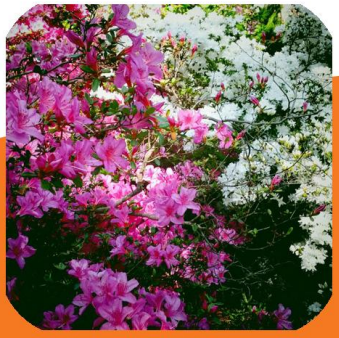
THE CITY OF TAKOMA PARK

2014 SUSTAINABLE ENERGY ACTION PLAN







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EXECUTIVE SUMMARY

The City of Takoma Park is already a leader on many fronts with respect to community environmental sustainability. In the City's long history of environmental programming it has led by example in its own operations through actions such as completing building energy retrofits, reducing its vehicle fleet size and maximizing fleet efficiency, achieving the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) certification for its buildings, installing solar energy projects, and purchasing renewable energy for its facilities. In the community it has helped protect and enhance tree cover, promoted low-impact development for managing stormwater, provided residential recycling opportunities, and promoted walkability.

The City – in partnership with its Committee on the Environment (COE) – has developed this Sustainable Energy Action Plan (SEAP) to serve as a road map for Takoma Park's next efforts related to energy sustainability and to prioritize the application of staff capacity and the annual funding Takoma Park sets aside in its budgeting process for sustainability projects.

While the City acknowledges the many environmental sustainability issues that are important to its citizens and businesses – stormwater, air quality, land use, and others - the SEAP specifically focuses on the issues of energy and associated GHG emissions. Specifically, the City determined that energy efficiency and conservation offer the opportunity to help Takoma Park's residents and businesses save money and become more energy resilient while also helping reduce GHG emissions that contribute to climate change – arguably the most pressing environmental sustainability issue of our time. And while the SEAP focuses on these issues now, it offers a replicable framework and cyclical process so that other issues can be added to the plan over time.

The SEAP was developed over the course of approximately nine months, including the review of existing programs and policies that might influence GHG emissions in Takoma Park, an update of the City's GHG inventory, and evaluation and drafting of screening criteria and proposed strategies.

The review of the existing programs and policies impacting the community resulted in a mapping exercise that, in combination with dialogue with the COE and City Staff, was used to identify gaps, consolidate proposed strategies, and develop a list of strategies for more detailed analysis.

The SEAP includes an update to Takoma Park's original inventory that recognizes the many advances in community GHG accounting protocols, increased availability of applicable data, and the changes in the community since 2000. The total resulting emissions of 94,572 MTCO2e represents per capita emissions of just 5.5 MTCO2e. This is well below the low end of the range

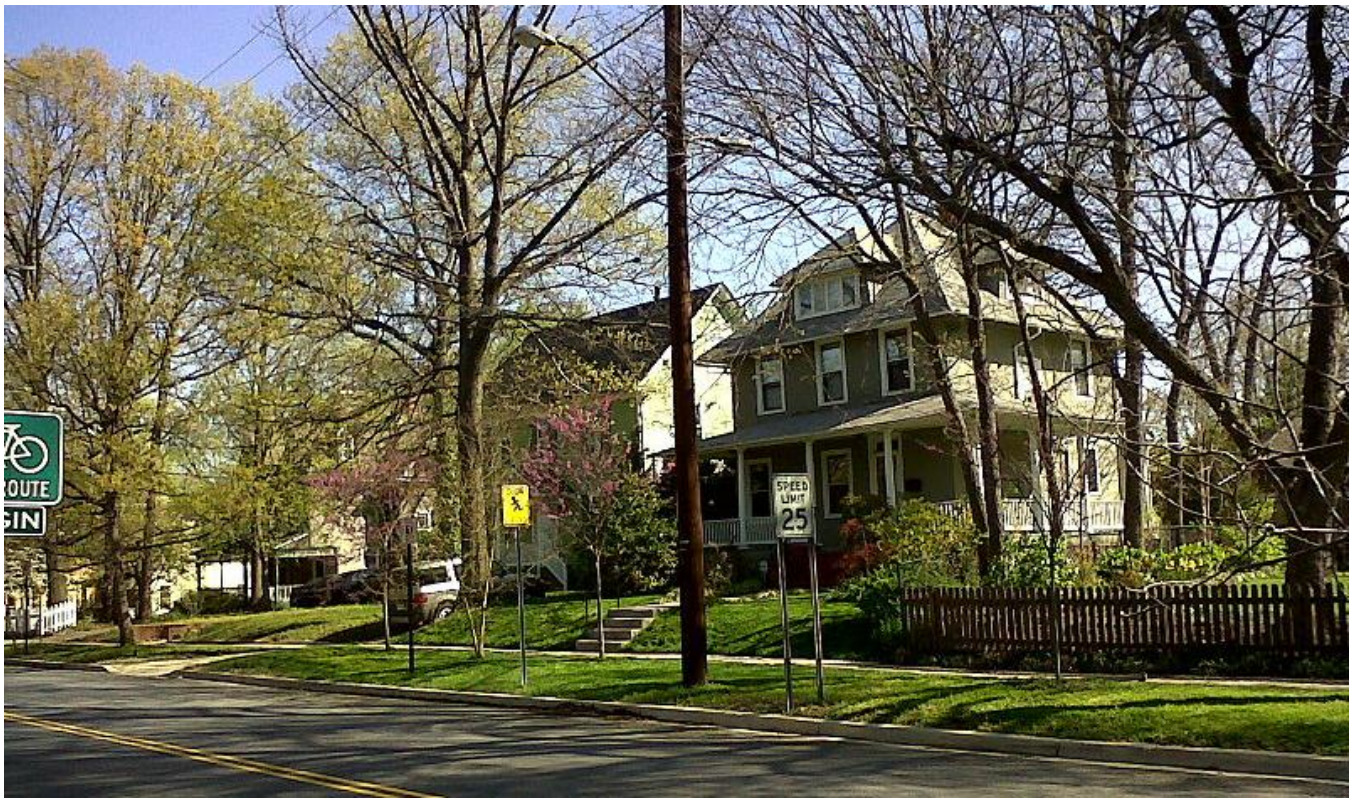
of GHG emissions for other U.S. cities (10 to 20 MTCO2e/capita is typical) and is competitive with many international cities.[1] The resulting takeaway of the GHG inventory is that the biggest sources of GHG emissions in the community are residential buildings, commercial buildings, and personal transportation. This updated inventory provides the data necessary to prioritize and quantify the strategies considered in the SEAP.

Based on the review of existing programs and policies, the GHG inventory, interviews with City staff, discussions with the COE, and best practices identified in other communities, a list of 17 strategies was developed for Takoma Park. These strategies include leveraging recently installed smart meters, expanding carpooling and car sharing, installing efficient equipment and products, purchasing renewable energy, and many more. The strategies are described and analyzed in Section 3.

A prerequisite to the implementation of most of the considered strategies will be the hiring of a full-time City sustainability coordinator to provide staffing resources. Such an individual would help with outreach to the community, management of the overall plan and sustainability program implementation, partnership building with organizations within and outside the community, and pursuit of funding and financing mechanisms. Targeting community-focused programs and services, the coordinator would also provide technical support for strategy implementation, from building energy and water assessments to community planning, alternative vehicles, and renewable energy.

[1] Representative GHG Baselines for Cities and their Respective Countries, http://www.unep.org/urban_environment/PDFs/Representative-GHGBaselines.pdf

1. INTRODUCTION AND BACKGROUND



The City of Takoma Park is already a leader on many fronts with respect to community environmental sustainability. In the City's long history of environmental programming it has led by example in its own operations through actions such as completing building energy retrofits, reducing its vehicle fleet size and maximizing fleet efficiency, achieving the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) certification for its buildings, installing solar energy projects, and purchasing renewable energy for its facilities. In the community it has helped protect and enhance tree cover, promoted low-impact development for managing stormwater, provided residential recycling opportunities, and enhanced walkability.

When the City's efforts to date are combined with programs from Montgomery County, the State of Maryland, utilities, and others, there are over 60 sustainability programs and projects in the category of energy alone affecting Takoma Park that are complete or underway. All of these efforts have helped contribute to Takoma Park's quality of life.

The City – in collaboration with its Committee on the Environment (COE) – has developed this Sustainable Energy Action Plan (SEAP) to serve as a road map for Takoma Park's next efforts related to energy sustainability, and to prioritize staffing and the annual funding Takoma Park sets aside in its budgeting process for sustainability projects.

1.1 Purpose of the SEAP

The SEAP is an action-driven road map for how best to prioritize City time, budget, and other resources – and leverage the extensive and ongoing work of the City and many others in the region – to maximize beneficial outcomes for environmental sustainability with an emphasis on energy. It also focuses the City's efforts on top priorities and prioritizes implementation efforts given finite staffing and funding capacity.

Specifically, the SEAP prioritizes those actions that are most cost effective and provide a balanced mix of enhancing Takoma Park's quality of life, improving the environment, and promoting economic development and jobs. The City is committed to seeing priority actions through to fruition so that Takoma Park's residents and businesses can start to immediately benefit.

Why a Focus on Energy?

While environmental sustainability covers many topics – energy, water, waste, wildlife and ecosystems, air quality, and others – the focus on this plan is on energy. The types and amounts of energy we use are closely link to our greenhouse gas emissions that contribute to climate change. Using energy more efficiently also offers many benefits to Takoma Park's citizens and businesses, including cost savings.

The SEAP also builds on, rather than replicates, the extensive work reflected in the City's Local Action Plan to reduce greenhouse gas (GHG) emissions (2000) and the 2010 Task Force on Environmental Action (TFEA) Report. Both of these past planning documents include a number of goals and recommended strategies for furthering environmental sustainability in Takoma Park – many of which are carried forward in the SEAP with further analysis to determine costs, benefits, and priorities for action.

1.2 Scope of the SEAP

While the City acknowledges the many environmental sustainability issues that are important to its citizens and businesses – stormwater, air quality, land use, and others - the SEAP specifically focuses on energy and associated GHG emissions. In discussions on the scope of the plan, City staff, Committee on the Environment (COE) members, and the consultant team determined that focusing on these targeted issues offered several advantages. Specifically, energy efficiency and conservation offer the opportunity to help Takoma Park's residents and businesses save money and become more energy resilient while helping reduce GHG emissions that contribute to climate change. And while the SEAP focuses on these issues now, it offers a planning framework so that other issues can be added to the Plan over time.

The SEAP and its actions focus on five big "levers", or topic areas, namely single-family residences, multi-family buildings, commercial businesses, energy supply, and transportation. The SEAP also evaluates a number of implementation channels for proposed actions. For example, do proposed actions lend themselves to having the City lead by example or using policy and planning mechanisms? Can actions be accomplished by expanding education and engagement, motivating and incenting participation, recognizing achievement, and/or providing direct implementation support?

1.3 Development Process and SEAP Organization

The SEAP was developed over approximately nine months, from review and refinement of the City's energy use profile and GHG inventory to evaluating and drafting screening criteria and proposed actions. It was built both top down – framed by policy and guiding principles and aligned with current City plans – as well as guided by the set of topic areas and goals developed through a facilitated process with City staff and the COE. It was also built "bottom up" by completing a baseline analysis of current impacts and practices, reviewing best practices from other communities, conducting interviews and community engagement activities, and holding workshops with City staff and the COE (Figure 1).

Figure 1. SEAP Development Framework

1.3.1 Coordination with the COE

Along with City staff, the COE served as the primary advisory body to the consultant team as the SEAP was developed. The consultant team met with the COE three times (twice in person and once by webinar) over the course of Plan development to review proposed scope and organization, affirm assumptions in revising the City's GHG inventory, provide input on the strategy screening and quantification process, and select priority strategies and actions. The team used a Basecamp project web site as a platform for exchanging ideas, reviewing project deliverables, and sharing comments.

1.3.2 Public and Stakeholder Meeting

Other stakeholders and the public were also engaged in developing the SEAP. Througout the course of the project the consultant team met or corresponded with stakeholders from state agencies, utilities, Montgomery County, representatives of the business community, peer communities, and other miscellaneous stakeholders. This input was used to help identify gaps in existing programs, target needs for new strategies and actions, leverage resources of others, and develop the evaluation methodology.

Residents and businesses in Takoma Park received regular updates on SEAP development through the City's web site. In July 2013, the City hosted an open house where the consultant team shared an update on progress to date and collected comments on proposed strategies and how they should be prioritized (Appendix A).

2. CURRENT PRACTICES AND CONDITIONS

As an initial step in developing the SEAP the consultant team: 1) compiled a summary of current energy-related practices and programs; and 2) updated the City's energy baseline and GHG inventory.

2.1 Existing and Potential Practices and Programs

The consultant team identified over 60 programs or practices addressing energy sustainability that are or have been available to residents and businesses in Takoma Park. These were either completed or current programs that address energy sustainability in residential and multi-family energy use, commercial building energy use, energy supply, and transportation.

In addition to reviewing existing programs and activities, the consultant team also considered the recommendations made in Takoma Park's Local Action Plan for Reducing Greenhouse Gas Emissions (2000) and the 2010 Task Force on Environmental Action's Final Report to identify potential ideas for programs and practices that may still be relevant to the SEAP. The following sources reviewed as part of this process:

- Takoma Park City policies
- Takoma Park Master Plan
- Takoma Park Capital Improvement Program - Fiscal Years 2013 to 2017
- Takoma Park Local Action Plan for Reducing Greenhouse Gas Emissions (2000)
- Takoma Park 2010 Task Force on Environmental Action Final Report
- Takoma Park Draft Planning documents (e.g., New Hampshire Corridor Plan)
- Montgomery County policies and plans
- Montgomery County Commercial Building Energy Efficiency Policy Study
- Washington Metropolitan Council of Governments 2013-2016 Action Plan
- State of Maryland policies
- State of Maryland 2011 Greenhouse Gas Reduction Act Plan
- State of Maryland National Capital Park and Planning Commission programs
- Maryland Energy Administration programs

- PEPCO programs
- Washington Gas programs

As they were compiled, the project team organized existing and potential practices by their program type and the sector served. Program types included:

- Provide Entry-Point/Motivate Engagement
- Identify Opportunities
- Motivate Action
- Provide Implementation Support
- Recognize Achievements

Existing and potential practices were also divided between those that were perceived to be relatively straightforward (e.g., low-cost, minimal staffing, politically and technically feasible) and those that would be more difficult and/or costly to implement.

Existing and potential practices were also mapped to the sector(s) they served: single-family residences, multi-family buildings, commercial and institutional buildings, energy supply, and transportation. Appendix B includes the results of this mapping for each sector.

This mapping exercise was used to identify gaps, consolidate proposed strategies, and develop a list of potential strategies for more detailed analysis. These strategies are presented in Section 3.

2.2 GHG Inventory and Forecast

Takoma Park conducted a community GHG inventory and forecast in 2000 in conjunction with the Local Action Plan for Reducing Greenhouse Gas Emissions. In completing this inventory, Takoma Park was among the first communities in the U.S. to complete GHG inventories as part of the Cities for Climate Protection Campaign of the International Council for Local Environmental Initiatives (ICLEI).

The SEAP includes an update to Takoma Park's GHG inventory that recognizes the many advances in community GHG accounting protocols, increased availability of applicable data, and changes in Takoma Park since 2000. While the GHG inventory includes sources, such as solid waste, that do not directly relate to energy consumption, most sources in the inventory are directly tied to energy consumption in Takoma Park. This updated inventory informed quantification and prioritization of the strategies considered in the SEAP in Section 3.

2.2.1 Inventory Methodology

The updated inventory was developed in accordance with ICELI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Version 1.0, October 2012; Protocol). The protocol provides guidance specifically for community GHG inventories, including which

emission sources and activities to include, how to identify data sources and perform emission calculations, and how to report.

The Protocol identifies five basic, required emissions-generating activities to be included in community inventories:

1. Use of electricity by the community;
2. Use of fuel in residential and commercial stationary combustion equipment (e.g., furnaces, cooking);
3. On-road passenger and freight motor vehicle travel;
4. Use of energy in treatment and distribution of potable water and wastewater; and
5. Generation of solid waste by the community.

These sources are included because local governments have more capacity to control or influence these sources than others, the data necessary to estimate emissions are typically available, they are the most significant sources of GHG emissions, and they occur in most U.S. communities. Takoma Park elected to focus on these five primary sources to also streamline the inventory process and allocate more planning resources toward implementation.

The inventory includes three gases contributing to climate change: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Other Protocol-recognized GHGs are not generated in any significant quantities by the above activities. All results are portrayed as metric tons of carbon dioxide equivalent (MTCO2e), a unit that represents the relative GHG impacts of each of the included gases. More detail on calculating emissions by sources can be found in Appendix C.

2.2.2 Inventory Findings

The total GHG emissions in Takoma Park in 2012, based on the above sources and approaches, are estimated to be 94,572 MTCO2e. These emissions are depicted by sector and by source, respectively, in Figures 2 and 3.

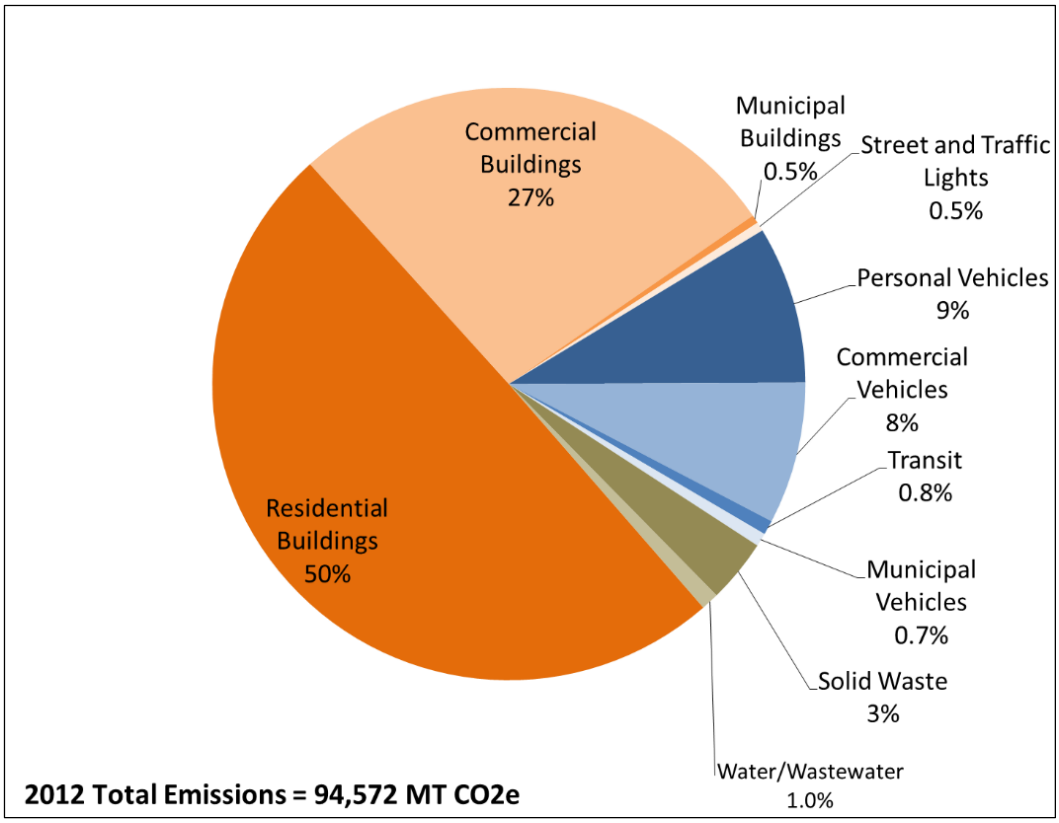


Figure 2. 2012 Takoma Park GHG Emissions by Sector

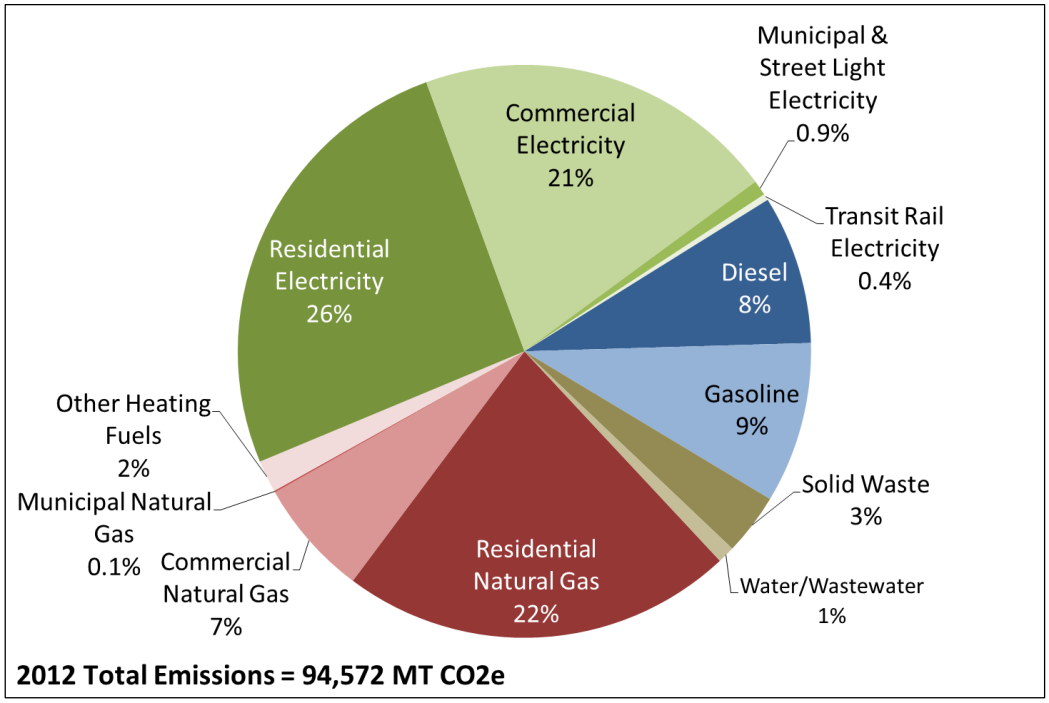


Figure 3. 2012 Takoma Park GHG Emissions by Source or Activity

The results of this inventory should not be compared to the results of the original inventory in 2000. Between the changes in data resolution (e.g., electricity and probably transportation) and differences in Protocol (e.g. now only attributing 50 percent of cross-boundary travel to Takoma Park), the inventories are too different in approach to be reasonably compared. The inventory methodology in Appendix C provides more detail on these differences.

The total resulting emissions of 94,572 MTCO2e represents per capita emissions for Takoma Park of 5.5 MTCO2e. This is well below the low end of the range of GHG emissions for other U.S. cities (10 to 20 MTCO2e/capita is typical) and is competitive with many international cities.[2] While benchmarking should be done with caution because of differing approaches in GHG inventories (e.g., the referenced benchmarks included aviation emissions), this low value initially generated some concern about the reliability and/or completeness of the source data behind the inventory. After additional review and benchmarking by individual source/activity, particularly with respect to commercial electricity consumption and personal vehicle travel, the low emissions value was verified. A number of reasons have been identified that contribute to lower than typical GHG emissions in Takoma Park:

- A low intensity of GHG emissions per unit of electricity due to the 34 percent nuclear energy component in Pepco's electric portfolio;
- Stringent building energy codes in Maryland;
- The dominance of residential land uses, which are typically less energy intensive than commercial, of which Takoma Park has relatively little, or industrial uses, of which Takoma Park has none. The ratio of per capita retail sales in Takoma Park to per capita retail sales in Montgomery County is 0.45, indicating the small size of Takoma Park's commercial sector relative to the County;
- Relatively short vehicle trip distances within Takoma Park; and
- Significant transit ridership.

[2] Representative GHG Baselines for Cities and their Respective Countries, http://www.unep.org/urban_environment/PDFs/Representative-GHGBaselines.pdf

Takoma Park residents also appear to purchase a relatively large amount of renewable energy from electricity suppliers.

The resulting takeaway of the GHG inventory is that the biggest sources of GHG emissions in the community are residential buildings, commercial buildings, and personal transportation; therefore, strategies that address these sources should be emphasized in the priority strategies selected for implementation.

The following pages include a series of icons to identify the primary focus of the SEAP's strategies. These include:	
	**City Operations**
	**Single-family Buildings**
	**Commercial/Institutional Buildings**
	**Multi-family Buildings**
	**Energy Supply**
	**Transportation**

3. SEAP GOALS AND STRATEGIES

The following sections outline performance goals for the SEAP, the criteria against which the SEAP strategies are considered, and the analysis of the strategies.

3.1 Emissions Forecast and SEAP Goals

The consultant team developed a forecast of future GHG emissions to facilitate goal setting and an understanding of the emissions reductions that might be required to meet particular goals. Based on discussions with the City's Planning Department, very little change in population is anticipated in Takoma Park in the next 10 years. Therefore, under a business-as-usual scenario it is reasonable to assume that emissions in the community will remain fairly constant.

The SEAP did not establish new goals for energy performance or GHG reductions in the community. Instead, taking direction from the City's Strategic Plan for fiscal years 2010-2015, the SEAP considers the implications of establishing reduction goals that, "are consistent with state, County, and MWCOG plans."

Figure 4 depicts the projected forecast through 2030 as well as the pathways to goals established by the State, MWCOG, and Montgomery County. The County's goal is the largest in magnitude in the long run but requires the least aggressive initial pursuit because of its longer overall term.

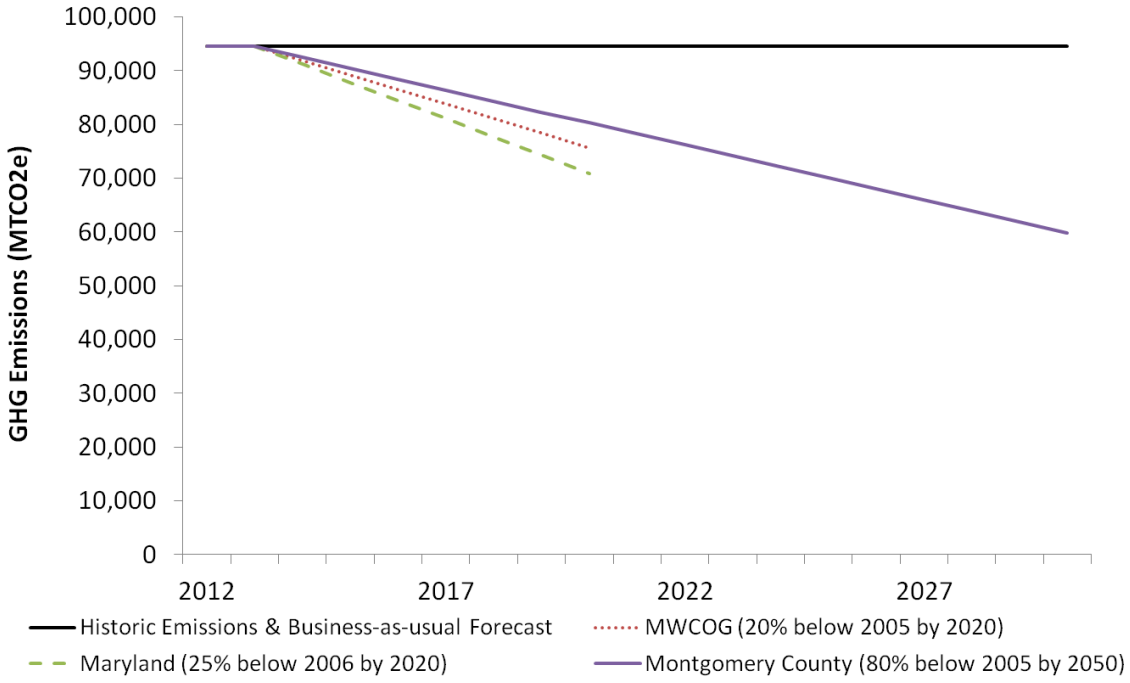


Figure 4. Forecast of Future Emissions and Goal Scenarios

Recognizing that many jurisdictions nationwide are not succeeding in attaining their energy and GHG reduction goals, the COE discussed setting a goal for Takoma Park that is attainable and applies specifically to what the City is able to achieve within its sphere of influence. Takoma Park can expect a significant amount of reduction to occur due to existing external policies, programs, and activities that will influence emissions in Takoma Park. These include Maryland's building codes (which now incorporate the International Energy Conservation Code (IECC) 2012 version), the Maryland Renewable Energy Portfolio Standard, voluntary purchases of renewable energy in the community, and federal vehicle fuel economy standards (CAFE standards). These external influences, coupled with other strategies considered in the SEAP, could keep Takoma Park largely on track with the pathway to the County's goal through the Plan's 2030 planning horizon. Figure 5 shows Montgomery County's reduction target, expected reductions from existing policies and programs, and potential additional reductions from implementation of strategies in the SEAP.

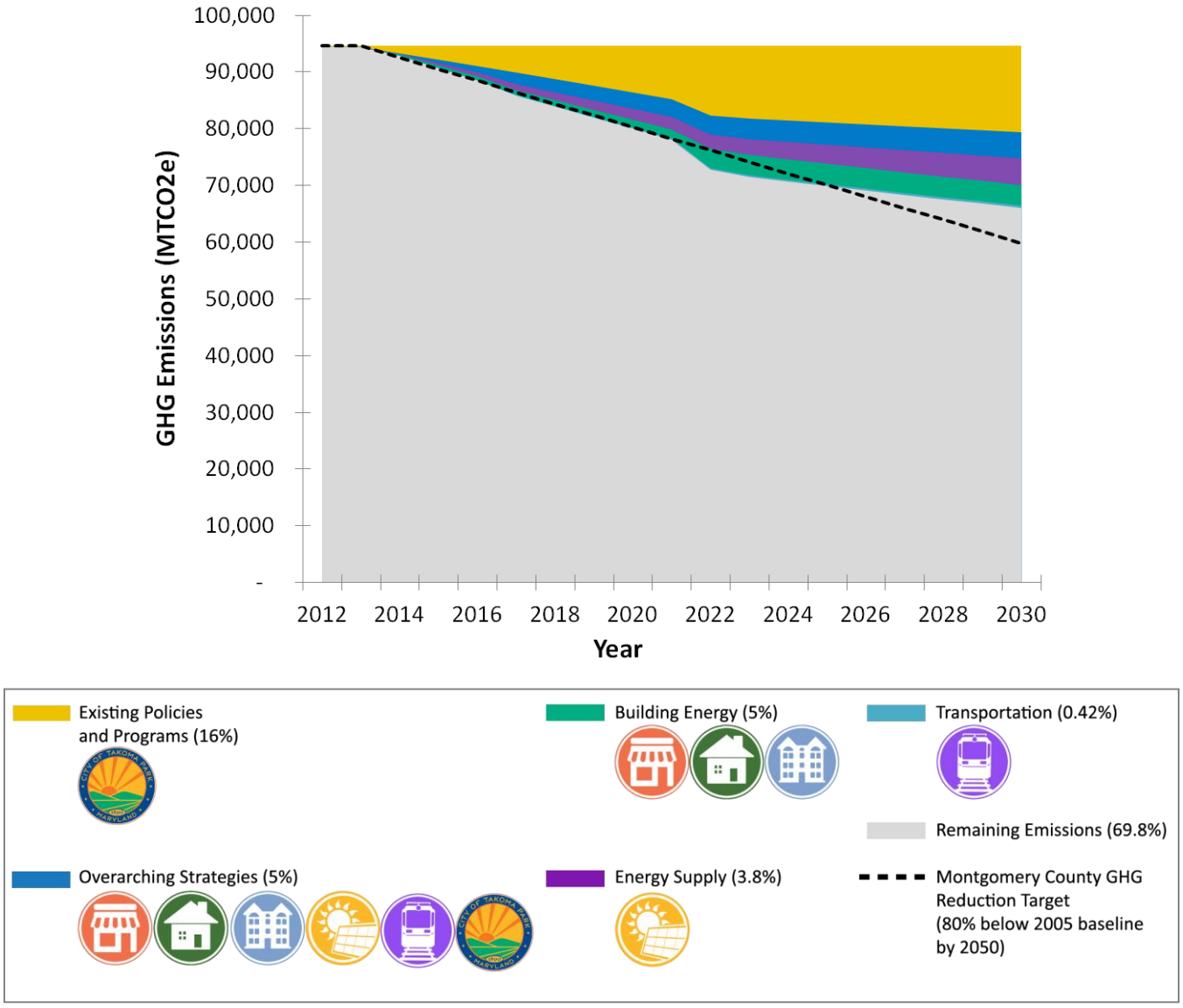


Figure 5. Potential Reductions Compared to Path to Montgomery County Goal

Achieving the scale of reductions required to achieve Montgomery County's reduction target will require implementation of all of the strategies in the SEAP. Implementing all the strategies at once would likely exceed Takoma Park's staffing and funding resources. However, by prioritizing implementation of strategies, staging their implementation over this timeframe, balancing energy-related strategies with other sustainability efforts, and seeking more aggressive implementation of strategies that are particularly successful in Takoma Park the community can likely stay on track with the County's goal trajectory.

3.2 Methodology and Criteria for Considering Strategies

With goals established for energy and associated GHG reductions, the next step in the SEAP process was to build off the baseline inventory of existing and potential practices and programs to identify, prioritize, and evaluate strategies - with the ultimate objective of identifying the most effective top strategies to move to the implementation phase.

3.2.1 Strategy Evaluation Methodology

A core component of the SEAP's development process was the identification, screening, and prioritization of strategies for implementation. The consultant team reviewed over 50 potential strategy ideas that were compiled from TFEA 2010 Report, interviews with staff, workshops with the COE, and best practices from other communities.

The team applied a two-phased screening process, shown in Figure 6, to narrow this initial list of 50 potential strategies to a smaller set of priority strategies for implementation.

In Phase 1, the first step to narrow this list included consolidating strategies that were similar or complementary in nature. This helped to reduce the number of strategies to approximately 30 to 40 while also creating a process to move other strategy ideas to an "activity pool" to be considered in future Plan updates so that no ideas were lost.

Also in Phase 1, the team organized potential strategy ideas by type (e.g., incentive, education, recognition) and mapped them against current programs already being offered by energy utilities, the City, the state of Maryland, or others. This mapping helped identify how strategies fit together, potential for consolidation, and where strategies could address gaps in available program offerings. The outcome was a shorter list of priority strategies to which more rigorous quantification was applied.

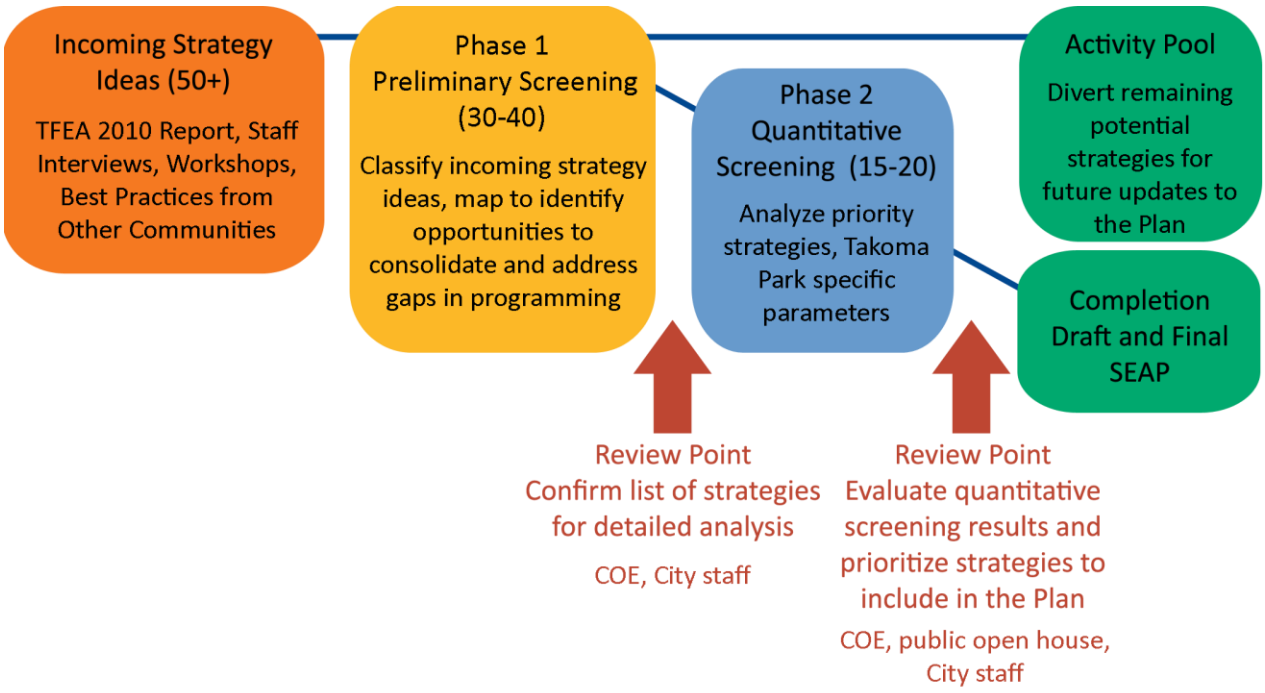


Figure 6. Strategy Development and Screening Process

In Phase 2 the team applied a quantitative analysis to a subset of 15-20 strategies to help prioritize strategies based on costs, savings, energy and GHG emissions, and other factors. This quantification process was informed by:

- Input from City staff and other stakeholders, including information from similar existing programs regionally;
- Locally relevant demographic, utility, and other data;
- Industry contacts, references, and rules-of-thumb;
- Case studies from other communities; and
- Professional experience of the project team.

3.2.2 Strategy Quantification and Screening Criteria

To complete Phase 2 quantification, screening, and prioritization process quantitative data was brought together with qualitative screening criteria and priorities relevant to Takoma Park to determine a final list of strategies for implementation through the SEAP to meet desired GHG reduction goals.

A number of criteria were considered in the analysis of each of the strategies in the SEAP. These criteria are summarized in Table 1.

Table 1: Criteria Considered in the Selection of Strategies for Implementation

Criteria	Definition
Timing and Participation Criteria	
Timeframe	Consideration of how long it would take to initiate a strategy, in the interest of identifying some strategies that could be implemented soon.
Estimated Participation Rates	The number of residences and/or businesses projected to participate in each program. Rates are based on benchmarking from similar programs elsewhere in the country.
Quantitative Criteria: Costs, Savings, and GHG Emissions Reduction	
Average Annual Program Cost	The average annual cost to the City government as a result of the strategy, exclusive of staffing over the planning horizon (through 2030).
Average Annual Participant Cost and Savings	The average annual cost and savings for residents and businesses over the planning horizon (through 2030)
***Cost Efficiency**	Cumulative Net Cost (implementation costs minus cost savings) in dollars divided by cumulative GHG emission reduction in MTCO2e over the planning horizon (through 2030). A negative value indicates net cost savings to the community.
***GHG Emissions Reductions**	Estimated annual reduction in GHG emissions, in metric tons of carbon dioxide equivalent (MTCO2e) in 2030 (end of planning horizon).
Qualitative Criteria	
Staff Resources Required	An estimate of the number of full-time equivalent staff required to implement the strategy at full implementation
Human Health Impacts	Qualitative local benefits to human health.
Livability Impacts	Other "co-benefits" of a strategy that contribute to Takoma Park's quality of life.
Social Justice Implications	Any costs or other barriers that make a particular strategy prohibitive for any portion of the population and/or program design requirements to ensure that there are not barriers to participation.
Priority Votes	The number of votes received at the July 29th Open House indicating the strategy is a priority for implementation. Each participant could vote on two strategies.

** Strategies with the most direct measure of effectiveness.*

While all of these criteria were presented for consideration and comparison of strategies, two criteria reflect the most direct measure of effectiveness for reducing GHG emissions: 1) a low or negative Cost Efficiency which indicates the strategy is effective at reducing GHG emissions relative to net costs to implement the strategy and 2) a larger GHG emissions reduction which indicates a more significant impact on emissions.

3.3 Strategies Evaluated

Using the strategy evaluation methodology described in Section 3.2.1, a total of 17 strategies were evaluated and prioritized for implementation. These strategies span across the five topic areas of residential energy efficiency, multi-family energy efficiency, commercial energy efficiency, energy supply, and transportation. Table 2 summarizes these 17 strategies, while Appendix D provides a more detailed description of each.

Table 2: Summary of Strategies Evaluated

Strategy		Description
	**Leverage Smart Meters**	Encourage residents and business owners to access and review their utility data on Pepco's My Account and provide support for interpreting data and determining next steps for reducing consumption.
	**Expand Carpooling and Car Sharing**	Encourage residents and businesses to increase carpooling and car sharing by promoting them on the City's web site. Provide links to regional carpooling services and establishing reserved parking spaces for exclusive use by carpooling and car sharing participants.
	**Directly Install Efficient Equipment and Offer Free Products**	Leverage existing equipment installation utility programs with neighborhood outreach, augmenting programs with additional equipment, and providing follow-up to encourage implementation.
  	**Facilitate Use of Property Tax Credits for Energy Efficiency Upgrades**	Pilot County property tax exemptions and credits for energy efficiency upgrades with local businesses and residents to establish replicable processes and increase uptake of these credits.

	**Building Energy Efficiency Process Coach**	Work with residences, businesses and large institutions to reduce energy consumption. Recruit homeowners, businesses, and institutions to participate and work with participants during each step in the process toward improving energy efficiency and conservation.
	**Have the City Lead by Example**	Engage the City organization in the strategies proposed in the plan (e.g. direct installs of energy efficiency technologies, participating in the tiered performance program, etc.).
	**Encourage Multi-family Building Efficiency**	Serve as the one-stop shop and knit together a number of utility, Montgomery County, and state programs that support multi-family building efficiency.
	**Develop a Commercial/ Institutional Voluntary Tiered Performance Program**	Establish tiers or categories of potential sustainability actions from which businesses could choose and provide resources and technical support as well as recognition.
	**Develop a Residential Voluntary Tiered Performance Program**	Establish tiers or categories of potential sustainability actions from which residents could choose and provide resources and technical support as well as recognition.
	**Purchase Renewable Energy**	More residents and businesses purchasing renewable energy individually or through a bulk purchase at a lower rate facilitated by the City.
	**Encourage Community Solar Projects**	Encourage community solar projects by educating residents, providing contacts and resources, acting as a catalyst to help build support and find residents interested in participating, providing land, and supporting negotiations with solar project developers and building owners that have suitable land, roofs, or parking lots.

	Provide Sustainability Guidelines for Redevelopment	Suggest green building guidelines, streamline the process for the property tax exemption for earning the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) certification (a separate strategy) and potentially offer incentives for improvements that exceed building code requirements.
	Develop a Transportation-specific Community Challenge	Host a "transportation" challenge to encourage friendly competition to reduce driving and increase use of transit, biking, and walking. Educate the public, engage drivers in behavior change and reward high performers.
	Expand Capital Bike Share Stations	Conduct outreach in the community and target projects to increase the effectiveness of the system
	Establish a Circulating Shuttle	Implement a small (25-passenger) alternative fuel circulating bus to supplement Ride On bus and Metrorail services and to fill the gap of service in, around, to, and from major activity centers and high-density neighborhoods.
	Expand Mobilization and Outreach for Sustainability	Support all other plan strategies by increasing outreach to and mobilization of residents and businesses to engage in implementation and action.
	Establish a Carbon Tax	Raise additional funds for Takoma Park's sustainability efforts. (A means of implementing such a tax within Takoma Park's authority is not apparent at this time.)

3.4 Summary of Strategy Evaluation

Table 3 on the following page summarizes the cost benefit analysis for each of the 17 strategies. The strategies are ordered in terms of cost efficiency at reducing GHG emissions through the 2030 planning horizon. Those with negative cost efficiencies indicate that the community would save money over the course of the planning horizon. Appendix E contains more information on the assumptions used for each strategy to conduct the evaluation as well as a detailed table comparing the evaluation criteria results for all 17 strategies. Overall, implementing these 17 strategies will cost a total of $14 million over the 2030 planning horizon. Over this same timeframe $26 million in cumulative cost savings and 140,000 MT CO_2e emissions reductions will be realized.

Table 3. Strategies Cost Benefit Analysis Summary

Strategy		Annual GHG Emissions Impact (MTCO2e in 2030)	Average Annual Program Cost through 2030 ($)	Average Annual Private Cost through 2030 **($)**	Average Annual Private Savings through 2030 ($ Savings)	Cost Efficiency (Cumulative $ Net Cost/ MTCO2e through 2030)
	**Leverage Smart Meters**	200	Included in Outreach and Mobilization	$0	$48,000	($310)
	**Expand Carpooling and Car Sharing**	250	$6,000	$0	$44,000	($290)
	**Facilitate Use of Property Tax Credits for Energy Efficiency Upgrades**	300	Included in Coordinator / Coach	$40,000	$50,000	($270)
	**Directly Install Efficient Equipment and Offer Free Products**	2,800	$30,000	$16,000	$420,000	($250)
	**Building Energy Efficiency Process Coach**	2,400	$20,000	$140,000	$550,000	($200)
	**Encourage Multi-family Building Efficiency**	1,300	$50,000	$0	$150,000	($170)
	**Have the City Lead by Example**	100	$5,000	n/a	$14,000	($170)

	Establish a Commercial Voluntary Tiered Program	600	$10,000	$34,000	$91,000	($160)
	Encourage Community Solar Projects	20	Included in Outreach and Mobilization	$8,600	$9,200	($20)
	Establish a Residential Voluntary Tiered Program	1,500	$10,000	$17,000	$15,000	$10
	Purchase Renewable Energy	3600	Included in Outreach and Mobilization	$170,000	$0	$70
	Expand Capital Bike Share Stations	160	$69,000	$0	$53,000	$140
	Provide Sustainability Guidelines for Redevelopment	100	Negligible	~2% increase in building costs	$31,000	$210
	Initiate a Transportation Challenge	10	$12,000	$0	$5,800	$490
	Establish a Circulating Shuttle	10	$58,000	$82,000	$5,100	$12,000
	Expand Mobilization and Outreach for Sustainability	Indirect	$10,000	Indirect	Indirect	n/a
	Establish a Carbon Tax	Indirect	Unknown	$190,000	$0	n/a

4. IMPLEMENTATION

Based on the evaluation of strategies in Section 3, the following sections provide the COE and project team's recommendations for how best to move forward with strategy implementation.

Considering Takoma Park's long history of sustainability planning and a strong desire to move forward with implementation, a portion of the budget from the SEAP planning process has been reserved to begin implementation. The specific scope has been left to be determined at the end of the planning process at which time City Staff and the consultant team will seek the direction of Council to determine the implementation scope.

4.1 Strategy for Implementation

The strategies in the SEAP were evaluated in isolation in Section 3 to provide an indication of the effectiveness of each potential strategy to meet the City's GHG reduction goals as well as support other benefits in a cost effective way. However, rather than selecting strategies in isolation of one another, a potential implementation approach is to select a number of strategies based on performance, potential for synergy, and preferences in the community for integration into a hybrid program.

The COE recommends an integrated approach to strategy implementation that focuses on the residential single-family and multi-family sectors; and incorporates elements of the proposed multi-family, community solar, and direct install strategies. Other strategies with high cost effectiveness and relatively low staffing and costs to the City such as leveraging smart meters, promoting the purchase of renewable energy, facilitating the use of existing County property tax credits, and promoting carpooling and car sharing could also be addressed as part of this implementation package. This set of residentially focused approaches could be delivered under the umbrella of a voluntary tiered performance program.

As a cross-cutting implementation step the COE and project team have also recommended that the City hire a full-time sustainability coordinator. Hiring a full-time coordinator would serve as a driver and provide staffing for many of the strategies. Such an individual would help with outreach to the community, management of overall plan and sustainability program implementation, partnership building with organizations within and outside the community, and pursuit of funding and financing mechanisms. Targeting community-focused programs and services, the coordinator would also provide technical support for strategy implementation, from building energy and water assessments to community planning, alternative vehicles, and renewable energy.

It is envisioned that such an individual would offer skills in both program management and community engagement, as well as technical capability with respect to energy/carbon management and other resource use issues (e.g., water, waste, transportation).

4.2 Implementation Scope Options

With the resources currently allocated, the implementation scope using remaining project funds could include the partial development of up to three of the priority strategies or a more full development of one priority strategy that carries it through the initial pilot phase and provides support to the Sustainability Coordinator. Table 4 provides illustrative descriptions of levels of development organized around two potential approaches.

Table 4. Illustrative Implementation Scope Options

Strategy		Approach A. Partially Develop up to 3 Strategies	Approach B. More Fully Develop 1 Strategy
	Encourage Multi-family Building Efficiency	Implementation plan, a process diagram and narrative describing the program in detail including interactions with State and utility programs, identifying owner and tenant champions	Outreach to specific multi-family properties, preliminary branding concepts and materials, preliminary contact with key program partners, potential contractor identification, pilot with 1 property
	Encourage Community Solar Projects	Identify potential legal mechanisms to implement and potential parties (e.g. buyers/investors, partners, site)	Begin process of developing a community solar system, outreach and commitment of potential buyers/investors, seek necessary partnerships (e.g. equity, site, utility, PPA), begin legal processes (could be a multi-year process)
	Establish a Residential Voluntary Tiered Program	Implementation plan, a process diagram and narrative describing the program in detail including requirements of each tier level and reporting mechanisms, mapping by neighborhood to customize approach to different neighborhood needs	Launch program and support City staff for first year of operation, marketing and outreach plan for enrolling participants, preliminary branding concepts and materials, basic program website
	Establish a Commercial Voluntary Tiered Program	Implementation plan, a process diagram and narrative describing the program in detail including requirements of each tier level and reporting mechanisms	Launch program and support City staff for first year of operation, marketing and outreach plan for enrolling participants, preliminary branding concepts and materials, basic program website
	Directly Install Efficient Equipment and Offer Free Products	Implementation plan, research coverage and performance of related utility programs, a process diagram and narrative describing the program in detail including interaction with utility programs, preliminary list of augmentation products	Pilot utility programs with at least 1 property in each sector (residential, commercial, and multi-family), confirm any opportunities for programs to be streamlined and augmented, design additional offerings to address gaps, develop a marketing plan to enroll residential and business customers

4.3 Monitoring and Reporting

A website is being developed to be a streamlined, accessible means for the community to learn about and follow the progress of implementing the SEAP. The website will include a concise

version of the plan for sharing its aims and priority strategies with the community. The site will also track the implementation status of priority strategies, their performance outcomes from year-to-year, and provide residents and businesses in Takoma Park resources for getting involved in the implementation of the plan.

APPENDICES

Appendix A: Summary of Comments from July 29, 2013 Open House

Overarching Strategies

- Can the sustainability coordinator and coach be combined into the same position? I'd think the majority of these programs couldn't be completed without this role filled, considering the city's limited resources.
- Create micro economies or job training opportunities for lower income residents. For example: reading energy efficiencies from solar power, or installation of some of the projects.
- Under establish a residential voluntary tiered program, low-impact landscape maintenance and storm water best practices are mentioned – this likely warrants more attention. Can the city look at replicating Rockville's or Gaithersburg's RainScapes program? RainScapes need compost, and compost can be made from city food scraps or yard trim. Nice closed loop sustainable project that reduces methane and helps reduce garbage sent to the county incinerator.
- The "establish a carbon tax" option might usefully be presented as two options: A) Establish a carbon tax in addition to existing property taxes. B) Establish a carbon tax to replace some existing property taxes. 2) Since the carbon tax would represent revenue to the city: in addition to being shown as a $196,000 private cost it might be shown as a $196,000 city saving. (If option "A" above is being used.

Building Energy

- In addition to installing energy efficient appliances/ other free equipment, have behavior-based energy efficiency programs been considered? Class 5 energy has proven energy savings in schools and businesses.
- As part of the tax credit for energy efficiency upgrades, I would like to see the city help facilitate disposal/recycling/reuse of the old equipment so it is not just focused on energy, but also other environmental impacts.
- The "direct Install" option might usefully be split into residential and commercial components since (I assume) levels of expense for individual residences and individual businesses will be very different.

Energy Supply

- Groundswell, an energy aggregator, has engaged in assembling churches and other institutions to have electricity providers bid for a competitive discounted rate for 100% wind power. Takoma Park Presbyterian and its members have participated for 2 years. The city could have a partnership like this for businesses and residences.
- Are there some cooperative solar investment models: some owners install and others provide financing?
- Use an energy aggregator to do bulk purchase of green power (100% wind) at a discounted rate.
- Collective power purchase from whole sale and bulk power suppliers (residents gather together and solicit bids from clean energy providers).

- I'm very interested in the creation of a local energy co-op that pools whatever possible PV or wind generation capacity we could create through a shared membership/public/private type organizational model.
- The State's RPS standard allows trash incineration to be counted as renewable. All of Takoma Parks' trash is burned at the county incinerator. Please – whatever we do- let's not incentivize trash burning. Only true renewable energy – such as solar and wind – should count.

Transportation

- Transit - Promote increased bus and rail ridership and ensure that new development (NH Axe, Takoma Langley Crossroads) is transit oriented.
- Electric car charging stations and incentives
- Better Bike lanes in Takoma Park (especially Takoma Junction)
- Instead of expensive circulator shuttle, work with Ride On to adjust routes or give more information on availability of routes.

Other Strategy Ideas

- Waste
    - Pay as you throw trash fees
    - City wide collection of food scraps
    - Backyard composting – training bin giveaways
    - Waste exchanges
    - Incentives to reduce trash
- Cultural diversity/awareness not represented at meetings
- Rainscapes - Conservation landscapes and rain garden rebate program (CO and Rockville and Gaithersburg do this)
- Lawn and garden equipment (NOx, VOC's, ozone)
- Dog Waste stations (reduce nutrients)
- Change tree ordinance to allow free cutting and pruning for solar installation
- Tell people to keep cats indoors during fledging season for birds
- Anti-idling ordinance
- No more wood burning fire places
- Get rid of speed humps
- Have arborist/gardener help residents plant native vegetation, get rid of lawns

APPENDIX B: Summaries of Existing and Potential Programs by Sector

* Proposed practices that would be more difficult and/or costly to implement are signified by a bold font.

Table 5. Mapping of Existing and Proposed Programs

Single-family Buildings

Program Relevance to the SEAP	Existing Practices and Programs	Proposed Programs (SEAP Opportunities)
Entry-point/ Motivate Engagement	• My Account from PEPCO	• Disclosure of utilities at time of sale (already in Montgomery County) • Energy efficiency requirement for Rent Increase Petitions • Time of Sale efficiency requirement • Requirement of Main Street Façade Improvement Grant • Neighbor-to-neighbor marketing • Challenge program • Energy efficiency mortgages • Household energy benchmarking
Identify Opportunities	• Quick Home Energy Check-up Program • Home Performance with ENERGY STAR • Low Income Energy Efficiency Program (LIEEP)	• Trade ally identification, training, incentives • Real estate agent education
Motivate Action (incentives, grants, disincentives)	• Same as above • HVAC Efficiency • Energy Wise Rewards • Lighting rebate program • Appliance rebate program • Appliance recycling program • Maryland Home Energy Loan Program	• Tiered Program with recognition, include other actions beyond building energy (e.g. tree planting, transportation, recycling/composting, limited pesticides, hand or electric lawn-care, etc.) • **Property Assessed Clean Energy (PACE)** • **Revolving loan fund (expansion of current low-income improvement loan program)** • **Group purchasing**
Implementation Support		• **Implementation support provider for whole process, "energy coach"**

Multi-family Buildings

Program Relevance to the SEAP	Existing Practices and Programs	Proposed Programs (SEAP Opportunities)
Entry-point/ Motivate Engagement	• My Account from PEPCO (some)	• Energy efficiency requirement for Rent Increase petitions (green lease options) • Time of Sale • Business-to-business and neighbor-to-neighbor marketing • Direct outreach to owners • Challenge program • Building energy benchmarking
Identify Opportunities		• Trade ally identification, training, incentives • Support for identifying opportunities, "energy coach" • **Performance Contracting for Apartment, Commercial and Institutional Buildings** • **Solar Thermal leasing**
Motivate Action (incentives, grants, disincentives)	• Multi-Family Properties (PEPCO program) • Low Income Energy Efficiency Program (LIEEP) • Maryland Home Energy Loan Program • Multifamily Energy Efficiency and Housing • Affordability Program (fully allocated)	• Tiered program with recognition, include other actions beyond building energy • **Same as above** • **Excise tax or allocation of existing property tax to green building/efficiency** • **DHCD's Neighborhood BusinessWorks** • **Group Purchasing** • **Commercial Property Assessed Clean Energy (pending in County Council)**
Implementation Support		• **Implementation support provider for whole process, "energy coach"**
Recognition (measure, report, certify)		• Case studies of program participants • Social media site for interaction regarding program • System for commitments and goal setting • Achievement labeling (yard-sign, decal) • Building energy benchmarking

Commercial/ Institutional Buildings

Program Relevance to the SEAP	Existing Practices and Programs	Proposed Programs (SEAP Opportunities)
Entry-point/ Motivate Engagement	• Montgomery County Green Business Certification	• Requirement of Main Street Façade Improvement Grant • Time of Sale • Business-to-business marketing • Challenge program • Mandate with building permitting • Building energy benchmarking (Portfolio Manager)
Identify Opportunities	• Existing Buildings Program • Small Business Program • Continuous Energy Improvement • Commissioning (CEIC) • Full Recommissioning	• Trade ally identification, training, incentives • **Performance Contracting for Apartments, Commercial And Institutional Buildings**
Motivate Action (incentives, grants, disincentives)	• Same as above • O&M Training • Occupant Training • Small Business Program • Continuous Energy Improvement Commissioning(CEIC) • Full Recommissioning • HVAC Tune-up • Jane E. Lawton Conservation Loan Program • Public Schools Energy Efficiency Initiative Engineering Design Program • PACE • Smart Energy Communities from Maryland Energy Administration	• Tiered program with recognition, include other actions beyond building energy (could build on County Green Business program) • **Same as above** • **Excise tax or allocation of existing property tax to green building/efficiency** • **DHCD's Neighborhood BusinessWorks** • **Group Purchasing** • **Commercial Property Assessed Clean Energy (pending in County Council)**
Implementation Support	• Existing Buildings Program • Small Business Program	• **Implement support provider for whole process, "energy coach"**
Recognition (measure, report, certify)		• Case studies of program participants • Social media site for interaction regarding program • System for commitments and goal setting • Achievement labeling (yard-sign, decal) Building energy benchmarking (Portfolio Manager)

Energy Supply

Program Relevance to the SEAP	Existing Practices and Programs	Proposed Programs (SEAP Opportunities)
Entry-point/ Motivate Engagement	• RGGI (10% reduction electric utilities) • State RPS (20% renewable by 2020) • New Hampshire Avenue Corridor Redevelopment	• Seek EPA Green Power Communities status • Business-to-business and neighbor-to-neighbor marketing • Solar community solar garden (Power Purchase Agreements)
Identify Opportunities	• State Anemometer Loan Program	• Solar Photovoltaic Schools Program • Trade ally identification, training, incentives • Preliminary mapping of available roof or land areas for solar development • Residential PV versus shading tradeoffs • **Municipal Utility** • **Combined Heat and Power for Washington** • **Adventist Hospital and University and/or Montgomery College**
Motivate Action (incentives, grants, disincentives)	• Smart Energy Communities from Maryland Energy Administration • Clean Burning Wood Stove Grant Program • Clean Energy Grant Program • Bioheat Tax Credit Program • Commercial Clean Energy Grant Program • Game Changer Program: Energy Innovation Competitive Grants • Clean Energy Production Tax Credit • CHP Program	• Tiered program with recognition, include renewable energy opportunities • **PACE programs**
Implementation Support		• **Implementation support provider for whole process, "energy coach"**
Recognition (measure, report, certify)	• Smart Energy Investment Map (15 residential installs for 54 kW)	• Case studies of program participants • Social media site for interaction regarding program • System for commitments and goal setting • Achievement labeling (yard-sign, decal) • Building energy benchmarking

Transportation

Program Relevance to the SEAP	Existing Practices and Programs	Proposed Programs (SEAP Opportunities)
Entry-point/ Motivate Engagement	• Flower Avenue Green Street Project • ADA sidewalks • Transit oriented development • Low carbon fuel standard • Regional mass transit planning • Sidewalk connectivity improvement • CAFE and national fuel efficiency standards • Public Transportation Initiatives – MDOT • CA vehicle emission standards • Purple line light rail (on track)	• Improve transit information • Business-to-business and neighbor-to-neighbor marketing • Challenge program • **Improve bicycling accessibility through traffic improvements** • **Improve pedestrian accessibility through sidewalks, signals, and other improvements** • **Car sharing** • **Work with SHA to recalibrate stoplights to keep traffic flowing.**
Identify Opportunities	• New Hampshire Avenue Corridor Redevelopment	• Identify priority areas for pedestrian and bicycle infrastructure improvements (e.g. Takoma Junction) • Mapping tool for residents to suggest areas for mobility/walkability improvement
Motivate Action (incentives, grants, disincentives)	• Vehicles Scrappage Program • Maryland Electric Truck Voucher Program • Maryland Natural Gas Vehicle Voucher Program • Alternative Fuels Tax Credit • Titling -Excise Tax Credit for Plug-in Electric Vehicles • Electric Vehicle Supply Equipment Tax Credit Program	• Tiered program with recognition, include other actions beyond building energy
Implementation Support		
Recognition (measure, report, certify)		• Case studies of program participants • Social media site for interaction regarding program • System for commitments and goal setting • Achievement labeling (yard-sign, decal)

APPENDIX C: GHG Inventory Methodology

Electricity

Electricity emissions are estimated from the quantity of electricity consumed and an emission factor that represents the emissions from electricity-generating resources (e.g., coal, natural gas, hydroelectric, solar, wind, etc.) in a utility's portfolio.

The quantity of electricity consumed in Takoma Park was determined from queries of utility billing records for the electricity utility Pepco, which serves Takoma Park. The resulting data indicates consumption by residential and commercial account categories. Since most multi-family accounts are likely billed as commercial, the project team made an effort to identify the larger multi-family accounts in Takoma Park based on address and include these with residential electricity consumption.

The original inventory, conducted in 2000, appears to have used consumption data for the ZIP code that covers most of Takoma Park (20912). The boundaries of the ZIP code and the City's boundary, however, are not exactly coincident and the City includes parcels in a number of other ZIP codes, as illustrated in Figure 8

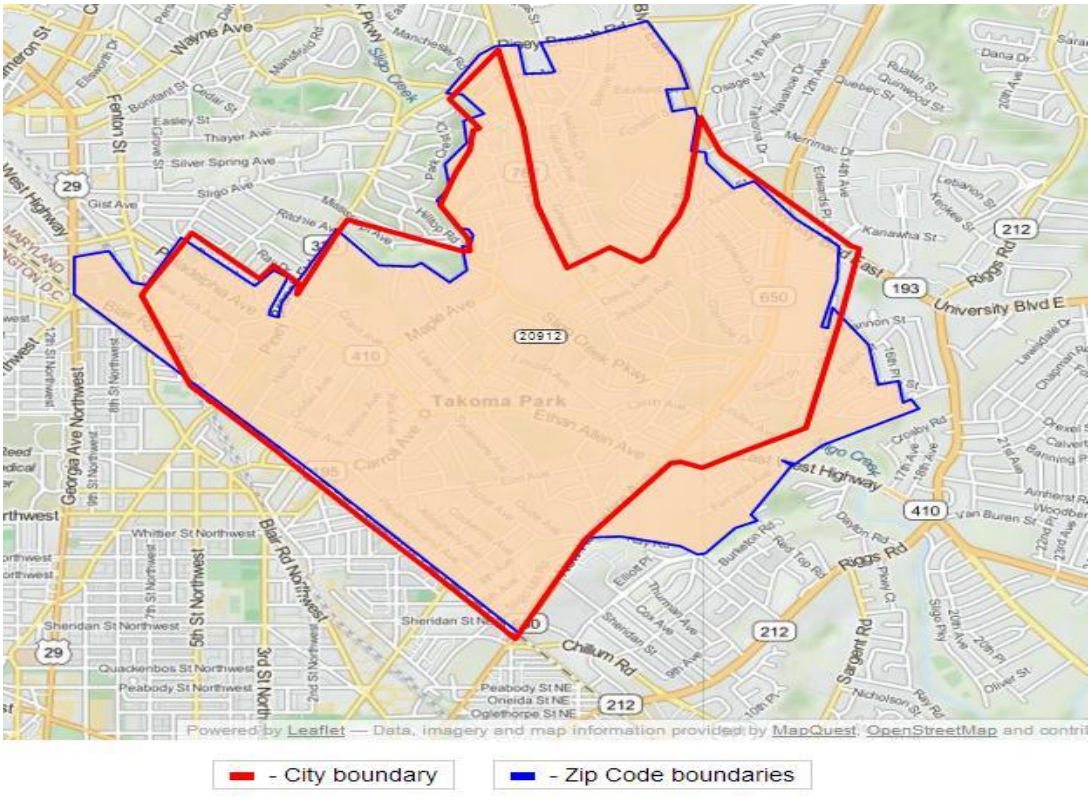


Figure 7. Comparison of ZIP Code 20912 and City Boundary3

[3] City Data, http://www.city-data.com/zipmaps/Takoma-Park-Maryland.html

The team collected electricity consumption data at a higher resolution using ZIP+4 codes. This was accomplished using an address list from the City's geographic information system (GIS) and a third-party provider that attached ZIP+4 codes to the provided addresses. This list of ZIP+4 codes was then provided to Pepco to query consumption for an area that more closely matched the City's boundary.

The emission factors for electricity consumed in Takoma Park were determined by reviewing reports to the State of Maryland by Pepco. Twice annually Pepco produces a Maryland Environmental Information for Standard Offer Service Report, which documents the portfolio mix and GHG emissions intensity of electricity provided during the previous year. In conformance with the Protocol, the inventory does not include adjustments for renewable energy voluntarily purchased by Takoma Park residents and businesses, but the benefits of these purchases are addressed in Section 3.1.

The higher resolution data used in the updated inventory had a significant impact on the resulting consumption of electricity, particularly in the commercial sector where consumption was far lower than documented in the original 2000 GHG inventory.

Fuels Combusted in Stationary Equipment

Fuels combusted in stationary equipment include those used for heating homes, heating water, and cooking. In Takoma Park, the primary stationary fuels are natural gas and fuel oil. There is also a local co-op that provides dried corn for home heating and has a number of participants in Takoma Park. Emissions from these fuels are estimated from the quantity of fuel consumed and an emission factor associated with each fuel.

The quantity of natural gas consumed in Takoma Park was determined from queries of the utility billing records for the natural gas utility Washington Gas. Like electricity, the original inventory appears to have used ZIP code data for 20912 to estimate emissions for Takoma Park. Washington Gas was not able to provide consumption data based on ZIP+4 codes. Based on the ZIP+4 resolution analyses for electricity - which indicated that ZIP code-only data overestimated commercial sector consumption for Takoma Park - the consultant team sought an approach that achieved better resolution for natural gas data as well.

The higher resolution ZIP+4 electricity data from Pepco was used to build an estimate of natural gas consumption that better aligned with Takoma Park's boundary. The average natural gas consumption per residential and commercial account was calculated for each ZIP code in Takoma Park using data from Washington Gas. This average level of consumption per account was then applied to the counts of residential and commercial electrical accounts in each ZIP+4 code. While this method is imperfect since the relationship between electrical and natural gas meters is unknown and using the average value of consumption per account may not be representative of particular accounts in Takoma Park, it may be more representative of consumption in Takoma Park than using just the available data for the 20912 ZIP code.

Fuel oil data are difficult to collect because there are usually numerous fuel oil providers in the community. Instead, the consultant team used the fraction of homes in the community heating with fuel oil estimated by the American Community Survey of the U.S. Census and the average energy consumption per home in Takoma Park to estimate fuel oil consumption.

The corn heating co-op provided records of the weight of corn withdrawn from its Takoma Park bin.

On-road Passenger and Freight Motor Vehicle Travel

On-road passenger and freight travel includes personal, commercial, transit, and municipal vehicles that combust gasoline, diesel, or other fuels; or use electricity (like the Metro trains). By Protocol, the emissions associated with trips that occur entirely within Takoma Park are attributed 100 percent to Takoma Park's inventory. Those that cross the City boundary, either coming or going, are attributed 50 percent to Takoma Park's inventory (and 50 percent to the origin/destination). Trips that just pass through Takoma Park are not accounted for in Takoma Park's inventory because it is largely beyond Takoma Park's ability to influence these trips.

The approach to calculating transportation emissions varies depending on the data available in each community. In Takoma Park, the Household Travel Survey conducted by the Metropolitan Washington Council of Governments (MWCOG) in 2007 and 2008 was the best source of data available for estimating transportation emissions. The Survey sampled residents in the MWCOG region and documented the number of trips they made, their origin and destination, the length of the trip, and the mode of travel. Based on survey results, the consultant team extrapolated the vehicle miles travelled (VMT) by mode for Takoma Park and applied appropriate emission factors to estimate GHG emissions.

The MWCOG recommends a sample size of at least 400 households for statistically relevant results. Since only 125 households were surveyed in Takoma Park, the consultant team recommended that other similar communities be included in the analysis to increase the sample size. The values used in this estimate include other geographically small communities in the region with close proximity to a Metro stop. These communities were Hyattsville, North Kensington, Chillum, and Langley Park. The survey also represents only weekday travel patterns; therefore, adjustments were made using national data to estimate a typical weekend travel pattern. The mode split, based on total miles per mode, was estimated to be 10 percent train, 5 percent bus, 58 percent car, 27 percent van/truck, and 5 percent walk/bike. Only 2.4 percent of total miles traveled were for trips internal to Takoma Park; the remainder were internal-external or external-internal trips, of which only 50 percent of the associated emissions are attributed to Takoma Park. The Household Travel Survey accounts only for personal travel.

The team estimated commercial vehicle emissions based on the ICLEI-recommended approach for community inventories. This approach uses the number of jobs in truck-trip-generating sectors in Takoma Park relative to the total jobs in these sectors state-wide to attribute state-wide commercial vehicle emissions to Takoma Park. The U.S. Census data on jobs

by sector were used along with the State's estimate of commercial vehicle emissions in the Maryland Climate Action Plan: Maryland Department of Transportation Draft 2012 Implementation Plan.

Municipal vehicle emissions were estimated using the actual volumes of fuel consumed, provided by the City of Takoma Park.

Other sources of data and emissions factors used to calculate transportation emissions included the following:

- U.S. National vehicle Populations and Fuel Economies from the U.S. Department of Energy's (DOE's) Transportation Energy Data Book
- Emission factors for standard fuels (e.g., gasoline and diesel) from The Climate Registry
- Emission factor for the Washington Metro and the Washington Metropolitan Area Transit Authority from U.S. Department of Transportation, Federal Transit Administration, Public Transportation's Role in Responding to Climate Change

Treatment and Distribution of Potable Water and Wastewater

The Washington Suburban Sanitary Commission (WSSC) provides water and wastewater service to Takoma Park. Most of the emissions associated with treating and distributing potable water and wastewater are generated outside of Takoma Park's geographic boundaries. The Protocol requires, however, that Takoma Park attribute a portion of these emissions to its inventory to acknowledge the use of these services. The WSSC calculates a GHG inventory for its operations annually. These emissions were attributed to Takoma Park based on the ratio of Takoma Park's population to the total service population in WSSC's territory (less than 1 percent).

Generation of Solid Waste

The GHG emissions associated with solid waste relate to disposal and can include emissions generated from waste decomposing in a landfill, or from incinerating the waste. These emissions are usually calculated using an estimate of the amount of waste and an emission factor appropriate to the type(s) of disposal used.

The only solid waste generation data available for Takoma Park were for accounts served by the City of Takoma Park. This includes solid waste, recycling, and the City's pilot food waste collection program for single-family residences, some smaller multi-family properties, and the City's own municipal facilities. Solid waste quantities for the larger multi-family properties and commercial properties were extrapolated based on national average waste generation rates minus the data that were available.

All of Takoma Park's solid waste is incinerated at the Resource Recovery Facility operated by Covanta Montgomery, Inc. The emission factor for this facility was estimated using data reported to the U.S. Environmental Protection Agency (EPA) through FLIGHT – the Facility Level Information on Greenhouse Gases Tool. This factor represents the direct emissions that result

from burning waste at high temperatures. While the Protocol does not include the full life-cycle of waste management options, some emissions are reduced due to the electricity generated and the avoided emissions from recycling metals recovered through the incineration process.

The inventory also considered the potential for GHG emissions from the City's mulching efforts that capture locally generated yard waste and chip it for use in the community as mulch. The EPA's Waste Reduction Model (WARM) includes composting emission factors for emissions associated with transporting, managing, and applying composted material. While these factors vary from case to case, WARM indicates net carbon storage (a carbon sink) for composting of yard wastes.

APPENDIX D: Strategy Descriptions

Leverage Smart Meters

Pepco installed smart meters in Takoma Park in 2012 and provides access to customer electricity use on an hourly, daily, weekly, or monthly basis, with a 1 day delay, through the online My Account service. The City can encourage residents and business owners to access and review their utility data on Pepco's My Account and provide support for interpreting their data and determining next steps for reducing consumption. Evidence has shown that awareness of energy consumption can help consumers reduce their use.

Expand Carpooling and Car Sharing

Carpooling and car sharing are tactics to reduce vehicle miles traveled and associated greenhouse gas emissions. Carpooling is an established method for commuters to travel to work and reduce costs. Car sharing is a relatively new method that allows individuals to easily use a vehicle by the hour to run errands or go on a weekend day trip. Both transportation methods reduce greenhouse gas emissions and are already used by Takoma Park residents. The City can encourage residents and businesses to increase carpooling and car sharing by promoting them on a separate webpage on the City's web site. The web site can provide links to regional carpooling services, such as CommuterConnect, and also car sharing services such as ZipCar. Establishing reserved parking spaces throughout the City for exclusive use by carpooling and car sharing participants is another way to promote these transportation methods.

Directly Install Efficient Equipment and Offer Free Products

Programs under which businesses and residents directly install relatively low-cost efficiency equipment or make simple operational changes (e.g. CFL/LED light bulbs, wrapping water heaters, pipe insulation for water pipes, low-flow showerheads, low-flow faucet aerators, power strips, changing air filters, adjusting setpoints, etc.) have proven effective at reducing energy consumption. Pepco currently offers the Quick Home Energy Check-up and Small Business Program, which provide a base package of these installs at no charge to residential and commercial customers. Takoma Park could leverage these existing programs by:

- Coordinating volunteer groups to conduct outreach on the programs (e.g. door knocking in neighborhoods);
- Encouraging enrollment of groups of residents/businesses by geography to facilitate scheduling and more rapid response from Pepco;
- Augmenting direct install offerings from Pepco by offering customers additional equipment or equipment in other categories (e.g. programmable thermostats); and
- Providing follow-up to participating residences and businesses to encourage further implementation.

Facilitate Use of Property Tax Credits for Energy Efficiency Upgrades

Montgomery County provides property tax exemptions and credits for energy efficiency upgrades. Takoma Park could seek to pilot these processes with local businesses and residents in order to establish replicable processes and increase uptake of these credits. The Energy and

Environmental Design property credit provides a 10% property tax credit for 3 years for existing commercial buildings (over 10,000 square feet) that have been "extensively modified" and achieve a U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) rating for existing building operations and maintenance (EB O+M) rating of Gold. Buildings achieving Platinum ratings can receive a credit of 50% of property taxes and other credits are available for new construction and core & shell. The Renewable Energy (Energy Conservation Devices) property tax credit provides homeowners up to a $250 credit for purchasing and installing an energy conserving device (e.g. a more efficient room air conditioner would qualify but standard household appliances such as washer/dryer and refrigerators do not).

Building Energy Efficiency Process Coach

A Building Energy Efficiency Process Coach would work with residences, businesses and large institutions to reduce energy consumption. The Coach would recruit homeowners, businesses, and institutions to participate in the coaching program and work with participants during each step in the process toward improving energy efficiency and conservation. These steps could include requesting an energy assessment of their home or building, reviewing energy savings options to implement, working with a building contractor (if necessary), determining rebates and other incentives to reduce the cost of projects, and helping fill out paperwork for rebates and other assistance. A pilot project called STEP-UP has been successfully implemented in nearby University Park that demonstrates increased participation in energy efficiency upgrade programs for residences by having a dedicated coach work directly with homeowners.

Have the City Lead by Example

The City of Takoma Park has completed a number of sustainability-related projects including a "green" Public Works building, significant installations of roof-top solar panels and the purchase of renewable energy. The City would continue the practice of leadership by example by engaging the City organization in the strategies proposed in the plan (e.g. direct installs of energy efficiency technologies, participating in the tiered performance program, etc.). These activities, in addition to planned energy assessments and upgrades to City facilities, would help demonstrate benefits to and for the community. The City could also consider implementing an enterprise energy management system software package to better track resource consumption and measure benefits of the City's actions.

Encourage Multi-family Building Efficiency

About 50 percent of Takoma Park's households are comprised of multi-family units. Energy efficiency efforts in multi-family buildings can be challenging because of the complexity of ownership structures and responsibility for paying utility costs. Effective programs in multi-family energy efficiency have provided both owners and tenants a one-stop shop for the whole process of increasing building efficiency. Takoma Park could serve as the one-stop shop and knit together a number of utility, Montgomery County, and state programs that support multi-family building efficiency. A roadmap for supporting a customer of the one-stop shop could include helping in the following ways:

- Facilitate an energy assessment. This step appears to be a gap in current utility program offerings that Takoma Park could fill by coordinating and potentially funding an assessment. Funding could be contingent on property owner commitment to fund upgrades to a certain level.
- Coordinate tenant participation in Pepco's Quick Home Energy Check-up to achieve immediate savings from direct installs of energy efficient equipment.
- Coordinate training of building manager or engineer in energy efficiency to create an on-site champion for efficiency. Pepco's Operations & Maintenance Training program will fund a large portion of training costs in a number of recognized certifications.
- Assist owner and tenants with accessing rebates from Pepco's Multi-Family Properties program.
- Provide long-term assistance and technical support for energy efficiency implementation, recommissioning, and capital equipment replacement.
- Develop property labeling program to help potential tenants understand the level of energy efficiency upgrades at a property (e.g., unit level low-cost improvements, appliance upgrades, central system, and building envelope upgrades).
- Assist with mechanisms that may help to defray costs and establish payback for building ownership, such as the County's existing property tax exemption offering for affordable housing (PILOT) or energy efficiency rent increase petitions for rent-controlled housing.

Develop a Commercial/Institutional Voluntary Tiered Performance Program

Much like a residential voluntary tiered program, a commercial and institutional program would establish tiers or categories of potential sustainability actions from which businesses could choose. For each potential action the program could provide resources and technical support. To drive participation and adoption of the actions, the program could encourage businesses to set goals, pledge to complete actions and report on progress. Challenges, or friendly competitions, could also be instituted between businesses and commercial areas in the community. Such a program could also include sustainability actions other than those related to building energy and transportation, such as low-impact landscape maintenance and stormwater best practices.

Develop a Residential Voluntary Tiered Performance Program

A residential voluntary tiered program would establish tiers or categories of potential sustainability actions from which households could choose. As households completed actions they would advance into higher tiers, and for each potential action the program would provide resources and technical support. To drive participation and adoption of actions, the program would encourage households to set goals, pledge to complete actions and report on progress. Challenges, or friendly competitions, could also be instituted between households, blocks and neighborhoods. The program would seek to leverage the strong community and peer-to-peer relationships in Takoma Park. Such a program could also include sustainability actions other than those related to building energy and transportation, such as low-impact landscape maintenance and stormwater best practices.

Purchase Renewable Energy

In Maryland's deregulated electricity market, consumers have a choice between many electricity suppliers (over 30 for residential and over 70 for commercial). Pepco provides electricity distribution and will supply electricity for consumers that do not choose a different supplier. By selecting a different supplier residents and businesses in Takoma Park have the opportunity to pick a supplier that has a greater percentage of renewable energy in their portfolio and/or one that purchases renewable energy credits to reduce the contribution of their electricity supply to greenhouse gas emissions. In 2012, Takoma Park's residents and businesses purchased an estimated 3-4 percent of total electricity consumed in the community from Clean Currents, just one supplier of green energy available in Takoma Park. This strategy evaluates the benefits of more residents and businesses purchasing renewable energy individually or through a bulk purchase at a lower rate facilitated by the City.

Encourage Community Solar Projects

Takoma Park has a very dense urban forest and tree canopy that provides significant shading and reduced building cooling requirements but also prevents many residents and businesses from installing solar photovoltaic (PV) systems on their homes and buildings. Community solar options, such as co-op projects, provide an alternative for residents and business owners to purchase renewable energy. A co-op forms a legal entity, such as an LLC, and members buy shares like they would invest in stocks. The co-op identifies a suitable location for a PV system and negotiates with the owners to establish a power purchase agreement (PPA) to purchase the electricity produced. The co-op receives revenue from the electricity sold through the PPA and the sale of renewable energy credits (SRECs). The LLC can also take advantage of the 30 percent federal tax credit and depreciation.

The City can encourage community solar projects by educating residents on the process, providing contacts and resources, acting as a catalyst to help build support and find residents interested in participating, providing land for a project, and supporting negotiations with solar project developers and building owners that have suitable land, roofs, or parking lots. Potential sites in Takoma Park could include roof-tops of commercial buildings at Langley Crossroads, of a church, or of a larger multi-family building.

Other potential options to consider are listed below:

1. Legislative changes – Legislation will likely be introduced again this year proposing to mandate virtual net metering, which would greatly simplify the process of implementing a community solar project often referred to as a solar garden. Virtual net metering allows members to buy into a remotely located solar project and have the net metering virtually connected to their bill.
2. Clean Energy Collective (CEC) model – CEC started doing community solar projects in Colorado and developed a financing/business structure and software to work with utilities and implement virtual net metering even if it is not mandated by law.

3. Local electricity provider – Providers such as Clean Currents could be encouraged to provide local solar as one of their product offerings even if it is at a premium cost.

The next step would be to form a core group of residents and City staff to further investigate the options and determine which one(s) to pursue.

Provide Sustainability Guidelines for Redevelopment

Takoma Park has two large commercial zones, New Hampshire Avenue and Langley Crossroads, where planning is underway for to guide future redevelopment. While the City does not have much direct influence on the redevelopment of these areas, they can encourage green building practices by directly reaching out to developers. Under this strategy the City would suggest green building guidelines, streamline the process for the property tax exemption for earning the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) certification (a separate strategy) and potentially offer incentives for improvements that exceed building code requirements.

Develop a Transportation-specific Community Challenge

Under this strategy Takoma Park would host a "transportation" challenge to encourage friendly competition to reduce driving and increase use of transit, biking, and walking. Initiating such a challenge would educate the public, engage drivers in behavior change, and reward high performers. It also would bring people together around a common goal through team participation, either by neighborhood, employer, district, or other segment of the community. By establishing a transportation challenge that encourages drivers to reduce and record the number of car trips they make in a specified time frame and offering incentives and public recognition, Takoma Park could eliminate an estimated 5,000 trips and 30,000 vehicle miles traveled annually.

Expand Capital Bike Share Stations

Capital BikeShare stations offer automated, low cost bike rentals as a transit option for short one-way or round trips, both personal and work related. Bicycling reduces and shifts vehicle miles traveled from driving and reduces greenhouse gas emissions. Four stations will be installed in Takoma Park late in 2013, with equipment expected to be delivered in September. Takoma Park can encourage use of BikeShare by conducting outreach in the community and targeting projects to increase the effectiveness of the system (e.g., Bike Takoma Park maps at stations, infrastructure projects to increase connectivity between stations, etc.).

Establish a Circulating Shuttle

This strategy would entail implementing a small (25-passenger) alternative fuel circulating bus to supplement Ride On bus and Metrorail services and to fill the gap of service in, around, to, and from major activity centers and high-density neighborhoods in Takoma Park. This strategy could reduce an estimated 70,000 vehicle miles related to short, internal trips by single-occupant vehicles in Takoma Park. The service would have a high- frequency schedule with minimal headways (10 to 15 minutes) and regular and circular routing to maximize benefits and

convenience. While not projected to be self-sustaining financially, this service would enhance and encourage public transit use, reduce parking and traffic congestion, and create a greater sense of community.

Expand Mobilization and Outreach for Sustainability

This strategy would also support all other plan strategies by increasing outreach to and mobilization of residents and businesses to engage in implementation and action. Outreach efforts would be expanded using channels such as the City's web site, living room chats, community programs, business and professional associations, landlord and tenant associations, and community events and tours. It would also include increased relationship building with key stakeholder groups and organizations, from neighborhood and homeowner associations to multi-family housing organizations, K-12 schools and colleges, the real estate industry, and business associations and property owners.

Establish a Carbon Tax

A carbon tax may be an option to raise additional funds for Takoma Park's sustainability efforts, though a means of implementing such a tax within Takoma Park's authority is not apparent at this time. One model, which has been implemented in Boulder, Colorado, is a tax levied, with the cooperation of the electric utility, on the consumption of electricity by residences and businesses. While Boulder's tax is not designed to be "revenue neutral" - reducing other taxes to offset the increase in electricity costs – the revenue generated is utilized to provide programming in the community which helps to reduce utility costs for participating residences and businesses.

APPENDIX E: Strategy Evaluation Assumptions

Existing programs and polices are listed first, through Existing Purchases of Renewable Energy, and then the strategies listed by order of evaluated cost effectiveness.

Existing Programs and Policies

- **Existing Building Energy Code (IECC 2012)**
  - 87 kBtu/sqft average existing EUI based on City of Boulder Code work
  - 60 kBtu/sqft 2012 IECC commercial building EUI, Boulder Code work and Comparative Analysis of Prescriptive, Performance-Based, and Outcome-Based Energy Code Systems - Alaska Housing & Cascadia, http://www.ahfc.us/files/9013/5754/5384/cascadia_code_analysis_071911.pdf
  - 50% electricity, 50% natural gas assumed elect/natural gas split of EUI, Boulder modeling
  - 320,000 square feet new or remodeled in New Hampshire Avenue Corridor from Corridor Concept Plan
  - 480,000 square feet new or remodeled in Langley Crossroads from Crossroads Sector Plan
- **Maryland Renewable Portfolio Standard (RPS)**
  - 5.7% renewable energy in Pepco Standard Offer portfolio in 2013
  - Increase to 20% renewable energy in 2022 according to RPS
  - Added renewable energy is zero or near-zero carbon
- **Federal Fuel Economy Standards (CAFE)**
  - 2010 fleet fuel economy 23.0 miles per gallon (MPG) for cars, 17.1 MPG for small trucks from Transportation Energy Data Book, Oak Ridge National Laboratory
  - 2012 new vehicles 29.7 MPG, 2025 requirement of 54.5 MPG from National Highway Traffic Safety Administration
  - 6% of existing fleet is replaced with new vehicles each year, estimated from data in Transportation Energy Data Book
- **Existing Purchases of Renewable Energy**
  - 3,000,000 kWh purchased from Clean Currents in Takoma Park
  - Assume that Clean Currents holds 75% of renewable energy purchase market
  - Likely a conservative estimate of total purchases in Takoma Park

Assumptions for Specific Strategies

- **Leverage Smart Meters**
  - 1.0% electricity savings from behavior change (conservative relative to providers such as Opower)
  - Includes residential and commercial
- **Expand Carpooling / Car Sharing**
  - Assume $5,000 annual combined cost for carpool and car share program after first year
  - Carpool
    - Assume 1.46% of residents move to carpooling, which is half the 2.9% increase modeled in Reason.org study of metro DC. The study authors also said the 2.9% was unfeasible unless a drastic rationing of fuel occurred within timeframe of study. Half their estimate seemed more reasonable.
    - A 0.6% reduction in VMT, which is also half the Reason.org studies 1.1% reduction
    - Annual savings from carpooling based on calculation done in rideshareonline.com's calculator
  - Car sharing
    - Average reduction in GHGs due to car sharing comes from Mineta Transportation Institute's Greenhouse Gas Emission Impacts of Carsharing in North America report
    - Assumption of percentage of Takoma Park residents using car sharing is double the national average from Rand Corp. study
    - Annual savings from using car sharing comes from Nelson/Nygaard's report
- **Directly Install Efficient Equipment and Offer Free Products**
  - Residential savings of 578 kWh and 8 MCF per household from Home Energy Squad, ACEEE Leaders of the Pack
  - Commercial savings of 7,500 kWh and 165 MCF per business from PRPA Efficiency Expre$$ Commercial Energy Implementation Program
  - $215 per household installed cost from Home Energy Squad, assumed to be covered 80% by Pepco's existing direct install programs
  - Estimated program cost of $1,800 per business based on PRPA Efficiency Expre$$ and including adjustments for existing program components that Pepco may provide. Participant cost estimated at $600 per business based on PRPA Efficiency Expre$$.
- **Facilitate Use of Property Tax Credits for Energy Efficiency Upgrades**
  - Existing Montgomery County tax credits
  - Commercial tax credits for building to LEED standards:
    - Average cost per square foot for upgrading and certifying LEED for existing buildings from Continental Automated Buildings Association's The Economics of LEED for Existing Buildings for Individual Buildings

        - The average utility cost for LEED EB certified buildings is 16% less than for standard buildings
        - Property tax credit is only available for commercial buildings over 10,000 square feet, which is about 18 buildings in Takoma Park
        - Assume 7, or ~40%, of eligible commercial buildings take advantage of the program by 2030
    - Residential tax credit for installing an energy conserving device
        - Assume 17%, or 43 each year, of residences take advantage of program by 2030.
- **Building Energy Efficiency Process Coach**
    - Assume 10 year life of program
    - Residential
        - Targeted savings is 10%, which is a more conservative estimate than from STEP-UP program in University Park
        - Average household costs and available rebates taken from information for STEP-UP program in University Park
        - Assume between 2.5% and 3% of residences join program annually after first year
    - Commercial and Institutional
        - Energy use averages for institutional (educational and hospital) taken from the Energy Information Administration's Commercial Buildings Energy Consumption Survey
        - Targeted savings is 10%, assumed the same as for residential
        - Implementation cost data taken from Pike Research's Energy Efficiency Retrofits for Commercial and Public Buildings report
        - Assume 2% of commercial buildings join program annually after first year
        - Assumes there are only three institutions in Takoma Park and each one joins the program within the first three years of the program
- **Have City Lead by Example**
    - City achieves stated goal of 15% energy consumption reduction by 2020
    - Average payback of implemented measures is 5 years
- **Encourage Multi-family Building Efficiency**
    - Energy savings per unit is 205 kWh and 76 therms based on the Energy Savers program, administered by CNT and acknowledged by ACEEE Leaders of the Pack
    - Implementation cost per unit is $750 from Energy Savers
- **Establish a Commercial Voluntary Tiered Program**
    - 1.3 MTCO2e reduction per participating business based on City of Fort Collins Climate Wise program. Adjusted for lower solid waste and electricity emission factors in Takoma Park.
    - 50% of reductions accrue from year-to-year (e.g. energy efficiency) and 50% are one time annual reductions such as renewable energy purchases
    - Assumes $450/MTCO2e based on City of Fort Collins Climate Wise program

- **Establish a Residential Voluntary Tiered Program**
  - Could contain a variety of tiered requirements. Assumes for now components of other strategies included in plan.
  - Strategy adoption rates for program participants include 10% for Building Energy Efficiency Process Coach, 100% Leverage Smart Meters, 10% Property Tax Credit, and 50% Purchase Renewable Energy.
- **Purchase Renewable Energy**
  - An additional 0.5% of total electricity consumption purchased from renewable energy sources each year for 10 years.
  - Cost based on rates for Clean Currents Neighborhood Wind program
- **Encourage Community Solar Projects**
  - 50 kW system size
  - $4.00/watt installed cost, assumes PV system is bought upfront and not leased, DOE Tracking the Sun report
  - $60/kW, MEA Small Commercial Clean Energy Grant Incentives, http://energy.maryland.gov/Business/cleanenergygrants/index.html
  - $130/MWh, 2013 SREC price, An SREC represents the environmental attributes associated with 1,000 kilowatt-hours of generated solar power
  - 15% annual decrease in SREC price, adjusted so that 2020 price is <$50 based on info from David Brosch about declining schedule
  - 30% federal tax credit
  - PPA pricing assumes $0.01/kWh less than retail rate
  - $10,000 in City of Takoma Park program/support cost
  - Potential land/roof lease cost not included
- **Provide Sustainability Guidelines for Redevelopment**
  - Assumes impact on 200,000 sqft of commercial redevelopment that voluntarily adopts
  - 60 kBtu/sqft EUI for baseline 2012 IECC commercial building based on City of Boulder work
  - 10% reduction in energy beyond 2012 IECC code assumed
  - 50% electricity, assumed electricity/natural gas split of EUI based on Boulder modeling
  - 2% increase in construction costs based on City of Boulder work and other studies
  - $225/sqft baseline construction costs based on City of Boulder
- **Transportation Challenge**
  - Based on 5-year outcomes from Salt Lake City Clear the Air program
  - Results adjusted to reflect Takoma Park population and shorter trip distances, as well as slightly increased engagement in community
- **Expand Capital Bike Share**
  - Projections based on CapitalBikeShare survey data (43% response rate) and availability of new stations in and near Takoma Park
  - Data indicated percent use for personal trips, one-way, commute or combined with transit

    - Data also included average driving reduction miles by members, as well as personal travel cost savings averages
    - Cost data based on proposed station construction and layout
- **Establish a Circulating Shuttle**
    - Projections based on Washington DC Circulator study and Bethesda Circulator data
    - Used data from household internal trip survey to estimate number of potential internal trips
    - Costs based on DC and Bethesda and scaled for Takoma Park population and trip survey, as well as regional vehicle cost data
- **Expand Mobilization and Outreach for Sustainability**
    - No direct benefits attributed
    - $10,000 budget for developing and distributing outreach materials
- **Carbon Tax**
    - Carbon tax revenue based off of City of Boulder's Climate Action Plan tax (i.e. carbon tax)
        - $0.0043/kWh for residential customers
        - $0.0009/kWh for commercial customers
        - Implementation cost based off of Boulder's utility provider charging a 5% fee to collect tax and disburse to Boulder

Table 6. Summary of Proposed Strategies

Strategy	Sector(s) Impacted	Timeframe	Penetration/ Participation Rates (year 1 / full implementation)	Annual GHG Emissions Impact (MTCO2e in 2030)	Human Health Impacts	Livability Impacts	Average Annual Program Cost through 2030 ($)	Average Annual Private Cost through 2030 ($)	Average Annual Private Savings through 2030 ($ Savings)	Cost Efficiency (Cumulative $ Net Cost/MTCO2e through 2030)	Staff Resources (FTE at full implementation)	Social Justice Implications	Priority Votes (from Open House)
Leverage Smart Meters	All	Immediate	5% / 55% of all electric accounts	200	n/a	n/a	Included in Outreach and Mobilization	$0	$48,000	($310)	Included in Outreach and Mobilization	Requires internet access	0
Expand Carpooling and Car Sharing	All	1-2 years	15 / 260 regular carpoolers 25 / 400 regular car sharers	250	Reduced local pollution	Reduced traffic	$6,000	$0	$44,000	($290)	Included in Outreach and Mobilizaiton	n/a	1
Facilitate Use of Property Tax Credits for Energy Efficiency Upgrades	Commercial, residential	< 1 year	0 / 4 commercial buildings LEED EB O+M 40 / 470 residences	300	Reduced local pollution	Increased employer recognition of sustainability	Included in Coordinator/Coach	$40,000	$50,000	($270)	Included in Coordinator/Coach	Residential credit may cover full cost of device	2
Directly Install Efficient Equipment and Offer Free Products	Residential, commerical	1-2 years	200 / 2,100 residences 13 / 125 businesses	2,800	Reduced local pollution	n/a	$30,000	$16,000	$420,000	($250)	0.1	Very low cost to participant because of leveraged utility programs	4
Building Energy Efficiency Process Coach	All	< 1 year	40 / 1,000 residences 5 / 100 businesses 3 institutions	2,400	Reduced local pollution	More comfortable and productive residences and workplaces	$20,000	$140,000	$550,000	($200)	1.2	Target outreach and incentives for low-income	3
Encourage Multi-family Building Efficiency	Multi-family	1-2 years	40 / 1,300 units	1,300	Reduced local pollution	Increased comfort	$50,000	$0	$150,000	($170)	1	Requires closer examination of cost to individual tenants	7
Have the City Lead by Example	Municipal	Immediate	n/a	100	Reduced local pollution	n/a	$5,000	n/a	$14,000	($170)	Assumed to be undertaken by existing staff	n/a	2
Establish a Commercial Voluntary Tiered Program	Commercial, institutional	1-2 years	30 businesses / 70 businesses	600	Reduced local pollution	Increased employer recognition of sustainability	$10,000	$34,000	$91,000	($160)	1.1	Include low- and no- cost actions in tiers	4
Encourage Community Solar Projects	All	1-5 years	50 kW of new solar capacity	20	n/a	n/a	Included in Outreach and Mobilization	$8,600	$9,200	($20)	Included in Outreach and Mobilization	First costs are prohibitive for many	8
Establish a Residential Voluntary Tiered Program	Residential	1-2 years	50 / 450 residences	1,500	Reduced local pollution	Increased resident recognition of sustainability	$10,000	$17,000	$15,000	$10	1.7	Include low- and no- cost actions in tiers	4
Purchase Renewable Energy	All	Immediate	Additional 5% of electricity purchased from renewable suppliers	3600	n/a	n/a	Included in Outreach and Mobilization	$170,000	$0	$70	Included in Outreach and Mobilization	Increased electricity cost may not be feasible	3
Expand Capital Bike Share Stations	All	<1 year	45% increase in bike trips over 4 years	160	Reduced local pollution, health benefits of cycling	Reduced traffic	$69,000	$0	$53,000	$140	Any requirements are already covered	Fees may be cost prohibitive	0
Provide Sustainability Guidelines for Redevelopment	Commercial	1-5 years	~10% of existing commercial floor space	100	Reduced local pollution	Building occupant comfort	Negligible	~2% increase in building costs	$31,000	$210	Negligible	n/a	0
Initiate a Transportation Challenge	All	1-2 years	500 / 550 participants	10	Reduced local pollution	Reduced traffic	$12,000	$0	$5,800	$490	0.2	n/a	0
Establish a Circulating Shuttle	All	1-5 years	150 / 180 daily ridership	10	Reduced local pollution	Convenience	$58,000	$82,000	$5,100	$12,000	Included in the Program and Private (Fare) Cost	n/a	6
Expand Mobilization and Outreach for Sustainability	All	< 1 year	n/a	Indirect	Indirect	Indirect	$10,000	Indirect	Indirect	n/a	0.4	Outreach can be targeted to underserved and low-income populations	1
Establish a Carbon Tax	All	Unknown	All residents and businesses	Indirect	n/a	n/a	Unknown	$190,000	$0	n/a	Unknown	Would impact lower income households more significantly	1