Public Disclosure Authorized

Using the climate auction model to promote energy-efficient buildings in Indonesia

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Acknowledgments

The Climate Auction Model is an innovative, pay-for-performance mechanism piloted by the World Bank Group to stimulate investment in projects that reduce greenhouse gas emissions while maximizing the impact of public funds and leveraging private sector financing. This study on using innovative pay-for-performance mechanisms like the climate auction model to promote energy-efficient buildings in Indonesia has relied on the critical support of multiple entities and individuals that the World Bank team would like to acknowledge.

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The EDGE program offers a green building certification for new energy efficient buildings and advises governments on new green building codes. Launched in 2013, EDGE certification works at the early design stage to reduce operational expenses and environmental impact. The EDGE certification tool—a web-based software application—currently contains data on 125 countries and has 4,500 registered users. The EDGE standard requires a minimum 20 percent reduction in water, energy, and embedded energy in materials, compared to a base case building. To date, the EDGE program has certified 880,000 square meters of floor space in developing countries. The EDGE software allows users to instantly estimate not only the energy, water, and material efficiency of a design, but also the expected kilowatt-hours of electricity savings, cubic meters of water savings, tons of carbon dioxide equivalent greenhouse gas savings, and financial costs and benefits of a design. The software is freely available at www.edgebuildings.com.

Acronyms and abbreviations

AC	air conditioning
APERSI	Association of Indonesian Housing and Settlement Developers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASPERI	Indonesia Public Housing Developers Association
BAPPENAS	Ministry of National Development Planning
BAU	business as usual
BSN	National Standardization Agency
BSPS	*bantuan stimulan perumahan swadaya* (incremental support for self-built housing)
BUM	*bantuan uang muka* (down payment subsidy)
CFC	chlorofluorocarbon
CFL	compact fluorescent lamp
CMHDC	Coordinating Ministry for Human Development and Culture
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COP	coefficient of performance
DG	Directorate General
EDGE	Excellence in Design for Greater Efficiencies
ESCO	energy service company
ESMAP	Energy Sector Management Assistance Program
FLPP	Fasilitas Likuiditas Permbiyaan Perumahan (Housing Financing Liquidity Facility)
FSA	Otoritas Jasa Keuangan (Financial Services Authority)
GBCI	Green Building Council Indonesia
HIMPERA	Association of Public Housing Developers
Rp	Indonesian rupiah
IFC	International Finance Corporation
IMB	*izin mendirikan bangunan* (building construction permit)
JCM	Joint Crediting Mechanism
km	kilometer
$ktCO_2e$	kiloton carbon dioxide equivalent
LED	light emitting diode
LIH	low-income housing
m^2	square meter
MEMR	Ministry of Energy and Mineral Resources
MEPS	Minimum Energy Performance Standards

MoF	Ministry of Finance
MoPWH	Ministry of Public Works and Public Housing
MTF	Multi-Tier Framework
MWh	megawatt-hour
NAHP	National Affordable Housing Program
NPV	net present value
OSIS	one-stop integrated service
OTTV	overall thermal transfer values
PAF	Pilot Auction Facility for Methane and Climate Change Mitigation
PLN	state-owned utility company
PPP	public-private partnership
PT SBH	PT Sertifikasi Bangunan Hijau
PT SMI	PT Sarana Multi Infrastruktur
PVs	photovoltaics
REI	Real Estate Indonesia
RENSTRA	Strategic Plan of the Ministry of Public Works and Public Housing
RPJMN	Rencana Pembangunan Jangka Menengah Nasional (National Medium-Term Development Plan)
Rusunami	owned multi-story public housing
Rusunawa	rental multi-story public housing
SDGs	Sustainable Development Goals
SLF	*sertifikat layak fungsi* (building occupancy certificate)
SNI	Indonesian National Standard
SSA	*subsidi selisih angsuran* (mortgage interest buydown)
SSB	*subsidi selisih bunga* (mortgage interest buydown)
TOE	tonnes of oil equivalent
VA	volt-amperes
VAT	value added tax
VGF	Viability Gap Fund
WC	water closet
WPS	*wilayah pembangunan strategis* (strategic development areas)

1. Introduction

1.1 Background

In the **financial incentive space**, the World Bank Group[1] has developed new finance models to attract investment in projects that mitigate climate change. These include the climate auction model introduced by the Pilot Auction Facility for Methane and Climate Change Mitigation (PAF).[2] By setting up competitive auctions for private sector bidders, the PAF incentivizes efforts to reduce greenhouse gas (GHG) emissions in the most cost-effective way, maximizing the impact of public funds.

Auction mechanisms used in various arenas (e.g., telecommunications, electricity, emissions abatement) have proved efficient tools for price discovery and allocation of scarce resources. The World Bank Group seeks to build on its experience with PAF to adapt the mechanism to other sectors. A study carried out by the Carbon Trust asserts that a similar auction model could be applied to incentivize energy and resource efficiency in the building sector and especially in affordable low-income housing (Carbon Trust 2018).

The World Bank Group is exploring opportunities to pilot a combination of the proven climate auction model and the Excellence in Design for Greater Efficiencies (EDGE) voluntary certification[3] to encourage the green building sector, helping to avoid the locking in of assets that are energy inefficient, polluting, and expensive. The auction model would offer an innovative, results-based approach to promote private sector investment in green buildings, while the EDGE certification would provide a metric against which to disburse funds.

Indonesia and its affordable (low-income) housing sector have been identified as the first potential country and sector for such an auction pilot.

1.2 Objectives of the study and structure of the report

This study informs the design of a successful climate auction pilot in the low-income housing (LIH) sector in Indonesia.

This report presents a summary of the main results of the analysis. It includes the following sections:

- **Section 1** introduces the main scope and objectives, and methodology of the study.
- **Section 2** provides an overview of the regulatory context for the housing sector in Indonesia, including current policy and regulatory frameworks at the national and sub-national levels in Indonesia that are relevant to energy efficiency, green buildings, and the housing market, especially its low-income segment, which is the main focus of the overall study.
- **Section 3** discusses the institutional setup and key stakeholders involved in the low-income housing and green building segments in Indonesia.
- **Section 4** provides an overview of two voluntary green building certification schemes in Indonesia, namely GREENSHIP and EDGE, and examines their suitability for the climate auction pilot.
- **Section 5** presents the current status of the LIH market in Indonesia.
- **Section 6** examines the four geographies suitable for a pilot phase of the climate auction mechanism.

[1] The World Bank Group consists of the IFC, the Energy Sector Management Assistance Program (ESMAP), the Bank's Climate Change Group, and the Urban Global Practice (Social, Urban, Rural and Resilience).
[2] More information is available on the PAF website: https://www.pilotauctionfacility.org/content/about-paf.
[3] EDGE is a global green building certification and standard developed by IFC for emerging markets. The EDGE app, a free and publicly available web-based tool (available on www.edgebuildings.com), can be used at an early stage of building design to plan for design and operational expenses and to measure environmental impacts. EDGE focuses on strategic reductions in energy (operational and embodied) and water consumption, offering certification for energy-efficient buildings that fulfill its requirements.

- **Section 7** provides an analysis of key market players involved in the LIH segment in Indonesia and their suitability as well as potential interest in participating in the climate auction. This section also discusses the existing opportunities and challenges for the potential bidders.
- **Section 8** reviews the base case values in the EDGE tool for LIH units in Indonesia to determine whether they represent the business-as-usual (BAU) scenario, and provides recommendations for their revision, where necessary, to ensure that incentives to be provided through the climate auction will increase the energy and resource efficiency of typical low-income housing.
- **Section 9** presents the results of the financial analysis for estimating the required incentives that are deemed necessary to enable the incremental investment needed to improve the housing unit's energy performance and bring it up to the desired level.
- **Section 10** provides an overview of available access to financing and incentives for LIH developers.
- **Section 11** summarizes the key findings of the study and provides a set of recommendations for the climate auction pilot design.

2. Regulatory and policy landscape for the housing and green building sectors in Indonesia

This section provides an overview of government policies and regulations relevant to the provision of low-income housing and buildings, especially green buildings.

2.1 Regulations and policies in the housing sector

Law No. 1/2011 on Housing and Settlement Area serves as an umbrella for all housing regulations in Indonesia including low-income housing provision. It differentiates five types of housing in Indonesia by their target market: **public housing, self-built housing, special housing, state housing, and commercial housing**. This section focuses on subsidized housing and public housing targeted at low-income households—the markets that are of main interest for the climate auction pilot.

2.1.1 Housing segmentation and low-income housing provision

Through the Ministry of Public Works and Public Housing (MoPWH), the government develops regulations, allocates assistance funds, and provides incentive schemes for the provision of low-income housing. Public housing and self-built housing targeting low-income segments can receive such government assistance. Meanwhile, private sector developers lead the provision of housing for middle- and high-income communities through market mechanisms. Table 2.1 categorizes the available types of housing in Indonesia by their respective target segments, sources of funding, and the stakeholders working in the segment.

Table 2.1 Five types of housing and target market segments in Indonesia's housing sector

Housing type	Target market	Initiator and source of funding	Government assistance
Subsidized housing Developer built with demand-side government subsidies supporting low-income households in homeownership	**Low-income households**	Government or private sector	Yes
Public housing Built by the government for low-income households			
Self-built housing Individually built by homeowners	**Low-income households**	Initiated by individual households, co-funded by the government (local and central) and community	Yes
Special housing Built to meet special requirements	Refugees, orphans, elderly people	Government (central and local)	No
State housing Built and owned by the state for the use of civil servants and their families	Civil servants and their families	Government (central and local)	No
Commercial housing Built by the private sector for the open market (for profit)	Middle- and high-income households and also **low-income households** (under balanced occupancy—see section 2.1.3)	Private sector	No

Source: Original compilation based on Law No.1/2011 on Housing and Settlement Area.

Thus, the **low-income housing market** can be divided into two main categories: subsidized (i.e., receiving governmental subsidies) and non-subsidized. In turn, low-income housing units—under

both subsidized and non-subsidized categories—can be either **landed houses** or **apartments in multi-story buildings**.

The **subsidized low-income housing** segment includes "public housing" provided by the government and public and private developers, and "self-built housing," which can be built on an individual basis by low-income households. MoPWH Regulation No. 10 of 2019 on Criteria of Low-income Households and Requirements for Low-income Housing Facility Provision defines the maximum income threshold for a household to be eligible for subsidized low-income housing. In general, the total monthly income of the household must not be more than three times the amount of a monthly installment payment under a commercial housing payment scheme. The value of the monthly installment depends on the selling price of the house to the end user, which varies in each province.

In the subsidized low-income housing segment, "self-built housing" would be outside the scope of the climate auction, as it would be difficult for individual low-income households to engage as potential bidders.

In addition to subsidized low-income housing, the government requests private developers to support the low-income housing sector through **a mixed-income construction (balanced occupancy) policy**, stipulated by the Ministry of Public Housing Regulation No. 10 of 2012 on Balanced Occupancy, revised by the Ministry of Public Housing Regulation No. 07 of 2013. This regulation requires private sector developers building high-income commercial housing projects to provide three low-income housing units and two middle-income housing units for every high-income commercial housing unit they build. Low-income housing built under a balanced occupancy plan is not eligible for government subsidy; however, the balanced occupancy policy imposes criminal sanctions on developers in case of violation.[4] For more details on balanced occupancy, see section 2.1.3.

The Government of Indonesia has issued several legal instruments to organize low-income housing provision, which are summarized in table 2.2. An assessment of these regulations is important for any future auction program.

Table 2.2 Regulations relevant to low-income housing provision

Topic	Law or regulation	Content
Provision schemes	Law No. 20/2011 on Multi-Story Housing	Provision of low-income apartments. The law mandates commercial apartment developers to provide low-income apartments covering at least 20% of the total floor area of commercial apartments built.
	Government Regulation No. 14/2016 on Implementation of Housing and Settlement Area	Role of central and local governments in housing provision.
	Ministry of Public Housing[5] Regulation No. 10/2012 on Balanced Occupancy	Guidance to design balanced occupancy using a 1:3:6 scheme (see section 2.1.3).
Technical specification	Ministry of Public Works Regulation No. 5/2007 on Technical Guidelines for Development of Simple Multi-Story Housing	Technical standards for multi-story housing for low-income households.
	Ministry of Settlement and Regional Infrastructure[6] Decree No. 403/KPTS/M/2002 on Technical	Technical standards for various types of landed housing.

[4] A real estate association interviewed was not aware, however, of any developer that had been sanctioned.
[5] Former name of the MoPWH. This ministry is now defunct and was merged with the former Ministry of Public Works to form the current MoPWH.
[6] This ministry is now defunct and was merged with the former Ministry of Public Works to form the current MoPWH.

Topic	Law or regulation	Content
	Guidelines for the Construction of Healthy Simple Housing	
Assistance scheme—financing	MoPWH Regulation No. 20/2019 on Home Ownership Assistance for Low-Income Households	Guidance on the provision of assistance for low-income housing, specifically for financial assistance.
	MoPWH Regulation No. 38/2015, amended by MoPWH Regulation No. 03/2018 on Assistance for Public Facility for Public Housing	Guidance on the provision of public facilities in a low-income residential complex for low-income housing developers.
Assistance scheme—infrastructure	MoPWH Regulation No. 01/2018 on Construction and Operational Assistance for Multi-story Housing	Guidance on the provision of assistance for low-income housing infrastructure, including ease of licensing, land provision, and basic infrastructure provision.
Procurement process	MoPWH Regulation No. 7/2019 on Standard and Guidelines for Construction Services Procurement through Services and Goods Providers	Overview of the procurement process for construction and consulting services for public works.
Licenses	Government Regulation No. 83/2015 on the State-Owned Company of National Housing Development (*Perum Perumnas*)	Regulates the state-owned company in charge of national housing development, which holds the licenses to develop low-income housing.
	MoPWH Regulation No. 24/2018 on Accreditation and Registration to the Association of Housing Developers, and Certification and Registration of Housing Developers	Specifies requirements for private developers to be eligible to provide housing development, including for low-income housing.
Permits	Government Regulation No. 64/2016 on Low-Income Housing Provision (Permit Scheme on Low-Income Housing Provision by Private Developers as Legal Entities)	Guidance for local governments on conducting a permit scheme for low-income housing provision.
		An incentive program that allows value added tax (VAT) exemption for right-to-property/land acquisition fees to be provided to low-income housing developers, with thresholds set by local governments based on the selling price of the housing. The VAT exemption is further regulated by the Ministry of Finance.
Ceiling prices	MoPWH Decree No. 552/KPTS/M/2016 on Household Income Limit for Subsidized Credit Financing, Selling Price Limit for Landed Low Income Housing and Multi-Story Housing Unit, and Subsidy for House Down Payment.	The maximum individual basic income to be eligible for subsidized homeownership credit is Rp 4 million ($282[7]) for low-income landed housing and Rp 7 million ($494) for low-income multi-story housing. The decree also stipulates that the amount of government assistance for a down payment on low-income housing, to be given to qualified Housing Financing Liquidity Facility (FLPP) or mortgage interest rate buydown (SSB) beneficiaries, is fixed at Rp 4 million ($282) per house.
	MoPWH Decree No. 535/KPTS/M/2019 on Selling Price Limit for Landed Housing	The decree introduces ceiling prices for low-income landed housing obtained

[7] Here and below, the exchange rate used is $1 = Rp 14,183 as per the Minister of Finance Decision KMK No. 35/MK.10/2019 (August 7–13, 2019).

Topic	Law or regulation	Content
	Procured through Credit/Subsidized Homeownership Financing	through subsidized financing, applicable for 2019 and 2020 (the ceiling prices are updated periodically). Please refer to Annex II for more details on the ceiling price.

Source: Original compilation, based on the regulations listed.

As table 2.2 shows, Indonesia already has a comprehensive set of regulations pertaining to low-income housing, including the provision of financing schemes. However, none of the available financing schemes are directed at project developers. Although technical standards are in place, no mandatory energy-resource-efficient measures are included. Compounded by the ceiling price imposed on low-income housing, which limits profit margins, developers are often reluctant to introduce energy- and resource-efficient measures to their projects. Supportive financing schemes, such as climate auctions, could be well positioned to support the additional costs required for building resource-efficient housing.

2.1.2 Technical standards for low-income housing

The technical standards for low-income housing are regulated:

- **For multi-story buildings**, by the Ministry of Public Works Regulation No. 5 of 2007 on Technical Guidelines for Development of Simple Multi-Story Housing; and
- **For various types of landed housing**, by the Ministry of Settlement and Regional Infrastructure Decree No. 403 of 2002 on Technical Guidelines for the Construction of Healthy Simple Housing.

Landed houses

The Ministry of Settlement and Regional Infrastructure Decree No. 403 of 2002 provides technical guidance for low-income landed housing in Indonesia. The regulation serves as the minimum standard to which developers must adhere. Compliance with this regulation is mandatory for building construction permit (IMB) issuance for both subsidized and non-subsidized low-income housing projects.

The regulation stipulates the minimum area per housing unit based on the number of occupants. The minimum area for low-income housing is 7.2 square meters (m^2) per person with a minimum land area of 60 m^2 per unit, as summarized in table 2.3. Table

Table 2.3 Minimum required building and land area for a low-income landed housing unit

Standard area per person (m^2)	Area (m^2) For three occupants				Area (m^2) For four occupants			
	Building area per housing unit	Land area			Building area per housing unit	Land area		
		Min	Effective	Ideal		Min	Effective	Ideal
Threshold (7.2)	21.6	60	72–90	200	28.8	60.0	72–90	200
Indonesia (9)	27.0	60	72–90	200	36.0	60.0	72–90	200
International (12)	36.0	60	N/A	N/A	48.0	60.0	N/A	N/A

Source: Ministry of Settlement and Regional Infrastructure Decree No. 403 of 2002.
Note: The threshold standard refers to the minimum standard area per person for a "core house." The Indonesian or international standard must be followed when a core house is expanded into a fully built house.

Developers commonly deliver fully built low-income landed housing units to households. Nevertheless, there are many low-income households that still cannot afford fully built houses. Thus, an **incremental housing concept** has been introduced to reduce housing prices. In an

incremental housing scheme, developers build only the **core house**, after which the homeowners can continue the development to accommodate their needs according to their income and savings growth.

The Ministry of Settlement and Regional Infrastructure Decree No. 403 of 2002 stipulates the **minimum requirements for a core house**, which includes one bedroom, one open multi-purpose room, and one bathroom. These three rooms can be expanded later to a fully built house through several development stages. Annex III provides more details.

Comparing the typical design of fully built subsidized and non-subsidized low-income housing, there are no significant differences in floor plan design. What distinguishes them are the materials used in the design and construction.

The main difference between one low-income landed housing project and the other—for both subsidized and non-subsidized housing—is the floor and land area, which can vary between 21 m^2 and 36 m^2. Based on stakeholder interviews, developers commonly build low-income landed housing with a floor area between 30 and 36 m^2 per house unit.[8] Prospective buyers are often not interested in purchasing a house smaller than 30 m^2.

Box 2.1 Minimum required area for low-income housing

Article 23(2) of Law No. 1 of 2011 regulated that certain types of housing (including low-income housing) should be at least 36 square meters (m^2) in size. However, in 2012 the Constitutional Court through its legal review rights decided to annul the article, citing that Article 22(3) is against the Constitution (UUD 1945) and is not legally binding. Several developers engaged under this project have also confirmed that the requirement for minimum size stipulated in Law No. 1 of 2011 is no longer valid and they have been able to develop low-income housing of various sizes below 36 m^2. The minimum requirement for floor area now follows the Ministry of Settlement and Regional Infrastructure No. 403/2002 Technical Guidelines, and would be best applied to the auction pilot.

Apartments in multi-story buildings

In relation to low-income multi-story housing, the Ministry of Public Works issued Regulation No. 05 of 2007 on Technical Guidelines for Development of Simple Multi-Story Housing. Simple multi-story housing is defined as multi-story housing built for low- and lower-middle-income communities.[9] The regulation stipulates that each apartment unit should consist of two bedrooms, one living room, one bathroom, and one service room (i.e., kitchen and laundry room) with a total area of 30 m^2.

Compared to low-income landed housing, low-income multi-story housing does not have as much room for significant floor plan/design modifications, implying that the initial unit design can be largely maintained in the future.

Table 2.4 further summarizes the requirements provided under the two regulations.

Table 2.4 Technical requirements for low-income housing

Technical requirements		Landed housing	Multi-story housing
Location		In accordance with regional/local spatial planning	
Design and facility	**Design**	House design	N/A
	Open space	Must be provided in each unit	Must be provided in public spaces
Health and comfort	**Natural lighting**	Minimum opening for light entering is 10% of the floor area	Optimize natural lighting to accommodate the occupant's daily activities

[8] A low-income house must have a maximum area of 36 m^2 to be eligible for a subsidy.
[9] The regulation does not specify whether it is applicable only for subsidized housing or for both subsidized and non-subsidized projects. However, as it covers apartments for both low- and lower-middle-income households, it is assumed that both types would fall under this regulation.

Technical requirements		Landed housing	Multi-story housing
	Artificial lighting	N/A	For exterior or public spaces
	Ventilation	Minimum opening area is 5% of the floor area	
Safety and security	**Building structure**	Proper quality of the building structure	
	Fire safety	N/A	Proper fire safety system

Source: Original compilation based on Ministry of Public Works Regulation No. 5 of 2007 and Ministry of Settlement and Regional Infrastructure Decree No. 403 of 2002.
N/A = not applicable, or not provided in the regulations.

As can be seen in table 2.4, the prevailing technical standards overlap with only a small portion of the green building standards, such as natural lighting and ventilation, which are intended to provide a healthy and comfortable living environment for building occupants. Furthermore, the technical standards stipulated in these regulations serve as guidance without strict enforcement by the government. Based on the findings of the present study, developers often opt for cheaper materials with little to no enforcement of quality standards in order to sell low-income houses under the government-set ceiling price. Furthermore, based on interviews with both public and private stakeholders, there is a concern that applying green building design requirements to government-funded low-income housing will increase construction costs, making it harder for developers to sell the houses under the set ceiling prices. It may be for this reason that developers' willingness to adhere to such requirements is still low. To increase developers' interest, engaged stakeholders suggested that an auction can provide incentives to low-income housing, not only for the required green building materials and higher construction quality, but also for basic infrastructure such as water and waste management facilities, which is often lacking in low-income housing areas, according to the stakeholders interviewed.

2.1.3 Financing schemes for low-income housing

A majority of urban residents cannot obtain housing ownership due to limited income growth—despite an increase in employment opportunities. The World Bank (2017) found that in metropolitan areas, 20 percent of households cannot afford a basic housing unit[10] without high subsidies, and 40 percent of households in a higher-income group still need some subsidy support. This higher-income group has a monthly income slightly higher than that defined as eligible low-income housing. The inability to purchase housing results in informal, self-built housing, which continues to comprise approximately 71 percent of total houses in Indonesia (World Bank 2017). This can lead to substandard and vulnerable housing conditions (e.g., using low-quality material and applying poor construction techniques without providing proper sanitation).

In response to this issue, the government implements policies that support local governments and citizens and provides incentives for the private sector to supply low-income housing. In general, the government supports low-income housing provision through financing schemes for three market groups (see table 2.5).

Table 2.5 Government financing support for low-income housing provision

Market group	Financing scheme provided
Low-income households whose income is insufficient to save for homeownership	Provision of multi-story low-income rental housing on land provided by the local government for buildings provided by the central government
Low-income households that can allocate a little of their income toward homeownership	Direct subsidies for low-income housing mortgage and indirect subsidies that cover the provision of infrastructure, utilities, and public facilities as well as incentives for low-

[10] Based on an estimated cost of Rp 250 million ($17,600) for a 36 m^2 basic housing unit. Here and below, the exchange rate used is $1 = Rp 14,183 as per Minister of Finance Decision KMK No. 35/MK.10/2019 (August 7–13, 2019).

Market group	Financing scheme provided
	income housing developers (i.e., VAT exemption for right-to-property/land acquisition fees)
Low-income households that own land and/or houses but cannot allocate their income to improve or reconstruct their houses	Fund allocation for housing development and improvement (of self-built houses)

Source: Original compilation.

The Government of Indonesia has provided support for low-income households through various subsidy programs since 2006, notably through the MoPWH and its predecessors. In 2015 the government launched its Five-year National Medium-Term Development Plan (RPJMN), and a new and ambitious housing provision program, One Million Homes, to be implemented by the MoPWH.

The MoPWH implements various **state-funded housing support programs** for low-income households such as the incremental support for self-built housing (BSPS), subsidy for rental multi-story public housing (*Rusunawa*), affordable mortgage financing (Housing Financing Liquidity Facility, FLPP), subsidies for housing mortgage, mortgage interest rate buydown (SSB), and down payment subsidy (BUM). Based on interviews with developers, FLPP is the most popular support program and has been the driver of the subsidized low-income housing market. This scheme provides concessional funds to lenders, who offer mortgages at fixed-interest rates to end users at 5 percent p.a. for 20 years. Annex IV provides more details on the support programs implemented by the MoPWH.

The MoPWH also provides support **programs for stakeholders other than households**, including capacity-building and planning support to local governments and tax waivers (1–5 percent tax) for private developers who sell multi-story rental housing units (*Rusunami*) at a price below Rp 144 million ($10,100).

In parallel, other ministries implement other housing support programs for low-income households. The Coordinating Ministry for Human Development and Culture (CMHDC) runs the **National Program for Community Empowerment in Urban Areas** (under **Program Nasional Pemberdayaan Masyarakat**), which focuses on direct support for poor urban communities (e.g., in slums) to build small-scale infrastructure (e.g., drainage, sanitation, streets) and to support socio-economic development. The Ministry of Finance (MoF) provides a **mortgage interest rate buydown scheme** (SSA, introduced in 2015). The SSA subsidizes interest rates paid by consumers on eligible mortgages, enabling households to pay a flat 5 percent rate for the duration of the loan tenure, and provides reimbursement to lenders who provide 100 percent of capital. The key difference between SSA and SSB is the source of funds. The SSA has financed 13,187 units through the state-owned Bank Tabungan Negara as of 2015.

In addition to the above state-funded programs, through the MoPWH the government requests private developers to support low-income housing provision through **a mixed-income construction (balanced occupancy) policy**, stipulated by the Ministry of Public Housing Regulation No. 10 of 2012 on Balanced Occupancy, revised by the Ministry of Public Housing Regulation No. 7 of 2013. In a balanced occupancy, for each high-income housing unit, each developer must construct two middle-income housing units and three low-income housing units (balanced occupancy in a 1:2:3 ratio). Annex V provides more details on the technical requirements of the balanced occupancy policy.

Last but not least, for financing low-income housing, the MoPWH is currently planning a new scheme to help low-income districts increase their budget for housing and settlements. Under the concept of a regional cross-subsidy, the government is trying to find ways to utilize profits from the sales of land in high-income areas to subsidize the development of low-income areas within the same province. The scheme is still under development (interview with MoPWH, 2019).

2.1.4 Public procurement process

All public procurement activities in Indonesia must follow regulations stipulated in Presidential Regulation No. 16 of 2018 on Procurement of Goods and Services for Government. For public procurement of housing specifically, MoPWH Regulation No. 7 of 2019 on Standards and Guidelines for Construction Services Procurement through Services and Goods Providers must also be followed. These standards and guidelines are applied to housing projects funded by the public and contributions received through government institutions at the local and national level. Housing facility projects funded by private developers are not mandated to follow these standards and guidelines.

Any housing developer can participate in low-income housing provision provided that it is a legally certified developer and is registered with a developers' association (MoPWH Regulation No. 24 of 2018).

MoPWH Regulation No. 7 of 2019 regulates consultation and construction services in public works (funded by the government). Procurement for both types of services is conducted through a tender, with different terminologies used for consultation services ("selection") and construction services ("tender"). A direct appointment of service providers can be done without following the tender process if only one tender participant passes the qualification stage. This regulation does not require sustainability construction methods to be applied by the selected service providers. It stipulates only that if construction services are conducted using "sustainability methods," then sustainable construction practices should be implemented. It can be concluded that the use of sustainable construction practices is not a mandatory pre-condition for participation in public auctions.

The funds allocated by the MoF for subsidized mortgage loan programs (i.e., FLPP and SSB) are disbursed to participating banks through the MoPWH Housing Provision Financing Agency as fund manager.

Overall, the low-income housing sector in Indonesia is heavily regulated. Both the central and local government agencies are deeply involved in the low-income housing provision, including in offering financial incentives.

2.2 Regulations and policies on building energy and resource efficiency

The government has enacted a series of laws, regulations, and standards to help promote energy efficiency in buildings. These will be discussed in the following subsections.

2.2.1 National regulations and standards on energy efficiency in buildings

The Government of Indonesia has put regulations in place to promote energy efficiency in buildings. Government Regulation No. 70/2009 on Energy Conservation (currently under revision) requires any building with an annual energy consumption of more than 6,000 tons of oil equivalent (TOE) (approximately 70,000 megawatt-hours [MWh] of electricity consumption, which roughly corresponds to a building floor area of 279,120 m^2)[11] to implement energy conservation measures using energy management. Furthermore, commercial buildings consuming 500 TOE (5,800 MWh) per year may be required to implement energy conservation measures according to the planned revision. Under this reduced limit in the revised regulation, low-income apartments are expected to be within the scope of the regulation. Except for the utilization of more-energy-efficient equipment in households (e.g., compact fluorescent lamp [CFL] lighting and air-conditioning [AC]), no specific requirements for buildings in the housing sector have been

[11] Assuming an office building consumes 250 kilowatt-hours (kWh) of electricity per square meter floor area per year. According to expert judgment, most commercial buildings in big Indonesian cities consume less than 6,000 TOE of energy per year.

included in the draft revision; other regulations that illustrate the country's recent efforts to regulate energy efficiency are listed in Annex VI.

In addition to the above regulations, the country has also adopted Indonesian National Standards (SNIs) in energy efficiency that need to be enforced through other government regulations. Although the application of these standards is not mandatory, they are useful as technical references for industries and building designers. The benchmarks set by these national standards are also frequently used as requirements by Building Codes released by several local governments. Adhering to building codes is mandatory for new buildings in these cities, thus making these national standards mandatory technical requirements within their jurisdiction. The National Standardization Agency (BSN) is responsible for the formulation of national standards that are frequently adopted from the International Standard Organization. National standards relevant to energy-efficiency measures in buildings include the following:

- **SNI 03-6389-2011 on Energy Conservation in Building Envelope** contains design criteria for building envelopes as well as energy conservation and recommendations for an optimal building envelope (including benchmark values) to achieve the efficient use of energy without compromising users' comfort. The standard includes procedures to calculate overall thermal transfer values (OTTV)[12] and roof thermal transfer values[13] with parameters adjusted to the Indonesian context.
- **SNI 03-6197-2011 Energy Conservation in Lighting System** recommends measures for lighting level, color rendering index, and color temperature for different rooms in various building types, including residential.
- **SNI 03-6572-2001 on Procedure of Ventilation System and Air Conditioning System in a Building** provides minimum requirements for designing ventilation and air conditioning systems in buildings.
- **SNI 03-6390-2011 on Energy Conservation for Air Conditioning System in a Building** contains technical calculations, selection, measurements, and tests for energy conservation, and provides recommendation for AC systems.
- **SNI 03-2396-2001 on Planning Procedures for Natural Lighting System in a Building** stipulates minimum requirements for the natural lighting system in any building, including design criteria, design procedures for natural lighting, system testing, and maintenance.

Unless they are made mandatory by local governments through specific regulations (e.g., green building codes), these national standards are voluntary. Many SNIs are outdated or less relevant to the Indonesian context since many were adopted from international standards without sufficient adaptation to the Indonesian context. In addition, there is no incentive or disincentive attached to the implementation of these standards.

Based on stakeholder consultation, the above-mentioned regulations and standards are not well enforced. For instance, although Government Regulation No. 70 of 2009 is mandatory, there is no punishment imposed on entities failing to comply with it. In addition, the government states that fiscal incentives can be difficult to provide. Since green building compliance is under local government jurisdiction, any fiscal incentives (e.g., tax exemption) will affect local government revenues. However, innovative financing mechanisms, including an auction scheme, could be introduced to provide incentives to accelerate green building uptake without constraining local government budgets.

[12] A value indicating the average rate of heat transfer into a building through the building envelope.
[13] A value indicating the average rate of heat transfer into a building through the building roof.

Box 2.2 Market-based mechanisms

Indonesia has passed regulations that can serve as a basis for market-based instruments for climate change mitigation. These include **Law No. 17 of 2004 on the Kyoto Protocol Ratification**, **Law No. 32 of 2009 on Environmental Protection and Management**, and **Law No. 16 of 2016 on the Paris Agreement Ratification.** More specifically for mobilizing funding for mitigation actions, the government has established **Government Regulation No. 46 of 2017 on Environmental Economic Instruments.** Three types of instruments are included in this regulation—development planning and economic activities, environmental funding, and incentives-disincentives—and it explicitly mentions emissions trading systems.

Since 2017, the government has brought together a cross-ministerial technical team for preparing market-based instrument options to be implemented in Indonesia, with its steering and implementing committees led by the Coordinating Ministry for Economic Affairs with the Ministry of Energy and Mineral Resources, the Ministry of Environment and Forestry,[14] and the Ministry of Industry. The recently published Presidential Regulation No. 77 of 2018 stipulates principles and mechanisms for an environmental fund management agency, and mentions carbon trading as one of the fund distribution strategies.

2.2.2 National regulations on green buildings

The Government of Indonesia regulates building construction through **Law No. 28 of 2002 on Buildings (Building Law)**, which defines general requirements related to the construction of a new building (e.g., that its location not disrupt the ecological balance of a protected or otherwise preserved area, or public infrastructure functions). It does not include any reference to green building codes. **Law No. 23 of 2014 on Local Government Law** gives the authority to regulate buildings and any associated permits to sub-national governments. In line with the Building Law, this law stipulates that the construction of a building (except special function buildings) can be carried out only after the technical drawing of the building is approved by the local government through the issuance of IMBs.

More specifically, the Government of Indonesia has issued national-level regulations on green buildings:

- **Ministry of Environment Regulation No. 8 of 2010 on Criteria and Certification of Eco-Friendly Building** is one of the country's earliest regulations, issued in response to the emergence of green building certifications in Indonesia. It introduces a definition of an eco-friendly building as one that uses locally sourced and eco-labeled materials, and includes energy and water conservation measures, wastewater treatment, and non-hydrofluorocarbon refrigerants, among others. This regulation also acknowledges the potential roles of green certification schemes (such as GREENSHIP) that operate in the country and outlines the requirements for an agency wishing to establish a green building certification.
- **MoPWH Regulation No. 2 of 2015 on Green Buildings** provides, among others, criteria for green building, building targets, the certification process, and the role of community. Considering the formal mandate borne by the MoPWH, this regulation is the key green building policy enforced at the national level.

A green building is defined by MoPWH Regulation No. 2 of 2015 on Green Buildings as a building that has measurable and significant savings in energy, water, and other resources, achieved through the application of green building principles applicable to its functions throughout its planning and operational stages, in addition to meeting administrative and technical requirements.

[14] The name of this ministry was changed to Ministry of Environment and Forestry after the Ministry of Environment and Ministry of Forestry were merged in 2015.

The types of buildings covered by MoPWH Regulation No. 2 of 2015 are shown in table 2.6. **Low-income housing is included in the regulation**. However, the regulation does not elaborate design criteria or what constitutes high energy consumption. Thus, it is unclear whether low-income housing is included in a mandatory, recommended, or voluntary scope. Seven green building measures are included in the regulation: **site management, energy efficiency, water efficiency, indoor air quality, use of environmentally friendly materials, waste management,** and **wastewater management.** The regulation suggests parameters that could be included under each measure without giving the parameters any quantitative value.

Table 2.6 Three compliance levels under MoPWH Regulation No. 2 of 2015

Mandatory	Recommended	Voluntary
• Any medium- or high-rise mixed residential building, offices, warehouses, commercial buildings, laboratories/industries, or public buildings with sophisticated/special complexity design • Commercial buildings, warehouses, laboratories/industries, public buildings of up to two stories and total floor area of 5,000 m^2 • Buildings with extremely high consumption of energy, water, and other resources, and which therefore have significant savings potential • Any buildings designated by the local government based on local urgency and conditions	• Medium- or high-rise residential buildings with a medium degree of complexity, including residential buildings with basements • Laboratories, industries, factories and/or car workshops, and public buildings of up to two stories with total floor area of 500–5,000 m^2 • Buildings with high consumption of energy, water, and other resources, and which therefore have savings potential • Any buildings designated by the local government based on local urgency and conditions	• Residential buildings including landed housing, laboratories, industrial facilities, factories and/or car workshops, and public buildings with simple degree of complexity • Any buildings designated by the local government based on local urgency and conditions

Source: MoPWH Regulation No. 2 of 2015.

Although MoPWH Regulation No. 2 of 2015 is key to green building promotion, it mainly **serves as guidance and does not include legal capacity to enforce implementation** among building owners. **Instead, the authority to enforce green building design criteria lies with sub-national governments**, which are responsible for issuing building permits and enforcing building codes within their territory. Therefore, the existence and enforcement of local government regulations on green building codes is critical. As a follow-up to the issuance of Regulation No. 2, the MoPWH issued Circular Letter No. 86/SE/DC/2016 to regional governments, encouraging them to adopt local regulations to enforce green building principles. Local governments decide the details of building sectors to be subject to green building regulations.

2.2.3 Sub-national regulations and green building codes

As of September 2019, mandatory green building regulations had been established by **DKI Jakarta Province** (under the Governor of DKI Jakarta Regulation No. 38 of 2012 on Green Buildings), **Bandung City** (Mayor of Bandung City Regulation No. 1023 of 2016 on Green Building Code), and **Semarang City** (Mayor of Semarang City Regulation No. 24/2019 on Green Building Code). According to engaged stakeholders, similar regulations are being developed by other municipalities, including Makassar, Manado, and Surabaya, but no concrete progress has yet been reported. On account of its comprehensive and progressive nature, the decree of DKI Jakarta Province offers other local governments a model for the formulation and enforcement of green building policies.

DKI Jakarta Provincial Green Building Codes

The Governor of Jakarta Province issued Regulation No. 38 on Green Buildings in 2012 (also referred to as a green building code). Notably, the mandatory green building code was the first of its kind in the country, prior to the enactment of MoPWH's national regulation. The Jakarta

Province regulation targets three categories of commercial buildings: large offices, shopping malls, and apartments (with a floor area of more than 50,000 m^2); hotels and hospitals (greater than 20,000 m^2); and education facilities (greater than 10,000 m^2). DKI Jakarta's green building code does not cover multi-story low-income housing due to its typical size,[15] nor landed low-income housing.

The code lays out different requirements for new and existing buildings. New buildings must comply with 25 criteria during their construction, design, and operational phases, including energy efficiency, indoor air quality, water efficiency, land management, waste management, and reporting. Annex VII shows the requirements stipulated in the code. The regulation sets specific values for parameters under energy efficiency (e.g., OTTV), whereas other parameters (e.g., AC systems) refer to the SNIs. The code is not applicable to low-income housing.

Existing buildings are required to implement energy conservation and efficiency plans (including energy audits), implement water conservation and efficiency plans (including water recycling and ensuring quality of wastewater discharge), ensure indoor air quality and thermal comfort, and perform upkeep, maintenance, monitoring, and evaluation. New and existing buildings can adjust their green building design if the development concept changes due to certain acceptable reasons. Meeting the above green building requirements is a pre-requisite for obtaining a Building Construction Permit for new building construction and an Occupancy Certificate for newly constructed and existing buildings, both issued by authorities under the DKI Jakarta government.

Bandung City Regulation

The Mayor of Bandung City Regulation No. 1023 of 2016 is mandatory for buildings of all sizes and types including residential buildings.[16] Specifically, requirements apply to new buildings and existing buildings seeking to expand their floor size. Different requirements for new buildings are applied to two groups of buildings: (i) buildings with a gross floor area above 5,000 m^2 (e.g., shopping malls); and (ii) below 5,000 m^2 (e.g., landed housing). Similar to the regulations of DKI Jakarta, the Bandung City green building code is also a pre-requisite for the issuance of a new building construction permit. Bandung City also offers an incentive for exceeding the minimum requirements. **Building developers who satisfy voluntary standards may get incentives such as a reduction in property tax or an increase in building floor area or height allowance.** By February 2019, 3,000 buildings with a total floor area of 876,273 m^2 had complied with the code requirements, resulting in a total savings of around Rp 56 million ($4 million). In addition, 2.7 million m^2 of building area is expected to adhere to the code requirements by 2021, leading to total electricity savings of 140,000 MWh or the equivalent of around Rp 227 million ($16 million) (Government of West Java 2016; Ekonomi Bisnis 2019).

Although the code covers all types of buildings, including low-income housing, not all aspects in the code are applicable to multi-story low-income housing, which has a simpler design and smaller floor area than buildings such as shopping malls or office towers. Criteria that are commonly applicable to and achievable by low-income multi-story housing include OTTV, efficient lighting, green open space, and appropriate room density. Annex VII provides a detailed overview of the Bandung green building code.

According to the findings of this study, the voluntary standards have not yet been implemented. The city government is planning to start the process of certifying buildings with star ratings (see Annex VII) in the next two to three years.

[15] Multi-story LIH buildings usually consist of five to six floors with an approximate floor area of less than 50,000 m^2.

[16] The city of Bandung is the capital city of West Java Province, located approximately 150 kilometers (km) from Jakarta. The city area is 167.31 square kilometers (km^2) and its population stood at 2.49 million in 2016.

Semarang City Regulation

The recently published Mayor of Semarang City Regulation No. 24 of 2019 stipulates mandatory green building requirements for four types of buildings,[17] defined as (1) large (with floor area of more than 5,000 m^2); (2) medium (with floor area between 2,500 m^2 and 5,000 m^2); (3) small (with floor area less than 2,500 m^2; and (4) landed housing (with a minimum area of 300 m^2). This regulation is applicable to all new buildings, building expansion, and retrofitting. Similar to the green building codes of DKI Jakarta and Bandung, the code in Semarang is used as a requirement to obtain a building construction permit and is therefore mandatory.

Not all aspects of the code are applicable to multi-story low-income housing, however. Criteria in the code that are commonly applicable to, and achievable by, low-income multi-story housing include the building envelope (e.g., OTTV), efficient lighting, and the water flow rate.

With the exception of landed housing, the regulation requires a building's owner or manager to report the building's energy and water consumption as well as its energy efficiency plans every year. This report must be verified before the building's application for an extension of its Building Occupancy Certificate (SLF) can be approved. If the report is not delivered, a written warning will be issued.

The party responsible for evaluating the building's compliance with the green building code differs by building type and size. The local government office collaborates with a building expert team in evaluating large buildings. The local government office evaluates all types of buildings except for landed housing. For landed housing, the building owner or planner conducts a self-assessment, using a form provided by the local government office. The local government office will then perform a random inspection of low-income landed housing. The city regulation states that an incentive will be given to buildings that meet the building code requirements, but it is still unclear what the incentive is and how it will be delivered.

The Semarang green building code is expected to save energy and water by up to 28 percent and 27 percent, respectively. The building code is also predicted to help Semarang reduce its carbon emissions by 28 percent (Liputan6.com 2019). Annex VII summarizes the code.

Table 2.7 lists the existing green building codes in Indonesia and outlines their scope and applicability for low-income housing, in particular. As can be seen from the table, only the national green building code issued by the MoPWH covers low-income landed housing.

Table 2.7 Summary of green building codes in Indonesia

Code	Targeted building	Covers multi-story housing	Covers landed housing	Covers low-income landed housing	Covers low-income multi-story housing
MoPWH Regulation No. 2 of 2015	• Residential buildings • Commercial buildings (hotels, hospitals, laboratories) • Industry facilities	Yes	Yes	Yes	Yes
DKI Jakarta	• Offices • Shopping malls • Apartments • Hotels and hospitals • Education facilities	Yes, if the floor area is more than 50,000 m^2	No	No	No
Bandung	All new buildings	Yes	Yes	Yes	Yes
Semarang	All new buildings	Yes	Yes, if the floor area is more	No, as low-income landed	Yes

[17] Semarang is the capital city of Central Java province, located approximately 440 km from Jakarta. The city has an area of 373.3 km^2. As of December 2018, the total population stood at 1.67 million (Government of Semarang City 2019).

Code	Targeted building	Covers multi-story housing	Covers landed housing	Covers low-income landed housing	Covers low-income multi-story housing
			than 300 m^2	housing size is less than 300 m^2	

Source: Original compilation.

2.3 Other regulations and policies relevant to an auction model

2.3.1 Electricity and water subsidies for low-income households

Electricity tariffs

The electricity tariffs in Indonesia are set by the central government and must be approved by the parliament before being implemented. They are classified into three different groups based on electrical power capacity: (1) small household, 450–2,200 volt-amperes (VA); (2) medium household, 3,500–5,500 VA; and (3) large household, more than 6,000 VA, as summarized in table 2.8.

The **Law of the Republic of Indonesia No. 30 of 2007 on Energy** and the **Law of the Republic of Indonesia No. 30 of 2009 on Electricity** stipulate that the government should provide an energy subsidy including for electricity bills for low-income households. To be eligible for a subsidy, a household must be registered in the national database of low-income households established by the Ministry of Social Affairs. Table

Table 2.8 Electricity tariffs for households in Indonesia

Type of consumer	Electrical power	Tariff ($/kWh)	Tariff subsidized by the government
Small household	450 VA	0.029	Subsidized
	900 VA for low-income households	0.043	Subsidized
	900 VA	0.095	Not subsidized
	1,300 VA	0.103	
	2,200 VA	0.103	
Medium household	3,500–5,500 VA	0.103	Not subsidized
Large household	>6,000 VA	0.103	Not subsidized

Source: Detik Finance 2019b.

Water tariffs

Water utility companies in Indonesia are owned by the local governments. Water tariffs are regulated by each city (the mayor, or in the case of Jakarta, the governor), and therefore differ across regions. Some cities subsidize the utility bills of low-income households. For instance, in 2016, DKI Jakarta Province provided a subsidy of $0.14 from the initial tariff of $0.53 per cubic meter of water for residents of low-income multi-story housing (Kompas.com 2017). The percentage of households with access to water utilities is smaller than that of households that source their water elsewhere, including from deep well water. In Jakarta, it is estimated that 35–38 percent of total households use deep well water. However, the data might not represent the situation on the ground, since there are many unregistered wells in the city (GeoMagz 2014). Similar data from other cities were not readily available. Low-income apartment owners are subject to a local tax if they source water from the ground, whereas low-income landed households are not. The tax rate varies from one city to another. For instance, the tax rate in Jakarta and Semarang is 20 percent (Grafita 2013).

2.3.2 Building construction permits and occupancy certificates

According to Law No. 28 of 2002 on Buildings, two kinds of permits and licenses are to be obtained by building owners and developers throughout the building life cycle:

(1) **A building construction permit (IMB)** shall be obtained by the building owner or developer from a building permit/license authority under the relevant local government before building construction commences. As part of the legal system for property and a crucial part of regional development planning, it is important for building owners or developers to obtain an IMB once they have secured a land certificate. The IMB explains the purpose and specifications of the planned building and certifies that the building design has been approved. The permit is required to carry out building construction and serves as proof of registration throughout the building's life cycle.

Specific procedures and the relevant authority for the issuance of IMBs depend on the building type and are formulated by each local government. **For example, in DKI Jakarta**:

- Applications for individual residential/housing building permits are submitted to a one-stop integrated service (OSIS) at the sub-district office.
- Applications for permits for residential/housing buildings in a real estate area and/or multi-story building (eight floors or fewer) are submitted to OSIS at the mayor's office in a given city.
- Applications for permits for a multi-story building (nine floors and more) are submitted to OSIS at the provincial governor's office. The fee for permit issuance is regulated under DKI Jakarta Regional Regulation No. 3 of 2012, which takes into account building floor area, building characteristics (e.g., complexity, function), and price per unit (Rp 25,000/m^2).

(2) **An occupancy certificate (SLF)** is to be obtained—after building construction is completed and before operation starts—from a building permitting/licensing authority under the regional government where the building is located. Issuance of an SLF indicates that a building has fulfilled the technical design requirements set by the local government in accordance with its proposed function, has been constructed in line with the specifications approved in the IMB, and has passed a technical inspection carried out by an authorized officer, which includes a site visit. An SLF has a validity period of five years for general purpose buildings and ten years for residential housing, after which it must be reissued.

Similar to those for IMBs, procedures and levels of authority for SLF issuance vary depending upon the local government and building type. Applications for SLFs are submitted to the OSIS counter at a sub-district office, a mayor's office, or a provincial governor's office. The OSIS is responsible for a detailed technical review and a visit to the construction site to confirm compliance with administrative and technical requirements. Finally, an SLF is given upon a positive review. In practice, many green design features are often not included in the SLF and IMB checklists, and OTTV is the only green design feature frequently used as a requirement for obtaining SLF and IMB.

Technical guidelines for the issuance of the two permits adhere to national regulations, namely MoPWH Regulation No. 5 of 2016 for IMBs and Ministry of Public Housing Regulation No. 25 of 2007 for SLFs. Issuance of the permits serves as a means of ensuring compliance. However, their enforcement depends on the existence of regulations under local governments, which is highly dependent on local leaders' initiative. As of April 2018, 468 of 509 cities/regencies in Indonesia had established local building regulations and 48 cities/regencies had implemented SLF regulations (MoPWH 2018). According to the MoPWH, the existing building regulations have not been fully implemented.

Low-income housing development is carried out in four stages, namely preparation, pre-construction, construction, and post-construction. Annex VIII lists the stages of the low-income housing development where the above permits are issued, as well as the roles and responsibilities of both the developers and local governments during each stage.

2.3.3 Regulation on residential solar rooftop photovoltaic (PV)

In 2018, the Ministry of Energy and Mineral Resources (MEMR) issued **MEMR Regulation No. 49 of 2018** on rooftop solar PV for customers of the state-owned utility company (PLN). The regulation allows for PLN consumers, including household consumers, to export their excess electricity generated by a solar rooftop PV to the utility grid through a net-metering scheme. The regulation stipulates that the utility will account for 65 percent of the exported electricity, and the amount will be offset against the next month's utility bill.

While solar rooftop PV can help reduce a household's electricity bills, it is currently not economically attractive for subsidized low-income housing projects due to the ceiling price set by the government. The installation costs for residential rooftop solar PV systems are still high, ranging from $0.7 to $1.4 per watt-peak for residential systems with a capacity of less than 10 kilowatt-peak. Nevertheless, with prices of solar PV falling, some developers have expressed interest in the possibility of installing solar PV systems in their future (non-subsidized) low-income housing projects.

2.3.4 Regulations on sustainable financing

There are two regulations issued by the Financial Services Authority (FSA) and that serve as the umbrella regulations for sustainable financing and encouraging green investments, including in green buildings.

The FSA Regulation No. 51 of 2017 on Sustainable Financing mandates financial institutions and public companies to implement sustainable financing practices in their business, including responsible investments. The regulation also mandates them to establish a sustainable financing road map, which must include plans for increasing their financing portfolios, investments, or placements on financial instruments or projects in line with sustainable financing principles such as those of green buildings. The FSA will give incentives to financial institutions and public companies that implement sustainable financing. The incentives may include invitations to participate in capacity-building programs or win accolades such as a Sustainable Finance Award. On the other hand, financial institutions and public companies that fail to comply with the regulation will be given a written warning by the FSA.

Another FSA regulation on sustainable financing is FSA Regulation No. 60 of 2017 on Issuance and Requirements for Green Bonds. This regulation states that green bonds can only be issued for financing environmentally friendly projects, including green buildings.

3. Key stakeholders in the low-income housing and green building sectors

Key stakeholders involved in low-income housing include the central and local governments, state-owned and private developers and real estate associations, financial institutions, and low-income homeowners. This section briefly describes the roles of those stakeholders who would be particularly affected by the climate auction pilot.

3.1 Government entities

3.1.1 Central government

The central government is involved in low-income housing through policy formulation and implementation led by the MopWH. The **MoPWH, under the Directorate General (DG) of Cipta Karya,** provides technical guidelines for landed and multi-story low-income housing. The DG is also responsible for policy formulation and implementation in the residential sector and providing guidance for building arrangements. The **MoPWH DG for Housing Provision** formulates and implements policy in the housing provision sector while the **DG for Public Infrastructure and Housing Financing** is in charge of policy formulation and financing for low-income housing. The **MoPWH DG of Housing Provision and DG of Infrastructure Finance** oversee subsidized housing for ownership and rental, and upgrades of sub-standard housing.

The **MoF** sets the ceiling (selling) price of low-income housing as recommended by the **MoPWH's Research and Development Center for Housing and Settlement**. The MoF also provides budgets for state-supported housing programs and oversees their financial management.

Other ministries involved in the green building and low-income housing sectors include the **MEMR** and the National Development Planning Agency **(BAPPENAS)**. The MEMR sets and enforces regulation and policies on energy conservation, while BAPPENAS designs the national development plan. The **CMHDC** plays a small role in the housing sector through its National Program for Community Empowerment in urban areas. The **BSN** is responsible for developing national standards and standardization processes, including for green buildings**.**

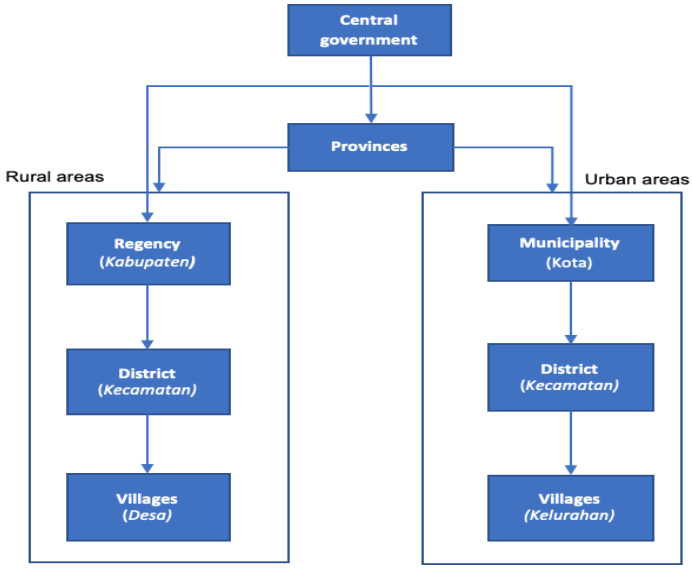
Box 3.1 Governance structure in Indonesia

Indonesia is a country composed of 34 provinces and 514 cities and regencies. The Republic of Indonesia Law No. 23 of 2014 on Local Government outlines the responsibilities and jurisdictions of the central government and local governments, making the country's governance highly decentralized. In the housing sector, the central government is responsible for housing provision for low-income households and the development of financing systems for low-income housing. However, the local (municipal/city and regency) governments are responsible for issuing building construction permits (IMBs), developing housing projects, and providing building occupancy certificates (SLFs). This shows that, in the building and housing sector, local governments have a direct and more powerful decision-making role than the provincial and central governments. Provincial governments have direct responsibility for housing provision only after a disaster event has occurred at the provincial level.

Figure B3.1.1 shows that the governance hierarchy in Indonesia is similar for both urban and rural areas. The main differences between a regency and a city are in size, demographics, and economic activities. According to the Ministry of Home Affairs Instruction No. 34 of 1986, a city is defined as "an area that is a center for economic, social, and governmental activities." A city has a greater population size and density and its economic activities are primarily outside the agriculture sector.

Within this context, it is recommended that **the auction pilot focus on the second level of the local governance hierarchy**, and particularly **on cities**.

Figure B3.1.1 Governance hierarchy in Indonesia



Source: Original compilation, adopted from Simanjuntak et al. (2012).

3.1.2 Local government

The local government, usually through OSIS, is responsible for the permitting process for low-income housing, that is, for the issuance of IMBs and SLFs. The local government may also be involved in the actual development of low-income housing. It may build, own, and maintain special housing or multi-story low-income housing within its jurisdiction. When developing low-income housing, the municipality/regency government may collaborate with either state-owned developers or private developers.

3.2 Developers

3.2.1 State-owned developers

State-owned developers (e.g., PT Perum Perumnas, PT Hutama Karya) are mandated by the government to build low-income housing, both for general low-income households and for specific households (e.g., public servants or military personnel). State-owned developers may collaborate with private developers to construct mixed-used buildings or housing for middle- and high-income developers. PT Perum Perumnas had an approximately 1.9 percent share of the total low-income housing market in 2018 (PT Perum Perumnas 2019).

3.2.2 Private developers

Private developers have made a significant contribution to low-income housing development, having built about 57 percent of low-income housing in 2018 (Kata Data 2019). According to **Real Estate Indonesia (REI),** approximately 3,900 out of 10,000 private developers in Indonesia are active in the low-income housing sector.

3.2.3 Developer associations

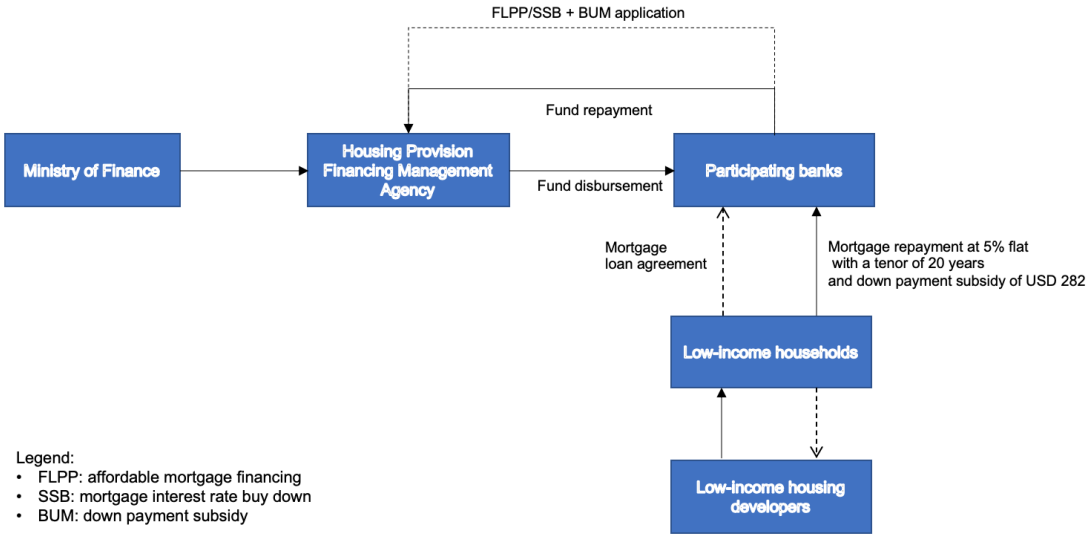
There are several private developer associations in Indonesia. These include the Association of Indonesian Housing and Settlement Developers (APERSI), Indonesia Public Housing Developers Association (ASPERI), Association of Public Housing Developers (HIMPERA), and REI, which has regional offices in each province in the country. In 2018, REI members successfully built 394,686 housing units nationwide (about 30 percent of the total housing units built in the year), of which 214,686 were for subsidized low-income housing (Detik Finance 2019a).

3.3 Homeowners/occupants (low-income households)

In the case of landed housing/multi-story homes, once a developer delivers a completed house/apartment unit to a homeowner, the developer does not have any responsibility for house maintenance. This gives homeowners a high degree of flexibility in choosing their own electrical appliances (e.g., whether to install AC or use energy-efficient lighting) or modifying the design of the floor plan . It is not uncommon for low-income homeowners to expand their house by adding another story. This, in turn, could make it difficult to monitor energy and/or water consumption in low-income landed housing.

For subsidized low-income housing, homeowners deal directly with participating banks if they wish to apply for a subsidy to buy a house or apartment (see figure 3.1).

Figure 3.1 Subsidy provision scheme for low-income housing



Source: Original compilation, adopted from MoPWH (2017c).

3.4 Financial institutions

Financial institutions such as private and state-owned domestic banks are crucial to Indonesia's housing sector. So are state-owned enterprises that provide housing, develop the secondary mortgage market, and extend mortgage insurance. These enterprises include the **Secondary Mortgage Facility**, the state insurance companies **(Jaminan Kredit Indonesia—Jamkrindo**), and public mortgage guarantee providers **(Asuransi Kredit Indonesia—Askrindo)**.

Financial institutions involved in low-income housing provision include national state-owned and local government-owned commercial banks. Banks play an important role in the low-income housing market by providing housing mortgages. Government subsidies are also channeled to low-income home buyers through these banks. As of 2019, there were 25 banks participating in the subsidized mortgage loan scheme, six of which were state-owned national banks while the rest were local government-owned banks[18] (Okefinance 2018). BTN bank holds the highest market share (90 percent) for providing housing mortgages to low-income households. These banks also provide loans to developers for their housing projects.

[18] Bank BTN, Bank BRI, Bank BNI, Bank Papua, Bank Sumut Syeriah, Bank BJB Syariah, Barik BJB, Bank Sumut, Bank Kalbar, Bank Mandiri, Bank BRI, Bank Sultra, Bank Suiselbar, Bank Sumseibabel, Bank Susebar Syariah, Bank NTT, Bank BTN Syariah, Bank Jambi, Bank Jatim, Bank Jatim Syariah, Bank Nagari, Bank Sumselbabel Syariah, Bank Kalteng, Bank Kalsel, and Bank Kalsel Syariah.

3.5 International donors

International donors also play a role in the housing sector in Indonesia. For instance, the World Bank Group is implementing the National Affordable Housing Program, providing concessional loans to eligible potential homeowners through participating lending institutions.

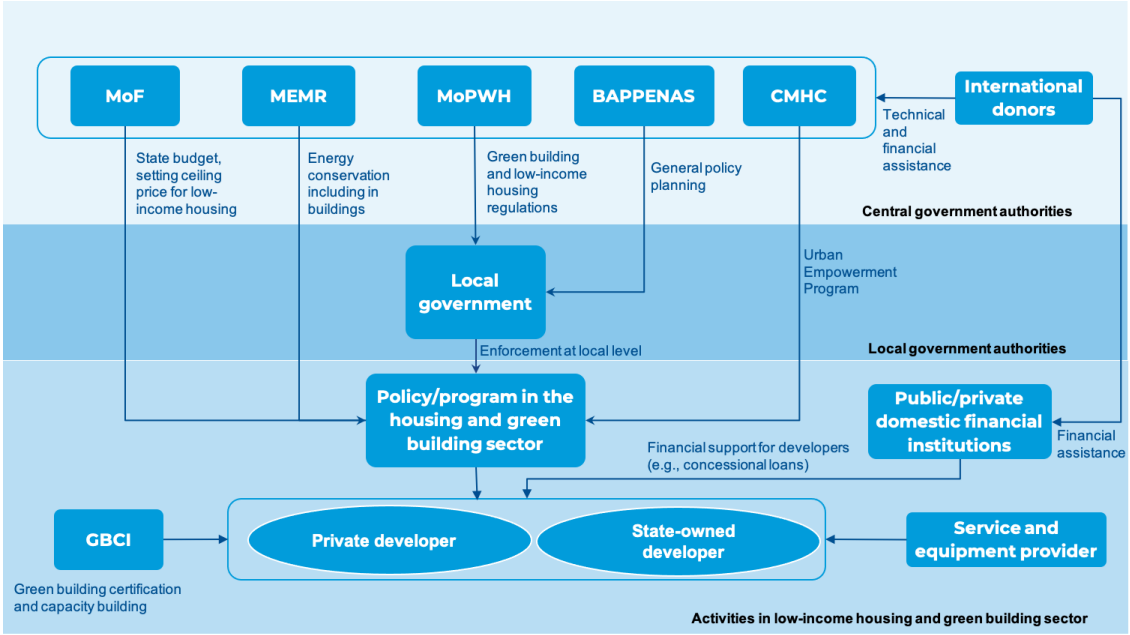
In the green building sector, the World Bank Group, through the **International Finance Corporation (IFC),** has provided assistance to the Indonesian government to help develop a national green building code toolkit, as well as policy assistance at the regional level (e.g., for the DKI Jakarta, Bandung, and Semarang green building codes).

3.6 Professional associations

The Green Building Council Indonesia (GBCI) and PT Sertifikasi Bangunan Hijau (PT SBH) are responsible for green building certification in Indonesia. Notably, GBCI issued its own green certification scheme, GREENSHIP, and is the official partner for EDGE certification in Indonesia. GBCI is also active in building capacity for practitioners in the green building sector by providing training and workshops for GREENSHIP/EDGE certification.

The landscape for relevant stakeholders in low-income housing and the green sector is illustrated in figure 3.2.

Figure 3.2 Stakeholders that affect Indonesia's low-income housing and green building sector



Source: Original compilation.

4. Voluntary green building certification schemes in Indonesia

This section outlines existing green building certification schemes in operation in Indonesia.

4.1 GREENSHIP

GREENSHIP[19] is a green building rating and certification program managed by GBCI since 2010. This certification scheme was developed in collaboration with local engineers, architects, and interior designers, and considers the country's characteristics and existing national regulations and standards.

Among the five types of GREENSHIP rating certificates,[20] GREENSHIP New Building and GREENSHIP Home are the most relevant to the low-income housing segment.

- GREENSHIP New Building is applicable to new buildings and existing buildings undergoing at least 90 percent of mechanical or structural retrofit work. The certification process covers the entire building construction cycle, from design to completion, including setting a rating target and areas of design to focus on, project registration, consultation workshops, and assessment of design and constructed forms.
- GREENSHIP Homes is applicable to single new and existing landed houses, and existing houses undergoing redevelopment, including low-income landed housing.

The GREENSHIP rating tool assesses the design and performance of each building using seven eligibility criteria, six categories (location, energy efficiency and conservation, water conservation, material resources, indoor health and comfort, and environmental management), and 46 assessment criteria.

The GREENSHIP certification awards each building with a rating based on a qualitative assessment, in which the building accumulates points when it meets the GREENSHIP criteria. The certification process does not consist of an assessment of building efficiency performance in a quantitative manner, that is, calculating energy- and resource-efficiency gains due to its design, nor does it estimate the incremental costs of adopting a criterion or efficiency measure. In addition to a final assessment certification for constructed buildings, a GREENSHIP Design Recognition certificate can be awarded for an eligible final design and plan.

Among the GREENSHIP-certified buildings in Indonesia, only two are residential housing (premium apartment complexes), while the remaining are mostly commercial buildings. So far, no low-income housing buildings have been certified by GREENSHIP New Building or GREENSHIP Homes (PT SBH 2019).

According to interviews with stakeholders, the complexity of GREENSHIP assessment criteria is one of the reasons hindering developers from registering their projects. It is also possible that low-income housing developers have not heard of GREENSHIP due to its closer engagement with big building developers (offices and mid-to-high-range apartments).

4.2 EDGE

EDGE is a global green building certification, standard, and software developed by IFC. Launched in 2013, EDGE is applicable to more than 160 countries.[21] The free and publicly available software[22] provided on the EDGE website is intended for use by architects, engineers, developers, building owners, and anyone interested in green building design.

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[19] Information on GREENSHIP is available at http://gbcindonesia.org/greenship.
[20] GREENSHIP New Building, GREENSHIP Homes, GREENSHIP Existing Building, GREENSHIP Interior Space, and GREENSHIP Neighborhood. Further description of GREENSHIP certification is available in Annex IX.
[21] As of December 2019, retrieved from https://www.edgebuildings.com/marketing/edge/.
[22] Information on EDGE is available at: www.edgebuildings.com.

EDGE offers three levels of certification: EDGE Certified (level 1), EDGE Advanced (level 2), and Zero Carbon (level 3). EDGE Certified recognition is given to projects that have achieved at least 20 percent savings across the three resource categories (energy, water, and embodied energy in materials). EDGE Advanced is given to projects with at least 40 percent savings. Zero carbon certification is awarded to EDGE Advanced buildings that have 100 percent renewable energy on or off site or have purchased carbon offsets to achieve zero carbon emissions.

As of April 30, 2020, 21 building projects in Indonesia had received final EDGE certification and an additional 23 projects had received preliminary certification. Homes, including low-income housing projects in Subang Regency and Maja District, both in West Java, accounted for the majority of the certified buildings, with 2,629 low-income units obtaining final EDGE certification, and another 2,370 low- to lower-middle-income units obtaining preliminary certification. As of December 2019, EDGE-certified buildings in Indonesia, including in the residential, business, industrial, and education sectors, had saved 28,243 tCO_2 per year, of which 6,309 tCO_2 (about 22 percent) were from homes. According to interviews with stakeholders, developers prefer more internationally recognized certification schemes, such as EDGE, for marketing purposes.

More information on EDGE certification can be found in Annex IX.

4.3 Comparing EDGE and GREENSHIP

To gauge their suitability for integration in a climate auction pilot, the baseline data, design of parameters and measures, as well as tool features of EDGE and GREENSHIP were compared. The comparison exercise found that:

- First, the **EDGE base case dataset has a high level of detail**. The base case data for the housing sector are specified for each household income group and location. EDGE also has a city-specific climate dataset, which is not provided under GREENSHIP. On the other hand, GREENSHIP has an advantage in crediting environmental protection measures that are not limited to resource-efficiency benefits, such as the use of safe local materials, the installation of oil traps, the use of certified wood products, and continuous improvement. It also promotes adoption of SNIs, which local developers are familiar with. These are currently not being credited or promoted by EDGE.
- Second, the **EDGE web-based tool has a feature to calculate potential energy savings** that can be achieved through each efficiency measure. Currently, the GREENSHIP Homes web-based self-assessment tool enables homeowners, designers, and developers to assess their house design in meeting GREENSHIP criteria on a qualitative basis using key parameters (see table A9.2). However, the tool does not calculate potential energy and resource savings.
- Third, **EDGE calculates incremental cost components** to help building owners choose among cost-efficiency measures to be adopted. This cost calculator is a unique feature that is not commonly found in other certification schemes including GREENSHIP. This gives EDGE a key advantage in supporting a financial incentive mechanism such as an auction, compared with GREENSHIP and other standards.
- Fourth, the **user friendliness** of both web-based tools was considered. The GREENSHIP tool is arguably easier to use than EDGE. GREENSHIP uses a stream of “yes/no” questions in simple language and visual examples that flow according to the selected answers, while EDGE lists advanced measures that may not be easy to understand for less experienced users. Yet such details are needed to estimate energy savings. Both EDGE and GREENSHIP can be used in the Bahasa Indonesia language, which is highly important for the local audience. Visual examples for each measure may be considered in the next update of the EDGE tool.

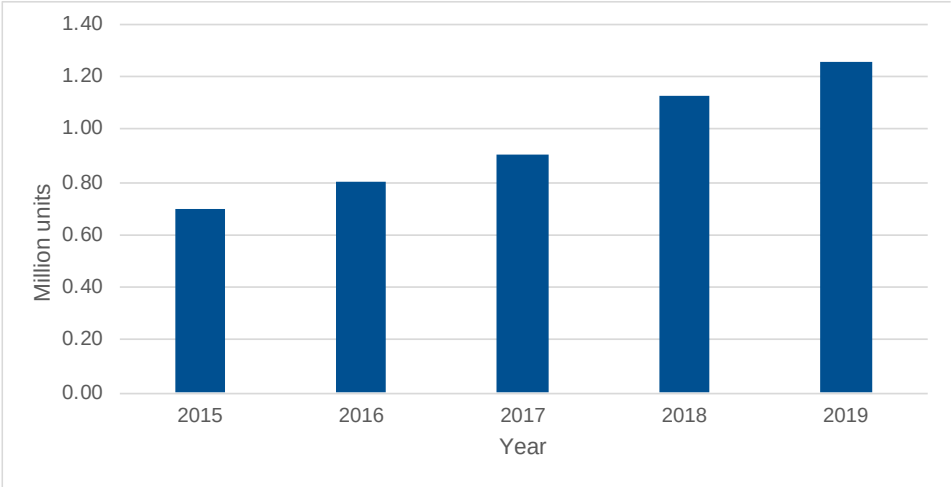
Based on this comparison above, EDGE was chosen as a basis for a climate auction pilot. If GBCI upgrades the GREENSHIP tool with an energy and resource savings calculator as well as cost component features, it could also be well positioned to support a climate auction. However, such

an upgrade is not planned at the time of writing. Furthermore, the GREENSHIP tool is only applicable in Indonesia, which will hinder comparison between developers in different countries participating in an auction.

5. Current status of low-income housing in Indonesia

The housing market in Indonesia grew steadily between 2015 and 2019, as depicted in figure 5.1, with a total demand of more than 1.2 million houses in 2019.

Figure 5.1 Annual growth of housing market in Indonesia



Source: Original compilation, based on MoPWH (2020).

To meet this demand, the central government launched the One Million Houses Program in 2015. The government set a target of building a million houses per year for the low-income household segment, including both landed and multi-story housing. According to data from the Center for Education and Training on Roads, Housing, Settlements, and Regional Infrastructure Development, MoPWH (2017c), the private sector was expected to play a key role in this program, by building more than 65 percent of the total units (603,516 units by 2019). State-owned developers (e.g., Perumnas) and the government—both national and local—were expected to account for the rest of the target. The government's role includes providing funding for the development of multi-story low-income housing rentals (*Rusunawa*), improving the quality of sub-standard landed and owned low-income housing (under the BSPS program; see Annex IV for details), and directly building new landed low-income housing units. It is also possible for state-owned developers to enter a public-private partnership with private developers to build low-income housing.

Based on interviews with developers, **subsidized low-income housing projects have indeed been the main driver for housing market growth on the ground**. As much as 69 percent of the housing units built in 2018 were low-income households (75 percent in 2019). More than half (54–57 percent) of the low-income housing developed in 2018–2019 was built by private developers, as can be seen in table 5.1 (Tempo 2019; MoPWH 2020).

Table 5.1 Distribution of developers of low-income housing (both subsidized and non-subsidized), by category, 2018–2019

Developer category	Number of low-income housing units built	
	2018	2019
Private	447,364	514,864
Private sector funding through corporate social responsibility	458	589
Public with central government funding	217,064	396,190
Public with local government funding	111,821	26,936
Self-funded by homeowners	8,934	6,582

Developer category	Number of low-income housing units built	
	2018	2019
Total	785,641	945,161

Source: Tempo 2019; MoPWH 2020.

However, despite the government's efforts, the One Million Houses program only began to achieve its target in 2018. In the preceding years, the program had managed to deliver only 70–90 percent of its target per year. The program was predicted to achieve only 95.8 percent of its total target by the end of its operation in 2019 (CNN Indonesia 2019). One of the main reasons for the slow uptake from the developers' perspective is the lack of incentives (e.g., tax or land acquisition privileges). On the public sector side, the limitation of the central government's budget for housing provision led to the slow growth of the program (BAPPENAS 2017; IPOTNEWS 2019; and interviews with stakeholders, 2019). To date, there are no data available on the official results of the program.

By March 2019, the MoPWH reported that there is an overall housing deficit of 7.6 million units (MoWPH 2019). Although the data do not specify in which regions the deficit is found, according to the MoPWH, in 2015 West Java had the largest housing backlog, with approximately 2.3 million households not owning a home, while in Jakarta, 1.3 million (51 percent) households did not. North Sumatra is another province in the bottom three in the country in terms of the homeownership rate (PPDPP 2015). It is unclear, however, whether this trend is continuing, as more recent data are unavailable.

Comparing this demand with actual low-income housing units built in 2018 and 2019 (table 5.1) shows a gap of around 10 million housing units. Considering the size of this gap, the Indonesian government has named **housing provision for low-income households as one of its main national development priorities**, as is reflected in its 5-year National Medium-term Development Plan (RPJMN). For 2020–2024, the government aims to reduce the accumulated housing backlog of 7.6 million units by providing financial support and tax waivers, developing affordable housing, and setting the price ceiling for low-income housing (MoPWH 2019).

According to the developers interviewed for this study, the current housing backlog, especially in the low-income housing sector, provides an opportunity to stay in the market and expand their portfolios, provided that government housing incentives are still available to low-income households.

Low-income households still require subsidies from the government to be able to afford to buy a house or an apartment unit. Among the available financial assistance packages or subsidies available from the government, both banks and developers consider FLPP to be the main driver of low-income housing uptake in an otherwise slow-growing market. Banks, in particular, prefer to provide financing to subsidized housing rather than non-subsidized housing. From January to April 2019, FLPP funded 36,480 house units, valued at $246.8 million (Kompas.com 2019). According to MoPWH data (2019), West Java leads in terms of FLPP disbursement, with $59.01 million (24 percent of total FLPP funds disbursed) provided for 8,415 house units in the first quarter of 2019, followed by Jakarta, Banten, Riau, East Java, and West Kalimantan. On the project developers' side, incentives from the MoPWH in the form of grants are available to develop the infrastructure for low-income housing project development, including neighborhood roads, drainage systems, and street lighting. (More details on access to financing for low-income housing developers are discussed in section 10.)

For 2020, government has allocated $776 million for FLPP to provide subsidies for 102,500 house units, averaging $7,570 per unit. However, developers consider this allocation to be insufficient for accommodating the housing needs of low-income households in Indonesia, and FLPP's budget is often exhausted before the year's end (Bisnis.com 2019). Nevertheless, despite these challenges, private developers are still keen on expanding their business in the low-income

housing segment, especially since the demand in middle- to high-income housing has been low due to the country's slowing economic growth.

With regard to **regional market trends**, according to REI, the 10 provinces experiencing the fastest growth in the low-income housing market are, in no particular order, North Sumatera, South Sumatera, Banten, West Java, Central Java, East Java, West Kalimantan, South Sulawesi, and West Nusa Tenggara (interviews with REI, 2019). The developers interviewed for this study revealed that new low-income housing projects are usually developed in industrial regions with close proximity to national highways. For instance, in West Java province, regions with substantial low-income housing development include Subang, Karawang, Bekasi, Cirebon, Tasik, and Bandung Barat District (interviews with REI, 2019), which are located near industrial zones and/or along national highways.

In the housing market, **low-income buyers prefer landed housing over multi-story housing**. According to the MoPWH, between 2010 and 2016, only 0.05 percent or 245 low-income multi-story housing units were sold under the FLPP scheme, while more than 475,000 low-income landed housing units were sold during the same period (LPDPP 2016). According to the developers interviewed, this trend still prevails due to buyers' preference for having a backyard, which cannot be fulfilled by multi-story housing.

6. Geographical targeting for an auction mechanism

This section considers where an auction mechanism for green buildings might have the highest changes of succeeding in Indonesia. This analysis focuses on cities, not regencies. Urban areas have larger populations and greater economic growth than regencies in Indonesia, and hence, greater demand for new housing and low-income housing in particular. Third, cities are where the offices of developer companies, financial institutions, and associations are typically concentrated, making the process of engaging stakeholders in the pilot phase of the auction easier.

Box 6.1 DKI Jakarta Province in context

A city, for the purposes of this study, is defined as a jurisdictional area with its own governance. Satellite cities or suburban areas with separate administrative boundaries have been excluded.

Overall, there are 415 regencies, 1 administrative regency,[23] 93 cities, and 5 administrative cities[24] within 34 provinces in Indonesia.

DKI Jakarta has the status of a province but has a special governance structure due to its position as the capital of the country. The Governor of DKI Jakarta oversees governmental affairs and the mayors of the administrative cities report directly to him. In contrast to other provinces in Indonesia, which have limited jurisdictions and responsibility in relation to spatial planning and settlements, including for low-income housing and green buildings, the Governor of DKI Jakarta province has the autonomy to establish regulations pertaining to low-income housing and green buildings, as can be seen in Governor's Regulation No. 38 of 2012 on Green Buildings.

6.1 Methodology

This study considers cities with a sizeable low-income housing market, and where it might be relatively easy to catalyze the construction of low-income housing that is both resource and energy efficient (e.g., due to existing supportive governmental policies, priorities, and programs; green building codes; and the availability of experienced developers). Other considerations were taken into account, such as the diversity of the prioritized cities in terms of their geographical location or size (tier), the cities' experience and connection with the World Bank/IFC, and the general willingness and readiness of local stakeholders to participate in the auction.

The following criteria were used to assess which cities have the potential to host the pilot phase of the auction mechanism:

(1) Alignment with national strategic priorities

(2) Prioritization in national development planning and housing programs

(3) Low-income housing market potential

(4) Potential and readiness for a green building market (either a market is existing or planned, and local stakeholders are training in the National Green Building Toolkit)

Some cities in Indonesia have special characteristics such as being located in strategic positions (e.g., port cities) or having an abundance of certain natural resources. These special characteristics lead the central government to include and prioritize these cities in national spatial planning, national development planning, and housing programs.

The MoPWH has outlined 35 strategic development areas (WPSs) in the Strategic Plan of the MoPWH (RENSTRA) based on their special characteristics. The 35 WPSs consist of 119 areas including cities, regencies, and towns. WPSs are used as the basis for integrated planning in infrastructure development. It has been reported that the WPSs will change as a result of the plan

[23] In contrast to a regency, an administrative regency does not have autonomy within its jurisdiction. It does not have its own legislative body and the regent is appointed by the governor as opposed to being directly elected by citizens. The only administrative regency in Indonesia is in the Seribu Islands, in the Special Capital Region of Jakarta Province.
[24] Similar to an administrative regency, an administrative city also does not have autonomy within its jurisdiction and does not have its own legislative body. The administrative cities in Indonesia are in the Special Capital Region of Jakarta Province, composed of South Jakarta, North Jakarta, Central Jakarta, East Jakarta, and West Jakarta.

to relocate Indonesia's capital to East Kalimantan province in 2040 (Bisnis.com 2019). It is still unclear what the changes will be but major improvements to infrastructure development in East Kalimantan are expected.

Out of the 119 areas, **55 cities are included in the WPSs**. All of these cities were selected for the target geographic analysis and screened against the key criteria listed above to determine their potential to become host geographies for the pilot phase of the auction. (They are presented in the assessment sheet in Annex X.) As a result of the screening, 20 cities have been added to a long list of potential locations for the auction, with 7 of them prioritized. Finally, 4 cities out of these 7 have been shortlisted for the pilot phase of the auction.

6.2 Prioritized locations for the auction mechanism

6.2.1 Long list of priority cities for the climate auction

The cities in the WPS with the highest-potential low-income housing market were considered against the criteria outlined above. The long list of potential cities is provided in Annex X with full assessment results.

Figure 6.1 shows the location of the 20 cities long listed for the auction pilot. It can be seen from the figure that most of these cities are located in Java or Sumatera islands and only a few are located in the islands of Sulawesi and Kalimantan. The four cities shortlisted through an additional analysis (see subsection below) are shown in green.

Figure 6.1 Location of 20 cities prioritized for the auction pilot

Source: Original compilation.

6.2.2 Cities shortlisted for the auction pilot

From the long list of cities noted in figure 6.1, the information and recommendations obtained during stakeholder interviews were used to narrow down the long list of **auction pilot candidate cities to four cities**.

For instance, despite their sizeable market potential, Medan and Surabaya were excluded since the awareness, engagement level, and interest from local stakeholders appeared insufficient to host the pilot phase of the auction. Developers interviewed in Surabaya expressed strong disinterest in introducing green features to their low-income housing projects, while the local government in Medan has not yet prioritized green buildings or housing in their development planning and, according to the IFC team in Indonesia, is not easy to engage.

On the other hand, cities in the Greater Jakarta region, which includes Jakarta, Tangerang, Bekasi, Bogor, and Semarang, were often recommended by stakeholders, such as the MoPWH, as strong potential locations for the auction pilot. Industrial cities that have requirements for SLFs

are also considered to be strategic locations for the climate auction. Only a few cities/regencies have released requirements for SLFs, including Jakarta, Semarang, Surabaya, Malang, Merauke, and Southwest Maluku (interview with MoPWH, 2019). In addition, other aspects were considered in the short-listing process to ensure a diverse representation of geographies in the auction pilot, including the location of the city (i.e., to make sure that not all shortlisted cities are on the Java island) and tier size (so that tier 2 cities with populations of fewer than 1 million people are also included). Despite not satisfying the criteria under green market potential and readiness, Samarinda and Balikpapan have also been shortlisted due to their proximity to the new capital, which will be located in East Kalimantan.

Based on the analysis in sections 6.2.1 and 6.2.2, the following four cities were shortlisted as potential locations for the pilot phase of the auction: **Jakarta, Bandung, Semarang, and Balikpapan**. For more detailed information on each of these geographies, please refer to Annex X.

Table 6.1 Cities prioritized and shortlisted for the potential auction pilot

No.	City	Population	Low-income housing needs	Comments
1	Jakarta	10,467,629	915,956	• Large potential market • High level of awareness from local stakeholders
2	Bandung (West Java)	2,412,090	124,225	• Large potential market • High level of awareness from local stakeholders
3	Semarang (Central Java)	1,786,114	55,755	• Tier 1 city and located in Java • Availability of green building codes indicates sufficient awareness from local stakeholders • Sufficient market size • Part of WPS (industrial city in close proximity to national highways)
4	Balikpapan (East Kalimantan)	636,012	36,347	• Tier 2 city • Close to new capital • Rapid growth potential

Source: Original compilation.

Based on this analysis, **Bandung is the city best suited to hosting the auction facility pilot**. In addition to meeting the above criteria, Bandung offers the following advantages:

- The city has good transportation links to suburban areas, which is where low-income housing would likely be located and where landed houses can still be developed.
- Local authorities have demonstrated interest in supporting green building initiatives (e.g., green building code designs). They have also demonstrated capacity to implement measures that help create an enabling environment that is conducive to such construction (e.g., green building permit procedures). EDGE-certified, auction-supported low-income housing will need to be developed and permitted. It is thus important that procedures and resources be in place locally to enable this to proceed smoothly, reduce transactions costs, and mitigate perceived risks to project developers.
- There is abundant land on which low-income landed houses can be built. Given the potential size of the opportunity, Bandung is expected to be of particular appeal to the Real Estate Indonesia West Java's approximately 300 members who are involved in low-income housing development.

7. Analysis of potential bidders in an auction mechanism

This section provides more detailed analysis of the key stakeholders in the low-income housing sector introduced in section 3, evaluating their potential interest in participating in a green buildings auction.

7.1 Housing developers

Housing developers constitute the most relevant group of stakeholders likely to become potential bidders in a climate auction (box 7.1). Developers have control over and direct access to building designs, materials, and construction plans. Also, they take the greatest financial risk in housing projects. Although financial institutions may be a source of asset financing, their cash flow and risk buffer are built around the loan product rather than the housing product.

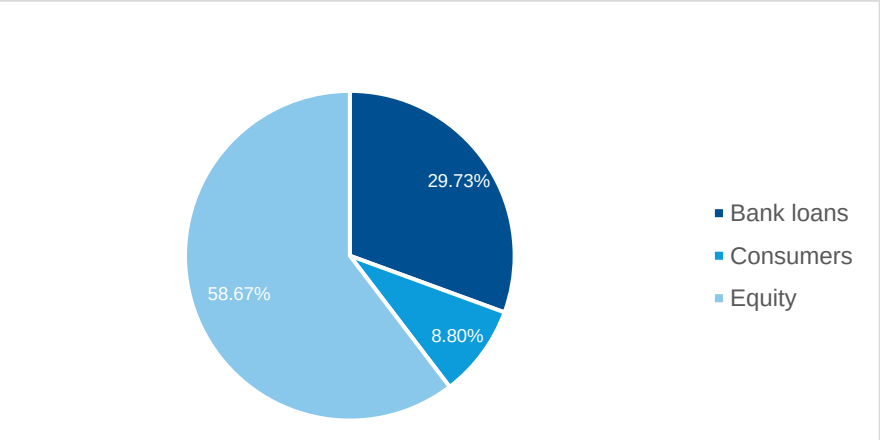
As mentioned in section 3.2, housing developers in Indonesia are primarily divided into public (state-owned) developers and private developers. Around 11,789 private developers are recorded in the national MoPWH registry (Kontan 2019).

Box 7.1 Developers as key stakeholders in climate auctions

Considering their direct influence over the design and specification of a house, and also taking into account that developers are the ones absorbing the market volatility (both in terms of product absorption and fluctuation of the lending market), **housing/real estate developers would be the most relevant participants in an auction**. The uptake to ensure product availability is predominantly reliant on the developer's rate of adoption of green housing. This is an important consideration as an auction mechanism relies on portfolio delivery performance (generation of verified emission reductions), which is mainly controlled by developers.

Based on several surveys conducted by the Bank of Indonesia between 2018 and 2019, a typical financing structure for the housing projects of both private and public developers consists of internal funds/equity, bank loans, and funds received from customers. For low-income housing projects, the financing structure may be complemented by programs or subsidy schemes made available by the government. A typical share of these instruments is illustrated in figure 7.1.

Figure 7.1 Typical financing structure of public and private developments



Source: Bank of Indonesia 2019.

The figure shows that, for the average housing developer in Indonesia, the lion's share of project finance is sourced from two channels: their own funds (58.67 percent) and bank loans (29.73 percent). This applies to both public and private developers. This indicates that, compared to other stakeholders involved in housing development, developers are the group that will be most affected by the volatility of the market and regulatory dynamics given their stake in a given project. This also indicates that they are the stakeholders with the most potential influence on project's

design specifications, since these correspond to potential market absorption and their internal rate of return on the project. The economic attractiveness of a climate auction designed to increase the uptake of resource-efficient housing is potentially greatest for this group of stakeholders. Additionally, the uptake of green buildings, once they are considered economical, will contribute to transitioning and mainstreaming how developers structure and develop their future projects, which in turn will trigger the housing sector to embrace more sustainable solutions.

7.2 Financial institutions

In the housing project life cycle, financial institutions interact with two stakeholder groups: housing developers and individual homeowners. Financial institutions include commercial banks (either public and private) that provide loans to both developers and homeowners; banks can be financed from savings accounts, managed capital, mortgage bonds issuance, and asset-backed securities. While different banks may offer different mortgage or loan packages, under Bank of Indonesia Regulation No. 21 of 2019 concerning Amendment to Regulation No. 20 of 2018, the central bank introduced updates on the Loan to Value and Financing to Value cap for housing, which relaxes the ratios by 5 percent, and also includes an additional 5 percent (i.e., lower down payment requirement) for green certified homes, which applies to first home purchases of all home types except for landed houses between 21 m^2 to 70 m^2 in size (Art. 11A (1) a) where the additional 5 percent only applies to second home purchases (Art. 11A (1) b 2).

As seen in figure 7.1Figure , bank loans contribute about 30 percent on average to a typical housing project cost structure. As required by the central bank's ring-fencing regimes and the FSA regulations,[25] banks assess housing developers' projects based on the commercial terms and risk profiles of the developers before granting a loan. For homeowners, assessments are done based on monthly income, outstanding loans, and credit history rating. This indicates that, while financial institutions provide a large portion of funding to a housing project, this stakeholder group may not generally be influenced by the climate auction or building design features as their financing assessment is based on the ability of the borrower to make payments to the loan and not the resource-efficiency levels of the purchased or developed house. One developer interviewed for this study shared that the only design aspect that banks look at is whether it satisfies the minimum national standard.

An opportunity could be explored with banks that are members of the "First Movers" program under the FSA's Indonesia Sustainable Financing Initiative, which is co-convened by the World Wildlife Fund Indonesia (Hijauku.com 2018). The initiative, launched in 2017 by the FSA and formalized in 2018, covers eight banks (Artha Graha, BRI Syariah, Bank Central Asia, Mandiri, Muamalat, Bank Negara Indonesia, Bank Pembangunan Daerah West Java, and Bank Rakyat Indonesia). In the initial phases, the initiative focuses on knowledge transfer to the member banks on environmental risk management, the revision of financing policies, and Standard Operating Procedures, especially those that create more accommodating terms for business sectors and projects with relatively high environmental and social risks compared to conventional projects. The goal is to acclimatize member banks to develop project portfolios that contribute to environmental resilience and are directly linked to achieving the United Nations Sustainable Development Goals (SDGs) for 2030. There may then be interest from these banks in targeting housing projects that are certified as resource efficient, particularly green buildings that have been identified as a potential target for the program's sustainable financing initiatives (FSA 2017). However, the implementation of green design features would still depend on developers.

7.3 Real estate associations

As discussed in section 3, real estate associations (e.g., APERSI, ASPERI, HIMPERA, and REI) compose a key stakeholder group in the housing sector. One of their main functions is to expand

[25] An example of such a regulation is the FSA Regulation No. 42 of 2017 on Development and Implementation of Credit and Bank Financing Policies for Commercial Banks.

and develop cooperation among members, particularly with regard to government programs and targets (REI 1995). These associations also attempt to encourage their members to support a number of government programs such as the balanced occupancy policy (Tribun 2016).

In the context of a climate auction, real estate associations could attract more developers, especially smaller-scale developers. According to some of the REI representatives interviewed for this study, there is general support for resource-efficient housing. However, there would be a further need to determine in detail the role that such associations could play (e.g., as an aggregator or through assisting member developers in preparing bids).

8. Review of the affordable housing sector baseline in the EDGE tool

In order to determine the base case parameters for efficiency in each of the required areas—i.e., energy, water, and embodied energy—EDGE relies on information on typical building practices and national building performance codes, where these exist. For example, if an energy-efficiency code is enforced in a certain country, such as China or South Africa, then it is used for the base case calculation. Where such codes are not enforced in the country, typical efficiencies for heating, ventilation, and AC systems as of December 2019 are based on the ASHRAE 90.1-2007[26] standard without amendments.[27]

These parameters are considered in the EDGE tool's design and used for the sake of comparison with the estimation of efficiency improvements obtained from the building designer's choices for each technology or design measure. The base case value for each parameter varies by building type and location and takes into consideration local building regulations or typical practice (business as usual). The parameters used in the EDGE assessment for homes[28] are as follows:

- Solar reflectivity for wall paint: the percentage of the full solar spectrum that is reflected by the exterior wall finish on average over the year
- Solar reflectivity for roof paint: the percentage of the full solar spectrum that is reflected by the roof finish on average over the year
- Window-to-wall ratio: the proportion of total glazed area (windows, doors, and curtain walls, including frames) to the gross exterior wall area
- The U-value of a housing unit's enclosures (roof, wall, and glass)
- Hot water boiler efficiency
- Efficiency of AC system
- Flow rate of a showerhead, kitchen faucet, bathroom faucet, and water closet (WC)
- Materials used for floor slabs, roof construction, external walls, internal walls, flooring, window frames, wall insulation, and roof insulation

This section provides an overview of what the relevant Indonesian standards and codes, both mandatory and voluntary, stipulate in terms of building design as well as energy, water, and materials performance, with an emphasis on low-income housing. These are then compared with EDGE base case assumptions to determine whether these assumptions represent prevailing practice. Where this is judged to not be the case, values are provided for the parameters.

Table 8.1 lists the mandatory regulations and voluntary standards in Indonesia that have been assessed.

Table 8.1 Regulations, building codes, and standards considered for the baseline assessment

Name of regulation/building code/standard	Mandatory/ voluntary	Entry into force
MoPWH Regulation No. 2 of 2015 on Green Buildings	Mandatory	2016
Governor of DKI Jakarta Regulation No. 38/2012 on Green Buildings	Mandatory	2013
Mayor of Bandung City Regulation No. 1023/2016 on Green Building Code	Mandatory	2016
Mayor of Semarang City Regulation No. 24/2019 on Green Building Code	Mandatory	2019
National Standards of Indonesia (SNIs)	Voluntary	2001 and 2011
GREENSHIP rating tool (New Building and Homes)	Voluntary	2012

Source: Original compilation.

[26] ASHRAE 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings is published by the American National Standard, a national voluntary consensus standard developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
[27] Based on information shared by the EDGE team during a consultation meeting, in July 2020, there will be an update to ASHRAE 90.1-2016 standard along with broader baseline updates.
[28] Based on Low Income Homes base case data for Indonesia EDGE v2.1.

The requirements set by the MoPWH regulation, as well as the green building codes set by DKI Jakarta Province, Bandung City, and Semarang City, are explained in section 2.

The SNIs considered in this assessment are those associated with building design and efficiency that are relevant to EDGE energy-efficiency measures. These include SNI 03-6389-2011 on Energy Conservation in Building Envelope, SNI 03-6197-2011 on Energy Conservation in Lighting System, SNI 03-6572-2001 on Procedure of Ventilation System and Air Conditioning System in a Building, SNI 03-6390-2011 on Energy Conservation on Air Conditioning System in a Building, and SNI 03-2396-2001 on Planning Procedures for Natural Lighting in a Building.

The comparison table in Annex XI[29] provides the following information for each selected EDGE tool parameter:

- The parameter's base case value assumed/assumption made in the EDGE tool
- The applied values that the relevant codes or standards prescribe/suggest, that is, values for each EDGE parameter considered
- Whether any given EDGE-based assigned parameter value:
    - Is considered, based on expert opinion, to represent current practice (yes or no). If "yes," this is indicated by BAU in the table, in which case the assumed EDGE base case assumptions need not be tightened.
    - Differs from what is considered, in the experts' opinion, to represent current practice. In this case, the table indicates whether the EDGE value is considered higher or lower than current practice, and consequently, whether it should be tightened, and if so, what value ought to be considered common practice.

The following sub-section explains the main findings of the base case value assessment.

8.1 Main findings from EDGE baseline assessment

MoPWH Regulation No. 2 of 2015, a national regulation, does not set values for most of the EDGE base case parameters considered in Annex XI. This is important considering that this regulation aims to inform technical building code regulations designed and enforced at the city level.

The DKI Jakarta regulation is mandatory for multi-story low-income housing, but not for landed housing.

The Bandung and Semarang regulations are mandatory for multi-story low-income housing, but not mandatory for low-income landed housing because its area is typically less than that covered by the regulation (i.e., a minimum of 300 m^2).

8.1.1 Energy-efficiency values

- **Passive design energy features and performance requirements**:
    - Among EDGE base case parameter values, the window-to-wall ratio parameter is included in the mandatory regional green building codes. In addition, OTTVs included in the mandatory local green building codes are dependent on glass sizing, glass specifications, glass shading, and roof and wall insulation, all of which are EDGE base case parameters.
    - For the window-to-wall ratio, the Semarang City regulation requires multi-story housing with a floor area of less than 2,500 m^2 to design building envelopes with a window-to-wall ratio between 5 percent and 25 percent.
    - The base case values for the following EDGE passive design features and base case parameter values do not represent the BAU scenario:

[29] Three additional assessment tables in Annex XI provide: (1) expert judgment on EDGE values for "base case of resource-efficiency measures"; (2) a comparison of EDGE key assumptions on fuels used, emission factors, and prices of energy, with current values; and (3) additional information on benchmark values used in GREENSHIP standards.

    - Window-to-wall ratio (base case: 20 percent, the BAU for landed low-income housing is 15 percent);
    - Solar reflectivity for paint for external wall and roof (base case for roof: 0.3, base case for wall 0.4; the BAU for multi-story low-income housing is 0.45);
    - Glass U-value (base case: 5.8; the BAU for landed and multi-story low-income housing is 6.0); and
    - Glass solar heat gain coefficient (SHGC) (base case: 0.8; the BAU for landed and multi-story low-income housing is 0.89).
- **Active design considerations:** All local mandatory regulations and voluntary standards place a great emphasis on active design considerations, especially on AC systems. However, they are notably silent on the use of renewable energy sources.
    - **Air conditioning:** The EDGE base case for AC assumes a split AC type as the most common type for homes, with a coefficient of performance (COP) of 2.7. All reviewed mandatory and voluntary standards prescribe 2.7 as the COP value for AC split systems. Therefore, a COP of 2.7 can be considered as the BAU for such AC systems, and thus it does not need to be tightened. It is worth pointing out, nevertheless, that the assessed mandatory standards in DKI Jakarta and Bandung prescribe various COPs depending on the type of AC system used, based on SNI 03-6390-2011 on Energy Conservation for Air Conditioning System in a Building. The GREENSHIP voluntary standard also applies the same SNI values as credit criteria.
    - **High-efficiency boiler for hot water:** The use of a high-efficiency boiler for hot water is not common in the low-income housing sector in Indonesia. Therefore, the base case cannot be compared against a representative BAU.

8.1.2 Water efficiency values

EDGE base case values and technology set for single-flush WC do not represent BAU for the low-income housing sector, as the buildings typically have squat WC instead of flush WC. The resulting EDGE baseline figures would thus need to be tightened for low-income housing, since the water consumption for flush WC would be assumed to be higher than for squat WC. It is also worth pointing out that, compared with the flow rates of shower heads and WC installed in non-low-income housing, the EDGE base case is less stringent than the local values set by the GREENSHIP credit criteria.

The values set for shower heads, kitchen faucets, and bathroom faucets are deemed to be BAU for low-income housing. However, it is important to note that low-income housing buildings typically have water tubs installed instead of showers, which are assumed as the base case technology by EDGE. Regular faucets are typically installed in the kitchen and bathroom. It is also worth pointing out that, compared with the flow rates of faucets for non-low-income housing, the EDGE base case is less stringent than the local values set by the GREENSHIP credit criteria.

With regards to water efficiency, the voluntary MoPWH green building codes as well as the DKI Jakarta, Bandung, and Semarang mandatory green building codes require the use of efficient water fixtures. The Bandung and Semarang codes set maximum flow rates for showerheads, kitchen faucets, bathroom faucets, and single-flush WCs that are lower (more stringent) than the EDGE base case values. In addition, the voluntary GREENSHIP standard sets values for the same parameters that are below the values assumed by EDGE to represent the base case.

8.1.3 Embodied energy in materials

None of the existing codes and standards in Indonesia contain requirements for embodied energy in building materials. EDGE base case materials are deemed to represent BAU, according to the expert's judgement. Hence, no adjustment to the base case assumptions is necessary.

Annex XI provides the detailed baseline validation assessment for each of the EDGE parameters considered.

9. Cost-benefit analysis of constructing resource-efficient versus conventional low-income housing

9.1 Methodology

Building low-income housing to the EDGE standard by increasing resource efficiency by 20 percent entails additional capital expenditure. Based on discussions with project developers, a potential homebuyer in the low-income segment would not be willing to pay a higher price for an EDGE-certified home. In other words, it is assumed that, in this market segment, the project developer does not have the means to recoup the incremental investment made in a low-income housing building to bring it up to the EDGE standard. Thus, recouping these additional up-front investments required for the EDGE certification constitutes the main barrier to overcome.

The recommended approach to redesigning low-income housing to achieve the EDGE standard thus seeks to incur the lowest incremental up-front capital costs possible (see Annex XIII for details).

9.2 Inputs into the cost-benefit analysis

Building design

After engaging Indonesian housing developers and experts, two typical building designs for low-income housing were identified, namely landed houses and apartments (see Annex XII for specifications). These designs are based on the Ministry of Settlement and Regional Infrastructure Decree No. 403/2002 Technical Guidelines.[30] Low-income housing in Indonesia is commonly occupied by young couples with one child only. For the designs, we thus assumed a household occupancy of three.

Low-income housing designs considered do not include an AC system. However, homeowners will eventually install one. EDGE assumes that introducing certain energy-efficiency measures at the design stage will save energy once the home is occupied and air conditioning has been installed. Thus, the energy savings that will eventually be realized are termed “virtual” energy savings. These energy savings are counted toward the low-income housing’s design EDGE certification. They are also taken into account in the cost-benefit analysis because it is assumed that they will eventually be realized (as soon as the homeowner installs the AC system).

Baseline resource demand

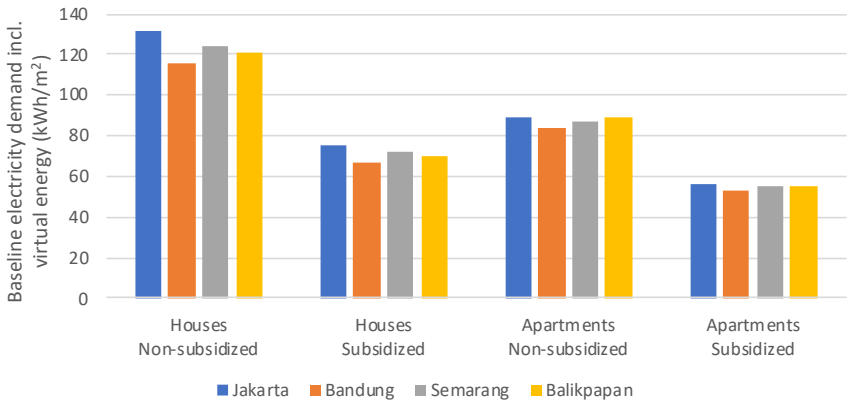
Baseline resource demand was calculated with the EDGE online tool (an overview of resource demand breakdown for landed houses and apartments is provided in Annex XIV). Figure 9.1 compares the baseline energy demand between the four low-income housing designs and subtypes for each of the four shortlisted cities. As can be seen, energy demand per square meter of floor area is generally higher for landed houses than for apartments, since the need for cooling requirements are higher for the former. Cooling requirements in Jakarta, where the climate is warmer, are also higher per square meter than in Bandung, where the climate is more moderate.

Energy demand is also generally higher for non-subsidized buildings than for subsidized buildings. This is due to the assumed income category “lower middle” for non-subsidized low-income housing, which results in different usage patterns and thus higher energy demands than the “low” income category.

[30] These technical guidelines stipulate a minimum floor area of 9 m^2 per person, which the implemented designs adhere to. Article 22(3) of Law 1 of 2011 requires that certain types of housing (including low-income housing) should be at least 36 m^2 in size but this was annulled in 2012 by the Constitutional Court, citing that Article 22(3) contravenes the Constitution (UUD 1945) and thus is not legally binding. Several developers have confirmed in interviews that the requirement for minimum size stipulated in Law 1 of 2011 is no longer valid and they have been able to develop low-income housing of various sizes below 36 m^2. However, a future pilot auction, in coordination with the local governments, may choose to limit auction participation to unit designs with a minimum floor area of 36 m^2.

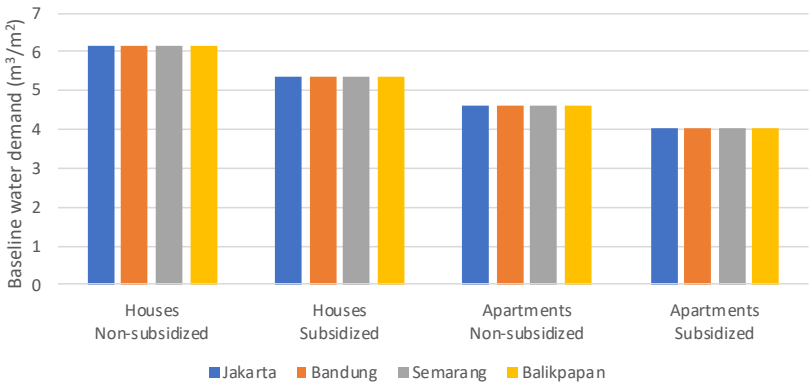
Figures 9.2 and 9.3 additionally show baseline water demand and embodied energy.

Figure 9.1 Baseline energy demand (including virtual energy) for the four focus regions, differentiated by low-income housing design and subtype



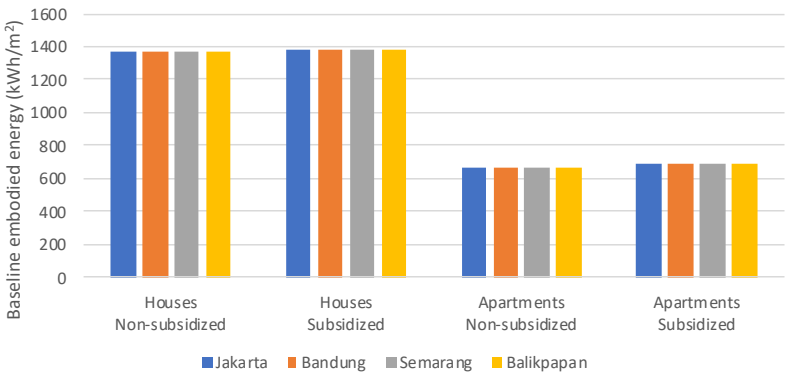
Source: Original compilation based on data from the EDGE online tool.

Figure 9.2 Baseline water demand for the four focus regions, differentiated by low-income housing design and subtype



Source: Original compilation based on data from the EDGE online tool.

Figure 9.3 Baseline embodied energy for the four focus regions, differentiated by low-income housing design and subtype



Source: Original compilation based on data from the EDGE online tool.

9.3 Resource-efficiency measures and incremental construction costs

Annex XIV provides a list of resource-efficiency measures that were considered for the current study. Both tables also include the associated incremental costs for materials and construction as well as the percentage gains in resource efficiency achieved against conventional, more resource-intensive low-income housing designs for the Jakarta region. The measures in the two tables are listed in order of lowest cost (see Annex XIII for a description of how these measures were selected in order to achieve the lowest incremental costs to reach a given efficiency standard).

For landed houses, considerable gains in energy efficiency can be achieved with passive cooling measures, such as reducing the window-to-wall ratio or designing for natural ventilation. As previously seen, the cooling requirements in landed houses per square meter of floor area are significantly larger than for apartments. Passive measures have a relatively small effect on the energy efficiency of apartments, which require active measures such as energy-saving lighting in order to achieve the 20 percent reduction in energy demand necessary for EDGE certification. As noted above, the low-income housing designs considered do not include a cooling system when first built, so any energy savings provided by passive measures are ones that it is assumed would be realized at some point in the future once the homeowner installs an AC system. However, passive measures are often cheaper to implement than active measures and have a life span equivalent to that of the building itself, accruing energy savings over a longer period than active measures. A future pilot auction, in coordination with local governments, may opt to limit auction participation based on specific technical guidelines, for example, stipulating that buildings must have a minimum window-to-wall ratio of 15 percent.

It is important to note that a number of efficiency measures have negative incremental costs, that is, they result in lower costs than their less-resource-efficient alternatives. In the case of a reduced window-to-wall ratio, this is due to saving costs on glass and window frames. Similarly, autoclaved aerated concrete blocks require less raw material and are thus cheaper than the common plaster-covered brick assumed for the base case.

9.4 Analysis across four housing types

The incremental costs of building the four low-income housing types to the EDGE standard in Jakarta are listed in table 9.1Table , along with the estimated resource savings (energy, water, embodied energy, and CO_2 emissions) and the resulting savings on utility bills for the homeowner that would be achieved by building to the EDGE standard. As the table shows, designing low-income housing to achieve and at times slightly exceed the 20 percent resource savings required by the EDGE minimum standard results in incremental costs between -165,00[31] Rp/m^2 (-12 \$/m^2) and -116,000 Rp/m^2 (-8 \$/m^2) for landed houses and around 82,000 Rp/m^2 (6 \$/m^2) for apartments.

Building a typical landed house to the EDGE standard can thus actually reduce construction costs, whereas construction costs for apartment buildings might increase slightly. In other words, substantial gains in resource efficiency (20 percent or more) can be achieved in low-income housing through little and at times no incremental costs to the developer in Jakarta.

Stakeholders have indicated that construction costs for landed houses on the island of Java vary between 1,700,000 Rp/m^2 (120 \$/m^2) and 2,200,000 Rp/m^2 (155 \$/m^2). Construction costs in Balikpapan are generally around 1.5 times as high as in Java, ranging from 2,500,000 Rp/m^2 (176 \$/m^2) to 3,000,000 Rp/m^2 (212 \$/m^2) for landed houses and around 6,000,000 Rp/m^2 (423 \$/m^2) for apartments. Thus, constructing to the EDGE standard may reduce construction costs by up to 10 percent for landed houses but increase apartment construction costs by up to 5 percent relative to baseline construction costs.

[31] Here and below, the exchange rate used is \$1 = Rp 14,183 as per Minister of Finance Decision KMK No. 35/MK.10/2019.

Table 9.1 Costs and benefits of EDGE-certified buildings in Jakarta

Parameters	Units	Landed houses		Apartments	
		Non-subsidized	Subsidized	Non-subsidized	Subsidized
Incremental costs to developers					
Design, planning, and consultancy	kIDR/m^2	140	140	140	140
Construction and material costs	kIDR/m^2	-311	-262	-76	-75
Certification costs	kIDR/m^2	6	6	3	3
Cost of capital	kIDR/m^2	0	0	15	15
Total incremental costs	kIDR/m^2	-165	-116	82	83
Resource savings					
Electricity savings (not including virtual energy)	kWh/m^2/year	0	0	16	13
Electricity savings (virtual energy[32])	kWh/m^2/year	28	15	7	3
Water savings	m^3/m^2/year	1	1	1	1
Embodied energy savings	kWh/m^2	376	392	147	153
Operational CO_2 emissions reduction[33]	kgCO_2e/m^2/year	23	13	20	14
Embodied CO_2 emissions reduction	kgCO_2e/m^2	117	122	46	47
Utility savings to homeowners					
Monthly savings on electricity	kIDR/month/family	97	53	109	77
Monthly savings on water	kIDR/month/family	16	13	16	13

Source: Original compilation.
Note: Data for additional regions can be found in Annex XIII.

Table 9.1 also shows the resources that would be saved in low-income apartments and landed houses per square meter of floor area. Resource savings per square meter of floor area depend on the set of measures implemented to achieve EDGE certification and are generally higher for landed houses than for apartments, and for non-subsidized low-income housing than for subsidized low-income housing. As the table suggests, EDGE standard levels of energy performance can be achieved in low-income landed houses through passive design measures alone. These reduce the amount of electricity that it is assumed will eventually be consumed by AC systems, once these are installed. Such savings range from 15 to 28 kilowatt-hours (kWh)/m^2 per year.

The annual electricity savings for apartments are between 13 and 16 kWh/m^2 (not including virtual energy). These savings depend on the implementation of active efficiency measures, such as installing energy-saving lighting. Although in apartments the implementation of passive cooling measures is not sufficient to reach EDGE certification, these measures still account for savings of between 3 and 7 kWh/m^2/year.

Water savings for both low-income housing designs are around 1 cubic meter (m^3)/m^2 per year. Operational CO_2 emissions can be reduced by 13 to 23 kilograms of carbon dioxide equivalent (kgCO_2e)/m^2/year.

In the case of embodied energy and embodied CO_2 emissions, savings per square meter of floor area are also higher for landed houses (117–122 kgCO_2e/m^2) than for apartments (46–47

[32] Virtual energy is future energy that it is assumed will be required to ensure human comfort. Virtual energy savings are assumed to be realized once the homeowner installs an AC system and starts to benefit from the energy saving measures that were built into the home during its design phase. This virtual energy is included by EDGE to determine the 20 percent improvement required.
[33] Including savings from virtual energy.

kgCO_2e/m^2). While the cheapest measure for both designs involves replacing the external walls, landed houses profit more from this measure in absolute terms than apartment designs.

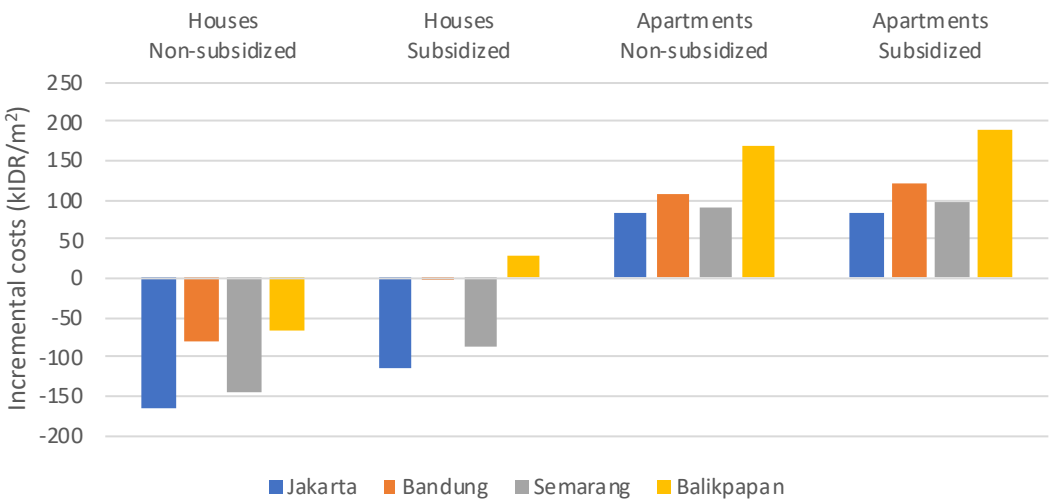
In addition to the resource savings, EDGE certification also results in cost savings on electricity and water, directly benefiting the homeowner or tenant. Savings amount to Rp 50,000 ($3.6) to Rp 109,000 ($7.7) per month per family, or Rp 600,000–1,300,000 ($42–92) per year. Given that the maximum monthly income of subsidized homeowners is Rp 4 million ($282), this results in monthly savings of at least 2 percent per family.

Figures 9.4, 9.5, and 9.6 show the incremental costs and energy and water savings per square meter of floor area, respectively, associated with achieving EDGE certification for the four shortlisted cities of Jakarta, Bandung, Semarang, and Balikpapan. Incremental costs and energy savings per square meter of floor area are higher for apartments than for landed houses in all four regions. Incremental costs vary more widely for landed houses than for apartments. This is because they depend more heavily on passive cooling measures to reach EDGE certification and are thus more susceptible to differences in climate. Incremental costs are lowest for subsidized low-income housing and, in terms of cities, lowest for Jakarta, followed by Semarang, Bandung, and finally Balikpapan.

Analysis using the EDGE tool suggests that building landed houses to the EDGE standard can entail negative incremental costs in all four regions considered. In other words, based on the EDGE cost model, the cost of planning, building, and certifying low-income housing with a landed house design is generally less than the cost of building similar housing using conventional, less-resource-efficient designs. As shown in Annex X1V, primary contributors toward these negative costs are the reduction in window-to-wall ratio and the use of autoclave aerated concrete blocks in place of common bricks in building walls.

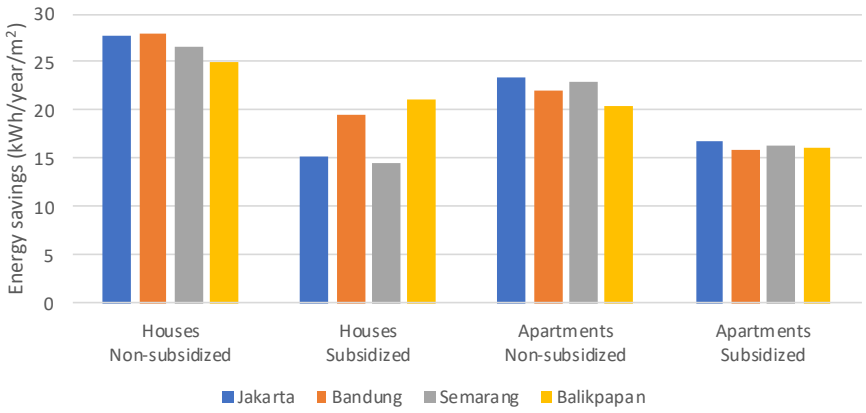
On the other hand, costs for planning, building, and certifying apartments to the EDGE standard are higher than for similar but less-resource-efficient designs in all regions.

Figure 9.4 Total incremental costs for EDGE certification by region and housing design



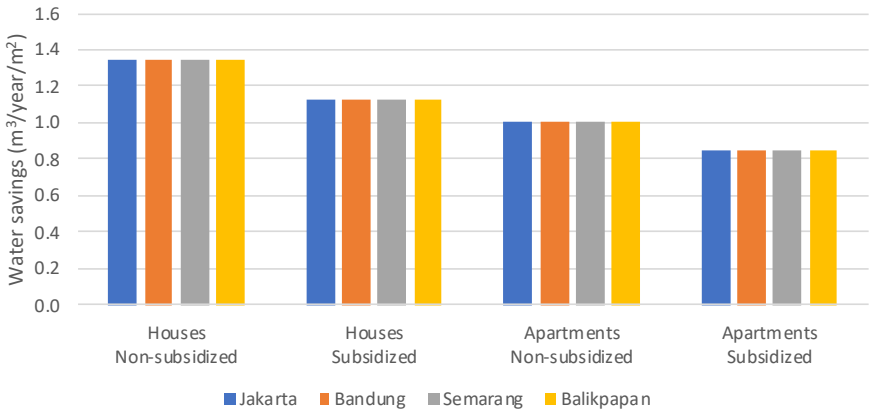
Source: Original compilation.

Figure 9.5 Energy savings (including virtual energy) as a result of EDGE certification by region and housing design



Source: Original compilation.

Figure 9.6 Water savings as a result of EDGE certification by region and housing design



Source: Original compilation.

Sensitivity analysis

According to the results obtained using the EDGE tool, EDGE certification can be achieved with either no or relatively minor incremental construction costs to low-income-housing developers. Moreover, stricter requirements in terms of energy and water efficiency could eventually be mandated, which would result in a higher baseline resource efficiency (figure 9.7). The above exercise was also carried out for the EDGE Advanced standard (40 percent resource savings in electricity, water, and embodied energy relative to baseline demand) to determine the incremental costs that would be required to achieve efficiency targets under a scenario with stricter requirements.

As shown in table 9.2, by certifying to EDGE Advanced, costs increase by 20,000–46,000 Rp/m^2 (1.4–3.2 $/m^2) for landed houses and by 53,000–60,000 Rp/m^2 (3.7–4.2 $/m^2) for apartments, relative to certifying to EDGE Standard (20 percent resource savings). Costs are lower for landed houses since they need to implement fewer measures in order to reach target resource savings: with regard to electricity savings, landed houses can reach the EDGE Advanced standard in all four shortlisted cities by reducing their window-to-wall ratio, implementing natural ventilation, and switching to energy-efficient lighting (measures HME01, HME09, and HME16 in Annex XIV). Apartments, on the other hand, also require the installation of solar PV systems, use of external

shading, and energy-efficient lighting in common areas (measures HME20, HME04, and HME17 in Annex XIV).

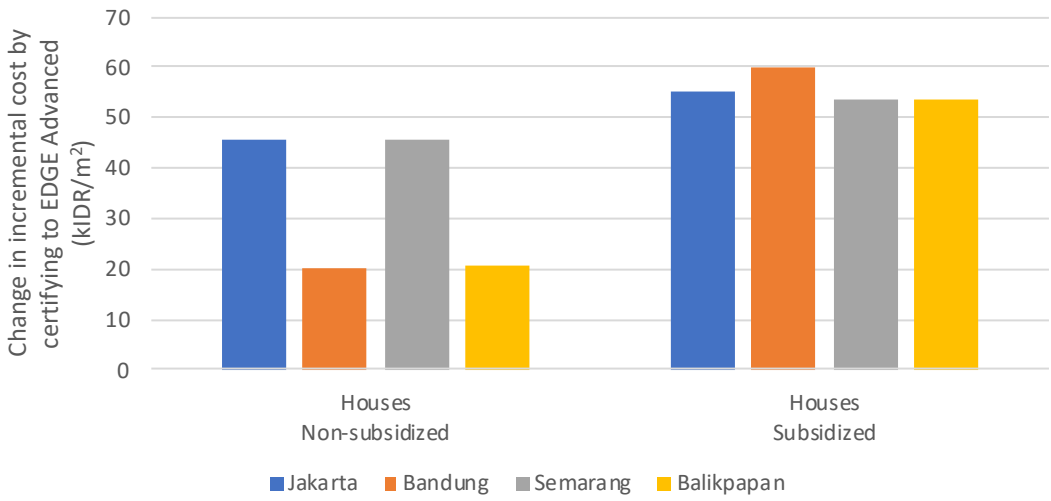
Incremental costs as modeled with the EDGE cost model could also differ from the actual incremental construction costs faced by developers. Preliminary data to verify costs (Basari, 2019) indicate that a pilot auction would prove instrumental in determining the real incremental costs faced by developers. Based on the calculations here, incremental costs relative to the baseline for certifying as EDGE Advanced might amount to up to 8 percent of average construction costs, or 243,000 Rp/m^2 (17 $/m^2). It is interesting to point out that for Jakarta and Semarang, landed house designs still have negative incremental costs even for the EDGE Advanced target.

Table 9.2 Total incremental costs for constructing to EDGE Standard and EDGE Advanced relative to conventional designs

Region	Units	EDGE Standard 20% vs conventional	EDGE Advanced 40% vs conventional	Cost increase (EDGE 40% vs EDGE 20%)
Landed houses (subsidized)				
Jakarta	kIDR/m^2	-116	-70	46
Bandung	kIDR/m^2	-1	19	20
Semarang	kIDR/m^2	-86	-40	46
Balikpapan	kIDR/m^2	29	49	21
Apartments (subsidized)				
Jakarta	kIDR/m^2	83	138	55
Bandung	kIDR/m^2	121	181	60
Semarang	kIDR/m^2	97	151	54
Balikpapan	kIDR/m^2	189	243	53

Source: Original compilation.

Figure 9.7 Cost increase for certifying to EDGE Advanced as opposed to EDGE Standard, by focus region and low-income housing type



Source: Original compilation.

9.5 Potential market size and impact

9.5.1 Incentive

As discussed in section **Error! Reference source not found.**, constructing low-income housing to the EDGE standard is expected to lead to increased costs for planning, materials, construction,

and certification for apartment designs, while it is expected to lead to reduced costs for some landed house designs.

In both cases, introducing new designs and materials may also lead to construction delays and will require training of foremen and workers, as well as additional transaction costs associated with the EDGE certification itself.

Discussions with key local stakeholders suggest that developers will expect additional incentives above and beyond the incremental costs mentioned above (section **Error! Reference source not found.**) in order to build to the EDGE standard. We assume developers will want to see an additional incentive equivalent to 30–35 percent of the observed incremental costs to design and build to the EDGE standard, or at least an additional 4 percent of the average cost of construction (80,000 Rp/m^2 or 5.6 \$/m^2) in the cases where incremental costs are zero or negative. This is the margin developers might expect to make in order to bring housing design to the EDGE standard.

The incentive that is estimated to be needed to enable low-income housing construction to the EDGE standard in the regions considered thus varies between Rp 80,000 ($5.6) to Rp 309,000 ($21.8) per square meter of low-income housing floor area. Since incremental costs estimated using the EDGE tool are negative for most landed houses, the lower of the two figures is assumed to be the incentive per square meter needed to build a landed house to the EDGE standard. That is, developers will expect such an incentive to be provided even if the incremental costs estimated by EDGE are negative.

The above figures are, however, indicative. It will ultimately be up the project developers to put a price on building low-income landed houses and apartments to the EDGE standard. The pilot auction should help to determine a price per square meter of EDGE-certified floor area.

Table 9.3 Total incentive required for developers to construct low-income housing to the EDGE standard in Jakarta

Parameters	Units	Landed houses		Apartments	
		Non-subsidized	Subsidized	Non-subsidized	Subsidized
Total incremental costs	kIDR/m^2	-165	-116	82	83
Total incentive required	kIDR/m^2	80	80	162	163

Source: Original compilation.
Note: Data for additional regions can be found in Annex XIII.

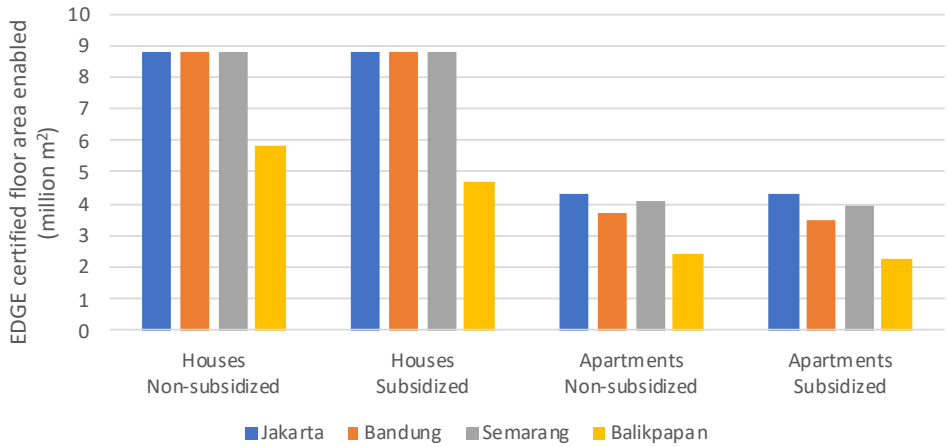
9.5.2 Potential market

The potential low-income housing market is assumed to be capped by the number of low-income housing units that are expected to be built in the following years. Exact data on current and projected construction activity are difficult to come by, as developers are often reluctant to share their data. In Balikpapan, REI estimates that its members built approximately 4,000 low-income housing units in 2019 (both landed houses and apartments). In Semarang, discussions with stakeholders suggest that approximately 9,000–11,000 units are built annually. In West Java, including Bandung, around 15,500 subsidized low-income units were built in 2019, mostly landed houses (Bank of Indonesia 2019), though no figure for non-subsidized low-income housing can be provided. These numbers likely underestimate the total construction activity and, depending on the focus city, construction of 25,000–100,000 units over the course of five years seems plausible.

Based on the incentive shown above, we can calculate the floor area of EDGE-certified housing that could be enabled through a climate auction of a given size. Assuming an auction fund of $50 million, figure 9.8 shows the EDGE-certified floor area enabled per shortlisted city and housing type. For landed houses, this amounts to around 8.7 million m^2, corresponding to approximately 283,000 units. For apartments, the figure varies between 2.3 and 4.3 million m^2 (55,000 to 104,000 units). A fund totaling $50 million thus would have the potential to EDGE certify the estimated low-income housing demand in two cities for up to five years. The number of families and the population that would directly benefit from living in an EDGE-certified home in each city

varies between 165,000 and 850,000 people, depending on the city and low-income housing design.

Figure 9.8 EDGE-certified floor area enabled per focus region and housing design



Source: Original compilation.

9.5.3 Potential impact

The scale of impact that can be achieved by injecting $50 million in EDGE-certified low-income housing construction in each of the cities over the next five years considered is substantial.

Each year, between 40 and 250 GWh of electricity and 2 to 12 million m^3 of water could be saved. Operational CO_2 emissions, that is, those associated with the low-income occupant's energy consumption at home, could be reduced by between 30 and 210 $ktCO_2e$ annually (figure 9.8). Embodied CO_2 emission reductions associated with materials used in low-income housing construction are also substantial, from 110 to 1,100 $ktCO_2e$ (Figure .9). It is worth noting, however, that the energy cost savings and CO_2 reductions are based on the assumption that up to 70 percent of homeowners would install an air conditioner by the third year after home purchase, that is, it is only at this point that the "virtual" energy savings are realized. Policy makers should be aware of this point.

These resource savings also translate into financial savings. Indonesia struggles to increase power-generating capacity to keep up with the growing demand, and its power infrastructure will require substantial investment in the future (PWC 2018). As demand is projected to grow for the foreseeable future, more-energy-efficient housing stocks help to defer investment in additional power generation capacity. Based on the current cost of power generation[34] (PLN 2019), we estimate a net present value (NPV) of savings in power generation between $33 and $245 million, not counting potential savings on power infrastructure such as grid expansion.

Additionally, since the water tariff in the low-income housing segment is subsidized by the local government, we estimate the NPV of subsidy cost savings at up to $5 million, assuming a subsidy phase-out after 5 years. These savings could be reallocated to addressing the needs of the local population in sectors such as health or education.

An EDGE-certified home can save its owners between Rp 600,000 ($42.3) and Rp 1,300,000 ($91.6) per year in electricity bills, in addition to Rp 90,000 ($6.3) to Rp 190,000 ($13.4) per year per home in water bills. For the homeowners, the NPV of savings on electricity bills amounts to $40–260 million, while the NPV of savings on water bills amounts to $5–60 million.

Finally, the wide-scale uptake of greener low-income housing would support the transition to a greener construction industry and economy. The implementation of resource-efficiency measures

[34] This includes costs for fuel as well as for maintenance, personnel, and depreciation of equipment.

at scale helps to build up local expertise in the provision of resource-efficient solutions, for example, in the area of low-embodied-energy construction materials, in the construction of shading devices, or in the planning of green buildings, as well as their certification and related verification services. It should be noted that all the services, materials, and technologies needed to implement the resource-saving measures that enable the EDGE standard to be achieved are readily available in the local market. Moreover, interviews with housing developers have indicated that all materials used are sourced domestically as opposed to being imported, meaning that embodied energy savings and resulting CO_2 emission reductions accrue within Indonesia, not abroad, and thus benefit Indonesia.

The $50 million incentive funding that would be provided through the auction is used to cover just the incentive and incremental construction costs for green buildings relative to conventional designs, which amounts to up to 10 percent of the total construction costs. Thus, this financial stimulus would leverage an even greater of amount of investment in less CO_2-intensive building products and materials.

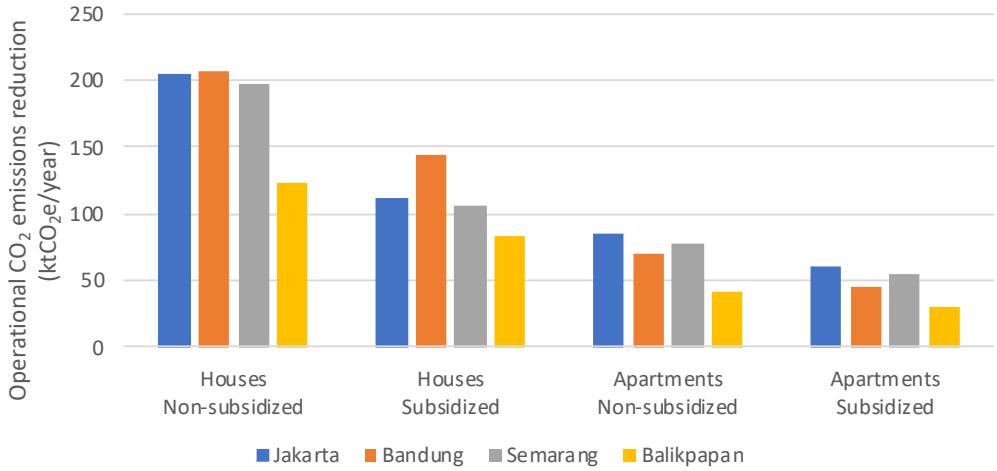
Table 9.5 illustrates the potential benefits that would be enabled by injecting a $50 million green building/EDGE-compliant stimulus in low-income housing in the Jakarta region.

Table 9.5 Potential benefits enabled through a climate auction of $50 million for the region of Jakarta

Parameters	Units	Landed houses		Apartments	
		Non-subsidized	Subsidized	Non-subsidized	Subsidized
EDGE-certified low-income housing enabled					
Low-income housing floor area	million m^2	8.8	8.8	4.3	4.3
Number of low-income housing units	thousand housing units	283	283	105	105
Number of people benefiting	thousand people	848	848	314	313
Resource savings					
Annual electricity savings (without virtual energy)	GWh/year	0	0	71	57
Annual electricity savings (virtual energy)	GWh/year	243	134	31	15
Annual water savings	million m^3/year	12	10	4	4
Embodied energy savings	GWh	915	954	176	183
Operational CO_2 emissions reduction	$ktCO_2e$/year	204	113	85	60
Embodied CO_2 emissions reduction	$ktCO_2e$	1,021	1,065	197	204
Potential savings for policy implementer					
NPV of savings on power generation	$ million	181	100	85	63
NPV of savings on water subsidy	$ million	5	5	2	2
Savings to homeowners					
NPV of savings on electricity bills	$ million	210	116	99	73
NPV of savings on water bills	$ million	56	47	17	14

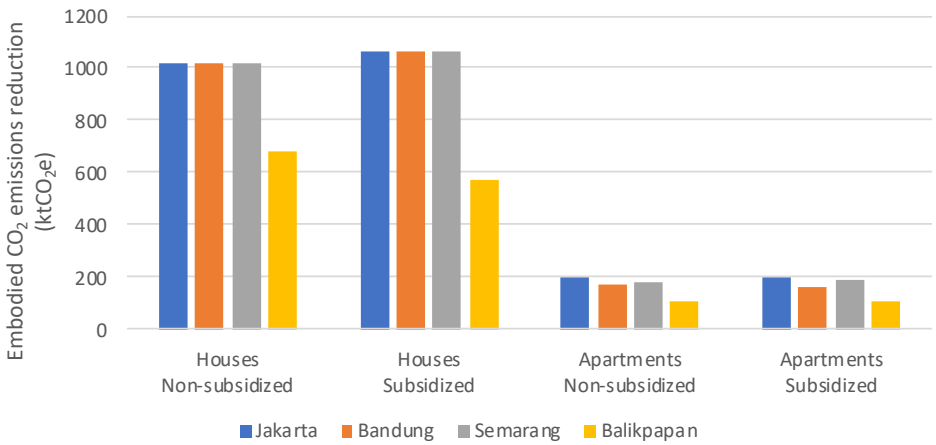
Source: Original compilation.
Note: NPVs were calculated over the average service life of the applied EDGE measures, between 15 and 22 years.

Figure 9.9 Operational CO_2 emission reductions for the four focus regions



Source: Original compilation.

Figure 9.10 Embodied CO_2 emission reductions for the four focus regions



Source: Original compilation.

10. Access to financing and incentives

10.1 Access to financing

Housing developers in Indonesia are generally grouped into public (state-owned) developers and private developers. Although a public-private partnership (PPP) scheme in the public housing sector was introduced under Presidential Regulation 38/2015, there has been no such PPP to date.

Based on the quarterly survey conducted by the Bank of Indonesia, a typical finance structure for a developer of conventional housing projects in 2018–2019 was composed of the developer's own funds/equity (55–62 percent), bank loans (26–32 percent), and funds received from customers (7–10 percent) (Bank of Indonesia 2019). Internal funding is mostly derived from retained earnings and paid-up capital, also known as "on balance sheet finance." The financing sources to develop green housing projects would be roughly similar to the conventional ones. For example, the EDGE-certified low-income housing projects in West Java (Griya Lima Garuda and Citra Maja), both built by private developers, are financed under a structure similar to that of conventional low-income housing projects. The EDGE certification and its associated capital increments were made possible due to support from the IFC's program; developers stated that complying with EDGE would not otherwise have been possible given the regulatory restrictions on subsidized low-income housing pricing.

10.2 Incentives

Incentives for low-income housing have so far been targeted at the home buyers rather than developers, such as down payment assistance under the FLPP. Though not directed toward project developers, these incentives do nonetheless stimulate the demand for low-income housing by facilitating financing for home buyers to purchase low-income housing. Project developers do receive other forms of direct incentives from the government, but these are limited to the development of the infrastructure and utilities needed to support low-income housing project development, such as neighborhood roads, drainage systems, and street lighting.

An overview of existing direct financing and incentives for green buildings targeted at project developers is provided in table 10.1.

Table 10.1 Current financing and incentive landscape for green building projects in Indonesia

Financing/incentive program	Eligible recipients	Scope
PT Sarana Multi Infrastruktur (PT SMI) subordinated loan facility scheme	Private/public developers	Infrastructure projects, including green buildings
PT SMI Equity Investment Scheme		
PT SMI Green project funding from green bond/green sukuk proceeds		Energy efficiency improvements in infrastructure, green buildings with at least 10% savings from business as usual (BAU)
Joint Crediting Mechanism (JCM): Government-to-government scheme providing a grant from the Government of Japan to Indonesian companies to purchase energy-efficiency technologies from Japanese companies	Public/private developers	Energy efficiency in buildings
SDG Indonesia One by PT SMI: blended private/public financing scheme	Private/public developers	Infrastructure projects related to the achievement of Sustainable Development Goals (SDGs),

Financing/incentive program	Eligible recipients	Scope
		including green buildings
Viability Gap Fund (VGF)	Public developers/public-private partnership (PPP)	Infrastructure projects under the PPP scheme
Tax waivers	Private/public developers	Multi-story rental housing units (*Rusunami*)
Energy service company (ESCO)	Private/public developers	Energy efficiency in buildings

Source: PT SMI 2019; Coordinating Ministry of Economic Affairs 2016; Sustainable Energy for All 2019.

As the table shows, although green building projects are incentivized through various public funding instruments and channels, there is a very limited incentive dedicated to low-income housing projects. Furthermore, disbursement of green/climate financing for green building projects has not been prioritized. Hence, it is deemed reasonable to assume that the finance needed to build EDGE-compliant low-income housing will need to be derived from existing green buildings financing sources.

Green bond and **green sukuk**[35] are two of the potential financial instruments that could be used to raise the capital needed to develop green building projects in the country, as listed in table 10.1. Internationally, Colombia has set a precedent of how green bonds can accelerate the shift toward sustainable construction at scale, as outlined in the case study in Annex XV. In Indonesia, the green bond/green sukuk mechanism was established in 2018 by PT SMI with technical assistance from the World Bank Group. The Green Bond Berkelanjutan I Sarana Multi Infrastruktur was the first corporate green bond issuance in the country, with stage 1 allocation of Rp 500 billion (MoF 2018). The proceeds from green bonds and green sukuks are administered and channeled directly by PT SMI to eligible green projects meeting pre-defined criteria. Energy efficiency and green building projects are two of the nine green project categories eligible for green bond/green sukuk financing and are assigned a low to medium priority. This means that green building projects are at a disadvantage when competing against renewable energy and clean transportation projects for funding. As an example of this prioritization, in 2018 two mini hydro projects and one light rail transit project were selected from 18 green project portfolios and pipelines that were considered for refinancing from the Green Bond Berkelanjutan I stage I by PT SMI, as shown in table 10.2 (PT SMI 2019).

Table 10.2 Disbursement of Green Bond Berkelanjutan I Sarana Multi Infrstrucktur Stage I Year 2018 proceeds

Number of projects	Selected project type	Financing type	Disbursement proportion	Disbursement amount
3 selected from pool of 18 projects	2 mini hydro projects	Refinancing	36.3%	Rp 181,451,490,001 ($12,794,000)
	1 light rail transit project	Refinancing	63.7%	Rp 318,414,873,637 ($22,450,000)

Source: PT SMI 2019.

In addition to the green bond/green sukuk proceeds, PT SMI offers other commercial financing products including senior loans (investment/term loan, working capital loan, bridge loan, take-out financing, promoter financing, and non-cash financing), subordinated loans, mezzanine loans, and equity investment. PT SMI is also able to channel grants, semi-concessional loans, and a blend of loan/grant financing.

In February 2020, IFC also invested $100 million in the Sustainability Green Bonds issued by the OCBC NISP bank. This bond has a blended finance component and will be used to finance green

[35] Green sukuk are sharia/Islamic-compliant securities backed by a specific pool of assets which are used to finance environmental projects.

certified projects in Indonesia. The bank is currently preparing an attractive financial product (possibly with some incentives) to support that objective.

Despite the availability of financing and incentives for green buildings as discussed above, the disbursement of these financing sources to resource-efficient buildings has been very limited. The barriers vary for different groups of stakeholders and could be summarized as follows (APEC 2017):

- ***Barriers for financial institutions.*** Energy efficiency has not been highly prioritized for state-owned lenders and is often ranked below other clean energy projects such as renewable energy generation. For commercial lenders, financial credit regulations are designed to protect against risky lending practices, which ostensibly apply in the case of green buildings since the cash flows from energy savings are often not recognized as collateral. Financial institutions also often lack technical knowledge on energy- and resource-saving-based lending models, which hinders appropriate risk assessments. Furthermore, the limited number of green building projects in the pipeline and the small average project size results in high transaction costs.
- ***Barriers for project developers and commercial building owners.*** Project developers usually have limited experience in preparing bankable business cases. Housing developers often do not see energy and resource efficiency as core businesses and consequently, their importance is not commonly reflected in the corporate investment guidelines of real estate companies.

The climate auction scheme could raise awareness and help bridge the knowledge gap within the financial sector by using a recognized green building standard such as EDGE. This could in turn reduce some of the hurdles faced by project developers in accessing finance for green building projects.

11. Summary of findings and recommendations

The World Bank Group is exploring opportunities to pilot a combination of the proven climate auction model and the Excellence in Design for Greater Efficiencies (EDGE) voluntary certification for green buildings, with the goal of encouraging resource-efficient construction in a way that maximizes the impact per dollar of incentive given. Indonesia and its affordable (low-income) housing sector have been identified as the first potential country and sector in which such an auction pilot could be held.

This report provides the information needed to inform the detailed design and implementation of the pilot in Indonesia as well as the selection of a suitable location in which to host it. The information and analysis provided herein builds on the extensive local stakeholder consultation carried out over the course of the assignment.

Policy and regulatory framework:

- **MoPWH Regulation No. 2 of 2015** is key to green building promotion, as **it serves as guidance on matters pertaining to green building design and operation.** Although it is not mandatory, it informs the design of sub-national green building codes that could be made mandatory.
- **DKI Jakarta Province, Bandung City,** and **Semarang City have issued mandatory sub-national green building codes.** They include various (passive and active) energy efficiency, water efficiency, and materials efficiency measures. Each jurisdiction, however, defines the extent to which these codes are mandatory in relation to low-income housing.
- The **provision of low-income housing**, particularly that which is subsidized, **is heavily regulated by the national government**. For example, MoPWH Decree No. 552 of 2016 stipulates the maximum household income eligible for Subsidized Homeownership Credit, the rate of government assistance (subsidy) for a down payment on low-income housing, and a selling price ceiling for low-income housing. A household is eligible to receive a subsidy for low-income landed housing if its monthly income is less than or equal to Rp 4 million ($282). The subsidy for low-income multi-story housing can be given to households with a monthly income of less than or equal to Rp 7 million ($494). Regarding assistance in a down payment, the decree stipulates that the government subsidy for a down payment on low-income housing (given to household buyers) is fixed at Rp 4 million ($282) per house. However, **the most important regulatory aspect in the context of the auction facility is the selling price ceiling or cap**, whereby a landed housing unit's ceiling price varies from $10,611 to $15,441. A number of stakeholders consulted are concerned that the introduction of green building design features would result in an increase in construction costs that they would not be able to add to the housing unit's selling price. In other words, the introduction of such additional resource-efficiency features would erode their profit margins. The auction facility would be welcomed as it would enable such an incremental cost to be offset, thus allowing the developer to continue selling low-income housing units at a price no higher than the cap without having to sacrifice profit. It shall be noted that this is only an issue in the case of subsidized low-income housing. No such selling price cap exists in the case of non-subsidized low-income housing. In this case, the incremental costs could be passed on to the buyer.
- The MoPWH implements various **financing programs** for low-income housing including BSPS, FLPP, KPRS and KPRS *Mikro-Bersubsidi*, SSB, and BUM. **All the financing programs directly benefit low-income homeowners, as opposed to the project developers that build such housing units.**
- **Building construction permits (IMBs) and occupancy certificates (SLFs)** are the main permits that every housing developer needs to obtain in order to construct a house, and then to be able to sell it. Local governments are responsible for putting in place the specific procedures that need to be followed as well as designating the authorities

responsible for issuing these permits. **Bandung City is one of the sub-national authorities that has tied the issuance of the IMB and SLF permits to green building code compliance**. Bandung City illustrates how the scope of an existing permit process can be expanded to enable compliance with green building code requirements to be enforced. It also demonstrates the role that **local governments at the regency (*kabupaten*) or city level** can play in enabling green building code compliance.

- **The MoPWH is the key public sector stakeholder** in the low-income housing sector. It formulates and implements national policy in the housing sectors, including oversight and provision of technical support for policy implementation at the sub-national level. The MoPWH, **through its DG for Housing Provision**, formulates and implements housing provision policy while the **DG for Public Infrastructure and Housing Financing** is responsible for policy formulation and financing for low-income housing, as well as setting the low-income housing ceiling prices. The **MoPWH**, through the **DG for Human Settlement and Spatial Planning (*Cipta Karya*)**, is responsible for the national green building code design, which is used by local governments as guidance to inform the design of sub-national green building codes.
- **The Coordinating Ministry for Economic Affairs** and the **Ministry of Environment and Forestry** head an inter-ministerial technical team commissioned to regulate market-based mechanisms to be introduced in the country to support climate-friendly actions (including reduction of CO_2 emissions from improved energy and resource efficiency). Presidential Regulation No. 77 of 2018 stipulates principles and mechanisms for an environmental fund management agency. Carbon trade is mentioned as one of the possible means to raise and distribute funds for environmental management purposes.
- **Overall implementation of an auction mechanism can be coordinated at the national level. However, sub-national governments must be engaged from the beginning**. Interviews with both public and private sector stakeholders including the MoPWH and private sector housing developers in DKI Jakarta, Bandung, and Surabaya revealed that **awareness of green building design and its potential benefits is quite limited in Indonesia.** This suggests that the implementation of an auction pilot should be preceded by well-conceived awareness raising and capacity building programs, which should be scheduled appropriately, considering the pilot auction's design and launch.
- The construction of low-income housing is carried out by both **state-owned developers and private developers** (excluding self-built housing, which is built by households). According to REI**,** approximately 3,900 out of 10,000 private developers in Indonesia are active in the low-income housing sector.

Potential locations and bidders for the auction pilot:

- **It is recommended that the climate auction be carried out in cities** as opposed to provinces and regencies, as cities are responsible for issuing green building permits, have greater demand for new housing, and are the center of economic activities, making stakeholder engagements in the pilot phase of the auction easier.
- **Jakarta, Bandung, Semarang, and Balikpapan have been identified as potential locations for the climate auction**, since they have a large potential market. The availability of green building codes in Jakarta, Bandung, and Semarang indicates a sufficient awareness level among local stakeholders. Balikpapan was included as it has rapid growth potential due to its proximity to the recently announced new capital of Indonesia. Furthermore, to ensure a diverse representation of geographies in the auction pilot, Balikpapan was chosen since it is a tier 2 city (that is, with a population of fewer than 1 million) and is located outside Java.
- Bandung is recommended as the best city in which to pilot the auction model and demonstrate the viability of the auction concept in the low-income housing sector. Bandung offers the following advantages:

    - The city has good transportation links to suburban areas, which is where low-income housing would likely be located and where landed houses can still be developed.
    - Local authorities have demonstrated interest in supporting green building initiatives (e.g., green building code design). They have also demonstrated capacity to implement measures that help create an enabling environment that is conducive to such construction (e.g., green building permit procedure). EDGE-certified auction-supported low-income housing would need to be developed and permitted. It is thus important that procedures and resources be in place locally to enable this to proceed smoothly, reduce transactions costs, and mitigate perceived risks to project developers.
    - There is abundant land on which low-income landed houses can be built. Given the potential size of the opportunity, Bandung is expected to be particularly appealing to the approximately 300 members of Real Estate Indonesia West Java who are involved in low-income housing development.
- **Project developers have the greatest potential to be bidders in a climate auction,** as they have the greatest control and direct access over building design, materials, and construction. Additionally, developers take the most financial risks in a housing project.
- **GREENSHIP and EDGE** are the two most popular voluntary green building certification programs in Indonesia. As of October 2019, GREENSHIP had certified 26 buildings in Indonesia, mostly for commercial (office) purposes and located in the Jakarta region. GREENSHIP recommends measures for (passive and active) energy efficiency, water efficiency, and materials selection (e.g., environmentally friendly, FSC-certified, and locally sourced materials). **GREENSHIP rewards the uptake of recommended green building measures in building design but does not allow the resulting building's resource efficiency nor the incremental costs associated with such measures to be quantified.**
- The EDGE tool provides the minimum criteria for resource-efficient low-income housing design that merits an incentive. Some EDGE base case values, such as window-to-wall ratio (EDGE base case: 20 percent while the BAU for landed low-income housing is 15 percent), glass U-value (base case: 5.8; the BAU for landed and multi-story low-income housing is 6.0), and WC technology (single-flush WC when in reality low-income housing typically has squat WC instead of flush WC) need nonetheless to be adjusted to better represent the BAU scenario in the low-income housing segment in Indonesia.
- The EDGE software tool enables the building's resource efficiency to be quantified, which in turn enables a set of benefits to be communicated to both homeowners and policy makers. EDGE has an additional advantage over GREENSHIP in that the tool provides project developers with indicative estimates of the likely incremental costs resulting from resource-efficiency measures. According to local private housing developers, EDGE is also deemed to be more attractive for marketing purposes than GREENSHIP, as it is used internationally. Hence, **EDGE certification is deemed to be a more appropriate certification scheme upon which to base the auction pilot design and implementation.**

Cost-benefit analysis:

- Annual resource savings for low-income landed houses amount to 15–28 kWh/m^2 energy, 1 m^3/m^2 water, and 12–24 $kgCO_2e/m^2$ carbon dioxide emissions, with embodied CO_2 savings of 117–122 $kgCO_2e/m^2$. For low-income apartment design, 16–23 kWh/m^2 energy, 1 m^3/m^2 water, and 13–20 $kgCO_2e/m^2$ carbon dioxide emissions can be saved each year, with embodied CO_2 emissions being reduced by 46–47 $kgCO_2e/m^2$.
- Substantial gains in resource efficiency (20 percent) can be achieved in low-income construction for landed houses (at little or at times no incremental construction cost to developers). For example, designing low-income housing in Jakarta to achieve EDGE certification results in incremental costs between -165,000 Rp/m^2 (-12 \$/m^2) and -116,000 Rp/m^2 (-8 \$/m^2) for landed houses and around 82,000 Rp/m^2 (6 \$/m^2) for

apartments. That is, building an EDGE-certified low-income landed house in Jakarta, can cost less than building a less-resource-efficient, conventional one. Low-income housing construction costs in Java and Balikpapan are such that constructing to the EDGE standard may reduce low-income landed house construction costs by up to 10 percent and increase low-income apartment construction costs by up to 5 percent.

- Discussions with key local stakeholders suggest, however, that developers will expect additional incentives beyond those needed to cover the incremental construction and material costs estimated using the EDGE model to build EDGE-certified low-income housing. This additional incentive is assumed to be approximately 30–35 percent of the modeled incremental costs or at least 4 percent of the average cost of construction (i.e., around 80,000 Rp/m^2 or 5.6 \$/m^2), in cases where such incremental costs are zero or negative (i.e., where it is estimated that it will cost less to build an EDGE-certified home than a conventional, more resource-intensive one). The estimated incentive to enable low-income housing construction to the EDGE standard in the various cities considered therefore ranges between Rp 80,000 ($5.6) to Rp 309,000 ($21.8) per square meter of EDGE-certified low-income housing floor area. These figures are nonetheless indicative; it will ultimately be up to individual project developers to put a price on building low-income houses and apartments to EDGE-certified designs which fully accounts for the developer's actual costs and expected returns.
- Building low-income landed houses and apartments to EDGE Advanced (40 percent resource efficiency) instead of certifying them to EDGE (20 percent) increases modeled construction cost by a further 20,000–46,000 Rp/m^2 (1.4–3.2 \$/m^2) for low-income landed houses and by 53,000–60,000 Rp/m^2 (3.7–4.2 \$/m^2) for apartments. However, the construction and material costs of building low-income landed houses to EDGE Advanced in Jakarta and Semarang might still be less that those associated with a conventional less-resource-efficient equivalent home. (This will not be the case in Bandung.) Landed houses can reach the EDGE Advanced standard in all four auction pilot-shortlisted cities by reducing window-to-wall ratio, implementing natural ventilation, and switching to energy-efficient lighting. Apartments, on the other hand, also require the installation of solar PVs, external shading, and energy-efficient lighting in common areas to be certified EDGE Advanced.
- Given the relatively minor incremental costs associated with building to EDGE Standard, the potential low-income EDGE-certified area that could be enabled by a $50 million capitalized incentive facility is substantial: around 8.7 million m^2 of EDGE-certified low-income landed house floor space, that is, approximately 280,000 landed houses or between 2.3 and 4.3 million m^2 of EDGE-certified low-income apartment floor space (around 50,000 to 100,000 low-income apartments). This is roughly equivalent to the low-income housing demand in two cities for up to five years.
- The impact that could be achieved by injecting $50 million in EDGE-certified low-income housing varies depending on the city and type of low-income design support, but is substantial in all cases:
    - Each year, between 40 and 250 GWh of electricity and 2 to 12 million m^3 of water could be saved. Operational CO_2 emissions, that is, those associated with low-income occupants' energy consumption at home, could be reduced by between 30 and 210 ktCO_2e annually (i.e., 600–4,200 ktCO_2e over 20 years). Embodied CO_2 emission reductions associated with materials used in low-income housing construction are also substantial, from 110 to 1,100 ktCO_2e.
    - An EDGE-certified home can save its owners between Rp 600,000 ($42.3) and Rp 1,300,000 ($91.6) per year in electricity bills, in addition to Rp 90,000 ($6.3) to Rp 190,000 ($13.4) per year per home in water bills. The number of families and the population that would directly benefit from living in EDGE-certified homes in each city varies between 165,000 and 850,000 people, depending on the city and low-income housing design.
    - The NPV of electricity cost savings to homeowners ranges from $40 to $260 million, while the NPV of savings on water bills amounts to $5 to $60 million.

Additionally, since the water tariff in the low-income housing segment is subsidized by the local government, subsidy costs savings of up to NPV $5 million could also be realized (assuming a subsidy phase-out after five years).

- A pilot auction that targets the landed low-income housing segment is likely to have more impact than one that targets the multi-story segment. Building a typical landed house to EDGE standard can reduce construction costs by up to 10 percent, whereas construction costs for apartment buildings might increase by up to 5 percent. Resource savings per square meter, although dependent on the set of measures implemented, are also generally higher for landed houses. Furthermore, the general market interest is higher on the landed than the multi-story housing.

Access to financing and incentives:

- Financing for conventional and green housing projects built by private developers are typically financed by the developers' own funds/equity (55–62 percent), commercial bank loans (26–32 percent), and funds received from buyers (7–10 percent) (Bank of Indonesia 2019). According to stakeholders, there are no financing programs that incentivize private housing developers. On the other hand, there are incentives such as concessional finance and lower interest rates for state-owned public developers. The Consultant recommends that such differences be taken into account when establishing the climate auction participation eligibility criteria.
- Emerging climate finance schemes such as the green bond/green sukuk do not prioritize energy-efficiency and green building projects. Financial institutions also often lack technical knowledge on energy- and resource-saving lending models, which hinders appropriate risk assessments. The climate auction could raise awareness and help bridge the green building knowledge gap within the financial sector by using a recognized green building standard such as EDGE. This could in turn reduce some of the hurdles faced by project developers in accessing finance for green building projects.

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Annex I. Meeting notes from stakeholder engagements

<annex is submitted as a separate annex>

Annex II. Ceiling price for low-income landed housing and multi-story housing

Table A2.1 Ceiling price for low-income landed housing in different regions

Region	Maximum ceiling price ($)	
	2019	2020
Java (except Jakarta, Bogor, Depok, Tangerang, Bekasi) and Sumatera (except the Region of Riau Islands, Bangka Belitung, and Mentawai Islands)	9,871	10,611
Kalimantan (except Murung Raya Regency and Mahakam Ulu Regency)	10,788	11,598
Sulawesi, Bangka Belitung, Mentawai Islands, and the Region of Riau Islands (except Anambas Islands)	10,294	11,034
Maluku, North Maluku, Bali, Nusa Tenggara, Jakarta, Bogor, Depok, Tangerang, Bekasi, Anambas Islands, Murung Raya Regency, and Mahakam Ulu Regency	11,140	11,845
Papua and West Papua	14,947	15,441

Source: MoPWH Decree No. 535 of 2019.

Table A2.2 Ceiling price for low-income, multi-story housing in each province and region in Indonesia

Province/region	Maximum ceiling price ($)	
	Per m^2	Per apartment unit
Province		
Nangroe Aceh Darussalam (Atjeh)	599	21,575
North Sumatera	550	19,798
West Sumatera	620	22,337
Riau	670	24,113
The Region of Riau Islands	705	25,383
Jambi	620	22,337
Bengkulu	564	20,306
South Sumatera	613	22,083
Bangka Belitung	628	22,90
Lampung	564	20,306
Banten (except the city of Tangerang, Tangerang Regency, and South Tangerang city)	536	19,291
West Java (except Depok, city of Bogor, Bogor Regency, city of Bekasi, and Bekasi Regency)	515	18,529
Central Java	508	18,275

Province/region	Maximum ceiling price ($)	
	Per m^2	Per apartment unit
Yogyakarta	515	18,473
East Java	557	20,052
Bali	585	21,067
West Nusa Tenggara	522	18,783
East Nusa Tenggara	606	21,829
West Kalimantan	684	24,621
Central Kalimantan	663	23,860
North Kalimantan	691	24,875
East Kalimantan	698	25,129
South Kalimantan	635	22,844
North Sulawesi	550	19,798
Gorontalo	585	21,067
Central Sulawesi	486	17,514
Southeast Sulawesi	578	20,814
West Sulawesi	613	22,083
South Sulawesi	515	18,529
Maluku	536	19,291
North Maluku	677	24,367
Papua	1,107	39,851
West Papua	754	27,159
Region		
West Jakarta	628	22,590
South Jakarta	649	23,352
East Jakarta	620	22,337
North Jakarta	677	24,367
Central Jakarta	656	23,606
City of Tangerang, Tangerang Regency, and City of South Tangerang	592	21,321
Depok	599	21,575
City of Bogor and Bogor Regency	606	21,829
City of Bekasi and Bekasi Regency	592	21,321

Source: MoPWH Decree No. 552 of 2016.

Annex III. Technical standards for landed low-income housing

The technical standards for landed low-income housing is based on the Ministry of Settlement and Regional Infrastructure Decree No 403 of 2002, as follows:

- First stage: core incremental house with a total area of 21 square meters (m^2) with the following rooms:
    - Main bedroom (3 x 3 m^2);
    - Multi-purpose room, no walls (3 x 3 m^2); and
    - Bathroom + toilet, no ceiling (1.5 x 1.2 m^2).

  At this stage, the number of occupants is assumed to be a maximum of two people, e.g., a young couple.

- Second stage: simple and healthy house[36] with a total area of 28.8 m^2 with the following rooms:
    - Two bedrooms (3 x 3 m^2);
    - Service room/area, e.g., kitchen, laundry room, garage, and storage room (2.5 x 3 m^2); and
    - Bathroom + toilet (1.5 x 1.2 m^2).

  At this stage, the number of occupants is assumed to be a maximum of four people, e.g., a family with two children.

- Final stage: fully built simple and healthy house with a total area of 36 m^2 with the following rooms:
    - Two bedrooms (3 x 3 m^2);
    - Children's bedroom (3 x 3 m^2);
    - Living room (2.5 x 3 m^2);
    - Room (3 x 3 m^2);[37] and
    - Bathroom + toilet (1.5 x 1.2 m^2).

  At this stage, the number of occupants is assumed to be a maximum of four people, e.g., a family with two children.

The Decree also stipulates the recommended materials used for the house, as follows:

- River stones for the house foundation;
- Concrete for house floors;
- Concrete blocks for walls;
- Wood for window and door jambs;
- Wooden truss for ceilings; and
- Zinc sheets/fiber sheets for ceiling covers.

For sanitary facilities, low-income housing is required to have a minimum of a squat toilet, a fiber or plastic water tub, and a manual water pump installed outside the house.

[36] According to the Ministry of Health (2012), a healthy house is defined as a dwelling which has a proper sanitary system, access to clean water, a proper waste and wastewater disposal facility, and good ventilation, as well as adequate occupancy density and a house floor not made of soil.
[37] The regulation does not specify the purpose of this room.

Annex IV. Financing schemes for low-income housing

The Ministry of Public Works and Public Housing (MoPWH) implements various state-funded housing support programs for low-income households as follows (World Bank 2017; Consultant's own compilation 2019):

1) **Incremental support for self-built housing** (BSPS, introduced in 2006):
   - Provides construction materials for home improvement or new construction of self-built housing in rural and peri-urban areas at a value of Rp 15–30 million ($705–$2,115);
   - Targets low-income households with income below Rp 1.5 million ($105) per month;
   - Aims to support 450,000 home improvement solutions reaching over 1.8 million beneficiaries;
   - Reached 544,000 beneficiaries, with an average per unit cost of Rp 20 million ($1,410) per unit in 2010–2013; and
   - Is the most efficient and best-targeted public housing program.

2) **Subsidy for rental multi-story public housing** (*Rusunawa*, introduced in 2007):
   - The central government (MoPWH) allocates a capital subsidy for the construction of rental public housing, while local governments are responsible for identifying and servicing program sites and managing units upon completion;
   - Tenants must earn below the provincial minimum wage, with a nation-wide income limit of Rp 2.5 million ($176) per month;
   - Rents are set at 30 percent of the minimum wage;
   - Support allocated reached Rp 2.4 trillion ($169.16 million) in 2014;
   - Characterized by low-budget utilization rates, underachievement of targets, high vacancy rates for units, and poor maintenance.

3) **Affordable mortgage financing** (Housing Financing Liquidity Facility [FLPP], introduced in 2011):
   - Provides concessional funds to lenders, who offer mortgages at fixed-interest rates to end users at 5 percent p.a. for 20 years;
   - Liquidity is 90 percent funded by the government (at 0.3 percent for 20 years) and 10 percent by the participating banks;
   - Served an average of 68,000 households per year in 2011–2014.

4) **Subsidies for housing mortgage** (KPRS and KPRS Mikro-Bersubsidi, introduced in 2006):
   - Provides mortgage subsidy for fixed and non-fixed low-income people for home improvement or development, mortgage interest rate buydown (KPRS Bersubsidi), and small-scale mortgage subsidy for development or housing improvement (KPRS Mikro-Bersubsidi).

5) **Mortgage interest rate buydown** (SSB, introduced in 2016):
   - Supports achievement of the "One Million Homes" Plan;
   - Eligibility criteria aligned with the FLPP scheme;
   - Subsidizes the interest rate paid by consumers on eligible mortgages.

6) **Down payment subsidy** (BUM, introduced in 2015):
   - Supports achievement of the "One Million Homes" Plan;
   - Provides down payment assistance for household buyers with a monthly basic income of less than Rp 4 million accessing either FLPP or SSB;

- Waiver on value added tax (typically 10 percent) on landed house units purchased under the FLPP and SSB programs.

Annex V. Technical requirements of balanced occupancy policy

Table A5.1 Technical requirements of balanced occupancy

Number of houses
• For each high-income housing unit,[a] each developer needs to construct two middle-income housing units and three low-income housing (LIH) units (a balanced occupancy in 1:2:3 ratio). • The total number of LIH units to be built must equal the sum of the number of middle-income housing units and high-income housing units built. • If it is not possible to build low-income landed housing (due to area limitations or high land prices, resulting in unreasonable prices of low-income housing), developers may build low-income multi-story housing. • The total floor area of multi-story low-income housing must be at least 20 percent of the total floor area of commercial housing (i.e., middle- and high-income housing; in this context, commercial means market-driven housing and other type of properties). • The following residential groups[b] are subject to this regulation: housing complexes with 15–1,000 housing units, settlements with 1,000–3,000 housing units, residential complexes with 3,000–10,000 housing units, and residential areas with more than 10,000 housing units.
Location
• Balanced occupancy must be observed in one site/residential complex if the site area can accommodate a minimum of 1,000 housing units. • Balanced occupancy in a separate site/building may be observed in a residential complex that can accommodate a minimum of 50 housing units. • For balanced occupancy observed in separate sites/residential complexes, the low-income housing should be located/built within the same city as the commercial housing. Access to a service center and workplaces must be provided.
Land area
• Land area allocated for the LIH building should be a minimum of 25 percent of the total area allocated for the entire housing complex being constructed.

Source: Ministry of Public Housing Regulation No. 7 of 2013.
a. Unit is defined as one landed house or individual apartment within a building to be constructed.
b. Housing complex is a group of individual houses; "settlement" is a group of housing complexes; "residential complex" is a group of settlements; and "residential area" is any environment outside of protected forests occupied by residents.

The Ministry of Public Housing Regulation No. 10 of 2012 on Balanced Occupancy, revised by the Ministry of Public Housing Regulation No. 7 of 2013, requires private sector developers building high-income commercial housing projects to provide three low-income housing (LIH) units and two middle-income housing units for every high-income commercial housing unit they build. The regulation does not offer an incentive for developers or local governments but imposes criminal sanctions on developers in case of violation.

From the Consultant's engagements with private housing developers and developers associations, it was revealed that, despite the release of the regulation in 2013, the 1:2:3 ratio has not been implemented in practice, and the previous policy of 1:3:6 ratio (stipulated in the 2012 version of the regulation) is still the "prevailing ratio." According to the private developers interviewed, meeting this requirement is not easy. Furthermore, the real estate association officers acknowledged that the balanced occupancy policy had not been fully enforced due to a lack of clarity surrounding the regulation and the incompatibility with housing construction business models. The developers and association mentioned that unclarity of terms in the regulation, and difficulty in finding land areas that fit the developer's budget to meet the requirements, make it economically unattractive from a business perspective.

Low-income housing built under a balanced occupancy plan is not eligible for government subsidy. The one-stop integrated service (OSIS) DKI Jakarta office shared one example of a

housing complex in Jakarta that could meet the balanced occupancy ratio. One of the two developers interviewed by the Consultant in Jakarta had developed a LIH project as part of the balanced occupancy requirement for their high-income apartment project.

Regarding the enforcement of sanctions, the MoPWH and/or the local government are responsible for the monitoring, evaluation, and correction of construction under a balanced occupancy policy. However, the real estate association engaged by the Consultant is not aware of any developer who had been sanctioned.

The Ministry of Public Housing Regulation No. 7 of 2013 has been in a long process of amendment due to criticism from housing developers. In 2018, the MoPWH stated five main points that are being considered for amendment of the regulation: removal of the criminal sanctions, addition of tax incentives (including land tax) and a cooperation scheme between developers, greater leniency in the balanced occupancy ratio, and more clarity in the definition of a “site area” (Kontan 2018).

Annex VI. National regulations on energy efficiency in buildings

The Government of Indonesia has put regulations in place to promote energy efficiency in the buildings sector:

- Government Regulation No. 70/2009 on Energy Conservation (currently under revision) requires any building with annual energy consumption of more than 6,000 tonnes of oil equivalent (TOE) (approximately 70,000 megawatt-hours [MWh] of electricity consumption, which roughly corresponds to a building floor area of 279,120 m^2) to implement energy conservation measures using energy management. The regulation also stipulates standards and labeling for energy-efficient equipment. The government will provide incentives to buildings that successfully implement energy conservation, indicated by a reduction in specific energy consumption and energy consumption elasticity for a certain period; manufacturers producing equipment with an efficiency level higher than the benchmark; and manufacturers that provide labeling for their products. The incentives provided include import duty exemption, tax reduction, and reduced interest rates for investments in energy efficiency, while the disincentive measures include warnings, public announcements in the mass media, and fines. The details for such incentives and disincentives are set by the Ministry of Energy and Mineral Resources (MEMR). According to a July 2019 draft version of the revised regulation, the scope of this regulation will be expanded to transportation, industry, households, and commercial buildings. Furthermore, commercial buildings consuming 500 TOE (5,800 MWh) per year may be required to implement energy conservation measures according to the planned revision. Except for the utilization of more-energy-efficient equipment in households (e.g., compact fluorescent lamp [CFL] lighting and air conditioning), no specific requirements for buildings in the housing sector have been included in the draft revision.
- MEMR Regulation No. 13 of 2013 on Efficiency in Electricity Utilization requires energy efficiency measures in all state-owned buildings to achieve 20 percent electricity efficiency relative to the consumption in the six months before the regulation came into force. Energy-efficiency measures should be completed within six months after the regulation has been enacted and results should be maintained throughout the next phase of building operation.
- The MEMR also regulates and oversees the Energy Audit Program, Energy Manager Training Program, Minimum Energy Performance Standards (MEPS), and labeling for energy-efficient appliances. For instance, the MEMR has enacted MEMR Regulation No. 57 of 2017 on MEPS and labeling for AC appliances, which is well enforced.

Annex VII. Green building codes in cities in Indonesia

Jakarta

Table A7.1 Green building code for new buildings under the Jakarta Province Regulation

Energy efficiency	
Maximum overall thermal transfer 45 watts per square meter (W/m^2)	Photosensors for lights
Air conditioning: AC system set at 25ºC, relative humidity 60% +- 10%, temperature sensor	Maximum lighting power
Minimum cooling efficiency	Variable-voltage/variable-frequency drive for lifts with a speed of 60 meters per second (m/s)
Variable air volume for central cooling	Sensors for escalators
Variable speed drive for chilled water pump	Building management systems for central AC system
Chilled water pump pipe insulation	Sub-metering for power for class > 100 kilovolt-amperes (kVA)
Indoor air quality	**Water efficiency**
Minimum ventilation rates	Maximum water consumption limit
CO_2 sensor control	Sub-metering of water sources
CO_2 control in parking	Grey water recycling
Chlorofluorocarbon (CFC)-free refrigerants	
Land management	**Waste management**
Minimum green open area	Solid/liquid waste management
Permeable exterior walkways	
Rainwater collection with minimum volume is 0.05 meters multiplied by the ground floor area in m^2	
At least one bicycle rack for every 2,500 m^2 building area and shower facilities for cyclists that equals at least 10% of the total number of bicycle racks	

Source: Governor of DKI Jakarta Regulation No. 38 of 2012.

The DKI Jakarta government has set action plans to realize the targets, including the creation of press releases for public awareness, publication of user manuals for the green building code, capacity building, launch of a data collection and monitoring system, and a list of proposed revisions to the code to expand its scope and increase the effectiveness of implementation. The revised code will increase potential savings by adding mandated building size and types. For instance, the minimum floor area included under the code is expected to be reduced from more than 50,000 m^2 to 10,000 m^2 for offices, malls, and apartments, while the minimum floor area for hotels and hospitals will be reduced from 20,000 m^2 to 10,000 m^2. Landed houses of more than 200 m^2 will also likely be included in the revised code (IFC n.d.).

Bandung

Table A7.2 Green building code under the City of Bandung regulation

Parameter	Building types and sizes	
	New buildings and expansion of existing buildings (floor area more than 5,000 m^2)	New buildings (floor area less than 5,000 m^2)
Mandatory requirements		
Energy efficiency	• Building envelope overall thermal transfer values (OTTV) < 45 W/m^2 (only for buildings other than houses) • Variable speed drive for the secondary loop chilled water pump • Minimum air-conditioning efficiency standards	

Parameter	Building types and sizes	
	Lighting system (natural and artificial) with photoelectric or motion sensor; lighting power density standard for artificial lighting	Window-to-wall ratio > 15% and lighting system with efficient lighting (light-emitting diode [LED] bulbs, compact fluorescent lamps [CFL], T5 fluorescent, and luminous efficacy > 75 lumen/W)
Water efficiency	• Infiltration pond and infiltration well • Water-efficient sanitary equipment with maximum standards except for individual houses (only need to use dual-flush water closet)	
	• Rainwater harvesting with water treatment plant • Wastewater (grey water) treatment recycling system • Wastewater piping and treatment plant	
Indoor air quality management	• Window opening area of at least 5% of the building area • Mechanical ventilation system with a CO_2 sensor with alarm (< 1,000 parts per million [ppm]) • Carbon monoxide (CO) sensor with alarm (< 35 ppm) • Room density > 25 people/100 m^2	Mechanical ventilation system, except for housing
Site management	• On-land green open area (lawn); off-land green open area (green roof or vertical garden) covering < 25% of the total building on-land green area • Pedestrian area • Bicycle parking: one for every 25 car parking spaces • Solid waste management system for housing (at least a system that separates organic and inorganic wastes)	
Building management system	For buildings with an area of > 10,000 m^2 • Monitoring and control system for energy and water consumption	N/A
Voluntary codes		
2-star rating	10% more than minimum requirements, OTTV 35 W/m^2, coefficient of performance (COP) for full load AC system: 3.5	
3-star rating	30% more than minimum requirements, OTTV 30 W/m^2, COP for full load AC system: 3.5 for landed houses and 3.7 for apartments	
Others	Existing buildings are required to report their electricity usage, water consumption, and waste disposal	

Source: Mayor of Bandung City Regulation No. 1023 of 2016 on Green Building Code.

Semarang

Table A7.3 Green building code under Semarang city Regulation

Parameters	Building types and sizes Small building: < 2,500 m^2 and landed housing > 300 m^2	Medium building: 2,500–5,000 m^2	Large building: > 5,000 m^2
Energy efficiency	**Building envelope**		
	• Operable window as natural ventilation with minimum area 5% of floor area • Maximum wall-to-window ratio: 25%	• Maximum overall thermal transfer values (OTTV): 40 watts per square meter (W/m^2) • Maximum roof U-value: 1.2 watts per square meter Kelving ($W/m^2.K$)	
	Air conditioning system		
	• Minimum coefficient of performance (COP) 3.7 for commercial buildings, office buildings, hospitals, hotels; minimum COP 3.0 for apartments and educational institution buildings	• Minimum COP 3.7 for commercial buildings, office buildings, hospitals, hotels; minimum COP 3.0 for apartments and educational institution buildings • Maximum temperature 25°C ± 1°C • Relative humidity 60% ± 10%.	• Minimum COP 3.7 for commercial buildings, office buildings, hospitals, hotels; minimum COP 3.0 for apartments and educational institution buildings • Maximum temperature 25°C ± 1°C • Relative humidity 60% ± 10% • Thermal zoning • Installation of thermostat • Variable speed drive for chiller pump • Building management system, i.e., automatic control for chiller, pump, and air-handling unit
	Artificial lighting		
	• Energy-efficient lighting: light-emitting diode (LED), compact fluorescent lamp (CFL), or T5 fluorescent lamps	• Motion sensor for toilet lights with a minimum area of 25 m^2 • Photoelectric-sensor-controlled lights for open offices, conference rooms, and lobbies with a minimum area of 100 m^2, with windows • Energy-efficient lighting: LED, CFL, or T5 fluorescent lamps	• Motion sensor for toilet lights with a minimum area 25 m^2 • Photoelectric-sensor-controlled lights for open offices, conference rooms, and lobbies with minimum area of 100 m^2, with windows • Maximum light power density value is 8 $watt/m^2$
Energy efficiency	**Electrical system**		
	N/A	N/A	• Separate sub-metering for lighting, escalators, and elevators

Parameters	Building types and sizes Small building: < 2,500 m^2 and landed housing > 300 m^2	Medium building: 2,500–5,000 m^2	Large building: > 5,000 m^2
Water efficiency			• Centralized AC system in offices, hospitals, hotels, and schools
	Building transportation system		
	N/A	N/A	• Variable voltage variable frequency for non-hydraulic lift • Automatic control systems for elevators
	Water flow rate		
	• Shower: 8 liters/minute • Sink faucet: 6 liters/minute • Lavatory faucet: 4 liters/minute • Dual flush closet: full flush 4.5 liters/flush; reduced flush: 3 liters/flush • Urinal valve: 2.5 liters/flush		
	Rain harvesting and sub-metering		
	N/A	• Sub-metering • Rain harvesting through raw water tank with specification of 0.025 meters multiplied by ground floor area • Water supply planning and rainwater harvesting	
Indoor air quality management	N/A	N/A	• CO sensor in indoor carpark • CO_2 sensor in rooms larger than 100 m^2 for meeting rooms, conference rooms, auditoriums, theaters, and classrooms

Source: Mayor of Semarang City Regulation No. 24 of 2019.

Annex VIII. Building construction permits and occupancy certificates

According to Government Regulation No. 64 of 2016 on Low-Income Housing Provision, low-income housing (LIH) developers should be a legal entity. LIH development is carried out in four stages: preparation, pre-construction, construction, and post-construction.

Table A8.1 Development process for low-income housing

Development stage	Legal entity	Local government
Preparation	• Proposal arrangement – Design and planning of housing – Design and planning for infrastructure utilities – Land acquisition – Fulfillment of requirements	
Pre-construction	• Proposal submission to local government through the one-stop integrated service (OSIS) • Supporting documents submission (land certificate, receipt of the last land tax payment, land use permit)	• Building construction permit (IMB) issuance by OSIS
Construction	• Drawing documents and examination • Site preparation • Construction activity • Final construction examination • Handover	• Supervision of construction management activity by local government • Functionality examination • Building occupancy certificate (SLF) by OSIS
Post-construction	• Proposing land and building tax issuance for built low-income housing • Proposing the splitting of the land certificate according to each unit	• Issuing land and building taxes for low-income housing • Setting the price to obtain utilization rights for land and low-income housing

Source: Original compilation.

Annex IX. Voluntary green building certifications in Indonesia

1. GREENSHIP

There are five types of GREENSHIP rating certificates:

1. GREENSHIP New Building is applicable to new buildings and existing buildings undergoing a minimum 90 percent of mechanical or structural retrofit work. The assessment for certification under this type covers the design process to the completion of the construction process.
2. GREENSHIP Existing Building is applicable to buildings that have been in operation for at least one year.
3. GREENSHIP Interior Space is suitable for those who do not have ownership of the building but strive for a healthier and safer environment. This type of GREENSHIP certification needs to be followed by "fit-out" activities by space occupants to make sure the design is suitable for use as intended. Fit-out activities may include installation of ceilings, floors, furnishings, and partitions of a building.
4. GREENSHIP Homes is applicable for single landed houses, new and existing houses, and existing houses undergoing redevelopment.
5. GREENSHIP Neighborhood can be applied to housing complexes, business districts, and industrial complexes.

a) GREENSHIP New Building

GREENSHIP assesses each building design and performance using 7 eligibility criteria, 6 categories, and 46 assessment criteria under those categories.

The 46 criteria are categorized into three types: (1) pre-requisite criteria, those that must be met and represent the minimum standards for environmentally friendly buildings; (2) credit criteria, those that are voluntary and will be scored for the overall GREENSHIP rating; and (3) bonus criteria, those that represent added values from building specifications that are difficult and rarely found in the field. Points are given for every adopted measure assigned as "credit criteria" and "bonus criteria."

As a voluntary certification scheme, GREENSHIP assessment is only conducted for a building that has met the following eligibility criteria:

1) Covers a minimum building area of 2,500 m^2;
2) Whose owners are willing to share data for the certification process;
3) Is being used in accordance with the approved purpose of land based on the regional/local site planning;
4) Holds mandatory environmental permits (Planned Environmental Management Efforts, Environmental Monitoring Efforts);
5) Complies with earthquake-proof resistance standards;
6) Complies with the building code according to the accessibility standard; and
7) Complies with the safety and fire code.

Table A9.1 Categories and criteria assessed for GREENSHIP New Building certification

Category 1: Appropriate site development	**(8 criteria)**
Basic green area (pre-requisite, 0)	Bicycle facility (2)
Site selection (2)	Site landscaping (3)
Community accessibility (2)	Microclimate (3)
Public transportation (2)	Stormwater management (3)
Category 2: Energy efficiency and conservation	**(7 criteria)**
Electrical sub-metering (pre-requisite, 0)	Ventilation (1)
Overall thermal transfer values (OTTV) (pre-requisite, 0)	Climate change impact (1)
Energy-efficiency measures (20)	On-site renewable energy (bonus) (5)
Natural lighting (4)	

Category 3: Water conservation	(8 criteria)
Water metering (pre-requisite, 0)	Water recycling (3)
Water calculation (pre-requisite, 0)	Alternative water resources (2)
Water use reduction (8)	Rainwater harvesting (3)
Water fixtures (3)	Water efficiency landscaping (2)
Category 4: Material resources and cycle	**(7 criteria)**
Use of non-CFC (chlorofluorocarbon) refrigerant (pre-requisite, 0)	Use of certified wood (2)
Reuse of building and material (2)	Use of pre-fabricated materials (3)
Use of environmentally friendly materials (3)	Use of locally sourced materials (2)
Use of materials without ozone-depleting potential (2)	
Category 5: Indoor health and comfort	**(8 criteria)**
Outdoor air introduction (pre-requisite, 0)	Outside view (1)
CO_2 monitoring (1)	Visual comfort (1)
Tobacco smoke control (2)	Thermal comfort (1)
Chemical pollutant (3)	Acoustic level (1)
Category 6: Building environment management	**(8 criteria)**
Basic waste management (pre-requisite, 0)	Proper commissioning (3)
GREENSHIP Professional as a member of the project team (1)	Green building submission data (2)
Pollution of construction activity (2)	Fit-out agreement (1)
Advanced waste management (2)	Occupant survey (1)

Source: GBCI 2014.

b) GREENSHIP Homes

Eligibility criteria of GREENSHIP Homes:

1) Covers for a maximum area of a four-story house;
2) At least 70 percent of the house floor area is used as living space;
3) Permanently occupied by at least one person;
4) Has building construction permit;
5) No change in building function within three years of certification period;
6) Has fulfilled all pre-requisites of GREENSHIP Homes; and
7) Owner agrees to share all required data with the Green Building Council Indonesia (GBCI) for future case studies.

Table A9.2 Categories and criteria assessed for GREENSHIP Home certification

Appropriate site development (13 criteria)	
Appropriate location (pre-requisite, 0)	Community accessibility (2)
Basic green area (pre-requisite, 0)	Pest control/management (2)
Additional green area (4)	Availability of public transportation (1)
Availability of supporting infrastructure (2)	Stormwater management
Energy efficiency and conservation (15 and 2 bonus criteria)	
Electricity metering (pre-requisite, 0)	Thermal condition (2)
Passive design analysis (pre-requisite, 0)	Heat reduction (4)
Sub-metering (2)	Energy-saving home appliances (3)
Artificial lighting (4)	On-site renewable energy sources (bonus points, 2)
Water conservation (5 criteria)	
Water metering (2)	Water saving irrigation (2)
Water saving fixtures (3)	Wastewater management (3)
Rainwater harvesting (3)	
Material resource and cycle (9 criteria)	
Fundamental refrigerant (pre-requisite, 0)	Use of environmentally friendly processed materials (1)
Use of non-ozone-depletion-potential refrigerant (1)	Use of certified wood (1)

Use of reused materials (1)	Use of pre-fabricated materials (2)
Use of environmentally friendly sourced materials (2)	Use of local materials (2)
Environmentally friendly processed materials (1)	Carbon footprint (1)
Indoor health and comfort (13 criteria)	
Asbestos free (pre-requisite, 0)	Pollutant source minimization (3)
Fresh air circulation (5)	Acoustic level (1)
Natural lighting (2)	Spatial comfort (1)
Visual comfort (1)	
Building environment management (12 and 2 bonus criteria)	
Basic waste management (pre-requisite, 0)	Advanced waste management (1)
Sustainable design and construction (4)	Safe and secure environment (1)
Availability of home guidelines (2)	Innovation (3)
Green activities (1)	Home design development (bonus criteria, 2)

Source: GBCI 2014.

GREENSHIP assigns each building one of the four rating levels based on its total score. For instance, a building will be certified GREENSHIP Platinum if it attains at least 74 points out of the 101 maximum points. From 2012 to July 2019, GREENSHIP certified a total of 26 buildings: platinum (7 buildings), gold (17), and silver (2) ratings. This result demonstrates that the GREENSHIP criteria are not difficult to meet.

Table A9.3 Rating levels under the GREENSHIP certification depending on points obtained by a building

Points obtained by building		Rating awarded
GREENSHIP New Building (out of maximum 101)	GREENSHIP Home (out of maximum 77)	
≥ 74	> 56	Platinum
58–73	43–55	Gold
47–57	35–42	Silver
35	26–34	Bronze

Source: GBCI 2013.

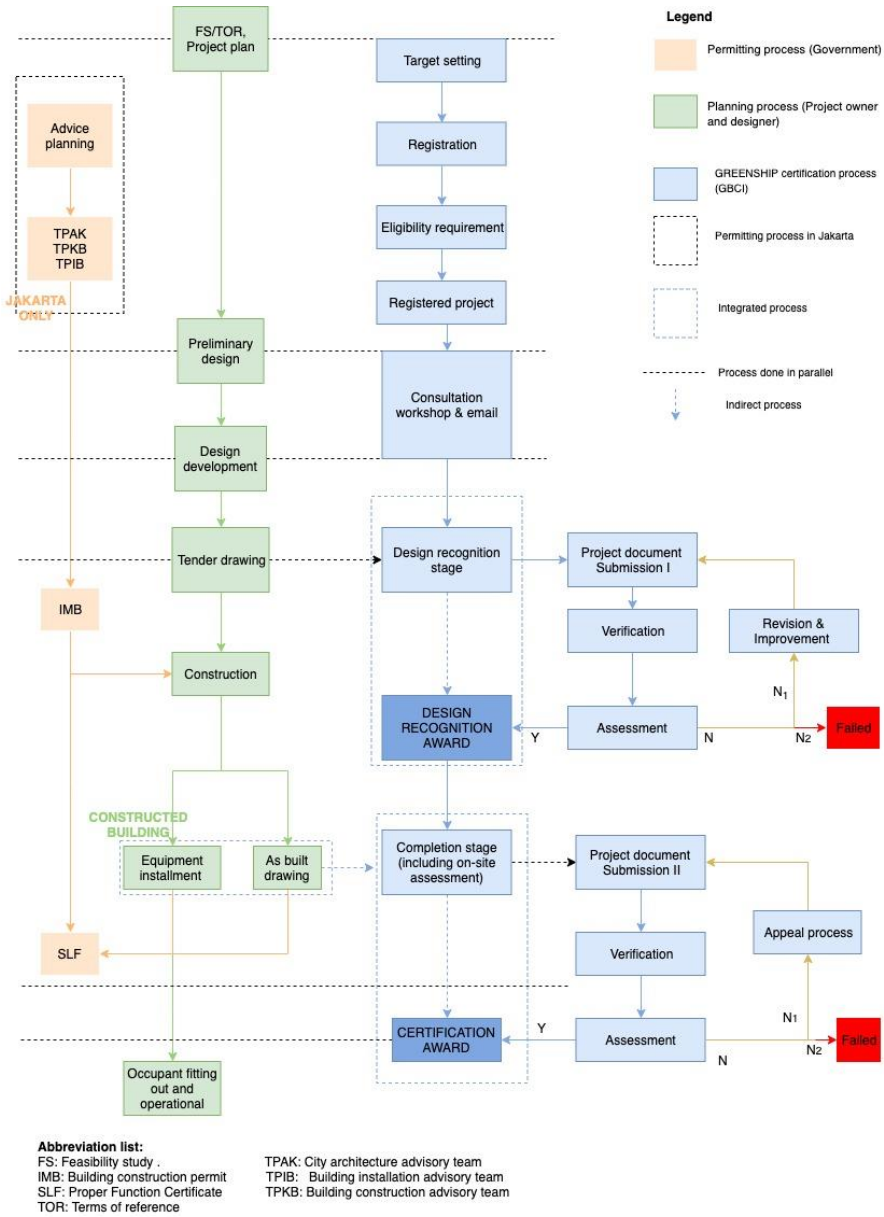
The GBCI appointed PT Sertifikasi Bangunan Hijau (PT SBH) as GREENSHIP's implementing agency and building assessor. After a self-assessment by the building owners, assessors from PT SBH score the building design for each GREENSHIP criterion against the set benchmarks. The benchmark values are adopted from Indonesian National Standards (SNIs)—SNI 03-6389-2011, SNI 03-6197-2011, SNI 03-6390-2011, SNI 03-7065-2005—and standards from the Ecolabel Foundation Indonesia and Forest Stewardship Council, as well as local green building regulations.

For GREENSHIP Homes, the homeowner or architect conducts an online self-assessment.[38] If the assessment results exceed the minimum points for GREENSHIP Homes certification, the homeowner may then proceed to apply to GBCI for GREENSHIP certification.

PT SBH will issue an Official Verification Report consisting of the building assessment result, which will finally be scored and evaluated by the GREENSHIP Evaluation Assessment Board. The complete GREENSHIP certification process can be seen in figure A9.1.

[38] The free self-assessment can be made online on http://www.greenshiphomes.org.

Figure A9.1 GREENSHIP certification process



Source: GBCI 2013.

2. EDGE

Calculation of resource-efficiency gains using the Excellence in Design for Greater Efficiencies (EDGE) tool considers the climatic conditions of the building location, type, and occupant use as well as its design and specifications (IFC 2018).

The EDGE tool can be used at an early stage of building design to plan for design and operational expenses and measure environmental impacts of the building. EDGE focuses on strategic reductions in energy (operational and embodied) and water consumption, offering certification for resource-efficient buildings that fulfill its requirements.

The EDGE tools depict base cases of building conditions according to common practices as a reference for comparing design or actual condition and reflection of achievements on each set of parameters in energy, water, and material consumption. The EDGE baseline is updated every three to five years in line with updates in relevant regulations, field practices, and market

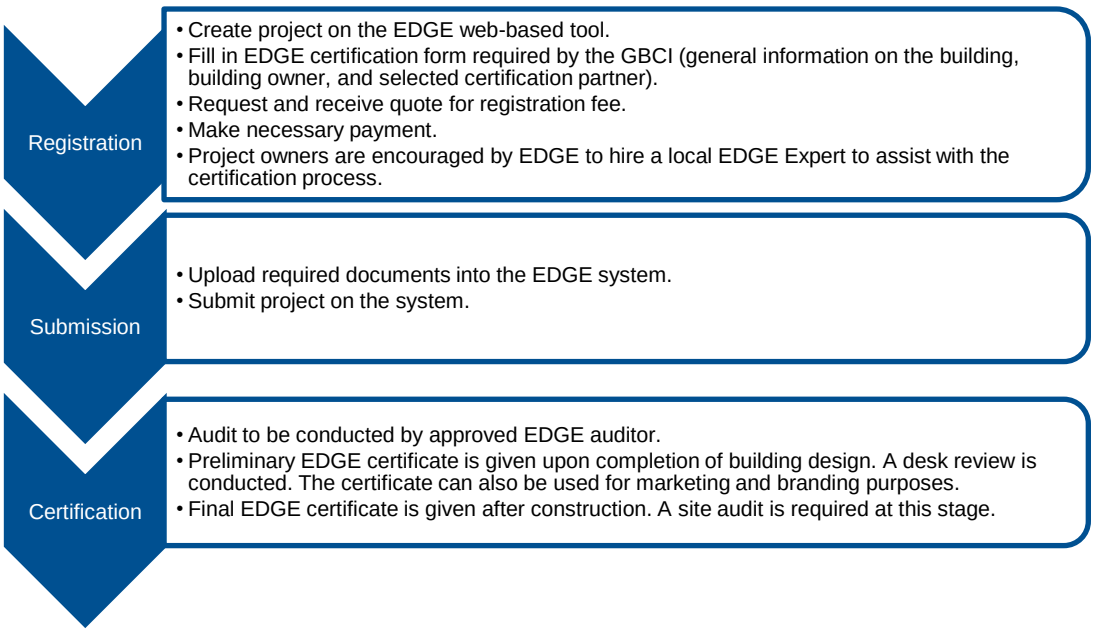
conditions. As of January 2020, the EDGE certification tool contained data for 160 countries, including Indonesia, and had more than 27,500 registered users.

An EDGE certification package covers a preliminary certificate (upon completion of design) and a final certificate (after building construction). A stand-alone final certificate can be given to projects that have already been built.

GBCI has been appointed as the certification partner for EDGE in Indonesia since 2013. PT Sucofindo, a prominent Indonesian audit and assurance company, is also listed on GBCI's website as an EDGE certification partner.

Figure A9.2 Flow of EDGE certification in Indonesia

Projects in Indonesia can obtain EDGE certificates by completing three steps:



Source: Original compilation, based on IFC (2020) and GBCI (2020).

Applicants pay registration fees to GBCI and appoint one of 27 EDGE auditors in Indonesia. The applicant should also pay certification fees upon submitting the application. The certification fees listed in table A9.4 cover both design and construction stages but exclude tax and auditor fees.

Table A9.4 Prices for EDGE certification in Indonesia

Building size	Less than 5,000 m^2	5,000–10,000 m^2	More than 10,000 m^2
Registration	Rp 2,694,770 ($190)	Rp 2,694,770 ($190)	Rp 2,694,770 ($190)
Certification	Rp 35,003,644 $2,468	Rp 55,001,674 $3,878	Rp 74,999,704 $5,288
Total	Rp 37,698,414 $2,658	Rp 57,696,444 $4,068	Rp 77,694,474 $5,478

Source: EDGE website, 2019.

While not required, applicants might also engage an EDGE Expert who can provide technical advice on the best ways to design and build green buildings. As of December 2019, there were 38 EDGE experts in Indonesia.

Table A9.5 Segmentation of housing sector and availability of climate data in EDGE

Housing segment	Income level	Availability of climate data on Indonesian cities
Landed house and apartment	Low, lower middle, upper middle, high	Balikpapan, Bandung, Banjarmasin, Denpasar, Jakarta, Makassar, Manado, Medan, Padang, Palembang, Solo, Surabaya

Source: Original compilation.

Table A9.6 Differences across EDGE certification level

Parameter	Level 1: EDGE Certified	Level 2: EDGE Advanced	Level 3: Zero Carbon
Criteria	Minimum of 20% savings in energy, water, and embodied energy in materials	Minimum of 40% savings in energy, water, and embodied energy in materials, on-site	• EDGE Advanced criteria, with 100% renewables on-site or off-site, or, with purchased carbon offsets to compensate emissions up to 100% • Goal for new buildings: to be zero carbon by 2030 • Goal for all buildings: to be zero carbon by 2050
Time of certification	At preliminary and final certification stages	At preliminary and final certification stages	At least one year after final EDGE certification with 75% occupancy
Renewal requirements	Not required	Not required	• Every four years for buildings with 100% renewables • Every two years for buildings that purchased offsets
Cost	Registration and certification fees	Registration and certification fees	• Registration and certification fees • A maximum of $500 at the project level • A maximum of $50 per housing unit for each renewal period

Source: Original compilation from the EDGE website (2020).

Annex X. Assessment of the potential cities for the climate auction pilot in Indonesia

Alignment with national strategic priorities

An auction mechanism designed to support cost disbursement for energy- and resource-efficient buildings should ultimately contribute to the achievement of national development plans for the (low-income) housing sector to utilize public money for less-resource-intensive projects and deliver optimum benefit to both new homeowners and Indonesia as a whole.

To identify cities targeted by government housing programs, the Consultant has reviewed government regulations on spatial planning, the National Mid-Term Development Plan published by the Ministry of National Development Planning or BAPPENAS (National Medium-Term Development Plan, RPJMN), the Strategic Plan of the Ministry of Public Works and Public Housing (RENSTRA), and the One Million Houses program established and overseen by the President. These three programs cover the period 2015–2019. Additionally, the Consultant reviewed the World Bank's National Affordable Housing Program (NAHP). The World Bank supports NAHP through an investment loan of $450 million. The NAHP, which has been implemented since 2017 and is expected to end in 2020, aims to improve access to affordable housing for lower-income households.

The RPJMN aims to provide housing for 2.2 million low-income and non-low-income households using the government budget, but does not specify target geographical areas. Therefore, it can be assumed that the RPJMN covers all 514 cities and regencies in Indonesia.

The provision of housing in Indonesia is closely linked to spatial planning laws and regulations. According to Law No. 26/2007, the government has designated 76 National Economic Strategic Areas based on national interests and economic, environmental, defense and security, social, and cultural considerations, as well as the utilization of natural resources and technology in these areas.

The Ministry of Public Works[39] Regulation No. 15 of 2012 on the Guidelines for the Preparation of National Strategic Areas, further specifies the **national economic strategic areas**, which are classified into three zones as listed in table A10.1.

Table A10.1 Classification of the National Economic Strategic Areas

No.	Classification of the National Economic Strategic Areas	Key criteria
1	Metropolitan Zone	• Socio-economic and cultural functional links between the main urban area and the surrounding urban areas • The growth of built-environment areas • High commuter movements between the main and the surrounding areas (including distance and travel time based on commuter movement) • Ecological balance and water resources • Other relevant laws and regulation
2	Integrated Economic Zone	• Flagship economic activity • Distribution of economic activity facility centers • Accessibility between flagship economic activity and economic facility centers • Other relevant laws and regulations
3	Special Economic Zone	• Zone with special economic facilities for economic activities (Core Zones)

[39] Former name of the MoPWH. The Ministry of Public Works was merged with the Ministry of Public Housing to form the current MoPWH.

No.	Classification of the National Economic Strategic Areas	Key criteria
		• Zones with the function to protect the Core Zones and which are impacted by the Core Zone's economic activities (Buffer Zones) • Other relevant laws and regulations

Source: Ministry of Public Works Regulation No. 15 of 2012.

In the Consultant's view, the National Economic Strategic Areas, particularly the Metropolitan Zones, provide an attractive environment for housing market growth due to their potential economic development and, in turn, population growth. The high growth of built-environment areas, including offices, commercial buildings, and industrial zones, will attract population from other areas of Indonesia, and thus, drive up housing demand in these National Economic Strategic Areas.

There are 10 Metropolitan Zones[40] as determined by the Ministry of Agrarian Affairs and Spatial Planning (presented in table A10.1). These zones have one larger metropolitan city (written in bold) surrounded by smaller cities (satellite cities) and are usually well connected by national highways or national roads.

Table A10.1 Metropolitan Zones in Indonesia

No.	Metropolitan zones	Cities within the metropolitan zones
1	North Sumatera Metropolitan	**Medan,** Binjai, Deli Serdang, Karo
2	DKI Jakarta, Banten, and West Java Metropolitan	**Jakarta**, Bogor, Tangerang, Bekasi, Puncak, Cianjur
3	West Java Metropolitan	Greater **Bandung**
4	Central Java Metropolitan	Kendal, Demak, Ungaran, **Salatiga**, Purwodadi
5	East Java Metropolitan	Gresik, Bangkalan, Mojokerto, **Surabaya**, Sidoarjo
6	Bali Metropolitan	**Denpasar**, Badung, Gianyar, Tabanan
7	South Sumatera Metropolitan	**Palembang**, Betung, Indralaya, Kayugaung
8	South Kalimantan Metropolitan	**Banjarmasin**, Banjarbaru, Barito
9	North Sulawesi Metropolitan	Bitung, Minahasa, **Manado**
10	South Sulawesi Metropolitan	**Makassar**, Maros, Sungguminasa, Takalar

Source: Ministry of Agrarian Affairs and Spatial Planning/National Defence Agency 2017.

The MoPWH, in its RENSTRA Plan 2015–2019, has identified strategic development areas, where specific development projects, including in the housing sector, are planned. The RENSTRA 2015–2019 includes more than 75 cities across the country. For the development of low-income housing, the RENSTRA specifically targets three cities: **Jakarta**, **Surabaya**, and **Palu**.

The One Million Houses program was launched by the Indonesian President through Presidential Regulation No. 3 Year 2016 and Presidential Instruction No. 1 Year 2016 on the Acceleration of National Strategic Projects Implementation. This program targets a ramp-up of government financial and construction support to provide 1 million units of low-income housing. In its original regulation, the program covers the period 2015–2019 and targets the **Special Capital Region of Jakarta province**, **South Sumatera**, **North Sumatera**, **Riau**, **Banten**, **West Java**, **East Java**, **Central Kalimantan**, **East Kalimantan**, and **South Sulawesi** (Government of Indonesia 2017). The One Million Houses program will continue under the incumbent president's second term from 2020 to 2024. The total target for its second phase is 3.9 million housing units within five years, which is lower than the first phase's target of 5 million units in five years (CNBC Indonesia 2019).

The World Bank's NAHP aims to support the provision of low-income housing in urban areas by the government through financial and technical support, especially through the incremental support for self-built housing (BSPS) and Housing Financing Liquidity Facility (FLPP) programs

[40] Most areas included in the Special Economic Zones are already included in the Special Development Areas assessed in this report; the Consultant has therefore focused on the Metropolitan Zones in this section.

which are focused on landed housing. The areas covered by the programs include **Greater DKI Jakarta**, **Kerrawangs**, **Deli Serdang**, and **Serang**.

Potential low-income housing market size

To determine the potential LIH market size of cities, the Consultant considered the housing needs of households in the 55 cities included in the strategic development areas (WPS) based on the data of dwelling ownership from the National Statistics Agency (2019). In the absence of available statistical data on low-income population or demand for low-income housing in each city, the Consultant used average income distribution data for the whole country (see table A10.2 for income distribution in Indonesia), which was then used as a proxy to estimate the low-income population and respective LIH needs in the cities. These numbers, though indicative, will help illustrate the relative demand for LIH development in cities, and subsequently, the market potential for the future auction.

Table A10.2 Income distribution in Indonesia

Decile	Household's monthly income (Rp million)	Household's monthly income ($) [a]
1	1.2	84.6
2	1.8	127.0
3	2.1	148.0
4	2.6	183.3
5	3.1	218.6
6	3.6	253.8
7	4.2	296.1
8	5.2	366.6
9	7.0	493.5
10	13.9	980.0
Mean	4.5	204.5

Source: MoPWH 2017b.
[a.] Here and below, the exchange rate used is $1 = Rp 14,183 as per Minister of Finance Decision KMK No. 35/MK.10/2019 (August 7–13, 2019).

Assuming that the low-income households are defined with the same eligibility criteria as for housing subsidies (i.e., each household must have basic individual income of less than Rp 4 million/$282),[41] it is estimated that about 70 percent of households in Indonesia are low income. This is in line with the National Statistics Agency (2019) data, according to which the average wage in Indonesia in 2019 was Rp 2.79 million ($197).

Table A10.3 shows the housing needs at the city level. The housing needs across all income levels were calculated using the percentage of urban backlog data. The urban backlog data represent the ratio of households across cities in a given province that do not yet own a dwelling. This number was then multiplied by the number of households to determine the total number of housing needed at a household level in the city. Due to the unavailability of data on the number of low-income households in these cities, the Consultant assumed that 70 percent of households across these cities are low income.

[41] There are two income ceilings for low-income housing. Rp 4 million ($282) for low-income landed housing and Rp 7 million ($494) for low-income multi-story housing. For this study, the Consultant took a more conservative approach by taking into account the lower-income ceiling in the assessment process.

Table A10.3 Cities in the WPS with the greatest housing needs

No.	City	Province	Population	No. of households	Urban housing backlog at provincial level (%)	Urban housing needs at city level (no. of households)	Urban LIH needs at city level (no. of households)
1	Jakarta	Special Capital Region of Jakarta	10,467,629	2,509,080	52.15	1,308,508	915,956
2	Surabaya	East Java	2,886,000	789,730	18.63	147,144	103,001
3	Bekasi	West Java	2,859,630	682,878	26.55	181,295	126,906
4	Bandung	West Java	2,412,090	668,452	26.55	177,465	124,225
5	Medan	North Sumatera	2,264,145	519,485	38.19	198,379	138,865
6	Tangerang	Banten	2,139,891	565,489	24.21	136,879	95,815
7	Semarang	Central Java	1,786,114	454,134	17.54	79,651	55,755
8	Palembang	South Sumatera	1,643,488	371,050	31.77	117,871	82,510
9	Makassar	South Sulawesi	1,508,154	341,460	31.45	107,396	75,177
10	Batam	The Riau Islands	1,329,770	369,250	24.21	89,379	62,565
11	Pekanbaru	Riau	1,117,360	266,106	44.19	117,595	82,316
12	Bogor	West Java	1,081,010	249,933	17.54	43,836	30,685
13	Bandar Lampung	Lampung	1,033, 803	243,902	22.09	53,883	37,718
14	Padang	West Sumatera	939,112	219,457	38.29	84,030	58,821
15	Denpasar	Bali	914,300	228,119	28.25	64,454	45,118
16	Malang	East Java	866,000	232,757	18.63	43,368	30,357
17	Samarinda [a]	East Kalimantan	843,446	186,603	36.90	68,860	48,202
18	Banjarmasin	South Kalimantan	692,793	173,190	34.84	60,341	42,239

No.	City	Province	Population	No. of households	Urban housing backlog at provincial level (%)	Urban housing needs at city level (no. of households)	Urban LIH needs at city level (no. of households)
19	Balikpapan [a]	East Kalimantan	636,012	140,711	36.90	51,925	36,347
20	Yogyakarta	Yogyakarta	427,498	140,858	29.91	42,135	29,495

Source: National Statistics Agency 2019.
Note: a. The number of households in the cities of Samarinda and Balikpapan were estimated by dividing the total population with the national average household members due to the unavailability of data on the number of households.

Table A10.3 shows that **Jakarta**, **Medan**, **Bekasi**, **Bandung**, and **Surabaya** have the highest LIH needs of the WPS cities. This is in line with the MoPWH (2017a) data revealing that the top three provinces with the most potential for subsidized low-income housing under the FLPP scheme are West Java, North Sumatera, and Central Java, while the municipalities and regencies with the most potential for subsidized low-income housing are **Bandung**, **Surabaya**, and **Medan**. In addition, these cities are located in the provinces where the largest FLPP funds have been disbursed—**Jakarta**, West Java (**Bekasi** and **Bandung**), and East Java (**Surabaya**).

Table A10.3 also shows that the top 13 cities in terms of housing needs (more than 25,000) are Tier 1 cities (cities with a population over 1 million), while only seven Tier 2 cities (cities with a population between 500,000 and 1 million) have housing needs of more than 25,000 units.

Green buildings market potential and readiness

Availability of green building codes

The availability of green building codes indicates a high level of awareness, potential for co-operation, and support by local policy makers. It can also mean a high level of awareness across the buildings' value chain (project developers, lenders, suppliers, owners/tenants, etc.). The cities that have already established green building codes would likely have a larger potential market for green buildings. **Jakarta**, **Bandung,** and **Semarang** were the first cities in Indonesia to release mandatory regulations on green building codes. Similar regulations are being developed by **Makassar**, **Manado**, and **Surabaya** (interview with IFC, 2019). However, no concrete progress has been reported.

Green buildings market

The existing green buildings market is also an important factor in selecting target locations for the auction pilot. An auction mechanism has more promise in markets where potential bidders and other key stakeholders (private and state-owned building developers, real estate managers, associations, financial institutions, suppliers, and local authorities) are already aware of the specifics of more energy- and resource-efficient building development and may possess practical experience in areas like green building certification.

Bandung (more than 3,000 buildings) and **Jakarta** (260 buildings) have the highest number of registered green buildings in the country (Ekonomi Bisnis 2019). The mandatory green building codes that were established in 2012 and 2016 for Jakarta and Bandung, respectively, help drive green building development.

On the other hand, the current status or projected green building growth in other jurisdictions is difficult to assess as there is no centralized mechanism for the registration of green buildings at the local or national level. To identify the market potential for green buildings and the housing sector in other cities, the Consultant assessed areas with the largest number of GREENSHIP- and EDGE-certified buildings to date. The assessment results show that cities with the most green building activity outside Jakarta and Bandung include **Bali**, **Makassar**, **Medan**, **Surabaya**, and **Yogyakarta.** The results also revealed that almost 70 percent of the total certified buildings in the country are located in the Greater Jakarta area and Banten Province, particularly in Tangerang and Serang (12 percent), implying that green building activities are still centralized in select cities and regions.

Engagement in the National Green Building Toolkit training

Another criterion used for the green building market potential and readiness assessment for the climate auction pilot was the engagement of local governments in the National Green Building Toolkit training developed by the International Finance Corporation (IFC) for the MoPWH and conducted in September 2019. This criterion indicates which local governments possess a certain level of awareness of green buildings, and thus would be more likely to discuss support

mechanisms for green building development, including the introduction of an auction pilot in their jurisdictions.

The following cities have been engaged in the training (IFC, personal communication, 2019):

1) Banjarmasin—Center for Settlement Infrastructure South Kalimantan
2) Pontianak—Center for Settlement Infrastructure West Kalimantan
3) Denpasar—Center for Settlement Infrastructure Bali
4) Yogyakarta—Center for Settlement Infrastructure Special Region of Yogyakarta
5) Semarang—Center for Settlement Infrastructure Central Java
6) Surabaya—Center for Settlement Infrastructure East Java
7) Bandung—Center for Settlement Infrastructure West Java
8) Palembang—Center for Settlement Infrastructure South Sumatera
9) Padang—Center for Settlement Infrastructure West Sumatera
10) Bandar Lampung—Center for Settlement Infrastructure Lampung
11) Tanjung Pinang—Center for Settlement Infrastructure the Riau Islands Region
12) Makassar—Center for Settlement Infrastructure South Sulawesi
13) Manado—Center for Settlement Infrastructure North Sulawesi
14) Kendari—Center for Settlement Infrastructure Southeast Sulawesi
15) Serang—Center for Settlement Infrastructure Banten
16) Jakarta—Center for Settlement Infrastructure Jakarta Metropolitan Region

This list shows that a number of cities outside of the Java (and its largest cities like Jakarta, Surabaya, and Bandung) and Sumatera islands have been engaged in the training. This implies that green buildings could have wider uptake in the country in the future, provided that the cities listed above follow through with the national government's efforts and develop their own green building codes and regulations.

Table A10.4 Assessment results for longlisted potential cities for the climate auction pilot

City	Low-income market size potential (25,000+ housing units)	Prioritization in the national development planning and national housing				Green buildings market potential and readiness		
		WPS (strategic development areas)	LIH planning under National Medium-Term Development Plan (RPJMN)	National Affordable Housing Program (NAHP)	National Economic Strategic Area planning (Metropolitan Zones)	Availability of green building codes	Market potential for the green building sector	Engagement in the National Green Building Toolkit training
Jakarta	✓	✓	✓	✓	✓	✓	✓	✓
Surabaya	✓	✓	✓		✓		✓	✓
Bandung	✓	✓			✓	✓	✓	
Makassar	✓	✓			✓		✓	✓
Medan	✓	✓			✓		✓	
Semarang	✓	✓				✓		✓
Palembang	✓	✓			✓			✓
Padang	✓	✓						✓
Yogyakarta	✓	✓					✓	✓
Banjarmasin	✓	✓			✓			✓
Denpasar	✓	✓			✓			✓
Tangerang	✓	✓			✓			
Bekasi	✓	✓			✓			
Bandar Lampung	✓	✓						✓
Batam	✓	✓						
Balikpapan	✓	✓						
Pekanbaru	✓	✓						
Samarinda	✓	✓						
Bogor	✓	✓						
Malang	✓	✓						
Palu		✓	✓		✓			

City	Low-income market size potential (25,000+ housing units)	Prioritization in the national development planning and national housing				Green buildings market potential and readiness		
		WPS (strategic development areas)	LIH planning under National Medium-Term Development Plan (RPJMN)	National Affordable Housing Program (NAHP)	National Economic Strategic Area planning (Metropolitan Zones)	Availability of green building codes	Market potential for the green building sector	Engagement in the National Green Building Toolkit training
Serang		✔	✔	✔			✔	
Manado		✔			✔			✔

Source: Original compilation.

Jakarta

Jakarta is the most populous city in the country with a population of more than 10 million. Jakarta also has the highest number of households in Indonesia, 70 percent of which are low-income households that find it difficult to buy a house or apartment. Approximately 52.15 percent of residents in Jakarta do not yet own their own home and live in rented housing. To address this backlog, especially for low-income housing, the government of Jakarta has rolled out the **"0% down payment program"** for low-income multi-story housing. The government has introduced its first low-income apartment project and is planning to roll out more over the next few years (Tempo 2019).

In relation to housing development, the high land prices in Jakarta pose a challenge to developers. According to Real Estate Indonesia (REI) Jakarta, most private developers in the city are more interested in developing commercial-purpose buildings and/or middle- to high-income housing, and only 21 out of the 400 REI members are active in the city's LIH market segment. Developers typically have the same fixed costs for low-income housing as for middle- to high-income housing, yet their margin is very limited due to the ceiling prices of the subsidized LIH market segment (Ekonomi Bisnis 2018). Furthermore, with the limited land availability and high land prices, multi-story low-income housing is considered more feasible than landed housing in Jakarta (interview with stakeholders, 2019).

Spurred by the introduction of a green building code in 2012, Jakarta has become the nation's pioneer in advancing green building development. Low-income housing, however, is not targeted under the code.[42] In addition, Jakarta is the seat for developer associations including REI, the largest and oldest developer association in Indonesia, and serves as the headquarters of many major developers.

Although the LIH segment has not yet been prioritized in Jakarta's green building code, the Jakarta government's level of awareness of green buildings and its commitment to becoming the country's Green Building Center of Excellence, as well as private developers' general awareness of green buildings, is encouraging for the introduction of green building measures for future low-income apartments built under the "0% down payment program."[43]

Bandung

The City of Bandung, located about 153 kilometers (km) from Jakarta, is the capital of West Java province. Bandung has a population of roughly 2.5 million with an annual growth rate averaging 1.4 percent (Government of Bandung 2018).

LIH provision in Bandung is hindered by high land prices and the low ceiling price set by the government. As a solution, developers are looking to build multi-story low-income housing in the city (Bisnis.com 2017).

The government aims to reduce slum areas in the city by converting them to multi-story LIH complexes. The government launched the "*Apartement Rakyat*" program, which provides affordable apartments for low-income households. This includes low-income housing for rent (*Rusunawa*), low-income apartments for sale (*Rusunami*), and town row houses. The housing projects under the *Apartement Rakyat* program will be built in 13 locations across the city. Many of the planned apartment complexes will be built as a part of mixed-income development (e.g., under the Balanced Occupancy Policy) (Government of Bandung 2018).

With regard to green buildings, the government of Bandung established a regulation for green building codes in 2016. Unlike in Jakarta, low-income housing, especially low-income apartments, are within the scope of the code. The residential sector plays an important part in the code, since

[42] DKI Jakarta Green Building Codes do not cover low-income housing due to its smaller size. For example, the codes cover apartments of more than 50,000 m^2 in area, while low-income apartments usually have an area less than 50,000 m^2.

[43] It has been reported that this program has been rolled out for political reasons and its implementation remains to be seen.

residential buildings make up about 55 percent of all buildings in the city (Government of Bandung 2018). In the last five years alone, about 80 percent of total construction permits issued were for residential buildings. During the Consultant's engagement with the local government, it was revealed that the green building code is well enforced for new buildings and all new buildings have now complied with the code. The good coordination among different government agencies and other stakeholders such as the Green Building Council Indonesia (GBCI) also helps the successful implementation of the code. It is the Consultant's view that the level of commitment shown by the government to green building development and low-income housing makes Bandung a good candidate to host the future auction program.

Semarang

The city of Semarang is the capital of Central Java Province and is located approximately 450 km from Jakarta. Semarang had a population of 1,753,092 in 2017. Driven by immigration to the city, the population growth rate in Semarang was 3.05 percent between 2015 to 2017, which was higher than the national population growth rate (BPS Kota Semarang 2018).

Balikpapan

Balikpapan is the second-largest city in East Kalimantan province. The city had a population of 645,727 in 2018 with an annual population growth rate of 1.53 percent in 2017–2018 (National Statistics Agency of Balikpapan 2019).

In relation to dwelling ownership status, in 2018 about 61.82 percent of the total population were homeowners and 22.39 percent rented or leased their dwelling, while the remaining 15.8 percent had other types of ownership status (e.g., living in official residences) (Statistics Agency of East Kalimantan 2019). As such, Balikpapan is experiencing a housing backlog which reached 500,000 units in 2018 (Prokal 2018).

The housing market in Balikpapan is dominated by subsidized low-income housing. These new developments are mostly located in the North Balikpapan area, where there are vast lands available and thus land prices are a lot cheaper than other areas in the city. Furthermore, the north area of Balikpapan is close to the center of economic activities, making it convenient for residents to commute to and from work. On the other hand, new developments in other areas in the city, such as in the East Balikpapan, are for industrial facilities, plantations, and recreational facilities (Rumah.com 2019).

According to the Office of Housing and Settlement of Balikpapan, between 2015 and 2019, developers had planned to build 23,425 units of subsidized low-income houses. By 2019, only 70 percent or 16,397 units had been built by 39 developers (Rumah.com 2019). Among these, two developers, PT Muraker Griya Permata Asri and PT Jaya Sejahtera Borneo, have the largest portfolio of subsidized low-income housing in the city with a total of 3,285 and 2,586 built units, respectively (Bisnis.com 2019).

Developers consider the lack of available public facilities such as electricity and water as a challenge in developing new projects, and thus in achieving their targets. Furthermore, the ceiling price set by the government is hardly sufficient to cover land prices and land management costs. Nevertheless, housing associations are still planning to build subsidized low-income housing to meet the market demand, especially in the outskirts of the city. Government assistance to achieve the development target is still required (Prokal 2018).

Located about 40–80 km from the new capital city of Indonesia, the government is building infrastructure such as new highways and formulating a public transportation master plan connecting Balikpapan with the new capital (CNN Indonesia 2019; Bisnis.com 2020).

Annex XI. Baseline assessment

<annex is submitted as a separate excel sheet>

Annex XII. LIH building design characteristics

Table A12.1 Design characteristics

Description	Units	Landed houses	Apartments
Unit area	m^2	31	33
Common area per unit	m^2	0	8
External wall length per unit	m	13	6.75
Window-to-wall ratio	-	20%	20%
Bedrooms per unit	-	2	2
Floors	-	1	19
Units per project	-	300	595
Total floor area	m^2	9,300	24,544
Occupancy	people/unit	3	3
AC available	-	No	No
Water heating available	-	No	No
Ceiling fans available	-	No	No

Source: Original compilation.

Floor plan apartment design

Figure A12.1 An exemplary floor plan of apartment design

Source: Kalibata Residence 2019.

11.1 Floor plan landed housing design

Figure A12.2 An exemplary floor plan of landed housing design

Source: PT Multi Sanggar Utama 2019.

Annex XIII. Methodology of cost-benefit analysis

The first step to determining the incremental costs of EDGE-certified low-income housing (LIH) is to establish the design specifications for such housing units. Based on consultations with Indonesian housing developers, two typical building designs for low-income housing were identified for landed houses and apartments (see Annex XII for specifications). The Consultant additionally differentiated between subsidized and non-subsidized low-income housing (i.e., receiving government subsidies; see 2.1.1), leading to a total of four LIH types (i.e., two different "designs" with two "subtypes" each). For the purposes of this analysis, the subtypes differ only in terms of the income category from the EDGE online tool applied to each design. In the terminology of the EDGE online tool, we assume an income category of "low" for subsidized low-income housing and an income category of "lower middle" for non-subsidized low-income housing, as was also agreed with the International Finance Corporation (IFC)/EDGE team, leading to different usage patterns and a higher energy and water demand for the latter.

The four building designs were subsequently inputted into the EDGE online tool in order to determine the base case resource efficiency for each of the designs (i.e., energy, water, and embodied energy demand). Where possible, base case assumptions were adapted to reflect the findings from the first "Regulatory context analysis" task of the current project.

In order to determine the incremental costs of materials and construction that a developer needs to incur in order to achieve EDGE certification, an EDGE-compliant design needs first to be defined. The EDGE online tool provides a set of resource-efficiency measures that can be combined in order to increase LIH resource efficiency to the point at which EDGE certification can be achieved. Based on this set of EDGE measures, a shortlist of feasible measures was compiled in collaboration with local green building experts and LIH developers for both landed houses and apartments. This ensures that the resource-efficiency measures chosen are viable in the local context, that is, the materials, building products, and expertise needed to implement the resource-efficiency measures are present in the local market.

For the next step, a combination of resource-efficiency measures was chosen, which, if introduced to the LIH design, would enable 20 percent savings in energy, water, and embodied energy required for EDGE certification to be achieved. In order to achieve EDGE certification at the lowest incremental cost possible to the project developer, the set of resource-efficiency measures were developed as follows:

1. Resource-efficiency measures were added to the design in order of increasing cost until resource-efficiency targets (20 percent in the case of the EDGE standard or 40 percent for EDGE+) were met or exceeded.
2. Next, any superfluous measures were removed again (with the most expensive measures removed first), until the resource savings were equal to or just above the two EDGE certification levels mentioned above. Resource-efficiency measures that resulted in negative incremental costs (i.e., that reduce the construction cost of the low-income housing) were not removed, in line with the approach adopted which seeks to enable EDGE certification to be achieved at the lowest cost to the building developer.

The above procedure guarantees the lowest incremental cost for a given efficiency standard and was carried out for apartment and landed house designs for a selection of four focus cities for the analysis—Jakarta, Bandung, Semarang, and Balikpapan. This selection is based on the initial findings of the Market Scoping study.

The EDGE online tool estimates the incremental costs of construction and materials that would result from the introduction of selected resource-efficiency measures (based on the EDGE cost model), as well as the associated operational resource savings that homeowners would perceive as a result of inhabiting an LIH EDGE-certified home. For each of the certified designs modeled in the EDGE online tool, these datasets were transferred to an Excel tool (attached as a separate Annex XIII to this report). Building low-income housing to EDGE standard and certifying it entails, however, additional costs. The additional costs are not reflected in the EDGE tool. They are

nonetheless presented in the Excel tool and taken into account when estimating the incremental costs that developers will need to incur in in order to achieve EDGE certification.

The incremental costs associated with building low-income housing to the EDGE standard therefore include:

- Design, planning, and consultancy costs for achieving EDGE certification, including the consultancy cost for assisting the project developer in selecting the resource-efficiency measures for increasing resource efficiency to EDGE certification level and managing the EDGE certification process, including the preparation of the necessary documentation during the project's design and construction stages.
- Construction and material costs, including labor, materials, and equipment required, as well as import duties, local taxes, wastage allowances, and system commissioning. These costs were taken from the EDGE online tool.
- Certification costs for EDGE, including account registration (per project site).
- Cost of capital, under the assumption that a developer would have to take a loan to cover the incremental up-front investment, that a developer would expect this incremental investment to return and that the incentive needed to compensate for such additional investment will only be disbursed once auction facility requirements have been met.

The incremental costs to the LIH developers are those that the auction facility would need to be able to offset.

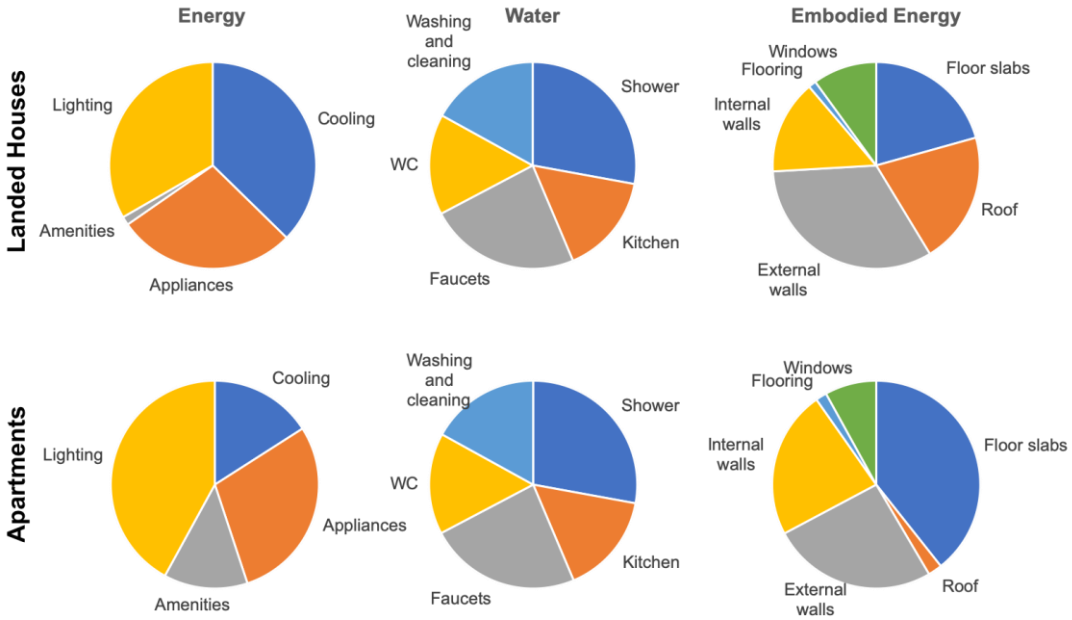
The Excel tool provides metrics that can then be used to estimate the potential impact at scale that could be achieved for a given climate auction incentive budget in terms of energy, water, and operational and embodied CO_2 emissions saved, that is, how much EDGE-certified floor space would a certain volume of incentive money be able to "buy" (approximately).

11.2 Cost-benefit analysis tool

<annex is submitted as a separate excel file>

Annex XIV. Breakdown of baseline resource demand for landed houses and apartments

Figure A14.1 Distribution of resource demand for subsidized low-income landed houses and apartments



Source: Original compilation.

11.3 EDGE efficiency measures and their respective incremental costs

Table A14.1 EDGE efficiency measures considered for landed LIH house designs, along with the incremental costs for construction and materials as well as the resource savings associated with each measure (for the Jakarta region) with respect to the base case

	Efficiency measure	EDGE code	Incremental cost (kIDR/m^2)	Energy savings	Water savings	Embodied energy savings
Material efficiency measures						
1	Autoclave aerated concrete blocks in external walls	HMM03	-119	4.1%	-	26.3%
2	In-situ reinforced concrete slab (70 mm) and steel rebar (0.01 kg/m^2)	HMM01	-	-	-	17.4%
3	Autoclave aerated concrete blocks in internal walls	HMM04	-	-	-	11.2%
4	Common brick wall (150 mm) with plaster	HMM03	17	-0.6%	-	9.0%
5	Clay roofing tiles on steel rafters	HMM02	85	-3.1%	-	13.2%
Water efficiency measures						
1	Dual-flush WC	HMW04	11	-	9.2%	-
2	Low-flow showerheads (8 liters/minute)	HMW01	14	-	9.2%	-
3	Low-flow bathroom faucets	HMW03	21	-	11.9%	-
4	Low-flow kitchen faucets	HMW02	21	-	2.0%	-
5	Recycled grey water for flushing	HMW07	40	-1.4%	15.8%	-
Energy efficiency measures						

	Efficiency measure	EDGE code	Incremental cost (kIDR/m^2)	Energy savings	Water savings	Embodied energy savings
1	Reduced window-to-wall ratio	HME01	-168	2.8%	-	0.5%
2	Natural ventilation	HME09	-	16.2%	-	-
3	Reflective wall paint	HME03	23	1.6%	-	-
4	Energy-saving lighting—internal spaces	HME16	29	21.4%	-	-
5	PVs (10% of annual use)	HME07	37	5.1%	-	-
6	High thermal performance glass	HME08	46	7.0%	-	-1.8%
7	External shading	HME04	176	4.1%	-	-

Source: Original compilation.
Note: The measures are shown in order of lowest cost (1 = least expensive measure). Please see methodology in section 9.1 for an explanation of how measures were combined in EDGE to reach required resource savings at the lowest total cost and greatest cost-effectiveness.

Table A14.2 EDGE efficiency measures considered for LIH apartment designs, along with the incremental costs for construction and materials as well as the resource savings associated with each measure (for the Jakarta region) with respect to the base case

	Efficiency measure	EDGE code	Incremental cost (kIDR/m^2)	Energy savings	Water savings	Embodied energy savings
Material efficiency measures						
1	Autoclave aerated concrete blocks in walls	HMM03	-46	2.2%	-	20.7%
2	Composite in-situ concrete and steel deck	HMM01	-	-	-	23.7%
3	Autoclave aerated concrete blocks for internal walls	HMM04	-	-	-	17.5%
Water efficiency measures						
1	Dual-flush WC	HMW04	8	0.3%	9.2%	-
2	Low-flow showerheads (8 liters/minute)	HMW01	11	0.3%	9.2%	-
3	Low-flow bathroom faucets	HMW03	16	0.4%	11.9%	-
4	Low-flow kitchen faucets	HMW02	16	0.1%	2.0%	-
5	Recycled grey water for flushing	HMW07	30	-0.9%	15.8%	-
Energy efficiency measures						
1	Reduced window-to-wall ratio	HME01	-65	1.5%	-	0.4%
2	External shading	HME04	-10	2.7%	-	-
3	Natural ventilation	HME09	-	6.6%	-	-
4	Energy-saving lighting – common areas	HME17	7	2.3%	-	-
5	High thermal performance glass	HME08	18	4.5%	-	-1.4%
6	Energy-saving lighting—internal spaces	HME16	23	23.3%	-	-
7	PVs (10% of annual use)	HME20	37	8.3%	-	-

Source: Original compilation.
Note: The measures are shown in order of lowest cost (1 = least expensive measure). Please see the methodology in section 9.1 for an explanation of how measures were combined in EDGE to reach required resource savings at the lowest total cost and greatest cost-effectiveness.

Annex XV. Current financing and incentive landscape for green building projects

Table A15.1 Current financing and incentive landscape for green building projects in Indonesia

Financing/incentive program	Eligible recipients	Access	Scope	Remark
PT Sarana Multi Infrastruktur (PT SMI) subordinated loan facility scheme	Public/ private developers	PT SMI	Infrastructure projects, including green buildings	To date, no energy efficiency project in the commercial building sector has been financed by these credit lines
PT SMI Equity Investment Scheme				
PT SMI Green project funding from green bond/green sukuk proceeds			Energy efficiency improvements in infrastructure, green buildings with at least 10% savings from business as usual	Green sukuk is channeled through PT SMI's subsidiary, Unit Usaha Syariah (Sharia Business Unit)
Joint Crediting Mechanism (JCM): government-to-government scheme providing a grant from the Government of Japan for Indonesian companies to purchase energy efficiency technologies from Japanese companies	Public/ private developers	Indonesia JCM Secretariat (under the Coordinating Ministry of Economic Affairs)	Energy efficiency in buildings	JCM provides finance of up to 50% of the project financing, while projects must find the remaining 50% from private sources
Sustainable Development Goals (SDG) Indonesia One by PT SMI: blended private/public financing scheme	Public/ private developers	PT SMI	Infrastructure projects related to the achievement of SDGs, including green buildings	Relevant products are the de-risking facilities, financing facilities, and equity fund
Viability Gap Fund (VGF)	Public-private partnership (PPP)	Ministry of Finance	Infrastructure projects under the PPP scheme	Available only as last resort financing. To date, no energy efficiency project in the commercial building sector has been financed by VGF
Tax waivers	Public/ private developers	Tax waiver by the Directorate General of Taxes, Ministry of Finance	Multi-story rental housing units (*Rusunami*)	1–5% tax waiver for private developers selling multi-story rental housing units (*Rusunami*) at a price below Rp 144 million ($10,100)

Financing/incentive program	Eligible recipients	Access	Scope	Remark
Energy Service Company (ESCO)	Public/ private developers	Business-to-business between the building owner and the ESCO	Energy efficiency in buildings	ESCOs are typically contracted by a commercial building owner to provide energy efficiency services under a specific tenor but not develop green low-income housing

Source: Coordinating Ministry of Economic Affairs 2016; PT SMI 2019; Sustainable Energy for All 2019.

Box A14.1 Case study: Green financing support for green buildings in Colombia

Colombia is among the top 20 fastest-growing markets globally for construction spending. Driven by the opportunity to achieve the national greenhouse gas reduction commitment through this sector, the Colombian Government liaised with the International Finance Corporation (IFC) to develop national green building codes promoting energy efficiency and water conservation in building construction (IFC 2017)

The National Chamber of Construction is tasked with leading the implementation of the national green building codes, which were formulated to be in line with the Excellence in Design for Greater Efficiencies (EDGE) certification. IFC also further encouraged the financial and construction sectors to tap into this new green building market by issuing green bonds as a new financial product in the sector. Bancolombia and Davivienda, two of the largest commercial banks in Colombia, worked with IFC on issuing about $260 million in green bonds to support climate projects, including green buildings. VerdeVivo Housing Project, for example, was financed with green bonds from Bancolombia. Another project that received green-bond funding from Bancolombia is Ariza Torre Oriente Housing developments, where green design and construction resulted in up to 25 percent savings in energy use and 29 percent savings in water use (EDGE 2019).

The strong drive from the government as picked up by the financial sector has been key in providing the enabling environment for green bonds to support green buildings in Colombia. The resource-efficiency innovations are helping buildings in the country use 10 percent to 45 percent less energy and water, which will avoid nearly 190,000 tons of greenhouse gas emissions by 2021 (IFC 2017). Davivienda marked a significant milestone in the Latin American financial sector by receiving the largest green bond issuance by a private institution from IFC, which has been used to finance large sustainable construction projects. Bancolombia and Davivienda are championing the use of EDGE certification to ensure a metrics-driven approach to their investments that reduces exposure to risk in the building construction sector. This exemplary leadership from financial institutions could be replicated in other nations including Indonesia, where commercial banks could encourage infrastructure developers to apply green codes/standards, hence “greening” the business-as-usual investments in the built infrastructure sector while retaining a sound economic case.