Opportunities and Quantification Requirements for Local Government Participation in Greenhouse Gas Emissions Trading Markets

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I. Introduction

As U.S. states (and the federal government) consider policies for mitigating climate change and controlling greenhouse gas (GHG) emissions, particular attention should be paid to the role of local governments. Local government policies influence GHG emissions associated with many types of activities. In particular they directly affect emissions related to transportation, energy use in buildings, and waste, which together are responsible for close to 40 percent of U.S. emissions. There are many ways that local governments can help to reduce GHG emissions, both within their own operations and across the communities over which they have jurisdiction.

At both state and federal levels, the primary policy tool being considered for controlling GHG emissions is the creation of regulatory emissions trading systems. These systems work by placing an overall cap on the GHG emissions allowed from a certain set of sources, and allowing sources to comply with the cap by either achieving emission reductions or purchasing pollution rights from other regulated entities. In most GHG trading systems, emission rights can also be purchased from unregulated entities that achieve emission reductions at sources outside the "cap," (i.e., by creating "carbon offsets"). As GHG emissions trading systems are put in place, it is important to consider how they may interact with local government policies. In particular, it is important to ask how GHG trading systems might be leveraged to help fund and promote local government measures that reduce emissions. Can local governments generate tradable emission reductions, and if so, how? What are the different ways that local governments can participate in GHG trading systems, and what are the technical requirements for them to do so?

This report provides some preliminary answers to these questions, focusing on the general requirements for quantifying emission reductions in order sell emission rights in a GHG trading system. Part II of this report surveys the types of measures that local governments can undertake to reduce emissions. Part III identifies the options that local governments may have for participating directly in an emissions market, or for otherwise obtaining funding to achieve emission reductions, depending on whether their measures affect sources within or outside an emissions cap. Part IV discusses likely quantification requirements for selling emissions allowances, generating carbon offset credits, or obtaining funding from allowance "set-aside" or auction revenue programs.

The conclusions of this report are based, where relevant, on the likely design of an emissions trading system under the Western Climate Initiative (WCI). Participating members of the WCI – which currently include nine U.S. states and Canadian provinces – are still negotiating the details of this trading system, and the descriptions of it provided here should be considered preliminary. Major conclusions include the following:

- A large percentage of the GHG emissions that local governments in the WCI region may be able to influence are likely to be covered under a WCI emissions cap, especially if the cap is expanded to include more sources over time (in line with current proposals). This means that the potential for local governments to

participate directly in emissions trading (by selling emissions allowances or carbon offset credits) may be limited.

- Local governments may still be able to fund GHG emission reduction measures by obtaining allowance "set-asides" (i.e., free allocations of emissions allowances) or allowance auction revenues.
- If local governments own facilities that are directly regulated by a cap-and-trade system, they may be able to generate revenue by reducing emissions and selling excess emission rights. No special quantification requirements or procedures would be necessary to do this.
- To generate and sell carbon offset credits, local governments would need to demonstrate that emission reductions meet a number of basic criteria. Specifically, they will need to show that reductions are "real, additional, verifiable, permanent, and enforceable." Only a small number of local government measures are likely to produce emissions reductions that meet these criteria well. The most promising opportunities for carbon offsets would be measures to reduce fossil fuel combustion in government-owned vehicles, and measures to capture and destroy various sources of methane. Generating offset credits would require the development and/or adoption by the WCI of quantification protocols specific to these types of measures.
- If local governments seek allowance set-asides or auction revenues to fund emission reductions, they may need to meet the same kinds of quantification criteria applied to carbon offsets. However, these criteria would not need to be applied as rigorously, and ownership rights to emission reductions would not be a concern. A much larger set of measures may therefore be good candidates for government funding using set-asides or auction revenues.

II. Possible Local Government Measures to Reduce GHG Emissions

To understand the role that local governments might play in a GHG emissions trading system, it is important to understand the full spectrum of options for reducing GHG emissions that local governments have at their disposal. At the broadest level, there are two ways in which local governments can achieve emission reductions. One is by implementing changes in their own operations. The other is by establishing regulations, ordinances, or programs that reduce emissions on a community-wide basis. Table 1 presents a basic typology of local government measures that could reduce GHG emissions, along with examples of measures in each category. The list of measures is intended to be comprehensive, though not necessarily exhaustive.

Table 1. Possible Local Government Measures to Reduce Greenhouse Gases		
Sector	**Government Operation Emissions**	**Community-Wide Emissions** (By Regulation/Ordinance)
Transportation	• Provide transit and carpool incentives to city employees, e.g. free bus passes • Provide telecommuting, teleconferencing, and flex-time options for municipal employees • Reduce business travel; shift to less emitting modes, e.g. rail over air travel • Convert city bus fleet to alternative fuels (CNG, etc) • Increase fuel economy of vehicle fleet, e.g. hybrid vehicles or smaller fleet • Establish fuel efficiency standards for new municipal vehicle purchases • Utilize alternative fuel vehicles (bio-diesel, ethanol, electric, compressed natural gas) for city fleet • Restrict idling of municipal vehicles • Station police officers on bicycles • Retire old and under-used vehicles • Utilize fuel-efficient vehicles (e.g. scooters) for parking enforcement • Use car sharing programs in lieu of a city fleet • Provide incentives to employees for purchasing fuel-efficient vehicles (e.g., rebates on efficient car purchases) • Provide parking incentives to employees for fuel-efficient vehicles	• Promote commute trip reduction programs, incentives for car and van pooling • Promote public transit: Expand public transit systems (e.g. light rail lines), promote increased ridership, increase frequency, provide discounted fares • Restrict idling at public facilities • Improve traffic signal synchronization • Open local government alternative fueling stations to the public • Promote community purchases of compact and hybrid vehicles • Establish car sharing programs • Implement bicycle and pedestrian infrastructure programs: expand bike paths and bike facilities, promote multi-use street traffic • Provide electric plug-in stations for freight vehicles at truck stops or boats marinas and ports • Require large employers to reduce employee commute trips • Increase parking charges • Provide tax incentives to encourage public transit, carpooling • Promote multi-mode freight transportation • Impose transportation fuel taxes • Impose congestion pricing/charges • Provide incentives for updating/retrofitting non-road/off-road mobile sources (e.g., lawnmowers, generators, construction equipment) • Public-private vehicle demonstrations (e.g., hybrid delivery trucks) • Provide incentives for purchasing fuel-efficient vehicles (e.g., rebates on efficient car purchases) • Provide parking incentives for fuel-efficient vehicles
Land Use Management	• Co-locate government facilities to reduce travel time and maximize building use • Utilize brownfield sites where possible	• Promote high-density, transit- and pedestrian- oriented development through zoning policies • Preserve open space • Institute growth boundaries, ordinances or programs to limit suburban sprawl • Give incentives and bonuses for development in existing downtown areas and areas near public transit • Encourage mixed land use • Encourage in-fill and brownfield development • Require transportation impact study for new developments • Discourage sprawl through impact, facility, mitigation, and permit fees
Energy Efficiency & Green Buildings	• Install efficient lighting at city buildings • Perform energy-efficient building lighting retrofits • Institute a “lights out at night” policy • Institute a “lights out when not in use” policy • Install building/office occupancy sensors • Purchase only ENERGY STAR equipment	• Adopt stringent residential or commercial energy code requirements • Promote energy conservation through campaigns targeted at residents and businesses • Implement a low-income weatherization program • Implement district heating and cooling • Implement time-of-use or peak demand energy pricing

	and appliances for city use • Conduct an energy audit of municipal facilities • Implement an energy tracking and management system • Perform heating, cooling and ventilation system retrofits (e.g. chillers, boilers, fans, pumps, belts, fuel-switching from electric to gas heating) • Install green or reflective roofing • Improve water pumping energy efficiency • Install energy-efficient traffic lights • Install energy-efficient street lights (e.g. high pressure sodium) • Decrease average daily time for street light operation • Require all new construction projects to be LEED certified • Require all retrofit projects to become LEED certified	• Install energy-efficient co-generation power production facilities • Launch an "energy efficiency challenge" campaign for community residents • Promote participation in a local green business program • Promote the purchase of ENERGY STAR appliances • Promote water conservation through technological and behavioral modification • Provide incentives or mandate developers to construct LEED certified or ENERGY STAR homes • Green building standards for construction within city, technical assistance, education & financial incentives to builders • Free insulation for low income single family homes • Public-private energy conservation partnerships • Convert traffic lights to LED signals • Convert street lighting to photovoltaic or LED • Weatherization and energy conservation assistance to low income families • Free home energy audit • Financing for energy retrofits (e.g. zero interest loans)
Green Power	• Install solar panels on municipal facilities • Install solar cells on maintenance vehicles • Install district heating from CHP • Purchase green electricity from solar, geothermal, wind or hydroelectric sources • Purchase green tags/renewable energy certificates • Generate electricity from landfill or wastewater methane or refuse • Solar light fixtures in public facilities • Solar panels for street crossing signals	• Renewable energy demonstration projects • Tax credits for geothermal space & water heating systems • Install wind turbines, other renewable generation • Promote community clean energy use through green power purchasing or on-site renewable technologies • Offer incentives for solar photovoltaic installations in the community • Implement a form of community choice aggregation
Waste Reduction & Recycling	• Reduce waste generated at facilities • Expand recycling programs • Implement organics and yard debris collection and composting • Establish system for reuse or recycling of construction and demolition materials for government construction projects • Implement environmentally preferable purchasing program (e.g. set standards for recycled content of purchased goods) • Sustainable paper use policy to minimize paper generation from city operations • Establish a methane collection system for landfills or build a waste-to energy facility	• Implement solid waste reduction programs • Expand recycling programs and set aggressive recycling targets/goals • Residential curbside recycling at no cost • Implement organics and yard debris collection and composting • Implement penalties for non-compliance with recycling programs • Pay-as-you-throw trash rates • Business/commercial recycling programs, e.g. require every commercial work site to establish and use a recycling system, or require businesses to recycle a specific fraction of the solid waste that they generate • Food waste collection programs • Landfill methane recovery (waste to energy) • Establish system for reuse or recycling of construction and demolition materials
Water & Wastewater Management	• Install variable frequency drives for water pumps • Install energy efficient motors into equipment • Make heating, cooling, and ventilation improvements in these facilities • Establish methane recovery systems in local wastewater treatment plants, e.g. for neighboring industry and building heating • Install an anaerobic digester at the wastewater treatment facility and optimize the cogeneration potential of this technology	• Implement water-use efficiency programs

Forestry	• Plant trees on municipal property	• Tree planting initiatives • Forest maintenance and tree stewardship • Revise landscape code to require strategic tree planting • Plant trees to reduce energy use for building heating/cooling

III. Options for Participating in a GHG Trading Market

Regulatory GHG trading systems generally consist of two basic components. The primary component is a "cap-and-trade" program designed to compel aggregate emission reductions at a particular set of sources (e.g., power plants, industrial facilities, users of fossil fuels, etc.). Cap-and-trade programs work by setting an overall limit on emissions from these sources, and distributing tradable quotas of emissions rights to them on that basis. Regulated sources must surrender a number of emissions rights (usually referred to as "allowances") corresponding to their emissions. If they have too few allowances, they must either reduce emissions or purchase excess allowances from other sources. Sources that can reduce emissions cheaply can profit in this kind of market by making reductions and selling excess allowances to others. Local governments could participate directly in this kind of system to the extent that they own or control regulated GHG emissions sources (and therefore could directly sell allowances). Beyond this, there are many other ways in which local government measures might reduce emissions at "capped" sources in ways that could affect the allowance market.

The second major component of most GHG trading systems is a "carbon offset" program. Offset programs reduce overall compliance costs in a cap-and-trade system by giving regulated sources access to low cost-reduction opportunities at unregulated sources, i.e., sources of GHG emissions not covered by the cap. Tradable "credits" issued for reductions at uncapped sources can be used by capped sources to help meet their compliance obligations. The basic premise of offsets is that they allow an increase of emissions from capped sources, but this increase is compensated for by reductions at uncapped sources, leading to the same total level of net emissions. Local governments may be able to generate and sell offset credits to the extent that their efforts reduce emissions at uncapped sources.

The opportunities for local governments to participate in GHG trading depend greatly on how cap-and-trade and offset programs relevant to their jurisdictions are configured. Two design elements of cap-and-trade programs will dictate the kinds of options available to local governments:

1. **Scope**. The scope of a cap-and-trade system determines which GHG emissions it will cover. The Regional Greenhouse Gas Initiative in the Northeast, for example, covers only CO_2 emissions from power plants. The EU Emissions Trading System covers CO_2 emissions from power plants and many industrial facilities, and may be expanded in the future to cover additional facilities and other kinds of GHGs. At the federal level in the United States (and within the Western Climate Initiative) proposals are being considered that would cover CO_2 emissions from the transportation sector as well as the power and industrial sectors. Scope is important because it determines whether the GHG sources affected by local

government measures will be capped or uncapped. Only GHG emission reductions at uncapped sources can be used to generate carbon offset credits.

2. **Point of Regulation**. Cap-and-trade programs do not always impose an emissions quota directly on the sources of emissions. For practical reasons, allowances may be allocated to the producers or distributors of fossil fuels (or of non-CO_2 greenhouse gases) rather than the actual sources where emissions occur. Such "upstream" allocation of emissions rights allows program administrators to focus on regulating a limited and manageable number of entities, rather than every possible end-use source of emissions (e.g., vehicle tailpipes). Point of regulation matters because it will determine whether local governments can deal directly in the trading of emissions allowances (i.e., for regulated facilities they own or control), or whether their actions will simply affect the emissions budgets of regulated entities.

The final scope and points of regulation for the WCI trading system have yet to be decided. Current proposals are recommending that the WCI system cover emissions of all six major greenhouse gases (CO_2, CH_4, N_2O, SF_6, HFCs, and PFCs). They also suggest that sources in the electricity, industrial, and large commercials sectors will be covered, with transportation, residential, and small commercial sectors phased in over time. Sources that have less than 25,000 metric tons of annual CO_2-equivalent emissions would be excluded. In terms of point of regulation, current proposals recommend that industrial and electricity sector emissions be regulated at the point of emission (i.e., at the "smokestack," or at the first point of delivery into the WCI for imported electricity). Transportation fuels would most likely be regulated at an appropriate point in the distribution system (e.g., fuel terminals, fuel distributors, wholesalers, refineries, terminal racks, etc.) Finally, it is currently proposed to regulate residential and commercial emissions from fuel usage at the point where fuels are distributed (e.g. local distribution networks for natural gas).

Table 2 indicates how the different sectors potentially affected by local government measures might be covered under the WCI if these preliminary recommendations are followed.

Table 2. Expected WCI Coverage of Sectors Potentially Affected by Local Government Measures

Sector	Expected Coverage	Point of Regulation
Transportation	• Phased in, but not covered initially	• Distribution system
Land Use Management	• Not directly covered (affects primarily transportation fuel usage)	• N/A
Energy Efficiency & Green Buildings	• All electricity consumption will likely be covered. • Direct fuel consumption will be covered for large industrial & commercial buildings & facilities. • Residential and small commercial building fuel consumption may be	• Electricity regulated at power plants • Fuel usage regulated at distribution network

	phased in.	
Green Power	• Grid electricity emissions will be covered • Industrial fuel-use emissions will be covered • Off-grid emissions from energy generation may be phased in	• Power plants for grid electricity • Industrial facilities for industry fuel-use • Fuel distribution networks for off-grid energy
Waste Reduction & Recycling	Depends on where emission reductions occur… • Transportation emissions may be phased in • Electricity emissions will be covered • Fuel usage emissions will be covered (industrial / large commercial) or may be phased in • Forestry sector emissions (from paper usage) likely not covered • Landfill methane emissions may be covered (but unlikely)[1]	• Transportation fuels covered at distribution system • Electricity covered at power plants • Fuel-usage covered at facilities (large) or at distribution networks • Forestry not covered • Landfill methane not covered
Water & Wastewater Management	• Electricity and energy emissions likely to be covered or phased in • Methane emissions may be covered (unlikely)	• Power plants, facilities, or distribution networks for energy • Methane N/A
Forestry	• Not likely covered (unless measures affect energy usage)	• N/A

A. Emissions Market Opportunities for Measures Affecting Covered Sources

Whether and how local governments can benefit from GHG emissions markets depends first and foremost on whether the emission reductions they can achieve come from capped or uncapped sources. This section describes options for local governments where the measures they undertake affect sources or facilities that are covered by an emissions cap. There are basically two ways local governments could obtain revenue from an emissions market: direct trading in allowances, and obtaining set-asides or auction revenues to fund emission reductions.

1. Direct Trading in Emissions Allowances

[1] There are currently discussions within the WCI about including methane emissions (e.g., from landfills) under the cap on the condition that emissions can be accurately measured. In practice, it may be quite difficult to achieve measurement accuracy for landfill (and other) methane emissions comparable to that for CO_2 emissions from fossil fuel combustion. The Chicago Climate Exchange, for example, explicitly excludes landfill methane emissions from its member companies' commitments because of measurement uncertainties.

For most local governments, the opportunity to participate directly in allowance trading under a cap-and-trade system will likely be limited. Local governments will only be able sell allowances if they own or control facilities that are directly regulated (i.e., either direct sources of emissions, or upstream distribution systems). WRI has not researched whether specific local governments in Washington State actually own or control any sources or facilities that are likely to be directly regulated by a WCI cap-and-trade system (i.e., facilities that would fall under the points of regulation listed in Table 2). Table 3 lists some possibilities, however, and what kinds of measures could lead to monetizable emission reductions (i.e., sellable allowances) under different scenarios.

Table 3. Local Government Measures That Could Lead to Monetizable Emission Reductions Under Different Ownership Scenarios

If the local government owns…	Government operations measures	Community-wide measures	Notes
A (local) fossil-fuel power plant	Fuel-switching or efficiency upgrades at the power plant Energy efficiency measures in government-owned facilities that reduce consumption of electricity. Installation of green power equipment that displaces electricity generated by the power plant.[2]	Energy efficiency measures that reduce community-wide consumption of electricity. Measures that promote green power purchases and installations.	These measures would only be effective to the extent that they actually reduce emissions at the government-owned power plant, and therefore reduce the need for allowances. Energy efficiency improvements and green power installations will have only an indirect (and probably dilute) effect on specific power plant emissions.
A landfill	Establish a methane collection system for landfills or build a waste-to energy facility Reduce waste generated at facilities Implement organics and yard debris collection and composting	Implement solid waste reduction programs Implement organics and yard debris collection and composting Pay-as-you-throw trash rates Food waste collection programs	These are measures targeted primarily at reducing or capturing methane produced by the landfill. Assumes landfills are in fact covered by a WCI cap.
A wastewater treatment facility	Establish methane recovery system Install an anaerobic digester	Implement water-use efficiency programs	Measures targeted at reducing and/or capturing methane emissions from wastewater. Assumes wastewater methane is in fact covered by a WCI cap.
A natural gas or fuel-oil distribution	Energy efficiency measures in government-	Energy efficiency measures that reduce community-wide	Assumes measures would affect fossil fuel

[2] Direct installation of solar panels or landfill-gas-to-energy facilities would be most effective (see Table 1). Purchases of green power (e.g., in the form of RECs) would probably be less effective, since they may not have any impact on output from the government-owned power plant.

system	owned facilities that reduce consumption of fossil fuels (e.g., for heating/cooling). Installation of green power or combined heat-and-power equipment that displaces or reduces onsite fossil fuel usage.	consumption of fossil fuels. Measures that promote green power or combined heat-and-power installations that displace or reduce community (residential or commercial) fossil fuel usage.	consumption from a local government-owned distribution system that is regulated under the WCI cap.

Quantification Issues

To sell allowances associated with the kinds of measures identified in Table 3, no special quantification protocols or methods would be necessary. The measures would simply reduce the emissions (or fossil fuel deliveries) measured by meters or monitoring equipment at local government-owned, regulated facilities. Local governments could then sell allowances if their total monitored emissions fall below the total number of allowances they hold.

2. Obtaining Set-Asides or Auction Revenues

Measures that reduce GHG emissions (or fossil fuel deliveries) at capped facilities owned or controlled by other entities will not create any emissions trading opportunities for local governments. Instead, these measures will simply make it easier for other entities to meet their compliance obligations. In some cases, however, local governments could argue that they should receive financial support to undertake these kinds of measures. This support could come in the form of allowance set-asides, distribution of allowance auction revenues, or some other form of government incentive payments. Under a set-aside program, the administrator of the cap-and-trade program distributes allowances to certain entities free-of-charge. Local governments receiving set-asides could sell allowances and use the revenues to fund emission-reduction measures. Alternatively, some or all of the allowances in a cap-and-trade system may be distributed through an auction. Revenues from such auctions could also be used to fund local-government measures.

Within the WCI, it has not yet been decided how many allowances might be set aside for various purposes, or what percentage might be auctioned. Preliminary recommendations are that up to 50 percent of allowances could be set aside or auctioned to produce revenue for public benefit purposes, including energy efficiency measures. Local governments could make the case that they are well-positioned to implement some of these measures and should therefore receive a portion of the set-asides or auction revenues.

The case for receiving such incentives would probably be strongest for measures that address community-wide GHG emissions. This is especially true for measures that directly address market barriers or inefficiencies that would increase costs of compliance under the cap-and-trade system. For example, building developers may not make optimal investments in energy efficiency measures because they will not bear the costs of energy use in their buildings. But by foregoing energy efficiency investments, they will make it

harder for tenants to adjust to the higher energy prices caused by a cap-and-trade system. Because energy usage will be higher, demand for GHG emissions will be higher, leading to higher allowance prices within the cap-and-trade system. A local government program that compels or promotes energy efficiency investments in new buildings could help lower allowance prices and alleviate overall compliance costs. This could justify the expenditure of set-aside or auction revenues to support such a program. Similar arguments could be made for local government measures to promote green power investments.

Table 4 lists the kinds of community-wide local government measures that could in principle be good candidates for set-asides or auction revenues intended to ensure low-cost compliance with a WCI cap. The case will be strongest for measures for which local governments must pay out of their own budgets (**highlighted in blue**), as opposed to regulations or ordinances, for which firms or individuals must bear the cost.

The case for funding changes in local government operations with set-asides or auction revenues will generally be less strong. This is because local governments can reasonably be expected to take appropriate measures to respond to higher energy prices imposed by a cap-and-trade program, without the need for subsidy from other branches of government.

Table 4. Community-Wide Local Government Measures Likely to Affect Emissions from Capped Entities Within the WCI

Sector	Community-Wide Measures
Transportation*	• **Promote commute trip reduction programs, incentives for car and van pooling** • **Promote public transit: Expand public transit systems (e.g. light rail lines), promote increased ridership, increase frequency, provide discounted fares** • Restrict idling at public facilities • **Improve traffic signal synchronization** • **Open local government alternative fueling stations to the public** • **Promote community purchases of compact and hybrid vehicles** • **Establish car sharing programs** • **Implement bicycle and pedestrian infrastructure programs: expand bike paths and bike facilities, promote multi-use street traffic** • **Provide electric plug-in stations for freight vehicles at truck stops or boats marinas and ports** • Require large employers to reduce employee commute trips • Increase parking charges • **Provide tax incentives to encourage public transit, carpooling** • **Promote multi-mode freight transportation** • Impose transportation fuel taxes • Impose congestion pricing/charges • **Provide incentives for updating/retrofitting non-road/off-road mobile sources (e.g., lawnmowers, generators, construction equipment)** • **Public-private vehicle demonstrations (e.g., hybrid delivery trucks)** • **Provide incentives for purchasing fuel-efficient vehicles (e.g., rebates on efficient car purchases)** • **Provide parking incentives for fuel-efficient vehicles**
Land-Use Management*	• Promote high-density, transit- and pedestrian- oriented development through zoning policies • Institute growth boundaries, ordinances or programs to limit suburban sprawl • **Give incentives and bonuses for development in existing downtown areas and areas near public transit**

	• **Encourage mixed land use** • **Encourage in-fill and brownfield development** • Require transportation impact study for new developments • Discourage sprawl through impact, facility, mitigation, and permit fees
Energy Efficiency & Green Buildings	• Adopt stringent residential or commercial energy code requirements • **Promote energy conservation through campaigns targeted at residents and businesses** • **Implement a low-income weatherization program** • **Implement district heating and cooling** • Implement time-of-use or peak demand energy pricing • **Install energy-efficient co-generation power production facilities** • **Launch an "energy efficiency challenge" campaign for community residents** • **Promote participation in a local green business program** • **Promote the purchase of ENERGY STAR appliances** • **Promote water conservation through technological and behavioral modification** • **Provide incentives** or mandate developers **to construct LEED certified or ENERGY STAR homes** • Green building standards for construction within city, **technical assistance, education & financial incentives to builders** • **Free insulation for low income single family homes** • **Public-private energy conservation partnerships** • **Convert traffic lights to LED signals** • **Convert street lighting to photovoltaic or LED** • **Weatherization and energy conservation assistance to low income families** • **Free home energy audit** • **Financing for energy retrofits (e.g. zero interest loans)**
Green Power	• **Renewable energy demonstration projects** • **Tax credits for geothermal space & water heating systems** • **Install wind turbines, other renewable generation** • **Promote community clean energy use through green power purchasing or on-site renewable technologies** • **Offer incentives for solar photovoltaic installations in the community** • **Implement a form of community choice aggregation**
Waste Reduction & Recycling[*,†]	• **Implement solid waste reduction programs** • **Expand recycling programs** and set aggressive recycling targets/goals • **Residential curbside recycling at no cost** • **Implement organics and yard debris collection and composting** • Implement penalties for non-compliance with recycling programs • Pay-as-you-throw trash rates • Business/commercial recycling programs, e.g. require every commercial work site to establish and use a recycling system, or require businesses to recycle a specific fraction of the solid waste that they generate • **Food waste collection programs** • Require landfill methane recovery (waste to energy)[†] • **Establish system for reuse or recycling of construction and demolition materials**
Water & Wastewater Management	• Implement water-use efficiency programs (mandated or **subsidized**)
Forestry	• Revise landscape code to require strategic tree planting • **Plant trees to reduce energy use for building heating/cooling**

[*] Assumes transportation fuel emissions are included under the cap
[†] Assumes landfill methane emissions are included under the cap (waste reduction/recycling measures may also affect energy-related emissions)

Quantification Issues

If set-asides or auction revenues are allocated for local government measures, the question becomes how to determine the right amount of allocation. From an environmental standpoint, any metric could in theory be used. This is because the reductions achieved by the measures in Table 4 will not actually reduce aggregate emissions. Instead – because the reductions would occur at covered sources or facilities – they would simply free up allowances that could be held or traded for later use. Total emissions from covered sources will rise to the level of the cap, notwithstanding the lower price of allowances that might result from local government measures.

From the standpoint of economic efficiency, however, it may still make sense to allocate set-aside allowances or auction revenues on the basis of imputed emission reductions (so that they are not over- or under-allocated). The appropriate quantification methods may depend on the type of measures involved and what kinds of emissions sources are affected. In general, though, quantification methods would not have to be as rigorous as they would be for carbon offset reductions, where any imprecision has implications for environmental integrity. Appropriate quantification requirements are described more fully in the final section of this report.

B. Emissions Market Opportunities for Measures Affecting Uncovered Sources

For measures that affect sources of GHG emissions *not* covered by a cap-and-trade system, local governments again have two basic options for obtaining emissions market revenues: certifying emission reductions as carbon offsets, or securing set-asides or auction revenues (similar to above).

1. Certifying Emission Reductions as Carbon Offsets

Reductions in GHG emissions achieved at uncovered sources can in principle be used as carbon offsets. Certifying an emission reduction as a carbon offset requires meeting a number of specific requirements established by the regulatory bodies overseeing an emissions market. For the WCI, these requirements have not yet been agreed or spelled out in detail. However, the basic requirements for carbon offsets are well-known. In most programs, offset credits are issued to specific projects ("offset projects") that can be shown to reduce emissions. The general requirements for certifying offsets are described in the next section.

For quite a few local government measures, certification of offsets may be difficult. This is because of higher quantification difficulties and uncertainties relative to other types of carbon offsets.

2. Obtaining Set-Asides or Auction Revenues

Set-asides and auction revenues do not necessarily have to be allocated to activities that reduce emissions at capped sources. They can also be used to fund emission reductions at sources not covered by the cap. The reductions achieved would be above and beyond any reductions required of capped sources. In principle, any measures that affect uncovered emissions could be candidates for receiving set-asides or auction revenues – including measures affecting government operations.

Quantification Issues

Unlike with carbon offsets, the quantification of emission reductions achieved through set-asides or auction revenues will not have implications for the environmental integrity of the cap-and-trade program. Accurate quantification may still be desirable in order to ensure that funds are being spent appropriately. Because quantification would not have to be as rigorous, however, funding emission reductions through set-asides or auction revenues may be appropriate where certification of carbon offsets would be difficult. These issues are more fully described in the next section.

IV. Emission Reduction Quantification and Certification Requirements

To receive compensation for achieving GHG emission reductions, local governments will have to accurately quantify the effects of the measures they undertake. Specific quantification requirements, however, will depend on whether local governments are seeking to sell allowances, generate offset credits, or simply establish a basis for receiving incentive payments (e.g., set-asides or auction revenues). This section describes quantification requirements under each scenario. The bulk of this section is devoted to offset quantification requirements, since these are the most demanding. Quantification requirements for receiving incentive payments may be similar, but in principle can be less rigorous.

A. Selling Allowances

As described above, there are no special quantification methods necessary for a local government to be able to sell allowances associated with reductions it achieves at regulated facilities that it owns or controls. To sell allowances, the local government only needs to ensure that regulated emissions are lower than the total number of allowances it holds. Regulated emissions will generally be determined through direct monitoring, and not subject to complex quantification rules or requirements.[3]

[3] The exception might be if sources like landfills are included under the cap, in which case modeling or formulas may be required to estimate methane emissions since they cannot be measured directly.

One challenge in this context might be evaluating the effects of measures that reduce emissions from regulated sources indirectly. For example, to reduce emissions from a local power plant, a local government could implement community-wide energy saving programs. The impact of these programs on actual power plant emissions could be difficult to evaluate and quantify. It could therefore be difficult to decide whether such programs are truly cost-effective. However, while this would be a legitimate concern from a budgetary perspective, it would have no bearing on the regulatory requirements for selling allowances.

B. Selling Offset Credits

The greatest quantification challenges for regulatory purposes are likely to arise in the context of certifying GHG emission reductions as carbon offsets. Specific rules and procedures for certifying carbon offsets can differ from program to program, but most of the literature on carbon offsets refers to a core set of basic criteria, derived from criteria established under the 1977 Clean Air Act. Specifically, offsets must be "real, surplus (or additional), verifiable, permanent, and enforceable" in order to create a standardized trading commodity (i.e., an offset credit) and maintain the integrity of an emissions trading system.[4] Interpretations of these criteria vary, but their essence can be summed up as follows.

Real. An offset credit must represent an actual net emission reduction, and should not be an artifact of incomplete or inaccurate emissions accounting. In practice, this means methods for quantifying emission reductions should be conservative to avoid overstating a project's effects. It also means that the effects of a project on GHG emissions must be comprehensively accounted for.[5] Some projects may reduce GHG emissions at one source, for example, only to cause emissions to increase at other sources. A frequently cited example would be a forest protection project that simply shifts logging activities to other forest land, causing little net decrease in carbon emissions. Unintended increases in GHG emissions caused by a project are often referred to as "leakage." For carbon offsets to be real, they must be quantified in ways that account for leakage.

Additional . Only emission reductions that are a response to the incentives created a carbon offset market should be certified as offsets. Reductions that would occur regardless of an offset market (e.g., those that result from "business as usual" practices)

[4] The concept of air emission offsets originated under the "New Source Review" program established by the United States Clean Air Act of 1977. Under this program, offsets are required to be "real, creditable, quantifiable, permanent, and federally enforceable." These basic criteria have been modified and adopted in general form under a variety of other offset programs, including programs for carbon offsets. Current carbon offset programs (including for example, the one established by the Regional Greenhouse Gas Initiative in the Northeastern United States) generally require that offsets must be "real, surplus, verifiable, permanent, and enforceable" or some close variation thereof. See, for example, Liepa, I., 2002. *Greenhouse Gas Offsets: An Introduction to Core Elements of an Offset Rule.* Climate Change Central, Alberta, Canada.

[5] For a full elaboration of quantification and accounting principles for offset projects, see World Resources Institute and World Business Council for Sustainable Development, 2005. *The Greenhouse Gas Protocol for Project Accounting*. Washington, D.C. / Geneva, Chapter 4. Available at http://www.ghgprotocol.org.

should not be counted. The rationale for this is straightforward. The basic premise of carbon offsets is that they maintain net GHG emissions at a level set by a trading system's cap. Total emissions should be the same with or without an offset program. Since offset credits allow regulated sources in a cap-and-trade system to increase their emissions, offset reductions must be "additional" in order to maintain net emission levels. Crediting reductions that would happen anyway will result in higher total emissions than a cap-and-trade program without offsets.

Although this general concept (called "additionality") is straightforward, it is vexingly difficult to put into practice. Determining which projects (and therefore which reductions) would not have occurred in the absence of an offset market is frequently challenging and always subjective. Within existing carbon offset programs, there are two basic approaches to determining "additionality": project-specific and standardized.[6]

Project-specific approaches seek to assess, by weighing certain kinds of evidence, whether a project in fact differs from an imagined baseline scenario where there is no carbon offset market. Generally, a project and its possible alternatives are subjected to a comparative analysis of their implementation barriers and/or expected benefits (e.g., financial returns). If an option other than the project itself is identified as the most likely alternative for the baseline scenario, the project is considered additional. The Kyoto Protocol's CDM requires project-specific additionality tests.

Standardized approaches evaluate projects against objective criteria designed to exclude non-additional projects and include additional ones. For example, a standardized test may count as "additional" any project that:

- Is not mandated by law
- Is not a "least-cost" option (objectively defined)
- Is not common practice (objectively defined)
- Involves a particular type of technology
- Is of a certain size
- Is initiated after a certain date
- Has an emission rate lower than most others in its class (e.g., relative to a performance standard)

Several U.S.-based carbon offset programs (including the California Climate Action Registry, the Chicago Climate Exchange, and the Regional Greenhouse Gas Initiative) have adopted standardized additionality tests. Although the WCI has not officially decided on an approach for testing additionality, preliminary recommendations are to follow other U.S. programs in adopting a mostly standardized approach.

Verifiable. Carbon offsets should result from projects whose performance and effects can be readily monitored and verified. Verification is necessary to demonstrate that emission reductions have actually occurred and can therefore be used to offset emission increases at regulated sources. Verification helps ensure that offset reductions are "real" and not

[6] See International Emissions Trading Association, 2007. *Expanding Global Emissions Trading: Prospects for Standardized Carbon Offset Crediting.* Prepared by World Resources Institute, Washington, DC. http://www.ieta.org/ieta/www/pages/getfile.php?docID=2730

overestimated. Because of the importance of maintaining net emissions levels within a trading system, projects whose effects are difficult to verify – or whose effects cannot be measured with reasonable precision – may not be suitable for generating carbon offsets.

Permanent. Since emission increases are effectively permanent (e.g., fossil fuel emissions cannot be put back in the ground), offsetting emission reductions should be permanent as well. Permanence is only an issue where the effects of a project can be reversed, such as forestry projects where carbon stored in trees or soils can be released to the atmosphere due to fires, harvesting, or other disturbances. In these cases, a mechanism is required to make reversible reductions/removals functionally equivalent to permanent reductions for the purpose of issuing offset credits. There are at least three possible ways to do this:

1. *Issuing credits on a discounted basis*. For example, only one credit is issued for every two tons of CO_2 sequestered in trees or soils.[7] Although this approach has been proposed in the literature,[8] it has not been put into practice within existing offset programs.
2. *Issuing temporary or expiring credits*. Credits for reversible reductions can be made to expire at a predefined date, or canceled if verification indicates that a reversal has occurred. In both cases, the holder of the credits would have to procure other credits or allowances in order to remain in compliance with the cap-and-trade system. This approach has been adopted by the CDM for reforestation and afforestation projects.
3. *Establishing an insurance or buffer system*. Buyers or sellers of reversible reductions could be required to buy "insurance" in some form to compensate for reversals, or establish carbon sequestration buffers that serve the same function. There are many ways these mechanisms can be structured, and they may be combined with requirements for landowners to commit to maintaining carbon stocks over the long term (e.g., through easements). The U.S. Regional Greenhouse Gas Initiative has adopted this approach for reforestation projects.

No decision has been made yet about which approach might be adopted within a WCI carbon offset program. Preliminary indications are that the third option (an insurance or buffer system) is most likely.

Enforceable. Carbon offsets should be backed by regulations and tracking systems that define their creation and ownership, and provide for transparency. Clear definitions of ownership are essential for enforceability. For example, both the manufacturer and the installer of energy efficient light bulbs might want to claim the emission reductions caused by the light bulbs – as might the owners of the power plants where the reductions actually occur. Regulatory rules must establish who has claim to emission reductions, who is ultimately responsible for ensuring project performance, who is responsible for project verification, and who is liable in the case of reversals.

[7] There are different ways to calculate the discount. Under most proposals, a discount would be given based on how long carbon is expected to be sequestered relative to its average residence time in the atmosphere (e.g., 100 years).

[8] For example, see Fearnside, P.M., 2002. "Why a 100-year time horizon should be used for global warming mitigation calculations." *Mitigation and Adaptation Strategies for Global Change* 7(1): 19-30.

To create a functioning market for carbon offsets, the criteria outlined above must be elaborated in set of standards and those standards administered by a regulatory body responsible for certifying and issuing offset credits. Standards are required to create a carbon offset "commodity" that is as uniform as possible, i.e., one offset credit equal to one ton of CO_2-equivalent emission reductions regardless of where it is sourced. Three related sets of standards are necessary to fully define a carbon offset commodity:[9]

1. **Procedural and technical standards.** These are standards related to the validation, monitoring, and verification of offset projects, as well as the certification and crediting of GHG reductions. Procedural and technical standards ensure that offsets are ***verifiable***.
2. **Contractual standards**. These are standards for the establishment and transfer of property rights related to carbon offsets, for information disclosure, and for the assignment of liability. They can include terms for payment and delivery, allocation of risk, and compensation where emission reductions are reversed or not realized. Contractual standards are necessary to avoid double-counting of reductions and double-issuance of credits, and ensure that offsets are ***enforceable***.
3. **Accounting standards.** These are standards related to the actual quantification of carbon offsets. Accounting standards specify methods for defining quantification boundaries, estimating baseline emissions, and correcting for unintended changes in emissions (i.e., "leakage"). Accounting standards also cover methods for demonstrating "additionality." Finally, they may specify methods for treating reversible GHG reductions on an equal footing with permanent reductions. Accounting standards are a first-order requirement for ensuring that "a ton is a ton" and ensure that offsets are ***real, surplus, and permanent***.

Most carbon offset programs establish accounting standards in the form of "protocols" or "methodologies" describing quantification requirements for specific types of projects. The appendix to this report lists a series of specific project types and identifies which existing carbon offset programs have adopted protocols for different project categories.

1. Quantification and Ownership Issues for Carbon Offsets

In principle, any kind of activity that reduces (or sequesters) GHG emissions at uncapped sources can generate carbon offset credits. In practice, regulators of a GHG market are likely to look more favorably on some types of activities than others. Whether an activity makes a good carbon offset project depends on how much confidence regulators have in its quantification, additionality, verification, permanence, and ownership. Risks and uncertainties associated with carbon offsets fall into five categories:

[9] In addition to establishing these standards, many carbon offset programs will impose eligibility criteria for offset projects intended to ensure that they are compatible with goals beyond simply reducing GHG emissions. Eligibility criteria may exclude certain types of projects based on secondary environmental or social concerns (e.g., nuclear waste, or community displacement caused by hydro reservoirs), or they may ensure that projects contribute to additional social, economic, and environmental objectives (e.g., "sustainable development"). While these criteria are ancillary to defining a carbon offset with respect to climate change impacts, they nevertheless help to define the "commodity" within a particular program and may be particularly important in the context of linking to other trading systems.

1. *Measurement uncertainty*. Accurately quantifying emission reductions requires being able to accurately monitor and verify the performance of a project and its effect(s) on emissions or sequestration. Accurate measurement is easier for some types of projects than others.
2. *Baseline uncertainty*. Accurately quantifying emission reductions also requires reasonable certainty about a project's baseline emissions and its additionality. A project's baseline and additionality are closely related.[10] Baseline uncertainty will be higher for projects that have numerous possible alternatives, for projects that provide significant compensation or revenue aside from their emission reductions, and for any type of project where it is difficult to define "business as usual."
3. *Leakage potential*. Accurately quantifying emission reductions requires accounting for any unintended increases in emissions caused by a project. Leakage can add significant uncertainty to a project because it often difficult to monitor and quantify. Some types of projects are more prone to leakage than others.
4. *Reversibility risk*. The potential for reversal of a project's emission reductions creates uncertainty about its value as an offset. Reversibility is only a concern for projects whose emissions benefits result from sequestration.
5. *Ownership uncertainty*. As noted above, for some types of projects there can be multiple parties that could in theory claim "ownership" of emission reductions. To avoid ambiguity, a government regulatory authority must usually specify in law which entities have title to certified emission reductions. It is often easier to develop rules for offsets where ownership is relatively unambiguous, however.

2. Challenges for Creating Carbon Offsets from Local Government Measures

Participants in the WCI are currently deliberating about what types of projects should qualify for carbon offsets within a WCI emissions trading system. While it is too early to say what the initial list of project types will look like, it will probably include very few of the local government measures listed in Table 1. There are numerous reasons for this, but the general challenge is that only a few activities that local governments might undertake score well against the basic criteria for carbon offsets. Significant issues include the following:

Quantification Challenges

The biggest difficulty facing many local government measures is how to quantify GHG emission reductions with a sufficient degree of certainty. Many types of local government measures – especially community-wide measures – suffer from both high measurement uncertainty and high baseline uncertainty. Measures that target behavioral changes, rather than technology use, can have effects that are especially difficult to quantify. For these

[10] Because the goal is to maintain net emissions at capped levels, the baseline for an offset project should in theory represent the emissions that would occur at the sources it affects in the absence of a carbon offset market. If the project is not additional, baseline and project emissions will be identical (because the project itself would have happened in the baseline scenario).

measures, it can be hard to measure activity data (e.g., how many people carpool every day) and to determine appropriate baselines (e.g., how many people would carpool in the absence of an online carpool-matching service). By contrast, the effects of a technological change, like installing energy efficient light bulbs, may have a more certain baseline (e.g., use of incandescent bulbs) and be easier to measure (e.g., by examining electricity bills).

Community-wide measures may be especially challenging from the perspective of determining baselines and additionality. As described above, these issues concern what would have happened in the absence of a carbon offset market. While different approaches to testing additionality have been developed for private-sector projects, it is not clear how they would be applied in the context of public-sector policies and regulations. How should regulators determine whether a local-government program or ordinance was enacted due the presence of a carbon offset market? The most likely approach would be to agree on a list of "best practice" measures that would automatically qualify. Developing such a list would require new and innovative work by WCI partners, however, since these kinds of activities have not yet been included in other carbon offset programs (see the appendix to this report).

Another quantification challenge for community-wide measures has to do with leakage. Most carbon offset programs to date have focused on crediting emissions reductions from relatively small-scale, individual projects. The secondary, unintended effects of such projects on GHG emissions are usually not very significant.[11] Community-wide measures, by contrast, tend to be programmatic and larger in scale, with a greater potential for unintended consequences. For example, a congestion pricing system to curtail traffic and reduce emissions in the city center may increase emissions outside the center (and possibly outside local government jurisdictional boundaries). For these kinds of measures, unique modeling and measurement techniques to correct for leakage may be necessary.

Ownership Challenges

Community-wide measures may also face challenges related to ownership. If a local government implements a program that persuades people to reduce emissions, does the local government have ownership rights over the reductions? In principle, this is something for offset program regulators to decide. However, since nearly all community-wide measures cause reductions at sources owned or controlled by other entities – who may also want to be able to claim the reductions and/or sell offsets associated with them – it may be difficult to reach consensus on ownership. This challenge is not insurmountable, but it may make it hard to promulgate rules for community-wide measures, especially compared to other offset project types where ownership is not an issue.

[11] For a full discussion of the accounting requirements related to leakage and "secondary effects," see the WRI/WBCSD *GHG Protocol for Project Accounting*, Chapter 5. Available at http://www.ghgprotocol.org.

3. Implications for Local Government Carbon Offsets

The unique challenges associated with quantifying and establishing ownership of emission reductions may make community-wide measures poor candidates for carbon offsets. From a policy perspective, it may therefore make sense to focus on projects that reduce emissions associated with local governments' own operations. Table 5 provides a simple qualitative assessment of how different kinds of local government operations measures fare against basic criteria for carbon offsets, and which measures are probably the strongest candidates for inclusion in a carbon offset program. Measures with the highest suitability for carbon offsets include transportation fuel-switching or efficiency improvement projects, and various kinds of methane capture and destruction projects.

For further reference, a table listing the types of projects that are eligible in other carbon offset programs around the world is provided in an appendix to this report. Many of the types of local government measures with the highest suitability as offsets are eligible for crediting under existing programs.

4. Developing Quantification and Verification Protocols

The appendix also identifies whether existing programs have adopted quantification and verification protocols for specific types of projects. Developing these protocols is one of the most challenging and resource-intensive tasks for any carbon offset program. Because of the cost involved, the WCI is likely to borrow protocols from other programs where possible. Note that protocols already exist in other programs for several kinds of potential local government measures with high suitability for generating carbon offsets, as identified in Table 5. Whether such protocols would be appropriate in the context of the WCI has yet to be decided.

It may be possible to develop robust quantification and verification protocols for certain kinds of local government measures not recognized in existing offset programs – even, potentially, for measures involving community-wide emission reductions. This would require extensive technical work by local governments or other entities in collaboration with the regulators of a WCI offsets program. Detailed accounting guidance around which these protocols can be developed is contained in the WRI/WBCSD *Greenhouse Gas Protocol for Project Accounting* (2005).[12]

[12] Available at http://www.ghgprotocol.org.

Table 5. Local Government Measures Most Conducive to Offset Crediting

Measure	Measurement Uncertainty	Baseline Uncertainty	Leakage Potential	Reversibility Risk	Ownership Uncertainty	Suitability for Offset Crediting
Transportation						
Provide transit and carpool incentives to city employees, e.g. free bus passes	High	High	Low	N/A	Medium	Low
Provide telecommuting, teleconferencing, and flex-time options for municipal employees	High	High	Medium-High[13]	N/A	Medium	Low
Reduce business travel; shift to less emitting modes, e.g. rail over air travel	Medium	Medium	Low	N/A	High	Low-Medium
Convert city bus fleet to alternative fuels (CNG, etc)	Low	Low	Low	N/A	Low	**High**
Increase fuel economy of vehicle fleet, e.g. hybrid vehicles or smaller fleet	Low	Low	Low	N/A	Low	**High**
Establish fuel efficiency standards for new municipal vehicle purchases	Low	Low	Low	N/A	Low	**High**
Utilize alternative fuel vehicles (bio-diesel, ethanol, electric, compressed natural gas) for city fleet	Low	Low	Low	N/A	Low	**High**
Restrict idling of municipal vehicles	Medium	Medium	Low	N/A	Low	Medium
Station police officers on bicycles	High	Medium-High	Low	N/A	Low	Low-Medium
Retire old and under-used vehicles	Low	High[14]	Medium	N/A	Low	Low-Medium
Utilize fuel-efficient vehicles (e.g. scooters) for parking enforcement	Low	Low	Low	N/A	Low	**High**

[13] Telecommuting can reduce transportation emissions, but lead to increases in home energy usage (for example).
[14] Old vehicles are likely to be retired anyway under business-as-usual; it would be difficult to develop a credible baseline estimate for generating offsets.

Measure	Measurement Uncertainty	Baseline Uncertainty	Leakage Potential	Reversibility Risk	Ownership Uncertainty	Suitability for Offset Crediting
Use car sharing programs in lieu of a city fleet	High	High	Medium	N/A	Medium	Low
Provide incentives to employees for purchasing fuel-efficient vehicles (e.g., rebates on efficient car purchases)	Medium-High	High	Low-Medium	N/A	Medium	Low
Provide parking incentives to employees for fuel-efficient vehicles	High	High	Medium	N/A	Medium	Low
Land Use Management						
Co-locate government facilities to reduce travel time and maximize building use	High	High	Medium	N/A	Low	Low
Utilize brownfield sites where possible	High	High	Medium	N/A	Low	Low
Energy Efficiency & Green Buildings*						
Conduct an energy audit of municipal facilities	High	High	Low	N/A	Low	Low[15]
Implement an energy tracking and management system	Low	Medium	Low	N/A	Low	Medium
Perform heating, cooling and ventilation system retrofits	Medium	Medium	Low	N/A	Low	Medium
Install green or reflective roofing	Medium-High	Medium	Low	N/A	Low	Medium
Require all new construction projects to be LEED certified	Medium	Low-Medium	Low	N/A	Low	Medium
Require all retrofit projects to become LEED certified	Medium	Low-Medium	Low	N/A	Low	Medium
Green Power*						
Install district heating from CHP	Medium	Medium-High	Low-Medium	N/A	Low	Medium
Generate electricity from landfill or wastewater methane or refuse	Low	Low	Low	N/A	Low	**High**[16]

[15] Demonstrating how an energy audit quantifiably reduced emissions would be difficult in most cases.
[16] Methane destruction component; electricity sector emissions would most likely be capped.

Measure	Measurement Uncertainty	Baseline Uncertainty	Leakage Potential	Reversibility Risk	Ownership Uncertainty	Suitability for Offset Crediting
Waste Reduction & Recycling*						
Reduce waste generated at facilities	High	High	Low	N/A	Low	Low
Implement organics and yard debris collection and composting	High	High	Medium	N/A	Low	Low
Establish a methane collection system for landfills or build a waste-to energy facility	Low	Low	Low	N/A	Low	**High**
Water & Wastewater Management						
Make heating, cooling, and ventilation improvements in waste-handling facilities	Medium-High	Medium	Low	N/A	Low	Medium
Establish methane recovery systems in local wastewater treatment plants	Low	Low	Low	N/A	Low	**High**
Install an anaerobic digester at the wastewater treatment facility and optimize the cogeneration potential	Low-Medium	Low-Medium	Low	N/A	Low	**Medium-High**[17]
Forestry						
Plant trees on municipal property	Medium-High	Medium-High	Low	Medium-High	Low	Low[18]

* Assumes measures affect uncapped fuel consumption and/or GHG emissions.

[17] High suitability for methane destruction component.
[18] Municipal tree-planting would in most cases be subject to higher quantification uncertainties than rural reforestation/afforestation projects.

C. Receiving Set-Asides or Auction Revenues

As described in previous sections of this report, local governments may seek allowance set-asides or auction revenues to fund measures that reduce GHG emissions at sources covered by a cap-and-trade system, or at uncovered sources that are not included in an offset program. In both instances, errors in quantifying emission reductions or determining "additionality" will have no effect on the total net emissions achieved by the cap-and-trade system. Because of this, quantification does not need to be as rigorous as it should be for carbon offsets, at least from an environmental perspective. Nevertheless, it will generally be important to have an accurate understanding of the effects of different measures on GHG emissions in order to determine an appropriate level of funding.

To maximize the benefits of set-asides or auction revenues, it may still make sense to screen possible measures according to some of the same basic criteria applied to carbon offsets. In particular, it may make sense to ensure that emission reductions are "real, additional, verifiable, and permanent," as these criteria are defined above. Enforceability is probably less of a concern, since no tradable emission rights would be created (although regulators may wish to ensure that funds are spent properly). In most cases, however, it would not be necessary to apply these criteria with the same level of rigor or stringency. For example:

- Estimation of baselines and quantification of reductions could be done using simplified procedures tailored to specific circumstances. It would not be necessary to follow standardized protocols, as is required in a market where a standard commodity (i.e., carbon offset credits) is being created. For many local government measures – especially community-wide measures – GHG emission reductions could be estimated in aggregate over several years, rather than quantified annually on a case-by-case basis.
- Avoiding and mitigating leakage from funded activities would be desirable, but the extent of leakage would not have to be rigorously quantified.
- On balance it would be desirable to fund "additional" activities, but in most cases simplified tests or screening procedures could be used. The effects of community-wide measures could be considered in aggregate. An analogy would be rebate programs for energy efficient appliances, which usually operate under the assumption that some rebate recipients would buy high-efficiency appliances even without a rebate. Because screening out these "free riders" would be costly and difficult, it is generally not attempted. Instead, rebates are given without restriction, and the funding of some "non-additional" purchases is tolerated as a cost of running the program. Because the purchases are not being used to offset energy consumption elsewhere, it does not matter (as much) that buyers are not screened for additionality.
- Verification of funded activities would still be necessary, but could be limited to a simple confirmation that activities are being undertaken rather than checking their performance in ways that are necessary for precise quantification. Measurement of the effects of funded activities would be primarily for informational purposes, not for ensuring that quantified reductions can be used as offsets on a ton-for-ton basis.

- Long-term carbon storage for sequestration projects would be desirable and could be encouraged, but designing complicated insurance mechanisms to put carbon sequestration on equal footing with permanent emission reductions would not be necessary.
- Ownership of emission reductions would not be an issue.

Virtually any of the measures identified in Tables 4 or 5 could in principle be candidates for receiving set-asides or auction revenues. However, even though quantification would not have to be as rigorous, the most promising candidates will still be those that score well in terms of having relatively low measurement and baseline uncertainties, low leakage potential, and little risk of reversibility. Measure with high quantification uncertainties (e.g., programs to promote high density development) may be extremely valuable, but may have a harder time competing for funding allocated on the basis of achieving quantifiable emission reductions.

V. Conclusions

Because of the likely broad coverage of a WCI cap-and-trade system, the potential for local governments to participate directly in emissions trading will probably be limited. There may be some opportunities for local governments to generate and sell carbon offset credits, but these could easily be limited to measures affecting government-owned vehicles – whose emissions may ultimately be covered under an expanded WCI cap – or various measures to reduce methane emissions (e.g., from landfills or wastewater treatment plants).

The greatest opportunities for local governments to help reduce GHG emissions will be at sources that are not government-owned and are covered under an emissions cap. In many cases, quantifying the effects of local government measures on emissions may be difficult. Many of these kinds of measures are nevertheless extremely important from a climate change mitigation perspective, especially community-wide measures that reduce energy use in buildings and emissions from transportation. Funding or providing incentives for these measures should therefore be a high priority for the designers of a cap-and-trade program. The most straightforward method for doing so would be to allocate allowances, or allowance auction revenues, to local governments in order to facilitate the implementation of these measures. Measures whose effects are somewhat easier to quantify should be the highest priority for these allocations, including a variety of measures affecting energy use in government- and community-owned buildings and facilities.

Appendix

Eligible Offset Project Types and Available Protocols Across Programs

Source: WCI Offsets Subcommittee, June 2008

Key: E – Eligible (under trading system); NE – Not eligible; P – Protocol available;

Sector/Category	Project Type	Lieb-Warner	RGGI	Canada	EU ETS[19]	JI[20]	CDM	EPA Climate Leader	CCAR	CCX	Alberta	NSW
Less likely in C&T Scope												
Forestry	Afforestation/ Reforestation	E	E/P		NE	E/P	E/P	E/P	P	E/P	E/P	E/P
Forestry	Forest management	E			NE	E/P	NE		P			
Forestry	Forest preservation; conservation				NE	E/P	NE			E/P		
Forestry	Wood product use/substitution				NE		NE					
Agriculture	Soil carbon / conservation tillage (e.g. low-till or no-till)	E			*NE*[21]					E/P	E/P	
Agriculture	Alt. cropping/pasture practices (e.g. winter cropping, perennial, irrigation/dry land)	E								E/P		
Agriculture	Livestock manure mgmt. (digesters, etc.)	E	E/P				E/P	E/P	P	E/P	E/P	
Agriculture	Livestock systems	E					E				E/P	

[19] Only not eligible project types are included here. For all other project types CDM eligibility applies.
[20] For all other project types, not indicated, CDM eligibility applies.
[21] Not explicitly specified assumed to be not eligible based on general guidelines.

Sector/Category	Project Type	Lieb-Warner	RGGI	Canada	EU ETS[19]	JI[20]	CDM	EPA Climate Leader	CCAR	CCX	Alberta	NSW
	change (e.g. enteric fermentation control, alternative feed)											
Agriculture	Nitrogen fertilizer management	E					E					
Agriculture	Ag land conservation				NE		NE					
Agriculture	Ag land conversion (e.g. to range or grassland)	E			NE		NE					
Phased-in or Potential Scope												
Below Threshold in Capped	Energy efficiency, renewables, etc.											
Waste Management	Landfill methane capture/ destruction	E	E/P				E/P	E/P	P	E/P	E/P	
Waste Management	Wastewater methane avoidance/capture						E/P					
Waste Management	Avoided methane generation						E				E/P	
Fossil Fuel Supply	Coal mine methane capture and destruction						E/P			E/P		
Fossil Fuel Supply	Natural gas T&D (methane capture)						E					
Fossil Fuel Supply	Oil and Gas Production/Processing (fugitive methane)	E					E/P				E/P	
Res/Comm Fuel	Energy efficiency, fuel switch		E/P				E/P				E/P	E/P
Transportation Fuels	Mass Transit						E/P	E/P				

Sector/Category	Project Type	Lieb-Warner	RGGI	Canada	EU ETS[19]	JI[20]	CDM	EPA Climate Leader	CCAR	CCX	Alberta	NSW
Transportation Fuels	Biofuels						E/P				E/P	
Likely in Scope												
Industrial Process	HFC refrigerant avoidance/destruction						E			E/P		
Industrial Process	HFC destruction at HCFC facilities				E/P[4]	E/P[22]	E/P[4]					
Industrial Process	PFC avoidance at aluminum and other facilities						E/P					
Industrial Process	N2O destruction in nitric and adipic acid production						E/P					
Industrial Process	Sulfur hexafluoride (SF6) reduction at electric facilities		E/P				E					
Industrial Process (Cement)	Blended cement						E/P					
Electricity and Stationary Comb	Energy efficiency						E/P	E/P (boilers)				E/P
Electricity and Stationary Comb	Fuel switch						E/P					
Electricity and Stationary Comb	Renewable energy						E/P			E/P	E/P	E/P
Electricity and Stationary Comb	Nuclear energy				NE	NE	NE					

[22] New HCFC-22 facilities are not eligible.

Sector/Category	Project Type	Lieb-Warner	RGGI	Canada	EU ETS[19]	JI[20]	CDM	EPA Climate Leader	CCAR	CCX	Alberta	NSW
Other												
Geological sequestration	CCS at power stations or other CO2 producing facilities											

Key: E – Eligible (under trading system); NE – Not eligible; P – Protocol available