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Policy Note

Economic Benefits of Baltimore's Climate Action Plan[1]

A preliminary analysis using the Genuine Progress Indicator

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Overview

In November 2012 the City of Baltimore Climate Action Plan (CAP) was officially adopted by the Planning Commission.[3] With that action and previous commitments made by way of the Baltimore Sustainability Plan the City joined the ranks of 450 units of local government across the nation taking actions to mitigate and prepare for climate change.[4] By all accounts, climate change is likely to impose enormous costs on Baltimore in the form of increases in infrastructure damaged or lost by floods and sea level rise, severe weather, forest and wetland loss, loss of fish and wildlife populations, contamination of water, heat related illnesses and risks to key economic sectors including tourism, shipping, and housing.[5] Economic costs are projected to be well over $1 billion per year by mid-century.[6]

Baltimore's CAP is designed not only to diminish the City's contribution of greenhouse gas (GHG) emissions to the atmosphere but also help the City become more resilient to climate change and thereby reduce the magnitude of these potential costs. Baltimore's CAP includes 37 distinct measures grouped into 13 strategies that fall into three overriding goal areas: energy savings and supply, land use and transportation, and growing a green city. While the impacts of the CAP on GHG emissions are fairly well understood, the economic benefits of implementing the CAP have yet to be addressed in any formal way. This report provides a preliminary assessment using the Genuine Progress Indicator (GPI) as a framework.

The GPI was first adopted by Maryland in 2010 as a measure of sustainable economic wellbeing, and is now being developed for use at the county and municipal level. The first iteration of Baltimore's GPI is now available and served as the basis of our analysis. Baltimore's GPI accounts for the benefits of household spending, infrastructure, unpaid labor, parks and open space, as well as the costs of income inequality, pollution, and social costs like unemployment and homelessness. After determining all the ways Baltimore's CAP could enhance the GPI, we quantified those effects that could be with readily available data. By doing this, we found:

- Once fully implemented, Baltimore's Climate Action plan is likely to generate a significant boost to the City's GPI. Annual benefits are likely to range between $548 million and $720 million per year, an increase of 4 to 5% over a business as usual scenario. This means that if the CAP were in place today, Baltimore's GPI could rise from $13.94 billion to as much as $14.66 billion each year.

[3] City of Baltimore. 2013. Baltimore Climate Action Plan (CAP). Available online at: http://www.baltimoresustainability.org/climate-action-plan.

[4] The International Council for Local Environmental Initiatives (ICLEI) maintains the most up to date registry of state and local governments leading the way on sustainability and climate action. Currently, ICLEI has 450 member counties, cities, and towns in the US. See: http://www.icleiusa.org/about-iclei/members.

[5] Center for Investigative Environmental Research. 2008. Climate Change Impacts on Maryland and the Cost of Inaction. College Park, MD: CIER, University of Maryland.

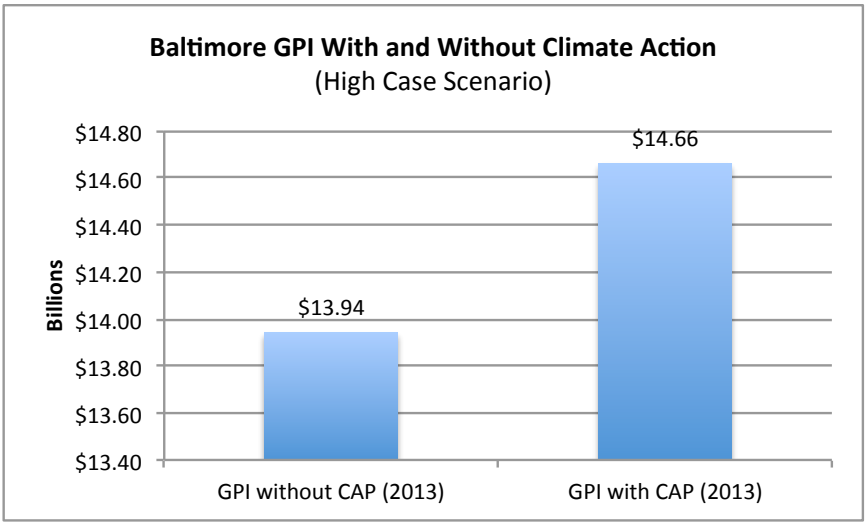
[6] According to estimates by the Rhodium Group for the Risky Business Project, climate costs in Maryland are likely to be 2-3% of gross state product by mid-century. The $1 billon figure for Baltimore is at the very low end of projections. See: Rhodium Group. 2014. American Climate Prospectus: Economic Risks in the United States. New York: Rhodium Group, LLC.

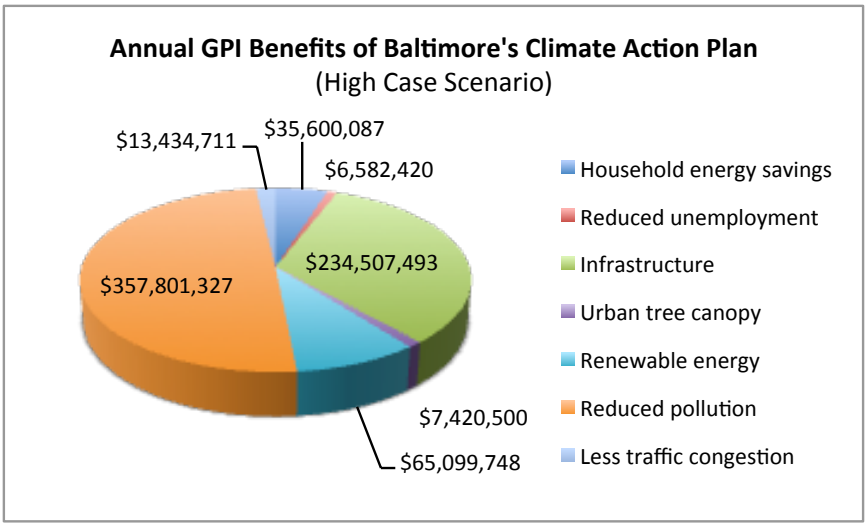
- The most significant benefits will be generated by the reduced costs of greenhouse gas emissions and associated air and noise pollution. These benefits are likely to amount to nearly $358 million per year. Air and noise pollution benefits will be associated with a 25% reduction in vehicle miles traveled.

- New transportation, water, and household infrastructure in the form of cool rooftops, solar panels, efficient appliances, weatherization, energy saving streetlights, bike lanes, and electric vehicles will generate between $129 million and $235 million in benefits per year.

- Income freed up by energy savings as well as income generated by new jobs will boost Baltimore's GPI by $19 million to $36 million each year. New jobs will help push down the costs of underemployment by nearly $6.6 million.

- Other significant annual benefits will be associated with decreased dependence on fossil fuels ($17 million - $65 million), less traffic congestion ($13 million) and an enhanced urban tree canopy ($5.9 million - $7.4 million).





What is the Genuine Progress Indicator?

The GPI is measure of economic wellbeing that takes into account the benefits of economic activity as well as the social and environmental costs it creates for households and communities. The GPI was first published in the late 1980s and has been vetted in the scientific literature since that time.[7] While the original scope of the GPI was for use at the national level, new methods and sources of information have now made it possible to calculate the GPI at the state and local level. As such, the GPI can provide a way for governors, mayors, and state and local agencies to monitor economic performance and assess the impacts of budget decisions, land use plans, infrastructure investments, and many other policy decisions. The GPI measures economic wellbeing by considering three major factors, including:

1. Economic benefits we receive from consumption of goods and services.
2. Economic benefits we receive from social and community assets like neighbors helping neighbors, public parks, and infrastructure.
3. Economic costs that are often hidden from view. These include the costs of environmental degradation, social costs like unemployment, homelessness, poverty and crime, and spending on items like insurance that are not actually consumed.

Working in collaboration with the Baltimore Sustainability Commission and other stakeholders, Center for Sustainable Economy (CSE) has completed the first iteration of GPI accounts for the City.[8] The Baltimore GPI accounts consist of 12 aggregate indicators that fall into each of the three categories of economic wellbeing discussed above. The initial accounts indicate that on a per capita basis, Baltimore's GPI has risen by over 5% between 2012 and 2013 and now stands at approximately $22,000. This is just 36% of the regions' per capita GDP, which underscores the fact that GDP greatly overstates economic wellbeing because of its failure to address inequality or the social and economic costs of economic growth.

How Does the Climate Action Plan Affect the GPI?

Baltimore's Climate Action Plan can influence the GPI in a number of ways. As investments in energy efficiency and renewable energy are made, households save money on their electricity and gas bills and reduce the amount of energy going up the chimney or out the windows and doors as waste. This frees up money to be spent on consumer goods and services that provide direct benefits to households. It also creates jobs and new income for the community because spending on non-energy goods and services tends to create more jobs per dollar spent.[9] New jobs in turn reduce the costs of underemployment and unemployment.

As public and household infrastructure is made more efficient and modernized, it enhances the annual value of services this infrastructure generates. For example, as houses are

[7] Daly, Herman and John Cobb Jr. 1989. For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future. Boston: Beacon Press.
[8] Talberth, John and Michael Weisdorf. 2014. Economic Wellbeing in Baltimore: Results from the Genuine Progress Indicator 2012-2013. Washington, DC: Center for Sustainable Economy. Available online at: http://sustainable-economy.org/solutions/baltimore-genuine-progress-indicator/.
[9] American Council for an Energy Efficient Economy (ACEEE). How Does Energy Efficiency Create Jobs? Available online at: http://www.aceee.org/blog/2011/11/how-does-energy-efficiency-create-job.

weatherized, it makes heating and cooling far more efficient and effective. Under the CAP, new infrastructure investments will include a wide range of energy-saving infrastructure solutions such as electric vehicles, cool roofs, weatherization, solar water heaters, photovoltaic systems, composting units, LED street lights, bike lanes, and repairs to leaky water mains. The GPI counts the value of services from these new investments.

The GPI also counts the value of the services provided by nature – so called ecosystem services. These include heating and cooling provided by shade trees, clean water filtered by intact forests, wetlands, ands stream corridors, and scenic values provided by open space. Measures carried out to achieve the CAP's land use and transportation goals will enhance the urban tree canopy and create more green space. As such, the value of the ecosystem services provided by these measures will be reflected in a higher GPI.

The GPI will also be improved by increasing Baltimore's reliance on renewable energy and decreasing reliance on fossil fuels. In the GPI framework, depleting nonrenewable energy resources creates costs that eventually have to be borne by future generations as they pay for the technologies needed to switch from coal, oil and gas to cleaner forms of energy. So as consumption of fossil fuels decreases, these costs go down and the GPI rises.

The GPI will also rise as the CAP helps reduce the costs of pollution. Obviously, the costs of greenhouse gas pollution will fall. But in reducing the use of fossil energy and reducing the number of cars on the roads, other forms of air pollution will fall as will noise pollution – the latter related to the CAP's goal of reducing vehicle miles traveled by 25%. Another side benefit of reducing the number of vehicles on the roads is less traffic congestion, and lower costs of commuting because commuters' vehicle related costs (fuel and depreciation) would decline.

These are just some of the linkages between the CAP and the GPI. They have been highlighted here because there is fairly good data linking the two and fairly concrete CAP goals that we can translate into GPI benefits. As implementation of the CAP becomes more refined and as quantitative targets are set for measures that are now discussed qualitatively –like high quality pedestrian and transit oriented neighborhoods – it will be possible to quantify additional GPI benefits.[10]

Methods, Data, and Results

This section provides a brief overview of the steps CSE used to put preliminary figures on the CAP benefits discussed above. Technical details are available in a spreadsheet posted along with this report on the CSE website. As an overall method, CSE estimated what the GPI would be today if all the CAP measures were already in place. What this does is sidestep the economic benefits that may be generated in the short term – such as the new jobs and income associated with building new infrastructure. Instead, we concentrate on more permanent, longer-term effects.

It should also be noted that without more precise implementation data for the CAP, the analysis was limited to just those measures in the CAP that were quantified. There are many other elements of the CAP that are discussed only in general terms, but when they are refined, the analysis of GPI benefits can be revisited.

Details of the benefit calculations are as follows:

[10] CAP measure LUT 1A.

1. Benefits associated with energy savings

According to the latest GPI update for Baltimore, on average, households spent $1,283 on electricity and $433 on gas in 2013. Due to inefficient appliances, lack of insulation, and lack of weatherization, a significant portion of this money is wasted since some of the energy is not actually consumed. As efficiency improves, less money is wasted and available to be spent on consumer goods and services that generate GPI benefits. To model these benefits, we assume that the CAP's energy savings goals for household electricity (7-16%) and gas (14-42%) provide a proxy for how much energy is now wasted.[11] If these efficiency goals were met today for 24% of participating households (as assumed by the CAP) this would translate into additional household consumption expenditures on non-energy goods and services of between $11 million and $28 million each year.

This additional spending, in turn, helps create new jobs, new income, and yet more household spending. One recent study estimates that for every million dollars in spending diverted from energy to other goods and services, seven new jobs are created.[12] If this figure holds, it would mean194 new, long-term jobs created in Baltimore. At a median wage of $21.75 (the 2013 estimate from Bureau of Labor Statistics) this translates into roughly $8.8 million in additional income. Not all income is spent, and in the GPI calculations for Baltimore the share spent is roughly 90%. So the amount of new household spending generated by these new jobs would be roughly $7.9 million. All told then, the GPI benefits associated with energy savings are likely to range between $19 million and $36 million if the CAP were fully implemented today.

2. Reduced underemployment

Because the CAP will generate new, long-term jobs, it will help push down the social costs of unemployment and underemployment. In the GPI framework, these costs represent the "psychic" costs of being idle rather than working, and are a function of unprovided hours and foregone earnings. If 194 new full time jobs were created through energy savings we estimate the costs of underemployment in Baltimore would fall by nearly $6.6 million each year.

3. Benefits from new infrastructure

Because the CAP will require substantial new investments in transportation, household, and water infrastructure, the annual services generated by this infrastructure will rise. Using cost data from the Baltimore region and elsewhere, we were able to generate ballpark figures on overall investment costs for 12 CAP investments for which implementation targets have been quantified. These include home weatherization and energy efficiency, street light retrofits, cool roofs, photovoltaic systems, solar water heaters, home rehabilitation, new bicycle infrastructure, electric vehicles, composting units, water main repairs and home water efficiency fixtures and appliances. At current market prices, we estimate the overall costs of meeting targets for these measures to range from $681 million to $1.2 billion, excluding water main repairs. Water main

[11] In other words, if it is relatively easy given best available technologies to reduce gas consumption by 42%, then 42% of what is used now is needlessly wasted as is the money used to purchase it.

[12] ACEEE, Note 7. The figures represent the difference in jobs per million spent on the energy sector versus an average of all other industries.

repairs could cost another $3 billion according to published estimates for Baltimore.[13] However, these repairs are likely to be made to fulfill other regulatory obligations, and so cannot realistically be attributed to the CAP alone.

In Baltimore's GPI accounts, the value of annual services from infrastructure range from 20% of the capital stock for household capital and 7.5% of the capital stock for both water and transportation infrastructure. If the CAP were fully implemented today, the stock of household capital (e.g. solar water heaters, cool roofs) would rise by $623 million to $1.15 billion and the stock of transportation infrastructure (e.g. bike lanes, LED street lights) by $57 million to $60 million. This corresponds to an annual increase in infrastructure services of $129 million to $235 million.

4. Services from natural capital

The CAP calls for 75,000 new urban trees in place to help provide cooling and absorb carbon emissions.[14] Under land use and transportation goals, there is mention of new parks and open space associated with bike and pedestrian paths and mixed-use development. However, these are not quantified. So our analysis for now is limited to urban trees.

To put a value on the urban tree canopy, Baltimore's GPI uses the National Tree Benefit Calculator – a tool developed by Casey Trees and Davey Tree Expert Company that estimates the annual ecosystem services urban trees provide taking into account benefits associated with carbon sequestration, air quality, stormwater control, energy savings and property values.[15] To calculate the benefits of the 75,000 additional trees called for by the CAP, we multiplied this figure by low ($82) and high ($102) estimates for the annual ecosystem service values from small to mid diameter trees commonly used in Baltimore's tree planting programs (ash, sycamore, and oak). The results suggest natural capital benefits would range from $5.9 million to $7.4 million each year if these trees were already planted.

5. Reduced costs of nonrenewable energy depletion

Energy efficiency and conservation gains achieved through the CAP coupled with an increase in solar energy solutions will decrease Baltimore's consumption of nonrenewable energy from electricity and natural gas. Because the GPI's calculation of nonrenewable energy depletion costs is based on electricity consumption and transportation fuels, we did not address natural gas savings at this point – especially since there are other CAP measures that call for switching from heating oil to natural gas, making the impact ambiguous.[16] There are additional gains that can be achieved if the State's renewable energy portfolio is increased to 26%, but this would involve activities outside Baltimore's jurisdiction so we did not model this either.

To calculate the benefits of reduced nonrenewable energy use we calculated the kilowatt-hour (kwh) savings associated with the CAP's goal of reducing residential (7-16% reduction) and commercial (4.5-25.5% reduction) electricity use from the baseline consumption figures reported in the CAP. These kwh savings totals were then multiplied by the share of electricity in Maryland that is currently generated by nonrenewable sources (80%) and then by the GPI's

[13] This is the reported amount for the City's 10-year capital improvement program for water infrastructure.
[14] CAP measure GGC 3.A.
[15] The National Tree Benefit Calculator is available online at: www.treebenefits.com.
[16] CAP measure ESS 1.H.

replacement cost figure per kwh ($0.0875) to arrive at the final benefit figures. Depending upon how effective electricity savings measures are, annual GPI benefits will likely range from $17 million to $65 million.

6. Reduced costs of pollution

The CAP will reduce three primary forms of pollution tracked in the GPI framework: carbon emissions, carbon monoxide emissions, and noise. The social costs of carbon emissions in the GPI are priced at $111.02 per metric ton (MT-C). Baltimore's emissions are expressed in metric tons of carbon dioxide equivalent units (MT-CO2-e) and in 2013 were estimated at 7,243,173. Using standard conversion factors, this translates into 1,975,411 MT-C, a GPI cost of over $219 million. The CAP's goal is to reduce emissions to 892,256 MT-CO2-e, which translates into 243,343 MT-C and a residual carbon emission cost of roughly $192 million. The difference - $27 million – represents the carbon emission reduction benefits of the CAP if it were fully implemented today.

The CAP will also reduce vehicle miles traveled (VMTs) – an important factor in both carbon monoxide and noise pollution costs tallied by the GPI. The CAP includes 25% reduction targets for VMTs in the context of two measures: LUT 1.A (pedestrian and transit oriented neighborhoods) and LUT1.B (mixed use neighborhoods). It is unclear whether this target is citywide, or just for new development. But an overall reduction in VMTs citywide (and for the economy as a whole) would be in line with national aspirations, so we assume that this is the intent.

Baseline VMTs for each county in Maryland are estimated annually by the Maryland Department of Transportation.[17] In 2012, Baltimore VMTs were estimated to be 3,457,000,000, and based on recent trends, a little lower in 2013. We reduced the 2013 figure by 25% to model the benefits of achieving CAP goals. This reduction, in turn, reduced the amount of carbon monoxide emissions damage emitted by mobile sources from $141 to $105 million, implying a CAP benefit of over $36 million each year. For noise pollution, the benefit estimate is much larger since, as explained in the Baltimore GPI analysis, noise pollution has been shown to have impacts on both property values and public health. With the CAP, noise pollution costs will drop from over $1.18 billion to $887 million, a reduction of $295 million per year. Adding the reduced costs of pollution from carbon, carbon monoxide, and noise together suggests that if the CAP were in place today, Baltimore's GPI would be over $358 million higher.

7. Reduced costs of commuting

The CAP's reduction in VMTs will also translate into lower costs of commuting since there will be less vehicle use and therefore lower costs of fuel and depreciation. In the GPI accounts, vehicle costs are calculated at the GSA rate of $0.57 per mile. But not all vehicle use is for getting to and from work, so the GPI segregates this out by using US Department of Transportation National Household Travel Surveys. The latest surveys suggest that 2.78% of VMTs in Baltimore are commuting related, so we use this percentage as the basis of our calculations. By multiplying the VMT reduction figures from above by 2.78% and then by the

[17] Maryland Department of Transportation, 2013 Maryland Mobility Report. Available online at: sha.maryland.gov/OPPEN/2013_Maryland__Mobility.pdf.

GSA rate, we arrive at a reduced commuting cost figure of over $13 million each year associated with achieving CAP goals.

The final tallies adding all these benefit figures together is presented in the Overview. As discussed there, Baltimore's Climate Action plan is likely to generate a significant boost to the City's GPI. Annual benefits are likely to range between $548 and $720 million per year, an increase of 4 to 5% over a business as usual scenario. This means that if the CAP were in place today, Baltimore's GPI could rise from $13.94 to as much as $14.66 billion each year in the high case scenario, with annual benefits from reduced greenhouse gas, carbon monoxide and noise pollution ($358 million) and new household and transportation infrastructure ($129 - $235 million) leading the way.

Discussion and Concluding Thoughts

In this analysis, we demonstrated how Baltimore's new Genuine Progress Indicator could be used to quantify the economic benefits of major policy initiatives – in this case, the Climate Action Plan. Although the analysis is preliminary and limited to only those CAP measures with quantitative targets that have bearing on the GPI, the figures are encouraging, demonstrating that the large portfolio of measures the CAP will implement in the context of energy efficiency and savings, transportation and land use, and growing a green city goals are not only a tool for mitigating and adapting to climate change but for promoting genuine economic progress.

A natural extension of this work would be a detailed analysis of CAP implementation costs to get a sense of how the CAP stacks up from a benefit-cost perspective. Here, we compiled some preliminary figures on one major cost component of the CAP – the 12 measures that set targets for new transportation, household, and water infrastructure. Excluding water infrastructure for the reasons discussed earlier and converting cost figures into annual values, we estimate that implementation costs for the CAP's household and transportation infrastructure components will likely range from $97 million to $172 million per year.[18] This results in a benefit-cost ratio of between 4.18:1 and 5.66:1. Even if the remaining CAP components double implementation costs, the benefit-cost ratio is likely to exceed 2:1.[19] In other words, the social, environmental, and economic benefits of the CAP will probably exceed its implementation costs by a very wide margin. In the next phase of this research, adding in quantitative estimates for CAP measures now treated qualitatively and refining costs of implementation will set the stage for a more precise analysis of CAP benefits.

[18] Annualizing infrastructure investment costs is a technique for spreading out such costs over the life of the investment items taking into consideration the opportunity costs of using those funds elsewhere (the opportunity cost of capital). The figures reported here assume an average investment life of 10 years for the 11 CAP infrastructure items and an opportunity cost of capital of 7%.

[19] With just the household and transportation infrastructure components, the benefit cost ratio ranges from 4.18:1 to 5.66:1.