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Clean energy utility for multifamily housing in a deregulated energy market

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ABSTRACT

Energy efficiency and renewable energy (EERE) investment in multifamily residences in the United States has not kept pace with investment in resident-owned facilities. Split incentives, where owners cannot benefit economically from energy cost savings for residences and resident investment in EERE is not feasible, have posed a significant barrier. A clean energy utility is posited to circumvent this barrier. This utility would be responsible for power purchase from the grid, ideally as a real-time purchase agent from the grid manager; investment in energy efficiency and renewable energy; and demand management through control of water heating, as well as supply-side management through deployment of stored solar at near-peak grid power purchase cost. A clean energy fee is posed for recovery of costs, in contrast to typical consumption strategies (per kW h).

A case study approach is employed to evaluate the feasibility of this type of utility of reducing carbon production in this building sector. Considered in the analysis is a 2008 multifamily facility located in the Midwest of the U.S., with apartment level interval meters for both power and water. Historical data from these meters were used to assess the savings and demand-side management potential from investments in improved efficiency lighting, refrigeration, heat pumps, and water heaters, as well as investments in solar PV and storage for supply-side management. The results show that the packaged retrofit EERE investment could yield costs for residents and profits for energy manager comparable to those in the current residential pricing scheme, while reducing grid-sourced energy by 42%. When solar PV and battery storage are added to the solution, it is shown that a clean energy fee structure can cost-effectively drive savings to over 54%. For new construction, even deeper cost effective savings are realizable. This research demonstrates the potential to drive deep energy savings in the multifamily building sector that can lower costs to residents through the establishment of clean energy utilities which recover investments in energy efficiency, demand management, and solar PV/battery systems through resident clean energy fees rather than consumption fees.

1. Introduction

Customer-funded energy efficiency programs more than doubled over the latter half of the past decade, increasing from roughly US$2 billion in 2006 to US$4.8 billion in 2010 [1] (Consortium for Energy Efficiency (CEE), 2012). A recent study estimates that by 2025 this spending will rise to between US $6.5-16.5 billion. However, even with recent investments, energy consumption in the building sector has remained approximately flat [2] (Barbose, Goldman, Hoffman, & and Billingsley, 2013). Therefore, it is easy to argue that 'business as usual' through reliance on customer-funded energy reduction will not help the US achieve the substantial energy and carbon emissions reduction needed to respond to the looming climate change challenges.

One-third of the U.S. population live in the country's 500,000 multifamily buildings [3] (Environmental News Network, 2014), but reducing energy use in this sector is especially problematic. An energy efficiency gap for this sector relative to owner-occupied residences and rented single-family residences have been observed. This gap widens with lower residential income. A recent study documented that rental multifamily residences had energy intensities that were 37% higher than for owner-occupied multifamily units (i.e. condos or co-ops), 41% higher than for renter-occupied single family detached units, and 76% higher than in owner—occupied

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single family detached units [4] (Pivo G., 2014). This gap is partly correlated to 20% higher inhabitant densities, the significantly less energy efficient rental buildings [5] (Pivo G., 2012), and to the fact that energy costs are most typically bundled into rental payments. There is some evidence that the inability of renters to see their energy bill directly leads also to less conservation behavior. The likelihood of turning down the heat at night is 13% higher among the households that pay for gas [6] (Gillingham, 2012). Furthermore renters in the U.S. and Canada who do not pay their own utilities tend to keep their apartments warmer while they are out than those who pay for their own heat [7] (Levinson & Nieman, 2004) [8] (Maruejols, 2011). Further, a 2014 study of 3000 apartments showed that tenants used 30% more heating energy when owners paid the bill [9] (Goodman, 2014).

A number of obstacles to energy efficiency and adoption of renewable energy exist for this sector. Foremost is the 'split incentives' barrier which emerges because the costs of energy efficiency improvements are paid by the building's owner while the economic benefits of the resulting savings largely benefit the tenants if they pay the energy costs. Other impediments include: the diversity of multifamily building stock; the dispersion of building ownership – with many multifamily residences having absentee owners; the lack of access to financing for building owners; the lack of data about multifamily energy use and retrofit performance; and some legal and regulatory barriers [1] (Consortium for Energy Efficiency (CEE), 2012). Furthermore, like most buildings in the residential sector, even if an economic case could be made for investment, an underlying impediment to action is an inability to systemically reach the population of multifamily building owners to educate them about the opportunities present to them.

To encourage owners to make investments in energy efficiency, the availability of attractive utility, tax, and government incentives are likely important, as well as an emerging tenant-driven demand for green options [10] (Energy Programs Consortium, 2013). Collectively, however, these drivers have not yet realized sector-wide action.

One pathway to achieve systemic energy reduction is offered through the model provided by Virtú Investments, a large multifamily-facility manager. This organization, which embeds energy costs in rental fees, has used Property Assessed Clean Energy (PACE) financing for EE investment to realize energy savings of 12%. Their economic model has been designed to be operationally cost neutral for owners with no cost penalty for residents, with rental fees unchanged after investment. Energy cost savings are simply used to pay back the property assessment [11] (Waypoint Building Group, 2014). While operationally cost-neutral for owners they benefit through the increased property value realized from the investments. They also potentially benefit from being able to advertise their facility as a green facility to potential renters. Thus, occupancy rates could increase.

Another alternative emerges from a partnership between building owners and energy efficiency service companies and utilities through energy performance contracting [12] (McKibbin, Evens, Nadel, & Macres, 2012). In this model, energy performance contractors provide the investment in energy efficiency, and recover their investment via a contracted cost recovery with the building owner [13] (Energy Programs Consortium, 2013). Another option for cost recovery of energy efficiency investment, is through utility managed investment, with subsequent on-bill repayment (OBR). According to the American Council for an Energy Efficient Economy (ACEEE), currently utilities in at least 23 states have implemented or are about to implement OBR programs [14] (ACEEE). Both of these options have wide-scale viability, however, performance contracting service commitments will necessarily be conservative in order to ensure cost recovery. Second, OBR still needs a broker between the utility and building to identify the best investments.

A key for deep penetration of these options is the establishment of a utility business model based upon the decoupling of utility revenues from sales [15] (The Regulatory Assistance Project, 2011), [16], where residential energy fees aren't linked directly to energy consumption. One recent manifestation of this decoupling has emerged in Delaware in the form of a "Sustainable Energy Utility." The benefit of this type of utility is that "energy users can build a relationship with a single organization whose direct interest is to help residents and businesses *use less energy* and *generate their own energy cleanly*" [17] *(Sustainable Energy Utility Task Force, 2007)*. While the structure proposed in Delaware was not based upon establishing an economically advantageous model, it at least informs the value of utility led clean energy in reaching customers.

One means to establish an economically advantageous utility-building partnership in the multifamily building sector is in the growing third-party utility sub-meterering industry. In 2011, a GreenBiz article stated "It's starting to look like the next frontier is energy submetering – using IP-connected sensors and meters to fine-tune your energy management data" [18] (Baier, 2011). This industry is already 'on-the-ground' establishing relationships with building owners throughout the U.S. It could easily adapt to become the "Sustainable Energy Utility" for multifamily buildings.

This paper presents a model of a clean energy utility for apartments that leverages the best elements of existing models, including the use of PACE financing for investment in EERE investment, energy performance contracting coupled to some type of OBR, and submetering of individual apartment units and common spaces. Uniquely, however, the model presented here utilizes apartment-level real-time energy (and water) information to evaluate the best alternatives for EERE investment, as well as demand dependent energy pricing. However it has been shown that energy dependent pricing is not enough for energy efficiency improvement in residential sector. On average it shifts about 2.44% of the peak usage to off peak [19] (Tracey & Wallach, 2003). To fully take the advantage of real time or energy dependent pricing the potential for demand-side and supply-side management has been considered. The benefits of demand side management in addition to energy efficiency improvement and energy bill cost have been discussed in [20] (Strbac, 2008). Further, a clean energy fee structure is proposed, whereby residents pay a fixed energy fee that is not directly linked to their consumption in order to recover costs from EERE investment yielding deep carbon reduction. Disconnecting the resident energy fee from consumption is shown to be essential in order to drive economically advantageous deep carbon reduction.

2. Methodology

Five principles guide the model of a multifamily building clean energy utility. First, this clean energy utility is responsible for billing residents for the energy services offered. Second, it is responsible for collection and analysis of energy, and possibly, water data to continuously improve the proposed energy fee structure. Third, the utility is responsible for prioritizing clean energy, demand-side and supply-side management investments. Fourth, it is responsible for guiding the multifamily residence owners through clean energy financing and the process to access federal, state, and local tax credits, as well as utility rebate incentives, for energy efficiency and renewable energy investment. Finally, the clean energy utility is responsible for potential sales of capacity, frequency regulation and demand response and energy efficiency relative to a Regional Transmission Organization (RTO). Conceivably, if this utility serviced a sufficient number of multifamily residences, they could be a certified energy retailer for the RTO, purchasing power in the day-ahead Reliability Pricing Market (RPM).