Sensible Incentives:
Enabling Energy Efficiency in Rental Housing

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About This Study

This report is an adoption of work done for Fresh Energy in 2011 by Will Nissen and John Mitchell at the Humphrey School of Public Affairs, University of Minnesota.

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Refrigerators are the largest single end-user of electricity in rental housing.
EXECUTIVE SUMMARY

Energy efficiency is routinely highlighted as the most cost-effective way to conserve energy and reduce the production of greenhouse gases. However, there are multiple barriers that prevent investments in cost-effective energy-efficient technologies from taking place. These barriers are even more pronounced in rental housing, due to the fact that property owners have no direct financial incentive to make investments in energy saving measures for which they do not pay energy costs. This is known as the “split incentives” barrier, and has proven to be extremely challenging to address.

In this report, we focus on four policy options that offer potential to address the split incentives barrier to investment in energy efficient technology in rental housing in areas throughout Minnesota:

1) **Rebates** for energy efficient upgrades;
2) **Benchmarking**, a local ordinance that would require rating the energy use of rental housing and mandatory efficiency upgrades for inefficient buildings;
3) **On-Bill or utility financing** of energy efficient upgrades by tenants; and
4) **Green Leases**, an addendum to a lease agreement that allows property owners to bill tenants a finance charge for energy efficiency upgrades that reduce the utility bills that tenants pay.

We examine the potential energy and cost savings from the replacement of old, inefficient refrigerators with new, energy-efficient refrigerators. Refrigerators are the largest single end-user of electricity in rental housing (20 percent), and are present in 100 percent of rental housing.

The rental housing market represents 25.8 percent of all occupied housing units in Minnesota, and 28.8 percent of all occupied housing units in the Twin Cities, totaling approximately 320,000 units in the seven-county metro area.

Applying national appliance profiles to county-level housing data, an estimated 88,000 refrigerators in rental housing in the Twin Cities are 10 years of age or older, with significant potential for energy savings from replacement. Our preliminary analysis estimates that potential energy savings from replacing these 88,000 refrigerators with new, Energy Star™ qualified refrigerators exceeds 36 gigawatt hours per year, enough to power over 3,100 average American households every year, with aggregate energy cost savings of over $3.7 million per year to consumers.
The rental housing market represents 25.8 percent of all occupied housing units in Minnesota.

We also report the results of surveys of two key stakeholder groups directly involved in this issue, property owners and tenants, to determine their perspectives on these four policy options. Based on these opinions, we identified three themes that serve as guidelines for the design of programs serving this market: Time, Trust, and Transparency.

Finally, we present three recommendations for policy makers to improve the energy efficiency performance of rental housing in Minnesota:

**Option I:** Customized Conservation Improvement Programs targeting large rental property owners, including rebates for replacement of old, inefficient refrigerators.

**Option II:** Mandate public energy use disclosure for apartment buildings.

**Option III:** A pilot PAYS-based On-Bill Financing Program for appliance upgrades serving rental housing.

Of these options, Option I is the most politically feasible, and would likely face much lower transaction costs than other residential CIP conservation efforts.
The split incentives barrier, in which a property owner has no economic incentive to make investments from which only the tenant benefits, has significantly hindered the uptake of energy efficient technologies in the rental housing sector.

Refrigerators are the largest single end-user of electricity in rental housing at 20 percent, present in nearly 100 percent of rental housing units, and highly susceptible to the split incentives barrier.

The rental housing market represents 25.8 percent of all occupied housing units in Minnesota, and 28.8 percent of all occupied housing units in the Twin Cities, totaling approximately 320,000 units in the seven-county metro area.

The potential energy savings from replacing refrigerators that are 10 years of age or older in rental housing units in the seven-county metro area with new, Energy Star™-qualified refrigerators is estimated at over 36 gigawatt hours per year. This is enough energy to power over 3,100 average American Households every year—an aggregate energy cost savings to customers of over $3.7 million per year.
THE STUDY

Conservation Legislation in Minnesota

Energy conservation in Minnesota is driven by two statutes. The first, Minnesota’s Conservation Improvement Statute 216b.241, requires public utilities in the state to set aside a portion of revenues to fund energy conservation programs, known as Conservation Improvement Programs (CIP). The second statute, the Next Generation Energy Act (NGEA) passed in 2007, requires Minnesota utilities to achieve annual energy savings equal to 1.5 percent of annual retail energy sales of electricity and natural gas. Minnesota utilities attempt to achieve these energy savings largely through their CIP funds. Utilities use these conservation funds to provide financial incentives, such as rebates or low-interest loans for their customers towards the purchase of energy-saving technologies or building improvements. The funds can also be used for other conservation efforts that have an indirect impact on energy conservation, such as subsidized energy audits or consumer education.¹

Energy efficiency upgrades in residential buildings are one of the most cost-effective ways to achieve the 1.5 percent energy savings goal established under NGEA. However, realizing energy savings in residential buildings has proven more costly and challenging than energy savings in commercial and industrial buildings. Indeed, the majority of energy savings that Minnesota’s utilities have achieved so far to meet the goals established under NGEA have come from commercial and industrial customers (see Figure 1).

Market Barriers to Energy Efficiency

Energy savings in the residential sector have been difficult to achieve because of two significant barriers that prevent many of these investments from taking place: The up front capital costs and the dispersion of costs, benefits, and solutions. Although many energy efficiency upgrades are very cost effective, the up front capital costs required represent significant investments for individuals. The initial costs to add insulation, replace an old boiler, or buy an energy-efficient appliance are usually several times the energy cost savings realized over time.² The second significant barrier to energy efficiency upgrades is the dispersion of costs, benefits and solutions. Potential energy efficiency improvements can be found in millions of buildings using billions of different devices. It is very difficult for one or several government agencies, private companies, or non-profit organizations to develop widespread solutions on a broad, cross-sector scale.

While these two distinct barriers to upgrades apply to all areas of energy efficiency potential, they are compounded in the U.S. rental housing sector by a third barrier known as “split incentives.” Split incentives in rental housing arise from the fact that property owners have no direct financial incentive to make investments in energy saving measures for which they do not pay energy costs. For example, the higher up front cost of an Energy Star™ appliance represents a significant

barrier to efficiency investments; and because the tenant realizes the benefits of an energy efficient appliance through lower energy bills, the property owner’s best economic choice will be to purchase the cheapest appliance available.

One form of energy use in rental housing that is particularly susceptible to the split incentives dilemma is electricity. Almost all rental units are billed individually for electricity, because this use is largely determined by individual tenant behavior through the use of televisions, computers, etc. However, some electrical appliances that are provided by the property owner run solely on electricity, the most prominent being the refrigerator. In fact, according to the U.S. Energy Information Administration, refrigerators are the largest single end-user of electricity in rental housing, consuming 20 percent of the total end-use electricity used. Refrigerators are present in 100 percent of rental housing, run continually while the rental unit is occupied, and experience no significant seasonal fluctuations in their rate of energy use. For all of the above reasons, refrigerators serve as a useful case study to explore policy options to overcome barriers to energy efficiency upgrades in rental housing.

FIGURE 1: Minnesota CIP Spending Versus Energy Savings by Customer Class, 2003

Cooperative and municipal utilities not included. *380 million kilowatt-hours saved, using EIA average (for residential, commercial and industrial sectors) retail price of electricity to ultimate customers in 2003 of $0.0729/kilowatt-hour (EIA, 2011). **1.78 million Mcf (thousand cubic feet) saved, using EIA annual average price (for residential, commercial and industrial sources) in 2003 for natural gas of $7.97/Mcf (EIA, 2011).

Energy Efficiency Potential from Refrigerator Replacement

Refrigerators represent one of the most cost effective investment measures to improve energy efficiency in residential housing (See Figure 2).

Refrigerator energy consumption depends primarily upon the age, size and type.

- Manual defrost models use 40 percent less energy than models with automatic defrost.
- Top freezer models use 13 percent less energy than side-by-side models.3

According to recent Residential Energy Consumption Survey data, the average refrigerator in an apartment today is an automatic defrost, 15 to 18 cubic foot, top-and-bottom configuration refrigerator between five to nine years of age. However, approximately 27.6 percent of refrigerators in apartment buildings with two or more units are more than 10 years old. Annual electric consumption of refrigerators increases significantly with age (see Figure 3).

Refrigerator energy efficiency has improved significantly in the past 15 years. Replacing older refrigerators with new, energy efficient models offers the promise of significant electric load reduction. For example, replacing a 15 year-old refrigerator with a new Energy Star™ model will reduce refrigerator electric consumption by 70 percent, from an average of 1228 kWh/year to 370 kWh/year for an average-sized refrigerator.

3 See the California Energy Commission’s Consumer Energy Center for more information on energy consumption in refrigerators.

**FIGURE 2: Annualized Cost of Home Energy-Efficiency Investments, per MMBTU**

In the seven county metro area of the Twin Cities the energy savings potential is likewise impressive. Applying national appliance profile data to county-level housing characteristics, replacing all of the old refrigerators in rental housing in the metro area with Energy Star™ rated refrigerators could save and estimated 36 gwh per year, with potential electricity cost savings to renters of over $3.7 million dollars collectively. The net present value of these electricity savings over the average life of a new refrigerator exceeds $27 million dollars (see Table 1).

![Annual Refrigerator Energy Use by Age, 15-18 ft³ Top-Freezer Model](image)

**FIGURE 3: Annual Refrigerator Energy Use by Age, 15-18 ft³ Top-Freezer Model**

*SOURCE: EIA, Residential Energy Consumption Survey, 2005; Average retail price of Electricity to Ultimate Minnesota residential customers in January 2012: $0.1076/kWh (EIA, 2012)*

<table>
<thead>
<tr>
<th>Age of Refrigerator In Years</th>
<th>Energy Savings (GWh/yr)</th>
<th>Energy Cost Savings ($) (millions)</th>
<th>Electric Load Reduction (MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>370</td>
<td>$40/year</td>
<td></td>
</tr>
<tr>
<td>5 - 9</td>
<td>535</td>
<td>$58/year</td>
<td></td>
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<tr>
<td>10 - 14</td>
<td>746</td>
<td>$80/year</td>
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</tr>
<tr>
<td>15 - 20</td>
<td>1228</td>
<td>$132/year</td>
<td></td>
</tr>
</tbody>
</table>

| Cumulative Annual Savings    | 36.853                  | $3.75                             | 4.2                           |
| Savings over Estimated Lifetime* | 515.694                | $27.1                             |                               |

**TABLE 1: Potential Savings for Replacement of Refrigerators 10 Years Old or Older, seven-county Twin Cities Metro Area**

* The EPA assumes the estimated lifetime of a new refrigerator is 14 years, based upon data reported by the appliance industry in Appliance Magazine. SOURCE: 2005 RECS data, EIA, authors calculations. Note: Calculations based upon refrigerator electricity consumption data derived from Weatherization Assistant (DOE) software, EPA, and 2005 RECS data.
It is important to note, however, that this represents potential savings. Achieving a large percentage of this potential will require significant investment of resources and effort, in terms of policy innovation, marketing and outreach. However, the authors assumed no funding for such efforts from the federal or state government, only financial resources already required by Minnesota law under the Conservation Improvement Statute.

**Tenants and Property Owners in the Seven County Metro**

According to data from the American Community Survey through 2010 by the U.S. Census Bureau, over 537,000 of the total occupied housing units in Minnesota, or roughly 25.9 percent, are occupied by renters. Of those 537,000 rental units in Minnesota, nearly 320,000, or roughly 59 percent, are located in the seven county metropolitan area. In addition, over 66,000, or roughly 12 percent, of the rental housing units in Minnesota are located in selected rural counties throughout the state (see Figures 4 and 5).

**FIGURE 4: Rental Housing in Minnesota**

*SOURCE: 2006-2010 American Community Survey 5-year Estimates*

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4 Seven-county metro consists of Hennepin, Ramsey, Dakota, Anoka, Washington, Carver and Scott counties.
There are three significant stakeholders involved in the split incentives dilemma in Minnesota’s rental housing sector: Public utilities, property owners and tenants. The CIP statute and NGEA discussed earlier have created an environment in which public utilities in Minnesota have strong incentives to increase energy efficiency and reduce energy consumption. This research, therefore, focuses primarily on programs that aim to overcome the split incentives barrier that exists between property owners and tenants in rental housing. The data we analyzed indicates that energy and cost savings potential exist so that both property owners and tenants benefit from overcoming the split incentives barrier regarding refrigerators in rental housing units.

We interviewed 15 property owners in the seven county metro area to learn the factors that are important to them when replacing refrigerators. These property owners control over 17,000 units, representing roughly 5.6 percent of the total number of rental units in the Twin Cities area. We also interviewed 35 tenants to learn the factors that are important to them when choosing an apartment. Finally, we asked both parties their opinions on the four programs that follow to determine their feasibility among these two significant stakeholders. The results of these surveys were used to formulate the three recommendations featured at the conclusion of this report.

![Bar chart showing number of occupied rental units in Minnesota counties](image)

**FIGURE 5: Rural Rental Housing in Minnesota**

SOURCE: 2006-2010 American Community Survey 5-year Estimates

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5 Depending on the scale, scope and aspect of the split incentives dilemma one examines, other stakeholders may include state and local government, program financiers such as banks, appliance distributors, and organizations that implement energy efficiency programs. However, we focus on the three major stakeholders indicated.
PROGRAM OPTIONS

We examined four program options intended to overcome the split incentives barrier, and assess their feasibility and potential for success in the rental housing sector:

- Rebates
- Benchmarking (with mandatory efficiency upgrades)
- On-Bill Financing
- Green Leases

Since rebates and a benchmarking program would not affect tenants directly and would be largely invisible to them, tenants were only asked their opinions of on-bill financing and green leases. Property owners were questioned about all four policy options.

Rebates

Cash rebates for energy efficient products have been a mainstay of CIP in Minnesota. For example, most electric utilities in Minnesota offer rebates for major home appliances to privately-owned homes, such as refrigerators, dishwashers, and washing machines, while Minnesota’s gas utilities offer rebates for major gas appliances, such as furnaces, boilers and water heaters.6

Our study explored a potential package of rebates targeting major appliances in rental housing affected by the split incentives problem: Refrigerators, dishwashers, and washing machines. The rebate package we considered was modeled after a rebate program offered by Xcel Energy for new home construction that offers home builders a rebate of $500 for the installation of an Energy Star™ refrigerator, dishwasher, washing machine, and at least 20 compact florescent lights. Property owners were asked whether the offer of a bundled rebate of $300 for the purchase of an Energy Star™ refrigerator, dishwasher, and clothes washer, or a $100 rebate per major appliance would motivate them to replace their old appliances right away.

Benchmarking

Benchmarking is the collection and comparison of a building’s current energy use, or energy use over time, with that of similar buildings or a model of potential energy use using a building standard such as Energy Star™ or the International Energy Code. Comparable buildings are based on size, building type, age, heating type, etc. Benchmarking can be done by analyzing utility bills to produce a simple metric such as energy use per square foot, or via inspection and/or energy modeling. The benchmarking process can either be voluntary or mandatory as required by state and local governments.

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6 See the North Carolina Solar Center’s Database of State Incentives for Renewables & Efficiency (dsireusa.org) for detailed descriptions of rebate programs in Minnesota.
Minnesota already requires benchmarking of public buildings. Legislation passed in 2001 requires the Department of Administration to collect energy use information and to develop conservation plans for public buildings based on this information. The law led to the Buildings, Benchmarking, and Beyond (B3) project, which has benchmarked nearly 6,500 public buildings in the state.7

In Texas, the Austin City Council adopted an Energy Conservation Audit and Disclosure (ECAD) Ordinance to improve the energy efficiency of buildings in Austin, including multifamily buildings. The ordinance requires mandatory energy audits and energy use disclosure of all buildings in Austin that receive electricity from Austin Energy, the local municipal utility. The ordinance also mandates energy conservation upgrades to buildings that use more than 150 percent of the average energy use per square foot by multifamily properties in the Austin Energy service area. Austin Energy offers rebates of up to 80 percent to offset the cost of these upgrades.8 We used Austin’s ECAD Ordinance as a model for the benchmarking program we presented to property owners to solicit their opinions of a mandatory benchmarking program.

On-Bill Financing

Utility-based “on-bill” financing programs finance energy efficiency improvements such as insulation or efficient heating and cooling systems through “surcharges” or “tariffs” on the utility bill. Utility customers repay the cost of these improvements through an amortized payment on their utility bills. We selected a specific on-bill financing program design, the Pay As You Save (PAYS®) model developed by Harlan Lachman and Paul Cillo of the Energy Efficiency Institute, as a model for the program we presented to property owners and tenants.

The PAYS model has three distinct features that offer the potential to overcome the split incentives barrier. First, surcharges are attached to the meter, not the individual customer, and remain with the property. Second, the program allows for disconnection of service to the individual account holder for non-payment of the surcharge (or their utility bill in general). Finally, the amount of the surcharge is set so that a customer’s monthly energy cost savings from the efficiency upgrade exceed the monthly finance charge. The model assumes that this surcharge is set at 75 percent of monthly cost savings. These three features address the up front cost barrier, concerns about whether the energy efficiency investments will pay for themselves, and whether the person or entity making such investments will see a return on their investment.

(continued on page 16)

7 See the Minnesota Department of Administration’s B3 website mn.b3benchmarking.com for more information on the B3 program.
8 See Austin Energy’s Energy Conservation Audit and Disclosure Ordinance for Multifamily Properties.
Save enough electricity to power

3,100 Houses*

* Based on average American resident utility
Data: Energy Information Administration, 2010
Refrigerators in the Twin Cities 10+ years old: 88,000

Replacing these old appliances could save 36 Gigawatt Hours

OR...

$3.7 million in annual savings

*Based on average American resident utility Data: Energy Information Administration, 2010
As of May 2011, Midwest Energy, a small electric and natural gas cooperative in central and western Kansas that serves 40,000 customers, offered the only PAYS®-based on-bill financing program in the U.S. that serves residential customers, known as How$mart. To qualify for the program, utility customers only need to be current on their Midwest Energy bill; they do not undergo a credit check. Midwest Energy provides in-house energy auditing services, which identify measures to improve efficiency that fit within the program’s savings-to-invest ratio requirements. The How$mart program sets the monthly surcharge at 90 percent of projected monthly energy savings.9

Although major home appliances are not eligible for financing in the How$mart program, the replacement of refrigerators more than 10 years old appears to fit well within the PAYS® model, given the requirement that monthly energy cost savings exceed finance charges (see Figure 6). For example, the monthly energy cost savings from replacing a 15 year old refrigerator with a new Energy Star™ refrigerator exceeds the monthly finance charge as long as the refrigerator is financed over seven years or more.10

![Figure 6: Monthly Energy Cost Savings versus Sample On-Bill Finance Charges from Refrigerator Replacement](image)

**Figure 6: Monthly Energy Cost Savings versus Sample On-Bill Finance Charges from Refrigerator Replacement**

Note: Assumes replacement of a 15 year old refrigerator (Kenmore model 2539333010) with a new Energy Star™ refrigerator (Frigidaire model LFHT1713LW).

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9 See Midwest Energy’s website for more info on the How$mart program: www.mwenergy.com/howsmart

10 Seven years is half the appliance industry’s accepted “lifetime” of 14 years for a new refrigerator.
Our study sought opinions regarding an on-bill financing program from both property owners and tenants, since both parties would have to be involved in and would be affected by such a program if used to finance new, efficient appliances affected by the split incentives barrier. We explained a hypothetical program modeled after the Midwest Energy How$mart program, and asked owners and tenants their level of interest in taking advantage of an on-bill financing program from their utility. Both parties were also asked what concerns they would have about an on-bill financing program.

**Green Leases**

A “Green Lease” is a lease clause or separate agreement that allows a property owner to raise the rent to finance energy efficiency improvements to an apartment, such as new appliances or insulation, that lower energy costs for tenants.\(^1\) Like the PAYS\(^\text{®}\) system, the green lease model assumes that energy cost savings should exceed finance charges, and should be set at a percentage of monthly energy cost savings to the tenant, typically 75 to 90 percent of monthly cost savings. The goal of the strategy is to align the financial incentives of property owners and tenants. Theoretically, the property owner benefits because the tenant explicitly finances appliances upgrades and other property improvements. The tenants also benefit, assuming that energy savings actually exceed the monthly rent increase.

We found no evidence of the green lease concept being applied to rental housing in a specific program in the U.S. We sought opinions from tenants and property owners on a green lease model based upon the financial assumptions described above, assuming that the lease program would be designed so that any monthly finance charges added to the rent would be no more than 75 to 90 percent of monthly energy cost savings. In both the on-bill financing and green lease programs, we assume that the monthly surcharge or rent increase would expire after the energy efficiency improvement was paid in full.

\(^1\) The Green Lease concept was developed by Beth Williams in a 2008 master’s thesis at Massachusetts Institute of Technology.
A GUIDE TO THE OPTIONS: THE THREE T’S

A full description of the methodology used in the owner and tenant surveys, and the full results of the interviews, can be found in the online supplement\textsuperscript{12} at mn2020.org. Through the opinions gathered in the interview process, we created the following guidelines of important considerations when constructing any energy efficiency program in the rental housing sector in Minnesota.

Time / Timing

Tenants and property owners were nearly unanimous in stating that any support for a program hinges on its simplicity from start to finish. For example, tenants indicated that their interest in an on-bill financing program would drop dramatically if the paperwork required to participate took up more than two hours of their time. Comments from property owners indicated that negative past experiences with utility rebate programs raised a significant barrier to interest in future programs. For example, one property owner told how nearly 43 hours of employee time was spent to get a $400 rebate for a $100,000 boiler system – a poor investment of resources from the owner’s perspective. In cases where the rebate process was seen as smooth and hassle-free, property owners had a specific contact person or representative at the utility who made the process quick and easy.

The timing of a potential efficiency program is also important, particularly when the program is available. Both tenants and property owners expressed more interest in both the on-bill and green lease programs if they were implemented when tenants moved in or when leases were renegotiated. Interest fell for both parties if unscheduled lease renegotiations were required. A crucial aspect of program timing for property owners is when the appliance is replaced. All the property owners we interviewed stated that they replace refrigerators on an as-needed basis. Oftentimes this is when a refrigerator breaks, but numerous property owners stated that they will repair old refrigerators before replacing them with new models if it is the cheaper option. Interest remained high in on-bill, green lease and rebate programs if they could be used when refrigerators break. However, many property owners indicated that without significant rebate support (in the neighborhood of 50 percent of cost or more), these programs would not persuade them to replace older, but still functioning refrigerators right away. Ensuring that replacement programs benefit tenants and property owners when their interest is highest will be important for the success of any future programs.

\textsuperscript{12} Detail about methodology and data can be found at: http://www.mn2020.org/issues-that-matter/sensible-incentives
Trust

When discussing the on-bill and green lease programs with tenants and property owners, it became clear that distrust between the two parties – and of the public utilities – is an issue that could affect the success of either option. Tenants either trusted or distrusted property owners and utilities based on current and past relationships, and preferred either on-bill financing or green leases according to that level of trust. While many property owners were willing to let utility companies conduct much of the administrative work in the on-bill program, some also expressed distrust in the interests and intentions of the utility company. In particular, the large property owners that possess the capabilities to finance and administer the green lease program themselves expressed interest in implementing the program in-house and obtaining their own energy use figures for their units.

In the case of mistrust of other parties, involvement of a neutral third party was suggested to ensure proper and accurate compliance within the program guidelines. This involvement could simply include utility companies in the on-bill program, or could be provided by an energy services corporation, a non-profit organization, or state-run agency. Regardless of how or whether a third party becomes involved, our third ‘T’, Transparency, can provide significant means to overcome trust barriers in efficiency programs.

Transparency

The interviews we conducted illuminate the need for transparency in programs that required relations between tenants, property owners and utilities. In the on-bill and green lease programs, educating tenants about the program was cited as crucial to encourage participation by both tenants and property owners. This means ensuring that tenants know the details of each program, can easily see or know their energy savings and monthly charges, and understand the purpose of the program. Nearly every tenant expressed concern about who would determine the energy savings of a new refrigerator, and how these predicted savings would be estimated. Tenant concerns regarding exploitation by either property owners or utilities can be overcome by establishing transparency in the implementation and execution of these programs.
RECOMMENDATIONS

Option 1: Facilitate Customized Rebate Programs for Large Rental Property Owners

As stated earlier, Minnesota utilities have had much less success achieving energy savings in the residential sector versus the commercial and industrial sectors. Although aggregate energy consumption in the residential sector is high, decision-making is highly dispersed, resulting in much higher costs for CIP administration, marketing, etc. In addition, benefit-cost guidelines for CIP programs issued by the Minnesota Department of Commerce may restrict the types of energy efficiency programs that can be implemented to residents on an individual basis.13

Utilities in Minnesota and throughout the country, however, do offer customized conservation programs to commercial and industrial sectors that cater to the specific needs of different groups in those markets. Therefore, we recommend a program that approaches large rental property owners throughout the state as commercial entities and offers them customized conservation programs. This program would act as a liaison between several large property owners and their corresponding utilities to determine the financial and energy savings requirements for a customized rebate or technical assistance package.

Nearly all of the customized rebate programs offered by utilities require detailed energy savings predictions and application processes with short deadlines. For example, the Custom Incentive Application for Business Customers for the Moorhead Public Service utility requires scheduled visits and follow-up evaluations from the utility, repeated submissions of energy savings predictions and evaluations that require information provided by the utility, and a 90-day deadline to submit paperwork. Given the results of our property owner survey, this time-consuming process may deter property owners from pursuing this rebate option. In addition, through our interviews with property owners we found that programs that did not directly benefit property owners economically were significantly less favored. One large property owner (over 7000 units) resisted energy efficiency upgrades that did not provide an adequate return on investment (ROI) for the company. If existing and established rebate programs do not meet these ROI requirements, large property owners will not pursue these rebate options.

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A customized rebate program for large property owners can also aggregate the electricity consumption of many tenants in several buildings renting from one property owner or manager into one rebate package, which may overcome some of the benefit-cost restrictions from targeting residential tenants on an individual basis. In addition, facilitating the replacement of many old, inefficient appliances with new, energy efficient ones through one property owner provides a more cost effective approach than focusing on numerous individual renters. Furthermore, property owner concerns about the time required to use rebates could be alleviated by a streamlined approach provided by a program that specifically serves large property owners. Finally, large property owners have the economies of scale to provide significant and cost-effective conservation gains to meet utilities’ CIP requirements.

Option 2: Require Energy Cost Disclosure for Rental Units

The inattention to energy costs and energy efficient appliances among tenants that we interviewed represents a significant part of the split incentives barrier in the rental housing sector. While programs such as On-Bill Financing and Green Leases seek to create economic incentives for property owners to implement energy efficiency upgrades, increasing renters’ awareness of energy costs may also facilitate these upgrades. If renters placed significant market pressure on property owners for lower energy costs, property owners would have economic incentives to reduce energy use without the need for large rebate programs or shared savings plans. Given similar rent price, location and other amenities in units owned by competing property owners, which are already advertised to potential tenants prior to signing a lease, Energy Star™ appliances and low energy costs would be a positive selling point for a rental unit.

Our second recommendation is to require energy use disclosure for rental units prior to tenants signing a lease agreement in order to publicize this living expense to potential renters. This recommendation draws from the benchmarking work already done by Fresh Energy.

We recommend basing an energy cost disclosure program on average monthly energy costs in rental units for the utilities paid by the tenant. Although architects or energy engineers may find energy use metrics such as thousands of BTUs per square foot intelligible, most potential renters only want to know what their monthly energy costs are likely to be.
We also recommend using past energy bills as the determinant rather than using energy efficiency metrics, energy usage intensity, or other methods that may require inspections or energy audits. These techniques can be costly, time consuming, and logistically difficult to execute in large apartment buildings or for a large number of buildings.

In contrast, average monthly energy costs for an individual rental unit can be readily obtained from the utility providing that service. We recognize that monthly energy costs for an individual rental unit can vary depending on the habits and behavior of a given tenant, and on seasonal energy use changes. However, extending the time period used to get the average monthly costs to three years or more may help even out behavioral and seasonal fluctuations. Additional research examining the legal or statutory barriers to implementing mandatory energy disclosure in the rental process is necessary.

**Option 3: Pilot a PAYS®-Style On-Bill Financing Program For Appliance Upgrades**

The features of a PAYS®-style on-bill financing program can effectively address the issue of split incentives that affects refrigerators (and other major appliances) in rental housing. Our property owner survey indicated that a rebate would have to exceed roughly 50 percent of the replacement cost of a new refrigerator to accelerate the replacement of old refrigerators affected by the split incentives inherent in rental housing. Evidence suggests that PAYS®-style on-bill financing programs could reduce the need for such subsidies dramatically while still enabling efficiency investments.

Experience with on-bill financing programs indicates that programs forced upon unwilling utilities have failed. Furthermore, each individual utility’s concerns regarding a potential on-bill program must be addressed. Through conversations and interviews with several Minnesota utility representatives, potential concerns may be the cost of changes to a utility’s billing system, the source of funding for efficiency projects, and the financial risk to the utilities if defaults on the “loans” to customers are high. Unfortunately, there is a limited number of existing on-bill financing programs from which to draw lessons.

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Further research to address these concerns is recommended as a first step before efforts to pursue this option are undertaken. We also recommend a more comprehensive survey of Minnesota’s public utilities and cooperatives as these groups will be crucial stakeholders in any effort to implement an on-bill financing program.

Additional concerns related to property owners and tenants remain to be addressed regarding a pilot On-Bill Financing Program, including which party (property owner, tenant or utility) chooses the appliance, ability of the utility to repossess the appliance if an account defaults, and potential for disappearance due to appliances’ portability. However, none of these concerns appear to be fatal flaws.

Considering the first, all three entities would most likely be involved to some extent. The property owner would likely have to sign off on the product chosen, and the utility could simply require a minimum efficiency rating, such as Energy Star™ compliant. The legal issues surrounding the second concern are beyond the authors’ expertise. Finally, although an appliance such as a refrigerator is theoretically portable, as long as the agreement involved specified that the appliance was ultimately the property of the property owner, it seems unlikely that this potential portability would be an issue.
CONCLUSIONS

This study provides insight on how the split incentives barrier affects energy efficiency upgrades in rental housing. We estimate the energy and cost savings potential of replacing old, inefficient refrigerators with new, energy efficient ones. In addition, the survey data we accumulated gives preliminary, qualitative insight into how property owners and tenants make energy-related decisions in the rental housing sector. To obtain statistically significant data regarding property owner and tenant opinions, future survey work must be done on a much larger scale. The survey work we conducted in this study can be used to inform larger future survey efforts regarding questionnaire structures, survey methodologies, and interview techniques.

By analyzing the energy use differences between old, inefficient refrigerators and new, energy efficient refrigerators, we found significant potential for energy and cost savings through upgrading the energy efficiency of refrigerators in rental units. However, this potential is unrealized in the rental housing sector because of the split incentives barrier that discourages property owners from making investments for which they do not enjoy the benefits. Interviews with property owners and tenants focused on possible programs designed to address this barrier, and revealed important insights into the opinions and decision making process of both stakeholders regarding energy efficiency and energy costs.

Based on these interviews and the quantitative analysis in the study, we formulated three program options that address and overcome the split incentives barrier as it applies to refrigerators, home appliances in general, and overall energy efficiency efforts. Each option has different political and administrative feasibility implications, levels of cost effectiveness, and projected impact on the split incentives barrier. Furthermore, the success of each option can be improved by future research to address concerns from various stakeholders involved (see Table 2).
<table>
<thead>
<tr>
<th>OPTION</th>
<th>POLITICAL FEASIBILITY</th>
<th>ADMINISTRATIVE FEASIBILITY</th>
<th>COST EFFECTIVENESS</th>
<th>POTENTIAL IMPACT</th>
<th>FUTURE RESEARCH</th>
</tr>
</thead>
</table>
| Customized Rebates for Large Property Owners | High - Utilities and property owners likely to support; potentially little political action required. | Moderate - 3rd party liaison limits administrative costs for utilities and property owners, but 3rd party currently does not exist. | Moderate - Minimizes costs by tailoring rebates to specific needs of utilities and property owners, but 3rd party may increase overall cost of the program. | High - Focus on large property owners with highest market impact potential. | ✓ Utility support  
   ✓ Additional cost of 3rd party  
   ✓ Rental market characterization |
| Mandatory Energy Cost Disclosure | Unknown - Property owners and realtors historically have opposed; potential legal barriers. | Moderate - Utilities have data on hand; but potential difficulty transferring data to property owners. | High - Utilities already have data on hand; little investment required. | Unknown - Publicized energy costs may not change tenant behavior or choice. | ✓ Property owner and realtor support  
   ✓ Impact on tenant behavior  
   ✓ Ease of data transfer from utility to property owners |
| PAYS-style On-Bill Pilot | Moderate - Utilities may oppose; property owners may support; potential legal barriers. | High - Utility companies already have complex billing systems in place. | Unknown - Depends on loan financing details and administrative costs for utilities. | Moderate - Appliance replacement at little to no cost to property owners and tenants; but some dispersion of impact. | ✓ Utility and property owner support  
   ✓ Administrative cost to utilities  
   ✓ Legal implications of appliance ownership |

**TABLE 2: Recommended Program Options**


EIA. (2009). Residential Energy Consumption Survey Table HC3.1: Appliances in U.S. Homes, By Housing Unit Type. Washington, DC: EIA.


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