Climate Justice Project

Fighting Energy Poverty in the Transition to Zero-Emission Housing: A Framework for BC

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By Marc Lee, Eugene Kung and Jason Owen

September 2011

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CANADIAN CENTRE
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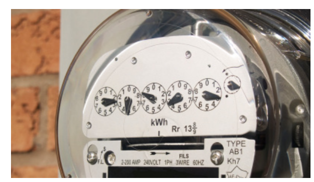
SUMMARY

Fighting Energy Poverty in the Transition to Zero-Emission Housing: A Framework for BC

CLIMATE ACTION DEMANDS THAT JURISDICTIONS like British Columbia reduce and eventually eliminate greenhouse gas emissions (GHGs) from burning fossil fuels. For BC's housing stock, this means shifting away from natural gas for space and water heating in favour of clean electricity, and building homes that are dramatically more energy efficient.



Efforts to reduce greenhouse gas emissions from residential buildings need to be carefully designed to prevent adverse impacts on low-income households.

But efforts to reduce GHGs from residential buildings need to be carefully designed to prevent adverse impacts on low-income households. Higher costs associated with new green electricity supplies, re-investment in electricity infrastructure and energy conservation all point to rising prices over the coming years. A shift away from fossil fuels in both buildings and transportation may exacerbate this situation, leading to greater demand for electricity.

Higher electricity prices are thus an important political and social issue, with potential to deepen poverty in BC unless well-designed policies are implemented that take equity considerations into account. This report highlights two major concerns:

- Rate increases from BC Hydro can exacerbate *energy poverty,* which exists when households have to spend a disproportionate amount of their income just to meet basic energy needs, especially necessities like home heating.
- Current energy efficiency retrofit programs mainly benefit affluent homeowners in single-family housing, not low-income people, who tend to be renters, or those who live in multi-unit buildings.

This paper looks at electricity conservation and pricing policies through the lens of energy poverty, and makes recommendations for a comprehensive approach that would both reduce GHG emissions and improve quality of life for all British Columbians.

ENERGY POVERTY IN BC

While BC has low electricity rates compared to other jurisdictions, it also has among the worst records on poverty in Canada. A report for the Ministry of Energy, Mines and Resources estimated that 18% of BC households lived in energy poverty in 2005. Energy poverty can lead to respiratory, cardiovascular and other health problems caused by cold, dampness or mold, and preventable winter deaths.

Low-income households are more likely to have housing or appliances that are not energy efficient, and are most in need of retrofits that would conserve energy and also improve health and quality of life. On the other hand, wealthier British Columbians are more likely to live in homes that are already more efficient, and have enough capital to invest in upgrades without needing government subsidies.

Low-income households are more likely to have housing or appliances that are not energy efficient, and are most in need of retrofits that would conserve energy and also improve health and quality of life.

Household energy expenditures display a regressive pattern, meaning lower-income households spend a greater share of their income on energy:

- The bottom 20% of households spent 5% of their total income on energy in 2009, and 3% of income just on electricity.
- Households in the top 20% spent only 1.5% of their total income on energy, and less than 1% on electricity.

Without measures to deliberately offset the impact of higher prices or to make retrofit programs more accessible, energy poverty will inevitably rise. This is unfair and may even be politically counter-productive if it provokes a backlash against climate action.

ELECTRICITY RATE INCREASES

In 2008, BC Hydro implemented a new two-tier pricing structure designed to encourage electricity conservation, and also began to increase rates. In early 2011, BC Hydro proposed to raise rates even more substantially. While a BC government review has led to smaller price hikes over the next couple of years, rate increases will still have a much greater impact on low-income households:

- Households with incomes under $20,000 will see electricity bills rise from 3.6% of income in 2008/09 to 4.3% in 2013/14.
- Households with incomes over $150,000 will not likely notice their bills rise from 0.4% of income in 2008/09 to 0.5% in 2013/14.
- Beyond 2014, rate increases are likely to continue. Under BC Hydro's proposed plan in Winter/Spring 2011, low-income households would spend 6.3% of their income for the same amount of electricity in 2017/18.

BC Hydro's two-tier conservation pricing system (Residential Inclining Block), in which rates increase after a certain level of consumption, has had a beneficial but small impact for low-income households:

- Households with incomes under $20,000 saw their electricity bills drop by $29 per year on average.
- Households with incomes over $150,000 saw their bills increase by $78 per year.

BC Hydro is also installing smart meters in BC homes by the end of 2012. Smart meters allow BC Hydro to better manage the electricity system, and will likely lead to time-of-use (TOU) pricing structures that make electricity more expensive during peak periods. However, they are likely to have little benefit for low-income households. The $1 billion in funding for smart meters would have been better used to invest in programs for energy conservation.

ENERGY EFFICIENCY PROGRAMS AND LOW-INCOME HOUSEHOLDS

Well-designed household energy efficiency programs can help reduce energy poverty, but current programs in BC are aimed at single-family homeowners. With few exceptions, existing programs are not relevant to low-income households:

- Low-income households do not have the upfront capital for upgrades.
- Energy efficiency programs are not generally available for multi-unit residential buildings where many low-income households live.
- Some 30% of BC households rent their housing, and face barriers to energy efficiency upgrades.

Without measures to deliberately offset the impact of higher prices or to make retrofit programs more accessible, energy poverty will inevitably rise.

Low-income energy efficiency programs are "low-hanging fruit" that can yield relatively greater energy savings than mainstream energy efficiency programs because low-income households live in less energy-efficient homes than the average household.

Because low-income households are already budget-constrained, and would not have made investments otherwise, there is good reason to believe that targeted and well-designed programs for energy efficiency in low-income households would dramatically reduce two common problems with efficiency programs: free rider effects (public subsidies going to households who would have made investments anyway) and rebound effects (where savings are offset by increased energy use).

KEY RECOMMENDATIONS

A smooth transition to zero-emissions housing requires more attention to be paid to impacts on low-income households and other vulnerable populations, as well as the housing stock where they live. This should be a key component of a next generation LiveSmart program for BC, and it should also be linked to green job creation and skills development.

- FIGHT ENERGY POVERTY: If electricity price increases are necessary, low- to middle-income households should receive an income transfer to ensure that the most vulnerable are not worse off. There is also significant potential to address energy poverty through targeted low-income energy efficiency programs.
- INCREASE THE PROGRESSIVITY OF TIERED PRICING: Higher rates in the second tier of pricing will create stronger incentives for conservation and efficiency among high-income consumers, while having minimal impact on low-income households. For low-income households that are adversely affected due to their circumstances, a cap on electricity expenditures as a share of income (at say 5% of total household income) could be considered.

- MANDATE ENERGY AUDITS AND TARGET OLDER HOUSING STOCK: Eventually all housing in BC should have a completed energy audit, with the results available in the public domain. This process should start with the oldest housing stock, plus audits of all homes at the time of sale or during major renovations. BC's older housing stock has poorer energy performance and higher GHG emissions, with homes built before 1983 worse than the provincial average.

- RETROFIT MULTI-UNIT BUILDINGS AND RENTAL HOUSING STOCK: A provincial fund is needed to support energy efficiency projects across rental properties, multi-unit buildings and the non-profit housing sector, to fund "deep retrofits" and renewable energy, currently missed by most utility and government incentive programs.

A smooth transition to zero-emissions housing requires more attention to be paid to impacts on low-income households and other vulnerable populations, as well as the housing stock where they live.

- ACCELERATE FINANCING REFORM: Financing through the public sector can also ensure credit is available to low-income households, landlords and others. A key dimension to this is for BC Hydro or governments to pay for cost-effective upgrades up front and link repayment to the property rather than the occupant.

- ESTABLISH PROGRESSIVELY HIGHER MINIMUM STANDARDS FOR APPLIANCES AND BUILDINGS*:* Future changes to building codes must drive builders toward net-zero buildings and passive house standards. Progressively higher marketplace standards for energy efficiency of appliances should be set.

- INVEST IN SKILLS DEVELOPMENT FOR GREEN JOBS: An aggressive approach, as outlined above, would require planning and sequencing of retrofits in accordance with the availability of skilled labour. The associated needs for training, apprenticeships, etc. would need to be evaluated in line with the annual budget for retrofits.

We estimate that a budget of $220 million per year, over 10 years, in support of retrofitting BC's housing stock would lead to substantial reductions in GHG emissions and energy poverty in BC homes. Carbon tax revenues are an ideal source of public subsidies for such a program. This investment would lead to 12,000 direct green jobs per year (and total increase in employment of 20,000 jobs if we include indirect and induced job creation).

Our Climate Justice framework on household energy efficiency and energy poverty concludes that the household sector can reduce and eventually eliminate GHG emissions, although this will be a process that rolls out over a few decades, and must be integrated into longer-term land use planning for sustainability.

Introduction

THIS PAPER CONTEMPLATES A BRITISH COLUMBIA where the greenhouse gas emissions (GHGs) causing climate change are eliminated for BC homes. Some 4.3 million tonnes of CO_2 were emitted from residential buildings in 2008, largely from the use of natural gas. As an overarching objective, BC should aim to reduce and eventually eliminate fossil fuel combustion from its housing stock, and we follow the lead of other Climate Justice publications in arguing that this can be achieved by 2040.

Some 4.3 million tonnes of CO_2 were emitted from residential buildings in 2008, largely from the use of natural gas. As an overarching objective, BC should aim to reduce and eventually eliminate fossil fuel combustion from its housing stock by 2040.

Homes in a zero carbon BC will draw primarily on clean electricity from BC Hydro, supplemented by on-site and neighbourhood-level green energy technologies, such as geothermal, solar hot water heating and photovoltaic systems, and biomass-based district energy systems. Moreover, that energy will be used much more efficiently, providing the same energy services in BC homes (heating/cooling, hot water, lighting and powering appliances) but at a fraction of the energy used today. Energy efficiency and renewable energy are the "twin pillars" of a shift to a sustainable economy.[1]

Getting there will require that new buildings are constructed to the highest efficiency standards (e.g. Passivhaus). But since much of BC's current housing stock will still be around in 2040 the province will also need to retrofit existing buildings. Done properly, a major expansion of retrofit programs for residential buildings (and other commercial and institutional buildings) is a win-win opportunity for the creation of new green jobs while meeting BC's GHG emission targets.

In addition to the carrot of retrofit programs, the stick of higher energy prices (including carbon taxes and electricity prices) is a prominent policy, with major implications for equity. Carbon taxes increase the cost of burning fossil fuels, but are regressive in the absence of income transfers to protect the most vulnerable. A Climate Justice report on carbon pricing recommends enhanced credits for low- to middle-income households and expenditures on public transit, energy retrofits and other climate action in conjunction with a rising carbon tax.[2]

This paper looks more closely at the equity dimensions of rising electricity prices. Higher costs associated with new green electricity supplies, re-investment in electricity infrastructure and energy

1 W. Prindle, M. Eldridge, M. Eckhardt and A. Frederick, *The Twin Pillars of Sustainable Energy: Synergies between Energy Efficiency and Renewable Energy Technology and Policy* (Research report E074, American Council for an Energy-Efficient Economy, 2007), www.aceee.org/research-report/e074

2 M. Lee, *Fair and Effective Carbon Pricing: Lessons from BC* (Vancouver: CCPA, 2011), www.policyalternatives.ca/publications/reports/fair-and-effective-carbon-pricing

conservation all point to rising prices over the coming years. A shift away from fossil fuels in both buildings and transportation may exacerbate this situation, leading to greater demand for electricity. Higher electricity prices are thus an important political and social issue, with potential to deepen poverty in BC, unless well-designed policies are implemented that take equity considerations into account.

While BC has very low electricity rates when compared to other jurisdictions, it also has among the worst records on poverty in Canada. A major increase in prices would represent a financial shock for low- to moderate-income households that already pay much more of their income towards energy than higher-income households. Many are already considered to be living in a state of *energy poverty*, where a household's quality of life is compromised by the high cost of energy needed for heating, hot water, lighting and appliances.

This paper focuses on how to ensure a smooth transition for all households, so that growing numbers of British Columbians do not experience energy poverty as a side-effect of a green agenda.

This paper focuses on how to ensure a smooth transition for all households, so that growing numbers of British Columbians do not experience energy poverty as a side-effect of a green agenda. Without measures to deliberately offset the impact of higher prices, energy poverty will inevitably rise. This is unfair and may even be politically counter-productive if it provokes a backlash against climate action. Instead, a comprehensive approach must consider climate policy and energy poverty together. One interesting model for BC is Germany, where electricity is three to four times more expensive, but highly efficient buildings, heating systems and appliances lead to monthly bills similar to those in BC.[3] By the standards of Germany, BC is highly inefficient in its use of energy.

In the next section we review the state of energy poverty in BC. We then turn to pricing issues that will have consequences for low-income households — the shift to tiered electricity rates, the prospect of time-of-use pricing, and the overall framework of rate increases. Household energy efficiency programs are a promising antidote to higher prices, but are largely inaccessible to low-income households due to many barriers. We review these factors before setting out a Climate Justice framework for household energy seeking to reduce GHG emissions and energy use, while maintaining a high standard of living, and doing so in a way that is effective and fair.

3 German Ministry for the Environment, Nature Conservation and Nuclear Safety, *Electricity from Renewable Sources* (April 2009). Some of the German advantage is due to more compact urban form — such change transcends retrofits of existing buildings, and it will take several decades for BC to catch up through redevelopments and new housing stock.

Energy Poverty in BC

POVERTY IS A COMPLEX SOCIAL ISSUE associated with having inadequate financial resources to meet basic needs. But poverty also has pervasive impacts that extend far beyond the direct harms caused by material deprivation to cover multiple facets of disadvantage, insecurity and marginalization, all of which impose costs to the different levels of government and to society as a whole. A recent CCPA study estimated the cost of poverty in BC to be $9 billion per year, or almost 5% of provincial GDP.[4]

Energy poverty occurs when the quality of life in a household is compromised by the cost of energy. Higher energy prices will thus exacerbate poverty at the bottom of the income ladder, unless mitigating features are deliberately built into the design of policies.

While there is no official measure of poverty in Canada, various low-income thresholds can be used to assess whether a particular individual or family is experiencing poverty. According to the after-tax Low Income Cut-Off, over half a million British Columbians — 12% of the provincial population — lived in poverty in 2009. In spite of robust economic growth and low unemployment rates in the 2000s, poverty in BC has been remarkably persistent, and higher than the national rate. On a number of measures, BC ranks among the worst performers in Canada in terms of poverty rates and overall inequality.

Energy poverty occurs when the quality of life in a household is compromised by the cost of energy. Households faced with a disproportionate energy burden — the percentage of income spent on household energy costs — are compromised in their ability to afford other essential elements of a healthy and decent lifestyle in order to heat their homes to a comfortable temperature. This problem is amplified by the fact that low-income households are the least able to alter their use of energy or pay for energy efficiency improvements, while occupying the greatest proportion of older homes with low efficiency insulation and appliances.[5] Higher energy prices will thus exacerbate poverty at the bottom of the income ladder, unless mitigating features are deliberately built into the design of policies.

Energy poverty is one aspect of poverty more broadly considered, but some households may be at greater risk of experiencing energy poverty due to their circumstances (for example, those who live in older, draftier housing stock). A report for the Ministry of Energy, Mines and Resources estimated that about 292,000 BC households (18%) were living in energy poverty in 2005.[6]

4 I. Ivanova, *The Cost of Poverty in BC* (Vancouver: CCPA, 2011).

5 L. Kelly, *Affordable Energy, Diversifying DSM Programs in BC: A discussion paper* (Eaga Canada on behalf of the Ministry of Energy, Mines and Petroleum, 2007).

6 Ibid at 17. This figure is based on the benchmark that a household must spend 10% or more of its after-tax income on home energy to be energy poor. Note that in Table 1 and Figure 1 we use total (or pre-tax) income, not after-tax income.

An update of energy poverty by the University of Victoria's Environmental Law Centre for 2007 estimated between 297,000 (17%) and 349,000 (20%) households living in energy poverty.[7] Thus, the extent of energy poverty in BC is significant.

Household energy expenditures display a regressive pattern, meaning lower-income households spend a greater share of their income on energy than higher-income households (Figure 1). Households in the lowest quintile (or the bottom 20%) spent 5% of their total income on energy in 2009, and 3% of income just on electricity. These households typically spend all of their income, and thus already face a strong incentive to conserve energy where they can.

In contrast, households in the top income quintile (the top 20%) spent only 1.5% of their total income on energy, and less than 1% on electricity. While higher-income households consume more energy in absolute terms, the share of total income going to energy is much less. In addition, these households are more likely to have incomes greater than consumption, so any additional energy costs would come out of reduced savings or reduced consumption of luxuries rather than necessities.

Households in the lowest quintile spent 5% of their total income on energy in 2009, and 3% of income just on electricity. In contrast, households in the top income quintile spent only 1.5% of their total income on energy, and less than 1% on electricity.

This dynamic is important to keep in mind as we move on to a consideration of the distributional impact of electricity price increases. A doubling of electricity prices would have a substantial and meaningful impact on the livelihoods of low-income households, but would be less noticeable for the highest-income households. Moreover, high-income households have much greater capacity to invest in upgrades that will reduce future energy consumption and save them money.

Table 1: Energy Use in BC Homes by Quintile, 2009

	Total income	Electricity expenditure	Natural gas expenditure	Other fuel expenditure	Total energy expenditures
	$ per household				
Poorest households	16,309	491	260	48	799
2nd quintile	37,016	751	514	83	1,348
3rd quintile	58,981	802	483	78	1,363
4th quintile	87,430	992	794	94	1,880
Richest households	175,582	1,321	1,300	82	2,703
All households	75,064	872	670	77	1,619

Source: Statistics Canada, Survey of Household Spending 2009

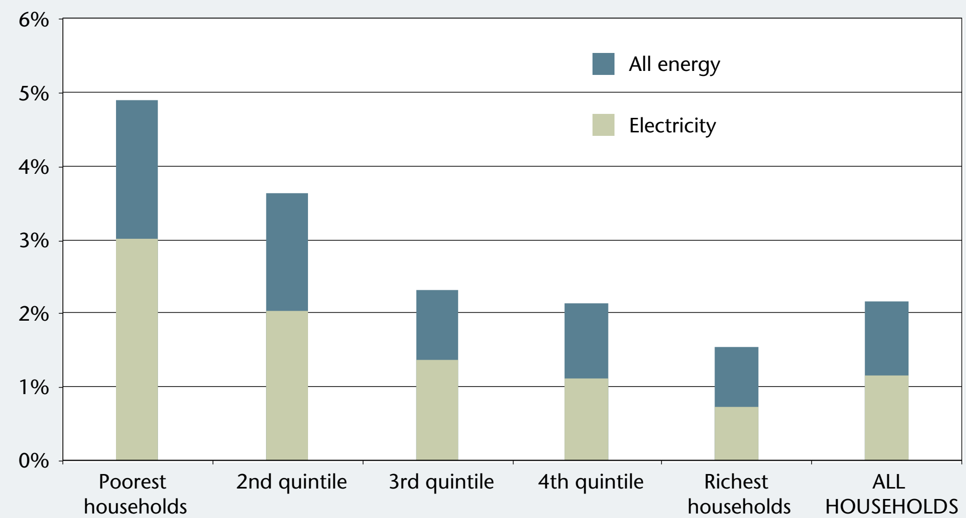
Living in energy poverty poses a range of health risks. Energy inefficiency and poverty can cause cardiovascular and respiratory health problems by contributing to an indoor environment in which condensation, dampness, and molds flourish.[8] There is a growing body of work that identifies causal links between poverty, older homes that are poorly insulated and heated, temperature-related sicknesses, and preventable winter deaths.[9]

7 M. McEachern and J. Vivian, *Conserving the Planet without hurting Low-Income Families: Options for Fair Energy-Efficient Programs for Low-Income Households* (University of Victoria Environmental Law Centre in support of the Climate Justice Project, 2010), www.elc.uvic.ca/press/energy-poverty-report-May2010.html

8 John D. Healy and J. Peter Clinch, "Quantifying the severity of fuel poverty, its relationship with poor housing and reasons for non-investment in energy-saving measures in Ireland" (2004) 32:2 *Energy Policy* 207.

9 See for example WHO Regional Office for Europe, "Housing, Energy and Thermal Comfort: A review of 10 countries within the WHO European Region" (Copenhagen: WHO, 2007), www.euro.who.int/document/e89887.pdf

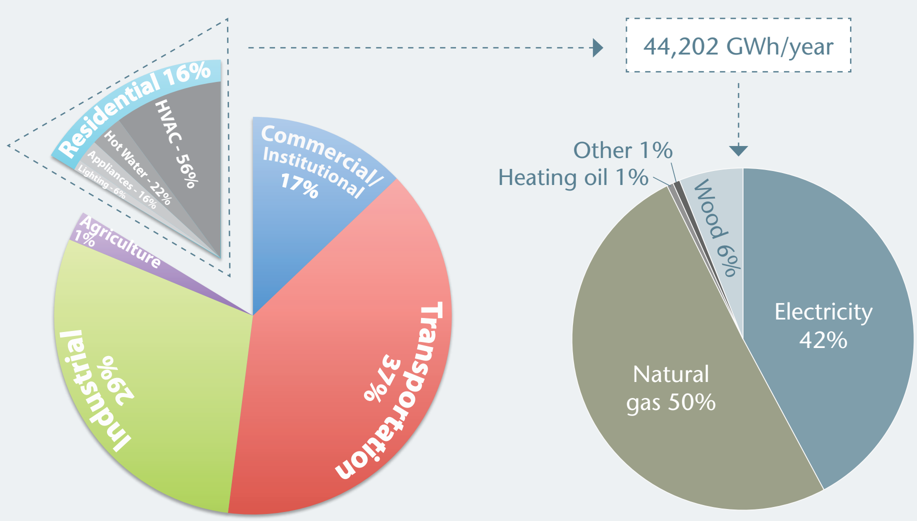
Figure 1: BC Home Energy Expenditures as a Share of Income, 2009



Source: Statistics Canada, Survey of Household Spending 2009

Energy poverty is more prevalent among certain types of households, including single parents (mostly female), seniors, and young adults, all of whom are more likely to be renters and live in older and less energy-efficient housing stock. Certain groups, such as immigrant communities and First Nations, are also at greater risk due to a higher prevalence of low-income compared to the rest of the population. Geography will also play a role; for example, households in BC's Interior living in poor quality housing stock will face additional challenges due to extreme cold in winter and heat in summer.

Figure 2: Breakdown of Energy Use in BC, 2008



Source: Statistics Canada, *Report on Energy Supply and Demand in Canada*, 2008 retrieved June 1, 2010, from www.statcan.gc.ca: www.statcan.gc.ca/pub/57-003-x/57-003-x2008000-eng.pdf

While much is made of upgrading lightbulbs and unplugging techno-gadgets, for low-income households the key energy issue is keeping the heat on. Across BC homes, more than three-quarters of household energy use is for heating and cooling (56%) and hot water (22%). Switching to compact flourescent (CFL) bulbs may help, but lighting accounts for only 6% of residential energy use.[10] The numerous gadgets and appliances populating modern homes comprise only 16% of total energy consumption, from which the electrical drain tends to come from big-ticket items like fridges, ovens, washers and dryers.

While much is made of upgrading lightbulbs and unplugging techno-gadgets, for low-income households the key energy issue is keeping the heat on.

There are three aspects to energy poverty: energy efficiency of homes and appliances, energy prices, and household income. On the income side, energy poverty is symptomatic of poverty in general. Society-wide policies to eliminate poverty and reduce inequality are the best way to tackle energy poverty. These would include labour market provisions such as ensuring all jobs are paid a living wage and increased unionization in workplaces, as well as actions by government, including income transfers and an array of public services and investments from which all citizens benefit. In the absence of such measures, policies that strive for sustainability need to be designed to take equity considerations into account.

This paper considers the other two aspects of energy poverty in BC. First, low-income households are constrained in their ability to respond to higher prices because they are renters and/or do not have the upfront cash to purchase new equipment or make renovations. Second, low-income households face substantial barriers to participating in energy efficiency programs, due to information gaps, excessive program complexity, financing challenges, rules that limit eligibility, and inadequate housing tenure to allow/justify improvements.

10 CFLs have also been cited for health and environmental concerns due to their mercury content. Others argue that levels are too small to have an impact, even if a bulb was to be smashed.

Equity and Electricity Pricing

SINCE 2008, BC HAS SEEN PROGRESSIVELY HIGHER PRICES for electricity, and in early 2011 BC Hydro proposed to raise rates substantially (leading to a review by the BC government). Rate increases have been justified as reflecting the cost of new and replacement infrastructure investment, but also reflect the high cost associated with purchasing new electricity supply (largely from private power producers).

A shift away from fossil fuels is likely to increase demand for electricity and put upwards pressure on prices.

BC Hydro argues it has experienced a rapidly growing customer base and resulting increased demand for electricity that is stretching the utility to the limits of its existing hydroelectric output and transmission capabilities. But there are important issues around how much new supply is needed (if at all) and for whom. In particular, BC Hydro's own forecasts show relatively flat energy demand for residential and commercial customers between 2011 and 2014, compared to a 17% increase for large industrial consumers (including GHG-intensive industries like mining and oil and gas).[11]

Residential buildings account for a relatively small source of BC's energy use (16%) and GHG emissions (6%). Policy makers may be overly inclined to focus on emissions from homes as part of energy and GHG reduction strategies, rather than commercial or industrial emissions. A full analysis of fair pricing and conservation must consider factors beyond the scope of this report. These include the BC government's requirement to source new electricity supply from private power producers at premium prices, and new demand for electricity from commercial and industrial sectors.[12]

Nonetheless, we accept that higher prices for electricity are on the horizon, and a shift away from fossil fuels is likely to increase demand for electricity and put upwards pressure on prices. From the perspective of energy efficiency, BC's low electricity prices serve as a barrier to investments in efficiency, and thus reduced energy consumption. Higher prices would encourage conservation and make adopting more efficient technologies more economical, but must be done in a way that does not increase energy poverty.

11 Demand forecast from BC Hydro, *F2012-2014 Revenue Requirement Application* (Submission to BC Utilities Commission, 2011), Vol. 1, Ch. 3 Load and Revenue Forecast, www.bcuc.com/Documents/Proceedings/2011/DOC_27065_B-1_BCHydro_F12_F14-RR-application.pdf

12 We review this broader macro-context in a forthcoming Climate Justice paper on conservation and clean energy in BC. That analysis is critical of the need for expensive new supply, particularly given growing demand from GHG-intensive industries like mining and oil and gas.

This section examines the electricity pricing policies in BC with a specific look at distributional impacts. BC Hydro has begun to implement new pricing structures designed to encourage electricity conservation. We look at two-tier pricing (known as the Residential Inclining Block, or RIB) as well as the impact of electricity price increases over the coming years. In addition, government-mandated smart meters are being installed in BC homes over the next year, and will likely lead to some form of time-of-use (TOU) pricing before long. These new pricing policies, aimed at increasing conservation, have the potential to place an added burden on those who are already experiencing, or are vulnerable to, energy poverty.

TWO-TIER PRICING

BC Hydro's new pricing structures, aimed at increasing conservation, have the potential to place an added burden on those who are already experiencing, or are vulnerable to, energy poverty.

A shift to two-tier electricity pricing in BC was implemented in October 2008. Known as the Residential Inclining Block (RIB) rate structure, it includes a lower rate charged up to 1,350 kilowatt-hours (kWh) of bi-monthly consumption (Step 1 rate) and a higher rate for consumption above the threshold (Step 2 rate). A basic charge (or daily connection fee) is also billed, on the premise that it recovers some of the fixed costs of servicing customers.

The shift from flat rates to a two-tier rate structure was designed to be revenue neutral, with the RIB rate intended to address the disproportionate load imposed on energy demand from BC Hydro by a minority of residential customers. According to BC Hydro, the top 20% of residential customers (ranked by electricity consumption) consume 44% of the total residential load.[13]

BC Hydro estimated that 75% of residential customers would be better off with the RIB rate than they would have been under a flat rate escalating in accordance with rate increases to meet revenue requirements in 2009/10.[14] The resulting rate structure was designed to avert adverse impacts on residential customers of various groupings, based on household income, region of the province, dwelling type, household size, heating fuel type, and customer age.[15]

To evaluate the impact of the RIB rate, we used household energy use data for different income groups to estimate annual electricity consumption. We estimated pricing under the RIB rate for 2009/10, then under the revenue-equivalent flat rate price. The results in Table 2 show that the shift from flat rate to RIB had a relatively small impact on annual bills, but did have a beneficial distributional impact, with lower-income groups paying less and higher-income groups paying more. The average bi-monthly electricity consumption of the lowest-income group (1,134 kWh) is below the 1,350 kWh bi-monthly threshold; only in the mid-winter months (December to April, not shown) does the average consumption in this group exceed the Step 2 threshold. For those groups with household income greater than $80,000, the Step 2 threshold is exceeded in each bi-monthly billing period.

Our estimates of the distributional impact of the revenue-neutral shift from flat-rate pricing to RIB pricing show that RIB, on average, is a better system because it forces the biggest consumers to

13 BC Hydro, *Residential Inclining Block Application* (2008), retrieved June 22, 2010, from BCUC website: www.bcuc.com/Documents/Proceedings/2008/DOC_18056_B-1_Residential_Inclining-Block-Rate.pdf

14 BC Hydro, *BC Hydro Residential Inclining Block Application Final Argument* (2008), retrieved July 1, 2010 from BCUC website: www.bcuc.com/Documents/Proceedings/2008/DOC_18749_B-7_BCH-IR2-to-BCUC&Intervenors.pdf

15 BC Hydro estimates were based on a 1600 kWh threshold for reaching the second pricing tier. The BC Utilities Commission altered the threshold in its rate decision, approving a 1350 kWh threshold.

pay more. Thus, the intention of RIB pricing to charge more to bigger consumers of electricity (who tend to have higher incomes) was achieved in a modest and progressive manner. However, we caution that the range can be quite large within a quintile, and it may mask those who will still be worse off (e.g. a low-income household living in a drafty house with baseboard heating in northern BC).

Table 2: Revenue-Neutral Comparison Between RIB and Flat Rate Pricing Structures, 2009/10

Household income (pre-tax)	Share of households	Annual bill, flat rate	Annual bill, RIB	Price increase
Less than $20,000	11.7%	$483	$455	$(29)
$20,000 to less than $40,000	18.8%	$633	$620	$(13)
$40,000 to less than $60,000	19.3%	$647	$637	$(10)
$60,000 to less than $80,000	14.3%	$625	$610	$(14)
$80,000 to less than $100,000	9.5%	$737	$745	$8
$100,000 to less than $150,000	17.8%	$766	$782	$16
$150,000 and over	8.6%	$986	$1,065	$78

Note: Based on RIB prices for 2009/10, our estimated equivalent flat rate was 6.43 cents per KWh.
Source: Authors' estimates based on BC Hydro rate data and Natural Resources Canada Survey of Household Energy Use 2007.

The average consumption of the lowest income group is already below the threshold for most of the year. Raising the threshold for the tier 2 rate is not advised as it would provide a greater benefit to higher income groups whose consumption is higher than the threshold.[16] Raising the threshold is akin to increases in the tax brackets of the personal income tax system — they give the most benefit in dollar terms to those who are above the threshold.

While the change from flat-rate to RIB pricing had minimal but positive distributional impacts, a more pressing concern is the call from BC Hydro for rate increases over the coming years and how those will affect consumers.

BC HYDRO RATE INCREASES

While the change from flat-rate to RIB pricing had minimal but positive distributional impacts, a more pressing concern is the prospect of large rate hikes over the coming years. BC Hydro's December 2010 application to the BC Utilities Commission called for major increases in electricity rates for residential consumers. On top of rate increases in recent years, BC Hydro's proposed rates would have meant an average 84% ($559) rate increase by 2017/18 compared to 2008/09.

Due to political backlash, the BC government and BC Hydro agreed in August 2011 to maintain the 8% rate increases in the current (2011/12) year, and restrict increases to 3.9% in each of the next two fiscal years. They estimate that rate increases as of April 2013 will thus be about half of what BC Hydro originally proposed. To illustrate the impact of rising prices, we estimate bill impacts as percentage of total income from 2008/09 to 2013/14 based on 2008 consumption

16 For example, from 1,350 kWh to 1600 kWh, as originally proposed by BC Hydro in its RIB application to the BCUC. The BCUC approved the rate structure, but with the lower threshold. Households with incomes over $150,000 would save $44 from an increase to 1600 kWh, while those under $20,000 income would save $8.

patterns for each income group.[17] However, beyond 2014, pressure to increase rates is likely to continue, so we also show the impact in 2017/18 of BC Hydro's previous proposal to BCUC.

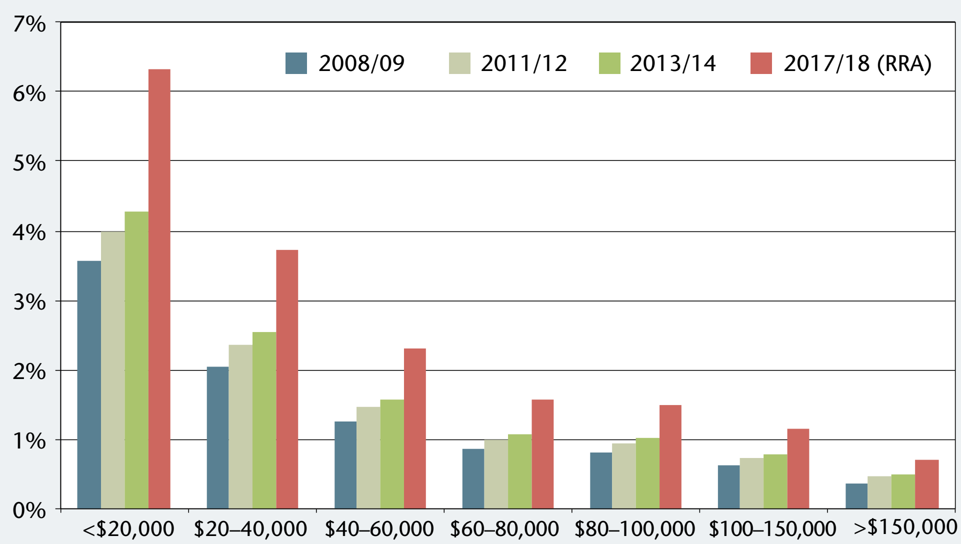
Figure 3 shows electricity costs for households as a share of income. There is a clearly regressive pattern, meaning lower income households pay a greater share of their income in electricity costs, and this worsens over time as rates increase. Under the new rate scheme set out by the government and BC Hydro, households with incomes under $20,000 would see electricity bills rise from 3.6% of income in 2008/09 to 4.3% of income in 2013/14 (assuming no change in income or consumption patterns). BC Hydro's rate application earlier in Winter/Spring 2011 would have seen this share rise to 4.9% in 2013/14 (not shown), and to 6.3% of income by 2017/18.

In contrast, higher income households will experience a smaller hit relative to their income. Households with more than $150,000 of income will not likely notice their bills rise from 0.4% of income in 2008/09 to 0.5% in 2013/14. Even under BC Hydro's more aggressive pricing proposal, costs would only rise to 0.7% of income in 2017/18.

Under the new rate scheme set out by the government and BC Hydro, households with incomes under $20,000 would see electricity bills rise from 3.6% of income in 2008/09 to 4.3% of income in 2013/14.

Figure 3: Percent of Total Income Spent on Electricity, by Income Group

Under the new rate scheme, households with incomes under $20,000 would see electricity bills rise to 4.3% of income in 2013/14. BC Hydro's revenue rate application (RRA) earlier in 2011 would have seen this share rise to 6.3% of income by 2017/18.



Note: 2008/09 and 2011/12 are actual rates; 2013/14 represents increases resulting from BC government review of BC Hydro in August 2011; 2017/18 is a comparator based on BC Hydro's rate application to BCUC in Winter/Spring 2011.

Source: Authors' calculations based on BC Hydro, Statistics Canada and BC Utilities Commission data.

17 This research assigned the average total income for the lowest income group based on the figure for the lowest income quintile from the 2008 report on Income in Canada (Statistics Canada, 2010). Total income for the other income groups was estimated as the midpoint between the income range for each group. This analysis does not account for overall increases in income over time due to inflation, or reduced consumption from conservation.

Income growth and reduced consumption would both moderate the impact of rising prices. But is clear that higher electricity rates increase energy poverty. Strangely, while the BCUC does actively consider distributional impacts on low-income households as part of its rate approval decisions, it has argued that a price structure that places too much of the cost burden on high consuming residential customers is "unjust and unreasonable."[18] Given that higher-income households consume more energy, and that a large proportion of residential demand comes from the highest electricity consuming quintile (44% of total), a fairer outcome would be to concentrate rate increases in the second tier rather than be equally applied to both tiers.

SMART METERS AND TIME-OF-USE PRICING

In its 2010 Clean Energy Act, the provincial government enabled another form of electricity conservation pricing through the mandated network-wide installation of "smart meters" by the end of the 2012 calendar year. Traditional electromechanical meters measure the amount of electricity consumed in kWh and require manual reading each billing period. A smart meter records electricity usage and communicates this information digitally to the utility. Smart meters allow transfer of to-the-hour consumption data between the utility and its customers, which in turn enables the implementation of a variety of time-of-use (TOU) pricing structures aimed at peak load reductions and improved system efficiency.

A key point about time of use pricing is that it is less about reducing total demand (conservation), as it is about reductions in system peak capacity (the maximum amount of electricity that can be generated at one moment in time) by spreading out electricity usage over time periods when the system is below peak capacity.

Additional technological devices in the home are required to enable customers to better manage their energy consumption, and potentially sell power back to the utility from small-scale on-site generation. This aspect of the smart grid will likely provide valuable opportunities for integration of on-site renewal energy technologies and will have particular value if and when electric vehicles become commonplace. Individual customers would have to purchase these devices themselves, although BC Hydro states it will provide a rebate program (amounts not specified).

Most of the benefit of smart meters and smart grids is found in the ability of a utility to differentiate pricing based on peak and off-peak demand periods. Customers are provided with information about upcoming on- and off-peak rates with the intention of shifting demand away from the peak use periods. This can allow customers to save money on their electricity bill by adjusting their consumption patterns accordingly. From the utility's perspective, reductions in peak demand can offset the need for large investments in new generation capacity.[19]

A key point about this system is that it is less about reducing total demand (conservation), than it is about reductions in system peak capacity (the maximum amount of electricity that can be generated at one moment in time) by spreading out electricity usage over time periods when the system is below peak capacity. This matters a great deal in systems that use coal to generate electricity, as the power plant needs to run at a certain level and cannot be ramped up and down easily. This is less the case for BC's hydroelectric power — where dams act as batteries for the

18 BC Utilities Commission, *BC Hydro and Power Authority Residential Inclining Block Rate Appplication, Reasons for Decision to order G-124-08* (2008), retrieved June 17, 2010, from BCUC website: www.bcuc.com/Documents/Proceedings/2008/DOC_19754_BCH-RIB-Decision-WEB.pdf

19 J. Girvan, *The Ontario Smart Metering Initiative: What does it mean for Ontario's residential consumers?* (2009), retrieved July 21, 2010, from Industry Canada website: www.ic.gc.ca/app/oca/crd/dcmnt.do?id=2660&lang=eng

system, and water flow through hydro dams can be adjusted to match supply and demand as needed — although reducing peak demand still is of benefit to the system.[20]

The extent to which the above benefits are realized also depends on a number of factors not directly related to the initial capital investment in metering and infrastructure. In the case of reduced consumption and peak load shifting, customer uptake of new technologies and behavioural change will dictate the level of impact of TOU programs.

There are examples of time-based energy pricing, enabled by smart meters and smart grids, throughout North America. Many jurisdictions have implemented pilot programs to test the various assumptions around time-based pricing structures, customer behaviour, and peak load reduction. While TOU rates can induce load shifting and conservation, they do not necessarily do so. TOU pricing is more effective when combined with enabling technologies, such as display monitors, smart thermostats, and cycling switches for air conditioners.[21]

A limitation of pilot programs is that full cost/benefit analyses of the capital and long-term costs and savings of smart metering were not included in any of the studies. Thus, the potential benefits to customers from smart meters and TOU pricing structures are highly uncertain with respect to future bill impacts and total conservation. Any level of reduced consumption will be related to the extent to which each individual customer has the means to shift their use patterns, pay for, and gain the knowledge of new technologies.

Because low-income households are more likely to rely on less efficient appliances and live in energy inefficient homes, they may be faced with insurmountable barriers to adjusting their energy use patterns. A single parent, for example, has little choice but to consume electricity for cooking, cleaning, laundry, etc. before or after regular work and school hours. Renters living in apartment buildings may face the additional barrier of restricted hours of operation of shared laundry facilities. Purchasing new devices that could enable personal benefit from smart metering may be out of the question. Although the burden of capital expenditures is equally distributed among residential customers, it is less likely to be offset by conservation potential and reduced peak energy consumption for the low-income households. Thus, the biggest electricity consumers will tend to benefit more than low users.

Given that smart meters will do little to reduce household energy consumption in the short term, could almost $1 billion have been better spent to reduce consumption?

Given that smart meters will do little to reduce household energy consumption in the short term, could almost $1 billion have been better spent to reduce consumption? We turn to that question in the next section.

20 In addition, if BC was to become a major electricity exporting jurisdiction, ensuring dependable peak capacity in neighbouring jurisdictions would become more important.

21 J. Girvan, *The Ontario Smart Metering Initiative: What does it mean for Ontario's residential consumers?* (2009), retrieved July 21, 2010, from Industry Canada website: www.ic.gc.ca/app/oca/crd/dcmnt.do?id=2660&lang=eng; A. Faruqui and S. Sanem, *The Power of Experimentation: New evidence on residential demand response* (The Brattle Group, 2008), www.brattle.com/_documents/uploadlibrary/upload683.pdf

Energy Efficiency Programs and Low-Income Households

AS NOTED IN THE INTRODUCTION, there are three aspects to energy poverty: energy prices, energy efficiency in homes, and household income. The previous section cautions that higher prices for electricity in BC can increase energy poverty in the absence of policy measures to reverse their regressive impact on low-income households.

Higher prices for electricity in BC can increase energy poverty in the absence of policy measures to reverse their regressive impact on low-income households.

In this section, we turn to another aspect of BC policy: energy efficiency programs, and key considerations for low-income households. Well-designed household energy efficiency programs can be a complementary strategy to new pricing regimes. In theory, energy efficiency improvements and accompanied price increases could serve to create a culture of energy conservation, while ensuring that average monthly bills fall or at least stay the same. Moreover, accompanied by training and education programs this could be a major source of green jobs in BC.

Energy efficiency programming in BC is centred on the LiveSmart program, launched in 2008 with $60 million in funding for energy audits, retrofit incentives and equipment rebates. The BC program was over-subscribed and ran out of funding by August 2009. In April 2011, the BC government announced a $30 million expansion of the LiveSmart program.[22] The 2011 federal budget provided new federal funding for the ecoENERGY housing program.

Data from the BC government show that residential retrofits as of June 2011 have totaled 38,602 participants with $45.9 million in expenditures, or an average of $1,189 per home ($150 of which subsidizes the initial energy audit).[23] LiveSmart estimates that $1 of public investment levers $9 to $10 in personal investment per home, and with an employment multiplier of 10 to 15 jobs created per $1 million in investment, this translates into between 4,252 and 7,086 jobs (person-years of employment) created through the residential portion of LiveSmart. Energy savings averaged 26.5% per participant, and average CO_2 reductions were 2.76 tonnes per year (a total of over 100 kt of CO_2 reduced).

Households have been able to access additional subsidies and rebates through the federal government's ecoENERGY program (which also has periodic funding windows that tend to be over-subscribed). Federal expenditures in BC in support of 48,640 energy retrofits were $67 million

22 BC Ministry of Energy and Mines and Minister Responsible for Housing, "Increased home efficiency rebates help families save" (News Release, April 6, 2011), www2.news.gov.bc.ca/news_releases_2009-2013/2011ENER0010-000348.htm

23 Data provided by Manager of Energy Efficiency Programs, Ministry of Energy and Mines.

between 2007/08 and 2009/10, or about $1,378 per participant (because of the timing of the federal and BC programs these figures are not directly comparable to the BC numbers above). In addition, programs through BC Hydro and Fortis BC (formerly Terasen Gas[24]) also provided rebates on specific equipment purchases totaling $8 million going back to 2008/09.[25]

For low-income households, LiveSmart has provided over $11 million for three pilot programs. Most of this funding has gone to upgrade 5,305 social housing units, of which 3,000 have been completed at a cost of approximately $2,000 per unit. An additional $1 million has been provided to build 67 units of near-net-zero new low-income housing. These are currently under construction, and include leveraged funds of $4 million from utilities and the private sector. Finally, $300,000 was provided to BC Hydro in support of 30,000 "energy savings kits" that support a number of low-cost energy efficiency improvements.

Building on current pilot programs, much more could be done to invest in energy efficiency for low-income housing stock.

Building on these pilot programs, much more could be done to invest in energy efficiency for low-income housing stock. In BC, the total social housing stock is in excess of 65,000 units.[26] The LiveSmart program, when announced, called for $18 million in funding for upgrades to 9,000 units of low-income housing. Thus, within the overall funding envelope for LiveSmart, dollars were reallocated to increase the number of general residential retrofits.[27] The new 2011/12 funding for LiveSmart does not have any social housing or low-income component.

CHALLENGES FOR ENERGY EFFICIENCY PROGRAMS

Experience in BC and other jurisdictions points to a number of barriers to accessing energy efficiency programs, most of which are exacerbated for low-income households. These include:

- INFORMATION GAPS: Most households have not analyzed their existing energy consumption patterns, and where they could be changed. There is also a high degree of uncertainty regarding the payback period for energy investments (i.e. the value of energy saved versus up-front cost), which itself hinges on future prices that are unknown.
- COMPLEXITY: Energy efficiency programs are often difficult to navigate, even for knowledgeable consumers, due to different providers of rebates and incentives (federal and provincial governments, hydro and gas utilities), and hiring contactors.
- FINANCING: Upfront costs of energy efficiency investments are a barrier for many households. Some households with low incomes may have difficulty getting private financing (or may have to pay a premium interest rate). While private financing vehicles have emerged (like Vancity's Bright Ideas loans), owners who may move will have diminished incentives to make investments that do not have an immediate payback (whereas many investments may have a payback period of 10 to 20 years). Financing options that tie payback to the property itself rather than the current owner are increasingly being examined.

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24 Fortis is also the electricity utility in parts of BC, including the Okanagan and West Kootenays.

25 Ibid.

26 Counting these units can be challenging. Seth Klein and Lorraine Copas, in *Unpacking the Housing Numbers: How Much New Social Housing is BC Building?* (CCPA, 2010) outline the number and types of BC social housing. For the purposes of this paper, we count 5,530 units for the homeless, 19,070 units of assisted/supportive housing, and 40,940 units of independent social housing as per their Table 1.

27 BC Budget 2008 announced $60 million in funding over three years, of which $4 million was for small business energy assessments, $38 million for the general retrofit program (which aimed to reach a target of 30,000 retrofits), and $18 million in funding for 9,000 units of social housing.

- ELIGIBILITY: Programs are generally limited to more traditional single-family homes or duplexes, with little action on multi-unit buildings. Older, heritage buildings can also run into barriers with things like replacing windows in a manner consistent with the original character.

- TENURE: Many low-income households are renters, and they may not be able to reduce their consumption directly or make new investments to upgrade efficiency. Differing incentives between landlords and tenants create barriers to improvements, known as "split incentives," where tenants pay energy bills and landlords lack the incentive to pay money to curb those costs — and where landlords pay energy bills, tenants have no incentive to conserve, which may undermine retrofit investments.[28]

The latent potential for energy efficiency gains, if these barriers can be overcome, is large. In a future world with redesigned housing, industrial processes and transportation networks, the same amount of energy services we enjoy (heating, lighting, useful gadgets) could be provided with one-tenth of our current energy. Limits due to cost-effectiveness and the inertia of existing urban form and economic arrangements will reduce "real world" potential efficiency gains. Still, a one-third reduction in energy use is not unreasonable.[29]

The effectiveness of public expenditures on efficiency programs can be undermined if they primarily benefit *free riders*, or those who would have made upgrades anyway in the absence of the program. A survey of clients made as part of an evaluation of the federal ecoENERGY program found a 25% free ridership rate, although the evaluation argues that this is offset by unplanned investments made after an energy audit, many of which received no financial incentive.[30]

Another well-known challenge of energy efficiency programs is that the lower cost of using energy due to efficiency improvements can perversely lead to increased consumption that offsets some of the original savings (for example, installing a more efficient heating system, then turning up the temperature). This *rebound effect* may also be indirect in the form of other expenditures and emissions arising from savings—our society has demonstrated a tendency to growing consumption of energy in line with economic growth and technological development. A survey on rebound effects for the UK Energy Research Centre puts direct rebound effects at between 10% and 50% of efficiency gains, and argues that rebound effects can be reduced through carbon/energy pricing that ensures the cost of energy services remains relatively constant.[31]

The bottom line is that achieving energy efficiency gains requires government spending action to overcome market failures.

The bottom line is that achieving energy efficiency gains requires government spending action to overcome market failures.[32] Energy efficiency actions to provide information, set standards and give financial incentives can tip the scales for many households who would not have otherwise made the investment. Even with some free riders, these programs can provide a public good (above and beyond private gains), including GHG reductions. For utilities, successful demand-side management programs can be much more cost-effective that building new generation capacity.

28 See Jamie Abbott, Guy Dauncey and Blaine Juchau, *Green Landlords: Solving the Rubik's Cube of Energy Efficiency in Rental Housing* BC Sustainable Energy Association (April 3, 2009), www.bcsea.org/greenlandlords, at 18-20.

29 Mark Jaccard reviews the literature on energy efficiency and its discontents in *Sustainable Fossil Fuels* (Cambridge University Press, 2005).

30 Natural Resources Canada, *Evaluation of Energy Efficiency for Industry, Housing and Buildings,* 2010.

31 S. Sorrell, *The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency* (Sussex Energy Group for the UK Energy Research Centre, 2007), www.ukerc.ac.uk/Downloads/PDF/07/0710ReboundEffect/0710ReboundEffectReport.pdf

32 A recent report from the Organization for Economic Cooperation and Development and the International Energy Agency reviews market failures in much more detail, and reviews empirical findings for appliances and buildings. OECD/IEA, *Energy Efficiency Policy and Carbon Pricing* (2011), www.iea.org/papers/2011/EE_Carbon_Pricing.pdf

INTEGRATION WITH CLIMATE ACTION

From a climate perspective, there is a historical paradox that energy efficiency subsidies have been available for fuel switching from electricity to natural gas. In reviews of the BC program, these perverse incentives have been removed, although a number still exist in the federal ecoENERGY program in regards to space and water heating systems.[33] This is rooted in analyses that favour natural gas from purely energy efficiency grounds because it is combusted on the spot, thereby eliminating energy lost in transmission for electric heating systems. However, this perspective does not take GHG emissions into consideration, and a sustainable energy system needs to take into account both energy efficiency and renewable energy.[34]

In BC, natural gas is much cheaper than electricity per unit of energy, and this undermines incentives to shift away from fossil fuels. In the Lower Mainland, the delivered cost of natural gas is approximately 3.28 cents per kWh, plus 0.45 cents per kWh in carbon tax.[35] This compares to BC Hydro residential rates of 6.67 cents (tier one) and 9.62 (tier two) per kWh for electricity.[36] Thus, gas prices are 56% the cost of the tier one electricity rate and 39% of the tier two rate, creating a perverse incentive to use gas as a fuel source instead of electricity.

In terms of climate action and economics, there is an externality, or a cost borne by third parties to the market transaction, associated with burning fossil fuels. A recent study put the value of these external costs at as much as $893 per tonne of CO_2.[37] Relative to current prices above, this implies that the price of natural gas is five times lower than it would be if all costs were included in the market price.

In BC, natural gas is much cheaper than electricity per unit of energy, and this undermines incentives to shift away from fossil fuels.

Making prices tell the truth, eventually, is needed if BC is to reduce and eventually eliminate fossil fuels like natural gas over the course of the next few decades. The BC government considers natural gas to be a source of clean energy, and often talks about GHG reductions and increased gas production in the same breath.[38] This perception is reinforced by some reports on BC's green economy.[39] At best, it is merely the cleanest of fossil fuels. In regions where electricity is produced by coal, a switch to natural gas can lower GHG emissions per unit of energy, although in the case of shale gas fracking, natural gas emissions may actually be on par with coal.[40]

33 Natural Resources Canada, *Grant table for ecoENERGY Retrofit—Homes*, Effective June 6, 2011, http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/retrofit-qualify-grant.cfm

34 Prindle et al., supra note 1.

35 Fortis BC rates for Lower Mainland service area, other taxes and fees not counted, rates quoted in GJ, then converted to kWh, www.fortisbc.com/NaturalGas/Homes/Rates/Pages/Lower-Mainland.aspx. Carbon tax as of July 1, 2011 estimated from BC Ministry of Small Business and Revenue, *Carbon Tax Rates by Fuel Type* (June 20, 2008).

36 Based on interim rates approved by BCUC and in place at the time of writing. Note that the proposed BC Hydro rate for 2011/12 shown in Table 3 is higher than these rates. Rates from BC Hydro, www.bchydro.com/youraccount/content/residential_rates.jsp

37 F. Ackerman and E. Stanton, *Climate Risks and Carbon Prices: Revising the Social Cost of Carbon* (Economics for Equity and the Environment, 2011), www.e3network.org/social_cost_carbon.html. This is the high end of a range of estimates. Translated to kWh, it would imply a carbon tax of 16 cents per kWh.

38 Ministry of Energy and Mines and Minister Responsible for Housing, *Revised 2011/12 to 2012/13 Service Plan* (May 2011).

39 For example, a report commissioned by the BC government, *BC's Green Economy: Building a Strong Low Carbon Future* (Globe Foundation, 2010), comments that BC's 1,000 trillion cubic feet of natural gas reserves in the ground represents a "low carbon resource opportunity for both transportation and for export to other economies around the world" (www.globe.ca/media/3887/bcge_report_feb_2010.pdf). Converted to GHG emissions, these natural gas reserves represent 55.8 billion tonnes of CO_2 (almost two years worth of global emissions). See M. Lee, *Peddling GHGs: What is the carbon footprint of BC's fossil fuel exports?* (Vancouver: CCPA, 2010), www.policyalternatives.ca/peddling-ghgs

40 Natural gas has typically been cited as producing about half the emissions of coal per unit of energy. This has now been disputed by life-cycle analyses that count the large emissions associated with gas extraction

From a consumption perspective, space and water heating are the two sources of GHG emissions in homes: space heating (2.9 Mt CO_2e) and water heating (1.4 Mt CO_2e) together comprise 99% of residential emissions (the remaining 1% is from appliances).[41] Electricity and natural gas are thus competing energy technologies.[42] For space heating, about 29% of the energy consumed is electric (near-zero GHGs) whereas most of the remainder is from natural gas (58%), with some wood burning in the mix (11%). For water heating, 16% of energy consumed is electric, compared to 83% natural gas.[43]

A fuel switching strategy to get homes off of fossil fuels must focus squarely on space and water heating (in more efficient, less drafty homes). Existing homes using natural gas heating/cooling and hot water systems (typically hydronic systems) could be converted to renewable fuel sources such as waste heat, biomass, geo-exchange, and solar thermal. Heap pumps of various types (including ductless models that can replace electric baseboard heaters) are also a very efficient way of providing space heating. Neighbourhood-level or district energy systems (including waste heat recapture) could also play a major role in the transition away from fossil fuels.

Removing perverse incentives in favour of natural gas via carbon pricing is also needed in order to make the economics of transitioning off of fossil fuels favourable.

A fuel switching strategy to get homes off of fossil fuels must focus squarely on space and water heating (in more efficient, less drafty homes).

THE CASE FOR LOW-INCOME RETROFITS

There is good reason to believe that public funds could be used more effectively to reduce free ridership and rebound effects by steering funds away from more affluent households in single-family homes (the main focus of existing programs). A more focused use of public funds on energy efficiency that more coherently links to GHG reductions and fighting energy poverty could yield superior outcomes.

Current programs offered to homeowners who have the upfront capital required for energy investments will tend to benefit households with higher incomes. In some cases, such as utility-run programs that are funded through the general revenues from all ratepayers, this means that low-income households, who cannot avail themselves of the programs, are effectively subsidizing the middle- to high-income households who do. Poorly designed energy efficiency programs can contribute to greater inequality.

With few exceptions, existing programs are not relevant to low-income households who do not have their own capital to contribute toward upgrades, or who are most likely to be renters. In

and production. See overview of research by US Environmental Protection Agency by Abrahm Lustgarten, "Climate Benefits of Natural Gas may be Overstated" at www.propublica.org/article/natural-gas-and-coal-pollution-gap-in-doubt. More recently, research has suggested that shale gas does not share this advantage. See R. Howarth, R. Santoro and A. Ingraffea, *Methane and the greenhouse-gas footprint of natural gas from shale formations,* forthcoming in *Climatic Change*, http://graphics8.nytimes.com/images/blogs/greeninc/Howarth2011.pdf

41 Natural Resources Canada, "Comprehensive Energy Use Database, Residential Sector — British Columbia," Table 2, data for 2008 (Ottawa: Office of Energy Efficiency), http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/trends_res_bc.cfm

42 About one-tenth of BC's electricity comes from gas-fired power plants, though these supplies are being phased out in favour of low-emission sources, and BC imports coal-based electric power from Alberta during off-peak hours.

43 Natural Resources Canada, "Comprehensive Energy Use Database, Residential Sector — British Columbia," Table 2, data for 2008 (Ottawa: Office of Energy Efficiency), Tables 5 and 6 for space heating and Tables 10 and 11 for water heating, http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/trends_res_bc.cfm

addition, Energy efficiency programs are not generally available for multi-unit residential buildings where many low-income households live.

As noted above, the BC government has made some smaller efforts to upgrade the province's social housing stock, essentially a budget measure that provides long-term energy savings. Provincial utilities have also made some modest strides in developing low-income programs.[44] These early efforts provide a basis for moving forward with a more coherent and aggressive program of retrofits for low-income households (for example, there are about half a million households with income under $40,000).[45]

With few exceptions, existing programs are not relevant to low-income households who do not have their own capital to contribute toward upgrades, or who are most likely to be renters. In addition, Energy efficiency programs are not generally available for multi-unit residential buildings where many low-income households live.

Low-income energy efficiency programs are "low-hanging fruit" that can yield relatively greater energy savings than mainstream energy efficiency programs because low-income households tend to live in less energy-efficient homes than the average household. Because low-income households are already budget-constrained, and would not have made investments otherwise, there is good reason to believe that targeted and well-designed programs for energy efficiency in low-income households would dramatically reduce both free rider and rebound effects. Low-income efficiency programs are a thus smarter and more effective use of public funds compared to existing programs.

Some 30% of BC households rent their housing, and face barriers to energy efficiency upgrades due to "split incentives." In this area, there are clear gains to be had from a comprehensive approach that starts with mandatory energy auditing for rental housing, and implements minimum standards for energy efficiency, combined with financing mechanisms to support upgrades (starting with the worst performing housing stock).

Multi-unit buildings have generally been excluded from BC's energy efficiency upgrades, which have generally targeted single-family homes. There are vast numbers of three- to four-storey apartment buildings built in the 1960s and 1970s that would benefit from deep energy retrofits, with associated building envelope improvements. More than half of units in apartment buildings are rented, and conversely, well over half of renters live in apartment buildings, so a strategy for multi-unit buildings inevitably overlaps with the need for a housing retrofit strategy for rental units.

44 BC Hydro's Energy Conservation Assistance Program (ECAP) is the low-income version of the PowerSmart program. BC Hydro, "Energy Conservation Assistance" (2009), www.bchydro.com/powersmart/residential/energy_conservation.html. In conjunction with an energy audit, ECAP provides qualified low-income residential customers with the installation of energy-saving products, including: compact flourescent bulbs; faucet aerators; low-flow showerheads; water-heater pipe wrap and blanket; draft-proofing materials (weather-stripping, caulking, and outlet gaskets); insulation for attics, walls, and crawlspaces; low-wattage night lights; and an Energy Star® refrigerator. To qualify for ECAP one must be a BC Hydro residential customer living in the Lower Mainland or on Vancouver Island, whose electricity consumption exceeds 8000 kWh/yr, and whose combined household income is below Statistic Canada's LICO. Renters may participate in the program by having their landlord complete a consent form. BC Hydro also offers a more modest LIEEP in its provision of free energy saving kits to customers who are below the LICO.

45 Natural Resources Canada, "Survey of Household Energy Use 2007."

Next Steps for BC

DEVELOPING SUSTAINABLE HOMES IN BC will require a balanced approach that includes carefully designed pricing structures and aggressive support of energy efficiency improvements. Our analysis is unique in that it brings together research in different fields — home efficiency, climate change and energy poverty — towards a coherent action plan.

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Climate action demands that GHG emissions be reduced and ultimately eliminated, and is compatible with an aggressive program of energy efficiency investments. But a smooth transition requires more attention to be paid to impacts on low-income households and other vulnerable populations. Fighting energy poverty by focusing on low-income individuals and families, and the housing stock where they live, can lead to fairer and more effective policies. This should be a key component of a next generation LiveSmart program for BC, and it should also be linked to green job creation and skills development.

We recommend the following next steps for the BC government.

DEVELOP A LONG-TERM VISION OF GREEN BUILDINGS IN COMPLETE COMMUNITIES

Complete communities exist where higher residential densities enable greater numbers of people to live in closer proximity to jobs, public services, commercial areas and transit. Combined with green building design, a new generation of low-energy-use buildings and communities is possible, without detracting from a high standard of living.[46]

Advances in the understanding of green buildings point to design features that can eliminate the need for conventional heating and cooling systems, even in cold climates. Super-efficient standards like *passivhaus* rely on thick layers of insulation on exterior walls and between the ground and foundation, and better windows to prevent heat loss.[47] The addition of "thermal mass" inside the house moderates temperature the way a lake does for a town on its shores. Buildings are also placed on site and designed in a manner to take advantage of sun and shade at different times of the year, to capture solar energy for space and hot water heating.

46 For more on this vision, see a companion Climate Justice report by P. Condon et al., *Transportation Transformation: Building Complete Communities and a Zero Emission Transportation System in BC* (Vancouver: CCPA, 2011).

47 A series in *The Tyee* by Monte Paulson looks at the pontential application of passivhaus standards to BC and Canada: "Step Inside the Real Home of the Future: Passivhaus," http://thetyee.ca/News/2011/01/25/Passivhaus/

These design features help to keep temperature fluctuations within a smaller range than normal buildings, dramatically reducing energy consumption. A ventilation system with heat exchange (that captures waste heat from air leaving the building to heat incoming air, and vice versa) is sufficient to meet heating and cooling needs. In some circumstances, a small amount of energy would be needed to add heat in this process, but this design can replace the need for a furnace, baseboard heaters or air conditioner. Indeed, with solar panels or other renewable on-site electricity generation these buildings could create more energy than they use. Neighbourhood-level systems, like Southeast False Creek's district energy facility, are another complementary means of greening buildings.

It will take many decades for BC's building stock to turn over, to fully realize a vision of complete communities. Much of the focus in the interim should be on existing buildings that can be retrofit to dramatically improve their energy efficiency. The vast majority of these buildings may never achieve passivhaus standards, but major gains can be made in both efficiency of energy use, and shifts in the source of the energy that powers our homes away from fossil fuels.

FIGHT ENERGY POVERTY

The task of reducing and eliminating GHG emissions is made more difficult in a highly unequal society. Policy aimed at improving energy efficiency and reducing GHG emissions should be consistent with an overall approach to poverty reduction in BC. Because poverty is a complex phenomenon, a multi-pronged approach is needed (such as outlined in the CCPA's Poverty Reduction Plan for BC[48]).

The BC Utilities Commission should actively consider distributional impacts as part of its rate approval decisions. Faced with electricity price increases, low- to middle-income households should receive an income transfer that would ensure that the most vulnerable are not worse off.

Measures that increase the price of necessities will have a disproportionate impact on low-income households, who spend a much larger share of their incomes on energy to begin with. While low-income households are already highly motivated to conserve energy, BC's biggest energy consumers, those most likely to be of a higher income group, experience cost increases that are relatively insignificant in proportion to income.

The BC Utilities Commission should actively consider distributional impacts as part of its rate approval decisions. While we find that BC Hydro's RIB rate has a limited but progressive distributional impact, the ongoing increase in electricity prices, as currently proposed, will adversely impact low-income households. A commitment to reduce and then eliminate energy poverty (with targets and timelines) should accompany applications in support of conservation pricing.

A straightforward way of reducing energy poverty (and poverty in general) is to increase incomes of the poorest. Faced with electricity price increases, low- to middle-income households should receive an income transfer that would ensure that the most vulnerable are not worse off. There is a precedent for such actions in Ontario. Its 2010 Budget introduced a tax credit (worth up to $200) to offset the impact of higher electricity prices on low- to middle-income households.[49] Similar considerations could apply for non-profit societies, who are not allowed to increase rents (and have a mandate to provide affordable housing) but pay the utility bills.

48 S. Klein et al., *A Poverty Reduction Plan for BC* (Vancouver: CCPA, 2008). This is a summary report of policy recommendations from the CCPA–Simon Fraser University Economic Security Project.

49 Government of Ontario, *Ontario Energy and Property Tax Credit*, www.rev.gov.on.ca/en/credit/oeptc/index.html

This is analogous to a Climate Justice Project recommendation on carbon pricing, where a portion of more aggressive carbon tax revenues can be used to address regressive impacts for low- to middle-income households.[50] Such transfers are also good macroeconomic policy by facilitating increased expenditures from low-income households. In the absence of income transfers, higher prices would mean reduced spending elsewhere.

Given the barriers to low-income households to participating in typical energy efficiency programs, there is significant potential to address energy poverty and energy conservation through targeted low-income energy efficiency programs. It is critical that these programs include and target landlords and property owners as they are the key players able to authorize, manage, and better evaluate the value of energy efficiency upgrades. A comprehensive energy efficiency strategy must be coordinated through a centralized clearing house to facilitate ease of use, including information and marketing in languages other than English, and program delivery from trusted community partners. There are also good reasons to believe that there are substantial co-benefits from this approach, including public health improvements from reduced mortality and morbidity from extreme heat and cold spells; better ventilation would also lead to a reduction of molds.

INCREASE THE PROGRESSIVITY OF TIERED PRICING

Apart from the overall increase in prices looming for BC households, our assessment finds that two-tier electricity pricing is progressive. This is because this pricing model puts a greater onus on the biggest consumers, who tend to have high incomes and spend a very small share of those incomes on electricity.

Higher prices in the second tier of pricing will create stronger incentives for conservation and efficiency among high-income consumers, while having minimal impact on low-income households. However, because households are very diverse in terms of where they live and how much they rely on electricity for basic heating, there may be some low-income households that are adversely affected by such a move. A cap on electricity expenditures as a share of income (at say 5% of total household income) could be considered to avoid unintended outcomes (this would also help to identify households in need of deep retrofits).

A number of alternative design options for the RIB rate are possible, including removing the basic charge (just under $50 per year) on hydro bills, and/or introducing a third tier to the pricing system with a very high rate. Apart from ensuring a more progressive pricing structure, we do not recommend a specific model for change. The key point is to deliberately design mechanisms that ensure environmental goals are achieved without making the most vulnerable households worse off. This is preferable to the more blunt tool of overall price increases that pose significant challenges to low-income customers.

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MOVE CAUTIOUSLY ON TIME-OF-USE PRICING

Smart metering and TOU pricing structures are intended to incent off-peak electricity consumption and reduce the need for added capacity. Experience in other jurisdictions have shown that the extent of energy savings and potential for positive bill impacts largely depend on the ability of the customers to anticipate peak rate periods and apply enabling technology, at an added cost, within the home.

50 See M. Lee, *Fair and Effective Carbon Pricing: Lessons from BC* (Vancouver: CCPA, 2011).

The projected $960 million cost of smart meters and grid upgrades would be better spent on energy efficiency and conservation programs. But this is a moot point as plans are already underway to roll them out across BC. The costs and benefits to BC households are unclear, however, and require further study before time-of-use pricing is adopted (thus far, BC Hydro has not explicitly stated that it intends to shift to time-of-use pricing).

Furthermore, it is not clear how TOU pricing would interface with the current RIB structure, or whether it would replace RIB. If combined together, there is a great potential for violating a basic rule of utility pricing — simplicity — and this could undermine incentives for conservation. Much will depend on the details of how BC Hydro proposes to implement new pricing regimes.

To take advantage of TOU pricing, households will require both the ability to adjust use patterns and the financial means to implement enabling technologies in the home. This strategy has the potential to increase the cost burden of electricity on vulnerable low-income households without providing any benefit to those in need. There is some danger that time-of-use pricing will have adverse impacts on low-income households for certain activities, like cooking, that cannot easily be shifted to late-evening or weekends when rates are lower.

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PHASE OUT NATURAL GAS

De-carbonizing homes requires, minimally, that the existing perverse incentives favouring natural gas over electricity be eliminated over time through effective carbon pricing. And this must also take into consideration looming increases in electricity prices. The cost of natural gas may rise on its own account, but additional carbon pricing measures may be required to avert a widening gap.

BC's population is expected to increase from about 4.6 million residents to over 6 million by 2036.[51] New housing and redevelopments should not be adding to BC's appetite for natural gas, nor should energy efficiency programs subsidize conversion to natural gas. Instead, a slow-and-steady transition off of natural gas toward clean electricity from the grid and other on-site and neighbourhood-scale alternatives is needed, synchronized with energy efficiency gains to avert a major increase in electricity demand that could drive up prices.

For social housing, BC Housing's policy that any new properties it funds must never use more than 10% of energy sources from natural gas is a step in this direction. However, the affordability of new low-income developments can be adversely affected if more complex mechanical systems (geothermal, solar thermal, complex controls, heat recovery) result in higher operating costs. These clean energy systems may have a poor rate of return under current gas and electricity prices, and the prospect of additional costs needs to be factored into grants and subsides for social housing providers. Space for creative solutions, which may result in properties that incorporate sufficient passive design and renewable energy strategies, should be left to the consumer or building owner as to how to meet a certain performance standard with respect to energy and GHG emissions.

51 BC Stats, British Columbia Population by Selected Age Groups: Estimated (1971-2009) and Forecasted (2010-2036), drawn from Statistics Canada data and projections.

TARGET OLDER HOUSING STOCK

In general, it is BC's older housing stock that has poorer energy performance and higher GHG emissions. Over time, building standards have improved home energy efficiency and are projected to continue to do so. More than two-fifths of BC's housing stock was built before 1983, and 12% of the total before 1960. While some older buildings have already been retrofitted, and others may be demolished in the future for redevelopment, retrofitting these buildings represent the greatest gains for BC's energy system and GHG reductions overall.

Table 3: Space Heating Energy Use and GHG Emissions by Housing Vintage, BC, 2008

Home vintage	Number of homes (thousands)	Share of total	Space heating energy and GHG emissions			
			Total energy use (PJ)	Energy use per home (GJ)	Total GHG emissions (Mt CO_2e)	GHG emissions per home (tonnes CO_2e)
Before 1946	106	6%	7.5	71.4	0.2	2.2
1946–1960	117	6%	7.8	66.6	0.2	2.0
1961–1977	357	20%	20.3	56.9	0.6	1.7
1978–1983	227	12%	11.9	52.4	0.4	1.6
1984–1995	502	28%	22.1	44.0	0.7	1.3
1996–2000	200	11%	7.1	35.4	0.2	1.1
2001–2005	204	11%	8.4	41.0	0.3	1.2
2006–2008	111	6%	3.8	33.7	0.1	1.0
Total	1,823	100%	88.8	48.7	2.7	1.5

Note: Data are available for space heating only, but this is the most energy intensive function in a typical home. These figures do not adjust for average home size, which has grown over the course of many decades.
Source: Natural Resources Canada, Survey of Household Energy Use, 2008, Residential Sector, Tables 7 and 15.

Table 3 shows that homes built before 1983 have higher GHG emissions and energy use than the average of all homes, and the older the vintage the worse the performance. Thus, a concerted effort to retrofit these buildings is a top policy priority, with the added benefit for reducing energy poverty that low-income households are more likely to live in older and less efficient housing stock.

Homes built before 1983 have higher GHG emissions and energy use than the average of all homes, and the older the vintage the worse the performance. Thus, a concerted effort to retrofit these buildings is a top policy priority, with the added benefit for reducing energy poverty that low-income households are more likely to live in older and less efficient housing stock.

Starting with the oldest buildings, a retrofit program would include energy audits followed by a package of financial incentives for retrofits of building envelope and space and water heating systems, accompanied by financing for all cost-effective investments with payback periods within a specified timeframe (15 to 20 years). A 10-year plan to retrofit older housing stock would thus imply about 60,000 units per year audited and retrofit, assuming three-quarters of units are in need of a retrofit.

Older housing stock is also more likely to require deep energy retrofits, i.e. upgrades that go beyond the scope of existing retrofit programs. A recent UBC study found that current policy directions around housing retrofits are insufficient to meet BC's long-term emission reduction targets.[52] More aggressive strategies for *deep housing retrofits* include replacing windows, re-

52 E. Pond, D. Caverns, N. Miller and S. Shepherd, *The Retrofit Challenge: Re-thinking Existing Residential Neighbourhoods for Deep Greenhouse Gas Reductions* (UBC, 2010).

cladding houses with extra insulation, insulating sub-floors, and installing heat pumps and solar thermal systems, plus expansion of district energy systems (based on biomass) and on-site power generation (e.g. solar panels).

MANDATE ENERGY AUDITS

The vast majority of people do not understand energy efficiency as it relates to their homes (aside from campaigns to upgrade lightbulbs). The process of undertaking an energy audit provides a major opportunity to educate and inform households about issues like heat leakage in their homes and what cost-effective measures could be implemented that would save them money (and reduce energy use and GHG emissions).

Energy audits provide a major opportunity to educate and inform households about issues like heat leakage in their homes and what cost-effective measures could be implemented that would save them money (and reduce energy use and GHG emissions).

Mandatory energy audits should be implemented so that eventually all BC housing has been audited, with the results available in the public domain. This process should start with the oldest housing stock, likely to be least energy efficient and highest in GHG emissions, and proceed to progressively newer housing over time. Full costs associated with the audit should be covered by the BC government.

We do not recommend mandatory retrofits, as owners may elect to pay higher prices or to redevelop inefficient buildings. However, the auditing process would more clearly make energy efficiency upgrades transparent to owners, and with a package of incentives and financing arrangements it is reasonable to expect a better response than the status quo.

In addition to the focus on older housing stock, audits of all homes at the time of sale or during major renovations should be implemented. If combined with public release of auditing data, these actions would represent a major step toward comprehensive energy labeling for BC homes. Berkeley, CA is an example of a jurisdiction that requires energy audits when a home is sold, and requires some energy efficiency improvement be made, as part of its Residential Energy Conservation Ordinance.[53]

RETROFIT MULTI-UNIT BUILDINGS AND RENTAL HOUSING STOCK

A provincial fund is needed to support energy efficiency projects across rental properties, multi-unit buildings and the non-profit housing sector, to fund "deep retrofits" and renewable energy, which is currently missed by most existing utility and government incentive programs. Because each rental situation is different in terms of housing type and vintage, and whether the landlord or tenant pays for heating, hot water and electricity, a legislative commitment is required to actively protect tenants from price increases. Security of tenure should also be included—for example, if landlords qualify for funding to improve their buildings, the units should be linked to low-income renters for a set period, perhaps the amortization period of the improvements.

Minimum energy efficiency standards should be implemented for rental housing stock to overcome "split incentive" problems. Working with an energy advisor, and with provincial subsidies in place and perverse incentives for natural gas removed, a wide range of deep energy improvements could be implemented to dramatically improve energy efficiency at no cost to either landlord or tenant. In fact, there would be net savings, though how these would be distributed between landlord and tenant would depend on the specific circumstances. Similar issues arise in

53 Residential Energy Conservation Ordinance, www.ci.berkeley.ca.us/ContentDisplay.aspx?id=16030

Estimating the Cost of an Upgraded Retrofit Program

As detailed in Section 3, homeowners have been able to access about $2,500 per typical single-family home in BC and federal grants. Targeting all older housing stock (pre-1983) over a 10-year action plan (less homes that have already been retrofit) yields approximately 60,000 homes, two-thirds of which are single-family dwellings.

This implies an annual commitment of $100 million per year, some of which could be covered by the federal government, although the focus of funds should be on building envelope improvements and fuel switching rather than appliances (that will be replaced over time, anyway). For deep retrofits this figure could be higher, and the figure does not account for upgrades to post-1983 housing stock.

A revitalized program also needs to move beyond single-family dwellings to include multi-unit buildings and address the perverse incentives surrounding upgrades where landlords rent housing to tenants. LiveSmart pilots for social housing have spent about $2,000 per unit, although it is likely that a full package of deep energy retrofits would be much more costly. Many multi-unit buildings require other non-energy upgrades (such as sprinkler systems) as well, so it would make sense to combine efforts so that buildings are retrofit only once.

A budget of $220 million per year in support of retrofitting BC's housing stock would be in line with significant reductions in GHG emissions and energy poverty in BC homes.

While there is limited cost-benefit data on retrofits of multi-unit buildings, we estimate $6,000 per unit for 20,000 units per year to retrofit older multi-unit housing.[a] This would be another $120 million per year (again, deeper retrofits would be more expensive). In addition, higher operating costs for the maintenance and operation of renewable energy systems in BC social housing also need to be considered, or affordability will be undermined.

A budget of $220 million per year in support of retrofitting BC's housing stock would be in line with significant reductions in GHG emissions and energy poverty in BC homes. A more aggressive approach based on deeper housing retrofits would be more costly, and data are not readily available to make an estimate. Such an approach would have to evaluate costs versus benefits of particular retrofits, as well as the option of redevelopment in the context of the age and energy efficiency of particular buildings.

Carbon tax revenues are an ideal source of public subsidies for such a program. The existing carbon tax will bring in about $1 billion in revenue in 2011/12, and a rising tax in line with what is needed to fulfill BC's GHG targets would raise billion more. As another Climate Justice paper on fair and effective carbon pricing illustrates, a $200 per tonne carbon tax that enabled BC to meet its 2020 emission targets would raise almost $8 billion per year that could go toward reinforcing climate action and transfers to low- to middle-income households to offset regressive impacts.

[a] Based on estimates from the BC Non-Profit Housing Association, personal communication. Retrofit costs would be higher to completely eliminate natural gas as an energy source.

all multi-unit buildings due to common space that must be heated and lit, and the presence of shared hot water and heating.

Financial incentives can also have an impact, such as the price discrepancy between natural gas and electricity per unit of energy (discussed above). For rental properties, current taxation rules allow landlords to write off 100% of building maintenance costs against rental profits, but energy efficiency retrofits are considered capital investments and landlords can only write off 5% of these costs. The BCSEA Green Landlords report makes a number of recommendations to provide better information, improve financing, and streamline incentives so that barriers to energy efficiency are reduced in landlord-tenant situations.[54]

For rental properties, current taxation rules allow landlords to write off 100% of building maintenance costs against rental profits, but energy efficiency retrofits are considered capital investments and landlords can only write off 5% of these costs.

A pilot initiative by the City of Vancouver in collaboration with the BC Sustainable Energy Association and Vancity will engage retrofits of 15 strata-titled buildings.[55] The pilot will invest an average of $150,000 per building and is anticipated to reduce GHG emissions by 20%. Specific investments will be made in common areas, solar hot water, and energy metering in suites. It is hoped that this will provide a model for widespread implementation in Vancouver and beyond.

Innovative approaches to retrofitting multi-unit buildings include the BC Non-Profit Housing Association's Strategic Energy Management Plan for the non-profit housing sector (covering a share of BC's rental housing stock).[56] The plan analyzed the energy consumption and energy efficiencies of various building types within the sector and identified a number of barriers to managing energy use in the non-profit sector. A special fund could be developed for energy efficiency projects across the sector to fund deep retrofits and renewable energy, streamline applications, align funding timelines, and leverage project funding.

ACCELERATE FINANCING REFORM

A key dimension to this is to pay for cost-effective upgrades (savings are greater than the amortized cost of the upgrade) and link repayment to the property itself — this means there is no disincentive against energy efficiency if people move before the period in which the investment is paid off. Financing through the public sector can also ensure credit is available to low-income households, and can also ensure low interest rates. An overview of the state of financing in different Canadian provinces was recently published by the Columbia Institute.[57]

Increasingly, governments are looking to alternative financing vehicles that remove the upfront cost from the homeowner, with repayment tied to the property itself to address moving concerns. For example, the City of Vancouver (in conjunction with Vancity) launched a pilot program that would cover the upfront cost of a retrofit, paid back through an incremental change to property tax bills (based on an annual interest rate of 4.5% over 10 years).[58] For other BC municipalities, financing could involve an arrangement with the provincial Municipal Finance Authority.

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54 Abbott et al., supra note 28.

55 City of Vancouver, *BC Sustainable Energy Association Vancouver Retrofit Energy Efficiency Financing Pilot Program for Strata-titled Condominiums* (Director of Sustainability to Standing Committee on Planning and Environment, July 4, 2011).

56 Developed by CityGreen Solutions, in partnership with BC Hydro, Terasen Gas and BC Housing.

57 R. Duffy and H. Fussell, *This Green House: Building Fast Action for Climate Change and Green Jobs*, (Centre for Civic Governance, May 2011).

58 City of Vancouver, *Vancouver Retrofit Energy Efficiency Financing Pilot Program for One and Two-Family Dwellings* (Director of Sustainability to City Council, May 5, 2011), vancouver.ca/ctyclerk/cclerk/20110531/documents/rr1.pdf

At time of writing, the BC government has tabled legislation to enable utilities like BC Hydro to implement on-bill financing for energy efficiency retrofits (as is already the case in Manitoba). Alternatively, municipal governments could cover upfront costs and have repayment on property tax bills (similar to existing local improvement charges for infrastructure improvements).[59] A recent report for the David Suzuki Foundation argues that municipal finance is superior to utility financing as it can better enable deep housing retrofits that may span the service interests of multiple utilities. In our framework emphasizing clean electricity, this is less of an issue and BC Hydro is ideally poised to play a more prominent role in deep retrofits.

ESTABLISH PROGRESSIVELY HIGHER MINIMUM STANDARDS FOR APPLIANCES AND BUILDINGS

Many rebate programs for appliances are riddled with free rider and rebound problems. In these areas, a simpler approach is to steadily raise the energy efficiency and life-cycle GHG standards for products in the marketplace. This could entail removing the worst performing products entirely and/or applying a fee-bate system that would raise the cost of the worst performers and use the proceeds to subsidize the costs of the best-in-class performers.

For new houses, tighter regulations over time have improved energy efficiency, and this should continue. Future changes to building codes must drive builders toward net-zero buildings and passive house standards.

For almost all appliances, capital stock turnover works in favour of improved energy efficiency and GHG reductions. Within a 20-year time frame, almost all of the appliances in a home will be replaced. Thus, they key is to set progressively higher standards for those appliances. Free rider problems are likely to be larger for appliances that periodically need to be replaced (such as fridges and dishwashers) as opposed to longer-term structural changes to the building itself (building envelope improvements and fuel switching).

A standards-based approach for appliances would reduce public expenditures lost to free riders, and also help to overcome other market failures in energy efficiency.[60] This would leave more public money available for financial incentives in areas where GHG emissions are concentrated (space and water heating) and that are more intensive retrofit areas than just replacing appliances.

An innovative approach is to set progressively higher marketplace standards for classes of products with the objective of absolute gains in energy use, rather than just greater efficiency (today's televisions, for example are much more efficient than their cathode-ray predecessors, but gains have been lost to screen size). This would guard against rebound effects of greater efficiency in one area leading to more energy use in another.[61]

For new houses, tighter regulations over time have improved energy efficiency, and this should continue. Future changes to building codes must drive builders toward net-zero buildings and passive house standards.

59 S. Persram, *Property Assessed Payments for Energy Retrofits* (David Suzuki Foundation, April 2011), www.davidsuzuki.org/publications/reports/2011/property-assessed-payments-for-energy-retrofits/

60 OECD/IEA, supra note 32.

61 Such an approach is outlined by C. Calwell in *Is Efficient Sufficient? The case for shifting our emphasis in energy specifications to progressive efficiency and sufficiency* (European Council for an Energy Efficient Economy, March 2010).

INVEST IN SKILLS DEVELOPMENT FOR GREEN JOBS

Retrofits of buildings have tremendous potential for the development of green jobs. Research by David Thompson for the Columbia Institute and BC Federation of Labour estimated that basic retrofits of BC's older housing stock could comprise between 8,200 and 13,200 person-years of employment in BC.[62] Thompson assumes that half of BC's pre-1984 homes, or 400,000 homes, are in need of retrofits, at 5 to 8 person-days per home for a basic retrofit.

Our estimate above of $220 million per year in retrofit financing would lever additional funds from the private sector. This could amount to a total investment of about $1.1 billion per year, using a conservative multiplier for private expenditures of five dollars for every dollar of public spending. At approximately 11 direct jobs per $1 million spent, based on BC government economic multipliers,[63] this investment would lead to over 12,000 direct green jobs per year (and total increase in employment of almost 20,000 jobs if we include indirect and induced job creation). To put this number in perspective, the oil and gas industry (the leading cause of GHG emissions in BC) directly employs 3,000 British Columbians.

Our estimated investment of $220 million in retrofit financing would lead to over 12,000 direct green jobs per year (and total increase in employment of almost 20,000 jobs if we include indirect and induced job creation).

This would represent a major increase in expenditures and labour supply that, pragmatically, would need to be ramped up over time. More comprehensive deep energy retrofits would scale up these employment numbers, though it is difficult to project by how much. An aggressive approach, as outlined above, would require planning and sequencing of retrofits in accordance with the availability of skilled labour. The associated needs for training, apprenticeships, etc. would need to be evaluated in line with the annual budget for retrofits. There is vast potential to create training and jobs today for underemployed persons in property energy management, building envelope maintenance, HVAC operations and maintenance, tenant engagement and education, contractor administration and project management.

Where possible, green jobs training programs should seek to provide opportunities for disadvantaged populations. The Vancouver Island Highway project is an excellent BC example of investments that deliberately created employment for local women and First Nations people.[64] If the political will exists to open up these doors, green jobs can constitute a valuable pathway out of poverty.

OUR CLIMATE JUSTICE FRAMEWORK on household energy efficiency and energy poverty concludes that the household sector can reduce and eventually eliminate GHG emissions, although this will be a process that rolls out over a few decades, and must be integrated into longer-term land use planning for sustainability. It is also a major source of green job creation, as part of a more coherent green industrial policy framework for BC. Energy poverty is a key issue in this transition, and must actively be considered in core areas like electricity pricing. Existing energy efficiency programs have been developed to overcome market barriers, and BC's experience offers many lessons for a next generation of programs that contribute to fighting energy poverty.

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62 D. Thompson, *Jobs, Justice, Climate: Building a Green Economy for BC* (Discussion paper for BC Federation of Labour and Columbia Institute conference, *Jobs, Justice, Climate*, September 2010).

63 While LiveSmart estimated 10 to 15 jobs per $1 million spent, this is conservative. The BC economic multiplier model estimates 6.5 direct jobs (and 13 jobs total including indirect and induced jobs) per $1 million in construction, and 16 direct jobs (23 jobs total) in repair and maintenance. Because retrofits are likely be more labour-intensive that general construction, we choose 11 direct jobs (and 18 total jobs) per $1 million as a mid-point. See G. Horne, *2004 British Columbia Provincial Economic Multipliers and How to Use Them* (Victoria: BC Stats 2008).

64 M. Cohen and K. Braid, *The Road to Equity: Training Women and First Nations on the Vancouver Island Highway—A Model for Large-Scale Construction Projects* (Vancouver: CCPA, 2000).

THE CLIMATE JUSTICE PROJECT

The Climate Justice Project is a multi-year initiative led by CCPA and the University of British Columbia in collaboration with a large team of academics and community groups from across BC. The project connects the two great “inconvenient truths” of our time: climate change and rising inequality. Its overarching aim is to develop a concrete policy strategy that would see BC meet its targets for reducing greenhouse gas emissions, while simultaneously ensuring that inequality is reduced, and that societal and industrial transitions are just and equitable.

CCPA
CANADIAN CENTRE
for POLICY ALTERNATIVES
BC Office

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