



## 1. Project Data

**Project ID**  
P127035

**Project Name**  
Shanghai low-carbon city

**Country**  
China

**Practice Area(Lead)**  
Energy & Extractives

**L/C/TF Number(s)**  
IBRD-82330

**Closing Date (Original)**  
31-Dec-2018

**Total Project Cost (USD)**  
104,345,000.00

**Bank Approval Date**  
20-Mar-2013

**Closing Date (Actual)**  
31-Dec-2018

	<b>IBRD/IDA (USD)</b>	<b>Grants (USD)</b>
Original Commitment	100,000,000.00	0.00
Revised Commitment	100,000,000.00	0.00
Actual	100,000,000.00	0.00

**Prepared by**  
Chikako Miwa

**Reviewed by**  
Fernando Manibog

**ICR Review Coordinator**  
Ramachandra Jammi

**Group**  
IEGSD (Unit 4)

**Project ID**  
P127034

**Project Name**  
CN GEF Shanghai Low-Carbon City ( P127034 )

**L/C/TF Number(s)**  
TF-14205

**Closing Date (Original)**

**Total Project Cost (USD)**  
4345000.00

**Bank Approval Date**  
20-Mar-2013

**Closing Date (Actual)**



	IBRD/IDA (USD)	Grants (USD)
Original Commitment	0.00	4,345,000.00
Revised Commitment	0.00	4,345,000.00
Actual	0.00	4,345,000.00

## 2. Project Objectives and Components

### a. Objectives

**Project Development Objective (PDO):** The PDO is to “pilot green-energy schemes and scale up low-carbon investments in buildings in Shanghai Municipality, with a focus on Changning District, and the higher-level global environment objective of the Project is to support Shanghai Municipality’s low-carbon city development by promoting green-energy schemes, with a focus on Changning District.” (Loan Agreement dated June 14, 2013, Schedule 1, page 5).

For the purposes of this ICR Review, the following sub-objectives will be assessed:

Sub-objective 1: To pilot green energy schemes in Shanghai Municipality, with a focus on Changning District

Sub-objective 2: To scale up low-carbon investments in buildings in Shanghai Municipality, with a focus on Changning District.

**Global Environment Objective (GEO):** To support Shanghai Municipality’s low-carbon city development by promoting green-energy schemes, with a focus on Changning District.

### b. Were the project objectives/key associated outcome targets revised during implementation?

No

### c. Will a split evaluation be undertaken?

No

### d. Components

#### 1. Technical Assistance and Incremental Support for Near Zero-Emission Buildings (Appraisal cost: US\$10 million, Actual cost: US\$37.57 million)

The actual cost for the technical assistance and incremental support for near zero-emission buildings increased from the appraisal cost, mainly due to an increase in activities on green energy building (from US\$6.66 million at appraisal to US\$30.73 million, 461 per cent of the original estimate) and on capacity building and project management support (from US\$2.04 million to US\$5.782 million, 283 per cent of the original estimate). The increased costs were financed by an increase in contribution from the Changning



district government and project developers for green energy building (from US\$4 million at appraisal to US\$ 28.595 million).

(a) Green-Energy Buildings

- Provision of technical assistance to and capacity building of Changning District for the green-energy retrofitting of buildings, that covered implementation of energy-efficiency and renewable-energy technologies in existing buildings.
- Demonstration of at least one (1) near zero-emission building in Changning District.

(b) Low-Carbon Energy Supply

- Provision of technical assistance to Changning District for the implementation of distributed generation from renewable energy and natural gas and a pilot carbon emissions cap and trade scheme.

(c) Green Mobility

- Provision of technical assistance to Changning District for the design and development of implementation plans for the improvement of local public transport systems to discourage the use of private vehicles.

(d) Capacity Building and Project Management Support

- Carrying out of due diligence reviews of Part 2 of the Project, and promotion of low-carbon investments.
- Capacity building of key stakeholders for the development and implementation of low-carbon initiatives.
- Project management, implementation, and monitoring and evaluation and donor coordination.

**2. Low-Carbon Investments (Appraisal cost: US\$246 million, Actual cost: US\$332 million)**

The actual cost for low-carbon investment increased from the appraisal cost, mainly due to an increase in contributions from IBRD, Shanghai Pudong Development (SPD) Bank and the Bank of Shanghai (BOS), and project developers for new green energy buildings (from US\$ 15 million to US\$ 240.67 million).

(a) Green-Energy Retrofitting of Buildings

- Implementation of low-carbon technologies in existing buildings.

(b) New Green-Energy Buildings

- Implementation of low-carbon technologies above municipal building code requirements in new buildings.



### e. Comments on Project Cost, Financing, Borrower Contribution, and Dates

**Project Cost:** At appraisal, the original cost estimate was US\$256 million. The actual cost was US\$369.89 million (ICR, para. 20). There was an almost 50 percent increase in total cost due to a cost increase for constructing green energy buildings. The increase in project cost was covered by contributions from the Implementing Agencies, which were the Changning District Government, Shanghai Pudong Development (SPD) Bank, and the Bank of Shanghai (BOS), as well as project developers.

**Financing:** At appraisal, the IBRD loan financing and the GEF grant were estimated at US\$100 million and US\$4.345 million, respectively. The actual IBRD disbursement and the GEF grant were the same as the estimates.

**Borrower Contribution:** At appraisal, the Implementing Agencies and project developers were expected to contribute US\$151.655 million. The actual contribution was US\$222.255 million. The details of the contributions were presented in Annex 3, page 45 in the ICR.

**Dates:** Upon the Government's request, the Project underwent a Level Two restructuring on July 23, 2018. The allocation for the expenditure on goods, services, and training was increased while the allocations for green energy building sub-grants and operating costs were decreased (ICR, Table 2, page 13). The project closed on December 31, 2018, as originally planned.

A split evaluation was deemed unnecessary, as the PDOs, the outcome targets, the PDO Indicators, and the components remained unchanged during implementation.

## 3. Relevance of Objectives

### Rationale

Country Context. At the time of appraisal, the significant consumption of fossil fuels, especially coal, had been posing threats to the country in terms of air pollution, climate change, and energy security. The coal consumption was expected to intensify due to rapid urbanization. Cities accounted for 85 percent of China's commercial energy use (PAD, para 3). The large cities (i.e., Shanghai, Beijing and Tianjin) generated CO<sub>2</sub> emissions per capita that were three to four times higher than the national average (PAD, para 3). Over the next 20 years, it was projected that urban areas would receive an additional 300 million migrants, which would multiply the energy demand and the related CO<sub>2</sub> emissions by 3 times for buildings and 4 times for transport (PAD, para 2).

Recognizing these threats, the Government of China (GoC) set cities as the core of the action plan to achieve its carbon intensity reduction target, which targeted to reduce the carbon intensity by 40-45 percent from 2005 to 2020 (PAD, para 1).

Sector Context. The Shanghai Municipal Government and Changning District Government were committed to adopt green-energy schemes. Shanghai was one of the pioneer cities to pilot carbon emissions trading schemes (ETS). Changning established the online platform to monitor energy use for public buildings in 2017, which was the first one in Shanghai. The municipal and district governments had also dedicated funds for energy conservation and emissions reduction activities to achieve various targets including in the



building sector. Shanghai and Changning sought to benefit from international knowledge and best practice to accelerate and enhance the quality of their low-carbon urban development initiatives.

The analysis at appraisal concluded that the highest emission reduction potential in Changning was in building retrofits. Buildings were estimated to contribute as much as 90 percent of total final energy consumption in Changning (ICR, para 3). Building retrofits, especially of commercial buildings, would contribute more than half of the estimated potential reduction of emissions in Changning. Retrofitting buildings would have wide replication potential in China, but the single largest barrier was that owners were reluctant to invest in Energy Efficiency (EE) measures. The reluctance stemmed from several factors: (a) energy costs were a small share of building operating costs; (b) building retrofit investments usually had long payback periods; (c) building retrofits may disrupt building users and thus lead to foregone rent; and (d) building managers and users faced conflicting incentives. This is because building managers bear costs of EE investments but direct benefits from the EE investments would be felt only by building users who pay energy bills.

Relevance to Government Strategies. At appraisal, the PDO was relevant to the GoC's 12th Five-Year Plan (FYP) (2011-2015), which was targeted to: cut the energy intensity of the economy by 16 percent by 2015, increase the share of non-fossil fuels in primary energy from 8 to 15 percent from 2011 to 2020, increase the implementation rate of new green building standards by 14 percent by 2015, and reduce the per capita energy consumption of public buildings by 15 percent by 2015. Moreover, the PDO was aligned with the priorities under Shanghai's 12th FYP for Energy Conservation and Climate Change (issued in March 2012), which aimed to: strengthen energy-saving monitoring and management systems, accelerate the development of energy saving and low carbon transportation, and promote low-carbon buildings.

In 2007, Changning had established the first online platform to monitor energy use for public buildings in Shanghai. This became a model for replication in all other districts as mandated by the Shanghai Municipal Government in 2012. Expanded coverage was expected to address performance risk by allowing the monitoring and verification of consumer behavior and management of building energy systems. The municipal and district governments had also dedicated funds for energy conservation and emissions reduction activities to achieve various targets including in the building sector. In January 2013, Changning District Government issued "Low-Carbon Development Special Funds Management Measures" to provide subsidy incentives for building retrofits.

At project closure, the PDO was relevant to the 13th FYP (2016-2020). However, the PDO's relevance to the Government strategies was weakened regarding: (1) the ETS for buildings and (2) the subsidies for building retrofits. due to the anticipated shift in focus of the emerging national ETS to the energy sector, oversupply of offsets under the China Certified Emissions Reduction program relative to demand, and the central government's indication that renewable energy purchase would be required. In addition, the relevance of the subsidies to incentivize the retrofits were weakened due to the lack of the policy that makes building retrofits mandatory.

Relevance to Bank Strategies. At appraisal, the PDO was relevant to the World Bank Group Country Partnership Strategy (CPS) (FY2013-2016). At present, the PDO remains relevant to the same CPS. There was no subsequent CPS available at project closure.

Institutional Capacity and Realism. The first component of the Project was implemented by the Project Management Office (PMO) in the Changning District Government, while the second component was



implemented by Shanghai Pudong Development (SPD) Bank and the Bank of Shanghai (BOS), the participating financial intermediaries (PFIs) responsible for channeling the Bank loan.

At appraisal, SPD Bank and BOS were selected as the implementing agencies because those commercial banks: (a) were committed to green credit businesses, had previous experience with building Energy Efficiency (EE) and Energy Service Companies (ESCO) investments, and focused strongly on SME finance; and (b) had the Shanghai municipal government as the largest shareholder (PAD, para. 57, page 13).

The PAD (para. 13, page 34) stated that the implementing agencies (PMO, SPD Bank, and BOS) have limited experience in managing Bank projects, although SPD Bank is a partner under the IFC's China Utility-Based Energy Efficiency (CHUEE) program. Therefore, the implementing agencies needed to hire qualified experts and strengthen their capacity through training in Bank procurement, financial management, and safeguard policies and procedures, as well as technical due diligence skills. The capacity development of the implementing agencies was conducted under Component 1 of the Project.

Previous Sector Experience. The design of the project has benefitted substantially from the successful financial intermediary (FI) experience of the China Energy Efficiency Financing (CHEEF) program, under which three participating banks on-lent IBRD loans to sub-borrowers for industrial and building EE projects. The Second Phase of China Renewable Energy Scale-Up Program (CRESP) intended to support RE policies and pilot RE applications in cities, particularly tackling the issue of grid connection for roof-top solar PVs. Establishing Measurement and Verification System for Energy Efficiency in China aims to establish an energy savings measurement & verification (M&V) methodology and system. The Shanghai project could be an M&V pilot in the building sector using its on-line energy monitoring platform. The Partnership for Market Readiness is assisting China in designing, piloting, and eventually implementing a carbon cap and trade scheme, under which Shanghai is also a pilot city. Finally, the GEF Heat Reform and Building Energy Efficiency Project focused on new residential building codes in northern China (PAD, para. 45, page 10).

## **Rating**

Substantial

## **4. Achievement of Objectives (Efficacy)**

### **OBJECTIVE 1**

#### **Objective**

Sub-objective 1: To pilot green energy schemes in Shanghai, with a focus on Changning District

As indicated in Section 2.a. above, the PDO will be assessed in terms of its underlying sub-objectives.

#### **Rationale**



**Theory of Change (TOC) for Sub-objective 1:** There were three paths to achieve Sub-objective 1.

- **Green energy buildings:** The activities of developing of green-energy building policies, making financing mechanism recommendations, expanding online energy monitoring platform, and conducting diagnosis and feasibility studies of buildings would be expected to lead to an increase in investments in building retrofits, while construction and demonstration of a Near Zero Emissions (NZE) building would lead to attract new investments in NZE buildings. Retrofitted green-energy buildings and NZE buildings would lead to energy savings and greenhouse gas emissions reductions. Key assumptions include: the green-energy building policies would come into effect early during the project duration, financing mechanism would be developed as recommended, and the retrofitted green-energy buildings and demonstrated NZE building would attract sufficient investments.
- **Low-carbon energy supply:** Constructing and demonstrating distributed generation centers, as well as supporting participation of buildings in the carbon emission cap and trade scheme (ETS) in Changning, would lead to an increase in low-carbon energy supply.
- **Green Mobility:** Bus and Non-Motorized Transport (NMT) areas were adopted after the development of plans to connect the “last mile” between metro/train stations and office buildings. During implementation, the activities on buses were dropped due to the private sector’s entry in the business of renting bicycles. The key assumption was that, after the bus and NMT system was adopted, people would increase their use of NMTs.

**Outputs:**

- Green-energy building policies, business models, and financing mechanism recommendations were completed.
- Online energy monitoring platform for all large buildings in Changning was established.
- Audits, diagnoses, and feasibility studies of building retrofits were completed.
- New NZE building was constructed.
- Technical design of a pilot distributed generation center in Changning District, which was designed to use renewable energy and/or natural gas, was completed.
- TA to design and implement pilot participation of buildings under the city’s cap-and-trade scheme including through purchase of ‘green electricity’ was completed.
- Three non-motorized transport areas were designed to be implemented as part of an overall plan for Changning district.
- Of the 67 subprojects under the Project, 26 subprojects on NZE buildings leveraged the co-financing of US\$19.39 million from the project developers.

**Intermediate Results:**

The achievements of the relevant Intermediate Results (IR) indicators were as follows.

- Innovative policies were piloted in relation to green-energy retrofitting of buildings by October 2018, achieving the target after the original target date of “by fiscal year (FY) 2016”. The issuance of



Changning District “Public Buildings Energy Efficiency Management Measures” was delayed. IEG concurs with the ICR team that “[i]f adopted, implemented, and scaled-up sufficiently early before project completion, the pilot schemes could contribute indirectly to the outcome at completion as measured by GEO Indicator, and to PDO Indicators 2 and 3 on energy savings and emissions reductions from investments in low-carbon buildings (ICR, para 74, page 24). Nevertheless, considering that the city pioneered in setting up policies for green-energy retrofitting in China, the policy’s impact on energy saving and carbon emission reduction in the long term would be promising (The ICR team’s written response dated March 23, 2020 to the draft ICR Review; hereafter, comments from the ICR team).

- There were 187 online energy monitoring platforms established, achieving the target of 160 against the baseline of 100; however, according to the ICR (page 34), the achievement was only modestly attributable to the Project. The coverage was expanded in alignment with the government policy that had been established; the Project’s main contribution against this IR indicator’s target was to improve the platforms’ capabilities and functions. The energy monitoring platforms in Changning district were widely replicated in other districts as well as Shanghai Municipal Government to administer building energy efficiency. Approximately 1,600 large commercial buildings to gain access to the municipal platform of Shanghai by 2018 (The PMO’s written response dated March 13, 2020 to the draft ICR Review; hereafter, comments from the PMO).
- One NZE building was piloted by December 2018, achieving the target (100 percent of the original target). It was replicated and awarded by both central government and international agencies.
- No innovative financing mechanisms were developed for green-energy retrofitting of buildings, thus not achieving the target. This was due to the District Government’s unwillingness to develop a guarantee mechanism to mitigate risks of lending to Small and Medium Enterprises (SMEs). As alternative measures to the guarantee mechanism, the Changning government conducted a disclosure of energy consumption, energy audits, and an adaptable government subsidy program, aiming to promote the retrofit of existing buildings (Comments from the ICR team).
- Seven distributed generation centers (i.e., distributed combined heat and power generation systems in two subprojects and distributed PV in five subprojects) were built by December 2018, exceeding the target (700 percent of the original target).
- NMT system was piloted by December 2018. The Project cancelled the activities on buses to avoid an overlap of activities with the private sector, as shared bicycle businesses were emerged to address the last-mile issue. During the project implementation, the project activities on green mobility shifted its focus to support NMT system through piloting roads and passages for pedestrians and cyclists and conducting a study on NMTs to be included as a part of the government plan (Comments from the ICR team).
- Project experience and knowledge were shared through publications and international forums.

#### Outcomes:

- Annual energy savings in the amount of 78,083 tons of coal equivalent (tce) per year were supported by the investments under the Project (11,752 tce and 66,331 tce per year under Component 1 and 2, respectively). The achievement exceeded the target of 76,000 tons of coal equivalent per year (103 percent of the original target). The pilots of green-energy schemes indirectly contributed to the energy savings under the Project as a whole, by providing a foundation to scale-up the low-carbon investment under Component 2.



- Use of renewable energy increased by 25,901 MWh/year (The ICR team's written responses dated February 24, 2020 to IEG's questionnaire; hereafter, the ICR team's responses).
- Energy costs for building users decreased. Annual energy savings of 78,083 tce came from reduced consumption of grid electricity, diesel and natural gas which are priced per Table 6-1 of the ICR (Comments from the ICR team). Specifically, the retrofits allowed the tenants of Yuandong International Mansion and Wenguang Mansion to reduce their energy costs associated with the retrofitted systems by more than 50% and 70%, respectively.
- Share of trips with public transport, cycling, and walking increased. In parallel to the Project, there was a private company that provided cycling options for commuting. While quantified data on a change in the share of NMT was not available, the ICR team confirmed that the infrastructure improvements were conducted in line with the design studies for the NMT activities. (Photos of the improved structure for pedestrians and cyclists were provided in the ICR team's written response.)

As the ICR (page 31 and 38) indicated, there was no specific overall indicator for Sub-objective 1 in the Results Framework. To measure the achievement of outcome of Sub-objective 1, the ICR referred to the set of indicators listed in Table 3, namely: IR Indicators 1, 3, 4, 5, and 6; supplemented by evidence of two other schemes piloted under the project (advanced functioning of online monitoring platform, and low-carbon community designs).

Key outputs, intermediate results, and outcomes among those listed above were highlighted in terms of three pillars to pilot green energy schemes in Shanghai with a focus on Changning District, namely, operationalizing green energy buildings, developing of low-carbon energy supply, and constructing green mobility. Operationalizing green energy buildings was the core of the activities to achieve the Sub-objective 1, considering its relevance to carbon dioxide emissions reduction and the fact that 81 percent of total component cost was allocated to it after scaling down activities in the other two pillars during project implementation. Under this component, green-energy building policies, business models, and financing mechanism recommendations supported implementation of building retrofits and construction and demonstration of NZE building. Online energy monitoring platform's capabilities and functions were improved to accumulate data and information on energy savings and carbon dioxide emissions reductions. Seven distributed generation centers, of which two centers used renewable energy, were established and started operations. Though the issuance of measures to enhance green-energy retrofits was delayed and the guarantee mechanism for lending to SMEs by the District Government was not developed, the technical assistance provided under Component 1 supported capacity development of the stakeholders to pilot green-energy building schemes, thus contributing to achievements of outcomes in Sub-objective 2. The pilot schemes led to energy savings of 11,752 tce per year under Component 1.

On one hand, the policies on retrofitting of buildings, the NZE demonstration building, and the distributed generation centers, were successfully established to pilot the green energy schemes. On the other hand, the delay in development of policies and the cancellation of development of a guarantee mechanism for lending to SMEs negatively affected the pilot. The planned financing mechanism was not developed for retrofitting of buildings. On balance, the achievement of the Project's efficacy in achieving Sub-objective 1 was assessed as substantial.



## Rating

Substantial

## OBJECTIVE 2

### Objective

Sub-objective 2: To scale up low-carbon investments in buildings in Shanghai, with a focus on Changning District

### Rationale

**TOC for Sub-objective 2:** The increased availability of financing sources, greater access by developers, and a faster pace of investments, would lead to the scaling-up of investments in low-carbon buildings. An additional low-carbon investment in the amount of US\$ 246,000,000 was expected by the project closure, compared to a baseline of US\$ 0 in 2013.

### Outputs:

- Of the 67 subprojects under the Project, 41 subprojects on low-carbon investments leveraged the co-financing of US\$116.93 million from the participating financial intermediaries (PFIs) and the equity of US\$115.40 million from the project developers.

### Intermediate Results:

The achievements of the relevant IR indicator were as follows.

- Low-carbon investments in the amount of US\$332,190,136 had been supported by 2018, exceeding the target of US\$ 246,000,000 (135 percent of the original target).
  - At appraisal, the Project planned to finance only the incremental costs for new building measures (PAD, para 51, Annex 3). During implementation, the Project financed not only the incremental costs but also the costs of high-efficiency technologies in new buildings, which costed US\$68.8 million (ICR, para 43). When considering only the low-carbon investments in the incremental costs, the achievement was as follows: Low-carbon investments in the amount of US\$263.5 million were supported under the Project by 2018, exceeding the target of US\$ 246 million (107 percent of the original target).

### Outcomes:

The achievements of the PDO indicators were as follows.

- Annual energy savings in the amount of 78,083 tons of coal equivalent (tce) per year achieved (11,752 tce and 66,331 tce per year under Component 1 and 2, respectively). The achievement exceeded the target of 76,000 tons of coal equivalent per year (103 percent of the original target).



- Annual carbon dioxide emissions reduction in the amount of 189,946 tons of coal equivalent per year was achieved, exceeding the target of 165,000 tons of coal equivalent per year (115 percent of the original target).

Key outputs, intermediate results, and outcomes among those listed above are highlighted below. Low-carbon investments in buildings were scaled up from the US\$0 baseline to US\$332.19 million in actual achievement, overachieving its original target by 135 percent. The low-carbon investment included the co-financing of US\$116.93 million from the participating financial intermediaries (PFIs) and the equity of US\$115.40 million from the project developers. The Project's low-carbon investments in buildings increased the energy savings and reduced carbon dioxide emissions. The low-carbon investments in buildings led to energy savings of 66,331 tce per year under Component 2 (84 percent of the total energy saved). Through the activities conducted under Component 1 and Component 2, the Project achieved carbon dioxide emissions reductions of 189,946 tce per year.

There were four sub-categories of buildings: *Commercial, Residential, Existing, and New*.

*Commercial v. Residential:* At appraisal, it was expected that the market would favor investing in commercial buildings than residential buildings. A study conducted during the project preparation pointed out the larger energy saving potential of commercial buildings as well as the higher implementation resistance for the residential buildings. To address it, the Bank team and the PMO agreed to put more emphasis on commercial buildings than residential buildings with arrangements, while allowing the FIs to finance residential buildings under the Bank's agreement (Comments from the ICR Team).

*Existing v. New:* In light of key expected outcome at appraisal, the ICR (para.16, page 9) stated that "[t]he focus on Changning implies a focus on building retrofits as the leading measure identified for reducing emissions in Changning." During the project implementation, constructing the new energy efficient buildings attracted larger demand from the market (ICR, para. 71, page 23). The amount of investments in retrofitting remained less than anticipated at appraisal; because, (i) there was no policy to make retrofit of existing buildings mandatory and (ii) the retrofit projects required the project developers to access special type of financing (ICR, para.70-71, page 23). The retrofit subprojects demonstrated financial viability in terms of government subsidy. At appraisal, the government subsidy was assumed at Chinese Yuan (CNY) 8,260 per tce. At project closure, the actual subsidies for 46 retrofit subprojects ranged from CNY791 per tce to CNY17,639 per tce with the average of CNY2,721 per tce (Comments from the ICR team; detailed data shown in ICR Annex 5). In light of attracting investments to retrofits, however, the amounts of subsidies could not have been expected to compensate for the lack of a mandatory policy (ICR, para.70, page 23).

Regarding (i), as discussed under the efficacy section for Sub-objective 1 above, retrofitting did not become mandatory during the project implementation due to a delay in setting benchmarks (ICR, para. 70, page 23). The first public reports on benchmarking in Changning would be released in 2020, which was expected to increase incentives to retrofit.

Regarding achievements, the Project scaled-up low-carbon investments in buildings which contributed to saving energy and reducing carbon dioxide emissions. On the other hand, the investment for EE building retrofit did not grow as expected at appraisal due to the delay in setting benchmarks and thus the mandatory



policy for retrofitting and the limited access of the project developers to access special type of financing. On balance, the achievement of the Project's efficacy in achieving Sub-objective 2 was assessed as substantial.

### **Rating**

Substantial

## **OBJECTIVE 3**

### **Objective**

Global Environment Objective (GEO): To support Shanghai Municipality's low-carbon city development by promoting green energy schemes, with a focus on Changning District.

The GEO was part of the PDO statement in the Loan Agreement but will not be rated in line with the guidelines.

### **Rationale**

**TOC for GEO:** Improved green-energy investment policies and measures, improved capacity of the stakeholders, and increased ease of access to finance would lead to increased amounts of green-energy investments. The investments would build more energy-efficiency into retrofitted buildings, NZE buildings, DG centers, and NMT areas, which would contribute to energy savings and greenhouse gas emission reductions.

### **Outputs:**

- The total of 67 subprojects were implemented to improve building lighting, heating, ventilation, and air conditioning (HVAC) systems, insulation, and energy management systems of the target buildings, covering 5.87 million m<sup>2</sup> of floor area (around 45 percent of floor area) in Changning District.

### **Outcomes:**

PDO Indicator 1 (GEO Indicator): The target of reducing accumulated carbon intensity per unit of GDP in Changning District from the baseline of 100 percent to 77.4 percent was more than achieved; at the project's closing, that figure was 69 percent, or 112 percent of the original target. IEG concurred with the ICR team that the achievement of GEO was modestly attributable to the Project (ICR, page 31). The delays in piloting could be the one of the reasons that the replication of the green energy schemes did not happen within the project period, limiting the attribution of the reduction of accumulated carbon intensity per unit of GDP to the project. Nevertheless, the Project implemented and scaled up the investments in building energy efficiency and engaged the key stakeholders by promoting the green energy schemes in eight events held in Shanghai, supporting the municipality and the district to replicate the schemes in the future.



## Rating

Not Rated/Not Applicable

## OVERALL EFFICACY

### Rationale

The achievement of Sub-objective 1 was substantial. The green energy schemes were successfully piloted; however, the replicability of the schemes across Shanghai was weakened by the shortcomings on the development of the financing mechanisms for green-energy retrofitting of buildings. The achievement of Sub-objective 2 was substantial, as it achieved energy savings and carbon dioxide emission reduction.

### Overall Efficacy Rating

Substantial

## 5. Efficiency

**Economic Analysis:** At appraisal, Economic Internal Rates of Return (EIRR) were calculated for five typical types of subprojects that were planned to be financed under the Project in Changning district (i.e., a hotel; an office building; a hospital; a mixed use commercial building with offices, apartments, and conference halls; and a mixed-use building with a hotel, restaurants and offices). The coverage/scope was 2.4 percent of total project cost. The EIRRs ranged from 12.4 to 33.9 percent, thus exceeding the 10 percent EIRR benchmark that was normally applied to Bank projects in China (PAD, para 69; Table A6.1., page 54; The ICR team's responses).

At project closure, for the 63 building subprojects besides the four demonstration buildings, the overall weighted average EIRR was 17.6 percent with coverage/scope at 85.1 percent of total project cost (ICR, Table 4, page 20). The weighted average EIRR of the four demonstration buildings was 5.1 percent. Of the 63 building subprojects, the weighted average EIRR for 46 EE retrofit, 13 EE new buildings, and 4 large Distributed Generation (DG) were 23.1 percent, 12.9 percent (22.5 percent when the incremental costs were considered), and 17.0 percent, respectively (ICR, Table 6-2, page 58). The weighted average EIRR of 63 projects at project closure was within the range of EIRRs estimated at appraisal.

According to those EIRRs, the retrofit subprojects had higher economic value, including the benefits from the reduction of CO<sub>2</sub> and local pollutants, than the new building and large DG subprojects (ICR, Table 6-2, page 58). Notwithstanding the greater returns on retrofitting subprojects, the amount of investments at project closure in retrofitting was less than anticipated at appraisal because: (1) retrofitting of buildings was not mandatory under policies of the Changning District, (2) the Government subsidies were not sufficient to cover the lack of a mandatory policy, (3) financing for retrofitting was harder to secure than for constructing new EE buildings, and (4) guarantees for retrofitting were not established (ICR, para.70-71, page 23).



**Financial Analysis:** At appraisal, excluding government subsidies, the five types of subprojects was estimated to have Financial Internal Rates of Return (FIRR) ranging from 10.1 to 31.9 percent with payback periods from 2.6 to 6.7 years (PAD, page 56). Including government subsidies, the FIRR was estimated to range from 14.4 to 38.3 percent with payback periods from 2.1 to 4.8 years (ICR, Table 4, page 20), which were within the five-year period attractive for investors.

At project closure, the weighted average FIRR (with subsidies) for the 63 building subprojects was 13.9 percent (ICR, Table 4, page 20), which was lower than the range of FIRRs at appraisal. In addition, the simple payback period was 5.7 years (ICR, Table 4, page 20), which exceeded the payback period estimated at appraisal and five-year period attractive for investors. The FIRRs of 63 subprojects ranged from 3.2 to 53.6 percent, with payback periods ranged from 1.7 to 13.8 years. The ranges of FIRRs and payback periods of 63 subprojects at project closure were broader than those at appraisal. Considering only the incremental costs of EE new building subprojects, the weighted average FIRR was above 14 percent with the weighted average payback period of below 5 years (Comments from the ICR team).

It was noted that, at project closure, the calculations on EIRR and FIRR were made based on a wider variety of subprojects than the five typical types of subprojects anticipated at appraisal. It caused the ranges of EIRR and FIRR to be widened at project closure than appraisal. For example, there was a subproject with an investment cost as low as 1 million Chinese yuan. On the other hand, the Disney International Tourism and Resort Zone Energy Station Distributed Generation subproject was added as a subproject during project implementation, which had an investment cost of 580 million Chinese yuan and accounted for 33 percent of emissions reductions of 63 subprojects (ICR, Annex 6, page 59-60). In addition, all of the five typical types of subprojects anticipated at appraisal involved retrofitting, while subprojects to develop new EE buildings were conducted during project implementation. Therefore, comparison of the EIRRs and the FIRRs at appraisal and project closure would require granular analysis for each type of subprojects.

**Aspects of Design and Implementation that Influenced Efficiency:** There was a delay in piloting innovative policies on green-energy retrofitting of buildings. The issuance of Changning District “Public Buildings Energy Efficiency Management Measures” was delayed for two years, negatively affecting investments for retrofit of buildings. The policy on energy consumption benchmarking and disclosure issued by Changning government was the first one in China and only available in several cities globally (Comments from the ICR team). This implied that there could be an oversight at project design to schedule sufficient time for supporting development of such innovative policies. Moreover, the grant and lending implementation was delayed in the early years of the Project. The delay in grant implementation was caused by insufficient capacity in the PMO (ICR, para. 68, page 22). The delay in loan implementation could be attributed to the following: (1) the Project originally limited its geographical scope to Changning District, (2) calculation of incremental costs of energy efficiency was time consuming, and (3) environmental review of subprojects took a long time (ICR, para. 68, page 22).

In terms of achievements, the weighted average EIRR of 63 projects at project closure was within the range of EIRRs expected at project appraisal. On the other hand, there was the implementation delay in establishing the innovative policy on green-energy retrofitting of buildings and the grant and lending implementation in the early years of the Project. On balance, the efficiency was rated as substantial.

## Efficiency Rating



Substantial

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal		0	0 <input type="checkbox"/> Not Applicable
ICR Estimate	✓	17.60	85.10 <input type="checkbox"/> Not Applicable

\* Refers to percent of total project cost for which ERR/FRR was calculated.

**6. Outcome**

The relevance of objectives was substantial. The efficacy was substantial. The efficiency was substantial. Overall, the outcome was rated as satisfactory.

a. **Outcome Rating**  
Satisfactory

**7. Risk to Development Outcome**

The anticipated risks and planned mitigation measures were as follows:

**Risk 1:** Buildings could end up being operated below their designed efficiency.

This risk has been mitigated by the building managers' monitoring of building users' energy consumption patterns by utilizing advanced information and communication technology (ICT) (ICR, para. 91, page 28).

**Risk 2:** The general economic slowdown in China could decrease incentives for costly retrofits.

This is not a major risk in the long run because the PFIs continue to show incentives for low-carbon investments, even though the repayments to the Project's sub-loans would not be sufficient to cover the future investments on low-carbon that were planned by them (ICR, para. 91, page 28). The SPDB also set annual targets for low-carbon investments.

**Risk 3:** The PMO's role needs to be assured as a continuing source of technical advice.

To mitigate the risk, the PMO receives general budget funding from the District Government, and remains a unit to provide technical advice to projects financed by SPDB, BOS, and other local banks.



## 8. Assessment of Bank Performance

### a. Quality-at-Entry

Strategic relevance and approach were thoroughly considered, by focusing on gaps and opportunities for interventions in China's energy sector to achieve Changning's energy-saving targets. Major relevant aspects such as technical, financial, economic, institutional, and procurement were adequately considered to develop the project design. The assessments on risks and mitigation measures were sufficiently conducted. The task team at entry had the appropriate mix of technical expertise. The task team was committed to resolve complex issues that needed to be addressed before implementing climate change mitigation interventions.

On the other hand, M&E arrangements at project design were not sufficient. Indicators were not thoroughly prepared, as discussed in detail in section 9.a. In addition, the original schedule for the activity to support establishment of innovative policies turned out to be unrealistic. Moreover, the need for strengthening capacity of the PMO at project entry was not adequately addressed. The limited number and capacity of PMO staff delayed implementation of the GEF-financed component for the first few years (ICR, para. 68, page 22).

On balance, most of the major relevant aspects of the project design were adequately considered, except for the M&E arrangements and the need for strengthening capacity of the PMO at entry. On this basis, the Bank's performance at entry was rated as satisfactory.

### Quality-at-Entry Rating

Satisfactory

### b. Quality of supervision

The Bank's task team for lending and implementation had a good mixture of expertise and manpower, as shown in the ICR, Annex 2, page 46. The task team conducted supervision missions approximately every 6 months. The ICR noted that the task team responded to all Government's requests appropriately and on time. The project restructuring and funds reallocation were conducted in a timely manner.

The actual disbursements were US\$ 3.32 million (3 percent of the total IBRD loan) on December 17, 2015, which was 2 years and 9 months after the project approval. The ISR archived on June 30, 2016, right after the Mid-Term Review (MTR), rated as moderately unsatisfactory both the Development Outcome (DO) and the Implementation Progress (IP) (ICR, page 3). Based on lessons learned from the project implementation by the MTR, the Bank team adjusted the Project to open the market beyond retrofitting buildings the investments to other districts in Shanghai (Comments from the ICR team). These adjustments contributed to accelerate the pace of the actual disbursements and the ratings of the DO and the IP gradually improved.



In sum, the task team with a right balance of expertise provided appropriate support to the PMO and the IP on time. The disbursement was slow at the first half of the Project, but it improved after the MTR. There was, however, a significant increase in the actual project cost in Component 1. The quality of the Bank's supervision was rated as satisfactory.

### **Quality of Supervision Rating**

Satisfactory

### **Overall Bank Performance Rating**

Satisfactory

## **9. M&E Design, Implementation, & Utilization**

### **a. M&E Design**

No outcome indicator for PDO 'A' was set at appraisal. The relevant IR indicators for PDO 'A' had milestones until the middle of the Project duration, but no overall target for the whole Project duration. Therefore, the IR indicators provided evidence of achievements of results to a limited extent. For example, piloting innovative policies were set as an intermediate result to encourage setting up the relevant policies well in advance of the project closure. The delay in establishment of innovative policies negatively affected the Project, as discussed in Section 4, Objective 1 above. IEG concurs with the ICR (para. 83, page 26) that "M&E could thus have benefited from more definitive indicators of PDO 'A' of piloting green energy schemes." According to the ICR team, an appropriate overall indicator for Sub-objective 1 could be "Number of green energy schemes piloted" with a baseline of zero, and a target value of 5 (Comments from the ICR team). Moreover, IEG concurs with the ICR team (para. 77, page 25) that an indicator in the Shanghai municipality level regarding the replication of the Project would have benefited measuring the performance of the Project.

### **b. M&E Implementation**

The PMO (with relevant inputs from the two PFIs) was responsible for the overall M&E system, including regular data collection to assess progress towards achieving results. The PMO managed the GEF grants, which supported activities for PDO 'A,' while the PFIs managed the low-carbon investments for PDO 'B.' There were delays in submission of reports from the PFIs to the PMO especially at the beginning of the Project, causing challenges for the PMO to collect quality data on energy savings in buildings and to support the government in formulating benchmarking policies for setting up subsidies.

### **c. M&E Utilization**

The online monitoring platform data collected under the Project informed the Changning District Government to design the policies on subsidies and benchmarking that were issued in 2018.



The data on saved energy for the buildings with low-carbon technologies was utilized to design the relevant policies in Changning. However, the PDO outcome indicator for PDO 'A' was not set throughout the Project and the M&E reports from the PFIs were not provided on time. Overall, the M&E quality was rated as modest.

### **M&E Quality Rating**

Modest

## **10. Other Issues**

### **a. Safeguards**

The Project was assigned Category “FI” under the Bank's environmental and social safeguards policies as it involved financial intermediaries. The Environmental Assessment (OP4.01) was triggered because of the nature of activities that included small-scale sub-projects though the social impacts were limited. Land use certificates were provided for all existing commercial buildings. For new commercial buildings, the District Government completed the land acquisition and resettlement before the lands were sold to potential developers. On this basis, developers of new commercial buildings received land use certificates or land lease sale contracts when they purchased clear lands (ICR, para. 84, page 27). An Environmental and Social Management Framework was prepared and implemented, under the supervision of the PMO and the PFIs with technical assistance from the environmental management consultant. There was no specific statement in the ICR regarding compliance issues under safeguards policies.

### **b. Fiduciary Compliance**

The ICR (para. 84, page 27) noted that the Project was fully compliant with fiduciary requirements as evidenced by the establishment of the internal control arrangements and the adequate maintenance of the financial management, procurement, and disbursement systems. All of the external audit reports were submitted on time, including the final audit carried out by an internationally affiliated firm in full compliance with the international standards. The auditors expressed ‘unqualified audit opinion’ on the financial statements of the recent years, which indicated that financial statements gave a true and fair view on the financial state of the Project.

### **c. Unintended impacts (Positive or Negative)**

There were both positive and negative impacts for the grid company operating in Shanghai. On the positive side, the grid company was able to postpone making investments in distribution infrastructure upgrade thanks to the Project's investments in low-carbon buildings. On the negative side, the energy sales could have been decreased due to the energy-saving technologies installed in the buildings under the Project.



On balance, IEG concurs with the ICR team (para. 62, page 21) that those impacts to the grid company would be considered as marginal, given the growing trend of energy demand in Shanghai.

**d. Other**

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**11. Ratings**

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Satisfactory	Satisfactory	
Bank Performance	Satisfactory	Satisfactory	
Quality of M&E	Modest	Modest	
Quality of ICR	---	Substantial	

**12. Lessons**

- 1. The rehabilitation of existing buildings, especially residential buildings, could improve the efficiency of green energy interventions and contribute to carbon dioxide emissions reduction.** As discussed in Efficiency section above, the retrofit subprojects had higher EIRRs than the new building and large distributed generation subprojects. Nevertheless, rehabilitation of existing buildings was not conducted as planned at appraisal, due to the inadequate government policies and subsidies, and the insufficient investments and guarantees. Moreover, the retrofitting of residential buildings faced additional challenges regarding multiple ownership and conflicting interests. Addressing these challenges would improve efficiency and efficacy of project interventions on low-carbon city development.
- 2. Collection of good quality data in an efficient way is essential for enhancing the efficacy of achieving energy savings.** At appraisal, the level of project financing was to be based on models calculating incremental costs of building investments. During implementation, modeling for all subprojects proved challenging given the available time and skillsets. Efficient methods to collect, aggregate, and analyze data on energy savings would be important to monitor implementation status and achievements of project activities on developing EE buildings. Moreover, producing data on energy savings was not readily available. Paying attention to these factors would support the governments to benchmark and establish subsidies related to the EE buildings.

**13. Assessment Recommended?**



No

#### **14. Comments on Quality of ICR**

The ICR provides a detailed overview of the project. The ICR was candid and generally aligned to the project development objective. The Project's Theory of Change in the ICR thoroughly explained the causal relationships among inputs, outputs, outcomes, and impacts. The quality of evidence and analysis is aligned to the messages outlined in the ICR, though there may be some minor misalignments of data and information with the arguments. For example, regarding the investments in retrofits, the ICR could have done a more thorough job of explaining how the Project considered its performance on retrofitting subprojects in comparison with new EE building subprojects in Section 3.B. Key Factors During Implementation. The ICR stated that "the amount of investments in retrofitting remained less than anticipated at appraisal (para.70-71, page 23)" and showed that retrofitting projects had greater returns (Table 6-2). The ICR then explained one of the reasons was that the government subsidies for retrofits were not sufficient to cover the lack of a policy that made retrofits mandatory (para.70-71, page 23). Later, the ICR team interpreted the low level of subsidies positively and stated that "the retrofit subprojects were financially viable with significantly less subsidy on average than was expected at appraisal" (Comments from the ICR team). Notwithstanding the misalignments, the quality of the ICR was rated as substantial.

##### **a. Quality of ICR Rating** Substantial