Chapter 13: Energy

A. INTRODUCTION

This chapter describes the effects of the Cornell NYC Tech project on the use and conservation of energy. The chapter first provides a discussion of the existing and future energy supply for the project area and the relevant energy codes and energy conservation regulations. Based on project specific information, the chapter then discloses the amount of energy that would be consumed during the 2018 analysis year for Phase 1 and during the 2038 analysis year for Full Build.

The chapter also describes planned "green measures" to reduce the proposed project's energy consumption and to use renewable energy sources. Energy measures that would be included in the proposed project, enabling it to achieve at least the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) Silver certification, are also described.

As described in this chapter, the proposed Cornell NYC Tech project would not result in significant adverse energy impacts in either the 2018 or 2038 analysis years.

B. METHODOLOGY

As noted in the June 2012 *City Environmental Quality Review (CEQR) Technical Manual*, the incremental demand caused by most projects would not create a significant impact on energy supply. Consequently, a detailed assessment of energy impacts is limited to those projects that may have a significant effect on the transmission or generation of energy. The proposed project would not have such effects. Energy would be generated on site using renewable resources, which would reduce the demand on existing energy systems serving the city. The onsite energy generation would not have a significant effect on the transmission or generation of energy beyond the project site.

Based on a preliminary assessment the projected energy consumption for the proposed project in Phase 1 and Full Build is disclosed. A range is presented for the amount of electricity that may be generated on-site, using renewable resources and distributed generation. The energy consumption projections for Phase 1 are based on energy modeling for prototype buildings, scaled to account for the reasonable worst case development scenario (RWCDS) floor area analyzed in this EIS, and doubled to conservatively account for uncertainties in the occupancy schedules assumed in the energy model. For the Full Build, the Phase 1 energy consumption projections were adjusted to account for the Full Build RWCDS floor area. Energy efficiency features that were accounted for in the building energy modeling include technologies aimed at reducing energy use by approximately 30 percent as compared with ASHRAE 90.1 standard.[1] It was assumed that the Phase 1 academic building would be designed to an even higher level of

[1] The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1 – Energy Standards for Buildings, is the guidance standard used by LEED® to define energy standards for rating.

energy efficiency, representing the approximate limit of readily-available technology to limit loads, a better building envelope, better controls, and geothermal heat pumps providing all heating and cooling needs, except for a small gas-fired hot water unit. In addition, it was assumed that at least 20 percent of the annual electricity consumed in Phase 1 and Full Build could be generated on-site using distributed generation.

C. EXISTING CONDITIONS

ENERGY PROVIDER

Electricity on Roosevelt Island is distributed by Con Edison. The electricity is supplied from a variety of sources that originate both within and outside New York City, including locations across the Northeast, and from places as far away as Canada. The electricity consumed in New York City is produced both by non-renewable sources, such as oil, natural gas, coal fuel, and uranium; and renewable sources, such as hydroelectricity and, to a much lesser extent, biomass fuels, solar power, and wind power.

Con Edison distributes power throughout the city. Transmission substations receive electricity from the regional high voltage transmission system and reduce the voltage to a level that can be delivered to area substations. Area substations further reduce the voltage to a level that can be delivered to the distribution system, or street “grid.” Within the grid, voltage is further reduced for delivery to customers.

Con Edison also provides natural gas service to Roosevelt Island. There is no Con Edison steam service on Roosevelt Island, but there is a Roosevelt Island steam plant located just north of the Ed Koch Queensboro Bridge that provides heat to the Goldwater and Coler Hospitals as well as the Sportspark and the Motorgate Garage. As discussed below, it is expected that this steam plant would be decommissioned independent of the proposed project.

In 2010 (the most recent year for which data are available), annual electricity usage totaled approximately 59 billion kilowatt-hours (KWH), or 200 trillion Btu in Con Edison’s delivery area. In addition, Con Edison supplied approximately 124 trillion Btu of natural gas and approximately 23 billion pounds of steam, which is equivalent to approximately 23 trillion Btu. Overall, approximately 347 trillion Btu of energy are consumed within its New York City and Westchester County service area.[2]

For 2011-2012, the independent, non-profit New York State Reliability Council (NYSRC) recommends that a minimum of 81 percent of the city’s peak load be provided by sources within the city. Presently, there is sufficient capacity within the city to meet this 81 percent local energy generation requirement.[3] However, as the energy demand increases over time, additional in-city generation would be needed to satisfy this requirement.

RECENT ENERGY CONSERVATION DIRECTIVES

In 2001, New York State began implementing measures to address the increasing electrical power capacity needs of the New York City region. New York State Governor’s Executive Order No. 111 (EO 111) was introduced in June 2001, directing state agencies, state authorities, and other affected entities to address energy efficiency, renewable energy, green building

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[2] Con Edison of New York, *Annual Report*, year ended December 31, 2010.

[3] New York State Reliability Council, New York Control Area Installed Capacity Requirements for the Period May 2011 through April 2012, December 10, 2010.

practices, and alternate fuel vehicles. EO 111 identified the New York State Energy Research and Development Authority (NYSERDA) as the organization responsible for coordinating and assisting agencies and other affected entities with their responsibilities. NYSERDA and other utilities have implemented programs to encourage businesses to reduce energy usage and increase energy efficiency.

DISTRIBUTED GENERATION AND PLANYC 2030

PlaNYC 2030 encourages the development of clean distributed generation (clean DG), which enables properties to create their own power with higher efficiencies and less environmental impact than central plants. For example, cogeneration systems can achieve high efficiencies by capturing the heat by-product of electricity production and reusing it for heating and cooling. Such clean DG systems help lower peak demand for electricity and improve the reliability of the city's electrical grid.

PROJECT SITE

Currently, Goldwater Hospital occupies the project site. Gas is provided to the site from Manhattan and Queens via the Ravenswood Tunnel, and electrical service is provided from the 63rd Street Substation in Manhattan. In addition, heat is provided to Goldwater Hospital by a steam plant located slightly north of the Queensboro Bridge.

D. FUTURE WITHOUT THE PROPOSED PROJECT

The New York Independent System Operator (NYISO), which manages the safety and reliability of the state's electric transmission system, reported in September 2010 that the state's wholesale electric power system will continue to meet accepted reliability standards through 2020. According to the NYISO's *2010 Reliability Needs Assessment*, the accepted reliability standards will be met because there are two new proposed generating plants totaling 1,060 MW and because there is lower energy demand forecasted since a) the 2009 recession reduced the peak demand forecast for 2011 by 1,400 MW, reducing the projections of peak load in subsequent years; and b) statewide energy efficiency programs seek to lower energy consumption on the electric system by 15 percent, resulting in energy savings of 13,040 GWh by 2018 and 13,684 GWh by 2020.[4] Because of the existing supply, the addition of the proposed NYISO generating plants, and the State's planning process to identify potential shortfalls years before they would materialize, it is expected that an adequate generating capacity, which would exceed projected demands, would be available in the New York City metropolitan area through the 2038 Full Build analysis year for the proposed project.

In the future No-Action condition, in both the 2018 and 2038 analysis years, the Goldwater Hospital campus on the project site is expected to be vacant. Therefore, energy use at the project site is expected to be minimal. The Roosevelt Island steam plant is expected to be decommissioned, independent of the proposed project.

E. PROBABLE IMPACTS OF THE PROPOSED PROJECT

Cornell NYC Tech would develop and operate the proposed project in a manner that maximizes energy efficiency and on-site renewable energy generation. These energy measures ensure that Cornell NYC Tech's operations consume less fossil-fuel derived energy than comparable New

[4] New York Independent System Operator, *2010 Reliability Needs Assessment*, September 2010.

York City institutions. Projected energy consumption for Phase 1 and Full Build, the energy conservation measures to be incorporated in the proposed project design, and a description of the proposed on-site generation systems are described in the following sections.

As noted in Chapter 1, "Project Description," in support of the Cornell NYC Tech project, Con Edison would upgrade an existing gas line to Roosevelt Island. The upgrade would require the replacement of some piping and the change-out of pressure regulators within the Con Edison system.

2018 ANALYSIS YEAR (PHASE I)

The projected electricity, natural gas, and total energy consumption for Phase 1 is presented in **Table 13-1**.

The projected energy consumption for Phase 1 would not affect Con Edison's ability to continue supplying sufficient electricity and natural gas to Roosevelt Island and New York City. The proposed project in Phase 1 would therefore not have an adverse significant impact on energy.

Table 13-1
Annual Energy Consumption, Phase 1 (2018)

Proposed Uses	Electricity (MWh)	Natural Gas (MMBtu)	*Total Energy (MMBtu)*
Academic	3,656	975	13,440
Corporate Co-location	2,133	1,189	8,463
Residential	3,650	13,082	25,527
Executive Education Center	2,196	7,814	15,301
Central Energy Plant	427	238	1,693
Total	***12,062***	***23,298***	***64,423***

Note: The estimates are based on project-specific energy modeling by AKF, an energy modeling consultant. A factor of safety of 2 (doubling all of the values) was imposed to reflect the very early stage of design and space programming, and Cornell's experience with achievable energy demands, so as to allow a conservative assessment of potential impacts.
Sources: Cornell and AKRF.

2038 ANALYSIS YEAR (FULL BUILD)

The projected electricity, natural gas, and total energy consumption for Full Build is presented in **Table 13-2**.

Table 13-2
Annual Energy Consumption, Full Build (2038)

Proposed Uses	Electricity (MWh)	Natural Gas (MMBtu)	*Total Energy (MMBtu)*
Academic	11,334	5,970	44,612
Corporate Co-location	10,667	5,947	42,315
Residential	9,733	34,885	68,071
Executive Education Center	2,196	7,814	15,301
Central Energy Plant	853	476	3,385
Total	***34,783***	***55,092***	***173,694***

Note: The estimates are based on project-specific energy modeling for Phase 1 and the ratio of the proposed floor area in Full Build to Phase 1.
Sources: Cornell and AKRF.

By 2038, full development of the proposed project is projected to result in a combined annual energy demand of 173,694 million Btu. The proposed project's total combined energy intensity is 81,542Btu per square foot. This is substantially lower than the average intensities in New York City:[5] This efficiency would come from design of the proposed buildings (see "Cornell NYC Tech Energy Conservation Measures," below) and the use of geothermal energy for heating and cooling.

The proposed project's energy demand would account for approximately 0.05 percent of energy consumed within Con Edison's New York City and Westchester County service area, and would be considered a negligible increment. The proposed project would not be an energy intensive facility that would significantly affect the transmission or generation of energy, and would not result in significant adverse impacts to the transmission or generation of energy.

CORNELL NYC TECH ENERGY CONSERVATION MEASURES

ENERGY EFFICIENT BUILDINGS

As described in Chapter 1, "Project Description," Cornell has committed to achieving a minimum of LEED® Silver certification for all project buildings. LEED® certification requires building energy efficiency that results in energy expenditure at least 10 percent lower than the baseline building designed to meet minimum code requirements. The building design would be aimed at attaining an energy efficiency of 30 percent better than code, which is well above the minimum LEED® requirement. Some energy efficiency measures (high-efficiency building envelopes and systems; high efficiency lighting and controls, and heating and cooling building envelopes and systems; high-efficiency lighting and controls, and heating and cooling set-points which are Cornell standards) were included in the energy modeling and are reflected in the results presented above; however, additional efficiency may be achieved due to sustainable project elements not yet designed and additional measures still under consideration. To attain the LEED® certification, the designs for the proposed project would include:

- Energy efficient building envelopes to reduce cooling/heating requirements;
- High-efficiency heating, ventilation, and air conditioning (HVAC) systems or generators;
- Green roofs or rooftop gardens, that would provide shade and remove heat from the air through evapotranspiration, reducing the building energy needs and providing other environmental benefits;
- Features to optimize interior daylighting and minimize heat loss and solar gain (e.g., window glazing, superinsulation);
- Motion sensors and lighting and climate controls;
- Efficient, directed exterior lighting;
- A commitment to conduct third party building commissioning to ensure energy performance; and
- Building orientation that minimizes energy use.

Other measures likely to be part of the design include high-albedo roofing materials except on roofs with solar panels or green roofs; peak shaving or load shifting strategies, subject to acceptable life-cycle cost evaluation; efficient lighting and elevators and Energy Star appliances; an on-site charging station for electric vehicles; and other sustainable design features that may

[5] *CEQR Technical Manual* Table 15-1.

indirectly also reduce energy consumption, such as use of water conserving fixtures that exceed building code requirements, water efficient landscaping, and potential re-using of gray water and/or collection and re-use of rainwater.

ENERGY GENERATION

Cornell has also set a goal to achieve net-zero energy consumption for its Phase 1 academic building. This means that the campus collectively would generate enough electricity from renewable sources to offset the cumulative electrical power, heating, and cooling energy use of the Phase 1 academic building on an annual basis. The electricity would be generated using photovoltaic (PV) panels and would reduce the need for electricity that would be purchased from Con Edison. This Phase 1 academic building would also use geothermal energy for heating, if economically feasible. In addition, the installation of fuel cells or microturbines would be considered for both Phase 1 and Full Build. These systems would require additional use of natural gas, but would reduce the need for grid power. While these systems have not been designed yet, it is anticipated that they could likely supply approximately 20 percent of the electricity demand. Depending on individual building as well as campus thermal and electric loads and economic considerations, as much as 50 percent of the electricity demand for the Full Build development could be met through on-site generation. The on-site systems would be designed for high efficiency and could potentially reduce source energy consumption by 2 to 6 percent, assuming a factor of 2.867, to estimate the source energy for the grid given electricity output.[6]

The systems that are being considered to generate energy on-site are briefly described below:

- A below-grade closed-loop geothermal well field would be developed to serve the academic building. Approximately 140 geothermal wells may be constructed during Phase 1. These wells, linked to a heat pump system, would likely meet the heating and cooling demand for the academic building. Cornell is also considering whether other heat rejection means (such as cooling towers) could be used to reduce the peak heating and cooling needs. Cornell may expand the geothermal system as practical for the Full Build, depending on the success of the Phase 1 system.
- The utility plants would provide space for in-coming utility services and may also include equipment to supply power, chilled water, and heat to portions of the campus. As the campus develops, it may also evolve to contain (in this structure or added facilities) distributed energy generation units that would operate on natural gas (fuel cells, micro-turbines, or novel engine-generators) to support the campus energy demand while reducing fossil fuel needs (and thus reducing the campus carbon footprint).
- Photovoltaic (PV) panels would be installed throughout the project site (e.g., on roofs of proposed buildings and on the southern portion of the project site during Phase 1). PV panels may also be integrated into the landscape to form pavilions, covered rest areas, and similar ground-mounted structures as needed to achieve the renewable electricity goals of the campus.

F. CONCLUSIONS

The proposed project would not result in a significant adverse impact with respect to the transmission and generation of energy. The proposed project would comply with the New York City Energy Conservation Code (NYCECC) and Energy Conservation Construction Code of

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[6] PlaNYC, Inventory of New York City Greenhouse Gas Emissions, p. 39, September 2011.

New York State (ECCCNYS), incorporating all measures relating to energy efficiency and thermal transmittance.

By 2038, full development of the proposed project is projected to result in a combined 173,684 million British thermal units (Btu) of energy demand annually. The proposed project's total combined energy intensity for Full Build is 81,542 Btu per square foot. This is substantially lower than the average intensities in New York City.[7] The proposed project would incorporate a number of measures intended to reduce energy consumption. Cornell has committed to achieve a minimum of LEED® Silver certification for all project buildings.

In Phase 1, Cornell NYC Tech would design the academic building to consume net zero energy. The building would use on-site generated solar power and be heated and cooled using geothermal energy. Cornell is exploring the feasibility of additional on-site power generation, using fuel cells and microturbines. ✷

7 *CEQR Technical Manual* Table 15-1.