KfW Development Bank

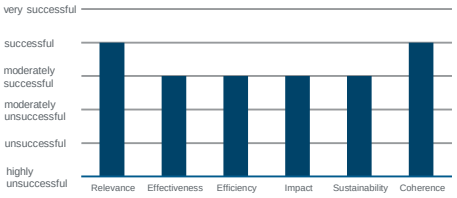
Ex - post evaluation
EcoCasa II, Mexico

Title	FC programme for renewable energy, energy efficiency and environmental protection II (EcoCasa)		
Sector and CRS code	Energy conservation and demand-side efficiency, 23183		
Project number	201567833		
Commissioned by	Federal Ministry for Economic Cooperation and Development (BMZ)		
Recipient/Project-executing agency	SOCIEDAD HIPOTECARIA FEDERAL (SHF)		
Project volume/ Financing instrument	EUR 54,997,728 / low-interest external loan		
Project duration	04/2016 – 12/2020		
Year of report	2023	**Year of random sample**	2023

Objectives and project outline

The objective at outcome level was to reduce electricity consumption and the associated expenditure on electricity and carbon emissions in EcoCasa housing units compared to reference housing units. At impact level, the goal was to reduce greenhouse gas emissions in the residential sector compared to the business-as-usual scenario. To achieve the objectives, the project provided low-interest loans for project developers and building companies to finance the construction of energy-efficient housing units. The programme's direct beneficiaries were low- and medium-income households.

Overall rating:
moderately successful



Key findings

As part of the project, 12,852 housing units were built; their energy requirements were calculated to be over 20% lower than those of reference buildings. However, the real energy savings achieved in practice were significantly lower. The project was rated as "moderately successful" for the following reasons.

– The project largely met Mexico's national objectives in housing construction and the objectives of the German Federal Government. The design was generally appropriate. However, some indicators were only partially suitable for recording the benefit of the project for the target group and the developmental impacts. The relevance of the project is still rated as good overall.

– The project was characterised by very good cooperation between the various Mexican organisations in the construction sector. This is the main reason for evaluating the coherence as successful.

– Significantly more energy-efficient housing units were built than planned. However, the user behaviour did not correspond to the special features of the housing units. In addition, modifications were carried out so that the real electricity savings were significantly lower than calculated, which also affected the efficiency of the use of funds and the developmental impacts. The effectiveness, efficiency and impact are therefore only moderately successful.

– The project has helped to create necessary capacities for the sustainable use of energy efficiency measures in the Mexican construction sector. Despite the current downturn in these types of new construction projects due to a lack of financial incentives, sustainability is regarded as successful in the medium term.

Conclusions

– Low-interest bridging loans for commercial developers combined with financial incentives for buyers have proven to be very effective in the promotion of energy-efficient new construction in social housing.

– Calculation tools with transparent and clear award criteria give commercial developers planning certainty in their investment decisions.

– User behaviour influences the energy efficiency of buildings. Proper use requires extensive clarification and should be considered more closely in future projects, including as part of complementary measures.

– Projects with the aim of contributing to a sector transformation require a medium- to long-term perspective. They should initially focus on creating the necessary prerequisites for the transformation.

Ex post evaluation – rating according to OECD-DAC criteria

Overview of sub-ratings:

Relevance	2
Coherence	2
Effectiveness	3
Efficiency	3
Impact	3
Sustainability	3
Overall rating:	**3**

General conditions and classification of the project

The project is the second phase of the FC programme FC module for renewable energy sources, energy efficiency and environmental protection in Mexico (EcoCasa II). The second phase was intended to expand the results of the first phase, the predecessor project EcoCasa I (BMZ no. 2011 66 164), and to achieve a greater broad impact at national and international level. In addition, individual conceptual further developments were planned, including the integration of further sustainability criteria in the provision of low-interest construction loans. In the first phase of the EcoCasa project, a number of houses were initially built on low-cost land away from the city centres, where there was a lack of any infrastructure or connections to local public transport. Poorer households not only had poorer access to public services, but the longer transport routes also caused higher emissions. Due to the unattractiveness of flats far from the city, vacancies increased.

This was taken into account in the design of the project's second phase by making qualitative and quantitative changes to the selection criteria for settlements with energy-efficient housing units. These criteria included (i) the proximity of the new housing units to the city centres, (ii) the existence of infrastructure facilities and public transport or urban infrastructure, (iii) the energy and greenhouse gas footprints of the building materials used over their entire life cycle, and (iv) water consumption. EcoCasa II also included the construction of energy-efficient rental apartments.

Brief description of the project

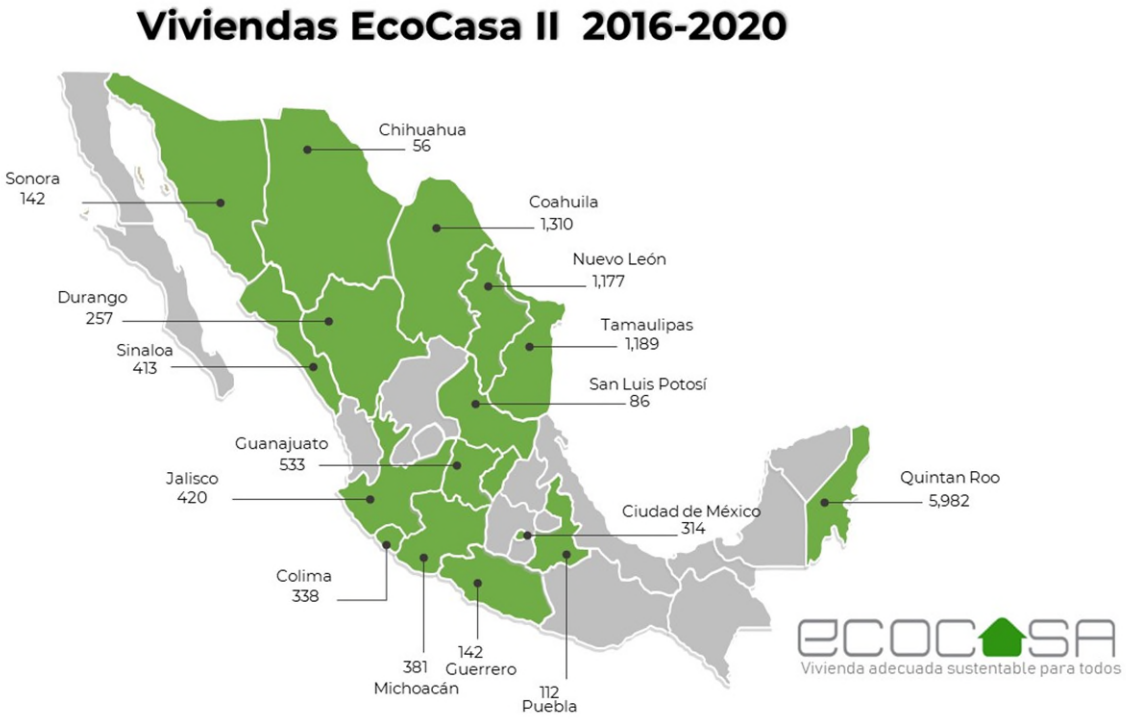
The development policy objective of the EcoCasa programme was to achieve a reduction or avoidance of CO_2e emissions in Mexico's housing sector and thus contribute to greater climate friendliness or sustainability of the energy system in Mexico overall. This should be done by reducing energy consumption in newly built housing units. To this end, the project provided a low-interest loan for the financing of two credit lines: a) bridging loans for particularly energy-efficient owner-occupied flats/houses (Component 1 – Venta) and b) long-term loans for the construction of energy-efficient rental apartments (Component 2 – Renta). The Sociedad Hipotecaria Federal (SHF) state development bank was the borrower and project-executing agency. It granted low-interest loans to commercial developers via commercial banks for projects with residential units that demonstrated higher energy efficiency and sustainability than comparable standard buildings. Direct beneficiaries of the programme were low- and medium-income households in Mexico. The agreed project term was originally scheduled to run from April 2016 to December 2021. The second phase was already completed at the end of 2020 December due to the rapid and efficient implementation of the planned measures.

Breakdown of total costs

		Inv. (planned)	Inv. (actual)
Investment costs (total)	**EUR million**	**81.4**	**81.4**
Counterpart contribution	EUR million	26.4	26.4
Debt financing	EUR million	55	55
of which BMZ funds	*EUR million*	*55*	*55*

Map/satellite image of the project country including project areas

Figure 1: EcoCasa II project regions with number of supported housing units – status 2020



Source: SHF

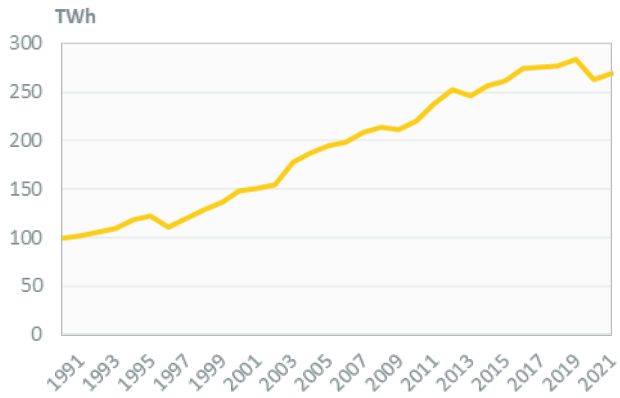
Rating according to OECD-DAC criteria

Relevance

Policy and priority focus

The EcoCasa programme, which started its first phase in 2013 and is currently in its third phase, was part of a strategy of the Mexican government under President Peña Nieto to slow the high growth of national energy consumption and greenhouse gas emissions. In particular, national electricity consumption had increased by 166% from 99 to 264TWh between 1990 and 2012, while carbon dioxide emissions increased from 257 to 459MT during the same period (Figure 2).[1] Mexico was therefore one of the 15 countries with the highest electricity consumption and the highest greenhouse gas emissions in the world. To date, only Brazil has higher electricity consumption and emissions in Latin America.

Figure 2: National electricity consumption of Mexico



Given the significant importance of the residential sector for electricity consumption, which accounts for an average of around 24% of national consumption[2], the government has implemented several energy-saving programmes since the late 90s in which it promoted the use of energy-efficient lamps and household appliances. In addition, electricity tariffs for high consumption have been increased. These measures contributed to a reduction in the average annual electricity consumption per household from 1,750kWh in 2001 to 1,600MWh in 2013.[3] However, there were differences between parts of the country with temperate and hot climates: In temperate climates, electricity consumption was generally lower and decreased significantly, while in warmer areas it was significantly higher and stagnated over the years, which was linked to the increasing demand for room cooling using air conditioning.[4] Significant savings can be achieved here through more energy-efficient residential units that better protect the interior climate from high outside temperatures. However, the willingness of the construction sector to implement energy efficiency measures for new buildings was low due to cost and profitability reasons as well as a lack of experience and the availability of suitable materials. This was precisely where the basic concept for all phases of the EcoCasa programme started, in which it compensated for the additional costs by providing low-interest loans for the financing of corresponding construction projects and facilitated experience with new building materials and technologies.

[1] https://www.iea.org/countries/mexico ; 1TWh (terawatt hour) equals 1 billion kWh (kilowatt hours)

[2] https://www.enerdata.net/estore/energy-market/mexico/

[3] According to the German Federal Statistical Office, the annual electricity consumption in Germany is between 2,000 and 5,000kWh, depending on the size of the household
https://www.destatis.de/EN/Themes/Society-Environment/Environment/Environmental-Economic-Accounting/private-households/Tables/electricity-consumption-private-households.html

[4] Análisis de la evolución del consumo eléctrico del sector residencial entre 1982 y 2017 e impactos de ahorro de energía
https://www.gob.mx/cms/uploads/attachment/file/439598/cuaderno2nvociclo_1.pdf

For the Government of Mexico, improving the energy balance and sustainability of new buildings, as set out in the 2013 National Sustainable Housing Strategy (Estrategia Nacional de Vivienda Sustentable), was a high priority.[5] Due to population growth and increasing prosperity, there was substantial need for new housing units. Expectations were that several hundred thousand new residential units would be built each year. The government specifically promoted social housing, as more than 20% of the population were affected by housing shortages and did not have the financial means to buy small houses on the regular market without subsidies. For this reason, the EcoCasa programme also focused on socially oriented housing projects by private commercial developers.

The objectives of EcoCasa corresponded to the German Federal Ministry for Economic Cooperation and Development's (BMZ) policy priorities and quality characteristics in several respects, in particular with regard to achieving the UN Sustainable Development Goals and the international climate targets. On the one hand, the project aimed to contribute to improving the housing and living conditions of low-income families with regard to Sustainable Development Goals 1 (No Poverty) and 11 (Sustainable Cities and Communities), and on the other hand, the project focused on the more efficient use of electricity (Sustainable Development Goal 7) and the associated reduction or avoidance of greenhouse gas emissions in the housing sector (Sustainable Development Goal 13). It should also be noted that the EcoCasa programme was part of a Nationally Appropriate Mitigation Action (NAMA). The measure for energy-efficient residential buildings (new construction) was a "supported NAMA", which in turn was based on the conceptual approaches of NAMA for sustainable living.[6] Since the beginning of the 2000s, the Federal Republic has advocated at the international Conferences of the Parties (COP) to the United Nations Framework Convention on Climate Change for the establishment of NAMAs as nationally appropriate, intended mitigation measures of developing and emerging economies and committed to extensive technical and financial assistance, including the significant financing of a special NAMA facility. In this respect, the NAMAs for sustainable housing in Mexico, which were supported by Germany with technical and financial assistance, served as an international model and were presented with effective publicity at COP 17 in Durban in 2011. The NAMAs' targets were also included in the Nationally Determined Contributions (NDCs) for achievement of the Mexican government's Paris climate targets in 2014 and in the updated 2022 version, in which the government pledged a significant reduction in greenhouse gas emissions compared to a business-as-usual scenario, including through the promotion of energy-efficient buildings.

Focus on needs and capacities of participants and stakeholders

In Component 1, the project target group was "Venta" households with low and medium incomes, which had a gross income of no more than twelve times the minimum wage (EUR 1,300 in the 2016 project appraisal year).[7] There was particularly high demand for housing in this income group; it was estimated to be over eight million housing units in 2016. The Mexican government provided loans and grants to lower-income families to enable the acquisition of low-cost residential property and stimulate demand. An increase in the price of houses by 10 or 20% as a result of energy efficiency measures would not have been enforceable in this market segment due to a lack of purchasing power. The costs and thus the prices of energy-efficient buildings therefore had to be almost the same compared to conventional houses. With low-interest loans, cost parity was established and the construction industry was motivated to make corresponding investments. In terms of running costs, the target group had a high interest in keeping their expenditures on electricity, gas and water as low as possible. Particularly in the hot regions of Mexico, where outdoor temperatures often exceed 30°C even at night, the use of air conditioning systems can account for over 50% of electricity costs.[8] Households therefore have conflicting objectives between ensuring a comfortable room temperature with the help of the air conditioning system and the lowest possible electricity consumption to save money. The conflicting objectives can be significantly mitigated by an energy-efficient house, making this particularly relevant for households in hot regions.

[5] See also Estrategia Nacional de Vivienda Sostenible (https://ecotec.unam.mx/wp-content/uploads/EstrategiaNacionalparalaViviendaSustentableCONUEE.pdf)

[6] NAMAs could be registered as either domestic or supported NAMAs. Supported NAMAs are actions that are performed with the help of external support.

[7] At the start of the second phase, the minimum wage in 2016 was MXN 73 (= EUR 3.55 per day, approx. EUR 106.5 per month); https://www.gob.mx/cms/uploads/attachment/file/104993/Tabla_de_salarios_minimos_vigentes_a_partir_de_01_enero_2016.pdf

[8] Electricity and gas are the main energy sources in Mexican households. The percentage distribution of energy consumption by final-consumption activity in 2014 was as follows: Hot water (65.0%), cooking food (17.2%), air conditioning and ventilation (7.0%), cooling food (6.9%), lighting (2.8%) as well as entertainment and other (1.1%), see: https://www.frontiersin.org/articles/10.3389/frsc.2021.662968/full. Energy efficiency measures in the building envelope can reduce electricity consumption for room cooling and gas consumption for heating in particular. However, the latter plays only a minor role, even in Mexico's temperate climate regions.

The target group of Component 2 “Renta” were households in multi-occupancy buildings with a gross income of up to 15 times the minimum wage (EUR 1,600). Unlike in the first phase, EcoCasa II used this component for the first time to promote the construction of energy-efficient rental apartments in urban areas with high population density, good transport connections and public services in order to establish energy efficiency standards on the market when building new rental apartments. As rental prices are high in city centres, the target group here has been expanded to include families with higher incomes. Interest rate reductions that go beyond SHF’s usual terms for loans to families with higher incomes were not provided in the “Renta” component.

Since the project has an impact at the level of domestic households, there was no explicit focus on gender. Nevertheless, it was assumed that women in particular would benefit from the expected improvement in room temperature, as they tend to spend more time in the housing units during the day.

Appropriateness of design

The design of the project was technically, organisationally and financially appropriate and very well suited to contributing to solving the core problem (strongly increasing electricity consumption and correspondingly increasing electricity costs and greenhouse gas emissions in the housing sector). At the same time, the design had a holistic approach, as it had an impact on the environmental (CO_2 e-savings), social (target group: low-income families) and economic levels (market development). The target system with the various indicators was understandable and logical, although individual indicators were located at the wrong level (outcome instead of output and impact instead of outcome). A fundamental shortcoming was that the value allocation for many indicators was based purely on simulation tool calculations with the structural-physical properties of the buildings as input. The assumptions underlying the calculation with regard to user behaviour and the development of the electricity mix are not mentioned and are therefore not verifiable. In principle, it would have been possible and better in terms of the meaningfulness of the intended impacts to work with real values for most indicators, but this would have required a well-functioning monitoring system. The original indicator, which quantifies the CO_2e reduction over the lifetime of the houses built, is generally not verifiable because it lies far in the future. It therefore represents a theoretical value.

New indicators were developed as part of the EPE. Table 1 contrasts the old targets and success indicators with the new targets and indicators. Specifically, the following has been adapted: The project constitutes an FC module as part of an FC programme. The project’s contribution to the programme objective in accordance with the results matrix from 7 January 2016 (“The sustainability of the energy system in Mexico is increased.”) was too broadly defined and only partially matched the impact level of the FC module in terms of content. The DC programme objective (impact) was specified as follows for this EPE and supplemented with the corresponding indicators. The focus here is on whether the project achieves an impact in Mexico’s housing sector in the form of a growing proportion of energy-efficient houses and reduced greenhouse gas emissions in addition to the direct impact on the supported housing units.

Table 1: Initial and adjusted targets

Targets	Success indicators (old)	Targets (new – EPE)	Indicators (new):
DC programme objective: The sustainability of the energy system in Mexico has increased.	1. Increase in annual primary energy generation from new renewable energy sources 2. Increase in annual savings in energy consumption 3. Increase in annual avoided greenhouse gas emissions	*Greenhouse gas emissions in the residential sector are lower than the business-as-usual scenario.*	1. Proportion of energy-efficient houses in registered new buildings at project completion. 2. The electricity-based greenhouse gas emissions in the residential sector amount to 95% of the business-as-usual scenario.
Outcome Contribution to the government’s efforts to reduce CO_2e emissions in	Reduction of CO_2e emissions from housing units promoted under the EcoCasa programme	*Electricity consumption and the associated expenditure on electricity and CO_2e emissions are*	1. Reduction of electricity consumption per m^2 of floor area to 67% of the value of a

the new construction sector.	(EcoCasa I, EcoCasa II) over the life cycle of the housing (40 years).	*reduced in EcoCasa housing units compared to reference housing units.*	reference residential unit (baseline value) 2. Reduction of electricity costs per housing unit/year to 67% of the baseline value. 3. Reduction of carbon emissions per m^2 of floor area to 73% of the baseline value based on tCO_2e/m^2 and year
Output Energy-efficient housing units are properly built and sold to final beneficiaries.	1. Number of energy-efficient housing units financed under the EcoCasa programme completed and sold by 2020: 2. Electricity consumption per m^2/year: 3. Electricity costs per housing unit/year 4. Reduction of CO2e emissions per m^2/year 5. Improvement of the comfort standard in the household (C) (temperature 20°–25°C – according to "Supported NAMA for Sustainable Housing in Mexico")	*Unchanged, same formulation as the old target*	Number of energy-efficient housing units financed under the EcoCasa programme completed and sold by 2020.

The theory of change (construction of energy-efficient housing units → Savings in electricity consumption and electricity costs + reduced emissions → Energy-efficient building becomes the standard + high CO_2e savings in the sector) is plausible. The main output "Financing and construction of 8,400 energy-efficient housing units" will lead to a "reduction in electricity consumption, electricity costs and CO_2e emissions per m^2" if used appropriately by the target group. If the savings (outcomes) achieved prove to be sufficiently attractive for all relevant stakeholders, the concept of energy-efficient buildings in the housing sector will continue to spread, so that more energy-efficient houses will be built and more CO_2e emissions will be avoided in the housing sector in the medium to long term. The allocation of indicators was modified in accordance with this results logic and individual indicators were added.

Response to changes/adaptability

As a result of the change of government in Mexico in December 2018, some government institutions, including the executing agency Sociedad Hipotecaria Federal (SHF), have reduced salaries and pensions for senior executives, which is why a large share of management has left the organisation. The project-executing agency made every effort to fill the resulting staff gaps with qualified personnel as quickly as possible. However, the change in personnel and the protracted process of filling new vacancies reduced SHF's performance for months.

President López Obrador's government reduced subsidies for housing purchases as part of a new housing policy, which led to a decline in demand, especially in social housing. It was not possible to compensate for the lack of grants under the EcoCasa project, so the project was prepared for a downturn in annual construction work.

The number of construction projects was also reduced in 2020 due to the COVID-19 pandemic, which meant significant revenue losses for the commercial developers. With special measures, SHF supported the survival of the commercial developers and thus contributed to securing the future of the EcoCasa project in the post-COVID period.

In the course of the second phase, SHF adapted the building properties and efficiency values of the reference buildings and standardised them for all climate zones. On the one hand, this had a positive impact on the

planning for the developers, who are building across different climate zones; on the other hand, the adjustment meant a reduction in the efficiency of the reference construction, especially for the temperate climate region. In order to achieve a sufficiently high level of energy efficiency, SHF requested higher CO_2e savings (30% instead of 20%) compared to the new baseline for some climate zones.

Summary of the rating:

The project was largely in line with Mexico's national objectives, the planned rapid construction of new housing units for low- and medium-income families while simultaneously improving energy efficiency and sustainability of the buildings. This was intended to contribute both to the Sustainable Development Goals (SDGs), in particular Goal No. 7 "Ensure access to affordable, reliable, sustainable and modern energy for all", as well as to the climate framework agreement and to meeting the Paris climate goals, which is largely in line with the Federal Ministry for Economic Cooperation and Development's (BMZ) targets.

The design of the second phase of the project was generally appropriate and took into account important learning experiences from the first phase. However, some indicators were only partially suitable for recording the benefit of the project for the target group and the developmental impacts. In addition, their assignment within the theory of change was not consistent. One shortcoming of the design was that the steps for following up on the project's impacts were not specifically defined.

Relevance: 2

Coherence

Internal coherence

The project was an FC module as part of the DC programme "Sustainable Energy in Mexico", which consisted of three additional FC and four technical cooperation (TC) modules at the start of EcoCasa II. It was part of a more extensive Mexican-German cooperation in the energy sector, which began in 2005 and in which several German federal ministries (Federal Ministry for Economic Cooperation and Development (BMZ), Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), Federal Ministry for Economic Affairs and Climate Action (BMWK)) were involved on behalf of the German Federal Government. The cooperation included, among other things, advisory programmes to create favourable framework conditions for investments in renewable energy sources, support for the use of solar and wind energy, subsidies for solar hot water systems, improvement of energy efficiency in the industry sector and the promotion of energy-efficient buildings through both TC and FC programmes. Overall, the various projects served to support a sustainable energy transition in Mexico. The objectives were to increase primary energy generation from new renewable energy sources and to reduce energy consumption and associated greenhouse gas emissions.

The EcoCasa programme was based on the conceptual preliminary work of the TC project "Mexican-German NAMA Programme – ProNama" (PN: 2011.9037.0), which supported the Mexican partner in developing NAMAs to avoid emissions in the building sector and other sectors. As part of the TC project activities, energy consumption and greenhouse gas emissions of various standard buildings were analysed and a tool for calculating savings when using energy-efficient technologies was developed. In addition, the TC project supported the EcoCasa project in the first and, to some extent, the second phase with conceptual measures and training activities. As part of the project "Implementation of the New Housing NAMA in Mexico" of the NAMA facility (PN: 2012.9223.4), which included a TC and FC component, further TC accompanying measures were implemented in the second phase of the EcoCasa project. They were used to train private housing developers, transfer energy-efficient technologies and raise awareness among home buyers. With the funds provided, the FC component promoted bridging loans specifically for small and medium-sized housing developers, grants to housing developers for certain technologies and specific advice for construction financing. The second phase of the EcoCasa project evaluated here was therefore complementary and collaborative within German DC, with the various instruments complementing each other effectively.

External coherence

During the EcoCasa II term, the Mexican government tried to use various instruments to boost social housing while simultaneously reducing household energy consumption. The Ministry of Agrarian, Territorial and Urban

Development's (SEDATU) National Housing Commission (CONAVI) granted income-based subsidies to families for the purchase of small houses, particularly families with an income of up to five times the minimum wage. CONAVI worked closely with the Mexican National Workers' Housing Fund Institute (INFONAVIT) for socially insured workers in the private sector and the Housing Fund of the Institute for Social Security and Services for State Workers (FOVISSSTE) for workers in the public sector. The aim was to provide more than 500,000 mortgage loans per year for the purchase of housing units, especially for low-income families. INFONAVIT also offered green mortgages to buyers of social housing. The intent was to use an additional contribution to the traditional loans to cover the additional costs of technologies and measures that lead to lower consumption of electricity, gas and water. Both financing offers, the grants from CONAVI and the green mortgage loans, were initially based on existing standards for determining and labelling the energy efficiency of household appliances and systems. Later, in a coordination effort between the different organisations (CONAVI, INFONAVIT, SHF), it was agreed that the official (mandatory and voluntary) standards concerning the energy efficiency of the building envelope or the overall efficiency of the building are also required for the grants to be provided. Complementary to these various financial measures, which were primarily aimed at buyers of single-family and two-family homes, SHF's EcoCasa programme was used to attract and accelerate the interest of private commercial developers in the construction of energy-efficient social housing units through favourable bridging loans. Since both CONAVI and INFONAVIT, whose offers were used by numerous socially insured low- and medium-income buyers, used the same, uniform criteria and tools for assessing the energy efficiency and environmental friendliness of new buildings for the individual promotional measures as EcoCasa, they favoured EcoCasa-financed projects when making their promotional funds available. Consequently, the construction of energy-efficient buildings was supported simultaneously from several sides.

In addition to Germany, other countries also supported the Mexican government's efforts to make the construction of housing units more sustainable. The project was implemented in cooperation with other donors in the sector, in particular with the Inter-American Development Bank (IDB), which participated financially in the credit line for the bridge loans for project developers and building owners, and financed various complementary measures to qualify the participants. In parallel to EcoCasa, the EU's Latin America Investment Facility (LAIF) funded the construction of passive houses and the training of project developers. As mentioned above, the project "Implementation of the New Housing NAMA in Mexico" was implemented with funds from the NAMA Facility, a joint initiative of the German Federal Government, the British Department for Business, Energy and Industrial Strategy (BEIS), the Danish Government, the EU and the Children's Investment Fund Foundation (CIFF). Other donors such as Canada, France, the World Resource Institute, Denmark and the World Bank promoted further, smaller measures in the building sector.[9]

The main difficulty of cooperation between the various national and international partners was that overarching government bodies at ministry level were only indirectly involved in the project, just as they were in the other promotional programmes. Although this allowed the various donors' partner organisations (SHF, CONAVI and INFONAVIT) to further develop and implement the respective programmes relatively quickly and unbureaucratically, there was a lack of a leading authority to coordinate and systematically promote the sustainability of the building sector and evaluate existing measures as part of an overall strategy. This also includes a long period of failure to verify the effects calculated in simulation tools in the form of energy savings, energy expenditure savings, greenhouse gas reductions and improvements in living comfort under real conditions, which reduced the validity of the calculated savings and improvements. This also revealed possible weaknesses in the promotional programmes, such as insufficient knowledge of energy efficiency technologies and their proper use. Since this affected all donors and national organisations involved, a stronger joint and coordinated effort by all would have been necessary here in order to adequately evaluate the impacts actually achieved and to be able to draw the corresponding consequences for the funding programmes. It was only in 2022 that studies were carried out on the impact of EcoCasa housing units on energy consumption and living comfort under real conditions, the preliminary results of which were taken into account in this evaluation.

Summary of the rating:

EcoCasa II was a central component of the overall concept of German-Mexican cooperation to improve energy efficiency, climate friendliness and sustainability of the Mexican housing sector, in which TC and FC cooperated well and complemented each other. At the same time, the programme was an integral, important part of the Mexican government's policy to overcome existing problems in building energy-efficient houses with the help of various government organisations and promotional programmes. The EcoCasa project used the experience of

[9] NAMA apoyada para la Vivienda Nueva en México Acciones de Mitigación y Paquetes Financieros Actualización 2017

existing promotional programmes and built on newly developed concepts from other projects. In addition, in the second phase of EcoCasa, there was close coordination between the various organisations (CONAVI, INFONAVIT, SHF), which supported energy-efficient construction projects from several sides. In addition to Germany, the Mexican government's efforts in the construction sector were also supported by other donors, with a large part of the financial funds provided being pooled and implemented via German TC and FC. However, due to a low level of involvement of higher-level government bodies, a coordinated, sustainable transformation of the building sector as part of an overall strategy to improve the carbon footprint and housing situation of lower-income households was not sufficiently promoted.

Coherence: 2

Effectiveness

Achievement of (intended) targets

The objective adjusted as part of the final evaluation was *Electricity consumption, electricity expenditures and the associated CO_2e emissions are reduced in EcoCasa housing units compared to reference housing units.*

The target achievement at outcome level is summarised in the table below:

Indicator	Status during PA	Target value PA/EPE	Actual value at PCR (optional)[10]	Actual value at EPE[11]
(1) Reduction in electricity consumption per m^2 of floor area compared to the value of a reference housing unit, in %	100 %	67 %	61 %	Partially achieved: Modelled approx. 67% Preliminary data measured in three regions > 80%
(2) Reduction in electricity costs per housing unit/year compared to the value of a reference housing unit, in %	100 %	67 %	71 %	Partially achieved: Modelled 67% Preliminary data measured in three regions 80%
(3) Reduction in annual CO_2e emissions per m^2 of floor area (measured in tCO_2e/m^2 and year) compared to the value of a reference housing unit, in %.	100 %	73 %	81%	Partially achieved: Modelled 70 % Preliminary data measured in three regions >85%

Contribution to achieving targets

According to the executing agency's data, a total of 12,852 energy-efficient housing units were built using the EcoCasa II funds by the end of 2020, including 12,479 for sale and 373 for rental. This far exceeded the target of a total of 4,850 housing units (according to the agreement with SHF) or 8,400 housing units (according to the PA results matrix). Due to the rapid use of funds and the results achieved, the implementation period of the project was shortened by 12 months, and the second phase ended in 2020 December. However, the number of rental units built was low at 373 compared to the units for sale. It was slightly exceeded the target of 350 in the separate agreement and slightly below the target of 400 in the PA results matrix. Overall, demand for loans for the rental apartment construction component was rated as weak. As rented apartment construction mainly involves

[10] The figures given here refer to the calculated savings of all housing units supported by EcoCasa I, II and III and not only to the buildings supported in the second phase.

[11] The modelled values refer to the calculated savings of all housing units supported only by EcoCasa II compared to the value of a reference housing unit. Data are derived from SHF information, taking into account both original and up-to-date baseline values. The assessment referred to as "measured" refers to the data from a study on the impact of EcoCasa houses in the cities of Acuña, Cancún and Playa del Carmen. Since the energy savings in the random samples varied but did not exceed 11%, no absolute values are stated here, but rather which consumption value is exceeded in each case in relation to the baseline value.

financially well-equipped project developers and investors who have no problems with accessing loans, SHF's offer for this market segment was too uninteresting, which is why SHF concentrated on component 1 "Venta" after 2016, when the loans were granted for the construction of the 373 rental apartments.

As a general rule, new buildings supported by EcoCasa II loans had to meet the following conditions:

1. According to the DEEVi calculation tool's calculations, they had to have at least 20% lower energy requirements (electricity and gas) than the reference residential units, which were identical in geometry, use and orientation, but were equipped with the common state of technology and standard building materials. In the hot and very dry regions, energy requirements had to be at least 30% lower. The project developers were free to choose which technologies they used. The typical technologies used were roof insulation, insulating walls made of hollow blocks filled with insulation material, multi-glazed windows and energy-efficient hot water heating (gas boiler or solar thermal).
2. According to the SAAVI simulation tool, the water requirement also had to be lower than in the reference housing units due to the use of water-saving taps, with the result that the housing unit achieved at least the identifier "D" on a sustainability scale for buildings (IDG) starting with "A" as the best value and "G" as the worst value.
3. They had to be integrated into urban structures where a defined minimum of infrastructure services, including access to public transport, was ensured, as quantified with the HEEVI tool. If necessary, the project developer itself had to provide social infrastructure such as playgrounds and green spaces.

Compared to EcoCasa I (running in parallel to EcoCasa II), the energy efficiency requirements were lower. However, the interest rate subsidies compared to the usual SHF conditions was only minus 115 basis points compared to minus 260 basis points for EcoCasa I.

The selection criteria for the "Renta" programme component were similar:

1. Reduction of the energy demand and the resulting greenhouse gas emissions of the home by at least 20%.
2. Reduction of water consumption and associated greenhouse gas emissions by at least 20% as well.
3. The location of the flats had to be within urban catchment areas and rated positively by the HEEVi tool.

There were also other criteria defined by SHF, such as thermal comfort, the installation of bicycle parking spaces for 10% of the building's occupants and 5% of visitors, the existence of a comprehensive recycling strategy for at least three of the following types of waste (organic, inorganic, glass, packaging, composting) and the use of paints that contained a low amount of volatile organic compound. Housing projects for rental received low-interest long-term loans compared to the terms and conditions of traditional banks, but these were not subsidised.

The bridging loans and building loans for rental apartments covered up to 65% of the total construction costs. The remaining investment costs were provided by the project developers or those purchasing the homes.

The high number of newly built housing units for sale was achieved by the fact that the funds KfW provided for this component were reutilised 2.3 times on a revolving basis by the end of 2020 due to the short term of the bridging loans (one to a maximum of three years). In the "Renta" component, the loans had a longer term of up to 20 years, which is why the funds here do not flow back in time to be used again.

The calculated lower electricity demand was particularly pronounced in warm, dry and humid tropical regions, where building cooling with air conditioning systems is widespread. In the temperate climate regions of Mexico, where the buildings are neither cooled nor heated and the energy demand is mainly determined by hot water production, hardly any savings could be achieved. As only 12% of the houses were built in temperate climate regions, they were of little importance in the overall calculation.

In order to check whether the expected results were achieved and to assess the effectiveness of the energy-saving measures, various attempts were made during the course of the EcoCasa programme to measure electricity consumption in a representative number of supported housing units compared to standard housing units. However, the investigations failed due to methodological weaknesses and due to the electricity supplier CFE's lack of willingness to provide consumption data from EcoCasa households and reference houses. Only a new survey conducted in 2021 and 2022 in 480 households (of which 240 in EcoCasa and 240 in reference houses) allowed a comparison between calculated and real-world electricity savings.[12] The preliminary results of this study in two pilot regions show that no savings or only minor savings in electricity consumption and electricity costs were achieved with EcoCasa houses compared to reference houses. The differences calculated with the DEEVi tool

[12] This is a study commissioned by GIZ and coordinated with SHF and KfW, but not yet published, by the consulting firm FabCity Yucatán A.C.: Monitoreo simple y detallado del desempeño higrotérmico y energético de viviendas construidas bajo el programa EcoCasa

therefore did not occur in practice in these regions. Likewise, the room temperatures in both the EcoCasa and the reference houses were significantly more often above the assumed thermal comfort level (20–25°C and 27.5°C respectively) than expected according to the DEEVi calculation. The reason for the significant deviation of the practical values from the calculated values is, on the one hand, the user behaviour of the households, which does not correspond to the special properties of the EcoCasa housing units. For example, many households open the windows in hot weather to create draughts, but this undermines the insulation properties of the EcoCasa houses' building envelopes. Households in the reference houses use the air conditioning systems less intensively than expected due to the cost. But also structural factors, such as sub-contractors' poor construction quality, structural changes (mainly by the residents) and the uncontrolled air exchange through crevices, gaps and small openings in doors, windows and masonry, influenced the effectiveness of the efficiency technologies. They require a modification of the DEEVi tool's algorithms and/or an adjustment of the construction measures and a change of individual habits of the residents through intensive education.

Quality of implementation

The project was carried out by Sociedad Hipotecaria Federal, S.N.C. (SHF). SHF is a state-owned financial institution founded as part of the Mexican Development Bank in 2001. Its mission is to develop the market for construction loans to provide the Mexican population with access to high-quality housing by providing mortgage loans and bonds. As part of the project, SHF had several additional tasks in addition to the awarding of contracts to financial intermediaries and the management of the programme, including calculating the expected demand for energy (electricity and gas) using the DEEVi simulation tool and for water using the SAAVi simulation tool, reviewing the financed construction measures and providing technical advice to project developers.

Despite multiple staff changes and minor difficulties, SHF proved to be a professional project-executing agency with good implementation capacity, high management competence and efficient processing of the bridging loans. However, significant weaknesses occurred in the follow-up with regard to the results: Seven years after the start of the project, SHF also failed to verify whether and to what extent the predicted energy savings actually occurred. Similarly, data analysis and reporting on calculated savings were not always consistent. To be fair, it should be noted that intensive follow-up on the impact of construction measures is not one of SHF's typical tasks.

KfW closely supported the project. Various construction projects were visited as part of annual trips by the responsible Technical Expert. During these trips, construction progress, compliance and the quality of the use of eco-technologies and other agreements were reviewed, and both the developers and SHF were given advice and recommendations in areas where weaknesses were identified.

Unintended consequences (positive or negative)

There is no evidence of unintended effects.

Summary of the rating:

The project was extremely successful in terms of its construction objectives (output) in the second phase as well as in the first. The target number of newly built housing units that meet the set energy and water efficiency criteria was significantly exceeded and achieved earlier than planned. The project developers have accepted the offer of low-interest bridging loans for the construction of EcoCasa buildings with great interest. This is also reflected by the high number of project developers who participated in the EcoCasa II project. The interest of the commercial developers was only modest in the "Renta" component, which was to be used to promote energy-efficient rental apartments, and the offer of the EcoCasa II project was not attractive enough. Accordingly, from 2017 onwards, the construction loans concentrated on the "Venta" component.

At the module objective level (outcome), which expresses the impact of the target group's use of the built housing units, there are numerous well-founded indications that the actual savings in energy and electricity expenditure are significantly lower than those calculated by the DEEVi simulation tool. The project has therefore achieved its objectives with regard to the calculated electricity demand and the associated theoretical electricity costs, but not with regard to the savings actually achieved.

Effectiveness: 3

Efficiency

Production efficiency

The total costs of the second phase of the EcoCasa programme amounted to around EUR 81 million, of which EUR 55 million came from FC, which was used exclusively to finance bridging loans and long-term loans for project developers.[13] The counterpart contribution on the Mexican side amounted to around EUR 26 million. Programme-related costs for accompanying measures, in particular Technical Assistance (TA), were not agreed, as technical consulting services were provided by the NAMA facility in parallel to the second phase of the EcoCasa project as part of the TC component of the project "Implementation of the New Housing NAMA in Mexico".

The funds provided by FC in the amount of EUR 55 million corresponded to MXN 1,255 million (Mexican pesos) at an exchange rate of 1 to 22.8118. By December 2020 SHF had planned and issued construction loans in the amount of MXN 3,714 million under EcoCasa II, including MXN 3,154.54 million for the "Venta" component and MXN 560 million for the "Renta" component. So far, FC funds have been used on a revolving basis 2.74 times, meaning that project developers had a total of around EUR 150.7 million (EUR 55 million x 2.74) in bridging and long-term loans at their disposal.[14] For a total of 12,852 housing units, this corresponds to a loan averaging around EUR 11,726 per housing unit or EUR 248 per m² with an average floor area of 47.27m² of the housing units built. Since the total loan amounted to no more than 65% of the construction costs, the average investment costs per housing unit were around EUR 18,040. These costs include the extra expenses for energy-saving technologies ranging from EUR 500 to EUR 5,000 depending on the climate zone and the technologies deployed. Overall, construction costs were favourable against international comparisons at an average of EUR 382 per m² of floor area; the loan amount was appropriate.[15] Since the purchase of the housing units was also subsidised by the state with grants for low-income households, the housing units were affordable for large sections of the population.

The aim of the EcoCasa bridge loans was to absorb the additional costs for energy efficiency measures by means of interest rate subsidies, so that the houses were sold without price surcharges in comparison with the reference houses. The amount of the interest rate subsidy was not determined. It generally ranged between 1–1.5% p.a. Based on the average loan of EUR 12,670, this meant savings of EUR 127–190 with a 12-month term of the loan for the project developers. For two-year terms, the savings increased accordingly to up to EUR 380. It was therefore only possible to achieve full cost neutrality in a few projects with high interest rate subsidies and comparatively low additional investments. Nevertheless, investments in the EcoCasa housing units were attractive for both project developers and buyers, as subsidies from the 'Comision Nacional de Vivienda' (CONAVI) were granted to low-income households and the green mortgage loans were given priority for the purchase of EcoCasa housing units. As a result, the EcoCasa houses were up to 20% cheaper than a conventional house in the same location when purchased for low-income households. This was positively reflected in the demand from this income group. For higher-income buyers of the housing units, who received no or only very low subsidies, the EcoCasa houses were similarly expensive or only slightly more expensive than the typical reference houses.

Allocation efficiency

According to SHF's calculations using the DEEVi tool, the 12,479 housing units supported by EcoCasa can achieve savings in electricity consumption averaging 41kWh per m^2 per year and in gas consumption averaging 16kWh per m^2 per year.[16] With an electricity tariff of 0.034 USD/kWh and a gas price of 0.075 USD/kWh, as assumed in the calculation tool, this corresponds to savings of USD 2.594 per m^2/year (1.394 + 1.2) or USD 122.62 per year for an (average) apartment size of 47.27m². Based on the above-mentioned investment costs of at least EUR 500 for the energy-saving technologies, non-subsidised investments for the buyers of the housing units would amortise in the best case after five years, in the normal case after ten years or more. However, regional differences can occur here if the savings are higher in regions with intensive air conditioning use. The

[13] The PP states an amount of EUR 57.98 million. However, it was noted that the share of the budget funds is a provisional estimate. The subsequent calculation for the loan agreement resulted in a total amount of EUR 54,997,728.13. A loan amounting to USD 57,050,000 was contractually agreed with SHF.

[14] Even after the official end of the project, the FC funds will continue to be used to finance bridging loans.

[15] https://www.construction-physics.com/p/construction-costs-around-the-world

[16] This value is based on the updated baseline and the updated EcoCasa results. Using the original baseline results in an electricity savings value of 28 kWh/m²/year

amortisation times are significantly extended by the low electricity price, which is not cost-covering but subsidised by the state.

According to the DEEVi calculations, the calculated emission savings would be 22.34 kgCO_2e/m^2/year or 1,056 kgCO_2e/average housing unit/year. If the price currently defined in the German emissions trading system of EUR 30/t is taken as the basis, the savings are around EUR 33 per year, i.e. after around 15 years, investment costs of EUR 500 would be compensated by the CO_2e savings, with investment costs of EUR 1,000 after 30 years. However, since a price of EUR 55/t and higher is envisaged in the medium term in the emissions trading system, the investment costs would be compensated for significantly earlier by the CO_2e.

For the Mexican state, promotional funds for energy-efficient houses could also be worthwhile in terms of saving electricity subsidies. The Mexican state subsidises the price of electricity with approx. MXN 2/kWh (~EUR 0.09). It would therefore save around EUR 174 per year (41kWh x 47.27m^2 x EUR 0.09) per EcoCasa II housing unit with an average size of 47.27 m^2, i.e. possible investment costs in the amount of EUR 500 would be compensated in four years if the calculated electricity savings were confirmed in reality. Subsidies for natural gas liquids, which the Mexican state would save by reducing gas consumption, would also potentially have to be taken into account. However, no information is available on the subsidisation of natural gas liquids.

The calculations and projections based on the DEEVi values assume that (a) the installed energy-saving technologies are consistently installed and used properly, (b) the installed energy-saving technologies function without significant impairments (for up to 40 years), (c) all housing units are continuously occupied, (d) no energy-saving measures are carried out over time in comparable reference buildings, (e) a life cycle analysis is not taken into account (not taking into account the additional emissions for production, transport and disposal of energy-saving technologies), (f) the energy mix and emission factors remain constant despite the medium-term decarbonisation of the electricity sector planned in the NDC, (g) the savings are not reduced by rebound effects[17] and (h) the proportion of buildings equipped with air conditioning does not change. However, the implemented impact assessment, as well as an early study by the Inter-American Development Bank, shows that the assumptions currently do not apply in many cases.[18] According to the available information, the energy and CO_2e savings are therefore significantly lower than those calculated in the calculation tool, which reduces the allocation efficiency.

Summary of the rating:

The project is characterised by very high production efficiency. Thus, the agreed number of newly built housing units was significantly exceeded one year before the originally planned end of the second phase. The main reasons for the high number of promoted new buildings were the high interest in the bridging loans from project development and the revolving use of the FC funds provided. Another contributing factor was the fact that significantly more funds went into the “Venta” component with its short-term loans than originally planned and accordingly less went into the “Renta” component with its long-term loans, where the interest of the project developers was significantly lower.

Investments in structural energy efficiency technologies did not pose an additional burden for the buyers of the housing units. On the contrary, low-income households received government subsidies for the purchase of EcoCasa houses, which made the purchase of these housing units attractive. However, buyers were generally not made aware of the special building features of the EcoCasa houses and were not informed about how they could be used optimally. Accordingly, there is no difference in user behaviour between EcoCasa and reference housing units. Studies show that the suboptimal user behaviour of households, construction errors and later modifications only lead to low energy savings and no increased living comfort. The result is that the subsidies and the low-interest loans fail to have their intended effects on the living conditions of the target group and greenhouse gas emissions, at least in the short term. The savings potential of EcoCasa houses will therefore only become effective in the medium to long term if rising temperatures and rising prosperity lead to longer and more intensive use of air conditioning systems, and electricity tariffs become less subsidised and therefore more expensive. The allocation

[17] A rebound effect occurs when the expenditures saved by the efficiency measures are used by households to use air conditioning systems or other household appliances for longer than usual, for example to further reduce living space temperatures.
[18] GIZ: Monitoreo simple y detallado del desempeño higrotérmico y energético de viviendas construidas bajo el programa EcoCasa; IDB: How Effective is Energy-efficient Housing? Evidence From a Field Experiment in Mexico WORKING PAPER SERIES Nº IDB-WP-843

efficiency of the FC funds used is currently only moderate, but can be significantly higher in the medium and long term.

Efficiency: 3

Impact

Overarching developmental changes (intended)

The objective adjusted as part of the EPE was *Greenhouse gas emissions in the residential sector are reduced compared to the business-as-usual scenario.*
Target achievement of the newly formulated objective at impact level can be summarised as follows:

Indicator	Actual status 2016	2020 target value	Actual value at EPE
(1) Proportion of energy-efficient houses in registered new buildings at project completion.	8	18	30 % (Achieved)
(2) The amount of electricity-based greenhouse gas emissions from the residential sector is 95% of the business-as-usual scenario.	Only qualitative analysis possible at the time of the EPE.		

Contribution to overarching developmental changes (intended)

Indicator 1:

According to the last census, there were 35.22 million housing units in Mexico in 2020. In the 2015 survey, the number of housing units was 31.95 million. Over the five years, the number of housing units increased by 3.27 million or around 654 thousand per year.[19] More than half of the housing units are built independently or without bank financing. All housing units financed with the help of mortgage loans were recorded in the central RUV register (Registro Unico de Vivienda) from 2013 to 2022. The data from the RUV register show a clear downward tendency in the number of loan-financed newly built housing units between 2015 and 2020.[20]

Between 6% and 49% of the housing units registered with the RUV were analysed using the various sustainability tools and assessed in accordance with the IDG sustainability index. Housing units rated A, B, C or D are considered energy efficient and sustainable, with the sustainability level of A being the highest. An IDG score of at least D was a prerequisite for EcoCasa II loans, as outlined in the Effectiveness section. This corresponds to a reduction to a maximum of 80% of energy consumption compared to a reference housing unit. In 2015, 22% of the housing units analysed by IDG received at least classification D (Table 3). By 2020, the share increased to 69%. Based on the total number of housing units registered with the RUV, the proportion of A–D-classified housing units was 1% in 2015 and 30% in 2020. The data therefore show a significant increase in the proportion of energy-efficient houses in the registered housing units for the period from 2015 to 2020.

Table 2: Registered, newly built housing units (HU) and classification according to IDG (source: RUV)

Year	Housing units registered in RUV (HU)	HU classified with IDG	with A–D classified HU	Share of A–D HU in the total number of IDG HU	Share of A–D HU in the total number of RUV HU
2015	351,199	21,871	4,754	22%	1%
2016	375,039	66,376	30,432	46%	8%

[19] https://www.inegi.org.mx/temas/vivienda/
[20] https://portal.ruv.org.mx/index.php/cifras-basicas-ruv/

2017	250,200	67,256	37,066	55%	15%
2018	262,978	80,038	62,379	78%	24%
2019	189,045	69,565	50,397	72%	27%
2020	183,053	79,322	54,588	69%	30%

In interviews, project developers and sector experts confirmed that a significant number of energy-efficient housing units were built between 2015 and 2020 that were not financed through EcoCasa. INFONAVIT alone, the largest donor of mortgage loans, financed around 180,000 housing units between 2017 and 2020, which were rated at least D in accordance with the IDG sustainability index and are therefore considered energy efficient. The proportion of D-classified housing units increased from 59% in 2017 to 76% in 2020. The EcoCasa project made a significant contribution to this increase by being a pioneer in the financing of energy-efficient houses in the first phase and, in the second phase, creating further positive project examples while simultaneously contributing to the expansion of the instruments for evaluating the sustainability of buildings used by all construction financiers. CONAVI's subsidies and INFONAVIT's green mortgage loans, which made the purchase of sustainable housing units attractive, were also decisive for the increase in the construction of energy-efficient buildings. EcoCasa's low-interest loans alone would not have been sufficient.

Indicator 2:

An important objective of the project is its broad impact, which should ultimately also reduce residential sector emissions. However, the indicator is only assessed qualitatively in the following, as detailed figures on the residential sector's emissions for the project period were not available at the time of the EPE. In addition, it must be taken into account that the second phase of the project was only recently completed and sectoral transformations tend to require a longer period of time.

In 2016, Mexico officially set itself the goal of unconditionally reducing its emissions by 22% below a business-as-usual (BAU) scenario and up to 36% below BAU by 2030, as a contribution to the Paris Agreement, provided it receives financial and technical support as well as support in building the corresponding capacities. In 2020, Mexico submitted an updated version of its climate plans with the same percentage reduction targets but a higher BAU scenario. The original 2016 document included a sectoral breakdown of BAU and a breakdown of each sector's contribution to achieving the targets. Only the sectoral BAU breakdown is included in the amended version. For the electricity sector, BAU scenario expectations are that greenhouse gas emissions will increase from 149MtCO_2e to 166MtCO_2e in 2013 and 2020.[21]

In fact, a reduction in greenhouse gas emissions in the electricity sector compared to the BAU scenario was achieved between 2013 and 2020. However, at -2%, the difference is very small and is far from the -22% and 36%, respectively, that Mexico as a whole aims to achieve by 2030.

Increased avoidance of greenhouse gas emissions from the electricity sector is prevented, among other things, by increasing electricity demand in the residential sector. For example, electricity consumption in the residential sector increased by 36% from 53TWh to 72TWh between 2013 and 2020. At the same time, as the share of renewable energy in electricity generation only increased slowly, the residential sector's emissions increased by 27%, significantly more than the 11% of the electricity sector expected in the BAU scenario. Accordingly, in 2020, the residential sector accounted for more than 20% of greenhouse gas emissions from the electricity sector. The second indicator of the objective at impact level was therefore missed by a significant amount.

[21] https://unfccc.int/sites/default/files/NDC/2022-06/NDC-Eng-Dec30.pdf, the category "Residential y Commercial" mainly refers to the combustion of gas (as a primary energy source)

Table 3: Greenhouse gas emissions (GHGS) in the electricity and residential sectors (own calculations based on SENER data)

	BAU		ACTUAL						
Year	Electricity sector GHGs (MtCO2e)	Increase 2013–2020	Electricity generation (GWh)	Electricity sector GHGs (MtCO2e)	GHGs actual/BAU (%)	Residential sector electricity consumption (GWh)	Residential sector GHGs (MtCO2e)	Increase 2013–2020	GHGs residential/electricity sector (%)
2013	149		296,944	149	100%	53,094	26.65		17.88%
2020	166	11%	325,833	163	98%	72,250	33.09	27%	22.17%

The increasing demand for electricity in the period 2013–2020 is due to both population growth and the construction of new housing units, as well as higher electricity consumption in residential buildings due to increasing incomes and the associated desire for living comfort, especially cooling and hot water. The growth dynamics of private electricity consumption could not be sufficiently slowed down by the promotion of energy-saving household appliances or by the construction of sustainable housing units.

According to calculations by SHF, the housing units financed by the three EcoCasa credit lines by the end of 2020 can save 55,497tCO_2e per year (2,219,893tCO_2e/40 years). Around 80%, i.e. 45,000tCO_2e or 0.045MtCO_2e per year, would be saved by avoiding electricity consumption. This corresponds to 0.136% of the current greenhouse gas emissions from the residential sector. Even if the number of newly built energy-efficient housing units were ten times higher, the emissions caused by the residential sector would only be reduced slightly. If the actual savings achieved are taken as a basis, the reduction is even much lower.

Contribution to (unintended) overarching developmental changes

EcoCasa II, like its predecessor EcoCasa I, has contributed to a broader anchoring of the concept of sustainable construction and to high visibility at national and international level. Other unintended developmental changes could not be observed.

Summary of the rating:

As part of a broader FC programme, the EcoCasa project was intended to help increase the number of energy-efficient residential buildings and thereby reduce greenhouse gas emissions, particularly in the residential sector, compared to a BAU scenario. The broader the impact of the EcoCasa project is, the greater the contribution, i.e. the more energy-efficient housing units are also built beyond the project. The data provided by the responsible institution RUV on newly built sustainable housing units as well as the data from INFONAVIT show that building funds and financiers have adopted and promoted the concept of energy-efficient housing units. In this respect, EcoCasa has achieved a broad impact and contributed to a possible turnaround of the construction sector towards greater sustainability. However, the impact was not sufficient to make a visible contribution to the greenhouse gas emissions from the residential sector.

Impact: 3

Sustainability

The present report evaluates the second phase of the EcoCasa programme, which covers the period from 2016 to 2020. The EcoCasa programme is now in its third phase. A final assessment of the entire EcoCasa programme's sustainability is only possible once international support ends, so a preliminary assessment is made here based on the results of the first and second phases.

Capacities of participants and stakeholders

During the seven years of the EcoCasa programme's first and second phases, a considerable number of project developers were able to gain extensive technical knowledge about how energy-efficient technologies work and are used in the construction of houses and flats. According to data from SHF, 79 Mexican commercial developers carried out a total of 240 new construction projects with EcoCasa financing. During the technical expert's on-site visits, the quality of the construction measures and the professional competence of the commercial developers in the design and implementation of sustainable new buildings were rated as high. The building financiers involved, the partner SHF, the financial intermediaries cooperating with SHF, as well as the central funds for mortgage loans INFONAVIT and FOVISSTE and the grant provider CONAVI were also able to gain extensive experience in financing sustainable new buildings. In the context of EcoCasa, an extensive network of technical experts has also been created that can advise commercial developers on applying for promotional funds and verify compliance with efficiency standards.

There are information deficits among the target group, low- and medium-income families living in energy-efficient housing units. The families are not aware of the advantages of their EcoCasa house, so they do not know how to optimally use the special features, particularly the temperature-insulating properties. In some cases, the energy-efficient buildings also do not align with living habits, so the families later modify their homes in ways that compromise energy efficiency. While there is a high level of expertise on the part of the project developers and implementers, residents lack this proficiency, reducing the effectiveness of the approach.

Contribution to supporting sustainable capacities

Thanks to their high financing volume, the EcoCasa I and II projects played a decisive role in demonstrating the practicality and benefits of building energy-efficient social housing units in practice in 240 new construction projects, and the project developers were able to gain experience in the selection, evaluation, procurement and installation of various products and technologies. The project developers acquired additional expertise through accompanying further training events. Other actors, such as financial intermediaries, government officials, specialists and consultants, were also involved in the qualification measures. Overall, this created a broad base of experts on energy-efficient construction in the Mexican construction sector.

In the second phase of the EcoCasa project, the calculation tools which can be used to analyse housing units' energy and water requirements, the ecological footprint of building materials and the living environment with regard to its infrastructure (urban quality), continued to form the basis for assessing the energy efficiency and sustainability of construction projects. The parameters of the reference buildings were adapted in accordance with the technologies typically used in standard houses, and some tools were further developed. On the whole, all those involved in construction measures were able to deepen their experiences with the toolset, so that the tools in the construction sector became the generally accepted system for assessing the sustainability potential of residential projects. The results of the calculations also served to identify the overall impact of housing units on the environment (IDG labelling), which was recorded in the national building register "Registro Único de Vivienda" (RUV). However, it should be pointed out that the calculation tools only represent the basic building properties and the resulting performance potential of the houses, such as possible energy and water savings compared to reference buildings. The real effects can deviate significantly from this due to the factors already mentioned, such as user behaviour, construction defects and modifications. In order to determine the actual expected savings in practice, regionally specific correction factors would have to be included in the calculations.

The high number of construction projects financed with EcoCasa funds and the broad impact of the project boosted demand in the Mexican market for energy-efficient technologies such as windows with multiple glazing, insulation materials and solar hot water systems. As a result, local companies also invested in these technologies. At the same time, the practical experience with the technologies enabled the further development of the energy efficiency standard NOM-020-ENER, in which maximum thermal conductivity values were defined for the masonry and windows.

Durability of impacts over time

The continued positive impact of the EcoCasa programme depends largely on the extent to which the use of energy-efficient technologies is becoming the standard in the Mexican construction sector and the extent to which a market for such technologies is developing. Market development is in turn determined by government policies, incentives for sustainable construction, financing options, the level of information and knowledge of stakeholders,

the supply of affordable technologies and cultural habits in building and housing. Currently, some factors are hampering the construction of energy-efficient housing units, while others continue to have a positive effect.

Mexico itself has a well-developed legal framework regarding sustainability in the construction and building sector, including general laws and binding and voluntary standards. However, the standards are currently rarely implemented. While there are plans to promote and enforce application of the regulations, there is currently little indication that the proposed measures are actually being implemented.

After the change of government at the end of 2018, the framework conditions for complying with and expanding energy efficiency standards in new construction have become less favourable. Government promotional programmes for energy efficiency measures, such as the “Hipoteca Verde” programme, were severely reduced, ended or decoupled from compliance with efficiency criteria. This is the case, for example, with grants from the state social housing authority CONAVI or the credit lines from INFONAVIT, where the housing units are no longer classified in accordance with the IDG sustainability index. Instead, the government’s housing policy focuses more on the informal housing sector, which accounts for around 50% of construction projects. The aim is to create adequate housing for particularly disadvantaged population groups and to repair, refurbish and rehabilitate existing housing without special consideration of existing sustainability criteria. New construction of social housing for low- and medium-income households is no longer a priority. Consequently, construction activity in this segment also declined.

An additional central problem for building energy-efficient houses is the subsidisation of electricity tariffs, which means that the financial benefit of energy-efficient housing units for households with low and medium consumption is relatively low.

At the same time, it can be noted that the corresponding technologies such as wall insulation and the use of solar hot water tanks have since become firmly established on the Mexican market, and a considerable number of developers have the necessary know-how on sustainable construction. This will continue to encourage Mexican commercial developers to build sustainable housing units in the future. In addition, new financing instruments have been developed for energy-efficient houses that are independent of the state housing policy. For example, SHF has had the EcoCasa programme certified by the Climate Bond Initiative to facilitate the financing of climate-friendly houses via green bonds. One of the major project developers (CADU Real Estate) has already used this opportunity and issued certified green bonds for selected projects.

Overall, it can be expected that the construction of energy-efficient housing units will continue even without international promotion, but at a lower level than during the EcoCasa programme. In addition, demand will shift more to middle- to high-income households because low-income groups cannot afford the additional costs of efficiency measures without subsidies. In addition, the more air conditioners and heaters are used, the greater the savings in energy costs that can be achieved, making them more attractive for higher-income budgets.

Summary of the rating:

The second phase of the EcoCasa programme has helped to lay essential pillars for the sustainable use of energy efficiency measures in the Mexican construction sector and to develop a market for the technologies. This means that energy-efficient construction measures in accordance with the EcoCasa concept can be expected to continue even after the end of the promotion. However, a significant downturn in the number of newly built, energy-efficient housing units for low- and medium-income households can be expected because the cost savings for the target group are not sufficient compared to possible additional costs. A medium-term change in the subsidisation of the electricity tariff is not expected. Due to the elimination of state subsidy programmes and low-interest loans for efficiency measures, there is no significant incentive to build these types of housing units. However, in the near future, a change in the housing policy of the future government, which will be elected in 2024, may fundamentally change the framework again, resulting in a new upswing with regard to concept of sustainable construction.

Sustainability: 3

Overall rating: 3

At the time of planning and implementation, the project was a central component of the Mexican government's policy to anchor energy efficiency measures in social housing construction on a broader scale. This was highly relevant. It was very well embedded in the network of organisations and their initiatives to drive the transformation of the construction sector towards greater sustainability. German DC worked well together with the construction sector and the energy sector. The coherence was therefore high. The project was extremely successful in terms of the results achieved in the new construction of energy-efficient housing units (output). Significantly more housing units were built in a shorter time than contractually agreed. However, according to the available information the actual energy and electricity savings achieved and the level of living comfort are significantly below the calculated values. The project therefore achieved its objectives (outcome) with regard to the calculated savings potential of the housing units, but not with regard to the savings actually achieved. This results in limited effectiveness. The different effectiveness at output and outcome level is also reflected in the different results in production efficiency and allocation efficiency. The developmental impacts on the transformation of the construction sector, climate action and sustainability of the energy sector are limited at the end of the second phase.

More significant effects in combination with other measures, such as increasing the share of renewable energy in electricity generation, are to be expected in the medium and long term. This also applies to the sustainability of the project. Continued construction of new energy-efficient housing units is to be expected at a lower level in the short term and rather for higher income classes, as the political framework conditions, such as subsidised electricity prices, have an inhibiting effect and have in some cases become less favourable. However, a change in policy can be expected in the medium and long term if the interest in energy-efficient houses increases among broad sections of the population due to living comfort and the savings that can be achieved with increasing heatwaves and rising energy prices. In this case, compliance with the agreed efficiency standards could be monitored more closely and the capacity created could be better used by the key players in the construction sector. The transformation of the construction sector towards a climate-friendly construction method would then intensify, albeit later than hoped.

Contributions to the 2030 Agenda

According to the PA, the intent was for the project to contribute to combating global climate change and strengthening the sustainability of cities and settlements and thus to achieving the Sustainable Development Goals (SDGs) 11 ("Sustainable Cities and Communities") and 13 ("Climate Action"). Although the impact of the project on the development of the sector's overall CO_2e emissions is currently rather low, it could become greater and more visible in the medium and long term. This would be the case if energy-efficient housing were to become more widespread and the capacities created by developers, manufacturers and suppliers of energy-efficient housing technologies were to be fully utilised. The same applies to the contribution to SDG 11. The project played a key role in the development of various assessment tools for sustainable construction and sustainable municipal development. Their application in the promoted projects has helped to create more sustainable and liveable new housing developments. With a corresponding broad effect, this could positively change the development of Mexican cities and settlements.

Project-specific strengths and weaknesses as well as cross-project conclusions and lessons learned

The main strengths of the project include:

- The project made an important contribution to the financing of energy-efficient new buildings in Mexico and thus addressed a core problem for the transformation of the construction sector towards more sustainability.
- By focusing on social housing construction, the project has created a globally recognised example of how energy efficiency measures can be introduced and implemented in this segment.
- The project is characterised by good cooperation with TC and the relevant actors in the Mexican construction sector. The main results of this cooperation are:
  (a) the development of tools for calculating energy and water needs and assessing urban quality, and new construction projects' interconnection with services, thereby creating a common reference framework allowing all stakeholders to assess the sustainability of projects transparently;

(b) the qualification of developers, financial actors and advisory institutions in the various aspects of sustainable construction;
(c) the further development of national standards and norms for the building sector.

- The project was very effective and efficient in implementing the activities and exceeded the set objectives at output level.

The main strengths of the project include:

- In terms of its broad impact, the project is too heavily dependent on government promotional programmes. In the event of a reduction or the discontinuation of corresponding funds (as is currently the case), a wider use of energy-efficient technologies is not to be expected in the construction of new housing units.
- The households in the energy-efficient new buildings have very limited knowledge of the special features of their housing units and therefore do not make sufficient use of the existing savings potential.
- The project did not monitor the real effects of the energy-efficient construction measures, but relied on the results of the calculation tools to assess the outcomes and the developmental impact. As a result, it was not recognised at an early stage that residents need more information and instructions on how to use their housing units or that individual measures need to be better adapted to the households' living habits.

Conclusions and lessons learned:

- Providing low-interest bridging loans to commercial developers has proven to be an effective financing mechanism for promoting energy-efficient new construction in social housing.
- The success of this type of project depends on clear, transparent and uniform criteria with the corresponding calculation tools, so that commercial developers have planning security for their investments. In the case of EcoCasa, positive experiences were gained with the evaluation of urban infrastructure in addition to the calculation of energy requirements.
- Equally crucial is the complementarity of different promotional instruments and the coherence of the work of the relevant actors in a sector.
- In social housing construction, it is not expected that the target group will have sufficient information about the special features of energy-efficient housing. Comprehensive information is therefore necessary in order to fully exploit the potential for energy savings. However, due to prosperity effects and population growth, energy consumption in the residential sector will show an upward trend.
- Energy efficiency projects in the infrastructure sector should avoid using target indicators for CO_2e savings that lie far into the future. CO_2e emissions are subject to various influencing factors, such as the development of the energy mix, which are not predictable. Instead, the broad impact and development of the market for energy-efficient technologies should be taken into account in the indicators and during follow-up.
- Programmes such as EcoCasa only achieve a limited number of new buildings financed by project developers through bridging loans. However, around 50% of new buildings in Mexico are built independently without project developers financed by credit. Similar conditions must also be expected in other countries. The independent construction sector needs a different project approach in which the implementation of government building standards and efficiency standards is more closely controlled and guaranteed.
- Projects such as EcoCasa, which aim to transform the sector, require a medium to long-term perspective, as these kinds of social change processes do not generally move quickly. The objectives of the initial phases should accordingly focus on creating the essential prerequisites for transformation and, in this context, on achieving intermediate stages.

Evaluation approach and methods

Methodology of the ex post evaluation

The ex post evaluation follows the methodology of a rapid appraisal, which is a data-supported qualitative contribution analysis and constitutes an expert judgement. This approach ascribes impacts to the project through plausibility considerations which are based on a careful analysis of documents, data, facts and impressions. This also includes – when possible – the use of digital data sources and the use of modern technologies (e.g. satellite data, online surveys, geocoding). The reasons for any contradicting information are investigated and attempts are made to clarify such issues and base the evaluation on statements that can be confirmed by several sources of information wherever possible (triangulation).

Documents used:

a) Project documentation
- Programme proposal (PP) for the DC programme Renewable Energy and Energy Efficiency II
- Final report, FC module: FC programme for renewable energy, energy efficiency and environmental protection (EcoCasa II) in Mexico
- Loan agreement between SHF and KfW, and separate agreement between SHF and KfW
- Reports (progress reports) from KfW to the German Federal Ministry for Economic Cooperation and Development (BMZ)
- Reports (semi-annual reports) from SHF to KfW
- Back-to-office reports from the responsible department (LGa) and the TE as well as Ayuda Memoria

b) Official documents of the Government of Mexico and the partner
- Ley de Vivienda from June 2006
- Ley General de Cambio Climático from June 2012
- National Determined Contributions (NDC) 2020 update
- ESTRATEGIA NACIONAL PARA LA VIVIENDA SUSTENTABLE Componente Ambiental de la Sustentabilidad (2013)
- SENER/CONUEE: NORMA Oficial Mexicana NOM-020-ENER-2011, Eficiencia energética en edificaciones — Envolvente de edificios para uso habitacional
- SHF: Guia de Operación ECOCASA (2021)
- INFONAVIT: Informe anual de actividades
- CONAVI: REGLAS de Operación del Programa de Vivienda Social para el ejercicio fiscal 2023 (2022)
- CONAVI: Apoyos que otorga la Comisión Nacional de Vivienda en 2023

c) Specialist literature, studies
- NAMA apoyada para la Vivienda Nueva en México Acciones de Mitigación y Paquetes Financieros (2017)
- SENER/CONUEE: Análisis de la evolución del consumo eléctrico del sector residencial entre 1982 y 2017 e impactos de ahorro de energía
- Roadmap for building energy codes and standards for Mexico (2017)
- PEEB: Eficiencia energética en edificios en México, Incentivos no financieros para movilizar la inversión privada, (2021)
- Climate Bonds Initiative: Financing low-carbon buildings in Mexico (2020)

d) Evaluations, reports from other donors, secondary specialist literature, strategy papers, context, country and sector analyses, impact evaluations, comparable evaluations, systematic reviews, media reports.
- GIZ: Monitoreo simple y detallado del desempeño higrotérmico y energético de viviendas construidas bajo el programa EcoCasa
- IDB: How Effective is Energy-efficient Housing? Evidence From a Field Experiment in Mexico WORKING PAPER SERIES Nº IDB-WP-843
- IDB: Informe de Terminación de Proyecto – ME-L1121

Data sources and analysis tools:
- Monitoring data from the partner
- Publicly available or data provided in interviews from INFONAVIT, RUV, SENER, STPS, INEGI
- International Energy Agency Enerdata statistics and data from the World Bank about Mexico

Interview partners:

As part of the evaluation, representatives of the following institutions and groups were interviewed:

- SHF
- GIZ
- RUV
- Project developer (Alfa Viviendas)
- Financing fund for construction loans (INFONAVIT)
- Industry associations for energy-efficient technologies (AMEVEC and ANELEC)
- Target group (residents of EcoCasa houses)
- Experts in the construction sector

The analysis of impacts is based on assumed causal relationships, documented in the results matrix developed during the project appraisal and, if necessary, updated during the ex post evaluation. The evaluation report sets out arguments as to why the influencing factors in question were identified for the experienced effects and why the project under investigation was likely to make the contribution that it did (contribution analysis). The context of the development measure and its influence on results is taken into account. The conclusions are reported in relation to the availability and quality of the data. An evaluation concept is the frame of reference for the evaluation.

On average, the methods offer a balanced cost-benefit ratio for project evaluations that maintains a balance between the knowledge gained and the evaluation costs, and allows an assessment of the effectiveness of FC projects across all project evaluations. The individual ex post evaluation therefore does not meet the requirements of a scientific assessment in line with a clear causal analysis.

The following aspects limit the evaluation:
The security situation in several regions of Mexico limited the number of project sites that were eligible for a visit by the local expert as part of the evaluation.

Methods used to evaluate project success

A six-point scale is used to evaluate the project according to OECD DAC criteria. The scale is as follows:

Level 1 very successful: result that clearly exceeds expectations

Level 2 successful: fully in line with expectations and without any significant shortcomings

Level 3 moderately successful: project falls short of expectations but the positive results dominate

Level 4 moderately unsuccessful: significantly below expectations, with negative results dominating despite discernible positive results

Level 5 unsuccessful: despite some positive partial results, the negative results clearly dominate

Level 6 highly unsuccessful: the project has no impact or the situation has actually deteriorated

The overall rating on the six-point scale is compiled from a weighting of all six individual criteria as appropriate to the project in question. Rating levels 1-3 of the overall rating denote a “successful” project while rating levels 4-6 denote an “unsuccessful” project. It should be noted that a project can generally be considered developmentally “successful” only if the achievement of the project objective (“effectiveness”), the impact on the overall objective (“impact”) and the sustainability are rated at least “moderately successful” (level 3).

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List of annexes:

Target system and indicators annex

Risk analysis annex

Project measures and results annex

Recommendations for operation annex

Evaluation questions in line with OECD DAC criteria/ex post evaluation matrix annex

Target system and indicators annex

Project objective at outcome level	Rating of appropriateness (former and current view)
During project appraisal: Reduction of carbon emissions (total amount for newly built social housing/homes based on 40 years)	The objective at impact level formulated in the project appraisal represents an effect that occurs if households properly use the newly built, energy-efficient housing units (output). This would be reflected in lower power consumption. In order to convince households of the advantages of energy-efficient housing units, lower electricity consumption should go hand in hand with lower energy expenditure and improved living comfort. In the sense of a stringent theory of change, lower energy consumption with lower energy expenditure and improved living comfort is therefore more appropriate for the objective at impact level (use of the output). The reduction of carbon emissions with regard to the sector is moved to the impact level.
During EPE (if target modified): The aim of the FC module is to reduce electricity consumption and the associated expenditure on electricity and carbon emissions in households in EcoCasa housing units compared to reference housing units.	

Indicator	Rating of appropriateness (for example, regarding impact level, accuracy of fit, target level, smart criteria)	PA target level Optional: EPE target level	PA status (2016)	Status at final inspection (2021)	Optional: Status at EPE (2023)
Financed low-carbon housing units	This indicator meets the SMART criteria, but is an output indicator. What is actually meant by “low-carbon housing units” is also not specified. It would be more precise to state the target energy efficiency level (70 = 70% of the energy requirement of a reference unit).	8,400 (8000 Component 1, 400 Component 2) New: moved to the output level	0	12,852	12,852
CO_2 savings	The indicator does not meet SMART criteria. It is not sufficiently specific, as it is not noted that these are model calculations based on the structural-physical properties of the buildings and therefore not real values. The assumptions underlying the calculations are not mentioned and	350,000tCO_2e[1] New: CO_2 savings in the sector are shifted to impact level with new indicators	0	394,000tCO_2e	See new indicator at impact level (Indicator no. 3)

[1] The PP states a total saving of 1,350,000tCO2e for the first and second phases of the EcoCasa project. In the PCR, this figure was then broken down as follows: EcoCasa I = 1,000,000tCO2e and EcoCasa II = 350,000tCO2e

	are therefore not verifiable. The target value itself cannot be verified either, as it calculates the CO_2 savings for the next 40 years, i.e. far into the future. As part of the EPE, the CO_2 savings at outcome level per m^2 of floor area were compared to the reference building (see below). CO_2 savings in the sector have been moved to the impact level. See the indicators in the next section.				
Reduced electricity consumption per household New: Reduction of electricity consumption per m^2 of floor area	The indicator matches the new objective at impact level and meets the SMART criteria. However, both the baseline and the status values of the PCR are not real figures, but the results of model calculations based on the structural-physical properties of the housing units. In order to verify the extent to which the figures reflect reality, the assumptions underlying the model calculations should be checked for plausibility or real consumption data should be determined. The indicator and the value allocation are formulated in a slightly contradictory manner. The indicator refers to electricity consumption per household, the value allocation to consumption per m^2. Standardisation has therefore been carried out.	At 67% of baseline value (BLV) based on kWh/m^2	100%	61.31%	according to the simulation tool calculations, achieved: 67.49% (old BLV) 66.78% (new BLV) According to preliminary results of measurements of a study in three regions, not achieved > 80
Reduction of electricity costs per housing unit / year:	The indicator matches the new objective at impact level and meets the SMART criteria. However, both the baseline and the status values of the PCR are not real figures, but the results of model calculations based on the structural-physical properties of the housing units. In order to verify the extent to which the figures reflect reality, the assumptions underlying the model calculations should be checked for plausibility and real electricity cost data should be obtained.	To 67% of the baseline value	100%	70.91%	according to the simulation tool calculations, achieved: 66.76% According to measurements in three regions, not achieved >80%
Reduced carbon emissions per household	This indicator is closely linked to the electricity consumption indicator and is based on the same data basis. Depending on the amount of savings in electricity consumption, greenhouse gas emissions are also reduced accordingly. Therefore, the above evaluation also applies	At 73% of the baseline value based on tCO_2e/m^2 and year	100%	80.97%	according to the simulation tool calculations, achieved: 70%

New: Reduced carbon emissions per m^2 of floor area	here. However, the wording of the indicator and the value allocation have been formulated in a slightly contradictory manner. The indicator refers to carbon emissions per household, the value allocation to emissions per m^2. Standardisation has therefore been carried out.				According to measurements in three regions, not achieved >85%
Improvement in household comfort standards New: Deletion of the indicator	The indicator is very relevant for the objective of promoting the construction of energy-efficient housing units in Mexico because a possible increase in comfort alongside the reduction of energy costs will be the main reason for increased demand for renewable energy housing units. However, the value allocation does not meet the SMART criteria. It is more a description of a technical standard for EcoCasa buildings and not a comparison of living comfort with reference houses. An improvement of the comfort standard would be possible if temperature measurements in EcoCasa and reference apartments were carried out and put in relation to energy consumption. However, this type of data is not available. Alternatively, households could be asked about their subjective impression of living comfort, which would be much more inaccurate. Therefore, the improvement in living comfort is not taken into account as an indicator for achieving the project objective in the EPE, but instead is treated as an additional intended effect under Effectiveness without precise value allocation.	Indoor temperature 20–25°C (or up to 27.5°C with fan) Tropical climate: 40% of the time Dry, hot climate: 60% of the time Moderate climate: 80% of the time		Tropical climate: 52% of the time Dry, hot climate: 75% of the time Moderate climate: 90% of the time	Status was not recorded.

Project objective at impact level	**Rating of appropriateness (former and current view)**
During project appraisal: The sustainability of the energy system in Mexico is improved	The DC programme objective is too broadly defined and only partially matches the impact level of the FC module in terms of content. The DC programme objective (impact) is specified for this EPE and supplemented with the corresponding indicators. The focus here is on whether the project has achieved a direct impact in Mexico's housing sector beyond the direct impact on the promoted housing units.
During EPE (if target modified): Greenhouse gas emissions in the residential sector are reduced compared to the business-as-usual scenario.	

Indicator	Rating of appropriateness (for example, regarding impact level, accuracy of fit, target level, smart criteria)	Target level PA / EPE (new)	PA status (2016)	Status at final inspection (2021)	Status at EPE (2023)
Increase in annual primary energy sources from new renewable energy sources (PJ/year)	Not relevant for this FC module, as the project did not promote the expansion of renewable energy sources. Indicator is therefore not included in the evaluation.	Not quantified	No data	No data	Status was not recorded
Increase in annual savings in energy consumption (PJ/year or GWh/year)	The project can contribute to savings in energy consumption. The size of the contribution or the extent to which the country's total energy consumption is affected depends on the significance of the construction sector. Overall, quantification is very difficult, as the total energy consumption is determined by many factors over which DC has a very limited influence. The indicator is therefore located at an excessively high aggregation level and is only taken into account roughly with regard to quality.	Not quantified	none	No data	Status was not recorded
Increase in annually avoided greenhouse gas emissions (tCO2e/year) New: Avoidance of greenhouse gas emissions in the residential sector	The project can contribute to this indicator. The size of the contribution or the extent to which the country's greenhouse gas emissions are affected depends again on the importance of the construction sector. Overall, it is difficult to quantify the indicator, as the total greenhouse gas emissions are determined by many factors over which DC has only a very limited influence. It is therefore more sensible to focus on the residential sector when considering the impact of the FC module	Not quantified New: 1) Proportion of energy-efficient houses in registered new buildings increases by 10 percentage points at project completion. 2) The level of electricity-based greenhouse gas emissions from the residential sector is 95% of	8%	–	Indicator 1: 30% Indicator 2: qualitative analysis shows insufficient avoidance of greenhouse gas emissions

		that in the business-as-usual scenario			

Risk analysis annex

All risks should be included in the following table as described above:

Risk	Relevant OECD-DAC criterion
The Mexican government does not implement the originally planned energy reform and does not reinforce the importance of energy efficiency in achieving national climate targets. **Risk materialised:** After the change of government in 12/2018, the political framework conditions for the use of renewable energy sources and for the use of energy-efficient technologies and materials in the construction sector deteriorated. Government promotional funds for sustainable construction were reduced or cancelled, or energy efficiency requirements were lifted during the award of contracts.	**Relevance, coherence, sustainability**
The demand drops for low-interest bridging loans from project developers. **Risk materialised:** As a result of the reduction in state subsidies for the purchase of social housing and the occurrence of the COVID-19 pandemic, there has been a significant downturn in demand on the housing market since 2018 and a corresponding downturn in bridging loans on the part of project developers. SHF has set up an emergency programme to cushion the effects of the coronavirus pandemic on the residential construction market, which prevented the insolvency of numerous companies, but did not absorb the decline in demand.	**Sustainability**
The energy efficiency technologies are properly installed by the construction companies in the promoted housing units, and the apartments are properly used by their residents. **Risk materialised:** Although only minor shortcomings in the implementation of the measures could be identified in the on-site progress review, a detailed investigation of two selected sites revealed construction defects mainly due to sub-contractors and modifications made by the residents. In addition, many residents do not use the residences according to their energy efficiency characteristics.	**Effectiveness, efficiency**
The real estate sector in Mexico does not continue its recovery in 2016. **Risk occurred to some extent:** the real estate sector developed well at the start of the project (2016), but then went into a recession (see above point on demand for bridging loans).	**Effectiveness, sustainability**
SHF's operational capacity is further limited by the extensive internal changes due to personnel changes and restructuring, and the restrictions in the course of the coronavirus pandemic in 2020. **Risk did not occur or only occurred to a minor extent:** The personnel changes and restructuring triggered by the salary adjustments in public banks had a minor impact on SHF's operational capacity in 2019.	**Efficiency**

Project measures and their results annex

The following measures were realised by the project:

Measure	Status
Award of low-interest bridging loans from SHF to construction companies that create energy-efficient new construction of flats/houses for purchase for low and medium-income groups under Component 1 of EcoCasa.	With the funds of the project, SHF provided building contractors with bridging loans worth MXN 3,154,540,000 (around EUR 124 million) for the construction of a total of 12,476 energy-efficient residential units.
Award of low-interest long-term financing (term up to 20 years) to project developers and investors who build and rent energy-efficient rental apartments under Component 2 of EcoCasa.	With the project funds, SHF provided long-term loans worth MXN 560,000,000 (around EUR 24 million) for the construction of 373 energy-efficient rental apartments to project developers and investors.
Quality assurance of EcoCasa projects by SHF.	SHF used various tools (DEEVi, SAAVi, HEEVi) to check whether the construction companies' construction plans meet the requirements of the EcoCasa project with regard to the expected sustainability characteristics. In the event of a positive assessment and lending, the implementation of the construction measures was checked on a random basis.

Recommendations for operation annex

No operating recommendations were made in the PCR from 1 March 2021.

Evaluation questions in line with OECD-DAC criteria/ex post evaluation matrix annex

Relevance

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Policy and priority focus			1	0	
Are the objectives of the programme aligned with the (global, regional and country-specific) policies and priorities, in particular those of the (development policy) partners involved and affected and the Federal Ministry for Economic Cooperation and Development (BMZ)?	Which official Mexican documents listed energy efficiency and climate protection objectives and measures at the time of the appraisal? Which of the German Federal Ministry for Economic Cooperation and Development (BMZ) quality characteristics are relevant for the programme and formed the basis for the objective?	Government documents on its energy and climate policy (including Ley de Vivienda of June 2006, Ley General de Cambio Climático from June 2012, National Determined Contributions (NDC) 2020 update, Estrategia Nacional para la Vivienda sustentable – Componente Ambiental de la Sustentabilidad (2013) and German Federal Ministry for Economic Cooperation and Development (BMZ) position papers			
Do the objectives of the programme take into account the relevant political and institutional framework conditions (e.g. legislation, administrative capacity, actual power structures (including those related to ethnicity, gender, etc.))?	What framework conditions existed in Mexico for the dissemination of energy efficiency measures in the construction sector? In particular, what energy efficiency standards existed for buildings in Mexico? To what extent have new standards been adopted by the National Commission for the Sustainable Use of Energy and Energy Savings (CONUEE)? What role do the various Mexican authorities and organisations play in the promotion and enforcement of energy efficiency measures in the construction sector?	Project-executing agency analysis in PP and PCR, survey of important national actors, analysis of documents			
Other evaluation question 1	What relevance did the construction sector have with regard to Mexico's total emissions?	Analysis of relevant documents			

Evaluation dimension: Focus on needs and capacities of participants and stakeholders			2	0	
Are the programme objectives focused on the developmental needs and capacities of the target group? Was the core problem identified correctly?	Did the programme help to stabilise or increase the target group's disposable income? To what extent have poor households benefited from the programme? What other consequences did building energy-efficient housing units have for the owners and residents?	Survey of target group, analysis of relevant documents			
Were the needs and capacities of particularly disadvantaged or vulnerable parts of the target group taken into account (possible differentiation according to age, income, gender, ethnicity, etc.)? How was the target group selected?	Which target group was the beneficiary of the construction of energy-efficient housing units? How were the programme beneficiaries selected? What proportion of the target group was disadvantaged or vulnerable?	Partner survey, KfW, analysis of reports			
Would the programme (from an ex post perspective) have had other significant gender impact potentials if the concept had been designed differently? (FC-E-specific question)	Were potential impacts on gender-specific issues identified during the course of the programme and, if necessary, taken into account?	Partner survey, KfW, analysis of reports			
Evaluation dimension: Appropriateness of design			3	0	
Was the design of the programme appropriate and realistic (technically, organisationally and financially) and in principle suitable for contributing to solving the core problem?	What design consequences were drawn from the first phase of the EcoCasa project? Was the design of the second phase suitable for reducing electricity consumption and the associated greenhouse gas emissions in the construction sector?	Comparison of the concepts of the first and second phase. Estimate of actual savings with business-as-usual scenario and with the development of electricity demand during the project period.			
Is the programme design sufficiently precise and plausible	How were the savings with regard to electricity consumption and emissions calculated? What assumptions were the	Survey of SHF, KfW, target group, relevant actors in the sector, analysis of studies if available			

(transparency and verifiability of the target system and the underlying impact assumptions)?	calculations based on? Were the assumptions (economic and useful life of energy efficiency technologies, constant emission factor, user behaviour, rebound effect, etc.) realistic? To what extent were the theoretically determined values and assumptions verified by surveys of the households or a comparable monitoring system?	
Please describe the theory of change, incl. complementary measures, if necessary in the form of a graphical representation. Is this plausible? As well as specifying the original and, if necessary, adjusted target system, taking into account the impact levels (outcome and impact). The (adjusted) target system can also be displayed graphically. (FC-E-specific question)	For more information, see Logframe in the PP and PCR. For plausibility and adjustment of the target system, see above Annex “Target system and indicators”	
To what extent is the design of the programme based on a holistic approach to sustainable development (interplay of the social, environmental and economic dimensions of sustainability)?	Has the programme sufficiently taken all sustainability dimensions into account? To what extent has the design taken into account possible financial consequences of the energy efficiency measures for the developer, the buyer and the tenant? To what extent has the market development for energy efficiency technologies been taken into account in the design?	Survey of SHF, KfW, relevant stakeholders, analysis of studies
For projects within the scope of DC programmes: is the programme, based on its design, suitable for achieving the objectives of the DC programme? To what extent is the impact level of the FC module meaningfully linked to the DC programme (e.g. outcome impact or	Did the measure make a relevant contribution to the objectives of the DC programme?	Survey of GIZ, KfW. Evaluation of documents

output outcome)? (FC-E-specific question)					
Other evaluation question 1	Given their benefits, why did energy efficiency measures not establish themselves, and instead needed government support?	Survey of building owners, document analysis			
Evaluation dimension: Response to changes/adaptability			2	0	
Has the programme been adapted in the course of its implementation due to changed framework conditions (risks and potential)?	To what extent did the framework conditions for energy efficiency measures in the construction sector and for the main promotional measure (provision of low-interest loans) change during the course of the project? What were the consequences of this?	Survey of SHF, KfW, relevant stakeholders			

Coherence

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Internal coherence (division of tasks and synergies within German development cooperation):			2	0	
To what extent is the programme designed in a complementary and collaborative manner within the German development cooperation (e.g. integration into DC programme, country/sector strategy)?	Which other German DC interventions were carried out in the construction and energy sectors, or upon which other interventions was the present project based?	GIZ, KfW			
Do the instruments of the German development cooperation dovetail	To what extent were various German DC instruments used in a conceptually sensible manner as part of the	Survey of GIZ, KfW			

in a conceptually meaningful way, and are synergies put to use?	programme, and did synergies arise from this?				
Is the programme consistent with international norms and standards to which the German development cooperation is committed (e.g. human rights, Paris Climate Agreement, etc.)?	In addition to the MDGs/SDGs and the Paris Agreement, which international norms and standards are addressed by the programme and to what extent have they been taken into account?	Document analysis			
Evaluation dimension: External coherence (complementarity and coordination with actors external to German DC):			2	0	
To what extent does the programme complement and support the partner's own efforts (subsidiarity principle)?	What measures has the government taken to improve the energy efficiency of new and existing buildings? What was the specific need for support from FC? To what extent is the programme supplementary to the partner's own efforts? Was the project-executing agency SHF's and other partner organisations' own contribution to the programme appropriate?	Project documents, SHF survey			
Is the design of the programme and its implementation coordinated with the activities of other donors?	What coordination was there with other relevant donors? Which other donors are active in the sector, with which projects?	Analysis of information with regard to World Bank, EU, IDB			
Was the programme designed to use the existing systems and structures (of partners/other donors/international organisations) for the implementation of its activities and to what extent are these used?	Which systems and structures exist in Mexico's construction sector that were relevant for the project? To what extent did the design and implementation of the programme envisage the use of the existing systems and structures?	Survey of key stakeholders in the construction sector and SHF			

Are common systems (of partners/other donors/international organisations) used for monitoring/evaluation, learning and accountability?	How did the partner monitor and evaluate the results of the activities? What other monitoring and evaluation systems exist? How were possible learning experiences (particularly in the first phase) discussed among those involved?	Survey of SHF and relevant stakeholders, if necessary final report from IDB.

Effectiveness

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Achievement of (intended) targets			4	0	
Were the (if necessary, adjusted) objectives of the programme (incl. capacity development measures) achieved? Table of indicators: Comparison of actual/target	Were the planned theoretical savings in electricity consumption, electricity costs and greenhouse gas emissions actually achieved through energy-efficient building technologies? Has the interior climate changed in line with the objectives?	Analysis of documents, survey of SHF, KfW, relevant stakeholders and target group			
Other evaluation question 1	How plausible are the assumptions upon which the calculation of the savings is based?	Survey of SHF, KfW, relevant stakeholders and target group, analysis of documents			
Other evaluation question 2	What monitoring data was collected to plausibly prove the achievement of the objectives and the outputs on which they are based?	Survey of SHF, KfW, relevant stakeholders, analysis of documents			
Evaluation dimension: Contribution to achieving targets			1	0	
To what extent were the outputs of the programme delivered as planned (or adapted to new	Has the planned number of residential units been built? Did the sales price remain constant during the project term?	SHF survey, monitoring data analysis			

developments)? *(Learning/help question)*		
Are the outputs provided and the capacities created used?	To what extent do the residents use the energy-efficient housing units properly (mainly periodic forced ventilation instead of creating draughts)? How were residents informed about the proper use of efficiency technologies?	Target group survey, SHF
To what extent is equal access to the outputs provided and the capacities created guaranteed (e.g. non-discriminatory, physically accessible, financially affordable, qualitatively, socially and culturally acceptable)?	Who lives in the energy-efficient housing units? Is there any evidence of discrimination in the purchase and rental of energy-efficient housing units?	Target group survey, SHF
To what extent did the programme contribute to achieving the objectives?	What energy efficiency level/class was achieved? What other sustainability-enhancing features do the newly built residential units have? To what extent do the supported housing units differ from conventional housing units?	Survey SHF, construction companies
To what extent did the programme contribute to achieving the objectives at the level of the intended beneficiaries?	To what extent is the energy-saving potential of the installed building technologies actually exploited by the residents, and were there factors that limited the positive effects on income?	Target group survey
Did the programme contribute to the achievement of objectives at the level of the particularly disadvantaged or vulnerable groups involved and affected (potential differentiation according to age, income, gender, ethnicity, etc.)?		No objectives were formulated at the level of particularly disadvantaged or vulnerable target groups.

Were there measures that specifically addressed gender impact potential (e.g. through the involvement of women in project committees, water committees, use of social workers for women, etc.)? (FC-E-specific question)		The programme did not address any gender impact potentials.			
Which project-internal factors (technical, organisational or financial) were decisive for the achievement or non-achievement of the intended objectives of the programme? *(Learning/help question)*	How decisive were the technical, organisational and financial resources of SHF and other institutions involved in the project for the success of the measure?	Survey of SHF and other relevant stakeholders			
Which external factors were decisive for the achievement or non-achievement of the intended objectives of the programme (also taking into account the risks anticipated beforehand)? *(Learning/help question)*	To what extent did the general interest rate development, the development of electricity tariffs and other factors influence the achievement of the targets?	SHF survey, commercial developers			
Evaluation dimension: Quality of implementation			3	0	
How is the quality of the management and implementation of the programme to be evaluated with regard to the achievement of objectives?	To what extent was SHF's management and implementation of the programme focused on target achievement? How professionally was the focus pursued?	Survey of relevant stakeholders in the construction sector			
How is the quality of the management, implementation and participation in the programme by the partners/sponsors evaluated?	Did the composition of SHF's decision-making bodies in terms of gender and ethnicity have an impact on the achievement of the goals?	Survey of commercial developers			
Were gender results and relevant risks in/through the project (gender-	How is the quality of the management and implementation of the measure by	Target group survey			

based violence, e.g. in the context of infrastructure or empowerment projects) regularly monitored or otherwise taken into account during implementation? Have corresponding measures (e.g. as part of a CM) been implemented in a timely manner? (FC-E-specific question)	SHF generally assessed by the developers?				
Evaluation dimension: Unintended consequences (positive or negative)			2	–	Unintended effects did not play a significant role
Can unintended positive/negative direct impacts (social, economic, ecological and, where applicable, those affecting vulnerable groups) be seen (or are they foreseeable)?	Are there any known negative environmental characteristics of the technologies used (during use, disposal) that must be taken into account? Have the technologies used led to a significant increase in costs in housing construction?	Survey of commercial developers, literature review			
What potential/risks arise from the positive/negative unintended effects and how should they be evaluated?	If one of the two previous questions is answered positively, what are the resulting short-term, medium-term and long-term risks?	Survey of SHF and relevant stakeholders in the construction sector			
How did the programme respond to the potential/risks of the positive/negative unintended effects?	If negative effects have occurred or could occur, what measures has SHF taken to mitigate or exclude these effects?	SHF survey			

Efficiency

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Production efficiency			2	0	

How are the inputs (financial and material resources) of the programme distributed (e.g. by instruments, sectors, sub-measures, also taking into account the cost contributions of the partners/executing agency/other participants and affected parties, etc.)? (Learning and help question)	What input was provided by the project-executing agency and other involved organisations to implement the project? What was the administrative and financial burden on the part of SHF and other organisations involved in implementing the project? Who bears the costs for this, what share did the project-executing agency have?	Project completion report, survey and documents from SHF and other relevant organisations.
To what extent were the inputs of the programme used sparingly in relation to the outputs produced (products, capital goods and services) (if possible in a comparison with data from other evaluations of a region, sector, etc.)? For example, comparison of specific costs.	How high was the subsidy for the construction loans? How high was the subsidised interest rate compared to non-subsidised interest rates? Was the amount of the subsidy appropriate? What is the share of administrative costs compared to the loans granted and the number of energy-efficient housing units achieved?	Survey of SHF, commercial developers and banks
If necessary, as a complementary perspective: To what extent could the outputs of the programme have been increased by an alternative use of inputs (if possible in a comparison with data from other evaluations of a region, sector, etc.)?	To what extent could direct subsidies for energy-efficient construction projects and/or individual technologies have led to a higher number of corresponding housing units?	Analysis of alternative models, survey of relevant institutions in the construction sector?
Were the outputs produced on time and within the planned period?	Was the planned number of residential units with the corresponding efficiency levels created within the planned time period?	Target-actual comparison
Were the coordination and management costs reasonable (e.g. implementation consultant's cost component)? (FC-E-specific question)	How many SHF employees were involved in the implementation of the project? Was the number and qualification of employees adequate? To what extent were SHF's overall management costs appropriate in relation to the objectives pursued?	Analysis of costs incurred.

Evaluation dimension: Allocation efficiency			3	0	
In what other ways and at what costs could the effects achieved (outcome/impact) have been attained? *(Learning/help question)*	Is investing in energy-efficient houses a cost-effective measure compared to other measures to achieve significant savings in electricity consumption and greenhouse gas emissions?	Survey of target group and commercial developers, calculation of costs per tonne of CO_2 saved			
To what extent could the effects achieved have been attained in a more cost-effective manner, compared with an alternatively designed programme?	How is the cost-effectiveness of the other measures to be assessed?	Calculation of costs per tonne of CO_2 saved			
If necessary, as a complementary perspective: To what extent could the positive effects have been increased with the resources available, compared to an alternatively designed programme?	To what extent is the programme scalable with the available resources? Were imitation effects observed that increased the positive effects?	Survey of relevant stakeholders, analysis of reports and statistics			
Note: If the internal identifier PSP (Private Sector Participation; see Inpro under 1.11) was issued for the project or there is generally cooperation with private actors (commercial banks, companies, professional NGOs) in the implementation of FC (private sector as an instrument), the following evaluation question must be taken into account:					
In what respect was the use of public funds financially complementary?					

Impact

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Overarching developmental changes (intended)			3	0	

Is it possible to identify overarching developmental changes to which the programme should contribute? (Or if foreseeable, please be as specific as possible in terms of time.)	Has the project made a significant contribution to the efficient use of scarce energy resources and to climate action?	Estimate of the actual energy savings achieved and the corresponding CO_2 reduction and CO_2 avoidance costs			
Is it possible to identify overarching developmental changes (social, economic, environmental and their interactions) at the level of the intended beneficiaries? (Or if foreseeable, please be as specific as possible in terms of time)	What general effects did the programme have on the target group's living conditions? What role did the requirements for construction projects that go beyond energy efficiency play?	Interviews with target group, commercial developers			
To what extent can overarching developmental changes be identified at the level of particularly disadvantaged or vulnerable parts of the target group to which the programme should contribute? (Or, if foreseeable, please be as specific as possible in terms of time)	To what extent did particularly disadvantaged or vulnerable parts of the population also benefit from the programme? To what extent did they have access to the housing units built?	SHF survey, commercial developers Interviews with target group			
Evaluation dimension: Contribution to overarching developmental changes (intended)			3	0	
To what extent did the programme actually contribute to the identified or foreseeable overarching developmental changes (also taking into account the political stability) to which the programme should contribute?	What role does residential construction play in terms of the percentage of primary energy consumption and carbon emissions in Mexico over time since the start of the project and projected up to 2030? What is the comparison between the business-as-usual scenario and a scenario in which all newly constructed flats have the EcoCasa standard in terms of energy and carbon footprint? Was the assumption of a constant grid emission factor realistic?	National and international statistics, analysis of reports and studies			

	Are there indications of rebound effects (e.g. through the use of additional electrical equipment, lamps)?	
To what extent did the programme achieve its intended (possibly adjusted) developmental objectives? In other words, are the project impacts sufficiently tangible not only at outcome level, but at impact level? (e.g. drinking water supply/health effects)	What contribution did the project's impact on energy consumption from fossil sources and greenhouse gas emissions actually make? To what extent did this make a significant contribution to Mexico's national climate targets?	Analysis of national statistics and documents (NDC report)
Did the programme contribute to achieving its (possibly adjusted) developmental objectives at the level of the intended beneficiaries?		The programme had no development policy objectives at the level of the intended beneficiaries.
Has the programme contributed to overarching developmental changes or changes in life situations at the level of particularly disadvantaged or vulnerable parts of the target group (potential differentiation according to age, income, gender, ethnicity, etc.) to which the programme was intended to contribute?	If particularly disadvantaged or vulnerable parts of the target group benefited from the EcoCasa housing units, what overall effect on quality of life did the programme contribute to? Can substantial improvements in income or the health situation be observed due to a better interior climate?	KfW and SHF survey, EcoCasa accompanying studies
Which project-internal factors (technical, organisational or financial) were decisive for the achievement or non-achievement of the intended developmental objectives of the programme? *(Learning/help question)*	How decisive were the technical, organisational and financial resources of SHF and other institutions involved in the project for the development policy success of the programme?	Survey of SHF and relevant organisations involved
Which external factors were decisive for the achievement or non-	To what extent did the general development of interest rates, the development of	Analysis of documents and statistics on the development of Mexico as a whole

achievement of the intended developmental objectives of the programme? *(Learning/help question)*	electricity tariffs, the electricity sector and the growth of the economy and incomes influence the achievement of the targets?				
Does the project have a broad-based impact? - To what extent has the programme led to structural or institutional changes (e.g.in organisations, systems and regulations)? (Structure formation) - Was the programme exemplary and/or broadly effective and is it reproducible? (Model character)	To what extent did the programme lead to a change in building standards and/or a change in building loans and thus to structural or institutional changes? To what extent has a market for energy-efficient building technologies and construction projects emerged that has achieved a broad effect? To what extent were the promoted energy-efficient housing units imitated without promotion?	Research and survey of SHF and relevant stakeholders in the construction sector.			
How would the development have gone without the programme (developmental additionality)?	Were energy-efficient residential housing units already built at the start of the project? How was the growth forecast for this type of construction? Were there regions where the programme was not active? If so, how has the supply and demand for energy-efficient housing units developed there?	Survey of relevant stakeholders in the construction sector			
Other evaluation question 1	Have other countries in the region benefited from the experiences of the programme?	Document analysis			
Evaluation dimension: Contribution to (unintended) overarching developmental changes			2	–	Unintended developmental changes did not play a significant role.
To what extent can unintended overarching developmental changes (also taking into account political stability) be identified (or, if	Are there any known negative environmental characteristics of the technologies used (during use, disposal) that could have a negative impact on development policy processes? Have the technologies used led to a significant increase in costs in housing	Survey of target group, commercial developers, SHF and, if necessary, environmental actors			

foreseeable, please be as specific as possible in terms of time)?	construction, which affects the development of the construction sector?	
Did the programme noticeably or foreseeably contribute to unintended (positive and/or negative) overarching developmental impacts?	To what extent have negative developmental impacts actually occurred? Was there any positive overarching developmental impact, such as significant improvements in living conditions (education, health, mobility) to which the programme has contributed?	Survey of target group, commercial developers, SHF and, where applicable, environmental actors, civil society organisations, analysis of articles and studies
Did the programme noticeably (or foreseeably) contribute to unintended (positive or negative) overarching developmental changes at the level of particularly disadvantaged or vulnerable groups (within or outside the target group) (do no harm, e.g. no strengthening of inequality (gender/ethnicity))?	To what extent have negative developmental impacts occurred that affect particularly disadvantaged and vulnerable groups? Was there any potential positive overarching developmental impact specifically for these groups, such as significant improvements in living conditions (education, health, mobility) to which the programme has contributed?	Survey of target group, commercial developers, SHF and, where applicable, environmental actors, civil society organisations, analysis of articles and studies

Sustainability

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Capacities of participants and stakeholders			3	0	
Are the target group, executing agencies and partners institutionally, personally and financially able and willing (ownership) to maintain the positive effects of the programme over time (after the end of the promotion)?	Would SHF and the commercial developers be able to continue the EcoCasa approach with low-interest construction loans for commercial developers or a similar programme after the end of the project? Are there companies that offer energy-efficient building technologies (insulation material, multi-glazed windows) and have the capacity to expand?	Survey of SHF, commercial developers, CONAVI, target group			

	Are residents willing and able to use the energy efficiency of their housing units over time?				
To what extent do the target group, executing agencies and partners demonstrate resilience to future risks that could jeopardise the impact of the programme?	Is the target group (buyers and tenants of housing units) aware of the benefits of energy-efficient housing units and do they have the knowledge and resources to address risks and changes affecting energy efficiency? To what extent would the commercial developers be able to continue implementing energy-efficient construction projects under changed framework conditions (e.g. end of promotional funds)? To what extent can SHF or another institution continue to pursue the EcoCasa approach, even if the government shifts its priorities?	Survey of commercial developers and target group, survey of SHF and CONAVI			
Evaluation dimension: Contribution to supporting sustainable capacities:			3	0	
Did the programme contribute to the target group, executing agencies and partners being institutionally, personally and financially able and willing (ownership) to maintain the positive effects of the programme over time and, where necessary, to curb negative effects?	Are SHF and the commercial developers interested and willing to continue the EcoCasa approach with low-interest construction loans for commercial developers or a similar programme after the end of the project, provided that overarching entities and the framework conditions allow this? Are there companies that want to expand their investments in energy-efficient building technologies (insulation material, multi-glazed windows)?	Survey of SHF and commercial developers			
Did the programme contribute to strengthening the resilience of the target group, executing agencies and partners to risks that could jeopardise the effects of the programme?	Has the programme helped commercial developers and residents to be aware of the advantages of energy-efficient housing units and to be willing to continue investing in them, even if the framework conditions change (e.g. higher construction costs, lower electricity costs or higher availability of energy-efficient air conditioning systems)? To what extent has the project contributed to SHF	Survey of commercial developers, SHF and target group			

	or another institution continuing to pursue the EcoCasa approach, even if the government shifts its priorities?				
Did the programme contribute to strengthening the resilience of particularly disadvantaged groups to risks that could jeopardise the effects of the programme?	Has the programme contributed to particularly disadvantaged groups being aware of the advantages of energy-efficient housing units and therefore wanting to live in such housing units, even if the framework conditions change unfavourably?	Target group survey			
Evaluation dimension: Durability of impacts over time			3	0	
How stable is the context of the programme (e.g. social justice, economic performance, political stability, environmental balance)? (*Learning/help question*)	Has the context of the programme changed significantly over time and if so, how?	Survey of SHF, CONAVI, commercial developers and target group			
To what extent is the durability of the positive effects of the programme influenced by the context? *(Learning/help question)*	What influence does the new government's energy policy, the level of electricity prices and other societal developments have on supply and demand for energy-efficient housing units?	Survey of SHF, CONAVI, commercial developers			
To what extent are the positive and, where applicable, the negative effects of the programme likely to be long-lasting?	To what extent can the savings achieved in electricity consumption and electricity costs as well as the improvement of the interior climate be expected to last in the longer term?	Analysis of the quality of the construction measures, assessments of SHF and commercial developers			
To what extent are the gender results of the measure to be considered permanent (ownership, capacities, etc.)? (FC-E-specific question)	To what extent did the programme show results with regard to gender? How is their longevity to be assessed?	Target group survey, SHF			