Chapter 12: Greenhouse Gas Emissions and Climate Change

A. INTRODUCTION

As described in Chapter 1, "Project Description," based on projections issued by the national Centers for Disease Control, Memorial Sloan Kettering Cancer Center (MSKCC) expects that new cancer cases in New York City will increase from the current rate of 40,000 annually to 60,000 annually by 2050. While this increase is a projection among all age groups, this rise is being driven by two populations: older patients, whose cases are more acute and require more complex treatment, and younger patients who are being diagnosed with prostate, colon, and breast cancer at alarming rates. To meet this increase in patient volume and the new interventions that are needed to treat the growing number of acute cases, MSKCC will need to supplement its existing capacity with a purpose-built structure with 28 operating rooms (with four dedicated to interventional radiology procedures) and up to 206 patient beds including intensive care unit (ICU) and single rooms for immunocompromised patients, as well as medical support areas.

To fulfill this need, MSKCC is requesting a series of zoning actions to establish a zoning envelope to facilitate the development of a new 31-story (up to 598.3 feet including mechanical bulkhead), approximately 903,065 gross square foot (gsf) inpatient hospital building (the Proposed Project), also referred to as the "MSK Pavilion." It would be located on York Avenue between East 66th and East 67th Streets and would consist of 28 operating rooms, including recovery and intensive care facilities, up to 206 single-bedded patient rooms, clinical support, and 5 mechanical floors to house intensive technologies and air exchange systems. A two-story patient bridge across East 67th Street (Patient Bridge) connecting floors 5 and 6 of the Proposed Project with floors 8 and 9 of the Memorial Hospital building would serve as the primary connector for patients in either building to access medical services in the other building.

This chapter evaluates the potential greenhouse gas (GHG) emissions from the development of the Proposed Project on MSKCC's main campus, as well and its consistency with citywide GHG reduction goals. The 2021 *City Environmental Quality Review* (*CEQR) Technical Manual* recognizes that climate change is projected to have wide-ranging effects on the environment, including rising sea levels, increases in temperature, and changes in precipitation levels. Although this is occurring on a global scale, the environmental effects of climate change are also likely to be experienced at the local level. New York City's sustainable development policies, starting with the updated *PlaNYC* as well as *OneNYC*, established sustainability initiatives and goals for greatly reducing GHG emissions and for adapting to climate change in the City.

In accordance with CEQR guidance, the citywide GHG reduction goal is currently the most appropriate standard by which to analyze a project under CEQR. The *CEQR Technical Manual* recommends that a GHG consistency assessment be conducted for any project conducting an environmental impact statement (EIS) and that would be expected to result in 350,000 square feet (sf) or more of development and/or consist of other energy-intense projects. Since the Proposed Project would exceed this development threshold, a GHG consistency assessment was performed for the Proposed Project.

Climate change has also contributed to rising sea levels and increases in storm surge and coastal flooding. An analysis of climate change is deemed warranted for projects at sites located within the 100- or 500-year flood zone. A review of the City's flood hazard information was performed as part of the EAS. The Development Site is located over 400 feet outside of the nearest potential end-of-century flood hazard zone identified by the New York City Panel on Climate Change (NPCC). In addition, the Development Site is located outside of areas of stormwater flooding greater than 4 inches (considered nuisance flooding), as projected by the City's stormwater flood hazard information. Therefore, the Proposed Project is unlikely to be impacted directly by future climate conditions, and an assessment of the potential impacts of climate change on the Proposed Project (e.g., sea level rise, flooding, etc.) is not warranted.

PRINCIPAL CONCLUSIONS

The Proposed Project would not result in significant adverse GHG emission or climate change impacts. The assessment of GHG emissions estimates that the building energy and vehicle use associated with the Proposed Project would result in up to approximately 14 thousand metric tons of carbon dioxide equivalent (CO_2e) emissions per year with a building carbon intensity of 0.00693 metric tons CO_2e per square foot—much less than the Citywide average of 0.01184 metric tons CO_2e per square foot for hospitals. In addition, total GHG emissions associated with the construction, including direct emissions and upstream emissions associated with construction materials (embodied emissions), would be approximately 24 thousand metric tons – equivalent to less than two years of operation. It was determined that the Proposed Project is consistent with the applicable citywide GHG emissions reduction and climate change goals, and that there would be no significant adverse GHG emission or climate change impacts.

The *CEQR Technical Manual* defines five goals by which a project's consistency with the City's emission reduction goal is evaluated: (1) efficient buildings; (2) clean power; (3) sustainable transportation; (4) construction operation emissions; and (5) building materials' carbon intensity.

The Proposed Project would replace the existing Sloan and Scholars buildings with an energy efficient, sustainable, state-of-the-art inpatient cancer treatment facility that would meet the needs for projected increased annual cancer rates while achieving reductions in building energy consumption. The Proposed Project would meet these needs and achieve reductions beyond what would be achievable through refurbishing the existing buildings. This would be done through a building design that incorporates building insulation and window glazing that will exceed building code requirements, high-efficiency heating systems, and roofing systems to reduce heating/cooling loads. Overall, the Proposed Project would support the City's GHG goals by virtue of its density and location in an area well-served by public transportation, and through commitments to utilize electric systems or Con Edison district steam for heating, ventilation and air conditioning and other services. Therefore, the Proposed Project would align with the City's emissions reduction goals, as defined in the *CEQR Technical Manual*.

Furthermore, specific energy efficiency measures and design elements that may be implemented for the Proposed Project are being evaluated with the commitment to achieve Platinum-level certification under the Leadership in Energy and Environmental Design (LEED) for Building Design and Construction rating system, version 4.1, for Healthcare. In order to achieve the prerequisite energy efficiency requirements under LEED, the design under consideration for the Proposed Project would focus on reduced energy consumption, high energy efficiency, and would likely exceed the minimum LEED requirement. To qualify for LEED, the energy efficiency requirements specify that a project meets the energy requirements described in the ASHRAE 90.1-

2016 standard (currently the minimum building code requirements under New York City's building code). Furthermore, the Proposed Project would demonstrate energy performance optimization improvements by at least 5 percent for new construction when compared to a baseline building designed to meet but not exceed the minimum building code requirements, resulting in lower energy expenditure.

B. GREENHOUSE GAS EMISSIONS

POLLUTANTS OF CONCERN

GHGs are the gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This phenomenon causes the general warming of the Earth's atmosphere, or the "greenhouse effect." Water vapor, carbon dioxide (CO_2), nitrous oxide (N_2O), methane, and ozone are the primary GHGs in the Earth's atmosphere.

There are also a number of entirely anthropogenic GHGs in the atmosphere, such as halocarbons and other chlorine- and bromine-containing substances, which also damage the stratospheric ozone layer (and contribute to the "ozone hole"). Since these compounds are being replaced and phased out due to the 1987 Montreal Protocol, there is no need to address them in GHG assessments for most projects. Although ozone itself is also a major GHG, it does not need to be assessed as such at the project level since it is a rapidly reacting chemical and efforts are ongoing to reduce ozone concentrations as a criteria pollutant (see Chapter 11, "Air Quality"). Similarly, water vapor is of great importance to global climate change, but is not directly of concern as an emitted pollutant since the negligible quantities emitted from anthropogenic sources are inconsequential.

CO_2 is the primary pollutant of concern from anthropogenic sources. Although not the GHG with the strongest effect per molecule, CO_2 is by far the most abundant and, therefore, the most influential GHG. CO_2 is emitted in a variety of ways: from any combustion process (both natural and anthropogenic); from some industrial processes, such as the manufacture of cement, mineral production, metal production, and the use of petroleum-based products; from volcanic eruptions; and from the decay of organic matter. CO_2 is removed ("sequestered") from the lower atmosphere by natural processes such as photosynthesis and uptake by the oceans. CO_2 is included in any analysis of GHG emissions.

Methane and N_2O also play an important role since the removal processes for these compounds are limited and because they have a relatively high impact on global climate change as compared with an equal quantity of CO_2. Emissions of these compounds are included in GHG emissions analyses when the potential for substantial emission of these gases exists.

The *CEQR Technical Manual* lists six GHGs that could potentially be included in the scope of a GHG analysis: CO_2, N_2O, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). This analysis focuses mostly on CO_2, N_2O, and methane. There are no significant direct or indirect sources of HFCs, PFCs, NF_3, or SF_6 associated with the Proposed Project.

To present a complete inventory of all GHGs, component emissions are added together and presented as CO_2e emissions—a unit representing the quantity of each GHG weighted by its effectiveness using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP). GWPs account for the lifetime and

the radiative forcing[1] of each chemical over a period of 100 years (e.g., CO_2 has a much shorter atmospheric lifetime than SF_6, and therefore has a much lower GWP). The GWPs for the main GHGs discussed here are presented in **Table 12-1**.

Table 12-1
GWP for Major GHGs

Greenhouse Gas	100-year Horizon GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	140 to 11,700
Perfluorocarbons (PFCs)	6,500 to 9,200
Sulfur Hexafluoride (SF_6)	23,900

Note: The GWPs presented above are based on the Intergovernmental Panel on Climate Change's (IPCC) Second Assessment Report (SAR) to maintain consistency in GHG reporting. The IPCC has since published updated GWP values that reflect new information on atmospheric lifetimes of GHGs and an improved calculation of the radiative forcing of CO_2. In some instances, if combined emission factors were used from updated modeling tools, some slightly different GWP may have been used for this study. Since the emissions of GHGs other than CO_2 represent a very minor component of the emissions, these differences are negligible.
Source: 2021 *CEQR Technical Manual*

POLICY, REGULATIONS, STANDARDS, AND BENCHMARKS FOR REDUCING GHG EMISSIONS

Because of the growing consensus that human activity resulting in GHG emissions has the potential to profoundly impact the Earth's climate, countries around the world have undertaken efforts to reduce emissions by implementing both local and global measures addressing energy consumption and production, land use, and other sectors. Although the U.S. has not ratified the international agreements that set emissions targets for GHGs, in December 2015, the U.S. signed the international Paris agreement[2] that pledges deep cuts in emissions, with a stated goal of reducing emissions to between 26 and 28 percent lower than 2005 levels by 2025[3] to be implemented via existing laws and regulations with executive authority of the President of the United States. On January 20, 2021, the President of the United States signed an executive order to bring the United States back into the Paris Agreement. Regardless of the Paris Agreement, the U.S. Environmental Protection Agency (EPA) is required to regulate GHGs under the Clean Air Act and has begun preparing and implementing regulations. In coordination with the National Highway Traffic Safety Administration (NHTSA), EPA currently regulates GHG emissions from newly manufactured on-road vehicles. In addition, EPA regulates transportation fuels via the Renewable Fuel Standard program, which will phase in a requirement for the inclusion of renewable fuels increasing annually up to 36.0 billion gallons in 2022. In 2015, EPA also finalized rules to address GHG emissions from both new and existing power plants that would, for the first

[1] *Radiative forcing* is a measure of the influence a gas has in altering the balance of incoming and outgoing energy in the Earth-atmosphere system and is an index of the importance of the gas as a GHG.

[2] Conference of the Parties, 21st Session. *Adoption of The Paris Agreement, decision -/CP.21*. Paris, December 12, 2015.

[3] United States of America. *Intended Nationally Determined Contributions (INDCs)* as submitted. March 31, 2015.

time, set national limits on the amount of carbon pollution that power plants can emit. The Clean Power Plan sets carbon pollution emission guidelines and performance standards for existing, new, and modified and reconstructed electric utility generating units. On February 9, 2016, the Supreme Court stayed implementation of the Clean Power Plan pending judicial review. In October 2017, EPA proposed to repeal the Clean Power Plan and issued the Affordable Clean Energy rule June 19, 2019, replacing the Clean Power Plan. The Affordable Clean Energy rule establishes revised emissions reduction measures accepted as best technology and focusing on energy efficiency improvements in place of direct emissions reduction measures.

There are also local and regional efforts to reduce GHG emissions. In 2009, Governor Paterson issued Executive Order No. 24, which established a goal of reducing GHG emissions in New York State by 80 percent, compared with 1990 levels, by 2050, and created a Climate Action Council tasked with preparing a climate action plan outlining the policies required to attain the GHG reduction goal; an interim draft plan has been published.[4] The state is now seeking to achieve some of the emission reduction goals via local and regional planning and projects through its Cleaner Greener Communities and Climate Smart Communities programs. The state has also adopted California's GHG vehicle standards (which are at least as strict as the federal standards).

The New York State Energy Plan outlines the state's energy goals and provides strategies and recommendations for meeting those goals. The latest version of the plan was published in June 2015. The new plan outlines a vision for transforming the state's energy sector that would result in increased energy efficiency (both demand and supply), increased carbon-free power production, and cleaner transportation, in addition to achieving other goals not related to GHG emissions. The 2015 plan also establishes new targets: (1) reducing GHG emissions in New York State by 40 percent, compared with 1990 levels, by 2030; (2) providing 50 percent of electricity generation in the state from renewable sources by 2030; and (3) increasing building energy efficiency gains by 600 trillion British thermal units (BTU) by 2030.

In 2019, New York State enacted the Climate Leadership and Community Protection Act to achieve the GHG reductions goals established in the New York State Energy Plan as well as establishing a new long-term goal to reduce statewide GHG by 100 percent, compared with 1990 levels by 2050. The legislation charges New York State Climate Action Council with establishing statewide GHG emission limits and agency regulations to reduce emissions, increase investments in renewable energy sources, and ensure that significant portions of investments are made in disadvantaged communities. Pursuant to these requirements, the Climate Action Council has prepared and approved a scoping plan outlining recommendations for attaining the GHG emission limits and reduction goals.

New York State has also developed regulations to cap and reduce CO_2 emissions from power plants to meet its commitment to the Regional Greenhouse Gas Initiative (RGGI). Under the RGGI agreement, the governors of nine northeastern and Mid-Atlantic States have committed to regulate the amount of CO_2 that power plants are allowed to emit, gradually reducing annual emissions to half the 2009 levels by 2020. The RGGI states and Pennsylvania have also announced plans to reduce GHG emissions from transportation, through the use of biofuel, alternative fuel, and efficient vehicles.

Many local governments worldwide, including New York City, are participating in the Cities for Climate Protection™ campaign and have committed to adopting policies and implementing

[4] New York State Climate Action Council. New York State Climate Action Plan Interim Report. November 2010.

quantifiable measures to reduce local GHG emissions, improve air quality, and enhance urban livability and sustainability. New York City's long-term comprehensive plan for a sustainable and resilient New York City, which began as PlaNYC 2030 in 2007 and continued to evolve as *OneNYC*, with the inclusion of more ambitious GHG emissions reduction goals, many specific initiatives that can result in emission reductions, and initiatives aimed at adapting to future climate change impacts. In April 2023, New York City published *PlaNYC: Getting Sustainability Done*—the latest outline of the City's strategies to achieve its sustainability goals. The goal to reduce city-wide GHG emissions to 30 percent below 2005 levels by 2030 ("30 by 30") was codified by Local Law 22 of 2008, known as the New York City Climate Protection Act (the "GHG reduction goal").[5] The City has also announced a longer-term goal of reducing emissions to 80 percent below 2005 levels by 2050 ("80 by 50"), which was codified by Local Law 66 of 2014, and has published a study evaluating the potential for achieving that goal. More recently, under the *OneNYC 2050* report and continued in *PlaNYC*, the City announced a more aggressive goal for reducing emissions from building energy down to 30 percent below 2005 levels by 2025 and achieving net-zero city-wide GHG emissions by 2050.

In December 2009, the New York City Council enacted four laws addressing energy efficiency in large new and existing buildings, in accordance with *PlaNYC*. The laws require owners of existing buildings larger than 50,000 sf to conduct energy efficiency audits and retro-commissioning every 10 years, to optimize building energy efficiency, and to "benchmark" the building energy and water consumption annually, using an EPA online tool. By 2025, commercial buildings over 50,000 sf will also require lighting upgrades, including the installation of sensors and controls, more efficient light fixtures, and the installation of submeters, so that tenants can be provided with information on their electricity consumption. The legislation also creates a local New York City Energy Conservation Code, which along with the Energy Conservation Construction Code of New York State (as updated in 2020), requires equipment installed during a renovation to meet current efficiency standards.

To achieve the GHG reduction goals, the City is convening Technical Working Groups to analyze the GHG reduction pathways from the building sector, power, transportation, and solid waste sectors to develop action plans for these sectors. The members of the Technical Working Groups will develop and recommend the data analysis, interim metrics and indicators, voluntary actions, and potential mandates to effectively achieve the City's emissions reduction goal. In 2016, the City published the building sector Technical Working Group report, which included commitments by the City to change to building energy code and take other measures aimed at substantially reducing GHG emissions.

In May 2019, the New York City Council enacted Local Law 97 of 2019—the Climate Mobilization Act. For most buildings that exceed 25,000 gsf (excluding electricity/steam generation facilities, rent-regulated accommodations, places of public worship, and City-owned properties), the City has established annual building emission limits beginning in 2024 and would require the owner of a covered building to submit annual reports demonstrating the building is in compliance with the current GHG emission limits. For buildings not covered under the GHG emissions limits, owners may either demonstrate compliance with the current limits or implement specified energy conservation measures where applicable. In 2023, New York City Department of Buildings adopted maximum carbon intensity factors for buildings through 2050 by Energy

[5] Administrative Code of the City of New York, §24-803.

Star Portfolio Manager (ESPM) property type.[6] Under the 2023 rule, a building's emissions limit would be estimated using the appropriate carbon intensity factor for each property type and the floor area of that property type. Maximum carbon intensity factors would decrease over time until 2050, where all covered buildings are required to demonstrate that the systems would have no direct GHG emissions.

For certain projects subject to CEQR (e.g., projects with 350,000 gsf or more of development or other energy intense projects), an analysis of the projects' contributions to GHG emissions is required to determine consistency with the City's reduction goal, which is currently the most appropriate standard by which to analyze a project under CEQR, and is therefore applied in this chapter.

A number of benchmarks for energy efficiency and green building design have also been developed. For example, the LEED system is a benchmark for the design, construction, and operation of high-performance green buildings that includes energy efficiency components. Similarly, EPA's Energy Star is a voluntary labeling program designed to identify and promote the construction of new energy efficient buildings, facilities, and homes, and the purchase of energy efficient appliances, heating and cooling systems, office equipment, lighting, home electronics, and building envelopes.

METHODOLOGY

Climate change is driven by the collective contributions of diverse individual sources of emissions to global atmospheric GHG concentrations. Identifying potential GHG emissions from a proposed action can help decision makers identify practicable opportunities to reduce GHG emissions and ensure consistency with policies aimed at reducing overall emissions. While the increments of criteria pollutants and toxic air emissions are assessed in the context of health-based standards and local impacts, there are no established thresholds for assessing the significance of a project's contribution to climate change. Nonetheless, prudent planning dictates that all sectors address GHG emissions by identifying GHG sources and practicable means to reduce them. Therefore, this chapter assesses the total GHG emissions potentially associated with the Proposed Project and identifies measures that would be implemented and measures that are still under consideration to limit emissions. Note that this differs from most other technical areas in that it does not account for the increment between the condition with and without the Proposed Project. The reason for this different approach is that to account for the incremental emissions only would require speculation regarding where patients may travel to in the future without the Proposed Project if the inpatient facilities are not built at this location, what energy use and efficiency might be like for those alternatives and other related considerations, and similar assumptions regarding commercial and other uses. The focus is therefore on the total emissions associated with the uses, and on the effect of measures to reduce those emissions.

CO_2 is the primary pollutant of concern from anthropogenic emission sources and is accounted for in the analysis of emissions from all development projects. GHG emissions for gases other than CO_2 are included where practicable or in cases where they comprise a substantial portion of overall emissions. The various GHG emissions are added together and presented as metric tons of CO_2e emissions per year (see "Pollutants of Concern," above).

[6] Rule of the City of New York, 1 RCNY §103-14. Requirements for Reporting Annual Greenhouse Gas Emissions for Covered Buildings.

The potential GHG emissions associated with the Proposed Project have been estimated, including off-site emissions associated with electricity use or district steam, on-site emissions from heat and hot water systems, and emissions from vehicle use associated with the Proposed Project. GHG emissions that would result from construction and solid-waste-related emissions are discussed qualitatively.

As mentioned above, the City has introduced carbon intensity limits for most buildings over 25,000 sf that would reduce GHG emissions over time. The Proposed Project would be designed to meet the immediate carbon intensity limits beginning in 2024 and 2030. Therefore, the analysis of GHG emissions from building energy usage is based on these emission intensities. The Proposed Project would meet these intensities by utilizing either electric systems for heating and hot water, or through direct usage of Con Edison district steam. The carbon intensity of electricity and steam will likely be lower in the 2030 analysis year and lower still in future years, as the fraction of electricity generated from renewable sources continues to increase as part of the State and City's goal for net zero electricity generation by 2040.

Vehicular emission factors will also continue to decrease in future years as vehicle engine efficiency increases and emissions standards continue to decrease, resulting in lower emissions in future years. Overall, the emissions presented for the 2030 analysis year are conservatively high as compared with subsequent operational years.

Since the methodology does not account for future years and other changes described above, it also does not explicitly address potential changes in future consumption associated with climate change, such as increased electricity for cooling, or decreased on-site fuel for heating. Furthermore, since detailed design information is not yet available, emissions reduction measures, described later in this chapter, are also not included in the quantified emissions. Overall, this analysis results in conservatively high estimates of potential GHG emissions.

The following sections describe the methodology used for quantifying GHG emissions associated with the development anticipated under the Proposed Project.

BUILDING OPERATIONAL EMISSIONS

Estimates of emissions from building electricity and fuel use were prepared using building carbon intensity by use type as detailed the City's carbon intensity limits for 2024 and 2030.[7] The intensity factors were multiplied by the building floor areas (gsf) by use type in the Proposed Development. Future emissions are expected to be lower as efficiency and renewable energy use continue to increase with the objective of meeting state and City GHG reduction goals.

MOBILE SOURCE EMISSIONS

The number of annual weekday and Saturday vehicle trips by mode (cars, taxis, and trucks) that would be generated by each land use was calculated using the transportation planning assumptions developed for the analysis and presented in Chapter 10, "Transportation." The assumptions used in the calculation include average daily weekday and Saturday person trips and delivery trips per bed, the percentage of vehicle trips by mode, and the average vehicle occupancy, and were applied to the number of beds and floor areas (gsf) described above. To calculate annual totals, the number of trips on Sundays was assumed to be the same as on Saturday. Travel distances shown in Table

[7] 1 RCNY §103-14 *Requirements for Reporting Annual Greenhouse Gas (GHG) Emissions for Covered Buildings*.

18-6 and 18-7 and associated text of the *CEQR Technical Manual* were used in the calculations of annual vehicle miles traveled by cars, taxis, and trucks. Table 18-8 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type and the mobile GHG emissions calculator provided with the manual was used to obtain estimate GHG emissions from car, taxi, and truck trips.

Based on the latest fuel lifecycle model from Argonne National Laboratory,[8] emissions from producing and delivering fuel ("well-to-pump") are estimated to add an additional 25 percent to the GHG emissions from gasoline and 22 percent from diesel. Although upstream emissions (emissions associated with production, processing, and transportation) of all fuels can be substantial and are important to consider when comparing the emissions associated with the consumption of different fuels, fuel alternatives are not being considered for the Proposed Project, and as per the *CEQR Technical Manual* guidance, the well-to-pump emissions are not considered in the analysis. The assessment of tailpipe emissions only is in accordance with the *CEQR Technical Manual* guidance on assessing GHG emissions and the methodology used in developing the New York City GHG inventory, which is the basis of the GHG reduction goal.

The projected annual vehicle miles traveled associated with each use type, forming the basis for the GHG emissions calculations from mobile sources, are summarized in **Table 12-2**.

Table 12-2
Vehicle Miles Traveled per Year

Roadway Type	Passenger	Taxi	Truck
Local	124,382	13,788	519,221
Arterial	271,378	30,083	1,132,845
Interstate/Expressway	169,611	18,802	708,028
Total	**565,371**	**62,673**	**2,360,094**

CONSTRUCTION EMISSIONS

A description of construction activities is provided in Chapter 16, "Construction." Construction emissions include emissions from on-road trips, on-site non-road engines, and materials extraction, production, and transport.

The number of vehicle trips by mode (worker cars, delivery trucks) that would be generated by construction activities was calculated using the assumptions developed for the analysis and presented in Chapter 16, "Construction." The assumptions used in the calculation include average daily workers, the percentage of auto trips, and the average vehicle occupancy to develop annual vehicle miles traveled (VMT) associated with commuting workers. An average round-trip commute distance for construction workers in the New York City Region of 25.3 miles (based on the average trip to work distance for the New York Metropolitan Area)[9] was used. Similarly, the numbers of trucks (concrete trucks, dump trucks, and tractor trailers) for each phase of construction activity were used to estimate truck VMT. Distances for truck deliveries were developed based on estimates of the origin and destination of materials for the Proposed Development as well as sites in the Additional

[8] Based on GREET1_2022 model from Argonne National Laboratory.

[9] New York State Department of Transportation (NYSDOT). *2009 NHTS, New York State Add-On*. Key Tables. Table 3: Average Travel Day Person-Trip Length by Mode and Purpose, trip-to work distance for SOV in NYMTC 10-county area. 2011.

Affected Area. Table 18-8 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type, and the most recent version of the EPA MOVES model was used to obtain an estimate of car and truck GHG emission factors used to produce the associated emissions attributable to the Proposed Project.

The Proposed Project would result in construction worker travel of approximately 6.0 million VMT. Additionally, the Proposed Project would result in construction truck trips totaling approximately 2.1 million VMT. These data were used as the basis for the GHG emissions calculations from mobile sources, applying emission factors as described above for operational mobile source emissions.

On-site emissions were calculated for non-road construction engines based on specific estimates of construction activity and fuel consumption data from the NONROAD emissions module within model EPA's MOVES model. A detailed schedule for the use of non-road construction engines was developed, as described in Chapter 16, "Construction." The detailed data, including the number, type, power rating, and hours of operation for all construction engines was coupled with fuel consumption rate data from EPA's MOVES model to estimate total fuel consumption throughout the duration of the construction activities. Non-road construction engines are estimated to require approximately 170 thousand gallons of diesel equivalent throughout the duration of construction. The quantity of fuel was then multiplied by an emission factor of 10.30 kilograms CO_2e per gallon of diesel fuel.[10]

Upstream emissions related to the production of construction materials were estimated based on the expected quantity of iron or steel and cement. Although other materials will be used, cement and metals have the largest embodied energy and direct GHG emissions associated with their production, and substantial quantities would be used for the Proposed Project.

The construction is estimated to require 10,094 metric tons of cement for the Proposed Project. An emission factor of 0.928 metric tons of CO_2e per metric ton of cement produced was applied to estimate emissions associated with energy consumption and process emissions for cement production.[11] The precise origin of cement for the Proposed Project is unknown at this time.

Construction is estimated to require 14,865 metric tons of steel. An emission factor of 0.6 metric tons of CO_2e per metric ton of steel product produced was applied to estimate emissions associated with production energy consumption,[12] and 0.65 metric tons of CO_2e per metric ton of steel product produced for process emissions associated with iron and steel production were applied.[13]

EMISSIONS FROM SOLID WASTE MANAGEMENT

The Proposed Project would not fundamentally change the City's solid waste management system. Therefore, as per the *CEQR Technical Manual*, the GHG emissions from solid waste generation, transportation, treatment, and disposal are not quantified.

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[10] EPA. Emission Factors for Greenhouse Gas Inventories. 1 April, 2023.

[11] The Portland Cement Association. Life Cycle Inventory of Portland Cement Manufacture. 2006.

[12] Arpad Horvath et al. Pavement Life-cycle Assessment Tool for Environmental and Economic Effects, Consortium on Green Design and Manufacturing. UC Berkeley. 2007.

[13] Based on 42.3 teragrams of CO_2e emitted and approximately 65,460,000 tons produced; Source: EPA. *Inventory of U.S. Climate Change and Sinks: 1990–2009*. April 15, 2011.

PROJECTED GHG EMISSIONS

BUILDING OPERATIONAL EMISSIONS

The building floor area, emission intensity, and resulting GHG emissions from each of the uses are presented in detail in **Table 12-3**. The analysis presents the total emissions after construction. In general, the uses with more floor area result in greater annual GHG emissions, except for the garage parking, which has a substantially lower GHG intensity than other uses.

Table 12-3
Annual Building Operational Emissions

Source Use	Building Area (gsf)	GHG Intensity Limit (kg CO_2e / gsf / year)	Annual GHG Emissions (metric tons CO_2e)
Hospital Inpatient Facilities	850,791	7.34	6,241
Parking	50,906	0.21	11
		TOTAL:	**6,252**

Notes: Totals may not sum due to rounding.
GHG Intensity Limits represent the maximum emission limits that will begin in 2030 for the Hospital (General Medical & Surgical) and Parking ESPM Property Types, as specified in 1 RCNY §103-14. Future emissions are expected to be lower.

MOBILE SOURCE EMISSIONS

The mobile-source-related GHG emissions from all potential uses are presented in detail in **Table 12-4**. In addition to the direct mobile-source emissions included in the analysis, an additional approximately 25 percent of emissions associated with fuel extraction, production, and delivery would be emitted upstream.

Table 12-4
Annual Mobile Source Emissions
(metric tons CO_2e)

Use	Passenger Vehicle	Taxi	Truck	*Total*
Hospital – Inpatient Facility Staff	232	10	0	*243*
Hospital – Inpatient Facility Deliveries	0	0	7,440	*7,440*
Hospital – Inpatient Facility Patients and Visitors	233	36	0	*269*
Total	**465**	**47**	**7,440**	***7,952***

Note: Totals may not sum due to rounding.

CONSTRUCTION EMISSIONS

The estimated GHG emissions from construction of the Proposed Project are presented in **Table 12-5**. Total construction emissions, 22,911 metric tons CO_2e, would be equivalent to approximately 1.6 years of operational emissions. Emissions for the Proposed Project are approximately proportional to the size of their respective development areas.

Table 12-5
Total Construction GHG Emissions
(metric tons CO_2e)

Use	Total GHG Emissions
Nonroad	*1,617*
Transportation	*7,201*
Materials	*14,840*
Total	23,657
Notes: Totals may not sum due to rounding.	

SUMMARY

A summary of GHG emissions by source type is presented in **Table 12-6**. Emissions associated with mobile sources and the building energy emissions represent approximately one half of the total emissions, with mobile sources accounted for a higher percentage of the emissions. Note that if new buildings were to be constructed elsewhere to accommodate the same number of units and space for other uses, the emissions from the use of electricity, energy for heating and hot water, and vehicle use could equal or exceed those estimated for the Proposed Project, depending on their location, access to transit, building type, and energy efficiency measures. The Proposed Project is not expected to fundamentally change the City's solid waste management system, and therefore, emissions associated with solid waste are not presented.

Table 12-6
Summary of Annual GHG Emissions
(metric tons CO_2e)

Use	Building Operations	Mobile	*Total*
Hospital Inpatient Facilities	6,241	7,952	*14,193*
Parking	11	0	*11*
Total	**6,252**	**7,952**	***14,204***
Note: Totals may not sum due to rounding.			

The operational emissions from building energy use include emissions associated with the production and delivery of the electricity or district steam to be used on-site. Since the above estimate reflects the minimum efficiency of existing buildings, the resulting emissions are conservatively high.

In addition, total GHG emissions associated with the construction, including direct emissions and upstream emissions associated with construction materials (excluding fuel), would be approximately 24 thousand metric tons.

ELEMENTS THAT WOULD REDUCE GHG EMISSIONS

The Proposed Project would include a number of sustainable design features that would result in lower GHG emissions, detailed below, addressing the PlaNYC goals as outlined in the *CEQR Technical Manual* as well as New York State GHG reduction goals stated in the CLCPA.

BUILD EFFICIENT BUILDINGS

Specific measures also under consideration would include the installation of high efficiency HVAC systems, efficient lighting systems, and incorporating inverted roofing systems—locating waterproofing element below thermal insulation elements to reduce heating/cooling loads.

MSKCC has identified several measures under consideration that may be implemented in the final design and would reduce GHG emissions (directly or indirectly). Specific measures also under consideration would include the installation of high efficiency HVAC systems, reduced energy demand using peak shaving/load shifting strategies, motion sensor lighting/climate controls, and re-use of gray water/collected rainwater. These measures include the following (this list represents measures currently under consideration, but other measures may be included once the specific design progresses):

- High efficiency HVAC systems with the all-electric systems with on-site sterilization processes using district steam rather than on-site generation;
- Incorporate building insulation and window glazing that exceed building code requirements;
- Use of environmentally friendly refrigerants (refrigerants with low global warming potential such as ethane, isobutane, propane, R-441A, and HFC-32) when required;
- Incorporate efficient, directed exterior lighting;
- Incorporate motion sensors for light/climate controls in specific locations;
- Incorporate invert roofing systems to reduced heating/cooling loads;
- Electric kitchen with hybrid electric/induction equipment;
- Incorporate recycled content in some building materials, such as finishes, structural steel, and concrete design if practicable;
- The Proposed Project will be designed to achieve Platinum-level certification under the LEED for Building Design and Construction rating system, version 4.1, for Healthcare. To qualify for LEED, the energy efficiency requirements specify that a project meet the ASHRAE 90.1-2016 standard (currently the minimum building code requirements under New York City's building code) and would demonstrate that the project exceeds the energy requirements of a baseline building; and
- To qualify for LEED, the project would include charging infrastructure for electric vehicles equipped at a minimum of 10 percent of all parking spaces.

Therefore, the Proposed Project would support the goal identified in the *CEQR Technical Manual* of building efficient buildings.

USE CLEAN POWER

Under the carbon intensity limits for most buildings in New York City, the Proposed Project would be required to demonstrate that their GHG emissions fall below these limits. While the use of fossil fuels would not be specifically prohibited by LL97, the Proposed Project would utilize either electric-powered systems or utilize district steam for normal operations. The Proposed Project would also be designed to utilize available rooftop space for the installation of solar generation, consistent with Local Laws 92 and 94. It is also possible that additional local renewable power production (e.g., geothermal, solar, wind) would be considered while reviewing the principles of LEED, EPA Energy Star, to achieve the above efficient building goals.

Therefore, the Proposed Project would support the goal identified in the *CEQR Technical Manual* of using clean power.

TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

MSKCC would consider the use of pedestrian-oriented public spaces and wayfinding principles as part of the design for the Proposed Project to ease the connection to bicycle networks. To qualify for LEED certification, charging infrastructure for electric vehicles would also be included for at least 10 percent of the parking provided. The Project Area is supported by transit options that include the No. 6, F, N, Q, R, and W subway lines at the Lexington Av/59th Street, Lexington Av/63rd Street, and 72nd Street Stations, as well as local buses throughout the Project Area. The Project Area also includes several Citi Bike stations.

Therefore, the Proposed Project would support the goal identified in the *CEQR Technical Manual* for transportation.

REDUCE CONSTRUCTION OPERATION EMISSIONS

Construction specifications would include an extensive diesel emissions reduction program, as described in detail in Chapter 16, "Construction," including diesel particle filters for large construction engines and other measures. These measures would reduce particulate matter emissions; while particulate matter is not included in the list of standard GHGs ("Kyoto gases"), recent studies have shown that black carbon—a constituent of particulate matter—may play an important role in climate change.

USE BUILDING MATERIALS WITH LOW CARBON INTENSITY

Recycled steel may be used for most structural steel since the steel available in the region is mostly recycled. Some cement replacements such as fly ash and/or slag may also be used, and concrete content would be optimized to the extent feasible. The use of local, rapidly renewable, or certified sustainable wood, and recycled build-out materials would be considered. The Proposed Project would implement a Construction Waste Management Plan to promote the waste reduction and set a target to divert 75 percent of waste from landfill, consistent with LEED requirements. Additionally, the MSKCC is exploring the use of biodiesel engines or electric construction equipment.

As described above, the Proposed Project would include substantial energy efficiency and other design measures and features aimed at reducing GHG emissions. The implementation of the various design measures and features described above would result in development that is consistent with the City's emissions reduction goal, as defined in the *CEQR Technical Manual*. ✷