**General comment:**

We appreciate the acknowledgement that the economic benefits of implementing the plan outweigh the economic costs of inaction. But more can be said to quantify the shifting of costs from paying for the damages caused by climate change, including to health, to paying to reduce those damages in the first place. Many people have provided cost estimates, and as far as public health is concerned, Stanford’s Mark Jacobson and colleagues have provided roadmaps for getting our economies off fossil fuels, including state-by-state scenarios starting with NYS in 2013\*, a move that would not only help the planet but greatly reduce morbidity and mortality due mainly to air pollution caused by fossil fuels, which, in addition to the immeasurable societal impacts, cost us billions of dollars each year, much of which is absorbed across the population through increased health costs for everyone. This helps the conversation of “how are we going to pay for all this” since either way, we’re going to be paying, but inaction will result in far more in terms of health and human suffering as well as costs. \*Jacobson, M.Z., R.W. Howarth, M.A. Delucchi, S.R. Scobies, J.M. Barth, M.J. Dvorak, M. Klevze, H. Katkhuda, B. Miranda, N.A. Chowdhury, R. Jones, L. Plano, and A.R. Ingraffea, Examining the feasibility of converting New York State’s all-purpose energy infrastructure to one using wind, water, and sunlight, *Energy Policy 57*, 585-601, 2013.

**Specific comments:** please see comments in the margins.

**Chapter 8. Public Health**

**8.1 Climate Change Impacts on Public Health**

Climate change directly and indirectly impacts physical, social, and mental health and will intensify some health stressors and cause other new health threats to emerge. Possible health impacts are far-reaching, even if not all are equally likely to occur among New Yorkers in the immediate future.

This year, COP26 emphasized public health more than ever before and referred to Climate Change as a “public health emergency.”57 Recently, the editors of over 200 medical journals united to issue a call for urgent government action to address global warming and protect public health and nature.58 NYSERDA’s ClimAID report describes the impacts and adaptation strategies for New York’s water resources, coastal zones, ecosystems, agriculture, energy, transportation, and telecommunications sectors, as well as vulnerabilities and adaptation strategies related to climate change and public health. According to the New York State Department of Health (DOH) Climate and Health Profile59 there are several potential climate-related health impacts in the State:

1. Increased heat stress (such as heat edema, heat stroke, heat cramps, heat stress, and dehydration) and other heat-related morbidity and mortality
2. Exacerbation of respiratory conditions (including pneumonia, asthma, and chronic obstructive pulmonary disease) and cardiovascular disease
3. Increased risk for food- and water-borne diseases due to increasing temperatures and flooding
4. Increased duration and severity of allergy symptoms due to increased duration and intensity of pollen season
5. Increased risk for vector-borne diseases (such as Lyme disease, West Nile virus, and other pathogens)
6. Increased risk of injury and death following extreme precipitation events and flooding

Other significant impacts associated with public health that are not listed above include droughts, rising sea levels that threatening infrastructure, saltwater intrusion of our groundwater resources (which may



1. Romanello, M. et al. 2021. The 2021 report of the *Lancet* Countdown on health and climate change: code red for a healthy future. The Lancet. 398(10311): 1619-1662.
2. “Call for Emergency Action to Limit Global Temperature Increases, Restore Biodiversity, and Protect Health” see for example the *New England Journal of Medicine* September 5, 2021.
3. DOH. 2015. Building Resilience Against Climate Effects (BRACE) – Climate and Health Profile. Accessed at [climatehealthprofile6-2015.pdf (ny.gov).](https://www.health.ny.gov/environmental/weather/docs/climatehealthprofile6-2015.pdf)

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impact drinking water supplies), poor indoor air quality (such as mold and moisture), and deteriorating outdoor air quality, particularly ground-level ozone that increases with rising temperature.60 Climate change will add uncertainty to the continuity of the food system, which may have impacts on food security, particularly in low-income communities.61 Heatwaves and extreme heat events result in greater risk of heat stress.62 Heavy rainfall associated with the remnants of Hurricane Ida resulted in flooded subways and drowning deaths in basement apartments and cars. Superstorm Sandy resulted in the deaths of 44 New York City residents and caused $19 billion in damages (see [*Chapter 2. The Time is Now to*](#bookmark=id.2jxsxqh) [*Decarbonize Our Economy*)](#bookmark=id.2jxsxqh)*.*63These kinds of extreme weather events have been associated with anxietyand post-traumatic stress disorder. Some populations are more vulnerable to certain climate and health impacts than others, whether due to demographic factors, socioeconomic status, physiological condition, place, or occupation. Many impacts of climate change disproportionally affect Disadvantaged Communities.

In New York, as well as other parts of the U.S., significant disparities in health outcomes exist for certain groups by age, race, ethnicity, and socioeconomic status. Disparities are observed in life expectancy and rates of diabetes, cancer, heart disease, asthma, infant mortality, and low birth weight.64,65,66 Cardiovascular disease is the leading cause of death nationally and in New York.67 Research studies have shown an association between exposure to air pollutants, which are released through combustion of fossil



1. Stowell, Jennifer D., et al. “The impact of climate change and emissions control on future ozone levels: Implications for human health.” Environment International 108 (2017): 41-50.
2. USDA. 2015. Climate Change, Global Food Security, and the U.S. Food System. Accessed at https://www.usda.gov/sites/default/files/documents/FullAssessment.pdf.
3. DOH, “About Heat Stress,” DOH, Accessed at

https://www.health.ny.gov/statistics/environmental/public\_health\_tracking/about\_pages/heat\_stress/about\_hs.

1. Centers for Disease Control and Prevention. Health concerns associated with mold in water-damaged homes after Hurricanes Katrina and Rita--New Orleans area, Louisiana, October 2005. MMWR Morb Mortal Wkly Rep. 2006 Jan 20;55(2):41-4. PMID: 16424858.
2. CDC. Health Disparities and Inequities Report, United States. Morbidity and Mortality Weekly Reports. January 14, 2011.
3. Insaf TZ, Talbot T. Use of Spatial Epidemiology in Identifying Areas at Risk of Low Birth Weight: Small Area Surveillance Study. Preventive Medicine 2016, 88:108–114; doi: https://doi.org/10.1016/j.ypmed.2016.03.019.
4. DOH. New York State Minority Health Surveillance Report: Public Health Information Group. 2007. Accessed at http://www.health.state.ny.us/statistics/community/minority/docs/surveillance\_report\_2007.pdf.
5. DOH. Vital Statistics of New York State: 2018 Tables. Accessed at

https://apps.health.ny.gov/public/tabvis/PHIG\_Public/lcd/reports/#state.

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fuels, and increased hospitalization rates and mortality from cardiovascular disease.68,69,70,71 Nationally and in New York, there are disparities in heart disease mortality and stroke mortality by race. Rates are highest in Black non-Hispanics among all race and ethnic groups.72,73 Hospitalization rates for heart disease are also highest in Black non-Hispanics.74 In addition to cardiovascular disease, asthma is a major health problem nationally and in New York. Asthma is a multifactorial disease that has many contributing causes. This includes four components of air pollution, ozone, sulfur dioxide (SO2), NOX, and PM that are known to exacerbate asthma and to cause eye and respiratory tract irritation, cough, shortness of breath, and reduced lung function.75,76,77,78,79,80 Asthma hospitalization rates in New York are higher in low-income areas than in higher income areas.81,82 Asthma surveillance in New York has shown that the age-adjusted asthma emergency department visit, hospital discharge and mortality rates were higher among



1. He, M.Z., Do, V., Liu, S. et al. Short-term PM2.5 and cardiovascular admissions in NY State: assessing sensitivity to exposure model choice. Environ Health 20, 93 (2021). https://doi.org/10.1186/s12940-021-00782-3.
2. Brook, Robert. Air Pollution and Cardiovascular Disease: A Statement for Healthcare Professionals from the Expert Panel on Population and Prevention Science for the American Health Association. Circulation: Journal of the American Health Association. 109:2655-2671. 2004.
3. Al-Kindi, S.G., Brook, R.D., Biswal, S. et al. Environmental determinants of cardiovascular disease: lessons learned from air pollution. Nat. Rev Cardiol 17, 656–672 (2020). https://doi.org/10.1038/s41569-020-0371-2.
4. World Health Organization. Regional Office for Europe. (2018). Environmental noise guidelines for the European Region. World Health Organization. Regional Office for Europe. Accessed at https://apps.who.int/iris/handle/10665/279952.
5. DOH. New York State Minority Health Surveillance Report. 2012. Accessed at https://www.health.ny.gov/ statistics/community/minority/docs/surveillance\_report\_2012.pdf.
6. CDC. CDC Health Disparities and Inequalities Report. 2011. Accessed at https://www.cdc.gov/minorityhealth/chdir/2011/chdir2011.html.
7. CDC. CDC Health Disparities and Inequalities Report. 2011. Accessed at https://www.cdc.gov/minorityhealth/chdir/2011/chdir2011.html.
8. US. EPA. Integrated Science Assessment (ISA) for Particulate Matter (Final Report, Dec 2019). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-19/188, 2019.
9. Guarnieri M, Balmes JR. Outdoor air pollution and asthma. Lancet. 2014;383(9928):1581-1592. doi:10.1016/S0140-6736(14)60617-6.
10. EPA. 2004. Air Quality Criteria Document for Particulate Matter.
11. Burnett, Richard, et al. “Global estimates of mortality associated with long-term exposure to outdoor fine particulate matter.” Proceedings of the National Academy of Sciences 115.38 (2018): 9592-9597.
12. Samet, M., Jonathan. The National Morbidity, Mortality, and Air Pollution Study. Part II: Morbidity and Mortality from Air Pollution in the United States. Research Report Health Effects Institute. 2000. 94(pt 2):5-70, 71-79.
13. Gauderman, W. James. Association between Air Pollution and Lung Function Growth in Southern California. American Journal of Respiratory Critical Care Medicine. 2000. 162(4Pt1):1383-1390.
14. Lin, Shao, Fitzgerald, Edward, Hwang, Syni-An. Asthma Hospitalization Rates and Socioeconomic Status in New York State 1987-1993. Journal of Asthma. 2002. 36:239-251.
15. DOH. New York State Asthma Surveillance Summary Report. 2013. Accessed at

https://www.health.ny.gov/statistics/ny\_asthma/pdf/2013\_asthma\_surveillance\_summary\_report.pdf.

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non-Hispanic Black and Hispanic New Yorkers than non-Hispanic White.83 For more detail, see the Appendix F.

Climate change mitigation and adaptation policies are crucial in reducing the public health impacts described above, particularly for vulnerable communities and Disadvantaged Communities, such as those that can be identified by the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry Social Vulnerability Index. DOH has worked to support public health adaptation efforts. For example, DOH’s scientific research on the health effects associated with heat contributed to the National Weather Service lowering its Heat Advisory Threshold and led to the development of County Heat and Health Profiles, where users can view county temperature trends and projections, along with heat-related health effects and vulnerabilities.84 DOH staff have worked with local partners to enhance awareness and accessibility to cooling centers during heat advisories.85 DOH also identified populations that are vulnerable to extreme heat by developing a Heat Vulnerability Index. Studies have sought to increase awareness about climate impacts on health in New York,86 and have explored associations between temperature and respiratory outcomes, cardiovascular outcomes, renal diseases, and birth defects. Additional studies have explored climate change trends in New York, impacts of air pollutants on health (which could assist in understanding co-benefits to improved air quality through climate policy), and impacts of specific events that could stem from extreme weather. The State could conduct additional studies to continue to increase its understanding of the health impacts of climate change and the health benefits of climate policy.

**8.2 Considering Health in Climate Policy**

The development of sound policy to mitigate GHG emissions and adapt to the changing climate will provide direct and indirect public health benefits. Direct benefits will result from mitigating GHG emissions and adapting to global climate change by reducing the many public health impacts associated



1. Lin, Shao, Fitzgerald, Edward, Hwang, Syni-An. Asthma Hospitalization Rates and Socioeconomic Status in New York State 1987-1993. Journal of Asthma. 2002. 36:239-251.
2. Chow NA, Toda M, Pennington AF, et al. Hurricane-Associated Mold Exposures Among Patients at Risk for Invasive Mold Infections After Hurricane Harvey - Houston, Texas, 2017. MMWR Morb Mortal Wkly Rep. 2019;68(21):469-473. Published 2019 May 31. doi:10.15585/mmwr.mm6821a1.

Nayak SG, Shrestha S, Kinney PL, Ross Z, Sheridan SC, Pantea CI, Hsu WH, Muscatiello N, Hwang SA. Development of a heat vulnerability index for New York State. Public Health. 161:127-137. 2018.

1. Nayak, Seema G., Srishti Shrestha, Scott C. Sheridan, Wan-Hsiang Hsu, Neil A. Muscatiello, Cristian I. Pantea, Zev Ross et al. "Accessibility of cooling centers to heat-vulnerable populations in New York State." Journal of Transport & Health 14 (2019): 100563.
2. Insaf, T.Z., Lin, S., S.C. Sheridan. Climate trends in indices for temperature and precipitation across New York State, 1948-2008. Air Quality, Atmosphere & Health. 2013. 6(1): 247-257.

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with climate change. Indirect health benefits will occur when initiatives to mitigate GHG emissions also result in other beneficial outcomes such as reducing air pollutant emissions (co-pollutants), encouraging active transport (such as walking and cycling), and reducing home health risks through building energy efficiency retrofit interventions. Improved air quality will reduce incidences of asthma and cardiovascular disease, and increased physical activity will reduce obesity and negative cardiovascular outcomes. Cardiovascular disease is the leading cause of death nationally and in New York, with almost 44,000 New Yorkers dying of cardiovascular disease every year. Asthma is a major health problem nationally, and in New York 1.4 million adults and 315,000 children suffer from this disease.87

State and federal government programs to control air pollutant emissions through regulations and permitting have contributed to greatly improved air quality in New York over the last 40 years (see Appendix F). Although the State currently complies with the requirements of, or is “designated attainment for,” the National Ambient Air Quality Standards for the criteria pollutants carbon monoxide, lead, nitrogen dioxide (NO2), and PM, substantial additional health benefits will be achieved through continued emission reductions. For SO2, a small portion of St. Lawrence County has been designated as nonattainment. Nine counties, in which 65% of the State’s population reside, are currently not in attainment for the 2015 ozone standard. Concentrations of non-criteria pollutants attributed to fuel combustion have also decreased significantly over the last decade, due in part to programs and regulations directed at reducing transportation source pollution, including the adoption of reformulated gasoline programs and improvements in vehicle emissions technology, the statewide adoption of the California Low Emission Vehicle program, and emission reductions from oil refineries and other stationary sources under federal and State air pollution control programs. Recent studies of long-term air quality trends in NYC demonstrate that enactment of local and regional clean air regulations, as well as changes in fuel usage (e.g., natural gas out-competing coal), significantly reduced ambient levels of PM. During this time, the sources of PM and the PM composition changed (i.e., reduction in sulfate but increased organic matter).88,89



1. Centers for Disease Control and Prevention, “Most Recent Asthma State or Territory Data,” CDC, Accessed on November 23,

2021, https://www.cdc.gov/asthma/most\_recent\_data\_states.htm.

1. Blanchard *et al*. 2020. Accessed at https://www.tandfonline.com/doi/full/10.1080/10962247.2021.1914773?scroll=top&needAccess=true&.
2. Pitiranggon *et al*. 2021. Accessed at https://www.sciencedirect.com/science/article/pii/S135223102100056X.

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COVID-19 is one of the most significant emerging diseases of the 21st century. Air pollution, in particular PM2.5, which is released during combustion, can exacerbate symptoms of respiratory illness.90 Long-term exposure to PM2.5 from the 2020 wildfires in Western United States, which are increasing in frequency due to climate change, has also been shown to increase the risk of death from COVID-19. Disadvantaged Communities, as defined in the Climate Act, are likely to have greater health disparities (or inequities) and shoulder more significant environmental burdens than other communities. Elevated levels of NO2,91 which can be a product of vehicle combustion emissions, among other sources, and are air pollutants associated with Disadvantaged Communities, are associated with higher rates of COVID-19 infection and higher rates of death.92,93 By addressing climate change, we can decrease air pollution and reduce the effects pollutants have on respiratory illnesses, including COVID-19 infection, protect and improve health, and address underlying economic and social inequities using asset-based approaches.

**8.3 Sector-Specific Health Co-Benefits of Climate Policies**

In addition to the health impacts associated with climate change, the production, distribution, and use of carbon-based fuels can have many other health impacts. These impacts can arise from routine operations, accidents, and catastrophic events. Health impacts resulting from routine carbon-based fuel use and production can range from local to global in scale and examples include degradation of air quality due to the combustion of fossil fuels and accidents such as fires, fuel oil spills, natural gas pipeline explosions, and other occupational and nonoccupational accidents. Reduction of these impacts through GHG emissions reductions strategies results in health co-benefits. Some of these impacts are discussed in the sections below. [Table 3](#bookmark=id.tyjcwt) summarizes the human health effects that are associated with GHG emissions (climate change) and exposure to some air pollutants commonly associated with carbon-based fuel combustion.



1. Croft DP, Zhang W, Lin S, et al. The Association between Respiratory Infection and Air Pollution in the Setting of Air Quality Policy and Economic Change. Ann Am2 Thorac Soc. 2019;16(3):321-330. doi:10.1513/AnnalsATS.201810-691OC.
2. Liu T, Mickley LJ, Cooper M, Dominici F. Excess of COVID-19 cases and deaths due to fine particulate matter exposure during the 2020 wildfires in the United States. Sci Adv. 2021 Aug 13;7(33):eabi8789. doi: 10.1126/sciadv.abi8789.
3. Liang, D. Shi L., Zhao J., Liu P., Sarnat, J.A., Gao S., Schwartz J., Liu Y., Ebel S.T., Scovronick N., Chang, Urban H.H. 2020. Air Pollution May Enhance COVID-19 Case-Fatality and Mortality Rates in the United States, The Innovation, 1(3), https://doi.org/10.1016/j.xinn.2020.100047.
4. Lipsitt J, Chan-Golston AM, Liu J, Su J, Zhu Y, Jerrett M. Spatial analysis of COVID-19 and traffic-related air pollution in Los Angeles. Environ Int. 2021 Aug;153:106531. doi: 10.1016/j.envint.2021.106531. Epub 2021 Mar 22. PMID: 33812043; PMCID: PMC7983457.

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**Table 3. Health Effects Associated with Carbon-Based Fuel Combustion Pollutants**

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| **Air Pollutant** | **Human Health Effects** |
|  |  |
|  | Climate-related effects on morbidity and mortality (such as increased mold and pollen |
| GHGs | allergy incidence and severity, heat stress, heat-related mortality, vector-borne disease, |
|  | injury, and death due to flooding) |
|  |  |
| Carbon monoxide94 | Likely effects on existing cardiovascular disease |
| NO295 | Respiratory effects |
| Ozone96 | Respiratory effects |
| PM2.597 | Cardiovascular effects and pre-mature mortality (cardio-pulmonary) |
| SO298 | Respiratory effects |
| Metals99 | Effects vary depending on specific metal |
| Polycyclic aromatic | Cancer (not all polycyclic aromatic hydrocarbons) |
| hydrocarbons100 |
|  |
| VOCs101 | Effects vary depending on the specific chemical (some examples are central nervous |
| system effects; liver or kidney toxicity; eye, skin, and respiratory tract irritation; and cancer) |
|  |
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Many VOCs, such as toluene, can cause central nervous system effects, and some, like benzene, are carcinogens. In addition to VOCs and GHGs (discussed earlier), non-criteria pollutants that can be emitted from fuel combustion include chlorinated dibenzo-p-dioxins, chlorinated dibenzofurans, polycyclic aromatic hydrocarbons, and various metals, particularly mercury from coal combustion. Exposure to high levels of chlorinated dioxins and furans is associated with cancer and effects on the liver and skin. Health effects associated with exposure to metals vary by the metal. For example, mercury, after being transformed to methylmercury in the environment and entering the food chain, can cause effects on the nervous system, especially for children and fetuses. Exposure to high levels of some polycyclic aromatic hydrocarbons is associated with lung cancer. Modeling changes in health outcomes associated



1. EPA. EPA/600/R-019F/January 2010: Integrated Science Assessment for Carbon Monoxide, 2010.
2. EPA. EPA/600/R-15-068/January 2016: Integrated Science Assessment for Oxides of Nitrogen – Health criteria, 2016.
3. EPA/600/R-20/012, April 2020 U.S. EPA. Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants, 2020
4. EPA. EPA/600/R-19/188, December 2019: Integrated Science Assessment (ISA) for Particulate Matter, 2019.
5. EPA. EPA/600/R-17/451/December 2017.: Integrated Science Assessment for Sulfur Oxides- Health Criteria.
6. Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services. Toxicological Profiles for Specific Metals. [http://www.atsdr.cdc.gov/toxprofiles/index.asp.](http://www.atsdr.cdc.gov/toxprofiles/index.asp)
7. ATSDR. Toxicological Profiles for specific PAHs: [http://www.atsdr.cdc.gov/toxprofiles/index.asp.](http://www.atsdr.cdc.gov/toxprofiles/index.asp)
8. ATSDR. Toxicological Profiles for specific VOCs: [http://www.atsdr.cdc.gov/toxprofiles/index.asp.](http://www.atsdr.cdc.gov/toxprofiles/index.asp)

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with exposure to air pollutants can be helpful to inform policy, but modeling those for non-criteria pollutants is more challenging and uncertain.

***Power Generation***

The transition in the power generation sector away from carbon-based fuel combustion to meet the requirements of the Climate Act will result in the same kinds of health co-benefits achieved through this transition across all sectors. However, there are health concerns specific to this sector, and they have been considered in the development of this Plan. The health risks associated with combustion emissions and combustion waste products are not associated with renewable power generation and will substantially decrease with large-scale reduction in combustion for power generation. Coal—a fuel with significant emissions and associated health impacts—has already been phased out in New York power generation following DEC’s adoption of CO2 emission limits for power plants, as part of 6 NYCRR Part 251. Although emissions from power plant stacks can travel great distances, power generation facilities also contribute to air quality impacts in nearby communities, including Disadvantaged Communities.

Health concerns associated with onshore generation of wind energy are limited. Physical safety concerns can be mitigated through the choice of appropriate minimum setbacks (the minimum allowable distances between turbines and roads, property lines, or structures). Annoyance,102 associated with wind turbines producing characteristic sounds or noise as wind passes over the rotating blades, is a health effect according to the *Environmental Noise Guidelines for the European Region*, published by the World Health Organization in 2018.103 Data indicates that noise from wind turbines may be more noticeable, annoying, and disturbing than other community or industrial sounds of the same level. Reviewing acceptable noise thresholds for wind turbine siting as scientific understanding evolves will be important as onshore wind energy is increasingly adopted.

Finally, there are emerging energy technologies that may pose new opportunities as well as new risks that have yet to be fully understood. Hydrogen combustion does not directly generate most combustion byproducts such as PM, thus conveying a potentially large health benefit, but does emit NOx (which are precursors to ozone, PM, and NO2 formation) at levels that may be higher than those from natural gas combustion because of hydrogen’s high combustion temperature. Opportunities to further reduce NOx



1. Noise annoyance is defined by the World Health Organization as a (long term) feeling of displeasure, nuisance, disturbance, or irritation caused by a specific sound.
2. World Health Organization Regional Office for Europe. 2018. Environmental Noise Guidelines for the European Region. Copenhagen. Accessed at https://www.euro.who.int/\_\_data/assets/pdf\_file/0008/383921/noise-guidelines-eng.pdf.

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emissions from hydrogen combustion exist and need to be further studied. The combustion of renewable natural gas (RNG) is likely to result in pollutant emissions similar to fossil gas combustion.

While transitioning away from carbon-based energy sources, maintaining reliability of the energy system is crucial. Reliable electricity production is critical to maintain good public health in our energy-dependent society. Increasing the reliability of the electric grid can reduce health effects during high temperatures, when air conditioning is the principal means to prevent heat-related morbidity and mortality. During summer, power outages pose specific health-related impacts such as: (1) spoiled food and digestive tract illness; (2) spoiled vaccines; and (3) increased rodent populations as a result of discarded perishables.104,105,106 Winter outages also pose specific risks to public health such as carbon monoxide.107,108 Following a 2006 winter storm in Western New York, 264 people were diagnosed with carbon monoxide poisoning.109 After Hurricane Sandy, 80 carbon monoxide poisoning cases were reported.110,111 At least 57 deaths were attributed to this weather event, and there was over $195 million in property damage. By improving the reliability of the grid, the State can prevent millions of dollars in damages and prevent premature mortality.

***Transportation***

Opportunities for health co-benefits associated with transportation sector climate policies include reductions in traffic noise and accidents and reductions in morbidity and mortality associated with improved air quality and increased availability and use of active transportation options. Transportation sector emissions are usually concentrated at the ground level, often in densely populated areas, resulting in a tendency toward higher levels of exposure for more people than emissions associated with other



1. Bell, K.N. Risk Factors for Improper Vaccine Storage and Handling in Private Provider Offices. Pediatrics. 2001. 107(6): art-e100.
2. Marx, A. Melissa. Diarrheal Illness Detected Through Syndromic Surveillance after a Massive Power Outage: New York City, August 2003. American Journal of Public Health. 2006. 96:547-553.
3. Beatty, Mark. Blackout of 2003: Public Health Effects and Emergency Response. Public Health Reports. 2006.
4. Daley, W. Randolf. An Outbreak of Carbon Monoxide Poisoning after a Major Ice Storm in Maine. The Journal of Emergency Medicine. 2000. Vol. 18, No. 1, pp. 87–93.
5. Muscatiello, Neil, Babcock, G., Jones. R., Horn, E., and Hwang, S.A. Hospital Emergency Department Visits for Carbon Monoxide Poisoning Following an October 2006 Snowstorm in Western New York. Journal of Environmental Health. 2010. Volume 72, Number 6, pages 43-48.
6. Graber, Judith M. Results from a State-Based Surveillance System for Carbon Monoxide Poisoning. Public Health Reports. 2007. 122:145-154.
7. Center for Disease Control and Prevention. Notes from the Field: Carbon Monoxide Exposures Reported to Poison Centers and Related to Hurricane Sandy - Northeastern United States. 2012 Morbidity and Mortality Weekly Report. 66(44);905-905.
8. The University of Texas at Austin Energy Institute. 2021. The Timeline and Events of the February 2021 Texas Electric Grid Blackouts. Accessed at https://energy.utexas.edu/ercot-blackout-2021.

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energy use sectors. Some of the co-pollutants emitted are associated with an increased risk of respiratory and cardiovascular effects, among others. Numerous studies have investigated the increased risk of these effects by looking at the relationship between traffic patterns and the distance from roadways and the associated pollutant concentrations and health endpoints. Studies have found associations between asthma exacerbation or emergency room visits for respiratory illness and transportation-related factors such as traffic proximity or traffic density112 and diesel traffic density in particular.113

The recommendations for reducing single-occupancy vehicle travel and reducing gasoline and diesel use, discussed further in this Plan, could improve health outcomes. Transportation emissions have been concentrated in Disadvantaged Communities for generations and decarbonizing the transportation sector provides an opportunity to focus emission reductions in the communities that have historically been overburdened by pollution.114 Additionally, transportation planning that uses Complete Streets policies ensures that considerations are made for the safety of all roadway users (pedestrians, bicyclists, public transportation users, and motorists). Not getting enough physical activity is a risk factor for diabetes and obesity (which are also risk factors for those with high blood pressure and a family history of these health risks). Almost 1.7 million New Yorkers (10.5%) had diabetes in 2016, and obesity has reached epidemic proportions with more than half (60.8%) of New York adults reported to be overweight or obese in 2016. Being obese or overweight is currently the second leading preventable cause of death in the United States and may soon overtake cardiovascular disease as the leading cause of death. Additionally, one-third of New York’s children are obese or overweight. A reduction in the reliance on personal automobiles by incorporating smart growth and Complete Streets policies into transportation planning has the benefit of increasing opportunities for physical activity. In recent years, studies have begun to examine the relationship between neighborhood walkability and physical activity levels, body mass index, waist circumference, obesity, and hypertension. These studies have generally shown that neighborhood walkability is associated with increased physical activity and decreased body mass index, waist circumference, obesity, and hypertension.



1. Lin, S., Munsie, J.P., Hwang, S.A., Fitzgerald, E., Cayo, M.R.. Childhood Asthma Hospitalization and Residential Exposure to State Route Traffic. Environmental Research. 2002. Section A (88): 73-81.

Lwebuga-Mukasa, James S. Traffic Volumes and Respiratory Health Care Utilization among Residents in Close Proximity to the Peace Bridge Before and After September 11, 2001. Journal of Asthma. 2003. 40(8): 855-864.

Kim, Janice. Residential Traffic and Children’s Respiratory Health. Environmental Health Perspectives. 2008. 16(9):1274-9.

1. McCreanor, James. Respiratory Effects of Exposure to Diesel Traffic in Persons with Asthma. New England Journal of Medicine. 2007. 357(23):2348-58.
2. New York State Department of Transportation, “Complete Streets,” Department of Transportation, Accessed on November 23, 2021, https://www.dot.ny.gov/programs/completestreets.

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Health risks associated with transportation emissions can be reduced with a shift toward technologies that do not rely on carbon-based fuels and the enhancement of public transportation systems and other low-carbon mobility options. Currently, most mobile source emissions result from the combustion of gasoline and traditional petroleum-based diesel fuel. When compared with petroleum-based fuels, biodiesel and alcohol-based fuels have higher levels of combustion emissions of respiratory irritants and some ozone-precursors such as acrolein, carcinogens, formaldehyde, and acetaldehyde.115 Work conducted as part of the New York “Renewable Fuels Roadmap” discusses research suggesting that replacing gasoline with ethanol reduces emissions of carcinogenic benzene and butadiene but increases emissions of formaldehyde and acetaldehyde, which have other health impacts.116

Widely used public transportation results in considerably less fuel use and air contaminant emissions per person-mile traveled than other modes of transportation such as personal cars. Therefore, targeted geographic and temporal expansion of public transportation availability could reduce health risks associated with transportation emissions. Electrifying transit buses can ensure that emissions are reduced even further. Investments in transit bus electrification will benefit overburdened communities, both because many bus depots are located in these areas and because buses provide essential transportation services in these areas. Regulations limit school bus and heavy-duty vehicle idling, which produces harmful emissions, to protect the health of school children and others exposed to this type of air pollution and electrification of vehicles will reduce these harmful pollutants even further.117 Electrification of school buses would also prevent exposure of school children to diesel exhaust which often leaks into the cabin of buses posing a larger health threat than outdoor idling emissions. Electrification of heavy-duty farm equipment and construction vehicles, that are typically diesel-powered, will protect the health of farm and construction workers and reduce emissions (and noise) in rural and urban areas where that are often in close proximity to residents and pedestrians. Emissions associated with transportation can also be reduced through carpools and investments in infrastructure that supports safe walking and bicycling.



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These mechanisms can be supported through integrated local and regional transportation planning using Complete Streets principles.

Reductions in fuel use and emissions can also be achieved through congestion mitigation and smart growth planning that facilitates the establishment of more walkable communities, with sidewalks, bike lanes, and bike paths. Policies and technologies to reduce congestion, such as congestion pricing and traffic signal synchronization, can alleviate major bottlenecks and improve local air pollution, especially in communities located near busy roads. Bike sharing programs have become a popular feature in cities across the nation, providing additional opportunities for physical activity. Active transport for shorter journeys has both the benefits of reduced emissions and of exercise, leading to reduced risk for obesity, cardiovascular disease, and other health impacts. Nevertheless, in spite of the emission reductions associated with bicycling and walking for transportation and the health benefits, exercising in polluted air can also have health impacts, especially for vulnerable populations.118 However, among healthy adults, moderate to high-intensity exercise may neutralize any short-term negative effects of air pollution*.* While the benefits of increased physical activity have been found to outweigh the risks of exercise in polluted air,119 air quality in areas of heavy traffic should still be considered in the choices made for siting of bicycle lanes and paths.120 Further, traffic accidents have been found to increase in number and severity with increased active transport. Therefore, as active transport options continue to be made available, efforts to minimize accident potential become increasingly important.

Vehicle electrification can also contribute to reduced traffic noise, especially at slower and medium speeds where tire and wind noises are low. Particularly in cities, with high volumes of traffic, noise reduction is important health co-benefit for the deployment of EVs.

***Buildings and the Built Environment***

The building industry presents a unique and largely untapped resource for integrating climate action and public health. Workforce education, training, job placement, and job development equips New York’s current and future workforce to design, install, inspect, maintain, and operate healthy, comfortable, low-



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carbon buildings while increasing clean energy job placement for Disadvantaged Communities and advancing industry diversity. This could be accomplished by promoting broad public awareness and education to create strategic partnerships with trusted community leaders, and by scaling-up targeted outreach and decision-making to increase market demand and accelerate the transition to low-carbon, energy-efficient, all-electric buildings.

**Outdoor Built Environment**

The built environment is the primary environment people are exposed to because people spend approximately 90% of their time indoors.121 However, outdoor green space is also part of the built environment, and it can have health benefits (mental health, exercise, etc.) for those who have access. Consequently, there are significant opportunities for improving public health while reducing GHG emissions by introducing green space, such as parks, especially in urban environments and Disadvantaged Communities. Green spaces, such as parks, urban greenery, and street trees, as well as blue space, comprised of water elements, can have beneficial health effects, particularly in urban environments. Effects include decreasing risk of cardiovascular disease and type 2 diabetes mellitus while improving mental health and quality of sleep and increasing birth weight.122,123,124,125,126,127,128,129 Urban environments, which experience the “heat island effect,” trees and other green spaces can cool their



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surrounding areas by up to 1°C.130,131 Disadvantaged Communities can have less access to green space, and poverty is associated with greater distances to parks.132 To reduce inequality, the New York State Department of Agriculture and Markets (AGM) and DEC have provided grants to support community gardens in urban areas, and more can be done to bring accessible green space to Disadvantaged Communities.133,134

**Housing/Residential Built Environment**

Building energy efficiency measures provide significant energy savings and health benefits. These include the basic benefits of affordably maintaining a comfortable living and working environment, preventing hypo- and hyperthermia, and combatting fuel poverty (facing the choice between heating the home or feeding the family).

Tight insulation in residential buildings without ensuring appropriate ventilation, filtration, and/or inadequate weatherproofing can negatively impact indoor air quality. Disadvantaged Communities, in particular, experience these issues, which can worsen health disparities. The New York Building Code and Property Maintenance Code designates minimum air ventilation rates for new and existing buildings. Inadequate ventilation increases exposure to air contaminants such as VOCs (including those from consumer care products and off-gassing from building materials), radon gas, dust, allergens, mold, carbon monoxide, and CO2.

NYSERDA has programs to use industry-accrediting organizations to set standards and best practices for conducting energy efficiency upgrades. Program requirements concerning source removal, ventilation systems, minimum ventilation rates, and proper sizing and installing of HVAC systems help avoid and alleviate indoor air quality problems in existing buildings and the associated health effects. NYSERDA also strives to support advanced sustainability standards and tools by partnering with organizations like



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the Collaborative for High Performance Schools, the U.S. Department of Energy, the EPA, and the U.S.

Green Building Council.

When effectively combined with other home intervention programs (such as the New York State Healthy Neighborhoods Program), energy efficiency upgrades can have direct and indirect health benefits for residents.135 For example, these combined measures can reduce hot and cold thermal stress, arthritis symptoms, asthma hospitalization or emergency department visits, missed days of work, carbon monoxide poisonings, home fires, and trip and fall injuries for residents.136 These programs could also consider identifying code violations which increase risks associated with flooding, and thus contribute toward increased community resiliency.

Electrification of the building sector will also reduce the health risks associated with combustion-based appliances for heating, cooking, and other uses. Leaking home heating systems were the primary cause listed among the 15,000 carbon monoxide poisonings resulting in emergency department visits in the United States annually.137 In New York alone, there are approximately 1,500 emergency department visits and 160 hospitalizations for carbon monoxide poisoning annually.138 Electrification of home heating systems could prevent many of these poisonings going forward. Cooking with gas stoves can increase indoor air concentrations of NO2, carbon monoxide, and formaldehyde, and children living in homes with gas stoves can have an increased risk of being diagnosed with asthma.139 Disadvantaged Communities are disproportionately affected by asthma and may be more likely to have unvented and/or piloted gas stoves. Thus, electrification of gas cooking appliances can reduce the risk of asthma in Disadvantaged Communities and improve the health of all New Yorkers.



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Biomass and biofuels are burned in New York for heat and combined heat and power for the residential, commercial, and industrial sectors. Of these energy use sectors, the residential sector has the greatest use as residents increasingly turn to biomass to heat their homes. EPA estimates the PM2.5 emissions from residential wood heating in New York State, representing 2% of homes, is greater than that from the power generation sector and the entire and transportation sectors combined. Adverse health effects associated with exposure to wood smoke are consistent with those identified for PM2.5 (a major component of wood smoke) including exacerbation of cardiovascular symptoms (e.g., chest pain, heart rhythm changes, heart attack, stroke), and respiratory symptoms (e.g., asthma). The elderly, people with heart and lung diseases, people of low economic status, and children are particularly vulnerable to the effects of fine particle exposures in wood smoke. Wood smoke is found in particularly rural areas of the State, and some wintertime smoke impacts are significant.140

**Commercial/Industrial Built Environment**

In the industrial sector, in addition to the potential use of green hydrogen as described above for the power generation sector, carbon capture and sequestration could reduce GHG emissions. Depending on the specific technology, carbon capture and sequestration may also reduce emissions of some other pollutants, but in many cases does not. While carbon capture technology requires energy, which can lead to additional power sector emissions,141 potential increases in emissions for powering carbon capture and sequestration would depend on the energy generation source.



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