CLEAN ENERGY REVOLVING LOAN FUNDS: INTERNATIONAL EXPERIENCE

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List of Acronyms

AMI	Area Median Income
ANME	National Agency for Energy Conservation
ARRA	American Recovery and Reinvestment Act
BEEF	Bulgarian EE Fund
BID	Inter-American Development Bank
BOT	Bank of Thailand
CBO	Community-Based Organizations
CHUEE	China-Based Utility Energy Efficiency
DEDE	Department of Alternative Energy Development and Efficiency
DESL	Nebraska Dollar and Energy Saving Loans
DOE	U.S. Department of Energy
DSM	Demand-Side Management
EE	Energy Efficiency
EE4D	Energy Efficiency for Development
EE&C	Energy Efficiency and Conservation
EEP	Energy Efficiency Program
EGAT	Electricity Generating Authority of Thailand
EFE	Energy for Environment
EERF	Energy Efficiency Revolving Fund
EFS	Environmental Finance Solutions
ENCON	Energy Conservation
ESCO	Energy Service Company
ESG	Environmental, Social, and Governance
ESPC	Energy Service Performance Contract
ESP	Energy Service Provider
FTE	Energy Transition Fund
EVO	Efficiency Evaluation Organization
FAP	Mexico City Environmental Fund
FETE	Fund for Energy Transition
GEF	Global Environment Facility
GHG	Greenhouse Gas
GJGNY	Green Jobs Green New York

IAQ	Indoor Air Quality
IFC	International Finance Corporation
IPMVP	International Performance Measurement and Verification Protocol
IRB	Interest Rate Buydown
KPI	Key Performance Indicator
LLR	Loan Loss Reserve
LMI	Low-to-Moderate Income
M&V	Measurement and Verification
NASEO	National Association of State Energy Officials
NDB	National Development Bank
NDEE	Nebraska Department of Environment and Energy
NEO	Nebraska Energy Office
NEPC	National Energy Policy Council
NPPD	Nebraska Public Power District
NYSERDA	New York State Energy Research and Development Authority
OBR	On-Bill Recovery
PV	Photovoltaic
PVE	Petroleum Violation Escrow
RLF	Revolving Loan Fund
RGGI	Regional Greenhouse Gas Initiative
RSF	Risk-Sharing Facility
SCB	Siam Commercial Bank
SEP	State Energy Programs
SECO	State Energy Conservation Office
SEDEMA	Secretary of the Environment for Mexico City
TEEP	Energy Transition Program in Public Establishments
TPA	Third-Party Administrator
UOB	United Overseas Banks
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

INTRODUCTION

Tunisia's Energy Transition Fund (FTE), created in 2013, was established to promote energy efficiency and renewable energy projects in the public and private sectors. To overcome financing challenges related to the energy transition, Tunisia's National Agency for Energy Conservation (ANME) seeks both to strengthen available financial resources and to develop innovative financing structures. Revolving Loan Funds (RLFs) are one such innovative financing structure, used by countries around the world to foster the development of distributed clean energy projects. This report aims to inform policy makers and various stakeholders on the opportunity to design an RLF by drawing on successful experiences from other countries. Specifically, this report provides analytical support for discussions with ANME and its partners to develop an RLF in the context of Tunisia. It outlines the 12 essential steps for establishing a RLF and includes detailed case studies demonstrating successful RLF implementation across various contexts.

RLFs are pools of capital from which loans can be made for clean energy projects, including energy efficiency (EE) and distributed renewable energy (DRE) installations. As energy cost savings accrue from EE and DRE projects, the loan principal, plus interest and associated RLF administrative fees, are repaid to the RLF and then re-loaned for other EE and DRE projects. RLFs generally offer financing with lower interest rates and/or more flexible terms (e.g., longer-tenor loans and/or less restrictive underwriting requirements) than are typically found in commercial capital markets. If default rates are low, RLFs can serve as sustainable sources of revolving capital over the long term.

The primary objective of setting up an RLF is to incentivize private investment in reducing energy consumption and greenhouse gas (GHG) emissions by providing access to capital for new EE and DRE projects that otherwise would not be implemented. RLFs are usually sponsored by a government agency, a non-profit organization, or a utility to fund projects for a target group (e.g., public buildings or low-to-moderate-income households). In Tunisia, the FTE relies primarily on public funds allocated for its capitalization, supplemented by revenues from taxes on energy products. RLFs may also be accompanied by free technical assistance resources including audits and/or building energy data management platforms that can streamline project implementation, measurement, and verification (M&V) of energy and cost savings.

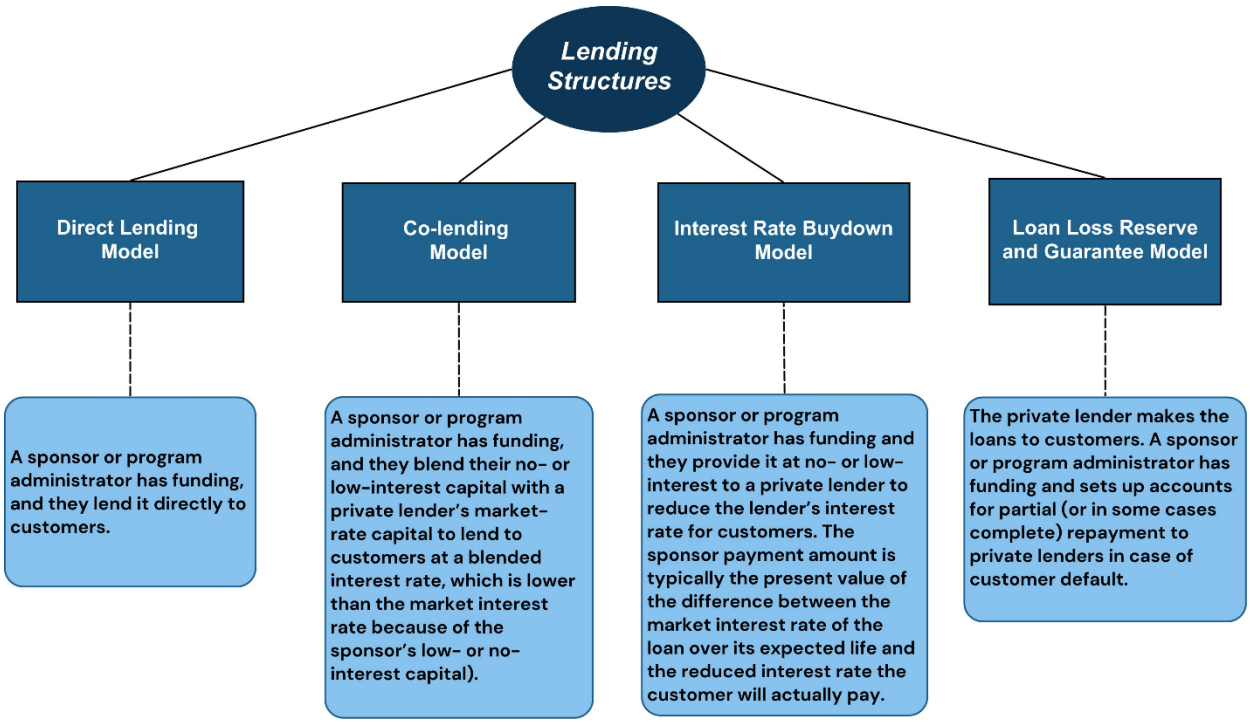
There are four main RLF lending structures:

- **The direct lending model,** which involves a single lender providing funds directly to building owners or contractors for EE and DRE projects.
- **The co-lending model,** which involves multiple lenders providing capital for EE and DRE projects, often from a mix of public and private sources of capital.
- **The interest rate buydown (IRB) model,** which involves reducing interest rates on loans provided by private lenders using funds from the RLF. In this model, the RLF pays the lender for the interest they forgo by reducing the interest rate that the borrower pays, thereby making financing more affordable for the borrower while incentivizing private lenders to participate.

- **The loan loss reserve (LLR)** and guarantee model, which involves setting aside funds to cover potential loan losses in case of borrower default, providing assurance to private lenders.

These lending structures are illustrated in Figure ES. 1.

Figure ES. 1 RLF Lending Structures



DEVELOPING A REVOLVING LOAN FUND

RLFs may be administered by government agencies, utilities, non-profit organizations, consulting firms, or other organizations. These entities oversee the fund's day-to-day operations and ensure compliance with relevant laws and policies. RLFs may be self-administered, or administrative duties may be partially or fully outsourced. The administration of RLFs involves four core functions: marketing and outreach; loan origination; loan servicing; and monitoring and reporting.

Regardless of lending structure, all RLFs contain five basic components: funding source; RLF administration; lending; EE and DRE project deployments and associated savings and benefits; and repayment. Figure ES. 2 shows the 12 key steps involved in developing an RLF. Each step builds upon the previous one to ensure a comprehensive and sustainable framework for financing clean energy projects. Each step is described in more detail below.

Figure ES. 2. Stepwise Approach to Developing an RLF

Step 1. Perform a Gap Analysis. The gap analysis assesses the market demand for energy efficiency (EE) and distributed renewable energy (DRE) financing through two key components: an evaluation of existing public and private funding sources, and stakeholder consultations to determine current financing limitations and needs.

Step 2: Establish a Legal Framework for the RLF. A legal framework sets forth the laws under which the RLF will operate. The first step is to determine if such a legal framework already exists. If not, new legislation may need to be enacted. Additionally, RLF administrators need to determine whether an existing legal entity (e.g., government agency, utility, or bank) can operate the RLF or whether a new legal entity (e.g., non-profit organization) must be established (Limaye et al., 2014).

Step 3: Establish Funding Sources. The RLF must be capitalized with sufficient public, private, utility, or blended funds to initiate operations and provide loans for EE and DRE projects. Administrators

should also identify ways to increase the capital base of the RLF over time through marketing, surveying stakeholders, and garnering political support (Limaye et al., 2014).

Step 4: Define RLF Goals and Target Markets. This step involves establishing RLF objectives, which may encompass goals such as achieving energy savings, reducing greenhouse gas emissions, and/or reducing energy poverty for Low and Moderate-Income (LMI) households. Goals should incorporate insights from the gap analysis conducted in Step 1.

Step 5: Develop an RLF Operational Plan. A detailed operational plan should be devised to guide the implementation of the RLF. It should define the governance structure, including specifying who will govern the fund and what their responsibilities will be. The operational plan should also describe the administrative structure, including identifying who will administer the RLF and what their responsibilities will be.

Step 6: Appoint a Board of Trustees and Hire Administrators. An RLF requires a qualified board of trustees and administrators. The board of trustees should include both government and private sector representatives, the combination of which helps prevent political capture. The administrative team should comprise staff with experience in financing, EE and DRE, contracting, credit and risk assessment, and loan disbursement and recovery (Huey, 2023; Limaye et al., 2014).

Step 7: Define the RLF Structure and Basic Elements. The board of trustees and administrative team should select the RLF structure (i.e., direct lending, co-lending, IBR, LLR, or guarantee) and define the RLF elements.

Step 8: Prepare RLF Forms. Based on the RLF structure and basic elements defined in Step 7, forms associated with the RLF should be prepared. Typical forms include loan applications, standardized audit templates, agreements, contracts, and Measurement and Verification (M&V) forms. Additionally, if sponsors will be working with private lenders, it is important to include a term sheet, which provides essential information about the program that private lenders will want to understand. Furthermore, a matrix should be created to help determine which projects to fund, considering RLF goals and target markets (Booth et al., 2011; Limaye et al., 2014).

Step 9: Define Technical Assistance and Other Service Offerings. Another important component of an RLF program is the provision of technical assistance, which can be critical to its overall success (Limaye et al., 2014; U.S. DOE Office of State and Community Energy Programs, 2023; Zimring et al., 2013). This assistance may benefit various stakeholders, including building owners, energy service companies (ESCOs), financial institutions, and underserved communities in the implementation of projects. Some examples of the types of free technical assistance that may be offered alongside an RLF include:

- Training and capacity building for building owners and ESCOs
- Building energy consumption data collection and benchmarking
- Building energy audits (remote or in-person)
- M&V of energy and cost savings

- Centralized procurement of EE technologies to obtain better pricing and reduce administrative and transaction costs
- Project feasibility studies
- Policy guidance and regulatory support
- Technology assessment and recommendations
- Capacity building for financial institutions
- Energy efficiency training and certification programs
- Public awareness campaigns and outreach events
- Customized financing solutions for underserved communities
- Performance monitoring and optimization services

Step 10: Develop the Marketing and Outreach Strategy. The RLF should develop a marketing and outreach plan to engage stakeholders in its target markets and promote the uptake of loans. This may include establishing a website, conducting a social media campaign, developing brochures and guidebooks, speaking at events and conferences, or other strategies.

Step 11: Develop a Project Pipeline using the marketing and outreach strategy established in Step 10.

Step 12: Develop a Monitoring and Evaluation Plan. The impact of the RLF needs continuous monitoring and evaluation. This step includes four aspects. *Monitoring* involves routinely gathering information on all aspects of RLF implementation to measure progress. *Evaluation* involves assessing whether an RLF has met or is likely to meet its target outcomes. *Measurement and verification* occur at the project level, where projects' actual energy and cost impacts are measured empirically to confirm performance and quantify benefits. Reporting involves routinely providing information on RLF technical and financial Key Performance Indicators (KPIs) to key organizations (e.g., funding sources, trustees) to ensure RLF target outcomes are achieved.

CASE STUDIES

This report also presents case studies of RLFs implemented by several countries, namely Thailand, the U.S. (in four states: New York, Michigan, Texas and Nebraska), China and Mexico. Main features of these case studies are shown in and further described below.

Table ES. 1 Case studies Summary

	Model	Administration	Target sector
Thailand's Energy Efficiency Revolving Fund (EERF)	Interest Rate Buy-Down	Self-Administered	Industry And Commercial Sector
Green Jobs-Green New York (GJGNY) Program	Direct Lending Model	Partially Outsourced	Residential, Small Business, And Low Income

Michigan Saves	Loan Loss Reserve	Fully Outsourced	Residential And Low Income
Texas LoanSTAR	Direct Lending Model	Self-Administered	Public And Institutional Sectors
Nebraska Dollar and Energy Saving Loans (DESL)	Co-Lending Model	Self-Administered	Building Improvements
China Utility-based Energy Efficiency Program (CHUEE)	Loan Loss Reserve (LLR)	Fully Outsourced	Industry Sector
Mexico City Fund Building Project	Direct Lending Model	Self-Administered	Public And Institutional Sectors

1. Thailand's Energy Efficiency Revolving Fund (EERF).

The Energy Efficiency Revolving Fund (EERF), established in 2003 through financial backing from the ENCON Fund and operating under DEDE's supervision, functions as an Interest Rate Buydown (IRB) model. This fund serves a dual purpose: stimulating substantial investments in energy efficiency within energy-intensive industries while also enhancing the capabilities of local banks in financing EE and RE projects. Initially capitalized at THB 2 billion ($64 million), the EERF received technical support from the Global Environment Facility (GEF) and the Danish government (GIZ et al., 2019).

The EERF operates through partnerships with nine commercial banks, providing low-cost funding (0-0.5% interest) which banks then extend to companies at maximum 4% interest rates for energy efficiency and renewable energy projects. With individual loans capped at THB 50 million ($1.6 million) and five-year repayment terms, the program acts as a catalyst for private sector involvement while building banks' capacity in clean energy financing. Through its first five phases (2003-2013), the fund allocated $216 million and leveraged an additional $262 million from financial institutions, supporting 295 projects split between energy efficiency (60%) and renewable energy (40%). During this period, the program achieved significant results, including annual savings of 1.2 GWh in electricity, 234 million liters in fuel, and $204 million in costs. However, the fund faced accessibility challenges, notably the lending structure primarily benefited larger companies with substantial collateral. To address this limitation, complementary initiatives like the ESCO Fund were developed to support smaller enterprises and bridge the capital equity gap.

2. The Green Jobs-Green New York (GJGNY) Residential Financing Program.

The GJGNY Program, established in 2009, aims to provide New Yorkers with comprehensive access to various services, including energy assessments, installation services, low-interest financing, and opportunities for training in "green-collar" careers. GJGNY funding sources include Energy Efficiency Conservation Block Grants from the U.S. DOE Better Buildings Program, as well as secondary market refinancing. Initially, the program also received significant funding through the Regional Greenhouse Gas Initiative (RGGI). The GJGNY Program supports residential, small business/non-profit, and multifamily customers through seven utility companies across the state. It is overseen by the New York State Energy

Research and Development Authority (NYSERDA) and involves private sector partners that originate and service loans. As of January 31, 2023, GJGNY had issued over 43,000 loans totaling over $563 million and generated substantial energy benefits, including over 6,317 MW of solar generation, 4,700 MW of electricity savings, and 344,000 MMBtu of fuel savings. This program has played a crucial role in advancing energy efficiency and sustainability in New York, making it more accessible to homeowners and property managers.

3. Michigan Saves.

Michigan Saves, recognized as the first U.S. nonprofit "green bank," has transformed Michigan's energy landscape (Michigan Saves, 2023). Established in 2009 by the State of Michigan, its mission is to bridge financing gaps in the market. As a green bank, Michigan Saves channels private investment into low-carbon and carbon-resilient infrastructure. Since its inception in 2010, it has facilitated approximately $450 million in financing for residential and commercial buildings. With an initial grant of only $6 million, Michigan Saves adopted a loan loss reserve (LLR) to leverage private capital efficiently. This structure not only enables favorable rates and terms, but also widens the scope of underwriting, allowing more individuals to qualify for accessible loans. The low default rate (under 2%) has allowed for recycling of funds, resulting in a remarkable leverage ratio of $30 of private investment for each dollar of public investment (Templeton, 2023). From September 2010 to December 2022, Michigan Saves financed a total of $450 million in energy improvements; in 2022, investments surged, with $105 million invested across various initiatives and 3.1 million metric tons of carbon emissions reduced. Moreover, Michigan Saves has supported the creation of 9,175 full-time jobs, underscoring the program's substantial economic and environmental benefits (Templeton, 2023).

4. Texas LoanSTAR.

The Texas Revolving Loan Fund, known as Texas LoanSTAR, has been pivotal in driving energy efficiency across the state. With a fund amounting to a substantial $230 million (NASEO, 2023a), the program is tailored to promoting energy efficiency in the public and institutional sectors via low-interest loans. One of the program's distinctive features is its financial structure, which enables public institutions to maintain their existing utility budgets while simultaneously redirecting the savings generated from energy retrofits toward capital improvements; this allows entities to finance energy efficiency upgrades without increasing their overall utility expenses. As a revolving loan fund, the base fund is intended to keep growing through interest payment receipts and last indefinitely. As of September 1, 2023, LoanSTAR had funded more than 337 loans totaling over $600 million and achieved total cumulative cost savings of more than $810 million – a direct savings to Texas taxpayers (NASEO, 2023a). Since its inception, the program has led to substantial energy savings including 21.6 billion kWh of energy and 24.6 million MMBTUs of natural gas, along with significant emissions reductions of 19 tons of nitrogen oxide, 7.1 tons of carbon dioxide, and 14.4 tons of sulfur dioxide (Trevino, 2023).

5. Nebraska Dollar and Energy Saving Loans (DESL) Program.

The DESL Program, launched in 1990, is a co-lending model administered by the Nebraska Department of Environment and Energy (NDEE), in partnership with nearly 300 financial institutions across the state. It uses a blend of public and private capital to offer low-interest loans for energy efficiency improvements, alternative energy projects, and waste minimization initiatives in various sectors, including residential, commercial, agricultural, and nonprofit entities. The program was initially capitalized with $10 million from Petroleum Violation Escrow (PVE) funds and later expanded to $45 million, including American Recovery and Reinvestment Act (ARRA) funds. By leveraging this capital, the DESL Program has funded over 30,000 energy-saving projects, generating roughly $105 million in energy savings and reducing CO_2 emissions by approximately 1.4 billion pounds (Nebraska Department of Environment and Energy, 2023). This revolving fund model allows continuous reinvestment, ensuring long-term financial sustainability and ongoing benefits from energy conservation. The program's success stems from a strong collaboration between the NDEE, local lenders, and a flexible loan structure that adjusts to changing market demands and needs (Nebraska Department of Environment and Energy, 2023).

6. China Utility-based Energy Efficiency Program (CHUEE).

CHUEE was initiated by the International Finance Corporation (IFC) to address significant hurdles in the market, such as banks lacking experience in assessing risks and cash flows associated with EE projects and commercial bank loans requiring high fixed asset collateral (i.e., tangible assets, such as property or equipment, that are pledged to secure a loan). By fostering partnerships between banks, ESCOs, and energy service providers, CHUEE sought to transform how EE projects were financed, ultimately driving reductions in greenhouse gas emissions and promoting sustainable energy practices across various sectors. IFC administered CHUEE over three distinct phases: CHUEE I, CHUEE II, and CHUEE III, each having distinct priorities and objectives. Notably, CHUEE demonstrated remarkable success across all three phases. In CHUEE I and II, a total of 178 sustainable energy projects received substantial financial support, securing loans amounting to $783 million (ICF China, 2014). This funding significantly contributed to GHG emissions reductions estimated at 19.3 million tons annually. CHUEE III provided loans totaling $558 million, supporting roughly 350 sustainable energy projects that reduced an additional 1.5 million tons of GHG emissions annually (Market Screener, 2021).

7. Mexico City Fund for the Zero Emissions Demonstration Building Project.

The Mexico City Fund for the Zero Emissions Demonstration Building Project is an evolving initiative currently under development, aimed at fostering sustainable practices in building infrastructure and advancing energy efficiency in Mexico City. The project focuses on establishing a sustainable financial model to support the transition of public office buildings into net-zero energy structures. It involves an energy audit of the Civil Registry Building, which serves as the demonstration project, to identify potential energy-saving measures such as upgrades in air conditioning, installation of photovoltaic systems, and lighting improvements. The USAID Mexico Partnership for Net Zero Cities is set to grant approximately $330,000 to the Secretary of the Environment for Mexico City (SEDEMA) (Ayala, 2023). This funding will be allocated to hiring an ESCO for the implementation of energy-efficient upgrades including air-conditioning and lighting systems, as well as the installation of rooftop solar photovoltaic panels in the

Civil Registry Building. Further, the initiative will be supported by the National Development Bank (NDB), which will secure funding from various sources, including the Mexican government, international grants, and loans from development partners and financial institutions. This program aims to support Mexico in achieving net-zero emissions by 2050, with a focus on improving energy efficiency in the buildings and transportation sectors. Additionally, it aims to reduce or avoid emissions equivalent to 17.35 million tons of greenhouse gases and mobilize $550 million in green financing (Research Triangle Institute, 2023).

CONCLUSION

Revolving loan funds serve as strategic financial tools that maximize public investment through continuous loan recycling, particularly in underserved markets where traditional financing is limited. Their effectiveness depends on careful model selection based on local market needs and implementation context, including government capacity, banking sector experience, and regulatory frameworks. As demonstrated by various case studies, successful RLF programs require alignment between the chosen lending model and local institutional capabilities, ensuring sustainable operation while bridging market gaps in energy efficiency and renewable energy financing across diverse sectors.

1. INTRODUCTION

In 2013, Tunisia created the Energy Transition Fund (FTE) by Law No. 2013-54 with the objective of promoting energy efficiency and renewable energy projects in both the public and private sectors. This fund is considered an essential financial lever to accelerate investment, particularly in the private sector (Official Gazette of the Republic of Tunisia, 2013). To overcome financing challenges for the energy efficiency and distributed renewable energy projects that are essential to Tunisia's energy transition, the National Agency for Energy Conservation (ANME) seeks both to strengthen available financial resources and to develop innovative financing structures.

Revolving Loan Funds (RLFs) are one such innovative financing structure, used by many programs around the world to foster development of distributed clean energy projects. RLFs provide a revolving source of financing through loan repayment, whereby the fund is replenished as individual projects repay their borrowings, allowing new loans to be made for other projects. RLFs can provide funding to parties to implement energy efficiency, renewable energy, and other sustainable development projects that generate energy savings. These savings are tracked and replenish the fund for the next investment round, establishing a sustainable funding cycle while reducing operational costs and environmental impact.

As part of a collaboration between Lawrence Berkeley National Laboratory (LBNL) and ANME, LBNL was asked to help design a Revolving Loan Fund (RLF) that could support the financial sustainability of the Tunisian Energy Transition Fund (FTE). Accordingly, this report provides a step-by-step guide for implementing an RLF, along with case studies summarizing RLFs in different contexts.

This report first provides an overview of RLF characteristics and the steps for establishing an RLF, including objectives, prerequisites, typical sources of capital, lending structures and administration, risk management, enabling policy, and advice for generating RLF participation. The report then presents different examples of RLFs implemented by several countries, namely Thailand, China, the U.S. (in four states: New York, Michigan, Texas and Nebraska), and Mexico.

The goal of this report is to inform policy makers and various stakeholders on the opportunity to design an RLF by drawing on successful experiences from other countries. Specifically, this report provides analytical support for discussions with ANME and its partners to develop an RLF in the context of Tunisia. It also provides a basis for adapting an RLF to Tunisian energy efficiency programs, and for considering how programs such as the Energy Transition for Public Establishments (TEEP) and promotions focusing on roof insulation (i.e., Promo-Isol) or specific structures (e.g., mosques) can be used to establish an RLF.

2. REVOLVING LOAN FUNDS

2.1 DEFINITION

Revolving Loan Funds (RLFs) are pools of capital from which loans can be made for clean energy projects, including energy efficiency (EE) and distributed renewable energy (DRE) installations. As energy cost savings accrue from EE and DRE projects, the loan principal, plus interest and associated RLF administrative fees, are repaid to the RLF and then re-loaned for other EE and DRE projects. If default rates are low, RLFs can serve as sustainable sources of revolving capital over the long term (U.S. DOE, 2023). RLFs generally offer financing with lower interest rates and/or more flexible terms (e.g., longer-tenor loans and/or less restrictive underwriting requirements) than are typically found in commercial capital markets.

RLFs are usually sponsored by a government agency, a non-profit organization, or a utility. (See Section 2.3 for examples of capital sources for RLFs.) RLFs provide financing for targeted market, such as public building improvements, small businesses or energy upgrades for low-to-moderate income (LMI) households, focusing on markets and technologies that lack adequate funding options. RLFs are also often accompanied by free technical assistance resources, including audits and/or building energy data management platforms that can streamline project implementation and the measurement and verification (M&V) of energy and cost savings (2014; Limaye et al., 2014).

Table 1 summarizes some of the primary advantages and disadvantages of RLFs.

Table 1: Primary Advantages and Disadvantages of RLFs

Advantages	Disadvantages
- Cheap, recyclable source of funds that will be available in the long term for EE projects. - Can customize eligibility requirements to meet policy goals. - Can have low interest rate on RLF funds. - Create a market of private lending for EE. - Increase job creation in ESCOs, retrofit companies.	- Government often acts as the administrator; requires time and expertise to establish. - Need to find capital to start the RLF. - Often slow to revolve, especially with longer loan terms (which are needed for deep retrofit projects). - Must have a robust credit analysis procedure (or risk a high default rate). - Collateral or other security may be required from borrowers.

Source: Booth et al., 2011.

2.2 Objectives and Prerequisites

The primary objective of setting up an RLF is to incentivize reductions in energy consumption and greenhouse gas (GHG) emissions through investments in clean energy projects that otherwise would not be implemented. Additionally, RLFs can support a number of advantages related to economic growth, workforce development, public health, and building occupant comfort and productivity. Typical benefits associated with RLFs are shown in Table 2.

Table 2: Typical Benefits from RLFs

Category	Typical Benefits
Clean Energy	- Reduce energy consumption - Reduce GHG emissions - Meet regulatory requirements
Economic	- Market capacity development - Economic development - Workforce development - Employee productivity - Commercial lender capacity development - Energy Service Company (ESCO) capacity development
Consumer	- Increased comfort - Improved health outcomes - Utility bill savings - Improved property value
Societal	- Broader participation in the clean energy economy/transition - Electric grid impacts - Support to LMI households - Support to small and medium enterprises (SME)

Source: Leventis et al., 2022.

RLFs focusing on building EE retrofits are particularly beneficial for job creation. Research from several institutions – including the University College London (UCL), the Buildings Performance Institute Europe (BPIE), the International Energy Agency (IEA), and the United Nations Environment Program (UNEP) – finds that building retrofits have the highest job creation rate per capital invested: three times that of wind power. These jobs usually stay local, and indirect manufacturing jobs are created in materials and equipment supply (UNEP, 2020; Music and Shepherd, 2021).

Another well-documented RLF benefit is the ability to support EE project implementation in historically underserved markets (e.g., LMI households, women-owned SMEs), as a potential borrower's status is

automatically examined and can thus be easily targeted for eligibility as part of the RLF loan approval process. This targeting is more difficult in traditional EE rebate programs (Delaney, 2023).

Additionally, according to World Bank research, RLFs can address important barriers to increasing EE and comfort in public agency buildings. For example, where energy tariffs are low, the long-tenor loans offered by RLFs can allow public agencies to more easily repay loans from energy cost savings. Also, where small EE project sizes can lead to high project development and transaction costs for public agencies, RLFs can reduce these costs by aggregating similar projects across agencies and standardizing implementation procedures (World Bank, 2018).

The World Bank identifies the following prerequisites for RLF success (Limaye et al., 2014):

- Strong government commitment to improving EE and DRE
- Numerous opportunities for improving EE in the market
- Demand for EE financing in the market
- Lack of affordable commercial financing for EE in the market
- End users are billed based on actual energy consumed
- Energy bill payment discipline among end users[1]

2.3 Sources of Capital

RLFs are typically capitalized by public, private, or utility funds; in some cases, capital is blended from a combination of these sources. Case studies from Tunisia, Thailand, and the United States exemplify various RLF funding mechanisms.

In Tunisia, the Energy Transition Fund (FTE) primarily relies on public funds for its capitalization, supplemented by revenues from taxes on energy products allocated by the central government. By year-end 2022, FTE resources reached 616 million Tunisian Dinars (DT), equivalent to $202 million. Funds were primarily sourced from taxes on tourist cars (55%), engines (17%), air conditioners (13%), energy products (7%), incandescent lamps (5%), and donations (3%) (ANME, 2023). Thailand's RLF relies on a mix of public capital, including revenue generated from environmental charges imposed on petroleum products and concessional loans obtained from development finance institutions. In the United States, capital for RLFs can come from a variety of sources, including state bond proceeds, treasury investments, utility ratepayer funds, GHG cap-and-trade systems, or other special funds. In the case of utility ratepayer funds, RLF capital come from public benefit fund charges (i.e., charges collected by utilities for programs that benefit the public) which are recovered in utility bills. Table 3 provides examples of different sources of capital used for RLFs.

[1] Energy consumers consistently pay their full energy bill on time.

Table 3: Typical Sources of RLF Capital

Category	Sources of Capital
Public Capital	- Capital raised via taxation - Revenues from GHG cap-and-trade systems - Funds from oil overcharge settlements - Special tariffs or levies on electricity sales - Petroleum taxes - Environmental charges - Concessional loans or grants from the public sector arms of multilateral development banks (MDB) and development finance institutions (DFI)
Private Capital	- Loans or lines of credit from commercial banks - Loans or lines of credit from private sector arms of MDBs such as the International Finance Corporation (IFC) - Revenue bonds sold to private investors - Philanthropic funds
Utility Capital	- Capital raised from utility customers (e.g., public benefits fund charges or demand-side management [DSM] program costs that are recovered in utility bills) - Capital contributed by a utility through its shareholders

Sources: de la Rue du Can et al., 2014 ; Deason et al., 2016.

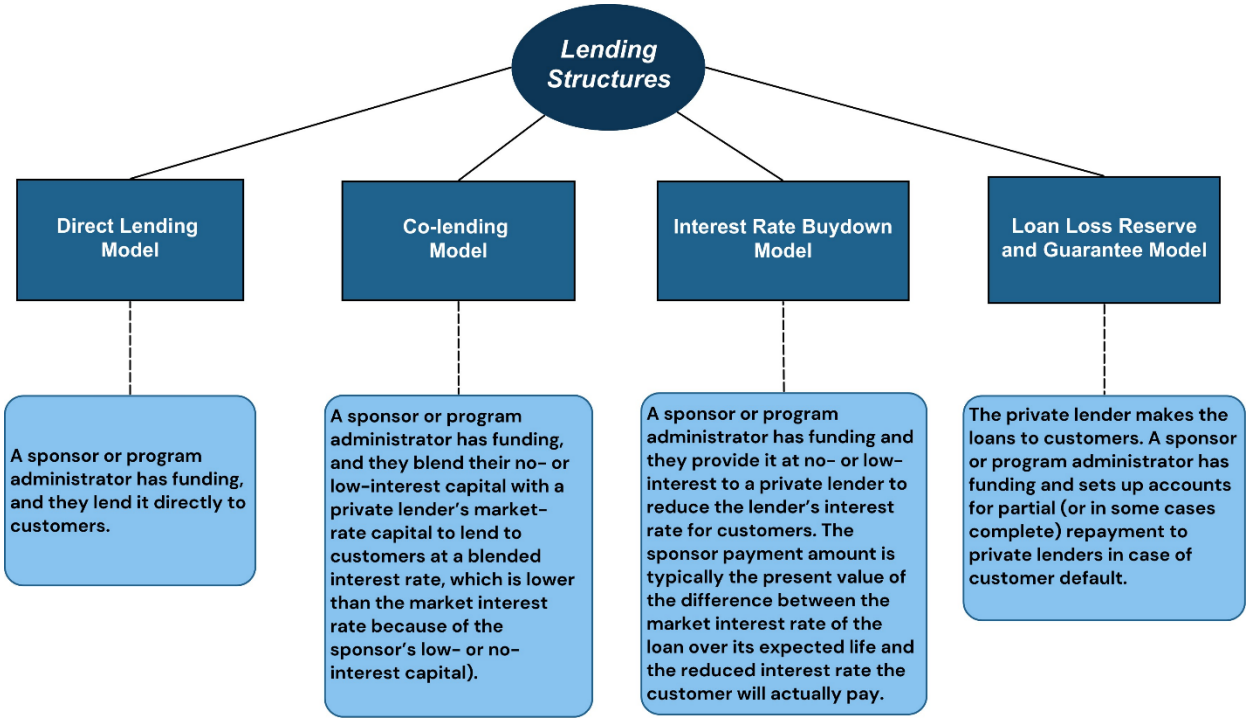
To be successful, RLFs need substantial up-front funding and a commitment from policy makers to increase RLF capitalization over time. Once the RLF deploys its initial pool of capital, the replenishment of that capital will take time. RLF administrators need to know several important things, namely: how many EE projects can be financed with the initial pool of capital; how many years before the RLF can begin issuing loans for new projects; the risk of borrower default and RLF losses; and the extent to which RLF capital can meet current and future market demand for EE financing.

Ideally, the RLF can access continuous financing, possibly via special tariffs or annual taxes, to ensure its longevity. One lesson learned comes from Bulgaria, where the government contributed significant up-front budget to establish the Bulgarian Energy Efficiency Fund (BEEF) but lacked commitment over time. Because the government did not actively increase the BEEF's capital base, the fund did not meet its objectives (Limaye et al., 2014).

2.4 LENDING STRUCTURES

This section describes four RLF lending structures: the direct lending model, the co-lending model, the interest rate buydown model, and the loan loss reserve and guarantee model. All but the direct lending model are done in partnership with private lenders and leverage private capital to some extent. Each lending structure offers distinct advantages and considerations; the choice of model often depends on RLF objectives, resources, and risk tolerance as well as market conditions and regulatory requirements. Figure 1 below illustrates these different lending structures and the following subsection describes ther characteristics.

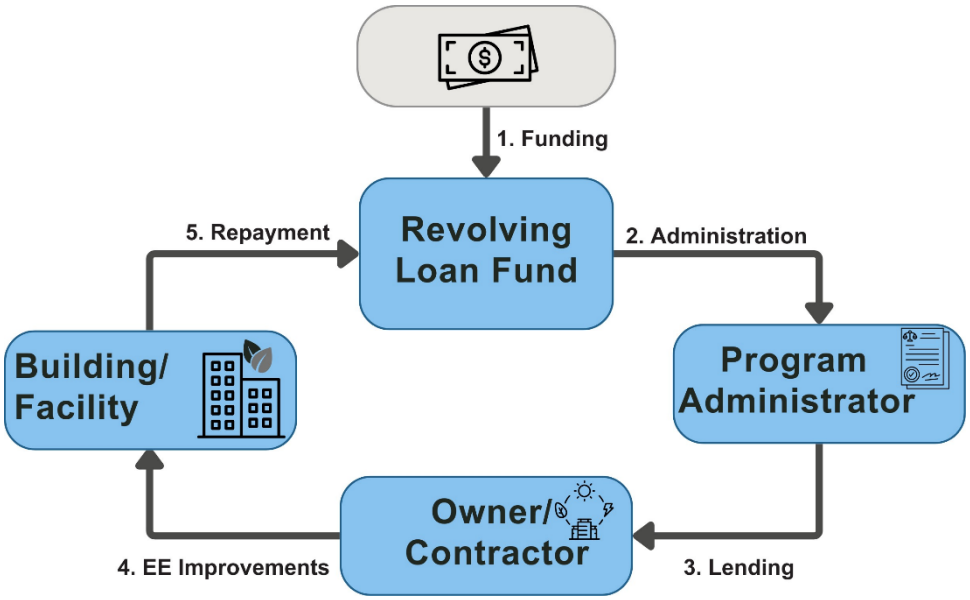
Figure 1: RLF Lending Structures



2.4.1 Direct Lending Model

The direct lending model is the simplest RLF structure, as it is characterized by a single lender. Figure 2 provides a basic diagram for a direct lending RLF model and the five minimum components that must be considered when designing and operating a direct lending RLF.

Figure 2: Direct Lending Model



Source: Based on Leventis et al., 2022.

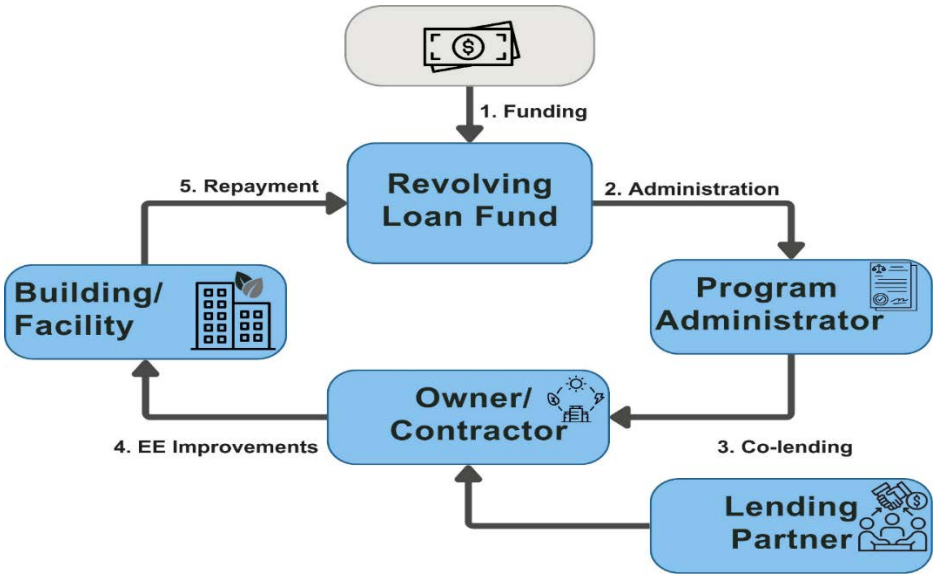
- **The first component is funding**. Public or utility funds capitalize the RLF.
- **The second element is RLF administration**. Typically, direct lending RLFs are administered by government agencies, a third-party program administrator, non-profit organizations, utilities, or a combination thereof. These entities oversee the fund's operations and ensure compliance with the RLF's established guidelines. Section 2.5 of this report discusses typical administration models in more detail.
- **The third element is lending**. RLF administrators access capital and lend it to building owners or contractors for implementation of EE and DRE projects. Lending terms are often more favorable and flexible (e.g., lower interest rates, longer-tenor loans, and/or less restrictive underwriting) than what is available in capital markets.
- **The fourth element is EE improvements**. Building owners or contractors utilize RLF funds to implement EE and DRE projects in buildings. In this case, we are using buildings improvement but this can also be targeted to other sector EE or DRE investment.
- **The fifth element is the repayment**, whereby building owners or contractors utilize cost savings from the EE project to repay the loan principal, plus interest and administrative fees, to the RLF. The recouped loans and fees are then utilized by RLF administrators for subsequent loans (Leventis et al., 2022).

An example of the direct lending model is Thailand's ESCO Revolving Fund, which provides direct financial support to building owners and contractors for implementing energy efficiency projects. It utilizes allocated funds for lending purposes and ensures favorable lending terms to facilitate project implementation and repayment. See accompanying case study in Section 4.

2.4.2 Co-lending Model

The co-lending RLF model is characterized by two or more lenders. In a co-lending RLF model (Figure 3), the RLF's five core elements are the same as the direct lending model, except for the third element (lending). With the co-lending model, funds lent by RLF administrators are supplemented by additional capital, often commercial bank loans. For example, a program administrator provides a $5,000 loan at 0% interest to a borrower (e.g., building owner or contractor), and a private lender provides another $15,000 loan at 7% interest to the borrower. Thus, the borrower receives a $20,000 loan at a blended interest rate, which is lower than market interest rates because of the 0% interest program administrator capital.

Figure 3: Co-lending Model



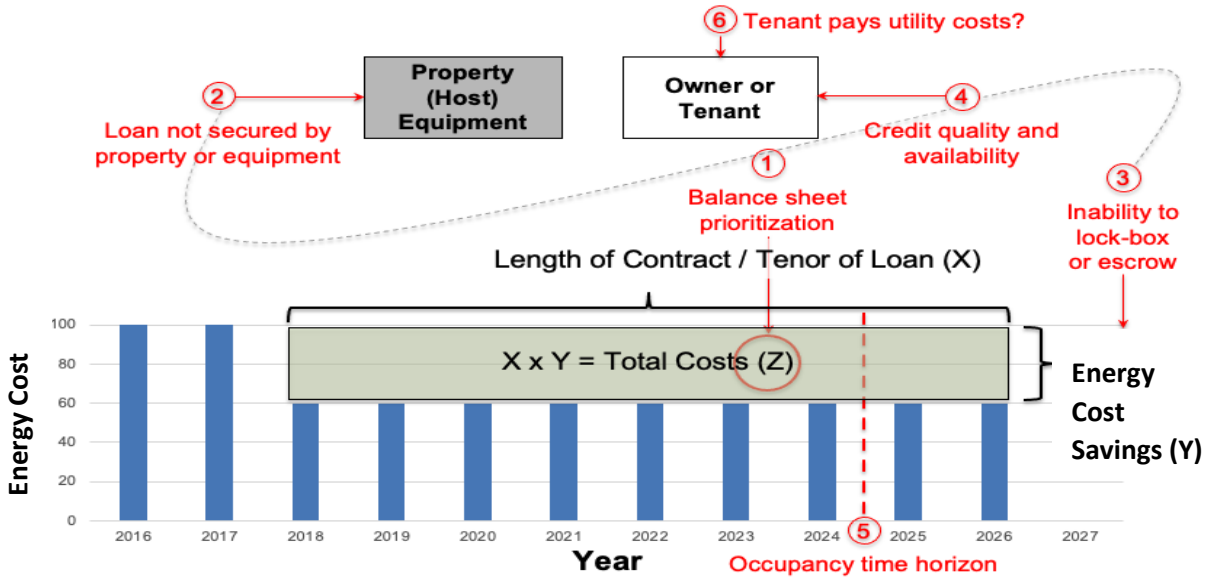
Source : Based on Leventis et al., 2022.

Many direct lending RLFs are established by government agencies or utilities and capitalized by public funds. Given that the amount of public funds are often limited, co-lending provides additional capital and administrative capacity to increase the number of EE projects implemented. Co-lending involves third-party private or public lenders (e.g., commercial banks, philanthropic organizations) to define standard processes and protocols for lender interactions with EE service providers and customers (e.g., energy service performance contracts [ESPCs], measurement and verification [M&V] protocols), thereby building private sector capacity for EE (Deason, Leventis, Goldman, and Carvallo, 2016).

While co-lending RLF models deliver important benefits such as expanding access to financing, they can also introduce complexities and increase administrative costs. A successful example is the Nebraska Dollar and Energy Saving Loans (DESL) Program, established in 1990, which utilizes a blend of public and private capital. The program offers loans at below-market rates by having the Nebraska Department of Environment and Energy (NDEE) purchase 50% to 90% of the loan at zero interest, effectively reducing the cost to borrowers. This approach enhances accessibility and affordability for residential energy efficiency customers. Section 8 describes this case study in further detail.

When considering a co-lending model involving a private lending partner such as a commercial bank, program administrators must take the financial institution's available budget and prior EE lending experience into account. Generally, private lenders have more restrictive lending terms (e.g., stricter underwriting requirements) due to the perceived risks and costs of lending for EE projects (Delaney, 2023). As shown in Figure 4 and as described further below, private lenders face a number of obstacles when financing EE projects.

Figure 4: Private Lender Barriers to EE Financing



- First, **Borrower balance sheet prioritization** presents a key challenge: although numerous energy efficiency opportunities may exist, their small individual size often falls below borrowers' self-financing thresholds. This limits the need for private capital and makes it difficult for lenders to meet their minimum investment requirements. Public programs like RLFs help address this by aggregating smaller projects into larger, more financially viable investments.
- Second, EE project loans are typically **unsecured** as it can be difficult for private lenders to use EE technologies (e.g., lightbulbs) as collateral.
- Third, private lenders are unable to **escrow future streams of energy cost savings**. This is in contrast to mortgage loans, for example, which are secured and can be escrowed.
- Fourth, in many market segments, particularly multifamily or small commercial, private lenders lack access to borrowers' **credit information** or borrowers themselves lack sufficient credit quality. This is often the case for LMI households or small and medium enterprises (SME).
- Fifth, there may be a disconnect between the building owner's (or contractor's) **time horizon** and the loan tenor for an EE project, putting lenders at risk if a loan is tied to the building owner or contractor and not the building itself.
- Finally, there is the **split incentive** problem, whereby building owners invest in EE measures (e.g., better insulation or appliances) but tenants receive the benefit of lower energy bills (Szum, 2018).

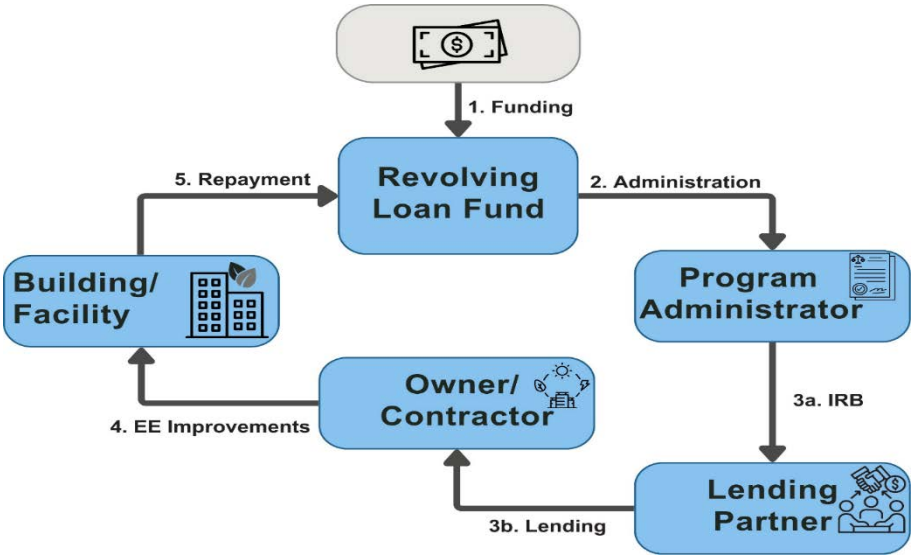
Despite these barriers, private lenders can successfully participate in RLFs through credit enhancement mechanisms that reduce lender investor risk, such as interest rate buydowns or loan loss reserves. This allows financing programs to better leverage and extend the impact of their own funds (Delaney, 2023). These RLF models are described further below.

2.4.3 Interest Rate Buydown Model

The Interest Rate Buydown (IRB) model is one in which RLF funds are provided at no or low interest to a private capital lending partner to reduce the interest rate of an EE loan.

As shown in Figure 5, the five core elements of the RLF remain the same as in the direct lending model, except for the third element, lending. In the IRB model, RLF funds are not lent directly to building owners or contractors; instead, RLF administrators send a direct payment to a private lending partner to reduce the interest rate of an EE loan (Figure 5, 3a and 3b). The payment amount is typically the present value of the difference between the market interest rate of the loan over its expected life and the reduced rate the building owner or contractor will pay (Zimring, 2014).

Figure 5: IRB Model



Source : Based on Leventis et al., 2022.

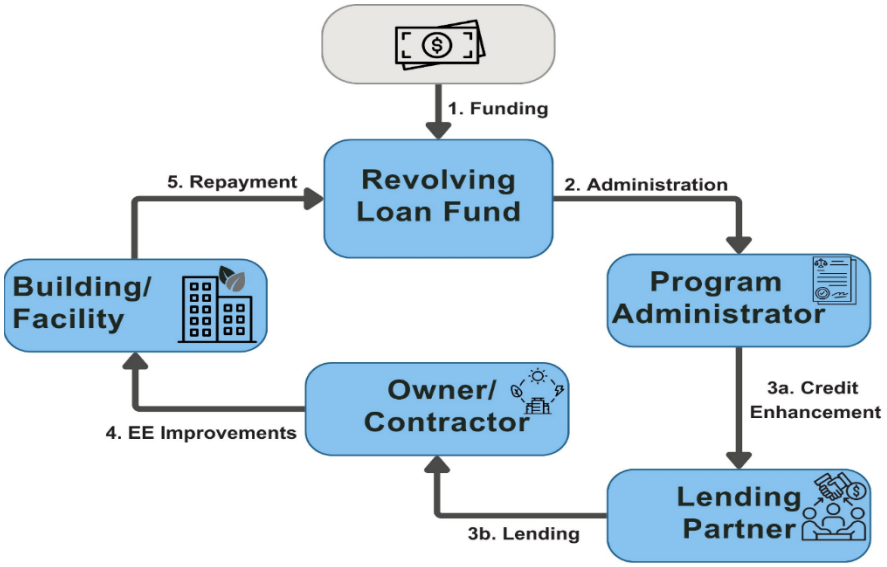
As with the co-lending model, the IRB model offers a number of advantages compared to the direct lending model. First, it can increase the number of EE projects implemented and the associated EE and GHG impacts. Second, it builds capacity among private lenders for EE lending. The disadvantages of this model are the added complexity and/or expense in administrating the RLF due to coordination with additional lenders (Delaney, 2023). An example of the IRB model includes Thailand's Energy Efficiency Revolving Fund (EERF), which provides a cost-effective funding source to banks, enabling them to extend loans to companies at rates not exceeding 4%. The EERF offers banks low-interest loans ranging from 0% to 0.5%, reducing banks' interest rates for companies investing in EE projects. Section 4 explains this case study further.

2.4.4 Loan Loss Reserve and Guarantee Models

The loan loss reserve (LLR) model and the guarantee model are co-lending models in which RLF funds are utilized for partial loss coverage (LLR) or complete loss coverage (guarantee) of EE loan balances to private lenders in the event of borrower default. The LLR model reduces the lender's risk and allows the program sponsor to leverage its funding; in other words, each dollar of program funding motivates more than a dollar in lending by the lender. Although these models are called "credit enhancements," they don't actually enhance borrower credit; rather, they lower the lender's risk.

Similar to the other lending models, the LLR RLF model shares four of the five core elements with the direct lending model, differing only in its lending mechanism, as illustrated in Figure 6. With the LLR models, RLF funds are not lent directly to the building owners or contractor for EE project implementation. Instead, private lenders make the loans and RLF administrators set up accounts for partial (LLR) or complete (guarantee) repayment in case of borrower default.

Figure 6: LLR and Guarantee Models



Source : Based on Leventis et al., 2022.

As with the IRB and co-lending models, the LLR and guarantee models allow private lenders to deliver more attractive financing (e.g., lower interest rates, reduced origination and servicing fees, longer loan terms) to customers. This helps expand customer access to capital and, by leveraging program funding, increase the number of EE projects implemented and the associated EE and GHG impacts (Deason et al., 2016). For example, consider an LLR with $5,000 in capital offering 5% loss coverage to private lenders. This allows lenders to safely issue up to $100,000 in loans, knowing the first 5% of defaults are covered. This creates a 20:1 leverage ratio ($20 in lending for each $1 of program funding), enabling $100,000 in clean energy project financing from just $5,000 in program funds (G. Levinson, personal communication, August 26, 2024).

The total LLR size, loan pool coverage ratio, and loss-share ratio are typically negotiated between RLF administrators and private lenders and are based on the private lender risk tolerance, RLF program goals, and the target market.

The disadvantages of the LLR and guarantee models are added complexity or expense in administrating the RLF and/or the need to coordinate with third-party guarantee providers (Delaney, 2023). Table 4 identifies some elements that must be considered before establishing an LLR model.

Table 4: LLR Considerations

Consideration	Description
Total LLR Size	- LLR size will depend on the risk of default payment. - LLR sizes are generally set higher than the portfolio's estimated loan losses. - For example, if estimated losses are 1.5%, the loss reserve might be 5-10%, depending on negotiations between the RLF administrator and the financial institution partner.
Loan Pool Coverage Ratio	- This ratio is the maximum percentage that can be recovered from the LLR. - For instance, a 10% LLR allows a lender to recover up to 10% of the RLF (100% of the LLR) in the event of defaults. - The lower the loan pool coverage ratio, the higher the RLF leverage : o A 10% LLR leverages LLR funds 10 to 1. o A 5% LLR leverages LLR funds 20 to 1.
Loss-share Ratio	- The **Loss-share Ratio** is the percentage of a lender's loss on each borrower default that can be recovered from the LLR. - For instance, a 90% loss-share ratio enables a lender to recover 90% of the value of the loss from each loan default from the LLR (up to the loan pool coverage ratio). The lender must absorb the remaining 10%.

Source: Zimring, 2014.

An example of the LLR model is the Michigan Saves program, which functions as an LLR by incorporating a 4% loss reserve pool from outstanding loan balances. This reserve acts as a safety measure, allowing lenders to mitigate the risk of default.

Another example of the LLR model is the China Utility-based Energy Efficiency (CHUEE) program. Private lenders participating in CHUEE provided EE loans to energy service companies (ESCOs) on attractive terms (e.g., longer loan tenors) and were supported by a public LLR covering $587 million (75%) of losses under the first and second phases of CHUEE and $294 million (50%) of losses under the third phase of CHUEE. Investment for the LLR was sourced from the IFC, China, Finland, Norway, and the Global Environment Facility (GEF). Partner banks included Industrial Bank, Bank of Beijing, and Shanghai Pudong Development Bank. Section 9 describes these case studies in further detail.

With the guarantee model, private lenders can recover 100% of loan losses in case of borrower default. Hence, a guarantee can be considered an LLR with a loan pool coverage and loss-share ratio of 100%. RLF administrators can guarantee all loans or limit the amount of loans they will guarantee. Unlike an LLR, which is put into escrow by RLF administrators, loan guarantees are supported by the credit of a third-party guaranteeing entity, often a government agency or a Multilateral Development Bank (MDB). While a guarantee benefits private lenders with low risk tolerance, a disadvantage is that they often require legislative approval to be established (Zimring, 2014). An example of the guarantee model is the Tennessee Valley Authority Single Family On-Bill Financing Guarantee.

2.5 ADMINISTRATION

The administration of RLFs involves four core functions: (1) marketing and outreach; (2) loan origination; (3) loan servicing; and (4) monitoring and reporting. Table 5 provides detailed descriptions of these functions.

Table 5: RLF Administrative Functions

RLF Function	Description
Marketing and Outreach	- Activities to promote uptake of loans (e.g., website, social media, press releases, brochures, case studies, guidebooks)
Loan Origination	- Process financing applications - Perform credit evaluations - Generate loan documents - Disburse loan proceeds
Loan Servicing	- Collect and process loan repayments - Send out statements (if required) - Delinquency collections - Default collections
Monitoring and Reporting	- Regular and consistent process (monthly) - Review applications (received/processed), loans issued, repayments, and delinquencies/defaults - Comply with reporting requirements from capital provider (where applicable)

Source: Leventis et al., 2022.

RLFs can be administered by various entities, including government agencies, utilities, non-profit organizations, and consulting firms. Each administrator type manages daily operations and ensures regulatory compliance. Table 6 outlines the advantages and disadvantages of these administrative models, which are further explored in the following sub-section.

Table 6: Advantages and Disadvantages of RLF Administration Models

Option	Advantages	Disadvantages
Self-administered	- Control over RLF delivery	- Require expertise that may not be available in house
Partially Outsourced	- Brings external expertise - Can be engaged using a performance-based contract that provides incentives for success and penalties for failure - Alleviates some staff burden	- Few fee-for-service providers to select from (except servicing) - Higher administrative and transactions costs for the RLF
Fully Outsourced	- Same as partially outsourced - Alleviates more staff burden	- Same as partially outsourced - Less control over RLF delivery

Source: Limaye et al., 2014.

2.5.1 Self-Administered

Some RLFs are administered "in-house," meaning that the organization that sponsors the program also administers it. For instance, the State Energy Conservation Office (SECO) in the U.S. state of Texas manages LoanSTAR, a direct lending program, for publicly owned and tax-district supported facilities. SECO has developed comprehensive program guidelines, receives and reviews loan applications, provides funds for approved projects, determines the amortization schedule for each loan, monitors the design, construction, and closeout of each project, and handles repayment collection and other loan needs. Since its establishment in 1998 with a capitalization of $128 million, LoanSTAR has made over 260 loans exceeding $443 million in project costs, according to the National Association of State Energy Officials (NASEO) database (NASEO, 2023a).

2.5.2 Partially Outsourced

Other RLFs are administered partly in-house and partly outsourced. For instance, a government agency operating an RLF may hire a contractor for loan origination and loan servicing but handle marketing, outreach, monitoring, and reporting itself.

An example of a partially outsourced RLF is the New York State Energy Research and Development Authority (NYSERDA) Green Jobs-Green New York (GJGNY) Residential Financing Program. Established in 2009, the program is overseen by NYSERDA and finances EE improvements across New York utilizing on-bill repayment (OBR). This program encompasses residential, small business/non-profit, and multifamily customers across seven utility companies in the state. The overall lending structure of GJGNY program emphasizes the direct lending model, with supplemental elements from co-lending practices, specifically to facilitate green energy financing and workforce development which are key components of the GJGNY initiative.

While the program is overseen by NYSERDA, it operates with key partners. Slipstream Energy Finance Solutions (EFS) serves as the loan originator, facilitating online applications and rapid pre-approvals based on credit scores. Concord Loan Servicing handles loan servicing, including payments and reports. In cases of delinquency, Blackwell Recovery manages collections. NYSERDA's staff oversees daily program operations, encompassing OBR, declarations, satisfaction processes, and more. They also handle liquidity analysis, budgeting, and lead efforts in bond securitizations. NYSERDA also manages reporting, which involves monthly, quarterly, semiannual, and annual reports for various stakeholders (NYSERDA Residential Financing Team, 2023).

2.5.3 Fully Outsourced

Some RLFs have partnered with a third-party administrator (TPA) to administer their entire RLF. A TPA takes on tasks associated with operating the RLF, including marketing and outreach, loan origination, loan servicing, and monitoring and reporting.

An example of a fully outsourced RLF was AlabamaSAVES, which targeted commercial and industrial borrowers in the U.S. state of Alabama. The Energy Division of the Alabama Department of Economic and Community Affairs hired a TPA, Abundant Power, to administer and originate program loans. AlabamaSAVES used a loan fund of $25 million to support over $50 million in projects, according to the NASEO database (NASEO, 2023b). Despite its success in funding projects, AlabamaSAVES has since been closed.

2.6 Risk Management

A key component of administering an RLF is minimizing non-performing loans (i.e., loan delinquency and loan default).

Loan delinquency occurs when payments fall behind schedule but have not been charged off[2]. A loan typically becomes delinquent after missing payments for a specified period (e.g., 30 days). Delinquency rates can be measured in two ways:

- By loan value: Total value of delinquent loans divided by total outstanding loan balance
- By loan count: Number of delinquent loans divided by total number of outstanding loans

For example, consider an energy efficiency loan portfolio with:

- Total outstanding balance: 500,000 DT
- Total active loans: 500
- Delinquent loans: 30 loans totaling 25,000 DT

This results in:

- Value-based delinquency rate: 5% (25,000/500,000)

[2] A charge-off occurs when a lender writes off a loan as a loss after multiple missed payments, closing the account to future charges. This is distinct from delinquency and represents a more severe status

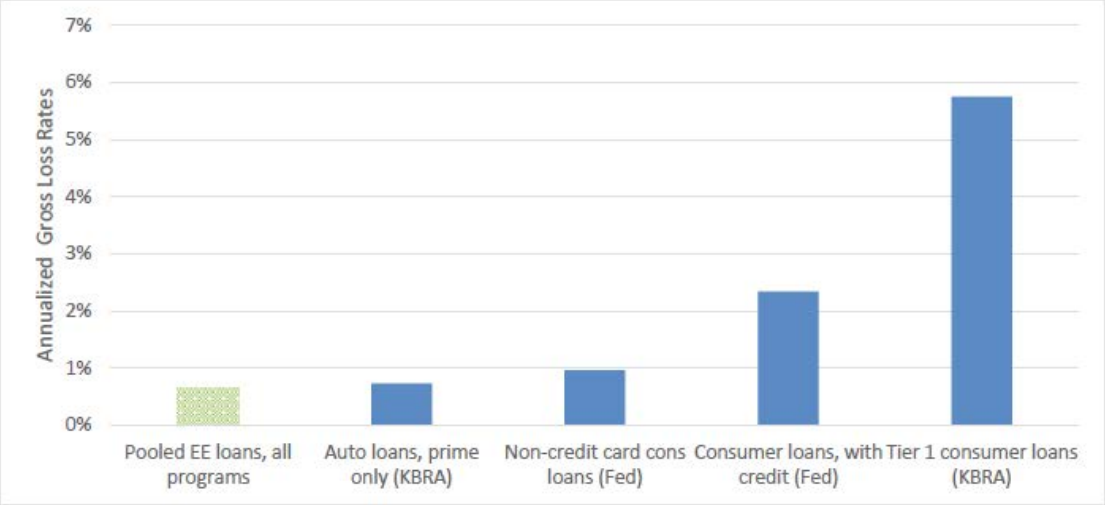
- Count-based delinquency rate: 6% (30/500)

Loan losses represent charged-off loans after prolonged nonpayment (default). These losses can be measured in two ways:

- Cumulative Gross Loss Rate
  - Calculation: Total charged-off amount ÷ Total cumulative loan balance
  - Example: With 1,000,000 DT in total loans and 20,000 DT in charge-offs, the gross loss rate is 2% (20,000/1,000,000)
- Cumulative Net Loss Rate
  - Calculation: (Total charge-offs minus recoveries) ÷ Total cumulative loan balance
  - Example: If 5,000 DT is recovered from the 20,000 DT charge-off, the net loss rate becomes 1.5% (15,000/1,000,000)

Publicly available data from the United States for four EE financing programs[3] found that the 30-day delinquency rate was 1.57% and the gross loss rates were 2.1% of the principal by Year 2, 3.3% by Year 4, 4.5% by Year 6, and 5.1% by Year 8 (Leventis et al., 2022). Despite these losses, research findings shown in Figure 7 below indicate that the repayment of EE loans was superior to other creditworthy unsecured consumer loans and comparable to prime auto loans (Deason, Leventis, and Murphy, 2021). No publicly available data for Tunisian programs exists at this time.

Figure 7: Annualized Gross Loss Rates for U.S. EE Loan Programs and Comparators



Source: Deason, Leventis, and Murphy, 2021.

The most important factor in reducing non-performing loans is underwriting. According to research conducted on the four EE financing programs in the United States mentioned above, all other factors

[3] Two of these programs are described in this report: Michigan Saves and NYSERDA's Green Jobs Green New York (GJGNY) Residential Financing Program. Other programs include the Connecticut Green Bank (CGB)'s Smart-E Loan program and the Keystone HELP program.

being equal (i.e., same interest rate, borrower income, and loan age), borrower credit score was the biggest predictor of whether a loan would perform or not. Researchers found that increasing the borrower credit score by 100 reduces the probability that a given loan is 30 days delinquent by 1.06 percentage points and the probability that a given loan is charged off by 5.81 percentage points.

Another important factor in reducing non-performing loans is proactively tracking loans. This involves carefully collecting and filing documents during the underwriting process. It also means being able to deviate from standard monitoring practices if a loan is at risk, including making site visits, providing additional technical assistance, reviewing credit factors, monitoring foreclosures or bankruptcy litigation, or working with other lenders involved in the loan to reduce default risk (Allen et al., 2020). Table 7 provides typical reasons for loan default that can be avoided with proactive monitoring.

Budget capture or on-bill financing (OBF) – in which the financing charges appear as a line item on the utility bill alongside energy charges – can be applied to RLFs to enhance loan repayments. In public buildings where dedicated funds are received from the finance ministry (or other government agency) to pay energy bills, the finance ministry (or government agency) reduces its budgetary transfers to the public building – after the building has fully repaid the RLF loan – by an amount equivalent to the energy cost savings because of the savings gained through EE. OBF can be applied when a utility establishes an RLF to finance EE projects for customers and recovers investments in EE projects through repayments on customer utility bills (Limaye et al., 2014).

Table 7: Why Loans Default

Typical Lender Mistakes	Typical Borrower Mistakes
- Making a poor lending decision - Not confirming the accuracy of borrower statements (e.g., income vs. expenditure) - Incorrectly completing loan paperwork - Poorly monitoring the loan	- Spent the loan on things other than EE - Provided misleading information on application - Under-capitalized - A significant and distracting event occurs

Source: Colorado Lending Source, 2020.

Signs of Potential Default

The following are signs that an RLF borrower may default on their loan:

- borrower has missed payment(s);
- borrower has requested a deferral;
- borrower has sold assets to fund working capital;
- borrower has sought additional financing;
- borrower has requested a release of primary collateral;
- there has been a change of property ownership;
- borrower credit scores have declined;

- borrower is facing or involved in a lawsuit or has declared bankruptcy;
- borrower does not meet loan commitments or supply required documentation;
- borrower has negative publicity;
- borrower is nonresponsive or rude;
- borrower has negative financial trends or is delinquent with taxes; or
- borrower is facing personal hardship, such as loss of job, divorce, or healthcare expenses

Source : (Allen et al., 2020; Khartit & Logan, 2024).

How to Address a Potential Default

If a borrower is at risk of loan default, RLF administrators can consider lowering the interest rate, extending the loan term (creating a longer amortization period), or establishing an interest-only forbearance. Table 8 provides an overview of several potential changes to loan terms and considerations.

Table 8: Changes to Payment Terms

Potential Change	Description	Considerations
Deferral	A temporary modification of repayment terms is granted (e.g., a three-month, interest-only deferral).	Is the problem short term? Will the deferral help or only delay eventual default? Has the borrower explained how they will avoid default?
Rate Modification	A reduction in the interest rate with a re-amortization over the remaining term of the loan.	
Workout/Full Debt Restructure	A reduction in the interest rate with additional factors included.	

If a workout is not feasible, then RLF administrators should proceed to liquidation (i.e., sale of collateral). If liquidation is insufficient, then litigation may be required (depending on costs and benefits). If litigation is not required, then referral to a collection agency and routine business credit reporting is likely the final solution (Allen et al., 2020).

Tips to Avoid Defaulted Loans

All loans should be regularly reviewed and "risk rated" using a system like the one shown in Table 9. Moreover, as soon as it is evident that a loan is challenged, RLF administrators should consider the following strategies:

- weekly late-pay calls;
- consistent follow-up and follow-throughs;
- frequent meetings with clients;
- site visits;
- holding borrowers accountable; and

- use of loan default procedures (see Table 7).

Table 9: Example of Risk Rating Loans

Class	Designation	Characteristics
1	Pass	Low, low/medium risk loans
2	Special Mention	High/medium risk loans
3	Substandard	High risk loans – full repayment expected
4	Doubtful	High risk loans – full payment possible
5	Loss	High risk loans – full payment unlikely

Source: Colorado Lending Source, 2020.

2.7 Generating RLF Participation

Generating RLF participation requires the right incentives; visibility (i.e., potential borrowers know about the RLF); and credibility (i.e., potential lenders and borrowers believe in the effectiveness of the RLF).

The right incentives include affordable financing (e.g., longer-tenor loans and/or lower interest rates) and/or free technical assistance resources (e.g., free audits or measurement and verification [M&V] of energy and cost savings).

Visibility can be achieved through a strong marketing and outreach strategy. Marketing, which involves engaging stakeholders and promoting the uptake of EE loans, generally consists of implementing both broad and targeted strategies. These include promotion on websites, social media, public radio, as well as through press releases, events, and in printed collateral (e.g., newsletters or sustainability reports). Targeted marketing involves face-to-face meetings, emails, or phone calls to potential borrowers to promote the RLF. Targeted marketing should focus on building trusted relationships, understanding borrower needs, and communicating a simple process for participation. Notably, most RLF applicants learn about the RLF from lenders, borrowers, energy service companies (ESCO), or trusted community groups (e.g., business associations, utilities, community action agencies, nonprofit organizations, lender networks, and ESCO networks). For this reason, RLF administrators should engage lending partners, ESCOs, and community groups and equip them with informational brochures and other promotional materials so they can communicate the RLF opportunity to their constituents and networks. Additionally, once a borrower participates in the RLF, it is important to educate them about the RLF so they can communicate the opportunity to others (Schrader and Weis, 2019).

Table 10 provides some best practices for marketing RLFs and generating an EE project pipeline.

Table 10: Best practices for involving RLFs

Best Practices for Generating RLF Participation
- Involve both RLF administrators and "channel partners" (e.g., lenders, community organizations, utilities) in EE project pipeline generation. - The strongest marketing is a connection with EE projects and a strong relationship with a lender or borrower. - Don't stop making connections and generating EE projects when lending funds are low. - Current successful EE projects usually translate to future successful EE projects through satisfied customers that lend credibility to the RLF. - Bringing in multiple lenders can be effective in building an EE project pipeline (although this may increase the complexity and cost of RLF administration).

Source: Schrader and Weis, 2019.

2.8 Broadening Access to RLFs for LMI Borrowers

LMI households are defined by the U.S. Federal Reserve, the central bank of the United States, as those having median family income levels lower than 80% of the area median income (AMI) (Board of Governors of the Federal Reserve System, 2023). According to the World Bank, LMI households often also have the highest energy burden (i.e., the ratio of annual energy expenditure to annual household income) (The World Bank Group Energy Sector Management Assistance Program, 2018).

Ensuring that EE financing is available to LMI households can support a broad range of policy goals, such as equity, job creation, public health, poverty alleviation, and environmental protection. From the perspective of utilities, extending EE financing to LMI households can avoid capacity investments, stabilize electricity market prices, and improve system reliability.

Direct benefits to LMI households include the following:

- the potential to improve EE for urgent projects (e.g., EE financing can make it possible to replace failed equipment with a more efficient model while adding supporting EE measures, such as air sealing of the building envelope);
- expanding conventional EE projects to include additional EE upgrades; and
- helping to reduce energy burdens, improve occupant comfort, lower household maintenance costs, and improve indoor air quality (IAQ).

In considering targeting LMI households as part of RLF programs, administrators should account for the unique characteristics of these households and be aware of the implications for program design. Table 11 describes several of these characteristics and their implications.

Table 11: Household Characteristics and Implications for RLF Program Design

Characteristic	Implications for RLF Program Design
More likely to occupy older housing	Housing may require health, safety, or structural work prior to EE improvements, thereby reducing the number of LMI households eligible for EE financing. Housing may be less energy efficient overall.
More likely to rent or live in multifamily housing	The owner-renter split incentive makes it difficult for renters to improve EE (even with financing assistance). EE financing for multifamily housing is different than for single family housing insofar as: (a) underwriting for multifamily housing is much broader; (b) financing for EE in multifamily housing does not impact individual borrower household finances; and (c) single family borrowers do not have to seek consent from other creditors.
May qualify for other types of financing	Availability of other financial assistance resources must be evaluated when considering offering financing for EE improvements in LMI households, as LMI households tend to qualify for a number of financial assistance programs. While many argue that LMI programs should focus on grants that do not require repayment, available grant money is often insufficient to meet the need for EE financing in LMI households.
Strong consumer protections are required	Disclosure: Before borrowers enter an agreement, the full costs (e.g., fees and interest) and implications (e.g., impact on the ability to sell the property) should be disclosed. Abuse: Protocols should ensure that practices such as fraud and predatory lending are unacceptable by lenders, and that borrowers know where to report abuse and gain support. Affordability: Lenders should assess the borrower's ability to repay EE financing and ensure loan repayments are not burdensome. This includes reviewing the borrower's income and debt burden. Protocols to help struggling borrowers: Loan modification, forbearance, loan forgiveness, and other protocols should be available to help borrowers avoid default. Supporting affordability: RLF administrators and industry can coordinate the use of incentives to reduce EE project costs and lower monthly repayments; require EE projects be cash flow-positive; and focus on LMI households with high-energy consumption.

In addition to adopting EE financing products and product features to facilitate access by LMI households, promoting coordination and collaboration among stakeholders including utilities and nonprofit organizations helps facilitate LMI borrowing in two ways:

- If RLF administrators work with organizations that have a history, reputation, and network in LMI communities, LMI households may be more willing to participate. These community networks can also help to reach more LMI households.
- RLF administrators may be able to collaborate with third-party organizations that can provide full or partial funding for EE projects (e.g., community development financial institutions) (State and Local Energy Efficiency Action Network, 2017).

2.9 Balancing Policy Goals and Financing Goals

Energy efficiency adoption faces five interconnected categories of barriers: market, technical, institutional, motivational, and financial impediments. (Table 12). While RLFs effectively address financial barriers, they are most successful when integrated into comprehensive market transformation programs. Successful implementation requires administrators to determine complementary policy and financing mechanisms, such as free energy audits, standardized M&V frameworks, or Energy Savings Performance Contracts (ESPCs), to holistically promote energy efficiency financing (The World Bank Group Energy Sector Management Assistance Program, 2018; de la Rue du Can et al., 2014; Becque et al., 2014).

Table 12: Decision Matrix to Develop a Holistic EE Market Transformation Program

Barriers	Possible Next Steps
Policy and Regulatory	Implement cost-reflective energy tariffs; develop and enforce codes or standards; address import duties on efficient equipment; and build capacity within relevant institutions.
Project Development and Transaction Costs	Implement tools for energy audits, M&V, and comparing alternative technologies; develop platforms to aggregate small and dispersed project investments; and standardize agreements and procedures.
Absence/ Asymmetry of Information	Utilize energy performance benchmarking and transparency tools, policies, and programs (e.g., building certification), energy consumption data, information on energy efficiency potential and opportunities, and evaluations of energy efficiency programs and their costs/impacts.
Lack of Technical Capacity for Energy Efficiency	Provide technical assistance to service providers to strengthen their capacity. Provide support services to energy efficiency project beneficiaries (e.g., by conducting energy audits and/or developing technical designs). Procure equipment; supervise construction and installation; complete M&V; and provide training, case studies, and standard documents and templates.

Source: The World Bank Group Energy Sector Management Assistance Program, 2018.

3. STEPS IN ESTABLISHING AN RLF

Establishing a successful RLF for energy efficiency financing requires a systematic approach. This section details the sequential steps outlined in Figure 8, which create a comprehensive framework for developing and sustaining an effective RLF program.

Figure 8: Stepwise Approach to Developing an RLF

3.1 STEP 1. PERFORM A GAP ANALYSIS

A gap analysis identifies the market need for EE financing. It involves both reviewing existing sources of public and private EE financing and meeting with stakeholders to determine the suitability of existing sources. Among the stakeholder groups to consider consulting in a gap analysis are ESCOs, households, private lenders, elected officials, economic development professionals, and trade associations. Groups should be consulted to understand what type of EE financing exists; what is missing; what is needed in

terms of interest rates, loan size, loan structure (e.g., would it be more helpful to have a loan that borrowers can pay back on their utility bill?), and loan tenor; and the types of EE improvements that need additional financing. Gaps may exist due to the high cost of commercial capital. Further, gaps may exist only for certain segments of the market that struggle to meet commercial lending requirements, such as LMI households or women-owned SMEs. RLFs that fill specific market gaps are especially valuable. RLFs should be designed to avoid displacing other capital already available for EE project implementation (Leventis et al., 2022).

3.2 Step 2: Establish a Legal Framework for the RLF

A legal framework sets forth the laws under which the RLF will operate. The first step is to determine if such a legal framework already exists. If not, new legislation may need to be enacted. Additionally, RLF administrators need to determine whether an existing legal entity (e.g., government agency, utility, or bank) can operate the RLF or whether a new legal entity (e.g., non-profit organization) must be established (Limaye et al., 2014). Table 13 provides a model RLF legal framework from the U.S., the federal Safeguarding Tomorrow through Ongoing Risk Mitigation Act (STORM Act) (Public Law 116-284). The STORM Act was signed into law on January 1, 2021, and helps US States establish RLFs to fund resilience projects. While the language for an EE RLF (vs. a resilience RLF) will differ from that shown in the table, the basic elements of a strong legal framework (i.e., title, definitions, purpose, intent, RLF overview, and effective date) would be the same for an EE RLF.

Table 13: Sample RLF Legal Framework from the United States

Section	Sample Content
1. Title	"This Act shall be known and cited as the 'Resilient Revolving Loan Fund Model Act."
2. Definitions	"For the purpose of this Act: (a) 'Fund' refers to the Resilient Revolving Loan Fund. (b) 'Emergency Management Department' refers to the state agency responsible for emergency management in the state passing the "Resilient Revolving Loan Fund Act." (c) 'Finance Authority' refers to a government authorized finance authority with lending experience for private property (d) 'STORM Act' refers to the 'Safeguarding Tomorrow through Ongoing Risk Management Act' (Public Law 116-284)."
3. Purpose	"For the purpose of establishing a special, non-lapsing loan fund, the Resilient Revolving Loan Fund, to provide loans for local resilience projects that address mitigation of all natural hazards and additional projects related to man-made threats and hazards. "
4. Intent	" (a) It is the intent of the legislature that the Emergency Management Department or other appointed administrative or financing agency apply to the FEMA under the

	provisions of the STORM Act, when funding is available, to enter into an agreement to capitalize the RLF established under this Act with money appropriated to the Fund. ”
5.RLF Overview	“1. The Fund consists of: i. Money appropriated in the state budget to the Fund; ii. Investment and interest earnings of the Fund; iii. Repayments of principal and interest loans made from the Fund; iv. Any other money from any other source accepted for the benefit of the Fund and v. The loan program shall have a ‘restricted’ fund that will hold private capital that allocated for the hazard mitigation of buildings only and not available for other uses. 2. The Fund is administered by the Emergency Management Department or financing authority. 3. The Fund may be used only to provide low – or no – interest loans to Finance authorities and non-profit organizations for hazard mitigation and resilience projects. These loan funds can be made to private property owners for the use in hazard mitigation project for the building. 4. The loans provided under the Fund shall be for a fixed loan period and can be attached to the property taxes, allowing the property to be sold as long as the new owner agrees to assume the debt obligation. 5. Any interest earnings of the Fund shall be credited to the Fund. 6. The loan program will also be established with graduated forgivability available to eligible individual recipients that shall at minimum: i. Provide full loan forgiveness for eligible households with between 80 percent and 50 percent of the area median income incomes for the area in which the property to which the loan applies is located. ii. Provide 50 percent loan forgiveness for eligible households with income equal to 80 percent to 100 percent of the area median income for the area in which the property to which the loan applies is located. iii. Additional forgivability percentages for households with incomes not within those directly addressed in this subsection can be applied by the implementing Emergency Management Department or financing authority based on: a. The number of eligible individual recipients participating in the program authorized under this subsection. b. The availability of funding. c. Any other factor that the implementing agency finds reasonable and necessary.”
6. Effective Date	“And be it further enacted that this Act shall take effect _____.”

Source: Model State Revolving Loan Fund Legislation, 2024.

In the case of Tunisia, the Energy Transition Fund (FTE) is an example of a legal framework to support energy conservation. The FTE was created by Finance Law of 2014 No. 2013-54 of December 30, 2013 (Article 67), which was modified and supplemented by Law No. 2014-54 of August 19, 2014. The rules of organization, operation, and terms of intervention of this fund were set by government decree No. 2017-983 of July 26, 2017, as amended by decree No. 2023-86 of February 2, 2023.

Table 14 describes the FTE's six core elements. Ideally, Section 5 of the law could incorporate additional language on an EE RLF should that be desired.

Table 14: FTE Legal Framework

Section	Content
1.Title	This Act shall be known and cited as the "The creation of an Energy Transition Fund to replace the National Energy Management Fund (FNME) to support the energy transition. Article 67 of law no. 2013-54."
2.Definitions	None.
3.Purpose	The purpose of Law no. 2013-54 is to establish a fund that, alongside the investment incentives provided by the FNME for energy management actions, plays a role in providing credits, subsidies, and capital participation for projects. It also specifies the budget for the fund in that specific year and the sources of funding for the fund.
4.Intent	The FTE is supposed to give a boost to energy conservation activities with a leverage effect in mobilizing private funds. It constitutes public support to support the development of these activities in line with the ambition of Tunisia's energy transition
5. RLF Overview	There is no RLF at this time, but it could possibly be added in the future. The FTE's mode of intervention, which was limited to the granting of bonuses, has been diversified to integrate both optimized and well-targeted investment subsidies, credits with concessional conditions in terms of duration and rates which come complement the current offering of commercial banks and equity investments to support certain types of investors requiring strengthening of their own funds.
6. Effective Date	December 30, 2013

Source: 2014 Finance Act, 2013.

3.3 STEP 3: ESTABLISH FUNDING SOURCES

It is important that the RLF be capitalized with sufficient public, private, utility, or blended funds to initiate operations and provide loans for a number of EE projects. (See Table 3 for examples of funding sources.) As described in Section 2.5, administrators should also identify ways to increase the capital base of the RLF over time through marketing, surveying stakeholders, and garnering political support (Limaye et al., 2014).

3.4 Step 4: Define RLF Goals and Target Markets

This step consists of establishing RLF objectives, which may encompass goals such as achieving energy savings, reducing greenhouse gas emissions, and/or reducing energy poverty for LMI households. Goals should incorporate insights from the gap analysis conducted in Step 1.

Table 2 provides examples of RLF benefits, which can serve as its objectives. Additionally, when establishing an RLF, it may be strategic to focus initially on a few target markets. The public sector, particularly administrative offices, schools, and/or hospitals, contains strong target markets for an initial RLF deployment due to the high EE potential and creditworthiness of the government.

3.5 Step 5: Develop an RLF Operational Plan

A detailed operational plan should be devised to guide the implementation of the RLF. It should define the governance structure, including identifying who will govern the fund and what their responsibilities will be. The operational plan should also describe the administrative structure, including identifying who will administer the RLF and what their responsibilities will be.

An important component of the administrative team is the Loan Review Committee, which is responsible for loan origination. Section 2.5 provides a description of administrative structure options and advantages and disadvantages of each type.

Additionally, the operational plan should clearly define how the RLF's four core functions will be implemented and by whom. Table 5 in Section 2.5 describes core RLF functions.

Ultimately, the operational plan should be utilized to create an RLF operation manual that provides guidance to all key participants involved in RLF governance and administration (Limaye et al., 2014).

3.6 Step 6: Appoint a Board of Trustees and Hire Administrators

An RLF requires a qualified board of trustees and administrators. The board of trustees should involve both government and private sector representatives. The combination of public and private sector trustees helps prevent the political capture of the RLF. The administrative team should be comprised of staff with experience in financing, EE and distributed renewable energy, contracting, credit and risk assessment, and loan disbursement and recovery (Huey, 2023; Limaye et al., 2014). It is recommended that the Loan Review Committee consist of a broad base of individuals, including an attorney, at least one private lender, a businessperson, an economic development professional, and an elected official (Delaney, 2023).

3.7 Step 7: Define the RLF Structure and Basic Elements

The board of trustees and administrative team should select the RLF structure (i.e., direct lending, co-lending, IBR, LLR, or guarantee) and define the RLF elements as shown in Table 15. See Section 2.4 for more information on various RLF structures.

Table 15: Basic Elements of an RLF

RLF Element	Sample Questions to Consider
Funding	- How much funding is needed or available to capitalize the RLF? - How many EE projects can be financed with that amount, and over what period? - Can the funding be leveraged (i.e., can RLF funds be used to bring more money to bear for clean energy projects)?
Lending	- What lending model will be used (e.g., direct, co-lending)? - What type of financial product will be offered (e.g., loan, lease, on-bill loan)? - Which borrowers will be eligible? - What loan sizes will be offered? - What are the underwriting requirements (e.g., cash flow coverage, loan-to-value ratio, credit rating, collateral requirements)? - What is the interest rate (e.g., variable or fixed; a standard rate or varying by project)? - What loan tenors are acceptable (e.g., the minimum and maximum lengths of eligible loans, in years)? - How many times can a borrower apply per year? - How many loan applications can be processed per year?
EE Improvements	- What building sectors will be eligible? - What EE projects will be eligible (e.g., lighting, air conditioning)? - With a limited amount of funds, what will be prioritized?
Repayments	- How fast will the loans turn around? - How will repayments be collected? - What will be the estimated rate of nonpayment? - What will be done in case of nonpayment and who will do it?

Sources: Huey, 2023; Leventis et al., 2022.

3.8 Step 8: Prepare RLF Forms

Based on the RLF structure and basic elements defined in Step 7, forms associated with the RLF should be prepared. Typical forms include loan applications, standardized audit templates, agreements, contracts, and M&V forms. Additionally, a matrix should be created to help determine which EE projects to fund, considering RLF goals and target markets (Booth et al., 2011; Limaye et al., 2014).

3.9 STEP 9: DEFINE TECHNICAL ASSISTANCE AND OTHER SERVICE OFFERINGS

Another important component of an RLF is free technical assistance, which is often critical to ensuring the overall success of the RLF (Limaye et al., 2014; U.S. DOE Office of State and Community Energy Programs, 2023; Zimring et al., 2013). Some examples of the types of free technical assistance that may be offered alongside an RLF include the following:

- Training and capacity building for building owners and ESCOs: This free technical assistance involves providing workshops, seminars, and training programs to enhance the knowledge and skills of building owners and ESCOs in energy efficiency practices, technologies, and financing options. Empowering stakeholders with the necessary expertise enables them to make informed decisions and effectively implement energy efficiency projects, leading to greater energy savings and financial benefits.
- Building energy consumption data collection and benchmarking: This technical assistance involves helping building owners collect and analyze energy consumption data to establish baseline energy usage and identify opportunities for improvement. By benchmarking energy performance against similar buildings or industry standards, stakeholders can prioritize energy efficiency measures and track progress over time, facilitating informed decision-making and continuous improvement in energy performance. Tools such as the Building Efficiency Targeting Tool for Energy Retrofits (BETTER|Tunisia)[4] can be utilized to streamline data collection, analysis, and benchmarking processes, enhancing accuracy and efficiency in energy management practices.
- Building energy audits (remote or in-person): Offering free energy audits by qualified professionals, whether conducted remotely or in-person, allows building owners to identify energy inefficiencies, prioritize energy-saving opportunities, and develop customized retrofit plans. These audits provide valuable insights into specific areas where energy efficiency improvements can be made, enabling stakeholders to optimize energy use, reduce utility costs, and enhance overall building performance.
- M&V of energy and cost savings: This technical assistance involves implementing Measurement and Verification (M&V) protocols to accurately assess and verify the energy and cost savings achieved through energy efficiency projects. By utilizing standardized methodologies and tools such as the BETTER tool, stakeholders can quantitatively measure the actual performance of implemented measures against predetermined targets, ensuring accountability and demonstrating the effectiveness of energy efficiency investments. This facilitates informed decision-making, encourages confidence among investors and funders, and enables continuous improvement in energy performance.
- Conducting procurement of EE technologies for a bundle of projects (i.e., centralized procurement) to obtain better pricing and reduce administrative and transaction costs.

[4] BETTER|Tunisia is a software toolkit that enables building operators to quickly and easily identify the most cost-saving energy efficiency measures in buildings and portfolios. Available at https://better.lbl.gov/country/tunisia/.

- Project feasibility studies: Following the example of Thailand's Energy Conservation Promotion Fund (ENCON Fund; see Section 4), providing technical assistance with conducting feasibility studies for energy efficiency and renewable energy projects. These studies enable potential beneficiaries to assess the viability and potential impact of proposed projects before seeking financing (Irawan and Heikens, 2012).
- Policy guidance and regulatory support: Emulating the approach of Thailand's Department of Alternative Energy Development and Efficiency (Section 4), providing technical assistance in offering guidance on energy efficiency policies and regulatory compliance. Workshops and seminars educating stakeholders on relevant laws, regulations, and incentives for energy efficiency projects play a pivotal role in fostering regulatory compliance and maximizing incentives (Irawan and Heikens, 2012).
- Technology assessment and recommendations: Following the model established by the ENCON Fund, offering technical assistance in assessing and recommending suitable energy-efficient technologies for specific applications. This assistance aids project developers in identifying the most cost-effective and environmentally friendly solutions for their initiatives (Irawan and Heikens, 2012).
- Capacity building for financial institutions: Emulating the CHUEE Program (Section 9), providing technical assistance in capacity building for financial institutions. This assistance involves training bank staff on assessing risks and cash flows associated with energy efficiency projects, enhancing their ability to evaluate and finance such initiatives (ICF China, 2014).
- Energy efficiency training and certification programs: Following the GJGNY Program's (Section 5) emphasis on workforce development, offering technical assistance in energy efficiency training and certification programs. This assistance involves providing training opportunities for contractors, technicians, and professionals in energy-efficient building practices and technologies, thereby expanding the skilled workforce capable of implementing projects (NYSERDA Residential Financing Team, 2023).
- Public awareness campaigns and outreach events: Taking cues from the GJGNY Program's efforts to engage residential building owners, offering technical assistance in public awareness campaigns and outreach events. This assistance involves organizing events, workshops, and promotional campaigns to raise awareness about the benefits of energy efficiency, the availability of financing options, and the process of accessing assistance programs, thereby encouraging more individuals to participate (NYSERDA Residential Financing Team, 2023).
- Customized financing solutions for underserved communities: Inspired by the Michigan Saves program (Section 6), offering technical assistance in developing customized financing solutions for underserved communities. This assistance involves conducting outreach, research, and stakeholder consultations to understand the unique needs and challenges faced by low-to-moderate income households and communities. By tailoring financing options to meet their specific requirements, such as alternative underwriting criteria or flexible repayment terms, these

solutions can increase access to energy efficiency financing for historically marginalized populations (Templeton, 2023).

- Performance monitoring and optimization services: Inspired by the Texas LoanSTAR program (Section 7), offering technical assistance in performance monitoring and optimization services. These services involve implementing monitoring systems, collecting data on energy usage and savings, and analyzing performance metrics to identify opportunities for optimization. By continuously monitoring project performance and providing recommendations for improvement, such technical assistance helps entities achieve and sustain energy savings over time (Trevino, 2023).

3.10 Step 10: Develop the Marketing and Outreach Strategy

The RLF should develop a marketing and outreach plan to engage stakeholders in its target markets and promote the uptake of EE loans. This may include establishing a website, conducting a social media campaign, developing brochures and guidebooks, speaking at events and conferences, or other strategies. The marketing and outreach strategy should include elements to engage private sector energy service providers (ESPs) in the implementation of EE projects. Participation by ESPs will build their capacity to undertake future EE projects and contribute to the development of an energy services industry (Leventis et al., 2022; Limaye et al., 2014).

3.11 Step 11: Develop a Project Pipeline

Developing a pipeline of energy efficiency projects to identify and secure potential projects that can help achieve energy savings and sustainability goals. Leveraging the marketing and outreach strategy from the previous step can establish links with potential implementers (e.g., ESCO networks, lender networks, utilities) and identify projects for interested parties.

3.12 Step 12: Develop a Monitoring and Evaluation Plan

The impact of the RLF needs continuous monitoring and evaluation. This involves four aspects: (1) M&V, monitoring, (2) Morinoting, (3) Evaluation and (4) Reporting. Each of these elements and associated best practices is described in more detail below.

Measurement & Verification

M&V occurs at the EE project level. It verifies that an EE project can save energy and energy costs (and quantifies potential savings) and/or quantifies an EE project's actual energy and cost impacts. Many M&V methodologies and protocols exist; one is the Efficiency Evaluation Organization (EVO) International Performance Measurement and Verification Protocol (IPMVP), which describes four M&V methods (IPMVP, 2023):

- Option A: Retrofit isolation, key parameters measurement
- Option B: Retrofit isolation, all parameters measurement

- Option C: Whole facility
- Option D: Calibrated simulation.

M&V best practices:

- Use a pragmatic M&V approach that balances M&V costs against the desired quality threshold for savings estimates
- All parties should agree to the adopted M&V protocol
- Where possible, use free, web-based tools to support EE project M&V, such as the BETTER|Tunisia tool, which supports IPMVP Option C.

Monitoring

Monitoring involves routinely gathering information on all aspects of RLF implementation to measure progress. Key elements involve establishing a set of key performance indicators (KPIs); determining the frequency of collection and reporting of KPIs (e.g., quarterly, semi-annually, annually); and determining to whom KPIs will be reported (typically sponsors, funders, or trustees). KPIs should be aligned with RLF goals.

Table 16 provides examples of KPIs for different RLF goals.

Monitoring best practices:

- Ensure the monitoring approach is suitable for the size and scope of the RLF
- Monitor both the technical and financial progress of the RLF
- Monitor all RLF components (e.g., planning, implementation, impacts, replicability, sustainability, outreach, etc.)
- Include periodic external audits of the RLF
- Routine progress reports should form the basis for monitoring, and feedback should be provided to RLF administrators to improve performance
- Automate data collection and reporting where possible (e.g., through the use of web-based building energy performance databases and analytical tools) (Limaye, Singh, and Hofer, 2014)
- Invest in information technology (IT) and staff capacity to manage complex financing deals and promote the fund's longevity.

Table 16: RLF Goals and Example KPIs

RLF Goal	Example KPI
Clean Energy	- Number of loan applications received (by funding size, borrower type, building type, etc.) - Number of EE projects assessed (by energy/cost/GHG savings range, EE technology type, building type, etc.) - Number of RLF loans approved (by funding size, borrower type, building type, etc.) - Number of EE projects approved (by energy/cost/GHG savings range, EE technology type, building type, etc.) - Total funds disbursed during the reporting period - Total principal, interest, and fees received during the reporting period
Economic	- Jobs created - Funds invested into the economy - Changes in energy burdens
Societal	- Number of participants from target groups (e.g., LMI households) - Technical assistance delivered (e.g., time spent and activities)
Program Sustainability	- Total operating expenses during the reporting period - Total funds leveraged during the reporting period - Average time elapsed for different stages of the loan origination and loan servicing processes - Number of loan applications rejected (by reason of rejection) - Number of projects with delays in the repayment of principal/interest/fees of more than 30-60 days (with reason for delay) - Number of non-performing loans (by size, type, and reason for default)

Source: Leventis et al., 2022; Limaye et al., 2014.

Evaluation

Evaluation involves assessing whether an RLF has met or is likely to meet its target outcomes. It serves as a critical component of good governance and is needed to assess planning assumptions, monitor results, compare RLF performance to targets, fine-tune implementation procedures, and incorporate lessons learned to improve the RLF operations. Evaluation best practices (Limaye et al., 2014):

- Should be conducted by a third party
- Should combine quantitative data with qualitative information

- Recommended to be performed at the midpoint and after completion to compare the RLF's progress or outcomes relative to targets.

3.12.1 Reporting

Reporting involves routinely providing information on RLF technical and financial KPIs to key organizations (e.g., funding sources, trustees) to ensure RLF target outcomes are achieved. Reporting best practices (Limaye et al., 2014):

- Financial progress: a periodic summary (usually monthly) of transactions, receipts, and disbursements by type, cash flows, outstanding balances, etc.
- Technical progress (e.g., number, size, and type of EE projects implemented; estimated energy and GHG impacts)
- Annual reports, including technical, financial, and administrative results.

4. THAILAND'S ENERGY EFFICIENCY REVOLVING FUND (EERF)

4.1 INTRODUCTION

Thailand launched its Energy Efficiency Revolving Fund (EERF) in 2003 as a key component of its Energy Conservation Program. The fund addresses financing barriers in Thailand's banking sector to promote energy efficiency investments while supporting national emissions reduction goals and is funded through the ENCON Fund.

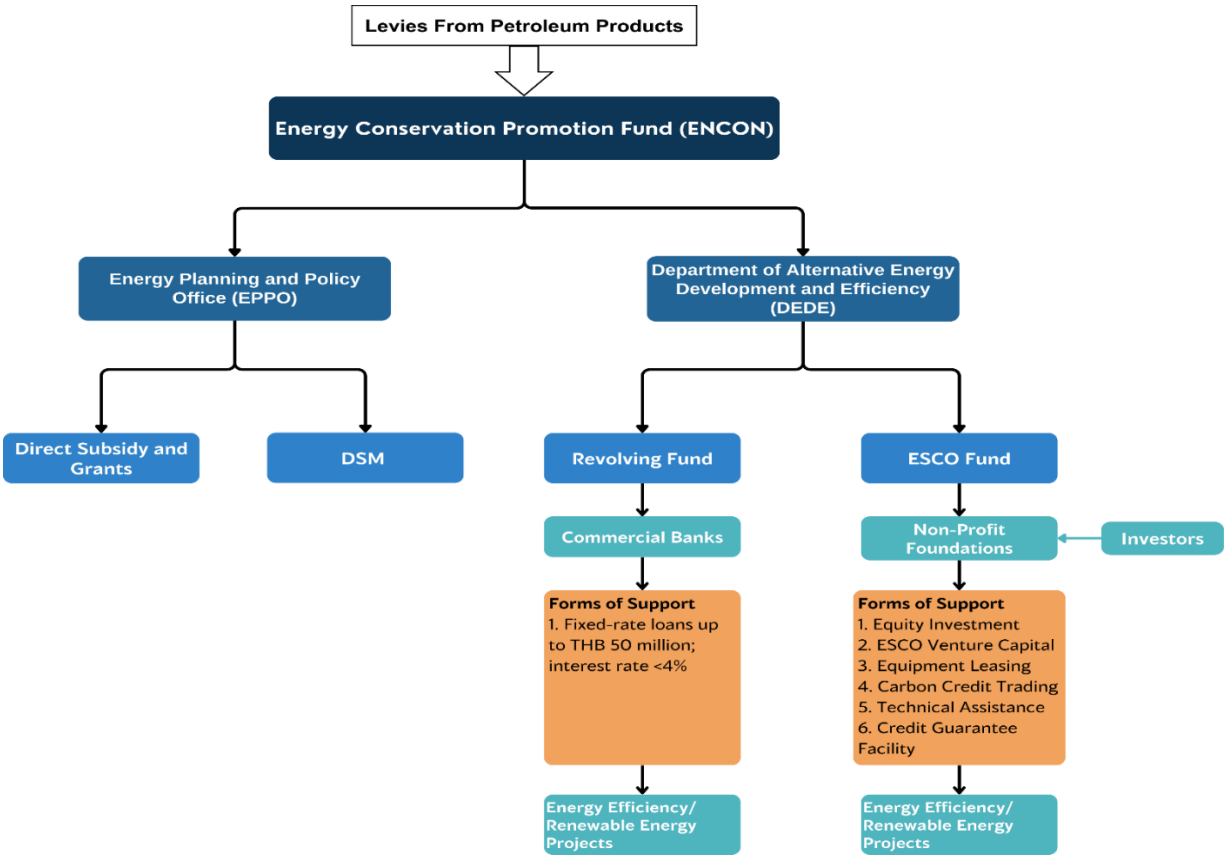
4.2 FUNDING SOURCE

The Thai government established the Energy Conservation Promotion (ENCON) Fund in 1992 as its primary financial mechanism to support energy efficiency and distributed renewable energy development. The ENCON Fund generates approximately $200 million annually through a $0.002 per liter levy on petroleum products, reaching a total value of $1.1 billion by 2017 (GIZ et al., 2019). These levies are applied to influence fossil fuel usage by increasing market prices and, at the same time, to provide sustainable financing for EE and DRE initiatives. Although the law allows for other funding sources (e.g., surcharges on electricity use, subsidies, private sector contributions, interest income), these sources have not significantly contributed to the fund.

The ENCON Fund operates under a well-defined management framework through two primary government agencies within Thailand's Ministry of Energy. The Energy Policy and Planning Office (EPPO) manages approximately two-thirds of the fund, while the Department of Alternative Energy Development and Efficiency (DEDE) oversees the remaining third. Sub-committees guide policy formulation, fund allocation, and petroleum tax contribution rates. This structure ensures coordinated oversight of the fund's operations and strategic direction. The ENCON Fund's implementation structure is illustrated in Figure 9. EPPO administers grants to different institutions such as government agencies, colleges, and

non-governmental organizations and oversee the DSM Bidding initiative. DEDE manages the Thailand Energy Efficiency Revolving Fund (EERF) and the ESCO venture capital.

Figure 9: ENCON Fund Implementation



Source: Based on Irawan and Heikens, 2012 and The Climate Bonds Initiative, 2021.

4.3 EERF Goals and Structure

The EERF functions as an Interest Rate Buydown (IRB) model and serves a dual purpose: stimulating substantial investments in energy efficiency within energy-intensive industries while also enhancing the capabilities of local banks in financing EE and RE projects. Initially capitalized at THB 2 billion ($64 million), the EERF received technical support from the Global Environment Facility (GEF) and the Danish government (GIZ et al., 2019).

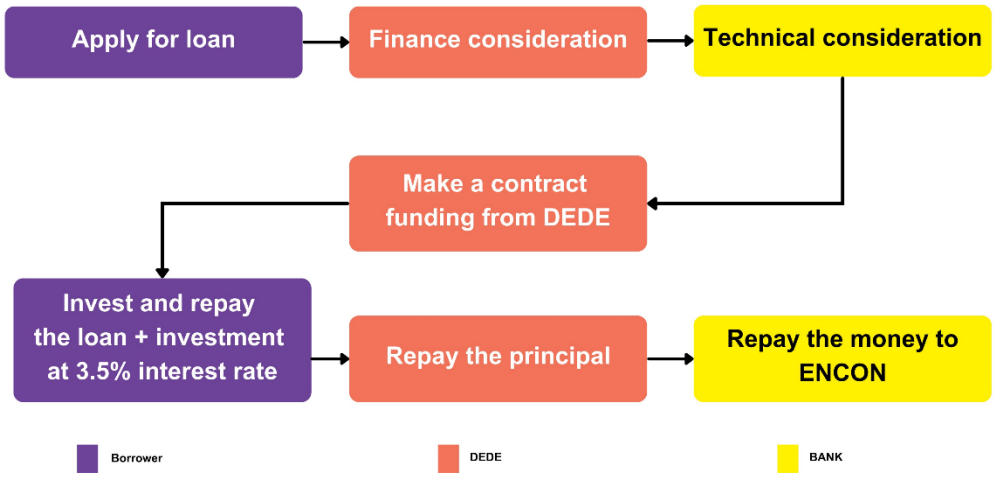
The EERF provides a cost-effective source of funding (at 0-0.5% interest rates) to banks that, in return, extend loans to companies at rates not exceeding 4%, thereby facilitating EE technology adoption among building and factory owners. This initiative involves nine commercial banks as implementing partners. Individual projects can receive a loan of up to THB 50 million ($1.6 million) at a maximum interest rate of

4%, with a repayment period of five years (GIZ et al., 2019). Actual interest rates may vary depending on project specifics and collateral.

The EERF serves as a catalyst for private sector involvement in EE and DRE projects, concurrently acquainting banks with the intricacies of financing these types of investments. The fund extends a line of credit to local banks, enabling them to offer concessional loans to project developers.

Figure 10 illustrates the loan eligibility process. DEDE initiates a standardized contract with the designated bank specifying the total loan amount, interest rates for both the bank and borrower, repayment terms, and other essential conditions. This process begins with the borrower applying for the loan, followed by a financial evaluation by the bank and a technical assessment by DEDE. Once approved, funding is provided by DEDE, enabling the borrower to invest and repay the loan with a 4% interest rate. Subsequently, the principal is repaid to the bank, and the funds are returned to ENCON by DEDE, completing the cycle.

Figure 10: EERF's Loan Eligibility Process



Source: GIZ et al., 2019.

EERF operates with a specialized team processing an average of 10 projects monthly. The staff includes six full-time technical evaluators and five part-time personnel for marketing and verification activities. Current program phases (6 and 6+) focus predominantly on energy efficiency initiatives, with limited allocation for renewable energy projects.

4.4 EERF'S MONITORING AND EVALUATION SYSTEM

DEDE employs a set of KPIs to monitor the performance of the Revolving Fund, with particular emphasis on its role in driving EE. To facilitate this supervision, participating banks are mandated to send DEDE monthly reports, which are subsequently compiled semi-annually and annually for in-depth analysis. These reports serve as the basis for DEDE's comprehensive assessment of EERF's accomplishments and overall effectiveness in promoting energy conservation and efficiency.

The monitoring and verification of performance-based programs is conducted by an external consultant hired by DEDE through a public contracting process. Eligible M&V consultants need to register at the Ministry of Finance and must demonstrate sufficient expertise and track records to be listed.

The assessment and tracking methods for gauging the effects of the ENCON Fund's programs exhibit some degree of diversity. Typically, the evaluation of governmental energy policies benefits from a solid foundation of essential energy data, which is routinely disclosed. DEDE is entrusted with the upkeep of pertinent historical energy data, covering the most recent 5-10 years.

4.5 CHALLENGES AND OPPORTUNITIES

- Project Scale

Among EERF's challenges and limitations are the size of projects. EE lending tended to favor larger companies, creating a disparity in accessibility for smaller businesses. Typically, only sizable companies and existing bank clients with substantial collateral capacity accessed loan funds. Generally, larger SMEs participated in EE bank lending, with annual revenues exceeding THB 75 million ($2.01 million). This left many SMEs unable to tap into these EE resources (Irawan and Heikens, 2012). However, efforts have been made to address this gap, notably through initiatives like the ESCO Fund, which is specifically designated to support SMEs and aims to alleviate the capital equity gap.

- Risk Perception Barriers

EE financing efforts are also limited by perceived risk. EE projects, often characterized by their smaller scale, entail higher transaction costs and perceived uncertainty in achieving projected energy savings. These savings, classified as "invisible income," may appear less tangible and riskier to CFOs and company managers. Consequently, investment decisions often favor improving production lines, procuring raw materials, and purchasing electricity over embracing small and distributed EE technologies.

Additional EERF challenges included issues such as incomplete proposal submissions, limited promotion of the EERF itself due to bundling with other bank services, and personnel changes within banks, necessitating ongoing communication, revision, and coordination with DEDE.

- Banking Market Development

Despite these challenges, numerous major Thai banks recognize the shift toward clean energy investments met since the development of the EERF. The landscape of sustainable banking for energy efficiency measures has witnessed significant developments driven by regulatory initiatives and the proactive role of financial institutions (mainly commercial banks). EERF has played a significant role in building banks' capacity to lend to enterprises for investment in EE. The longstanding collaboration between DEDE and Thai banks through the EERF has empowered banks to navigate the complexities of EE projects, driving significant investments in clean energy. In total, the EERF has catalyzed THB 24.3 billion ($654 million) of investment, including THB 10.1 billion ($272 million) from the EERF itself and co-financing from participating companies amounting to THB 14.2 billion ($382 million) (The Climate Bonds Initiative, 2021).

- Bank of Thailand (BoT)'s role

The Bank of Thailand (BoT) plays a pivotal leadership role. By encouraging banks to offer green financial products, enforcing sustainable implementation guidelines, and facilitating regular high-level meetings to inform stakeholders about clean energy financing opportunities, the Bank of Thailand further propel Thailand's journey toward energy efficiency and sustainability. The BoT encourages financial institutions to incorporate environmental, social, and governance (ESG) criteria into their operational models. The BoT has also joined the Network for Greening the Financial System[5] and embraced its core principles.

Moreover, the Thai Bankers' Association, led by the BoT, introduced the Sustainable Banking Guidelines for Responsible Lending in 2019. These guidelines mandate Thai banks to establish internal policies and processes to address key ESG risks in their lending practices. Private banks have been at the forefront of green finance, issuing green and sustainability bonds to fund eco-friendly assets. Notable examples include several Thai banks such as TMB Bank and Kasikorn Bank, which issued bonds worth $160 million. Several banks are also facilitating green loans and supporting green projects such as renewable energy and energy efficiency initiatives.

4.6 RESULTS

In the initial phases, spanning from 2003 to 2013[6], the EERF's THB 7.2 billion ($216 million) allocation leveraged additional funding of THB 8.7 billion ($262 million) from participating financial institutions at commercial rates. This combined funding supported 295 projects, with a 60-40 split between energy efficiency and distributed renewable energy initiatives. The blended financing structure enabled projects to access needed capital at less than 4%, promoting access to sustainable energy technologies. By the end of the period, eleven banks were participating in the program. The EERF program achieved substantial results through targeted investments in energy-efficient machinery, air-conditioning systems, manufacturing processes, and boiler upgrades. These improvements generated annual savings of 1.2 GWh in electricity, 234 million liters in fuel, and $204 million in costs reduction (GIZ et al., 2019).

Transitioning to the period of 2015 to 2019[7], 160 projects were financed with a budget of $126.3 million, resulting in about 60 GWh/year of electricity savings and $7.6 million in cost savings per year (GIZ et al., 2019).

Table 17 provides an overview of the fund's phases and achievements.

[5] https://www.ngfs.net/en

[6] Phase 1: 2003-2006, Phase 2: 2006-2009, Phase 3: 2007-2010, Phase 4: 2009-2012, and Phase 5: 2010-2013

[7] Phase 6: 2015-2017, Phase 6+: 2016-2019

Table 17: EERF Phases and Achievements

Aspect	Phases 1-5 (2003-2013)	Phases 6-6+ (2015-2019)
Total Investment	$505.6 million	$126.3 million
Loans from EERF	$229 million	
Loans from Banks	$276 million	
Projects Supported	295 projects	160 projects
Funding Allocation	60% EE 40% DRE	Emphasis on EE, minor funding for DRE
Maximum EERF Loan Size	$1.6 million	$1.5 million
Participating Banks	11	8
Interest Granted to Banks	0.5%	0.0%
Interest Granted by Banks	Less than 4%	Fixed 3.5%
Key Measures	Investments in energy-efficient machinery, air-conditioning replacements, manufacturing improvements, and boiler changes	Aligned with energy efficiency projects
Achievements	Electricity savings: 1.2 GWh/ year Fuel savings: 234 million liters/ year Total Cost savings: $204 million	Electricity savings: 60 GWh/ year Total Cost savings: $7.6 million /year

Source: ASEAN Center for Energy et al., 2019.

4.7 CONCLUSION

Here are some key lessons learned from the ENCON Fund experience:

- **Innovative Funding Source**: The ENCON Fund stands out in the Asia-Pacific region for directly collecting taxes on petroleum products and channeling these revenues into private investments for DRE and EE. This approach contrasts with many countries where environmental taxes are treated as general revenue and potentially diverted away from environmental initiatives.

- **Programmatic Instruments**: While the EERF is hailed as an exemplary financial tool for energy conservation and renewable energy, it constitutes just a portion of the larger ENCON Fund. To manage numerous grant projects, there's been a suggestion to engage fund managers, allowing DEDE and EPPO to focus on program oversight rather than on administrative tasks.
- **Tailored Programs for Diverse Beneficiaries**: Energy efficiency and renewable energy programs require targeted instruments for different beneficiary groups. Success depends on understanding stakeholders' distinct capacities and behaviors to develop customized solutions.
- **Regular Strategy Evaluation and Adaptation**: Ongoing assessments of program effectiveness are essential, enabling adjustments that align with evolving socio-economic and political contexts. For instance, the introduction of the ESCO Fund in 2008, which specifically targeted SMEs, illustrates the need for periodic program reviews.
- **Clear Policy Objectives and Targets**: The ENCON Fund's defined objectives and quantitative targets provide it with valuable strategic guidance. Specific policy goals facilitate performance monitoring and evaluation, linking resource allocation with policy achievements and performance indicators.

5. THE GREEN JOBS-GREEN NEW YORK (GJGNY) RESIDENTIAL FINANCING PROGRAM

The Green Jobs-Green New York (GJGNY) Residential Financing Program was established in 2009, leading to the issuance of the first loan in December 2010. The program aims to provide New Yorkers with comprehensive access to various services, including low-interest financing and opportunities for training in green-collar careers. The program places a significant emphasis on workforce development, recognizing the opportunities to create "green jobs". It actively collaborates with community-based organizations (CBOs) to engage residential, small business, not-for-profit, and multi-family building owners in energy assessment and financing programs. In essence, the program's overarching goal is to create a sustainable, energy-efficient future for New York, not only through the promotion of clean technologies but also by nurturing a trained workforce equipped for the challenges and opportunities of the green economy.

5.1 FUNDING SOURCES

GJGNY is facilitated by a fund totaling $298 million (NASEO Member Data and Coalition for Green Capital Data, 2023a). The program collects funding from a wide range of sources, including the Regional Greenhouse Gas Initiative (RGGI), Energy Efficiency Conservation Block Grant resources from the U.S. DOE Better Buildings Program, and secondary-market refinancing through revenue bonds and credit facilities.

5.2 PROGRAM ADMINISTRATION

The GJGNY Program supports residential, small business/non-profit, and multifamily customers through seven utility companies across the state. It is overseen by the New York State Energy Research and

Development Authority (NYSERDA), which introduced on-bill recovery (OBR) to recoup loans via energy bills.

NYSERDA staff oversee daily program operations encompassing on-bill recovery, declarations, satisfaction processes, and more. They also handle liquidity analysis, budgeting, and bond securitizations. Reporting is a significant aspect, involving monthly, quarterly, semiannual, and annual reports for various stakeholders.

The GJGNY Program operates with several key partners. Slipstream Energy Finance Solution (EFS), a nonprofit, serves as the loan originator, facilitating online applications and rapid pre-approvals based on credit scores. Concord Loan Servicing, a private company, handles loan servicing, including payments, reports and debt recovery in cases of delinquency through its Blackwell Recovery debt collection agency.

5.3 Financial Structure and Funding Disbursement

The program's financial structure underwent simplification in 2018, shifting to interest rates based solely on household income. Households with incomes of up to 120 percent of area median income (AMI) are eligible for reduced interest rates, set at 3.49% or 3.99%. An interactive geographic eligibility tool[8] helps customers and contractors determine qualification for lower interest rates, simplifying the application process (NYSERDA Residential Financing Team, 2023).

All loans under this program require an energy audit or assessment, conducted by approved contractors meeting specified qualifications under the solar or energy efficiency programs. Moreover, the program requires the inclusion of cost-effectiveness criteria, which is integrated into both the program framework and the tools designated for contractor use during assessments. This ensures a comprehensive evaluation process that aligns with the program's overarching goals and objectives. Furthermore, only contractors who have received approval and actively participate in NYSERDA programs or sanctioned utility programs are eligible to access these loans. Individuals are not permitted to undertake work independently or engage with non-participating contractors.

5.4 Loan Types

The GJGNY Residential Financing Program offers various loan products:

- Smart Energy Loan: This loan is tailored to residential borrowers with a vested interest in enhancing the energy efficiency of their properties. It offers monthly billing or automatic bank withdrawals for streamlined payment processes. To qualify, borrowers must either own, rent, or manage the residential building in question. Note that in the event of a property sale or transfer, the original borrower retains responsibility for the remaining loan balance, as the loan is not assignable or transferable. The loan structure is designed to ensure cost-effectiveness, with pre-qualified eligible measures accounting for at least 85% of the total loan amount or estimated lifetime energy cost

[8] https://www.nyserda.ny.gov/ny/lmi-contractor

savings constituting at least 80% of the loan's total principal and interest. For loans exceeding $13,000, a 15-year simple payback calculation must be met.

- On-Bill Recovery (OBR) Loan: This loan is primarily designed for residential borrowers seeking to improve the energy efficiency of their homes. Repayments for this loan are made through a charge on the borrower's electric/gas utility bill. The borrower must own the home and be named on the utility account. If the property changes hands, the loan can be transferred to the new owner, provided the original borrower informs potential buyers. The loan structure is geared towards ensuring cost-effectiveness, with monthly payments not exceeding 1/12th of the estimated average annual energy cost savings over the term of the loan. For loans surpassing $13,000, a 15-year simple payback calculation must be met. Recipients must adhere to payment schedules, as non-payment can lead to termination of utility service.
- Renewable Energy Tax Credit Bridge Loan: This loan caters to a diverse audience, including residential property owners, renters, and property managers. It's a short-term loan to finance costs eligible for federal, state tax credits, or NYC Real Property Tax Abatement. The loan structure entails a two-year term with a lump sum final payment (covering both principal and interest) due at maturity. For added flexibility, this loan can be paired with other offerings such as the GJGNY Term Loan (Smart Energy or OBR) and Companion Loan.
- Companion Loan: This loan is tailored for a wide range of recipients, including residential property owners, renters, and property managers. Similar to the Smart Energy Loan, this financing option requires the borrower to have a stake in the residential building, whether as an owner, renter, or manager. Monthly billing or automatic bank withdrawals allow convenient payment. To qualify, the borrower must enter into a loan agreement with NYSERDA's approved loan originator, EFS. In case of a property sale or transfer, the original borrower is responsible for the remaining loan balance, as it is non-assignable or transferable. Borrowers are encouraged to fully utilize the GJGNY Loan and to close both loans simultaneously, although the Companion Loan and GJGNY Loan are not mandated to have the same loan term. This flexibility allows borrowers to tailor the loan structure to their specific needs and circumstances.

5.5 Program Performances and Results

As of January 31, 2023, the GJGNY Program has issued over 37,000 loans totaling over $458 million of principal. The outstanding balance stands at $244 million (NYSERDA Residential Financing Team, 2023). The program maintains a low delinquency rate, with 7.4 percent being 1 to 120 days past due. Charge offs, for instances like bankruptcy or financial hardship, account for 3.06 percent of the original principal.

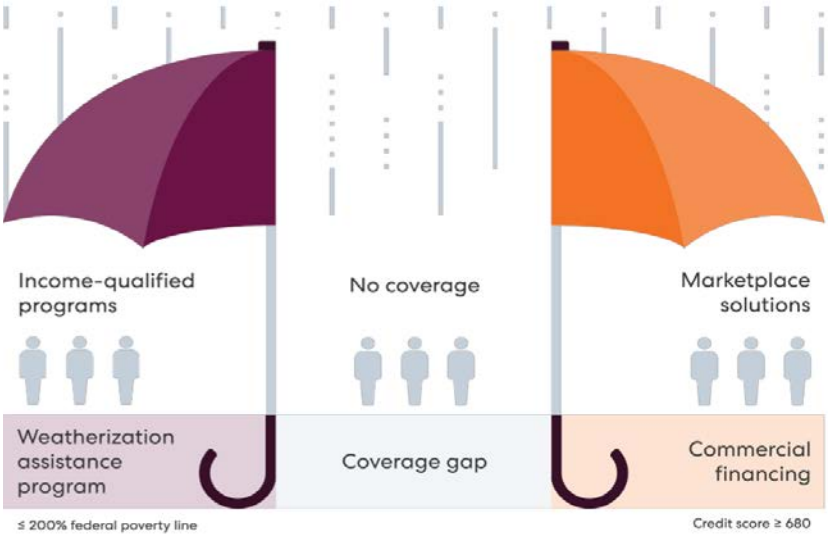
The program has generated substantial energy benefits, including over 6,317 MWh of solar generation, 4,700 MWh of electricity savings, and 344,000 MMBtu of fuel savings (NYSERDA Residential Financing Team, 2023). This program has played a crucial role in advancing energy efficiency and sustainability in New York, making it more accessible to homeowners and property managers.

Moreover, an evaluation concluded in 2016 estimated that GJGNY-related work resulted in the creation of 2,627 direct jobs in 2014 and 2015, 73% of which were new jobs and 27% were retained jobs and nearly one-third were in a disadvantaged community (NYSERDA, 2019)

6. MICHIGAN SAVES

Michigan Saves has been instrumental in transforming Michigan's energy landscape, with a focus on the residential sector. Recognized as the nation's first nonprofit "green bank," Michigan Saves is dedicated to accessible, equitable, and just investments in energy efficiency and clean energy improvements. Established in 2009 by the State of Michigan, its mission is to bridge the financing gaps in the market (Figure 11). Michigan Saves was spurred by the enactment of energy legislation in 2008 that recognized the need for accessible and affordable ways for individuals and businesses to invest in energy improvements.

Figure 11: How Michigan Saves Addresses Financing Gaps



Source: Mary Templeton, 2023

6.1 FUNDING SOURCES

Michigan Saves draws its financial support from various sources. Initially, it received funding from the Michigan Public Service Commission. Subsequently, it secured additional backing from the State Energy Office through the American Recovery and Reinvestment Act (ARRA) of 2009 (which made $3.1 billion available to fund U.S. state energy programs) (U. S. DOE National Energy Technology Laboratory, 2009). The fund also benefits from appropriations from the State of Michigan, ensuring a diverse range of financial resources to drive its initiatives.

6.2 FINANCING STRUCTURE

To serve Michigan's four million residents and business community, Michigan Saves leveraged its initial $6 million grant through an innovative loan loss reserve (LLR) mechanism, enabling efficient credit capital deployment and favorable lending rates. The program's exceptional performance, demonstrated by a default rate below 2%, allows continuous fund recycling. This efficiency has generated significant private

sector participation, achieving an impressive leverage ratio where each public dollar invested attracts $30 in private capital investment (Templeton, 2023). The lenders contribute to the LLR by setting aside a portion of each loan issued, but the reserve itself is maintained and managed by the program administrator or sponsor, ensuring proper allocation and oversight in the case of defaults.

Each lender maintains a loss reserve pool equal to 4% of its outstanding loan balance. For instance, if a lender issues a $10,000 loan, $400 is set aside in the loss pool. In the event of default (i.e., no payment for 90 days, depending on how default is defined), the lender receives 75% of the outstanding loan balance, up to the amount in the reserve pool (Templeton, 2023).

6.3 Empowering Communities

Michigan Saves has been a driving force in creating accessible financing, particularly in low-to-moderate income communities. Nearly 60% of residential loans have been extended to homeowners in these areas. However, there are still gaps; approximately 12% of households, about 500,000, are unable to qualify for existing financing programs (Mary Templeton, 2023).

To bridge this gap, Michigan Saves introduced the Detroit Loan Program, designed specifically for individuals denied loans in the City of Detroit. This alternative underwriting program assesses a person's ability to pay based on disposable income, rather than credit scores. So far, it has been highly successful, demonstrating approval rates of around 60%.

6.4 Results

Michigan Saves has demonstrated impressive growth and impact since its establishment in 2009. From September 2010 to December 2022, Michigan Saves financed a total of $450 million in energy improvements. In 2022, investments surged, with $105 million invested across various initiatives and 3.1 million metric tons of carbon emissions reduced. Moreover, Michigan Saves has supported the creation of 9,175 full-time jobs, underscoring the program's substantial economic and environmental benefits (Templeton, 2023).

7. Texas LoanSTAR

The Texas Revolving Loan Fund, known as Texas LoanSTAR, has been pivotal in driving energy efficiency across the state. Originated in 1988 as a DOE statewide energy efficiency demonstration program, it evolved to its current form by 1995. The target audience comprises taxpayer-supported institutions, including K-12 schools, local and county governments, hospital districts, higher education, and state agencies.

One of the distinctive features of Texas LoanSTAR is its financial structure. It allows entities to maintain their existing utility budgets while utilizing the savings from retrofits for capital improvements. This unique model results in the redirection of funds from utility cost savings to essential infrastructure improvements, all while adhering to the original budget.

7.1 FUNDING SOURCES

LoanSTAR was launched with an initial $95 million in funding from Petroleum Violation Escrow funds, which were derived from fines levied on oil companies for violating federal oil price caps (LBNL, 2024). It was then supplemented by financial backing from a combination of state appropriations and funds allocated through American Recovery and Reinvestment Act (ARRA) funds. With a fund amounting to $230 million (NASEO, 2023a), the program is tailored to promoting energy efficiency in the public and institutional sectors.

the Texas State Energy Conservation Office (SECO) plays a pivotal role in managing the fund and implementing diverse funding strategies to ensure program resilience. This responsibility extends to supporting a wide array of sustainable initiatives across Texas aimed at maximizing energy efficiency and minimizing environmental impact. Additionally, SECO administers and delivers a range of energy efficiency and renewable energy programs targeting various sectors including institutional, industrial, transportation, and residential. These initiatives are designed to reduce energy costs and consumption, contributing to the state's overall energy goals.

7.2 FINANCING STRUCTURE

The financial elements of Texas LoanSTAR are managed internally, residing in the state treasury. To be eligible for consideration, energy-saving or demand-reduction measures must demonstrate they can pay for themselves within their estimated useful lives.

In 2001, SECO received DOE's approval for LoanSTAR to begin financing energy service performance contracts (ESPCs). ESPCs are arrangements whereby an institution partners with an ESCO to devise and execute an energy-saving plan, along with the installation of energy-efficient upgrades. The ESCO takes responsibility for these processes, ensuring that projected energy savings are realized and used to recover the costs of upgrades over time. The ESCO also guarantees anticipated energy savings and provides regular reports validating actual savings.

As a revolving loan fund, the intent is that the base fund continues growing through interest payment receipts and lasts indefinitely. Low-interest-rate loans provided through the fund assist public institutions in financing energy cost-reduction efforts for their facilities. The borrower repays loans through the stream of cost savings realized from energy-efficiency retrofit projects. Partnering ESCOs are generally active in maintaining open lines of communication with SECO and monitoring funding opportunities as they become available.

The Texas LoanSTAR Program is characterized by its approval of three distinct borrower-vendor contracting mechanisms. These encompass traditional design/bid/build and ESPCs. The traditional design/bid/build approach (often referred to as the "do-it-yourself" route) involves the institution itself overseeing or procuring various aspects of an energy-saving project. This encompasses project evaluation, engineering, construction, and post-installation verification. This method is especially suitable for organizations with in-house technical expertise, as they can conduct tasks like investment-grade audits, commissioning, or measurement and verification (M&V) independently. It follows a more conventional procurement approach and can be cost-effective for institutions with the requisite technical capabilities.

7.3 Funding Process

The LoanSTAR application involves a utility assessment report, which takes approximately 140 days to complete. After approval, the subsequent stages include third-party review, loan agreement preparation, and contract execution, culminating in a kick-off meeting. The construction process involves meticulous planning, including stages of design, third-party reviews at 50% and 100% completion, and site visits. Repayment schedules are established in a systematic manner, ensuring smooth project execution.

Loan administration remains transparent, operating on a first-come, first-served basis. Certain criteria must be met, including property ownership, permanently affixed measures, and adherence to LoanSTAR Technical Guidelines. Oversight remains active throughout the life of the loan, with periodic checks on project performance.

Additionally, the program offers technical assistance through services such as ASHRAE Level 1.5 Audits, facility benchmarking, energy and water management, and feasibility studies for renewables and energy storage.

Through its innovative financial model and strategic approach, the Texas LoanSTAR Program has driven energy efficiency and environmental stewardship across the state, attesting to the power of well-designed programs in creating lasting impact.

7.4 Impacts and Results

LoanSTAR has succeeded in meeting its objectives. Program borrowers benefit from the energy savings and capital improvements made to their facilities, using the resulting energy cost savings to pay for the principal and interest of installed energy conservation measures. ESCOs benefit because they can promote low-interest loans to prospective public clients.

As of September 1, 2023, LoanSTAR has funded more than 337 loans totaling over $600 million. As a result of this financing, the LoanSTAR Program has achieved total cumulative program energy savings exceeding $810 million, a direct savings to Texas taxpayers (NASEO, 2023a). Since its implementation, the program has led to substantial environmental gains as well. Notably, it has saved an estimated 21.6 billion kWh of energy and 24.6 million MMBTUs of natural gas. Additionally, significant emissions reductions have been achieved including 19 tons of nitrogen oxide, 7.1 tons of carbon dioxide, and 14.4 tons of sulfur dioxide (Trevino, 2023).

A key achievement is LoanSTAR's zero-default record over its 30-year history, validating the low-risk nature of public sector lending and demonstrating the reliability of government institutions in meeting their financial obligations. (LBNL, 2024)

8. NEBRASKA DOLLAR AND ENERGY SAVING LOANS (DESL) PROGRAM

8.1 PROGRAM OVERVIEW

The Nebraska Dollar and Energy Saving Loans (DESL) Program was launched in 1990 as a co-lending model designed to address energy conservation needs across the state while leveraging the unique advantages of an RLF. The program, administered by the Nebraska Department of Environment and Energy (NDEE), operates in partnership with over 290 financial institutions, utilizing a blend of public and private capital to extend low-interest loans for building EE improvements in the residential, commercial, agricultural, non-profit, and local government sectors. The program encourages energy savings while simultaneously reducing the state's reliance on fossil fuels, thereby generating significant economic and environmental benefits for Nebraska (U.S. DOE Office of State and Community Energy Programs, 2023b). Moreover, by offering affordable loans, the DESL Program provides financial relief to borrowers, lowering their energy costs and reducing CO_2 emissions across the state.

8.2 PROGRAM FUNDING

The DESL Program was initially capitalized in 1990 with $10 million in Petroleum Violation Escrow (PVE) funds, which were derived from fines levied on oil companies for violating federal oil price caps. The NDEE strategically redirected these funds into energy conservation loans, effectively converting revenues from past environmental damage into investments for a cleaner future. In the following years, the program's capital base was expanded with an additional $23 million in PVE funds, supplemented by $12 million in ARRA State Energy Program stimulus funds. These initial investments created a total capitalization of $45 million through June 30, 2022 (U.S. DOE Office of State and Community Energy Programs, 2024b).

8.3 PROGRAM ADMINISTRATION

Design and implementation of the program was led by a NDEE staff members with banking experience. The Nebraska Bankers Association provided input into program design and coordinated initial outreach with lenders, which now accounts for 290 financial institutions across the state, including Nebraska-chartered banks, savings institutions, and credit unions (U.S. DOE Office of State and Community Energy Programs, 2023b). The program is administered internally by NDEE staff (approximately 3.5 full time-equivalent employees). The lending partners originate and service program loans. The NDEE is responsible for overseeing the program, reviewing loan applications, and ensuring that proposed projects meet the standards set by the program (U.S. DOE Office of State and Community Energy Programs, 2024b).

To support the lending institutions and facilitate a smooth loan application process, NDEE has streamlined the loan application forms, digitized the process, and incorporated familiar language that lenders and borrowers are accustomed to. This approach, alongside responsive communication, helps build trust between NDEE and the lending institutions, making them more willing to participate in the program. Additionally, the program has developed new loan products tailored to meet the needs of both lenders and borrowers.

The flexibility of the DESL program has been a key factor in its success. NDEE adjusts the program as needed to respond to market fluctuations and changing demand. For instance, following destructive flooding in Nebraska in 2019, the program temporarily lowered interest rates to 1% for flood-related loans to assist affected communities (Nebraska Department of Environment and Energy, 2023)

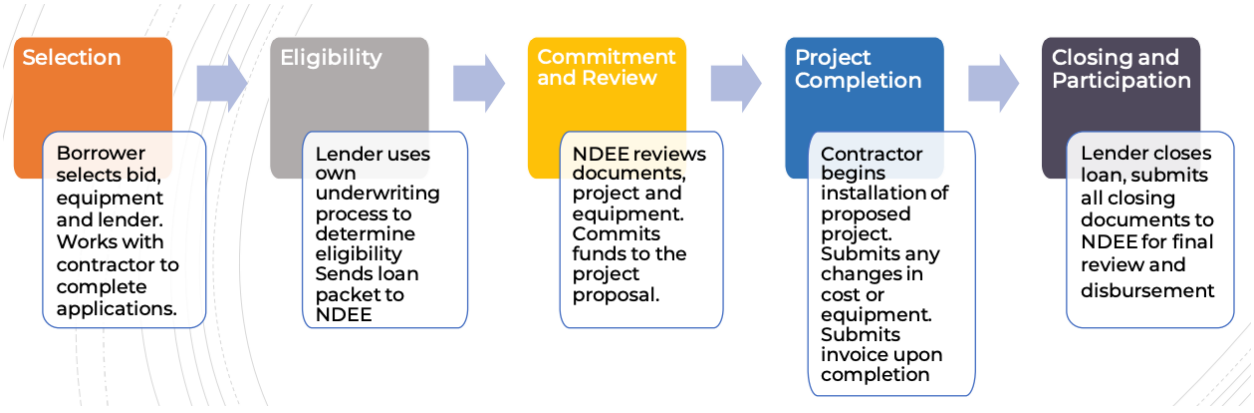
8.4 Funding Structure and Disbursement

Under the DESL program structure, participating financial institutions originate loans based on their own underwriting standards. Borrowers initiate the process by applying for loans through these local lenders, which include Nebraska-charted banks, savings institutions, and credit unions. Once the lender gives preliminary approval, the loan application is forwarded to NDEE, which reviews the project to ensure it meets the program's energy conservation criteria and reserves funds for the loan. Upon NDEE approval, NDEE provides 50% to 90% of the loan value at 0% interest (U.S. DOE Office of State and Community Energy Programs, 2024a). The exact proportion of NDEE's participation depends on the loan's interest rate. For example:

- NDEE funds 50% of loans where the interest rate exceeds 3.5%.
- NDEE funds 65% of loans with interest rates between 0% and 3.5%.
- NDEE funds 85% of loans for Nebraska Public Power District (NPPD) customers using qualifying heat pumps.
- NDEE funds up to 90% for loans at 1% interest rate for public schools.

After NDEE's commitment of funds, the lender notifies the borrower of loan approval and energy conservation project work begins. Within five months after NDEE's commitment of funds, all energy conservation project work must be completed. After project completion, the borrower notifies the lender, which closes on the loan and disburses the loan proceeds to the borrower. The lender also enters into a participation agreement for the loan with NDEE, and NDEE remits its participation share in the loan to the lender. The lender reports monthly to NDEE on its loan balances and remits to NDEE its share of loan payments received. Figure 12 provides an overview of this process.

Figure 12: DESL Process Overview



Source: U.S. DOE Office of State and Community Energy Programs, 2023b.

The maximum loan amounts are $125,000 for loans for projects for 1–2 family residential homes and $500,000 for loans for commercial building projects. The maximum loan repayment term is 15 years for most home/building improvements and five years for projects that only finance new appliances (U.S. DOE Office of State and Community Energy Programs, 2024b).

NDEE's 0% interest participation reduces the overall interest rate for the borrower, while the lender continues to receive interest on the entire loan amount. This unique structure incentivizes lenders to participate, as it allows them to offer competitive rates and attractive loan products without compromising their profitability. The revolving nature of the loan fund ensures that repayments flow back into the program, allowing for continual reinvestment into new projects, thus maintaining the program's financial sustainability over time.

Loan repayments are typically made on a monthly or quarterly basis, depending on the loan agreement. This partnership between NDEE and the local financial institutions creates a streamlined process for both lenders and borrowers, minimizing administrative burdens on NDEE while encouraging participation from a wide range of lending partners across the state.

By leveraging a co-lending model and revolving fund mechanism, the DESL program effectively mobilizes private capital to address EE needs while ensuring that public funds continue to have a lasting impact. With this financial model, the DESL program not only supports the state's EE goals but also provides an ongoing source of affordable capital for Nebraskans seeking to reduce energy costs and invest in cleaner, more efficient energy solutions (U.S. DOE Office of State and Community Energy Programs, 2024a).

8.5 Loan Types

The DESL program offers a range of low-interest loan options designed to support various upgrades across multiple sectors. These loans are available to residential, agricultural, nonprofit, local government, and commercial entities, providing flexibility to meet diverse needs.

1. **Residential Improvements**: Homeowners can access loans for a broad array of energy-saving enhancements. These include:
    - **Lighting Replacements**: Upgrading to EE lighting solutions to reduce energy consumption and costs.
    - **HVAC Upgrades**: Improving heating, ventilation, and air conditioning systems for better performance and EE.
    - **Insulation**: Enhancing home insulation to improve thermal performance and reduce heating and cooling expenses.
    - **Window and Door Replacements**: Installing energy-efficient windows and doors to minimize heat loss and gain.
    - **Solar Installations**: Financing solar power systems to generate renewable energy and reduce reliance on non-renewable sources.
    - **New EE Constructions**: Supporting new residential construction projects that meet high EE standards.
2. **Appliance Replacements**: Loans are also available for the replacement of outdated or inefficient appliances with modern, EE models. This includes appliances such as refrigerators, water heaters,

and more. These loans typically have shorter terms of up to five years to align with the expected lifespan of the appliances.

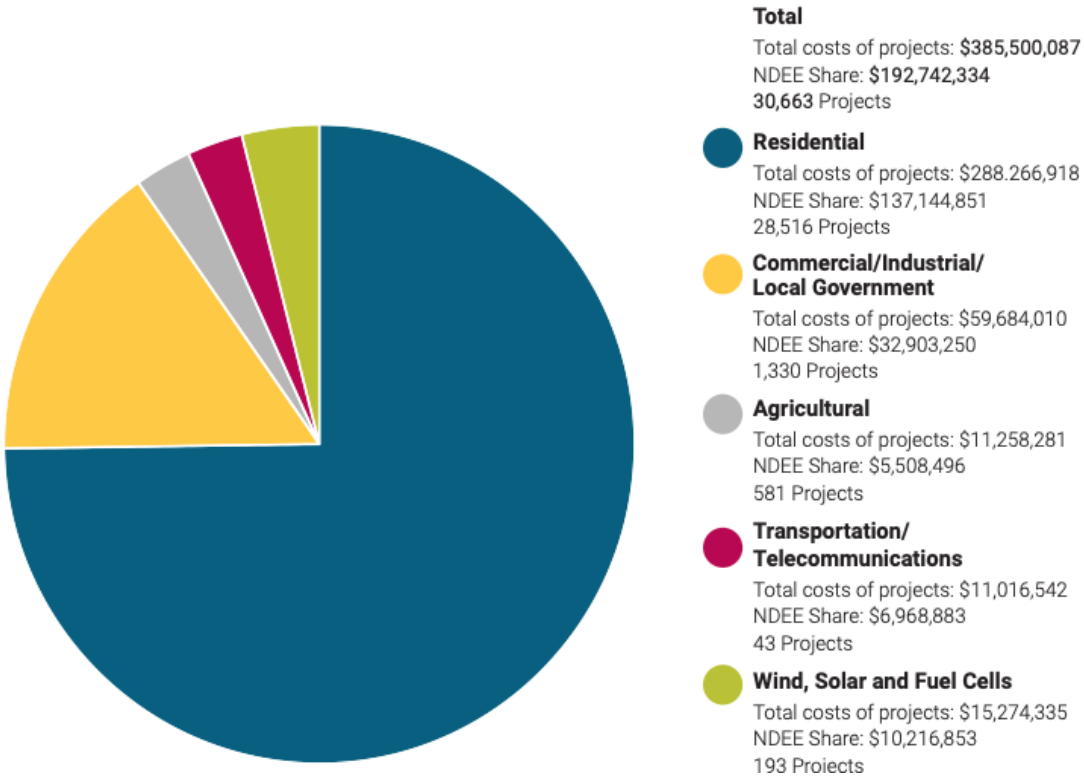
3. **Agricultural Sector**: Farmers and agricultural businesses can secure loans for EE projects such as upgrading irrigation systems, enhancing energy use in barns and storage facilities, and implementing renewable energy solutions.
4. **Nonprofit Organizations**: Nonprofits can access loans to improve their facilities' energy performance, including upgrades to lighting, HVAC systems, and other energy-efficient technologies, thus enabling them to allocate more resources to their core missions.
5. **Local Governments**: Municipalities can utilize loans for public building upgrades, EE street lighting, and other community-focused projects that aim to reduce energy consumption and environmental impact.
6. **Commercial Sector**: Businesses can benefit from loans to invest in energy-saving measures such as lighting retrofits, HVAC system improvements, and RE installations, contributing to lower operational costs and enhanced sustainability.

Each loan type under the DESL program is designed to facilitate upgrades tailored to specific sector needs while ensuring manageable financial terms. By offering loans with favorable conditions, the DESL program supports a wide range of energy-saving initiatives, fostering both economic and environmental benefits across Nebraska (U.S. DOE Office of State and Community Energy Programs, 2023b).

8.6 Program Performance and Results

Since its inception in 1990, the Nebraska Dollar and Energy Saving Loans Program has made a substantial and lasting impact on energy conservation across the state. Through its innovative co-lending model, the program has financed over 30,000 energy-saving projects, directing more than $385.5 million into EE improvements. This investment includes $192.7 million contributed by the NDEE and $139.4 million from participating lenders (U.S. DOE Office of State and Community Energy Programs, 2023b). Figure 13 shows the approximate breakdown of projects financed by sector and type through June 30, 2022 (Nebraska Department of Environment and Energy, 2022).

Figure 13: Total DESL Projects Invested by Sector/Type (Through June 30, 2022)



Source: Nebraska Department of Environment and Energy, 2022.

The long-term performance of the DESL program highlights its substantial contribution to both environmental and economic development. Over the life of the program, the following key impacts have been observed:

- **Total Energy Savings:** The program has delivered cumulative energy savings of 14.1 million kWh of electricity and 5.2 million therms of natural gas.
- **Economic Benefits:** The DESL program has generated an estimated $104.8 million in total energy savings for participants. Additionally, it has created a total economic output impact of $365.9 million, providing significant benefits to Nebraska's economy.
- **Environmental Impact:** The program has resulted in the reduction of approximately 1.4 billion pounds of CO_2 emissions, making a meaningful contribution to Nebraska's efforts to combat climate change and promote cleaner air.

The DESL program's RLF model has been essential to its success, enabling the continuous reinvestment of loan repayments into new projects. This self-sustaining financial structure ensures that the program will continue to provide long-term benefits to Nebraska's residents, businesses, and the environment (U.S. DOE Office of State and Community Energy Programs, 2023b).

8.7 Lessons learned and Conclusion

The DESL Program has provided valuable insights into effective program design and administration. Its success is largely attributed to several key practices, including building strong relationships with local lenders and contractors, creating a streamlined loan process, and simplifying funding mechanisms to ensure efficiency. Key lessons learned from the program include (U.S. DOE Office of State and Community Energy Programs, 2024b):

- **Engage local lenders and contractors in program design** and maintain good relations and communications with lenders and contractors.
- **Design an efficient loan process** that provides quick loan application approvals.
- **Provide only one source of funding per loan** to make program administration and financial reporting easier.

These lessons have laid a solid foundation for the program's continued impact and growth. As a result, the success of the DESL Program is a testament to its well-designed financial structure and strong partnerships with local lenders. By providing low-interest loans for energy-saving improvements, the program has helped Nebraskans reduce their energy costs, improve their homes and businesses, and contribute to a cleaner and more sustainable energy future. The positive impact of the DESL Program continues to grow, driving EE, reducing carbon emissions, and supporting economic development throughout the state.

9. China Utility-based Energy Efficiency Program

The origins of the China Utility-based Energy Efficiency Program (CHUEE) lay with the International Finance Corporation (IFC), which aimed to encourage Chinese commercial banks to invest in small-scale energy efficiency projects and engage with Chinese ESCOs by addressing the key barriers that had prevented them from doing so. CHUEE was initiated due to significant hurdles in the market, such as banks lacking experience in assessing risks and cash flows associated with EE projects. Moreover, commercial bank loans demanded high fixed asset collateral, limiting ESCOs' access to credit.

CHUEE aimed to reshape the landscape of EE investments by creating a financial model that incentivized banks to fund EE projects. By fostering partnerships between banks, ESCOs, and energy service providers, CHUEE sought to transform how EE projects were financed, ultimately driving reductions in greenhouse gas emissions and promoting sustainable energy practices across various sectors in China.

9.1 Program Objectives

The main goal of the CHUEE program was to reduce the risks associated with investing in energy efficiency projects by tackling both market-related and technical uncertainties. The program functioned through three distinct phases, employing a mix of blended finance and capacity building strategies. This approach included the establishment of an LLR and backing capacity-building initiatives. Funding for the program's guarantee came from various sources, including the IFC, China, Finland, Norway, and the GEF. Key banking

partners such as the Industrial Bank, Bank of Beijing, and Shanghai Pudong Development Bank actively participated in the program alongside other institutions.

9.2 Program Approach

The administration of the CHUEE program was carried out across three distinct phases: CHUEE I, CHUEE II, and CHUEE III, with each having specific focus areas and objectives. The program's approach was multifaceted, encompassing direct capacity building initiatives aimed at empowering banks with the necessary expertise. This involved training and support to enhance their abilities to assess risks and cash flows linked to energy efficiency projects. Additionally, the program facilitated the market by providing indirect support to banks, improving the integration of banking and engineering assessments of EE projects. This comprehensive approach aimed not only to mitigate risks but also to foster a conducive environment for banks to actively engage and invest in sustainable energy projects across various sectors.

9.3 Partnership with the Banks

The CHUEE program fostered partnerships with multiple commercial banks, encouraging their active involvement by providing favorable terms supported by an LLR. These partnerships facilitated the financing of sustainable energy projects and achieved substantial lending volumes. The majority of sustainable energy projects financed included industrial process EE, commercial building EE, heat recovery, and DRE such as solar PV. Specifically, CHUEE I and II saw substantial success, with loans totaling $783 million being disbursed for various sustainable energy initiatives. Similarly, CHUEE III promoted loans amounting to $558 million, furthering the funding support for sustainable energy projects across different sectors (ICF China, 2014). These collaborations were instrumental in driving significant financial contributions toward advancing EE initiatives in China.

9.4 Monitoring and Verification

The monitoring and verification process of the CHUEE program involved a mid-term evaluation, which played a vital role in showcasing sustainable energy financing to partner banks and highlighted the importance of the LLR and direct capacity building efforts. Moreover, feedback received from participating banks revealed their preferences for higher LLR loss coverage ratios (e.g., 75% vs. 50%) and credit limits associated with the risk-sharing facility (RSF). This feedback emphasized the substantial influence these factors had on the banks' active engagement within the program. It illuminated the significance of the LLR financial mechanism combined with capacity building in incentivizing and encouraging increased involvement from banking institutions in supporting EE initiatives.

9.5 Results

The CHUEE program demonstrated remarkable success across all phases. In CHUEE I and II, a total of 178 sustainable energy projects received substantial financial support, securing loans amounting to $783 million (ICF China, 2014). This funding significantly contributed to the reduction of GHG emissions,

estimated at 19.3 million tons annually. CHUEE III then provided loans totaling $558 million, supporting roughly 350 sustainable energy projects and reducing an additional 1.5 million tons of GHG emissions annually (Market Screener, 2021). These outcomes underscored the program's effectiveness in not only providing substantial financial aid but also in driving tangible reductions in GHG emissions, making significant strides toward sustainable energy practices in China.

The mid-term evaluation of CHUEE III revealed significant insights, which emphasized the importance of blended finance and direct capacity building in demonstrating sustainable energy financing to partner banks. This underscores the crucial role of direct capacity building initiatives in enhancing banks' involvement in financing sustainable energy projects.

10. MEXICO CITY RLF FOR NZE PUBLIC BUILDINGS

The Mexico City RLF for Net-Zero Energy (NZE) Public Buildings is an evolving initiative, currently in its planning stages, that is aimed at fostering sustainable practices in building infrastructure and advancing EE and NZE buildings in Mexico City. Led by the Secretary of the Environment for Mexico City (SEDEMA) in collaboration with USAID, Berkeley Lab, Research Triangle Institute (RTI) International, C40 Cities Climate Leadership Group Inc. and the Inter-American Development Bank (IDB), the project aims to establish a sustainable financial model to support the transition of public office buildings into NZE structures. The following sections outline the envisioned phases, key activities, and potential structure of a financial mechanism, offering insights into the projected evolution and objectives of this initiative.

10.1 ADMINISTRATION OF THE FUND

The administration of the Mexico City RLF for NZE Public Buildings is envisioned to be overseen by SEDEMA. In this case, SEDEMA would be responsible for coordinating the implementation of EE and NZE projects, overseeing financial transactions, and ensuring compliance with program objectives. To facilitate its role as administrator of the fund, SEDEMA (with support from IDB) conducted diagnostics for 25 public office and hospital buildings to assess energy saving opportunities in lighting and air conditioning, as well as the potential for installation of rooftop solar PV panels. SEDEMA also initiated an energy audit for the Civil Registry Building, which enabled the identification of opportunities and potential savings through various measures, including upgrades in air conditioning, installation of PV systems, and improvements in lighting. The assessment included a thorough evaluation of investment amounts, profitability, and the feasibility of implementing a PV system on the building.

10.2 POTENTIAL SOURCES OF CAPITAL FOR THE FUND

SEDEMA is considering different options for obtaining seed capital for the RLF to implement NZE retrofits in public buildings. One option is to capitalize the RLF with a grant from the Mexico City Environmental Fund (FAP). This non-reimbursable funding would be allocated towards hiring an ESCO for the implementation of the NZE upgrades encompassing air-conditioning and lighting systems, as well as the installation of rooftop solar PV panels in the existing Civil Registry Building. Upon completion of these upgrades, the energy cost savings would be directed into the RLF within the FAP. This RLF would support

further NZE projects by reinvesting savings into new initiatives, creating a sustainable financial model for ongoing improvements. In addition to this option, SEDEMA is exploring other options for fully or partially capitalizing the RLF with a loan from a public or private financial institution, whereby the loan would be repaid first to the financial institution prior to energy cost savings being directed into the RLF to fund future projects.

10.3 Fund Planning Phases

Phase 1 (2021-2023)

This initial phase of planning for the fund focused on foundational activities and preparatory work needed to set the stage for more extensive EE and RE projects.

Key Activities

- Identification of Priority Buildings: This involved identifying the first buildings that will be targeted for EE and NZE interventions.
- Data Collection and Baselines: Comprehensive data collection established baselines for energy consumption and emissions in selected buildings.
- Capacity Strengthening: Building the technical skills and competencies of relevant stakeholders, including energy managers.
- Tier 1 and Tier 2 Energy Audits: Energy audits were conducted in two buildings to assess the their energy performance and identify improvement opportunities.
- Roadmap Design: A strategic roadmap was developed to guide the implementation of EE and NZE measures.
- Project Initiation: The first demonstration project was launched in the Civil Registry Building.

Phase 2 (2023-2024)

Phase 2 involves refining the financial mechanisms and carrying out analysis to estimate costs and benefits of a scaled program.

Key Activities

- Designing the Financial Mechanism: This involves designing the financial mechanisms like the FAP Subaccount and Technical Committee to support project financing.
- Increasing Ambition: This involves conducting modeling and analysis and working with external stakeholders to assess the costs and benefits of establishing an RLF for implementing at least 95 NZE retrofit projects in public buildings.

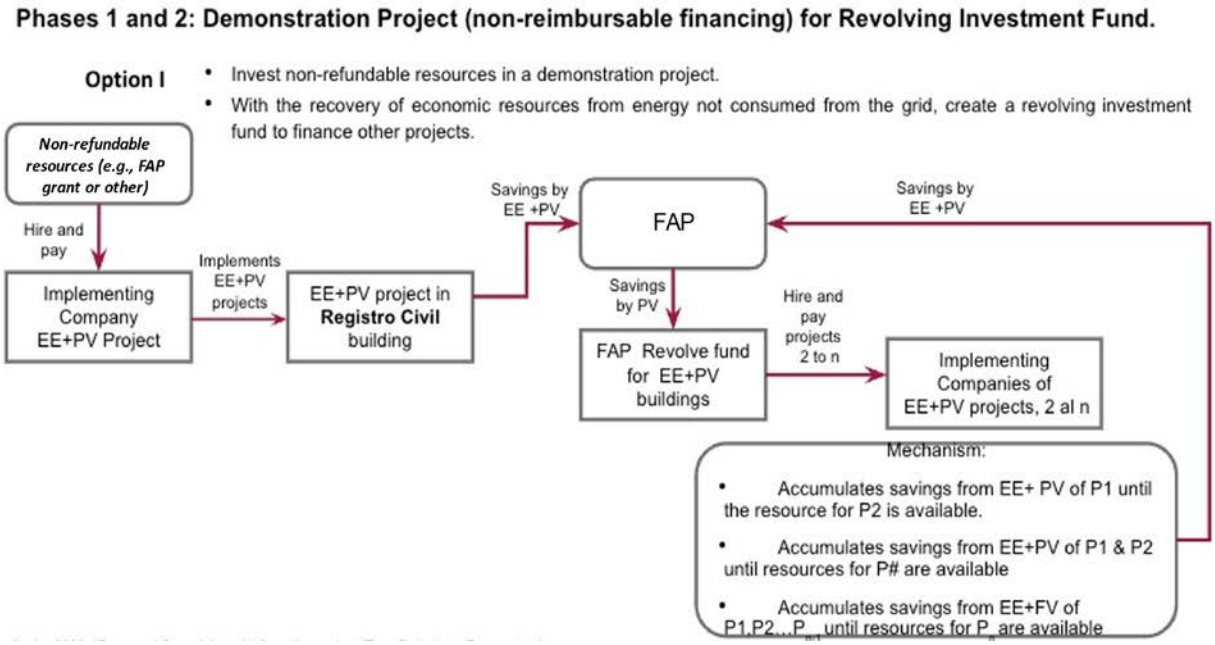
Phase 3 (2025-2030)

This phase represents the consolidation and implementation of the program. It aims to further expand the reach of EE and RE interventions, solidifying the transition to NZE buildings.

- Consolidated RLF: The revolving fund is fully operational and supports the financing of a wide range of EE and renewable energy projects in public buildings.

- Operating Rules and Governance: Program operating rules are refined, and governance structures strengthened, to accommodate additional facilities and projects.
- Adaptations for Policy Changes: The program may need to adapt to any changes in savings rules or policies.
- Energy Training and Diagnostics: Ongoing training and diagnostic activities are conducted to enhance the technical expertise of stakeholders involved in the program.

Figure 14: Mexico City Project, Phases 1 and 2



Source: Ayala, 2023.

10.4 Potential Results

The key initiative within this program is the proposed Mexico City RLF for NZE Public Buildings Project. The fund is designed to provide financing for EE retrofits in public office buildings, with a goal of turning them into NZE buildings.

This program aims to support Mexico in achieving its goal of net-zero emissions by 2050, with a focus on improving EE in buildings and transportation sectors.

Additionally, the program aims to reduce and avoid emissions equivalent to 17.35 million tons of greenhouse gases and mobilize $550 million in green financing (Research Triangle Institute, 2023).

11. Conclusion

Revolving loan funds serve as effective financial tools for governments to maximize public funds while advancing strategic energy goals. By recycling repaid loans into new projects, these funds create a

sustainable financing mechanism that multiplies the impact of initial public investment. Organizations can establish RLFs to target underserved markets—such as low-income households, small businesses, or emerging technology sectors—providing financing options where traditional private lending is limited or unavailable. This complementary approach to private financing helps bridge market gaps while promoting energy efficiency and renewable energy adoption across diverse sectors

The case studies presented in this report demonstrate that various lending models are available, each with distinct advantages and limitations. The selection of an optimal lending model depends primarily on two factors: the market needs identified through initial gap analysis, and the local implementation context. This context includes the local government's capacity to manage and administer funds, the banking sector's experience with energy efficiency lending, available administrative infrastructure, and the existing regulatory framework. The chosen model must align with both local market needs and institutional capabilities to ensure successful program implementation and sustainable operation.

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