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Aligning Incentives

Financial Models for Promoting Energy Efficiency Renovations in American Apartment Buildings

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Abstract

Buildings account for a significant portion of energy consumption and carbon dioxide production in the United States. Renovations could improve the energy efficiency of these buildings. However, a number of market barriers, e.g. high upfront costs, are resulting in a low adoption rate of energy efficiency technologies in the building sector. Apartment buildings face an additional challenge of overcoming the split incentive, or landlord-tenant dilemma. This study assesses public and private financial models that could address the split incentive in EE renovations in public and/or private apartment buildings. This thesis uses principal-agent (P-A) theory as a framework for understanding the contractual relationships in which a principal pays an agent to act on the principal's behalf or to provide a service to the principal. The objective of this thesis is three-fold. Firstly, financial models that address split incentives in apartment buildings were identified through a literature search. Analysis showed that most of the financial models do not suffiently address the problematic principal-agent relationship. Secondly, two models that did address the split incentive—green leases and on-bill programs—were examined further to explore how they alter the principal-agent relationship and to investigate the effects of these models. Data was collected primarily via literature analysis and supplemented with interviews. While both address the split incentive, only on-bill programs showed promise in contributing significantly to increasing energy efficiency renovation rates in American apartments. High transaction costs are preventing green leases from adoption in the residential market. Thirdly, a case study was conducted on How$mart, an on-bill program based in Kansas. This program has successfully overcome the split incentive barrier. The How$mart program packages EE renovations as a utility service that is financially attractive to landlords, tenants, contractors, and the utility company. This thesis concludes with a compilation of aspects that are key to a financial models success at addressing the split incentive and achieving a high participation rate. The thesis also found that, despite the success and promise of on-bill programs, EE financing programs tend to underserve non-low-income tenants in medium- and large-scale apartment buildings. Suggestions are provided on how to close this gap. Furthermore, developing on-bill programs in coordination with complementary policies would strengthen efforts to address EE renovation needs in American apartment buildings. Suggestions include minimum energy standards as a part of rental licensing, energy efficiency disclosures for apartments, and removing fossil fuel subsidies.

Keywords: Energy efficiency, buildings, renovation, split incentive, financial model

Executive Summary

Buildings account for a significant portion of energy consumption and carbon dioxide production. Energy efficiency policies for buildings started to appear in North America and Europe in the 1970's after the energy crisis of 1973. Approximately two thirds of rental housing units[1] in the United States were built prior to the 1980's and thus were largely designed without energy efficiency (EE) in mind. Renovations could improve the energy efficiency of these buildings. However, a number of market barriers, e.g. high upfront costs, are resulting in a low adoption rate of energy efficiency technologies in the building sector. The rental market, in particular, additionally faces the split incentive barrier, in which neither the tenant nor the landlord has an incentive to invest in energy efficiency improvements. Financial models that restructure the conventional financial responsibilities could remove this barrier.

This study assesses public and private financial models that could address the split incentive in EE renovations in public and/or private apartment buildings. In particular, the study aims to address the following research questions (RQ):

1. Which financial models address the split incentive market failure regarding EE renovations in apartment buildings?
2a. How do these financial models address the split incentive?
2b. What are the effects[2] of these models, particularly on the split incentive issue?
3. How do these models function in reality?

This thesis uses principal-agent (P-A) theory as a framework for understanding the contractual relationships in which a principal pays an agent to act on the principal's behalf or to provide a service to the principal. Using this theory, landlord-tenant relationships are mapped according to the assignment of (1) responsibility to pay energy bills and (2) authority to select EE technologies. The split incentive typically arises in the case of the tenant having the responsibility to pay energy bills, but not the authority to select EE technologies.

To identify financial models that address split incentives in apartment buildings (RQ1), a literature search was conducted. The selected financial models needed to be (1) applicable to the *residential* sector; (2) primarily a *financial* incentive (as opposed to, for example, an informative or regulatory program); and (3) focused on improving *energy efficiency* (whether or not it involves a renovation). The models were then organized into the following categories:

- preferential loans;
- funding without repayment;
- utility-run programs; and
- green leases.

Analysis showed that most of the financial models do not suffiently address the problematic principal-agent relationship. However, utility-run on-bill programs and green leases stood out as mechanisms that could address the split incentive.

[1] About 1/3 of U.S. households live in rental homes.

[2] The analysis looks at both the outcomes and the impacts of the financial models. *Outcomes* of a financial model would be subject responses, e.g. program participation or installation of ECMs. The use of the term *impact* refers to the changes in society or the environment (e.g. energy consumption) resulting from the outcomes. (Kiss, 2013; Mundaca Toro, 2008)

To address the research questions 2a and 2b, on-bill progams and green leases were analyzed further. First, the principal-agent relationships were mapped to visualize how the mechanisms address the split incentive issue. The analysis then looked at various aspects that can affect the mechanisms' impacts and outcomes. The analyses of both mechanisms were conducted primarily through literature and supplemented with interviews.

On-bill programs are market-based systems that utilize energy cost savings to finance energy conservation measures (ECMs). These programs address the P-A problem by shifting financial responsibility for ECMs to the tenant, making the tenant both the principal and the agent. The tenant pays for the renovation through a surcharge on the utility bill. The debt is typically also attached to the meter, not a tenant or the landlord, and thus removes a temporal split incentive. There are two main categories of on-bill programs: (1) on-bill financing (OBF), in which the surcharge is a service tariff and and (2) on-bill repayment (OBR), in which the surcharge is a loan repayment.

Both OBR and OBF are promising financial mechanisms, but OBF is likely preferable from both a utility and consumer perspective. Both OBR and OBF are flexible to fit into different markets, e.g. commercial, residential, municipal. Both are designed to be cost-effective, and experience lower non-payment rates than traditional loans. The use of cost savings to fund renovations allows a revolving fund for investment and thus persistence of the program. Utilities may be wary of offering an OBR program because they may not want to be subject to consumer lending laws.

Green leases theoretically address the split incentive issue. Three categories of green leases were found in literature, yet none has significant, if any, adoption. They so far fail to address other market barriers and are not penetrating the market. Green leases still leave the landlord responsible for upfront costs and financial risk. Furthermore, transaction costs are high. Green leases do not facilitate the process of learning about which technology to implement.

To address research question 3, the thesis then explored Midwest Energy's How$mart program in Kansas. How$mart is an OBR program based on the Pay As You Save® model developed by the Energy Efficiency Institute. The case study was conducted primarily through interviews with stakeholders in Kansas and the data was analyzed using the same criteria as used to address research questions 2a and 2b. The case study demonstrates an exemplary program that breaks down the split incentive barrier. Participation rates show that landlords are just as willing, if not more willing, than owner-occupiers to complete EE renovations through this program. The program is offered as a service from the utility company with low transaction costs for both the tenant and landlord. The program is spreading with several programs being modeled after it.

On-bill financing is a promising financial model for removing the split incentive in energy efficiency renovations of apartments and apartment buildings. The How$mart program in Kansas has successfully overcome the split incentive. It also demonstrated an ability to be flexible enough to service a broad range of income levels and housing types. The development of additional How$mart programs by other electric cooperatives demonstrates the replicability and scalability of the program, as well as its ability to meet different geographical contexts.

Analysis of green leases and on-bill financing found that the following aspects are important for a high participation rate:

- centralized coordination;
- "free" energy audit;

- flexibility to reach the diversity of customers;
- flexibility to cover a range of technologies;
- financial incentive for the program coordinator to continue the program;
- cost of program lower than the energy cost savings;
- contractor network; and
- EE renovation as a utility service.

Despite the success and promise of on-bill programs, EE financing programs tend to underserve non-low-income tenants in medium- and large-scale apartment buildings. Further research is needed to explore how to extend this program to meet this market sector. Suggested approaches include, but are not limited to, applying a utility cap and addressing artificially low energy prices.

Furthermore, developing on-bill programs in coordination with complementary policies would strengthen efforts to address EE renovation needs in American apartment buildings. Suggestions include minimum energy standards as a part of rental licensing, energy efficiency disclosures for apartments, and removing fossil fuel subsidies.

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Acronyms and Abbreviations

DNP	Disconnection in case of Non-Payment
EE	Energy Efficiency
ECM	Energy Conservation Measures
EPC	Energy Performance Contract
ESCO	Energy Service Company
HCD	Housing and Community Development
MUSH	Municipal, Universities, Schools, Hospitals
OBF	On-Bill Financing
OBR	On-Bill Repayment
P-A	Principal-Agent
PAYS®	Pay As You Save®
PHA	Public Housing Authority
WAP	Weatherization Assistance Program

Country and Region Codes

AT	Austria
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EU	European Union
FR	France
IT	Italy
LT	Lithuania
UK	United Kingdom
US	United States of America

Abbreviations for US States

CA	California
GA	Georgia
HI	Hawaii
IL	Illinois
IN	Indiana
KS	Kansas
KY	Kentucky
MA	Massachusetts
NH	New Hampshire
NY	New York
OR	Oregon
RI	Rhode Island
SC	South Carolina

1 Introduction

1.1 Energy Efficiency and Buildings

Buildings are a significant source of energy consumption, representing 31% of final energy use and 33% of energy-related carbon emissions globally (Ürge-Vorsatz et al., 2012). Furthermore, CO_2 emissions from buildings increased approximately 2% annually between 1971 and 2004 (IPCC, 2007). While buildings have a huge impact on the environment, they also provide a significant opportunity for climate change mitigation. As shown in Figure 1-1, the building sector shows the largest low-cost[3] potential for reducing carbon emissions by 2030. The American Council for an Energy Efficient Economy (ACEEE) estimates that cost-effective energy efficiency (EE) improvements in the building sector could reduce electricity consumption in the United States (US) by 23%, a savings of 100 billion USD annually (Bell, Nadel, & Hayes, 2011).

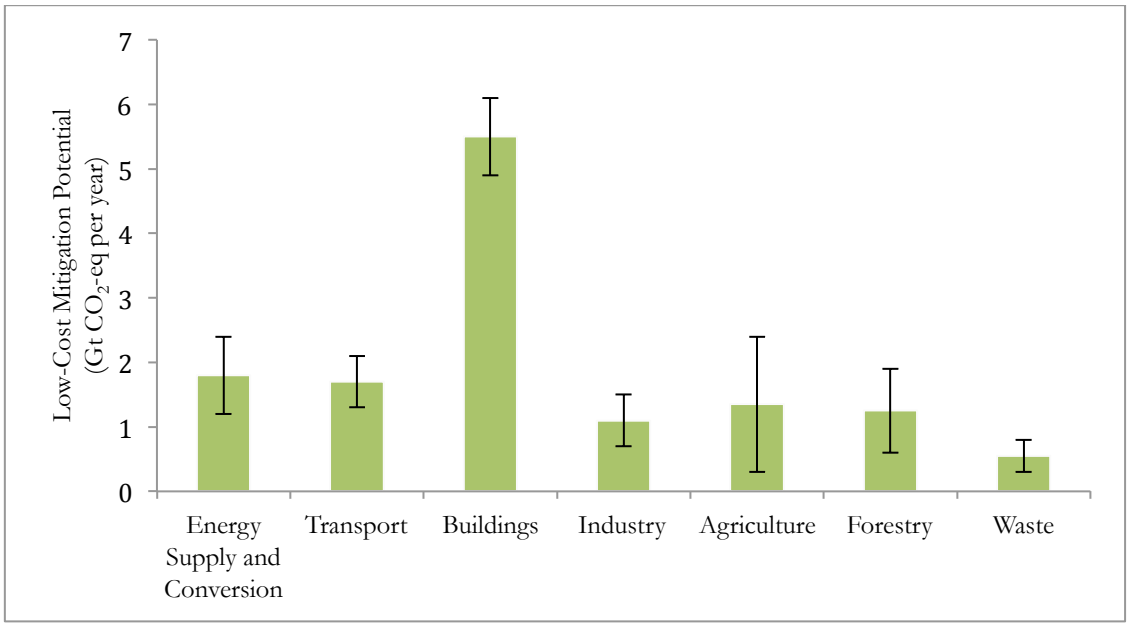

Figure 1-1: Global low-cost mitigation potential of carbon emissions across sectors. Energy use and savings are allocated to the end-user. Source: IPCC, 2007, p. 78.

There is a particular need to improve energy efficiency in rental housing in the US. Energy efficiency policies for buildings started to appear in North America and Europe after the Energy Crisis of 1973. California developed the first-in-the-nation building energy standards in 1978 (Burroughs, Fitzgerald, & Schultze-Allen, 2012). However, the majority of housing units in the United States were built prior to the 1980's and thus were largely designed without energy efficiency in mind. Over 2/3 of rental housing units were constructed before 1980 (United States Census Bureau, 2011). Furthermore, rental housing, as opposed to owner-occupied homes, experience split incentive, in which neither tenant nor landlord has an incentive to invest in energy efficiency improvements.

Governments and private organizations have goals for increasing energy efficiency. For example, President Obama aims to weatherize 1 million homes per year (US DOE, 2013). Some of these goals focus on multi-family homes: the California Public Utilities Commission set a long-term goal of decreasing purchased energy in all existing multifamily homes by 40%

[3] The estimates assume a carbon cost below 20 USD/Gt CO_2-eq.

by 2020 (Burroughs et al., 2012). Achieving these goals could have a significant positive impact on energy consumption and consumers' wallets. However, there are market barriers that are impeding households from meeting their energy efficiency potential.

1.2 Problem Definition

1.2.1 Market Barriers and Failures in Energy Efficiency Renovations in the Rental Residential Market

Market barriers, in the energy efficiency realm, are market-related factors that impede increasing energy efficiency (EE). Jaffe and Stavins (1994a) apply the term "market barrier" to refer to factors that account for limited adoption of cost-effective EE technologies. Market failures, a subcategory of market barriers, are factors that justify public policy intervention (Jaffe & Stavins, 1994a). Market barriers and failures relevant to energy efficiency are shown in Figure 1-2 and are discussed below.

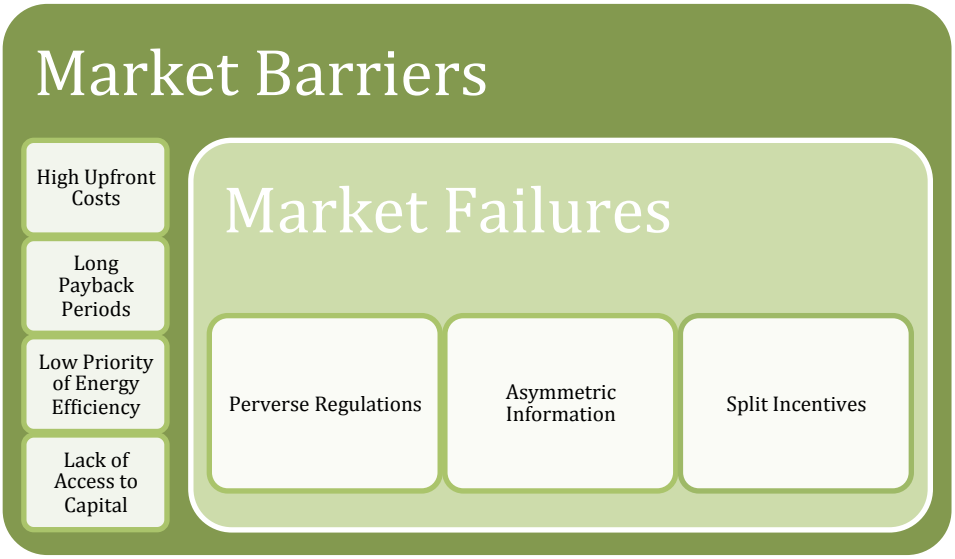

Figure 1-2: Market barriers and failures relevant to adoption of energy efficiency measures. Sources: IEA, 2007; Jaffe & Stavins, 1994b

High Upfront Costs

Energy efficiency equipment and renovations can require significant upfront capital, which can be a strong deterrent (OECD, IEA, & AFD, 2008). More energy efficient technologies generally have a higher upfront cost relative to less efficient alternatives (Kapur, Hiller, Langdon, & Abramson, 2011). Even if customers are provided with the knowledge that a more energy efficient technology will be more cost-effective over its lifetime, they typically opt for the less efficient product with the lower upfront cost (OECD et al., 2008). This failure could be because of a preference for lower upfront costs or simply be because the customer does not have the upfront capital (OECD et al., 2008; Sedano, 2011).

Long Payback Periods

The combination of high upfront costs and low energy costs result in long payback periods for EE equipment and renovations. Tenants – and even homeowners – often do not reside in the same place long enough to complete the payback period (Bell et al., 2011). In the US, homeowners move approximately every nine years. The disincentive from the long payback

period is more potent for tenants; they tend to move every two years (Bird & Hernández, 2012).

Low Priority of Energy Efficiency

Energy efficiency is commonly a low priority in commercial and residential markets (Kapur et al., 2011; OECD et al., 2008; OECD & IEA, 2007). In fact, renovations are typically for non-EE reasons, such as aesthetics or safety (OECD et al., 2008). Energy costs are typically low in comparison to costs for increasing energy efficiency, e.g. labor costs, and they can be low as a percentage of rent and operating costs (OECD et al., 2008).

Lack of Access to Capital

Building owners may have difficulties acquiring loans to cover the upfront costs of ECMs (Blumstein, Krieg, Schipper, & York, 1980). Multiple aspects prevent lenders from offering residential EE loans. First, residential projects tend to be smaller than commercial projects (OECD & IEA, 2007). Secondly, lenders are hesitant to provide EE loans because, *inter alia*, there is insufficient information to assess risks. There is not yet much data available because the EE loan market is young. Loan programs are also disjointed—often small-scale pilot projects spread across utility companies and government agencies. As such, data on delinquency and default rates are difficult to compile (Byrd & Cohen, 2011). Initial studies in the US are showing low default rates, but the data gaps are still large enough for lenders to avoid the risk (Byrd & Cohen, 2011).

Perverse Regulations

Perverse regulations are regulations that distort the market away from Pareto efficiency. For example, fuel subsidies can lower interest in energy efficiency. On a societal scale, energy efficiency is more cost effective than building new energy plants to meet a growing energy demand (Carter, 2013; OECD et al., 2008). However, artificially low energy prices prevent consumers from seeing the full marginal costs of energy consumption and from developing an interest in or actively pursuing energy efficiency (Buildings Performance Institute Europe, 2010; Jaffe & Stavins, 1994b). Low energy prices stem from perverse regulations such as fuel subsidies, but also from a lack of policies that internalize environmental externalities (Jaffe & Stavins, 1994b). As another example, building codes are regulations that can impose minimum EE standards. However, they typically apply only to new buildings and major renovations (Williams, 2008). Older buildings can be grandfathered into outdated standards and landlords may deter renovation to avoid needing to upgrade to current EE standards.

Lack of coordination between policies could also be an issue. As demonstrated by this list of market barriers, there are multiple reasons why American apartments are not achieving optimal energy efficiency. No single policy can address all of these reasons. A coordinated combination of approaches could help collectively remove the barriers (Williams, 2008).

Lack of Access to Information

The research necessary to plan, never mind complete, a renovation can be a hurdle. With new construction, an individual would need to consider *which* technologies to use. Energy labels on appliances can help with some of these decisions. However, not all EE technologies are labeled. Renovation of buildings involves an extra layer of research to determine *when* to conduct the installation (Jaffe & Stavins, 1994b). Prices of new technologies can drop, motivating some to wait. If prices stay high, some building owners may wait for the government to offer a rebate on the technology.

Apartment buildings experience an extra information challenge. When a prospective tenant is selecting an apartment, information on the EE of the living space is commonly not available. The decision is then based on other factors such as rent, location, and size of the apartment. This lack of information inhibits market demand for—and thus landlord incentive to invest in—EE (Gillingham, Harding, & Rapson, 2012).

Split Incentives

The issue of split incentives in the rental housing sector is a market failure in which neither the landlord nor the tenant has a financial motive to invest in energy conservation measures (ECMs) (Blumstein et al., 1980; Gichon, Cuzzolino, Hutchings, & Neiger, 2012; Gillingham et al., 2012). Typically, the landlord is responsible for capital investments, such as energy efficiency renovations and the tenant pays the utility bills. Even considering the possibility of increased property value after renovation, the landlord may not have a significant incentive to invest in energy efficiency. First, the tenant, not the landlord, reaps the financial benefit of reduced energy bills. Secondly, factors such as rent control or vacancy rates may prevent a landlord from raising the rent to accommodate the renovation costs. This issue is not local to the US. The European Commission notes in the EU Directive on Energy Efficiency (Directive 2012/27/EU, henceforth "the Directive") that the split incentive issues is one of the main barriers to achieving a sufficiently high renovation rate. The Directive explicitly obliges member states to evaluate the split incentive issue and implement measures to address it. This paper focuses on the split incentive issue.

1.2.2 Addressing Split Incentives

The split incentive issue, and how to address it has been a focus of research in the US for some time. Williams (2008) notes that there are three ways to reduce energy consumption in apartments in light of the split incentive issue:

1. Work around the issue,
2. Adjust tenants' behavior, or
3. Align the incentives.

The first approach would include regulations that set minimum energy efficiency (EE) standards.[4] This approach removes worst performing technologies and practices from the market (OECD & IEA, 2007). These standards usually apply to major appliances, such as refrigerators. However, these standards rarely address the building shell, which plays a critical role in the heating and cooling efficiency of a living space (Williams, 2008). There are building codes, which do set minimum energy efficiency standards, but these are generally only relevant to new buildings and major renovations (Williams, 2008). Older buildings can then be grandfathered into outdated EE standards. The fact that a renovation would force a landlord to bring a grandfathered building up to date could serve as a disincentive to renovate.

The second approach could include campaigns to reduce energy consumption through behavior. Community-based social marketing is one way to engage citizens in reducing energy consumption. For example, Citizens Energy has an on-line pledge to "live green" that includes advice on behaviors to decrease one's residential energy consumption (Citizens Energy Corporation, n.d.). However, programs like these have limited impact. For instance, they may reach only residents who are already environmentally conscious.

[4] At the time of writing, the author is aware of only one jurisdiction that has a minimum EE standard as part of the apartment rental licensing regulation: SmartRegs in Boulder, Colorado.

Aligning incentives, compared to promoting more energy efficient behavior, would lead to significantly better environmental improvements. An empirical study in California found that addressing split incentives regarding insulation would mitigate 10 times more CO_2 than modifying behavior with heating (Gillingham et al., 2012). This paper thus focuses on approaches to align incentives regarding energy efficiency renovations in apartment buildings.

1.2.3 Financial Models

One approach to tackle split incentives are innovative financial arrangements. The energy gap problem may not be that there is not enough money for cost-effective energy efficiency technologies. The Energy Efficiency Institute, Inc. (1999) argued that energy users in the US pay enough for energy to pay for implementation of all cost-effective energy efficiency technologies. The problem could be how financial responsibility is structured. Accordingly, this thesis investigates various models for reframing financial responsibility and promoting EE in apartment buildings. The term "financial model" is used loosely in this thesis to refer to program models that alter financial responsibilities and structures. This definition includes some models that are not traditionally referred to as financial models. The broader scope is used to allow inclusion of innovative and non-traditional approaches to restructuring EE financing.

1.3 Research Objectives and Questions

This study assesses public and private financial models that could address the split incentive in EE renovations in public and/or private apartment buildings. In particular, the study aims to address the following research questions:

1. Which financial models address the split incentive market failure regarding EE renovations in apartment buildings?

2a. How do these financial models address the split incentive?

2b. What are the effects[5] of these models, particularly on the split incentive issue?

3. How do these models function in reality?

1.4 Research Scope and Limitations

This research project focuses on financial models in the United States. To gain a more complete understanding of existing financial models, the scope was widened to include the European Union for the first objective.

This project focuses on apartment buildings. For clarification, the term "apartment" is used to refer to a rented living space in a multi-unit building. The term "condominium" refers to owner-occupied living space in a multi-unit building.

Keyword searches were conducted primarily in American English and, to a limited extent, in Swedish. Additional literature may exist that was not searchable via English and Swedish keywords. Some European search results may have been missed based on use of American spellings or word choice.

The analysis of residential green leases is based on literature and two interviews. Organizations that had researched and published on residential green leases declined interview requests, claiming their expertise on the topic was outdated or no longer available. Only a small amount

[5] The analysis looks at both the outcomes and the impacts of the financial models. *Outcomes* of a financial model would be subject responses, e.g. program participation or installation of ECMs. The use of the term *impact* refers to the changes in society or the environment (e.g. energy consumption) resulting from the outcomes. (Kiss, 2013; Mundaca Toro, 2008)

of literature was found on the topic. Most resources on green leases focused on the commercial sector.

Search results using Google may be affected by Google's customized search results feature. Information on current and past programs was more plentiful through Google searches than through searches of academic literature databases. Google search results are customized to the country domain (Google, 2013b). Both google.com and google.se were used, but no systematic method was used to test differences in results on the two domains. Furthermore, Google searches are customized based on search history. [6]

1.5 Audience

The inspiration for this thesis starts in Europe. The recast of the European Building Performance Directive emphasizes the importance of addressing the split incentive and promoting energy efficiency in multi-family homes. A municipal officer in Sweden suggested research into financial models in the United States, noting the development of a number of innovative programs there. This thesis is aimed at both American and European audiences, including academics, policy makers, utilities, and other actors in energy efficiency programs. The focus on the American context makes this thesis relevant to American actors in energy efficiency. While this thesis focuses on the American context, the results could still be relevant to Europe. The intention is two-fold: (1) to further American discourse on how to improve EE financing in the US and (2) to contribute to European discourse on how to address effectively the split incentive issue in apartment buildings through lessons and inspiration from the American experience.

[6] If the user is signed into their Google account, search results are customized via the users' Google web history (Google, 2013a). This feature was deactivated on the author's Google account to remove the influence of her personal and academic web history on the search results. If the user is not logged into a Google account, Google can use extract search history from anonymous cookies and customize results (Google, 2013a). This feature was turned off when the author became aware of it – after the literature search was completed. It is unknown to what extent the signed-out personalization has affected the search results. This feature may have influenced the fact that search results tended to be American rather than European.

2 Analytical Framework

This chapter introduces (1) principal-agent theory, the framework this thesis uses to conceptualize and analyze the split incentive issue and (2) the research methodology.

2.1 The Principal-Agent Theory

The principal-agent (P-A) theory provides a framework for understanding the contractual relationships in which a principal pays an agent to act on the principal's behalf or to provide a service to the principal (OECD et al., 2008; OECD & IEA, 2007). This theory argues that principals and agents have conflicting goals because the theory assumes agents act independently and tend to maximize their own interests, even at the expense of the principal. This goal conflict is commonly referred to as "misplaced incentives" or "split incentives." A second problem that arises in P-A relationships would be information asymmetry (OECD & IEA, 2007). This paper focuses on split incentives.

There is widespread interest in addressing the principal-agent in firms. A common example would be between shareholders (principals) who own a firm and the management (agents) whom the shareholders hired to run the firm.[7] The theory assumes that the problem lies in the inadequacy of the contract between the principal and the agent (OECD & IEA, 2007). A modification of the contract could minimize or eliminate the split incentive.

2.2 The Landlord-Tenant Problem: an Application of Agency Theory to the Rental Residential Market

In the landlord-tenant relationship, the tenant (principal) hires the landlord (agent) to provide a living space. The landlord and tenant have conflicting goals. The landlord wants to maximize the financial return on rent, in part through minimizing capital costs, such as energy efficient equipment. The tenant wants to minimize their energy costs, but may not have control over the energy efficiency of the building or the equipment used therein (OECD & IEA, 2007).

The P-A relationship regarding EE technology (e.g. insulation, heating system, refrigerator) can take a number of forms depending on how the responsibilities are assigned. The IEA (2007) divides possible landlord-tenant relationships regarding EE into four categories, three of which have a P-A dilemma. These categories are shown in Table 2-1. The IEA notes that different policies will be needed to address the different P-A situations (OECD & IEA, 2007).

Table 2-1: Categories of landlord-tenant relationships regarding energy efficiency technology. Source: OECD & IEA, 2007.

		Who Chooses the Technology?	
		TENANT	LANDLORD
Who Pays the Utility Bill?	TENANT (net lease)	Case 1: no PA dilemma	**Case 2: inefficient technology**
	LANDLORD (gross lease)	Case 3: excess usage and inefficient technology	Case 4: excess usage

[7] For example, Apple, the California-based computer company, is addressing this issue by having executive officers own a three times their base salary in company shares (Worstall, 2013). This corporate policy makes executive officers both principals and agents, thus removing the dilemma.

In case 1, the tenant pays the utility bill and has opportunity to choose the technologies for the living space. In this case, the tenant is both the principal and the agent and there is no P-A dilemma.

As shown in Figure 2-1, case 2 P-A relationships have the tenant paying the energy bills and the landlord choosing the technology. The landlord does not have an incentive to buy energy efficient technology if it is more expensive than the less efficient equipment because the tenant – not the landlord –benefits from the higher EE. The tenant has an incentive to adjust his or her behavior to keep the energy bill low. However, energy conservation through behavior change is limited by the inefficient technology. The tenant has limited capacity to influence the landlord to conduct an EE renovation.

Case 2 is the most common situation for rented living spaces (apartments and rented single-family homes) in the US. In 88% of rental living spaces in the US, the tenant pays the energy bills (Bird & Hernández, 2012). An OECD/IEA study (2007) on the split incentive found that approximately 2/3 of tenants in the US are in case 2 P-A relationships regarding refrigerators and water heaters.

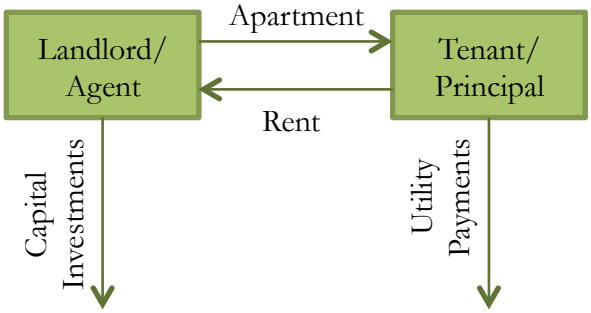

Figure 2-1: Principal-agent relationship in case 2. Modified from OECD & IEA, 2007.

In case 3, the tenant can choose the technology and the landlord pays the utility bill. In this case, the tenant has no incentive to consider either energy efficiency or energy conservation when selecting or using the technology. This case is rare, applying to only 4% of multi-unit residential housing in the United States (OECD & IEA, 2007).

The last case has landlord selecting the technology and paying the utility bill. The landlord has an incentive to invest in energy efficient technologies to keep the utility bill low. However, the tenant does not have an incentive to adopt energy conserving behaviors. The landlord then may chose to adopt technologies, such as motion sensors, that address the tenant's excess usage.

Tenants can be in multiple cases simultaneously, for example, in case 2 for matters such as insulation and water heaters and in case 1 for matters such as a television (OECD & IEA, 2007). Buildings that use district heating may have heating costs covered by the landlord (case 4) and electricity covered by the tenant (case 2).

2.3 Overview of Research Approach

The methodology for this research is divided into three parts according to the RQs, as shown in Figure 2-2. First, financial models that promote energy efficiency in apartments buildings were identified through a literature search. The subset of these models that address the split incentive—on-bill programs and green leases—were then analyzed further. Secondly, a

descriptive analysis of on-bill programs and green leases explored how these two models alter the principal-agent relationship and assessed their performance. The analysis is based on literature and interviews with stakeholders. In the third phase, a case study of an currently active program is conducted to explore how the program functions in reality and to see if it actually breaks down the split incentive. This analysis is predominantly based on interviews. The methodology is described in further detail below.

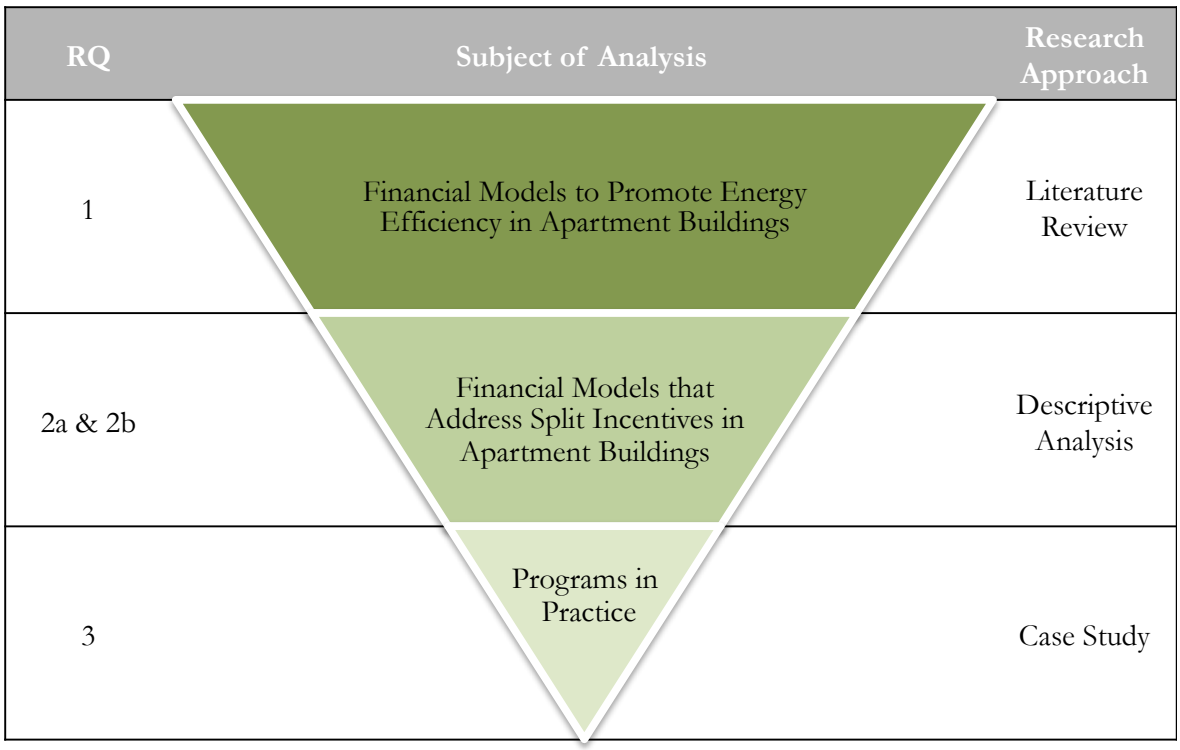

Figure 2-2: Overview of Research Approach

2.4 Identifying Financial Models that Address Split Incentives in Apartment Buildings

To address the first research question (RQ), a literature search was conducted. Initial keywords used included, *inter alia*, "split incentive," "finance," "energy efficiency," "renovation," "residential," "multi-family dwelling," "multi-unit," and "apartment." Searches were in both academic databases as well as with Google's search engine. Most of the academic literature search was conducted in Lund University's academic literature database, LUBsearch, which uses all of the university's EBSCOHost subscriptions. Web of Knowledge was also used to supplement the results from EBSCOHost. Publication lists of organizations known to do research in this area were also examined. Organizations included, *inter alia*, the American Council for an Energy-Efficient Economy (ACEEE), the European Council for an Energy-Efficient Economy (ECEEE), the Building Performance Institute Europe (BPIE) and the International Energy Agency (IEA). Results that solely addressed the commercial sector were ignored.

A collection of financial models and programs were compiled from the literature search. They were then organized using a categorization of policy instruments and measures similar to the one used in BPIE's 2010 report. The categorization was simplified and some additional categories were added to accommodate the variety of financial models found.

2.4.1 Criteria for selecting financial models

First, a list of financial models for energy efficiency in the residential sector was compiled. For this stage, financial models needed to (1) be applicable to the *residential* sector; (2) be primarily a *financial* incentive (as opposed to, for example, an informative or regulatory program); (3) focus on improving *energy efficiency* (whether or not it involves a renovation), and (4) interact directly with the building owner or tenant. Building owners could be public housing authorities (PHAs) or private entitites. The financing programs could be public, private, or public-private partnerships. The full list of programs considered is in Appendix 1.

The list was then screened further as to whether they address the split incentive market failure regarding EE renovations in apartment buildings. The following criteria were used to screen financial models:

1) The financial models must apply to EE renovations of multi-unit residential buildings in the rental market. In this study, the distinction between a renovation and a non-renovation ECM is that a renovation ECM requires alteration of the building's envelope.[8] Financial models for renewable energy installations or for non-renovation EE improvements were not considered, unless they are also applicable to EE renovations.
2) Financial models are considered if they alter the landlord-tenant relationship away from the conventional case 2 situation—regardless of whether the modification improves the split incentive problem or not.
3) The landlord, tenant, or both are engaged in paying for the renovation.

2.5 Assessing the Performance of the Financial Models

To address research questions 2a and 2b, financial models that apply to EE renovations and alter the landlord-tenant relationship are analyzed further. The assessment is largely based on literature analysis and is supplemented with interviews.

The analysis criteria are based on those presented by Per Mickwitz (2006) and modified to fit the specific context of this study (see Table 2-2). The analysis looks at both the outcomes and the impacts of the financial models. *Outcomes* of a financial model would be subject responses, e.g. program participation or installation of ECMs. The use of the term *impact* refers to the changes in society or the environment (e.g. energy consumption) resulting from the outcomes (Kiss, 2013; Mundaca Toro, 2008). The analysis criteria are presented in

[8] The European Building Performance Directive defines major renovations as those in which either (1) the cost of the renovation to the building shell and the energy installations is equal to or greater than 25% of the building value (omitting the value of the land) or (2) at least 25% of the building shell is renovated. The term "deep retrofit" is more common in the US than "deep renovation" and commonly refers to 30–50% reduction in energy consumption regardless of whether or not the envelope is altered or not. (Schnapp, Sitjà, & Laustsen, 2013)

Table 2-2 and are organized by which RQ they address. Most are addressing outcomes. The final criterion, energy savings, looks at the impact from the program. Energy conservation is the main motivating factor behind these financial models and thus it is important to assess if they actually achieve the desired goal.

To address RQ 2a, the analysis looked at the structure of the program. First, the principal-agent relationship was modeled. Aspects considered are (1) who pays the upfront costs for ECM installations; (2) if there is debt, how is it assigned; and (3) who pays the utility bills. As an extension to the principal-agent relationship, how financial risk is assigned was also considered. Participation rates will be considered as a potential indicator of the programs' ability to overcome the split incentive. Equal or near equal participation rates in the owner-occupied and rental sectors could demonstrate that landlords and homeowners are equally willing to participate in the program - - and that the split incentive is no longer an issue.

To address RQ 2b, the analysis then looks at various aspects that can affect the potential outcomes of the project, e.g. how well could this program be adopted and promote EE renovations in apartment buildings. A review of OBF case studies found that the best policies are *flexible* enough to meet the diversity of utility and regulatory structures (Bell & Nadel, 2012). Flexibility is also important to see how easily the financial model could be replicated in other contexts. *Accessibility* to low-income residents is addressed because low-income residents can be sensitive to high energy prices and costs and could be subject to energy poverty. In the US, low-income households spend about 14% of their income on energy, whereas other households spend about 3% (US DOE Agency Group 05, 2012). *Predictability* of future costs coule make a program attractive to stakeholders. *Persistence* is considered to see how long the program can be effective. If the program is only available for a short period, the potential outcomes, and thus impact, are limited. *Cost-effectiveness*, including various transaction costs of running the program, is considered, in part, as an extension of the potential persistence and for appeal to stakeholders. The *legal context* can affect the feasibility of a financial model in a particular region. For example, legal or regulatory changes may be needed to permit certain financial arrangements. This part of the analysis looks into what legal and regulatory context may be needed for the program to work.

The last criterion addresses at the impact from the program, primarily focusing on the environmental impact through energy conservation.

2.6 Assessing Programs in Practice

To address RQ 3, a case study of an existing program was conducted. One financial model was selected for a case study analysis based on the results of the assessment described in §2.5. First, a list of existing programs that use that financial model was compiled. Programs were limited to those that (1) catered to the residential market in the US and (2) were either in operation at the time of this research project or were publicized but still in development. From this list, a program that serves apartment buildings and assumes tenants pay utility bill was selected for a case study.

Data collection for the assessment of the program was conducted primarily through interviews with various actors, e.g. a program administrator, a legal council or government representative involved in the development of the program, and a customer.

The focus of the study is to explore how the program functions in reality and to assess its effectiveness as a tool for overcoming the split incentive. Data analysis uses the same criteria as is presented in

Table 2-2.

Table 2-2: Criteria for assessing the performance of financial models, with a focus on analyzing their capacity to address the split incentive issue.

RQ	Category	Criterion	Question
2a	Structure	Principal-Agent Relationship	How has the model reshaped the financial incentives for EE within the contractual landlord-tenant relationship?
		Risk	Who takes the financial risk? How does this affect the technology selection?
2b	Aspects Affecting the (Potential) Outcome	Flexibility	How flexible is the program to fit into different national contexts or different markets (e.g. commercial vs. residential)?
		Accessibility	How accessible is the model to low-income residents?
		Predictability	How predictable are factors for the different actors (e.g. predictability of payback period, costs, default rates, etc.)?
		Persistence	How permanent is the program? Will it be just a short-term, temporary fix or a long-term solution?
		Cost-Effectiveness	How cost-effective is the program?
		Legal Context	What are the (changes to) external legal structures that facilitated the implementation of this model? How dependent is the success of this model on these (changes to) external structures? Are payments for a loan or for a service? (How do the legal situations affect the decision between loan and tariff?)
	Outcomes and Impacts		What is the participation rate and how is it changing? How has the program impacted EE in apartment buildings? For example, how much energy was saved by the renovations?

3 Identification of Financial Models

Several financial models are being applied worldwide in an attempt to accelerate EE renovations of existing building stocks. Most aim to reduce the upfront costs, and only a few address split incentives. Programs found during the literature review are listed in Appendix I. The most common ones fall into the following categories: preferential loans, funding programs without repayment obligations, market-based instruments, utility-run programs, and green leases.

3.1 Preferential Loans

In general, preferential loans are public-private financing offered, under special conditions, with below-market interest rates. Government funds facilitate the availability of below-market interest rates. (Buildings Performance Institute Europe, 2010) In Europe, these funds could come from, *inter alia*, the European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD), and the Council of Europe Development Bank (CEB) (Buildings Performance Institute Europe, 2010). In the US, EE loan programs got a significant boost from American Recovery and Reinvestment Act grants — in particular the Energy Efficiency and Conservation Block Grant (Byrd & Cohen, 2011).

Preferential loans address the issue of access to capital and high upfront costs. Depending on the assignment of the debt, the loan can also address the long payback period. However, no examples were found that addressed split incentives. The programs in the residential sector tend to be limited to owner-occupied homes, where there is no principal-agent dilemma. If they do serve the rental market, the loan typically goes to the landlord and the landlord-tenant relationship remains in case 2. Some examples are discussed below.

Revolving Fund Scheme

The Revolving Fund Scheme for Energy Efficiency used EU-level funding to allow commercial banks to offer favorable loan rates in Estonia (Buildings Performance Institute Europe, 2010; European Union Regional Policy, 2010). In this scheme, EBRD and the CEB created a fund for EE refurbishments of homes. The funds were distributed to two commercial banks, Swedbank and SEB, which then offered loans to condominium associations.[9] The loans required an energy audit and a minimum estimated energy savings from the proposed ECMs (European Union Regional Policy, 2010). This particular funding scheme did not address the landlord-tenant dilemma because the scheme targeted owner-occupied multi-unit buildings, not rentals.

Property Assessed Clean Energy (PACE)

In the PACE model, a property owner gets financing for ECMs in exchange for a lien on their property. PACE programs tend to have low default rates because the lien is senior to any mortgages on the property. This set-up increases the probability that the debt will be paid off, but decreases the willingness of residential property owners to participate (Kim et al., 2012). This feature also makes PACE unpopular amongst mortgage firms (Byrd & Cohen, 2011). The model addresses the long payback period market barrier by attaching a lien to the property and not the property owner. As such, the lien transfers to the next owner in the case of a sale (Kim et al., 2012).

[9] In the literature, these associations are called "apartment associations." Apartment associations in Estonia are non-profit organizations of condominium owners who share a building (Estonian Union of Co-operative Housing Associations, n.d.).

In the US, PACE programs have been tested in a variety of building sectors. PACE programs spread rapidly across the country, with about half of the states passing legislation to authorize PACE programming (Byrd & Cohen, 2011; McCarthy, 2012). However, many programs were abandoned because of legal issues (Byrd & Cohen, 2011). The main killer of PACE programs was the 2009 announcement by secondary mortgage companies Freddie Mac and Fannie Mae that they would not back mortgages for properties with PACE loans (Center for Sustainable Energy California, n.d.). A few small governments have continued their PACE programs. Sonoma County in California has a popular and on-going program that is open to residential and commercial sectors (Byrd & Cohen, 2011; Center for Sustainable Energy California, n.d.). There is a strong demand in the residential market. Approximately 97% of renovation projects in Sonoma County are residential. Multi-family buildings are eligible for the program (Sonoma County Energy Independence Program, n.d.). The program did not specify if these multi-family buildings include only condominium buildings or if it includes apartment buildings. Regardless, the loan application can only be completed by the building owner and would not affect a case 2 landlord-tenant relationship.

3.2 Funding without Repayment Obligations

Funding options without repayment obligation include, *inter alia*, grants, subsidies, rebates, and tax deductions. These programs provide funding that does not need to be paid back, thus lowering the upfront cost barrier and financial risks for the landlord. The reduced upfront costs may increase a landlord's willingness to invest in ECMs. However, these programs do not, *per se*, alter the landlord-tenant relationship. Figure 3-1 illustrates this P-A relationship with reduced upfront costs for the landlord. If the grant or subsidy fully covers the cost of the ECMs, then the landlord-tenant relationship could be shifted. As shown in Figure 3-2, the financial burden of the capital investment is removed from the landlord-tenant relationship. The only case of this that was found is the Weatherization Assistance Program (WAP) in the US and is discussed briefly later in this section.

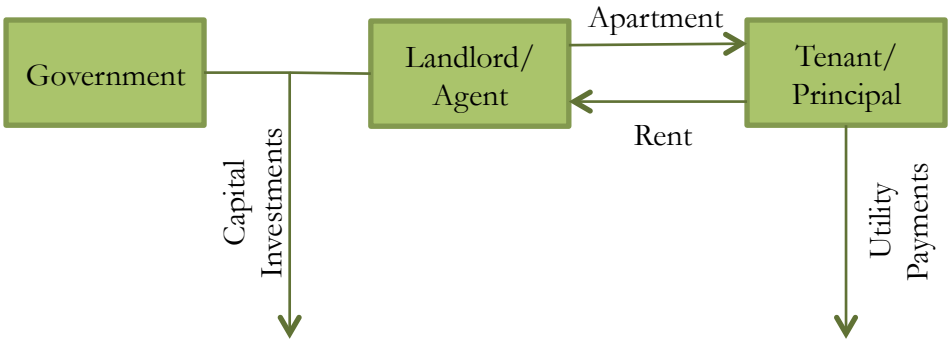

Figure 3-1: Principal-agent relationship with a government grant or subsidy that partially covers the renovation costs.

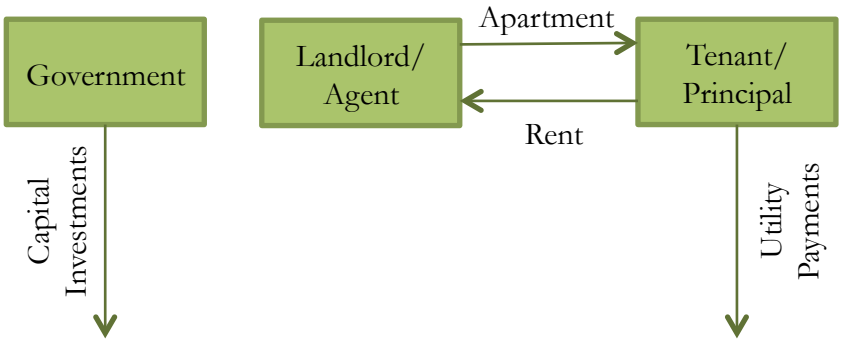

Figure 3-2: Principal-agent relationship with a government grant or subsidy that fully covers the cost of the ECMs.

Ratepayer-Funded Programs

Ratepayer-funded energy efficiency programs[10] are, collectively, the largest provider of energy efficiency in the US. Expenditures from these programs in 2010, excluding load-balancing projects, totaled nearly 4.8 billion USD (Barbose, Goldman, Hoffman, & Billingsley, 2013). These state programs first appeared in the US in the 1980's and were based on the fact that addressing energy efficiency is more cost-effective than increasing supply (Sedano, 2011). These programs can also be viewed as internalizing the societal and environmental externalities, which can provide some political favorability. For example, ratepayer programs in the US are reported to have collectively saved 112 TWh in 2010, equivalent to preventing the production of 78 million metric tons of CO_2 (Cooper & Wood, 2012).

Collection of funds from customers is commonly structured differently than recouping operational costs. Some states collect energy efficiency funding as a fee on a per-kWh or per-therm basis, whereas a utility company's operational costs are typically embedded in the energy tariff (Sedano, 2011; US EPA, 2006). The funds are then transferred to an energy efficiency fund administrator, which could be within the utility company, a government agency, or some other organization. The funding is applied to various sectors, including residential, commercial, and industrial. The residential sector received 31% of the energy savings in 2010 (Cooper & Wood, 2012). States can use these funds to run a variety of programs, including, but not limited to rebates on energy efficient technology (US EPA, 2006). As a general category of programs, ratepayer-funded programs do not address the split incentive. They address the issue of high upfront costs, but do not alter the P-A relationship.

Funding of these programs is limited by political favorability. The Energy Efficiency Institute (1999) argued that the perception that some customers' money is being used to subsidize other customers' energy savings could cause resentment toward the program. The Energy Efficiency Energy Institute (1999) further notes that funding for these programs is generally limited by ratepayers' willingness to pay, rather than the actual energy efficiency needs.

Weatherization Assistance Program

The Weatherization Assistance Program (WAP) is a nationally funded grant program that helps low-income households improve the energy efficiency of their homes. Funding is allocated to states, overseas U.S. territories, and Native American tribal governments, who then distribute funds to local program administrators (US DOE, 2013). The program was

[10] These programs are referred to by a number of names, such as Public Benefit Funds and Customer-Funded Energy Efficiency Programs.

started in 1976 in response to the oil crisis (US DOE, 2013). As a grant program, WAP needs to replenish funds regularly. For example, WAP received 5 billion USD from the American Recovery and Reinvestment Act of 2009 (US DOE, 2013). The funds from the program have weatherized over 6.4 million homes, as of 2012 (US DOE, 2013).

The program is open to homeowners and renters alike, and largely removes the landlord from the process. Renters, not landlords, apply to the program, as long as they have written permission from their landlord. The government pays for the ECM installation and participating households benefit from an average energy savings of 437 USD per year (US DOE, 2013). The P-A relationship is, in effect converted to a case 1 relationship, as illustrated in Figure 3-3. This program is also not available to the vast majority of Americans because eligibility is limited to those below 200% of the poverty line (US DOE, 2013).

Bird and Hernández (2012) argued that this type of program is not scalable and cannot reach the breadth of the low-income community that needs it because it depends on government funding. With exception of the record high funding in 2009, WAP funding has been on a decline since 1979 (Sissine, 2012).

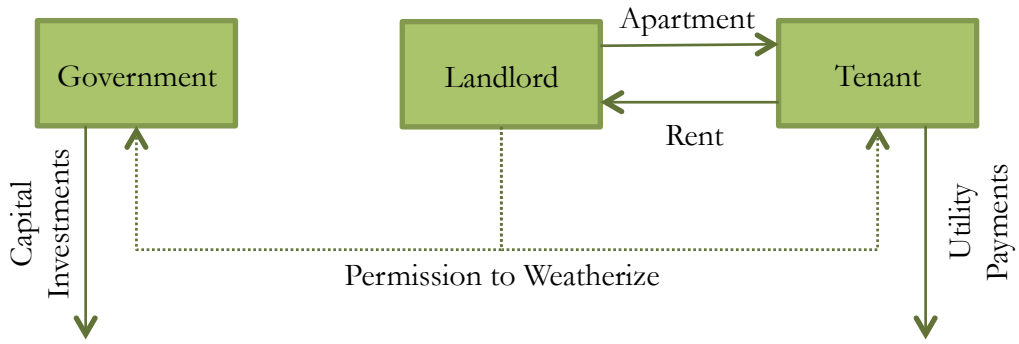

Figure 3-3: Principal-agent diagram for the Weatherization Assistance Program. The WAP program covers the costs of the ECM installation, removing the landlord financially from the renovation project. The tenant becomes both the principal and the agent.

3.3 Utility-Run Programs

Some utility companies provide innovative programs that use energy savings to pay for investments in ECM. In fact, utilities are increasingly big actors in promoting energy efficiency. Utilities collectively contributed 4.3 billion USD in 2009 to electricity and gas energy efficiency programs. Annual contributions from utilities are expected to rise to between 7.5 billion USD and 12 billion USD by 2020. The level of these annual investments is quite significant, nearly on par with the federal government's one-time 17 billion USD investment in energy efficiency via the American Recovery and Reinvestment Act of 2009 (McKibbin, Evens, Nadel, & Mackres, 2012). Utilities' incentive to invest in energy efficiency may rise from the fact that energy efficiency is more cost-effective than building new power plants (McKibbin et al., 2012).

Energy Performance Contracts

Utility companies can offer energy performance contracts (EPCs) in which they guarantee estimated energy savings and recoup costs through energy savings (Langenheld, 2012; Petersen, 2009). EPCs tend to focus on large projects such as those in industry or through municipalities. In some European countries, EPCs are emerging in the residential sector (Langenheld, 2012). In the residential sector, the contract is between the utility company and

the landlord. Similar to grants, loans, and subsidies, EPCs still struggle to overcome the landlord-tenant split incentive (Langenheld, 2012; Wargert, 2011).

On-Bill Programs

On-bill programs are similar to EPCs. They are loans or energy efficiency service programs that are structured such that energy costs savings pay for the ECMs (Burroughs et al., 2012). Similar as with an EPC, the utility company performs an audit on the home, presents an EE improvement plan, pays the upfront costs of the renovation, and guarantees a particular level of energy savings (Kim et al., 2012).

The main distinction is that on-bill programs reframe the landlord-tenant relationship. The tenant—not the landlord—repays the capital investment. There are two main categories of on-bill programs: on-bill repayment (OBR) and on-bill financing (OBF). In the case of OBR, repayment for the capital investment is in the form of loan payments added to the utility bill. For OBF, the repayments are paid via a tariff for resource efficiency service. Typically, the repayments are attached to the meter, not the landlord or tenant, removing the challenge of tenancy typically being shorter than the payback period (Kim et al., 2012; Wein & Howat, 2012). OBF and OBR programs are discussed further in chapter 4.

3.4 Green Leases

Principal-agent theory explains the split incentive problem as a faulty contractual relationship. Accordingly, one solution is to restructure or amend the lease contract with EE in mind. Green leases supplement or replace a standard lease to incorporate environmental factors into the contractual tenant-landlord relationship. There are multiple forms of green leases. For example, a green lease could reframe the financial responsibilities, allow landlords to be compensated for EE investments, and still provide cost savings to the tenant (Burroughs et al., 2012; Williams, 2008). Another structure of green leases formalizes a rent increase relative to improved EE and estimated energy cost savings. Green leases are discussed further in chapter 4.

4 Analysis of Financial Models that Address the Split Incentive Problem

4.1 On-Bill Programs

On-bill programs are market-based systems that utilize energy cost savings to finance ECMs (Brown, n.d.; Cillo & Lachman, 2004). A utility company performs an audit, proposes ECMs, and pays the upfront costs. The tenant then pays for the service through pre-determined, pro-rated payments on the utility bill (Brown, n.d.; Kim et al., 2012). The repayment fees cover the capital investments and financing charges (Brown, n.d.). Some utility companies guarantee that the monthly bills after the renovation—the sum of the energy tariff and the pro-rated payment—will be less than or equal to the utility bills prior to the renovation (Cillo & Lachman, 2004). Figure 4-1 shows how the utility bill decreases after installing the ECMs. Streamlining the payments with utility service bills makes it easy for the tenant to see the cost savings from the ECMs (Kim et al., 2012). The earliest program found existed between 1993 and 1995 in Wisconsin. The program format at the time was referred to as positive cashflow financing[11] (Bell et al., 2011).

On-bill programs are still relatively new. While on-bill programming was started almost two decades ago, the concept has only recently started to flourish. Most of the on-bill programs identified in the US (see Appendix II) have not started yet or were started in 2010 or later. DSIRE, the Database for State Incentives for Renewables & Efficiency, does not list on-bill programs as a policy type in its search feature, even though various on-bill programs are included in the database. These programs are categorized under "Utility Loan Program" regardless of whether the on-bill program is structured as a loan or not. The concept is spreading quickly. On-bill programs are already available in 14 states. The framework is apparently flexible across sectors. Existing programs serve various markets within the residential, commercial, and industrial sectors (McKibbin et al., 2012).

[11] The only search result containing the term "postive cashflow financing" was not relevant to on-bill financing. Rather, the website advertised invoice discounting services.

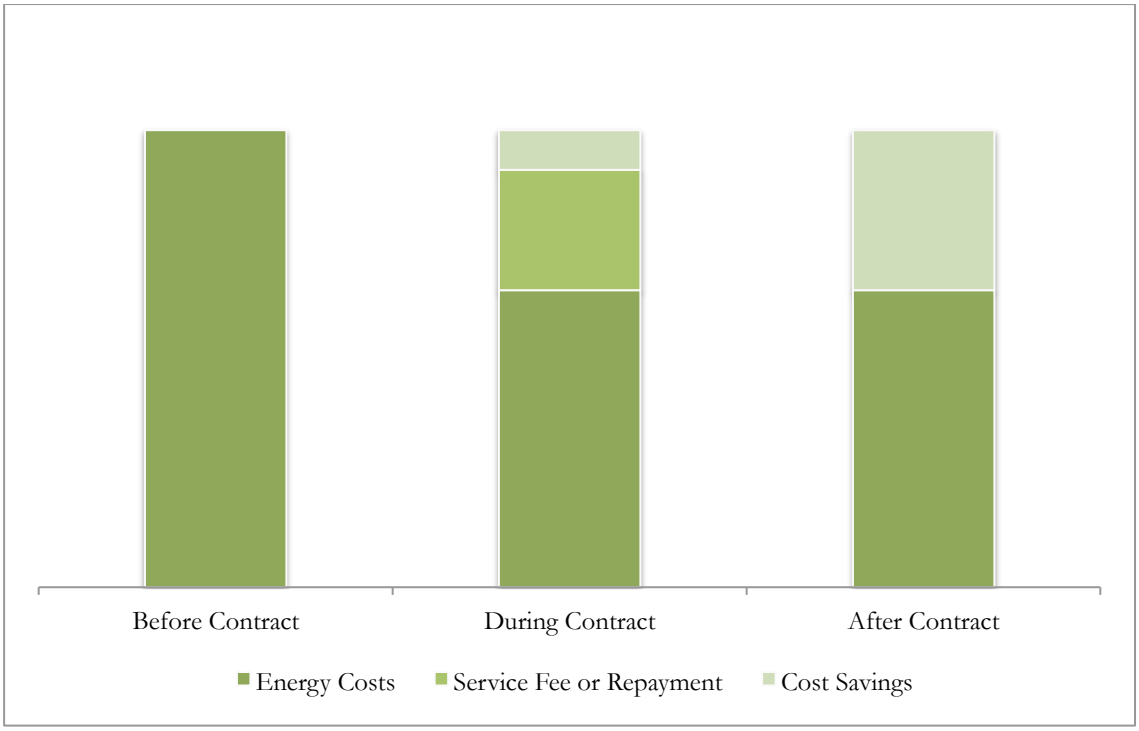

Figure 4-1: Comparison of utility bills before and after an energy efficiency renovation in an on-bill program. After the renovation, both (1) the service fee or repayment and (2) the energy bill are included on the utility bill. Modified from figure in BPIE, 2010.

The Energy Efficiency Institute in Vermont, US developed a tariff-based on-bill program model in 1999, and continues to promote it today. They coined the term Pay As You Save and hold the intellectual property rights to the Pay As You Save (PAY®) program model they developed and have trademarked both the name and the acronym (Harlan Lachman, personal communication, July 28, 2013). The intellectual property protection covers use in the US only. There are PAYS®-style programs outside of the US, e.g. in Canada and the UK. However, Mr. Lachman noted that while these programs are branded as Pay As You Save, they have little to no relationship to the trademarked PAYS® system. Key aspects of the PAYS® model include, *inter alia*, (1) the cost of the renovation being spread over time, (2) the service charge being attached to the meter, not to the customer, and (3) the estimated energy savings being greater than the cost of the energy efficiency installations (Cillo & Lachman, 1999). Utility companies across the country have implemented several variations of the program. Other variants of the concept that do not fit under the PAYS® framework have also developed. Appendix II lists residential on-bill programs in the US.

There are two main varieties of on-bill programs: OBF and OBR. The difference lies in whether the payment is for a service or for a loan. OBF utilizes utility capital and payments are made via a tariff for service. PAYS® is an OBF program. With OBR, payments go towards a loan from third-party capital (Brown, n.d.; Kim et al., 2012; Wein & Howat, 2012). The following analysis covers both OBF (including PAYS®) and OBR programs. The analysis is based on reports from five organizations listed in Table 4-1. The reports were selected to provide a variety of perspectives on on-bill programs. One organization is dedicated to promoting PAYS®, an OBF program model, and one is advocating for OBR legislation in California. Two legal organizations present critiques of on-bill programs. Two other organizations focus on energy efficiency more broadly and can comment on on-bill programs as one of several approaches to increasing EE in American homes.

Table 4-1: List of organizations whose reports were used in the analysis of on-bill programs

Organization	Authors	Year	Title
Energy Efficiency Institute[12]	Cillo & Lachman	1999	Pay As You Save Energy Efficiency Products: Restructuring Energy Efficiency
		2004	A Preliminary Analysis of the Cost Effectiveness of Potential PAYS® Products in Missouri
		2013	Status Report for programs based on the Pay As You Save® (PAYS®) system
Alliance to Save Energy	Brown	2013	Paying for Energy Upgrades through Utility Bills
Wilson Sonsi Goodrich & Rosati	Kim, et al.	2012	Innovations and Opportunities in Energy Efficiency Finance
Environmental Defense Fund[13]	Copithorne & Fine	2011	On-Bill Repayment: Unlocking the Energy Efficiency Puzzle in California
National Consumer Law Center[14]	Wein & Howat	2009	Comments of the National Consumer Law Center on the Adminstrative Law Judge's Ruling Regarding Energy Efficiency Finance
American Council for an Energy-Efficient Economy	Bell, Nadel, & Hayes	2011	On-Bill Financing for Energy Efficiency Improvements: A Review of Current Programs Challenges, Opportunities, and Best Practices
	Bell & Nadel	2012	On-Bill Financing: Exploring the Energy Efficiency Opportunities and Diversity of Approaches

4.1.1 Principal-Agent Relationship

How has the model reshaped the financial incentives for EE within the contractual landlord-tenant relationship?

Four of six organizations mention the term "split incentive" in their reports on on-bill programs and these four explicitly state that on-bill programs address the split incentive issue.

On-bill programs address the P-A problem by shifting financial responsibility for ECMs to the tenant, making the tenant both the principal and the agent. The program is attractive to

[12] Cillo and Lachman of the EEI developed the PAYS™ program model in 1999. Interviews with Mr. Lachman supplemented the reports.

[13] The Environmental Defense Fund designed an OBR program for California and lobbied for legislation that would permit it. Information on the bill is in Appendix IV.

[14] The NCLC is a non-profit organization that advocates economic justice for low-income customers and submitted commentary on the Environmental Defense Funds' proposed legislation in California.

tenants because the utility bill after the renovation – even including the repayments – is typically lower than before the renovation. It is also attractive to the landlord because the property gets renovated without needing to invest financially.

Furthermore, OBF programs may remove a temporal split incentive – a disincentive rising from the payback period being longer than the time period that the customer will benefit from the ECM. With OBF, the payment is tied to the meter – not the tenant (Cillo & Lachman, 1999). The tenant thus only pays for the service while living in the apartment. With OBR programs, the debt could be assigned to the customer (Brown, n.d.).

4.1.2 Risk

Who takes the financial risk?

One distinction between OBR and OBF program is whether or not the customer is taking on a debt. In OBR programs, the customer is taking a loan – and thus a debt. The National Consumer Law Center expressed concern about how the proposed California OBR program could add to consumers' debt. They noted that 32% of American homeowners have mortgage debt higher than their property value. Participation in an OBR program would add to these homeowners' debt loads. In OBF, the customer is paying a fee for a service – and is thus not taking on a debt.

A consequence of the loan versus tariff distinction is how the financial responsibility is handled when a tenant moves. The average tenancy in an apartment is commonly shorter than the payback period ECM installations. With OBF, the tariff is automatically transferred to the next bill payer, i.e. the next tenant. With OBR, the financial responsibility is in the form of a loan that cannot be automatically transferred to the next bill payer (Lachman, personal communication, September 20, 2013).

Different programs handle the financial risk of ECM failure differently. In some programs, including the PAYS® program model, the utility is responsible for replacing or repairing the ECMs that fail. (Brown, n.d.; Cillo & Lachman, 2013) This responsibility may be limited to pre-set warranty period. After this period, the utility may still be responsible for replacing or repairing the ECM. However, the utility may be able to extend the payback period, but not raise the repayment fee, to recoup the replacement or repair costs (Brown, n.d.). In some programs, the tenants can stop payments for the ECMs if the ECMs fail (Cillo & Lachman, 2004).

The utility takes on the financial risk of the customer not paying back the ECM service fee. While limited data are available, experience in the US so far shows that the risk is low (Copithorne & Fine, 2011; Lachman & Cillo, 2013). Utility companies in the state of New Hampshire have been running OBR programs for municipalities since pilot projects were started in 2001. Since then, the projects have financed 6.4 million USD worth of EE projects and only experienced approximately 100 USD (<0.002%) in measure failures and missed payments (Cillo & Lachman, 2013). A review of PAYS®-style programs across the United States – serving residential, commercial, and municipal customers – has shown a bad debt rate around 0.001% (Lachman & Cillo, 2013). A broader review of on-bill programs estimated a combined bad debt/default[15] rate between 0 and 2% (Kim et al., 2012).

[15] The terminology associated with customers not paying the on-bill surchage is different for OBR and OBF programs. Because OBR programs are loaning money to the customer, customers failing to pay is refered to as a *default*. With OBF programs, failure to pay is referred to as *bad debt*.

The low bad debt/default rate could be due to a policy of disconnecting utility service in the case of non-payment (henceforth referred to as DNP) (Kim et al., 2012). Three organizations mentioned DNP in a positive manner. The EEI lists it as an essential feature of PAYS® and the Alliance to Save Energy commented that the reduced financial risk lowers the program costs. The National Consumer Law Center was the only organization to speak negatively about DNP. They were particularly concerned about DNP for residential customers and requested that that aspect of the program be removed from the proposed California legislation. Kim, et al. noted that they see the benefit of DNP, but are uncertain of the legality of disconnecting utility service. Copithorne and Fine mentioned DNP matter of factly as part of an example program.

Only one organization mentioned that the landlord could be responsible for the on-bill surcharge in case a participating apartment is vacant. The report did note that the on-bill program could be designed to address this financial risk.

How does the distribution of financial risk affect the technology selection?

The utility company may control the ECM options available to customers, primarily limiting options to those that can be paid for with energy cost savings. Brown (n.d.) noted that utilities may select a list of eligible measures based on their initial cost and payback time. Cillo and Lachman (1999) listed as an essential feature of PAYS® that the agent who approves ECMs also ensures that the estimated cost savings exceed the ECM costs. Bell, Nadel, and Hayes (2011) note that the requirement that the energy cost savings exceed the ECM costs may inhibit the application of on-bill programming to deep retrofits. Copithorne and Fine (2011) suggested that the eligible technologies in the proposed California program could be selected based on which ones currently have rebates, and that the list could be updated based on proven energy efficiency performance levels.

4.1.3 Flexibility

How flexible is the program to fit into different national contexts or different markets (e.g. commercial vs. residential)?

The on-bill concept is flexible, and can be molded to fit local needs. Most of the reports explicitly or implicitly described the flexibility of on-bill programs. Bell and Nadel (2012) note that current programs are all unique. Bell and Nadel (2012), the Energy Efficiency Institute (2013), and Brown (n.d.) each present a list of current programs demonstrating the diversity of program designs. The collection of programs illustrates how the PAYS® concept is flexible to meet different markets (e.g. commercial, residential, vs. residential; and rural vs. urban) and apply to different technologies (water- and energy-efficiency, a single-technology or a category of technologies). Copithorne and Fine (2011) notes the flexibility of OBR programs to reach commercial, public, and residential buildings – both single-family and multi-family buildings.

4.1.4 Accessibility

How accessible is the model to low-income residents?

Most of the organizations suggest that on-bill programs can increase accessibility of energy efficiency measures to low-income consumers. Cillo and Lachman (2004) emphasize the importance of reaching low-income residents and how collaboration between low-income programing and a PAYS® program could improve access to ECMs. A PAYS® project would lower the energy bill. Furthermore, collaboration between low-income programs and a PAYS®-program could allow residents to pay the surcharge with fuel assistance funds. Kim, et al. (2012) note that utility companies can use a tenants' payment history rather than a credit

score to gauge their reliability, and thus be more accessible to residents with low credit scores. Furthermore, OBF programs are not loans and the debt does not go on the tenant's credit report (Brown, n.d.).

The National Consumer Law Center presented a plethora of concerns on how the proposed legislation in California could be problematic for low-income consumers. For example, they are concerned that bill neutrality may not be easily achieved and consumers could be stuck with higher utility bills.

4.1.5 Predictability

How predictable are factors for the different actors (e.g. predictability of payback period, costs, default rates, etc.)?

The cost to the customer is predictable. The on-bill surcharge is pre-determined and constant for the length of the payback period. The utility companies benefit from the predictability of payments. As discussed above, the default/bad debt rates so far have been low. The low default/bad debt rate may also be related to the fact that utility bills experience lower nonpayment rates than other traditional loan structures (Bell & Nadel, 2012; Copithorne & Fine, 2011).

4.1.6 Persistence

How permanent is the program? Will it be just a short-term, temporary fix or a long-term solution?

On-bill programs are still young and their longevity is based on an *ex-ante* approximation. The Energy Efficiency Institute suggests that PAYS® programs could be a long-term solution. Because nearly 100% of customers are making payments, funds are available for new customers (Cillo & Lachman, 2004). PAYS® programs in effect have a revolving fund. The Energy Efficiency Institute (2013) provided the example of the Public Service of New Hampshire's PAYS® program for municipalities and how they are using incoming payments to pay for new projects.

There is some concern about the scalability of these programs. ACEEE reports that the majority of programs use federal funding and/or ratepayer funds as source of capital for their EE projects. They note that the private sector may see this as a limitation of the programs' longevity.

4.1.7 Cost-Effectiveness

How cost-effective is the program?

Most reports present on-bill financing as a cost-effective means of providing energy efficiency upgrades to buildings. For example, Cillo and Lachman (2004) report on the feasibility of PAYS programs for public buildings, multi-family homes, and hotels found they would be cost-effective for both customers and vendors of EE technology. Kim, et al (2012) also note that the merging of the financing and utility services reduces transaction costs relative to a conventional loan system, by using the utility's pre-existing billing and customer service systems. Copithorne and Fine (2011) further note that the lower default rate with OBR relative to tradition loans permits lower interest rates. These lower rates make the program more cost-effective from a customer perspective.

The requirement in PAYS® programs that the on-bill surcharge be lower than the energy cost savings ensures that the project will be cost-effective. The National Consumer Law Center's

report was the only one that explicitly questioned the feasibility of bill neutrality – that the payments will be lower than or equal to energy cost savings. ACEEE mentioned that one program administrator they interviewed had difficulty finding cost-effective programs.

4.1.8 Legal Context

What changes to external legal structures facilitated implementation of this model?

All of the reports implicitly or explicitly note the need for legislation to enact these programs. For example, the reports from the Environmental Defense Fund and the National Consumer Law Center both focus on proposed legislation in California to expand OBR to residential customers. The original and amended texts of the bill are included in Appendix IV.

OBF/OBR programs may not be readily legal in certain jurisdictions. Legislative changes may be needed to permit a utility (1) to assign a tariff to a meter rather than a customer and (2) to charge a tariff for a service other than energy delivery (OECD et al., 2008; Williams, 2008). Several states, including New Hampshire and Kentucky, have declared that no futher legislation is needed to approve OBF programs (Harlan Lachman, personal communication, September 20, 2013). Harlan Lachman (personal communication, September 20, 2013) describes the core issue as determining if the provision of resource efficiency is an essential utility service. Furthermore, Kim et al. (2012) question the legality of DNP and propose that it be further researched.

The Environmental Defense Fund is promoting OBR legislation in Texas, Ohio, and North Carolina. OBR programs could be more appealing than subsidies or grants in predominantly Republican parts of the US. The politically conservative perspective in the US prefers small government and low taxes. OBR programs use third party capital - not tax or ratepayer funding. Compared with subsidies or grants, OBR programs are more independent from government bureaucracy (Gerdes, 2012).

Are payments for a loan or for a service? (How do the legal situations affect the decision between loan and tariff?)

The legal context can determine to which markets a utility company will offer OBR/OBF services and how they structure the financing. For example, utilities do not market OBR to residential customers in some parts of the US because of state-level consumer finance laws (Brown, n.d.). Kim, et al. (2012) noted that utilities avoid using ratepayer funds in OBF programs because the utilities would then be subject to lending laws.

4.1.9 Outcomes and Impact

What is the participation rate?

On-bill programs to date tend to be pilot programs or are still young. Bell, Nadel, and Hayes (2011), in a review of approximately eight on-bill programs, reported participation rates from <1% to 1.5% of the customer class.

How has the program impacted EE in apartment buildings? How much energy was saved by the renovations?

Four of the six organizations listed in Table 4-1 presented *ex-ante* or *ex-post* analyses of outcomes or impacts of on-bill programs. The Energy Efficiency Institute (2013) reported that a program in Kansas invested nearly 5 million USD (including over 200,000 USD in program fees) over five years in energy efficiency projects in 858 locations, 13% of which were in the residential rental market. The Environmental Defense Fund (2012), which

discussed a proposed program, provided an *ex-ante* estimation of the potential that if 1% of residential properties in California participate in an OBR program, 20,000 construction jobs would be generated and over 6 metric tonnes of CO_2 emissions will be avoided during the first five years of the program. This estimate does not distinguish between potential impacts on rental versus owner-occupied homes. Kim, et al (2012) suggested that on-bill programming might not be suited for deep retrofits.

4.2 Green Leases

Agency theory tells us that the core problem in the P-A dilemma is a faulty contractual relationship. The green lease approach addresses the P-A dilemma by redesigning the contractual landlord-tenant relationship to provide both the principal and the agent with an incentive to improve energy efficiency. Green leases are uncommon, with most discussion focusing on the commercial sector (Colletta, 2009; Institute for Market Transformation, n.d.; Taylor, Murphy, Kincaid, Garciano, & Hunton, 2012). There was, however, movement to introduce green leases to the apartment market (Tam, Eiseman, Montoya, & Denning, 2009; Williams, 2008).

Green leases replace or supplement the standard rental contract and directly address environmental issues. Different varieties of residential green leases were discussed in the limited literature found on the topic. These varieties are described in Table 4-2.

Table 4-2: Categories of green leases

Type	Description
I	This green lease format maintains the common net lease and formalizes the connection between a rent increase, the costs of ECM installations, and resulting energy costs savings. Landlords can recoup costs from implementing ECM and the tenants' benefit from reduction in energy costs (CMS, 2011; Tam et al., 2009).
II	Joseph LaRusso introduced this green lease type. It adopts a gross lease format with the tenant pays the landlord a flat heating/cooling fee that covers energy costs and debt service (Williams, 2008).
III	If a building has an eco-certification, a green lease may be needed, in part, to ensure the tenant complies with conditions of the certification, such as using only low-energy lighting installations (CMS, 2011).

The type I green lease addresses energy efficiency specifically. No existing green lease programs were found in the residential sector. The analysis of type I green leases is based on the concept presented, albeit briefly, in the literature.

Type II green leases also address energy efficiency. One example of a type II green lease was found. Joseph LaRusso, the Energy Efficiency and Renewable Energy Finance Manager at the City of Boston, drafted a green lease in 2008 with the specific intention of addressing the split incentive. He drafted this lease out of personal interest, not as a professional project. His inspiration came from watching a television program including an interview with Cambridge Energy Alliance (CEA) representatives who discussed the split incentive issue and presented Green leases as a potential solution. Intrigued, LaRusso, tried to find some sample residential Green leases, but could not find any. He then drafted one and brought it to a meeting with the same CEA representatives. Around the same time, an Urban Planning professor at MIT and her master's student, Beth Williams, were looking for an example of a residential green lease as part of Williams' thesis research. They could not find any, but then heard of LaRusso's. They contacted him and then included his green lease as a part of the student's thesis. Williams

(2008) wrote optimistically about residential green leasing and expressed hope that the green leasing concept would continue to develop and other variations would be written to meet the diversity of needs within the residential rental market. However, the residential green lease concept did not develop further, and the CEA stopped investigating the approach. LaRusso noted that an American municipal official contacted him about the residential green lease, but opted against using it. The analysis of type II green leases is based on LaRusso's lease and on interviews with LaRusso and the American municipal official.

A type III green lease does not particularly alter the P-A relationship. This lease type may require the tenant to comply with specific behaviors or use specific technologies. However, it does not particularly involve any cost sharing. Furthermore, the type III green lease does not specifically address energy efficiency. It encompasses a range of environmental aspects that could include energy efficiency. The type III green lease is not analyzed further.

4.2.1 Principal-Agent Relationship

How has the model reshaped the financial incentives for EE within the contractual landlord-tenant relationship?

Agency theory underscores that the core problem in the P-A dilemma is a faulty contractual relationship. The green lease approach addresses the P-A dilemma by redesigning the contractual landlord-tenant relationship.

Type I Green Lease

The type I green lease addresses the split incentive by formalizing the relationship between rent increase, ECM installation costs, and energy cost savings – and thus allows the landlord to share the cost of the ECM installations with the tenant. The lease declares that the rent increase (1) compensates the landlord for ECM installations and (2) will be accompanied by energy cost savings. In effect, the ECM installations are paid for, in part or in full, through cost-savings. Figure 4-2 illustrates the change in a tenant's payments. Depending on the relationship between the rent increase and the energy cost savings, the total payments could increase, decrease, or stay the same after installing the ECMs. To what extent the rent increase is correlated to the energy cost savings depends on how the lease is written.

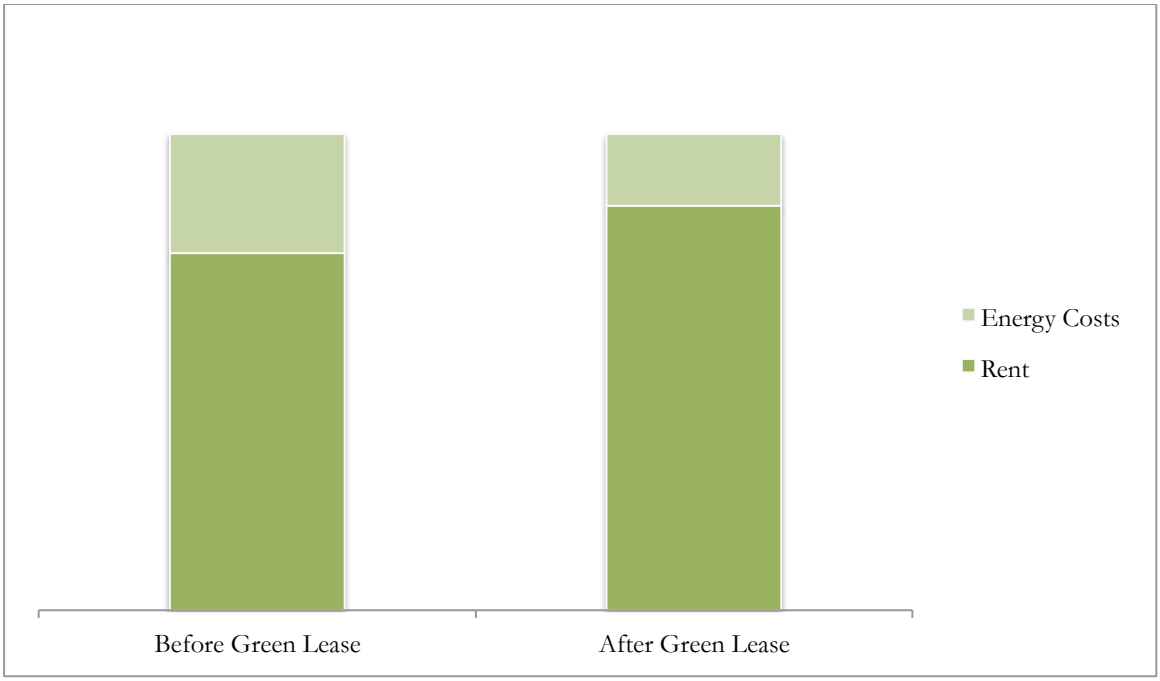

Figure 4-2: A comparison of rent and energy costs before and after starting a type I green lease. Depending on whether or not (and how) the lease connects the rent increase and cost savings, the sum of rent and energy costs may rise, decrease, or stay the same after initiating the green lease.

The P-A relationship, with the shared contributions to capital investments, is illustrated in Figure 4-3. The landlord has an incentive to install ECMs knowing he or she can share the costs with the tenant. The tenant has an incentive to support the ECM installation knowing he or she will have energy cost savings. The tenant continues to pay the energy bills, and thus maintains a financial incentive to conserve energy through behavior.

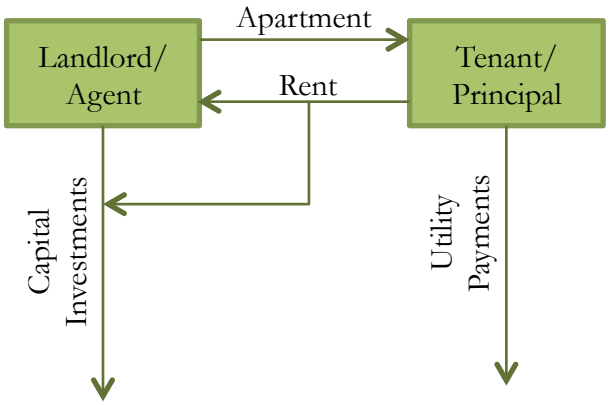

Figure 4-3: Principal-agent relationship under a type I green lease.

Type II Green Lease

LaRusso's green lease modifies the P-A relationship from case 2 to a modified case 4, in which both the landlord has a financial incentive to install energy efficient equipment and the tenant has an incentive to conserve energy through behavior.

The first mechanism in LaRusso's green lease provides the landlord with an incentive to ECMs with high energy savings. The landlord selects and pays for the ECMs. The green lease

transfers the financial responsibility for paying energy bills from the tenant to the landlord. In the first year, the tenant pays a monthly heating/cooling fee that is equivalent to 1/12 of the energy costs from the year prior to the ECM installations. As such, the green lease does not change how much the tenant pays during the first year relative to the pre-ECM year. The heating/cooling fee covers (1) the actual energy costs for the first year and (2) debt service for the ECMs. The landlord has an incentive to install ECMs with high energy savings because the lower the actual energy costs, the higher the percentage of the heating/cooling fee that can go toward debt service payments. Figure 4-4 compares the tenant's energy payments from before the ECM installations to the use of the heating/cooling fee during the year after the installations. A third party certifies the calculation of the heating/cooling fee.

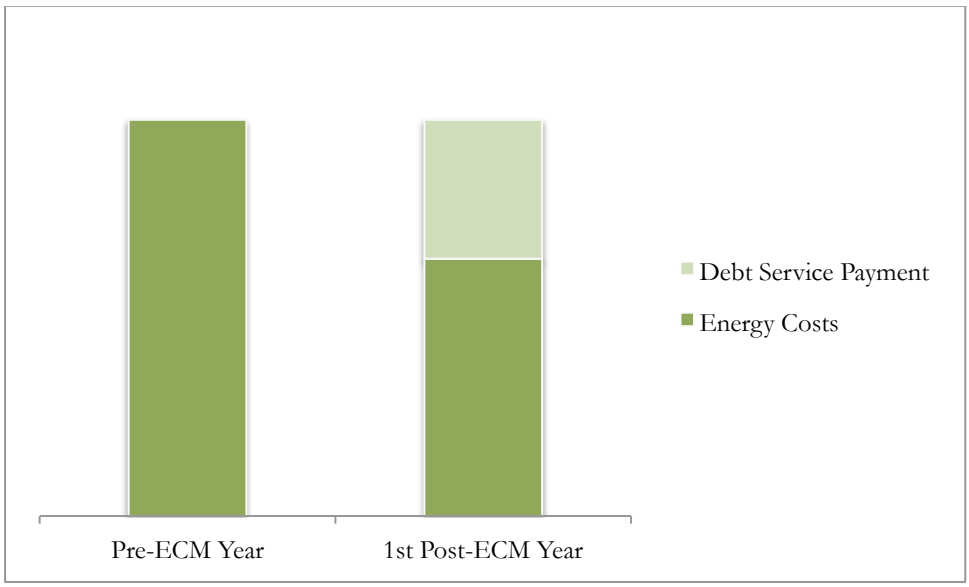

Figure 4-4: Comparison of the accumulative energy costs during the year before installation of energy conserving measures (ECM) with the heating/cooling fee paid during the first year after the ECM installations. The tenant pays the same amount for heating/cooling fee as they paid for energy prior to the ECM installations. After the ECM installations, the landlord pays the energy bills. All of the energy cost savings goes towards debt service payments.

With just the heating/cooling fee, the green lease could result in a case 4 P-A relationship with an excess use problem. LaRusso's green lease contains an additional mechanism to remove the excess usage problem that could arise in a standard case 4 P-A relationship. Starting at the end of the second year, the tenant and the landlord compare that year's energy consumption the first year's energy consumption. If the tenant increased energy consumption relative to the first year, they pay a balanced billing charge to the landlord. If the tenant decreased energy consumption relative to the first year, they receive a balanced billing refund from the landlord. A third party certifies the calculation of the balanced billing charge or refund.

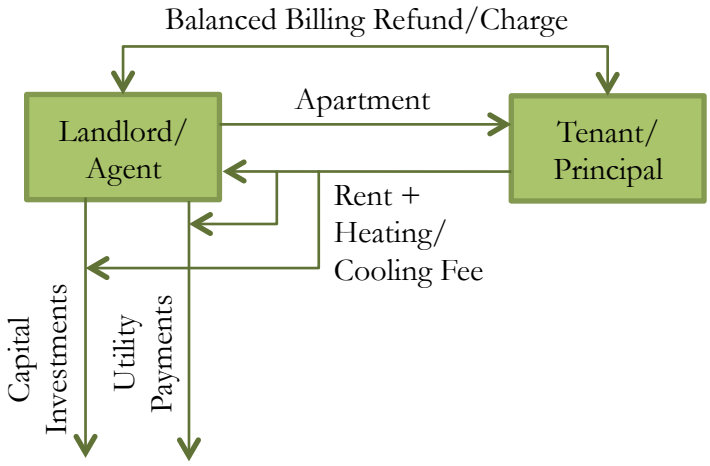

Figure 4-5: Principal-agent relationship using a green lease with a heating/cooling fee.

4.2.2 Risk

Who takes the financial risk?

In both types I and II, the landlord takes the financial risk. The landlord is responsible for (1) paying the upfront costs of the ECM installations or taking on a loan to cover said costs and (2) maintaining, repairing, or replacing the equipment in the case of malfunction. The rent increase or the heating/cooling fee is thus means for the landlord to recoup the costs.

How does this affect the technology selection?

No *ex-ante* analyses were found discussing how this could affect the technology selection. However, it is likely that with the landlord taking on the financial risk, he or she may make conservative technology selections.

4.2.3 Flexibility

How flexible is the program to fit into different national contexts or different markets (e.g. commercial vs. residential)?

The concept of green leases is far more common in the commercial sector than in the residential sector. In a Google search for "green leasing," all of the search results on the first two pages refer to green leasing for office tenants. The first Google result[16] to include residential green leases focuses on renting spaces for academic and office use. The Green Lease Library[17] offered by the Institute for Market Transformation offers some case studies, none of which are residential. Three of five toolkits listed on their page are tagged as related to residential buildings. However, none of them discussed residential green leases.

A Google search for "green lease residential" also provides limited results relevant to current residential green Leasing efforts. Seven of ten results were relevant to residential leasing. Two of those were for leasing of solar panels on residential properties – not related to energy efficiency in a rented living space. Two of the search results were explicitly unoptimistic about residential green leases. One result was positive about residential green leasing. However, the

[16] http://www.scps.nyu.edu/export/sites/scps/pdf/real-estate/sbe-green-lease.pdf
[17] http://www.greenleaselibrary.com/

report was from an organization that abandoned research on residential green leasing years ago. Another result is a report that discusses green leasing generally. However, its motivation is based in corporate social responsibility and the report thus has an implied focus on the commercial sector. This leaves only 1 in 10 search results being a current promotion of residential green leases.

Instead of asking if green leasing is flexible enough to fit into other markets, i.e. non-residential markets, a more appropriate question may be whether green leases are flexible enough to fit into residential markets, and if so, which sectors of the residential market. The American municipal official noted in his interview that he is not opposed to the idea of residential green leases in general, but he does not believe that the concept has matured enough to be useful in the market yet. He further commented that currently green leasing is only relevant in the residential market in the context of financing renewable energy installations. This type of leasing is for the rental rather than direct purchase of renewable energy equipment, e.g. solar panels. This application of the term "green leasing" is not within the scope of this thesis.

LaRusso's green lease was designed for small-scale landlords with built-in flexibility to either be a stand-alone agreement that modifies a tenancy-at-will or be an amendment to a formal rental agreement. (Williams, 2008) At the same time, the fact that the green lease has not been adopted in the residential market suggests a lack of appeal—perhaps relative to other available options— for green leases, even within these sub-sectors. LaRusso further suggested in his interview that his lease would not fit in well with large-scale landlords. The need to negotiate the lease, calculate the heating/cooling fee, and the balanced billing refund/charge may become too laborious if there are many tenants.

4.2.4 Accessibility

How accessible is the model to low-income residents?

Type I Green Leases

Legal and regulatory restrictions may limit accessibility of type I green leases for low-income residents. Rent for low-income rental units may be controlled through local regulations. Raising the rent to cover ECM installations—even if the sum of rent and energy costs are lower after the installation—could require overcoming regulatory hurdles, such as submitting a petition to a rent control board (Tam et al., 2009).

Raising the rent may also raise the upfront costs of moving to a new apartment. In the US, a security deposit on a rental unit is commonly equal to one-month rent. If the rent is increased to cover ECM installations, the security deposit will also increase by the same amount. The upfront cost of moving to a new apartment would thus include double the rent increase, which could reduce accessibility of apartments with type I green leases to low-income residents.

Type II Green Leases

LaRusso considered the concerns of low-income residents when designing his green lease. He intentionally kept the heating/cooling fee separate from the rent so that it would not increase the security deposit, which is typically based on the monthly rent rate.

4.2.5 Predictability

How predictable are factors for the different actors (e.g. predictability of payback period, costs, default rates, etc.)?

Type I Green Lease

The predictability of energy costs and rent increases in a type I green lease depend on how the lease is structured and whether or not an energy audit is conducted and energy costs savings are estimated. Tam, et al. (2009) suggest that the green lease could be in combination with a rebate or financing program. This partner program may include an energy audit and an energy cost savings prediction, which could provide critical information for designing the green lease.

Type II Green Lease

The heating/cooling fee, being the same amount every month, is more predictable than energy bills, which may fluctuate depending on factors such as energy prices and the season. At the same time, the annual bill balancing reduces predictability of the costs. Unless the tenant and landlord are regularly monitoring current energy consumption patterns relative to the base year, they cannot predict whether the annual bill balancing will be a cost or a benefit for them.

4.2.6 Persistence

How permanent is the program? Will it be just a short-term, temporary fix or a long-term solution?

The adoption of a residential green lease program is doubtful. Based on interviews, green leases do not appear to have any actor who has the combination of a financial incentive to promote them and the financial or technical resources to develop one. Furthermore, the American municipal officer noted that he is mainly interested in impact – increasing energy efficiency in buildings. He finds the development of green leases to be too slow for him to currently consider them. He finds that other approaches, such as grant programs, are more effective at completing energy efficiency renovations in residential rental properties.

4.2.7 Cost-Effectiveness

How cost-effective is the program?

Type I Green Lease

A study by SPUR in the San Francisco Bay Area (n.d.) calculated application of green leases to 3% of the rent controlled apartment market in San Francisco over a 10 year period would increase the Rent Board's case load by 3% and their annual budget by about 50,000 USD (1%). Assuming a 10% decrease in CO_2 reduction, this would be a cost of 43 USD per metric ton of CO_2. This estimate does not include the cost of negotiating or certifying the green lease. It also excludes the cost of marketing green leases. The report further notes that the success of this program is based, in part, on the City of San Francisco raising awareness of green leases. Considering San Francisco has not promoted residential green leases, the transaction cost of this marketing effort relative to the benefit of actual energy efficiency upgrades may be too high.

Type II Green Lease

LaRusso noted two types of costs for the landlord that could influence the cost-effectiveness of the green lease: the cost of acquiring or writing the lease and the cost of complying with the obligations of the lease.

Large-scale landlords are likely to have financial resources to hire lawyers to write lease contracts for them. These landlords could then include energy cost-sharing in the green lease writing process. Small-scale landlords do not have the financial resources to have customized lease forms. Instead, they can usually buy them at low cost from local housing organizations. For example, lease contracts are available from the Greater Boston Real Estate Board for 2 USD per form or 60 USD for one hundred forms. Members of the organization can get the

forms at a discount. Unless pre-made green lease forms are available at low-cost such as in this format, they are not likely to be adopted by small-scale landlords.

The type II green lease has high transaction costs. LaRusso, who actually is a small-scale landlord, opted against using it when he installed solar cells. LaRusso and his tenants decided that the effort needed to calculate and recalculate energy costs and energy use outweighed the benefits of the green lease. Instead, he is using a simplified version of the green lease, in which he pays the energy bills and the tenant pays a monthly fee equivalent to 1/12 of the energy costs from the year preceding the ECM installation. They do not recalculate the costs or conduct bill balancing. Considering LaRusso, with just one tenant, found the transaction costs of the green lease to be too high, the green lease will likely also not be cost-effective for landlords with multiple tenants.

LaRusso's first green lease draft, as published in Williams' thesis, includes the CEA as an independent third-party certifier of heating/cooling fee calculations and recalculations. They noted that they did not have the resources to provide this resource. LaRusso then rewrote the green lease such that the landlord and tenant conduct the calculations together.

4.2.8 Legal Context

What are the (changes to) external legal structures that facilitated the implementation of this model? How dependent is the success of this model on these (changes to) external structures?

Type I Green Leases

In areas with rent control, there may be need to adjust legislation to permit modest rent increases associated with certified green leases. For example, in San Francisco, a landlord who wishes to increase rent in a rent-controlled apartment must submit a petition to the Rent Board. Adjusting the Rent Control Ordinance to allow green lease rent increases without a petition could facilitate implementation of green leases, reduce the burden on the Rent Board, and lower transaction costs (Tam et al., 2009).

Type II Green Leases

No known legal changes are needed to introduce LaRusso's green lease.

4.2.9 Outcomes and Impact

What is the participation rate and how is it changing? How have green leases impacted EE in apartment buildings? For example, how much energy was saved by the renovations?

As there is no known active use of green leases in the residential market, any measure of impact from green leases would be an *ex-ante* approximation.

Type I Green Leases

A study by SPUR in the San Francisco Bay Area (n.d.) calculated that use of type I green leases in 3% of the rent controlled apartment market in San Francisco would save over 2,200 metric tonnes of CO_2 annually.

Type II Green Leases

Neither known use of a type II green lease nor an *ex-ante* analysis of potential impact was found.

5 Financial Models in Practice

5.1 On-Bill Programs in the United States

Kim, et al. (2012) report that on-bill programs have been started in at least 20 states as of 2012, serving various markets. Twelve programs spread over twelve states were found that serve the residential market. One of these programs is still to be implemented. One is not a program, *per se*. Rather, it is a senate bill that aims to establish programs in California. A list of these on-bill programs is included in Appendix II. Programs were only included if they serve the residential market. Some of these programs also serve commercial markets.

Residential on-bill programs are more likely to serve owner-occupied homes than rental homes: half of the programs specify that they serve the rental market, whereas all but one serve owner-occupied homes. Only four of the programs that serve the rental market specify that they serve apartments. The remaining two that serve the rental market did not specify if they serve only single-family homes or both single-family rental homes and apartments.

The programs cover different genres of technologies. For example, a pilot project in Hawaii focused only on solar water heaters[18] (Cillo & Lachman, 2013; Johnson, Willoughby, & Volker, 2011). The pilot project ended some years ago and is thus not included in the list of programs in Appendix II. The program in California will cover water and energy efficiency technologies such as low-flow toilets, drought-resistant landscaping, and appliances (Lachman & Cillo, 2013). The on-bill programs in Kansas and Kentucky focus on weatherization as well as heating and cooling systems (Lachman & Cillo, 2013; Contractor in Kansas, personal communication, August 2, 2013).

The water and energy efficiency program in California follows the PAYS® model and can use the PAYS® trademark from the Energy Efficiency Institute. The program will be the first PAYS®-style program to be run by a water utility. How$mart is based on the PAYS® model, but cannot use the trademark because it does not follow all of the criteria set by the Energy Efficiency Institute (Cillo & Lachman, 2013).

The following case study is on the How$mart program by Midwest Energy, Inc. (henceforth Midwest Energy) in Kansas. Only four programs explicitly stated that they serve apartments: MPower in Oregon; How$mart in Kansas; the PAYS® program in California; and the programs that would be created by California Senate Bill 37, if it passes. The MPower program was not selected for a case study because it only serves apartment buildings if the landlord, not the tenant, pays the utility bill – a case 1 relationship with the landlord being both the principal and the agent. This thesis focuses on financial models that address case 2 landlord-tenant relationships. The PAYS® program in California was also disqualified for a case study analysis because of its focus on water efficiency. Furthermore, the pilot program has not yet started and thus is not available for an *ex-post* analysis. Similarly, the program described by Senate Bill 37 does not yet exist. How$mart serves apartment buildings and focuses on permanent installations of energy efficiency technologies. It has been running for eight years, and thus is available for *ex-post* analysis.

[18] The SolarSaver program in Hawaii was a pilot for solar water heaters and exhausted their funding in 2009. The program had three years of funding, but used the funding in two years due to high demand – without marketing. (Cillo & Lachman, 2013) The program ended when the pilot project term was over. The program was successful in increasing adoption of energy efficient technology. One fifth of residents who used the SolarSaver program had previously refused to upgrade their water heaters. The state of Hawaii earlier this year approved legislation to permit a state-wide PAYS™ program (Cillo & Lachman, 2013).

The How$mart program is further a good candidate as a case study because other programs are being modeled after it. Johnson, et al. (2011) reported that Midwest Energy received over 200 inquiries from around the country, suggesting a strong nation-wide interest in this type of program. The programs in South Carolina and Kentucky are based on the How$mart program (Michael Volker, personal communication, July 21, 2013). The state of Kansas paid the Energy Efficiency Institute to license the intellectual property of the PAYS® program model with the intention of offering access to the intellectual property free of charge to other utilities within the state interested in starting a PAYS®-style program (Cillo & Lachman, 2013).

5.2 Implementation of the How$mart program by Midwest Energy in Kansas, US

The following case study is based on interviews with (1) Michael Volker, the Director of Regulatory and Energy Services at Midwest Energy; (2) David Springe, Consumer Counsel at the Citizen Utility Ratepayer Board; and (3) a professional who uses the How$mart program as a contractor, a property manager, and as a property owner (henceforth referred to as "the Contractor"). The Contractor works solely with rental units. His company manages 280 units, 30 of which they own. They also conduct contracting work, mostly on properties they manage, but also on other properties. The properties include single-family homes as well as apartment buildings ranging from small- to medium-scale. All three interviewees spoke very positively about the program and its ability to facilitate energy efficiency upgrades in rental homes. Background information on the development of the program was supplemented through interviews with Harlan Lachman, one of the co-founders of the PAYS® concept.

David Springe presented some concerns with the design of the program. His concerns were similar to those presented by the National Consumer Law Center. The main distinction between their comments lies in that the National Consumer Law Center commented on a proposed OBR program and How$mart is an OBF program. Unlike OBR programs, How$mart is not subject to concerns on consumer loans. Despite Mr. Springe's concerns, he emphasized that he views Midwest Energy and the How$mart program highly.

Midwest Energy is an electricity and gas cooperative that covers central and western Kansas. The utility serves 48,000 electric and 42,000 gas customers. The largest city in their service area is Hays, which has a population of 20,000 (Johnson et al., 2011). The residential market is primarily owner-occupied with under 15% of Midwest Energy customers renting homes (Johnson et al., 2011). David Springe described Midwest Energy as being a small, customer-focused utility company.

The development of the How$mart program stemmed from a desire to improve low-income tenants' access to energy efficiency upgrades. For a brief period, high natural gas prices led to unusually high tax income for the City of Hays. The city decided to use this extra revenue to help low-income residents pay energy bills. One requirement for this benefit was that the resident would have an energy audit on their home. Certain residents applied and received audits repeatedly. These residents were mostly low-income tenants – without the capital or authority to conduct energy efficiency upgrades on their homes (Johnson et al., 2011). Around the same time, Midwest Energy heard of the PAYS® concept developed by the Energy Efficiency Institute in Vermont. Midwest Energy based the How$mart program on this concept (Johnson et al., 2011). Midwest Energy hired the Energy Efficiency Institute to consult in the development of the program and paid to license the intellectual property associated with the program (Harlan Lachman, personal communication, August 6, 2013).

Midwest Energy has a history of addressing financial assistance with energy efficiency upgrades. A contractor from Hays noted that he has used Midwest Energy's financial

programs for approximately 20 years and that the program has been steadily improving. Initially, the program was set-up as a loan from Midwest Energy. In 2007, Midwest Energy lobbied for legislation that would restructure the financing from a loan to a tariff for service. The legislation passed, with modifications based on testimonies from Midwest Energy and from the Consumer Utility Ratepayer Board (Kansas Legislative Research Department, 2007). The legislative changes permitted the How$mart program as it is known today. The program was started in the autumn of 2007 as a pilot in four counties, and was converted to a permanent program in 2008, available to all 41 counties served by Midwest Energy. Midwest Energy covers the upfront costs and applies an ECM service charge on the utility bill. The ECM service charge is required to be no more than 90% of the estimated energy savings (Cillo & Lachman, 2013). The ECM service charge is attached to the meter, not to the landlord or the tenant (Johnson et al., 2011).

The program, in concept, uses anticipated energy cost savings to fund energy efficiency improvements. In practice, Midwest Energy utilizes its own funds to invest in the energy efficiency projects. Midwest Energy also uses low-cost capital when it is available, e.g. through energy efficiency government grant programs (Cillo & Lachman, 2013).

The program now consists of four major steps, illustrated in Figure 5-1. (1) The customer requests an energy audit. Michael Volker and the Contractor note that initiation of an audit usually starts with the complaint of a high energy bill. Midwest staff performs the energy audit. Typically, a contractor accompanies the auditor so that the contractor is familiar with the living space and its energy efficiency needs. The audit is free of charge unless the property owners opts not to continue with the How$mart program, in which case a 200 USD fee is charged to the customer. Michael Volker noted that this charge has increased participation in the program. (2) The next step is for the customer to collect bids and conservation plans from contractors participating in the program and submit the final bid to Midwest Energy. Both the tenant and landlord must agree to the bid. If the property owner wants to conduct a renovation that will cost more than 90% of the estimated cost savings, he or she is responsible for the costs over the 90% limit. (3) The selected contractor completes the installation and Midwest Energy covers the costs up to 90% of the estimated cost savings. (4) Midwest Energy applies an ECM service charge to the property's utility bill. The service tariff obligation is attached to the meter, and future tenants or property owners must be informed of the charge (Johnson et al., 2011).

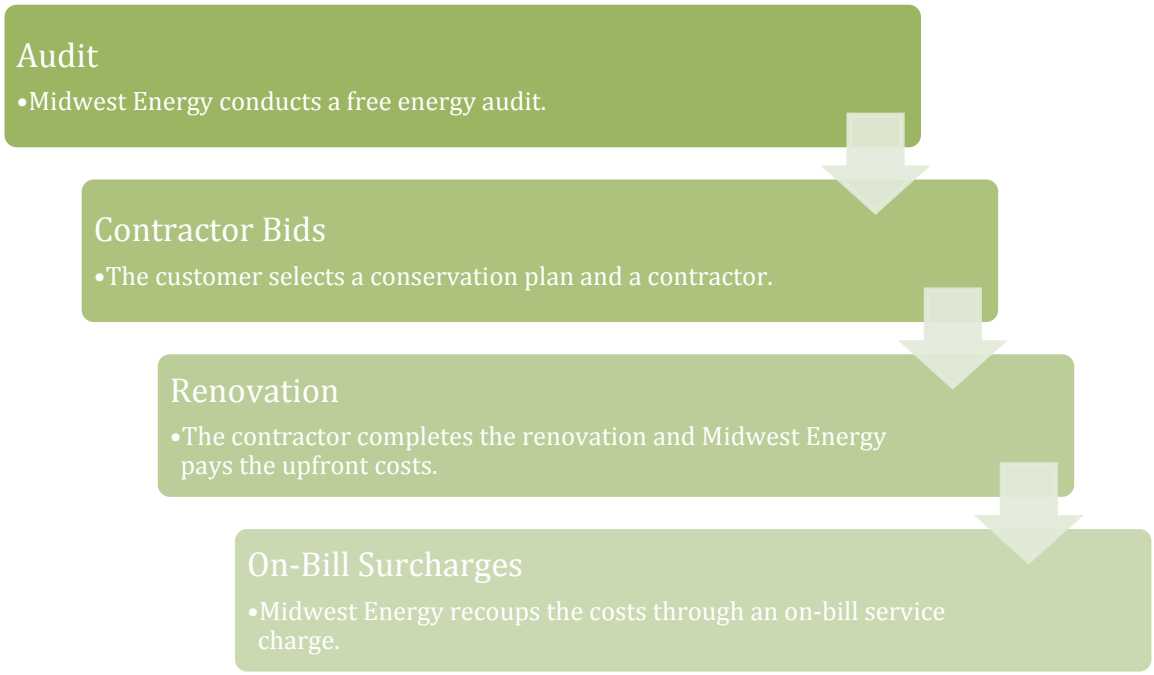

Figure 5-1: Process for completing an energy efficiency renovation with the How$mart Program. Sources: Johnson, et al., 2011

5.2.1 Principal-Agent Relationship

How has the model reshaped the financial incentives for EE within the contractual landlord-tenant relationship?

Both interviewees who were asked about the split incentive issue agreed that the How$mart program helps to address or addresses the tenant-landlord split incentive. Mr. Volker argued that the tenant's incentive to participate is two-fold. (1) The energy bill, including the service charge, is lower after compared to before the renovation. How$mart guarantees that the ECM service charge is no more than 90% of the estimated cost savings. (2) The program removes concerns of tenancy typically being shorter than the payback period. The service charge is attached to the meter, not the tenant. He further notes that the landlord has multiple incentives as well. The cost of the renovation is shifted to the tenant and their property receives improvements.

Participation rates in the program also show that the program does remove the split incentive. The participation rate of rental homes versus owner-occupied homes is about the same. Approximately 14% of projects are for rental properties; and approximately 14% of the housing market consists of rental properties – as opposed to owner-occupied homes. (Johnson et al., 2011) Furthermore, landlords/tenants are more likely to complete a project than an owner-occupier. Landlords/tenants submit 12% of project applications and complete 14% of projects (Johnson et al., 2011). *The fact that landlords are just as willing, if not more willing, to participate in the program compared to owner-occupiers suggests that there is, in effect, no split incentive barrier.*

Curiously, the nature of the P-A relationship under the program appears to differ from how it could be structured theoretically under the framework of the program and how it actually works in practice. However, in both situations, the relationship is close to a case 1 relationship. In theory, the P-A relationship could have the tenant be both principal and agent. An interview with a contractor showed that, in practice, the landlord is both principal and agent.

Interviews with those involved in the development of the How$mart program assumed an initial case 2 P-A relationship. The P-A relationship addresses both (1) who chooses the technology and (2) who pays the energy bills. In theory, with the How$mart program, the tenant could influence the technology because they (1) can initiate the process (with permission from the landlord) and (2) need to approve the conservation plan. Both the landlord and tenant are included in selecting the energy conservation technology, within the limitations that (1) Midwest Energy has set minimum standards and (2) different contractors may offer different technologies or brands. This theoretical P-A relationship is illustrated in Figure 5-2.

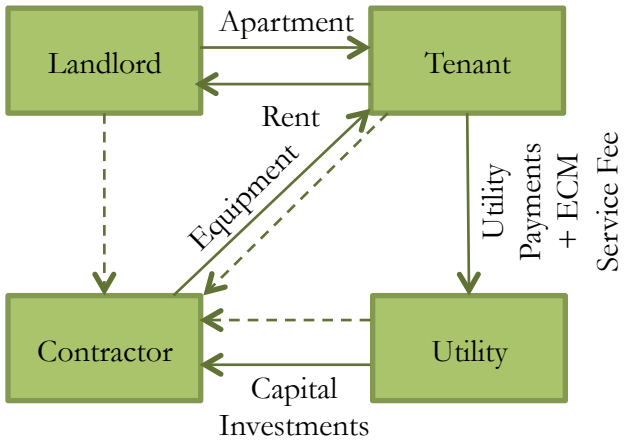

Figure 5-2: Theoretical principal-agent relationship under the How$mart Program by Midwest Energy, Inc. in Kansas. The solid lines represent monetary flows and dashed lines represent decision-making influence. The utility company influences the contractor by setting minimum energy efficiency standards. The landlord and tenant influence the contractor in that they both need to approve which technologies are used.

The interview with the Contractor revealed a different situation. The units that he manages do not actually start with a case 2 P-A relationship. For the convenience of the tenant and the property management firm, the energy bill is either paid in full by the management company (case 4) or the units have a utility cap (a hybrid of cases 2 and 4).[19] With the utility cap, the property management company charges a flat utility fee to the renter and pays the energy bill up to a certain cap. The tenant is responsible for any energy charges above the cap. The contractor noted that tenants rarely go over the cap. The property manager calculates the utility cap based on consumption data from Midwest Energy. In these situations, compared to the case 2 situation assumed by Midwest Energy, the landlord has a higher incentive to participate in the program. The landlord pays the utility bills and will directly benefit from lower energy costs. How common this utility payment structure is within the entire rental market covered by Midwest Energy is not known.

In practice, the P-A relationship under the How$mart program becomes a case 1 relationship with the landlord being both the principal and the agent. The Contractor noted that the tenant, in the vast majority of cases, plays a passive role in the How$mart program. Property owners, not tenants, are initiating energy efficiency projects. The property owners and the contractors engage the tenant only minimally in the process in an effort to minimize any inconvenience from the renovation process. This P-A relationship is shown in Figure 5-3.

[19] The Contractor considers this bundling of rent and energy costs a convenience package for both the landlord and the tenant. He is increasingly including cable television and internet with the convenience package.

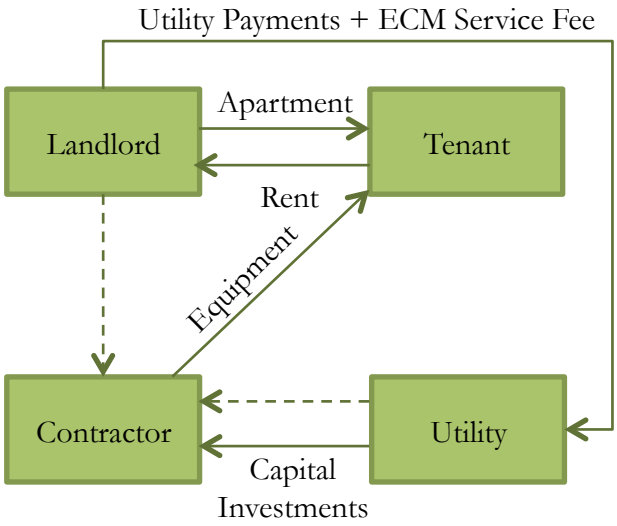

Figure 5-3: Principal-agent relationship that occurs in practice under the How$mart program, based on an interview with a professional with the perspectives of a contractor, a property manager, and a property owner. The landlord pays the utility bill, typically up to a cap.

5.2.2 Risk

Who takes the financial risk?

Different risks associated with the program are distributed amongst the different actors. For example, the property owner takes on the financial risk of the ECM installation malfunctioning. This is a deviation from the PAYS® program model, which assigns this risk to the utility (Cillo & Lachman, 2013). Michael Volker explained that Midwest's decision was based on meeting the local context. He said that both customers and contractors wanted to maintain a customer-contractor relationship and not have Midwest involved in equipment maintenance. Midwest decided to respect the local opinion. Mr. Volker noted that this could be because contractor-customer relations may be different in Kansas than they are in the Northeast, where the Energy Efficiency Institute is situated and where the PAYS®-model was developed.

The utility takes on an admittedly very low risk by investing in the How$mart projects with their funds. Michael Volker reported that, in part because of the risk of disconnect for non-payment, non-payment rates are less than 1%.

The risk taken on by the tenant is contested. David Springe argued that if energy prices fall significantly, the ECM service charge could be relatively unfavorable. Michael Volker argued this is not a significant concern because the energy savings estimate takes into consideration future price predictions and is a conservative estimate. The Contractor confirmed the conservative nature of the estimate noting that savings are almost always greater than anticipated.

5.2.3 Flexibility

How flexible is the program to meet different housing needs?

Interviewees disagreed on the flexibility of the program to apply to landlords of different scale rental buildings. Michael Volker noted that that program appeals to all landlord types. The Contractor commented that it has, in practice, limitations. He believes that, in the rental

context, it works best with 1–3 rental units. He explained that larger buildings are typically older and do not have centralized heating or cooling. He believes the How$mart programs work best with buildings with centralized heating and cooling systems. He commented that converting a building from multiple heating and cooling units to centralized heating and cooling systems would be too big a project for How$mart. He is, however, open to trying How$mart with different sized buildings. He has a project scheduled for a 20-unit apartment complex. Two of the units have already completed projects with How$mart. He would like to apply How$mart to the remaining 18 units, and is awaiting a response from Midwest Energy, on the feasibility of the project. The complex consists of two buildings, one with 5 units and the other with 13. He believes the project will be broken into smaller projects. The fact that an 18-unit project may need to be broken into multiple smaller projects suggests that the How$mart program may be cumbersome for landlords of medium- or large-scale buildings.

How flexible is the program to fit into different markets?

Michael Volker argued that his program is replicable and scalable. He supported his statement by noting three programs that have already been modeled after his program: (1) How$mart by Habersham Electric Membership Corporation in Georgia, (2) How$martKY offered by four electric cooperatives in Kentucky, and (3) Help My House, a pilot project offered by a collection of a electric cooperatives in South Carolina. Interestingly, all of these utility companies are electric cooperatives, rather than investor-owned utilities.

5.2.4 Accessibility

How accessible is the model to low-income residents?

There were disagreements on the accessibility of the program to low-income residents. The Contractor noted that, from his perspective, a tenant's income has no impact on the decision to use How$mart. Michael Volker argued the program is accessible because (1) it does not discriminate based on income, (2) that low-income residents are more affected by the high upfront cost barrier and thus could benefit more than middle income residents from programs such as How$mart, and (3) that low-income residents can combine the How$mart program with grants for low-income residents to lower the cost of the program.

The Citizens' Utility Ratepayer Board (CURB) argued differently, noting that the program could put residents in a vulnerable position. The legislation that permitted the How$mart program gives the utility company the right to shut off utility service in the event that the utility bill is not paid in full. If the resident is a tenant, they could further face eviction. This situation is particularly relevant to low-income residents.

Mr. Volker argued that CURB's concern is outside the scope of How$mart. He argued that the energy bill with the ECM service charge is lower than the energy bill before the ECM installation. If the tenant cannot pay the bill after the installation, they would not have been able to pay the bill without the ECM installation and would have their utility service cut off anyway. Mr. Volker reported that there have been no cases of incomplete payment (e.g. payment for energy but not for the ECM service charge) and that cases of nonpayment are below 1%. CURB's concern is not as relevant to tenants who live in properties managed by the interviewed contractor because those tenants do not directly pay the energy bill. The property management company pays the energy bills.

There are some safeguards to control the magnitude of the ECM service charge. The How$mart program requires that the ECM service charge is no more than 90% of the estimated energy savings. In theory, the utility bill, including the ECM service charge, should

be lower after the ECM installation than before. Furthermore, if a landlord wants a conservation plan that would lead to a service charge exceeding the 90% limit, the landlord, not the tenant, would be responsible for covering the extra costs.

However, CURB is still concerned that residents could be oversold service. For example, they could be sold a heating or cooling unit with more power than they need and then be forced to pay a higher ECM service charge than would be necessary for their apartment. This concern is particularly relevant to low-income customers because they would be more sensitive than a middle-class customer to a higher-than-necessary service charge. To what extent this occurs is unknown. The main control against this is the 90% limit and the fact that the landlord pays for costs above the limit. Interestingly, under the PAYS® program model, energy efficiency installations should fall within 75%, not 90%, of the energy savings estimate. Both the SolarSavr pilot in Hawaii and the How$mart program have opted to use a higher limit (Johnson et al., 2011).

5.2.5 Predictability

How predictable are factors for the different actors (e.g. predictability of payback period, costs, default rates, etc.)?

There is disagreement over the predicted financial benefit of a How$mart project. CURB is concerned that, if fuel prices drop, a customer could be stuck paying an energy bill higher than they would if they had not participated in How$mart. Mr. Volker argued that this should not be too big a concern because predictions of future fuel prices are incorporated into the energy savings estimation and that the estimations are conservative. Combining the conservative estimation and the fact that the service charge cannot exceed 90% of the estimated savings, Volker argues a low likelihood that the energy bill plus the service charge will lead to the situation CURB fears. The contractor confirmed that the energy savings estimations are indeed conservative. He noted that the actual savings are almost always greater, resulting in lower than expected energy bills. He noted that example of one project, in which the estimated savings would be 66 USD/month and the ECM service charge was set at 51 USD/month, resulting in a 15 USD/month effective savings. The actual achieved energy saving was actually between 100 and 110 USD/month. With the ECM service charge, the customer is actually saving around 50 USD/month. This example was presented as typical, not exceptional. Michael Volker reported that Midwest Energy has never had to refund a customer due to a poor estimate.

5.2.6 Persistence

How permanent is the program? Will it be just a short-term, temporary fix or a long-term solution?

None of the actors interviewed expressed concern about the program ending. In fact, Mr. Volker explained that Midwest intends to keep the program indefinitely and is actively improving the program. They aim to increase the number of projects completed per year and improve the cost-effectiveness of project delivery. Volker claimed high customer satisfaction motivates Midwest Energy to continue with the program. The Contractor, who actively promotes to the program to his own customers, noted that the program also sees the program continuing and improving. He observed Midwest Energy's dedication to program improvement over the past 20 years, six of which have been with the current How$mart program. David Springe's description of Midwest Energy's staff being dedicated and customer-focused fits with this picture. The Contractor further noted that Midwest Energy has a financial incentive to continue the program. Midwest Energy is permitted to earn a rate

of return on How$mart projects similar to other infrastructure investments, e.g. meters or distribution plants (Johnson et al., 2011).

5.2.7 Cost-Effectiveness

How cost-effective is the program?

Michael Volker and the Contractor agreed that the program is cost-effective. The cost-effectiveness stems from different perspectives of the program.

On-bill financing programs are more cost-effective than loans, in part because of the low bad debt rate. (Michael Volker, Personal Communication, August 1, 2013.) Michael Volker credited this low bad debt rate to the ability to disconnect utilities upon non-payment.

The Contractor has been using Midwest Energy's program for approximately 20 years and has found that the program has been improving over time the cost-effectiveness of EE renovations. Prior to the 2007 legislation, Midwest Energy ran the program as a loan and did not offer an audit. With the 2007 restructuring of the program, the ECM installations are paid for through a service tariff and an obligatory audit is conducted prior to contractors preparing bids. The audits, while an additional cost for Midwest, allow the contractors to tailor their conservation plans on the actual needs of the individual living space and provide a more cost-effective plan than would be prepared without the audit.

The billing system has also been improved, which improves participation and cost-effectiveness from an administrative perspective. Initially, if a customer wanted to pay off the principal early, the customer would be charged a penalty to compensate for the administrative burden (Johnson et al., 2011). Johnson, et al. (2011) report that updating the billing system to lessen the administrative burden and removing the early payment penalty fee has increased the willingness of landlords to participate in the program.

Limiting the cost of the EE renovation to 90% of the estimated cost savings promotes cost-effective conservation plans – in that the plans must be able to pay for themselves through energy savings. If a landlord wants to install technology that will cost more than 90% limit, they pay for costs above the limit. As of 2008, building owners have contributed 22% of the costs (Johnson et al., 2011).

5.2.8 Legal Context

What changes to external legal structures facilitated the implementation of this model? How dependent is the success of this model on these changes to external structures?

Because How$mart is a voluntary initiative rather than a legally mandated program, Midwest Energy had the flexibility to design the program to fit best the needs of the community and the utility (Johnson et al., 2011). One key legislative change was necessary to start the program. In 2007, Midwest Energy lobbied for a legislation permitting them to charge energy efficiency upgrades with a tariff for service just as they do for providing energy to their customers. The resulting legislation is listed in Appendix III. The return on investment from the How$mart projects is regulated by the state of Kansas and is the same as for other infrastructure investments (Johnson et al., 2011). This legislative change is important on multiple levels. For one, is clarifies that How$mart is not a financing program, it is a tariffed utility service. According to Kansas law §16a-1-202 (included in Appendix III), Midwest Energy and the How$mart program is exempt from consumer lending laws.

David Springe believes the legislative process involving testimony from Midwest Energy and from CURB improved the program design. For example, the legislation now permits Midwest

Energy to make agreements with landlords not just with the customer (tenant). Considering situation that the Contractor described with the landlords paying the utility bill, the landlords are more likely to initiate How$mart projects. The legislative process also gave the customer more legal protection. David Springe noted that the original bill submitted by Midwest West gave contractors and Midwest Energy a blanket liability exemption from consumer protection legal remedies, e.g. faulty workmanship. The modified bill that went into law, exempts only the utility company, but not third party actors, e.g. contractors. David Springe is still concerned about the liability waiver that Midwest Energy has, but is happy that customers have more consumer protection under the modified legislation than with the initial bill.

Are payments for a loan or for a service?

Payments in the How$mart program are for a service, not a loan. Michael Volker clarified that How$mart is not a financing program; it's a utility service.

5.2.9 Outcomes and Impact

What is the participation rate? How has the program impacted EE in apartment buildings? For example, how much energy was saved by the renovations?

The Midwest Energy does not measure the participation rate in the program, but data show an increase in participation. The Energy Efficiency Institute (2013) reported that the program has completed energy efficiency updates with 716 owner-occupied homes, 114 rental properties, and 28 commercial properties. To what extent these projects would have occurred if the How$mart program did not exist is not clear. However, an increasing percentage of customers receiving an energy audit are completing projects. The Energy Efficiency Institute (2013) reported that more than half of conservation plans lead to completed projects. Michael Volker noted that acceptance of projects is increasing and two-thirds of proposals are completed as projects. He associates the increase in participation with the implementation of a 200 USD fee for an energy audit that does not result in a completed project. The Contractor noted that effectively all of the energy efficiency renovations he completes use the How$mart program and that landlords rarely refuse a How$mart project. He further noted that the program does not have much competition, joking that the only other option is simply for the property owner to pay for the renovation upfront. In actuality, there is the option of a bank loan, however those cost more than a using the How$mart program. There is also WAP, but that is only available to low-income residents.

6 Discussion and Conclusion

6.1 Financial Models for Energy Efficiency Renovations

A variety of programs exist to help finance energy efficiency renovations. However, few actually address the split incentive issue. Green leasing and on-bill financing are two models that alter the P-A relationship.

Green leases, in theory, resolve the P-A dilemma by restructuring the contractual relationship between the tenant and the landlord. However, residential green leases have not been adopted and thus have not addressed the P-A dilemma in practice. The analysis of Type I and Type II green leases showed that green leases in the residential sector are unlikely to develop further. They appear to be a sophisticated academic - but not currently a pragmatic - solution to the energy efficiency needs of residential rental buildings. They do not have an actor with a financial incentive to promote them. Furthermore, they have high transaction costs relative to their benefits.

On-bill financing has proven to be effective at increasing the adoption rate of energy efficiency renovation. The case study of the How$mart program in Kansas showed that OBF programs can remove the split incentive barrier in rental housing. The program is flexible enough to shift both case 2 and case 4 P-A relationships to case 1. This stems, in part, because the program allows either the tenant or the landlord to initiate a renovation. Participation rates in the program demonstrate that the program indeed overcame the split incentive issue. Rental and owner-occupied homes were just as likely to participate in the program.

Based on the results of this study, the following program aspects are key to achieving a high adoption rate.

Centralized Coordination

Participation in the program should be *easy*, particularly from a customer perspective. Having the financing, billing, contracting, etc. coordinated by a central organization – rather than the customer – facilitates the process. The necessary motivation for a building owner to following through with a renovation may be too high if they need to coordinate numerous actors such as the energy auditor, the contractor, and the financer. Part of the success of the How$mart program is that it serves as a one-stop shop for EE renovations. It has streamlined the process into a utility service.

In addition to the coordination of the commercial actors (auditor, contractor, and financer), renovations of apartment buildings require cooperation between the landlord and the tenants. The American municipal officer noted that to reach his city's energy efficiency goals, the city invested in a full-time coordinator who manages the tenants and the landlord. The coordinator identifies buildings that are high priority for renovation, and then engages the tenants and the landlord in conversation about renovation. He also coordinates the various financing options for the program. For example, if some tenants qualify for WAP, the project may be partially covered by WAP and the remainder covered by other financing programs. The municipal officer noted that this coordination is critical. This coordinator works primarily with 2- and 3-unit buildings. Further research is needed to understand the coordination needs of larger apartments and how to meet those needs cost-effectively.

One reason why the type II green lease has not been adopted could be that it does not have a central coordinator. It is so far a draft lease that could be offered by a real estate board to local landlords. However, the green lease does not assist with the actual renovation. The landlord

still needs to coordinate the renovation – and the calculations of the energy fee – by him- or herself.

"Free" Energy Audit

A free energy audit greatly reduces the information market barrier by providing customers with information customized to their needs. As the Contractor noted, Midwest Energy's energy efficiency program improved as it became more comprehensive. One of the significant improvements is the free energy audit. The Contractor explained that the energy audit allows him to tailor conservation plans better to a home's specific needs. He further argued that the more targeted design improves the cost-effectiveness of the project. The energy audit is also an important tool in educating customers about the current energy efficiency of their home and the benefits of a renovation. Some programs charge a fee to customers who opt against conducting a renovation. The cost of the energy audit is included in the ECM surcharge for those who do complete a renovation.

Flexibility to Cover the Diversity of Customers

Coordinating the financing of a project is simpler when all households in a building can participate in the same financing model. The American municipal officer noted that his city has a full-time employee who coordinates the different financial programs that are used to renovate apartment buildings, primarily 3-family homes. Programs such as How$mart are available to both low- and non-low-income families. Using such programs could allow a renovation of an apartment building to be financed by one program.

Flexibility to Cover a Range of Technologies

The programs should cover a diverse range of technologies to, amongst other reasons, be cost-effective. A pilot PAYS® program in Hawaii offered only solar water heaters. The program was popular. With high customer demand, the program used up the program's three years of funding in only two years. However, the utility company that ran the program found that it was not cost-effective to run an OBF program for just one technology (Johnson et al., 2011). The How$mart program, on the other hand, offers a range of technologies covering, *inter alia*, heating, cooling, and insulation. Both the Contractor and the program director found that How$mart is a cost-effective program.

Financial Incentive for the Coordinator to Continue the Program

The ability of a program to persist depends on a number of factors including the financial incentive of the program coordinator to continue the program. Energy efficiency renovation leads to energy cost savings, and these cost savings can be used to perpetuate energy efficiency programming. With on-bill financing programs, the utility has a financial motive to continue the program. The ECM surcharge can be calculated to include profit for the utility. Furthermore, energy efficiency is a more cost-effective approach to meeting customers' energy needs than increasing production. Green lease programs, on the other hand, have not taken off in the residential sector. This could be, in part, because they do not serve as a revenue source for any organization. Grant programs do not utilize the fact that EE renovations lead to energy cost savings. The government pays for the EE upgrade, and the cost savings go directly to the utility bill payer. The cost savings do not contribute to future projects.

Cost of Program Lower than Cost Savings

The cost of a program, including monetary and transaction costs, should be lower than the cost savings. Such a situation provides an incentive for customers to participate and for the program administrator to continue running the program. The customers experience a net

decrease in energy costs even when including the cost of the renovation. The program administrator can earn a profit on the program.

On-bill programs require that the cost of a project be lower than the energy cost savings. Much of the cost-effectiveness stems from designing a conservation plan that costs less than it saves. At the same time, on-bill programs can be more cost-effective than taking a private energy efficiency loan. Part of this increased cost-effectiveness stems from streamlining the energy efficiency renovation as a utility service. Billing for the renovation and energy are on the same bill, eliminating the need for multiple billing and customer service systems. Furthermore, utility bills, in general, experience lower bad debt rates than loans and can thus offer lower interest rates. Another aspect could stem from funding source. While How$mart invests its own funds in energy efficiency projects, some on-bill programs utilize external funding. Unlike with student or car loans, statistics on energy efficiency loans default rates are lacking (Byrd & Cohen, 2011). The uncertainty of the EE loan market can lead to high interest rates for private loans to individuals. However, investing in a utility company with a portfolio of projects and extensive knowledge of EE renovations has lower risk and permits lower interest rates.

One reason why green leases have not been adopted in the residential sector could be that the transaction costs are too high. Joseph LaRusso admitted that he opted against using the green lease he drafted because of the high transaction costs. One of the transaction costs in LaRusso's green lease is the need to calculate the annual energy refund/fee. Green leasing could become easier if it is incorporated into a smart metering system and the calculations are automated. This could be developed perhaps as a software option included with smart metering systems.

Contractor Network

The strong, positive relationship between contractors and an EE renovation program is critical. Contractors benefit from connecting with an EE renovation program because it expands their customer base. The program needs the contractors to conduct the actual renovation. Furthermore, contractors can serve as a marketing tool for EE renovation programs (Johnson et al., 2011). Contractors are, in fact, How$mart's primarily marketing tool. The Contractor noted that his customers often are unaware of the How$mart program. He informs them of the option when he sees a need for an EE renovation.

EE Renovations as a Service

Structuring EE renovation programs as a service rather than a loan is friendlier to both the customer and the utility. Americans are already heavily in debt. In 2011, nearly 70% of American households reported holding debt. The 2010 median household debt load was nearly 75,000 USD (Bass, 2013). Even if an OBR loan would decrease energy expenditures, it would increase American debt. OBF allows the same renovation to occur, but without the strain of addition debt. Furthermore, OBF and OBR programs are subject to different laws. OBR is subject to consumer lending laws, whereas OBF is subject to utility tariff regulations. Utilities are already subject to tariff regulations and tend to avoid being subject to consumer lending laws.

6.2 Closing the Gap

There appears to be a gap in EE renovation programs. The American municipal official noted that EE renovation programs underserve non-low-income tenants in apartment buildings with 5 or more units. This trend was also observed during the research. A number of programs, predominantly grant programs such as WAP, focus on the low-income sector. Some programs

are explicitly for homeowners in single-unit homes. The Contractor noted that How$mart works best with buildings with one to three housing units. He observed that updating these buildings to central heating and cooling could be too expensive relative to the energy cost savings and thus not applicable to the How$mart program. This sentiment is in agreement with Kim, et al. (2012), who stated that on-bill programs are not suited for deep retrofits. Considering that more than 40% of apartments in the US are in the buildings with 5 or more units (United States Census Bureau, 2011), this gap in program coverage could be significant and needs to be addressed.

The on-bill format could fit into this subset of the rental market. The How$mart program has proven to be quite flexible. It reaches a range of income levels, as well as both renters and homeowners. The fact that it, in practice, it has no to limited experience with medium or large-scale apartment buildings does not mean that it cannot be applied to such apartment buildings. The Contractor did note that Midwest Energy has been regularly improving their EE renovation program over the past 20 or so years, and adapting the program to accommodate medium- and large-scale buildings could be a future improvement to the program. The Contractor did note that an 18-unit apartment is currently scheduled for an EE renovation with How$mart and that Midwest Energy is investigating the feasibility of developing a conservation plan compatible with the How$mart program. This renovation project could serve as a litmus test for the flexibility of this program type to apply to medium and large apartment buildings.

The on-bill format has, in fact, been used with large apartment buildings. Oregon MPower is an on-bill program that serves multi-unit buildings, including those with 5 or more units, but is restricted to buildings with low-income tenants and where the landlord pays the utility bills. The requirement that the landlord pays the utility bill allows for simpler application of the ECM surcharge. Mr. Volker of Midwest Energy stated that allocation of renovation costs amongst apartments can be tricky and is often conducted on a case-by-case basis. More research is needed to explore how the on-bill format could apply in large apartment buildings in which tenants pay the energy bills. A particular focus is needed to investigate how to divide program costs amongst apartments within a building.

Research could also explore the option of combining a utility cap with an on-bill program in medium- and large-scale apartments. A utility cap would simplify the payment of the utility bills and the on-bill surcharge because only one actor, the landlord, would pay the utility bill. The cap on the utility would help the landlord quickly identify equipment malfunction and encourage tenants to consume energy responsibly. The Contractor noted that he uses the utility cap on most of the properties he manages. His tenants rarely go above the utility cap. When they do, the problem can quickly be fixed.

6.3 Comprehensive Policy

Integrating OBF programs into a comprehensive and coordinated policy could help accelerate adoption of cost-effective EE renovations. On-bill financing programs are effective at addressing the split incentive. However, there are other market failures that hinder adoption of EE renovation – primarily lack of access to information and perverse regulations. A combination of policies is needed to present a rounded solution to EE needs of apartments in the US.

OBF programs require legislative changes, which open up opportunity for collaboration between the utility companies that run the OBF programs and the state governments that regulate them. Legislation that permits OBF programs could be designed to be part of a larger coordinated policy package.

In a 2007 study on split incentives for energy efficiency in the residential market, the International Energy Agency concluded that a mix of policy changes are needed, including:

- P-A contracts that expose both the tenant and the landlord to energy prices;
- Minimum energy quality standards to address the worst performers; and
- Information available to both the tenant and landlord.

The use of OBF with a utility cap would expose both the tenant and landlord to energy prices. Complimentary programs could address the latter two aspects.

Linking energy efficiency standards with licensing apartments for rental would force worst performers to renovate to meet or exceed the EE standard. SmartRegs in Boulder, Colorado is an example program implementing minimum energy standards for apartment buildings. It combines a number of policies and services to address worst performers, make it easy for landlords to renovate. The program's objective is to address the split incentives issue in rental housing. It is a package deal including regulation setting the minimum energy efficiency standard and a one-stop shop energy concierge service that helps the landlord bring properties up to standard (City of Boulder, n.d.). As part of the licensing process for renting apartments, each unit must meet minimum energy efficiency standards. A city-provided energy advisor can help coordinate rebate applications, hiring a contractor, etc. to bring below-standard apartments up to approval level.

Energy labeling of apartments could improve information availability to landlords and tenants. American municipalities and state governments could look into the experience of European energy labeling of buildings. There is extensive experience with building energy labeling across Europe. The EU's 2003 Energy Performance Directive mandated disclosure of building energy performance. Some countries have even longer experience.

It should also be noted that reframing how energy prices are calculated facilitate the promotion of energy efficiency. A Harvard University study showed that (1) consumers base the decision to invest in EE technology on current and not future energy prices and (2) that artificially low prices hinder adoption of EE technologies (Jaffe & Stavins, 1994b). Policies that keep energy prices artificially low thus discourage adoption of EE technologies.

Furthermore, artificially low energy prices could hinder the full effectiveness of OBF programs. Some actors believe that current OBF programs are not effective for deep retrofits or for medium- or large-scale apartment buildings. OBF programs typically require that the surcharge be less than the estimated cost savings. Current and predicted future energy prices are used in the calculation of the estimated cost savings. If the energy prices are artificially low, they will set a low bar for which technologies will be cost-effective. Adjusting energy prices to more accurately reflect the cost of energy production and delivery could potentially raise the estimate cost savings enough to extend OBF programs to deep retrofits and medium- and large-scale apartment buildings. Measures that could help achieve these price corrections include, but are not limited to removing fuel subsidies; internalizing environmental externalities; and incorporating future costs of energy production, e.g. new power plant construction.

6.4 Conclusion

On-bill financing is a promising financial model for removing the split incentive in energy efficiency renovations of apartments and apartment buildings. The How$mart program in Kansas has successfully overcome the split incentive. It also demonstrated an ability to be

flexible enough to service a broad range of income levels and housing types. The development of additional How$mart programs by other electric cooperatives demonstrates the replicability and scalability of the program, as well as its ability to meet different geographical contexts.

Analyses of green leases and on-bill financing found that the following aspects are important for a high participation rate:

- centralized coordination;
- "free" energy audit;
- flexibility to reach the diversity of customers;
- flexibility to cover a range of technologies;
- financial incentive for the program coordinator to continue the program;
- cost of program lower than the energy cost savings;
- contractor network; and
- EE renovation as a utility service.

Despite the success and promise of on-bill programs, EE financing programs tend to underserve non-low-income tenants in medium- and large-scale apartment buildings. Further research is needed to explore how to extend this program to meet this market sector. Suggested approaches include, but are not limited to, applying a utility cap and addressing artificially low energy prices.

Furthermore, developing on-bill programs in coordination with complementary policies would strengthen efforts to address EE renovation needs in American apartment buildings. Suggestions include minimum energy standards as a part of rental licensing, energy efficiency disclosures for apartments, and removing fossil fuel subsidies.

Personal Communications

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Appendices

Appendix I: Programs Considered for Analysis

Program	Location	Sector				Program Type			Address L-T?	Ref
		I	C	P	R	Reg.	Inf.	Fin.		
ELENA	EU			x				x	N	1, 2
Revolving Fund Scheme for energy refurbishment in housing	EE				x			x	N	1
JESSICA	LT				x			x	N	1
Grants for E savings in pensioners' dwellings	DK				x			x	N	1
Fiscal Incentives for energy savings in the household sector	IT				x			x	N	1
Energy Efficient Construction and Rehabilitation	DE				x			x	N	1
PAYS	UK				x			x	N	1
Berlin Energy Savings Partnerships	AT			x				x	N	1
Integrated Energy Contracting	AT			x				x	N	1
Energy Efficient Buildings (EeB) PPP	EU	x	x	x				x	N	1, 3
PACE	US		x		x			x	N	4, 5, 6, 7
Energy Performance Contracts	US			x	x			x	N	4, 8, 9
Landlord's Energy Saving Allowance	UK				x			x	N	10
Ratepayer Programs	US	x	x		x			x	N	11, 12, 13, 14
Energy Performance Contracts	EU		x	x	x			x	N	15, 16
Weatherization Assistance Program	US				x			x	Y	17, 18, 19
On-Bill Financing	US	x	x	x	x			x	Y	4, 20, 21
Green Leases	US		x		x			x	Y	20, 22

*This program reduces information asymetry between the landlord and tenant, but it does not address the split incentive issue.

Legend:

I = Industry, C= Commercial, P = Public, R = Residential

Reg. = Regulatory, Inf. = Informative, Fin. = Financial

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20. Burroughs et al., 2012
21. Wein & Howat, 2012
22. Williams, 2008

Appendix II: Residential On-Bill Programs in the US

Program Name	State**	OBF/ OBR	Year Started	Residential Market				Comments	References
				Owner-occupied	Rental*	Rental single-unit	Rental multi-unit		
Oregon Mpower Pilot Program	OR	OBF	2012				x	Limited to low-income apartments where the landlord, not the tenant, pays the utility bill.	MPower Oregon, n.d.; Warner & Daniel, 2012
How$mart	KS	OBF	2007	x		x	x	This program cannot use the PAYS® trademark because the landlord takes on the risk of measure failure.	Bell & Nadel, 2012; Energy Efficiency Institute, Inc., 2013; Johnson et al., 2011
Windsor Efficiency PAYS®	CA	OBF	N/A	x		x	x	This program will be the first PAYS® program to be run by a water utility company. It will cover both water and energy efficiency. The program is not yet available.	Energy Efficiency Institute, Inc., 2013; Energy Upgrade California, n.d.
SB 37	CA	OBR	N/A	x		x	x	Proposed legislation. Not (yet) an implemented program.	California Senate Bill 37; Copithorne & Fine, 2011
How$martKY	KY	OBF	2011	x	x			This program is based on the How$mart program by Midwest Energy and the PAYS® program developed by the Energy Efficiency Institute.	Bell, Nadel, & Hayes, 2011; Energy Efficiency Institute, Inc., 2013; MACED, n.d.
Rural Energy Savings Program Pilot	SC	OBR	2011	x	x			Loan tied to meter, not tenant or property owner.	Bell, Nadel, & Hayes, 2011; Bell & Nadel, 2012; Keegan, 2013

Residential On-Bill Programs in the US, continued

Program Name	State**	OBF/ OBR	Year Started	Residential Market				Comments	References
				Owner-occupied	Rental*	Rental single-unit	Rental multi-unit		
Clean Energy Works Oregon	OR	OBR	2009	x				The largest residential OBR program with a loan portfolio ca 7.8 million USD. Loans are assigned to the property owner, not the property.	Bell & Nadel, 2012; Clean Energy Works Oregon, 2013
New York On-Bill Recovery Loan Program	NY	OBR	2011§	x				Loan tied to property.	Bell, Nadel & Hayes, 2011; Bell & Nadel, 2012
National Grid	NH, MA, RI	OBR	1992#	x	N/K			Primarily serves commercial customers. Started serving residential customers recently.	Bell, Nadel, & Hayes, 2011
Superbowl Legacy BetterBuilding Program	IN	OBR	2011	x	N/K				Bell, Nadel, & Hayes, 2011
AFC First Financial	IL	OBR	2009§	x	N/K			Program mandated by state legislation in 2009.	Bell, Nadel, & Hayes, 2011
Co-op Energy Efficiency Loan Program	AL	OBR	N/K	x	N/K				Brown, n.d.; Dixie Electric Cooperative, 2013

* *No distinction declared between single-unit rentals and apartment buildings.
**Not all of these programs are statewide. Some occur just within some juristdictions within the state.
§ Year legislation passed that mandated program.
#Year that commercial program started. Program expanded recently to serve residential customers.

Appendix III: Kansas Legislation Relevant to Midwest Energy's How$mart Program

66-1248

Chapter 66.--PUBLIC UTILITIES

Article 12.--MISCELLANEOUS PROVISIONS

66-1248. Agreements to finance and install energy conservation measures; cost recovery; liability and limitations thereof.

(a) Electric and natural gas public utilities, as defined in K.S.A. 66-101a and 66-1,200, and amendments thereto, may enter into agreements with customers and landlords of customers for the financing of the purchase price and installation cost of energy conservation measures by such utilities.

(b) Such utilities may recover the cost of such financing and related program costs through tariffs approved by the state corporation commission pursuant to K.S.A. 66-117, and amendments thereto, and paid for by the customers benefiting from the installation of the energy conservation measures.

(c) Except as otherwise required by the state corporation commission, through the approved tariff or otherwise, such utilities shall assume no liability for the installation, operation or maintenance of such measures, and shall not provide any warranty as to the merchantability of the measures, or its fitness for a particular purpose, and no action shall be maintained against any such utility the basis of which is such liability or warranty.

(d) Nothing in this section shall be construed to limit any rights or remedies of utility customers and landlords of utility customers against other parties to a transaction involving the purchase and installation of energy conservation measures.

History: L. 2007, ch. 58, § 1; July 1.

16a-1-202

Chapter 16a.--CONSUMER CREDIT CODE

Part 2 SCOPE AND JURISDICTION

Article 1.--GENERAL PROVISIONS AND DEFINITIONS

16a-1-202. (UCCC) Exclusions. K.S.A. 16a-1-101 through 16a-6-414 do not apply to

(1) extensions of credit to government or governmental agencies or instrumentalities;

(2) except as otherwise provided in the article on insurance (article 4), the sale of insurance by an insurer if the insured is not obligated to pay installments of the premium and the insurance may terminate or be cancelled after nonpayment of an installment of the premium;

(3) transactions under public utility or common carrier tariffs if a subdivision or agency of this state or of the United States regulates the charges for the services involved, the charges for delayed payment, and any discount allowed for early payment;

(4) except with respect to disclosure, pawnbrokers licensed and regulated pursuant to statutes of this state;

(5) transactions covered by the Kansas insurance premium finance company act. (K.S.A. 40-2601 to 40-2613).

History: L. 1973, ch. 85, §10; Jan. 1, 1974.

Appendix IV: The Proposed On-Bill Repayment Legislation in California

The original and amended bill text, as well as the history of the bill, is extracted from Legiscan (n.d.).

Bill Text as Submitted December 5, 2012

BILL NUMBER: SB 37

INTRODUCED BY Senator De León

DECEMBER 5, 2012

An act relating to energy.

LEGISLATIVE COUNSEL'S DIGEST

SB 37, as introduced, De León. Energy efficiency and renewable energy upgrades: on-bill repayment program.

Under existing law the Public Utilities Commission has regulatory authority over public utilities, including electrical corporations and gas corporations, as defined. Existing law authorizes the commission to fix the rates and charges for every public utility and requires that those rates and charges be just and reasonable.

This bill would state the intent of the Legislature to enact an on-bill repayment program that will provide Californians greater access to energy efficiency and clean technology upgrades.

Vote: majority. Appropriation: no. Fiscal committee: no. State-mandated local program: no.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. The Legislature finds and declares all of the following:

(a) Despite existing programs, large numbers of Californians currently do not have access to energy efficiency and clean technology upgrades.

(b) Existing clean energy programs and incentives are important but limited in that they are underfunded and reach only a small number of Californians due to restrictions in income level, credit score, project size, or commercial-only eligibility.

(c) Energy efficiency and clean technology upgrades currently have especially low penetration rate due to a split incentive between renter and landlord over the costs and benefits of such projects.

(d) California's current economic condition necessitates that the Legislature develop pioneering ways to create sustainable, green collar jobs.

(e) On-bill repayment is an innovative and pioneering concept that would provide affordable financing of energy efficiency and on-site clean generation technology upgrades by tying repayment of the loan obligation to the utility meter.

(f) By tying repayment to the utility bill, ratepayers would repay the loan on the same bill where savings are realized from the investment, creating a potential net bill neutrality or even a decrease in the ratepayer's bill as a result of the investment.

(g) On-bill repayment would be a unique clean energy incentive program because it would not rely on ratepayer or taxpayer funding and it would expand access to energy efficiency and clean technology upgrades.

(h) On-bill repayment would incentivize private investors to invest in California's clean energy improvements, would stimulate the state's economy by creating jobs for contractors and other persons who complete new energy improvements, and would reinforce the leadership role of the state in the new energy economy, thereby attracting clean energy manufacturing facilities and related jobs to the state.

(i) It is the intent of the Legislature to enact an on-bill repayment program that will provide Californians greater access to energy efficiency and clean technology upgrades.

Excerpts of Bill Text Including Amendments[20]

BILL NUMBER: SB 37 AMENDED

BILL TEXT

AMENDED IN SENATE APRIL 9, 2013
AMENDED IN SENATE MARCH 19, 2013

INTRODUCED BY Senator De León
(Principal coauthor: Assembly Member Eggman)
(Coauthor: Assembly Member Muratsuchi)

DECEMBER 5, 2012

An act to add Sections 1940.10 and 2079.10b to the Civil Code, to amend Section 25402.9 of the Public Resources Code, and to add Chapter 7.6 (commencing with Section 2833) to Part 2 of Division 1 of the Public Utilities Code, relating to electricity.

LEGISLATIVE COUNSEL'S DIGEST

SB 37, as amended, De León. Energy efficiency and renewable energy upgrades: on-bill repayment program.

(1) Under existing law the Public Utilities Commission has regulatory authority over public utilities, including electrical corporations and gas corporations, as defined. Existing law authorizes the ~~commission~~ *Public Utilities Commission* to fix the rates and charges for every public utility and requires that those rates and charges be just and reasonable.

This bill would enact the California Clean Energy Consumer Access Act of 2013 and would authorize the commission to require an electrical or gas corporation with 250,000 or more service connections to develop and implement an on-bill repayment program providing

[20] The full text is available at http://legiscan.com/CA/bill/SB37/2013

financial assistance for energy efficiency, renewable energy, distributed generation, or demand response improvements by allowing for the repayment of the financial assistance to be included in the utility customer's utility bill (on-bill repayment). The bill would provide that the on-bill repayment obligation would run with the meter, as defined…

(2) Existing law requires sellers of property or landlords to provide specified disclosure, to prospective buyers or prospective or existing tenants, regarding the property. This bill would additionally require sellers of property or landlords to provide to prospective buyers or prospective or existing tenants a disclosure indicating that a portion of the utility bill is subject to an on-bill repayment obligation.

…

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. This act shall be known, and may be cited, as the California Clean Energy Consumer Access Act of 2013

SEC. 2. (a) The Legislature finds and declares all of the following:

(1) Currently, many Californians lack access to affordable financing for onsite energy efficiency and clean energy projects.

(2) Existing clean energy programs and incentives are important but limited in that they are funded by insufficient amounts of ratepayer or taxpayer moneys, and in that existing programs reach only a small number of Californians due to restrictions in income level, credit score, project size, or property and technology specific eligibility criteria.

…

(5) Allowing the *repayment of* financing ~~of~~ *obligations for* clean energy projects through the *use of* utility ~~bill~~ *bills* has the cobenefit of allowing for a more affordable interest rate than would be otherwise available due to the security of utility bill payments and allowing for ratepayers to see the benefits and costs of clean energy projects on the same document.

(6) By tying repayment to the utility bill, ratepayers will make payments for their upgrades on the same bill where savings are realized from the investment, resulting in a new bill that can be equal to or even less than their utility bill prior to energy upgrades.

(7) On-bill repayment is a unique clean energy incentive program because it does not rely on public funding and expands access to energy efficiency and clean technology upgrades.

…

SEC. 3. Section 1940.10 is added to the Civil Code, to read:

1940.10. (a) A property owner that authorizes a project financed by the OBR program pursuant to Chapter 7.6 (commencing with Section 2833) of Part 2 of Division 1 of the Public Utilities Code shall provide to an existing tenant who is responsible, directly or indirectly through the provisions of the applicable lease, for paying all or a portion of the

cost of utility service that is subject to an OBR obligation, the disclosure made available to the property owner pursuant to Section 2833.3 of the Public Utilities Code.

(b) Prior to the signing of a lease or rental agreement, an owner, or the agent of an owner of any premises with respect to which utility service is subject to an OBR obligation that will be paid by the tenant, whether directly or indirectly through the provisions of the applicable lease, shall provide a prospective tenant with the disclosure that was provided to the owner pursuant to Section 2833.3 of the Public Utilities Code.

…

SEC. 4. Section 2079.10b is added to the Civil Code, to read: 2079.10b. (a) Every seller of real property subject to an OBR obligation that runs with the meter, pursuant to Chapter 7.6 (commencing with Section 2833) of Part 2 of Division 1 of the Public Utilities Code, shall deliver to the buyer of the property the disclosure that was provided to the seller *pursuant to* Section 2833.3 of the Public Utilities Code.

…

(c) The notice shall further state that unless fully satisfied prior to the sale or transfer of the property, the OBR obligation survives changes in ownership, tenancy, or meter account responsibility and, until fully satisfied, constitutes an obligation of the person responsible for the meter account pursuant to Section 2833.8 of the Public Utilities Code. ~~(c)~~

…

(b) A utility shall not implement the on-bill repayment program without the express approval of the commission.

(c) The commission shall supervise on-bill repayment programs to ensure that the programs are administered in compliance with the terms approved by the commission.

…

(b) The commission shall limit technologies eligible to be financed through OBR obligations to those that will achieve reductions of greenhouse gases as defined in the California Global Warming Solutions Act of 2006 (Division 25.5 (commencing with Section 38500) of the Health and Safety Code).

(c) The commission shall ensure the on-bill repayment program includes all of the following program elements:

(1) (A) For two years from the initial approval of the program by the commission, all on-bill repayment programs shall require bill neutrality.

(B) Two years after the initial approval, the commission shall evaluate the success of projects financed through on-bill repayment to date. If the commission determines that the requirement for bill neutrality has unnecessarily limited the types of projects that may be financed through the program, the commission may limit the application of the bill neutrality requirement.

(C) Notwithstanding subparagraph (B), the bill neutrality requirement shall apply, at all times, in cases where a portion of the OBR repayment charges are expected to be paid by one or more tenants on the property, whether directly or indirectly.

(D) The commission may include changes in the expected operating and maintenance costs in calculating bill neutrality.

(2) A requirement that an OBR obligation shall not be put in place without authorization by all owners of the fee interest in the property where the premises served by the OBR improvements is located.

(3) *(A)* Consumer protections for ~~low-income~~ residential customers, including protections to prevent increases in the expected number of service terminations, such as targeted use of a commission-approved loan loss reserve in lieu of service termination, and, including, at all times, a requirement for bill neutrality for lower income households.

(B) The commission may include changes in the expected operating and maintenance costs in calculating bill neutrality.

(4) A requirement that the OBR partner implement consumer protections, loan eligibility, and credit determinations.

(5) A requirement that the OBR partner provide the utility or its agent with a copy of all financing documents associated with an OBR obligation.

(6) A requirement that the OBR repayment charge be listed by the utility as a separate line item on the customer's bill from the utility.

(7) A requirement that the on-bill repayment charge collected by the utility or its agents be remitted to the OBR partner pursuant to a timeframe determined by the commission.

…

(b) A standard disclosure required by Section 2079.10b of the Civil Code to be available for use by a seller of real property that is served by OBR improvements that is provided *by the OBR partners or its agent* free of charge to the seller upon request.

(c) A standard disclosure required by Section 1940.10 of the Civil Code to be available for use by a lessor of real property that is served by OBR improvements that is provided *by the OBR partners or its agent* free of charge to the lessor upon request.

2833.4. (a) If the amount paid by the utility customer is less than the amount billed to the customer on the utility bill, for a utility customer account to which an OBR obligation is in effect, the commission shall adopt one of the following methods for allocation of the payment:

(1) Allocate the payment in the following order of priority:

(A) Beginning with the earliest billing period in which an arrearage exists, allocate to the utility in respect of the outstanding arrearage in all charges other than OBR repayment charges (such charges, the non-OBR charges) accrued during that billing period. Upon the

satisfaction of that arrearage, allocation to the OBR partner in respect of the outstanding arrearage in the OBR repayment charges accrued during that billing period.

(B) Upon the satisfaction of arrearage pursuant to subparagraph (A), the remaining amount of the payment, if any, shall be allocated to the arrearages accrued in subsequent billing periods pursuant to subparagraph (A), with the arrearage accruing from any earlier billing period being satisfied before the arrearages accruing from subsequent billing ~~period~~ *periods* . With respect to any billing period, allocation shall be made first to the utility in respect of all non-OBR charges, and, after satisfaction of the arrearage in non-OBR charges accruing in such billing period, to the OBR partner in respect of the arrearage in OBR repayment charges accruing in such billing period.

(C) Upon the satisfaction of all prior arrearages accruing from prior billing periods, the remaining payment, if any, shall be allocated first to the utility in respect of the non-OBR charge in the current billing period. Upon the satisfaction of that charge, allocation shall be made to the OBR partner in respect of the OBR repayment charge in the current billing period.

(2) Allocate the payment to the utility and the OBR partner on a pro rata basis, in proportion to the non-OBR charge and OBR repayment charge due and owing during the applicable billing period, with arrearages from the earlier billing period being satisfied first, followed by arrearages from subsequent billing periods, which shall be addressed in chronological order, followed by charges that are due and owing during the current billing period.

(b) Any arrearage in payment for a billing period shall be included in subsequent billing periods until it is paid in full.

(c) In the event of an arrearage in payment, the full amount of the arrearage constitutes a failure to pay for electric or gas service and shall be treated consistent with the rules established by the commission for a customer's failure to pay for service.

2833.5. With respect to a utility account that has been closed and in which *an* arrearage ~~exist~~ *exists* , including *an* arrearage with respect to OBR repayment charges, the commission ~~may~~ *shall* adopt rules providing that after a *reasonable* period of time to be determined by the commission, the share of total arrearage that is attributable to the OBR obligation ~~may~~ *shall* be deemed, as of a date certain *that is no later than 90 days after the closing of the account* , to be an obligation owed directly to the OBR partner and not to the utility.

2833.6. (a) An OBR obligation shall run with the meter unless the commission has determined that it is not reasonable for the applicable category of OBR obligation to run with the meter.

…

(c) Utilities, to the extent they are carrying out required activities pursuant to an on-bill repayment program, shall not be responsible for lending, underwriting, and credit determinations, and are not subject to the California Finance Lenders Law (Division 9 (commencing with Section 22000) of the Financial Code), the California Financial *Information* Privacy Act (Division 1.4 (commencing with Section 4050) of the Financial Code), or the Rosenthal Fair Debt Collection Practices Act (Title 1.6C (commencing with Section 1788) of Part 2 of Division 3 of the Civil Code).

…

2833.12. (a) In lieu of waiving disconnect protections for third-party financing as provided in Section 2833.11, the commission shall develop, to the extent feasible and cost effective, a loan-loss reserve program or loan guarantee program as part of the on-bill repayment program for providing energy efficiency programs to residential customers. The program shall be directed to residential customers who experience disproportionate bill impacts from summer cooling and other demands on the electrical system that cause excessive usage and potentially significant bill impacts.

(b) Notwithstanding subdivision (a), but consistent with paragraph (3) of subdivision (c) of Section 2833.2, the commission may determine that Section 2833.11 applies in either of the following circumstances:

(1) A customer or project is not covered by a loan-loss reserve program or a loan guarantee program established in subdivision (a).

(2) A customer elects to waive the provisions of subdivision (a). ~~2833.12.~~

2833.13. (a) This chapter does not require that the on-bill repayment programs be identical and the commission may vary program elements for each utility based upon each utility's individual circumstances.

(b) This chapter does not limit the authority of the commission to approve and supervise separate on-bill repayment programs with different features for different categories of customers, including single-family residential, multifamily residential, industrial, governmental, commercial, and other categories of customers that the commission determines to be appropriate. Utilities shall not implement on-bill repayment programs without the express approval of the commission. SEC. 7. No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because the only costs that may be incurred by a local agency or school district will be incurred because this act creates a new crime or infraction, eliminates a crime or infraction, or changes the penalty for a crime or infraction, within the meaning of Section 17556 of the Government Code, or changes the definition of a crime within the meaning of Section 6 of Article XIII B of the California Constitution.

History of the Bill

Dec 05, 2012: Introduced. To Com. on RLS. for assignment. To print.

Dec 06, 2012: From printer. May be acted upon on or after January 5.

Jan 07, 2013: Read first time.

Jan 10, 2013: Referred to Com. on RLS.

Jan 10, 2013: Referred to Com. on RLS.

Mar 19, 2013: From committee with author's amendments. Read second time and amended. Re-referred to Com. on RLS.

Mar 21, 2013: Re-referred to Coms. on E., U., & C. and JUD.

Mar 22, 2013: Set for hearing April 16.

Apr 09, 2013: From committee with author's amendments. Read second time and amended. Re-referred to Com. on E., U., & C.

Apr 16, 2013: Set, first hearing. Failed passage in committee. Reconsideration granted.

Apr 16, 2013: Set, first hearing. Failed passage in committee. (Ayes 5. Noes 5. Page 564.) Reconsideration granted.

Apr 23, 2013: Set for hearing April 30.

Apr 30, 2013: Set, first hearing. Failed passage in committee.

Apr 30, 2013: Set for hearing May 2 in JUD. pending receipt.

Apr 30, 2013: Set, first hearing. Failed passage in committee. (Ayes 5. Noes 4. Page 749.)

May 01, 2013: Returned to Secretary of Senate pursuant to Joint Rule 62(a).