

# WHEEL

## Warehouse for Energy Efficiency Loans

WHEEL FEASIBILITY STUDY: INDIA, CHINA, BRAZIL, UK, AND THE EU

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## About Energy Programs Consortium (EPC)

The purpose of the Energy Programs Consortium (EPC) is to foster coordination and cooperation among government agencies in the areas of energy policy and program development. EPC is a joint venture of four US groups: the National Association of State Community Services Programs (NASCSPP), representing the state weatherization and community service programs directors; the National Association of State Energy Officials (NASEO), representing the state energy policy directors; the National Association of State Regulatory Utility Commissioners (NARUC), representing the state public service commissioners; and the National Energy Assistance Directors' Association (NEADA), representing the state directors of the Low Income Home Energy Assistance Program.

EPC provides technical assistance to develop energy efficiency, water conservation, transportation, resilience and renewable finance and bond programs. We coordinate efforts with the National Association of State Energy Officials, the US Department of Energy (DOE), the National Renewable Energy Laboratory (NREL), and Lawrence Berkeley National Laboratory (LBNL) to provide model documents and other resources.

If you are involved in finance, residential energy efficiency or solar programs in the countries studied, we would very much like to hear your thoughts and feedback on this study. Please contact Elizabeth Bellis at [ebellis@energyprograms.org](mailto:ebellis@energyprograms.org).

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# EXECUTIVE SUMMARY

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This report addresses key questions for each of the countries studied and addresses the extent to which each country has important components in place that would facilitate a Warehouse for Energy Efficiency Loans (WHEEL)-type project. It also discusses the adaptations that would need to be made for such a project to be successful in each country.

*Could a WHEEL-type program succeed in one or more of the studied regions? What would success look like?*

A WHEEL-type program has the potential to succeed in all of the studied markets. Most of the countries studied have sufficiently high homeownership rates, residential energy burdens similar to or greater than those in the United States, established securitization markets, government-sponsored energy efficiency rating systems for identifying appropriate home improvements to support, and governments committed to mitigating the impacts of climate change through innovative financing programs. Few appear to have established primary loan markets for home energy efficiency improvements segregated from other consumer debts, however, so a segregated market would need to be created to generate the pipeline for a WHEEL-type securitization. In addition, WHEEL-type programs outside of the US would often require a modified underwriting approach since numeric credit scores are less common in many of the markets studied than they are in the US.

*Are there interim milestones on the path to success? What key metrics might be utilized to measure success? How likely is such success?*

The interim milestones in each market would be to:

- (1) identify and engage with all of the needed partners (an originator, a servicer and servicing mechanism, a source of capital and credit enhancement, a pipeline via home improvement contracting networks or other vendors, and lawyers familiar with local consumer lending laws and securities regulations);
- (2) work with rating agencies and financial institutions to identify an underwriting approach that can result in a rated securitization;
- (3) work with public sponsors and vendors to identify appropriate improvements to finance in each market and an appropriate mechanism to screen installers;
- (4) create the legal documentation needed to facilitate the public-private partnership and the initial lending, including interest rate swaps and currency swaps if necessary;
- (5) begin marketing the program through the identified pipeline partners and aggregating the loans;

- (6) season the loans: hold the aggregated loans for a long enough time (3-5 years) to establish a good payment track record;<sup>1</sup>
- (7) obtain a rating on a securitization of the aggregated pool;
- (8) market the securities to investors; and
- (9) complete the first securitization.

Key metrics to measure success would include successful completion of the above milestones within a time frame appropriate to the state of each market and taking into account the numerous variables that affect execution. Success is very likely given a long enough time frame to develop the program and contractor network, and aggregate and season loans and sufficient support to cover the significant upfront development costs required for such a program. However, this success will be predicated on whether or not a WHEEL-type program is able to gather sufficient support from the public, private, and philanthropic sectors in the countries studied.

## Recommendations for Philanthropy

Without sufficient support from the public, private, and philanthropic sectors in each country studied, success in establishing a WHEEL-type program is highly unlikely. As such, the EPC team is proposing that the philanthropic sector consider providing funding to support the first four milestones listed above in India and the UK. Both countries have shown considerable interest, and we believe that the underlying infrastructure would benefit from this approach.

The four milestones represent essential steps in getting the project grounded as well as providing key information that would support participation by the private sector. This was the strategy that was followed in the US to set up the WHEEL project. Project milestones were covered through grants from the Rockefeller, Ford, Surdna, Energy, and William Penn Foundations. Additional support was provided by the US Department of Energy.

## Program Development Time Frame

*Within each region and across regions: How long might it take to realize full program success? Interim milestones? What factors might affect the time frame?*

A WHEEL-type program could reach a milestone first securitization in two to five years in the UK with sufficient support from the public and philanthropic sectors. This shorter time frame is possible for the UK because there is already an existing portfolio that could be securitized, and there is an active consumer credit securitization market. In India, existing portfolios from Energy Efficiency Services Limited (EESL) and KfW Development Bank, along with the typically shorter tenor on consumer financing there, also suggest the feasibility of a WHEEL-type securitization in a reasonable time frame, if the lack of credit card securitization models can be overcome.

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<sup>1</sup> For FitchRatings, a minimum of five years of historical data is needed to provide an initial rating for global consumer ABS because defaults often are not spread evenly over the lifespan of the loans. See "Global Consumer ABS Rating Criteria," FitchRatings, August 19, 2016, pgs. 2 & 19. For Kroll Bond Rating Agency, timeframes depend on the specific asset class and on the terms of the securitized asset. In some cases, Kroll can rate with less than 3 years of historical data. See "General Rating Methodology for Asset-Backed Securities," Kroll Bond Rating Agency, July 30, 2012, pg. 7.

Many of the milestones described above could be pursued simultaneously rather than sequentially. It may be necessary to provide very significant credit enhancement of the initial loan pool in order to achieve a rated securitization due to the lack of a long “track record” of the repayment performance of this type of loan in these countries. Once such a track record is established and a pipeline stimulated, however, a WHEEL-type program has great potential to improve energy and water efficiency in the countries studied.

Factors that might affect the time frame include: political and governmental changes (which impact credit enhancement support); legal changes (which may impact the primary loan market as well as the securitization structure and market, or which may drive demand for energy efficiency by imposing requirements on homeowners); centralization of contractors in networks (which impacts the resources needed to generate the pipeline and offer the financing to homeowners); energy prices (since sustained low energy prices reduce homeowner incentives to make energy efficiency improvements); rising labor costs; and resources committed to project development (greater staff resources can reduce the timeframe since many of the milestones can be pursued simultaneously by a well-coordinated team).

## Projected Environmental Benefits

*What environmental benefits might be attained as a result of a successful WHEEL-type program? What metrics might be used to estimate those benefits? How might benefits vary by region depending on existing regional characteristics and/or details of regional approach to a WHEEL-type model?*

WHEEL-type programs would help to reduce greenhouse gas (GHG) emissions—particularly carbon dioxide emissions—in the countries studied. A mature WHEEL program, generating USD 100 million in loans per year, could avoid 1,000 to almost 10,500 tons of carbon dioxide emissions annually in each of the countries studied. (See Figure 1).

Quantifying GHG emission reductions is still more of an art than a science. The environmental impact of financing energy efficiency measures in a country depends on both (1) the amount of energy saved (in megawatt hours and/or therms) and (2) the amount of GHG emissions generated per kilowatt hour or therm in the country.<sup>i</sup> For example, Renew Financial estimates that the first WHEEL securitization saved 6,171 MWh and 189,353 therms per year over the 15 year average useful life of the improvements made (a total of 92,562 MWh and 2,840,301 therms), thus avoiding approximately 3,822 tons of GHG emissions yearly (a total of 57,318 tons over 15 years). (See Appendix A for an explanation of the methodology Renew Financial uses to calculate these savings estimates).

It is impossible to determine variable #1 (how many MWh or therms would be avoided in WHEEL-type programs in other countries) exactly because those figures depend on many factors, including the measures financed, the use and maintenance of the measures after installation, and the efficiency differential between the supported measures and the default base case in the country in question. As such, for the purpose of this estimate we have simply assumed that USD 1 of WHEEL

loans in the countries studied would result in the same MWh and therms savings as it was estimated to have saved in Pennsylvania.

In assessing variable #2 (GHG emissions from electricity and natural gas usage), we look to data on carbon dioxide (CO<sub>2</sub>) emissions. CO<sub>2</sub> is the primary GHG emitted due to electricity generation and natural gas heating,<sup>ii</sup> and it is the GHG for which we have the best information. CO<sub>2</sub> emissions per kWh and CO<sub>2</sub> emissions per therm vary quite significantly across the countries studied in this paper. In compliance with the International Energy Agency’s (IEA) terms and conditions, these data points are not published here but were used in the estimation of avoided GHG emissions. (See Figure 1).

Based on these 2013 CO<sub>2</sub> emissions figures from the IEA and US Energy Information Administration (EIA), as well as on the estimated energy savings data gathered from the WHEEL program in Pennsylvania, the countries studied could each reduce greenhouse gas emissions by as much as 10,450 tons per year per USD 100 million in loans. (See Figure 1). Estimated impacts are not particularly great in China and India despite relatively heavy emissions in those countries in 2013 because of low residential energy consumption. (See Appendix A for methodology).

**Figure 1: Estimated Carbon Dioxide Savings by Country for Mature WHEEL Program (per USD 100 million in loans per year)**

Country	Estimated Avoided GHG Emissions (tons)
Brazil	1,636
India	4,606
China	4,976
France	5,007
Spain	7,737
EU	8,147
Germany	9,292
UK	10,450

Based on IEA data from *CO<sub>2</sub> Emissions from Fuel Combustion* © OECD/IEA 2015, [www.iea.org/statistics](http://www.iea.org/statistics), Licence: [www.iea.org/t&c](http://www.iea.org/t&c); as modified by Energy Programs Consortium.

**Program Groundwork**

*What key project components would need to be developed or built upon to develop a WHEEL-type project in other countries?*

Key project components for WHEEL include a sufficiently large population of creditworthy homeowners, an energy efficiency rating system to facilitate determination of appropriate measures for support, accessible networks of home improvement professionals with sufficient knowledge and

expertise to make energy efficiency improvements, a credit system that facilitates simple underwriting and that covers a sufficient portion of the population, and (drawing on the above components) a pipeline of energy efficiency loans segregated from other home improvement financing that can be bundled for securitization. Partners to provide credit enhancement, senior capital, program administration (including contractor oversight and quality assurance and control), origination and servicing, and program development funding are equally critical.

## Regional Prioritization

*If the approach is feasible in more than one region or market, should we focus first on one of the identified regions or markets? If so, why? If so, which one(s)?*

The UK and India might be the best markets on which to focus first because they have the highest number of key WHEEL components. (See Figure 2). The UK has established contractor networks from its experience with the Green Deal, homeowners with numeric credit scores facilitating similar underwriting to that used in the United States, and developed financing institutions. Improving energy affordability through efficiency and supporting the small businesses that make home energy improvements are both relevant politically in the UK just as they are in the United States.

India's relatively affluent urban population centers with strong credit score penetration and significant government support for energy efficiency and access initiatives make a compelling case for a WHEEL-type program in India as well.

Both the UK and India, like the US, have legal systems based on the English common law and use English as a primary language, which may make US WHEEL documentation more helpful in replicating the WHEEL approach in these countries with fewer legal expenses. Recent changes in Indian bankruptcy laws should improve the securitization landscape in India.

The UK also shows high potential for emissions reduction with the assistance of the WHEEL program relative to other countries studied. CO<sub>2</sub> savings within the first year of a mature WHEEL program with USD 100 million in loans are projected to be 10,450 tons in the UK. (See Appendix A).

In addition, replicating WHEEL may be simpler in the UK or India than in many countries in Europe where credit scores and debt utilization are less common and where aggregation of loans across numerous countries with separate legal regimes may be required to reach the scale needed for securitization in a practicable time frame. However, legal and political uncertainty, instability due to Brexit, and a downward trend in UK government investment in residential energy efficiency projects may impact this conclusion for the UK.

Figure 2: Checklist of Key WHEEL Components by Country

	UK (11/15)	India (9/15)	Brazil (8/15)	Germany (6/15)	Spain (6/15)	China (5/15)	France (4/15)
Pop. 60M+	✓	✓	✓	✓		✓	✓
High Home-ownership	✓	✓	✓		✓	✓	✓
Single-Family	✓	✓*	✓		✓		
High Energy Burden	✓	✓	✓	✓	✓		✓
EE Rating System	✓	✓	✓	✓	✓	✓	✓
EE Contractor Networks	✓		✓	✓			
Segregated EE Finance	✓	✓		✓			
Credit Score Coverage	✓	✓					
Credit Use	✓	✓	✓		✓	✓	
Credit Enhancement							
Senior Capital							
Program Administrator							
Program Development Funds							
HVAC/Insulation and/or Appliance Finance Market not Fully or Adequately Served by Existing Options	✓	✓	✓		✓	✓	
Comparatively High Estimated GHG Impact	✓			✓			

\*Single family homeownership is concentrated outside of the affluent urban areas with larger numbers of creditworthy consumers, however.

### Why Securitize Energy Efficiency Loans?

Unexpectedly high defaults in securitized products, particularly US mortgage-backed securities, were a central driver of the 2008-2009 financial crisis, which resulted in near-global recession. As

such, we must first review the benefits of securitization that made it such an important part of financial markets and the US economy. Since an alternative tool that delivers the same benefits has not yet been developed, securitization has rebounded in the US, even with additional regulations coming into effect to help prevent a recurrence of the problems that sparked the crisis.

Securitization of energy efficiency loans has many benefits. Perhaps most importantly, this approach creates liquidity needed to attract additional investors in the asset class. Banks no longer need to hold the loans on their books, which allows them to make many more loans than they could if they had to hold them and maintain associated capital coverage required by banking regulations (Basel III/Solvency II).

Second, securitization often results in a lower cost of capital (and lower interest rates to borrowers) because of the diversification benefit it provides to investors. Securitization allows investors to diversify their risk by taking a small piece of many loans rather than a large piece of a small number of loans.

Third, investors may generally choose which “piece” or “tranche” of the loans they wish to purchase based on their risk/reward profile. More senior tranches generally provide investors less yield while mezzanine and subordinate tranches offer greater yield but greater risk since they absorb the first losses that may come on the underlying assets if borrowers default. Tranching also allows public sector actors to remedy market failures without mobilizing large amounts of funding.<sup>iii</sup> For example, if private sector investors cannot be found to invest in the riskier tranches, the public sector may intervene without having to fund the entire project, as the European Fund for Strategic Investments (EFSI) has done for small- to medium-sized enterprise (SME) loan securitizations under Europe’s Investment Plan.<sup>iv</sup>

Finally, over time, regular securitization creates a wealth of historical performance data that facilitates risk assessment. With greater supply of investors and greater familiarity with the performance of the asset class, the cost of capital should decrease.<sup>v</sup>

Decreased capital costs due to liquidity, diversification, and greater familiarity with the asset class from an established performance track record in turn means lower costs to borrowers to do energy efficiency work. Lower borrowing costs should mean more work done by more borrowers and more energy-efficient buildings and systems.<sup>vi</sup> More energy-efficient buildings and systems should reduce energy demand and concomitant greenhouse gas emissions.

## **What is the Potential for Specialized Energy Efficiency Financial Products on the Secondary Market?**

The potential for specialized energy efficiency financial products on the secondary market is significant, around several hundred billion dollars in total.<sup>vii</sup> More than USD 1 billion in residential Property Assessed Clean Energy (PACE) assessments alone have been securitized already in the United States, and that represents just a small fraction of the market for clean energy improvements in the US, let alone globally. At the same time, more and more investors seek socially and environmentally responsible investments,<sup>viii</sup> including “green bonds.” In 2015, USD 41.8 billion in

green bonds were issued.<sup>ix</sup> Notably, while the European Union (USD 18.5 billion) and the US (USD 10 billion) accounted for more than half of all issuances, India (USD 1.1 billion) and China (USD 1 billion) have also been significant players in the labeled green bonds market.<sup>x</sup> Brazil entered the market in 2015 with USD 0.6 billion issued.<sup>xi</sup>

Specialized energy efficiency financial products may demonstrate better repayment rates than comparable financial products that are not used to finance energy efficiency improvements. For example, as of August 2016, the Green Jobs Green New York (GJGNY) Program had experienced a 0.50 percent annualized charge-off rate for its off-bill unsecured energy loans to creditworthy borrowers. For comparison, the US credit card charge-off rate in July 2016 was 2.41 percent.<sup>xii</sup>

This better performance of specialized energy efficiency financial products may be due to the fact that the home improvements they fund often reduce borrowers' expenses and create a stream of income that can pay back the financing. Additionally, borrowers who undertake energy efficiency improvements may be more conscientious than a comparable borrower who does not undertake such improvements. Whatever the reason, if the performance of GJGNY, WHEEL, PACE and other similar products bears out this hypothesis that specialized energy efficiency financial products will perform better than comparable general products, the creation of specialized asset classes should lead to reduced costs of capital for this type of work (a "green premium") and help to further drive adoption. A "green premium" may already exist, perhaps due to a greater demand for green assets than the current supply. In September 2015, Barclays reported as much as a 20 basis point difference in yield for green bonds.<sup>xiii</sup> Others report that green assets attract additional potential investors.

# INTRODUCTION

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In 2009, EPC began working with the Pennsylvania Treasury on the Warehouse for Energy Efficiency Loans (WHEEL) to address concerns by state energy offices about the need for a national unsecured residential energy efficiency loan product. The goal was to support the retrofitting of the nation's single family housing stock and meet broad-based public policy goals of transparency and inclusion of all income groups. In addition, many states wanted a program where they would not be required to manage their own energy efficiency program in order to participate; WHEEL would provide contractor management, quality assurance, and data sharing in a transparent manner that also meets broad-based public policy objectives.

The WHEEL project is groundbreaking because it brings together states, foundations, and the private sector to support a true multistate public-private-philanthropic partnership sharing resources to support an important societal goal: help increase the rate of retrofitting of the nation's single family housing stock and thereby reduce greenhouse gas emissions.

As countries around the globe begin working to implement the pledges made at COP21 in Paris and looking for approaches to bring in the significant private investment needed to accomplish their goals, WHEEL provides one public-private-philanthropic partnership model that may be replicable in other contexts.

This paper explores the feasibility of replicating the WHEEL model in the European Union (particularly Germany, France, and Spain), the United Kingdom (evaluated separately from the EU), India, Brazil, and China. We review key conditions that would be needed to replicate the WHEEL model in its narrow sense (e.g., unsecured loans to single-family homeowners with credit-score based underwriting and public credit enhancement) and discuss some modifications.

The WHEEL model used in the United States requires adaptation to meet the goals and conditions present in the countries described. Nonetheless, we find that energy loan securitization is feasible in each of the countries studied and in fact represents an important and necessary step in the transition to a clean energy economy.

# WHEEL BACKGROUND; METHODOLOGY NOTES AND EXPLANATION

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The approach this paper takes to determine feasibility is heavily informed by the history of the WHEEL program in the United States. While each country studied presents its own unique set of opportunities and challenges and suggests modifications to the model that worked in the United States, we nonetheless believe it is helpful in assessing the feasibility of energy loan securitization in other countries to consider the US WHEEL experience.

The US WHEEL program was born because a state had an unusual problem: an energy efficiency loan program that was too successful. The Pennsylvania Treasury Department had invested state funds in a residential energy efficiency loan program called Keystone HELP. The funding needed to meet the demand for loans was so great that it threatened to exceed portfolio diversification limits that the Treasury observed to fulfill its fiduciary role. Pennsylvania sought to sell its portfolio of loans but soon realized there was no market for this unfamiliar asset. Fannie Mae, the US government-sponsored enterprise, would buy the loans, and had bought similar assets for many years. However, it would only do so at a significant discount that was not warranted by Pennsylvania's loss experience with the assets. Pennsylvania explored the possibility of securitizing its portfolio and tapping the secondary capital markets. The state quickly realized that, despite the size and success of the program, it was not large enough on its own to regularly generate the large volumes of loans needed to create a liquid asset class that would interest investors and make securitization cost-effective. It was at that point that the Treasury launched an effort, along with several other interested parties, to establish a multistate facility to warehouse and then securitize these loans. Thus, WHEEL was born.

This background is important not only as context but also to explain the methodological approach we take in this paper in determining the feasibility of a WHEEL-type program in other countries. For example, knowing that a state of 12 million people that has a mature program (*i.e.*, Pennsylvania) can generate USD 18 million in residential energy efficiency loans per year through the WHEEL primary market model suggests that a demographically similar area would need at least 60 million people in order to achieve the minimum USD 100 million per year volume that is one benchmark of mature securitizable asset classes. An area with a lower percentage of homeowners with sufficient income and credit to undertake an energy project, or with lower average project costs, might need a larger total population to yield a securitizable program.

Similarly, we include statistics regarding the portion of single-family homeowners in the countries being studied because US WHEEL is currently limited primarily to that market. In the US, homeowners who do not live in single-family buildings are less likely to make purchasing decisions about heating and cooling systems as these tend to be centralized for the building. Since emergency replacement of heating and cooling is such a central aspect of WHEEL demand generation, this distinction may be significant. Homeowners in the US tend to have fewer financing options for these major purchases than they might for energy-efficient appliances bought on a

stand-alone basis, for which appliance stores often offer promotional rate credit cards. Our research suggests that this may also be the case in a number of the countries studied.

In the course of our study, steering committee members, who were tasked with reviewing, editing, and providing feedback on the paper, noted that such a limitation might not make sense in countries with higher rates of multifamily living or in which renters are required to provide their own appliances. Indeed, in some of the markets studied it may make sense to broaden the eligibility rules. However, we include information facilitating comparisons to the US and Pennsylvania in order to highlight the extent to which such an expansion might be important in identifying a large enough market to support energy loan securitization.

We include information about energy prices and consumption and compare those to corresponding figures in Pennsylvania and the US because these determine the payback period for many home energy improvements. Energy bills are an important factor driving the average homeowner to undertake certain energy improvements. If energy bills are very low, individuals may still be motivated to choose energy-efficient appliances if WHEEL financing makes them more attractive than non-efficient appliances (because, for example, financing is not available to them for those appliances or is comparatively expensive), but we cannot be as confident about the success of Pennsylvania's model where both motivating factors are not present. Of course, in areas where WHEEL-type programs would be used to provide access to energy to homeowners who currently have none and are not connected to the grid, this is a less relevant consideration.

We discuss the existence and density of networks of skilled home energy contractors, because in the US home energy improvements are often made by very small businesses that would be expensive to identify and train individually. To the extent that is the case in the countries studied, networks are a key mechanism for cost-effectively bringing in the contractors who in turn bring in the "pipeline" of work and financing that drives a securitizable home energy finance program. Ideally, we would like to see networks of contractors with a credible certification similar to the Building Performance Institute (BPI) certification used in the United States, but a program administrator (discussed below) can and should employ other means of oversight and quality assurance and control as well, such as conducting walk-throughs on a sample of jobs financed through the program.

In addition, we provide information about credit scores because WHEEL, like many consumer credit programs, relies heavily on consumer credit scores and debt-to-income ratios in underwriting loans and determining consumer creditworthiness. For example, the minimum credit score in the first WHEEL securitization was 640. Numeric credit scoring facilitates very fast approvals that can be done in the home rather than requiring the homeowner to visit a bank and fill out significant paperwork.

This underwriting approach also facilitates securitization because secondary market investors have a reasonably good idea of how likely it is that consumers with specific credit scores will repay loans. That predictability is also important for public sponsors, as their funds are (in the first WHEEL securitization structure) the first to be lost in covering defaults due to borrower nonpayment. WHEEL is structured so that public investors receive a small return intended to offset the losses from

such defaults, but if losses are higher than expected, the program would not be able to recycle the full amount of public funds invested at the end of the loan term.

Information on credit card utilization is included as an indicator of both lender ability to assess creditworthiness and homeowner willingness to utilize credit. The wide disparity in credit card utilization between the US and many of the countries studied suggests that consumer comfort with credit may be an important factor in WHEEL's success in the US.

We discuss other financing options that may be available to homeowners to make energy efficiency improvements for three reasons. First, if there is an existing specialized energy efficiency finance program that has not been securitized but offers a portfolio of existing loans and corresponding repayment history, securitization is more feasible than if the loan portfolio must first be created before it can be securitized. Second, this overview facilitates an assessment of the degree to which energy efficiency financing needs are already met. Finally, understanding existing financing options and terms provides a sense of the underwriting approaches and financing terms that may be expected or appropriate in a given market.

We also discuss possible sources of senior capital, credit enhancement, and program development funding because WHEEL-type programs require a number of different types of funding and financial support. There are significant upfront program development costs (including legal costs) that in the US were covered primarily by charitable foundations as well as by venture capital and private equity investors in Program Administrator Renew Financial. To make loans, there must be both low-cost, risk-averse capital ("senior capital") that funds the portion of the loans that will be sold via securitization, and some form of credit enhancement to protect that senior capital. In the US, that credit enhancement for WHEEL came in the form of below-market rate funds from state and local governments, often utilizing funds they received from the federal government. We will discuss potential sources of all of these funds because each is critical for WHEEL program success.

Finally, we examine the securitization landscape in each country studied because the feasibility of securitizing a loan portfolio depends on the existence of a functioning securitization market. The securitization market in the US has had its share of challenges, particularly during and after the 2008 financial crisis. It has rebounded significantly and issuance volumes and investor interest remain high. This allowed the first WHEEL securitization to achieve excellent execution despite its small size. Securitization markets elsewhere have generally been thinner or dominated more by mortgage-backed and auto loan securities, though green bonds are growing in all of the markets studied. While traditional investors, such as an insurance company, initially expressed interest in purchasing WHEEL, the eventual purchaser, Calvert Investments, was a mission-oriented green investor. WHEEL is more feasible in countries with more green investors active in the securitization markets.

The multiplicity of factors described above underscores the complexity and challenge of creating securitizable energy efficiency finance programs. Like the proverbial engine that does not run half as fast if it contains only half its parts, any key component that is missing can undermine the success of a WHEEL-type effort. That said, replacement parts and substitutions must be made to adapt the US-based model to other markets.

# REGIONAL MARKET CONDITIONS

## INDIA

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### Introduction/Summary of Findings

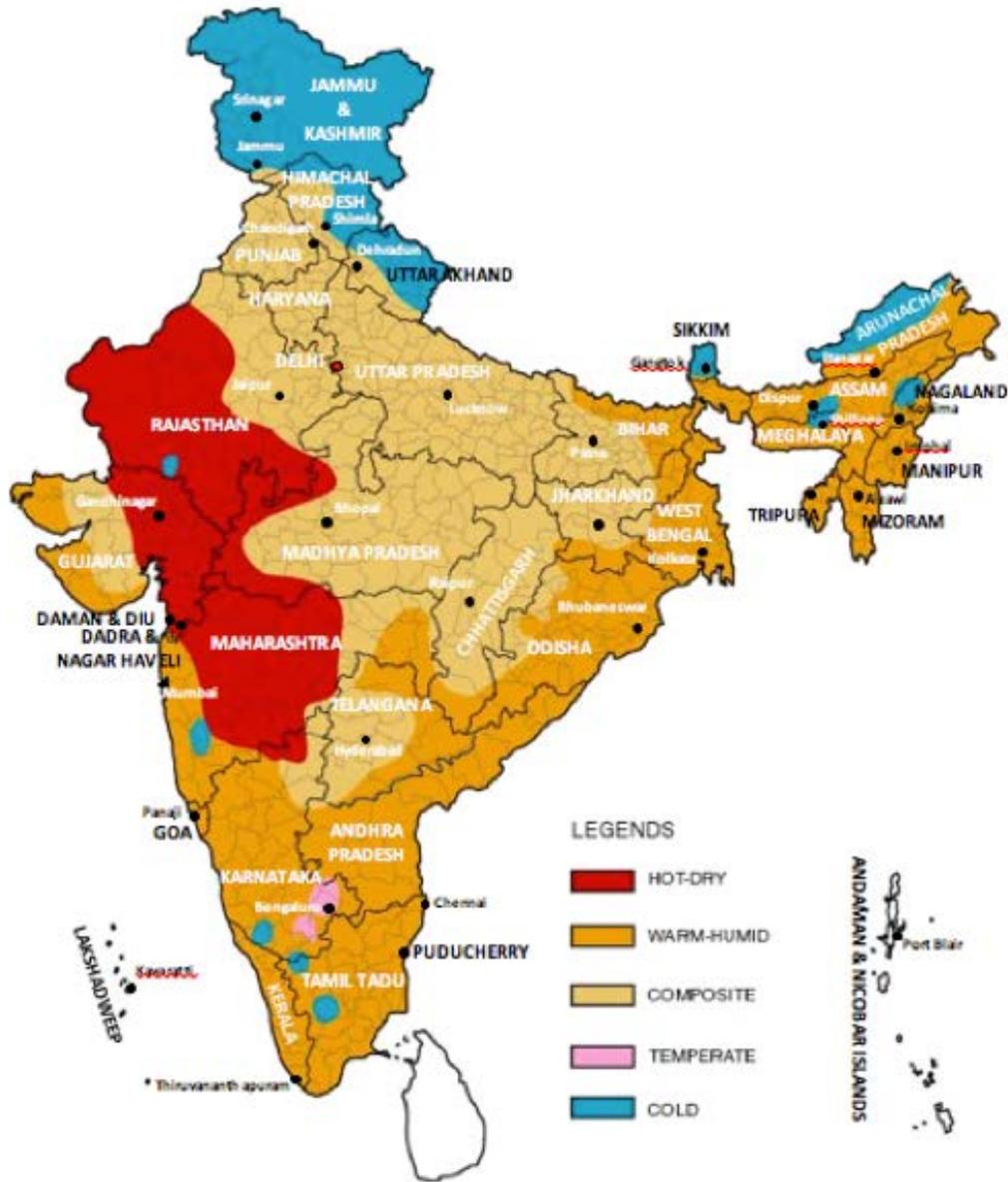
India is an exciting potential market for a WHEEL-type residential energy efficiency finance program. India has large numbers of relatively affluent urban homeowners with credit scores and reasonably high energy burdens and even larger numbers of rural homeowners; moreover, India has many low-income and medium-income households with aspirational values, which may further expand market size. Prime Minister Narendra Modi's government is committed to reducing the impacts of climate change and increasing energy access for all, and the Indian banking and financial markets are well-established. While public efforts have tended to focus on renewable energy projects rather than efficiency, government-sponsored funds for clean energy and energy efficiency projects, as well as a pilot program with the World Bank, do demonstrate possible sources of credit enhancement; corporate social responsibility (CSR) mandates could also be helpful in this regard. Banks (regional, national, and multinational) and housing finance companies could provide capital during the warehousing period. India also has a small but established securitization market.

### Climate

On the whole, India has a very hot climate. The majority of the country experiences a warm-humid or composite climate. (See Figure 3). The warm-humid climate of India is characterized by humidity of 70-90 percent, heavy precipitation, summers that vary between 77 and 95 degrees Fahrenheit (25 to 35 degrees Celsius), and winters that vary between 68 and 86 degrees Fahrenheit (20 to 30 degrees Celsius). Composite climates are very similar to the hot-dry climate, which has a mean monthly maximum temperature above 86 degrees Fahrenheit (30 degrees Celsius), but with more humidity during monsoon season.<sup>xiv</sup> Major cities like Mumbai and Kolkatha are situated in warm-humid regions, while Delhi and Hyderabad are in composite areas. The states of Rajasthan and Maharashtra have hot-dry climates, while a small portion of Northern India experiences a cold climate.

The climate distribution of India suggests that a WHEEL-type program in India would be utilized more for cooling, lighting, and water heating measures than for space heating measures.

Figure 3: Climate Zone Map for India



Source: Bureau of Energy Efficiency (BEE), India

### Population and Target Market(s)

According to the Ministry of Statistics and Program Implementation, the population of India is around 1.25 billion people,<sup>xv</sup> about 4 times that of the United States (312.6 million)<sup>xvi</sup> and 100 times that of the US state of Pennsylvania.<sup>xvii</sup> Due to the significant demographic differences between India and the United States, the subpopulation that would be the target market for a traditional WHEEL model (using credit scores and focusing on energy efficiency rather than energy access) is significantly smaller than this total, but still appears larger than the 60 million minimum suggested by the Pennsylvania experience, particularly if homeowners in multifamily buildings (common in urban areas) are included. Including renters (who often must purchase their own appliances,<sup>xviii</sup> including fans and air conditioners<sup>xix</sup>) would further expand the market.

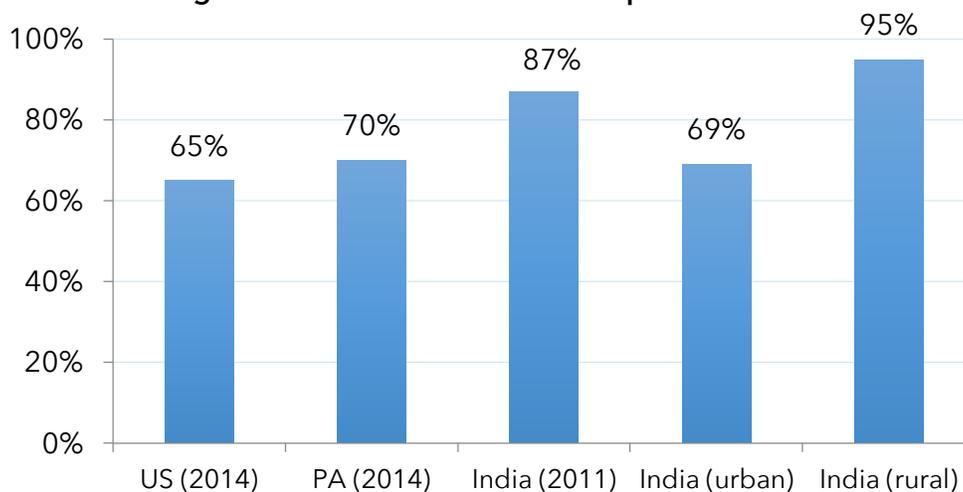
Homeowners in large urban areas tend to be more affluent and creditworthy and consume more energy at higher energy tariffs than their rural counterparts.<sup>xx</sup> The five largest cities (Delhi, Mumbai, Kolkatha, Hyderabad, and Bangalore) have a combined population of around 84 million people.<sup>xxi</sup> 406 million Indians have CIBIL credit scores, though many Indian consumers may not know that they have CIBIL scores (limiting their impact on consumer repayment behavior).<sup>xxii</sup> CIBIL scores are determined by four major factors: payment history, current outstanding debt balance, mix of secured (auto and mortgage) and unsecured (personal and credit cards) loans, and recently opened accounts.<sup>xxiii</sup> This is comparable to US FICO scores, which take into consideration the individual's payment history, debt burden, length of credit history, credit mix in use, and new credit.<sup>xxiv</sup>

A consumer credit securitization model is also relevant in addressing the challenge of delivering energy access<sup>xxv</sup> and water conservation measures<sup>xxvi</sup> to the generally less affluent rural areas. A WHEEL model for this market could utilize a microlending approach or could work with local solar developers to securitize a senior interest in pay-as-you-go solar contracts. Such a structure addresses the lack of a consumer credit score by looking to both the significant interest retained by the solar developer and to the customer's need to keep up payments in order to avoid shut-off. The model might be securitizable due to the somewhat predictable stream of future payments for services like electricity, but it may require the development of a track record.<sup>xxvii</sup>

### Single-Family Homeownership

Indian homeownership rates are high. The last Census of India (2011) reported that nearly 87 percent of Indians own a home, including approximately 69 percent of urban Indians and 95 percent of rural Indians, compared with 65 percent overall homeownership in the US (2014 Census).<sup>xxviii</sup> (See Figure 4). However, these homeownership rates reflect a broader definition of a home than might be utilized in comparable statistics for Western countries. Specifically, they include residents that own non-permanent structures such as lean-tos.<sup>xxix</sup> Property rights for such structures may be more precarious than for permanent structures.<sup>xxx</sup> Given that WHEEL does not generally lend to mobile homes in the US, a similar WHEEL-type program in India would be unlikely to lend to people living in lean-tos and other non-permanent structures.

**Figure 4: Rates of Homeownership: India vs. US**



Source: US Census (2014) & India Census (2011).

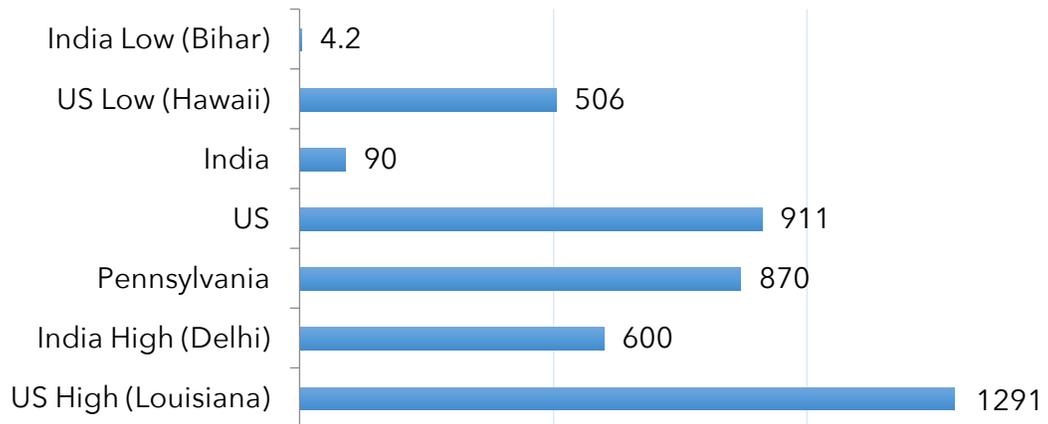
Unfortunately, the Census of India does not provide information on the rate of homeownership within each type of structure; it does note the total number of structures that are permanent as well as the number of total households. If we assume for simplicity that the proportion of renters to homeowners is approximately the same within each category, it is possible to derive a rough, back-of-the-envelope estimate of the percentage of Indians that own permanent structures by multiplying the homeownership percentage by the percentage of structures that are permanent.<sup>xxxv</sup> Doing so would suggest a ballpark estimate that 54 percent of Indians own permanent structures, including 43 percent of rural Indians and 59 percent of urban Indians.

It is difficult to estimate what percentage of these Indian homeowners own single-family permanent structures; again, the Census does not provide that level of granularity. However, it is likely that the portion of urban Indians owning single-family permanent structures is considerably lower than 59 percent given the increasing trend towards living in multifamily residences (flats), particularly in urban and peri-urban areas.<sup>xxxii</sup>

## Residential Energy Use

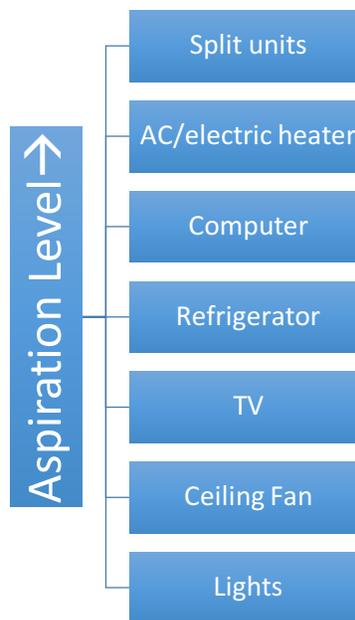
The average Indian household uses significantly less energy than the average US household. For example, average American per household residential electricity use in 2014 (911 kWh)<sup>xxxiii</sup> was more than 10 times as high as average Indian per household residential electricity use (90 kWh).<sup>xxxiv</sup> (See Figure 5). If the estimated 300 million Indian households without access to electricity<sup>xxxv</sup> are included in average use rates, then the gap between American and Indian electricity use further widens. A typical Indian household might use electricity to power a light and a fan.<sup>xxxvi</sup> (See Figure 6).

**Figure 5: Monthly Average Electricity Consumption in kWh:  
India vs. US (2013, 2014)**



Source: US Energy Information Agency data for 2014, IEA India data for 2013, & Enerdata data for 2014.  
Note: US numbers and India overall are per household; India cities are per capita.

**Figure 6: Appliance Ladder for India**



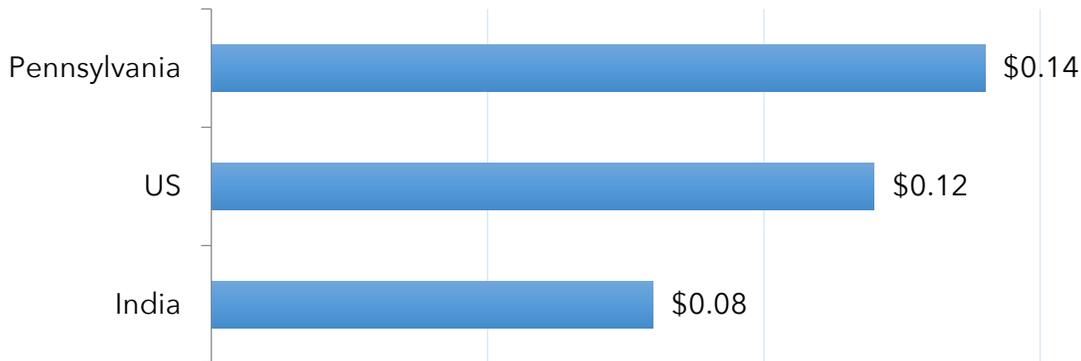
Source: Reshma Singh, Lawrence Berkeley National Laboratory, US-India CBERD.

Residential energy use also is projected to increase within the next few decades. India has 18 percent of the world’s population, yet consumes only 6 percent of its energy. Over the next 20 years, 350 million people are expected to gain electricity access. Furthermore, while only 15 percent of Indians currently own appliances, this figure is expected to increase to 45 percent within the next 15 years. If 70 percent of the population were to have cooling appliances, an additional 50 GW of power would be needed.<sup>xxxvii</sup>

## Residential Energy Pricing

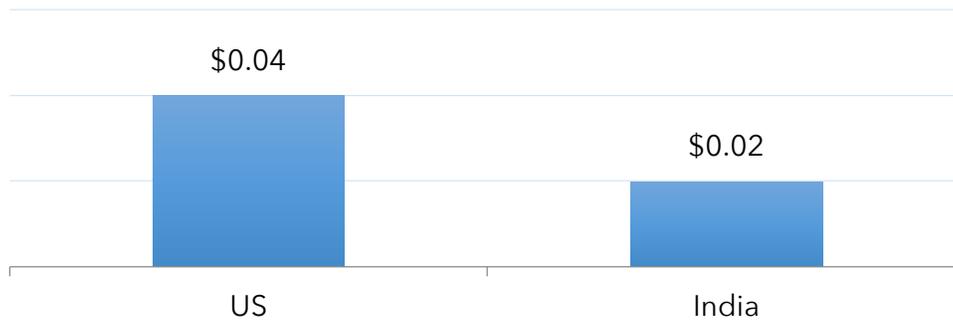
Energy prices vary widely across India. On average, however, Indians pay 4 cents less than Americans per kWh of electricity<sup>xxxviii</sup> and 2 cents less per kWh of natural gas.<sup>xxxix</sup> (See Figures 7 and 8). When adjusted for purchasing power parity (PPP) using 2011 figures, Indians paid significantly more than Americans: USD 0.32 per kWh compared with USD 0.12/kWh in the US and USD 0.14/kWh in Pennsylvania. Natural gas cost on average USD 0.08 per kWh compared with USD 0.13/kWh in the US and USD 0.14/kWh in Pennsylvania.<sup>xl</sup> While power theft is a significant problem in India, large numbers of Indians do pay for their monthly energy usage.

**Figure 7: Average Price per kWh of Electricity: India vs. US (2011)**



Source: 2011 Census of India & US Energy Information Agency.

**Figure 8: Average Price per kWh of Natural Gas: India vs. US (2014)**



Source: US Energy Information Agency & Index Mundi.

Note: India figures do not distinguish between residential and commercial. This assumes that 1 million Btu of natural gas = 293.0711 kWh.

Despite significant variability in Indian energy pricing, some generalizations may be made. For example, similar to utility billing in the United States, customers typically pay a demand charge that is a step function of total kWh usage, plus a rate per kWh, as well as some taxes and fees. Energy usage in rural areas is currently so low that energy bills tend to be very small, even compared to Indian average smaller disposable incomes. Energy subsidies, which are viewed as a right in India, are often used to lessen the energy burden on the lowest energy users. For instance, in the case of electricity, the government offers subsidies on tariff rates and also provides capital subsidies to state utilities. Tariffs are computed on a state-by-state basis, adjusted based on sector (residential, agriculture, commercial, industry, railways) and consumption level, and then given a markdown by

the government.<sup>xli</sup> Because of this, the lowest energy users, who are usually also the poorest individuals, have little incentive to invest in energy efficiency.<sup>xlii</sup>

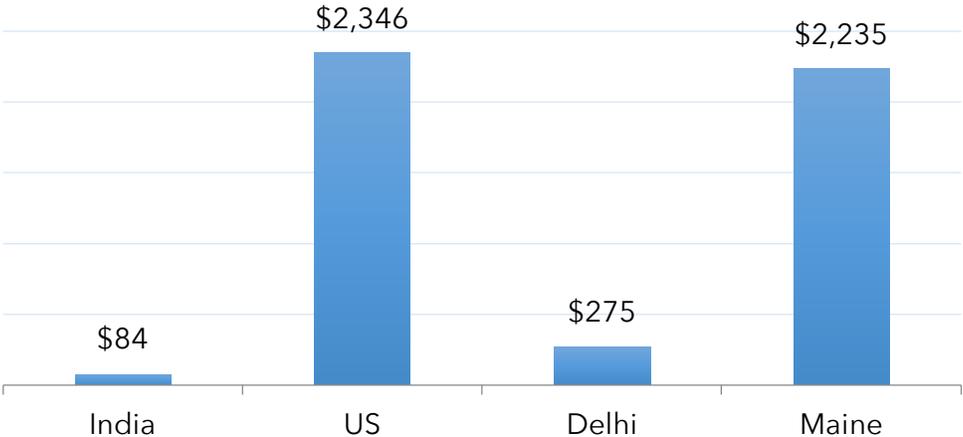
In urban areas, however, Figures 9 and 10 suggest that some customers pay an electricity bill that would be roughly comparable to the amount paid by an electricity customer in the US state of Maine, where residential energy efficiency finance programs such as Efficiency Maine (administered by WHEEL partner AFC First) have had significant uptake.

### Residential Energy Burden

Energy prices, utilization, and incomes vary greatly across India. However, countrywide figures suggest that the average Indian bears a heavier energy burden than the average American. The average monthly income in the US in 2013 (USD 2,346)<sup>xliii</sup> was nearly 30 times that of the average monthly income in India (USD 84) and about 10 times the average monthly income in Delhi (USD 275).<sup>xliv</sup> (See Figure 10). Nominally, monthly electricity bills and consumption in Delhi are similar to some US states,<sup>xlv</sup> but average monthly income in Delhi is less than 1/10<sup>th</sup> of the average income in these states, indicating a high energy burden borne by Delhi residents.<sup>xlvi</sup> In assessing the energy burden for India, we look only to electricity and not to gas because gas usage in India is minimal, reserved primarily for cooking rather than more intensive heating. (See Figures 9, 10 & 11).

The average household in Delhi would pay USD 63 per month for electricity, or more than one-fifth (23 percent) of average monthly income, whereas an average Massachusetts household might pay USD 124 per month for electricity (about 4 percent of average monthly income).

**Figure 9: Average Monthly Income: India/Delhi vs. US/US States (2013)**



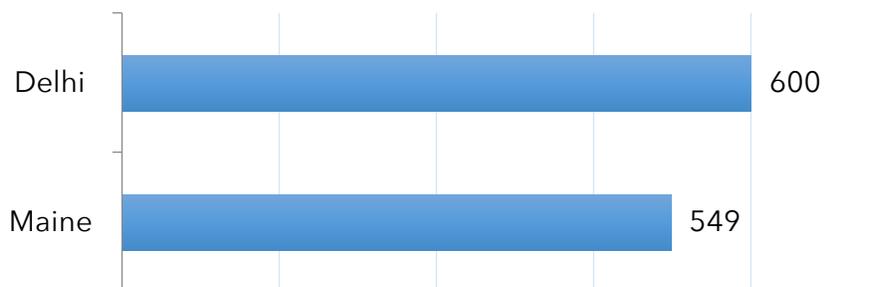
Source: *Economic Times* (citing government figures) & 2013 US Census<sup>xlvii</sup>.

**Figure 10: Average Price per kWh of Electricity: India vs. US (2014)**



Source: US Energy Information Agency data for 2014<sup>xlviii</sup>; <http://www.bijlibachao.com/news/domestic-electricity-tariff-slabs-and-rates-for-all-states-in-india-in-2016.html>; *Tariff & duty of electricity supply in India* (PDF). CEA, Govt. of India. March 2014. Retrieved Aug 12, 2014. Assumes Delhi consumption of 600 kWh.

**Figure 11: Average Monthly Consumption in kWh: Delhi vs. US States (2013, 2014)**



Source: US Energy Information Agency data for 2014 & IEA India data for 2013.  
Note: US numbers are per customer and India numbers are per capita.

## Eligible Measures; Energy Efficiency Rating System

India has an existing energy efficiency rating system for appliances run by the government's Bureau of Energy Efficiency (BEE). Relevant appliances that have been rated include air conditioners, fans, refrigerators, lighting, and water pumps.<sup>xlix</sup> This system could be used to identify appropriate measures to support through a WHEEL-type program. Rooftop solar (including solar water heating) and rainwater catchment systems could be included as well. Finally, as increasing numbers of Indians opt for cooling appliances in buildings constructed to ventilate air rather than contain it, weatherization measures like air sealing and insulation should be considered as well. Weatherization may take longer to implement in India, however, because the largely multifamily structure of urban housing makes it difficult to undertake building-wide retrofits,<sup>l</sup> and post-job audits would be particularly important for these types of measures to ensure work completion and quality.

There is an existing energy efficiency rating system for buildings in India as well. The Indian Green Building Council (IGBC) developed various energy efficiency rating systems for buildings, including LEED and the Green Homes rating system. Green Homes is the first rating program ever developed in India to focus solely on the residential sector. To become a certified IGBC Green Home, residential buildings need to meet certain criteria related to site selection and planning, water

conservation, energy efficiency, materials and resources, indoor environmental quality, and innovation and design process.<sup>li</sup>

Cooling makes up a large portion of energy demand in India and is on the rise. Households usually opt for fans (pedestal or ceiling) and room coolers first, then window air conditioning units or (for rooms without an external wall) split units.<sup>lii</sup> An Indian household might first install a window air conditioner in a bedroom, then another bedroom, and then finally in a living area.<sup>liii</sup> In 2007, only 2 percent of the country owned air conditioners, but growth in air conditioner sales was projected to increase at a rate of 20 percent per year.<sup>liv</sup> Indeed, between 2013 and 2014, 3.3 million units of air conditioning were added to the 25 million already existing in the country.<sup>lv</sup>

There are major barriers to energy efficiency in India, especially for air conditioners. Energy-efficient air conditioners in India are significantly more expensive than other options. The most energy-efficient model, a 5-star air conditioner, costs 40 percent more than standard models.<sup>lvi</sup> Moreover, a mistrust of advertised savings among the consumer base<sup>lvii</sup> and a general lack of information and awareness about the benefits of energy efficiency<sup>lviii</sup> further discourages purchasing better-starred air conditioners. A comparison of prices on India's Tata's website revealed that the most energy-efficient air conditioners cost INR 23,490–72,090 (USD 350.52–1075.73), while standard models cost INR 19,990–24,490 (USD 298.29–365.44). Overcoming these costs with the help of programs like WHEEL will be valuable for energy efficiency as 5-star air conditioners have the greatest potential for energy saving out of any other product or appliance, accounting for about 67 percent of total energy savings amongst all BEE-labeled products.<sup>lix</sup>

Washing machines, also a growing market, are measures to consider as well. Automatic washing machines are much more energy-efficient than semi-automatic ones; however, in 2010, 61 percent of washing machines sold were semi-automatic, while just 39 percent were automatic.<sup>lx</sup> This is because semi-automatic washing machines only cost INR 5,500–12,000 (USD 81.96–178.81), while automatic washing machines cost INR 12,500–75,000 (USD 186.26–1,117.58).<sup>lxi</sup>

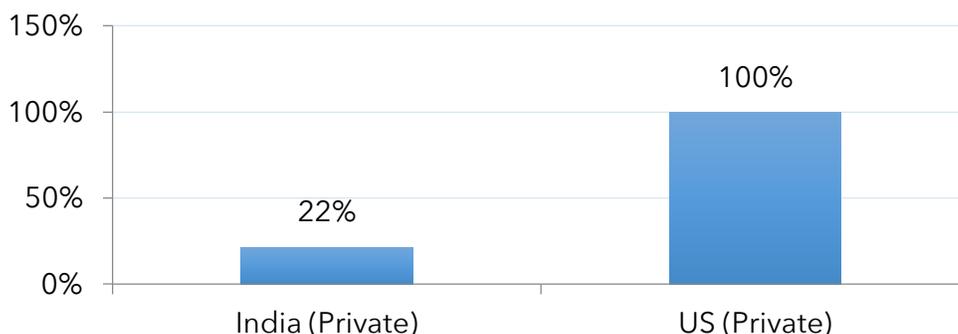
Efficient washing machines can be especially important for India because of the country's poor water security. High population density has exerted great stress on water supplies; 75.8 million people in India are without access to safe water, the most out of any country in the world.<sup>lxii</sup> Water shortage is an everyday reality and has a huge impact on water prices. In summer 2015, after Mumbai imposed a 20 percent water cut, water vendors were selling 20-50 liters of water for INR 1,800 – 2,000, up from the usual price of INR 40 – 200.<sup>lxiii</sup> Having higher efficiency washing machines that save both energy and water can perhaps alleviate some of these water shortage issues and protect families from unanticipated price increases.

## Consumer Credit Underwriting

Consumer credit scores are far less common in India than in the US. For example, the World Bank estimates that only 22 percent of adults in India are covered by private credit bureaus<sup>lxiv</sup> (such as Highmark, Equifax,<sup>lxv</sup> and Experian<sup>lxvi</sup>), while 90 percent of Americans have credit scores<sup>lxvii</sup> and 100 percent of American are covered.<sup>lxviii</sup> (See Figure 12). However, as of June 2015, CIBIL, India's largest credit information bureau, maintained credit information on more than 406 million consumer

accounts and has a membership base of more than 1400 banks and credit institutions.<sup>lxxix</sup> In partnership with TransUnion, CIBIL provides covered individuals with a credit score between 300 and 900; the majority of lenders (79 percent) prefer at least 750.<sup>lxxx</sup> CIBIL scores are determined by 4 major factors: payment history, current balance, mix of secured (auto and mortgage) and unsecured (personal and credit cards) loans, and recently opened accounts.<sup>lxxxi</sup>

**Figure 12: Consumer Coverage by Credit Bureaus: India vs. US (2015)**



Source: World Bank/Trading Economics.

We have not been able to find examples of credit card securitizations done with CIBIL-based underwriting, so it is difficult to ascertain whether CIBIL scores are sufficiently trusted by rating agencies and investors to serve as a FICO-equivalent for an Indian WHEEL program.

In July 2016, the Reserve Bank of India (RBI) issued a new disclosure directive requiring all banks and other financial institutions to share data with the four credit information bureaus, and vice versa. This is aimed at helping the microfinance industry so that they are aware of an individual's credit information. Previously, without access to this crucial information, microcredit organizations would grant inappropriate loans, which contributed to hundreds of farmer suicides across India in 2010 related to heavy debt burdens.<sup>lxxii</sup>

### Credit Card Penetration and Utilization

Credit card penetration is still fairly low (but increasing<sup>lxxiii</sup>) in India; debit cards and mobile wallet are the preferred non-cash options.<sup>lxxiv</sup> According to the RBI, as of December 2015, 22.74 million credit cards were in circulation - compared to 636.85 million debit cards.<sup>lxxv</sup> For comparison, at the end of 2012, there were 1.17 billion credit cards in the United States.<sup>lxxvi</sup> A number of different banks offer credit cards in India, including: Kotak, Axis Bank, RBL Bank,<sup>lxxvii</sup> Housing Development Finance Corporation (HDFC) Bank, ICICI Bank, CitiBank, SBI bank, Standard Chartered, and HSBC.<sup>lxxviii</sup> Credit card default rates (3-5 percent of total credit card balances) are higher than those typical in the US but for the most part remain lower than the Indian consumer lending industry's average bad loan ratio of 4.5 percent.<sup>lxxix</sup>

Misselling issues may be contributing to low credit card penetration and repayment statistics as well. For instance, some credit card holders are unaware that credit cards come with large annual fees and may simply stop paying when the fee shows up on the next bill. Other times, even when cardholders complete their payments on time, they may be charged a late fee because companies

are slow to process the payments.<sup>lxxx</sup>

In addition, household savings rates in India are fairly low and comparable to those of the US, signifying that smaller volumes of domestic funds are available for capital investment. In 2013, the household savings rate in India was 7.2 percent,<sup>lxxxi</sup> just slightly higher than that of the US (4.97 percent).

## Unmet Financing Demand; Existing Financing Options for Residential Energy Improvements

We have identified two specialized energy efficiency financing options in India: an on-bill option for LEDs and fans through Energy Efficiency Services Limited (EESL), and a KfW-supported National Housing Bank (NHB) secured finance option. Both demonstrate the market for residential energy efficiency finance in India.

In 2010, four state-run utility companies established EESL as a joint venture. In May 2015, EESL began offering on-bill financing for LEDs through UJALA (Unnat Jyoti by Affordable LEDs for All). LED prices declined from INR 400-500 before program commencement to INR 93 (in part due to EESL bulk procurement)<sup>lxxxii</sup> and allowed consumers to finance the acquisition of an LED by paying INR 10 upfront and the remainder over 9 monthly on-bill charges.<sup>lxxxiii</sup> Since annual savings from a single LED bulb amount to INR 162, the cost of the light bulb itself is recovered quickly. As of July 2016, more than 136 million LED bulbs had been sold through UJALA<sup>lxxxiv</sup> across the 11 states that have adopted the program.<sup>lxxxv</sup>

The success of UJALA has inspired EESL to turn its attention to energy-efficient fans. The National Energy Efficient Fan Programme (NEEFP), launched in April 2016,<sup>lxxxvi</sup> similarly relies on single procurement to bring down prices and offers households greater incentive to become energy-efficient. NEEFP promotes a switch from 75-80 Watts conventional fans to 50 Watts BEE 5-star rated ceiling fans, which are 30 percent more energy-efficient.<sup>lxxxvii</sup> Currently, BEE 5-star rated ceiling fans cost about INR 1,900 each.<sup>lxxxviii</sup> Under NEEFP, consumers can purchase up to two energy-efficient fans and finance them by (1) paying monthly installments of INR 60 over two years, or (2) paying INR 1250 upfront.<sup>lxxxix</sup> With annual savings of about INR 700, however, the cost of an energy-efficient ceiling fan can be recovered in just under two years.<sup>xc</sup>

In addition to these on-bill financing programs through EESL, NHB provides energy efficiency loans through the Energy Efficient Homes Programme. NHB partnered with Germany's state-owned KfW Development Bank to jointly launch this program in 2010. As of 2013, the NHB-KfW partnership had a line of credit of EUR 50 million. The program makes loans to individual borrowers through housing finance companies to purchase or construct energy-efficient homes.<sup>xcii</sup> The loans are capped at INR 5,000,000, require a mortgage of property as security, and have terms not exceeding 15 years.<sup>xcii</sup>

In addition to these existing specialized energy efficiency finance programs, the Indian Renewable Energy Development Agency (IREDA), which has financed residential renewables and efficiency on a

limited scale in the past,<sup>xciii</sup> announced in May 2016 plans to convert to a green bank to facilitate funding from foreign banks such as KfW.

In the meantime, Indian homeowners have a number of general financing options they may utilize for energy efficiency projects, including home improvement loans, top-up loans, personal loans, gold loans, loans against property (LAP), and loans for solar. (See Figure 13 summary). Home improvement loans cover construction and structural improvements to things like plumbing, but they generally do not support purchase of durables such as appliances;<sup>xciv</sup> those may be financed through store financing. Personal loans and gold loans are often quicker to obtain, but they come with higher interest rates, shorter terms, processing fees, and prepayment penalties. Gold loans may be utilized when the house is not in the borrower’s name or if the borrower’s credit history prevents a personal or home improvement loan.

**Figure 13: Existing Home Efficiency Financing Options in India**

Type	Security or Collateral	Maximum Amount	Typical Interest Rate Range	Typical Term	Speed & Simplicity of Application & Approval Process
Credit Card	No		15-36%	6 months-5 years	1-3 weeks
Personal Loan	No		15-24% per year	5 years	2-3 days
Gold Loan	Borrower’s gold jewelry	80% of the value of the jewelry	14.5-17%	12-15 months	1-2 days
Top-Up Loan (2 <sup>nd</sup> Mortgage)	Borrower’s house		Usually base rate plus a percentage; recently offered at same rate as home loan (9.5-10.5% yearly)	15-20 years	Same day upon request at bank (if eligible) since documents & payment history already with lender. Generally not available until 3-6 years after origination of mortgage.
Loan Against Property <sup>xcv</sup> (No Existing Mortgage)	Borrower’s house		12-16%	1-9 years	4-10 days
Home Improvement Loan (No Existing Mortgage)	Borrower’s house <sup>xcvi</sup>	75-90% of project cost; 2-3 times of annual income <sup>xcvii</sup> DTI 40%. <sup>xcviii</sup> Proceeds to contractor rather than borrower.	9.5-10.5% per year <sup>xcix</sup> (generally deductible from federal income taxes up to INR 30,000 per year) <sup>c</sup>	15 years <sup>ci</sup>	4-5 days for salaried borrowers; 7-9 days for self-employed. Applicant must show 6 months of bank account statements, work estimate & property documents, and often non-objection certificates from the relevant housing society. <sup>cii</sup>
EESL Financing - DELP	No	Households can buy up to 4 LED bulbs	11% <sup>ciii</sup>	9 months	Same-day: consumers can buy LEDs upon providing documents (electricity bill, photo ID, proof of address)

EESL Financing - NEEFP	No	Households can buy up to 2 energy-efficient fans	11%	2 years	Same-day: consumers can buy fans upon providing relevant documents
NHB-KfW Energy-Efficient Homes Programme	Borrower's house	INR 50 lakh		Up to 15 years	
Non-banking Finance Companies (NBFCs)	NBFC collects down payment in 4 equated monthly installments (EMI). NBFC then pays full price to seller and collects difference from buyer in 8 EMIs.		Advertised as 0% financing; actual interest rates range from 13% (with down payment) to 24% (without down payment) <sup>civ</sup>	1 year	
Loans for Solar Products (Tata Power & Bajaj Finance) <sup>cv</sup>	Small processing fee and 2-8 EMIs for down payment depending on scheme chosen. Remainder is paid back in EMIs.	INR 250,000 (USD 4,150)	0%	7-10 months	Very quick approval process; instant processing of loans

Sources: Live Mint, Economic Times, Bank Bazaar, Business Standard, Business Line, AllOnMoney.com & Deccan Chronicle, Tata Power, CleanTechnica.

The existing fully-private financing options have little incentive to limit the financing they offer to energy-efficient improvements if creditworthy customers want to buy inefficient models. If consumer securitization were more common in India, and it were clear that finance companies would receive a “green premium” on securitizing financing for efficient improvements, such companies would be more likely to offer segregated financing for efficient improvements at a lower rate than other products. In the meantime, support from public and philanthropic interests would likely be needed to encourage finance companies to offer such a product.

## Existing Contractor Networks

Home energy efficiency contractor networks remain fragmented in India. Appliance manufacturers and stores have networks of approved contractors who are trained to install and service their equipment but not to conduct comprehensive energy efficiency improvements in a home.<sup>cv</sup> India's Green Building Council includes construction industry stakeholders working on sustainable building and runs a Green Home certification program, but many small installers and handymen doing energy work are not members.<sup>cvii</sup> Some homeowners may use online service aggregators (an expanding sector in India), such as UrbanClap,<sup>cviii</sup> similar to Angie's List in the US, to find home improvement professionals who can make energy improvements. Others rely on word-of-mouth recommendations from friends, neighbors, and trusted contractors who work in other areas, such as interior decorators or general home refurbishment/renovation professionals.<sup>cix</sup> In big cities, there are also home renovation companies called “home service companies” that could act as general contractors for energy work.<sup>cx</sup>

## Possible Sources of Credit Enhancement

There are diverse potential sources of credit enhancement for a WHEEL-type program in India. First, the Indian government has committed funds toward greenhouse gas emissions reductions and launched a number of programs dedicated to the promotion of clean energy and environmental protection. State governments may support energy conservation efforts in order to save state-owned power distribution companies (“discoms”) from crippling debt. Other potential sources of credit enhancement are international carbon credit markets, Indian companies, the New Development Bank, the World Bank Multilateral Investment Guarantee Agency, and foreign development banks.

India pledged domestic funds toward the USD 2.5 trillion cost of its pledge to reduce greenhouse gas emissions intensity by 33-35 percent by 2030. The Indian government’s focus appears to be more on renewables (and particularly on facilitating access to power for rural Indians who might otherwise begin burning coal in the coming years) than on energy efficiency for those already using electricity.<sup>cxv</sup> However, Prime Minister Modi’s government is business-friendly and might be interested in supporting a WHEEL-type program to generate business for home improvement stores, manufacturers and contractors. A WHEEL-type program that helps deliver goods and services to Indian homeowners might have some popular appeal if eligibility is sufficiently broad.<sup>cxvii</sup>

In 2015, the Indian government and the World Bank jointly launched a USD 43 million Partial Risk Sharing Facility (PRSF) in Energy Efficiency developed and managed by Small Industries Development Bank of India (SIDBI).<sup>cxviii</sup> The facility includes a USD 37 million partial credit guarantee facility funded by Clean Technology Fund (CTF) and Global Environment Facility (GEF) for energy efficiency in various sectors, including buildings. The guarantee covers up to 75 percent of the loan with a maximum fee of 1 percent of the amount guaranteed. The fee for the guarantee would need to be covered through finance charges or other sources.

In addition, India’s National Clean Environment Fund has approximately USD 3 billion, funded from coal tax revenues, that can finance clean energy projects and tax-free infrastructure bonds.<sup>cxix</sup> Formerly the National Clean Energy Fund,<sup>cxv</sup> its mandate is now expanded from energy to include a number of environmental concerns, including cleanup of India’s water supply.<sup>cxvi</sup> Clean water funds in the United States have been used to support WHEEL in Pennsylvania and a similar residential energy efficiency finance program in New York. Since its establishment, however, the fund has provided funding primarily for renewable energy with a particular focus on solar. The intent to establish the fund was announced alongside an intent to establish a “National Solar Mission,” which may explain the fund’s heavy investment in solar thus far; it had not funded any energy efficiency projects as of July 2014.<sup>cxvii</sup>

The Indian Renewable Energy Development Agency (IREDA) is another potential partner, particularly given its recently announced green bank initiative. IREDA currently offers a small volume of capital for renewable and energy efficiency projects at interest rates around 11 percent.<sup>cxviii</sup> Its focus on innovative financing for energy efficiency and renewable projects provides a useful government-sponsored model.

India's state governments could be a potential source of credit enhancement as well after the recent development and implementation of a financing scheme called the Ujwal DISCOM Assurance Yojana (UDAY). State-owned Indian power distribution companies ("discoms") have been operating on losses for the last few years, compromising the operations of India's power sector and raising concern over possible default. UDAY allows state governments to take over 75 percent of discom debts over two years from 2015 to 2017 and sell bonds to pay back creditors;<sup>cxxix</sup> the remaining 25 percent will be covered by bonds issued directly by the discoms. The scheme also includes measures to reduce the debt burden by: correcting inefficiencies in operation that have resulted in loss of electricity; reducing power costs; and offering lower interest rates to discoms. With this strong focus on energy conservation, a scheme like UDAY may incentivize the states to support energy efficiency programs (like WHEEL) that can help reduce unpaid energy bills.<sup>cxx</sup>

Alternatively, India's position in international carbon markets may be beneficial to WHEEL. India is a major seller of carbon credits in the international market, second only behind China. In 2011, India held 6 percent of the market share, a figure projected to rise steadily over time.<sup>cxxi</sup> The capital that India generates by selling carbon credits can be a source of credit enhancement for a WHEEL-type program.

Certain Indian companies may be a source of funds for a WHEEL-type program as many have corporate social responsibility (CSR) obligations to meet.<sup>cxxii</sup> Hareon Solar, for instance, was funded by CSR. And Tata Power, whose CSR policies include the environment and resource and energy conservation,<sup>cxxiii</sup> has in the past provided cleaner, more efficient smokeless chullahs to replace traditional cooking devices in rural India. Tata Power also invests in environment awareness programs and afforestation.<sup>cxxiv</sup>

Additionally, the New Development Bank (NDB), a multilateral BRICS bank based in Shanghai, could lend support to WHEEL. The bank has stated that clean energy will be a major focus of its agenda.<sup>cxxv</sup> In April 2016, the NDB completed its first round of green energy loans, providing USD 811 million in total for clean energy projects in India, Brazil, China, and South Africa.<sup>cxxvi</sup> Of the USD 811 million in loans rewarded, India's Canara Bank received USD 250 million, USD 75 million of which will fund 500 megawatts worth of renewable energy projects.<sup>cxxvii</sup> NDB has intentions to finance USD 2.5 to USD 3 billion in sustainable development projects in 2017.<sup>cxxviii</sup> In September 2016, the World Bank and the NDB also formed a partnership to strengthen their cooperation in building infrastructure by pursuing more opportunities for co-financing projects and facilitating greater knowledge exchange.<sup>cxxix</sup> The extra support from the World Bank could make the NDB a more attractive source of credit enhancement for a WHEEL-type program.

The World Bank Multilateral Investment Guarantee Agency (MIGA) is another possible source of credit enhancement. It encourages foreign direct investment in developing countries (including India) by offering insurance against losses relating to currency inconvertibility and transfer restrictions, expropriation, war, terrorism and civil disturbance, breach of contract, and non-honoring of financial obligations.<sup>cxxx</sup>

Lastly, foreign development investors like the UK's Green Investment Bank (GIB) may show interest in being a source of credit enhancement. In 2015, the GIB was given USD 200 million to establish UK

Climate Investments LLP (UKCI) to invest in clean energy projects in Africa and India.<sup>cxxx</sup> UKCI targets renewable energy and energy efficiency.

## Possible Sources of Senior Capital During Aggregation Period (Warehousing)

Non-Banking Financial Companies (NBFCs) might self-finance a WHEEL-type program until aggregation.<sup>cxxxii</sup> IREDA is one such NBFC. NBFCs like Bajaj Financing, Sri Lan Financing, and Tata Financing currently offer air conditioner financing options that typically have interest rates up to 24 percent.<sup>cxxxiii</sup>

Housing finance companies (HFCs) are also a source of senior capital during the warehousing period. Currently, there are 71 registered HFCs.<sup>cxxxiv</sup> The quantum of loans varies from HFC to HFC. For example, for CanFin Homes Limited, the quantum of loan depends on the borrowing individual's repayment capacity and net income, and is capped at INR 7,500,000, or 70 percent of the property's market value, whichever is lower.<sup>cxxxv</sup> In contrast, the quantum of loan for Repco Home Finance is up to 85 percent for construction of a new home or up to 80 percent for purchase of a residential house.<sup>cxxxvi</sup>

In September 2015, the RBI approved 10 new entities<sup>2</sup> to operate as small finance banks that will extend credit to underserved markets including small businesses and farmers.<sup>cxxxvii</sup> The small finance banks are part of efforts to improve "financial inclusion" or access to financial services by underserved individuals and businesses.<sup>cxxxviii</sup> Ashoka Housing for All offers microcredit loans to low income Indians who lack credit scores.<sup>cxxxix</sup> These institutions would be excellent partners in developing appropriate alternative underwriting needed for a significant portion of the Indian population. By supporting loans to impoverished Indians in rural areas, they can enable rural Indians to reduce the common reliance on kerosene for lighting, increasing energy affordability (which increases comfort as more people will be able to afford fans and other goods), improving health, and reducing greenhouse gas emissions.<sup>cxl</sup>

## Indicators of Business Climate for Clean Energy Finance

According to the World Bank Ease of Doing Business Index, India ranks close to the bottom of the 189 countries with respect to ease of contract enforcement, with a rank of 178. The average number of days to resolve a lawsuit from filing to actual payment is 1,420 days, of which it takes an average of 305 days to enforce a judgment.

On the other hand, the World Bank Readiness for Investment in Sustainable Energy (RISE) indicates that India exhibits high performance in areas of energy access and medium performance in renewable energy and energy efficiency,<sup>cxli</sup> meaning that the investment climate of the energy access market is more favorable than that of the renewable energy and energy efficiency markets.

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<sup>2</sup> Eight of the ten new small finance banks were previously micro-finance institutions. These included: Janalakshmi Financial Services, Ujjivan Financial Services (Bangalore), Equitas Private Holdings (Chennai), RGVN Microfinance (Assam state), and Utkarsh Microfinance (Uttar Pradesh state). <http://www.ft.com/intl/cms/s/0/19459e1a-5c8c-11e5-97e9-7f0bf5e7177b.html#axzz4AFawEEhY>

For comparison, the US exhibits high performance in both renewable energy and energy efficiency.<sup>cxlii</sup> (The energy access market is not evaluated for the US because access is already widespread). The RISE Index forms these assessments of investment readiness based on an evaluation of each country's planning, policies and regulations, pricing and subsidies, and procedural efficiency.

## Securitization Landscape

In the fiscal year ended 31 March 2014, Indian securitization volumes were INR 490 billion (approximately USD 7.35 billion), dominated by residential mortgage-backed securities (RMBS), auto loan asset-backed securities (ABS), and microloan ABS.<sup>cxliii</sup> In 2012, SKS Microfinance conducted its first securitization, then the largest done to date at INR 2 billion (USD 36.4 million). We were not able to find any consumer loan or credit card securitizations.

The Indian securitization market grew by 45 percent in fiscal year 2016 and is projected to continue growing into fiscal year 2017.<sup>cxliv</sup> Prior to this recent uptick, Indian securitization volumes had been declining yearly since 2007-2008 due first to the financial crisis and then to the regulations implemented in response to it in 2011-2012. RBI guidelines require that originators of loans with maturities over 2 years hold the loans for at least one year and thereafter retain at least 10 percent of the loan portfolio.<sup>cxlv</sup> RBI also requires that all NBFCs hold loans for at least 3 months prior to securitization.<sup>cxlvi</sup>

Investors in Indian securitizations include (primarily domestic) banks, mutual funds, and insurance companies.<sup>cxlvii</sup> RBI requires Indian banks to lend 40 percent of credit to priority sector lending (PSL) targets, which include housing, renewables, small and medium sized enterprises (SMEs), and agriculture.<sup>cxlviii</sup> Private banks that lack the origination and servicing infrastructure to lend to borrowers across the wide geographical range required by the PSL targets<sup>cxlix</sup> can meet the RBI requirement by purchasing an NBFC pass through certificates (PTC) backed by loans to PSL targets.

India's potential for cross-border securitization is still weak because of its relatively low sovereign rating of BBB-/A-3.<sup>cl</sup> However, efforts are being made to expand this potential. In May 2016, the RBI issued guidelines allowing foreign portfolio investors to invest in Indian-originated securitizations.<sup>cli</sup> In addition, India's masala bond (Indian rupee-denominated bonds issued in overseas capital markets) market is taking off. India's HDFC issued INR 30 billion (approximately USD 447 million) of masala bonds in July 2016 in London at an annual rate of 8.33 percent,<sup>clii</sup> becoming India's first issuer of masala bonds. In August 2016, NTPC Limited, India's largest energy conglomerate, issued the first masala green bonds from India,<sup>cliii</sup> raising INR 20 billion.<sup>cliv</sup> Indiabulls Housing Finance issued INR 13.3 billion of masala bonds in September 2016 at a rate of 8.75-8.85 percent, on which it will have to pay a 5 percent withholding tax for offshore transactions. Despite the tax, Indiabulls finds the issuance reasonable because of the access to a greater diversity of investors.<sup>clv</sup> India's Power Minister Piyush Goyal predicts that state-backed energy companies alone will issue an additional USD 1 billion in masala bonds in the UK in 2016.<sup>clvi</sup>

## Alternatives to Residential Building Market: SMEs

Commercial and industrial energy efficiency loans, especially loans to SMEs which are often large energy users (particularly in the foundry, brick, glass, and textile industries where energy constitutes a major input),<sup>clvii</sup> may also be worth considering for a WHEEL-type program in India;<sup>clviii</sup> there is already existing governmental support for energy efficiency in the commercial sector. In 2007, the Indian government developed the Energy Conservation Building Code (ECBC), which sets minimum energy standards for commercial buildings with a connected load 100kW and above.<sup>clix</sup> Requirements are imposed on the thermal envelope of a building, HVAC systems, water heating, lighting, and auxiliary systems.<sup>clx</sup> Furthermore, governmental agencies like IREDA have developed financing schemes to promote renewable energy. In July 2015, IREDA launched a commercial soft loan program for rooftop solar. The program awards loans to system aggregators and developers at interest rates of 9.9-10.75 percent,<sup>clxi</sup> which is lower than the typical 12-13 percent rate for commercial solar projects.<sup>clxii</sup>

A WHEEL program with an SME portfolio with small corporate obligors may be assigned ratings according to consumer ABS criteria rather than criteria for SME collateralized loan obligations (CLOs). In FitchRatings' opinion specifically, certain SME portfolios exhibit default risks similar to those of consumer loan portfolios.<sup>clxiii</sup>

# CHINA

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## Introduction/Summary of Findings

China would be a challenging market for a WHEEL-type program due to relatively low energy burdens and lack of widespread consumer credit scoring. However, some factors do favor a WHEEL-type program. Most Chinese own their homes (to the extent permissible under Chinese law), and China has a growing securitization market. The government appears to be committed to reaching its pledges on climate change, as evidenced by its 13th five-year plan (announced in March 2016) and current programs focused on energy efficiency. With sufficient support, a WHEEL-type program is feasible in China.

## Climate

China consists of many varying climates. (See Figure 14). Southern China is hot most of the year, while Northern China (including major cities Beijing and Shanghai) is accustomed to much colder temperatures.

**Figure 14: Climate Zone Map for China**



Source: Berkeley Lab (2014)<sup>cxiv</sup>

## Population

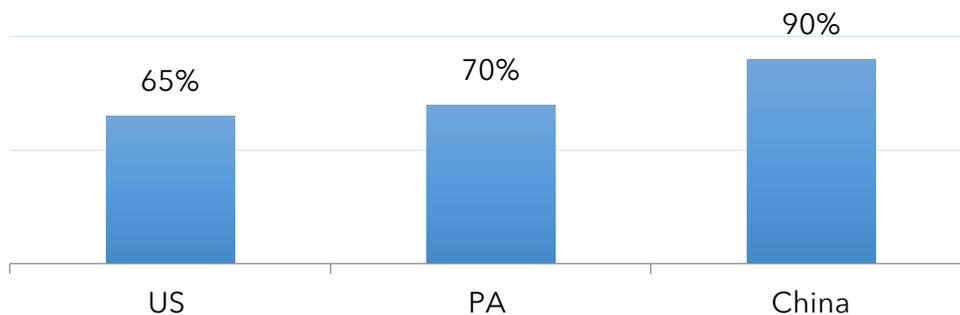
The Chinese population is large enough to support a WHEEL-type program even if participation rates in China were significantly lower than those in Pennsylvania due to differences in income and energy use. The National Bureau of Statistics of China estimates the current population of China to be almost 1.4 billion,<sup>clxv</sup> more than 4 times the estimated population of the United States and 100 times the population of the state of Pennsylvania.

## Single-Family Homeownership

Chinese homeownership rates are among the highest worldwide (90 percent in 2014).<sup>clxvi</sup> “Homeownership” in China is legally distinct from most other markets studied, however. Under a law enacted in the 1990s, Chinese homeowners own their building(s) and the right to live on a piece of land for 70 years, but at the end of the term, the government (the ultimate owner of all land in China) may or may not renew such rights.<sup>clxvii</sup> The Chinese government has not yet provided guidance on the renewal and extension process.<sup>clxviii</sup>

Formal statistics on the percentage of Chinese homeowners who own single-family homes versus multifamily homes are unavailable. Many urban Chinese live in multifamily buildings that are managed like commercial spaces so the residents have little role in maintenance of heating, cooling, windows and insulation. (See Figure 15).<sup>clxix</sup> Even so, high overall homeownership rates in China mean a robust potential market for a WHEEL-type program, particularly if it could address multifamily residents: there are approximately 1.2 billion Chinese homeowners<sup>clxx</sup> as compared to approximately 203 million US homeowners.

**Figure 15: Rates of Homeownership: China vs. US (2014)**



Source: US Census & Trading Economics/World Bank.

## Residential Energy Use

Residential electricity use is lower in China than in the US.<sup>clxxi</sup> Average monthly electricity consumption per household in 2014 was 132 kWh,<sup>clxxii</sup> or about one-seventh of that in the US (911 kWh). (See Figure 16). Appliances (refrigerators, air conditioners, clothes washers, televisions, and fans) make up the greatest share of Chinese household electricity use.<sup>clxxiii</sup> Residential energy use is dwarfed by that used in the commercial and industrial sectors, which make up 90 percent of total energy use in China.<sup>clxxiv</sup>

**Figure 16: Monthly Average Electricity Consumption in kWh: China vs. US (2014)**



Source: US Energy Information Agency & Enerdata.

### Residential Energy Pricing

Chinese residential electricity prices are considerably lower than American prices, whereas natural gas prices are similar. In 2014, residential electricity cost an average of USD 0.08 per kWh<sup>clxxv</sup> in China compared with USD 0.12 in the US. (See Figure 17). When adjusted for purchasing power parity (PPP),<sup>clxxvi</sup> 2014 Chinese electricity prices averaged USD 0.15 per kWh compared with USD 0.12/kWh in the US and USD 0.13/kWh in Pennsylvania. Between 3-8 percent of Chinese receive but do not pay for power.<sup>clxxvii</sup>

**Figure 17: Average Price per kWh of Electricity: China vs. US (2014)**

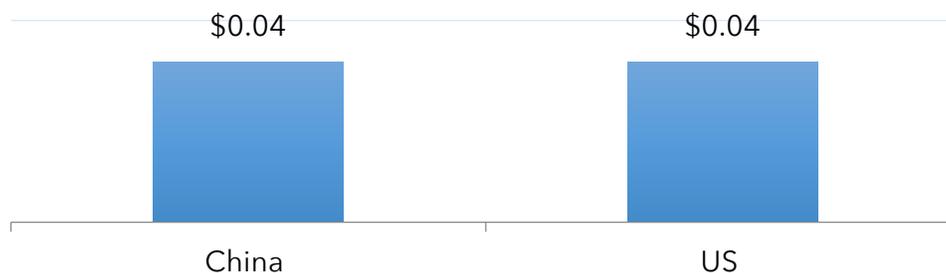


Source: US Energy Information Administration & International Institute for Sustainable Development.

Note: US figures assume average 2014 conversion rate of USD 1 = CNY 6.6.

Average natural gas prices in China are similar to those in the US following a pricing reform program launched in 2012 that increased historically low prices.<sup>clxxviii</sup> In 2014, both Chinese and Americans paid USD 0.04 per kWh for natural gas.<sup>clxxix</sup> (See Figure 18). After adjusting for purchasing power parity, however, natural gas prices in China averaged USD 0.08 per kWh in 2014, while Americans paid USD 0.04/kWh. Inexpensive district heating north of the Yangtze River<sup>clxxx</sup> results in low heating costs for many Chinese homeowners.

**Figure 18: Average Price per kWh of Natural Gas: China vs. US (2014)**



Source: US Energy Information Agency & China National Petroleum Corporation.  
Note: US figures assume average 2014 conversion rate of USD 1 = CNY 6.6 and 1 million BTU of natural gas = 293.0711 kWh.

## Residential Energy Burden

Average Chinese incomes are seven times lower than US incomes,<sup>clxxx</sup> resulting in higher Chinese PPP-adjusted electricity prices. Despite this, low energy consumption reduces the energy burden for Chinese residents relative to US residents. Monthly household energy costs in China are, nominally, only one-tenth of energy costs in the US. Indeed, the average US household consuming 911 kWh of electricity monthly at a rate of USD 0.12/kWh pays USD 109.32 in electricity bills per month. In contrast, the average Chinese household consuming 132 kWh of electricity at a PPP-adjusted rate of USD 0.15/kWh pays just USD 19.80 per month, less than one-fifth of the monthly energy costs incurred by the average US household.

Moreover, Chinese residents often use prepaid meters to pay for electricity,<sup>clxxxii</sup> and building management companies are often in charge of heating bills.<sup>clxxxiii</sup>

While an argument can be made that residential energy consumption (and concomitantly, residential energy burden) will likely grow as China becomes increasingly affluent, growth in energy demand has actually been slowing down in the past few years, perhaps due to slower economic growth. Total growth in energy demand dropped to 1.5 percent in 2015, a 17-year low.<sup>clxxxiv</sup> Growth in residential electricity consumption has been falling as well. Between 1980 and 2013, average growth rates were 13.5 percent a year; in 2014, residential electricity use grew just 2.2 percent.<sup>clxxxv</sup> Furthermore, the government has been actively trying to reduce energy usage. Its most recent five-year plan, published in March 2016, sets a cap on energy consumption, limiting it within 5 billion tonnes of standard coal equivalent by 2020.<sup>clxxxvi</sup>

## Eligible Measures; Energy Efficiency Rating System

Like the other countries studied, China has an existing energy efficiency rating system that would facilitate selection of measures to support if a WHEEL-type program were pursued. The China Energy Label Center (CELC) covers energy efficiency labels and standards for lighting and appliances (including HVAC).<sup>clxxxvii</sup>

Energy-efficient air conditioners are on average more expensive than standard ones, but the price differential is much smaller than that in India. For example, China's Hebei HuiLing Electric Appliance

Company sells some energy saving air conditioners for USD 187 and others for USD 299. Another company, Jiangsu Chuanglan, sells standard air conditioners for USD 185. China's largest e-commerce platform, Alibaba, allows customers to filter through appliances for obscure certifications (CE, RoHS, UL, etc.), but does not allow consumers to filter through products by simple energy efficiency labels such as the China Energy Label discussed below or other energy efficiency indicators expressed in layman's terms.

Similarly, heat pumps listed on the Appliances-China website<sup>clxxxviii</sup> have comparable prices. Heat pumps with a medium level of energy efficiency can be as inexpensive as USD 523 while standard models can be found for USD 500. However, the most energy-efficient heat pumps can be as costly as USD 2,896. Thus, in China, finding an energy-efficient HVAC appliance at a reasonable and comparable price to that of standard models is very possible, but the existence of a WHEEL-type program could provide further incentive to shift consumers toward more energy-efficient models.

### Consumer Credit Underwriting

The People's Bank of China maintains a national registry, the Credit Reference Center (CRC), which was developed in 2006 and has data on approximately 300 million out of more than 1.3 billion people;<sup>clxxxix</sup> this becomes an even higher proportion when considering only adults over 18 years of age. (See Appendix B for a sample credit report from the CRC). Banks and others considering lending to a Chinese homeowner may access credit reports with borrower consent.<sup>cx</sup> The CRC and other public credit registries cover about 90 percent of Chinese in total (see Figure 19) and include some repayment history,<sup>cxci</sup> outstanding credit and unpaid debts, as well as civil judgment, enforcement, and administrative penalty records.<sup>cxcii</sup> A recently-launched state-run website allows online inquiries for credit histories, tax avoidance, and failure to follow court rulings.<sup>cxci</sup>

However, most Chinese lack numeric credit scores, and there are few established private credit bureaus.<sup>cxci</sup> In January 2015, the government gave eight private companies permission to start credit rating agencies.<sup>cxci</sup> Alibaba and Tencent introduced a universal credit score with a range of between 350 and 950.<sup>cxci</sup> In addition, the Bank of China recently hired FICO to introduce credit scores. FICO is currently operating in China and had been focusing on customers not covered by the People's Bank of China, relying on criteria like phone and debit card use.<sup>cxci</sup>

Private credit bureaus that will use FICO or Alibaba/Tencent numeric scoring systems may lack access to traditional types of data used to compute such scores in Western countries, however. Private credit bureaus like Sesame Credit Management (created by Alibaba's financing arm) obtain some consumer repayment history information from Alipay (Alibaba's third party payment site) on late payments for online orders, commercial data that Tencent collects from WeBank (China's first online bank) and its brokerage, and payment of utility bills. However, these emerging private credit bureaus may also look to criteria that differ substantially from those used by Western credit agencies, including political views,<sup>cxci</sup> social networking profiles (under a "birds of a feather flock together" theory), and online purchasing behavior.<sup>cxci</sup>

Given that few Chinese have numeric credit scores and the scoring systems themselves have little track record of demonstrating success in predicting a consumer's likelihood of repaying a loan, the

quick application and approval process that has helped drive utilization of WHEEL in the US would likely not yet be possible. While alternative approaches may be used, this is a significant hurdle in replicating a WHEEL-type program in China.

**Figure 19: Consumer Coverage by Credit Bureaus: China vs. US (2015)**



Source: World Bank/Trading Economics.

### Credit Card Penetration and Utilization

Credit card usage demonstrates that consumers are willing to borrow and that there is a functional unsecured consumer lender underwriting framework in place. In this regard, Chinese credit card figures are somewhat encouraging. Credit card penetration and utilization is concentrated in major urban areas in China. A number of credit card companies are active, including UnionPay,<sup>cc</sup> Citic Bank, MYbank,<sup>cci</sup> Visa, Mastercard, and American Express,<sup>ccii</sup> although UnionPay is the dominant player. In 2015, there were 597 million active credit cards in use.<sup>cciii</sup>

Household savings may suggest greater hesitation toward consumer purchases such as some home energy improvements, or may be a good indicator of the availability of domestic funds for capital investment in the home. The 2013 household savings rate in China is 38.46 percent, much higher than the household savings rate in the US (4.97 percent).<sup>cciv</sup>

### Existing Financing Options for Residential Energy Improvements

As in most of the markets studied, we have not found any specialized energy efficiency financing options with widespread availability in China. Chinese homeowners do have a number of general financing options that may be utilized for home energy efficiency improvements, but most existing options are limited to fairly short terms. (See Figure 20).

For example, Chinese homeowners can take out personal home improvement or renovation loans that can be used for energy efficiency projects. Banks offering these general financing options include the Bank of China,<sup>ccv</sup> China Development Bank,<sup>ccvi</sup> Bank of Guizhou,<sup>ccvii</sup> and the Industrial and Commercial Bank of China.<sup>ccviii</sup> In addition, China has very large department stores that sell appliances, some of which offer credit cards.<sup>ccix</sup> The Beijing Sogo department store, for instance, was one of the first to offer consumer credit cards, which are valid for one year, do not require collateral or an initial payment, and are interest-free.<sup>ccx</sup> In other places, regional credit management consultants like Hua Xia Credit International have helped Chinese department stores set up credit systems to offer customers consumer credit cards.<sup>ccxi</sup>

**Figure 20: Existing Home Efficiency Financing Options in China**

Type	Security or Collateral	Maximum Amount	Typical Interest Rate Range	Typical Term	Speed & Simplicity of Application & Approval Process
Home Improvement Loan	Mortgage, pledge, surety bond, credit, combined guarantee or partial guarantee	CNY 1 million (USD 152,000) <sup>3</sup>		Up to 5 years	
Personal Entrusted Loan	Mortgage, pledge, guarantee, or combinations	Minimum CNY 10,000 (USD 1,520)	0-400% of PBOC's benchmark rate		
Personal Credit Loan	No	Up to CNY 500,000 (USD 76,000)	Based on published PBOC rate	Up to 3 years	
Personal Credit Consumer Loan	No	CNY 600-300,000 (USD 91-46,000)	As low as 6.9%	Up to 2 years	Loan is credited soon after a self-service application
Personal (Mortgage) Pledge Loan	Pledges include mortgage, bank deposit, treasury bond, financial products, gold, life insurance policy, precious metals	CNY 4-25 million (USD 608,000-3.8 million)	Set based on published PBOC rate	3-5 years, longer for VIP customers	
Personal Housing Provident Fund	Bank-recognized asset like house or other property for mortgage or pledge or a third party person or entity as the guarantor	Limit based on monthly contribution to the provident fund; not to exceed CNY 300,000 (USD 46,000) or 80-90% home purchase price		Set by local provident fund management center, up to 30 years	
Easy Loan (holders of ICBC debit/credit cards)	No	CNY 200,000 (USD 30,400)	10% higher than the benchmark rate set by PBOC	Up to 3 years (6 months, 12 months, 24 months, 36 months)	Immediate
Store-based Credit Cards	No		0%	1 year	Very simplified, with no restrictions on purchases

Source: Industrial and Commercial Bank of China; Bank of China; Bank of Guizhou

<sup>3</sup> <https://www.oanda.com/currency/converter/>

## Possible Sources of Credit Enhancement

China pledged to reduce its greenhouse gas emissions by 60-65 percent by 2030 compared with 2005 levels and to source 20 percent of its energy from low-carbon sources.<sup>ccxii</sup> The Chinese government expressed an intention in its pledge to the UN Framework Convention on Climate Change to use public-private partnerships to help with new financing mechanisms to aid low-carbon development. China's 13th five-year plan aims to reduce energy intensity by 15 percent between 2016 and 2020.<sup>ccxiii</sup>

In addition to pending initiatives in support of climate goals, China has existing programs that demonstrate the potential for collaboration in a WHEEL-like program. For example, the National Development and Reform Commission sets efficiency targets for the building, industrial, and transportation sectors.<sup>ccxiv</sup> The central and local governments have special funds dedicated to energy conservation projects and energy-saving products such as lighting.<sup>ccxv</sup> Implementation of energy-efficient labeling for household appliances and other consumer products as well as metering systems for household heating are part of this program. The government also provides direct subsidies to manufacturers to reduce the cost of energy-efficient air conditioners.<sup>ccxvi</sup>

The nonprofit China Council for International Cooperation on Environment and Development recently made a recommendation to establish a China Green Bank that would provide equity to improve access to financing for energy efficiency and other green projects.<sup>ccxvii</sup> Similar to KfW in Germany, a China Green Bank could provide low-cost capital to community banks, which could lend to homeowners for energy efficiency projects.

Support for a WHEEL-type program may also come from the NDB. Of the USD 811 million in green energy loans that NDB rewarded in April 2016, China's Shanghai Lingang Hongbo New Energy Development Co. received USD 81 million to finance 100 megawatts of rooftop solar.<sup>ccxviii</sup> Other potential sources of capital include the Asian Development Bank, which has pledged to double its annual climate financing by 2020 and is committed to supporting energy efficiency and resiliency measures.<sup>ccxix</sup>

Finally, the World Bank Multilateral Investment Guarantee Agency (MIGA) may be a source of credit enhancement as it encourages foreign direct investment in developing countries (including China) by offering insurance against losses relating to currency inconvertibility and transfer restrictions, expropriation, war, terrorism and civil disturbance, breach of contract, and non-honoring of financial obligations.<sup>ccxx</sup>

## Possible Sources of Senior Capital During Aggregation Period (Warehousing)

China has a Green Credit Policy Initiative, established by the China Banking and Regulatory Commission, Central Bank and Ministry of Protection, to encourage Chinese banks to finance climate-friendly projects including energy efficiency initiatives.<sup>ccxxi</sup> Potential sources of senior capital during aggregation include the Industrial Bank and Shanghai Pudong Development Bank (SPD Bank), both of which have issued green bonds.<sup>ccxxii</sup> The China Development Bank is also focused on sustainable infrastructure initiatives, including green buildings and water efficiency.

## Debt Collection Process

According to the World Bank Ease of Doing Business Index, China ranks very close to the top of the 189 countries with respect to ease of contract enforcement, with a rank of 7. The average number of days to resolve a lawsuit from filing to actual payment is 406 days, of which it takes an average of 190 days to enforce a judgment.

## Securitization Landscape

China's securitization market has expanded rapidly over the past several years. In 2014, issuances totaled USD 50 billion, a twelvefold increase from the previous year and double the amount of total historical securitization issuances.<sup>ccxxiii</sup> According to Moody's Investor Service, consumption-driven assets, including credit-card asset-backed securities (ABS), are becoming an important asset class in Chinese structured finance.<sup>ccxxiv</sup> For the first quarter of 2016, total consumer loan/credit card issuance increased from the last quarter in 2015.<sup>ccxxv</sup>

A vast majority of the Chinese securitization market is concentrated in collateralized loan obligations (CLOs), but there has been a recent increase in auto loan ABS.<sup>ccxxvi</sup> Investors in auto loan securitizations, which share many similarities with unsecured residential energy efficiency loans, could be interested in WHEEL-type securities, and we can expect particular growth in car sales in the future. Currently, only 20 percent of Chinese residents own cars compared to 95 percent in the US.<sup>ccxxvii</sup> In addition, 2016 saw the first Chinese solar ABS issued for CNY 1 billion (USD 152 million).<sup>ccxxviii</sup> Common investors in Chinese credit asset-backed securitizations (CABS) include banks and other financial institutions.<sup>ccxxix</sup> China Merchant Bank and Bank of China have also done non-performing loans securitizations at an average asset price of 27 percent. Two years ago, non-performing loans in China stood at USD 646 billion; by the first quarter of 2016, this amount had more than doubled to USD 1.4 trillion.<sup>ccxxx</sup>

New regulations in 2016 regarding foreign access to the China domestic interbank bond market (CIBM) offer promise for China's securitization landscape. According to the new regulations, investment quotas for eligible foreign investors under the qualified foreign investor investment (QFII) and renminbi qualified foreign investor investment (RQFII) schemes will be eliminated. In addition, foreign investors will no longer be limited to cash bonds and will be allowed to participate in onshore interest derivatives. Despite more open regulations, there remain some barriers. There is a 10 percent withholding tax on interest earned by QFII and RQFII investors. In addition, foreign financial institutions cannot participate in the interbank foreign exchange market without a license, which means that investors likely have to look to offshore markets instead to limit foreign currency risks.<sup>ccxxxi</sup>

Two legal frameworks for securitization might be utilized for a WHEEL-type program in China: CABS, which includes loans for clean energy, infrastructure, and housing projects, and ABS, which focus more on property rights including real estate and receivables. CABS are issued by banks and have more traction with international investors. ABS are issued by non-bank entities, including securities companies and subsidiaries of fund management companies.<sup>ccxxxii</sup>

In a CABS issuance, the financial institution sponsor establishes a special purpose trust (SPT), the issuing entity, and enters into an agreement with a trustee. The trustee, a licensed trust and investment company, then appoints a servicer and a custodian. CABS, which are regulated by the China Banking Regulatory Commission (CBRC) through their Administrative Rules and Regulations, require ratings from two agencies. If they are issued, traded, and transferred among a specific group of investors, then no rating is required. By contrast, ABS in China do not require ratings.<sup>ccxxxiii</sup> WHEEL loans could be issued under either category, but a bank partner and the CABS structure may be required to receive a rating.<sup>ccxxxiv</sup>

China is also a leader in green bond issuance as the largest issuing country in the world. A majority of these bonds are dedicated to transport: the single largest issuer is China Railway Corporation with USD 194 billion.<sup>ccxxxv</sup> In addition to this, the Chinese government announced that it would issue USD 46 billion of green bonds in 2016,<sup>ccxxxvi</sup> up from USD 44 billion in 2015,<sup>ccxxxvii</sup> continuing a growing trend in China. The People's Bank of China gives green bond issuers and investors more tax breaks and lower risk weightings and interest rates than any other central bank.<sup>ccxxxviii</sup>

Issuance of panda bonds, RMB-denominated bonds sold onshore in the CIBM,<sup>ccxxxix</sup> has also seen steady growth in the first half of 2016, but has been restricted by a lack of genuine foreign investors. Foreign issuers have been deterred from panda bond issuance because of uncertainty over the ability to repatriate proceeds offshore, as China has been severely limiting capital outflows in response to slowing economic growth.<sup>ccxl</sup> Additionally, requirements that all financial statements be translated to Chinese and conformed to Chinese accounting standards have imposed burdensome monetary and time costs on potential issuers,<sup>ccxli</sup> further disincentivizing participation in panda bond issuance. However, Chinese regulators are aware of these deterrents and are working to resolve and clarify these issues in the coming months.<sup>ccxlii</sup>

## Alternatives to Residential Building Market: SMEs and Electric Vehicles

Low residential energy burdens in China present a challenge for a traditional WHEEL-type program.<sup>ccxlili</sup> Homeowners may only be interested in energy-efficient upgrades if an old appliance or system has broken and the efficient item is less expensive (after financing and incentives are taken into account, but without considering energy cost to run it).

Commercial energy efficiency loans may be a better fit. Small- to medium-sized enterprises (SMEs) often have trouble getting loans and receive high interest rates of 15-20 percent; state-owned enterprises can get much lower rates of 4-5 percent.<sup>ccxliv</sup> Energy bills typically make up one-third of production costs of SMEs in China, and SMEs have subsequently become eager to launch energy conservation efforts that reduce energy expenses in the face of rising production costs and growing competition. Still, energy-efficient SMEs in China remain rare.

A WHEEL-type program with an SME portfolio and small corporate obligors may be assigned ratings according to consumer ABS criteria rather than criteria for SME CLOs. In FitchRatings' opinion specifically, certain SME portfolios exhibit default risks similar to those of consumer loan portfolios.<sup>ccxlv</sup>

# BRAZIL

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## Introduction/Summary of Findings

Brazil is a potentially strong market for a WHEEL-type program if economic and political forces continue to stabilize. Single-family homeownership is high, and Brazilian homeowners face considerable energy burdens due to high electricity prices and recent subsidy reductions. Like most countries studied, Brazil lacks a segregated primary loan market for residential energy efficiency loans. Yet Brazilians do show a willingness to take on debt to make home improvements, and Brazilian consumer creditworthiness is becoming easier to assess. Since credit scores were introduced in 2011, numeric scores have become more common; almost three-quarters of Brazilians are covered by credit registries. Brazil also has an established, although perhaps limited, securitization market.

Existing government-sponsored energy efficiency programs demonstrate possible sources of credit enhancement. However, the tenuous political environment and a weak economy might make it difficult for the government to make good on its climate change pledges.<sup>4</sup> The 2016 vote to impeach President Dilma Rousseff, which resulted in the ascension of Vice President Michel Temer to President, has been well received by global financial markets and provided some political stability that may improve Brazil's economic outlook.<sup>ccxlvii</sup> On the other hand, Temer's recent proposal to limit public spending through a constitutional amendment<sup>ccxlviii</sup> might deter state investment in a WHEEL-type program.

## Climate

Brazil experiences relatively high average annual temperatures, with large equatorial and tropical regions. (See Figure 21). Its capital, Brasilia, is located in a high altitude tropical region, while two major cities - Rio de Janeiro and Sao Paulo - are situated in Atlantic tropical areas. Because of the warm temperatures in Brazil, heaters are rarely found in Brazilian households, but water heating and space cooling are relevant.

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<sup>4</sup> Following the Senate vote to impeach President Dilma Rousseff, Environmental Minister Izabella Teixeira was fired. Ms. Teixeira played an instrumental role in Brazil's negotiations over and commitment to the Paris Agreement. See <http://www.eenews.net/climatewire/stories/1060037647>.

Figure 21: Climate Zone Map for Brazil



Source: Brazil My Country<sup>ccxlvii</sup>

## Population

The population of Brazil is significantly larger than the 60 million threshold the Pennsylvania WHEEL experience suggests as a minimum population size for success, putting aside demographic differences. The Brazilian Institute of Geography and Statistics (IBGE) estimates the current population of Brazil to be over 204 million,<sup>ccxlviii</sup> or about 63 percent of the current population of the United States and 16 times the estimated current population of the US state of Pennsylvania.

## Target Market

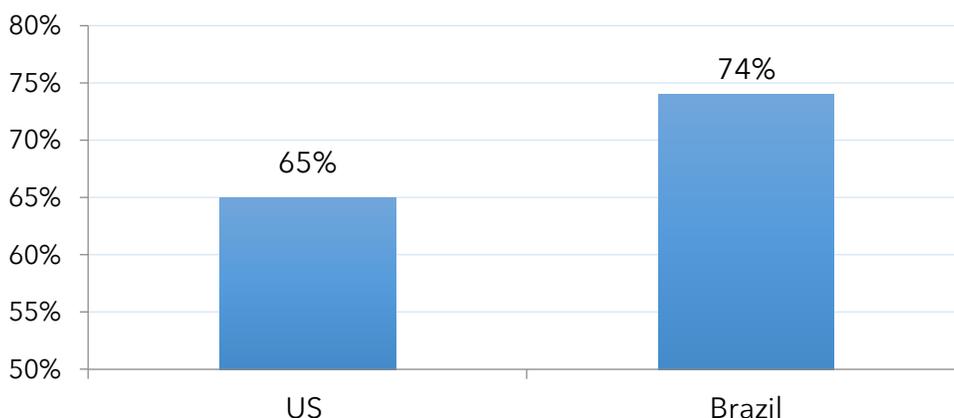
Brazilians, including those in low-income households, are interested in energy-efficient upgrades. Many have experienced receiving such improvements completely free of charge through local initiatives like refrigerator and light bulb exchange programs that cover both the cost of installation and the cost of the appliance.<sup>ccxlix</sup> Experience with such programs in the past may undermine Brazilian consumers' willingness to self-finance energy efficiency improvements.<sup>cc</sup>

Brazil instituted net metering in April 2012 with ANEEL Resolution 482,<sup>ccli</sup> which was revised in March 2016 to increase the attractiveness of the resolution to consumers.<sup>cclii</sup> According to the new provisions instituted in 2016, consumers that install small generators like solar panels or microturbines and return excess energy to the grid can receive utility bill credits for the value of the power generated to lower their next month's electricity bills. This system provides a timely opportunity to work with home energy contractors to offer a comprehensive financing tool to facilitate their work.

## Single-Family Homeownership

Brazilian homeownership rates are higher than those in the US. The Brazil Institute of Geography and Statistics (IBGE) estimates that in 2010, approximately 74 percent of Brazilians owned homes,<sup>ccliii</sup> whereas 65 percent of Americans were homeowners during the same period.<sup>ccliv</sup> (See Figure 22). The IBGE also indicates that in 2010 approximately 91 percent of Brazilians were living in single-family homes.<sup>cclv</sup> This high percentage of single-family homeowners suggests a big market of potential borrowers. However, continuing economic hardship in Brazil may reduce this market size as homeowners are unwilling to make investments in energy efficiency or otherwise in times of instability. Still, Brazil has seen energy efficiency investments in wealthier homes and condominiums.<sup>cclvi</sup>

**Figure 22: Rates of Homeownership: Brazil vs. US (2010)**

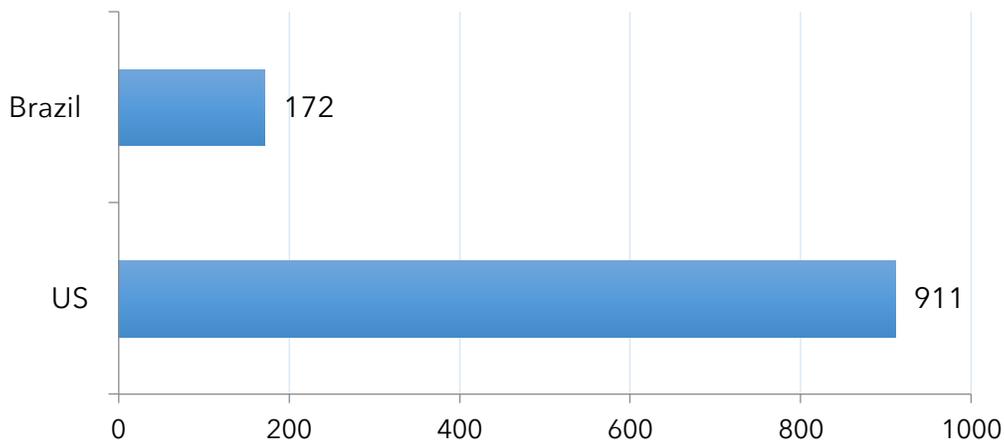


Source: US Census (2010, 2014) & Brazil Institute of Geography and Statistics (2010).

## Residential Energy Use

The average Brazilian household uses significantly less energy than the average American household. In 2014, average monthly US residential electricity consumption per household (911 kWh) was over five times higher than consumption in Brazil (172 kWh).<sup>cclvii</sup> (See Figure 23). A typical Brazilian household might use electricity to power a refrigerator, television, or washing machine.<sup>cclviii</sup> Space heaters are uncommon in Brazil. Although many homes use electricity to heat water in the kitchen sink and bathrooms, ovens and stoves typically use gas.<sup>cclix</sup>

**Figure 23: Monthly Average Electricity Consumption in kWh:  
Brazil vs. US (2014)**



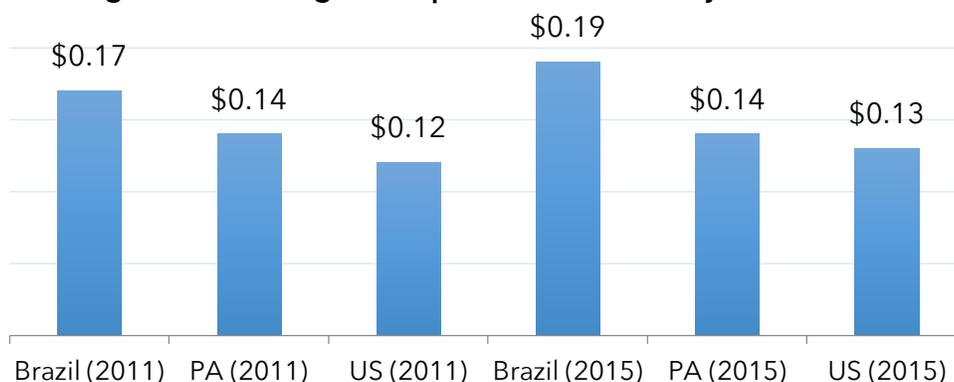
Source: US Energy Information Agency & EPE.

### Residential Energy Pricing

Brazilians face considerably higher electricity prices than Americans. In 2011, electricity cost on average USD 0.17 per kWh<sup>cclx</sup> compared with USD 0.12/kWh in the US and USD 0.14/kWh in Pennsylvania. The substantially depressed Brazilian real—which hit a historical low against the US dollar in 2015 due to an economic crisis with high levels of unemployment, high interest rates, and rising default rates—factors into the comparative costs of electricity bills. Electricity rates in 2015 were on average USD 0.19 per kWh (BRL 598.91 per MWh)<sup>cclxi</sup> compared with USD 0.13 in the US and USD 0.14 in Pennsylvania.<sup>cclxii</sup> (See Figure 24). Average natural gas prices are lower in Brazil, however. Brazilians paid USD 0.01 per kWh for natural gas in 2014,<sup>cclxiii</sup> while Americans paid USD 0.04/kWh. (See Figure 25). When adjusted for purchasing power parity using 2011 figures, Brazilians paid USD 0.27 per kWh of electricity compared with USD 0.12/kWh in the US and USD 0.14/kWh in Pennsylvania. For 2015 figures, Brazilians paid USD 0.33 per kWh compared with USD 0.13/kWh in the US and USD 0.14/kWh in Pennsylvania. Natural gas cost on average USD 0.016 per kWh, compared to USD 0.04/kWh in the US.

Energy and water bills are increasing due to the government's reduction in subsidies in 2015 to balance the federal budget in the face of a continuing economic crisis. The end of the Provisional Measure 579, which transferred approximately BRL 10 billion annually to the electric sector from the national Treasury, caused increases in customer tariffs by approximately 40 percent.<sup>cclxiv</sup> In the first quarter of 2015, the subsidy reductions resulted in electricity price increases for many consumers of as much as 50 percent. In Rio, for example, residential electricity bills increased in January and February of 2015 by two to five times the normal amount as a result of unusually intense summer heat, a drought causing a lack of water in hydroelectric plants, and rising energy costs – such as the 46 percent price increase for electricity generated from the bi-national Itaipu dam.<sup>cclxv</sup> Nonpayment of energy bills subsequently rose by as much as three times previous rates.<sup>cclxvi</sup> This suggests that Brazilians may be motivated to undertake home energy efficiency improvements to relieve some of this energy burden.

**Figure 24: Average Price per kWh of Electricity: Brazil vs. US**



Source: US Energy Information Agency & International Energy Agency & ANEEL.

Note 1: Brazil figures do not distinguish between residential and commercial rates.

Note 2: Brazilians prefer to provide BRL figures because the exchange rate has been very volatile the last 2 years. US figures assume 2015 conversion rate of BRL 1 = USD 0.31.

**Figure 25: Average Price per kWh of Natural Gas: Brazil vs. US (2011 & 2014)**



Source: US Energy Information Agency & Index Mundi.

Note: Brazil figures do not distinguish between residential and commercial rates.

## Residential Energy Burden

The energy burden for Brazilian residents is considerably greater than it is for the average American. Energy bills are high, particularly for electricity, despite lower consumption levels than in the US. In 2011, Brazilians paid 2 cents more per kWh of electricity and natural gas (USD 0.18) combined than Americans (USD 0.16), while the average Brazilian income is more than three times lower than the average in the US.<sup>cclxvii</sup>

## Eligible Measures; Energy Efficiency Rating System

Brazil has an established energy efficiency rating system that would facilitate the selection of measures to support a WHEEL-type program. The Brazilian Labeling Program (PBE) created the National Energy Conservation Label (ENCE), which focuses on energy efficiency ratings.<sup>cclxviii</sup> Labeled products, including heaters, air conditioners, and appliances, receive seals from either the National Program for Energy Conservation (PROCEL) or the Rational Use of Oil Products and Natural Gas Program (CONPET). Public buildings also receive an energy efficiency rating through PBE Edifica. In addition, the Brazilian National Electric Energy Agency (ANEEL) supports a label similar to the US Environmental Protection Agency's ENERGY STAR label.<sup>cclxix</sup>

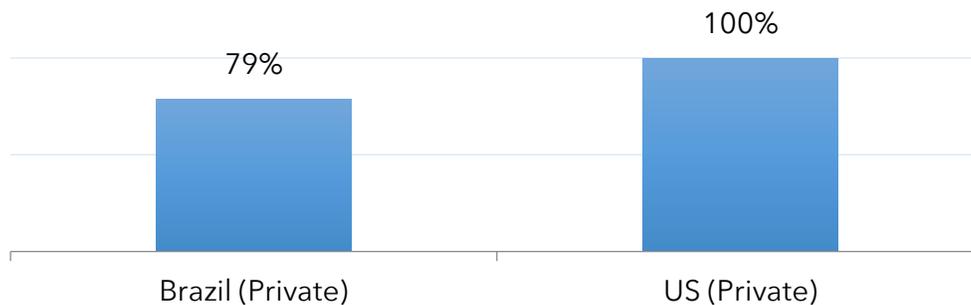
In Brazil, the price differential between efficient systems and inefficient ones is not as great as it is in India or China. Energy-efficient and standard air conditioners are both priced at comparable levels on Casas Bahia’s website, one of Brazil’s largest appliance stores.

### Consumer Credit Underwriting

Consumer credit scores are less common in Brazil than in the US due to a relatively new numeric credit rating system. The World Bank estimates that, in 2015, 79 percent of Brazilians were covered by private credit bureaus, compared with 100 percent of Americans.<sup>cclxx</sup> (See Figure 26). In the absence of independent credit scores, lenders have historically assessed creditworthiness based on whether consumers are paying their debts and reviewed only negative credit history.<sup>cclxxi</sup> For instance, credit reports indicate unpaid debts owed to cellular phone or car rental companies.<sup>cclxxii</sup> Even without credit scores, this system does act as a deterrent to nonpayment. Credit bureaus such as SPC and Serasa-Experian often report nonpayments disputed by the consumer and can take a long time to clear paid debts from a consumer’s report.<sup>cclxxiii</sup> Lenders have been allowed to assign internal credit scores, but they cannot share them with other banks or the individual consumer.<sup>cclxxiv</sup>

In 2011, the Brazilian Central Bank approved the creation of a positive credit registry.<sup>cclxxv</sup> This legislation<sup>5</sup> permits credit bureaus (with consumer consent) to form a database with positive consumer credit history, instead of just delinquency and nonpayments. This emergent credit rating system and relatively high level of coverage by the traditional bureaus provide a positive foundation for future consumer credit underwriting for WHEEL. (See Appendix B for an example of a Brazilian consumer credit report generated in 2016).

**Figure 26: Consumer Coverage by Credit Bureaus: Brazil vs. US (2015)**



Source: World Bank/Trading Economics.

### Credit Card Penetration and Utilization

Credit card utilization is well established in Brazil. A number of credit card companies are active in Brazil, including: Visa, Mastercard, Cabal,<sup>cclxxvi</sup> Elo, Good Card, Verdi Card, BanriCard, Discover, Diners Club, and American Express.<sup>cclxxvii</sup> In 2013, there were 82.6 million active credit cards in use.<sup>cclxxviii</sup>

<sup>5</sup> Federal Law 12414/2011, regulated by Federal Decree 7829/2012 and Monetary Council (CMN) Resolution 4172/2012.

Economic instability and increasing unemployment resulted in slowed consumer lending in 2015 and very high interest rates on credit cards.<sup>cclxxxix</sup> As of April 2015, over 55 million Brazilians or approximately 37 percent of the adult population were behind on credit card or loan payments.<sup>cclxxx</sup>

In addition, the household savings rates in Brazil is very low (5 percent in 2012) and comparable to those of the US (4.97 percent in 2013).<sup>cclxxxi</sup>

**Existing Financing Options for Residential Energy Improvements**

Brazilians interested in making home energy improvements have some financing options. For example, Brazilian home improvement stores like Leroy-Merlin and appliance stores like Casas Bahia offer financing. Stores usually do so through three options: regular credit cards, store-branded credit cards, and ConstruCard.<sup>cclxxxii</sup> (See Figure 27). Use of regular credit cards, like Visa and MasterCard, allow 6-10 interest-free monthly installments. Store-branded cards, which usually have Visa or MasterCard seals, allow 12-24 monthly installments at 1.99 percent interest per month, for a total of approximately 24 percent per annum. Finally, ConstruCard, which is issued by banks including Bank of Brazil and Caixa Econômica and accepted by accredited home improvement stores, allows as many as 60 installments. Interest rates for ConstruCard are around 15-20 percent per annum,<sup>cclxxxiii</sup> which is quite inexpensive considering that Brazil’s five-year government bonds have interest rates of 12-14 percent.<sup>cclxxxiv</sup> Credit limits for the ConstruCard, however, are approved by banks rather than home improvement stores.<sup>cclxxxv</sup>

In addition, Ashoka’s Housing for All Initiative provides low-income households access to credit for home improvements to improve their standard of living.<sup>cclxxxvi</sup> They provide these services in collaboration with partners including Brazil’s Banco do Nordeste, a state-owned development and commercial bank that operates in Brazil's Northeastern region and runs Brazil’s largest microfinance program, CrediAmigo. Banco do Nordeste underwrites the loans.<sup>cclxxxvii</sup>

None of these options appear to segregate energy efficiency loans from other types of borrowing, as is needed for WHEEL, but they demonstrate the feasibility of finance programs in Brazil generally.

**Figure 27: Existing Home Efficiency Financing Options in Brazil**

Type	Security or Collateral	Typical Interest Rate Range	Typical Term
Credit Card	No	0%	6-10 months
Store-based Credit Cards	No	1.99% per month (approx. 24% per annum)	12-24 months
ConstruCard	No	15-20% per annum	Up to 60 months

## Existing Contractor Networks

Brazil's established contractor networks<sup>6</sup> include energy efficiency and distributed solar installers.<sup>ccclxxxviii</sup> The residential solar PV installation market is growing.<sup>ccclxxxix</sup> Useful partners for recruiting contractors to use a WHEEL-type tool include: the Brazilian Photovoltaic Solar Energy Association (ABSolar), a nonprofit and trade association that coordinates stakeholders across the solar PV industry,<sup>ccxc</sup> the Brazilian Association of Energy Conservation Service Companies (ABESCO), a nonprofit that brings together Energy Conservation Services Companies (ESCOs) and represents the the Brazilian energy efficiency sector,<sup>ccxc</sup> and the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), an international association that covers contractors in Brazil working on residential, energy efficiency retrofits.<sup>ccxcii</sup> The Brazilian Chamber of Construction (CBIC) is another potential resource. CBIC is an associate of the Confederation of International Contractors' Associations (CICA), a trade association focused on energy efficiency, green construction, and reduction of the industry's carbon footprint.<sup>ccxciii</sup>

## Possible Sources of Credit Enhancement

Brazil pledged to reduce its greenhouse gas emissions by 37 percent by 2025 compared with 2005 levels and by 43 percent by 2030.<sup>ccxciv</sup> In order to realize these pledges, public investment is likely to be needed, but to date no specific programs have been announced. Efforts to meet these pledges on climate change have been stymied by ongoing political turmoil (including the impeachment of President Dilma Rousseff), recession, and a corruption scandal at state-owned Petrobras.<sup>ccxcv</sup> The pending national action plan should provide clarity on public investments necessary to reach these targets, but it is four years overdue.<sup>ccxcvi</sup>

In addition to potential initiatives to achieve Brazil's pledge, there are existing programs that might be interested in the WHEEL approach. First, energy efficiency laws (Federal Law 9.991/00 & Law 12.212/10) require utilities to set aside 0.5 percent of net annual revenue for energy efficiency projects of which 60 percent must go to low-income households.<sup>ccxcvii</sup> In the past, those funds have been used for various grant/rebate/finance programs administered by ANEEL to encourage low-income residents to replace inefficient refrigerators, air conditioners, and electric showers.<sup>ccxcviii</sup> Second, Eletrobrás administers the National Electrical Energy Conservation Program (PROCEL) that in the past has promoted energy-efficient lighting and appliances in residential buildings.<sup>ccxcix</sup>

The NDB is a possible source of credit enhancement for a WHEEL-type program as well. Of the USD 811 million in green energy loans that NDB rewarded in April 2016, Brazil's Banco Nacional de Desenvolvimento Econômico e Social (BNDES) received the largest share: USD 300 million to fund 600 megawatts of renewable energy projects.<sup>ccc</sup> BNDES will start to scale back lending for infrastructure as Temer's administration moves toward privatizing many of its existing projects,<sup>ccci</sup> so a public-private partnership approach such as WHEEL might be of interest.

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<sup>6</sup> For construction in general, there are many green certified contractor networks. These are usually associated with green building certifications like LEED and Acqua.

As mentioned above, energy subsidies for businesses and consumers have been on the decline. In 2015, electricity prices increased by 50 percent in some regions while defaults on energy bills tripled.<sup>cccii</sup> The population of ratepayers at risk of inability to pay energy bills therefore is likely to increase. Facilitating programs, which help to decrease energy bills and nonpayment rates by reducing energy consumption from old appliances and inefficient homes, will likely experience an increase in utility interest as well.

Finally, the World Bank Multilateral Investment Guarantee Agency (MIGA) encourages foreign direct investment in developing countries (including Brazil) by offering insurance against losses relating to currency inconvertibility and transfer restrictions, expropriation, war, terrorism and civil disturbance, breach of contract, and non-honoring of financial obligations.<sup>ccciii</sup>

## Possible Sources of Senior Capital During Aggregation Period (Warehousing)

Potential partners include: Caixa Econômica Federal, Banco do Brasil, Banco do Nordeste do Brasil (BNB), the Inter-American Development Bank (IADB), and the BRICS New Development Fund. The IADB is focused on green-investment efforts that include securitizations of assets backing environmentally-friendly projects.<sup>ccciv</sup> In September 2016, IADB issued USD 2.1 billion in AAA-rated bonds.<sup>cccv</sup>

The most active banks in debt capital markets in Latin America include Santander, JPMorgan, Bank of America Merrill Lynch, Citi, and HSBC.<sup>cccvi</sup> Citi, which partnered with WHEEL in the United States, is selling its consumer credit card business in Brazil, and as such may be less interested in partnering on a WHEEL-type program there.

## Debt Collection Process

According to the World Bank Ease of Doing Business Index, Brazil ranks 45<sup>th</sup> out of 189 countries with respect to ease of contract enforcement. The average number of days to resolve a lawsuit from filing to actual payment is 731 days, of which it takes an average of 210 days to enforce a judgment.

## Securitization Landscape

The securitization market in Brazil exists (USD 10.5 billion in 2011<sup>cccvii</sup>) but is limited and fairly illiquid.<sup>cccviii</sup> The Brazilian bond market continues to be dominated by sovereign bonds with few private issuers.<sup>cccix</sup> Domestically, mortgages appear to be the most common type of asset-backed securitization product, but Bloomberg listings for Brazil may not reflect the full breadth of the market.<sup>cccix</sup> We have not been able to find an example of a credit card or unsecured consumer loan securitization in Brazil that might serve as a model for a WHEEL-type transaction. The larger Latin American securitization market is similarly limited. The cross-border market for traditional securitizations is small and is dominated by esoteric ABS. There is a “buyer beware” sentiment attached to Brazilian and Latin American markets because of a lack of liquidity.<sup>cccxi</sup>

Climate-aligned bonds are still a small, but growing, share within the securitization market. As of May 31, 2016, Climate Bonds Initiative (CBI) identified USD 2.4 billion of climate bonds. A majority of these bonds (54 percent) are committed to funding transport improvements, while the rest are

split evenly between the renewable energy sector and multisector, which funds water and energy efficiency projects.<sup>cccxi</sup>

The introduction of two regulations in 2012, Resolution 3533 from the Brazilian Central Bank and Instruction 489 from the Comissão de Valores Mobiliários, may have changed the landscape of securitization in Brazil. Under these rules, transactions with thick equity tranches no longer receive off-balance sheet treatment.<sup>cccxiii</sup> As of June 2016, there has been a slowdown in Brazil's securitization market. Smaller securitization companies may leave the market, reducing the number of securitization trustee companies in Brazil and further concentrating an already very concentrated market.<sup>cccxiv</sup>

Despite the downward trend in issuances, the Brazilian securitization market continues to see transactions, including through the fairly common receivables investment fund structure, called Fundo de Investimento em Direitos Creditórios (FIDC).<sup>cccxv</sup> Mutual investment funds that invest at least 50 percent of net assets in FIDCs are a common securitization option for infrastructure projects and might be a relevant model here.<sup>cccxvi</sup> FIDCs are receivables-backed funds that include pools of credit cards, auto loans, and trade receivables.<sup>cccxvii</sup> The FIDC structure is appealing to foreign investors, in part due to potential for tax-exempt status if certain criteria are met.

Furthermore, the outlook for consumer ABS in Brazil in 2016 is stable, according to FitchRatings. Despite the economic recession in Brazil, Fitch-rated Brazilian consumer ABS has fared decently due to adequate credit enhancement and structural features.<sup>cccxviii</sup> In addition, Brazil is expected to see at least some economic growth (between 1 and 1.5 percent) in 2017<sup>cccix</sup> thanks to changes in economic policy that may become more market-friendly under President Temer, which may help Brazil attract greater investment.<sup>cccxx</sup>

Foreign direct investment in Brazil is increasing (particularly from Chinese investors) and is expected to rise 30-50 percent in 2016, but tends to be focused on large infrastructure-type energy projects<sup>cccxxi</sup> rather than consumer lending. Difficulty in hedging currency risk and volatility is a primary limiting factor; concerns about sovereign interference with payments, stability of the legal system, and commodities shocks and other economic crises are also factors.<sup>cccxxii</sup>

# UNITED KINGDOM

## Introduction/Summary of Findings

The UK is a compelling market for a WHEEL-type program as long as political will remains to support a residential energy efficiency finance program after the Green Deal's inability to meet its high goals. The relatively cold climate necessitates the type of reactive heating measures that WHEEL addresses well in the United States. The Green Deal has created networks of trained energy efficiency installers that can be tapped as the project pipeline for a WHEEL-type program. Homeowners have well-understood numeric credit scores that facilitate fast underwriting and approval. The UK has one of the most active securitization markets in the world, including numerous consumer credit card transactions. In sum, if the government is interested in pursuing home energy efficiency, then the WHEEL model would be a well-suited replacement for the Green Deal - especially in light of recent revelations that the UK is failing to stay on track to meet its climate targets due to significant policy and program gaps.<sup>cccxxiii</sup>

## Climate

Figure 28: Climate Zone Map for the UK



Source: BBC<sup>cccxxiv</sup>

The UK's climate varies by region. (See Figure 28). Northern regions generally have cooler summers than the south. London, located in the southeast, experiences cold winters and warm

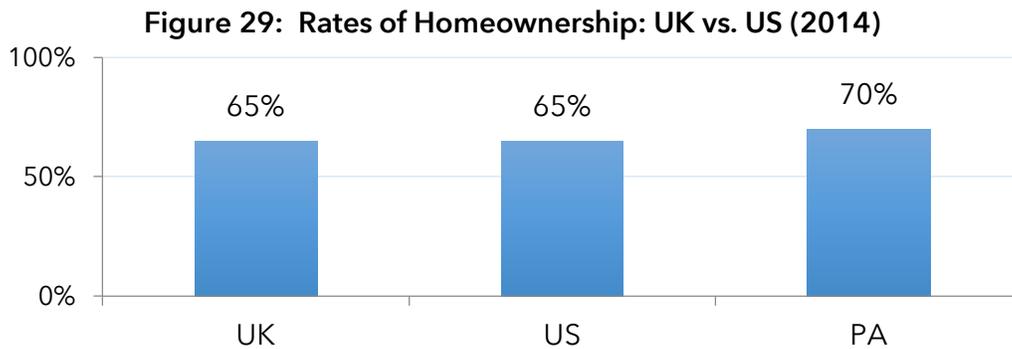
summers. Average annual minimum temperatures range from 0 to 40 degrees Fahrenheit (-18 to 5 degrees Celsius).

## Population

The UK is one of the bigger European countries, and is likely just large enough to support a WHEEL program given demographic similarities described below. According to Eurostat, the UK has a population of 64.9 million,<sup>cccxxv</sup> which is about one-fifth the population of the US and 5 times the population of Pennsylvania.

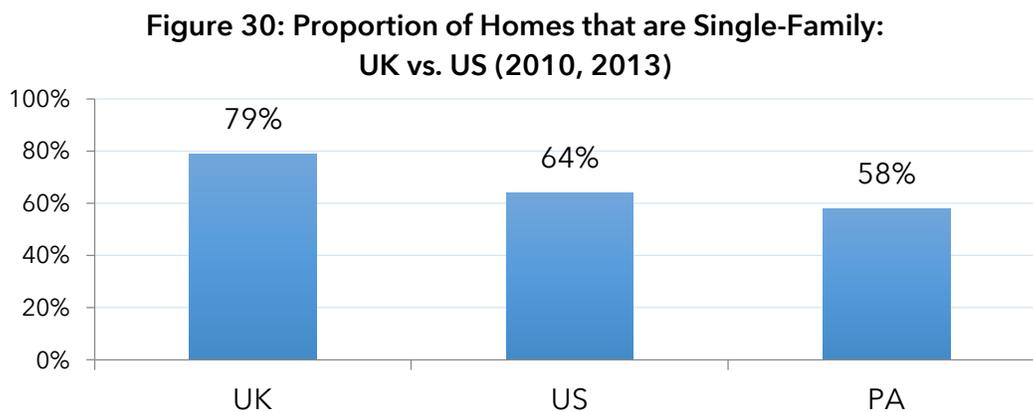
## Single-Family Homeownership

Homeownership rates in the UK (65 percent)<sup>cccxxvi</sup> are similar to those in the United States (65 percent)<sup>cccxxvii</sup> and those in Pennsylvania (70 percent).<sup>cccxxviii</sup> (See Figure 29). The UK's high rate of homeownership suggests a larger market of potential borrowers.



Source: World Bank/Trading Economics, Statista & US Census.

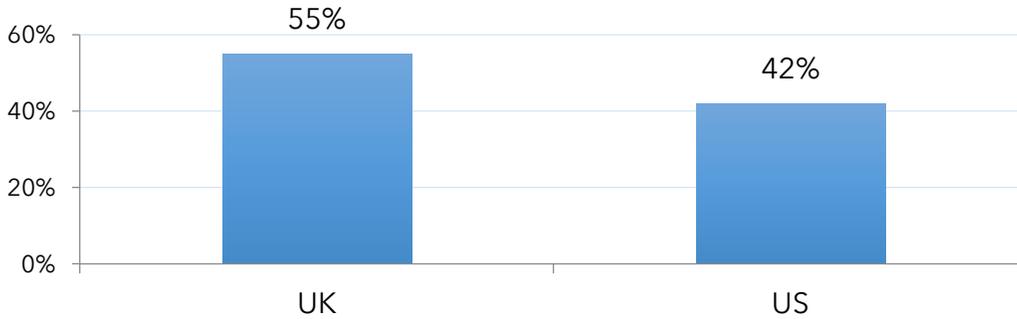
The proportion of homes that are single-family structures is higher in the UK (79 percent)<sup>cccxxix</sup> than in the US (64 percent)<sup>cccxxx</sup> and in Pennsylvania (58 percent).<sup>cccxxxi</sup> (See Figure 30).



Source: Ministry of the Interior and Kingdom Relations (NL) & US Census.

The UK also has more homes built before 1970 than the US. 55 percent of UK homes were built before 1970 compared to 42 percent in the US. (See Figure 31).

**Figure 31: Homes Built Before 1970: UK vs. US**

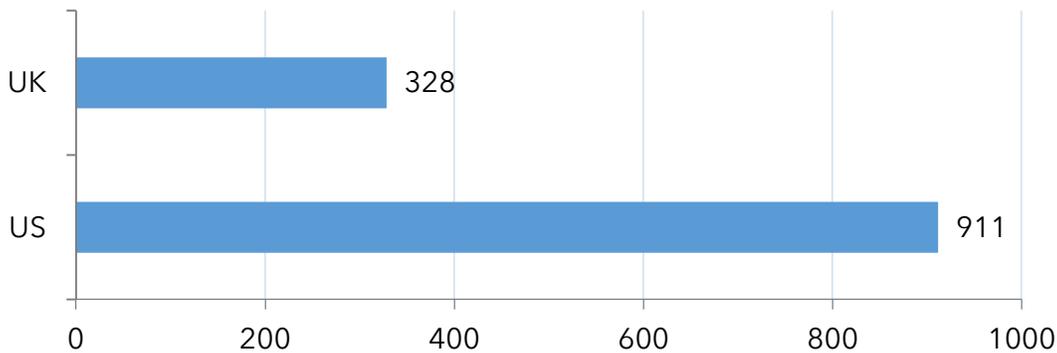


Sources: 2013 American Housing Survey (2013 US Census) & Ministry of the Interior and Kingdom Relations (NL) (2004/2005: UK).

## Residential Energy Use

Residential energy use in the UK tends to be lower than in the US. In 2014, average monthly US residential electricity consumption (911 kWh)<sup>cccxxxii</sup> was almost three times higher than in the UK (328 kWh).<sup>cccxxxiii</sup> (See Figure 32).

**Figure 32: Monthly Average Electricity Consumption in kWh: UK vs. US (2014)**



Source: US Energy Information Agency & Enerdata.

## Residential Energy Pricing

Despite using significantly less electricity than Americans, UK residents pay considerably more per unit of energy. In 2014, electricity for UK residents cost on average USD 0.27 per kWh<sup>cccxxxiv</sup> compared with USD 0.12/kWh in the US and USD 0.13/kWh in Pennsylvania.<sup>cccxxxv</sup> (See Figure 33). Similarly, UK residents paid over double the US rate for natural gas. In 2014, UK residents paid on average USD 0.09 per kWh for natural gas,<sup>cccxxxvi</sup> while Americans paid USD 0.04/kWh.<sup>cccxxxvii</sup> (See Figure 34). When adjusted for purchasing power parity using 2014 figures, UK residents paid USD 0.30 per kWh of electricity compared with USD 0.12/kWh in the US and USD 0.14/kWh in Pennsylvania. Natural gas cost on average USD 0.10 per kWh, compared to USD 0.04/kWh in the US.

**Figure 33: Average Price per kWh of Electricity: UK vs. US (2014)**



Source: US Energy Information Agency & Eurostat.

Note: Assumes medium household consumption band (2500 - 5000 kWh) & EUR 1 = USD 1.33.

**Figure 34: Average Price per kWh of Natural Gas (in USD): UK vs. US (2014)**



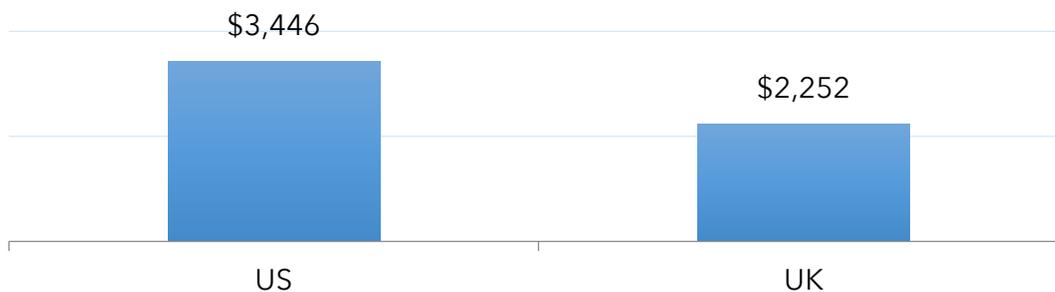
Source: US Energy Information Agency & Eurostat.

Note: Assumes medium household consumption (5,556 - 55,556 kWh), GBP 1 = USD 1.31 and 1,000 cubic feet of natural gas = 293.0711 kWh.

## Residential Energy Burden

The energy burden for the average UK resident is likely higher than that for the average American. Average incomes in the UK are somewhat lower than in the US.<sup>cccxviii</sup> However, average energy bills are probably similar due to the increased energy prices in the UK, offsetting decreased energy consumption. (See Figure 35).

**Figure 35: Average Monthly Household Net Adjusted Disposable Income: UK vs. US (2014)**



Source: OECD Better Life Index.

## Energy Efficiency Rating System

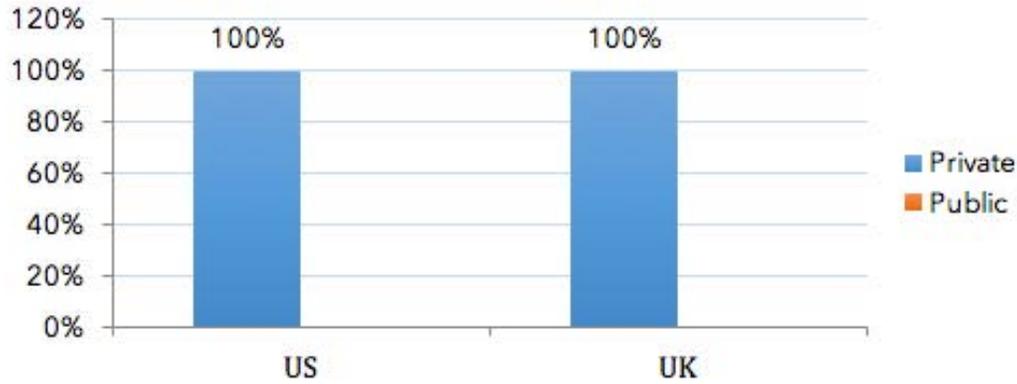
The Energy Performance of Buildings Directive recast 2010/30/EU provides home energy efficiency rating systems and mandates appliance energy labeling. This continues to apply to the UK until it officially leaves the EU, and the UK may well retain its approach post-Brexit. In the UK, Energy Performance Certificates (EPCs), which are also based on EU legislation, provide information on a home's energy efficiency. Anyone selling or renting out a housing unit is legally required to present buyers and tenants with an EPC, which contains details on the property's energy use, typical energy costs, and recommendations for reducing energy use. The rating system is valid for 10 years and is on a scale of 1-100, or A-G. A score of 92-100 (which corresponds to an A rating) represents the most energy-efficient homes, while a score of 1-20 (which corresponds to a G rating) represents the least energy-efficient homes.<sup>cccxxxix</sup> It is unclear whether or not the UK will retain any of these energy efficiency rating systems and EU mandates after it exits the EU.

## Consumer Credit Underwriting

In the US, consumer credit is based on a credit score system where data on consumers' bill payment history and other relevant information is maintained by private companies.<sup>cccxi</sup> Each company's data is used to generate a numeric credit score for the consumer, and potential lenders can look at one or multiple agencies' data and scores on a consumer when deciding whether to extend credit. However, while 100 percent of American adults with credit scores are covered by private bureaus as opposed to public ones, it is worth noting that, according to the US Consumer Financial Protection Bureau, about 10 percent of Americans are "credit invisible," meaning that they do not have any credit history at all, and therefore have no generated credit score.<sup>cccxi</sup>

UK residents are covered by similar private companies<sup>cccxlii</sup> that use similar types of information<sup>cccxliii</sup> to generate numeric scores (albeit ones<sup>cccxliv</sup> that are not directly comparable to US scores<sup>cccxlv</sup>). According to Experian, an estimated 45 million people in the UK have numeric credit scores.<sup>cccxlvii</sup> (See Appendix B for a sample credit report from Experian). In addition, like the US and unlike many other European countries, the entirety of the UK population is covered by private credit bureaus. (See Figure 36). These include private credit bureaus such as Callcredit.<sup>cccxlviii</sup> Noddle, part of Callcredit, provides free credit reports for more than 2 million Britons or approximately 3 percent of the population.<sup>cccxlviii</sup> (See Appendix B for a sample credit report from Noddle).

**Figure 36: Consumer Coverage by Credit Bureaus: UK v. US (2015)**



Source: World Bank/Trading Economics.

### Credit Card Penetration and Utilization

The UK has high rates of credit card usage. In 2015, there were 56 million credit cards in use in the UK.<sup>cccxlx</sup> Fifty five percent of UK residents over 15 years of age used a credit card to make a payment in the last year (2015), a rate comparable to 57 percent in the US. (See Figure 37).

However, household savings rates in the UK are extremely low. In 2013, the household savings rate in the UK was -0.05 percent<sup>ccccl</sup> compared to 4.97 percent in the US.

**Figure 37: Credit Card Utilization: UK vs. US (2015)**



Source: World Bank.

### Consumer Attitudes and Credit Profiles

UK residents tend to carry less debt (particularly mortgage debt) than Americans. While the United States generally allows full deductibility of primary residence mortgage interest payments, there is no home mortgage interest deduction in the UK.<sup>ccccli</sup>

### Debt Collection Process

According to the World Bank Ease of Doing Business Index, the UK ranks 33rd out of 189 countries with respect to ease of contract enforcement. The average number of days to resolve a lawsuit from filing to actual payment is 437 days, of which it takes on average 62 days to enforce a judgment.

## Existing Financing Options for Residential Energy Improvements

UK home improvement stores often offer financing for residential efficiency improvements (or any other improvements a customer might purchase at such stores). In addition, the UK has experimented with specialized state-sponsored financing for residential energy efficiency, such as the Green Deal, which was launched by the UK Green Investment Bank (GIB). The Green Deal ran for two years and offered loans for energy-efficient home improvements. Developed by the now-defunct UK Department of Energy and Climate Change (DECC), the government's Green Deal program provided GBP 59 million to the Green Deal Finance Company to get the program off the ground.<sup>ccclii</sup> The Green Deal Finance Company then loaned funds to 84 Green Deal Providers<sup>cccliii</sup> tasked with providing financing to homeowners, arranging home assessments, and setting up the retrofit work.<sup>cccliv</sup> Eligible measures for the UK Green Deal included insulation of walls and lofts; improvement of window insulation through double-glazing; renewal of heating systems and draft proofing; and installation of renewable measures such as solar PV panels.<sup>ccclv</sup> Over the course of two years, the Green Deal Finance Company established approximately 13,800 finance plans on behalf of Green Deal Providers totaling approximately GBP 50 million.<sup>ccclvi</sup> (See Figure 38).

The UK Green Deal was allowed to operate despite EU state aid rules. State aid rules prohibit member states from lending governmental support to a company that would give it an advantage over similar companies in other member states, thus distorting competition. However, the Commission approved the Green Deal, saying that the benefits of the program (increased energy efficiency) would outweigh any potential market distortions.<sup>ccclvii</sup> The European Commission similarly approved the GBP 3 billion public funding of UK GIB's creation in 2012. The Commission found that the UK GIB had sufficient safeguards against market distortion, and was therefore compatible with state aid rules.<sup>ccclviii</sup>

The Green Deal was terminated in July 2015 due to a number of factors including slow ramp-up of consumer demand, long waiting periods, high interest rates,<sup>7</sup> and complex processes.<sup>ccclix</sup> A Public Accounts Committee report published in July 2016 confirms that low consumer uptake as well as failure on the part of DECC to test the design scheme prior to implementation are to blame for the demise of the Green Deal.<sup>ccclx</sup> In addition, the report criticizes the Green Deal for making forecasts that were unrealistically optimistic: the deal was projected to grant GBP 1.1 billion by the end of 2015, when in actuality it had only granted GBP 50 million.<sup>ccclxi</sup>

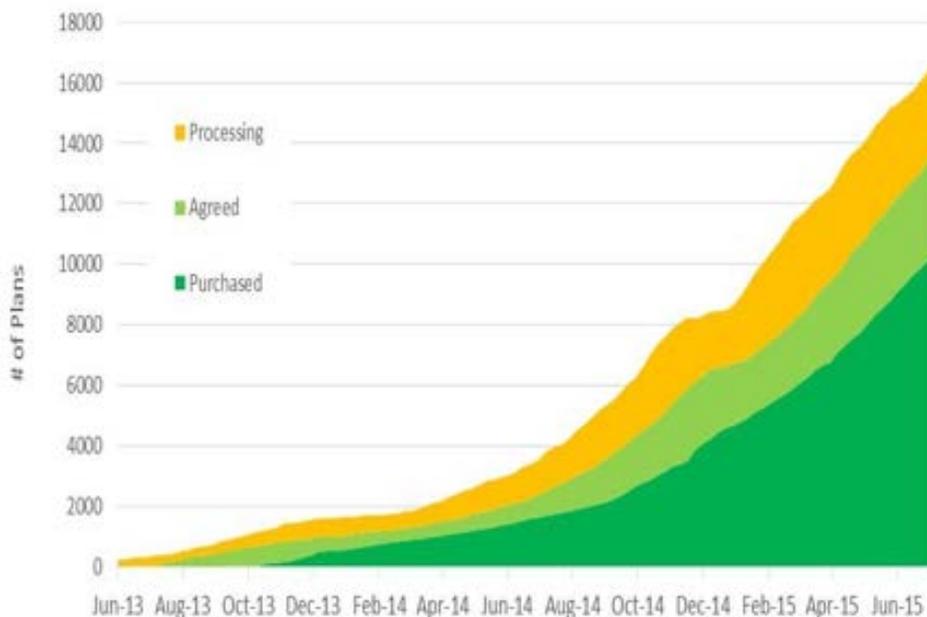
At the time of termination, the Green Deal was at record growth levels with 667 weekly applications totaling GBP 2.5 million, 10,612 plans worth GBP 38.5 million in repayment, 3,423 plans worth £11.8m awaiting installation completion, and 2,917 plan applications worth GBP 10.4 million in process.<sup>ccclxii</sup> The program is still honoring existing loans as it winds down, however, creating the possibility of a track record data set for future programs. And though it has been discontinued, many of the obstacles that led to its discontinuation are not present in the WHEEL model.

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<sup>7</sup> "The average APR in the GDFC's book was 8.3 percent for an average Plan size of £3,600. Only 9 percent of Plans had APRs in excess of 9.0 percent. This compares with an average interest rate on 5 year unsecured bank loans to consumers in the UK in the year to 30th June 2015 of 9.0 percent and an average cost of credit card debt of 17.7 percent." [http://www.tgdfc.org/assets/Energy\\_and\\_Climate\\_Change\\_Committee\\_GDFC\\_written\\_evidence\\_final\\_13Oct15.pdf](http://www.tgdfc.org/assets/Energy_and_Climate_Change_Committee_GDFC_written_evidence_final_13Oct15.pdf)

Additionally, the contractor network and loan performance data framework it built would contribute greatly to the success of a WHEEL-type effort.

**Figure 38: Growth of Green Deal (May 2013 - July 2015)**



Source: Green Deal Finance Company, October 2015.

## Comparing WHEEL and the Green Deal

WHEEL differs from the Green Deal in a number of ways. First, WHEEL's private program administrator, Renew Financial, is not government-funded but instead raises venture and private equity capital to fund its operations. Similarly, the nonprofit Energy Programs Consortium raised significant funds from charitable foundations to cover program development costs and legal fees. Public funds are used only when (and to the extent that) loans are made and the financing is structured so that they should be returned in full if the portfolio performs in accordance with its historical track record.

It is not clear whether a company could achieve similar fundraising success in the UK, since many of Renew Financial's funders may have been interested specifically in the synergy between WHEEL and PACE in the US, but at least one potential funder has expressed interest. If it is a replicable approach, it puts less political pressure on the program than the Green Deal experienced due to the very high level of public investment in the Green Deal Finance Company.

Another difference between WHEEL and the Green Deal is the servicing mechanism: while the Green Deal was an on-bill repayment program, WHEEL is entirely "off bill." Borrowers receive a paper statement in the mail stating the fixed monthly payment due.

In addition, there is no promise of “bill neutrality” for WHEEL improvements. That is, payments on a WHEEL loan may exceed savings generated from the work, and if that is the case, the homeowner still owes the loan in full.

There is no requirement for an audit or estimate of energy cost savings, speeding up the process and reducing hassle for WHEEL customers as compared with the Green Deal approach. The homeowner is expected to consult with the installation professional, seek multiple bids if appropriate, and make his or her own determination about the value of moving ahead with the project. Since many WHEEL borrowers come to the program because an important heating or cooling system has broken and must be replaced, this approach makes sense. They are going to buy something, because not doing so would mean a real comfort sacrifice. The goal in the United States is to encourage them at that decision point to invest in an ENERGY STAR-rated system, and make some insulation or air sealing improvements while the trained professional is already there.

US WHEEL offers similar interest rates to those that were offered in the Green Deal program and that many criticized as a cause of lower-than-expected uptake in the Green Deal. However, the WHEEL experience suggests that the most comparable financing alternative in the US, Green Sky Finance, offers significantly higher rates for all but the most creditworthy customers. Store credit cards are similar. Banks and credit unions require an in-person application that takes time. As such, for many homeowners, a rate of 8-10 percent is significantly better than the rates on comparable available financing, if they are even able to qualify for such financing. In addition, in WHEEL, public actors may choose to use public funds to buy the rates down further if desired to drive specific improvements or assist lower income individuals, and some of the programs have done so.

## Existing Contractor Networks

The UK has developed contractor networks through organizations such as InstaGroup, which coordinates a network of energy efficiency installers across the UK (“Snug Network”) and was also involved in delivering financing for the Green Deal.<sup>ccclxiii</sup> The highly developed contractor networks in the UK may also be thanks to the now-defunct Energy Company Obligation program, an energy efficiency mandate that was managed by utilities and largely implemented by contractors.

## Consumer Protection Laws & Regulations

The UK’s Consumer Credit Act of 1974 (amended 2006) was implemented to protect the rights of consumers in the credit market. (See Appendix C for Consumer Credit Act of 1974). It ensures that debtors and creditors all abide to the same standards across the market. The act requires that lenders present consumers with all relevant information, financial or otherwise, before entering a contract. It also regulates the content in credit agreements, the methodology used to calculate APRs, the default process, advertising, and certain credit card purchases. Additionally, creditors are required to evaluate a potential debtor’s creditworthiness prior to awarding credit.<sup>ccclxiv</sup>

Green Deal plans (aside from those that provided credit for primarily business purposes) were regulated as credit agreements under the Consumer Credit Act of 1974. In compliance with the Act, all Green Deal Providers were required to first obtain a consumer credit license before they could offer Green Deal plans to residences.<sup>ccclxv</sup> Many Green Deal Providers were already familiar with

these requirements and held the relevant licenses prior to participating in the Green Deal. Compliance with the UK's Consumer Credit Act will be an important cost consideration for a WHEEL-type program, and feasibility may be enhanced if WHEEL partners with installers who already hold licenses.

## Possible Sources of Credit Enhancement; Impact of Brexit

Possible sources of credit enhancement for a UK WHEEL program include the UK GIB, the newly created Department of Business, Energy, and Industrial Strategy, various utilities (directly or via a public benefits charge such as the now-defunct scheme discussed below), and the Treasury (the ministry of finance).

The sources and structure of credit enhancement may be impacted by Brexit. In particular, it is not yet clear whether the UK-EU exit agreement will stipulate continued UK compliance with EU "state aid" rules, which prohibit EU member states from lending governmental support to enterprises within their country that would give them an advantage over similar enterprises in other member states. However, the full impact of Brexit cannot be known at this time as it is still largely undefined. It is unlikely that an agreement between the UK and the EU will be made any time soon, and it is similarly uncertain when exactly the UK will decide to invoke Article 50 to begin the process of leaving, which will take an additional two years.<sup>ccclxvi</sup>

The UK GIB committed capital for the Green Deal, but never provided it since the volume of loans failed to hit a minimum threshold to trigger the GIB's commitment.<sup>ccclxvii</sup> Both the UK GIB and the Green Deal sought and received affirmative rulings from the European Commission that they would not violate state aid rules.<sup>ccclxviii</sup> A similar ruling would likely be necessary for a WHEEL-type program in the UK if state aid rules were to continue to apply post-Brexit.

Prior to Brexit, there were hints that the UK would be more favorable to green programs like WHEEL. This could be seen in certain UK actions such as the decision to devote 50 percent more of the foreign aid budget to addressing climate change.<sup>ccclxix</sup> However, political will to provide such support has become somewhat unclear as the government reorganizes itself post-Brexit.

In July 2016, Theresa May became prime minister. One of May's first acts as prime minister was to eliminate the DECC, which had been tasked with representing the UK at international climate talks, ensuring that the country met emissions targets, and managing subsidies for clean energy. DECC had been central to the Green Deal. In the restructuring process, DECC's responsibilities were reassigned to the newly created Department of Business, Energy, and Industrial Strategy headed by Greg Clark.<sup>ccclxx</sup> As of September 2016, the new government had not yet indicated its position on the UK's prior joint pledge with the EU to reduce greenhouse gas emissions by at least 40 percent by 2030 compared with 1990 levels.<sup>ccclxxi</sup> The UK's previous pledge to reduce net carbon emissions by at least 80 percent by 2050 compared with 1990 levels in the Climate Change Act 2008<sup>ccclxxii</sup> remains intact and will not be affected by Brexit.<sup>ccclxxiii</sup> However, in October 2016, the UK's Committee on Climate Change (CCC) announced that, given the current trajectory and policy landscape, the UK would not be able to meet this pledge.<sup>ccclxxiv</sup>

When the previous conservative government came into power, two residential energy efficiency programs were terminated: the Warm Front, funded by the Treasury (the ministry of finance), and the Energy Company Obligation, which included a tax (similar to US “public benefit charges”) on electricity bills to raise funds to subsidize low-income household energy efficiency measures.<sup>ccclxxv</sup> Total investment in energy efficiency measures declined by 53 percent from 2012 to 2015 (from GBP 1.5 billion to GBP 0.7 billion) and is expected to decline by 53 percent overall for the period between 2010 and 2020. Between 2012 and 2015, there was also a steep decline in the number of energy efficiency measures installed (80 percent decline) and in the number of households helped (76 percent decline). These are expected to decline by 73 percent and 76 percent overall, respectively, for the period between 2010 and 2020.<sup>ccclxxvi</sup>

With the discontinuation of the Green Deal in addition to these programs, there is a significant gap in energy efficiency financing in the UK that the new government may wish to fill with a new approach. WHEEL’s model, which requires no government expenditure unless, until and to the extent that loans are made, may be appealing given some of the criticisms of the Green Deal.

In sum, a number of credit enhancement options for a WHEEL-type program are viable in the UK, but they would require compliance with EU state aid rules (if and to the extent applicable) and sufficient political will.

### Possible Sources of Senior Capital During Aggregation Period (Warehousing)

Private banks could provide a warehouse line of credit during the pre-securitization aggregation period in a WHEEL-type program. HSBC and Barclays in the UK were recently ranked among the top 30 greenest banks worldwide and could also be interested.<sup>ccclxxvii</sup> However, Brexit’s negative impact on UK banks may undermine bank commitments to supporting fledgling green programs such as WHEEL-type efforts.

### Securitization Landscape

UK capital markets have historically been overshadowed by its banking sector, in contrast with the US, where capital markets financing dominates.<sup>ccclxxviii</sup> In addition, UK aggregate ABS trade volume was down 40 percent in February 2016 from February 2015.<sup>ccclxxix</sup> DBRS’s recent research on Brexit showing distributed UK issuance by sector quarterly between 2011 and 2016 found significantly reduced consumer issuance in 2015 compared with that of 2011 and 2012, but somewhat of a rebound starting in Quarter 2 of 2014 through Quarter 2 of 2015.

Still, the UK securitization market is robust. UK issuances made up 60 percent of the total European market in 2011.<sup>ccclxxx</sup> Additionally, according to the Association for Financial Markets in Europe (AFME), total issuance in the UK in 2014 amounted to EUR 49.1 billion (approximately USD 54.8 billion).<sup>ccclxxxi</sup>

Furthermore, the UK consumer ABS market has recently seen a healthy stream of securitization activity. In September 2016, NewDay, one of the UK’s largest issuers of credit cards, mandated Bank of America Merrill Lynch and Santander to reoffer the previously-retained class D tranche of a past securitization deal, NewDay Funding 2015-2, which currently has an outstanding amount of GBP

44.1 million.<sup>ccclxxxii</sup> One month later, in October 2016, NewDay also completed a reoffering of a class D tranche on its NewDay Funding 2016-1 deal through Bank of America Merrill Lynch and Lloyds Bank.<sup>ccclxxxiii</sup> In addition, Cerberus finalized its latest UK RMBS deal, Towd Point Mortgage Funding-Auburn 10, in the same month. The deal, originally planned to be GBP 600 million, was finalized at GBP 1.24 billion due to strong investor demand.<sup>ccclxxxiv</sup> These placements indicate that there is currently a lot of buyer interest in the UK's securitization market.

Green securitization is relatively well established in the UK as well. For example, the Independent Debt Capital Markets (IDCM), a primary markets debt boutique firm, has been doing securitizations backed by UK renewable assets in the private placement market since November 2012.<sup>ccclxxxv</sup>

# EUROPEAN UNION (EXCLUDING UK)

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## Introduction/Summary of Findings

While WHEEL-type programs are feasible in the EU, each of the countries studied in depth presents challenges that could undermine the success of WHEEL-type programs there. In France, Spain, and Germany, like in India, high multifamily living rates reduce the market size, which is worrying since the total populations of these countries are close to the 60 million minimum identified for an area with similar demographics to the US state of Pennsylvania. Lower homeownership rates in France and Germany and a smaller population size in Spain compound this problem. In France, existing heavily subsidized zero-interest loan programs would undermine the success of a less subsidized program, just as the existence of the heavily subsidized 3.49 percent Green Jobs Green New York financing program has presented real challenges for the 7.99 percent WHEEL program in New York. In Germany, the successful KfW program may already be addressing the market adequately despite its emphasis on more proactive whole-house type improvements. Finally, many homeowners in EU countries lack numeric credit scores, undermining the quick application and approval process that has helped WHEEL succeed in the US.

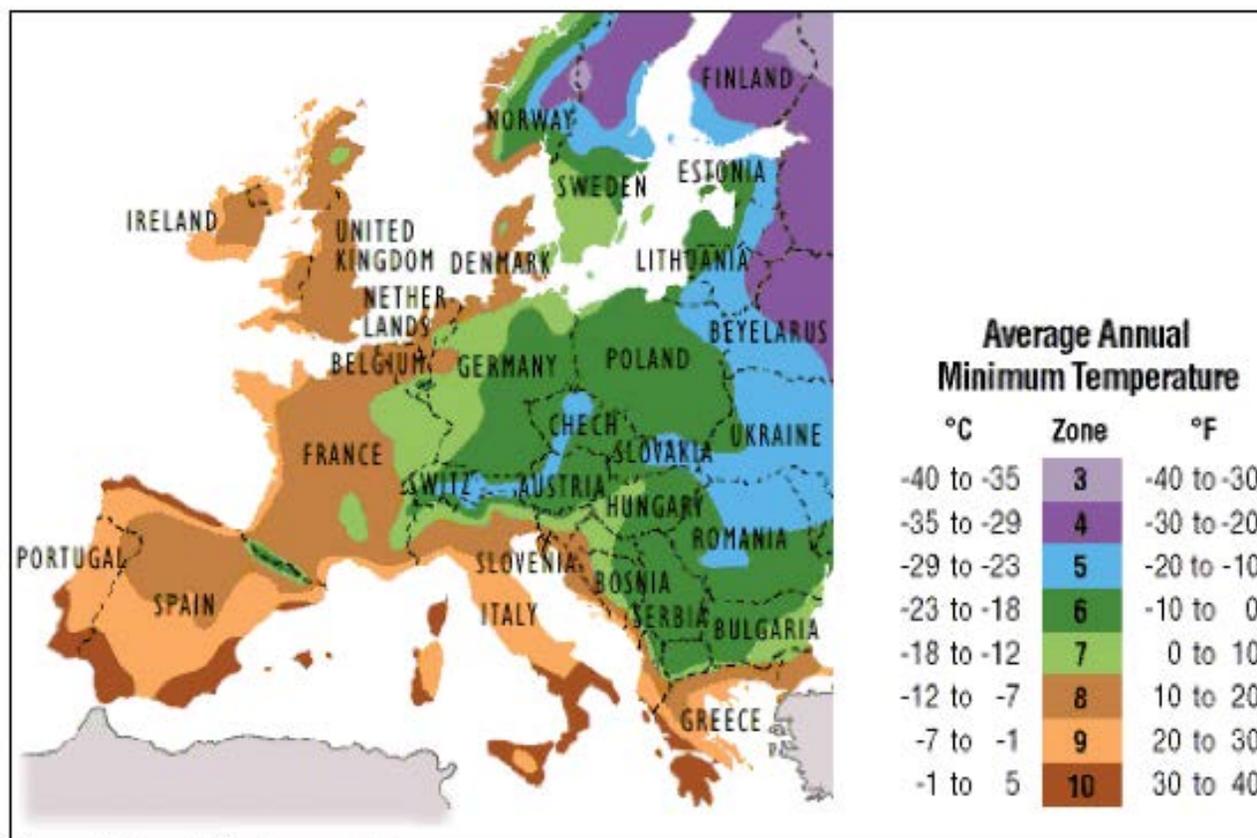
If all of the countries within the EU shared one legal system with respect to consumer protection, banking licenses, and capital markets, these challenges would be readily surmountable and the EU would be a compelling market for a WHEEL-type program. Since this is not the case, however, the outlook for WHEEL's feasibility in the EU has not been as rosy as we would have expected.

## Climate

The EU stands out in this feasibility study as it has a relatively cold climate. (See Figure 39). Even in its warmest regions, the average annual minimum temperature ranges between 30 and 40 degrees Fahrenheit (-1 to 5 degrees Celsius). Its coldest regions have average annual minimum temperatures ranging between -30 and -20 degrees Fahrenheit (-35 to -29 degrees Celsius). Cold temperatures make heating a necessity in the EU, especially in the winter.

France and Spain have average annual minimum temperatures ranging between 0 and 40 degrees Fahrenheit (-18 to 5 degrees Celsius). Germany is slightly colder, with large portions of the country experiencing average annual minimum temperatures of -10 to 0 degrees Fahrenheit (-23 to -18 degrees Celsius).

**Figure 39: Climate Zone Map for the EU**



Source: Backyard Gardener<sup>ccclxxxvii</sup>

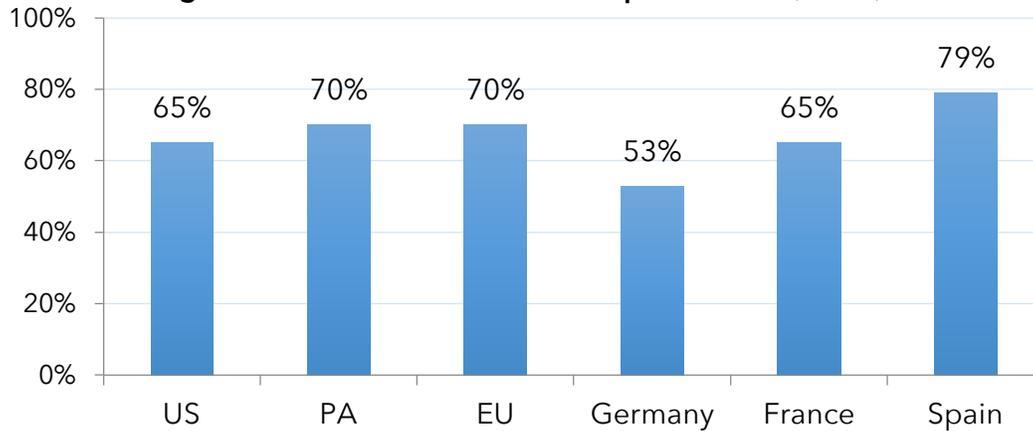
## Population

Eurostat estimates that the population of the EU was 508.5 million as of 2015,<sup>ccclxxxvi</sup> or one and a half times that of the United States (312.6 million)<sup>ccclxxxvii</sup> and 40 times that of the US state of Pennsylvania.<sup>ccclxxxviii</sup> Of the countries in the EU, Germany (81.2 million)<sup>ccclxxxix</sup> and France (66.4 million)<sup>cccxc</sup> are among the largest, each at about 5 times the population of Pennsylvania. Together with Italy (60.8 million)<sup>cccxcii</sup> and Spain (46.5 million),<sup>cccxciii</sup> these four countries have an estimated population similar to that of the United States as a whole.

## Single-Family Homeownership

Rates of homeownership in the EU overall (70 percent)<sup>cccxciiii</sup> are similar to those in the United States overall (65 percent).<sup>cccxcv</sup> There is significant variation between countries within the EU, however. For example, in 2014 the rate of homeownership in Germany (53 percent)<sup>cccxcvi</sup> was substantially lower than that in Pennsylvania (70 percent),<sup>cccxcvii</sup> the US state from which initial WHEEL volumes have primarily arisen. In contrast, Spain had a rate of homeownership comparable to the US.<sup>cccxcviii</sup> (See Figure 40). Lower homeownership rates mean a smaller potential market for a WHEEL-type program if the program is limited to homeowners as it is in the United States.

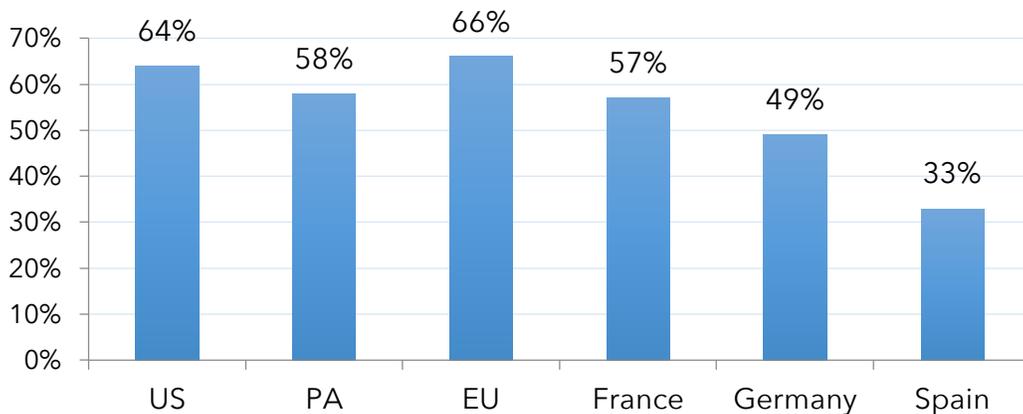
**Figure 40: Rates of Homeownership: EU vs. US (2014)**



Source: World Bank/Trading Economics, Statista & US Census.

The proportion of homes that are single-family structures is higher in the EU (66 percent)<sup>cccxcviii</sup> than in the US (64 percent),<sup>cccxcix</sup> but again, there is significant variation between countries in the EU.<sup>cd</sup> For example, in 2013, 49 percent of homes in Germany, 57 percent of homes in France, and 33 percent of all homes in Spain were single-family homes, as compared to 58 percent of homes in Pennsylvania in 2014.<sup>cdi</sup> (See Figure 41). Again, this difference limits the size of the market for a WHEEL-type program in some EU states unless WHEEL can be adapted away from its US focus on single-family homeowners.

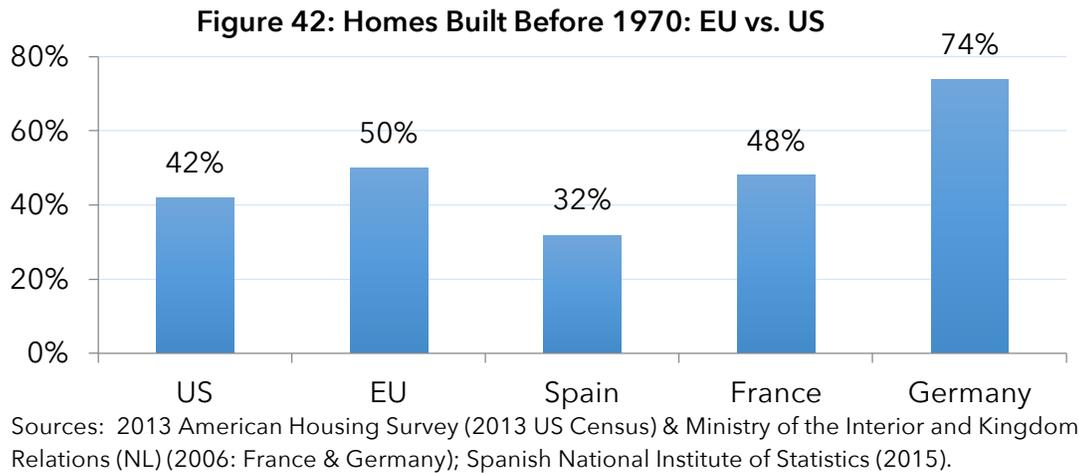
**Figure 41: Proportion of Homes that are Single-Family: EU vs. US**



Source: Ministry of the Interior and Kingdom Relations (NL) & US Census; Spanish National Institute of Statistics (2015).

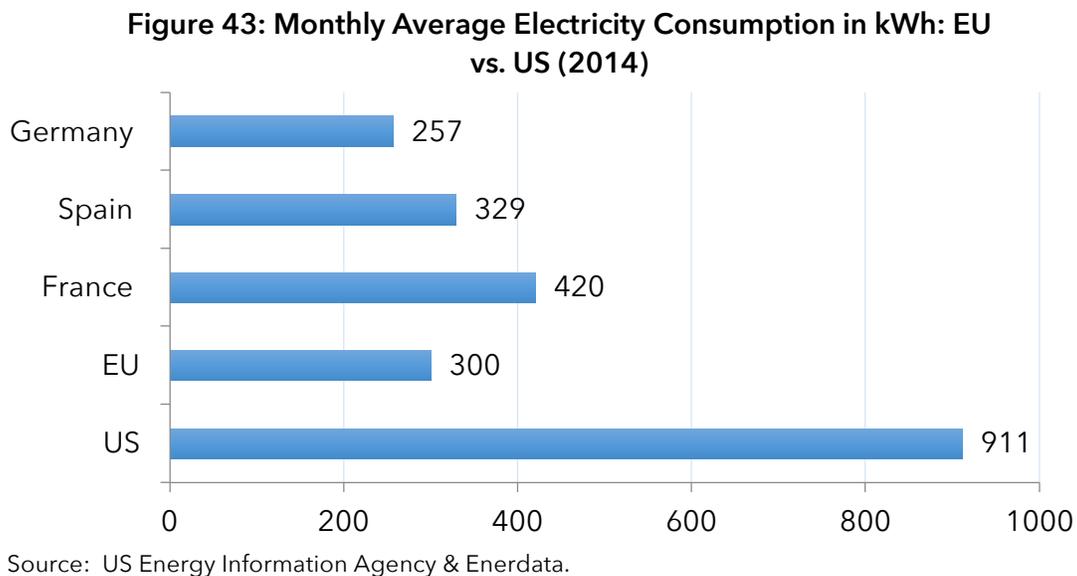
The EU does have large numbers of homes built before 1970. This factor suggests a potentially larger market for energy improvements than in some areas of the US where new construction is more common. While some well-built old homes are more efficient than poorly-built new ones, older homes tend to be less energy-efficient than newer ones; thus there is great potential for older buildings to achieve higher energy performance ratings through a WHEEL-type program. In Europe more than 50 percent of the residential buildings were built before 1970 and have poor insulation.<sup>cdii</sup> In France, 55 percent of the 33.4 million residential buildings were built before 1975, and over half of them (20 million) have poor insulation.<sup>cdiii</sup> In Spain, 55 percent of the existing building stock (approximately 25.2 million dwellings) was built before 1980, and almost 21 percent is more than 50

years old.<sup>cdv</sup> In the US, according to the American Housing Survey from the 2013 Census, 42 percent of homes were built before 1970, and the median year built is 1975.<sup>cdv</sup> (See Figure 42).



### Residential Energy Use

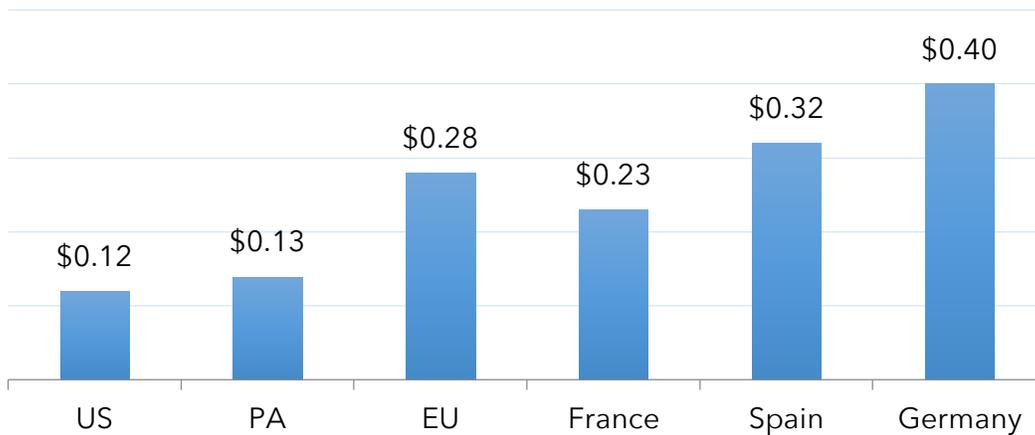
Residential energy use in the EU tends to be lower than in the US. In 2014, average monthly US residential electricity consumption (911 kWh)<sup>cdvi</sup> was more than three times higher than in the EU (300 kWh).<sup>cdvii</sup> There were similar disparities between the US and Germany (257 kWh), and between the US and Spain (329 kWh).<sup>cdviii</sup> Household electricity consumption in France was comparatively higher than the other relevant EU countries at just under two times US consumption (420 kWh). (See Figure 43). A typical European household might use electricity for appliances, space heating, and cooking.<sup>cdix</sup> Notably, a recent study by Marketwatch found that almost 20 percent of home appliances, including dishwashers and refrigerators, use more energy than advertised.<sup>cdx</sup>



## Residential Energy Pricing

Although EU residents tend to use much less energy than Americans, they also face significantly higher energy prices. In 2014, electricity for residents of EU member states cost on average USD 0.28 per kWh<sup>cdxi</sup> compared with USD 0.12/kWh in the US and USD 0.13/kWh in Pennsylvania.<sup>cdxii</sup> (See Figure 44). In addition, according to the US EIA, from 2006-2013, residential electricity prices in the EU increased faster than electricity prices in the US.<sup>cdxiii</sup> Similarly, EU residents paid more than double the US rate for natural gas. In 2014, residents of EU member states paid on average USD 0.10 per kWh for natural gas,<sup>cdxiv</sup> while Americans paid USD 0.04/kWh.<sup>cdxv</sup> (See Figure 45).

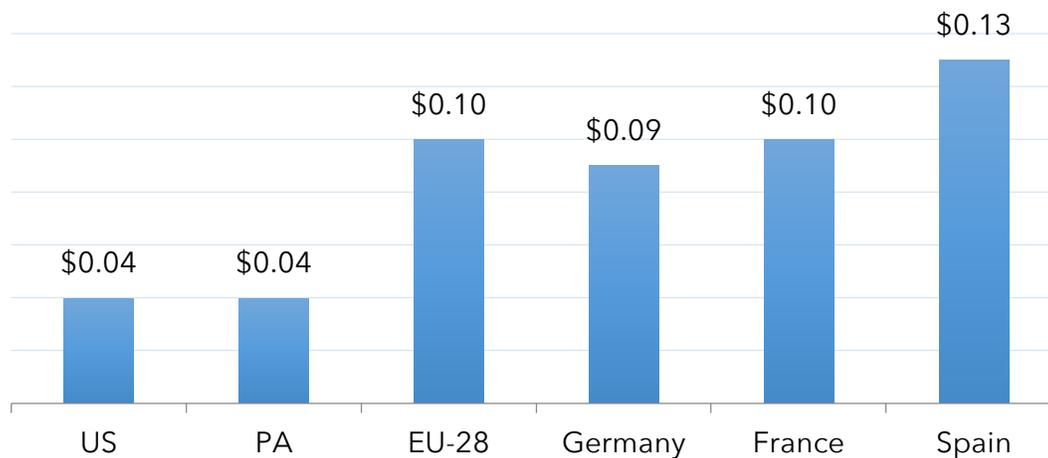
**Figure 44: Average Price per kWh of Electricity: EU vs. US (2014)**



Source: US Energy Information Agency & Eurostat.

Note: Assumes medium household consumption band (2500 - 5000 kWh) & EUR 1 = USD 1.33.

**Figure 45: Average Price per kWh of Natural Gas: EU vs. US (2014)**

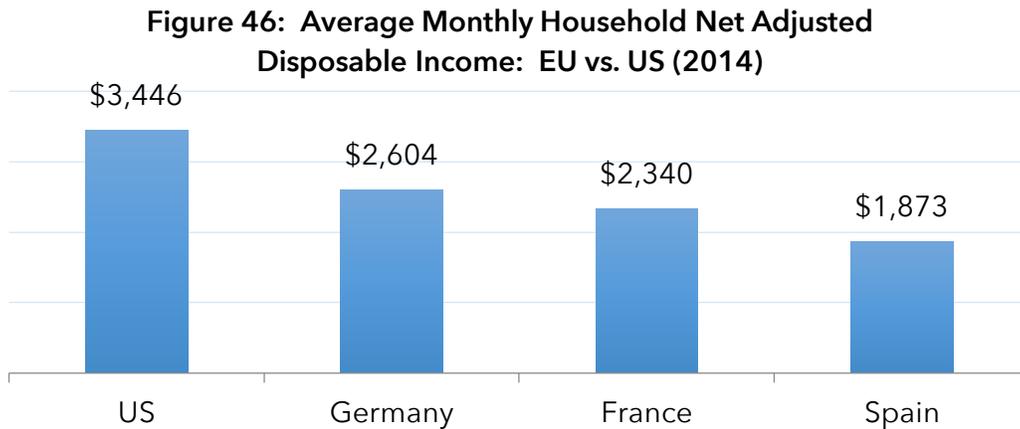


Source: US Energy Information Agency & Eurostat.

Note: Assumes medium household consumption (5,556 - 55,556 kWh), EUR 1 = USD 1.33 and 1,000 cubic feet of natural gas = 293.0711 kWh.

## Residential Energy Burden

The energy burden for the average EU resident is likely higher than that for the average American. Average incomes in the EU are somewhat lower than in the US.<sup>cdxvi</sup> However, average energy bills are similar due to the increased energy prices in the EU, offsetting decreased energy consumption. (See Figure 46).



Source: OECD Better Life Index.

## Energy Efficiency Rating System

The EU has an existing energy efficiency rating system under the Energy Performance of Buildings Directive recast 2010/30/EU as well as energy labeling that covers appliances, heaters, lighting, and air conditioners.<sup>cdxvii</sup> This rating system would allow a WHEEL-type program to identify appropriate energy efficiency measures to support with its financing.

In June 2013, Spain implemented the Urban Refurbishment, Regeneration and Renovation Act (L3R), which raised sustainability and efficiency standards for buildings. Prior to L3R, the only legal instrument capable of establishing the level of conservation in buildings was the "Technical Inspection of Buildings" (Inspección Técnica de Edificios or ITE). The new law foresees the elaboration of a "Building Assessment Report" (Informe de Evaluación de los Edificios or IEE), which is broader than the previous ITE but does not substitute it. The public administration would be able to request IEEs from all residential building owners with respect to the state of conservancy in the building, its level of accessibility (for handicapped persons), and energy efficiency performance (through the energy efficiency certificate). The IEE will be set up for a 10-year minimum period, and its lack of compliance would lead to an administrative sanction. The IEE could be endorsed by technical experts competent in the matter, according to the specific regulation.<sup>cdxviii</sup>

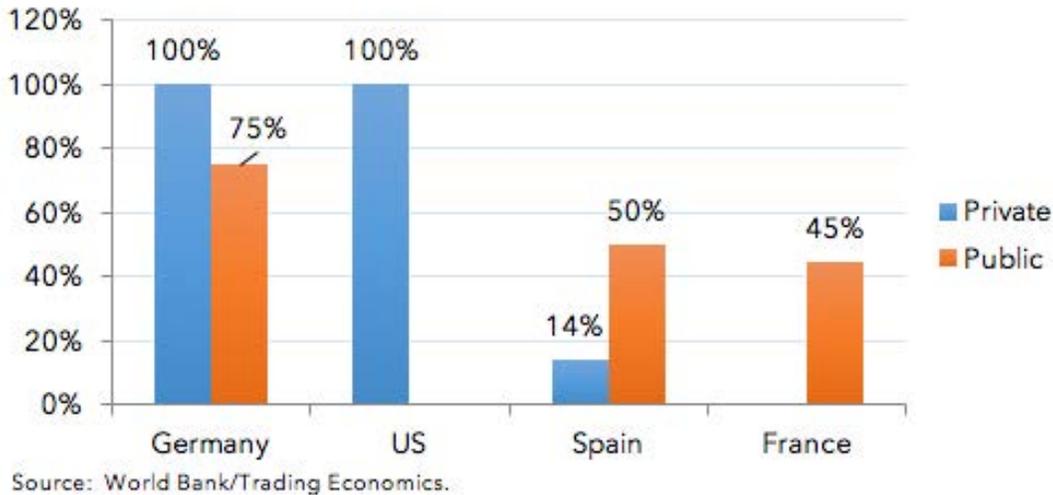
## Consumer Credit Underwriting

The credit system in many countries within the EU is different than that in the US. US consumer credit relies on a credit score system where private companies<sup>cdxix</sup> maintain data on individual consumers' bill payment history and other relevant information, both positive and negative. Each company's data is used to generate a numeric credit score for the consumer, and potential lenders

can look at one or multiple agencies' data and scores on a consumer when deciding whether to extend credit.

While most residents of Germany are covered by similar private companies<sup>cdxxx</sup> that use similar types of information<sup>cdxxi</sup> to generate numeric scores (albeit ones<sup>cdxxii</sup> that are not directly comparable to US scores<sup>cdxxiii</sup>), residents of many other EU countries like Spain and France do not tend to have numeric credit scores. (See Figure 47).

**Figure 47: Consumer Coverage by Credit Bureaus: EU v. US (2015)**



Instead, many Europeans are covered by public credit bureaus or registries.<sup>cdxxiv</sup> Public credit registries are databases that are usually managed by a country's central bank.<sup>cdxxv</sup> For instance, the Banco de España oversees Spain's Central Credit Register,<sup>cdxxvi</sup> and the Banque de France runs the National Database on Household Credit Repayment Incidents, known as the FICP.<sup>cdxxvii</sup> The French and Spanish public credit reports contain only negative information such as missed or late payments rather than evidence of bill payment history overall.<sup>cdxxviii</sup> Germany also has a Central Credit Register.<sup>cdxxix</sup>

Europe also has country-specific private credit bureaus such as SCHUFA in Germany.<sup>cdxxx</sup> SCHUFA covers more than 66 million persons, or approximately 82 percent of the German population, and unlike other German credit bureaus, SCHUFA provides positive credit information.<sup>cdxxxi</sup>

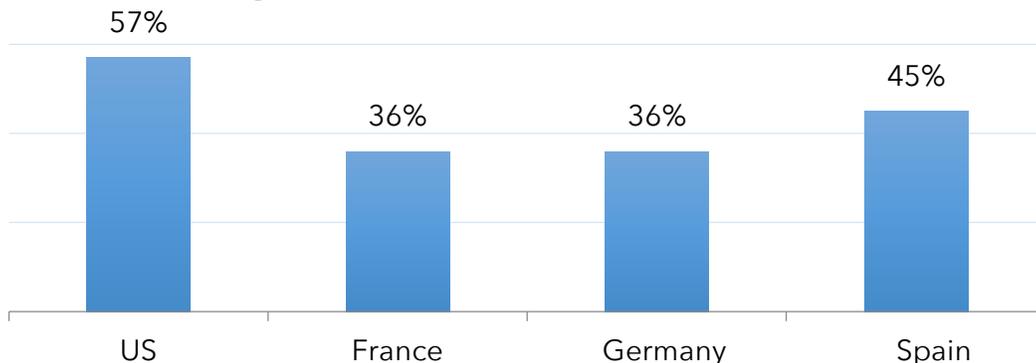
### Credit Card Penetration and Utilization

Credit card utilization in many EU countries is significantly lower than that in the US, including the EU countries covered in depth here. Spain had the highest percentage of credit card users; 45 percent of residents over 15 years old used a credit card to make a payment in the last year (2015).<sup>cdxxxii</sup> France and Germany had significantly lower rates of credit card use (36 percent). (See Figure 48).

Still, a number of credit card companies are active, including: Visa and MasterCard, which are offered through numerous regional banks including global players Barclays, BNP Paribas, Deutsche

Bank, and Santander.<sup>cdxxxiii</sup> Other cards are very country-specific. Large chain retail stores also issue a variety of credit cards.<sup>cdxxxiv</sup>

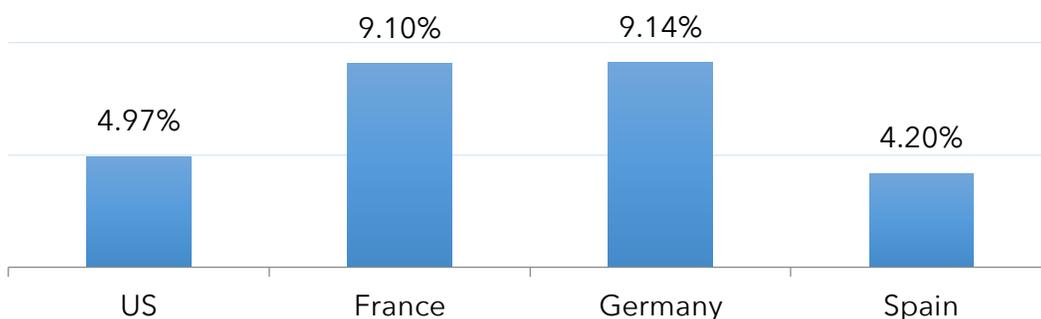
**Figure 48: Credit Card Utilization: EU vs. US**



Source: World Bank.

Household savings rates in many EU countries are also on the lower end of the spectrum. (See Figure 49). In Spain, the household savings rate was 4.20 percent in 2013,<sup>cdxxxv</sup> compared to 4.97 percent in the US. Household savings rates in France and Germany were somewhat higher at 9.10 percent and 9.14 percent respectively.<sup>cdxxxvi</sup>

**Figure 49: Household Savings Rate: EU vs. US**



Source: OECD.

### Consumer Attitudes and Credit Profiles

European homeowners have different debt profiles than their American counterparts. In particular, nearly two-thirds of 2014 European homeowners (61.3 percent) did not have mortgages or outstanding loans on their homes.<sup>cdxxxvii</sup> In contrast with the United States, which generally allows full deductibility of primary residence mortgage interest payments, there is no home mortgage interest deduction in Germany,<sup>cdxxxviii</sup> Spain,<sup>cdxxxix</sup> or France<sup>cdxli</sup>. In Germany, the word for debt, "schuld," is also the word for "guilt."<sup>cdxli</sup> The significantly lower use of credit by Europeans may make debt-to-income ratios of potential borrowers more appealing but also may indicate less willingness to borrow for energy efficiency improvements.

Despite this, consumer lending volumes have increased recently in Spain. Default rates in Spain are expected to be 4-6 percent for consumer loans and 5.5-6 percent for credit cards. The credit card

market in Spain has an outstanding debt of about EUR 10 billion, making it the largest unsecured consumer credit market in the country.<sup>cdxlii</sup>

## Debt Collection Process

According to the World Bank Ease of Doing Business Index, the European countries studied rank in the top 40 out of 189 countries with respect to ease of contract enforcement. The average number of days to resolve a lawsuit from filing to actual payment among the three countries is 445 days, of which it takes an average of 110 days to enforce a judgment. (See Figure 50).

**Figure 50: Ease of Doing Business**

Country	Ease of Contract Enforcement	Days to Resolve Suit	Days to Enforcement Judgment
Germany	12	429	90
France	14	395	60
Spain	39	510	180

Source: World Bank (2016).

## Consumer Protection Laws & Regulations

France’s Scrivener Law of 1978 was implemented to protect consumer rights in the credit market. The law contains numerous safeguards meant to protect the consumer and ensure that the consumer is aware of all the details of the contract needed to make an informed decision. For instance, the law specifies that font size can be no smaller than 8 points, repayment costs and interest rates have to be disclosed, and consumers have a seven-day grace period to withdraw from a credit agreement.<sup>cdxliii</sup>

## Existing Financing Options for Residential Energy Improvements

European home improvement stores often offer financing for residential efficiency improvements (or any other improvements a customer might purchase at such stores). For instance, Leroy Merlin (France)<sup>cdxliv</sup> offers financing through Banque Accord from 3-60 months for amounts ranging from USD 110 to USD 28,000 (EUR 100 to EUR 21,500).<sup>cdxlv</sup> Similarly, Bauhaus, a home improvement store with locations in several European countries including Spain and Germany, offers financing for 3, 6, 12, and 18 month terms.<sup>cdxvi</sup> As of March 2016, consumer interest rates in Spain were 8 percent while credit card interest rates were 21 percent—versus 6 percent and 17 percent, respectively, for Europe as a whole.

In addition to these general home improvement finance options, some countries in the EU, including Germany and France, have experimented with specialized state-sponsored financing for residential energy efficiency. These include KfW-financed programs through local banks in Germany and the French “Grenelle de l’Environnement 2008” plan. Despite this access to financing for home energy efficiency improvements, customer demand for loans specifically for energy efficiency lags behind available capital.<sup>cdxlvii</sup> Energy efficiency programs sponsored by many US states, local governments and utilities often have experienced similar issues, however, and in some cases programs have

required modification to make them more homeowner and contractor friendly. In particular, the WHEEL program's success may be due in large part to its fast and easy (when compared with typical credit union or home equity/second mortgage products) application and approval process.

## Germany

Through Germany's KfW Energy Efficiency Home Loan Program, state-owned KfW Development Bank provides funds to local German retail banks that originate low interest loans for home improvements and newly constructed energy-efficient homes. The German banks sell the loans to consumers at interest rates based on the energy quality of the property.<sup>cdxlviii</sup> Eligible measures include thermal insulation of walls, roofs and floor space; renewal of windows and exterior doors; installation and renewal of ventilation systems; renewal of heating systems; and optimization of heat distribution for existing heating systems.<sup>cdxlix</sup> Upon completion of a project, KfW Bank forgives a portion of the loan sum with a repayment bonus transferred to the borrower's account.<sup>cdl</sup> Germany has had great success with this KfW Bank-sponsored loan program; in 2014, KfW provided EUR 3.7 billion to homeowners for energy-efficient refurbishments and EUR 5.6 billion for construction and purchase of homes with high energy efficiency standards.<sup>cdli</sup> Our inquiry there focuses on whether there remains a need for a WHEEL-type program to address the reactive market and/or increase demand for energy efficiency improvements.

## France

The French government has also taken measures to incentivize energy-efficient home renovations as part of its "Grenelle de l'Environnement 2008" commitment to reduce energy consumption in residential buildings by 38 percent by 2020.<sup>cdlii</sup> Financing approaches include zero-interest loans and tax relief. These zero-interest loans have been very popular: by 2011, 200,000 zero-interest eco-loans had been signed.<sup>cdliii</sup> In 2015, after a revamp in the zero-interest loan program, 6,000 municipalities in France expressed interest in the program.<sup>cdliv</sup> Eligible measures include: improved heating, cooling and insulation systems; renewal of ventilation equipment; and more efficient hot water production. Energy suppliers have restructured their organizations in the face of increasing demand for home improvements.<sup>cdlv</sup> In addition, the Parisian Climate Agency's CoachCopro initiative provides a one-stop shop, including financing, for multifamily home energy renovations.<sup>cdlvi</sup> President Hollande recently announced the French government's commitment to redirecting funding to energy and environmental investments, including green bonds, with the help of public banks.<sup>cdlvii</sup>

## European Union

The European Fund for Strategic Investments (EFSI) mobilizes private financing for strategic investments in energy efficiency projects and infrastructure.<sup>cdlviii</sup> In 2015, the EFSI agreed to provide a guarantee for an innovative project focused on issuing loans to French homeowners for energy-efficient retrofits.<sup>cdlix</sup> The European Investment Bank (EIB) will fund approximately EUR 400 million of the expected total investment of EUR 800 million.<sup>cdlx</sup> The project will include collaboration among commercial banks, regional public entities, and public-private entities. Notably, the EIB also is looking into new measures to facilitate the development of a European green securitization market that would include warehousing facilities and extending the European Commission-backed Project

Bond Credit Enhancement Initiative, which is tasked with improving capital market financing for infrastructure projects in the transportation, energy, and information technology sectors.<sup>cdlxi</sup> With this initiative, the EIB hopes to attract capital market investors using a financing scheme aimed at increasing a project's credit rating through the provision of a subordinated tranche to raise the credit standing of the senior tranche.<sup>cdlxii</sup>

Finally, like KfW in Germany, the European Bank for Reconstruction and Development (EBRD), provides funds to local banks to finance energy efficiency work in some countries within the EU. For instance, the Moldovan Residential Energy Efficiency Financing Facility (MoREEFF) gave a EUR 35 million line of credit to local banks that lend to customers for residential energy efficiency upgrades, including window replacements.<sup>cdlxiii</sup> In May 2016, the EBRD announced a similar program in Croatia. It will provide a USD 60 million facility to finance partner financial institutions providing loans to homeowners for energy efficiency improvements including upgrades to more efficient windows, boilers, appliances, and heat pumps, as well as installation of solar water systems and insulation of walls, floors, and roofs.<sup>cdlxiv</sup> EBRD is able to avoid EU state aid rules because aid granted by supranational and multinational organizations is considered to be outside the scope of the State Aid Scoreboard.<sup>cdlxv</sup>

## Existing Contractor Networks

Under EU law, nearly all properties are required to provide buyers or renters with an energy efficiency rating (Energy Performance Certificate) prior to sale or lease, supporting networks of contractors with energy efficiency skills and expertise. In some countries, voluntary labels for high energy performance are also used. In Germany, property owners are required under the Energy Saving Ordinance (EnEV 2013 or "Energieeinsparverordnung") to make energy-efficient upgrades of buildings prior to a sale.<sup>cdlxvi</sup> Energy auditors that perform assessments for energy efficiency ratings may be potential WHEEL partners.<sup>cdlxvii</sup>

European utilities generally have energy efficiency programs, further supporting energy efficiency contracting.<sup>cdlxviii</sup> Unlike US utilities, which may approve a list of certain independent private contractors if a homeowner wishes to obtain a utility rebate or financing, European utilities often own contractor businesses directly in a more vertically integrated business model. The centralization of ownership of these contractors might simplify the process of generating loan pipeline if the utility owner directed its contractors to offer WHEEL-type financing.

In addition to pre-sale efficiency work and utility efficiency programs, governments in a number of EU countries have supported specific home energy efficiency programs that require contractors skilled in energy efficiency improvements. The German government, for instance, recently certified approximately 6,000-8,000 energy efficiency home project managers to perform comprehensive upgrades and help homeowners find the appropriate financing option at their local banks.<sup>cdlxix</sup> The French government incentivizes the work of individual "artisans," which means homeowners may need to consult with numerous professionals in order to complete a comprehensive or integrated home energy retrofit.<sup>cdlxx</sup> However, contractor networks of "eco-renovation advisors" are being established.<sup>cdlxxi</sup>

## Possible Sources of Credit Enhancement

National governments, development banks, and the super-national European Union bodies are natural possibilities to explore as sources of credit enhancement for a WHEEL-type program in the EU. Member states of the European Union jointly pledged to reduce their greenhouse gas emissions by at least 40 percent by 2030 compared with 1990 levels.<sup>cdlxxii</sup> The UK, which is on its way to reducing emissions by 57 percent by 2030 according to its own domestic Climate Change Act 2008, would have been a major contributor to fulfilling the EU's joint pledge. Because of Brexit, some EU member states will need to increase efforts for emission reduction to compensate for the UK's exit, a role that energy efficiency financing programs like WHEEL could fill.<sup>cdlxxiii</sup> In March, the European Council called on the European Commission to circulate proposals and to take legislative action to implement this framework.<sup>cdlxxiv</sup> Notably, Europe has more than 250 energy efficiency finance programs, although most are grants or secured credit.<sup>cdlxxv</sup> The European Commission is moving toward issuing loans instead of grants as part of a financing strategy that includes energy efficiency loans.<sup>cdlxxvi</sup> Residential loans originated with local authorities are one type of loan under consideration.

The EU also established the Energy Efficiency Directive (EED) to fulfill the promise of the EU 20-20-20 Strategy, which plans to cut primary energy consumption by 20 percent by 2020. Article 7 of the EED requires EU member states to establish Energy Efficiency Obligations or other policy measures that will help reduce final energy use by 1.5 percent each year. Significantly, of the 479 policy measures proposed by EU member states in response to the EED, 184 (38 percent) are financing schemes or fiscal incentives dedicated to investment in energy efficiency - which are expected to deliver 19 percent of total energy savings achieved by policy measures, equivalent to 49,032 ktoe (570,242,160 MWh).<sup>cdlxxvii</sup> An EU WHEEL-type program could potentially find funding from EU member states complying with the EED.

In 2015, the EFSI agreed to provide a guarantee for an innovative project focused on issuing loans to French homeowners for energy-efficient retrofits.<sup>cdlxxviii</sup> The EIB is also looking into new measures to facilitate the development of a European green securitization market that would include warehousing facilities and extending the European Commission-backed Project Bond Credit Enhancement Initiative, which is tasked with improving capital market financing for infrastructure projects.<sup>cdlxxix</sup>

In addition to these EU-wide efforts, individual countries within the EU may be a source of credit enhancement for a WHEEL-type program to the extent blessed by the European Commission (state aid tribunal). For example, France has provided funding for a residential energy efficiency loan program as part of "Grenelle de l'Environnement 2008." Furthermore, the French parliament recently expressed its willingness to support green projects by passing the Law on Energy Transition for Green Growth, which is thought to be the first-ever law to impose climate change-related disclosure requirements on investors.<sup>cdlxxx</sup> Similarly, the Spanish government has subsidized appliance and window replacement programs,<sup>cdlxxxi</sup> and it has pledged EUR 125 million to improve energy efficiency in residential housing and the hotel industry as part of its 2014-2020 National Energy Efficiency Action Plan and Aid Program for the Energy Renovation of Existing Buildings program (PAREER).<sup>cdlxxxii</sup> KfW in Germany, which provides very low-cost capital to retail banks for

residential energy efficiency loans, is a potential partner for loans in Germany and in other countries in which KfW operates.<sup>cdlxxxiii</sup> In June 2016, KfW brought in EUR 8 billion of demand for a negative yielding EUR 5 billion five-year deal.<sup>cdlxxxiv</sup> The UK GIB also may be a possible partner; it committed capital for the Green Deal, but never provided it since the volume of loans failed to hit a minimum threshold to trigger their commitment.<sup>cdlxxxv</sup> We were unable to find any notices issued by the European Commission approving these residential energy efficiency loan programs for being in compliance with state aid rules.

However, the Brexit referendum will have implications for the financial sector in the EU. While cities like Paris and Frankfurt may benefit as large banks consider leaving London for cities within the EU, the expensive relocation process of financial services will have a more widespread impact on businesses and households: cost of financial services will increase and there will be a loss of liquidity.<sup>cdlxxxvi</sup> All of these impacts on the financial sector raise doubts as to the potential success and ease of implementing a WHEEL-type program in the EU.

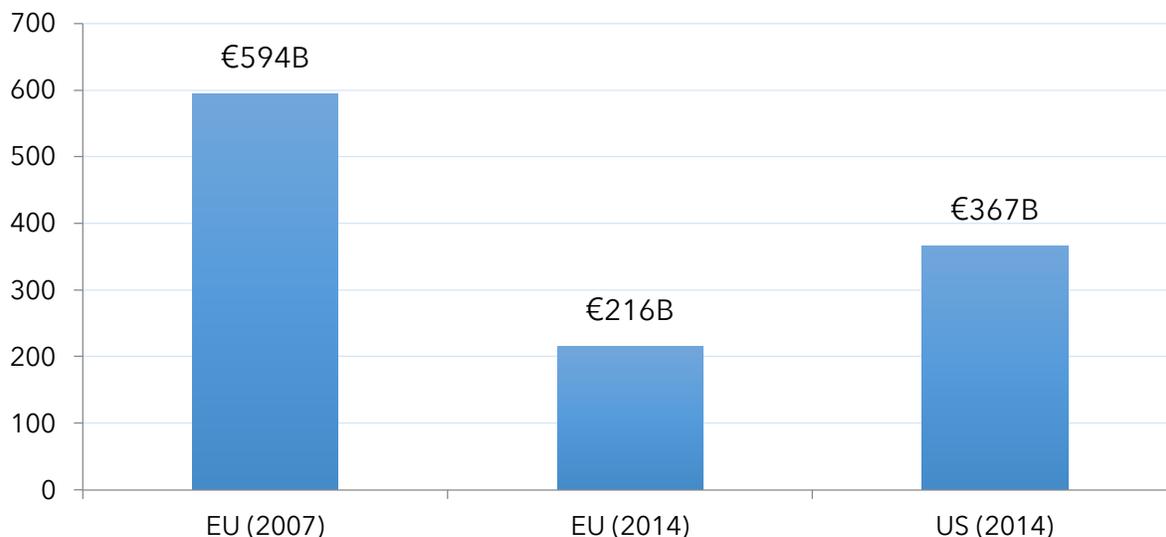
### Possible Sources of Senior Capital During Aggregation Period (Warehousing)

Private banks or public green finance institutions could provide a warehouse line of credit during the pre-securitization aggregation period in a WHEEL-type program. In the US, Citi has been the WHEEL private capital provider; prior to Citi, Rabobank had been involved. Banco Santander (Spain), BNP Paribas (France), Deutsche Bank (Germany), and Société Générale (France) were recently ranked among the top 30 greenest banks worldwide and could also be interested.<sup>cdlxxxvii</sup> A number of development banks and public green finance institutions, including the UK GIB, could also serve this role.

### Securitization Landscape

The European capital markets have historically been overshadowed by its banking sector, in contrast with the US, where capital markets financing dominates.<sup>cdlxxxviii</sup> European securitization volume has diminished significantly since before the financial crisis of the late 2000s: securitization volume in 2014 (EUR 216 billion, approximately USD 241 billion) was less than half of the pre-crisis amount (EUR 594 billion, approximately USD 663 billion).<sup>cdlxxxix</sup> (See Figure 51). European public issuance volume in the first quarter of 2016 (EUR 14.3 billion, approximately USD 16 billion) was at its lowest since mid-2011.<sup>cdxc</sup> And as of October 13, 2016, total issuance for the first half of the year was EUR 43 billion, compared with EUR 82 billion in 2015.<sup>cdxci</sup> The future of the European securitization remains very uncertain. Securitization is relatively unattractive due to the availability of cheaper alternative forms of financing, such as covered bonds. Moreover, there is a stigma attached to asset-backed securities that has only worsened after the financial crisis.<sup>cdxcii</sup>

**Figure 51: Securitization Volume: EU vs. US**



Source: *Wall Street Journal & Asset-Backed Alert & Financial Times*.

Note: 2014 US Securitization Volume nearly USD 488 billion and already nearly USD 500 billion in 9M 2016. US figures assume 2014 conversion rate of EUR 1 = USD 1.33.

The European securitization market is also highly concentrated: the majority of transactions are comprised of bank-sponsored residential mortgage-backed securities, and just a handful of countries (the Netherlands, Italy, Spain, Germany, and Belgium) made up a total of 81 percent of transactions occurring in the securitization market in 2014.<sup>cdxciii</sup> A proposed law to lift capital requirements on European banks and to boost “simple, transparent and standardized” (STS) securitizations is undergoing a thorough review to prevent pre-crisis conditions.<sup>cdxciv</sup>

Nonetheless, the European securitization market remains one of the most active in the world. The European securitization market includes the following asset classes: auto loan asset-backed securities (ABS), residential mortgage-backed securities (RMBS), commercial mortgage-backed securities (CMBS), credit card receivables, equipment and other leases, and consumer loans.<sup>cdxcv</sup> In September 2016, Crédit Agricole EUR 578.4 million Ginkgo 2016-PL1 deal was set for pricing.<sup>cdxcvi</sup> This deal, backed by unsecured consumer loans, indicates that securitization of these kinds of assets is possible in France. Germany’s Volkswagen VCL 24 deal, which was backed by auto leases and had a EUR 1.17 billion class A tranche and EUR 28.7 million class B tranche, was priced in October 2016, with more European auto loan securitizations expected to be finalized in the near future.<sup>cdxcvii</sup> Currently, European banks and captive finance companies owned by auto manufacturers are working on green loan securitizations as well.<sup>cdxcviii</sup> In addition, the Independent Debt Capital Markets (IDCM), a primary markets debt boutique firm, has been doing securitizations backed by UK renewable assets in the private placement market since November 2012 and is now working to securitize Italian collateral.<sup>cdxcix</sup> The green bond market is on the rise as well, as illustrated by France’s Agence France Trésor’s (AFT) September 2016 announcement of its plan to issue sovereign green bonds (green OATs) within the following year.<sup>d</sup>

Although the securitization market is well-established in Europe (which would facilitate the implementation of WHEEL on the back-end) and EU directives exist to create a more integrated

market (see Appendix C for the EU Prospectus and Transparency Directives), standardization is still lacking both across and within EU countries on issues such as legal structures and private placements.<sup>di</sup> The EU does have a single rulebook with which all EU financial institutions must comply, but it does not yet cover securitization.<sup>dii</sup> Furthermore, there is significant fragmentation along national lines, as the EU can only act within the limits of the competencies conferred on it; EU member states largely retain national competence in taxation, insolvency law, and private law.<sup>diii</sup> Thus, the many differences in securities law, taxation, debt enforcement, and insolvency regimes across the EU countries have had a role in creating the currently underdeveloped capital market<sup>div</sup> by restricting interest and the investor base.<sup>dv</sup> A proposed European Capital Markets Union (CMU) and the Pan-European Private Placement initiative seek to alter these gaps.<sup>dvi</sup> Development on the CMU project has been slow after the commissioner in charge, the UK's Jonathan Hill, resigned due to Brexit.<sup>dvii</sup> In September 2016, however, the EU's 'State of the Union' communication promised faster progress on the CMU project, calling for rapid implementation of the first measures proposed in the Action Plan. The European Commission also announced that the CMU would provide greater support to green finance: more European investment funds would be committed to green projects, and 20 percent of all EFSI funds would be reserved for climate initiatives. In addition to this, the Commission plans to create an "expert group" in order to develop a more comprehensive European strategy on green finance.<sup>dviii</sup>

Additionally, integration of securitizations across EU countries will be difficult. Notably, the European Energy Efficiency Fund (EEEF) tried to do a multicountry approach to securitization through Luxembourg, but the loan performance likely is not high enough to get an interest rate that is favorable enough to generate demand.<sup>dix</sup> (See Appendix C for Luxembourg securitization law). Still, cross-EU securitizations are feasible through Irish, Dutch, and Luxembourg vehicles, and have been done before using trade receivables. Acquiring securitizations through other countries like France or Italy would require additional structuring costs, namely creating a special purpose vehicle (SPV) that would issue a note to the main vehicles in Ireland (a particularly popular destination for SPV establishment due largely to its developed corporate legal system, lack of thin capitalization rules, and favorable tax regime),<sup>dx</sup> Holland, and Luxembourg. Cross-border securitizations of trade receivables are also feasible in Germany and Spain, but avoided because of the additional costs involved.

Another potential issue with securitization is currency risk. WHEEL might work best focusing on individual European markets since non-local investors may be deterred from participation over concerns about currency.<sup>dxii</sup>

The EU's state aid rules can also be a potential hurdle to WHEEL. (See "Possible Sources of Credit Enhancement; Impact of Brexit" in the UK section for more background on these rules). Though the European Commission's approvals of UK GIB and the Green Deal as well as the existence of several residential energy efficiency loan programs in France and Germany offer hope that a WHEEL-type program could similarly be deemed compatible with state aid rules, there is no guarantee that this will happen. Thus, ensuring that WHEEL can evade state aid rules will be essential to establishing a similar program in the EU.

## Alternatives

An alternative to WHEEL in the studied countries like Germany and France would be to focus on markets that do not already benefit from a strong state support mechanism.<sup>dxii</sup> For instance, Italy and other Southern European states tend to receive less government support for energy efficiency programs. They also have more sunshine, which could contribute to the rationale for financing energy efficiency upgrades that also include solar. Eastern Europe is also a potential market where there is a strong need for clean energy financing and a willingness from development banks to provide support for lending programs.<sup>dxiii</sup>

# APPENDICES

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## Appendix A: Methodology

### *Energy Savings for WHEEL 1.0*

Calculating energy savings requires knowledge of energy consumption after the completed installation of an energy efficiency measure (observed energy use) and energy consumption before installation (baseline). For their baseline, Renew Financial used existing figures on residential energy use per household from the state of Pennsylvania, which were separated between electricity (10,011 kWh/household), natural gas (940 ccf/household), heating oil (688 gallons/household), and propane (440 gallons/household). For energy consumption after installation of the measure, true consumption data cannot be known until a measure has been in operation for some time. Thus, Renew Financial had to estimate this figure, relying on various assumptions, citations, and formulas.

One assumption was that the WHEEL 1.0 program would achieve a 2.5 percent reduction in energy use per USD 1,000 of energy efficiency investment. This figure was based on the most conservative estimate put forth by the Weatherization Assistance Program's savings experience. This translated to a 22.50 percent reduction in energy use per home in the WHEEL 1.0 program as every participating home was projected to spend an average of USD 9,000 on energy projects.

Renew Financial also used data sourced from the US EIA concerning the percentage of homes heated by energy source in Pennsylvania: 28 percent of homes were heated by electricity, 40 percent by natural gas, 21 percent by heating oil, and 11 percent by propane. In terms of percentage of homes powered by energy source in Pennsylvania, the assumption was that 100 percent were powered by electricity, while natural gas, heating oil, and propane all contributed 0 percent.

To calculate estimated energy savings for the WHEEL 1.0 program, Renew Financial multiplied per home reduction in energy use (22.50 percent) by the average residential energy use per household in Pennsylvania by the number of homes participating in the program (2,079 homes) by the heating fuel share weighting plus the electricity share weighting. For example, total electricity savings of 6,171 MWh/yr were calculated as follows:

$$\text{Electricity Savings} = \delta \times \alpha_1 \times \mu \times (1 + \beta_1)$$

where  $\delta$  = expected percentage of reductions in energy use per home  
 $\alpha_1$  = the average amount of electricity consumed per household in PA  
 $\mu$  = the number of participating households  
 $\beta_1$  = the percentage of homes heated by electricity in Pennsylvania

Natural gas savings of 189,353 therms/yr (or 193,482 ccf/yr) were calculated in a similar fashion:

$$\text{Natural Gas Savings} = \delta \times \alpha_2 \times \mu \times \beta_2$$

where  $\delta$  = expected percentage of reductions in energy use per home  
 $\alpha_2$  = the average amount of natural gas consumed per household in PA  
 $\mu$  = the number of participating households  
 $\beta_2$  = the percentage of homes heated by natural gas in Pennsylvania

Using the same logic, Renew Financial found that the WHEEL 1.0 program could potentially save 70,681 gallons of heating oil and 22,601 gallons of propane.

### *Energy Savings and Greenhouse Gas Savings Per Country*

The model used in this paper to estimate carbon dioxide savings by country for a mature WHEEL program is based on the one used by Renew Financial to estimate savings for the Pennsylvania WHEEL program. Energy savings for each country were calculated using the same equations presented in the above section, with variables modified to be country-specific.

Two of the variables that were modified from Renew Financial's model are the average amount of electricity and natural gas consumed per household. These were tailored to each of the countries studied based on data from the US EIA, Enerdata, and IndexMundi. In addition, the number of participating households was recalculated to reflect a mature WHEEL program by dividing USD 100 million by average per project costs. We assumed average per project costs to be equivalent to those seen in WHEEL 1.0, meaning that 10,764 homes would be able to participate in a mature WHEEL program. Notable exceptions were India and Brazil, which have predominantly hot climates and, consequently, little need for space heating. In these countries, energy efficiency measures will primarily be in the form of air conditioning and ceiling fan replacement. Thus, per project costs were adjusted lower to USD 1,000, since the most energy-efficient air conditioners in India and Brazil range between USD 300-1,000, and labor costs are to be considered, too. Lower per project costs in India and Brazil mean that approximately 100,000 homes in each country will be able to participate in a mature WHEEL program.

One of the variables retained from Renew Financial's model was the assumption that energy efficiency measures would conservatively achieve a 2.5 percent reduction in energy use per USD 1,000 of investment. The percentage of homes heated by electricity versus those heated by natural gas in the studied countries were also assumed to be the same as the figures used in the Renew Financial model, except in the case of India and Brazil, since space heating is not widespread in these countries. However, water heating was taken into consideration. In India, water heating is seasonal and is typically used 2-4 months of a year. The most popular option for heating water is with the use of electric water heaters. Otherwise, households generally use stovetops to heat water.<sup>dxiv</sup> However, water heating on stovetops is not relevant to our calculations as India still relies primarily on solid fuels for stoves and WHEEL does not focus on energy efficiency measures related to cooking. In Brazil also, there is a heavy dependence on electricity for water heating, as electric showerheads are common fixtures found in Brazilian households. Taking these facts into consideration, we adjusted the heating fuel share of electricity to 90 percent and reduced the heating fuel share of natural gas to 10 percent. The energy savings calculated for each country are as follows (see Figure 52):

**Figure 52: Energy Savings Per Country**

Country	Electricity Savings (MWh)	Natural Gas Savings (therms)
India	5,130	22,811
China	5,453	119,751
Brazil	9,804	37,385
UK	12,595	678,940
Germany	9,869	676,724
Spain	12,634	691,852
France	16,128	628,237
The EU	11,520	663,065

Based on IEA data from *CO<sub>2</sub> Emissions from Fuel Combustion* © OECD/IEA 2015, [www.iea.org/statistics](http://www.iea.org/statistics), Licence: [www.iea.org/t&c](http://www.iea.org/t&c); as modified by Energy Programs Consortium.

To arrive at the amount of CO<sub>2</sub> saved in a WHEEL-type program from electricity generation, we performed a simple calculation multiplying electricity savings by the amount of CO<sub>2</sub> emitted in electricity generation by country. Data on country-specific CO<sub>2</sub> emissions resulting from electricity generation are taken from the US EIA and the IEA. The same simple calculation was used to estimate CO<sub>2</sub> savings from reduced natural gas usage, which was added to CO<sub>2</sub> savings from electricity generation to estimate total GHG savings from a mature WHEEL program. Below is a breakdown of GHG savings from electricity generation and natural gas. (See Figure 53).

**Figure 53: 2013 CO<sub>2</sub> Savings Per Country**

Country	Emissions reduction from Electricity Generation (tons)	Emissions Reduction from Natural Gas (tons)	Total Emissions Reduction (tons)
India	4,467	139	<b>4,606</b>
China	4,267	709	<b>4,976</b>
Brazil	1,405	231	<b>1,636</b>
UK	6,386	4,064	<b>10,450</b>
Germany	5,330	3,961	<b>9,291</b>
Spain	3,482	4,255	<b>7,737</b>
France	1,067	3,940	<b>5,007</b>
The EU	4,317	3,830	<b>8,147</b>

Based on IEA data from *CO<sub>2</sub> Emissions from Fuel Combustion* © OECD/IEA 2015, [www.iea.org/statistics](http://www.iea.org/statistics), Licence: [www.iea.org/t&c](http://www.iea.org/t&c); as modified by Energy Programs Consortium.

In India's case, domestic energy consumption is projected to increase at an unprecedented rate. Between 1970 and 2012, residential electricity consumption increased at a Compound Annual Growth Rate of 9.44 percent, faster than any other sector.<sup>dxv</sup> Rising incomes will only continue to fuel this rapid growth in energy consumption. In a business-as-usual scenario, the Global Buildings

Performance Network predicts that residential electricity consumption in 2050 will be eight times higher than in 2012. Single-family and multifamily households are expected to have the highest growth rates in energy consumption between 2005 and 2050.<sup>dxvi</sup> Given such rapid growth in residential electricity consumption, electricity savings calculated here for India are likely underestimated. Thus, actual electricity savings and GHG savings achieved could be much higher, which provides further indication that a WHEEL-type program could be beneficial to India.

## Appendix B: Sample Credit Reports

The People's Bank of China, Credit Reference Center

Report SN: 2010113003000014210351  
Inquiry Time: 2010.11.30 09:30:15  
Report Generation Date: 2010.11.30  
Name: Ouyang Guanjun  
Identity Type: ID Card  
Identity Number: 41010519750324xxxx  
Marriage Status: Married

### Credit Records

This section contains details of your credit history on credit cards, loans and other credit accounts. The amount recorded herein is in RMB, correct to the last yuan.

#### Summary

Late payments records may have negative impact on your credit standing.

	Asset Disposal	Compensation Made by Guarantor
Number of transactions	1	2

	Credit Card	Housing Loan	Other Loans
Number of accounts	7	3	4
Open accounts	4	2	3
Accounts with overdue payments	4	1	1
Accounts with payments overdue for more than 90 days	4	0	0
Guarantees for others	0	0	1

#### Asset Disposal

- XX Assets Management Company took over the RMB400,000 non-performing loans unde on November 8, 2010. The last repayment was made on January 8, 2011. The amount of unpaid loan is RMB20,000.

#### Compensation Made by Guarantor

- XX Financing Lease Guarantee Company made the last compensation on October 5, 2008, with the accumulative compensation RMB400,000. The last payment was made on January 8, 2011. The amount of unpaid loan is RMB20,000.
- XX Insurance Company made the last compensation on June 21, 2009, with the accumulative compensation RMB200,000. The last repayment was paid on April 5, 2011. The amount of unpaid loan is RMB135,000.

#### Credit Cards

Details of credit card accounts with overdue payments:

- Credit card (denominated in RMB) issued by XX Branch, A Bank on August 30, 2004. As of October 2010, the credit limit is RMB10,000, of which RMB500 has been used and the overdue amount is RMB500. In the last five years, the account has been overdue

in 11 months, among which payments were overdue for more than 90 days in 5 months.

2. Credit card (denominated in RMB) issued by the Credit Card Center of B Bank, on April 1, 2003. The card was cancelled in December 2009. In the last five years, the account has been overdue in 7 months, among which payments were overdue for more than 90 days in 3 months.

This institution stated in March 2010 that this client has commissioned XX Real Estate Development Company to repay the loan for him. However, the company failed to make payments on time for many times.

**Detailed information about quasi-credit card accounts with overdrafts for more than 60 days:**

3. Quasi-credit card (denominated in RMB) issued by XX Branch, C Bank on June 30, 2007. As of October 2010, the credit limit was RMB10,000 and the overdraft balance was RMB5,000. In the last five years, the account had overdrafts for more than 60 days in 6 months, among which overdrafts lasted for more than 90 days in 3 months.
4. Quasi-credit card (denominated in RMB) issued by XX Branch, D Bank on March 30, 2006. The card was cancelled in December 2009. In the last five years, the account had overdrafts for more than 60 days in 20 months, among which overdrafts lasted for more than 90 days in 16 months.

**Details of quasi-credit card accounts without any overdue payment or overdrafts more than 60 days:**

5. Credit card (denominated in USD) issued by XX Branch, E Bank on June 30, 2007. As of October 2010, the credit limit was RMB6,800, of which RMB100 has been used.
6. Credit card (denominated in RMB) issued by F Bank on July 1, 2006. The card was cancelled in December 2009.
7. Credit card (denominated in RMB) issued by XX Branch, E Bank on June 30, 2007. As of October 2010, the credit limit was RMB10,000, but the card has yet to be activated.

## Housing Loans

**Details of accounts with overdue payments:**

1. Personal housing loan of RMB608,000 (the loan was denominated in USD and converted to RMB in the report) granted by Beijing Branch, Agricultural Bank of China on August 30, 2008. The due date of the loan is August 30, 2028. As of September 2010, the balance was RMB572,750. In the last five years, the account was overdue in 1 month, with no overdue lasting more than 90 days.

**Details of accounts without any overdue payment:**

2. Personal commercial housing (including housing for both commercial and residential purposes) loan of RMB200,000 granted by XX Branch, C Bank on May 8, 2009. The loan will become due on May 8, 2029. As of October 2010, the balance was RMB50,000.
3. Personal housing provident fund loan of RMB200,000 granted by XX Branch, F Bank on July 1, 2006. The loan was settled in December 2009.

## Other Loans

**Details of accounts with past-due payments:**

1. Auto loan of RMB100,000 granted by XX Branch, A Bank on August 30, 2008. The due date of the loan is August 30, 2018. As of September 2010, the balance was RMB72,750 and the overdue amount was RMB2,200. In the last five years, the account was overdue payables in 2 months, during which no overdue lasted more than 90 days.

**Details of accounts without any overdue payment:**

2. Personal business loan of RMB100,000 granted by XX Branch, G Bank on May 8, 2009. The due date of the loan is May 8, 2019. As of October 2010, the balance was RMB50,000.
3. Auto loan of RMB100,000 granted by XX Auto Financing Company on April 15, 2008. The due date of the loan is April 15, 2013. As of

October 2010, the balance was RMB50,000.

4. Student loan with a contractual amount of RMB40,000 granted by XX Branch, C Bank on July 1, 2004. The loan was settled in December 2009.

### Guarantee Provided to Others

1. Guarantee provided on March 2, 2009 for a loan granted by XX Branch, C Bank to Zuo SJ (ID type: ID card; ID No.: 42010519850324xxxx). The contractual amount of the secured loan is RMB50,000 and the amount of guarantee is RMB50,000. As of October 5, 2010, the balance of the principal of the secured loan was RMB30,000.

## Public Records

This section contains your credit information concerning tax arrears, civil judgments & enforcements, administrative penalties and telecommunication arrears in the last five years. The amount recorded herein are in RMB, correct to the last yuan.

### Tax Arrears Records

Competent Tax Authority: Local Taxation Bureau, Dongcheng District, Beijing Time reported: October 2007  
Total amount of tax arrears: RMB500 Taxpayer's registration number: 12485

### Civil Judgment Records

Court of Filing: Beijing Xicheng People's Court Case Number: (2007) J.M.Y.CH.Z. No. 00056  
Cause of action: Divorce Conclusion: Judgment  
Time of filing: January 2007 Judgment/settlement result: Defendant Zhang San to compensate plaintiff Li Si with RMB420,000.  
Object of action: Real estate transaction dispute Time of effectiveness of judgment/settlement: April 2007  
Amount of object of action: RMB500,000

### Enforcement Records

Court of Filing: Beijing Xicheng People's Court Case No.: (2007) J.M.Y.CH.Z. No. 00059  
Cause of action: Divorce Conclusion: Enforcement  
Time of filing: June 2007 Status of Case: Enforcement completed  
Enforcement Target: House Enforcement Target (enforced): House  
Enforcement Value: RMB420,000 Enforcement Value (enforced): RMB420,000  
Time of settlement: August 2007

### Administrative Penalty Records

Penalising Authority: Beijing Dongcheng Local Tax Bureau Document Number: D.SHLF.Z. [2007] No. 7  
Penalty Type: Tax withholding Administrative review Y/N: No

Penalty Amount: RMB500	Result of Administrative Review: N/A
Penalty Takes Effect From: May 2007	Deadline for penalty: ----
Penalising authority: Hunan Provincial Construction Management Service Center	Document No.: HN0923456-CF
Penalty Type: Withholding, revocation, detention or cancellation of licence	Administrative Review Y/N: ----
Penalty Amount: ----	Result of Administrative Review: ----
Penalty Takes Effect From: August 2007	Deadline for Penalty: December 2007

### Telecommunication Arrears

Telecommunication Service Provider: China Mobile      Business Type: Fixed phone line      Account Date: October 2008  
Service Enabled Date: June 2007      Amount of Arrears: RMB500

### Inquiry Records

This section contains the inquiries made into your credit information in the recent two years.

SN	Date of Inquiry	Inquiry By	Reason for Inquiry
1	May 5, 2010	XX Branch, A Bank /user	Post-lending management
2	April 23, 2009	XX branch office , Credit Reference Center /user	Record holder (i.e., you)
3	December 10, 2008	XX Branch, B Bank /user	Loan approval
4	December 2, 2008	XX Branch, C Bank /user	XX Branch, C Bank/user

You also made another three inquiries online in 2010.

### Notes

- The Credit Report displays data in the system at the time of report generation. Apart from query records that are automatically generated by the system, all other data contained in this report are reported by financial institutions. The Credit Reference Center does not guarantee the authenticity and accuracy of such information. However, it is committed to an objective and neutral perspective during the whole process of information collation, processing and integration.
- This report only contains the key information that may affect your credit assessment. If you need more detailed records from the Consumer Credit Reporting System, please inquire at the local credit report inquiry office. You can visit the website of the Credit Reference Center ([www.pbccrfc.org.cn](http://www.pbccrfc.org.cn)) for specific addresses and contact information.
- You have the right to dispute information contained in your credit report. You may contact the data provider or bring up a dispute application at the credit report counters at local PBC branches or sub-branches.
- This report is provided only for you to better understand your credit status. Please keep it in a safe place. The Credit Reference Center will assume no liability for any disclosure of personal information arising from poor safekeeping.
- Please call our customer service hotline 400-810-8866 for more information.

Impressão

**FCDL-RS**

Produto: SPC  
 Operador: LARISSA  
 Data/Hora: 22.01.2016 | 17h:43m

**DADOS INFORMADOS**  
 CPF: [REDACTED]

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**INFORMAÇÃO CONFIDENCIAL.**  
 USO EXCLUSIVO DA EMPRESA ASSOCIADA PARA AUXÍLIO NA APROVAÇÃO DE CRÉDITO.  
 A DIVULGAÇÃO DE TAIS INFORMAÇÕES A TERCEIROS SUJEITARÁ O INFRATOR ÀS SANÇÕES PENAIS.

---

**RESUMO DAS OCORRÊNCIAS**  
 CPF: [REDACTED]  
 Nome: [REDACTED]

Ocorrência	Quantidade	Última Ocorrência	Valor
Confirmação dados telefônicos:	-	-	-
Registro de SPC:	2	09/2013	[REDACTED]
Informações do poder judiciário:	-	-	-
Registro de Cheque lojista:	-	-	-
Consulta realizada:	1	10/2015	-
Alerta de documentos:	-	-	-
Crédito concedido:	-	-	-

---

**IDENTIFICAÇÃO**  
 CPF: [REDACTED]  
 Situação do CPF: REGULAR em 29/01/2015 às 00:22  
 Nome: [REDACTED]  
 Data de Nascimento: [REDACTED]  
 Nome da mãe: [REDACTED]

---

**ENDEREÇO/LOCALIZAÇÃO**  
 Endereço: [REDACTED] ⓘ  
 Bairro: [REDACTED]  
 UF: [REDACTED]  
 Cidade: CARAPICUIBA  
 CEP: 06343-240

---

**REGISTROS DE INADIMPLÊNCIA - SPC**  
 Total de Registros: 2

Data Inclusão	Data Vencimento	Contrato	Comprador/Fiador/Avalista
1 22/09/2013 Valor [REDACTED]	09/02/2013	0000000127296719 Cidade/UF origem -	COMPRADOR Origem SERASA EXPERIAN
2 26/08/2012 Valor [REDACTED]	14/01/2012	0000000018734081 Cidade/UF origem -	COMPRADOR Origem SERASA EXPERIAN

*Prescreve em 9/2/2017*

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ALGUMAS ANOTAÇÕES DE INADIMPLÊNCIA CONSTANTES NESTE BLOCO PODEM SER PROVENIENTES DA SERASA EXPERIAN.

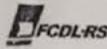
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**CONSULTAS REALIZADAS**  
 Total de Consultas (Últimos 90 dias): 1

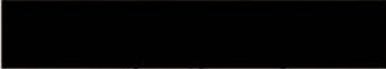
Data da Consulta	Associado/Empresa Consultante	Cidade Origem	Origem
02/10/2015 00:00:00	PORTO SEGURO	SAO PAULO / SP	SERASA EXPERIAN

*Prescreve em 14/1/2017*

Número do Protocolo: 001.497.052.204-10



Produto: SPC MIX (SPC + CHEQUE).  
 Operador: MANU  
 Data/Hora: 23.12.2014 | 17h:01m



**DADOS INFORMADOS**

CPF: [REDACTED]

SUZIANA  
 JULIANA

INFORMAÇÃO CONFIDENCIAL.  
 USO EXCLUSIVO DA EMPRESA ASSOCIADA PARA AUXÍLIO NA APROVAÇÃO DE CRÉDITO.  
 A DIVULGAÇÃO DE TAIS INFORMAÇÕES A TERCEIROS SUJEITARÁ O INFRATOR ÀS SANÇÕES PENAIS.

**RESUMO DAS OCORRÊNCIAS**

CPF: [REDACTED]  
 Nome: [REDACTED]

Ocorrência	Quantidade	Última Ocorrência	Valor
Confirmação dados telefônicos:	-	-	-
Consulta Online ao Banco:	-	Não foram informados cheques p/consulta	-
Informações do poder judiciário:	-	-	-
Registro de SPC:	3	06/2014	76,96
Cheques Sem Fundo - CCF:	-	-	-
Registro de Cheque lojista:	-	-	-
Cheque - Contra Ordem - Outras Ocorrências:	-	-	-
Consulta realizada:	2	12/2014	-
Alerta de documentos:	-	-	-
Crédito concedido:	-	-	-
Contra-ordem:	-	Não foram informados cheques p/consulta	-
Contra-ordem docto.diferente do consultado:	-	Não foram informados cheques p/consulta	-

**IDENTIFICAÇÃO**

CPF: [REDACTED]  
 Situação do CPF: REGULAR em 01/12/2013 às 05:40  
 Nome: [REDACTED]  
 Data de Nascimento: [REDACTED]  
 Nome da mãe: [REDACTED]

**ENDEREÇO/LOCALIZAÇÃO**

Endereço: [REDACTED] Cidade: CARAPICUIBA  
 Bairro: [REDACTED] CEP: 06343-240  
 UF: SP

**REGISTROS DE INADIMPLÊNCIA - SPC**

	Data Inclusão	Data Vencimento	Contrato	Comprador/Fiador/Avalista
1	17/06/2014 Valor [REDACTED]	23/05/2014 Associado/Credor LOCALIZA	AGMTZ 0084767201 Cidade/UF origem -	COMPRADOR Origem SERASA EXPERIAN
2	22/09/2013 Valor [REDACTED]	09/02/2013 Associado/Credor OI S.A.	0000000127296719 Cidade/UF origem -	COMPRADOR Origem SERASA EXPERIAN
3	26/08/2012 Valor [REDACTED]	14/01/2012 Associado/Credor OI S.A.	0000000018734081 Cidade/UF origem -	COMPRADOR Origem SERASA EXPERIAN

ALGUMAS ANOTAÇÕES DE INADIMPLÊNCIA CONSTANTES NESTE LOCAL PODEM SER PROVENIENTES DA SERASA EXPERIAN.

**CONSULTAS REALIZADAS**

CONSULTAS REALIZADAS NÃO SÃO INFORMAÇÕES DESABONADORAS, NÃO DEVENDO CONSTITUIR-SE EM FATOR RESTRITIVO DE CRÉDITO.

Data da Consulta	Associado/Empresa Consultante	Cidade Origem	Origem
22/12/2014 00:00:00	TIM CELULAR	-	SERASA EXPERIAN
03/10/2014 00:00:00	PORTO SEGURO	SAO PAULO / SP	SERASA EXPERIAN

Número do Protocolo: 001.307.599.407-7

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## Appendix C: Sample Case Studies

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# ENDNOTES

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GHG emissions avoided = (kWh saved \* GHG emissions per kWh) + (therms saved \* GHG emissions per therm)

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<sup>v</sup> See, e.g., “Accessing Secondary Markets as a Capital Source for Energy Efficiency Finance Programs: Program Design Considerations for Policymakers and Administrators.” SEE Action Financing Solutions Working Group February 2015: “Mature secondary markets often rely on highly standardized loan products and involve the packaging of multiple loans into tradable instruments. In these markets, high volume, the standardization of underlying loans, and the tradable nature of secondary market instruments can lead investors to require lower returns, which translate to lower interest rates for primary borrowers.”

<sup>vi</sup> See *Id.* An efficient secondary market for energy efficiency products is more likely to develop if (1) investors become familiar with specialized energy efficiency loan products; (2) originators successfully create tradable energy efficiency-backed instruments; and (3) some degree of standardization occurs. This could make more, lower-cost capital available, which would translate into lower interest rates for consumers. If consumer demand increases in response to these lower interest rates, total energy efficiency investment and savings would increase, moving the market closer to the vision of energy efficiency “at scale.”<sup>5</sup> If specialized energy efficiency loans outperform comparable loans over time, investors could view the loans as a distinct asset class and could reward energy efficiency products with even lower interest rates, which could further boost customer adoption.

<sup>vii</sup> See *Id.* (citing Choi Granade, et al., 2009 and Fulton & Brandenburg, 2012).

<sup>viii</sup> See “Sustainable investing is becoming much more important,” Thomas Merz, I&PE Magazine, May 2016, *available at* <https://www.ipe.com/reports/special-reports/etfs-guide-2016/sustainable-investing-is-becoming-much-more-important/10013232.fullarticle>. It identifies SRI assets by region and shows a huge amount in Europe (twice that in the US) and a small amount in Asia.

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