

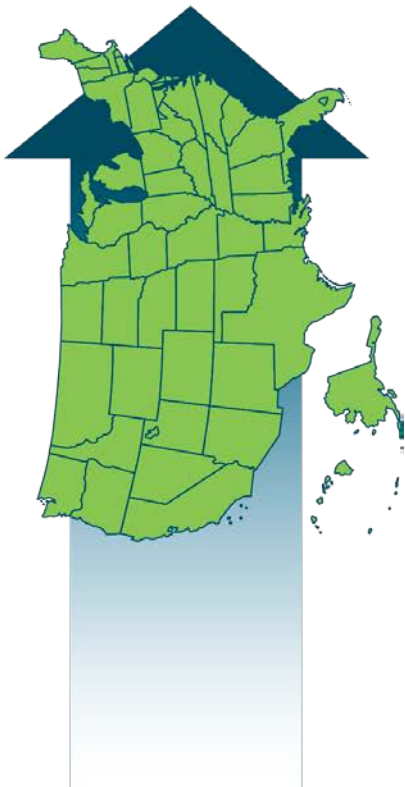
SEE Action

STATE & LOCAL ENERGY EFFICIENCY ACTION NETWORK

Financing Energy Improvements on Utility Bills: Market Updates and Key Program Design Considerations for Policymakers and Administrators


Financing Solutions Working Group

May 2014



The State and Local Energy Efficiency Action Network is a state and local effort facilitated by the federal government that helps states, utilities, and other local stakeholders take energy efficiency to scale and achieve all cost-effective energy efficiency by 2020.

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FOR MORE INFORMATION

Regarding *Financing Energy Improvements on Utility Bills: Market Updates and Key Program Design Considerations for Policymakers and Administrators*, please contact:

Johanna Zetterberg
U.S. Department of Energy
Johanna.zetterberg@ee.doe.gov

Brian Ng
U.S. Environmental Protection Agency
ng.brian@epa.gov

Regarding the State and Local Energy Efficiency Action Network, please contact:

Johanna Zetterberg
U.S. Department of Energy
johanna.zetterberg@ee.doe.gov

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Acronyms

ARRA—American Recovery and Reinvestment Act

CDFI—Community Development Financial Institution

CEWO—Clean Energy Works Oregon

CL&P—Connecticut Light and Power

CPUC—California Public Utilities Commission

CWSRF—Clean Water State Revolving Fund (overseen by the New York State Facilities Corporation)

DG—Distributed generation

DOE—U.S. Department of Energy

DR—Demand response

DSM—Demand-side management

DTI—Debt-to-income ratio

EE—Energy efficiency

EERE—U.S. DOE Office of Energy Efficiency and Renewable Energy

ESCO—Energy services company

GEFA—Georgia Environmental Finance Authority

IEEL—Illinois Energy Efficiency Loan program

IOU—Investor-owned utility

LIB—Line item billing

LLR—Loan Loss Reserve

MH—Manitoba Hydro (Canadian utility)

NA—Not available or not applicable

NEM—Non-energy measure

NR—Not reported

NYSERDA—New York State Energy Research and Development Authority


OBF—On-bill finance

OBR—On-bill repayment

OBRF—On-bill repayment finance (NYSERDA on-bill loan offering)

PACE—Property-Assessed Clean Energy financing

PAYS—Pay as You Save (on-bill model used by several programs)



PSRL—Power Smart Residential Loan (Manitoba Hydro)

RLF—Revolving loan fund

SBEA—Small Business Energy Advantage (CL&P and United Illuminating on-bill loan offering)

SEL—Smart Energy Loan (NYSERDA off-bill loan offering)

TVA—Tennessee Valley Authority

UK—United Kingdom

WPSC—Wisconsin Public Service Commission



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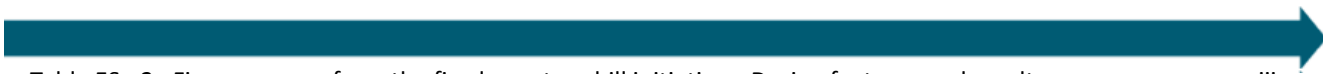


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Executive Summary

Many state policymakers and utility regulators have established aggressive energy efficiency (EE) savings targets that will necessitate investing billions of dollars in existing buildings over the next decade. These efficiency improvements will provide a range of benefits, both public and private, that far exceed the initial investment cost.

Typically, program administrators rely on utility bill-payer or taxpayer funds to achieve EE policy goals by incenting consumers to invest in energy efficiency measures and strategies. These funds are limited, necessitating significant levels of private investment as savings goals increase over time. For example, in California, it is estimated that \$70 billion of EE investment in existing buildings will be required over the next decade to achieve the state's policy goals—only a fraction of which will be provided by utility bill-payer funding (HB&C 2011).

Given this challenge, some EE program administrators and policymakers are exploring ways to increase their reliance on financing with the aim of amplifying the impact of limited program monies. In this context, offering programs that enable consumers to finance energy efficiency improvements on their utility bills are receiving increasing attention. The primary objectives of this report are: (1) to provide an updated review and analysis of existing on-bill programs and (2) to offer actionable insights on key program design issues for consideration by state policymakers, utility regulators and program administrators.

The Rationale for On-Bill Programs

A variety of barriers lead consumers to under-invest in energy efficiency, including the fact that some energy efficiency investments have “high first costs” compared to conventional measures (IEA 2008; Jaffe and Stavins 1994). While these up-front costs are often recouped over the lifetime of the efficiency measures through energy savings, some consumers lack the financial means or the willingness to use their existing resources to make the initial purchase of high-efficiency measures. On-bill programs are one of several forms of program-supported financing that have been deployed across the country to help consumers pay for energy-related improvements.¹

Broadly, on-bill programs involve repaying financing for energy-related improvements on the consumer's utility bill. Energy improvements may include a range of technologies that consumers can install on their premises: energy efficiency measures, distributed generation (e.g., solar photovoltaic, combined heat and power), and demand response (DR) technologies.

On-bill programs may be promising for several reasons. First, consumers typically have extensive experience making utility bill payments; it is already a routine part of their lives. It is also conceptually attractive to make an investment where the energy savings that result are reflected in the same bill as the payments on the loan that funded the investment. Second, proponents of on-bill programs argue that program administrators offering on-bill loans (perhaps aided by the threat of service disconnection for non-payment) may experience lower default rates compared to financing that is extended through instruments that are not repaid on the utility bill. If on-bill loan programs result in lower default rates, then program administrators may be able to offer more attractive financing (e.g., lower interest rate, longer loan term) than would otherwise be available. This could expand the number of consumers that can qualify for, or may be interested in, financing energy-related improvements.² Third, some on-bill programs also include features that are designed to address other barriers to efficiency, such as renter/owner split incentives, long project paybacks, and balance sheet treatment of debt, which lead to under-investment in certain market segments.

¹Examples of other common forms of program-supported financing for energy improvements include [Property Assessed Clean Energy](#) and unsecured consumer energy efficiency loans (e.g., [Keystone Home Energy Loan Program or HELP](#) in Pennsylvania).

²This assumes that other costs such as origination expenses, servicing costs, and collection expenses are also comparable or better and that sufficient consumer adoption occurs to justify investing in business systems to support the delivery of on-bill products to the market.



On-Bill Program Objectives

Since their inception in the 1980s, on-bill programs have evolved as program administrator and policymaker objectives and market needs have changed. We highlight the following trends in the evolution of on-bill programs objectives:

1. **Making Energy Efficiency Affordable.** When the first generation of on-bill programs was launched in the 1980s, interest rates were much higher than they are today. For example, mortgage interest rates reached the upper teens before settling into the seven to 10 percent range throughout that 1990s.³ Given high interest rates, the affordability of EE improvements—and financing to pay for them—was a key consideration for policymakers and program administrators initially.
2. **Expanding Access.** In recent years, although interest rates have remained low, capital access has been demonstrably restricted as lenders tightened underwriting standards and consumers faced historic financial challenges.⁴ In this context, some on-bill programs have been launched with the explicit intent of expanding access to capital among traditionally underserved populations (e.g., small businesses, middle income households).
3. **Driving Demand.** Some recently launched on-bill programs include specific provisions targeting a broader range of barriers to consumer adoption of efficiency (e.g., tenant-owner split incentives, balance sheet treatment of debt, long project payback periods) in addition to offering affordable, accessible financing. In this context, consumers that already have access to low-cost conventional loan products may be driven to adopt EE because on-bill loans might be more attractive or more convenient than other financial products.
4. **Increasing Leverage of Program Funds.** The increased interest in on-bill programs is part of a broader trend among policymakers and program administrators in some states that are looking to tap into private capital in order to stretch the impact of limited program funds, encourage significant cost contributions by participating consumers and mitigate rate impacts.

Scope and Limitations of this Report

This report reviews 30 existing on-bill programs and offers a detailed characterization of on-bill program design choices. These design elements are likely to have important impacts on a program's value to policymakers, lenders, investors, energy efficiency service providers, and participants. Design considerations discussed in this report include:

- Disconnection and meter attachment;
- Sources of capital;
- Underwriting criteria; and
- Eligible measures.

It is important to note that we do not address the question of whether policymakers and program administrators should launch or continue operating on-bill loan programs. The answer to that question will be context-specific.

³Data from Board of Governors of the Federal Reserve System Historical Data on 30-year fixed rate conventional mortgages: <http://www.federalreserve.gov/releases/h15/data.htm> (Accessed April 6, 2014).

⁴See Office of Comptroller of Currency's Survey of Credit Underwriting Standards 2012. In 2009, for example, 86 percent of commercial lenders tightened underwriting trends: <http://www.occ.gov/publications/publications-by-type/survey-credit-underwriting-practices-report/pub-survey-cred-under-2012.pdf>.

Based on LBNL research (Fuller et al 2010; Zimring et al 2011; Zimring et al 2013) and other studies, the up-front costs of energy improvements may be a hurdle for some consumers; however, financial products already exist in the private marketplace that enable many consumers to overcome this barrier. Allowing consumers to finance energy improvements on their utility bills is just one of several potentially valuable tools (e.g., mortgages, unsecured loans, leases, Property Assessed Clean Energy, etc.) for expanding access to capital.

Administrators also face difficult choices between allocating funds to financing or to other approaches designed to overcome other barriers to energy efficiency investments (e.g., rebates to participating consumers, technical assistance, or upstream incentives to energy services providers or retailers). Thus, robust assessments of financing’s role in reducing energy use in buildings are necessary to help policymakers and program administrators make better choices about how to allocate limited resources to achieve energy efficiency at scale. We address key areas of uncertainty regarding what energy efficiency financing programs can reasonably be expected to achieve, and for whom, in *Getting the Biggest Bang for the Buck: Exploring the Rationales and Design Options for Energy Efficiency Financing Programs* (Zimring et al 2013).

Overview of Existing Programs

As of January 2014, on-bill programs are operating or preparing to launch in the United States in at least 25 states, as well as in Canada and the United Kingdom. In aggregate, the 30 programs reviewed for this study have delivered over \$1.8 billion of financing to consumers for energy improvements (see Table ES - 1).

Table ES - 1. Summary statistics for surveyed on-bill programs⁵

Sector	Number of participants	Lifetime Loan Volume (nominal \$)	n =	Average Size of Loan	Median value and range of default rates	n =
Residential	182,324	\$1.05B	20	\$5,787	0.08% (0 to 3%)	15
Non-residential	50,339	\$775M	7	\$15,400	0.9% (0.6 to 2.9%)	7
Total	232,663	\$1.83B	27 ⁶	\$7,867		22 ⁷

On-bill programs offered by five administrators—Tennessee Valley Authority (TVA), Manitoba Hydro (MH), Alliant Energy Wisconsin, United Illuminating/Connecticut Light & Power (CT SBEA), and National Grid (NG)—account for over 90 percent of on-bill activity for programs included in this study in terms of both dollars loaned and number of participants (see Figure ES - 1).⁸

Table ES - 2 provides an overview of key design features (e.g., target sector, maximum loan term, disconnection and meter attachment, source of capital, and eligible measures) and results (e.g., 2012 and lifetime loan volume, default rates) of these five on-bill programs.

Twenty-two of the 30 programs (73 percent) targeted residential consumers and generated about 78 percent of overall financial product volume by number of loans to consumers and 58 percent of volume based on dollars originated.

⁵ Throughout this report, where sample size for summary statistics is less than 30, it is because programs either have not yet launched or have not provided sufficient data for a specific analysis.

⁶ Three programs discussed in this report (California’s emerging on-bill pilots, Hawaii’s emerging on-bill pilot and Oregon’s just-launched MPower pilot) are not included in the summary statistics because data was not available as of December 2013.

⁷ Default rates are not included either because programs have yet to launch (2), or have less than one year of data (5), or failed to provide this information (1).

⁸ Two of these initiatives include multiple programs. For example, Manitoba Hydro’s financing initiative includes four programs and the Connecticut Small Business Energy Advantage (CT SBEA) includes programs operated by CL&P and United Illuminating.

The average loan size is \$5,787 for the 20 residential programs that provided this information. For on-bill programs that target single-family consumers, average loan size ranges from \$525 to \$16,810. In contrast, average loan size is \$800k for property owners participating in PSE&G's Multi-Family Housing Program. For the three nonresidential programs that target small business consumers, the average loan size over the program lifetime ranged from about \$2,200 to \$8,000. Average loan size ranged between about \$7,800 to \$127,000 for the four other nonresidential programs that allow large commercial/industrial consumers to participate.

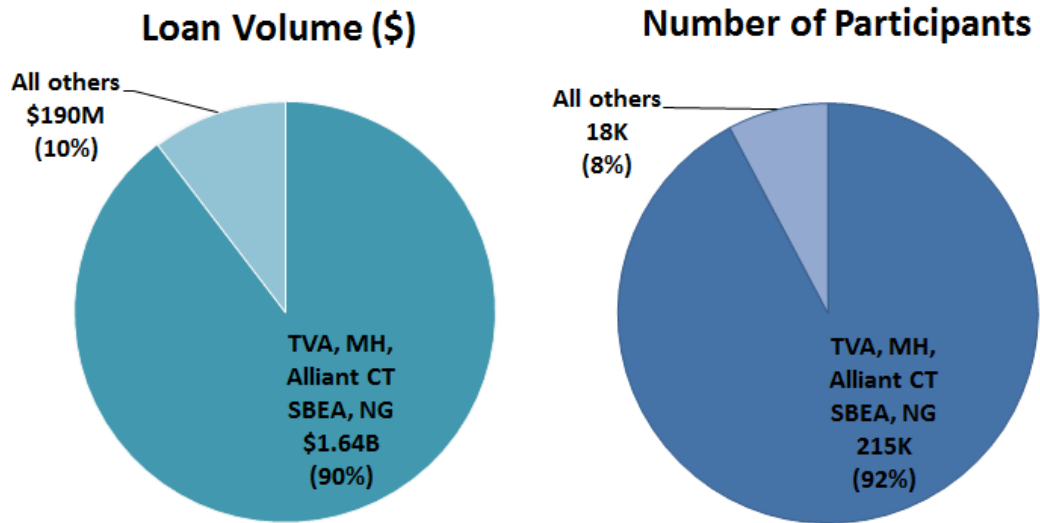


Figure ES - 1. Share of on-bill program volume by cumulative dollars loaned (left) and by number of participants (right)

Table ES - 2. Five programs from the five largest on-bill initiatives: Design features and results

	TVA	Manitoba Hydro	Alliant Energy	United Illuminating	National Grid
Target Sector	Res	Res	Non-Res	Non-Res	Non-Res
Lifetime Volume	\$500M	\$290M	\$524M	\$39M	\$44M
2012 Volume	\$45M	\$29M	\$393K	\$4M	\$22M
Interest Rate	6%-8%	4.8%	0%-3%	0%	0%
Max Loan Term	3 or 10 years	Up to 15 years	5 years	Up to 4 years	2 years
Default Rate	3%	0.48%	2.68%	0.9%	2.9%
Disconnection and Meter Attachment	On-Bill Loan w/ disconnection	On-Bill Loan w/ disconnection	Line Item Billing	Line Item Billing	Line Item Billing
Source of Capital⁹	OBR (warehouse w/TVA guarantee)	OFB (public monies)	OFB (utility monies w/interest rate buydown)	OFB (mix of utility monies w/interest rate buydown & utility bill-payer monies)	OFB (utility bill-payer monies)
Underwriting	Expanded	Hybrid	Hybrid	Alternative	Alternative
Eligible Measures	EE (mostly heat pumps)	EE	EE & RE	EE & Water Efficiency	EE

The average default rate over the program lifetime ranged from 0 to 3 percent for 16 residential programs that provided this information, and 0.57 percent to 2.90 percent for seven nonresidential programs. These default rates are low compared to common types of unsecured consumer lending, which may range from mid-single digits to low double-digits.


The next four sections describe some of the primary design considerations for on-bill programs.

Disconnection and Meter Attachment

There are several ways in which on-bill financial products can be unique from other standard financial products in addition to the fact that payments are made through the utility bill. Two key design questions are (1) whether nonpayment can lead to the disconnection of energy service; and (2) whether the charge is paid off when the building occupants change, or is attached to the meter (and is paid by the subsequent occupants). We divide these design considerations into three types of programs observed in the field:

- Line Item Billing (LIB)—no disconnection, no meter attachment.** The utility bill is simply used as a tool for participating consumers to make payments. In the event that a participant fails to make principal and interest payments, financing charges are typically written off or removed from the utility bill, and

⁹See “Sources of Capital” section of Executive Summary for more information on the various sources of capital used to fund on-bill programs. Broadly, we define On-Bill Financing programs as those funded by public, utility bill-payer or utility shareholder capital and On-Bill Repayment programs as those funded by non-utility, private investors.



capital providers are free to seek recourse unrelated to a participant’s utility service based on the terms of their contract with the consumers.

- **On-Bill Loan (or Lease) with Disconnection—disconnection allowed, no meter attachment.** On-bill loans with disconnection rights are treated as debt of the consumer. A broad range of financial products (e.g., unsecured loans, leases) may be re-paid on the consumer’s bill and the threat of utility service termination may act as an inducement for the consumer to repay the loan. In the event that a participating consumer fails to make financing payments, utilities typically use their normal collection protocols for utility bill delinquency, which may ultimately result in service termination.¹⁰
- **On-Bill Tariff—disconnection allowed, meter attached.**¹¹ An on-bill tariff is a charge that is associated with the utility meter rather than a debt of the consumer or property. The tariff structure is similar to an on-bill loan with disconnection in that non-payment of financing charges may lead to utility service termination. However, tying the charge to the utility meter is specifically designed to accomplish three key objectives: (1) automatic transfer of the tariff between consumers; (2) survival in foreclosure of a first mortgage on the property; and (3) off-balance sheet treatment for non-residential participants. This structure is a relatively recent innovation and is being hailed by some as a “game changer” because of its potential to deliver robust security and overcome a range of barriers to EE beyond up-front costs. However, uncertainty remains about the extent to which the structure will effectively achieve the three objectives described above—and what impacts a tariff will have on consumer adoption.

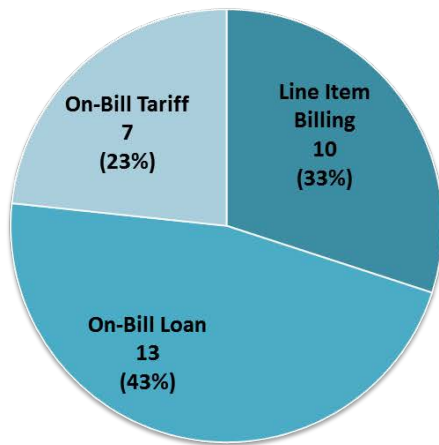
Of the 30 programs in this report, 10 offer line-item billing, 13 offer on-bill loans with disconnection, and seven offer on-bill tariffs (see Figure ES - 2). Nearly all on-bill financing (99 percent by dollar amount, and 77 percent by number of programs) has taken place through programs using line item billing or on-bill loans with disconnection (though on-bill tariffs are relatively new, and could expand in coming years).

In practice, the threat of disconnection of energy service has an uncertain benefit in reducing consumer default rates relative to financial products that lack this threat in the case of nonpayment. Consumers may not differentiate between the financial product charge and other utility charges, even if they have different consequences for nonpayment, which may result in default rates similar to historic utility nonpayment rates. Default rates were quite low for all three program types (i.e., most programs had a default rate of less than one percent).

¹⁰ In some cases, on-bill loan payments are subordinated to other charges on a consumer’s utility bill. See “On-Bill Financing Charge Payment Priority” section for more information on protocols should on-bill participants make partial payments of their utility bills.

¹¹ It is important to differentiate the definition of tariff for the purposes of this report from the definition of tariff often used in utility regulatory proceedings. For the purpose of this report, a tariff is defined as a charge that is undifferentiated from any other utility bill charge. In utility regulatory proceedings, tariffs are often used by utilities and their regulators to specify the rate and terms and conditions of consumer service, regardless of whether those terms and conditions involve differential treatment of an on-bill financial product from other utility bill charges.

Number of Programs



Loan Volume (\$)

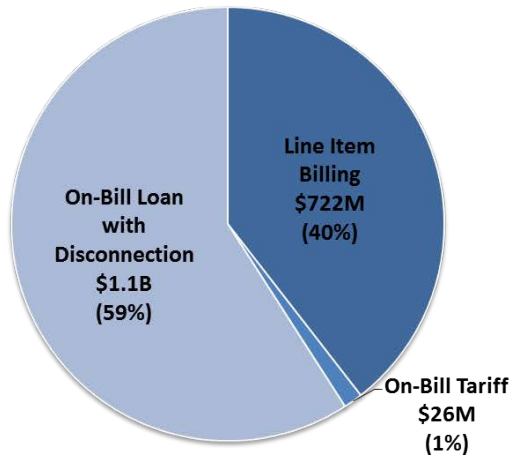


Figure ES - 2. On-bill loan products, by number of programs (left) and lifetime loan volume in dollars (right)¹²

Sources of Capital

In addition to the features described in the last section, we differentiate programs based on the capital source used to fund on-bill programs: **On-Bill Financing (OBF)** and **On-Bill Repayment (OBR)** (see Table ES - 3 for definitions). Of the 30 programs examined in this report, two-thirds of them are OBF programs and these OBF programs account for about two-thirds of the completed number of loans.

Table ES - 3. On-bill financing and on-bill repayment: Source of capital

Program Type	Source of Capital
On-Bill Financing (OBF)	Utility Shareholder, Utility Bill-payer or Public funds (e.g., taxpayer funds, greenhouse gas auction proceeds)
On-Bill Repayment (OBR)	Private Investors

We sub-divide OBR programs into one of three basic models, though other models are possible as well:¹³

- 1. Program Administrator Acts as Warehousing Entity.** In the warehouse model, a program administrator uses utility shareholder, utility bill-payer and/or public capital to initially fund financial products (e.g., loans) in Phase One. They then aggregate these loans and sell them to a second investor or investors in Phase Two (see Figure ES - 3), often providing a credit enhancement to support the sale.

¹² Alliant’s Shared Savings Wisconsin and PSE&G’s Multi-family Housing Program have large average loan sizes (PSE&G’s average loan was over \$1M and Alliant’s was more than \$43K in 2012) that cause a significant difference between the percentage volume done by number of loans and the percentage volume done by dollar amount of loans.

¹³ We acknowledge that other strategies are possible but focus on these three because the “warehousing” approach is common among OBR programs included in this study, raising private capital up front is getting substantial attention as Hawaii prepares its implementation, and the “open market” approach is being tested in Connecticut and California. Another model is for a utility to work with a single private capital provider, as is the case for Clean Energy Works of Oregon’s on-bill product offering, which uses capital from Craft3.

2. **Program Administrator Raises Private Capital Up-front.** In the up-front model, program administrators opt to raise capital from private investors up-front, rather than initially funding loans with utility shareholder, utility bill-payer, or public capital (see Figure ES - 4). In Phase 1, the program administrator issues a bond (or other financial contract) and investors provide capital that is then used to fund participant on-bill loans in Phase 2. This structure is very similar to the program administrator as warehouse model, but immediately brings in private capital and avoids the need for an initial pool of utility shareholder, utility bill-payer, or public capital.

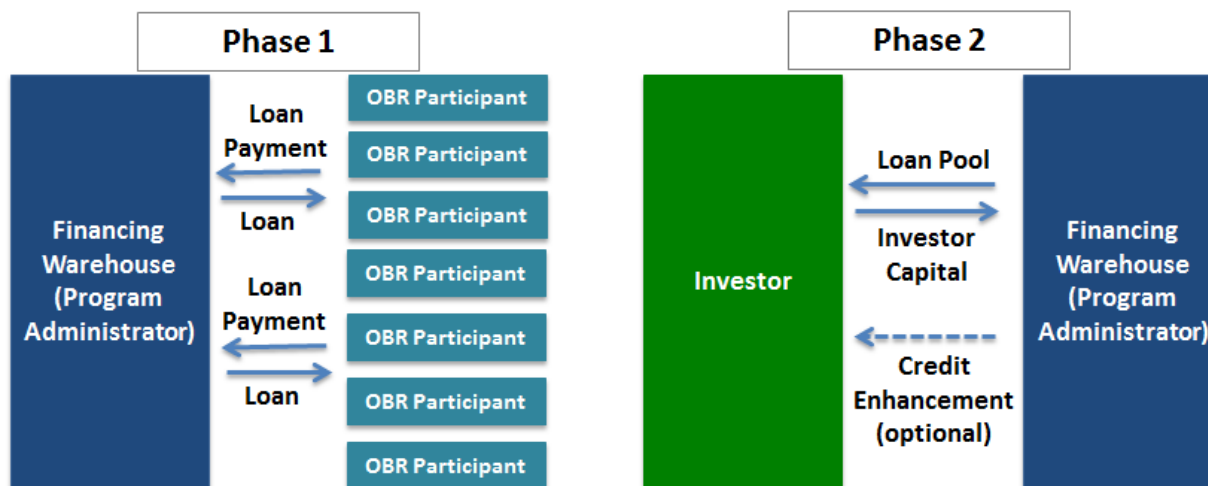


Figure ES - 3. Illustrative example of the role of a program administrator in aggregating OBR financial products before re-selling them to investors

3. **Open Market.** The third approach for sourcing private capital is the open market or “open source” model, in which one or more financial institutions underwrite individual consumers and deliver the financial products directly to them. Any qualified financial institution may participate, allowing them to use the utility bill for repayment. This model avoids utility involvement in capital provision and encourages competition, driving financial institutions to innovate and to offer more attractive (e.g., lower interest rate, longer term) and more accessible products. With the first two OBR models, there is a single entity interacting with utilities (or utilities offering the program themselves). The open market approach means that multiple financial institutions could be interacting with multiple utilities in a state (see Figure ES - 5), which may necessitate additional infrastructure to coordinate activities.

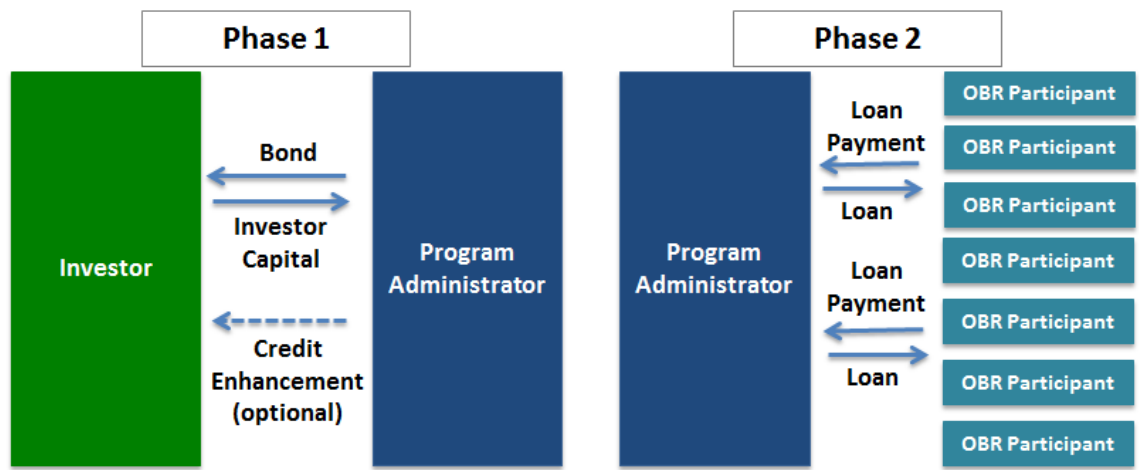


Figure ES - 4. Illustrative example of raising capital up-front

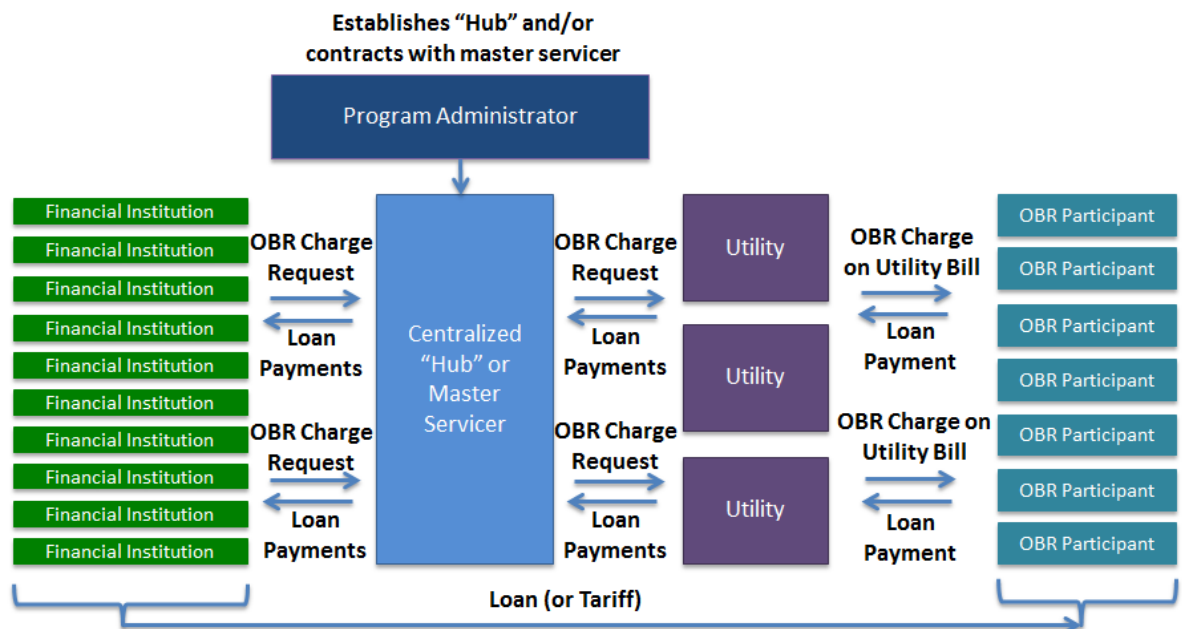



Figure ES - 5. Open Market-OBR. A centralized “hub” or master servicer can be used to streamline open-market OBR transactions between utilities and financial institutions

The majority of on-bill programs in this report are OBF initiatives, and OBF initiatives have delivered the lion’s share of overall on-bill program volume. However, in recent years, there has been a significant movement towards OBR by program administrators. Only one of the 12 programs launched prior to 2009 utilized OBR. Of the 16 programs launched since 2009, seven are OBR programs.¹⁴ Six of the nine on-bill programs that feature OBR rely on the

¹⁴ Only 28 programs are counted because two programs are under development.



program administrator warehouse model and these programs account for 99 percent of the total loan volume from programs that utilize OBR. Nonetheless, OBF programs continue to drive a significant majority of program volume. In 2012, OBF programs in this study delivered \$128M of capital to fund consumer energy improvements, while OBR programs delivered about \$62M in on-bill loans.

A program administrator's choice of capital source and mechanism for tapping into that capital source are often closely tied to the policy goals driving on-bill program operations. These choices will influence the cost of capital, the flexibility of the program, the volume of capital available, the accessibility of the program, and other factors—all of which may have substantial impacts on program success. Considerations for selecting a capital source are discussed in greater detail in section 4.

Assessing Consumer Creditworthiness

Underwriting describes the process and criteria that financial institutions and/or program administrators use to assess eligibility for financing, including the creditworthiness of applicants or suitability of the property for a financial product. The approach used may have significant impacts on program applicant transaction costs, application approval rates, and default rates for on-bill loan programs. Program administrators and financial institutions have taken a range of approaches to setting underwriting criteria that we group into four categories:

- **Traditional Underwriting Standards.** Administrators rely on traditional metrics that are used for underwriting other types of financial products. For example, in the single-family residential market, this approach often includes a minimum credit score of 640 and a maximum debt-to-income ratio (DTI) of 50 percent for unsecured consumer loan products.
- **Expanded Underwriting Standards.** The administrator relies on traditional underwriting metrics but relaxes the minimum standards for applicant approval in order to increase the number of target consumers that can qualify for financing. In the single-family residential market, this might mean a minimum credit score of 600 and a maximum DTI of 70 percent.
- **Alternative Underwriting Standards.** The program administrator uses alternative metrics such as a strong history of on-time utility bill repayment in lieu of traditional metrics in order to increase the number of applicants that are approved for financing and/or reduce the cost of the underwriting process (e.g., less time and money).
- **Hybrid Underwriting Standards.** The program administrator relies on a blend of alternative underwriting standards and traditional or expanded underwriting metrics. For example, in the single family residential market, this might mean a minimum credit score of 600 and a strong history of on-time utility bill repayment.

Of the 28 programs that reported underwriting criteria, only one program relies exclusively on traditional underwriting standards, three programs rely on expanded underwriting, nine programs employ hybrid underwriting criteria, and 15 programs use alternative underwriting criteria (see Figure ES - 6). When weighted by program loan volume, programs using hybrid underwriting approaches account for 51 percent of the on-bill loan volume, followed by programs that rely on expanded underwriting (31 percent).

In comparing among existing on-bill programs, we found no clear association between a program's underwriting criteria and participant default rates. Default rates were quite low across program designs suggesting that a range of underwriting approaches may lead to low participant default rates. However, the choice of underwriting criteria does appear to influence the financing application approval rate in these programs. For example, the one program that relies exclusively on traditional underwriting criteria rejected over eight times more applications than the median percentage rejected in programs that relied primarily on utility bill payment history (see Table ES - 4).

Those administrators that rely on private capital to fund their on-bill programs also need to consider the potential impact of using non-traditional underwriting standards on their ability to attract (and the cost of attracting) private

capital providers to the program. While repayment trends in on-bill programs have been quite strong, those programs that have successfully leveraged private capital have also provided robust credit enhancements (e.g., a loan loss reserve or guarantee that reduces the risk of poor repayment performance to private capital providers). Investors may be reluctant to accept (or require a discount for) loans not underwritten using standard metrics.

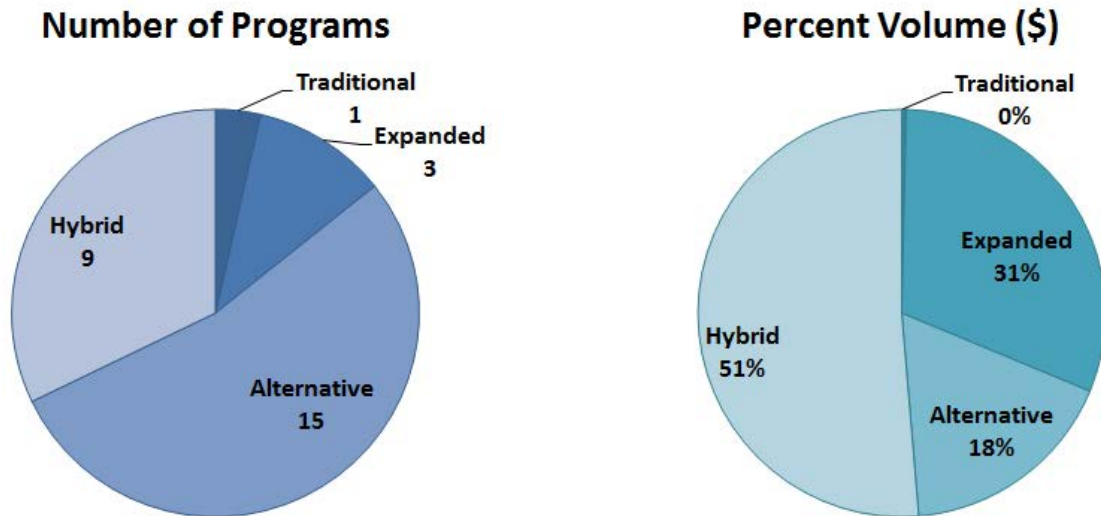


Figure ES - 6. Underwriting criteria used in on-bill programs: number of programs (left) and dollar volume (right)

For those programs seeking to rely primarily on utility billing history, and that intend to tap private capital without substantial credit enhancement, the tariff structure might provide benefits that allow investors and rating agencies to look to utility billing performance trends as comparables rather than consumer lending or other similar products.

Table ES - 4. Application decline rates and participant default rates for Residential and Non-Residential on-bill programs

Residential On-Bill Programs		
Underwriting Criteria (n=21)	Median and Range of Application Decline Rates (n=15)	Median and Range of Participant Default Rates (n=15)
Traditional Underwriting (n=1)	49%	0%
Expanded Underwriting (n=3)	25% (n=1)	3% (n=1)
Hybrid Underwriting (n=8)	4%-33% (median 10%)	0%-0.9% (n=7)
Alternative Underwriting (n=9)	2%-25% (median 6%) (n=5)	0%-0.9% (n=6)
Non-Residential On-Bill Programs		
Underwriting Criteria (n=7)	Median and Range of Application Decline Rates (n=6)	Median and Range of Participant Default Rates (n=7)
Traditional Underwriting (n=0)	NA	NA
Expanded Underwriting (n=0)	NA	NA
Hybrid Underwriting (n=1)	10%	2.68%
Alternative Underwriting (n=6)	0%-25% (median 6%) (n=5)	0.57%-2.9%

Selecting Eligible Measures

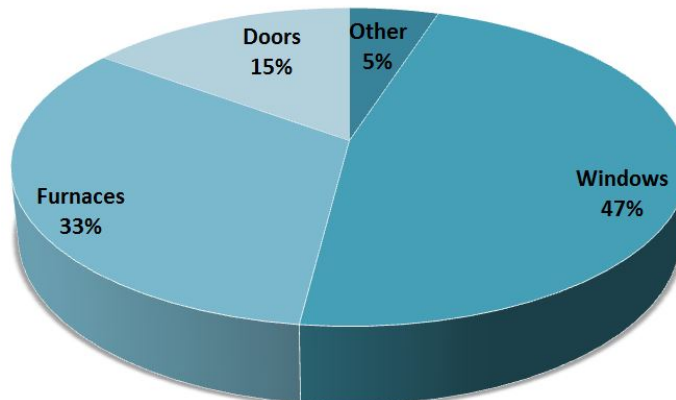
Selecting eligible measures requires program administrators (often following guidance from state regulators) to balance multiple objectives: enabling (or driving demand for) cost-effective energy efficiency, encourage adoption of distributed renewable technologies, and facilitate other program design or policy goals (e.g., contributing to market transformation by facilitating private financial institution investment in energy efficiency, creating jobs, and providing consumer safeguards). Three key areas of consideration for program administrators in selecting eligible measures for on-bill programs are: (1) types of measures; (2) single measure vs. comprehensive retrofits; and (3) whether to restrict project eligibility based on expected utility bill impacts.

1. **Types Of Eligible Measures.** The source of capital and program goals will heavily influence whether technologies beyond EE (e.g., distributed generation and demand response) may be financed on-bill—casting a broader net may help to drive consumer participation. In addition, some programs permit certain non-energy measures that address health and safety issues to be included as part of a retrofit package, which may be an important demand driver for certain market segments. However, including non-energy measures may raise cost-effectiveness challenges as these measures don't directly deliver energy savings. Twelve of 30 on-bill programs included in this report limited eligibility to EE improvements. Eleven programs allow renewable energy technologies, five allow non-energy measures, and four allow water efficiency measures to qualify for loan financing.¹⁵
2. **Single-Measure vs. Comprehensive Retrofits.** Programs that have achieved significant market penetration have typically allowed participants to finance single-measure improvements or have coupled on-bill eligibility with substantial financial incentives for multi-measure improvements. For example, Manitoba Hydro's Power Smart Residential Loan Program has funded almost \$300M in efficiency improvements in single family residences since 2001. Consumers are allowed to install and finance a wide range of energy-related measures—94 percent of on-bill loans have been used for single-measure window, door or furnace replacements (see Figure ES - 7).

¹⁵ Programs allowing RE, NEMs and water efficiency measures are not mutually exclusive: some allow one or more.

3. **Bill Impacts.** Some on-bill programs require “bill neutrality”—i.e., over the loan term, expected energy savings from efficiency improvements cover the loan repayment cost. On-bill programs that require bill neutrality have, on average, achieved lower historical volume than those that do not. In 2012, the average residential on-bill volume for the four programs that required bill neutrality was \$1.6M compared to \$11.7M for the 10 programs that do not require bill neutrality (see Figure ES - 8). The average 2012 non-residential on-bill volume for the three programs that required bill neutrality was \$7.6M compared to \$11M for the four programs that do not require bill neutrality. These results suggest that, in practice, requiring “bill neutrality” as a design element may actually have a demand-dampening effect by limiting the types of projects that can be financed on-bill.

Measures Financed in Manitoba Hydro's Power Smart Residential Loan Program



Note: “Other” includes multi-measure improvements. All other improvements involve only a single measure

Figure ES - 7. Manitoba Hydro Power Smart Residential Loan Program financed projects, 2001-2013 (by number of projects)¹⁶

Bill neutrality has been put forward as a consumer protection; however loan performance of bill-neutral and non-bill neutral programs has not been significantly different. Moreover, bill neutrality requirements may be a barrier to consumers taking on projects that achieve deeper savings. Thus, requiring bill neutrality offers uncertain potential as a consumer protection and driver of consumer EE adoption.

¹⁶Other includes projects that funded more than one type of energy improvement.

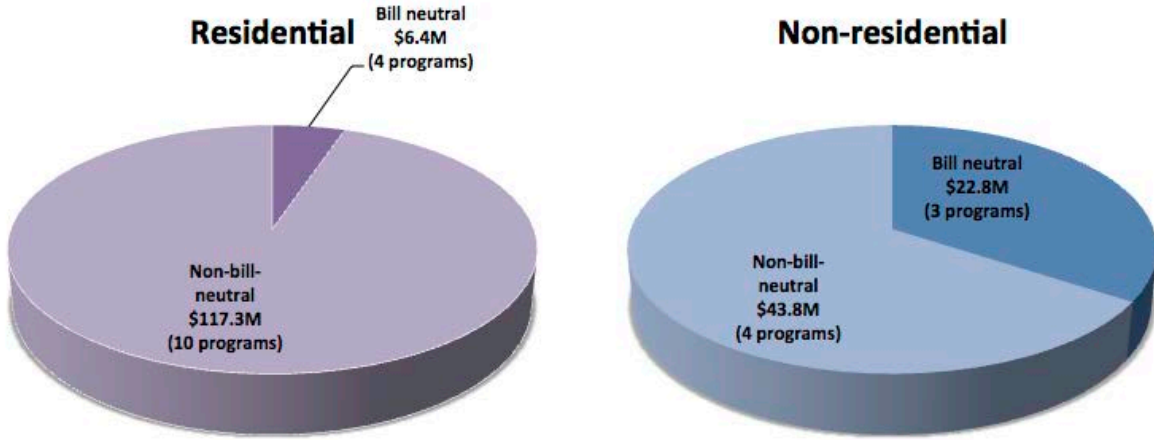


Figure ES - 8. Comparison of 2012 on-bill loan volume for programs that do or do not require bill neutrality




Conclusion

This report reviews 30 existing on-bill programs and explores key on-bill program design considerations for policymakers and program administrators. We organize our analysis of program design considerations around several issues: (1) the use of disconnection and meter attachment; (2) the source of capital; (3) assessing consumer creditworthiness; and (4) measure eligibility. Our findings include:

- **Disconnection and Meter Attachment.** In comparing existing on-bill programs, we found that programs allowing utility service disconnection tend to have slightly higher participant default rates (1.69% for programs that allow disconnection, 1.05% for those that don't). However, there are many other program characteristics, program design factors and attributes of a program's target consumer segment that contribute to default rates. Due to these other influences we do not believe it is appropriate to draw conclusions regarding differences in these default rates. All on-bill programs reviewed in this report have experienced low default rates. The overall low default rates suggest that enabling consumers to repay financing on-bill, regardless of the consequences of non-payment, may be a promising approach to delivering widespread consumer access to attractive capital at low risk.
- **Source of Capital.** Historically, on-bill programs have utilized public, utility bill-payer, or shareholder capital to fund loans. However, in recent years, we find more examples of on-bill programs that leverage private capital. We identified multiple pathways to tapping into private investor monies and found that the choice of a pathway may have significant impacts on program administration costs, risks and flexibility in program design. Additionally, while some program administrators have been reluctant to provide guarantees against losses to private sector on-bill investors, experience to date suggests that this credit enhancement strategy is worth consideration. Credit enhancements may be an effective way to access pools of low-cost private capital, at low risk to utility bill-payers, while maintaining program flexibility.
- **Assessing Consumer Creditworthiness.** Our analysis of existing on-bill programs did not yield an obvious association between a program's underwriting criteria and participant default rates, suggesting that a range of underwriting approaches—including those that rely primarily on utility bill repayment history—may be effective in identifying creditworthy applicants. However, the choice of underwriting criteria is an important design issue for program administrators because it appears to significantly influence on-bill program application approval rates. The one program that relies on traditional underwriting criteria rejects at about eight times as many applications compared to the median rejection rate of on-bill loan programs that rely primarily on utility bill repayment history.
- **Measure Eligibility.** On-bill programs that have achieved significant uptake in their target market have typically taken one of two approaches: (1) allow consumers to finance almost any “energy-related” improvements with particular focus on single measures (e.g., high-efficiency equipment, windows); or (2) access to on-bill lending is coupled with robust financial incentives (e.g., rebates). The former approach raises questions about the extent to which these initiatives lead to comprehensive retrofits or significantly transform existing efficiency services markets, while the latter approach may raise questions about the cost-effectiveness (and/or potential rate impacts) of these programs. We also found that programs requiring “bill neutrality” have often struggled to achieve significant market penetration and do not appear to have significantly fewer defaults.

Enabling consumers to finance energy improvements on their utility bills is one of several potentially valuable tools for expanding access to attractive capital, and it should be considered within the suite of options to encourage the adoption of energy efficiency. As on-bill initiatives continue to attract attention, it will be important for policymakers, administrators, and stakeholders to continue to rigorously assess their efficacy in achieving



programmatic goals and to share lessons learned broadly, so that we can better understand how, and for whom,¹⁷ these initiatives can help to deliver incremental, cost-effective energy savings at scale.

¹⁷ For more information around our understanding of what EE financing can be reasonably expected to achieve, and for whom, see [“Getting the Biggest Bang for the Buck: Exploring the Rationales and Design Options for Energy Efficiency Financing Programs”](#) (Zimring et al 2013).



Introduction

Many state policymakers and utility regulators have established aggressive energy efficiency (EE) savings targets that will necessitate investing billions of dollars in existing buildings over the next decade. For example, twenty states have adopted long-term, binding energy efficiency resource standards (EERS), which require utilities to achieve minimum energy efficiency savings targets that typically ramp up over extended time periods (e.g., 3–15 years), or issued regulatory decisions that require utilities to acquire “all cost effective” energy efficiency.¹⁸ Moreover, a number of state regulatory commissions set annual or multi-year savings targets for utilities as part of demand-side management (DSM) or integrated resource planning proceedings.

Typically, program administrators rely on utility bill-payer or taxpayer funds to achieve EE policy goals by incenting consumers to invest in energy efficiency measures and strategies. These funds are limited, necessitating significant levels of private investment as EE savings goals increase over time. For example, in California, it is estimated that \$70 billion of EE investment in existing buildings will be required over the next decade to achieve the state’s policy goals—only a fraction of which will be provided by utility bill-payer funding (HB&C 2011). These efficiency improvements are expected to provide a range of benefits, both public and private, that far exceed the initial investment cost—but access to capital will be vital to make this possible.

Given this challenge, some EE program administrators and policymakers are exploring ways to increase their reliance on financing with the aim of amplifying the impact of limited program monies. In this context, offering programs that enable consumers to finance energy efficiency improvements on their utility bills are receiving increasing attention.

On-Bill Programs: Definition and Rationale


Broadly, on-bill programs involve repaying financing for energy-related improvements on the consumer’s utility bill. Energy improvements may include a range of technologies that consumers can install on their premises: energy efficiency measures, distributed generation (e.g., solar photovoltaic, combined heat and power), and demand response (DR) technologies. In Chapter 2 and Chapter 3, we refer to all programs through which participants repay financing on their utility bills as “on-bill programs”. In Chapter 4, we apply a more detailed definition to on-bill programs and differentiate “on-bill financing” from “on-bill repayment” based on the source of capital used to fund participant loans.

A variety of barriers lead consumers to under-invest in energy efficiency, including the fact that some energy efficiency investments have “high first costs” compared to conventional measures (IEA 2008; Jaffe and Stavins 1994). While these up-front costs are often recouped over the lifetime of the efficiency measures through energy savings, some consumers lack the financial means or the willingness to use their existing resources to make the initial purchase of high-efficiency measures. On-bill programs are one of several forms of program-supported financing that have been deployed across the country to help consumers pay for energy-related improvements.¹⁹

On-bill programs may be promising for several reasons. First, consumers typically have extensive experience making utility bill payments; it is already a routine part of their lives. It is also conceptually attractive to make an investment where the energy savings that result are reflected in the same bill as the payments on the loan that funded the investment. Second, proponents of on-bill programs argue that program administrators offering on-bill loans (perhaps aided by the threat of service disconnection for non-payment) may experience lower default rates

¹⁸ Two other states have adopted broader renewable portfolio standards (RPS) or alternative energy standards under which energy efficiency is a qualifying resource.

¹⁹ Examples of other common forms of program-supported financing for energy improvements include [Property Assessed Clean Energy](#) and unsecured consumer energy efficiency loans (e.g., [Keystone Home Energy Loan Program or HELP](#) in Pennsylvania).



compared to financing that is extended through instruments that are not repaid on the utility bill. If on-bill loan programs result in lower default rates, then program administrators may be able to offer more attractive financing (e.g., lower interest rate, longer loan term) than would otherwise be available. This could expand the number of consumers that can qualify for or may be interested in financing energy-related improvements.²⁰ Third, proponents argue that financing is potentially an attractive tool for increasing program leverage and mitigating the rate impacts of utility consumer-funded efficiency programs.²¹ Fourth, some on-bill programs also include features that are designed to address other barriers to efficiency, such as renter/owner split incentives, long project paybacks, and balance sheet treatment of debt, which lead to under-investment in certain market segments.

Objectives and Approach

The primary objectives of this report are: (1) to provide an updated review and analysis of existing on-bill programs and (2) to offer actionable insights on key program design issues for consideration by state policymakers, utility regulators and program administrators. These design elements are likely to have important impacts on a program's value to policymakers, lenders, investors, energy efficiency service providers and participants.²² Program design considerations discussed in this report include:

- Disconnection and meter attachment;
- Sources of capital;
- Underwriting criteria; and
- Eligible measures.

Some on-bill programs have been operating for decades and have typically been funded with taxpayer or utility bill-payer capital. In recent years, we observe increasing interest among policymakers and some program administrators in leveraging limited programmatic monies with private capital. This infusion of private monies into on-bill programs increases the potential impact of program design choices on market actors.


This report builds on previous studies of on-bill programs (e.g., Bell et al 2011; Brown and Conover 2009). In terms of approach, we conducted a literature review, reviewed 30 on-bill programs, and conducted detailed case studies on 13 of these programs. It is worth noting that we had limited quantitative data for some on-bill programs and a number of on-bill programs have limited implementation experience. This makes conclusions about the efficacy of different on-bill financing initiatives challenging. Typically, we report sample size, the median value and range of values for key program indicators (e.g., loan default rates, market penetration).

We selected programs based on a range of factors including seeking initiatives that achieved significant market penetration and programs in which administrators have taken innovative approaches to program design. We also included a geographically diverse mix of utilities that have different ownership arrangements and regulatory

²⁰ This assumes that other costs such as origination expenses, servicing costs, and collection expenses are also comparable or better and that sufficient consumer adoption occurs to justify investing in business systems to support the delivery of on-bill products to the market.

²¹ Participants in an on-bill loan programs may ultimately re-pay most or all of the cost of efficiency measures installed in their premises. Depending on market adoption, on-bill programs may result in lower costs to the program administrator compared to a rebate program, if participating consumers are willing to finance and repay the cost of the efficiency measures.

²² We found cases where key design features of on-bill programs were “locked in” through enabling legislation or utility regulatory proceedings before these initiatives are launched, which may limit the ability of program administrators to adjust or modify programs based on implementation experience or market needs. If policymakers do find it necessary to “lock in” design upfront, they need a detailed understanding of the range of on-bill program design choices and the potential consequences of those choices in delivering cost-effective energy savings at scale.



oversight (e.g., rural electric cooperative, municipal utility, investor-owned utilities, power marketing authorities) as well as different entities acting as program administrators (e.g., utility, third party).

Scope and Limitations of this Report

It is important to note that we do not address the question of whether policymakers and program administrators *should* launch or continue operating on-bill loan programs. The answer to that question will be context-specific. Based on LBNL research (Fuller et al 2010; Zimring et al 2011; and Zimring et al 2013) and other studies, the up-front costs of energy improvements may be a hurdle for some consumers; however, financial products already exist in the private marketplace that enable many consumers to overcome this barrier. Allowing consumers to finance energy improvements on their utility bills is just one of several potentially valuable tools (e.g., mortgages, unsecured loans, leases, Property Assessed Clean Energy, etc.) for expanding access to capital.

Administrators also face difficult choices between allocating funds to financing or to other approaches designed to overcome other barriers to energy efficiency investments (e.g., rebates to participating consumers, technical assistance, or upstream incentives to energy services providers or retailers). Thus, robust assessments of financing's role in reducing energy use in buildings are necessary to help policymakers and program administrators make better choices about how to allocate limited resources to achieve energy efficiency at scale. We address key areas of uncertainty regarding what energy efficiency financing programs can reasonably be expected to achieve, and for whom, in *Getting the Biggest Bang for the Buck: Exploring the Rationales and Design Options for Energy Efficiency Financing Programs* (Zimring et al 2013).

Report Organization

In Chapter 2, we characterize the 30 on-bill programs that were reviewed, including summary data on key program features and results. In chapters three through six, we describe and discuss key program design considerations, relying primarily on the thirty programs to highlight key trends, lessons learned and trade-offs. Chapter 3 focuses on two design features that may impact on-bill participation and default trends: whether nonpayment can lead to the disconnection of energy service, and whether the on-bill charge is attached to the utility meter. Chapter 4 describes the various public and private capital sources that can be used to fund these financial products and the trade-offs between them. Chapter 5 provides an overview of underwriting criteria and their influence on program participation and financial product performance. Chapter 6 then reviews key program design features that affect eligible measures, and Chapter 7 summarizes key findings and conclusions. Appendix A includes 11 detailed case studies that summarize experiences of program administrators. Appendix B provides case studies of two on-bill programs that have been implemented in other countries (the United Kingdom and Canada).

The Landscape for On-Bill Energy Efficiency Financing Programs

Key Takeaways

- As of January 2014, on-bill programs are operating or preparing to launch in at least 25 states. In aggregate, the 30 on-bill programs in this report have delivered over \$1.8 billion of financing to consumers for energy improvements.
- Five program initiatives—Tennessee Valley Authority (TVA), Manitoba Hydro (MH), Alliant Energy Wisconsin, United Illuminating/Connecticut Light & Power (CT SBEA), and National Grid (NG)—account for over 90 percent of on-bill activity for programs in this study in terms of dollars loaned and number of participants.
- Twenty-two of the 30 on-bill programs included in this report (73 percent) are primarily focused on residential consumers.
- The market penetration rates for on-bill programs tend to be low. Ten of 17 residential on-bill programs report market penetration rates of less than 1 percent over their program lifetime while two long-running programs (12-13 years in the field) served 12-15% of their target market.
- Default rates over the program lifetime ranged from 0 to 3 percent for 16 residential programs that provided this information and from 0.57 percent to 2.90 percent for seven nonresidential programs. These average default rates are low compared to common types of unsecured consumer lending, which may range from mid-single digits to low double-digits.

Evolution of On-Bill Programs²³

Since their inception in the 1980s, on-bill programs have evolved as program administrator and policymaker objectives have shifted and market needs have changed.²⁴ We would highlight the following trends in the evolution of on-bill loan programs (and key objectives of policymakers and program administrators) over time:


- **Making Energy Efficiency Affordable.** When the first generation of on-bill programs was launched in the 1980s, interest rates were much higher than they are today. For example, mortgage interest rates reached the upper teens before settling into the seven to 10 percent range throughout that 1990s.²⁵ Interest rates on other financial products (e.g., unsecured consumer loans and credit cards) were even higher. In 2013, by comparison, 30-year conventional mortgage rates averaged just four percent.²⁶ Given high interest rates, the affordability of EE improvements—and financing to pay for them—was a key consideration for the policymakers and program administrators that launched the first generation of on-

²³The narrative in this section reflects the authors' perspective on the historical progression of on-bill program activity and may not universally represent policymaker and program administrator intent. The authors' benefitted from discussions with George Edgar on the historic evolution of on-bill programs.

²⁴ It is important to note that on-bill programs have developed at different times in various regions in response to local needs and objectives.

²⁵ Data from Board of Governors of the Federal Reserve System Historical Data on 30-year fixed rate conventional mortgages: <http://www.federalreserve.gov/releases/h15/data.htm> (Accessed April 6, 2014).

²⁶ Data from Board of Governors of the Federal Reserve System Historical Data on 30-year fixed rate conventional mortgages: <http://www.federalreserve.gov/releases/h15/data.htm> (Accessed April 6, 2014).



bill programs in the 1980s. This goal was reflected in low-interest, long-term loans to reduce the burden of regular debt service costs relative to energy savings.

- **Expanding Access.** In recent years, although interest rates have remained low, capital access has been demonstrably restricted as lenders tightened underwriting standards and consumers faced historic financial challenges.²⁷ In this context, some on-bill programs have been launched with the explicit intent of expanding access to capital among traditionally underserved populations (e.g., small businesses, middle income households). Policymakers and administrators have typically relied on the belief that private markets are inappropriately rationing credit for EE improvements²⁸ or the argument that on-bill has unique potential to drive improved loan repayment trends relative to off-bill financial products.
- **Driving Demand.** Some recently launched on-bill programs include specific provisions targeting a broader range of barriers to consumer adoption of efficiency (e.g., tenant-owner split incentives, balance sheet treatment of debt, long project payback periods) in addition to offering affordable, accessible financing. In this context, consumers that already have access to low-cost conventional loan products may be driven to adopt EE because on-bill programs might be more attractive or more convenient than other financial products.
- **Increasing Leverage of Program Funds.** The increased interest in on-bill programs is part of a broader trend among policymakers and program administrators in some states that are looking to tap into private capital in order to stretch the impact of limited program funds and encourage significant cost contributions by participating consumers. Recently, some on-bill programs have relied more heavily on private capital as utility funds for EE have become more constrained, given concerns about potential rate impacts in cases where utilities are expected to achieve aggressive savings goals (see Chapter 4: Selecting Sources of Capital where these trends are discussed in more detail).

On-Bill Programs: Overview

As of January 2014, on-bill programs are operating or preparing to launch in the United States in at least 25 states, as well as in Canada and the United Kingdom (see Figure 2-1). In aggregate, the 30 programs reviewed in this study have delivered over \$1.8 billion of financing to consumers for energy improvements (see Table 2-1).²⁹ In this chapter, we present key design elements of these programs and summarize program results: number of participants, loan volume, default rates, and estimates of cumulative market penetration over program lifetime.

²⁷See Office of Comptroller of Currency's Survey of Credit Underwriting Standards 2012. In 2009, for example, 86 percent of commercial tightened underwriting trends: <http://www.occ.gov/publications/publications-by-type/survey-credit-underwriting-practices-report/pub-survey-cred-under-2012.pdf>

²⁸See (Zimring et al 2013) for a detailed discussion of credit rationing.

²⁹Note that our sample is not an exhaustive list of all existing on-bill programs. The dollar value of loans over the life of programs (\$1.8B) is expressed in nominal dollars, due to data limitations. The cumulative dollar value of loans would be higher if expressed in terms of current (i.e., real) dollars.

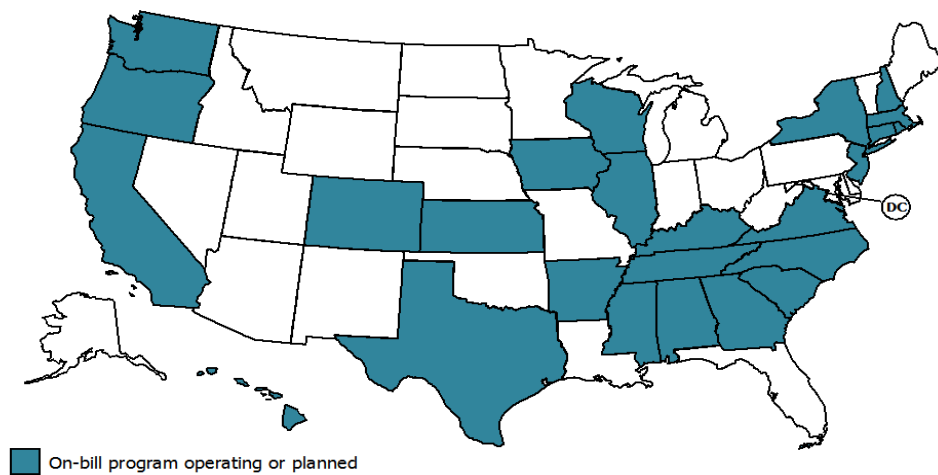


Figure 2-1. States with on-bill programs (shaded)

For ease of presentation, and because the importance of specific program design elements differs across consumer classes, we segment the 30 programs into those serving primarily residential (single & multi-family) consumers and those serving primarily non-residential consumers (commercial, industrial & institutional).

Table 2-1. Summary statistics for surveyed on-bill programs³⁰


Sector	Number of participants	Lifetime Loan Volume (nominal \$)	n =	Average Size of Loan	Median value and range of default rates	n =
Residential	182,324	\$1.055B	20	\$5,787	0.08% (0 to 3%)	15
Non-residential	50,339	\$775M	7	\$15,400	0.9% (0.6 to 2.9%)	7
Total	232,663	\$1.83B	27 ³¹	\$7,867		22 ³²

Twenty-two of the 30 programs (73 percent) targeted residential consumers and generated about 78 percent of overall financial product volume by number of loans to consumers and 58 percent of volume based on dollars

³⁰ Throughout this report, where sample size for summary statistics is less than 30, it is because programs either have not yet launched or have not provided sufficient data for a specific analysis.

³¹ Three programs discussed in this report (California’s emerging on-bill pilots, Hawaii’s emerging on-bill pilot and Oregon’s just-launched MPower pilot) are not included in the summary statistics because data was not available as of December 2013.

³² Default rates are not included either because programs have yet to launch (2), or have less than one year of data (5), or failed to provide data (1).



originated. On-bill programs offered by five administrators—Tennessee Valley Authority (TVA), Manitoba Hydro (MH), Alliant Energy Wisconsin, United Illuminating/Connecticut Light & Power (CT SBEA), and National Grid (NG)—account for over 90 percent of on-bill activity for programs included in this study in terms of both dollars loaned and number of participants (see Figure 2-3).³³

Figure 2-2 summarizes the operational history of these programs; 12 programs have five or more years of implementation experience, while 16 programs have been implemented since 2010 or are in the process of launching.

³³ Two of these initiatives are made up of multiple programs: MH's initiative includes four programs, and the CT SBEA is made up of initiatives that both CL&P and United Illuminating operate.

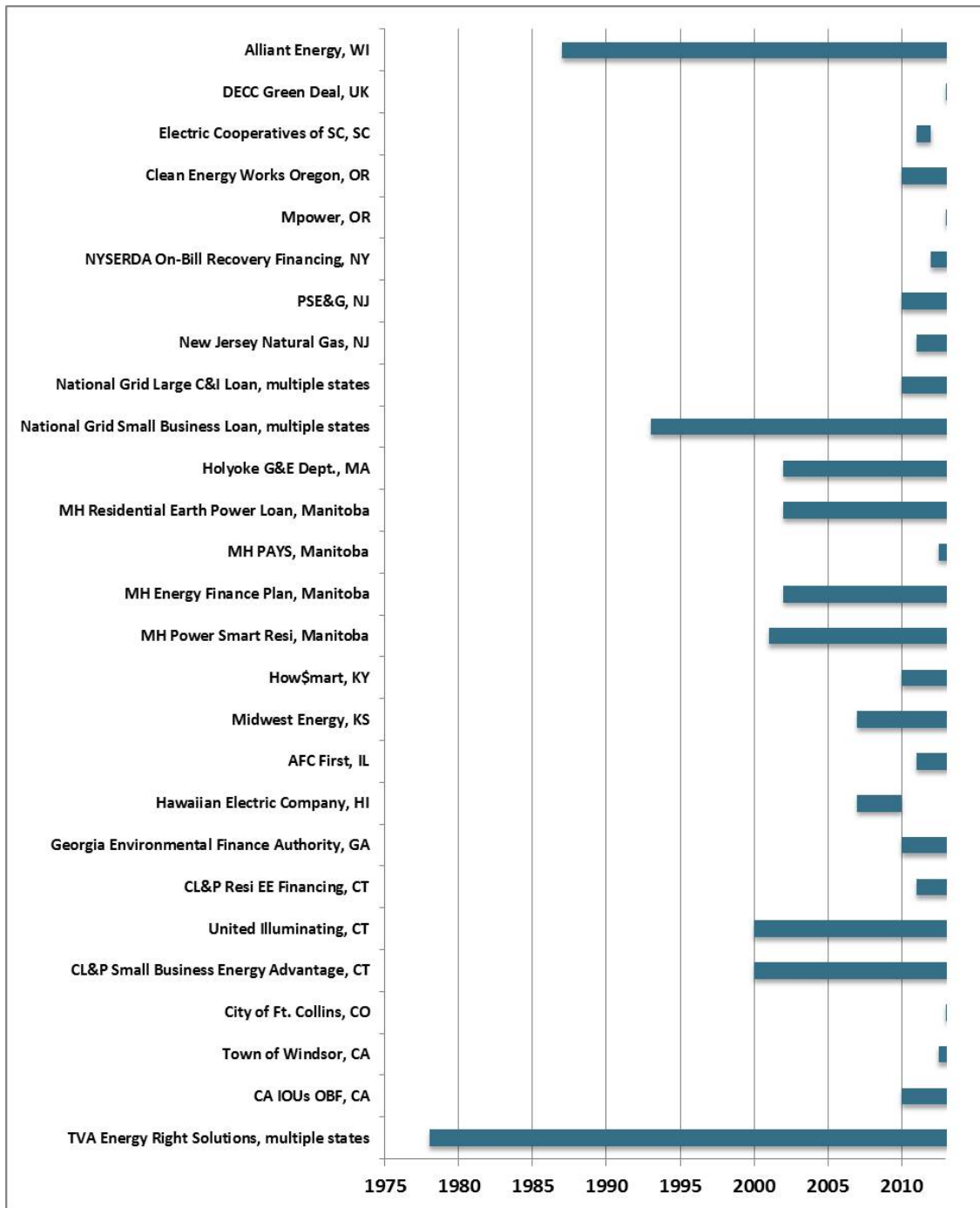


Figure 2-2. Operating history of on-bill programs in this report³⁴

³⁴ Programs that have not launched are excluded. Midwest Energy's initiative is treated as two programs in the data (residential and business sector) but are listed only once in the timeline.

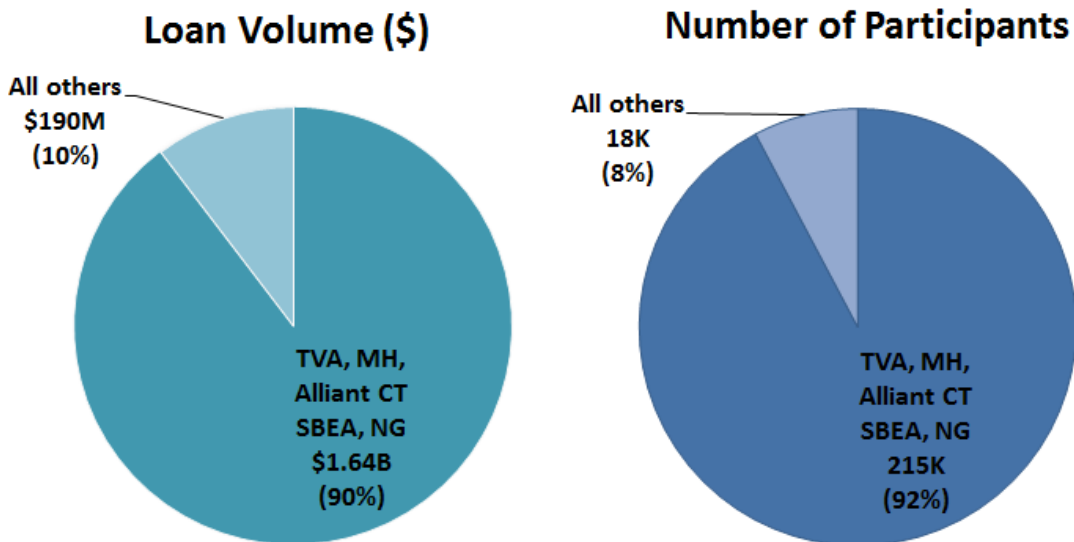


Figure 2-3. On Bill Finance Programs: Share of program volume by cumulative dollars loaned (left) and number of participants (right)

Target Sector

In the late 1970s, Tennessee Valley Authority offered one of the nation’s earliest on-bill financing programs, aimed at the residential sector. Since then, program administrators have targeted on-bill financing at multiple consumer classes (see Figure 2-4) and subsectors, such as small businesses. In recent years, though, most new programs have targeted the residential sector.


Non-residential programs tend to have longer operating histories than residential programs. For example, ~70 percent of residential on-bill programs in our sample were started in the last four years, while 75 percent of non-residential programs were implemented more than four years ago.

Residential Programs

Nine of the 22 residential programs are targeted only at single-family (four units or fewer) homeowners (see Table 2-2). Five programs allow multifamily property owners to participate, including two programs that are solely targeted to multifamily property owners and tenants (PSE&G Multi-family Housing Program and MPower Oregon). Four programs are targeted to both residential and small business consumers. Residential tenants are eligible to participate in seven programs.³⁵

The market penetration rates for on-bill programs tend to be low. The average age of residential on-bill financing programs included in this study is five years (see Table 2-2). Ten of 17 residential on-bill programs report market

³⁵ Programs that allow residential tenants to participate include Hawaii On-Bill Financing, Hawaiian Electric Solar Saver Program, Kansas How\$mart, How\$martKY, Manitoba Hydro Pay As You Save, NYSERDA On-Bill Financing Program, and Electric Cooperatives of South Carolina Help My House Pilot.



penetration rates of less than 1 percent over their program lifetime while two long-running programs (12-13 years in the field) served 12-15% of their target market (see Table 2-3).³⁶

The median cumulative penetration for residential on-bill programs that are five years old or less (11 programs) is 0.09 percent; for programs running longer than five years (six programs), it is 5.28 percent.

The average loan size is \$5787 for the 20 residential programs that provided this information. For on-bill programs that target single-family consumers, average loan size ranges from \$525 to \$16,810. In contrast, average loan size is \$800,000 for property owners participating in PSE&G's Multi-Family Housing Program.

The average lifetime default rate for 15 residential on-bill programs is 1.5% percent (ranging from zero percent to three percent).³⁷ These default rates are low compared to common types of unsecured consumer lending, which may range from mid-single digits to low double-digits.³⁸

³⁶ Seventeen of 22 residential programs provided data on number of participants during the program lifetime and target population so that we could calculate cumulative market penetration rate.

³⁷ Default rate represents the number of loans charged off as a percentage of all loans made.

³⁸ Appropriate comparison data on unsecured consumer lending default rates is difficult to identify. This range of estimates comes from several sources that include: (1) program administrators in New York and Pennsylvania that offer off-bill residential unsecured loan energy efficiency programs have indicated that default rates have been or are projected to be in the mid-to-high single digits; (2) 2011 data from Transunion suggests that delinquencies on residential debt could be as low as 4% (SEE Action 2011); and (3) 2014 Federal Reserve data suggests that charge-off rates for non-real estate consumer loans (assuming a seven year financial product lifetime to convert annual rates to lifetime rates) are approximately 14% (Federal Reserve Board 2014). Note: delinquencies may or may not become defaults, so comparing delinquency rates to default rates is not an apples-to-apples comparison.

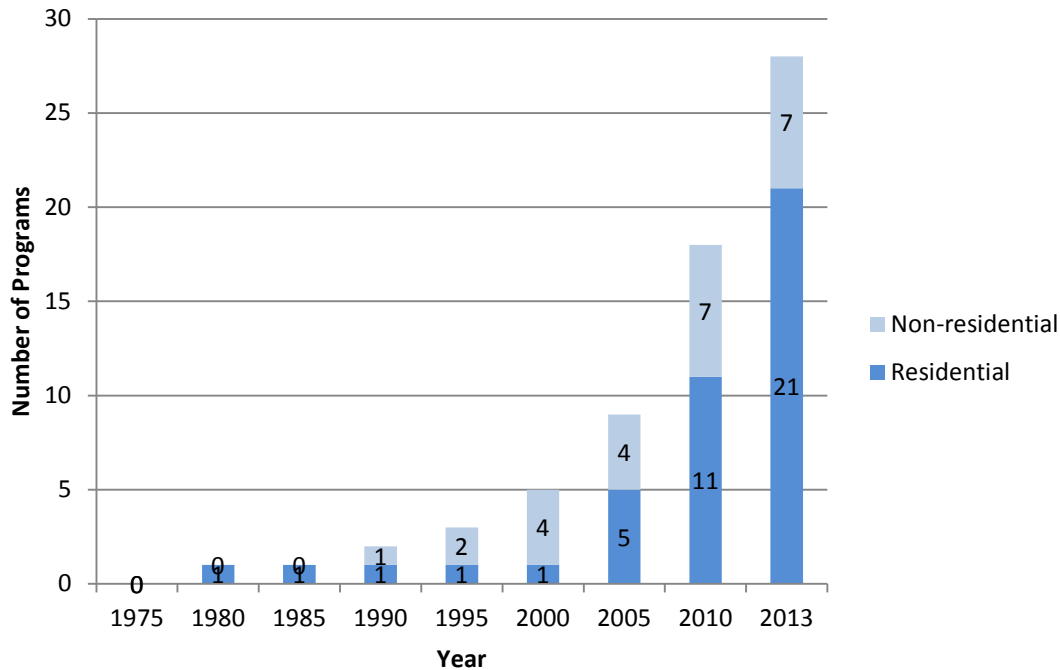


Figure 2-4. Primary target market for on-bill financing programs included in this study

Non-Residential Programs

Our sample of eight on-bill programs that target non-residential consumers includes two programs that have been offered since 2000 (United Illuminating and Connecticut Light and Power Small Business Energy Advantage) and two programs that started in the late 1980s/early 1990s (Alliant Energy Shared Savings and National Grid Small Business Loan Program) [see Table 2-4]. Two of the eight non-residential OBF programs are targeted exclusively at the hard-to-reach small business market, while the other six programs are offered to a broader range of non-residential consumers (e.g., large commercial, industrial, agricultural and institutional consumers).


Given their longer operating history, several programs have reached a significant number of non-residential consumers (19,000 to 20,000 consumers in CT and MA utility programs) and report high market penetration (e.g., 29% for United Illuminating Small Business program and 7% for Alliant’s program) [see Table 2-5].

The average loan size over the program lifetime ranged from about \$2,200 to \$8,000 for the four nonresidential programs that target small business consumers (see Table 2-5). Average loan size ranged between about \$32,000 to \$127,000 for the three other nonresidential programs that allow large C/I consumers to participate. The average default rate over the program lifetime ranged from 0.57 percent to 2.90 percent for the seven nonresidential programs that provided this information.

Table 2-2. Overview of on-bill financing programs targeted primarily on to the residential sector.

Program Name (Administrator)	Location	Launch Date-End Date (if applicable)	Primary Eligible Consumers*	Source of Capital (Cost of capital if available) ³⁹
Energy Right Solutions (Tennessee Valley Authority)	AL, GA, KY, MS, NC, TN, VA	1978	Residential homeowners	Private lender
Windsor Efficiency PAYS (Town of Windsor, CA)	Windsor, CA	2012	Single family homeowners and multifamily property owners	Town’s general capital replacement fund
Ft. Collins Utilities Residential On-Bill Financing Program (City of Ft. Collins, CO)	Ft. Collins, CO	2013	Single family homeowners	Utility reserve funds
Residential Energy Efficiency Financing Program (CL&P)	CT	2011	Single family homeowners	Utility ratepayers
Georgia Environmental Finance Authority (GEFA) Residential Loan Program (GEFA and three utility association groups)	GA	2010	Single family homeowners	Public—American Recovery and Redevelopment Act (ARRA)—grant money and private capital
Hawaii On-Bill Financing (Hawaii Energy, utilities and finance program administrator now being selected.)	HI	2014	Residential homeowners and tenants, commercial consumers	Private lender
Solar Saver Program (Hawaiian Electric Company)	HI	2007-2010	Single family homeowners and tenants	Utility funds (9.9%)
Illinois Energy Efficiency Loan Program (AFC First Financial)	IL	2011	Single family homeowners and multifamily property owners	Private lender

³⁹Source of capital is addressed in detail in Chapter 4.



Program Name (Administrator)	Location	Launch Date-End Date (if applicable)	Primary Eligible Consumers*	Source of Capital (Cost of capital if available) ³⁹
Kansas How\$mart (Midwest Energy)	KS	2007	Single family homeowners and tenants, multifamily property owners and commercial consumers	Utility funds (1.5%) and public grants
How\$mart, KY (Mountain Association for Community Economic Development)	KY	2010	Residential homeowners and tenants, commercial consumers	CDFI Fund (U.S. Treasury) and Foundation PRIs
Power Smart Residential Loan (Manitoba Hydro (MH))	Manitoba, Canada	2001	Residential homeowners	Utility funds
Energy Finance Plan (MH)	Manitoba, Canada	2002	Residential homeowners, non-residential consumers	Utility funds
Pay As You Save program (MH)	Manitoba, Canada	2012	Residential homeowners and tenants	Utility funds
Residential Earth Power Loan Program (MH)	Manitoba, Canada	2002	Residential homeowners	Utility funds
Residential Energy Conservation Program (Holyoke Gas & Electric Dept.)	Holyoke, MA	2002	Single family homeowners	Utility funds
Multi-family Housing Program (Public Service Electric and Gas Company)	NJ	2010	Multifamily property owners	Utility funds
SaveGreen Project (New Jersey Natural Gas)	NJ	2011	Single family homeowners	Shareholder funds (6.9%)
On-Bill Recovery Financing Program	NY	2012	Single family homeowners and	Regional Greenhouse Gas Initiative Funds



Program Name (Administrator)	Location	Launch Date-End Date (if applicable)	Primary Eligible Consumers*	Source of Capital (Cost of capital if available) ³⁹
(NYSERDA)			tenants, commercial consumers	
Clean Energy Works Oregon (CEWO) (CEWO, Craft3)	OR	2010	Single family homeowners	Private lender
Mpower Oregon (Craft3, Energy Trust of Oregon)	OR	2013	Multifamily property owners	HUD grant & private lender
Help My House Pilot (Electric Cooperatives of South Carolina)	SC	2011-2012	Single family homeowners and tenants	Internal funds, USDA loan
Green Deal sFinance (Department of Energy and Climate Change)	United Kingdom	2013	Residential homeowners	The Green Deal Finance Company

*'Residential' indicates no further specificity about what types of property are eligible to participate.

Table 2-3. On-bill residential financing programs: participation,⁴⁰ loan volume, and default rates⁴¹

Program Name (Administrator)	Loan Volume Over Program Lifetime				Loan Volume in 2012		
	Number of Participants (% of Consumers in Targeted Sector) ⁴²	Amount (\$) Financed	Average Loan Size (\$)	Default Rate	Number of Participants (% of Consumers in Targeted Sector)	Amount Financed (\$)	Average Loan Size (\$)
Energy Right Solutions (Tennessee Valley Authority)	~77,000 (2.03%)	~\$500,000,000	~\$6,500	~3%	6173 (0.16%)	\$44,500,000	\$7,209
Windsor Efficiency PAYS (Town of Windsor, CA)	328 (3.50%)	\$172,338	\$525	0.75%	162 (1.73%)	\$83,808	\$517
Ft. Collins Utilities Residential On-Bill Financing Program (City of Ft. Collins, CO)	3 (0.01%)	\$24,600	\$8,200	NR	NA ⁴³ (NA)	NA	NA
Residential Energy Efficiency Financing Program (CL&P)	740 (0.07%)	\$4,900,000	\$6,622	0.00%	340 (0.03%)	\$2,300,000	\$6,764
Georgia Environmental Finance Authority (GEFA) Residential	3811 (NA)	\$17,700,000	\$4,644	0.08%	NA (NA)	NR	NR

⁴⁰ For the purposes of this report, we assume that the number of on-bill loans is the same as the number of participants (i.e., each participant takes out just one loan).


⁴¹ NA: Not applicable; NR: Not reported

⁴² Percentages for market penetration were either provided by the program administrator or estimated by dividing the number of loans (cumulative and 2012 only) by the number of consumers in the targeted sector in 2012. This calculation is premised on the assumption that each loan represents a single participant.

⁴³ Launched in 2013.

Program Name (Administrator)	Loan Volume Over Program Lifetime				Loan Volume in 2012		
	Number of Participants (% of Consumers in Targeted Sector) ⁴²	Amount (\$) Financed	Average Loan Size (\$)	Default Rate	Number of Participants (% of Consumers in Targeted Sector)	Amount Financed (\$)	Average Loan Size (\$)
Loan Program (GEFA and multiple utility association groups)							
Hawaii On-Bill Financing (Hawaii Energy, utilities and TBD finance administrator)	NA ⁴⁴ (NA)	NA	NA	NA	NA (NA)	NA	NA
Solar Saver Program (Hawaiian Electric Company)	540 (0.2%)	\$3,000,000	\$5,556	0.37%	NA (NA)	NA	NA
Illinois Energy Efficiency Loan Program (AFC First Financial)	1318 (0.03%)	\$6,500,000	\$4,932	0.00%	490 (0.01%)	\$2,175,144	\$4,439
Kansas How\$mart (Midwest Energy)	989 (1.40%)	\$5,934,000	\$6,000	0.90%	168 (0.24%)	\$957,600	\$5,700
How\$mart, KY (Mountain Association for Community Economic Development)	127 (0.12%)	\$711,476	\$5,602	NR	84 (0.08%)	\$484,436	\$5,767
Power Smart Residential Loan (Manitoba)	70358 (15%)	\$290,419,984	\$4,128	0.48%	6202 (1.32%)	\$28,940,000	\$4,666

⁴⁴Not yet launched as of December 2013.



Program Name (Administrator)	Loan Volume Over Program Lifetime				Loan Volume in 2012		
	Number of Participants (% of Consumers in Targeted Sector) ⁴²	Amount (\$) Financed	Average Loan Size (\$)	Default Rate	Number of Participants (% of Consumers in Targeted Sector)	Amount Financed (\$)	Average Loan Size (\$)
Hydro (MH))							
Energy Finance Plan (MH)	16781 (3.65%)	\$41,346,680	\$2,464	0.20%	1983 (0.43%)	\$5,461,460	\$2,754
Pay As You Save program (MH)	52 (0.01%)	\$224,947	\$4,326	NR	NA ⁴⁵ (NA)	NA	NA
Residential Earth Power Loan Program (MH)	1160 (0.25%)	\$19,500,000	\$16,810	0.00%	24 (0.01%)	\$474,408	\$19,767
Residential Energy Conservation Program (Holyoke Gas & Electric Dept.)	2100 (12%)	\$10,500,000	\$5,000	0.00%	208 (1.19%)	\$1,000,000	\$4,808
Multi-family Housing Program (Public Service Electric and Gas Company)	36 (NA)	\$28,810,000	\$800,278	0.00%	10 (NA)	\$10,990,000	\$1,099,000
SaveGreen Project (New Jersey Natural Gas)	1945 (0.42%)	\$17,950,000	\$9,229	0.05%	721 (0.16%)	\$6,650,000	\$9,223
On-Bill Recovery Financing Program (NYSERDA)	1096 (<0.1%)	\$11,500,000	\$10,493	0.50%	473 (0.04%)	\$4,900,000	\$10,359

⁴⁵Launched in late 2012.



Program Name (Administrator)	Loan Volume Over Program Lifetime				Loan Volume in 2012		
	Number of Participants (% of Consumers in Targeted Sector) ⁴²	Amount (\$) Financed	Average Loan Size (\$)	Default Rate	Number of Participants (% of Consumers in Targeted Sector)	Amount Financed (\$)	Average Loan Size (\$)
Clean Energy Works Oregon (CEWO) (CEWO, Craft3)	2300 (0.40%)	\$30,000,000	\$13,043	0.90%	1092 (0.19%)	\$14,800,000	\$13,553
Mpower Oregon (Craft3, Energy Trust of Oregon)	NA ⁴⁶ (NA)	NA	NA	NA	NA (NA)	NA	NA
Help My House Pilot (Electric Cooperatives of South Carolina)	125 (<0.1%)	\$968,000	\$7,744	0.00%	NA (NA)	NA	NA
Green Deal Finance (Department of Energy and Climate Change)	1,173 (NA)	\$7,200,000	\$6,138	NR	NA (NA)	NA	NA

⁴⁶Launched in late 2013 and no data available as of writing of this report.

Table 2-4. Overview of non-residential-focused on-bill financing programs

Program Name (Administrator)	Location	Launch Date-End Date (if applicable)	Primary Eligible Consumers	Source of Capital (Cost of capital if available)
On-Bill Financing Program (California Investor-Owned Utilities (IOUs))	CA	2010	Commercial and institutional consumers	Utility ratepayer funds
On-Bill Repayment Pilot (CA IOUs)	CA	2014	Commercial, institutional and residential consumers	Private lenders
Small Business Energy Advantage (Connecticut Light & Power (CL&P))	CT	2000	Owner-occupied small business	Utility funds (10.95%)
Small Business Energy Advantage (United Illuminating)	CT	2000	Commercial and industrial consumers with annual peak demand between 10kW & 200kW	Utility funds (6.4%)
Kansas HowSmart (Midwest Energy)	KS	2007	Non-residential (including small business) owners & tenants	Utility funds and public grants
Large C&I Loan (National Grid)	MA, RI	2010	Large commercial & industrial	Utility & ratepayer funds
Small Business Loan Program (National Grid)	MA, NY, RI	1993	Small business	Utility & ratepayer funds
Shared Savings Wisconsin (Alliant Energy)	WI	1987-2013	Commercial & industrial	Shareholder funds (8.2%)

Table 2-5. On-bill non-residential financing programs: participation,⁴⁷ loan volume, and default rates⁴⁸

Program Name (Administrator)	Loan Volume Over Program Lifetime				Loan Volume in 2012		
	# of Participants (%of Consumers in Targeted Sector)	Amount (\$) Financed	Average Loan Size (\$)	Default Rate	# of Participants (%of Consumers in Targeted Sector)	Amount (\$) Financed	Average Loan Size (\$)
On-Bill Financing Program (California Investor-Owned Utilities(IOUs))	1374 (0.01%)	\$43,675,596	\$31,787	0.57%	451 (0.004%)	\$18,754,886	\$41,585 (NA)
On-Bill Repayment Pilot (CA IOUs)	NA ⁴⁹ (NA)	NA	NA	NA	NA (NA)	NA	NA
Small Business Energy Advantage (Connecticut Light & Power (CL&P))	19500 (NA)	\$99,000,000	\$5,077	0.90%	1500 (NA)	\$11,800,000	\$7,867
Small Business Energy Advantage (United Illuminating)	4900 (28.9%)	\$39,000,000	\$7,959	0.90%	302 (1.78%)	\$4,000,000	\$13,245
Kansas How\$mart (Midwest Energy)	25 (NA)	\$195,000	\$7,800	0.90%	8 (NA)	\$58,400	\$7,300
Large C&I Loan (National Grid)	400 (NA)	\$25,000,000	\$62,500	2.90%	154 (NA)	\$10,000,000	\$64,935
Small Business Loan Program (National Grid)	20000 (NA)	\$44,081,633*	\$2,204	2.90%	9800 (NA)	\$21,600,000	\$2,204

⁴⁷ We assume that the number of on-bill loans is the same as the number of participants (i.e., each participant takes out just one loan).

⁴⁸ NA: Not applicable; NR: Not reported)

⁴⁹ Not yet launched as of December 2013.



Program Name (Administrator)	Loan Volume Over Program Lifetime				Loan Volume in 2012		
	# of Participants (%of Consumers in Targeted Sector)	Amount (\$) Financed	Average Loan Size (\$)	Default Rate	# of Participants (%of Consumers in Targeted Sector)	Amount (\$) Financed	Average Loan Size (\$)
Shared Savings Wisconsin (Alliant Energy)	4140 (6.90%)	\$524,250,000	\$126,630	2.68%	9 (0.02%)	\$392,998	\$43,666

Disconnection and Meter Attachment⁵⁰

Key Takeaways

- There are three types of on-bill products, which differ by their disconnection and meter attachment features: line item billing, on-bill loans (or leases) with disconnection, and on-bill tariffs. Almost all (99 percent) of on-bill program volume has been through programs using line-item billing or on-bill loans with disconnection, though on-bill tariffs are a newer innovation.
- Disconnection and meter attachment have uncertain impacts on participant default rates. Our comparison of existing on-bill programs yielded no causative association between a program's security and participant default rates.
- However, the choice of on-bill product may have important impacts on a program's ability to overcome other barriers to consumer investments in efficiency, including: long project paybacks, tenant-owner split incentives, and balance sheet treatment of on-bill debt.

One key to the value of on-bill financing in delivering attractive (e.g., lower interest rate, longer loan term), accessible capital is the potential consequences of failing to repay the on-bill financial product. Financial products repaid on a consumer's utility bill can take many forms and can be divided into three categories:

- **Line Item Billing (LIB)—no disconnection, no meter attachment.** The utility bill is simply used as a tool for participating consumers to make payments. In the event that a participant fails to make principal and interest payments, financing charges are typically written off or removed from the utility bill, and financial institutions or the utility are free to seek recourse unrelated to a participant's utility service based on the terms of their contract with the consumer.
- **On-Bill Loan (or Lease) with Disconnection—disconnection allowed, no meter attachment.** On-bill loans with disconnection rights are treated as debt of the consumer. A broad range of financial products (e.g., unsecured loans, leases) may be re-paid on the consumer's bill and the threat of utility service termination may act as an inducement for the consumer to repay the loan. In the event that a participating consumer fails to make financing payments, utilities typically use their normal collection protocols for utility bill delinquency, which may ultimately result in service termination.⁵¹
- **On-Bill Tariff—disconnection allowed, meter attached.**⁵² An on-bill tariff is a charge that is associated with the utility meter rather than a debt of the consumer or property. The tariff structure is similar to an on-bill loan with disconnection in that non-payment of financing charges may lead to utility service termination. However, tying the charge to the utility meter is specifically designed to accomplish three key objectives: (1) automatic transfer of the tariff between consumers; (2) survival in foreclosure of a first mortgage on the property; and (3) off-balance sheet treatment for non-residential participants. This

⁵⁰In financing, "secured" lending typically refers specifically to a lender's claim on defined real property or assets. For example, the security for a mortgage is the property itself, which a mortgage holder may take ownership of in the event that a borrower fails to repay the mortgage. In this report, when we use the term 'security' it refers more broadly to the set of remedies that a financial institution has at its disposal in the event that a consumer fails to repay a financial product, such as termination of a consumer's utility service.

⁵¹In some cases, on-bill loan payments are subordinated to other charges on a consumer's utility bill. See "On-Bill Financing Charge Payment Priority" section for more information on protocols should on-bill participants make partial payments of their utility bills.

⁵²It is important to differentiate the definition of tariff for the purposes of this report from the definition of tariff often used in utility regulatory proceedings. For the purpose of this report, a tariff is defined as a charge that is undifferentiated from any other utility bill charge. In utility regulatory proceedings, tariffs are often used by utilities and their regulators to specify the rate and terms and conditions of consumer service, regardless of whether those terms and conditions involve differential treatment of an on-bill financial product from other utility bill charges.

structure is a relatively recent innovation and is being hailed by some as a “game changer” because of its potential to deliver robust security and overcome a range of barriers to EE beyond up-front costs. However, uncertainty remains about the extent to which the structure will effectively achieve the three objectives described above—and what impacts a tariff will have on consumer adoption.

Table 3-1 summarizes key features and differences among these three types of on-bill products, which are discussed in more detail in the discussion section of this chapter.

Table 3-1. Key features and differences among on-bill financial products

Feature	Line-Item Billing	On-Bill Loan w/ disconnection	On-Bill Tariff
Debt of Utility Meter or Consumer/Property?	Consumer/Property	Consumer/Property	Meter
Consequences of On-Bill Financial Product Non-Payment	No Threat of Utility Service Disconnection	Utility Service Disconnection	Utility Service Disconnection
Survives Bankruptcy/Foreclosure?	No	Unlikely	Maybe
Transferable?	Yes, with consent (if program rules allow)	Yes, with consent (if program rules allow)	Yes, automatic
Garners Off-Balance Sheet Treatment?	No	Maybe	Maybe

Of the 30 programs in this report, 10 offer line-item billing, 13 offer on-bill loans with disconnection, and seven offer on-bill tariffs (see Figure 3-1). Nearly all on-bill financing (99 percent by dollar amount and 77 percent by number of programs) has taken place through programs using line item billing or on-bill loans with disconnection. However, on-bill tariffs are relatively new and could expand in coming years.

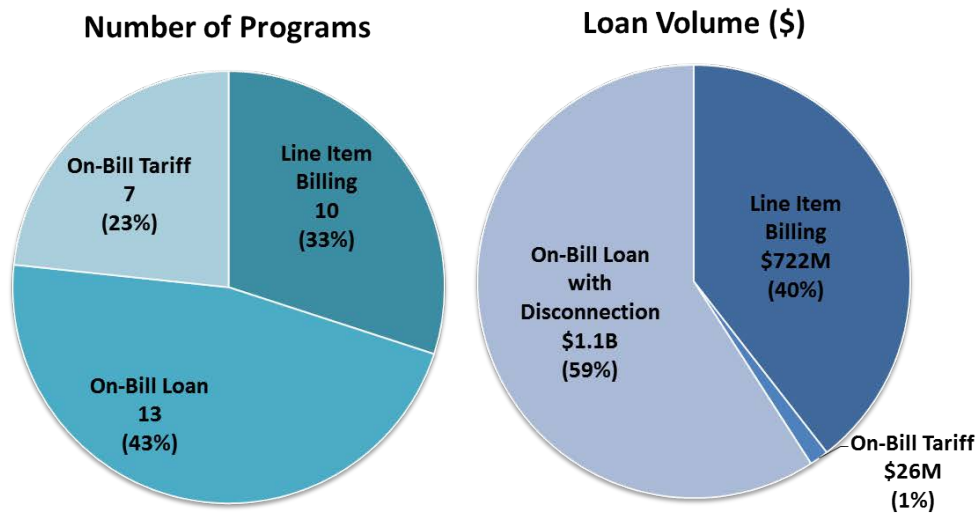


Figure 3-1. On-bill financing products, by number of programs (left) and lifetime loan volume in dollars (right)⁵³

Discussion: Key Considerations

This section highlights several key considerations for policymakers and program administrators when choosing disconnection and/or meter attachment as design features:


- On-bill's flexibility to accommodate multiple sources of security;
- Uncertainty about the value of the threat of utilities disconnection in driving low on-bill participant default rates;
- The potential for on-bill tariffs to solve multiple barriers to EE adoption in addition to the up-front cost barrier; and
- Who gets paid first in the event that a consumer only makes a partial payment of their utility bill.

Repaying Energy Efficiency Financing On-Bill: A Flexible Tool for Reducing Participant Defaults?

A range of traditional financial products (e.g., unsecured loans, mortgages, leases) can be repaid on-bill, using the threat of utilities disconnection as the primary (or one of several sources of) recourse in the event of participant default.⁵⁴ Almost half of the 30 programs analyzed for this report can disconnect energy service in the case of default. For example, if participants in the Illinois Energy Efficiency Loan (IEEL) residential on-bill program (which is

⁵³ Alliant's Shared Savings Wisconsin and PSE&G's Multi-family Housing Program have large average loan sizes (PSE&G's average loan was over \$1M and Alliant's was more than \$43K in 2012) that cause a significant difference between the percentage volume done by number of loans and the percentage volume done by dollar amount of loans.

⁵⁴ It is worth noting that consumer and corporate lending secured by neither specific assets nor the threat of utilities service disconnection for non-payment of debt service obligations still includes substantial inducements for borrowers to make payments. For example, the potential negative impacts of loan default or delinquency on corporate credit reports or consumer credit scores can be a powerful driver of loan repayment. In this report, we focus on the unique potential repayment trend impacts that may be attributable to different on-bill financial products.



operated across the territories of five utilities in the state) fail to make on-bill loan payments, the same processes and consumer protections are triggered as non-payment of any other utility bill charge, which may ultimately lead to service termination (see Appendix A for a case study on the IEEL program). In California, non-residential on-bill pilots will enable participants to finance leases on the utility bill. The underlying security for a lease is typically the financial institution's right to reclaim leased equipment should the participant fail to make lease payments. Thus, financial institutions will be able to rely on two sources of "security" for on-bill leases: (1) the threat of utilities disconnection; and (2) the right to reclaim installed equipment should participants fail to make financing payments (see Appendix A for a case study on the CA on-bill pilots).

What is the Threat of Utilities Disconnection Worth?

In practice, the threat of utilities disconnection has uncertain benefit in terms of reducing consumer default rates. Consumers may not differentiate between the financial product charge and other utility charges, regardless of possibility of disconnection, which may result in default rates similar to general utility non-payment rates. In comparing existing on-bill programs, we found that programs allowing utility service disconnection tend to have slightly higher average participant default rates (1.69% for programs that allow disconnection, 1.05% for those that don't). However, there are many other program characteristics, program design factors and attributes of a program's target consumer segment that contribute to default rates. Due to these other influences we do not believe it is appropriate to draw conclusions regarding differences in these default rates. All on-bill programs reviewed in this report have experienced low default rates.

Adam Zimmerman, executive vice president at Craft3 (a Community Development Financial Institution that partnered with the Clean Energy Works Oregon residential on-bill line item billing program), suggested that the potential for utility service disconnection would only be a minor credit/risk management tool since disconnection for non-payment of utility charges takes so long that Craft3 would have already written the loan off or removed the loan from the consumer's utility bill and addressed it through their standard loan collection processes by the time shut-off became available as a potential default remedy (see Appendix A for a case study on CEWO's on-bill program).⁵⁵

One key consideration for programs seeking to rely on private capital to fund on-bill programs is the potential importance of disconnection in supporting access to secondary markets.⁵⁶ Rating agencies play a key role in enabling primary issuers to access secondary markets as these agencies rate the credit quality (i.e., likelihood of repayment) of pools of loans. Many investors (e.g., institutional investors) require that pools of loans (or financial products supported by these loan pools) be rated. Rating agencies rely on the historical performance of comparable financial products to assess the credit quality of loan pools, and the presence of the threat of disconnection may be a key factor in a rating agency's choice of "comparables" and, ultimately, the attractiveness of an on-bill loan portfolio to investors. Uncollectable charges on consumer utility bills tend to be extremely low (relative to losses on unsecured consumer loans) so program administrators strongly prefer that rating agencies rely on historic utility bill repayment trends rather than unsecured consumer loan performance as comparables for on-bill loan performance. However, in order for rating agencies to do so, they need to have confidence that on-bill loans will experience similar repayment trends to all other utility charges. Advocates for including the threat of disconnection have argued that this feature is essential to convincing rating agencies to use utility bill repayment history in their risk analyses. Some proponents have gone further, arguing that the on-bill charge levied to fund EE improvements must be structured as a tariff which is undifferentiated from all other utility bill charges (see chapter 4 for additional discussion).

⁵⁵ Some programs have quicker disconnection processes. In Connecticut, for example, cutoff could be as fast as 45 days and, for United Illuminating's (UI) consumers, power can be shut-off remotely (see Appendix A for a case study on UI's Small Business Energy Advantage loan program).

⁵⁶ The re-sale of financial products is known as a "secondary" sale as the primary sale is the financial institution or utility's origination of the financial product to the consumer. Secondary markets are those markets whereby loans or pools of loans are re-sold from the primary issuer to secondary purchasers



Are On-Bill Tariffs a “Game Changer”?

In 2012, programs that rely on the on-bill tariff structure originated just \$6 million in financing—just over three percent of all on-bill financing that year (see Figure 3-1). However, this structure is a relatively recent innovation that has been promoted to program administrators and policymakers. Of the seven programs offering on-bill tariffs, five have launched since 2009. On-bill tariffs are being hailed by some as a “game changer” because of their potential to deliver extremely low losses and overcome a range of other potential barriers to EE adoption. The three key potential benefits of tariffs are:⁵⁷

- A. Transfer between consumers automatically
- B. Survive foreclosure
- C. Potential off-balance sheet treatment (for non-residential participants)

A. Automatic Transfer between Consumers


Energy-related improvements (particularly those multi-measure improvements that achieve deep energy savings) often have higher first costs than conventional improvements. Over the life of these improvements, the value of the energy savings is often comparable to or exceeds the difference in first costs. However, this payback period can be long and may exceed the consumer’s expected ownership of, or tenancy in, a property. The long payback barrier may be particularly acute in tenant-occupied buildings. The on-bill tariff features automatic transferability by which the obligation to repay the balance of the tariff must be accepted by a subsequent owner or tenant as a condition of that consumer setting up a utility service account at a meter encumbered with this type of charge. In contrast, line item billing and on-bill loans with disconnection may feature transferability at the mutual agreement of the outgoing and incoming property owner or tenant. By automatically transferring an on-bill charge to subsequent consumers (i.e., the charge “stays with the meter”), transferability may help overcome the “long project payback” barrier for owners and tenants because consumers may have increased confidence that they will only be responsible for making charge payments while they are occupying the property and benefiting from the improvements.

In the United Kingdom (UK), Green Deal Plans, which are repaid on participants’ electric bills, are automatically transferrable from one building occupant to the next. There is a requirement for the outgoing occupant/landlord to disclose the charge, but consent of the home purchaser or subsequent tenant is not required. Automatic transferability was a major priority for program developers in overcoming long payback times for some efficiency measures as the UK recently passed legislation that requires all privately-owned rental properties in the UK to have an Energy Performance Certificate rating of D (on an A to G scale) or higher by 2016 (see Appendix B for a case study on the UK’s Green Deal).⁵⁸

The value of automatic transferability—and transferability in general—as a program feature remains uncertain and is based on the assumption that subsequent tenants/owners will value the improvements, for which they are being asked to assume the obligation to make charge payments. In the event that subsequent owners (or tenants) do not value these improvements, one could reasonably assume that they will simply reduce the amount that they are willing to pay to purchase (or rent) a property or force the outgoing property owner/tenant to clear the tariff (i.e., pay the balance) as a condition of a property sale or lease. In fact, it has been argued that in transactions financed by a conventional residential mortgage, lenders are likely to treat outstanding on-bill obligations as an obligation to be cleared before a property is transferred rather than a routine utility bill for electricity or gas service

⁵⁷In Georgia, the tariff structure had an additional benefit beyond these three features. Electric Cities of Georgia (ECG), an organization that assists city-owned electric and gas distribution utilities in the state, structured its on-bill offering as a tariff (debt of the utility meter rather than the consumer) to avoid violating a Georgia law that prohibits public entities from making loans to their citizens (see Appendix A for a case study on ECG and other on-bill programs in Georgia that are supported by the Georgia Environmental Finance Authority).

⁵⁸ Further legislation will be required to enforce this requirement.



(Henderson 2013). It is important for on-bill programs that feature automatic or optional transferability to track data on transfer activity in order to better assess the value of transferability.

B. Survive Foreclosure

“Keeping the lights on” is essential to non-residential consumer businesses and to household well-being. Non-payment of utility bills is often correlated to financial distress. In instances of financial distress, the threat of utility service disconnection may not deliver substantial increases in repayment rates for on-bill financial products because threatening to shut off the power of a consumer that is going out of business or without sufficient household income to pay their current utility bills is unlikely to spur a change in that consumer’s behavior.⁵⁹ Some have argued that, for on-bill to deliver meaningful improvements in consumer access to attractive capital, it must—like other utility charges—survive these instances of consumer financial distress (which often result in lender foreclosure on a property) and be automatically assumed by a subsequent property owner or their tenant. While the security enhancement to the utility or lender of the on-bill obligation surviving foreclosure is clear, this structure may raise risks for mortgage lenders, program administrators and policymakers. Even if a program is designed as an on-bill tariff and codified in state law or through decisions of public utility regulatory commissions, a bankruptcy court (or financial regulators) might find that the financial product more closely resembles a loan than a tariff. Should a bankruptcy court not permit the tariff to survive a foreclosure proceeding, the tariff’s practical benefits might be restricted.

Jeff Pitkin, Treasurer of the New York State Energy Research and Development Authority (NYSERDA), which operates a residential on-bill tariff program, acknowledged this risk. New York law states that the tariff structure survives property transfer, which could be interpreted to include transfer through bankruptcy. However, lawyers advised NYSEDA that bankruptcy courts could simply choose to discharge any on-bill arrears or could discharge the entire unpaid on-bill obligation.⁶⁰ As such, uncertainty remains about the ultimate credit enhancement that the tariff structure will provide to lenders and investors. Two of NYSEDA’s on-bill participants are in the early stages of bankruptcy, so some of this uncertainty may be resolved in coming months (see Appendix A for a case study on NYSEDA’s on-bill program).

In California, the Public Utilities Commission (CPUC), decided not to structure its on-bill program as a tariff. Two of the CPUC’s five guiding program design principles for its on-bill pilots are to ensure that “...the (on-bill) program does not run afoul of federal bankruptcy law (and) that the (on-bill) program does not run afoul of California property law” (see Appendix A for a case study on California’s on-bill pilots).


C. Potential Off-Balance Sheet Treatment

In the non-residential sector, the on-bill tariff structure may enable participants to treat the tariff as part of the utility service, which could be treated as an operating expense under standard accounting principles. This is also known as an “off-balance sheet” obligation, in contrast with “debt” which is part of a company’s balance sheet. “Off-balance sheet” treatment enables non-residential consumers to fund EE improvements without increasing their debt-to-equity ratio, a metric that is studied closely by investors and often capped by lenders.⁶¹

Whether a company treats any obligation as debt in its financials is complicated and subject to many considerations that are likely beyond the scope of a utility program. The Natural Resources Defense Council’s Philip Henderson argues that, “The determination of whether a charge is debt will likely be based upon the nature of the obligation itself and whether, for the customer, it has the attributes of debt. It is not likely to be affected by whether the utility or others label it a loan payment, debt, service charge, or tariff, but rather how it functions. The determination might also vary depending on the customer type, the terms of the on-bill program, and the terms of

⁵⁹Consumer protections from utility service termination are far more robust in the residential than non-residential sector, so this feature of the tariff structure is a particularly important consideration for non-residential on-bill programs.

⁶¹For more information on the advantages and disadvantages of off-balance sheet financing, consult an accounting professional.



any agreement between the building owner and other vendors involved. The standards on this subject are in flux and could change at any time.” (Henderson 2013).

Who Gets Paid First?

In the event that a participant in an on-bill program fails to make full repayment of all charges on their utility bill, one key technical (and practical) consideration for program administrators is “who gets paid first?” Specifically, in the event of a partial utility bill payment, does the on-bill financing charge get repaid before other utility charges are paid, or is the payment distributed “pro rata” (proportionally) across all charges, or is the on-bill financing charge subordinated (i.e., is collected after all other utility charges are paid in full)? The payment priority of the on-bill financial charge relative to other charges is particularly important for those programs that seek to access third party capital (see Chapter 4). Private investors will seek senior or pro rata treatment for repayment of the on-bill financing charge and may look unfavorably upon subordination of the financing charge relative to other charges.

Of the 13 programs that shared data on on-bill payment priority in the event of partial payments from participants, one pays the on-bill charge first, six treat the on-bill charge equally to all other charges (i.e., pro rata), and six subordinate the on-bill charge to other charges. It is worth noting that only one of the programs that subordinate the on-bill charge to other charges uses private capital.

In New York, state legislation specified that on-bill charges are subordinate to other utility charges for the New York State Research and Development Authority’s (NYSERDA’s) on-bill program in the event of consumer partial utility bill payment. To mitigate the threat of this subordination to private investors, the utilities are contractually obligated to treat underpayment of an on-bill charge in the same manner that they would treat underpayment of other utility charges, which may ultimately result in disconnection of a consumer’s power. In practice though, the subordination has raised an unforeseen challenge for program administrators. Consumers who have entered into deferred payment arrangements with the utility to avoid shutoff are allowed to access the on-bill program.⁶² However, since the on-bill charge is subordinated to utility service charges, all utility bill payments, including those intended to pay the on-bill charge, from these consumers are being applied to pay utility arrearages. NYSEDA’s policy is to charge off⁶³ loans once they are more than 120 days past due, so this is resulting in increased on-bill loan charge-offs (see Appendix A for a case study on NYSEDA’s on-bill program). This legislative specification and the challenges it has raised for NYSEDA highlight the importance of “getting it right” in legislation or providing program administrators sufficient flexibility to address unanticipated challenges and opportunities once a program has been launched.

⁶² Deferred payment arrangements are special payment plans whereby consumers make past-due payments over the course of one or more years while they also make current payments. These past-due payments are spaced out based on a consumer’s ability to pay.

⁶³The term charge-off refers to overdue on-bill financing payments that are deemed uncollectible and treated as losses by NYSEDA.



Selecting Sources of Capital

Key Takeaways

- On-Bill Financing (OBF) programs rely on public, utility shareholder, or utility bill-payer capital to fund financial products, while On-Bill Repayment (OBR) programs rely on non-utility private capital.
- OBF programs account for 62 percent of all on-bill activity based on dollar volume and typically offers program administrators the most flexibility to define program rules to meet program objectives but may come at the expense of achieving leverage.
- Most OBF volume (86 percent) has been funded with utility shareholder capital. This capital is typically lent at lower interest rates than those earned by the utilities, and these implicit “interest-rate buy-downs” can be expensive for utility bill-payers.
- There are multiple pathways to use private capital through OBR: (1) those through which program administrators fund on-bill financial products and then re-sell them to investors (warehouse model); (2) those through which program administrators raise private capital up-front to fund financial products; and (3) the open market approach, through which individual financial institutions or investors deliver capital directly to program participants. To date, almost all (99 percent) of OBR volume has been through the warehouse model.
- The first two OBR approaches (i.e., warehouse model and Program administrators raise capital upfront) have typically involved program administrators guaranteeing investors that they will be re-paid, regardless of whether participants make loan repayments.
- The Open market OBR approach may drive competition and innovation, but also requires significant up-front program investment in centralized infrastructure to facilitate the market, which raises risks for policymakers and administrators should loan volume be slow to materialize.

In addition to whether they include the threat of disconnection and are structured as loans or tariffs, on-bill programs are also typically differentiated into two basic categories, based on the source of capital used to fund financial products: On-Bill Financing (OBF) and On-Bill Repayment (OBR) (see Table 4-1 for definitions).⁶⁴ Of the 30 programs, two-thirds are OBF and 63 percent of total program volume by number of loans has been through OBF initiatives.

The terminology that is often used to describe and define OBF and OBR raises some definitional issues because utility shareholder capital is a form of private capital. We acknowledge that the diversity of programs and approaches does not lend itself easily to a simple typology. However, for the purposes of this report, we use the conventional definitions on the respective sources of capital for OBF and OBR that are described in Table 4-2.

⁶⁴ In chapters 1 to 3, we referred to the term “on-bill financing” broadly to include OBF and OBR financial products repaid by consumers on the utility bill; this chapter applies a more detailed typology that differentiates between OBF and OBR products.

Table 4-2. On-bill financing and on-bill repayment: Source of capital

Program Type	Source of Capital
On-Bill Financing (OBF)	Utility Shareholder, Utility Bill-payer or Public funds (e.g., taxpayer funds, greenhouse gas auction proceeds)
On-Bill Repayment (OBR)	Private Investors (e.g., financial institutions, foundations)

The definitions of OBF and OBR are solely a function of the source of capital. They are unrelated to the financial product’s underlying security—each enables program administrators and their financial partners to structure products as line item billing, on-bill loans with disconnection, or as on-bill tariffs (see Chapter 3 for definitions). Table 4-2 shows a breakdown of programs by type and source of capital, which are the two main categories used to describe and categorize on-bill programs for this report.

Table 4-3. On-bill product type and sources of capital for on-bill products

Underlying Security	Source of Capital	Number of Programs	Percent of 2012 On-Bill Volume (by number of Loans)
Line Item Billing	OBF	6	19%
	OBR	4	8%
On-Bill Loan with Disconnection	OBF	10	45%
	OBR	3	25%
On-Bill Tariff	OBF	5	3%
	OBR	2	0%

On-Bill Repayment: Alternative approaches for accessing private capital

We also characterize OBR programs into one of three basic models in order to capture the range of approaches to tapping into private capital that have been pursued in the United States and abroad: warehousing, up-front, or open market.⁶⁵ The first two models entail a substantial role for the program administrator in delivering capital to program participants, as they must lead the charge in tapping into private financial markets to source capital for program participants and perform underwriting and servicing (or outsource it) themselves. The third approach—open market—involves a smaller role for the program administrator as financial institutions lend capital directly to program participants.

Program Administrator Acts as Warehousing Entity

In the warehouse model, a program administrator uses utility shareholder, utility bill-payer and/or public capital to initially fund financial products (e.g., loans) in Phase One. They then aggregate these loans and sell them to a second investor or investors in Phase Two (see Figure 4-1), often with a credit enhancement to support the sale.

⁶⁵We acknowledge that other strategies are possible but focus on these three because the “warehousing” approach is the most common form of OBR among programs included in this study, raising private capital up front is getting substantial attention as Hawaii prepares its implementation, and the “open market” approach is being tested in Connecticut and California. Another model is for a utility to work with a single private capital provider, as is the case for Clean Energy Works of Oregon’s on-bill product offering, which uses capital from Craft3.

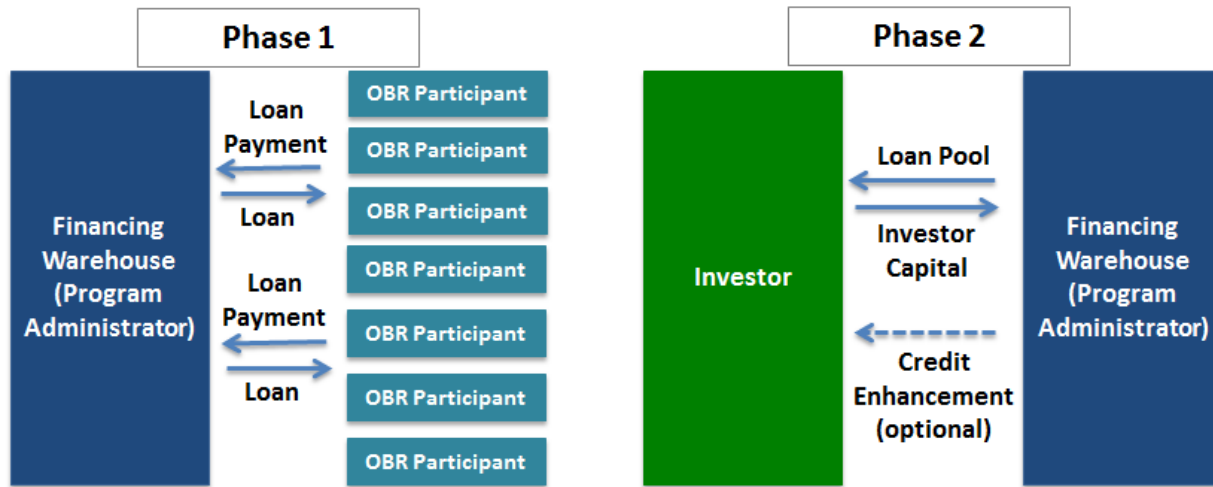


Figure 4-2. Illustrative example of the role of a program administrator in aggregating OBR financial products before re-selling them to investors

Program Administrator Raises Private Capital Up-front

In the up-front model, program administrators opt to raise capital from private investors up-front rather than initially funding loans with utility shareholder, utility bill-payer, or public capital (see Figure 4-2). In Phase 1, the program administrator issues a bond (or other financial contract) upfront, and investors provide capital that is then used to fund participant on-bill loans in Phase 2. This structure is very similar to the program administrator as warehouse model, but immediately brings in private capital and avoids the need for an initial pool of utility shareholder, utility bill-payer, or public capital.

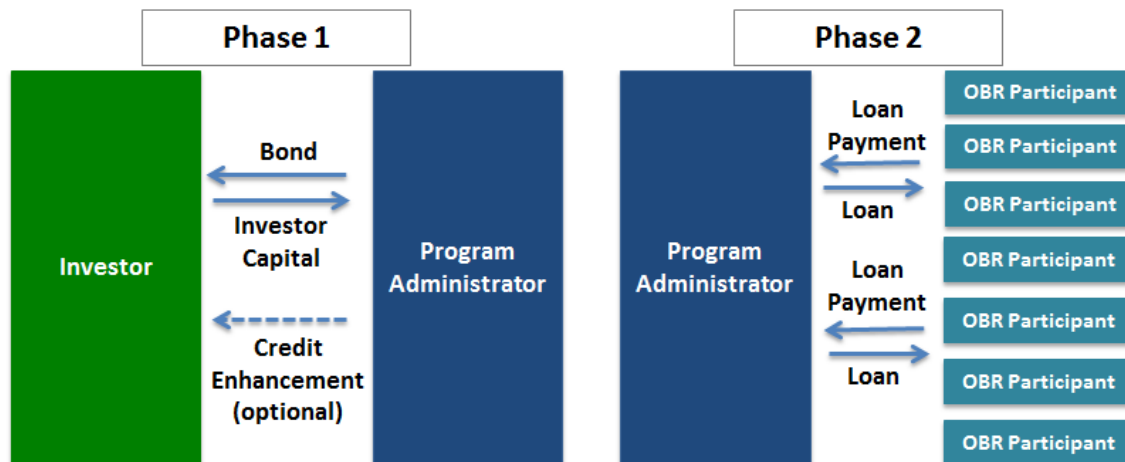


Figure 4-3. Illustrative example of raising capital up-front

Open Market

The third approach for sourcing private capital is the open market or “open source” model, in which one or more financial institutions underwrite individual consumers and deliver the financial products directly to them. Any

qualified financial institution may participate, allowing them to use the utility bill for repayment. This model avoids utility involvement in capital provision and encourages competition, driving financial institutions to innovate and to offer more attractive (e.g., lower interest rate, longer term) and more accessible products. With the first two OBR models, there is a single entity interacting with utilities (or utilities offering the program themselves). The open market approach means that multiple financial institutions could be interacting with multiple utilities in a state (see Figure 4-3), which may necessitate additional infrastructure to coordinate activities. In order to ensure consistency and reduce this potential complexity, the two states moving forward with open market OBR (CT and CA) have opted to develop centralized infrastructure that will stand in-between utilities and financial institutions so that financial institutions and utilities all have a single, consistent set of program participation protocols and processes and a single counterparty with whom to interact regarding the program. Both states plan to hire a Master Servicer that will be the primary conduit through which data and monies flow back and forth from utilities to financial institutions (see Figure 4-3).

Program Trends in Source of Capital

The majority of on-bill programs in this report are OBF initiatives. However, in recent years, there has been a significant shift towards OBR by program administrators (see Figure 4-4).

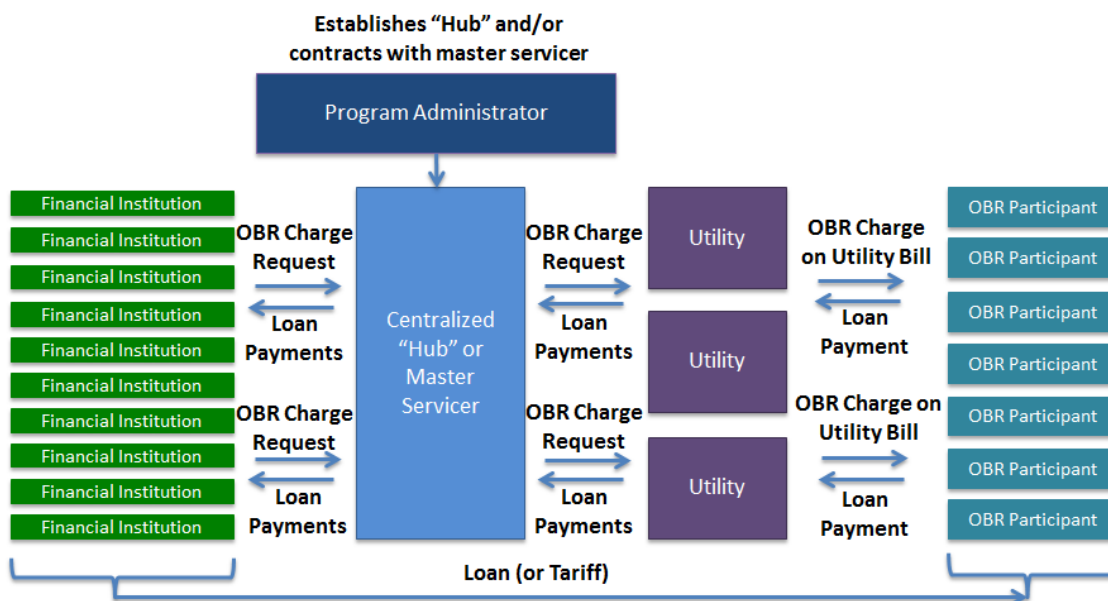


Figure 4-4. Open Market OBR: A centralized “hub” or master servicer can be used to streamline open-market OBR transactions between utilities and financial institutions

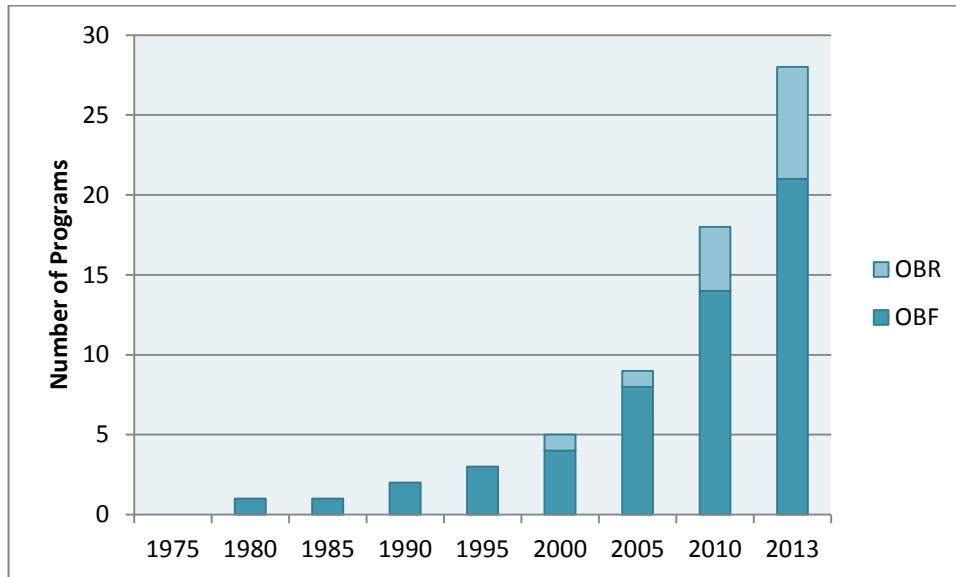


Figure 4-5. Number of on-bill financing and on-bill repayment programs, by year of inception

Only one of the 12 programs launched prior to 2009 utilized OBR. Of the 16 programs launched since 2009, seven have been OBR initiatives.⁶⁶ During this period, OBR programs grew three times as fast as OBF programs did (13.9% annual growth rate versus 3.8%), although growth was from a substantially lower baseline level of program activity. Despite the increasing number of OBR programs, OBF initiatives have continued to deliver the lion’s share of overall on-bill program volume. In 2012, OBF programs delivered \$128 million of capital to fund consumer energy improvements, while OBR programs delivered just under half as much capital, \$62M.

Of the 20 OBF programs, slightly more than half rely primarily on utility capital for funding. However, these 11 programs that utilize utility funds account for 86% of the total dollar volume for OBF programs in this report (see Table 4-3), with investor-owned utilities funding over half of overall OBF program volume and publicly-owned utilities funding just under a third of overall volume.

Table 4-4. Capital source for on-bill financing programs

Capital Source	Number of Programs	Number of Loans	Lifetime \$ Volume	% of OBF total (by \$)
OBF Total	20	146,264	\$1.2B	--
OBF—Utility (IOU)	5	26,161	\$673M	56%
OBF—Utility (POU/Co-op)	6	90,454	\$362M	30%
OBF—Utility Bill-payer	4	22,514	\$118M	9%
OBF—Public	1	1,096	\$12M	1%
OBF—Blend of Utility, Bill-payer & Public	4	6,039	\$46M	4%

⁶⁶ Only 28 programs are counted because two programs are under development.

Table 4-4 provides a summary of programs using different OBR approaches. Two-thirds of OBR programs rely on the program administrator warehouse model and these six programs are responsible for 99 percent of OBR volume. This OBR approach, particularly when combined with credit enhancement, appears to offer program administrators substantial program design and administration flexibility, access to large pools of attractive capital and reasonable risk of losses from offering guarantees (and other credit enhancements).

Table 4-5. On-bill repayment programs and cumulative program volume, by capital source

Capital Source	Number of Programs	Number of Loans	\$ Volume	% of OBR total (by \$)
OBR Total	9	87,076	~\$631M	--
OBR—Program Administrator Warehouse	6	85,903	\$624M	99%
OBR—Program Administrator Raises Private Capital Up-Front **	1	N/A	N/A	N/A
OBR—Open Market***	2	1,173	~\$7M	1%

**Hawaii's On-Bill Financing Program will raise capital up-front but has not begun yet.

***Loan data are for the UK Green Deal program only, because the other open market OBR program (California's on-bill pilot) has not yet been launched.

The current balance among public and private sources of capital may shift in the future, with the advent of potentially significant funds from the federal government, made available to rural cooperatives and municipal utilities through the U.S. Department of Agriculture (see text box below).



The USDA's Initiatives to Support On-Bill Programs

The U.S. Department of Agriculture has two new initiatives that support on-bill financing: the Rural Energy Savings Plan (RESP) and the Energy Efficiency Conservation Loan Program (EECLP). Both are modeled on South Carolina's "Help My House" residential on-bill pilot (See Appendix for case study).

In February 2014, the Rural Energy Savings Plan (RESP) was passed into law as part of the Farm Bill. The USDA's Rural Utilities Service will administer the RESP. The program will provide up to \$75 million annually (from FY 2014 to FY 2018) in zero percent interest loans to rural electric cooperatives and municipal utilities to operate on-bill financing programs. Co-ops and utilities can use this money for implementation costs to set up on-bill programs and for loans to residential and small business consumers to "implement durable cost-effective energy efficiency measures." The co-ops and munis can charge borrowers up to three percent on the loans to fund a loan loss reserve or to cover administrative costs. Underwriting criteria, interest rates and eligible measures will be up to the implementing co-op or muni. RESP is still unfunded and it is uncertain if and how EECLP and RESP will be coordinated. The Energy Efficiency Conservation Loan Program (EECLP) will make \$250 million available to rural electric utilities in 2014 for financing demand side management (DSM) projects and programs, including on-bill programs.

Once the implementation rules have been finalized, roughly 700 rural utilities for which USDA historically has financed power plants and transmission and distribution systems, may apply for federal funds to either invest in the efficiency of their own infrastructure or pass along to their consumers in the form of loans for DSM projects.

The goals of the Energy Efficiency and Conservation Loan Program are defined broadly and include:

- Increase energy efficiency at the end-user level;
- Modify electric load such that there is a reduction in overall system demand (e.g., fuel cells);
- Make more efficient use of existing electric distribution, transmission and generation facilities;
- Attract new businesses and creating jobs in rural communities by investing in energy efficiency; and
- Encourage the use of renewable energy fuels for either demand-side management or the reduction of conventional fossil fuel use within the service territory.

USDA has indicated that it expects many of these loans will be repaid on utility bills but has decided not to preclude other methods of repayment. Loans can be made to any consumer class and may be secured or unsecured. Interest charged to consumers is capped at 1.5% above the cost of the capital to the utility borrower. Administrative or "soft costs" for the utility loan programs are capped at 5% of the total loan amount. Loan terms are generally limited to 15 years (up to 30 years for ground-source heat pumps). Projects are required to have an economic payback period for participants or borrowers of 10 years or less, although USDA has said it will consider exemptions for longer-lived measures.

Projects to be financed with the federal funds must be cost effective under the proposed rule. Cost effectiveness in this context means that the benefits of the project—the value of avoided costs of otherwise supplying the energy or investing in generation, transmission or distribution assets, including avoided emissions costs—would exceed the cost to the utility of the project (including incentives, measurement and verification of the savings, and administration of the program).

The proposed rules are fuel neutral and expressly include fuel switching as an eligible purpose for the loans. Thus, a rural utility could make loans for a household to replace electric baseboard heating with a ground-source heat pump or gas furnace, as long as those projects provided relief to the utility system and were deemed cost effective. USDA has said that it expects more funds will be available in the future if the loan program succeeds.



Discussion: Key Considerations in Selecting a Capital Source for an On-Bill Program

A program administrator's choices of capital source and mechanism for tapping into that capital source are often closely tied to the policy goals driving on-bill program operations. These choices may have substantial impacts on program success; key considerations for each capital source are discussed in this section, including:

- OBF's potential to maximize program design flexibility;
- OBF's potential to minimize the need for information technology upgrades and alterations;
- The pros (potentially large pools of capital) and cons (potentially expensive) of relying on utility shareholder capital to fund an OBF program;
- The benefits of pre-negotiating "takeout" terms with secondary investors when tapping the OBR warehousing model;
- The importance of having high confidence that program participation will materialize if relying on the private capital upfront approach for OBR;
- The potential expense of infrastructure necessary to address the complexity of an Open Market OBR approach and the risks it raises should lender or consumer participation be below expectations, and;
- The important role that credit enhancement has played across all OBR models.

OBF: Maximizing Program Design Flexibility

Program administrators operating on-bill programs that rely on public, utility shareholder, or utility bill-payer capital to fund financial products typically have the most flexibility to define program rules to meet program objectives. Most OBF programs operate as revolving loan funds (RLFs): as funds are repaid by program participants, they are re-lent to new participants. Key program rules might include setting underwriting criteria, defining eligible measures and structuring financial product interest rates and terms. Public funds are often the most flexible, followed by utility shareholder and utility bill-payer funds. In many cases, program administrators that rely on utility bill-payer funds have to demonstrate that the financing program is delivering incremental energy savings that are cost-effective.

OBF: Minimizing IT Upgrades and Alterations

Many utilities have complex billing systems that are expensive to upgrade or alter and the new generation of on-bill programs may create unique challenges for these systems. Incorporating novel on-bill features such as automatic transferability will be necessary for both OBF and OBR programs. But, OBR programs raise the specter of substantial information technology (IT) costs to accommodate new parties seeking repayment through consumer utility bills. Inserting on-bill financing obligations into what, in many cases, is a complex set of rules for how partial utility consumer bill payments are allocated across the range of charges on a consumer's bill can raise both stakeholder conflict as well as the risk of substantial information technology (IT) upgrade costs to alter these rules. When on-bill financial product funding comes from utility shareholders or utility billpayers, "who gets paid first" (discussed in more detail in Chapter 3), is less important since the utility and the lender are the same entity. With OBR, though, these rules are critically important to the value of OBR and adjustments to IT systems may be unavoidable.

OBF: Relying on Utility Shareholder Funds Can Be Expensive—But Effective for Achieving Scale

Unlike public and utility bill-payer funds, utility shareholder funds must earn a rate of return. Of the seven utility-funded programs that shared their compensation level for capital that is used to fund on-bill products, they earned a volume-weighted average interest rate of 5.36 percent on capital lent through their OBF initiatives and charged on-bill participants a volume-weighted average interest rate of 1.47 percent. Were these utility funds simply lent

to participants at the utility’s 5.36 percent cost of capital,⁶⁷ this would not raise any concerns about these programs’ potential utility rate impacts. However, in practice, utility bill-payers are funding “interest rate buy-downs” from the rate at which utilities lend (5.36 percent) to the interest rate that participants pay (1.47 percent). Ratepayers ultimately fund this buy-down, which can be expensive. The merits of this approach need to be assessed relative to other ratepayer-funded strategies (e.g., rebates) that encourage consumers to invest in efficiency. As shown in Table 4-5, the interest rate buy-down among our sample of utilities is comparable to rebates of nine to 17 percent of project costs.⁶⁸ Program administrators and policymakers should ensure that they consider these buy-down costs when they evaluate the efficacy of on-bill programs.

Whether it is appropriate for utilities to earn this rate of return on capital lent to on-bill participants, particularly since many utilities are able to recover any losses from participant defaults directly from utility bill-payer funds, is also an issue worthy of attention by policymakers and program administrators. Nonetheless, some OBF programs have been quite effective in achieving scale. For example, United Illuminating (UI) earns a 6.4 percent rate of return on capital that it loans out through the Small Business Energy Advantage (SBEA) program. Consumers are offered a zero percent interest rate for SBEA loans; thus, utility bill-payer funds are used to buy down interest rates from 6.4 percent to zero percent. Having a zero interest financial product has been one key to UI’s success in reaching approximately 30 percent of small business consumers over the last 13 years (see Appendix A for a case study on the SBEA program).

Some on-bill program administrators have been reluctant to charge interest out of concern that this might subject them to state regulation as financial institutions. For example, in California, the Department of Corporations provided a letter stating it would not enforce licensing and regulatory requirements on exempted the state’s four investor-owned utilities (IOUs) from lending regulations for their operations implementing OBF programs only if they charged zero interest. In Wisconsin, Alliant Energy’s Shared Savings Wisconsin on-bill program delivered more than \$500 million in financing to commercial and industrial consumers from 1987 to 2013. The program offered consumers on-bill loans for up to five years, with an administrative fee of zero to three percent. An administrative fee, rather than interest, was charged to avoid being subjected to lending regulations. The loans were funded using utility shareholder funds, with a cost of capital of 8.2 percent (see Appendix A for a case study on Alliant Energy’s Shared Savings program).


Table 4-6. Comparison of an implicit interest rate buy-down for different on-bill loan terms

OBF Project Size	\$100,000	\$100,000
Utility Rate of Return on Capital Lent to OBF Participants	5.36%	5.36%
OBF Participant Interest Rate	1.47%	1.47%
OBF Financial Product Term (Years)	10	5
PV of Interest Rate Buy Down Cost (i.e., equivalent rebate that could be offered)	\$16,854 (16.9% of project costs)	\$9,138 (9% of project costs)

While utility capital may be expensive, relying on it to fund on-bill products is one potential approach to getting around the limits to scale that on-bill programs relying on public and utility bill-payer capital face. Public and utility bill-payer monies are a small fraction of the overall level of investment needed to achieve many states’ energy savings policy goals for existing buildings. Utilities, particularly when earning substantial returns, have the ability to raise large pools of capital to invest in these programs.

⁶⁷ This cost of capital is likely the utility’s “weighted average cost of capital” or WACC, a blended rate based on utility shareholder return on equity and cost of debt.

⁶⁸ In LBNL’s “Getting The Biggest Bang for the Buck: Energy Efficiency Program Design Choices and Rationales”, we offer program design guidance for reducing uncertainty about the impacts of interest rates on program participation—today, little is known about how consumer demand for energy efficiency responds to interest rates.



Despite the potential for financial returns, some utilities have objected to on-bill programs on the basis that operating loan programs changes their consumer relationship, could make them responsible for the funded improvements, consumer lending is not part of their core business and/or the fear that offering these programs might subject them to regulation as financial institutions.

OBR—Warehousing: Pre-Negotiate Terms

Under the warehouse model, some program administrators have pre-negotiated the terms of the sale of the pool of loans with a purchaser, while others have sought to sell these pools at “market rates” once sufficient volume has been aggregated. Of the nine programs operating OBR programs, six rely on the warehousing model. All but one program has relied on sales at pre-negotiated terms. The advantage of pre-negotiating terms of these sales is that program administrators have certainty in the pricing at which they will be able to resell on-bill financial products and can structure the pricing of their financial products to ensure they are able to make these sales without incurring substantial losses.

OBR—Raise Capital Up-Front: Necessitates Confidence in Ability to Repay Lenders

The “raise capital upfront” approach for OBR provides certainty to program administrators and efficiency service providers that large pools of capital are available to potential program participants. However, this approach necessitates administrator confidence that consumer participation will materialize, as investors will likely require compensation for capital that they have lent—whether there is demand from consumers for loans for energy improvements or not.


In Hawaii, regulators have authorized the issuance of up to \$200M of utility bill-payer-backed bonds. These bonds are secured by the right for bond investors to tap funds collected through utility bill-payer charges should participant on-bill financing repayments be insufficient to cover bond principal and interest payments. Even if the utility were to fail to make payments (e.g., if it were to enter bankruptcy protection), these utility bill-payer charges would still be collected and paid-out to investors, so this debt is extremely secure and should garner access to large pools of low-cost capital. With this in mind, the Hawaii program will be designed with the intent of setting consumer interest rates high enough to cover any potential default losses, so that these participant debt service payments are sufficient to repay the bonds and utility bill-payer funds will not need to be tapped to make up any shortfall.

OBR—Open Market: Necessitates Development of Substantial Program Infrastructure

Critical considerations for policymakers and program administrators contemplating the open market OBR approach are (1) the added complexity of accommodating multiple financial institutions; (2) the potential expense of building programmatic infrastructure to address the complexity; and (3) the risks this infrastructure creates should financial institutions or consumers not participate.

California and Connecticut, the two states in the process of implementing open-market OBR, have had distinctly different experiences with program implementation. In California, approximately \$8M has been budgeted for infrastructure costs such as administration, implementation and upgrades for IT systems and to work with the Master Servicer for \$75M of EE financing pilots (Zimring et al 2013). In Connecticut, on the other hand, program administrators have noted that implementation and administration costs are likely to be substantially lower. These differences may be due to several factors, including:

- CT already had an existing administrator in place (the Clean Energy Finance and Investment Authority) that could administer an on-bill program across multiple utility jurisdictions.. CA has faced substantial delays in getting legislative authority to empower a state agency (the California Alternative Energy and Advanced Transportation Authority) to operate the program;

- 
- CT's program will, during its pilot phase, rely on line item billing, which each of the utility's already can accommodate on their bills. That has enabled it to avoid the complexity of inserting the on-bill charge into existing payment priority rules in the event of utility bill partial payment as the charge is subordinated to all other charges;

While these programs' start-up and operational costs vary, program administrators of both programs face the risk that financial institutions will choose not to sign on to the programs or that consumer participation will be low. In this case these up-front financial and time investments may not, ultimately, be justified.

For All OBR Models: Credit Enhancement is Key

Full or partial credit enhancement structures can be used for any of the three OBR models. The first two OBR strategies have typically relied on substantial credit enhancements to private investors, either in the form of: (1) 100 percent guarantees against losses arising from consumer defaults on their on-bill debt); or (2) the right to tap utility bill-payer charges, should consumer repayments be insufficient to cover debt service obligations. While there is nothing inherent in warehousing or raising capital up-front that requires a guarantee to private investors, doing so has enabled program administrators to tap into large pools of extremely low-cost capital and avoid investor focus on individual consumer creditworthiness. This may have the effect of expanding access to attractive capital to under-served consumer markets. Program administrators relying on warehousing or raising up-front capital have also maintained significant flexibility in designing programs, because private investors have the alternative source of protection (e.g., guarantee), rather than simply relying on consumers to make timely repayment of their on-bill obligations. While some program administrators have been reluctant to provide guarantees to private sector investors, experience to-date suggests that this may be an effective strategy. Three examples from New York, TVA, and Illinois illustrate this:

- **NYSERDA:** NYSERDA recently completed a \$24.3M bond issuance, secured by repayments from its loan portfolio, which includes a portion of its pool of on-bill residential loans, and structured with federal Qualified Energy Conservation Bond interest subsidies to achieve a net bond interest cost of less than one-half percent (see Figure 4-5). The bond was structured with a guarantee from the New York State Environmental Facilities Corporation Clean Water State Revolving Fund (CWSRF) program that investors will be repaid all bond principal and interest, regardless of whether cash flows from the underlying pool of EE loans is sufficient to make these payments. This guarantee was necessary for the bond issue to receive an AAA rating. This "investment grade" rating indicates that a bond issue is of extremely low risk and typically yields large pools of low-cost investor capital. NYSERDA does not have an investment grade rating itself, so it relied on the CWSRF, which does, to provide the guarantee. NYSERDA, in turn, agreed to put funds in escrow as a credit enhancement for the CWSRF. NYSERDA will use the sale proceeds to replenish the revolving loan fund and make additional on-bill loans.
- **TVA:** A loan guarantee from TVA is the key to having a regional bank provide low-cost capital (two percent plus the five-year U.S. Treasury rate) to fund their on-bill loans—which they offer to consumers of participating distribution utilities at six percent. In the event of loan defaults, TVA re-purchases the receivables from the bank (see Figure 4-6). There is no limit to the size of the TVA guarantee or the amount of loan funding available. TVA retains the proceeds from the sale of the receivables (and earns approximately three percent interest on the outstanding on-bill loan volume), which is sufficient to pay for program administration costs, cover any loan defaults and earn a small return. Default coverage is priced into the interest rate on the loans.
- **Illinois Energy Efficiency Loan program (IEEL):** State legislation requires each participating utility to provide a guarantee on up to \$2.5M in on-bill loans (see Figure 4-7). Regardless of whether a borrower makes their monthly financing payment, the utility must ensure that the private lender receives payment. This allows the capital provider to offer a relative low interest rate (4.99%) for their on-bill loans.

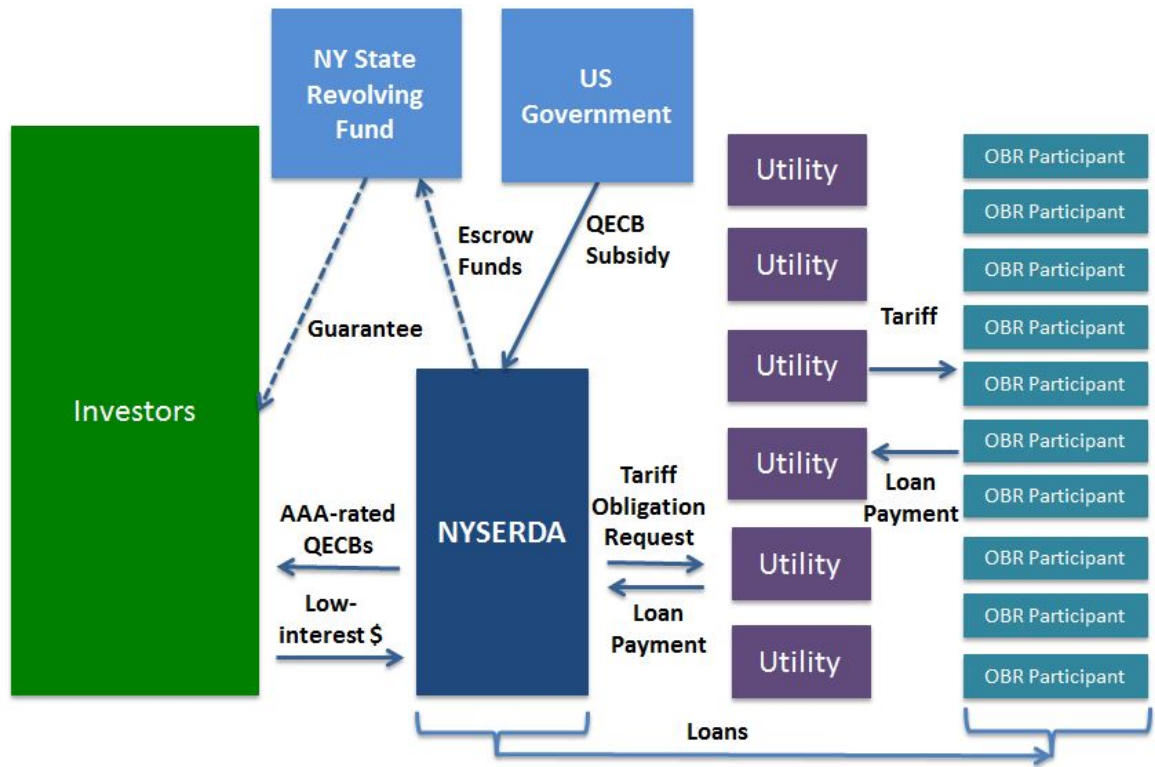


Figure 4-6. Illustration of NYSERDA's Bond Issuance Backed by Residential On-Bill Loans

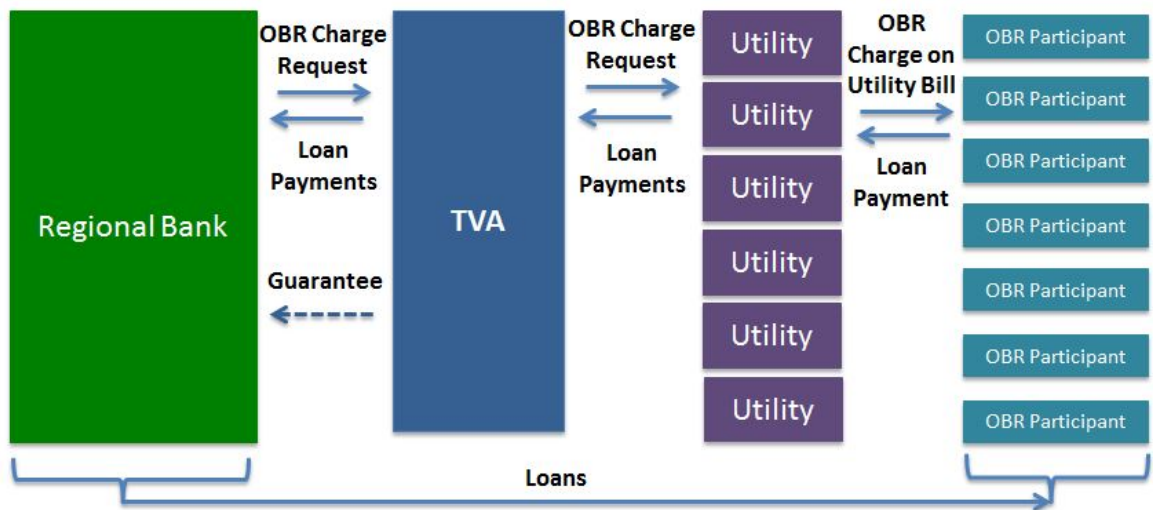


Figure 4-7. Illustration of TVA's On-Bill Loan Re-Sales to Regional Bank Purchaser

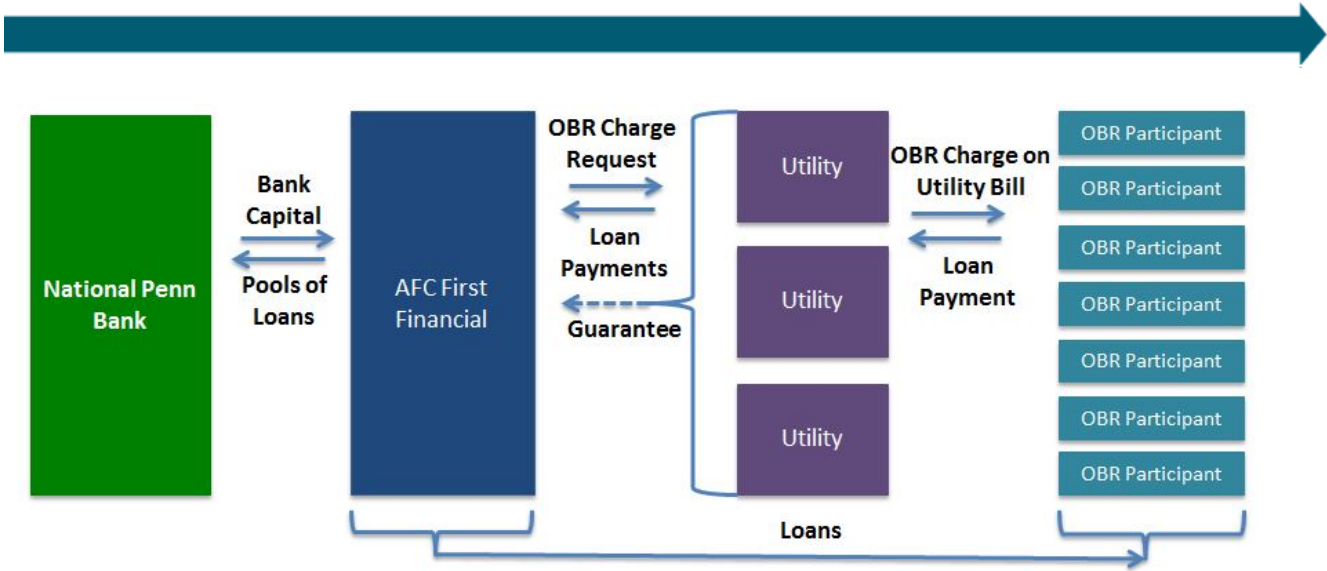


Figure 4-8. Illustration of the IEEL Program OBR Loan Funding Model

Some OBR programs are seeking to rely on lower levels of credit enhancement, by using traditional strategies of “partial loss coverage,” through loan loss reserves and/or subordinated debt to reduce bill-payer exposure to default risk. This reduced credit enhancement raises the risk, however, that some of the attractive features in existing on-bill programs (e.g., flexible underwriting, low-cost capital) will dissipate, as financial institutions underwrite to individual consumers, properties and/or utility meters, due to their limited protection from participant defaults.

Approaches to Assessing Consumer Creditworthiness

Key Takeaways

- Program administrators for on-bill programs and their financial institution partners use a range of criteria that to assess the creditworthiness of applicants for a financial product.
- Our analysis of existing on-bill programs yielded no obvious association between a program's underwriting criteria and participant default rates.
- The choice of underwriting criteria appears to significantly influence on-bill program application approval rates. On-bill finance programs that rely on traditional underwriting criteria reject four times more applications than programs that rely primarily on utility bill repayment history.

Underwriting describes the process and criteria that financial institutions and/or program administrators use to assess eligibility for a loan, including the creditworthiness of applicants and suitability of the property for a financial product. The approach used may have significant impacts on program applicant transaction costs, application approval rates and default rates for on-bill programs. Program administrators have taken a range of approaches to setting underwriting criteria that we group into four categories:

- **Traditional Underwriting Standards.** Administrators rely on traditional metrics that are used for underwriting other types of financial products. For example, in the single-family residential market, this approach often includes a minimum credit score of 640 and a maximum debt-to-income ratio (DTI) of 50 percent for unsecured loan products.

Example: The Illinois Energy Efficiency Loan (IEEL) on-bill program requires households to have a minimum credit score of 640 and a maximum DTI of 50 percent.⁶⁹ The program's application decline rate is 49 percent and the default rate has been zero percent⁷⁰ (see Appendix A for a case study on the IEEL on-bill program.)

- **Expanded Underwriting Standards.** The administrator relies on traditional underwriting metrics but relaxes the minimum standards for applicant approval in order to increase the number of target consumers that can qualify for financing. In the single-family residential market, this might mean a minimum credit score of 600 and a maximum DTI of 70 percent.


Example: The Tennessee Valley Authority (TVA) offers on-bill financing to single family households with credit scores as low as 625 and approves approximately 75 percent of applications, with a default rate over 16 years of approximately three percent.⁷¹ In practice, TVA participants' average credit score is 711, so even though lower credit quality consumers are eligible for the program, the average participant is quite creditworthy by traditional standards (see Appendix A for TVA case study).

- **Alternative Underwriting Standards.** The program administrator uses alternative metrics (e.g., a strong history of on-time utility bill repayment) in order to increase the portion of applicants that are approved for financing and/or reduce the cost of the underwriting process (e.g., less time and money).

⁶⁹ Consumers with DTIs above 50 percent may qualify for loans of up to \$2,500.

⁷⁰ The program has been operating for less than three years; thus, this low default rate may not be reflective of the expected lifetime default rate.

⁷¹ In some cases, local distribution utilities check applicant bill repayment history.

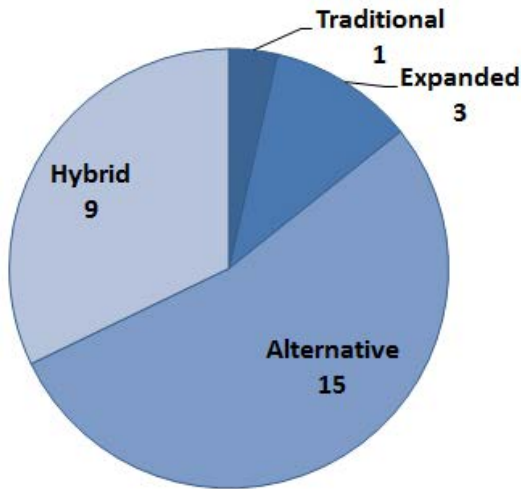
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- *Example:* Applicants to the Connecticut Light and Power (CL&P) or United Illuminating (UI) Small Business Energy Advantage (SBEA) loan program must have been in business for at least 12 months (six months for UI), have had no more than four late utility bill payments in the past calendar year and have no outstanding utility balances or special payment arrangements. The program has an application decline rate of just five percent and a default rate of less than one percent (see Appendix A for a case study on the United Illuminating SBEA program).
 - **Hybrid Underwriting Standards.** The program administrator relies on a blend of alternative underwriting standards and traditional or expanded underwriting metrics. For example, in the residential market, this might mean a minimum credit score of 600 and a strong history of on-time utility bill repayment.

Example: Craft3, a CDFI in the Pacific Northwest, uses a hybrid approach to underwriting for Clean Energy Works Oregon's (CEWO) residential on-bill program. The lender reviews credit scores (a traditional underwriting metric) as well as historical utility bill repayment. Applicants receive points if their credit scores are below 660, for current or historical utility bill delinquency and first mortgage delinquency. Applicants with five points or less are approved for financing, applicants with six points are given a second review, and those with more than six points are declined. The program has a decline rate of just 10 percent, and a default rate of less than one percent (see Appendix A for a case study on CEWO's on-bill program).

Program Trends in Choice of Underwriting Criteria

Of the 28 programs that reported underwriting criteria for this report, only one program relies exclusively on traditional underwriting standards, three programs rely on expanded underwriting, nine programs employ hybrid underwriting criteria, and 15 programs use alternative underwriting criteria (see Figure 5-1). When weighted by program loan volume, programs using hybrid underwriting approaches account for 51 percent of the on-bill volume for programs in this report, followed by programs that rely on expanded underwriting (31 percent). Programs using alternative criteria account for 18 percent of on-bill volume.

Number of Programs



Percent Volume (\$)

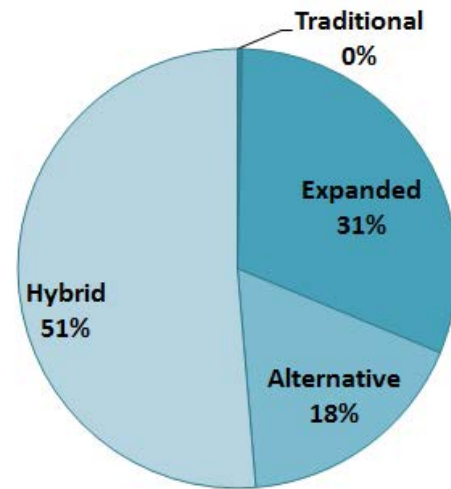


Figure 5-9. Underwriting criteria used in on-bill programs: number of programs (left) and dollar volume (right)

Discussion: Key Considerations in Selecting Underwriting Criteria

In comparing among existing on-bill programs, we found no clear association between a program's underwriting criteria and participant default rates. Default rates were quite low across program designs suggesting that a range of underwriting approaches may lead to low participant default rates. We provide "default rates" for on-bill programs and offer these numbers as insights into program results and customer behavior. These rates are indicative of the credit risk that lenders (including utilities) have undertaken in extending financing to customers in these on-bill programs and typically reflect the actual losses such programs have sustained from loans charged-off. These numbers should help any utility (or regulator) estimate and consider the likely cost-effectiveness of any on-bill program.⁷²

However, the choice of underwriting criteria does appear to influence the financing application approval rate in these programs. The one program that relies exclusively on traditional underwriting criteria rejected over eight times more applications than the median percentage of consumers rejected in programs that relied primarily on utility bill repayment history (see Table 5-1).

When considering underwriting criteria, program administrators must balance the desire to expand consumer access to attractive (e.g., lower interest rate, longer loan term) capital with the need to ensure that consumers who are granted access to capital are well-positioned to make repayment. Standard underwriting criteria exists for

⁷² We recognize and emphasize for our readers that default rates may not necessarily be comparable across programs or comparable to default rates reported for other kinds of conventional loans (e.g., home equity loans). The default rates reported could be materially affected by many factors not tracked, such as property value, property appreciation, whether a security instrument is recorded (as it is with the TVA Energy Right program), servicing methods, loan amounts, finance charges, contractor screening methods, and other important programmatic factors. It is likely that the servicing, loss mitigation, and collections functions that occur before an on-bill loan is deemed to be "in default" could vary widely across programs and could require costs (e.g., phone calls, letters) that conventional lenders do not incur. Definitions of when a payment is late and "in default" could also vary widely. We also understand that some utilities may not permit a customer to obtain service at a new address if the individual has outstanding obligations from a prior address (thus diluting the meaning of the "disconnection" attribute).

a reason: to ensure that consumers granted access to capital are willing and able to repay their loans. Thus, administrators should exercise some caution as they implement expanded, alternative and hybrid underwriting criteria. However, based on data from programs included in this report, it is encouraging that we did not find any obvious association between an on-bill product's underwriting criteria and consumer default rates.

Those administrators that rely on private capital to fund their on-bill financing programs also need to consider the potential impact of using non-traditional underwriting standards on their ability to attract (and the cost of attracting) private capital providers to the program. While repayment trends in on-bill loan programs have been quite strong, those programs that have successfully leveraged private capital have provided robust credit enhancements (e.g., a loan loss reserve or guarantee which reduces the risk of poor repayment performance to private capital providers). In today's market, investors may be reluctant to accept (or require a discount for) loans not underwritten using standard metrics.

One practical consideration for relying on utility bill repayment, particularly when utilities (or those contracted by them) are not the entities underwriting loans is how to get this data from utilities to financial institutions. In some cases, utilities may be reluctant to share detailed data on utility bill repayment trends across consumer classes (which many lenders and investors are likely to rely on to make choices about whether to participate in on-bill programs or how attractive and accessible to make financial products they do offer) due to concerns about protecting confidential consumer data and/or sharing proprietary information.

Table 5-7. Application decline rates and participant default rates for Residential and Non-Residential on-bill programs

Residential On-Bill Programs		
Underwriting Criteria (n=21)	Median and Range of Application Decline Rates (n=15)	Median and Range of Participant Default Rates (n=15)
Traditional Underwriting (n=1)	49%	0%
Expanded Underwriting (n=3)	25% (n=1)	3% (n=1)
Hybrid Underwriting (n=8)	4%-33% (median 10%)	0%-0.9% (n=7)
Alternative Underwriting (n=9)	2%-25% (median 6%) (n=5)	0%-0.9% (n=6)
Non-Residential On-Bill Programs		
Underwriting Criteria (n=7)	Median and Range of Application Decline Rates (n=6)	Median and Range of Participant Default Rates (n=7)
Traditional Underwriting (n=0)	NA	NA
Expanded Underwriting (n=0)	NA	NA
Hybrid Underwriting (n=1)	10%	2.68%
Alternative Underwriting (n=6)	0%-25% (median 6%) (n=5)	0.57%-2.9%

Selecting Eligible Measures

Key Takeaways


- Choice of eligible measures requires balancing the objectives of enabling (or driving) cost-effective energy efficiency and/or renewable energy adoption with a range of other policy or programmatic goals (e.g., facilitating sufficient program participation to offset up-front program implementation costs, contributing to market transformation by facilitating private financial institution investment in energy efficiency, creating jobs and providing consumer safeguards).
- Key program administrator considerations include:
 - **Types of Eligible Measures.** The source of capital and program goals will heavily influence whether technologies beyond EE (e.g., distributed generation and demand response) may be financed on-bill—casting a broader net may help to drive consumer participation. Permitting non-energy measures may also be a powerful way to drive consumer adoption, but it may raise cost-effectiveness challenges as these measures do not directly deliver energy savings. Twelve of 30 on-bill programs limited eligibility to EE improvements.
 - **Single-Measure vs. Comprehensive Retrofits.** Programs that have achieved significant loan volume (i.e., consumer participation) have typically allowed participants to finance single-measure improvements and/or coupled on-bill eligibility with substantial financial incentives for multi-measure improvements.
 - **Bill Impacts.** Requiring bill neutrality offers uncertain potential as a consumer protection and driver of consumer EE adoption. In practice, it may actually have a demand-dampening effect by limiting the types of projects that can be financed on-bill.

Three key areas of consideration for program administrators in selecting eligible measures for on-bill programs are: (1) types of measures; (2) single measure vs. comprehensive retrofits; and (3) whether to restrict project eligibility based on its expected utility bill impacts. In determining what approach to take for each area, program administrators, often following guidance from state regulators, may have to balance multiple objectives; cost-effective energy efficiency, encourage renewable energy adoption, and other program design or policy goals (e.g., contributing to market transformation by facilitating private financial institution investment in energy efficiency, creating jobs, facilitating sufficient participation to offset up-front program administration costs, and providing consumer safeguards).

Types of Measures

Depending on their source of capital and program goals, on-bill programs may permit, as eligible measures, a range of demand-side technologies: energy efficiency measures, distributed generation (e.g., solar photovoltaic, combined heat and power) and demand response (DR) technologies. Twelve of 30 on-bill programs included in this report limited eligibility to EE improvements. Eleven programs allow renewable energy technologies, five allow non-energy measures (NEM), and four allow water efficiency measures to qualify for loan financing.⁷³

⁷³ Programs allowing RE, NEMs and water efficiency measures are not mutually exclusive: some allow one or more.



In Hawaii, where policymakers are seeking to make “renewable energy and energy efficiency more accessible to the rental market and other underserved markets,” an on-bill program is being developed to fund measures including solar PV and solar water heater installations for residential consumers.⁷⁴ In California, the on-bill pilots launching in 2014 will permit consumers to finance EE, DG and DR measures as well as non-energy measures on-bill to test whether consumers are more likely to add EE projects while undertaking other types of improvement activities.⁷⁵

Certain non-energy efficiency measures (NEMs) that often address health or safety issues may be permitted in an on-bill program. Permitting NEMs to be financed as part of a package of EE improvements may be a valuable strategy for driving consumer adoption in certain market segments. For example, the homes of middle-income households often have structural and maintenance issues that can reduce their value and have adverse effects on the household’s health and safety. Permitting these households to finance NEMs through on-bill programs can address health and safety issues or issues that must be remediated for high-efficiency equipment to function appropriately. They may also help to drive EE investment alongside addressing these issues (Zimring et al 2011). Similarly, in projects implemented by ESCOs between 2005-2008, about 24% of the projects in public/institutional facilities (e.g., K-12 schools, local/state governments, universities/colleges) included non-energy measures, which was a significant increase compared to the 1990-1997 period when only 3% of ESCO projects included non-energy measures (Larsen et al 2012). However, including non-energy measures may raise cost-effectiveness challenges as these measures typically do not directly deliver energy savings or may weaken the justifications for treating an on-bill product as an off-balance sheet operating expense. Including NEMs often requires policymakers and program administrators to balance multiple goals (e.g., safe and efficient buildings, cost effective energy savings).

One key policymaker and program administrator consideration is the extent to which allowing a broader set of measures (e.g., RE improvements in programs funded with EE ratepayer funds) increases or reduces program costs. Many program administration costs are likely fixed or a function of the number of on-bill participants, not the size of the financial product. Other costs, like credit enhancements, are not fixed.

⁷⁴ <http://puc.hawaii.gov/wp-content/uploads/2013/07/DECISION-AND-ORDER-NO.-30974.pdf>

⁷⁵For financial products supported by credit enhancements, up to 30 percent of financed project costs may be NEMs. For non-residential on-bill financing products not supported by credit enhancements, up to 100 percent of financed project costs may be DG and DR. This structure was selected to maximize the extent to which utility bill payer funds targeted at EE, which are being used to fund credit enhancements for the pilots, will be used to support EE improvements while also providing consumers flexibility in project design to drive pilot participation. As of final publication of this report, there is uncertainty as to whether this 30 percent “carve out” will be implemented during the pilot period as regulators grapple with whether utility bill payer funds can be used to support projects that are not 100 percent EE.

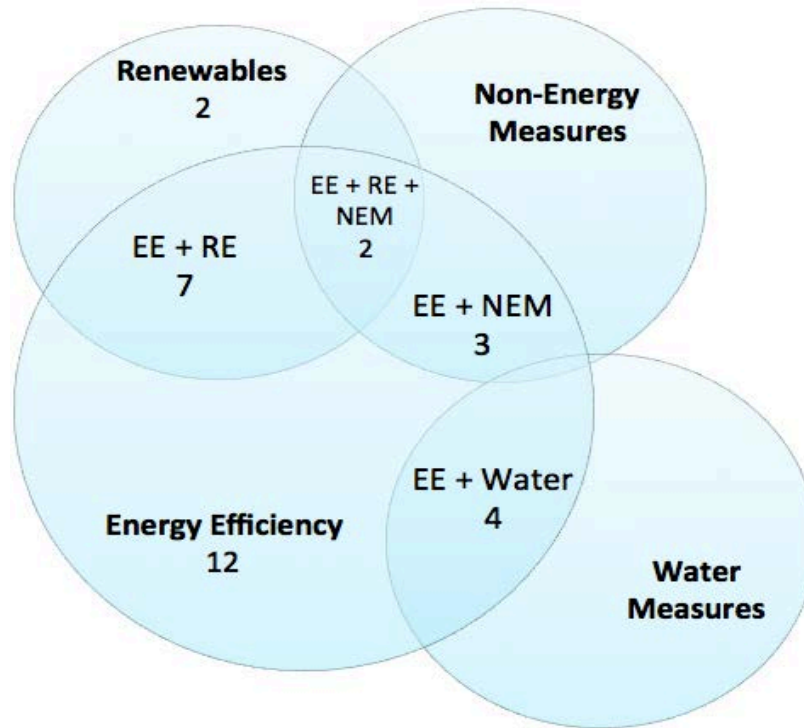


Figure 6-10. Number of programs allowing different measures

Single Measure vs. Comprehensive Retrofits

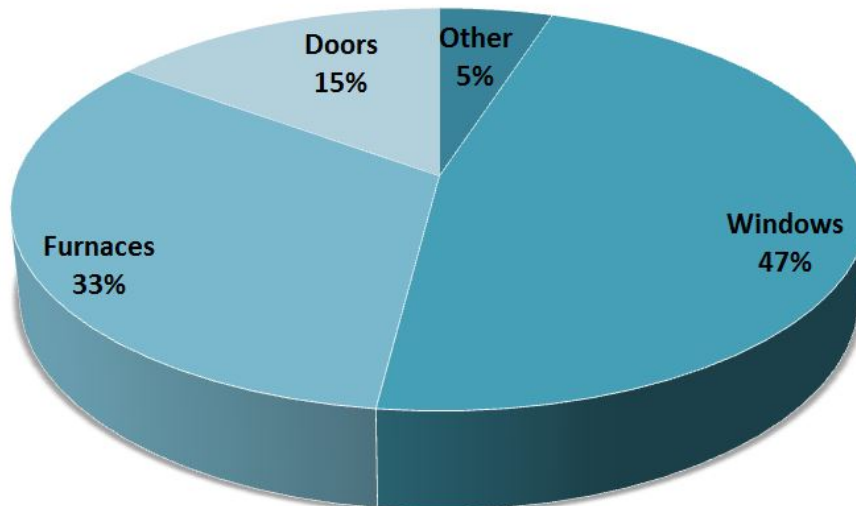
Some policymakers and program administrators seek to drive participants to adopt multi-measure, comprehensive energy improvements typically associated with deep energy savings. Others permit participants to finance single measures, such as boiler replacements to balance energy saving goals with others, such as the higher job creation that might come from single measure programs that may achieve higher participation levels more easily or quickly than comprehensive retrofit programs.

Most on-bill programs that have achieved significant loan volume or market penetration have typically allowed participants to finance single-measure energy improvements and have tended not to place much emphasis on implementing multi-measure, comprehensive energy improvements. For example, Manitoba Hydro’s Power Smart Residential Loan Program has funded almost \$300M in efficiency improvements in single family residences since 2001. Consumers are allowed to install and finance a wide range of energy-related measures and about 95 percent of the on-bill loans have been used for single-measure window, door or furnace replacements (see Figure 6-2) [see Appendix B for a case study on the Manitoba Hydro Power Smart Residential Loan Program].

Other examples of broad measure eligibility include:

- Tennessee Valley Authority’s Energy Right Solutions Program has funded over \$500M in single-family residential improvements since 1997. More than 95 percent of loans have been for single measure heat pump installations (see Appendix A for a case study on the TVA Program).

Measures Financed in Manitoba Hydro's Power Smart Residential Loan Program



Note: "Other" includes multi-measure improvements. All other improvements involve only a single measure

Figure 6-11. Manitoba Hydro Power Smart Residential Loan Program financed projects, 2001-2013 (by number of projects)⁷⁶

- In California, 60 percent of business and government participants in the four Investor-Owned Utilities (IOU) On-Bill Financing programs have funded lighting-only improvements. The programs are in the process of making a change targeted at encouraging consumers to invest in multi-measure projects that achieve deeper energy savings by requiring that no more than 20 percent of financed project costs be for lighting end uses (see Appendix A for a case study on the California On-Bill Financing Pilots).⁷⁷

Thus, allowing single-measure retrofits may help drive program participation; however, it leads to questions about whether these programs are delivering incremental energy savings or simply capturing existing market activity.

Utility Bill Impacts

Some on-bill programs have required that the expected energy savings from energy improvements offset 100 percent of project costs (including financing charges). This expectation, that energy savings will be at least as large as project costs, is known as "bill neutrality". Program administrators have defined "bill neutrality" in two ways: (1) require that expected energy savings from a project are sufficient to cover all financed project costs (including interest costs) over the life of the improvements; or (2) require that expected energy savings are sufficient to cover all financed project costs (including interest costs) over the life of the financial product (which is typically shorter than the life of the improvements).

⁷⁶Other includes projects that funded more than one type of energy improvement.

⁷⁷ The program change is being accompanied by the introduction of a third party capital on-bill pilot for which lighting-only improvements will still qualify.



The rationales for requiring bill neutrality include:

1. It may act as a consumer protection;
2. It may help to ration limited program funding to those projects that deliver the most energy savings relative to program cost to achieve them; and/or
3. It may help to drive consumer adoption of EE improvements.

Rationale 2 is quite evident, although it raises questions about whether bill neutrality requirements conflict with policy goals in some states to achieve all cost-effective energy efficiency savings.⁷⁸ We explore rationales 1 and 3 in more detail below:

The Value of Bill Neutrality Requirements as a Consumer Protection is Uncertain

In some cases, the expectation of bill neutrality has been included as a program requirement to keep participants' utility bills from increasing due to their participation (or to avoid a disproportionately large financing charge, relative to the participant's existing utility bill). This feature has been particularly common where service disconnection is a threat, should participants fail to pay their on-bill charges. Because this feature requires that financing payments be less than the dollar value of expected energy savings, it should, in theory, lead to better financial product performance and no increase in utility service termination rates.

However, in practice, there is uncertainty about whether bill neutrality requirements do provide protections for individual consumers and whether such protections are necessary.⁷⁹ Historically, the variance in actual energy savings versus estimates across individual participants has been substantial. That is, expected bill neutrality may not translate into realized bill neutrality at the individual participant level. To the extent that participants are relying on energy savings to repay financing and those savings fail to materialize, this feature may actually increase risk.

Bill neutrality has also been advanced as a program feature that provides consumer protection for tenants (e.g., prevents property owners from utilizing on-bill programs to finance building improvements that do not deliver sufficient energy savings or other benefits to offset tenant financing charges). Bill neutrality requirements may be an effective tool for preventing this scenario from arising. However, other requirements may be just as effective (e.g., tenants "consent" to the placement of an on-bill charge on their meter). Building owners that finance energy-related improvements without tenant consent, which are not repaid by bill savings, also may face lower occupancy rates and higher tenant turnover.

Does Bill Neutrality Help Drive Consumer Energy Efficiency Adoption?

Some policymakers and program administrators have argued that requiring bill neutrality may help to drive consumer energy efficiency adoption. However, existing programs' experience suggests that one of the key reasons that program administrators and policymakers should pay careful attention to bill neutrality considerations is that these features may actually raise practical challenges that constrain consumer program participation.

On-bill programs in this study that require bill neutrality have, on average, achieved lower historical volume than those that do not. In 2012, the average residential on-bill volume for the four programs that required bill neutrality

⁷⁸ Cost-effective energy savings are not necessarily "bill neutral", but are less expensive than supply side energy production options.

⁷⁹ The six on-bill programs that require bill neutrality have lower average default rates (0.65%) than the 16 programs without the requirement (1.62%). However, we do not believe that it is appropriate to draw conclusions regarding differences in default rates because many other factors influence a program's default rate and because of differences across these two groups of customers in target consumer segments. All on-bill programs reviewed in this report have experienced low default rates (0-3%).

was \$1.6 million compared to \$11.7 million for the 10 programs that do not require bill neutrality (see Figure 6-3). The average 2012 non-residential on-bill volume for the three programs that required bill neutrality was \$7.6 million compared to \$11 million for the four programs that do not require bill neutrality. In practice, requiring “bill neutrality” as a design element may actually have a demand-dampening effect by limiting the types of projects that can be financed on-bill.

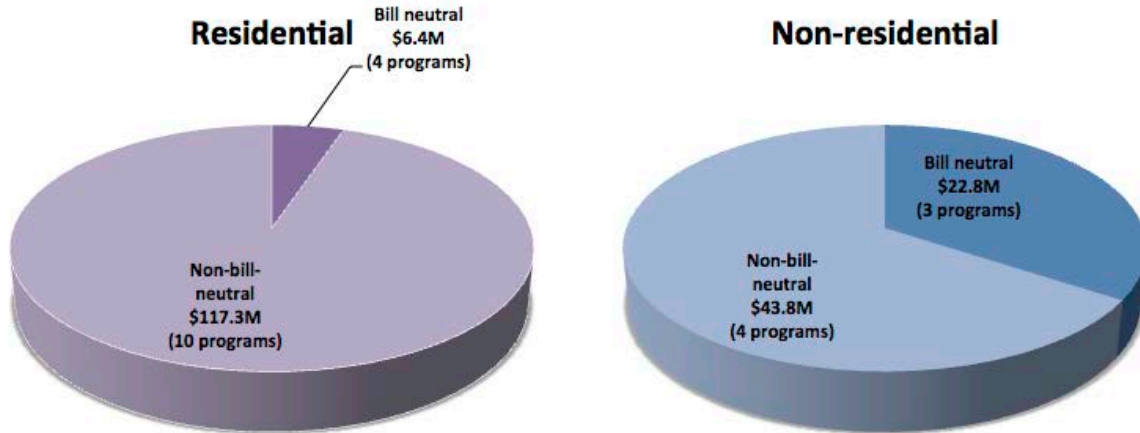



Figure 6-12. Comparison of 2012 on-bill financing volume by sector and by programs that do and do not require bill neutrality

Manitoba Hydro and NYSERDA each operate two residential financing initiatives—one that requires bill neutrality and one that does not.⁸⁰ These programs offer anecdotal evidence on the feature’s impacts on consumer adoption:

- Manitoba Hydro.** Manitoba Hydro operates both the Pay As You Save (PAYS) on-bill program, which requires bill neutrality, and the Power Smart Residential Loan (PSRL) on-bill program, which does not. PSRL has been available for 12 years and PAYS has only been offered for one year. However, the difference in consumer participation in the two programs is stark. In PAYS’ first five months, just 52 consumers participated in the initiative (\$225K of financing) while consumers borrowed approximately \$15M through PSRL during the same time period. Manitoba Hydro has low electricity rates (\$.07/kWh), which makes it more difficult for projects to meet the bill neutrality threshold. Program administrators attribute the difference in uptake of the two products primarily to PAYS’ bill neutrality requirement and to the different target markets as PAYS targets consumers that are unlikely to participate in PSRL due to creditworthiness challenges (see Appendix B for Manitoba Hydro case study).
- NYSERDA.** NYSERDA’s Green Jobs-Green New York program offers two financing options for efficiency upgrades: the On-Bill Residential Finance (OBRF) program, initiated in early 2012, which requires bill neutrality, and the off-bill Smart Energy Loan (SEL) product, which has been offered since 2010 and does not require bill neutrality. While the two loan products have seen approximately the same number of applicants (55 percent of applicants request OBRF), 14 percent of those that get approved for OBRF end up opting for an SEL loan. Program administrators attribute this switching primarily to OBRF’s bill neutrality requirement and noted that contractors and consumers have complained about their inability to finance non-bill neutral projects through OBRF (see Appendix A for NYSERDA case study).

Other program experiences are also informative:

⁸⁰ Both of Manitoba Hydro’s offerings are repaid on-bill. The bill neutrality requirement only applies to NYSERDA’s on-bill program, not its off-bill offering.

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- **The Green Deal (UK).** Program designers for the UK’s nationwide Green Deal on-bill financing program included a bill neutrality requirement, known as the ‘Golden Rule’. The requirement puts substantial constraints on consumers’ ability to finance targeted EE improvements. Program designers were aware of this challenge and anticipated that substantial incentives would be available from energy providers that would, in effect, buy down the cost of the projects to a “bill neutral” point. However, these incentives have been slow to materialize, and without them, many projects are not able to meet the Golden Rule requirement. This has been one of several important factors in the program’s low early participation (see Appendix B for a case study on The Green Deal).
 - **Clean Energy Works Oregon.** Adam Zimmerman, manager of Craft3’s consumer loan products (Craft3 is Clean Energy Works Oregon’s OBF financial partner), noted that, as a lender, he is not concerned with bill neutrality and does not think it is necessarily attainable, given the deep energy savings goals of their program, low energy prices in the region, and uncertainty about the behavior of the building occupants (and its influence on whether they will realize expected savings). Zimmerman indicated that the program allows the consumer and contractor to figure out the best options and pricing for that home (see Appendix A for a case study on Clean Energy Works Oregon).

A second consumer demand-related consideration for policymakers and program administrators is that if bill neutrality is a key requirement and selling point of a program, there may be an increased risk of participant dissatisfaction (and a loss of market momentum) should realized energy savings not meet expectations.⁸¹ In California, a compromise was struck. Rather than require bill neutrality, utility regulators required that energy efficiency service providers disclose expected bill impacts to consumers. This approach may maximize consumer flexibility to finance the projects that they want to invest in, while also ensuring that they are aware of the likely financial impacts of these projects (see Appendix A for a case study on the CA OBR programs).

On-Bill Structure Alone May Not Be Enough—Financial Incentives Are Often the Key to Success for Comprehensive Programs

Those programs that have successfully driven both substantial consumer participation and deeper, multi-measure EE projects, have coupled on-bill eligibility with substantial financial incentives. For example, in CT, the United Illuminating Small Business Energy Advantage Program has achieved ~20 percent average per-project energy savings by delivering zero percent on-bill financing and providing incentives of up to 50 percent of project cost if a project includes measures to reduce energy consumption across multiple end uses (see Appendix A for United Illuminating case study).⁸²

⁸¹ While this risk may exist whether a bill neutrality requirement exists or not, it is likely to be exacerbated where this requirement is present as participants may view this program element as an implicit program promise that they will save money.

⁸² United Illuminating reported that rebates average about 35 percent of project costs in their small business program.




Conclusion

Enabling consumers to finance energy improvements on their utility bills is one of several potentially valuable tools for expanding consumer access to attractive capital. While financing may be an attractive tool for increasing program leverage and mitigating the rate impacts of utility consumer-funded efficiency programs, administrators can face difficult choices between allocating funds to financing or to other approaches designed to overcome a broader set of barriers to consumer investment in energy efficiency.

This report focuses on key program design considerations for policymakers and program administrators. We do not address the question of whether policymakers and program administrators should launch or continue operating on-bill financing programs. The answer to that question will be context-specific. We organize our analysis of program design considerations around several issues: (1) the use of disconnection and meter attachment; (2) the source of capital; (3) assessing consumer creditworthiness; and (4) measure eligibility.

Our major findings include:

- **Disconnection and meter attachment.** In comparing existing on-bill programs, we found that programs allowing utility service disconnection tend to have slightly higher participant default rates (1.67% for programs that allow disconnection, 1.08% for those that don't). However, there are many other program characteristics, program design factors and attributes of a program's target consumer segment that contribute to default rates. Due to these other influences we do not believe it is appropriate to draw conclusions regarding differences in these default rates. All on-bill programs reviewed in this report have experienced low default rates. However, the overall low default rates suggest that enabling consumers to repay financing on-bill, regardless of the consequences of non-payment, may be a promising approach to delivering widespread consumer access to attractive capital at low risk
- **Source of capital.** Historically, on-bill programs have utilized public, utility bill-payer, or shareholder capital to fund loans. However, in recent years, we find more examples of on-bill programs that leverage private capital. We identified multiple pathways to tapping into private investor monies and found that the choice of a pathway has significant impacts on program administration costs, as well as administrator flexibility in program design. Additionally, while some program administrators have been reluctant to provide guarantees against losses to private sector on-bill investors, experience to date suggests that this credit enhancement strategy is worth consideration. Credit enhancements may be an effective way to access pools of low-cost private capital, at apparently low risk to utility bill-payers, while maintaining program flexibility.
- **Assessing Consumer Creditworthiness.** Our analysis of existing on-bill programs did not yield an obvious association between a program's underwriting criteria and participant default rates, suggesting that a range of underwriting approaches—including those that rely primarily on utility bill repayment history—may be effective in identifying creditworthy applicants. However, the choice of underwriting criteria is an important design issue for program administrators because it appears to significantly influence on-bill program application approval rates. The one program that relies on traditional underwriting criteria rejects at about eight times as many applications compared to the median rejection rate of on-bill loan programs that rely primarily on utility bill repayment history.
- **Measure Eligibility.** On-bill programs that have achieved significant uptake in their target market have typically taken one of two approaches: 1) allow consumers to finance almost any “energy-related” improvements with particular focus on single measures (e.g., high-efficiency equipment, windows); or 2) access to on-bill lending is coupled with robust financial incentives (e.g., rebates). The former approach raises questions about the extent to which these initiatives lead to comprehensive retrofits or significantly transform existing efficiency services markets, while the latter approach may raise questions about the cost-effectiveness (and/or potential rate impacts) of these programs. We also found that programs requiring “bill neutrality” have often struggled to achieve significant market penetration and do not appear to have significantly fewer defaults.




Enabling consumers to finance energy improvements on their utility bills should be considered within the suite of options to encourage the adoption of energy efficiency. As on-bill initiatives continue to attract attention, it will be important for policymakers, administrators, and stakeholders to continue to rigorously assess their efficacy in achieving programmatic goals and to share lessons learned broadly, so that we can better understand how, and for whom,⁸³ these initiatives can help to deliver incremental, cost-effective energy savings at scale.

⁸³ For more information around our understanding of what EE financing can be reasonably expected to achieve, and for whom, see [“Getting the Biggest Bang for the Buck: Exploring the Rationales and Design Options for Energy Efficiency Financing Programs”](#) (Zimring et al 2013).



References

- Bell, C., S. Nadel & S. Hayes. 2011. *On-Bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities, and Best Practices*. ACEEE report number E118. American Council for an Energy-Efficient Economy. [LINK](#)
- Board of Governors of the Federal Reserve System (Federal Reserve Board). 2013. "Charge-Off and Delinquency Rates on Loans and Leases at Commercial Banks." [LINK](#)
- Brown, M.H. and D. Carey, Harcourt Brown & Carey. January 17, 2013. "Using Financing to Scale Up Energy Efficiency: Conclusions from Interviews with Market Actors." Presentation to the SEE Action Financing Solutions Working Group." Data provided by Experian Corporation 2011. [LINK](#)
- Brown, M., Conover, B., Conover. 2009. *Recent Innovations in Financing for Clean Energy*. Southwest Energy Efficiency Project. [LINK](#)
- California Public Utilities Commission (CPUC). 2013. "Proposed Decision Implementing 2013-2014 Energy Efficiency Financing Pilot Programs" [LINK](#)
- Energy Efficiency Financing Pilot Programs." [LINK](#)
- Connecticut Clean Energy Finance and Investment Authority (CEFIA). 2013. "Comprehensive Plan: FY 2013 through FY 2015." [LINK](#)
- Cuomo, M. 2013. "NY Rising. 2013 State of the State." [LINK](#)
- Board of Governors of the Federal Reserve. 2014. Charge-off and Delinquency Rates on Loans and Leases at Commercial Banks. [LINK](#)
- Fuller, M. C. Kunkel, M. Zimring, I. Hoffman, K.L. Soroye, and C. Goldman. September 2010. "Driving Demand for Home Energy Improvements." LBNL-3960E. Lawrence Berkeley National Laboratory. [LINK](#)
- Harcourt Brown and Carey: Energy and Finance (HB&C). 2011. "On-Bill Financing for Energy Efficiency: Review of Programs to Date." Prepared for the Environmental Defense Fund. [LINK](#)
- Henderson P. 2013. On-Bill Financing: Overview and Key Considerations for Program Design. Natural Resources Defense Council. [LINK](#)
- International Energy Agency. 2008. "Promoting Energy Efficiency Investments: Case studies in the residential sector." ISBN 978-92-64-04214-8. [LINK](#)
- Jaffe, A. B., and R. N. Stavins. 1994. "The Energy Paradox and the Diffusion of Conservation Technology." *Resource and Energy Economics* 16, no. 2. Pp. 91–122. May 1994. [LINK](#)
- Keegan, Patrick. *Help My House Pilot Program: Final Summary Report*. 2013. Prepared for Central Electric Power Cooperative, Columbia, South Carolina, and The Electric Cooperatives of South Carolina, Cayce, South Carolina. [LINK](#)
- Larsen, P. C. Goldman, D. Gilligan and T. Singer. 2012. "Incorporating Non-energy Benefits into Energy Performance Savings Contracts." ACEEE Summer Study on Energy Efficiency in Buildings. [LINK](#)
- SEE Action Financing Solutions Working Group. 2011. Financing Solutions Working Group Blueprint. [LINK](#)
- Zimring, M. M.G. Borgeson, I. Hoffman, C. Goldman, E. Stuart, A. Todd and M. Billingsley. 2011. *Delivering Energy Efficiency to Middle Income Single Family Households*. Lawrence Berkeley National Laboratory, Report number 5244E. [LINK](#)



Zimring, M., M.G. Borgeson, I. Hoffman, C. Goldman, E. Stuart, A. Todd and M. Billingsley. April 4, 2012. "Alternative Underwriting Criteria—Using Utility Bill Payment History as a Proxy for Credit: Case Study on Clean Energy Works Oregon. Clean Energy Financing Policy Brief." Lawrence Berkeley National. [LINK](#)

Zimring, M., M.G. Borgeson and C. Goldman. 2013. "Getting the Biggest Bang for the Buck: Exploring the Rationales and Design Options for Energy Efficiency Financing Programs." Lawrence Berkeley National Laboratory, U.S. Department of Energy. [LINK](#)

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