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Energy Efficiency Program Financing

Where it comes from, where it goes, and how it gets there

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In this technical brief we characterize the programmatic energy efficiency financing market from a quantitative perspective. Financing in this report refers to provision of capital—which is paid back over time—to cover up-front costs of energy efficiency. It does not refer to rebates and other types of incentives. We gather and report data on the volume of capital for energy efficiency financing that originated from five programmatic sources: on-bill programs; other utility financing programs; property assessed clean energy (PACE) programs; state energy office (SEO) revolving loan funds (RLF); and energy savings performance contracting (ESPC) programs. We estimate the amount of investment moving through EE financing programs, the sources of capital they employ, and program availability and activity by geography and market sector (residential and non-residential). We also present information on trends in investment by program type, and on the presence or absence of certain program design features, such as credit enhancements and interest rate buydowns. The result is a much more comprehensive accounting of programmatic energy efficiency financing activity than exists elsewhere.

Our key takeaways include:

- Programmatic financing sources in our sample of programs accounted for about $4.8 billion in energy efficiency lending capital in 2014;
- ESPC represents about 85% of that total; the remaining efficiency finance programs accounted for about $700 million in 2014;
- Excluding ESPC, total loan volumes are heavily driven by a handful of programs that are lending large volumes while most programs are small;
- About 65% of the loan volume for efficiency finance programs in our sample targeted electric savings rather than savings from other fuels;
- Efficiency finance programs are available in most states in most sectors, though gaps do exist;
- Public capital, especially State Energy Program (SEP) and Energy Efficiency and Conservation Block Grant (EECBG) capital made available through the American Recovery and Reinvestment Act (ARRA), has played a role in many of the programs in our study;
- The programs that have attained the largest lending volumes have engaged private capital and tend to employ more credit enhancements and interest rate buydowns (IRB).

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Introduction

The last several years have witnessed substantial growth in interest and activity in the energy efficiency (EE) financing market. Easy access to attractive financing can help overcome a common barrier to EE: the higher first cost of more efficient products (as compared to standard products). Financing also offers promise as a means to maximize the impact of public funding for energy efficiency. Many state policymakers and utility regulators have established aggressive savings targets that will require billions of dollars of investment in existing buildings to realize. Most typically, EE program administrators rely on utility customer or taxpayer funds to achieve policy goals by incenting consumers to invest in high-efficiency measures and strategies. These funds are limited and many program administrators and policymakers are seeking to amplify their impact through EE financing programs by attracting private capital and encouraging substantial cost contributions from households, businesses and other energy users.

EE financing programs and products have many structures, with different goals and target markets. They are designed and implemented by a variety of actors, including public agencies at all levels of government; investor-owned, municipal, and cooperative utilities and third parties under contract with those utilities; and private providers of EE financing products/arrangements. Existing programs have emerged in a highly decentralized fashion, and it is challenging to obtain an overview of market activity nationally, by state and market sector.

This technical brief seeks to partially remedy that information gap. We estimate the amount of investment moving through EE financing programs, the sources of capital they employ, and their geographic and sectoral coverage. We also present information on trends in investment by program type and on the presence of program design features, such as credit enhancements and interest rate buydowns (IRB). Our goal is to provide a much more comprehensive accounting of programmatic EE financing activity than exists elsewhere.

Scope of study

Programmatic efficiency finance products vary widely and are often classified into a number of different product types (e.g., PACE or on-bill). It is also important to understand the level of efficiency finance market activity by market segment (residential, commercial/industrial, institutional sector), geographic region and sources of funds that are used to capitalize the loans.

We developed a framework that characterizes efficiency finance programs in five categories:

1. On-bill financing and repayment;
2. Utility financing programs (in which loans are not paid back on-bill);
3. Property Assessed Clean Energy (PACE) financing;
4. State energy office (SEO) revolving loan funds (RLF); and
5. Energy Savings Performance Contracts (ESPCs).

The categories are defined as follows:

On-bill financing and repayment (OBF/OBR): This category includes any offerings in which financing for energy efficiency is paid back on the borrower's utility bill. This includes both on-bill financing programs - in which ratepayer, utility, or public funds are used to capitalize efficiency loans - and on-bill repayment programs - in which efficiency loans are funded by private capital (e.g., through funds provided by financial institutions). Some OBF/OBR programs are administered by non-utility entities, all of these programs involve a utility in order to collect loan payments through utility bills. For more information on on-bill programs, see SEE Action (2014b).

Utility financing programs (in which loans are not paid back on-bill): This category includes financing programs administered by utilities (or a third party implementer selected by utilities) that use funds provided by utility customers (or utility shareholders) either to capitalize loans, provide credit enhancements, or buy down interest rates to customers. These programs do not fit into any other program category and are associated with utilities in one of the ways mentioned.

Property Assessed Clean Energy financing (PACE): In a typical PACE transaction, a municipality adds an assessment or charge to a property owner's property tax bill as a means to pay back an energy efficiency loan to the property owner for a period of time (e.g., 20 years). Municipalities must establish a special assessment district for this purpose, and in the majority of states, legislation is required to give municipalities this authority. To date, more than 30 states have passed legislation allowing for the creation of PACE districts. Although municipalities establish these programs and collect loan payments, the programs are often run by third party program administrators and loans are often funded by private capital providers.

State Energy Office (SEO) Revolving Loan Funds (RLF): Many state energy offices (SEO) administer revolving loan funds (RLF) in which loans are made to end users for eligible measures and the capital of the RLF is preserved through repayments of those loans by customers. RLFs that lend money for energy efficiency are counted in this category. For additional discussion of SEO RLFs see Goldman et al. (2011).

Energy Savings Performance Contracts (ESPC): ESPCs are performance-based contracts between Energy Service Companies (ESCOs) and building owners—most often customers in the institutional market (i.e., state/local governments, K-12 schools, universities/colleges, hospitals, and agencies of the federal government). The ESCO typically guarantees the building owner that the project will deliver certain level of energy or dollar savings – generally, a level sufficient to pay for financed project costs via those savings. Although ESPCs are not technically a financing product, they facilitate financing arrangements. For more on ESPC, see Stuart et al. (2014).

For an in-depth look at the financing products that are offered in each category (specifically unsecured, off-bill utility loans, PACE loans, on-bill loans, and ESPCs) see Lawrence Berkeley National

Laboratory's upcoming report *Current Practices in Efficiency Financing: An Overview for State and Local Governments* (Leventis et al., forthcoming).

Classifying efficiency finance programs into these five categories is not always straightforward because some programs could reasonably be counted in more than one category. For example, the New York State Energy Research and Development Authority (NYSERDA), which is the state energy office for New York, also acts as a third party administrator for some programs that use utility customer funds and administers other programs that utilize other funding sources. NYSERDA offers two loan products: a standard unsecured product and an on-bill product. In our rubric, we assign any on-bill lending to the on-bill category. Thus, we have split the NYSERDA program by product. We assign the on-bill lending to the on-bill category and the unsecured lending to the SEO category because the Smart Energy Loan product is funded by public (not utility) dollars and has limited utility involvement. On the other hand, we classify some programs managed by third party administrators as "utility programs" because they are funded primarily by utility customers although they may receive some support from State Energy Program funds. Examples include the Mass Save HEAT loans and New Jersey's Home Performance with EnergyStar program. As such, we urge caution and perspective when considering lending totals by program category.

It is also important to note that there are efficiency financing programs and programmatic mechanisms that fall outside of these five categories and are not covered in this technical brief. Examples include local government programs; private loan products, often offered by credit unions or community development financial institutions (CDFI), sometimes with public support; state programs run by agencies other than SEOs[1]; and federal vehicles designed to provide financing for EE projects, most notably qualified energy conservation bonds (QECB). As this study focuses on end user lending, we also excluded programs that support manufacturers of energy efficiency technologies rather than end users; we identified a limited number of these. Finally, we excluded cases in which a utility or SEO offered a grant or credit enhancement to an outside actor – usually a community development finance institution – to support a lending program but did not contribute lending capital and had little role in designing or implementing the program.

Approach and Data Sources

Apart from ESPC, our method was similar for each program category. First, we collected and compiled program-level data from various sources including several LBNL research projects (e.g., our ESCO database and on-bill finance study), other existing resources (e.g., the DSIRE database, NASEO data on SEO programs, and data on PACE programs collected by PACENation), and direct communications with program administrators. We then aggregated data and summarized lending activity, primarily by program category, sector, and state.

[1] These include programs administered by housing agencies (e.g., the Alaska Housing Finance Corporation's Home Energy Loan program), state treasuries (e.g., Pennsylvania's Keystone HELP program), or agencies that manage state facilities (e.g., the California Department of General Services' School Facility Modernization Program, which is not a dedicated EE financing product but does provide substantial capital to EE projects in California schools). It was necessary to set these programs aside to clearly define and manage the scope of data collection for this report.

In most cases, market activity data are not generally available in program documents or web sites. Thus, we are missing data on some programs where administrators did not respond to direct solicitation from LBNL or our data collection partners (e.g., NASEO). For three program categories – utility financing programs, on-bill programs, and PACE – we are confident that the missing programs constitute a very small fraction of total lending volume in those program categories. For RLF programs administered by state energy offices, we are missing information on lending volumes for more programs that may account for significant market activity in that category. We have chosen not to make any adjustments for missing program data, and as such our estimates of total market activity should be viewed as conservative (see Appendix A for more on treatment of missing data).

Many of the finance programs in our sample also fund renewable energy measures. We estimate and remove the share of lending that went toward renewable measures using either program-level (where available) or market-level data. For PACE programs, this is a fairly significant adjustment, removing 33% and 38% of capital loaned by residential and commercial PACE program administrators, respectively. For the other four program categories this adjustment is much smaller. Many programs also allow the borrower to finance certain costs that are not energy-related but may be incurred in the process of making energy upgrades; we have not attempted to remove these costs.

For ESPC, we do not have program-level information. Instead we leverage information from existing LBNL sources: a database of more than 5,200 ESCO projects and periodic interviews and discussions with senior ESCO representatives on industry and market trends. We use information from these interviews to estimate aggregate market activity financed through ESPCs by ESCOs industry as well as the breakdown in project costs between efficiency measures and renewable energy/onsite generation. We use the LBNL ESCO database (Stuart et al. (2014)) to estimate the regional breakdown of those investments. In this study, we also remove project costs attributable to renewables to develop our estimate of ESCO efficiency market finance activity (see Appendix A for a more detailed discussion).

Data sources

On-bill financing and other utility financing programs: These programs were identified through the Database of State Incentives for Renewables & Efficiency (DSIRE), a literature review, and conversations with program administrators. Data for on-bill programs and utility programs were collected similarly. We used public data if available and also communicated directly with program administrators to obtain information on the number of loans and annual loan volume in 2014. For on-bill programs, we drew upon data collected in a previous LBNL study (SEE Action 2014b).

Property Assessed Clean Energy financing: PACE Nation collects project-level data from commercial PACE providers. With the consent of those providers, PACE Nation graciously provided data for commercial PACE programs to LBNL. We collected residential PACE data through direct outreach to providers, through review of public documents, and from a recent LBNL report (Fadrhonc et al. 2016).

State Energy Office Revolving Loan Funds: The National Association of State Energy Offices (NASEO) periodically gathers information on revolving loan funds (RLF) from State Energy Offices. NASEO included a number of additional questions on their most recent questionnaire for this study. We also consulted DSIRE, gathered information from program websites and had limited direct communication with state energy offices.

Energy Savings Performance Contracts (ESPC): To estimate ESPC lending volumes and geographic distributions, we leverage information from existing LBNL sources. We drew upon the results of interviews with ESCOs on industry and market trends conducted by LBNL and the National Association of Energy Services Companies (NAESCO) (Stuart et al. 2014; LBNL 2015). We also utilized a database of more than 5,200 ESCO projects maintained by LBNL.

Characterizing the National Market for Efficiency Program Financing

Table 1 summarizes our estimates of total capital loaned to end users in 2014 for efficiency projects in the five program categories as well as the volume of capital loaned in each market sector.[2] About $4.8 billion was loaned in 2014 to customer efficiency projects in these five program categories. ESPC projects comprise about 85% of that total and are heavily concentrated in the public/institutional market ($3.9B), with modest market activity in commercial/industrial markets ($171M). On-bill programs are the other major source of programmatic capital for the C&I sector. PACE, utility loans, and on-bill programs have a sizeable presence in the residential market. For RLF administered by state energy offices, more than 50% of the loan volume is in the public and institutional sector.

Table 1. Programmatic Efficiency Lending Volumes in 2014

Program Type	Total Loan Volume ($M)	Residential Sector ($M)	Number of Residential Loans	Commercial / Industrial Sector ($M)	Public / Institutional Sector ($M)	Number of Non-Residential Loans
On-bill	$179	$76	9,486	$89	$14	11,468
Utility loan (not on-bill)	$202	$196	16,607	$6	$0.1	231
PACE	$267	$248	12,061	$18	$0.8	27
State Energy Office RLF	$74	$17	1,595	$12	$45	92
ESPC	$4,101	-	-	$171	$3,929	-*
Total	**$4,823M**	**$537M**	**39,749**	**$296M**	**$3.989M**	**11,818**

*Project-level data needed to estimate the number of loans for ESPC was not available.

[2] Lending for multifamily (MF) buildings is included in the commercial and industrial sector, which is consistent with how most program administrators operate their programs. Except for a few programs specifically designed for multifamily buildings, most program administrators include these MF buildings under their commercial programs.

Exclusive of ESPC, about $700 million was loaned for efficiency measures in 2014 in the four other program categories via about 52,000 individual loans.[3]

The average loan sizes for non-residential loans implied by Table 1 suggest that the various non-residential loans are serving quite different customers. On-bill and off-bill utility loan programs are largely serving small businesses and have average loan amounts similar to residential loans (especially in the case of on-bill programs), whereas SEO and PACE programs are lending for much larger projects in the large commercial, industrial, and institutional sectors.

When looking at aggregate efficiency finance market activity among these five program categories, we considered the possibility of double-counting between ESPC investment and other sources. We can confirm based on ESCO survey responses that at least one ESCO used an on-bill program as a capital source in 2014, and we know that other ESCOs used SEO RLF funds for public/institutional projects (and possibly for commercial/industrial projects).[4] However, in aggregate, we believe that only a small fraction of SEO lending goes toward performance contracting projects.[5]

Loan volume by program

Figure 1 presents loan volumes for all individual programs in four categories. We do not include ESPC because we do not have program-level estimates for ESPC. Most efficiency finance programs are relatively small; the smallest 60 of the 101 programs in our sample collectively account for only 2% of total lending. Moreover, a handful of programs drive a very large fraction of total volume. This is perhaps our most striking finding. The two largest programs – the California HERO program and the Mass Save HEAT Loan program – account for 46% of the total capital loaned, and the five largest programs – which also includes the Tennessee Valley Authority's Energy Right Solutions program, New Jersey's Clean Energy Program, and the on-bill financing program run by California's investor-owned utilities – account for 65%.

[3] Our data were generally not sufficient to identify how many loans were made for renewable projects as opposed to efficiency projects. We therefore applied the fraction of dollars loaned to renewables in order to back out the number of loans that went to renewables. Differences in average loan size between programs that support a lot of renewable energy (PACE, most specifically) may in part be due to these data concerns and not due to the volume of efficiency financed by the average loan.

[4] We know of one ESPC project that was financed using an on-bill loan, but the loan volume was very small. We are not aware of ESPC projects that used PACE or utility program funds as a capital source, although we cannot rule this out. However, market activity in commercial PACE and utility programs is very small relative to the total loan volume for ESPC in the C/I market and would not affect the results.

[5] Thus, we have not adjusted our SEO or ESPC totals for double-counting; we are confident that any error is more than offset by investment not accounted for because of non-response from SEOs.

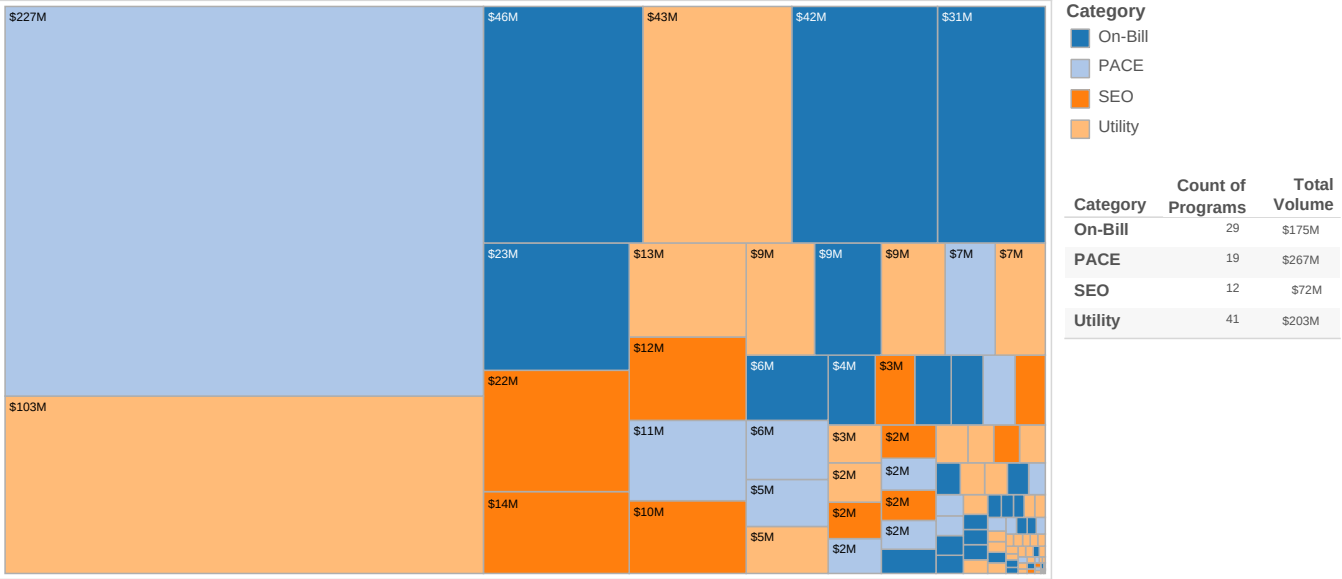


Figure 1. Loan Volume for Individual Efficiency Finance Programs: 2014

The relative importance of loan volumes of a few large programs is generally true within program categories and market sectors. Table 2 lists dominant programs by volume for each program category and sector. In every case, one or two programs account for more than half the loan volume.

Table 2: Minimum number of programs within each program category and market sector that, combined, account for 50% or more of the aggregate loan volume in that category and sector.

	Sector		
Program Category	**Residential**	**Commercial/Industrial**	**Public/Institutional**
On-bill	TVA Energy Right Solutions	California IOUs on-bill financing National Grid C&I program	California IOUs on-bill financing program
Utility	Mass Save HEAT Loan	Michigan Saves loan products	No significant volume
State Energy Office	NYSERDA Smart Energy Loan	AlabamaSAVES Nebraska Dollar and Energy Saving Loan Program	California ECAA loans Texas LoanStar
PACE	Renovate America HERO program	CT's C-PACE program	No significant volume

Loan volume by capital source

One of the motivations for many energy efficiency financing programs is to engage private capital markets and reduce the outlay of public and utility ratepayer funds required to drive deployment of

energy efficiency. We gathered data, where available, on sources of lending capital used to make loans for energy efficiency and summarize those results in this section.[6]

We break down sources of lending capital using the following typology and definitions:

- Private capital includes direct loans from banks, CDFIs, or other private lenders; capital from lines of credit issued by private institutions; and private capital contributions to loan funds. We also include municipal revenue bonds sold to private investors as a source of private capital. These bonds are generally backed by the proceeds of the projects funded (generally loan repayments) and borrowers do not have direct recourse to the issuing municipality if those revenues do not materialize.
- Utility capital includes money loaned by utilities, either directly or via contributions to loan funds. This includes both capital raised from utility customers (e.g., public benefits fund charges or DSM program budget costs that are recovered in utility bills) and capital contributed by a utility via its shareholders. Shareholder capital could be viewed as private; however, the vast majority of capital in this category is raised from utility customers.[7]
- Public capital includes capital raised via taxation or from other government revenue and which is appropriated for energy efficiency loan programs. This category includes capital originating from the federal government and granted to program administrators directly or via state agencies (including State Energy Program dollars, Energy Efficiency and Conservation Block Grants, and Better Buildings Neighborhood Program grants); money from state and local treasuries or general funds; revenues from greenhouse gas cap-and-trade systems; and funds from oil overcharge settlements.
- Hybrid capital is capital that is challenging to categorize due to secondary market transactions. In a secondary market transaction, a portfolio of loans made by a program is sold to an outside buyer. The program then uses those funds for further lending. For more on secondary market transactions for energy efficiency, see SEE Action (2015). Where the initial capital source is from a different category than the secondary source, there is no straightforward way to classify the capital used by that program. We classified capital sources for two loan programs as hybrid: the Smart Energy Loan and On-Bill Recovery Loan programs jointly run by NYSERDA.[8] Several other efficiency finance programs in our sample have closed secondary market sales, but both the original and secondary capital was privately sourced in all cases; thus, we categorize those programs' capital as private.

Many programs employ capital from more than one of these sources and a few programs blend public, private, and utility capital. For these programs, we gathered data on the share of lending capital that came from each source, and then apportioned the capital from these programs

[6] Capital sources for credit enhancements or interest rate buydowns are discussed in the next section.

[7] Quality of the data often does not allow us to disaggregate capital contributions from utility shareholders.

[8] NYSERDA sold a bond backed by a portfolio of these loans to private investors; the loans themselves were capitalized using public dollars.

accordingly. For example, a program that loaned $10 million in 2014 with 20% public and 80% private capital would contribute $2 million in public capital and $8 million in private capital to our totals.

We do not have sufficient data to reliably estimate capital sources for ESPC projects. Based on our collective knowledge of the ESPC market and conversations with ESCO industry experts, we expect that most capital for financed ESPC projects is private. However, some capital comes from bond issuances; some bonds for public/institutional sector projects are likely general obligation bonds, which are backed by the issuing municipality and have a much more public character. Some ESPC projects also rely on capital from state revolving loan funds (see section 2.1).

Table 3 provides our estimate of the capital source for each efficiency finance program category in 2014.

Table 3: Program category loan volume by capital source.

	Capital Source			
Program Category	**Utility ($M)**	**Private Sector ($M)**	**Public Sector ($M)**	**Hybrid ($M)**
On-bill	$114	$54	$0.3	$9.5
Utility	$18	$169	$4.4	None
State Energy Office	$10	$9	$44	$12
PACE	None	$246	$21	None
Total	**$142**	**$485**	**$63**	**$22**

Private capital is the largest capital source overall, contributing just over two thirds of the total for these four types of efficiency finance programs. This result is driven by large programs. The four largest programs in our data, which account for $418M in loan volume, are all privately sourced.

Interest rate buydowns and credit enhancements

Some efficiency finance programs in our sample employ interest rate buydowns (IRBs) or various credit enhancements. These mechanisms involve commitment of capital; that capital is not loaned out to individual end users, but does influence the terms at which programs offer their loans. For more on IRBs and credit enhancements see SEE Action (2014a).

Interest rate buydowns are payments typically made to a lender by another party to lower the interest rate of the loan or otherwise improve its terms. Among the programs in our sample, IRBs typically involve payments to private lenders using utility customer or public taxpayer funds.

Loan loss reserves and guarantees are two types of credit enhancements found in our sample of finance programs. Loan-loss reserves are accounts set aside for partial (or in some cases complete) repayment of lenders in the event that a borrower does not pay. Guarantees also protect lenders against nonpayment, but via a commitment from a third party to pay rather than a standing reserve. Public agencies provided the guarantees for programs included in this study.

We summarize our findings by program category.

SEO: Most SEO programs do not use IRBs or credit enhancements. The AlabamaSAVES program is the most notable exception; they used ARRA funds to buy down interest rates from private lenders and also created loan-loss reserves on a case-by-case basis. Several programs offer capital for a revolving loan fund at a low interest rate and require a match from private lenders, which leads to a lower rate for the borrower. This is not technically an IRB (because the RLF capital is repaid) or a credit enhancement (because it does not affect repayment risk for other lenders), but has a similar character.

PACE: Most residential PACE programs in California participate in a statewide loan loss reserve established by the California Alternative Energy and Advanced Transportation Authority (CAEATFA). Several commercial PACE programs and one non-California residential program have set up loan-loss reserves or debt service coverage reserves with ARRA grant funds. To our knowledge, no PACE program has implemented an IRB.

Utility and On-bill: Eight utility and on-bill programs used public money to provide credit enhancements. Most of these took the form of loan loss reserves funded through federal ARRA grants (one LLR was funded by state capital). The Tennessee Valley Authority (TVA) offers an on-bill repayment program to customers in which they buy back bad loans from the regional bank that capitalizes them, in effect a guarantee which allows the bank to offer the loans at below-market rates. NYSERDA re-capitalized their loan portfolio using a structure that involved a guarantee from the state's Clean Water State Revolving Loan Fund and the use of a qualified energy conservation bond (QECB), bringing NYSERDA's cost for the capital to below 1% and allowing them to lend to customers at less-than-market rates (SEE Action 2014b).

Fourteen utility or on-bill programs buy down the interest rates on their loan products. Of the ten programs that described their IRBs, all reported using utility customer funds to buy down interest rates on loans capitalized by private lenders. Three of the larger volume programs in this study (Mass Save HEAT loan, the New Jersey Clean Energy Program's Home Performance with Energy Star loan, and Michigan Saves' loan products) use this model.

We also find that larger-volume programs in our four categories (e.g., TVA and Mass Save HEAT) are more likely to employ IRBs or credit enhancements. However, causality is unclear: do IRBs and credit enhancements drive program volume, or do larger loan volumes (and therefore larger total liabilities) create the need for additional lender protection? IRBs and credit enhancements are most often used to induce private capital providers to participate. Therefore, this trend is directly related to and may be driven by the relationship between program size and private capital participation.

Trends in lending volume

We also compiled program loan volume data where possible by year from 2011 forward. For PACE we have data for the 2011-2013 period. For on-bill programs, we have data from 2012 from a previous study (SEE Action 2014b). For utility programs, we have loan volume data on many programs since 2011, although we are missing data for Mass Save HEAT from that year. Since Mass Save HEAT is the dominant program in this category, analyzing utility program trends from 2011 would not be informative. For ESPC, we have data for 2011 from our interviews with ESCOs on industry and market trends.

We note two important caveats. First, our data collection for programs that operated for part of this time but had closed by 2014 is likely partial. When generating our list of programs for data collection, we may well have missed programs that closed several years ago. Moreover, even where we did list such programs for data collection, we were less likely to be able to access data regarding programs that had closed. As a result, we are likely underestimating historic program volumes, particularly for SEO RLFs. Stimulus funding released under the American Recovery and Reinvestment Act (ARRA) in 2009 and 2010 created many RLFs and substantially expanded the capital pools of pre-existing RLFs. Four to five years later, when gathering data on SEO programs, we found that many of these programs were no longer open. We generally were not able to access data from these programs. Given these concerns, we do not display trend data for SEO RLFs.[9]

Second, as demonstrated above, the overall loan volumes by program category depend substantially on those of the largest programs. In particular, the trends for PACE and utility programs are strongly driven by those for California HERO and Mass Save HEAT, respectively.

Figure 2 shows historic lending volumes by program category for non-SEO finance programs in our sample that provided this information.

[9] In 2011 an LBNL study estimated that ARRA money committed to SEO RLFs could support a steady-state annual lending volume of $150-200 million. Our data suggest that today's loan volumes are smaller than this; in the years immediately following ARRA disbursement, volumes may have been closer to these values. See Goldman et al. (2011) for more.

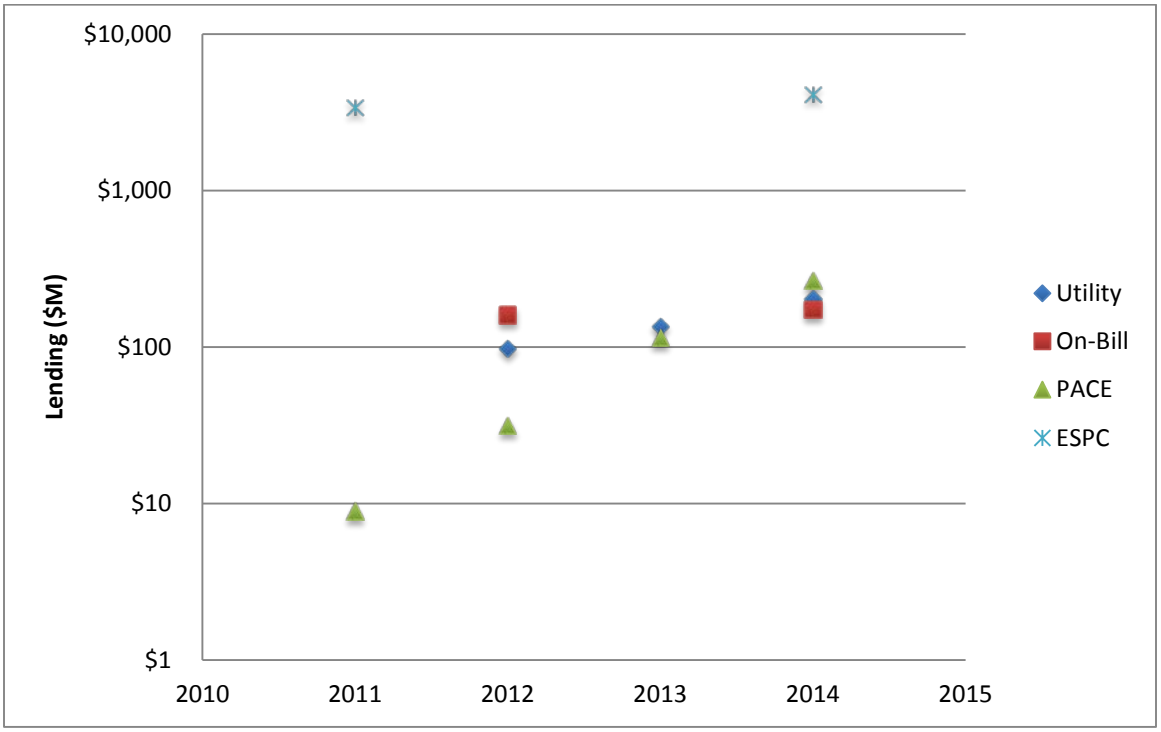


Figure 2: Trends in lending volume by program category

As Figure 2 shows. PACE loan volumes are increasing at a fairly significant rate since 2011 while ESPC, on-bill, and utility program volumes are expanding at a more modest rate. In our sample, EE lending from on-bill and utility loan programs respectively has grown by 4% and 44% annually from 2012 to 2014. EE lending from PACE has grown by 210% annually since 2011 and financed EE ESPC project volume has grown by 7% annually since 2011.

Estimate of investment in electric efficiency

Given the U.S. Department of Energy's focus on electricity in the current Quadrennial Energy Review, we offer an estimate of how investment supported by programmatic capital breaks down between measures that reduce electricity consumption and those that reduce consumption of other fuels.

As a first step, we excluded financing programs run by gas-only utilities from our analysis altogether. However, most if not all programs in our data impact both electricity use and use of other fuels through their lending. Indeed, even individual measures often impact both. Building shell improvements in buildings heated by other fuels and cooled by electricity should reduce usage of both fuels. Moreover, many improvements in efficiency of electric devices drive increased use of other fuels due to so-called interactive effects. More efficient electric devices generate less waste heat, which then requires space heating equipment (often powered by fuels other than electricity) to generate more heat and consume more fuel.[10]

[10] For more on interactive effects, see Sezgen and Koomey 1998, and Jyaweera and Haeri 2013.

We use the ESCO database to estimate the share of ESPC investment related to electricity. The ESCO database does not split project spending by fuel, but it does track savings by fuel. Using data from ESPC projects from the past ten years, we find that 62% of ESPC energy savings are electric. We assume that those savings are proportional to spending,[11] and therefore that 62% of our ESPC investment relates to electricity. This is about $2.5 billion.

Financing programs in the other four categories often do not track their spending or impacts by fuel. Therefore, to estimate electricity investment from these programs, we reference another LBNL database that tracks spending and savings from utility energy efficiency programs. See Hoffman et al. (2015) for more details on these data. The programs we extract from the database are not financing programs. Rather, they are other utility programs that support the same types of measures that financing programs support, and are therefore a good proxy for investments supported by financing programs. Among such programs, 82% of investment is apportioned to electricity. This percentage implies about $580 million in electricity investment from the other program categories.

On balance, therefore, we estimate $3.1 billion in electricity efficiency investment from the programs in our study.

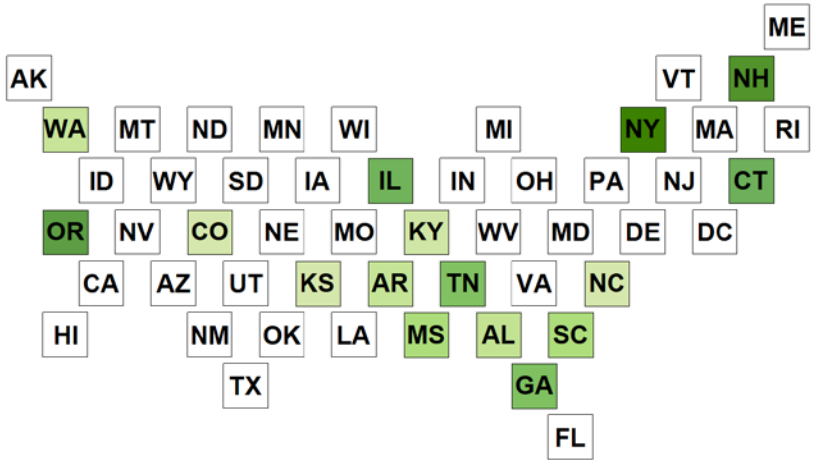
Efficiency Finance Program Availability and Investment by State and Region

Program availability

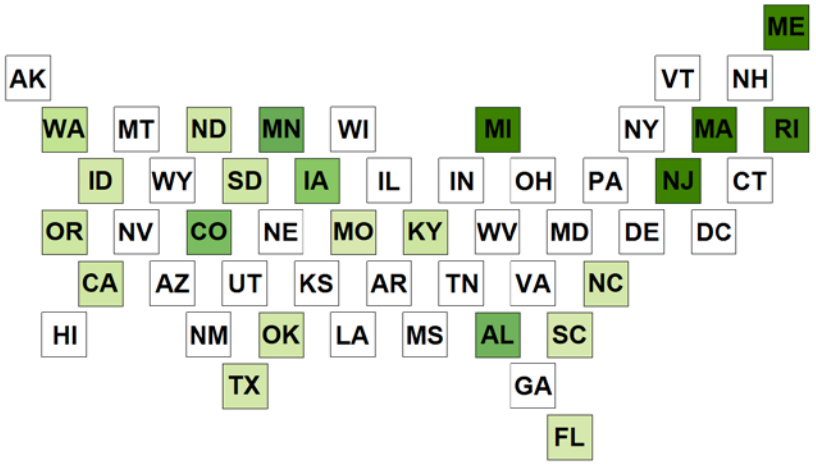
Figure 3 shows the geographic distribution of residential program availability by state for (clockwise from top left) on-bill, utility, SEO, and PACE programs. ESPC is not used for residential projects. The color scale shows the fraction of state residential load (in the case of on-bill and utility programs, which map readily to utility service territories) or residential population (in the case of PACE and SEO, which do not) that had access to at least one residential finance program in this category in 2014. The darker the color, the greater the proportion of residential customers in a state with access to a financing program.

[11] Strictly speaking, this assumption is likely not true. Non-electric measures (e.g., boilers) generally have a lower savings to cost ratio than electric measures (e.g., lighting and controls). Therefore, our electricity investment estimates for ESPC may be overstated. However, we have no evidence base that would justify a different assumption.

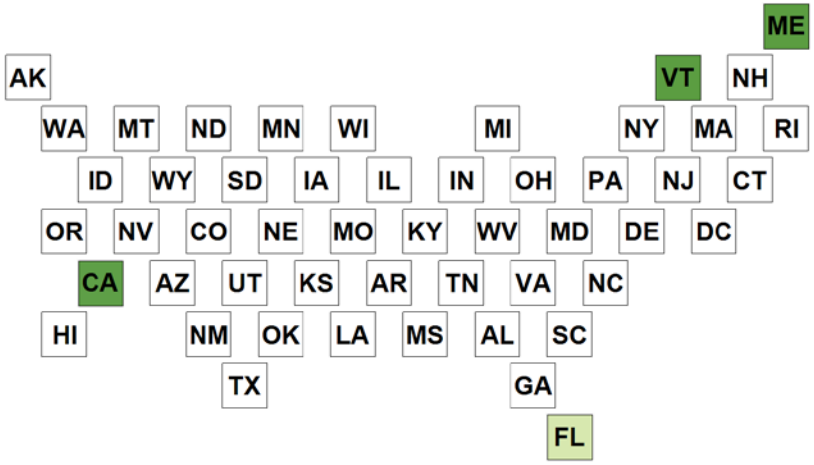
On-bill



Utility



PACE



SEO

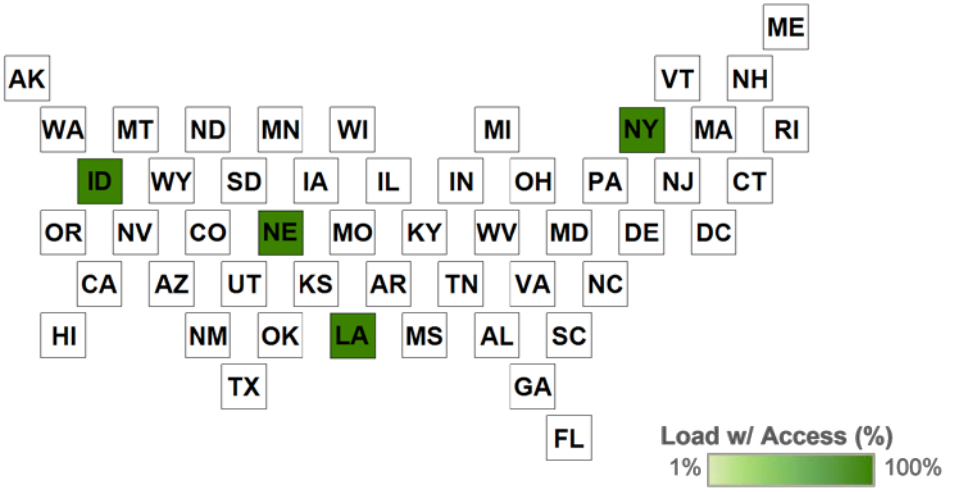
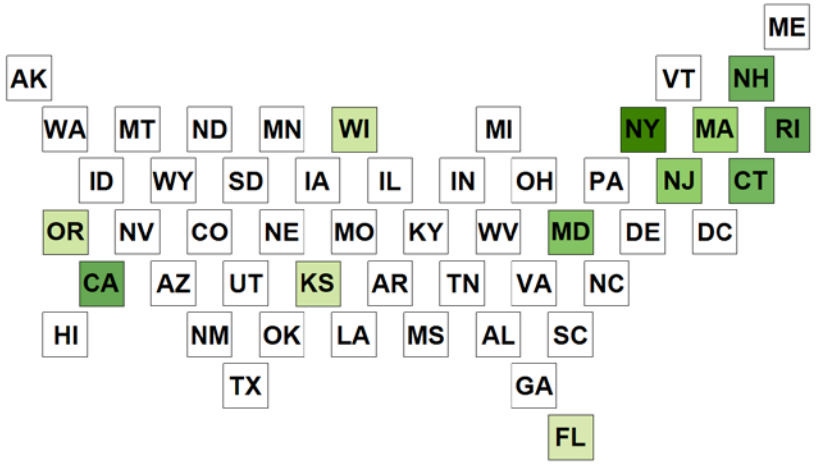
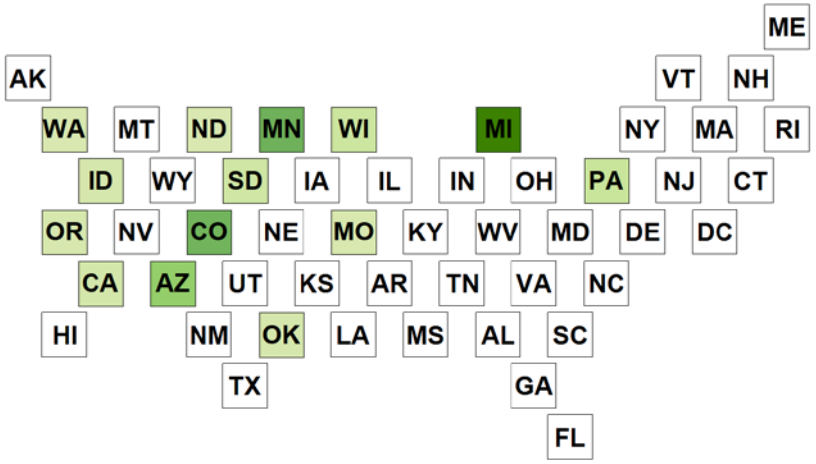


Figure 3: Availability of efficiency finance programs for residential customers by program category.

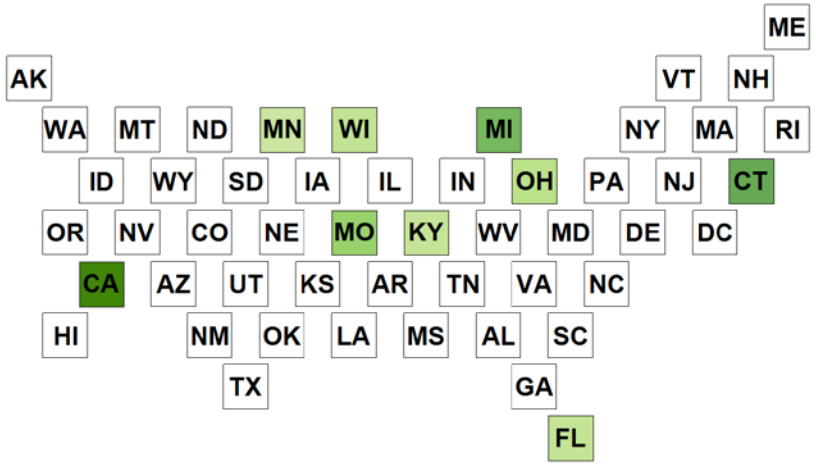
On-bill



Utility



PACE



SEO

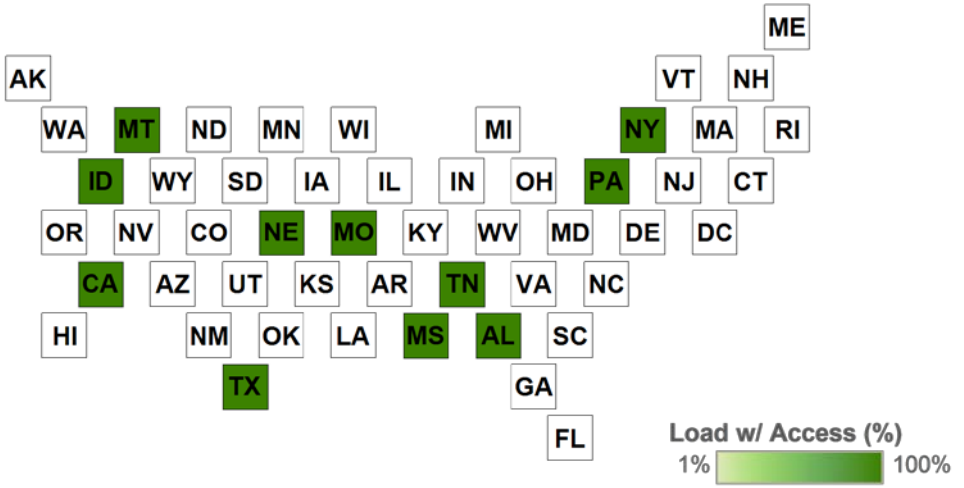


Figure 4: Availability of efficiency finance programs for non-residential customers by program category.

Figure 4 shows data on the availability of non-residential financing programs. PACE and SEO programs for non-residential customers were considerably more numerous than for residential customers. In aggregate, a non-residential program was available to at least some customers in most states. However, many programs cover only a portion of the non-residential market (e.g., only small businesses or industrial cutomers or institutional sector customers), which the maps do not reflect.

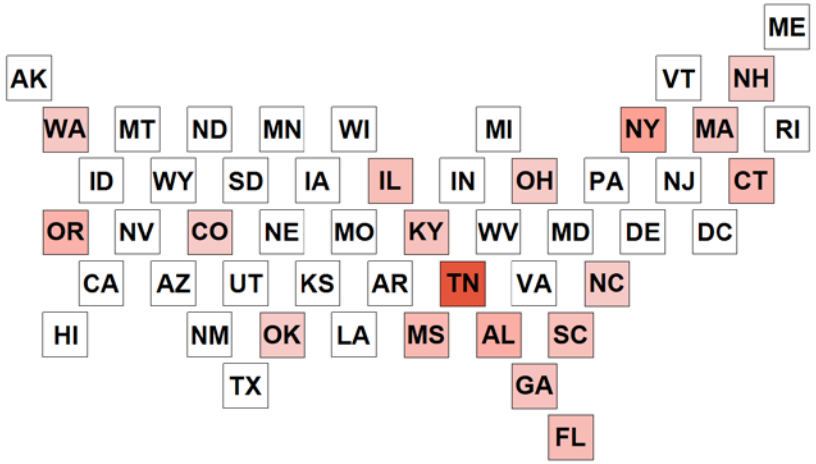
Program loan volume by state, non-ESPC

Figure 5 shows the dollar amounts loaned to residential borrowers from each program category in the same pattern. Colored states loaned money for EE in 2014; darker states loaned larger volumes.

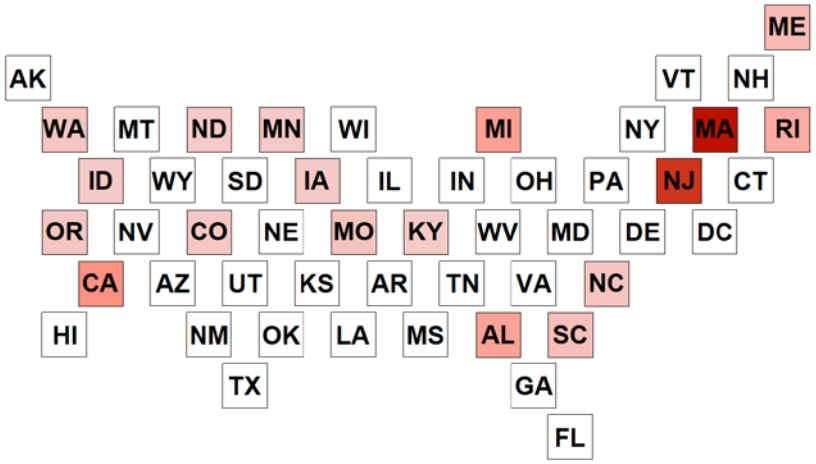
Figure 6 shows lending by state per MWh of state residential load. States on the yellow-red spectrum have positive lending; redder states have loaned more per MWh of load than yellower states.

Figure 7 shows lending volume and lending volume per MWh of state residential load for all categories combined. Colored states have positive lending amounts, while redder/darker states have larger loan volumes.

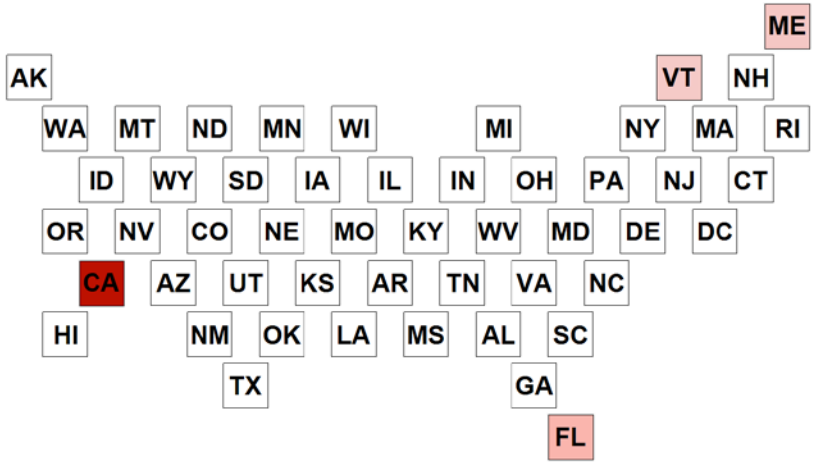
On-bill



Utility



PACE



SEO

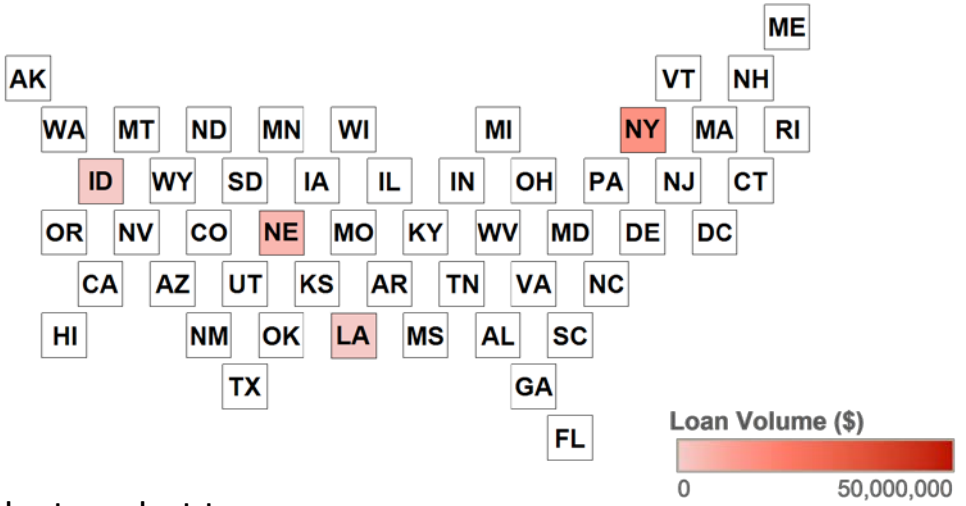
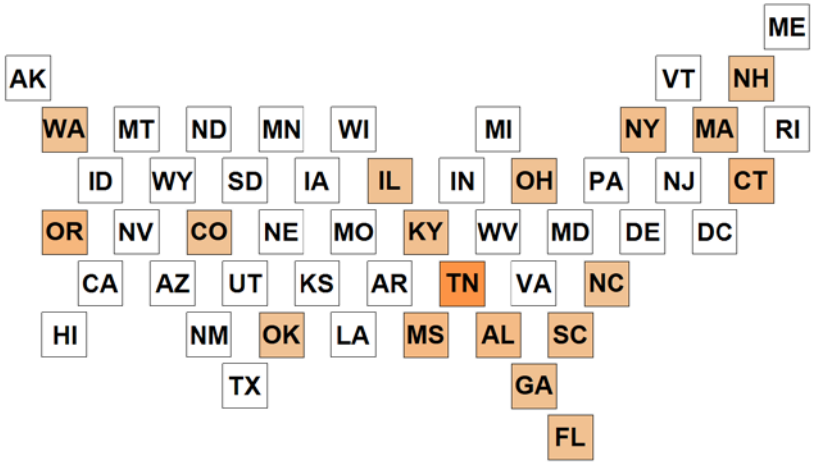
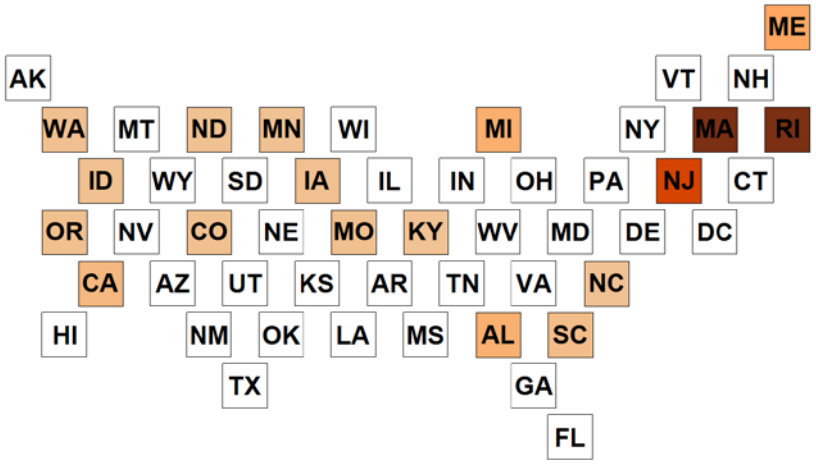


Figure 5: 2014 Efficiency finance program loan volume in 2014 for residential customers by state

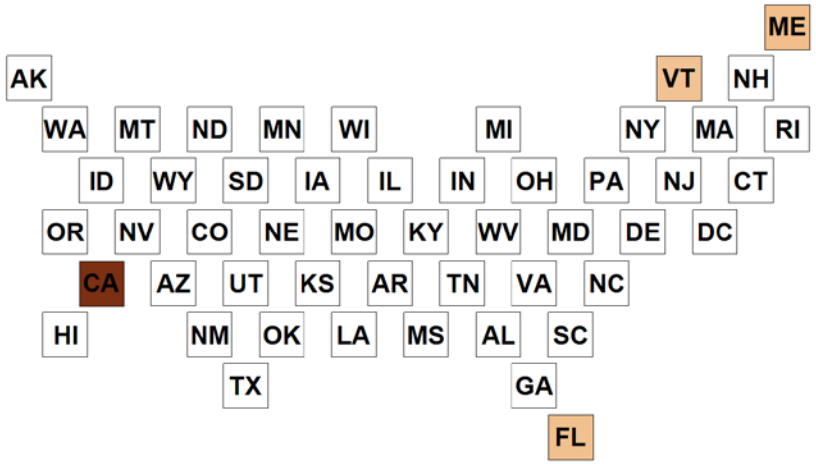
On-bill



Utility



PACE



SEO

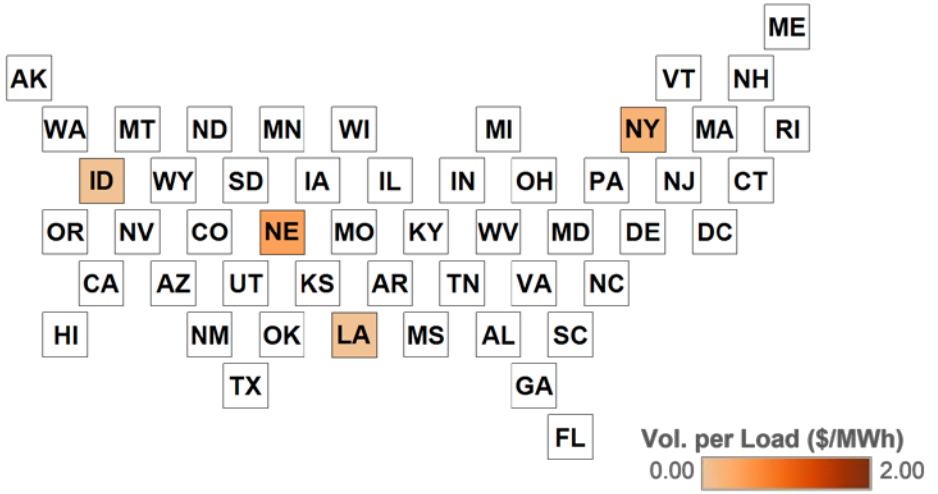


Figure 6: Efficiency loan volume in 2014 per MWh of residential load by state

All Categories: Residential Loan Volume

All Categories: Residential Loan Volume per MWh

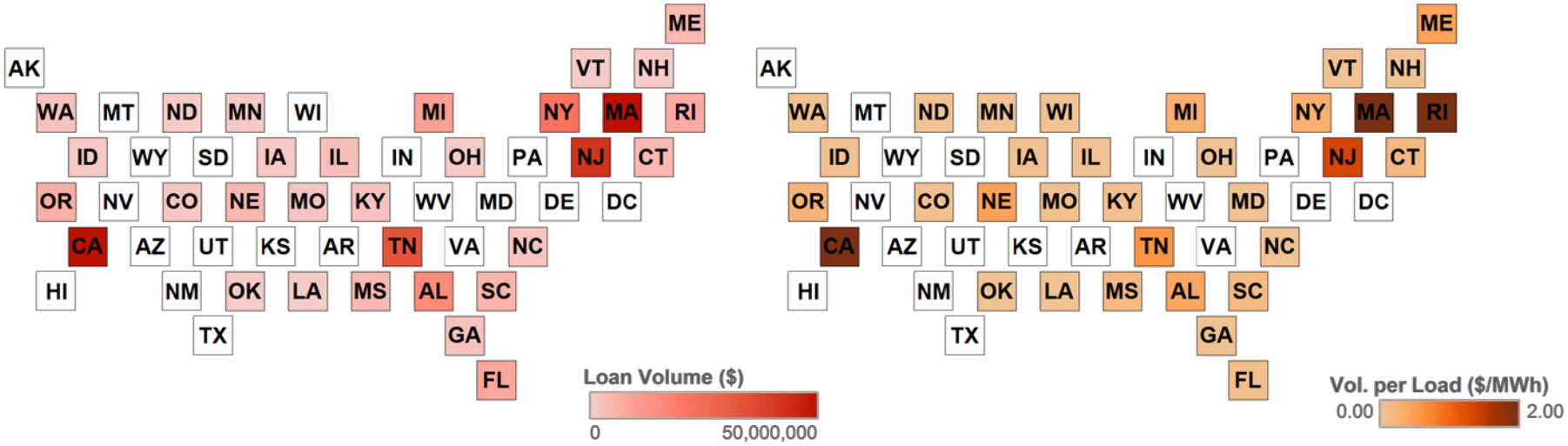
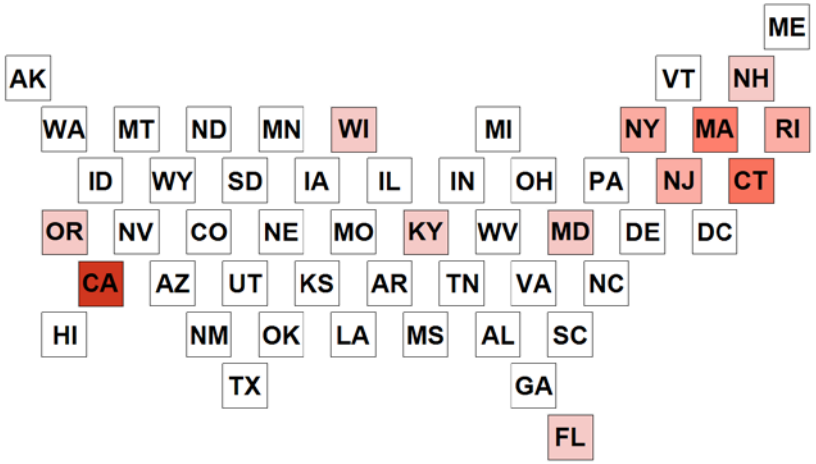


Figure 7: 2014 efficiency loans: absolute residential volume and loan volume per MWh of residential load by state

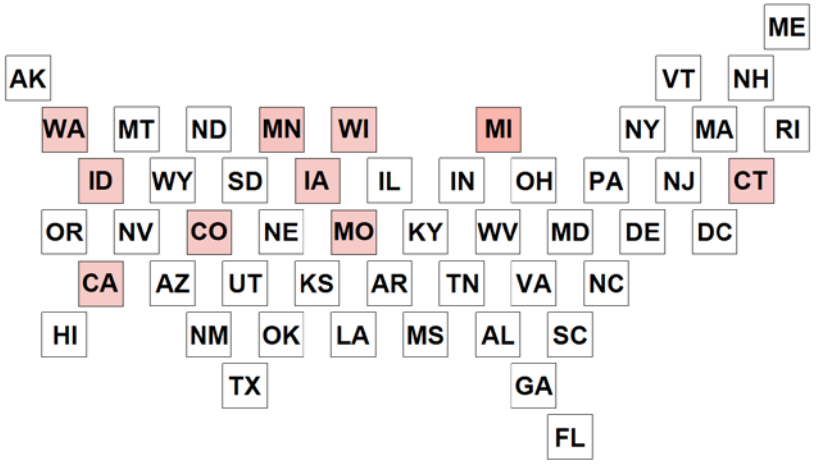
Per Figures 5 and 6, PACE was dominant in both availability and volume in California in 2014. In most other states, on-bill or utility loans predominated. In aggregate (Figure 7), California had the largest residential EE loan volume while Massachusetts had the highest finance loan investment per MWh of residential load. Nebraska is noteworthy because its activity occured via an SEO program – a relative rarity for the residential sector. The New York on-bill and SEO "programs" are two alternate loan products offered and marketed by NYSERDA, and perhaps are best thought of as one program.

Figures 8 and 9 present parallel information for the non-residential market. Figure 10 shows loan volume and loan volume per MWh of non-residential load by state for all program categories. As before, colored states have positive lending amounts, while darker states have larger loan volumes.

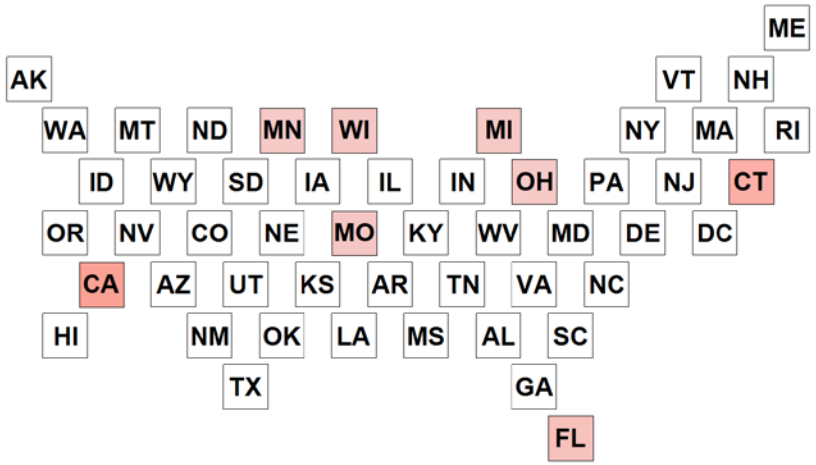
On-bill



Utility



PACE



SEO

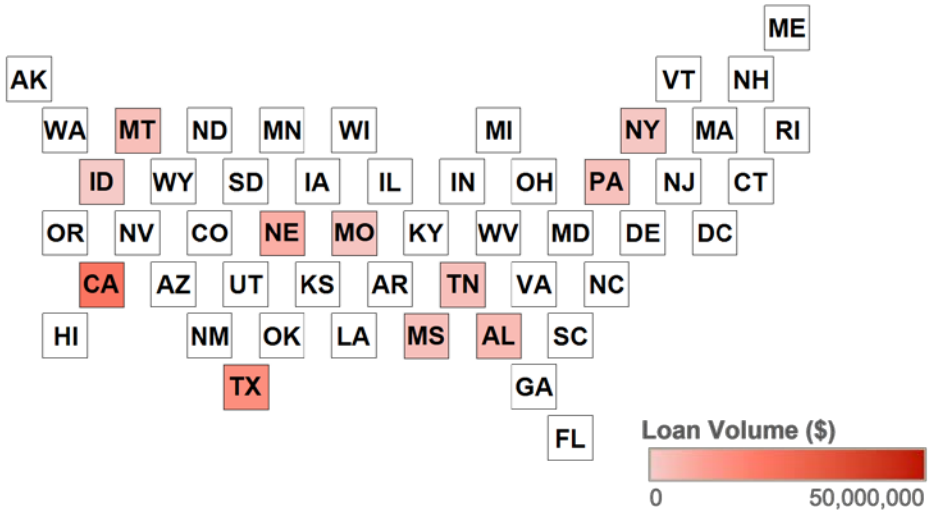
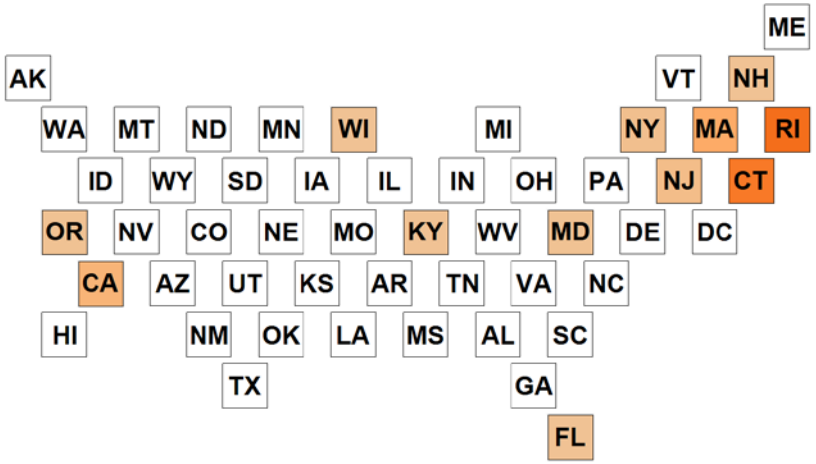
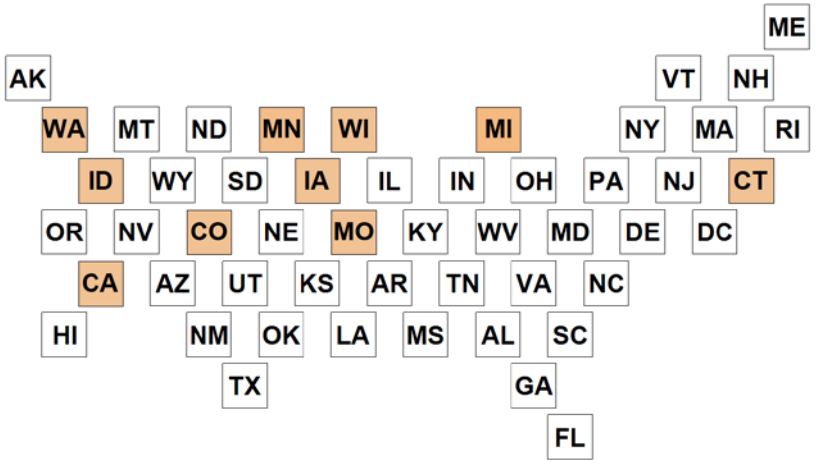


Figure 8: Efficiency finance program loan volume in 2014 for non-residential customers by state

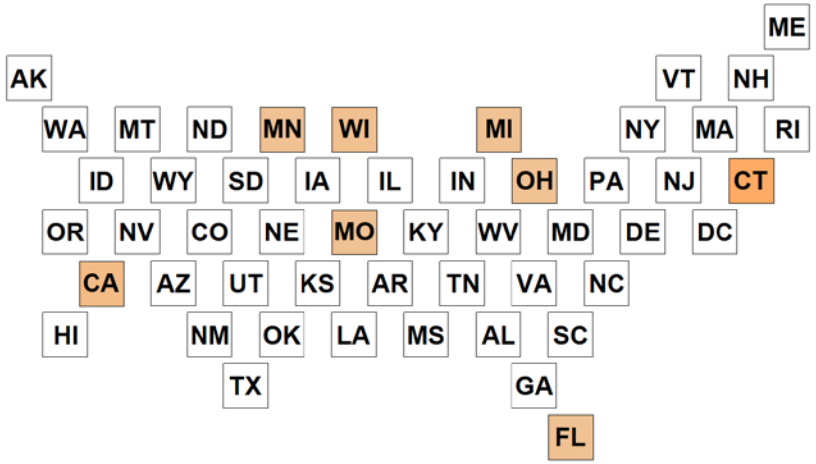
On-bill



Utility



PACE



SEO

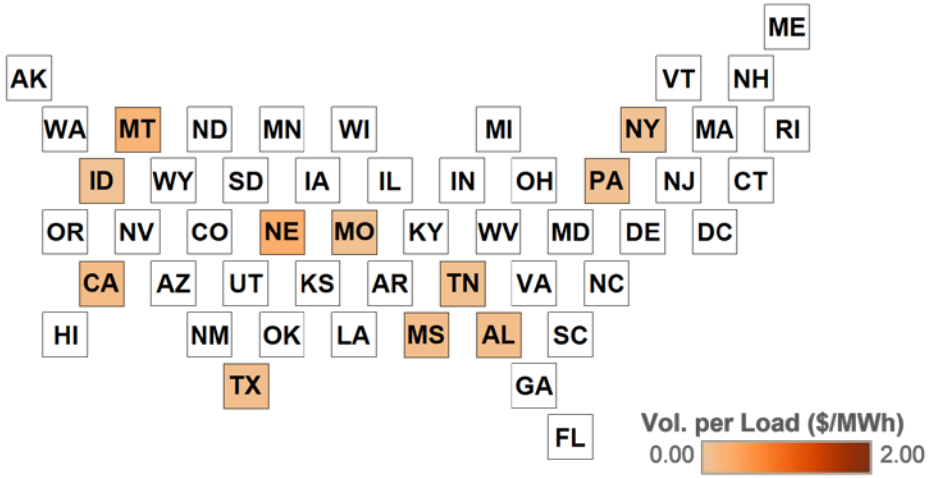


Figure 9: Efficiency loan volume in 2014 per MWh of non-residential load by state and region

All Categories: Non-residential Loan Volume

All Categories: Non-residential Loan Volume per MWh

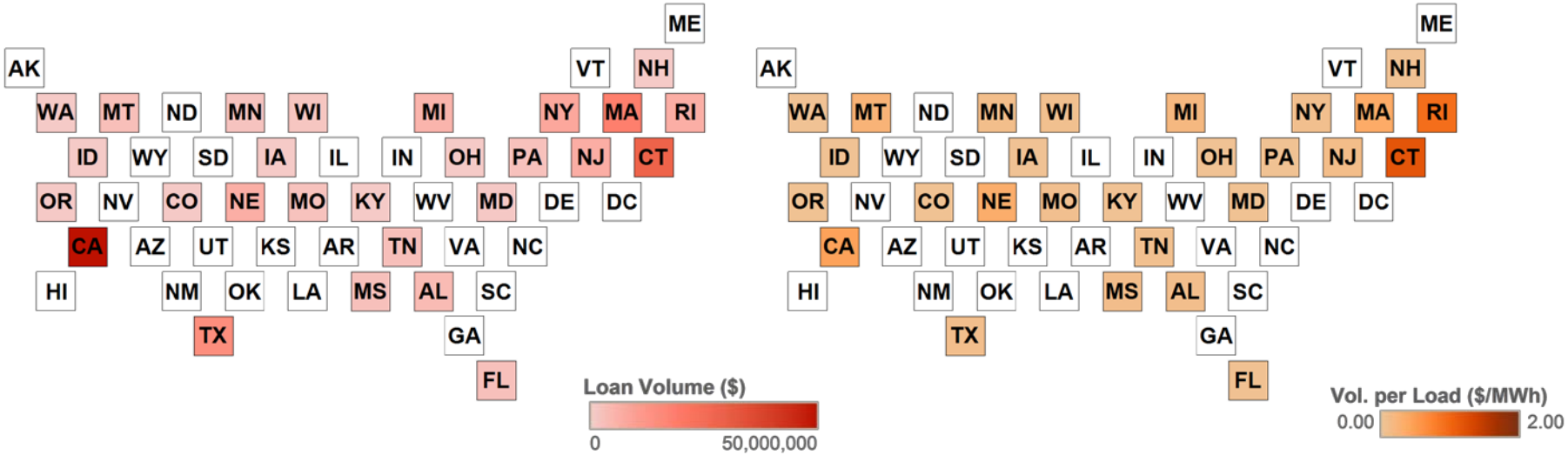


Figure 10: 2014 efficiency loans: absolute non-residential volume and loan volume per MWh of non-residential load by state

Non-residential lending programs have generally broad coverage across the U.S. Volumes in this sector were generally smaller (given that these figures exclude ESPC). In terms of absolute volume, California's on-bill financing program was the largest, followed by on-bill programs in Connecticut and Massachusetts, utility programs in Michigan and SEO programs in Texas and California. Normalized for the load that these programs serve, Connecticut had the highest investment per MWh, with Rhode Island, Massachusetts, California, Nebraska, and Montana (the last two through SEO programs) also making significant non-residential investments in EE through financing.

ESPC Program activity by region

Figure 11 shows ESPC lending data by census sub-region; these data are not available at the state level. We show absolute lending volume on the left side of Figure 11, while lending volume per region-wide non-residential electricity load is shown on the right side of Figure 11. ESPC financing loan volumes were greater in the Pacific and East North Central sub-regions while the Pacific and New England sub-regions had greater loan volume per MWh of load.

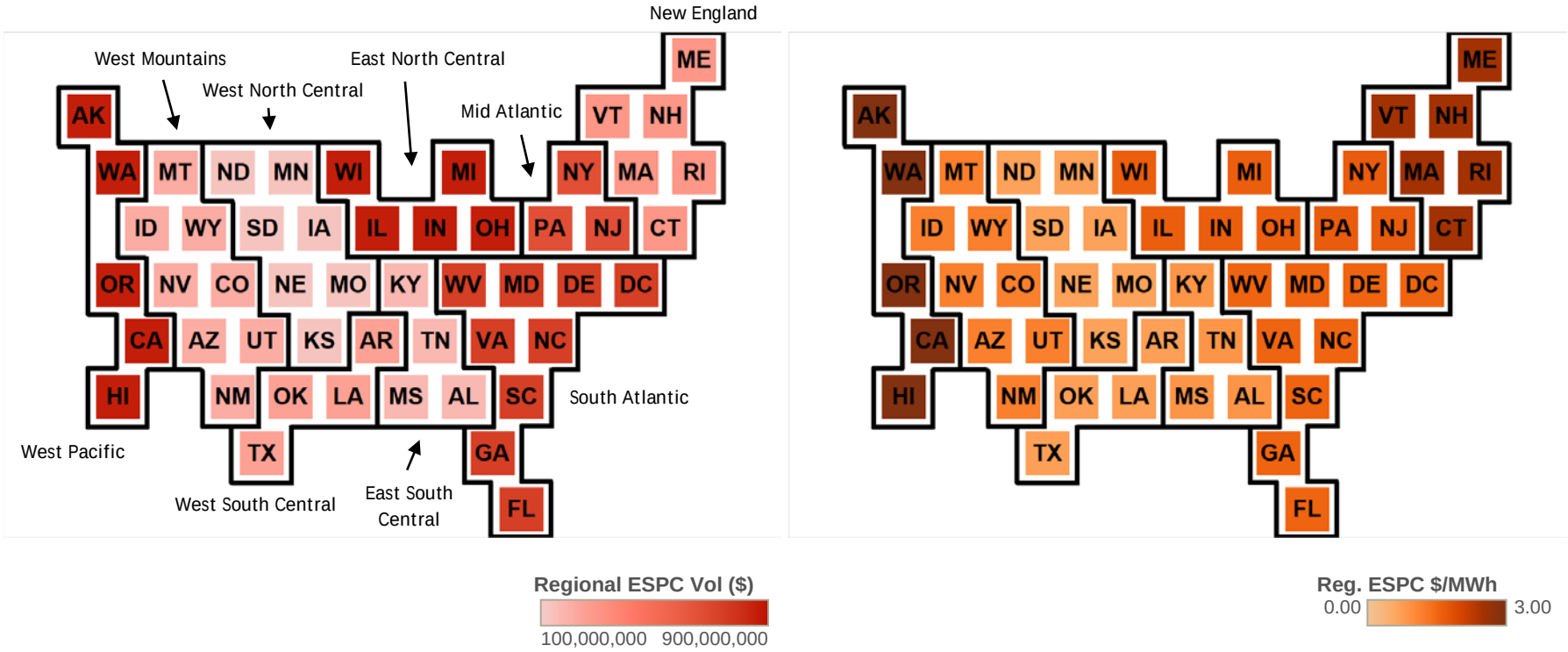


Figure 11: ESPC efficiency loan volume (left) and loan volume per MWh (right) in 2014 of non-residential load by region

The Role of Policy and Public Financial Support for EE Financing

This section briefly reviews the role of state and federal policy support for various types of efficiency finance programs.

Enabling legislation

Enabling legislation is necessary for, or is often associated with, three of our efficiency financing categories: on-bill, PACE and ESPCs.

On-Bill: Using utility bills to collect payments on debts that are not direct utility charges may raise issues such as consumer protections, the appropriate use of power disconnection for non-payment, and lending regulations. These issues could open utilities up to possible oversight by federal and state agencies that oversee lending and collection. On-bill charges can be considered an extension of debt or credit (although on-bill tariffs, which many consider debt of the utility meter and not the customer, could be considered a utility service). Some states' laws may prohibit extension of debt or credit by utilities and, as such, would prohibit utilities from operating these programs unless some sort of waiver has already been issued. (Burcat 2013, NCLC 2016, NCLS 2015, NYPSC 2008)

At least 12 states have legislation pertaining to on-bill programs.[12] Provisions in state laws include waivers on lending regulations for participating utilities, requiring utilities of a certain size to make on-bill loans available for their customers, and listing eligible measures for on-bill programs. Such legislation can lock in key program design features so policymakers should be aware of the issues involved and the tradeoffs of those features.[13]

PACE: PACE financing is based on special assessments levied by local governments that have established special assessment districts for this purpose. Generally, state approval is necessary for local governments to create these special clean energy assessment districts.[14] This enabling legislation lays out the procedure for creating a special assessment district to issue PACE loans and authorizes local governments to issue and sell bonds and accept government grants and loans to fund PACE programs or use other mechanisms for financing projects with private capital. These laws typically include provisions that establish the "public interest purpose" of the eligible improvements and may add them to other types of projects (e.g., sewers or parks) that are approved for creation of special tax districts. The state legislation can stipulate fundamental program characteristics including what types of properties can participate, loan and underwriting terms, and measures that are eligible to receive PACE financing. Once the enabling legislation is in place, each participating local government must establish a special assessment district through the appropriate local procedure. (NCSL 2016, Renewable Funding 2012)

[12] States with legislation pertaining to on-bill programs include: California, Connecticut, Georgia, Hawaii, Illinois, Kentucky, Maine, Massachusetts, Minnesota, New York, Oregon, and South Carolina. (NCLC 2016)
[13] For more on this issue, see SEE Action 2014b.
[14] In "home rule" states, where local governments have some authorities that ordinarily rest with the state, a local government might be able to implement a PACE program without state legislation. The only case we are aware of where this occurred in part was in New York, where the state gave some home rule municipalities permission to offer PACE before passage of a state statute.

ESPCs: Enabling legislation for ESPCs is important for three reasons: 1) it establishes market sectors (e.g., state/local governments, K-12 schools, universities/colleges) that are eligible to enter into ESPC in a state, 2) it may identify a state agency that is designated as the lead agency to develop ESPC guidelines, rules, sample contract, and qualify eligible ESCOs, and 3) it may define key terms and provisions in ESPC contracts (maximum contract term, eligible measures and activities, EM&V requirements). For example, Federal law allows federal agencies to enter into ESPCs that are as long as 25 years to save energy and for "benefits ancillary to that purpose." (DOE 2016)

The role of public capital in EE financing programs

Many of the programs in our sample received public dollars for some purpose. These funds came from several sources: federal dollars, mostly ARRA-related; petroleum violation escrow account funds disbursed by the U.S. Department of Energy; regional greenhouse gas auction revenues; QECBs; and funds from state or local treasuries.

SEO: State energy office programs made extensive use of federal financial resources. At least eleven SEO programs included in this study received federal funds from U.S. DOE via ARRA, the State Energy Program, and/or the Energy Efficiency Conservation Block Grant program. Nine of these eleven programs used the funds to capitalize their revolving funds, while one program used ARRA funds for both loan-loss reserves and interest rate buydowns. Five of the eleven programs used DOE funds as their exclusive capital source, while the other six blended DOE funding with other forms of capital (e.g., state money, private capital, utility capital, and/or greenhouse gas revenues).

At least eight programs received money from petroleum violation escrow account (PVEA) funds.[15] At least four states provided state funds to their programs, though none were fully capitalized with state money. One state program received greenhouse gas auction revenues.

PACE: A number of PACE programs initially used ARRA grant funds (from EECBG or SEP unless otherwise noted). Among program administrators that responded, only two used ARRA capital to fund projects directly. One program used ARRA funds to cover project-specific transaction costs. Three programs used ARRA funds for program setup costs. One program received ARRA grant funds in return for providing technical support for other PACE programs. Three PACE programs used ARRA funding to create loan-loss reserves or debt service coverage reserves; in two cases the money was later returned to the SEO. Three PACE programs used QECBs - tax-advantaged bonds that were authorized by ARRA – to raise capital. It is possible that other PACE programs received support from ARRA or other federal sources.

As for state and local sources, one PACE program lends a share of project capital in a subordinate position from a state green bank. Two PACE programs funded project lending from local treasury money. Several other programs used local resources for a set of initial projects, then packaged the loans into bond issuances and sold those issuances to private investors to recapitalize.

[15] Seven of the eight states capitalized their RLF entirely with PVEA funds.

On-Bill and Utility: In the utility and on-bill categories, of the programs that responded to requests for information, eight program administrators reported using public money to fund credit enhancements for their products while six reported using public money to fund loans.[16]

Three on-bill programs and three utility programs reported using public money (e.g., regional greenhouse gas initiative funds, ARRA grant funds, or U.S. Department of Agriculture's Rural Economic Development Loan and Grant program (USDA REDLG)) to fund loans at some point in the program's history. At least two programs have set up revolving loan funds using federal grant money (ARRA grant and USDA REDLG).

Summary and Discussion of Areas for Future Work

In this brief we characterized programmatic EE financing capital outlays in the year 2014, with some reference to past lending data as well. Our key takeaways include:

- Programmatic financing sources in our sample of programs accounted for about $4.8 billion in EE lending capital in 2014;
- ESPC represents about 85% of that total; the remaining efficiency finance programs accounted for about $700 million in 2014;
- Excluding ESPC, total loan volumes are heavily driven by a handful of programs that are lending large volumes; most programs are small;
- About 65% of loan volume for efficiency finance programs in our sample targeted electric savings rather than savings from other fuels;
- Programs are available in most states in most sectors, though gaps do exist;
- Public capital, especially State Energy Program (SEP) and Energy Efficiency and Conservation Block Grant (EECBG) capital made available through the American Recovery and Reinvestment Act (ARRA), has played a role in many of the programs in our sample;
- The programs that have attained the largest lending volumes have engaged private capital and tend to employ more credit enhancements and IRBs.

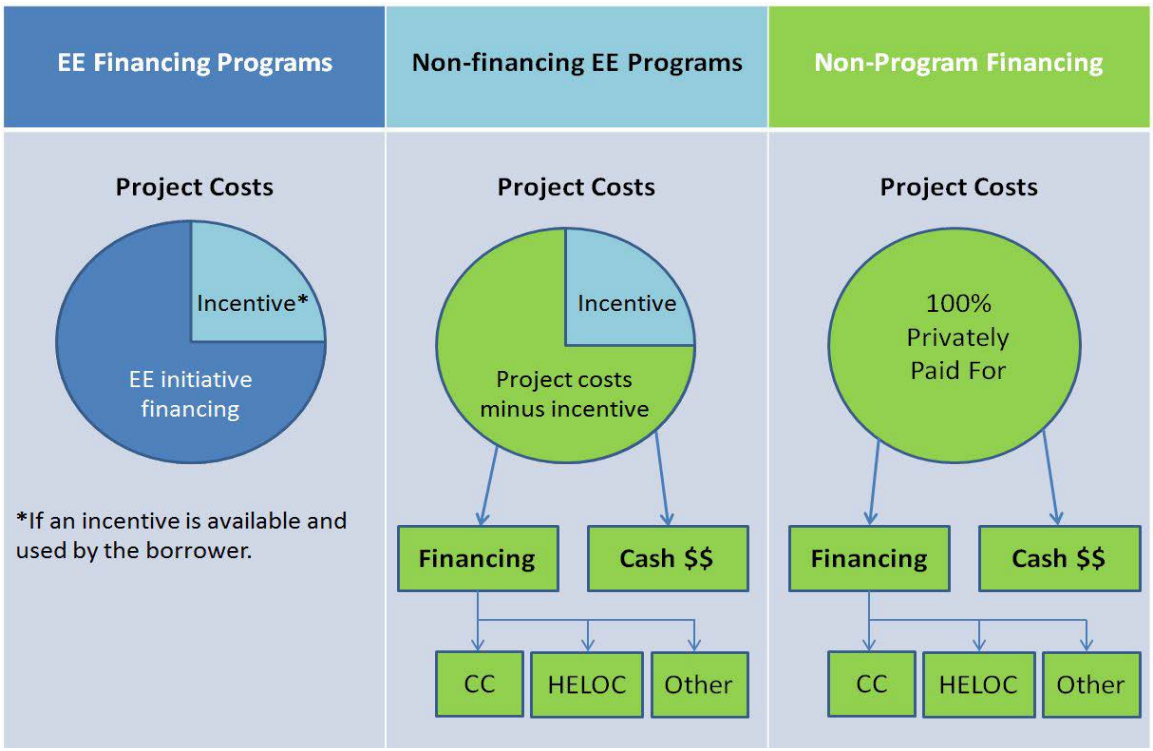
Discussion: Next Steps

Figure 12 provides a conceptual overview of the entire market for financing products for energy efficiency. In this technical brief, we focused on estimating a market activity baseline for energy efficiency financing through existing federal/state government and utility finance programs (the left side of Figure 12).

We also know that program administrators of utility customer-funded programs invest significant dollars in efficiency programs that do not involve financing (e.g., incentives, rebates, technical assistance, information). Rebate incentives typically only pay a portion of the upfront cost of an

[16] Public money used included American Recovery and Reinvestment Act (ARRA) funds, United States Department of Agriculture (USDA) funds, and state general funds. We are not including utility customer funds here.

efficiency project so participating customers must either pay cash or finance the remaining cost (see middle section of Figure 12). There is relatively little information available in the public domain on the payment and financing choices (e.g. cash, credit card, home equity loan, personal or corporate loan, leases, vendor financing) made by customers that obtain rebates for high efficiency measures/equipment. Establishing a baseline of energy efficiency financing through existing programs is necessary to assess which customer market sectors are well served and which are not and to assess proposed policies and programs to advance financing. In addition, a large, fully private/non-programmatic financing market funds many types of energy efficiency upgrades. This activity is not well tracked or understood (see right side of Figure 12). These are two areas where additional research would be helpful to establish a more comprehensive baseline of the size of the efficiency finance market that includes both public/utility programs and private sector efficiency activity.



CC - Credit Credits; HELOC - Home Equity Line of Credit

Figure 12. Market for Financing Products for Energy Efficiency.

Understanding this market baseline for financing is critical for at least two reasons:

- Energy efficiency financing programs funded by state governments or utility customers typically aspire to increase the total amount of energy efficiency activity. Without understanding baseline activity, progress towards this goal cannot be measured. (For more on assessing the impact of financing programs, see Kramer et al. 2015). This technical brief highlights the relatively impressive loan volumes that a handful of programs have achieved, the drivers of which are worth exploring. If these programs are generating loan volume by helping create additional EE projects, their impact on efficiency may be significant. On the other hand, if they are mostly displacing other financing

alternatives for projects that would have occurred otherwise, they are having less impact on total energy consumption. A small program that motivates additional savings may be more consequential from an energy consumption perspective than a large program that does not.

- Understanding the size and makeup of the private financing market for energy efficiency—and which customer-technology combinations are well served (and those not well served)—will provide administrators of these programs insights into how to design their offerings to enhance private-sector financing activity and fill gaps.

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Appendix A: ESPC financing volume estimation approach and treatment of missing data

Estimating ESPC financing volume

We interviewed ESCOs on industry and market trends in 2011 and 2014; individual ESCOs reported their total revenues. 2014 results (LBNL 2015) are currently preliminary, so we combined this information with a range of forecasts built from our 2011 study (Stuart et al. 2014) to arrive at our estimate of total market activity. Specifically, the preliminary results from 2014 suggest that growth in total ESCO market activity has been slower than anticipated by ESCOs in 2011 when they were asked to project growth in revenues over the next 2-3 years. As such, we create a range of total 2014 market activity that takes our *low* forecast of 2014 activity ($6.7 billion) from 2011 data as the *high* estimate and uses 2011 actual market activity ($5.3 billion) as the low estimate. For the results reported in this technical brief, we use the midpoint of that range ($6.0 billion) as our best estimate of total market activity by ESCOs.

ESCO market activity includes estimates by ESCOs of their revenues from traditional design/build projects, power purchase agreements for on-site generation, and utility implementation activities. These activities do not involve performance contracting, and therefore are not programmatic – they do not require implementing ESPC legislation nor benefit from programmatic supports such as standard performance contracts. Therefore, we remove them from our data. ESCOs reported the share of revenues that are due to ESPC and we apply this share (74% based on 2014 data) to the total revenue estimates to arrive at our estimate of ESPC activity.

ESCOs also break down their ESPC revenues by market sector: institutional, commercial/industrial and public housing. Only 4.5% of ESPC revenues flow from commercial, industrial, and public housing sectors.

Most but not all ESPC activity is financed. ESCOs also provide information on the percentage of projects that are 100% cash, partial cash, and 100% financed by sector. Interpreting the "partial cash" category requires an assumption; based on input from ESCO industry experts, we assume that "partial cash" projects are 30% cash and 70% financed. The share of partial cash projects in the data is small so alternate assumptions have little impact. We then estimated the total financed project volumes by market sector (see Table 1).

To develop estimates of ESPC activity by state, we drew upon and compiled data from the LBNL ESCO project database for the 2005-2014 period (1239 ESPC projects) to estimate ESPC market activity at the Census sub-region level.[17] We did not rely solely on project data from recent years to estimate ESPC market activity by state because of limited sample size.

[17] We checked and compared these values with estimates of regional breakdown of ESCO market activity provided by ESCOs in our interviews in 2014 and they are very close, giving us reasonable confidence in the estimates.

Treatment of Missing Program Data

In the report we decline to make 2014 loan volume adjustments due to missing data, claiming those adjustments would be very small. In this section we provide brief backup by category for this assertion. No backup is provided for ESPC, since we start with a market-wide estimate of lending volumes from a national survey and therefore have no missing data.

On-bill and Utility: We believe that on-bill and utility programs that did not respond to our request for information have small loan volumes. The vast majority of non-responders are small municipal utilities and electric cooperatives; they are small utilities (based on their annual sales volumes). We did a back-of-the envelope calculation and concluded that 2014 loan volume from program administrators that did not respond may increase our estimate of market activity for on-bill and utility finance programs by only 2-5%. We choose not to include this imputed data from non-respondents in our estimates of total market loan volume.

PACE: We believe that we are missing data on only one PACE program active in 2014: the Ygrene program in California. We are also missing data on some commercial projects in the Toledo C-PACE program. We do not expect that these missing data would result in significant change in our estimates of total PACE market activity.

SEO: We are missing 2014 data on a number of SEO RLF programs (primarily from smaller states) as NASEO's current data collection is still in progress. To get a sense of how much loan volume we may be missing, we matched our data up with older NASEO data from 2013. These data include the capitalization of each SEO RLF, which may be a reasonable proxy for loan volume. We eliminated data from RLF that have closed, are out of scope for our study, or that we have classified in another program category.[18] 28 programs from the 2013 data set remain after these exclusions. We have 2014 loan volume information for thirteen of them (or for programs that we believe to be their successors), which represent 81% of the RLF volume from those 28 programs. We do not have 2014 loan volumes for the other fifteen state programs, but they represent only 19% of the total RLF volume from those 28 programs.[19] Therefore, by this measure, we are capturing about 81% of the available capital from in-scope SEO programs in our sample.

[18] We believe that seventeen of the 66 programs in NASEO's 2013 data have closed and have no successor programs. These seventeen programs represent 27% of the total 2013 RLF volume. Another seventeen programs still exist but are out of scope for our study because they do not lend to EE, lend to manufacturers rather than end users, provide credit enhancements but do not run loan programs, are run by an agency that is not the SEO, or are outside the 50 states. These programs represent 20% of the total RLF volume. Five programs exist and are in scope, but we have placed them in another category (on-bill, utility, or PACE); these total 5% of the total 2013 RLF volume.
[19] We also have estimates of loan volumes for several programs that do not appear to have any relationship with programs in the 2013 NASEO data; these are either new programs or programs missed in the 2013 data collection.

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