8.0 EFFECTS ON THE USE AND CONSERVATION OF ENERGY RESOURCES

Energy consumption will occur during construction and occupancy of the proposed residences and hydroponic garden. During construction, energy will be used to power equipment and construction vehicles. The apartment building will consume energy for space heating, air conditioning, lighting, household appliances and other electrical devices once occupied.

Proposed Energy Use and Demand

Electricity and gas for the Buena Vista Teutonia development will be provided by Con Edison from a new distribution system that will distribute electricity from transmission lines in Buena Vista Avenue to the development. Actual electrical and gas demands will vary based upon the energy usage and habits of the future residents.

The 412 dwelling units would be inhabited by households that would place demand on various energy sources. In a residential dwelling, energy is consumed for space heating, air-conditioning, water heating, refrigerators, appliances and lighting. According to data published in the *1997 Residential Energy Consumption Survey* (Source: U.S. Department of Energy), approximately 123 million BTUs are consumed per household annually in New York State. Based upon these U.S. Department of Energy estimates, the 412 new households could consume up to 5.68 billion BTU[1] of energy annually. With a greater public awareness of energy consumption and energy efficiency, appliances and heating and cooling equipment have become more energy efficient over the past decade. Therefore, actual energy use may be less.

The project's mechanical engineer, Edwards & Zuck, P.C., estimated the Project's electrical demand in a letter provided to Con Edison dated March 10, 2010 (see Appendix B Correspondence). The electrical demands in the residential portion of the building would include: lighting and outlets, appliances, heat pump units, ranges, washer and dryers, and electric water heaters. Total demand for the residential units is estimated to be 12,285 kva. Common area electrical demand would include: common area lighting and power (parking and administration), HVAC loads, plumbing loads including pumps, elevators and pool equipment. Total demand for common areas is estimated to be 1,144 kva. Total demand using a residential connected load (23 % demand factor) would be 3,830 kva or 4,615 Amps.

A combined heat and power (CHP) system is proposed for the building and will consist of gas-fired microturbines. The CHP system is proposed to augment the heating and cooling system for the building. The electrical power produced will feed selected building loads such as the geo-thermal ground and condenser pumps and the mechanized parking garage (see discussion below for further details). The heat produced by the CHP system will provide heat for the hydroponic garden in the winter months as well as heat for other community areas such as the pool. A diesel fuel-fired emergency generator will be used for back-up emergency power.

The microturbine system will utilize natural gas to be supplied by Con Edison. The project utilities engineer has estimated the natural gas requirements of the microturbines in a letter to Con Edison dated May 24, 2010, as follows:

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[1] BTU, or British Thermal Unit, is a unit of heat equal to the amount of heat required to raise one pound of water one degree Fahrenheit at one atmosphere pressure; equivalent to 251.997 calories.

The estimated natural gas demand is as follows:

Load Component	Unit Gas Load	Quantity	**Total Gas Load**
Gas Microturbine	842	6	**5,052 MBH**

The estimated electric and natural gas demands for the project provide the total anticipated energy demands of the project as estimated by the project engineers for the various building uses and demands.

Energy Conservation Measures

The Buena Vista Teutonia project is designed with a number of sustainable design features that will reduce project energy consumption with the goal of achieving LEED certification. The level of LEED certification has not been determined at this time, but will be determined based upon final architectural, mechanical and material project plans. The energy conservation measures provided below are listed in the NYSDEC publication *Guide for Assessing Energy Use and Greenhouse Gas Emissions in an Environmental Impact Statement*.

The building will be served by a geothermal heating and cooling system. Bedrock wells installed in the public right-of-way will recirculate groundwater to reduce heating demand in the winter months and cooling demand in the summer months. The geothermal system will reduce overall energy demand for heating and cooling.

The project will employ a combined heat and power (CHP) system which will utilize six (6) natural gas fired microturbines. The microturbine system, using natural gas, is considered clean, state-of-the-art technology for power and heat generation. The electrical power produced will feed selected building loads such as the geo-thermal pumps and the mechanized parking garage (see discussion below for further details). The heat produced by the CHP system will provide heat for the purposes described previously.

A clean-tech mechanized parking system is proposed for the apartment building's residents. The parking garage will include three levels and will be primarily below street level. An automated parking system provides an alternative to self parking or valet parking. Residents will drive into one of four platform staging areas or "stalls", turn off the engine and exit the vehicle. A mechanized platform will then move the vehicle to a designated parking space below or above grade. When the resident wants to pick-up their vehicle, the process is reversed. Automated parking systems have been shown to substantially reduce both auto emissions and fuel consumption. In a study of comparable 350 space garages in New York completed in 2009 by EEA Consultants, fuel consumption was reduced by 83 percent when comparing an automated parking garage to a conventionally designed garage[2]. Vehicle emissions, including carbon-monoxide, nitrogen oxides and carbon dioxide, were reduced by 77 to 83 percent.

The hydroponic garden is a sustainable design feature that is intended to reduce indirect fossil fuel consumption and therefore, indirect greenhouse gas emissions. The majority of produce consumed in the United States is transported long distances to get from farm to table, thereby consuming large amounts of fuel. A local, year-round greenhouse will provide fresh produce to local restaurants and grocery stores thereby reducing fossil fuel consumption and greenhouse gas emissions.

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[2] EEA, Inc., Automated Parking Systems Offer Air Quality and Fuel Consumption Benefits, "Environmental Consulting Insights," Electronic Newsletter of EEA's Environmental Consulting Activities, (Garden city, NY: July 2009).

Stormwater will be detained in a subsurface stormwater cistern storage system consisting of storage pipes and galleys located under the proposed parking garage. The storage system will have a capacity of approximately 200,000 gallons. Stormwater collected in the cistern system will be utilized to provide up to 30 days of stored irrigation water for the rooftop hydroponic garden. This volume has been calculated as 69,300 gallons of storage.

The project will utilize water conservation fixtures that exceed building code requirements, minimizing water demand. Minimizing water use reduces the overall energy demand for water treatment and for pumping and distribution through the municipal and on-site water systems. The proposed water saving fixtures are estimated to reduce project water demand by approximately 60 percent compared to standard fixtures according to the project mechanical engineer.

As described in Section 2.0 Project Description, the project development will involve the redevelopment of a "brownfields" site, i.e., a site impacted by previous heavy commercial and industrial uses. The redevelopment, clean-up and re-use of the site provides an opportunity to avoid the use of undeveloped land and the related loss of trees and vegetation associated with such development. In addition, in keeping with sustainable design practices, the building footprint has been minimized to conserve land and reduce residential development "sprawl".

Another sustainable design feature is the project's location with respect to public transportation. The project is within short walking distance (less than 200 feet) from the Metro North Yonkers train station. Commuters can access Grand Central Station in New York City from the Yonkers station in approximately 30 to 40 minutes. A percentage of future project residents will commute to New York City and will not require the use of a vehicle for daily trips to and from work, thereby reducing project related (indirect) fuel use and resultant greenhouse gas emissions.

Building Design and Materials

Energy conservation is regulated at the state level. The design and plans for residential buildings must comply with the New York State Energy Conservation Construction Code.

The code specifies basic requirements that are mandatory for all residential buildings. Requirements apply to heating and cooling systems, the hot water system, electrical system, material and equipment specifications and, sealing the building envelope.

With regard to the design of building envelopes, the NYS Energy code requires that:

- insulation R-values and glazing and door U-factors be certified by the National Fenestration Rating Council (NFRC) or by using default values found in tables published in the Code.
- vapor retarders be installed in nonvented framed ceiling, wall, and floor areas.
- insulation levels for walls, roofs, and below-grade walls and glazing areas, and U-factors for windows and skylights meet or exceed minimum efficiency levels.
- air leakage be limited through the building envelope.

The NYS Energy Code also requires that water and air cooling and heating mechanical systems and equipment comply with code, and compliance is dependent on the type of mechanicals proposed.

In terms of lighting standards, the NYS Energy Code requires:

- manual or automatic controls or switches that allow occupants to dim lights and turn them on or off when appropriate. The Code identifies control, switching, and wiring requirements that apply to all buildings.
- total connected loads for indoor lighting systems that do not exceed power allowances for a building. The Code demonstrates how to comply with interior-lighting power limits.
- energy-efficient exterior lighting. The Code specifies criteria for complying with exterior-lighting requirements.

The Buena Vista Teutonia project will comply with the requirements of the NYS Energy Conservation Construction Code.

Greenhouse Gas Emissions

The proposed project has the potential to generate (GHG) emissions from both stationary sources (i.e. CHP project) and non-stationary sources (i.e. automobiles). Project related GHG emissions are considered either "direct" or "indirect". This section evaluates the potential for both direct and indirect GHG emissions from stationary and non-stationary sources that may result from the construction and operation of the Project. The evaluation is in accordance with the draft NYSDEC *Guide for Assessing Energy Use and Greenhouse Gas Emissions in an Environmental Impact Statement*[3].

According to the NYSDEC *Guide for Assessing Energy Use and Greenhouse Gas Emissions* (cited above), there are six main greenhouse gases (GHG):

- Carbon dioxide (CO_2)
- Nitrous oxide (N_2O)
- Methane (CH_4)
- Hydrofluorocarbons (HFC's)
- Perfluorocarbons (PFC's)
- Sulfur Hexafluoride (SF_6)

The great majority, or an estimated 88 percent of greenhouse gases emissions, are CO_2 [3]. The majority of CO_2 emissions are the direct result of fuel combustion. Additional GHG emissions are the result of electricity distribution, refrigerant substitutes, as well as municipal waste, wastewater treatment plants, agricultural practices and natural gas leakage.

According to the *Guide for Assessing Energy Use and Greenhouse Gas Emissions*, an evaluation of GHG should address both direct and indirect GHG emissions. For this assessment, direct emissions have been analyzed quantitatively. Indirect emissions have been assessed qualitatively, consistent with the Scoping Document.

Direct GHG Emissions

Direct GHG emissions related to the Project include emissions that will be generated from stationary source fuel combustion equipment such as the proposed CHP system and an

[3] NYSDEC "Guide for Assessing Energy Use and Greenhouse Gas Emissions in an Environmental Impact Statement", July 2009, (Albany, New York).

emergency generator. The state-of-the-art CHP system will deliver 390 kilowatts (kW) of electricity to the Project. In addition, the CHP system will provide heat to the proposed hydroponic garden.

There are no direct mobile sources of GHG emissions related to the Project because the Project will not own any mobile sources. GHG emissions associated with project-generated traffic are considered indirect.

Project-related direct carbon dioxide (CO_2) emissions have been quantified and are provided in Table 8-1. Although combustion of fossil fuels such as natural gas and fuel oil emit other GHG pollutants in addition to CO_2, other pollutants have not been quantified as per NYSDEC guidance. CO_2 emissions are based on expected fuel usage rates and emission factors published by the US Energy Information Administration (USEAI)[4].

Table 8-1
Potential CO_2 Emissions from Direct Stationary Sources

Emission Source	Annual Fuel Combustion Rate	CO_2 Emission Factor	CO_2 Emission Rate (lb/yr)	CO_2 Emission Rate (MT/yr)
Microturbines - 6 Units (Natural Gas)	44,256 (MMBtu)	117.08 (lb/MMBtu)	5,181,492	2,350
Emergency Generator (Diesel)	14,300 (gal)	22.384 (lb/gal)	320,091	145
Total:				**2,495**

Source: RPT Consultants, June 2010.
Notes: Microturbine emissions based on 8,760 hours of operation per year.
Diesel generator is used for emergency purposes only. Emissions based on 500 hours of operation per year.
Units: MMBtu– Million Btu
lb - pound
gal - gallon
yr - year
MT - metric ton

Indirect GHG Emissions from Stationary Sources

Indirect GHG emissions from stationary sources include emissions generated offsite by utilities that will be supplying the Project with energy such as electricity, heating or cooling. The power demand for the project will be reduced based on the operation of the CHP system.

The electricity and heat generated from the CHP system will offset project power demand that would have otherwise been generated off-site and transferred to the Project Site. As such, direct CO_2 emissions will offset indirect CO_2 emissions for this Project. The project's mechanical

[4] US Energy Information Administration (USEAI)- Fuel and Energy Source Codes and Coefficients. http://www.eia.doe.gov/oiaf/1605/coefficients.html

engineers have estimated that approximately 4,673,635 kW, and therefore, 1,766 metric tons (MT) of CO_2 will be offset by on-site power production. CO_2 emissions from avoided grid power was calculated by multiplying the state-wide average CO_2 emission factor of 850 pounds of CO_2 per MWh by 98% which is the emission factor for Con Edison who would deliver power to the Project. In addition, the CHP system also generates heat which will be used in the hydroponic garden. This heating demand would have otherwise been generated by additional air emission sources such as boilers. Based on manufacturer's data, the use of the CHP system will give an additional 60% reduction in CO_2 emissions as compared to generating equivalent heat from other sources such as boilers. Therefore, when the electricity and heat generated by the CHP system is combined, as compared to purchased electricity and boiler generated heat, the CHP system provides a CO_2 emissions reduction of 826 MT per year.

Indirect GHG Emissions from Mobile Sources

Indirect emissions from mobile sources include vehicle trips generated by the Project, in which the vehicles are not owned by the Project. These vehicle trips are associated with residents, visitors, suppliers/vendors and waste transportation. Based on the traffic data presented in Section 3.5 of the DEIS, the Project is expected to generate a maximum of 119 vehicle trips per hour. The traffic generation reflects the fact that some percentage of the future residents will utilize the Metro North and other forms of public transportation.

Indirect GHG Emissions from Waste Generation

Emissions associated with waste generation are considered indirect and are based on solid waste amounts and solid waste management practices. GHG emissions associated with waste generation are expected to be minimal.

Indirect GHG Emissions from Project Construction

Emissions from construction of the Project can be considered both direct and indirect. Direct emissions are associated with construction equipment exhaust and indirect emissions are those associated with the manufacture and transportation of construction materials. Similar to the pollutants discussed in the Air Quality section, GHG emissions from construction will be minimal based on project size and construction duration.

Summary of Energy Conservation Measures

As indicated above, the Buena Vista Teutonia project has been designed as a sustainable residential development. The project includes a number of design features that would reduce the project's operational and long term energy use, including:

- Geothermal heating and cooling system
- Combined Heat and Power (CHP) system using microturbines
- Automated garage system
- Hydroponic garden
- Proximity to public transportation
- Use of energy efficient building materials

- Use of water conservation fixtures that exceed building code requirements
- Collection and reuse of rain water for hydroponic garden irrigation
- Redevelopment of brownfields site to minimize vegetation loss on undeveloped land
- Minimize building footprint to conserve land for alternative uses or preservation

Given these energy reducing design features, the Project's proposed use of energy and the related generation of greenhouse gases have been reduced to the extent practical.