustainable energy financing and coordinate efforts with the national stakeholders. SDG tracking and the reporting process should be established in the jurisdiction in cooperation with relevant national-level stakeholders to ensure that local actions contribute to the achievement of national commitments on SDG 7. Preparation of Voluntary Local Reviews (VLRs) is one of the ways to analyse available data as well as track and report on progress for SDGs at the local level.

For national policymakers, consideration can be given to empowering cities to take on a greater role in the energy sector and give them necessary powers to intervene and maximize opportunities for locally relevant and integrated energy solutions. City activities on waste water, sanitation, urban planning, public transport etc. should be supported to identify opportunities for energy efficiency, renewable energy and systems integration. Cities can also be encouraged to set local energy strategies and targets, possibly linked to national energy or GHG targets or even aiming for greater ambition. This should be accompanied by strong capacity support for cities and dedicated financial support for project development and tendering. Power system regulations need to be adapted for the energy transition in order to reflect greater local production and local power system management to meet rising local power demand for cooling and transport. Power regulations can enable local selling and purchasing of renewable power and encourage demand side management, storage, and local production and use of power.

Analysed jurisdictions are currently implementing a number of specific actions in support of SDG 7 localization. Nevertheless, it is critically important to focus on further strengthening the local level implementation of various SDG 7 financing mechanisms in order to enable access to available extrabudgetary options that could be used to support execution of local-level projects. Additional capacity-building training for responsible administrative personnel, and the development of guidelines on accessing finance, are important steps towards establishing the framework for local procurement and financing procedures. Additional support for local governments in ASEAN is needed during the current COVID-19 pandemic and possible future disasters, by providing additional financial and human capacity possibilities for remote control and operation of the sustainable energy development projects and actions.

References

APEP (2020). Energy production mix in ASEAN. Web portal: Asia Pacific Energy Portal. Available at https://asiapacificenergy.org

ASEAN (2017). The 5th ASEAN Energy Outlook (2015-2040). Jakarta: ASEAN Centre for Energy. Available at https://aseanenergy.org/the-5th-asean-energy-outlook/

ASEAN (2018). ASEAN Sustainable Urbanization Strategy 2018/10. Jakarta: Association of Southeast Asian Nations. Available at https://asean.org/storage/2018/11/ASEAN-Sustainable-Urbanisation-Strategy-ASUS.pdf

Bappenas (2020). SDG mainstreaming at the local level in Indonesia. Jakarta: Ministry of National Development Planning, National Development Planning Agency (Bappenas). Available at http://sdgs.bappenas.go.id

Biardeau, L., L. Davis, P. Gertler and C. Wolfarm. (2019). Heat exposure and global air conditioning 2019. Berkley, United States of America: Haas School of Business University of California. Available at https://energyathaas.wordpress.com/2019/12/09/heat-exposure-and-global-air-conditioning/

C40 (2019). Bangkok's city hall makes the switch to better energy efficiency. Bangkok: C40 Cities. Available at https://www.c40.org/case_studies/bangkok-s-city-hall-make-the-switch-to-better-energy-efficiency

Carbon Trust (2016). Five steps to engaging with stakeholders in district energy projects. London: Carbon Trust. Availible at https://www.carbontrust.com/news-and-events/insights/five-steps-to-engaging-with-stakeholders-in-district-energy-projects

CDP (2019). The World's Renewable Energy Cities. Web Portal: CDP. Available at https://www.cdp.net/en/cities/world-renewable-energy-cities

CEMR (2019). How local & regional government associations bring the SDGs to life 2019. Italy: PLATFORMA. Available at http://platforma-dev.eu/wp-content/uploads/2019/09/CEMR-PLATFORMA-study-SDGs-2019-EN.pdf

Centre for Sustainable Energy and Energy Catapult Systems. (2020). Local Area Energy Planning Method. Web Portal: Centre for Sustainable Energy. Available at https://www.cse.org.uk/downloads/file/LAEP-method-final-review-draft-30-July-2020.pdf

Dickens, C., S. Nhlengethwa and B. Ndhlovu. 2019. Mainstreaming the Sustainable Development Goals in developing countries. Colombo, Sri Lanka: International Water Management Institute (IWMI). Available at http://www.iwmi.cgiar.org/Publications/Other/PDF/mainstreaming-the-sustainable-development-goals-in-developing-countries.pdf

EE Singapore (2020). Energy-Saving Tips. Web Portal: Energy Efficient Singapore. Available at https://www.e2singapore.gov.sg/overview/households/saving-energy-at-home/energy-saving-tips

Energy Malaysia (2019). Let's get Smart. Petaling Jaya, Malaysia: Energy Malaysia Available at https://www.st.gov.my/ms/contents/files/download/112/Energy_Malaysia_Vol._19.pdf

ESCAP (2018). Public Private Partnership in Thailand. Presentation materials: United Nations Economical Commission for the Asia and Pacific. Available at https://www.unescap.org/sites/default/files/Rules%20and%20Regulations_Public%20Private%20Partnership_Thailand.pdf

ESCAP (2020a). Asia and the Pacific SDG progress report 2020. Bangkok: United Nations. Available at https://www.unescap.org/sites/default/d8files/knowledge-products/ESCAP_Asia_and_the_Pacific_SDG_Progress_Report_2020.pdf

_____ (2020b). Regional Energy Trends Report 2020. Bangkok, Thailand: United Nations Economic and Social Commission for Asia and the Pacific. Available at https://www.unescap.org/sites/default/d8files/knowledge-products/Publication%20Regional%20Energy%20Trends%202020%20-%20Tracking%20SDG%207%20in%20the%20ASEAN%20Region.pdf

_____ (2020c). Asia-Pacific Regional Guidelines on Voluntary Local Reviews 2020. Web Portal: United Nations Economic and Social Commission for Asia and the Pacific Available at https://www.unescap.org/sites/default/files/Asia-Pacific%20Regional%20Guidelines%20on%20VLRs.pdf

ESMAP (2020). LPG Mobile Retail Dealers in Bangladesh. Web portal: Energy Sector Management Assistance Program. Available at https://www.esmap.org/sites/default/files/esmap-files/FINAL_EA-Case%20Studies.pdf

Fee L. (2020). Vertical Integration of Climate Change Policies and Actions in Asia-Pacific Cities 2020. Expert group meeting: United Nations Economic and Social Commission for Asia and the Pacific. Available at https://www.unescap.org/sites/default/files/VI_Climate%20action_AP_ESCAP.pdf

Fishman T.F. and M. Flynn (2018). Using public-private partnerships to advance smart cities 2018. Available al: Deloitte Development LLC. Available at https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Public-Sector/gx-ps-public-private-partnerships-smart-cities-funding-finance.pdf

GEF (2020). Blended finance. Web Portal: Global Environment Facility. Available at https://www.thegef.org/topics/blended-finance

Greeners (2019). Bantar Gebang Waste-To-Energy Plant is Ready to Operate. Jakarta,Indonesia: Greeners. Available at https://www.greeners.co/english/bantar-gebang-waste-to-energy-plant-is-ready-to-operate/

IEA (2017). Jakarta Regulation No. 38/2012 on Green Buildings. Jakarta, Indonesia: Governor Regulation of DKI Jakarta. Available at https://www.iea.org/policies/2523-jakarta-regulation-no-382012-on-green-buildings

IGES (2018). Toyama City Sustainable Development Goals Report Compact City Planning based on Polycentric Transport Networks. Kamiyamaguchi, Japan: Institute for Global Environmental Strategies (IGES). Available at https://sdgs.un.org/sites/default/files/2020-09/english-vlr-toyama-city-japan-2018.pdf

IRENA (2020). Mobilising institutional capital for renewable energy. Abu Dhabi: International Renewable Energy Agency. Available at https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Nov/IRENA_Mobilising_Institutional_Capital_2020.pdf?la=en&hash=DC9C2B87DBE05992267107FB512AC36D8005660A

IRP (2018). The Weight of Cities: Resource 2018. Nairobi, Kenya: United Nations Environment Programme. Available at https://www.resourcepanel.org/reports/weight-cities

Kelliher, (2018). Clean energy business model manual. Bangkok: C40. Available at https://c40-production-images.s3.amazonaws.com/other_uploads/images/2008_C40_Clean_Energy_Business_Model_Manual_-_Ezgi_Kelleher.original.pdf

Level 10 Energy (2018). What is Energy Aggregation? - A Primer. Web Portal: Level 10 Energy. Available at https://www.leveltenenergy.com/post/what-is-energy-aggregation

LGA (2009) Family-based Actions for Children and their Environs in the Slums (FACES) Anthology and Guidebook. Pasig City, The Philippines: Local Government Academy. Available at http://unhabitat.org.ph/wp-content/uploads/2015/11/FACES-Vol-2-Guidebook-and-Training-Manual.pdf

LGISB (2018). Cauayan city's PPP on localizing sustainable development goals. The Philippines: Local Governance Innovative Solutions Bank. Available at https://lgisb.lga.gov.ph/uploads/best_practice/CAUAYAN_PPP1.pdf

Local 2030 (2017). Localizing the SDGs Discover Tools. Web portal: Local 2030. Available at https://www.local2030.org/discover-tools

Local 2030 (2020). Multilevel governance. Web Portal: Local 2030. Available at https://www.local2030.org/library/tools/multilevel-governance

Martinot E. (2011). Global Status Report on Local Renewable Energy Policies. Paris, France: International Energy Agency. Available at https://inis.iaea.org/collection/NCLCollectionStore/_Public/46/105/46105568.pdf

Mendez A. and D.P. Houghton (2020). Sustainable Banking: The Role of Multilateral Development Banks as Norm Entrepreneurs. *Sustainability* 12, no. 3.: MDPI. Available at https://doi.org/10.3390/su12030972

Minh K., R. McKenna and W. Fichtner, 2017.The effects of urbanization on energy consumption and greenhouse gas emissions in ASEAN countries: Decomposition analysis. Web-portal: The International Association for Energy Economics. Available at https://www.iaee.org/en/publications/proceedingsabstractpdf.aspx?id=14606

Misselwitz, P. and J.S Villanueva (2016). The Urban Dimension of the SDGs: Implications for the New Urban Agenda In sustainable development goals and Habitat III: Opportunities for a New Urban Agenda. Brussels: Cities Alliance.

MOE Thailand (2011) 20 Year Energy Efficiency Development Plan (2011-2030). Bangkok, Thailand: Ministry of Energy of Thailand. Available at http://www.eppo.go.th/images/POLICY/ENG/EEDP_Eng.pdf

MOF Thailand (2016). Public Private Partnership in Thailand. Presentation materials: United Nations Economical Commission for the Asia and Pacific. Available at https://www.unescap.org/sites/default/files/PPP%20Thailand-sent.pdf

Mucci, M. (2012). Measurement, Reporting and Verification: A note on the concept with an annotated bibliography. Winnipeg, Canada: International Institute for Sustainable Development. Available at https://www.iisd.org/system/files/publications/mrv_bibliography.pdf

Ohshita S. and K. Jonson (2017). Resilient urban energy: making city systems energy efficient, low carbon, and resilient in a changing climate. Stockholm, Sweden: European Council for an Energy Efficient Economy. Available at https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/3-local-action/resilient-urban-energy-making-city-systems-energy-efficient-low-carbon-and-resilient-in-a-changing-climate/

Oosterhof, P.D. (2018). Localizing the Sustainable Development Goals to Accelerate Implementation of the 2030 Agenda for Sustainable Development: The Current State of Sustainable Development Goal Localization in Asia and the Pacific. Governance Brief: Asian Development Bank. Available at https://www.adb.org/publications/sdgs-implementation-2030-agenda-sustainable-development

Paloma Dulce B. (2018). Overview of the Philippines' Sustainable Development Goals (SDGs). Quezon City, The Philippines: United Nations Economic and Social Commission for Asia and the Pacific. Available at https://www.unescap.org/sites/default/files/Session1-Overview_of_the_Philippine_SDGs_implementation_commitment_to_WEE.pdf

Paris Climate Action Plan (2020). Paris Climate Action Plan, 2020.Paris, France : City of Paris. Available at https://cdn.paris.fr/paris/2020/11/23/257b26474ba3ba08ee02baa096f9c5dd.pdf

PLLENRO (2020). PLLENRO example of Batangas city. Batangas: Philippine League of Local Environment and Natural Resources Officers. Available at https://pllenro.org

REN21 (2019a). Asia and the Pacific Renewable Energy Status Report. Paris: REN21 Secretariat. Available at https://www.ren21.net/wp-content/uploads/2019/05/REN21_Asia_Report_2019_Web.pdf

_____ (2019b). Renewables in cities. Global status report 2019. Paris, France: REN21 Secretariat. Available at https://www.ren21.net/wp-content/uploads/2019/05/REC-2019-GSR_Full_Report_web.pdf

SDG7 Snapshots (2021). SDG 7 Localization snapshots. Bangkok,Thailand: Economic and Social Commission for Asia and the Pacific. Available at https://city.nexstepenergy.org/knowledge/citysnapshots

Siemens (2018). Powering the Future of Urban Mobility. Web portal: Siemens. Available at https://assets.new.siemens.com/siemens/assets/api/uuid:160bf0be-0238-4f75-afba-bc9ff79c8bcc/Powering-The-Future-of-Urban-Mobility.pdf

Sims, R. (2009). Cities, Towns and Renewable Energy: Yes in my front yard. Paris, France: International Energy Agency. Available at https://www.iea.org/reports/cities-towns-and-renewable-energy-yes-in-my-front-yard

Skinner, R., R.R. Nelson, W. W. Chin and L. Land (2015). The Delphi Method Research Strategy in Studies of Information Systems, Communications of the Association for Information Systems. Published by: Association for Information Systems. Available at https://core.ac.uk/download/pdf/288189603.pdf

Steiner A. (2017). Localizing the Implementation of the SDGs 2017. World Bank Group MC Building, Preston Auditorium: United Nations Development Programme. Available at https://www.undp.org/content/undp/en/home/news-centre/speeches/2017/localizing-the-implementation-of-the-sustainable-development-goa.html

SunStar CEBU (2018). City of Naga to treat waste from household septic tanks. Cebu, The Philippines: SunStar CEBU. Available at https://www.sunstar.com.ph/article/1748183

Thai Solar Fund (2020). Opening ceremony of Solar Prapokklao Hospital. Bangkok, Thailand: Thai Solar Fund. Available at https://thailandsolarfund.org/subprogress?id=5e32609631223a004eb07e4a

The ASEAN Post (2018). Smart City Spotlight: Bangkok. Kuala-Lumpur, Malaysia: Available at https://theaseanpost.com/article/smart-city-spotlight-bangkok

Trieunhaxan (2020). Million Green Homes Program in Viet Nam. Web Portal: Trieunhaxan. Available at http://trieunhaxanh.com.vn

UCLG ASPAC (2016). Roadmap for local government in localizing SDGs. Web Portal: Local2030. Available at https://www.local2030.org/library/view/253

UCLG ASPAC (2020). Regional Report on Asia-Pacific Region. Barcelona, Spain: United Cities and Local Governments. Available at https://issuu.com/uclgcglu/docs/eng-aspac_region_web-final

UN (2015). Transforming our world: the 2030 Agenda for Sustainable Development 2015. New York: United Nations. Available at https://sdgs.un.org/2030agenda

UN (2016). Mainstreaming SDGs into national policies, plans and strategies and integrating the three dimensions of sustainable development. Colombo, Sri Lanka: United Nations Knowledge Platform. Available at https://sustainabledevelopment.un.org/index.php?page=view&type=20000&nr=312&menu=2993

UN (2020). Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development. Web Portal: United Nations Statistics Division. Available at https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%202020%20review_Eng.pdf

UNDG (2014). Localizing the post-2015 development agenda 2014. United Nations Development Group. Available at https://www.uclg.org/sites/default/files/dialogues_on_localizing_the_post-2015_development_agenda.pdf

UNDP (2018). SDG localization in ASEAN: Experiences in shaping policy and implementation pathways. Siem Reap, Cambodia: United Nations Development Programme. Available at https://www.undp.org/content/dam/rbap/docs/Research%20&%20Publications/sustainable-development/RBAP-DG-2019-SDG-Localization-in-ASEAN.pdf

UNEP (2015a). District Energy in Cities: Unlocking the Potential of Energy Efficiency and Renewable Energy. United Nations Environment Programme. Available at http://www.districtenergyinitiative.org/sites/default/files/publications/districtenergyreportbook-07032017532.pdf

_____ (2015b). UNEP's Integrated Guidelines for Sustainable Neighborhood Design 2015. United Nations Environment Programme. Available at https://unepneighbourhoodguidelines.squarespace.com/case-studies

_____ (2015c). District energy in cities: unlocking the potential of energy efficiency and renewable energy. United Nations Environment Programme. Available at https://wedocs.unep.org/handle/20.500.11822/9317

UNEP (2018). Sustainable Urban Infrastructure Transitions in the ASEAN Region: a Resource Perspective 2018. Nairobi, Kenya: United Nations Environment Programme. Available at https://resourceefficientcities.org/wp-content/uploads/2018/07/ASEAN-Region-web.compressed.pdf

UNEP (2021). Integrated Neighborhood Approach for Energy and Resource Efficiency. United Nations Environment Programme. Available at https://www.neighbourhoodguidelines.org/

UNGA (2014). United Nations Secretary-General's Synthesis Report on the Post-2015 Agenda. New York, United States of America: United Nations General Assembly. Available at https://www.un.org/en/development/desa/publications/synthesis-report.html

UNHABITAT (2006). State of the World's Cities 2006/7. Nairobi, Kenya: United Nations Human Settlements Programme. Available at http://mirror.unhabitat.org/documents/media_centre/sowcr2006/SOWCR%205.pdf

UNHABITAT (2016). Roadmap for localizing the SDGS: Implementation and monitoring at subnational level 2016. Nairobi, Kenya: United Nations Human Settlements Programme. Available at https://unhabitat.org/sites/default/files/download-manager-files/Roadmap%20Localising%20SDG%20FINAL.pdf

VVSG (2018). Integrating the SDGS into your context analysis: How to start? Brussels, Belgium: Association of Flemish Cities and Municipalities (VVSG). Available at https://www.local2030.org/library/431/Integrating-the-SDGs-into-policy-planning-context-analysis.pdf

Westphal, M.I., S. Martin, L. Zhou, and D. Satterthwaite (2017). "Powering Cities in the Global South: How Energy Access for All Benefits the Economy and the Environment." Working Paper. Washington, DC: World Resources Institute. Available at https://files.wri.org/s3fs-public/powering-cities-in-the-global-south.pdf

World Bank (2016). Regulatory Indicators for Sustainable Energy (RISE). Web Portal: World Bank. Available at https://www.worldbank.org/en/topic/energy/publication/rise---regulatory-indicators-for-sustainable-energy

Annex I.

Questionnaire on SDG 7 localization in Southeast Asia

This Questionnaire aims at collecting data from various jurisdictions (i.e. provinces, municipalities, cities, districts, etc.) in Southeast Asia in order to assess their situation on the implementation of Sustainable Development Goal 7 (SDG 7) as part of the collaborative project of United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and United Nations Environment Programme (UNEP) to support city and sub-national governments in accelerating their efforts in the field of sustainable energy.

It is very important that participating jurisdiction complete this questionnaire in the most accurate and comprehensive way. It is recommended to conduct a local stakeholder consultation and involve various institutions and experts in order to reflect the situation in the jurisdiction in the best possible way.

Though the completion of the questionnaire requires certain commitments in terms of time and resources, the participating jurisdictions can benefit from it in many ways:

- They will be considered for a 'deep dive' conducted by ESCAP at no-cost in order to conduct a more in-depth analysis and prepare a Local Roadmap on SDG 7
- They will be invited to take part in the capacity building program on SDG 7, peer-to-peer events, thematic workshops and webinars organized by ESCAP, UNEP and partners
- They will be featured in the UN report
- They will receive the international exposure through UN processes and improved visibility for potential donors and investors

Part 1 of the Questionnaire is the most important one, hence, if you have time and resource constraints, please, prioritize the completion of this Part. However, when selecting jurisdictions for more focused and in-depth work ESCAP and UNEP will give the priority to those jurisdictions, who provided detailed answers to the highest number of questions. Part 2 of is aimed to support jurisdictions in tracking their status in implementation of various sector specific and cross sectoral energy efficient and renewable energy solutions, covering different available energy end-users and energy generation facilities. Part 3 gives the opportunity to provide the feedback to support improvement of the questionnaire in the future.

ESCAP and UNEP acknowledge that the invitation to complete this questionnaire comes during the times of the global health crisis with a lot of resources being mobilized at the sub-national level. However, we would like to emphasize that increasing sustainable energy access, energy efficiency and utilization of renewable energy are crucial for sustainable economic recovery from COVID-19 and making cities and provinces more resilient, adaptable and livable for the current and future generations. We are counting on your participation and are looking forward to working together to make your city or province more sustainable.

PART 1. Current status of SDG 7 and other related SDGs

1. Local context

1.1. Please, specify type of the sub-national jurisdiction (*Mark one answer that reflects the situation best*):

a) Province
b) County
c) Municipality
d) City
e) District
f) Other, please specify:

Note: For the purpose of simplicity we will be using the term 'jurisdiction' throughout the questionnaire to refer to the territorial and/or administrative entity, for which this questionnaire is being completed, e.g. province, city, district, etc. We will use 'local government' to refer to the government of any type of the sub-national jurisdiction

1.2. General information (*Write your answer in the provided fields*):

Name of the jurisdiction	
Country of the jurisdiction	
Population of the jurisdiction (*in million*)	
Area of the jurisdiction (*in km²*)	
Predominant climate	

1.3. Contact information (*Write your answer in the provided fields*):

Name, position of the Head of the local government/ administration	
Name, position of the contact person for this questionnaire	
Contact E-mail	
Contact telephone number:	

1.4. Which of the following powers the government of your jurisdiction is able to exercise? (*Mark ALL the answers that reflect the situation in your jurisdiction best*)

a) Introduce legislation
b) Enforce legislation or assign tasks of enforcement (monitor, penalize, award, surveillance)
c) Apply taxes (fiscal powers to create and collect taxes)
d) Subsidize and/or provide grants
e) Set targets and obligations
f) None of these powers

1.5. Is the jurisdiction a member of multi-stakeholder initiatives, networks and/or alliances? (*Mark ALL the answers that reflect the situation in your jurisdiction best*)

a) ICLEI
b) CityNet
c) United Cities and Local Governments Asia Pacific (UCLG ASPAC)
d) Global Covenant of Mayors

e) C40
f) UN Local 2030 Network
g) ASEAN Smart Cities Network (ASCN)
h) UN-HABITAT's City Prosperity Initiative (CPI)
i) Other, specify_____
j) Jurisdiction is not a member of any multi-stakeholder initiatives, networks and/or alliances
k) Not aware/no information is available

[*If (a)-(h) selected above*] Please, describe the nature of your involvement with each of the selected multi-stakeholder initiatives, networks and/or alliances:

1.6. Are there on-going or already implemented projects in your jurisdiction related to any of the following areas, which are producing tangible and visible impact and benefits: (*Mark ALL the answers that reflect the situation in your jurisdiction best*)

a) Energy efficiency
b) Renewable energy
c) Energy access
d) Smart systems/smart city/smart districts
e) Sustainable neighborhoods/ eco districts
f) Other, specify
g) No such projects currently exist in the jurisdiction
h) Not aware/no is information available

[*If (a)-(f) selected above*] Please, describe each of the existing projects, indicating duration, sources of funding, solutions applied and achieved (or expected) results

1.7. Has your jurisdiction been involved in preparation of the reports to track the progress on SDG targets: (*For each option put a Mark in the table below corresponding to the answer, that reflects the situation in your jurisdiction best*):

Area of data collection	**Yes**	**No**	**Not aware/no information is available**
Voluntary National Reviews of SDGs			
Voluntary Local Reviews of SDGs			
Other, specify:			

Note: "Voluntary Local Review (VLR) is a process whereby local and regional governments voluntarily carry out a review of progress being made in their implementation of the 2030 Agenda and its SDGs. This review includes policies, programmes, data, institutional set-ups and stakeholder engagement mechanisms to implement the 2030 Agenda at the local level".

1.8. Please, evaluate jurisdiction-wide data collection efforts and/or existing monitoring systems in the following areas: (*For each of the areas put a Mark in the table below corresponding to the answer, that reflects the situation in your jurisdiction best*)

A. No data collection and/or monitoring systems currently exist

B. There are some data collection efforts, but they are very fragmented and irregular, the quality of collected data is very low

C. Data collection efforts and/or monitoring systems take place with relative regularity, but the quality of collected data is low and/or data are not detailed

D. Data collection efforts and/or monitoring systems take place regularly, and the quality of collected data is adequately high and/or data are sufficiently detailed

E. Data collection efforts and/or monitoring systems take place regularly, and the quality of collected data is high and/or data are very detailed

F. Not aware/no information is available

Area of data collection	**A**	**B**	**C**	**E**	**D**	**F**
Energy efficiency						
Renewable energy						
Energy access						
Sustainable energy/ SDG7						
Different SDGs						
Energy supply and demand						
Other, specify						

[*If (B)-(E) selected above*] Please, describe data collection efforts and/or any existing monitoring systems existing in the jurisdiction

2. Sustainable energy / Sustainable Development Goal 7

Goal 7 of the Sustainable Development Goals (SDG7) has three clear and distinct targets by 2030:

1) Ensure universal access to affordable, reliable, and modern energy services;
2) Increase substantially the share of renewable energy in the global energy mix by 2030;
3) Double the global rate of improvement in energy efficiency by 2030

2.1. Please, evaluate the national commitments to SDG7 and their implementation at the local level through local policies and projects (*Mark one the answer that reflect the situation in your jurisdiction best*)

a) There are no national commitments to achieve SDG7 and no polices and projects on SDG7 are being implemented in the jurisdiction

b) There are national commitments to achieve SDG7, but they are not implemented in the jurisdiction

c) There are no national commitments to achieve SDG7, but the local government is implementing policies and projects on SDG7

d) There are national commitments to achieve SDG7, and the local government is implementing policies and projects on SDG7

e) Not aware/no information is available

[*If (b)-(d) selected above*] Please, briefly describe the nature of the existing commitments to SDG7 and how they are being implemented in your jurisdiction or existing barriers for their implementation

2.2. Is the local government involved in any national and/or international processes and forums related to sustainable energy and/or SDG7? (*Mark one the answer that reflect the situation in your jurisdiction best*)

a) Yes, regularly
b) Yes, occasionally/rarely
c) No
d) Not aware/no information is available

[If (a) or (b) selected above] Please, describe in which national and/or international processes and forums related to sustainable energy and/or SDG7 the local government has been involved and the nature of its participation

2.3. Please evaluate availability of administrative and/or institutional capacity responsible for implementation of initiatives related to sustainable energy and/or SDG7 (*Mark one the answer that reflect the situation in your jurisdiction best*)

a) There are no such institutions/appointed specialists in the jurisdiction
b) There are available guidelines for setting up such an institutional framework, but responsible department/dedicated specialists have not been appointed yet
c) Jurisdiction has an appointed responsible institution/dedicated specialist with limited technical and/or administrative capacity to support sustainable energy projects
d) Jurisdiction has an appointed responsible institution/dedicated specialists with sufficient technical and/or administrative capacity to support sustainable energy projects

[*If (c) or (d) selected above*] Please, list responsible institutions, which support sustainable energy projects

2.4. Please evaluate level of coordination between city, sub-national and national level administrations, regarding sustainable energy issues and/or implementation of SDG7 (*Mark one the answer that reflect the situation in your jurisdiction best*)

a) Coordination mechanisms (e.g. steering committees/councils/other institutions, which include representatives from both national, sub-national and local levels of governance) are not established. There is lack or even absence of the dialogue between relevant national agencies and sub-national and/or local administrations

b) Some coordination mechanisms exist, but are not supported by the relevant national regulatory and budgetary framework

c) Coordination mechanisms are established and supported by the relevant national regulatory and budgetary framework, but joint sustainable development activities are not implemented in the jurisdiction

d) Coordination mechanisms are established and supported by the relevant national regulatory and budgetary framework, and joint sustainable development activities are being implemented in the jurisdiction

e) Not aware/no information is available

[*If (b)-(d) selected above*] Please, describe existing coordination mechanisms related to sustainable energy/SDG7 implementation in your country and your jurisdiction's involvement or reasons for non-involvement in them

2.5. Please evaluate the role of local government in increasing citizen understanding and ownership of the SDG7 targets: (*Mark one the answer that reflect the situation in your jurisdiction best*)

a) Currently efforts on increasing citizen understanding and ownership of the SDG7 targets through awareness raising campaigns are not included in the local government's policy agenda

b) Local government recognizes the importance of increasing citizen understanding and ownership of the SDG7 targets, but has not yet implemented respective awareness raising campaigns

c) Local government is currently developing/implementing awareness raising campaigns to increase citizen understanding and ownership of the SDG7 targets

d) Local government has a track record of successfully implemented awareness raising to increase citizen understanding and ownership of the SDG7 targets

e) Not aware/no information is available

[*If (b)-(d) selected above*] Please, describe awareness raising activities that are implemented or prepared for implementation in your jurisdiction or reasons for such activities not being implemented

2.6. Please, evaluate the implementation of targets and regulations in the jurisdiction (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. are not introduced at the national level and are not implemented at the local level
B. are introduced at the national level, but are not implemented at the local level
C. are not introduced at the national level, but are implemented at the local level
D. are introduced at the national level, and are implemented at the local level
E. Not aware/no information is available

Energy consumers	Energy intensity reduction/ Energy efficiency target	Renewable energy target	GHG emissions/air pollution reduction target	Energy management systems and smart metering
Jurisdiction-wide*				
Buildings				
Residential sector buildings				
Public sector buildings				
Commercial buildings				
Slums and informal settlements				
Industry				
Food and Beverages				
Chemical and synthetic products				
Glass, cement and non-metals				
Iron and steel				
Pulp and paper				
Textile				
Leather and leather products				
Machinery and Transportation Equipment				
Wood and Other Products				
Agriculture and farming				
Other processing industry				
Centralized Energy generation				
Electricity generation				
District Cooling systems				
District Heating systems				
Transport				
Passenger Car				
Motorbike				
Taxi				
Auto Rickshaw				
Bus				
Tram				
Tractor				
Mini Bus				

Energy consumers	Energy intensity reduction/ Energy efficiency target	Renewable energy target	GHG emissions/air pollution reduction target	Energy management systems and smart metering
Freight Transport				
Metro				
Waste				
Landfills				
Waste recycling				
Street lighting				
Street lights				
Architectural and buildings lights				
Water				
Centralized water supply and				
Centralized sanitation systems				

Note: "Answers provided to jurisdiction-wide will cover certain energy consumers in specific targets and regulations. For example, if 'A' answer is given as jurisdiction-wide in the energy intensity reduction/ Energy efficiency target in building sector', then same 'A' answer will apply to that target/regulation in its sub-sectors such as residential sector buildings, public sector buildings, commercial building, and slums and informal settlements."

[*For each answer (B)-(D)* provided above] Please, provide the details on existing targets and regulations in the jurisdiction, and where possible for different energy consumers

2.7. Please evaluate implementation of each policy instrument in the building sector that exist or is planned to be introduced shortly in your jurisdiction (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. Policy is not introduced at the national level and is not implemented at the local level
B. Policy is introduced at the national level, but is not implemented at the local level
C. Policy is not introduced at the national level, but is implemented at the local level
D. Policy is introduced at the national level, and is implemented at the local level
e) Not aware/no information is available

Policy instruments	Jurisdiction-wide*	Residential sector buildings	Public sector buildings	Commercial buildings	Slums and informal settlements	Industry
Energy efficiency policy for new construction						
Energy efficiency policy for retrofit						

Policy instruments	Jurisdiction-wide*	Residential sector buildings	Public sector buildings	Commercial buildings	Slums and informal settlements	Industry
Program to promote utilization of local materials in construction and retrofits						
Sustainable procurement regulations						
Mandatory energy performance certification and labeling of buildings						
Voluntary energy performance certification and labeling of buildings						
Mandatory smart energy metering						
Voluntary smart energy metering						
Energy efficiency obligations schemes/ White certificates						
Carbon market project mechanisms/ Green certificates						
Awareness raising, education and information campaigns on sustainable energy						
Net-metering regulations						
Mandatory requirements for on-site solar generation						
Mandatory use of ecological standards (ISO 14001 or similar)						
Voluntary use of ecological standards (ISO 14001 or similar)						
Mandatory use of energy management standards (ISO 50001 or similar)						
Voluntary use of energy management standards (ISO 50001 or similar)						
Energy efficiency action plan						

Policy instruments	Jurisdiction-wide*	Residential sector buildings	Public sector buildings	Commercial buildings	Slums and informal settlements	Industry
Mandatory energy auditing						
Mandatory use of renewable energy for hot water						
Mandatory use of renewable energy for cooling (heating)						
Mandatory on-site water treatment						
Mandatory connection to the district energy source, in case of availability						
Other (could be several), please specify						

Note: "Answers provided to jurisdiction-wide will cover all energy consuming sector in specific policy instruments. For example, if 'A' answer is given as jurisdiction-wide in 'Energy efficiency policy for new construction, then same 'A' answer will apply to that policy instrument in all sectors, including residential building sector, public sector building, commercial building, slum and informal settlement, and industry."

[*For each answer (B)-(D)* provided above] Please, provide the details on existing policy instruments in the building sector in the jurisdiction

2.8. Please evaluate implementation of each policy instrument for the transport sector, that exist or will be introduced shortly in your jurisdiction (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. Policy is not introduced at the national level and is not implemented at the local level
B. Policy is introduced at the national level, but is not implemented at the local level
C. Policy is not introduced at the national level, but is implemented at the local level
D. Policy is introduced at the national level, and is implemented at the local level
e) Not aware/no information is available

Policy instruments in transport sector	Passenger transport	Freight transport	All transport*
Regulations on high standard liquid fuel use (petrol and diesel EURO-5 or higher)			
Regulations on hybrid engines use			
Regulations on electric engines use			
Regulations on LPG or similar gas type engines use			

Policy instruments in transport sector	Passenger transport	Freight transport	All transport*
Regulations on biogas engines use			
Regulations on hydrogen engines use			
Mandatory Eco-drive training			
Policies on integration of transport low emission zones and timing limits			
Bus rapid transit			
Other, please specify			

Note: Answers provided to "All transport" will cover specific policy instruments in both passenger transport and freight transport. Ex: if 'A' answers is given as "all transport" in regulations on high standard liquid fuel use (petrol and diesel EURO-5 or higher); then same 'A' answers will apply to that policy instrument in both passenger and freight transport.

[*For each answer (B)-(D) provided above*] Please, provide the details on existing policy instruments in the transport sector in the jurisdiction

2.9. Please provide information on available financial support (e.g. subsidies, grants, soft loans, tax reductions, etc.) for specific energy consuming sectors (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

Areas in which incentives are applied	Residential sector buildings	Public sector buildings	Commercial buildings	Slums and informal settlements	Industry	Transport	Waste management	Street lighting	Water management
Energy access/ electrification									
Energy access/ clean fuels									
Clean cooking									
Energy efficiency									
Renewable energy									
Overall implementation of SDG7									
Other, specify									

[*For each answer (B)-(D) provided above*] Please, provide the details on existing financial incentives and the measures, which are covered by them

2.10. Please evaluate contribution of energy types into the final energy consumption for different energy consumers, using the following scale (*For each of the areas in the Tables below insert one Letter (A-E) corresponding to the answer that reflects the situation in your jurisdiction best. If Energy Consumer is not applicable in your jurisdiction, please, do not fill out the respective row*):

A. Energy consumer is not present in the city

B. Energy source is not available

C. Energy source is available, but not used

D. Energy source is available and is not widely used (e.g. only in a few areas or projects)

E. Energy source is available and widely used, but the equipment and technologies are typically not energy efficient

F(1). Energy source is available and widely used, but utilization of related energy efficient technologies is limited (i.e. there are some cases of utilization of energy efficient technologies, but most of technologies are inefficient)

F(2). Energy source is available and widely used, utilization of related energy efficient technologies is moderate (i.e. both efficient and inefficient technologies are approximately equally present)

F(3). Energy source is available and widely used with utilization of predominantly energy efficient technologies (i.e. mainly energy efficient technologies are used for this fuel type)

G. Not aware/no information is available/not applicable

1. Energy consumers: Building sector and infrastructure	**Coal**	**Oil products**	**Natural gas**	**LPG**	**On-site solar**	**Biomass**	**Electricity**
Buildings							
Residential							
Public							
Commercial							
Slums and informal settlements							
Waste management							
Landfills							
Waste recycling							
Street lighting							
Street lights							
Architectural and buildings lights							
Water management							
Centralized water supply							
Centralized sanitation systems							

2. Energy consumers: Transport	**Gasoline**	**Diesel**	**Natural gas**	**Biodiesel**	**Hydrogen**	**Electricity**
Transport						
Passenger Car						
Motorbike						
Taxi						
Auto Rickshaw						
Bus						
Tram						

Tractor
Mini Bus
Freight Transport
Metro

3. Energy consumers: Industry	Coal	Oil products	Natural gas	LPG	On-site solar	Biomass	Energy from waste	Electricity
Industry								
Food and Beverages								
Chemical and synthetic products								
Glass, cement and non-metals								
Iron and steel								
Pulp and paper								
Textile								
Leather and leather products								
Machinery and Transportation Equipment								
Wood and Other Products								
Other processing industry								

Centralized Energy	Coal	Oil products	Natural gas	LPG	Solar	Biomass/ biogas	Hydro	Wind	Energy from waste
Electricity generation									
District Cooling systems									
District Heating system									

2.11. Indicate how many of each home appliances listed below an average household in your jurisdiction and whether each appliance category is covered by existing Minimum Energy Performance Standards (MEPs) (*Insert the actual number in each area in the Table below, or put '0', if appliance is not used*):

Home appliance	Is it covered by MEPs?		Households in urban areas	Households in slums and informal settlements
	Yes	No		
Air-conditioning				
Fan				
Television				
Refrigerator				
Freezer				
Water cooler				

Home appliance	Is it covered by MEPs?		Households in urban areas	Households in slums and informal settlements
	Yes	No		
Kitchen stoves				
Microwave				
Rice cooker				
Washing machines				
Clothes dryer				
Dishwasher				
Small kitchen appliances (kettle, blender, etc.)				
Laptop/ Computer				
Mobile devices (phone, tablet, etc.)				
Other, specify				

2.12. Evaluate utilization of different cooking methods by households in your jurisdiction (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. Cooking method is not used
B. Cooking method is used occasionally
C. Cooking method is used, but not a common practice
D. Cooking method is widely and/or common practice
E. Not aware/no information is available

Cooking method	Households in urban areas	Households in slums and informal settlements
Basic methods of burning fossil fuels (coal, oil products, wood, raw organic waste)		
Kerosene		
Ethanol/alcohol		
Improved wood cookstoves		
Electric cookers/pressure cookers		
Induction electric stoves		
High efficient natural gas or LPG stoves		
Low emission stoves (using fossil fuels or pellets/charcoal briquettes)		
Solar thermal cooking		
Solar concentrators		
Landfill or biomass methane gas cooking stove		
Other, specify		

2.13. Evaluate the significance of the problem of power outages in your jurisdiction (*Mark one answer that reflects the situation in your jurisdiction best*):

a) Power outages are not common and typically do not happen in the jurisdiction
b) Power outages happen rarely and/or last for very short periods of time
c) Power outages happen from time to time and/or may vary in duration (last for short or prolonged periods of time)
d) Power outages are common and/or can last for prolonged periods of time
e) Not ware/no information is available

3. Healthy lives and well being

3.1. Evaluate the availability of health facility-related spaces (e.g. hospitals, medical centers, etc.) with space cooling (air-conditioned) in the jurisdiction? (*Mark one answer that reflects the situation in your jurisdiction best*):

a) Existing facilities cannot satisfy health needs of the population (less than 50% of people can have access) and most of them do not have sufficient space cooling
b) Existing facilities cannot satisfy health needs of the population (less than 50% of people can have access) but most of them have sufficient space cooling
c) Existing facilities can moderately satisfy health needs of the population (between 50% and 90% of people can have access) and most of them have sufficient space cooling
d) Existing facilities can adequately satisfy health needs of the population (more than 90% of people can have access) and have sufficient space cooling
e) Not aware/no information is available

3.2. Evaluate the availability of the mobile vaccine/blood refrigeration facilities in your jurisdiction (*Mark one answer that reflects the situation in your jurisdiction best*):

a) Mobile vaccine/blood refrigeration facilities are not available in the jurisdiction
b) Mobile vaccine/blood refrigeration facilities are very limited, and do not cover the needs of the jurisdiction
c) Mobile vaccine/blood refrigeration facilities are available in the jurisdiction and cover jurisdiction's needs to a large extent
d) Mobile vaccine/blood refrigeration facilities are available and are able to cover jurisdiction's needs to full extent
e) Not aware/no information is available

Feel free to provide any comments on health facility-related spaces and/or mobile vaccine/blood refrigeration facilities in your jurisdiction

4. Water management and sanitation

4.1. Evaluate the quality of existing wastewater treatment practices in the jurisdiction (*Mark one answer that reflects the situation in your jurisdiction best*):

a) There are no high-quality wastewater treatment facilities in the jurisdiction
b) Less than 50% of wastewater undergoes good quality treatment
c) Between 50 and 90% of wastewater undergoes good quality treatment
d) More than 90% of wastewater undergoes good quality treatment
e) Not aware/no information is available

4.2. Evaluate the efficiency of water management and sanitation equipment in these facilities (*Mark one answer that reflects the situation in your jurisdiction best*):

a) Equipment is old and inefficient and requires major repairs and/or replacement

b) Equipment has relatively low levels of energy efficiency, functioning with significant energy losses due to poor system planning and design

c) Equipment has moderate levels of energy efficiency, functioning without significant energy losses with proper system planning and design

d) Equipment has high levels of energy efficiency, including renewable energy and advanced modern system design.

e) Not aware/no information is available

4.3. Evaluate the level of implementation of Integrated Water Resource Management (IWRM)* in the jurisdiction (Mark one answer that reflects the situation in your jurisdiction best):

a) There are no IWRM projects implemented in the jurisdiction

b) IWRM is not a common practice, but there are some related pilot projects in the jurisdiction

c) IWRM is recognized as an important practice and there are multiple cases of its implementation in the jurisdiction

d) IWRM is a common practice and is widely implemented in the jurisdiction

e) Not aware/no information is available

4.4. If IWRM is implemented in the jurisdiction, specify which of the following energy efficient technologies are commonly used as part of the IWRM (*Mark ALL applicable answers that reflect the situation in your jurisdiction* best):

a) Water pumps with VSD drive

b) Smart process control systems

c) Automated demand-side water supply regulation

d) Use of solar energy for water supply and treatment

e) Use heat pumps

f) Implementation of waste-to-energy technologies to utilize the liquid organic waste from the sanitation system

g) Not aware/no information is available

h) Other (please, specify):

4.5. Is jurisdiction already implementing and/or can have access to the international support for the following areas (*Mark ALL applicable answers that reflect the situation in your jurisdiction best*):

a) Rainwater harvesting

b) Desalination

c) Water efficiency

d) Wastewater treatment

e) Technologies for water recycling and reuse

f) Not aware/no information is available

g) Other (please, specify):

*Integrated Water Resources Management (IWRM) is a process which promotes the coordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment

Feel free to provide any comments on health facility-related spaces and/or mobile vaccine/blood refrigeration facilities in your jurisdiction

5. Resilient infrastructure

5.1. Evaluate the portion of population living in slums, informal settlements or inadequate housing in the jurisdiction (*Mark one answer that reflects the situation in your jurisdiction best*):

a) There are no slums, informal settlements or inadequate housing in the jurisdiction
b) Less than 25% of the population live in slums, informal settlements or inadequate housing
c) Between 25% and 50% of the population live in slums, informal settlements or inadequate housing
d) More than 50% of the population live in slums, informal settlements or inadequate housing
e) Not aware/no information is available

5.2. Evaluate the portion of population with the access to public or shared transport in the jurisdiction (*Mark one answer that reflects the situation in your jurisdiction best*):

a) There is no public or shared transportation in the jurisdiction
b) Less than 25% of the population has access to public or shared transportation
c) Between 25% and 50% of the population has access to public or shared transportation
d) More than 50% of the population has access to public or shared transportation
e) Not aware/no information is available

5.3. Evaluate the level of walkability of the jurisdiction (*Mark one answer that reflects the situation in your jurisdiction best*):

a) There are no pedestrian lanes in the jurisdiction
b) Pedestrian lanes are not very common in the jurisdiction and/or most of them are require substantial improvement
c) Pedestrian lanes are common in multiple places and most of them are convenient to walk on, but some lanes require improvement
d) Pedestrian lanes are common practice everywhere and are convenient to walk on
e) Not aware/no information is available

5.4. Evaluate the significance of the air pollution problem in the jurisdiction (*Mark one answer that reflects the situation in your jurisdiction best*):

a) Not aware/no information is available
b) Good (common level of air pollution is lower than 50ppm)
c) Moderate (common level of air pollution is between 51 and 100 ppm)
d) Unhealthy for sensitive groups (common level of air pollution is between 101 and 150 ppm)
e) Unhealthy (common level of air pollution is between 151 and 200ppm)
f) Very unhealthy (common level of air pollution is between 201 and 300ppm and higher)

5.5. Rank the main sources of air pollution (from 1 to 8) (*For each source insert a number between 1 and 8 into the Table below, where 1 is the most polluting source and 8 is least polluting*)

Sources	**Rank from 1 to 8**
Buildings	
Industry	
Centralized energy generation	
Transport	
Agriculture	
Waste treatment, including landfills	
Natural sources, including volcanic eruptions, windblown dust, sea-salt spray and emissions of volatile organic compounds from plants	
Other, specify	

5.6. Evaluate current status of urban solid waste treatment system in your jurisdiction (*Mark one answer that reflects the situation in your jurisdiction best*):

a) Solid waste is not collected or collected in a very inefficient way, without sorting and further recycling

b) Solid waste is collected, and simply transported to the open landfill without any treatment or sorting

c) Solid waste has basic on-site sorting, then collected and transported to the landfills. Some of the landfills have implemented pilot waste treatment and recycling equipment.

d) There is a modern and efficient waste management system in place including sorting, recycling, re-using and/or waste-to-energy solutions implemented

e) Not aware/no information is available

Feel free to provide any comments related to the urban infrastructure in your jurisdiction or regarding any questions in this section

5.7. Please indicate consumers, which receive fossil-fuels subsidies (Mar*k ALL applicable answers that reflect the situation in your jurisdiction best*):

a) There are no fossil-fuels energy subsidies

b) Buildings

c) Industry

d) Centralized energy generation

e) Transport

f) Landfills

g) Not aware/no information is available

h) Other (please, specify):

6. Climate change and its impacts

6.1. Please evaluate development and implementation of local disaster risk reduction strategies in the jurisdiction (*Mark one answer that reflects the situation in your jurisdiction best*):

a) There are no local disaster reduction strategies developed and implemented in the jurisdiction

b) There are some disaster reduction strategies and specific actions developed at the national level, but their implementation in the jurisdiction is currently limited/at the pilot stage

c) There are disaster reduction strategies developed at the jurisdiction level in line with relevant national strategies and they are currently under implementation

d) Disaster reduction strategies are implemented in the jurisdiction in line with relevant national strategies.

e) Not aware/no information is available

[*If (b)-(d) answered*] Please, provide the details on existing local disaster risk reduction strategies or other policies and/or actions related to climate change adaptation

PART 2. Implementation of sustainable energy urban solutions

Part 2 of the questionnaire is optional and is aimed to support jurisdictions in tracking their status in implementation of various sector specific and cross sectoral energy efficient and renewable energy solutions, covering different energy end-users and energy generation facilities available in the jurisdiction. It is recommended that this part of the questionnaire should be completed by energy experts with technical expertise in energy systems and good understanding of local energy practices (e.g. city energy manager).

The completion of Part 2 is required for the jurisdiction, interested in being considered for a deep dive analysis of the pathways to accelerate the progress on SDG7. Based on the answers provided by jurisdictions to this Questionnaire ESCAP will select several of them to provide technical assistance for development of a Local SDG7 Roadmap.

7. Sector specific sustainable energy urban solutions

7.1. Buildings

Please, evaluate the status of implementation of listed solutions in the building sector (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. The solution is not interesting/relevant for implementation in the jurisdiction and/or its implementation was not initiated
B. The solution is interesting for implementation and/or is currently at the pilot stage of implementation
C. The solution is relevant for the jurisdiction and is currently being widely implemented in the jurisdiction
D. The large-scale implementation of the solution in the jurisdiction has already been effectively accomplished

Buildings solutions	Residential sector	Public sector	Commercial sector	Slums
Energy efficient windows and glazing				
Building envelope Insulation				
Energy efficient lighting				
Motion sensors for the lights systems				
Daylight architecture solutions and shading				
Smart energy meters and remote data collection				
Smart building management system				
Energy efficient centralized air conditioning				
Energy efficient individual air conditioning				
Energy efficient home appliances				
Energy efficient pumps				
Energy efficient fans				
Automated and demand controlled ventilation				
Solar PV systems				
Solar thermal systems				
Use of biomass or biogas for individual energy generation				

Buildings solutions	Residential sector	Public sector	Commercial sector	Slums
Cool roofs				
Green/living roofs				
Vegetation for shading facades				
Automated or manual windows and glazing shading system				
Heat pumps				
Other, please specify				

7.2. Industry

Please, evaluate the status of implementation of listed solutions in industry: (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. The solution is not interesting/relevant for implementation in the jurisdiction and/or its implementation was not initiated
B. The solution is interesting for implementation and/or is currently at the pilot stage of implementation
C. The solution is relevant for the jurisdiction and is currently being widely implemented in the jurisdiction
D. The large-scale implementation of the solution in the jurisdiction has already been effectively accomplished

Note: In the framework of current questionnaire, industry sector is divided into energy intensive and energy non-intensive types.
Energy intensive industries include: Food and Beverages, Chemical and synthetic products, Glass, cement and non-metals, Pulp and paper, Iron and steel, Mining, Oil and Gas, and other similar
Non-Energy intensive industries include: Textile, Leather and leather products, Machinery and Transportation Equipment, IT companies, Electronics manufacturing, Agriculture, Farming and other similar

Industrial solutions	Energy intensive industry	Non-energy intensive industry
Energy efficient windows and glazing in industrial buildings and facilities		
Building envelope insulation of industrial buildings and facilities		
Process equipment and pipes insulation		
Energy efficient lighting in industrial buildings and facilities		
Motion sensors for the lights systems		
Daylight architecture solutions		
Smart energy meters and remote data collection		
Invertor type AC		
Energy efficient compressor and absorption type industrial chillers		
Energy efficient office appliances		
Energy efficient pumps and motors		
Energy efficient compressors		
Solar PV		
Solar thermals systems		
Use of biomass for energy generation		
Heat pumps and waste heat recovery		
Energy efficient process equipment		
Other, please specify		

7.3. Transport

Please, evaluate the status of implementation of listed solutions in transport (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. The solution is not interesting/relevant for implementation in the jurisdiction and/or its implementation was not initiated
B. The solution is interesting for implementation and/or is currently at the pilot stage of implementation
C. The solution is relevant for the jurisdiction and is currently being widely implemented in the jurisdiction
D. The large-scale implementation of the solution in the jurisdiction has already been effectively accomplished
e) Not aware/no information is available

Energy efficient and sustainable urban solutions for transport sector	**Private transport**	**Public transport**	**Freight transport**
Using of high standard petrol (EURO-5 or similar)			
Using of high standard diesel fuel (EURO-5 or similar)			
Use of hybrid engines			
Use of electric engines			
Use of solar powered charging stations for electric transport			
Use of LPG or similar gas type engines			
Use of biogas engines			
Use of hydrogen engines			
Car sharing			
Fuel economy driving training courses and capacity building programs			
Vehicles city tolling			
Integration of transport low emission zones and timing limits			
Bus rapid transit system (BRTS)			
Other, please specify			

7.4. Centralized Energy generation

Please, evaluate the status of implementation of listed solutions in centralized energy generation: (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. The solution is not interesting/relevant for implementation in the jurisdiction and/or its implementation was not initiated
B. The solution is interesting for implementation and/or is currently at the pilot stage of implementation
C. The solution is relevant for the jurisdiction and is currently being widely implemented in the jurisdiction
D. The large-scale implementation of the solution in the jurisdiction has already been effectively accomplished

Centralized energy generation	**Electricity generation**	**District cooling**	**District heating**
Energy efficient Combined Cycle Gas Turbine			
Energy efficient Heavy Fuel engine			
Energy efficient Gas fuel Engine (including cogeneration and trigeneration)			

Centralized energy generation	Electricity generation	District cooling	District heating
Energy efficient coal power plant, using low-emission working cycle (pyrolysis, specific burners and other)			
Solar PV			
Wind turbines			
Hydro power generators			
Waste-to-energy systems			
Biogas power plants			
Biomass power plants			
Geothermal power plants			
Generating surplus power from wastewater treatment			
Smart grids, remote energy metering			
Transmission network optimization			
Implementation of urban minigrids			
Large-scale battery storage			
Large scale thermal storage			
Other, please specify			

7.5. Street lighting

Please, evaluate the status of implementation of listed solutions in street lighting: (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. The solution is not interesting/relevant for implementation in the jurisdiction and/or its implementation was not initiated
B. The solution is interesting for implementation and/or is currently at the pilot stage of implementation
C. The solution is relevant for the jurisdiction and is currently being widely implemented in the jurisdiction
D. The large-scale implementation of the solution in the jurisdiction has already been effectively accomplished

Streetlighting solutions	Street lights	Architectural outdoor lights
Using of highly efficient LED technologies		
Smart daylight control system		
Remote energy monitoring and functional control		
Use of lamps sustainable recycling solutions		
Solar PV powered energy storage		
Other, please specify		

7.6. Waste management

Please, evaluate the status of implementation of listed sustainable urban solutions in waste management (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. The solution is not interesting/relevant for implementation in the jurisdiction and/or its implementation was not initiated
B. The solution is interesting for implementation and/or is currently at the pilot stage of implementation
C. The solution is relevant for the jurisdiction and is currently being widely implemented in the jurisdiction
D. The large-scale implementation of the solution in the jurisdiction has already been effectively accomplished

Energy efficient and sustainable urban solutions in waste management sector	Open type landfills	Waste sorting facilities
Using of deep municipal waste sorting for further safe recycle and reuse		
Implementation of low-emission pyrolysis technologies for municipal waste utilization		
Use of smart waste delivery and transportation systems		
Specific high temperature (and plasma) pyrolysis technologies for hazardous waste utilization		
Use of renewable energy source to cover self needs of the waste treatment facility		
Other, specify		

7.7. Water management

Please, evaluate the status of implementation of listed sustainable urban solutions in water management (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. The solution is not interesting/relevant for implementation in the jurisdiction and/or its implementation was not initiated
B. The solution is interesting for implementation and/or is currently at the pilot stage of implementation
C. The solution is relevant for the jurisdiction and is currently being widely implemented in the jurisdiction
D. The large-scale implementation of the solution in the jurisdiction has already been effectively accomplished

Energy efficient and sustainable urban solutions in water management sector	Water supply	Water sanitation
Water pumps with VSD drive		
Smart process control systems		
Automated demand-side water supply regulation		
Use of solar energy for water supply and treatment		
Use heat pumps for surplus heat generation		
Other, please specify		

8. Cross-sectoral integrated urban solutions

8.1. Please, evaluate the status of implementation of listed cross-sectoral integrated urban solutions in your jurisdiction (*For each of the areas in the Table below insert one Letter (A-D) corresponding to the answer that reflects the situation in your jurisdiction best*):

A. The solution is not interesting/relevant for implementation in the jurisdiction and/or its implementation was not initiated
B. The solution is interesting for implementation and/or is currently at the pilot stage of implementation
C. The solution is relevant for the jurisdiction and is currently being widely implemented in the jurisdiction
D. The large-scale implementation of the solution in the jurisdiction has already been effectively accomplished

Integrated Urban Solutions	Implementation status	Comments
Smart and digitalized energy system in cities. Solutions, that help to provide the managers insight into energy use of the building, allows active energy management and energy savings		

Integrated Urban Solutions	Implementation status	Comments
Implementation of improved Smart grids/Mini grids, using combined energy sources (traditional and renewable)		
Use of cold (heat) storage systems for district cooling (heating)		
Reduction of air pollution and GHG emissions by lowering the transport load (cycling, walkable communities, intellectual transporting and other)		
Use of waste heat in district energy systems		
Use of waste materials in construction (such as fly ash bricks and other)		
Use of recovered landfill (or sewage system gas for energy generation and industrial heat supply (for example heating of greenhouses)		
Development of electric vehicle (EV) infrastructure to support EV uptake		
Implementation of sustainable approaches to urban and district land-use planning (e.g. prioritization of sustainable energy projects, conduct energy benchmarking, support green investments and other)		
Integration of sustainable urban planning courses into the educational process (covers various target audience: students, specialists, ordinary energy end-users, private and government sector representatives)		
Reuse of treated sewage effluent and rainwater in cooling towers		
Land-use planning in consideration with energy available energy sources and end-users (including demand-side energy generation and management models)		
Use of plastic and municipal waste pyrolysis for transport fuel		
Integration of water extraction/distribution with thermal use (e.g. emergency water wells with geothermal/exchange; lake water cooling; seawater cooling; desalination heat capture; wastewater heat recapture; etc.)		
Other (please, specify)		

8.2. Please indicate any energy related specific needs or urban solutions, energy efficient or/and renewable energy technologies that your jurisdiction is interested in terms of a more detailed review, analysis, or potential implementation