USING LOCAL IMPROVEMENT CHARGES TO FINANCE SOLAR PHOTOVOLTAIC SYSTEMS IN CANADA

HARRIS BERTON
Carleton University, Canada

DANIEL ROSENBLOOM
Carleton University, Canada

OWEN TEMBY
The University of Texas-Pan American, USA

JAMES MEADOWCROFT
Carleton University, Canada

ABSTRACT

Despite rapidly falling costs, financing remains a serious barrier to the diffusion of distributed solar photovoltaics (PV) in Canada, a promising low-carbon electricity generation technology. We assess the potential of one financing program model, Property Assessed Payments for Energy Retrofits (PAPER), for the deployment of PV. This program design leverages Local Improvement Charges as a mechanism for financing energy investments, whereby annual income or cost-savings typically outweigh annual loan payments. We find there is significant potential for these programs to facilitate the deployment of PV in Canada. We conclude with recommendations linked to 6 possible objectives for PV-inclusive PAPER programs

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Corresponding Author:
Harris Berton - HarrisBerton@cmail.carleton.ca

Introduction

While distributed solar photovoltaics (PV) currently play a marginal role in Canadian electricity generation, costs for small, rooftop systems have fallen from $10.00/Watt in 2007 to ~$3.00/W in 2013/2014 (Poissant and Luukkonen, 2014). Amid these cost reductions, niches such as integration with building materials and electric vehicle infrastructure are emerging (Axsen and Kurani, 2013; Azadian and Radzi, 2013; IEA, 2013; Luukkonen et al., 2013). Furthermore, in the push toward a low-carbon energy system in Canada, distributed PV (i.e. small scale, rooftop installations, typically <10kw) holds several advantages over other renewable options. For instance, PV faces fewer public acceptance barriers and is more modular than other than other sources (Moore et al, 2013), enabling its deployment within electricity consumption centres. In addition, solar generation is well-positioned to meet peak demand as its electricity production profile coincides with higher daytime electricity use (IEA, 2010). However, while large, utility-scale PV installations (and other centralized generation options) benefit from corporate financing arrangements, the high upfront capital required for smaller systems (up to $30,000) remains a barrier to their diffusion in Canada (Luukkonen et al., 2013).

To promote the deployment of distributed PV installations, the Government of Ontario's micro Feed-in-Tariff (microFIT) program provides guaranteed prices and 20-year power purchase agreements to the owners of installations under 10kw (Ontario Power Authority, 2013). Yet despite this support, options for financing these small-scale systems remain limited to standard debt vehicles with rates based on existing credit rather than the viability of the PV investment, limiting the accessibility of small-scale PV use (Speer, 2012). Combined with additional barriers to energy investment (e.g. uncertainty about financial return), this indicates that the diffusion of PV faces barriers beyond the cost of system components. In particular, the substantial risks and costs associated with investments in PV systems for households and small businesses suggest a need for innovative financing and deployment mechanisms.

This challenge has not gone unnoticed, with significant development of innovative financing mechanisms in recent years (Speer, 2012). More than half of American states have attempted to address barriers to PV investment by providing long-term, low-interest loans through Property Assessed Clean Energy (PACE) programs (Speer, 2012). In Canada, the use of a similar program, Property Assessed Payments for Energy Retrofits (PAPER), has mainly been employed and discussed as a method of financing energy efficiency upgrades for existing buildings (Brownlee, 2013; Duffy and Fussell, 2011; Hill et al., 2013; Miller, 2013; Persram, 2011). While American programs regularly support PV alongside energy efficiency, the potential for these programs to facilitate the deployment of energy production technologies has not yet been adequately discussed in the Canadian context. Given the potential of PAPER programs and growing interest from Canadian policymakers (AMO, 2013; City of Toronto, 2013; HRM, 2013; Miller, 2013), we discuss how these programs could be extended to encourage distributed PV diffusion among households and businesses. We proceed by assessing the ways in which the PAPER financing model can be applied to encourage the deployment of distributed PV, concluding with an exploration of additional refinements for PAPER programs that could allow them to further erode barriers to this PV application.

PAPER programs

What are PAPER programs?

PAPER programs are designed to provide financing for the deployment of energy technologies. More precisely, these programs provide low-interest loans to property owners interested in making energy investments (e.g. insulation) that provide a financial return over time (e.g. through lower heating bills). Minor regulatory changes to provincial Municipal Acts (already carried out in Nova Scotia, B.C. and Ontario) permit the implementation of PAPER programs by expanding the applicability of “local improvement charges" (LICs) to energy projects (Duffy and Fussell, 2011). Traditionally, these LICs have been used to finance neighborhood-specific improvements such as parks or sidewalks (Persram, 2011). LICs, which are only available to municipal governments, allow the city to add an additional charge, labelled separately as "LIC", to the annual property tax bills of participating property owners. After the loan is provided, this charge can be used by the city to gradually collect the principal and interest of a PAPER loan over a period of 5-30 years (AMO, 2013; HRM, 2013; Speer, 2012). As these programs provide loans, not direct funding, the program has low long-run fiscal impacts. The substantial initial investment required from governments is eventually repaid by participants, and the cost of forgone investment revenue can be recouped by matching the PAPER interest rate with the typical annual return of government reserve funds. This approach has been employed by the Toronto PAPER program (City of Toronto, 2013).

How do these programs work?

PAPER programs do not feature uniform policy designs and can take multiple approaches to the basic process. While this can cause confusion among potential participants (Kothari, 2013), it allows policymakers to tailor program components to meet context-specific objectives (e.g. PV diffusion). That said, the process can be divided into 5 basic phases: (1) property owner application to the program and assessment of eligibility; (2) mutual approval of technologies and release of funding; (3) installation of technologies; (4) repayment of the loan; and (5) full ownership of the improvement by the property owner.

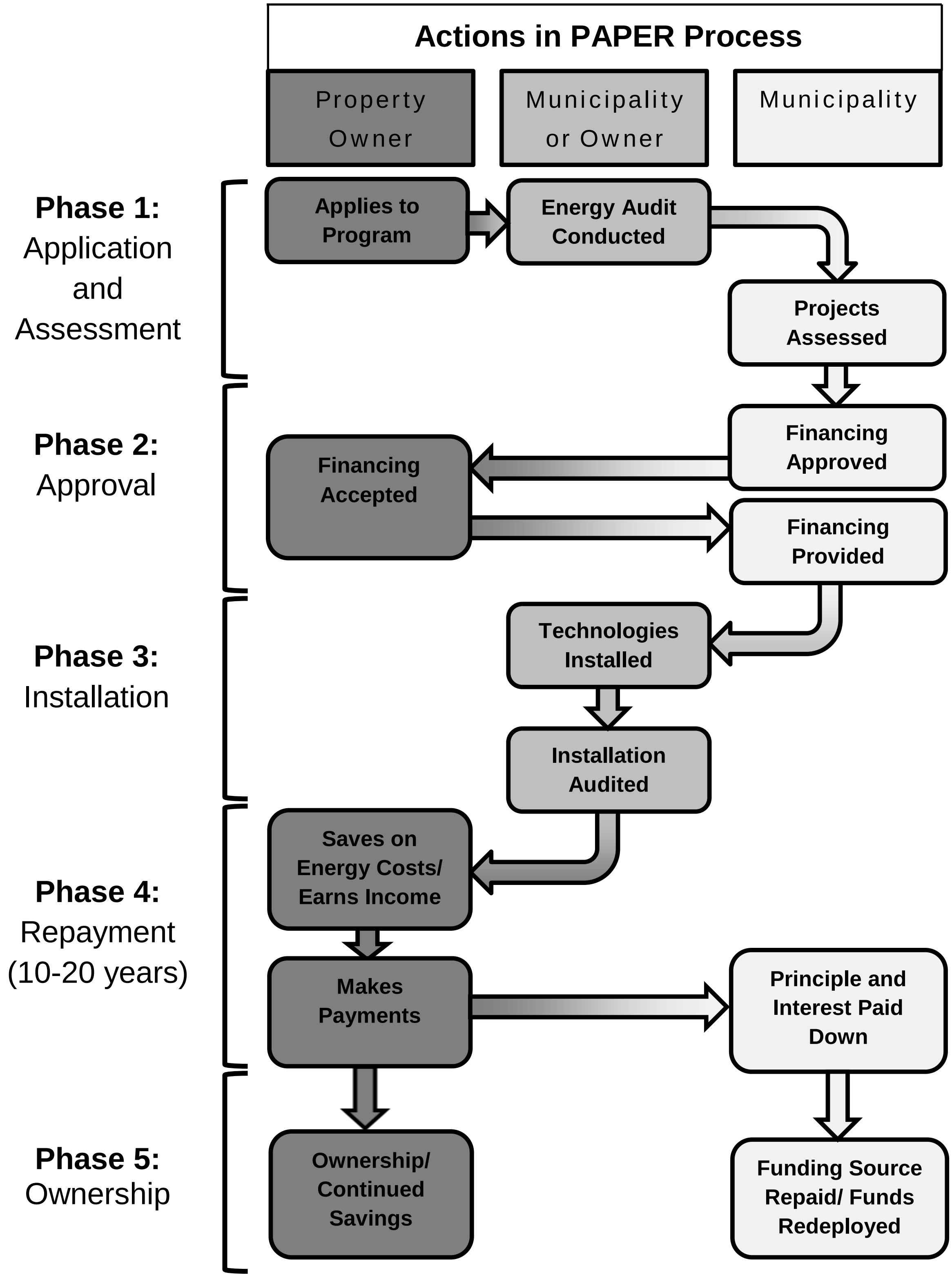

Figure 1 - This diagram illustrates the basic actions and sequence of events in the PAPER process. The steps in the centre column may be carried out by either the property owner or the municipality depending on the program design.

In phase 1, the energy audit can be contracted by either the property owner or by the city as part of the program's design. The information collected during phase 1 is used by the city to determine which technologies are likely to provide the most revenue or cost-savings as well as appropriate loan amounts and amortization periods. Property owners can then accept or reject funding based on which projects they would prefer, allowing for the release of funds corresponding to the equipment and installation cost. Subsequently, a loan is provided by the city and a lien is placed on the property. Note that there is considerable flexibility in terms of whether the funds are transferred to the property owners who then hire contractors individually, or if the city controls this process through a tendered sole-source contract (Toronto uses the former while Halifax uses the latter) (HRM, 2013; Miller, 2013). In any case, American experiences suggest it would be prudent for municipalities to conduct a subsequent third party quality assurance audit to ensure the investment is viable (Headen et al, 2012; Speer, 2012). During the repayment phase, property owners earn revenue (by selling energy generated) and/or save money (through lower energy bills). These savings and/or revenue can then be used to pay yearly LICs. When the city receives these repayments they can either be used to pay back the treasury, or be redeployed within the program (see Objective #6). Once the loan is repaid, property owners benefit from and own the energy improvement for its remaining useful life (potentially over 30 years).

How do PAPER financing programs benefit property owners?

PAPER programs, through the use of LIC regulations, offer several advantages over traditional financing methods (e.g. home equity loans). Under PAPER programs, a loan is reflected as a lien on the property, not a direct liability of the property owner, allowing the repayment obligation to be transferred to the new owner in the event the property is sold. This program feature mitigates concerns regarding whether energy investments will pay back before a property is sold (Persram, 2011). Perhaps most importantly, PAPER programs enable municipalities to offer revenue-neutral amortization periods and interest rates that may be unprofitable for traditional financial institutions. Unlike financing energy efficiency improvements through a bank, PAPER programs can allocate funds specifically based on the likely return of a given project, providing certainty to property owners that the investment is worthwhile. Further, as PAPER programs can provide 100% financing and ensure that annual savings and/or revenue exceed the LIC, the program is accessible to participants in a range of economic circumstances.

Supporting PV with PAPER programs

PV and Canadian PAPER programs

While PAPER-style frameworks in the United States are both common and regularly include a variety of energy production technologies, Canadian examples have been somewhat more limited in scope. Halifax has developed a fairly ambitious program to finance solar hot water heaters (HRM, 2013). In contrast, Toronto has recently begun implementing a program that uses LICs to fund energy efficiency improvements (Hill et al., 2013; Miller, 2013). Despite the exclusion of PV to date, both cities have indicated a broad interest in PV financing using PAPER frameworks, and there is considerable demand for the technology from potential participants (City of Toronto, 2013; HRM, 2013a; Kothari, 2013). Accordingly, the question of whether to fund energy production as part of PAPER programs in the Canadian context has emerged as a key question for policy (Miller, 2013). As distributed PV is particularly well-suited to individual ownership in comparison to other renewable technologies (particularly in urban areas), it is worthwhile to consider the feasibility of PAPER-based diffusion.

Similarities between PV and energy efficiency investment

The inclusion of PV in existing PAPER frameworks can be relatively straightforward as distributed PV and energy efficiency investments face similar barriers according to homeowners (Ipsos-Reid, 2010). In particular, PV and energy efficiency tend to have high upfront costs and long-term paybacks, this factor may hinder otherwise viable investments. There are also additional challenges, such as uncertainty regarding the rate of return on investment. By providing financing based on the likely return of an approved investment, PAPER programs mitigate many of these challenges, particularly for low-middle income property owners. It is crucial to note that even as PV component costs fall, these basic investment barriers will remain. This points to a longer term need for policies that can facilitate the timely deployment of PV as competitiveness increases and the reduction of carbon emissions becomes more pressing. While other financing options exist (e.g. small business loans), these arrangements cannot replicate the potential benefits PAPER presents for PV diffusion (we elaborate this point as part of the recommendations).

Contexts for PAPER-based PV diffusion

While the diffusion of PV through PAPER programs is highly feasible in Ontario due to the microFIT and associated system cost reductions, opportunities in the rest of Canada are likely to emerge more slowly in the absence of strong policy support. However, as competitiveness increases, PAPER presents a low-cost mechanism for diffusion as viable niches emerge, particularly in western provinces and remote communities. It should be emphasized however, that PV would likely be one among many technologies eligible for financing under PAPER programs. Even if PV is not currently viable in a particular municipality, the development of a PAPER framework for other energy technologies (energy efficiency in most cases) could help to streamline the eventual inclusion of PV as the key policy mechanisms will already be in place.

As mentioned, PAPER-based PV diffusion is already viable in the context of Ontario. The province's microFIT program provides guaranteed 20-year preferential power purchase rates to the owners of eligible distributed PV systems. While the incentive rates are geared at providing a reasonable return on investment, microFIT power purchase agreements are 20 years long, indicating that payback periods can exceed a decade (Ontario Power Authority, 2013). Therefore, if a loan financing a PV system is paid back over a 10-20 year period (a common loan range in American programs) (Speer, 2012), energy-related revenue or cost-savings will likely exceed annual LIC payments over the course of the microFIT contract. As a result, returns are realized early and are spread throughout the ownership of the system, rather than being concentrated during the latter part of the power purchase contract. Though the province has recently provided assistance to municipalities pursuing PAPER programs, they have not included PV as an eligible technology (despite displaying a PV system in the program brochure) (Infrastructure Ontario, 2013). As the microFIT is expected to be discontinued in coming years (Ministry of Energy, 2013), efficient but low-cost deployment mechanisms like PAPER program can help to maintain deployment levels and scale for the industry as policy support is removed. These programs may thus be a key component of reaching and maintaining residential grid parity for PV in Ontario (when the levelized cost of distributed PV electricity equals the cost of grid power).

In the rest of Canada, a combination of limited policy support, low electricity prices, and the prevalence of low-carbon hydroelectricity weakens the case for immediate PV diffusion. However, PAPER can be an important policy that strengthens developing niches for distributed PV technology. In the Yukon, for instance, LICs have been used as a method of financing PV systems in remote locations (Yukon, 2008). The Prairie Provinces present another emerging opportunity due to their combination of high solar irradiation (decreasing the average cost of PV generation) and high levels of carbon intensive electricity generation (NRCan, 2013). In these regions, municipalities wishing to reduce carbon emissions may consider PAPER as a promising mechanism to deploy low-carbon electricity at a marginal long-term cost to government. Long amortization periods with revenue neutral interest could substantially impact the effective levelized cost of PV electricity for program participants, promoting market development as PV nears grid parity in these regions.

Recommendations for the inclusion of PV in PAPER programs

This paper demonstrates that PAPER programs present a promising opportunity to promote the timely deployment of distributed PV in Canada. In particular, PAPER programs help overcome critical financing barriers by reducing the risks and costs associated with investment in PV. It strengthens existing support policies and can promote market development in jurisdictions which do not currently have support policies in place. Moreover, municipal governments, policy experts, and the public have articulated an interest in PV financing using PAPER frameworks (City of Toronto, 2013; HRM, 2013a; Kothari, 2013). Even so, to date, PV has been excluded in Canadian PAPER programs (Hill et al., 2013). The following recommendations detail how PAPER programs could be refined to better encourage the diffusion of PV and achieve associated policy objectives.

Objective #1: Reduce PV system costs

Recommendation

- Explore the potential for equipment and labour cost-savings through a tendered sole-source contract for these products.

While it is possible to design a PAPER program to allow property owners to select their own suppliers and contractors, bulk purchasing could considerably reduce the cost of distributed PV systems. Typically, utility scale PV installations have lower costs than small scale options (Luukkonen et al., 2013), and part of this relates to the bulk purchase of labour and equipment (Barbose et al, 2013). In the case of Halifax's PAPER program, bulk purchasing has been successfully leveraged to lower costs for solar hot water heaters (HRM, 2013a). However, municipalities would do well to consider the trade-offs of this approach in their specific context. Toronto's program, designed for basic energy efficiency, allows participants to hire contractors given the wide range of technologies supported. PV systems would likely be more homogeneous (especially on the equipment side) and more amenable to a large sole-source contract for all or some of the system components.

Objective #2: Lower insurance barriers

Recommendation

- Investigate the possibility of placing all PAPER-financed PV systems under the same insurance policy, with an aim to pool risk, lower costs, and streamline investment.

Certain utilities in Ontario require substantial liability insurance ($1 Million in the case of Hydro Ottawa) for microFIT-approved PV systems (Hydro Ottawa, 2013). In addition, the Insurance Bureau of Canada recommends the use of liability insurance for PV systems as a general risk management best practice (Hydro Ottawa, 2013). The need to purchase private insurance for each PV system may inflate the costs and complexity of PV deployment and will likely be a persistent barrier to PV diffusion. Pooling all PAPER-financed PV systems under the same insurance policy could mitigate this barrier to investment.

Objective #3: Expand number of potential investments

Recommendations

- Allow participation among residential as well as commercial, industrial, and institutional segments.
- Provide separate streams of funding for different property types (City of Toronto, 2013).

Discussion of PAPER programs in Canada has focussed almost entirely on the residential context (Duffy and Fussell, 2011; Miller, 2013; Persram, 2011). Yet, the experiences of jurisdictions in the United States indicate that expanding access to industrial, commercial, and institutional segments will play an important role in increasing the number of viable opportunities for investment in PV and other energy improvements (Headen et al., 2011; Speer, 2012). For instance, non-residential properties may have more roof area, allowing for larger, more cost-efficient PV systems. Additionally, these property owners may be willing to make larger investments. Creating separate streams of funding would be important to ensure program resources are not concentrated on one property type.

Objective #4: Promote equity

Recommendations

- Provide a 100% financing option in order to improve participation among low and middle income property owners.
- Use a means-tested interest rate; increase rates for high-income participants to cross-subsidize lower-income participants.

In the transition to a low-carbon energy system, efforts to involve those with lower-incomes will likely be a persistent challenge. PAPER programs can make PV investment viable across income levels by providing a 100% financing option. Beyond this, access to PAPER programs for lower-income property owners could be further enhanced through a means tested-interest rate. For example, a similar program in the United States offers loan interest rates based on income level such that higher income participants subsidize the financing costs of those with lower incomes, while still maintaining favourable rates for higher income participants (Speer, 2012). Currently, homeowners unable to afford the upfront cost of a PV installation can “rent” their rooftops to companies. Under this scenario, a roof-leasing firm installs and owns the PV system and also extracts the majority of the revenue from its energy generation (White, 2012). In contrast, PAPER programs could provide homeowners with a more robust return, and promote ownership of the system

Objective #5: Expand funding sources for initial investment

Recommendations

- Lobby federal and provincial levels of government to provide additional program support through loans or loan guarantees.
- Explore the possibility of securitizing PAPER investments; this would involve the creation of government-backed bonds tied to the pool of energy investments made through PAPER.

Although substantial upfront investment from governments is required, PAPER programs are low-cost policies in the long-run (as loans are repaid by participants). These programs are typically funded through standard government bonds, reserve funds, or a one-time operating expense. To offset these initial costs, in full or in part, bonds tied specifically to PAPER projects could be issued (Managan and Klimovich, 2013). Socially responsible mutual funds, in particular, may offer promise. There is growing interest and discussion surrounding this financing option in the United States, which merits further attention (Zimring et al, 2010; Managan and Klimovich, 2013). The Halifax program for Solar Hot Water heaters received repayable funding through the Green Municipal Fund federal grant program for sustainable development projects (HRM, 2013a). Funding sources like this for PAPER can be a key method for higher levels of government to support low-carbon energy technologies.

Objective #6: Design self-sustaining and flexible programs

Recommendations

- Direct LIC payments into a revolving fund to facilitate the re-deployment of funds for future PAPER investments.
- Regularly review policy to include emerging technologies as they become viable.

The funding allocated to a PAPER program could be redeployed within the program rather than returned to the treasury upon repayment (Miller, 2013). Additionally, depending on the interest rate, the program could be designed to generate income in the long-run (Speer, 2012). As noted, PV may not be currently viable in the vast majority of Canadian contexts. However as niches emerge and concerns over climate change intensify, a revolving fund, designed for currently viable technologies like energy efficiency, could be subsequently redeployed to promote the diffusion of emerging technologies such as PV.

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