Nuclear Development
244 Chestnut Street, Salem, NJ 08079

PSEG
Power LLC

ND-2012-0059
October 3, 2012

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: **PSEG Early Site Permit Application**
Docket No. 52-043
Response to Request for Additional Information, No. Env-14, ESP EIS 9.0 – Environmental Impacts of Alternatives

References: 1) PSEG Power, LLC Letter No. ND-2012-0031 to USNRC, Submittal of Revision 1 of the Early Site Permit Application for the PSEG Site, dated May 21, 2012

2) Env-14, Review Section: ESP EIS 9.0 – Environmental Impacts of Alternatives, dated August 31, 2012 (eRAI 6742)

The purpose of this letter is to respond to the request for additional information (RAI) identified in Reference 2 above. This RAI addresses Question Nos. ESP EIS 9.0-1 through ESP EIS 9.0-14 for the Environmental Report (ER), as submitted in Part 3 of the PSEG Site Early Site Permit Application, Revision 1.

Enclosure 1 provides our response for RAI No. Env-14, Question Nos. ESP EIS 9.0-1 through ESP EIS 9.0-6 and ESP EIS 9.0-8 through ESP EIS 9.0-14 (rALT-02, rALT-04, rALT-09, rALT-12, rALT-13, rALT-14, rALT-25, rALT-30, rALT-33, rALT-34, rALT-35, rALT-36, and rALT-38). The response to RAI No. Env-14, Question No. ESP EIS 9.0-7 (rALT-21) will be provided by October 18, 2012, as provided for in the issuance of the final RAI.

Enclosure 2 includes the revisions to the ER resulting from our response to RAI No. Env-14, Question No. ESP EIS 9.0-9 (rALT-30).

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If any additional information is needed, please contact David Robillard, PSEG Nuclear Development Licensing Engineer, at (856) 339-7914.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 3rd day of October, 2012.

Sincerely,

James Mallon

James Mallon
Early Site Permit Manager
Nuclear Development
PSEG Power, LLC

Enclosure 1: Response to NRC Request for Additional Information, RAI No. Env-14, Question Nos. Env-14, Question Nos. ESP EIS 9.0-1 through ESP EIS 9.0-6 and ESP EIS 9.0-8 through ESP EIS 9.0-14 (rALT-02, rALT-04, rALT-09, rALT-12, rALT-13, rALT-14, rALT-25, rALT-30, rALT-33, rALT-34, rALT-35, rALT-36, and rALT-38), Review Section: ESP EIS 9.0 - Environmental Impacts of Alternatives

Enclosure 2: Proposed Revisions, Part 3 – Environmental Report (ER), Chapter 9 – Alternatives

cc: USNRC Project Manager, Division of New Reactor Licensing, PSEG Site (w/enclosures)
USNRC Environmental Project Manager, Division of New Reactor Licensing (w/enclosures)
USNRC Region I, Regional Administrator (w/enclosures)
Oak Ridge National Laboratory

PSEG Letter ND-2012-0059, dated October 3, 2012

ENCLOSURE 1

RESPONSE to RAI No. Env-14

QUESTION Nos.
ESP EIS 9.0-1 (rALT-02)
ESP EIS 9.0-2 (rALT-04)
ESP EIS 9.0-3 (rALT-09)
ESP EIS 9.0-4 (rALT-12)
ESP EIS 9.0-5 (rALT-13)
ESP EIS 9.0-6 (rALT-14)
ESP EIS 9.0-8 (rALT-25)
ESP EIS 9.0-9 (rALT-30)
ESP EIS 9.0-10 (rALT-33)
ESP EIS 9.0-11 (rALT-34)
ESP EIS 9.0-12 (rALT-35)
ESP EIS 9.0-13 (rALT-36)
ESP EIS 9.0-14 (rALT-38)

Response to RAI No. Env-14, Question ESP EIS 9.0-1:

In Reference 2, the NRC staff asked PSEG for information regarding emissions from alternative energy sources, as described in Subsection 9.2.3.2.2 of the Environmental Report. The specific request was:

> *rALT-02: Provide additional information on the basis for the numerical entries in ER Table 9.2-2 regarding the emissions of SO2 and PM from an NGCC Advanced F Class power generation facility. In particular, demonstrate how these numerical values were derived and provide the source of the data used to derive the values.*
>
> *Supporting Information: Under ESRP 9.2.3, NRC staff need to ensure that competitive alternative energy sources are described in sufficient detail to enable an effective analysis of the environmental and human health impacts.*
>
> *The text in ER Section 9.2.3.2.2 indicates that the numerical entries in ER Table 9.2-2 were derived from those in NUREG-1437; however, the entries in NUREG-1437 show "negligible" for NGCC emissions of SO2 and PM. Therefore, additional clarification as to the origin of the numerical values for NGCC for SO2 and PM in ER Table 9.2-2 is requested.*

PSEG Response to NRC RAI:

The values for SO2 and PM emissions in ER Table 9.2-2 are based on PSEG's Linden Generating Station, a natural gas fired combined cycle power plant. Eight combustion turbines, in a combined cycle configuration similar to the Linden Power Plant, would have a generating capacity of approximately 2200 MW. Based on the SO2 and PM10 emission limits for one combustion turbine specified in Linden's New Jersey Department of Environmental Protection (NJDEP) Title V Operating Permit, there will be approximately 63 tons/year of SO2 emissions and approximately 662 tons per year of PM emissions for a 2200 MWe combined cycle power plant with a 90 percent capacity factor.

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. Env-14, Question ESP EIS 9.0-2:

In Reference 2, the NRC staff asked PSEG for information regarding the evaluation of competitive energy alternatives, as described in Subsection 9.2.3 of the Environmental Report. The specific request was:

> *rALT-04: Provide clarification as to whether the evaluation of competitive energy alternatives in ER Section 9.2.3 (1) assumed the same transmission lines for the competitive alternatives as for the nuclear plant and (2) assumed the same cooling system for the competitive alternatives as for the nuclear plant. If such similar assumptions were not made, provide an updated analysis and an updated set of impact levels that include consideration of transmission lines and cooling water systems for each of the competitive energy alternatives.*
>
> *Supporting Information: Under ESRP 9.2.3, NRC staff need to ensure that competitive alternative energy sources are described in sufficient detail to enable an effective analysis of the environmental and human health impacts.*
>
> *Clarification is requested as to whether the evaluation of competitive energy alternatives in ER Section 9.2.3 included similar sets of assumptions for each of the competitive energy alternatives as for the nuclear plant.*

PSEG Response to NRC RAI:

The competitive energy alternatives presented in ER Section 9.2.3 are scaled up to produce a baseload power output of up to 2200 MWe to be equivalent to the reactor technologies being considered for the PSEG Site. As noted in ER Subsection 9.2.3.3, PSEG's evaluation of competitive energy alternatives determined that "... combinations [of competitive energy alternatives] that include an intermittent renewable power source (for either all or part of the capacity of the new plant) must be combined with a fossil-fueled facility equivalent to the generating capacity of the new nuclear plant." The fossil-fuel plants used in combination with renewable resources will need to be designed for the full output of the new plant to account for those times when the intermittent renewable power source is idle. The discussions throughout Chapter 9 relative to a potential new transmission line are premised on the position that the new line will be needed to maintain transient grid stability for the PSEG site. The competitive fossil-fueled generating options discussed in Section 9.2.3, namely coal fired and natural gas fired plants, are all thermally based power generators with prime movers inherently synchronized to the grid and, hence, are subject to the same grid stability constraints imposed by the regional transmission operator. Therefore, if the grid impact studies performed by PJM to interconnect a new nuclear station at the PSEG site identify a need for a new transmission line to address stability constraints, the need for new transmission will equally apply for an equivalent gas fired or coal fired plant. The evaluation of the competitive energy alternatives in Section 9.2.3, therefore, is performed assuming the same potential for new transmission.

Similar to the above discussion on the potential need for new transmission, the competitive coal or gas fired generating plant assessed in Section 9.2.3 are scaled to equate to the power output of the reactor technologies being considered for the PSEG Site. Like the proposed nuclear power plant, the coal or gas alternative will need to be constructed with a closed loop cooling system (i.e. cooling towers) capable of accepting the heat rejection from the plant to condense the steam to supply the Feedwater systems. Hence the cooling systems of the fossil-fired backup to the alternative renewable power source will be equivalent to the proposed nuclear plant.

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. Env-14, Question ESP EIS 9.0-3:

In Reference 2, the NRC staff asked PSEG for information regarding biomass energy sources, as described in Subsection 9.2.2.6 of the Environmental Report. The specific request was:

> *rALT-09: Provide clarification as to the basis or source of the breakdown of the 240 MW from biomass that is attributed to urban wood and secondary mill residues (150 MWe) as discussed in ER Section 9.2.2.6.2 and to methane from landfills and wastewater treatment (70 MWe) as discussed in ER Section 9.2.2.6.3.*
>
> *Supporting Information: Under ESRP 9.2.2 and 9.2.3, NRC staff need to ensure that competitive alternative energy sources are described in sufficient detail to enable an effective analysis of the environmental and human health impacts.*
>
> *Numerical data are presented in ER Sections 9.2.2.6.2 and 9.2.2.6.3 for the amounts of energy available from biomass resources; however, no explanation or basis for these numerical data is presented. Additional discussion on the origin and validity of these numbers is requested. The explanation should include any assumptions that were made that are important to the derived values.*

PSEG Response to NRC RAI:

A detailed breakdown of the power (MWe) associated with each type of biomass available for power in New Jersey used as the basis for the information in ER Subsections 9.2.2.6.2 and 9.2.2.6.3, is provided in Table ESP EIS 9.0-3-1, along with detailed footnotes of the specific sources for the tabulated values.

It should be noted that switch grass, listed in National Renewable Energy Laboratory (NREL) Technical Report NREL/TP-560-39181, dated December 2005, (ER Reference 9.2-1), is omitted in order to develop a realistic estimate of the maximum capacity from existing resources (waste materials and crop residues) and not from sources that require incentive payments and transportation costs. NREL/TP-560-39181 states (p. 37) that the switch grass and willow or hybrid poplar tons are "the amount of energy crops that could be potentially grown" on Conservation Reserve Program (CRP) lands, which are defined as lands not suitable for conventional crops. However, the Rutgers report, "Assessment of Biomass Energy Potential in New Jersey", (ER Reference 9.2-25, p. 48) points out that growing energy crops requires the decision to convert the current food supply chain into energy production. Given New Jersey's location adjacent to the Philadelphia and New York metro areas, there are only about 1,830 active CRP acres, which have a potential capacity of about 3 MWe for the 21 tons of switch grass and willow or poplar. PSEG assumes that incentive programs are not developed to grow energy crops when the land has higher value for subdivisions and food supply.

Associated PSEG Site ESP Application Revisions:

None.

Table ESP EIS 9.0-3-1
Breakdown of Power (MWe) from New Jersey Biomass

Biomass Classification	Dry Tons In New Jersey (1000s)	Typical Heat Value (Dry) Btu/lb	Typical Plant Heat Rate Btu/kWh	Typical Capacity Factor	Available Energy (MWh)	Available Capacity (MWe)
Crop Residues	91.0	**7,700**[10-Avg.] Corn Stover/Wheat Straw	15,000[12] (stoker or bfb)	75%[12]	93,427	14.2
Methane fr Manure Mgt	0.3	**6,350** (500[13] Btu/scf, 0.0784 lb/scf)	12,500[14] IC Engine	85%[15]	305	0.0
Forest Residues	29.0	**8,000**[11]	15,000[12] (stoker or bfb)	75%[12]	30,933	4.7
Primary Mill Residues	0.2	**8,000**[11]	15,000[12] (stoker or bfb)	75%[12]	213	0.0
Secondary Mill Residues	58.0	**8,000**[11]	15,000[12] (stoker or bfb)	75%[12]	61,867	9.4
Urban Wood Residues	894.0	**8,000**[11]	15,000[12] (stoker or bfb)	75%[12]	953,600	145.1
Methane fr Landfill	497.0	**6,350** (500[13] Btu/scf, 0.0784 lb/scf)	12,500[14] IC Engine	85%[15]	504,952	67.8
Methane fr WWT	14.0	**6,350** (500[13] Btu/scf, 0.0784 lb/scf)	12,500[14] IC Engine	85%[15]	14,224	1.9
Total	**1,583.5**				**1,659,521**	**243.3**
Ag and Forest	120.3					19.0
Population based	1,463.2					224.3

FOOTNOTES:

10 *Biopower Technical Assessment* - Appendix 3, NREL/TP-510-33123, NREL, Mar 2003

11 *Biopower Technical Assessment* - Appendix 4, NREL/TP-510-33123, NREL, Mar 2003

12 *Lessons Learned from Existing Biomass Power Plants*, NREL/SR-570-26946, NREL, Feb 2000

13 *LFG Energy Project Development Handbook*, - Chapter 1, EPA Landfill Methane Outreach Program, Feb 2009

14 *LFG Energy Project Development Handbook*, - Chapter 3, EPA Landfill Methane Outreach Program, Jul 2009

15 *LFG Energy Project Development Handbook*, - Chapter 4-A, EPA Landfill Methane Outreach Program, Jan 2009

Response to RAI No. Env-14, Question ESP EIS 9.0-4:

In Reference 2, the NRC staff asked PSEG for information regarding combinations of energy alternatives, as described in Subsection 9.2.3.2 of the Environmental Report. The specific request was:

> *rALT-12: For the combinations of energy alternatives described in ER Section 9.2.3.2, provide a numerical estimate of the atmospheric emissions, including carbon dioxide, generated by each of the combined energy alternatives.*
>
> *Supporting Information: Under ESRP 9.2.1, 9.2.2, and 9.2.3, NRC staff need to ensure that competitive alternative energy sources are described in sufficient detail to enable an effective analysis of the environmental and human health impacts.*
>
> *The analysis must evaluate "competitive" and "feasible" alternatives, as well as combinations of alternatives. Provide an analysis that enables staff to evaluate the atmospheric emissions of each of the combinations of energy alternatives described in ER Section 9.2.3.3. Air emissions data similar to that in ER Table 9.2-2 is requested. Include the basis for the numerical data and the sources used to derive the values.*

PSEG Response to NRC RAI:

As discussed in ER Subsection 9.2.2, the worst case/upper bound of emissions is for the cases of combinations of wind and solar renewable energy alternatives when each renewable resource is unavailable, such that the baseload capacity has to be made up by the fossil fuel component of the combinations.

As noted in ER Subsections 9.2.2.1 and 9.2.2.5, the capacity factors for wind and solar are expected to be 30 percent and 15 percent, respectively. Accordingly, the fossil fuel component of the combinations is expected to have corresponding net capacity factors of 70 percent and 85 percent. In other words, the fossil fuel component of the combinations must run at those times when the renewable resource is not able to meet full baseload demand.

It should be noted that, in practice, the combination of renewable and fossil capacity factors does not exactly equal 100 percent. The fossil fuel plant's capacity factor will likely be in excess of 70 percent and 85 percent for wind and solar energy, respectively, to accommodate ramp rates, startup and shutdown times, etc., of the fossil generation, as well as to account for times when the renewable power source is completely idle. The values used herein are intended to simplify the analysis and establish a theoretical minimum limit which will be exceeded by actual emissions.

Based on these factors and assumptions, Table ESP EIS 9.0-4-1, developed from ER Table 9.2-2, presents the minimum air emissions associated with the combinations of energy alternatives that utilize wind energy with coal or gas fired generation, and solar energy with coal or gas fired generation.

Since biomass is also a thermal process that produces air emissions in excess of wind and solar, the theoretical minimum emissions calculated above is also used for the biomass and fossil fuel combination. In other words, the actual air emissions of the biomass combination will exceed the values shown in the table below.

Associated PSEG Site ESP Application Revisions:

None.

Table ESP EIS 9.0-4-1
Minimum Air Emissions Associated with Combinations of Fossil & Renewable Energy Alternatives

Resource	Wind		Solar	
Capacity Factor (%)	30%		15%	
ER Text	9.2.2.1		9.2.2.5	
ER Reference	9.2-5		9.2-26	
Air Emission	**Combined Wind & PC Supercritical**		**Combined Solar & PC Supercritical**	
CO2 capture	**No**	**Yes**	**No**	**Yes**
Net Power Output (kWe)	1,540,000	660,000	1,870,000	1,870,000
CO2 emissions (Tons/yr)	8,371,070	513,978	12,343,057	1,768,331
SO2 emissions (Tons/yr)	3,490	Negligible	5,146	Negligible
NOx emissions (Tons/yr)	2,882	1,776	4,249	6,110
PM emissions (Tons/yr)	535	330	789	1,134
Hg emissions (Tons/yr)	0.046	0.029	0.068	0.099
Air Emission	**Combined Wind & NGCC Advanced F Class**		**Combined Solar & NGCC Advanced F Class**	
CO2 capture	**No**	**Yes**	**No**	**Yes**
Net Power Output (kWe)	1,540,000	1,540,000	1,870,000	1,870,000
CO2 emissions (Tons/yr)	3,760,889	437,331	5,545,393	644,839
SO2 emissions (Tons/yr)	34	Negligible	51	Negligible
NOx emissions (Tons/yr)	287	334	424	493
PM emissions (Tons/yr)	360	154	531	531
Hg emissions (Tons/yr)	Negligible	Negligible	Negligible	Negligible
Capacity Factor:	**70%**	**70%**	**85%**	**85%**

Response to RAI No. Env-14, Question ESP EIS 9.0-5:

In Reference 2, the NRC staff asked PSEG for information regarding the 35,000 gpm water withdrawal rate used in the alternative site selection process as described in Subsection 9.3.1 of the Environmental Report. The specific request was:

> *rALT-13: Provide an explanation of the origin and basis for the value 35,000 gpm as the water withdrawal requirement that was used in the alternative site selection process. The explanation should include a discussion of the implications of this value in light of the larger value (i.e., 78,196 gpm) that was used in the evaluation of each alternative site in ER Section 9.3.2.*
>
> *Supporting Information: Under Regulatory Guide 4.2, Section 9.3, the availability of adequate water supplies is a valid criterion for the identification of alternative sites. ER Section 9.3.1 specifies 35,000 gpm as the minimum make-up water requirement for a new nuclear plant, and this value was apparently used in PSEG's site selection process. However, a larger numerical value (i.e., 78,196 gpm) is used in the subsequent evaluations of each of the four candidate sites in ER Section 9.3.2. A discussion is requested on the implications of this difference in numerical values and, in particular, how the site selection process would have been altered (if at all) by the use of a number significantly larger than the 35,000 gpm given in ER Section 9.3.1.*

PSEG Response to NRC RAI:

During the site selection process a reasonable value for water withdrawal due to a closed cycle cooling nuclear power plant is required for use in screening the Region of Interest. A review of the Environmental Reports for new nuclear power plants submitted at the time provided data on a range of water withdrawal requirements associated with a variety of environs (e.g., fresh water, brackish water, and salt water sites). From this review, the 35,000 gpm value for makeup associated with a single unit U.S. EPR is selected. The dual unit AP1000 plant water withdrawal rate is also typically around 35,000 gpm for a freshwater site with higher cycles of concentration.

It should be noted that the 35,000 gpm value is used only for exclusionary screening of the Region of Interest for the purpose of identifying Candidate Areas. The 35,000 gpm value is not an exact determination of water withdrawal requirements at any particular site, only a screening value. The value is significantly lower than that eventually used in assessing the impacts of water withdrawal for the sites in Candidate Area 7 (78,196 gpm) and similar to, but still lower than, the value used at Site 4-1 (40,300 gpm). Therefore, the use of the 35,000 gpm value for exclusionary screening is appropriate and conservative.

In the exclusionary screening, rivers and other water bodies are considered as suitable water sources if they are capable of supplying at least 35,000 gpm make-up. A river is considered suitable if it is capable of supplying 35,000 gpm without the need to withdraw more than 20 percent of the 7-day, 10-year low flow (7Q10). In other words, a river is suitable if it had a 7Q10 of at least 175,000 gpm (35,000 gpm divided by 20 percent).

For the exclusionary screening, 7Q10 values are derived from U.S. Geological Service (USGS) monitoring data as provided in Geographic Information System (GIS) databases. Based on these 7Q10 values, the entire length of the Delaware River in New Jersey is determined to be a suitable water source. The lowest 7Q10 value is found at the Montague, New Jersey, monitoring station, which is at the extreme northern end of New Jersey, near the border with the state of New York. USGS data show that the 7Q10 value at the Montague monitoring station was 397,300 gpm, which is well above the 175,000 gpm minimum requirement.

If the exclusionary screening had used 78,196 gpm as the make-up requirement instead of 35,000 gpm, a 7Q10 value of at least 390,980 gpm (78,196 gpm divided by 20%) is required in order for a river to be considered a suitable water source. As stated above, the lowest 7Q10 value found for the Delaware River was 397,300 gpm, at the extreme northern end of New Jersey. This value is higher than the required minimum 7Q10 value of 390,980 gpm, so the entire length of the Delaware River in New Jersey would still have been considered a suitable water source.

The only other bodies of water capable of supplying at least 35,000 gpm are the Atlantic Ocean and Lake Hopatcong, a large reservoir in the north-central part of New Jersey. However, Lake Hopatcong is located in an area that is eliminated from consideration due to both population density and restrictions associated with the New Jersey Highlands. Therefore, Lake Hopatcong does not affect the identification of Candidate Areas. The only water sources that affected the identification of Candidate Areas are the Atlantic Ocean and the Delaware River. Both of these water sources are capable of providing a make-up flow of 78,196 gpm. Therefore, if the exclusionary screening uses 78,196 gpm as the make-up requirement instead of 35,000 gpm, there is no change in the identification of Candidate Areas.

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. Env-14, Question ESP EIS 9.0-6:

In Reference 2, the NRC staff asked PSEG for information regarding the identification of Potential Sites, as described in Subsection 9.3.1.3 of the Environmental Report. The specific request was:

> *rALT-14: Provide a more detailed explanation than the one contained in ER Section 9.3.1.3 (and in the March 2010 Alternative Site Evaluation Study) on how the list of "potential sites" was derived from within the identified candidate areas. Additional information is requested on the specific selection criteria that were used and how those criteria were applied in the site selection process.*
>
> *Supporting Information: Under ESRP 9.2.3 and 9.3, candidate sites should "be among the best that can reasonably be found for the siting of a nuclear power plant."*
>
> *Under Reg. Guide 4.2, Section 9.2.1, "candidate sites must be realistic siting options, potentially licensable, and capable of being developed."*
>
> *The alternative site selection process should follow a clear and defensible process to determine the final alternative sites and the proposed site. The analysis performed on the four alternative sites to determine the proposed PSEG site appears to be logical; however, it is not clear how the candidate areas were screened to provide the list of potential sites. A clear explanation of the site screening process is needed to allow the staff to reach a conclusion as to whether this part of the process was logical and would reasonably be expected to produce a list of the best potential sites within the candidate areas.*

PSEG Response to NRC RAI:

The first step in identifying Potential Sites is to construct detailed Geographic Information System (GIS) maps for each Candidate Area. Digital U.S. Geological Survey topographic maps (digital raster graphics) and digital orthographic quadrangles (aerial photographs orthographically corrected) are used as the base layers for these maps. The following GIS data is highlighted on the base maps:

- Urban areas
- Schools, hospitals, and other public institutions
- Designated parks, preserves, and recreation areas
- Listed historical sites
- Surface water bodies
- 100-year floodplains
- Wetlands (based on National Wetlands Inventory and state mapping data)
- Public drinking water intakes
- Protected groundwater resources
- Electric transmission lines, substations, and power plants

- Transportation routes (highways, roads, rail lines, etc.)
- Airports
- Hazardous material pipelines (natural gas, oil, etc.)

The topographic maps and aerial photographs of each Candidate Area are examined by civil engineers and environmental specialists to find locations that satisfied pre-defined conditions considered important for a nuclear power plant site. The initial step is to identify locations with the following conditions:

- Reasonably flat and undeveloped land of sufficient size to accommodate the arrangement of the power plant facilities
- No contact with urban areas; residential developments; public institutions; designated parks, preserves, and recreation areas; listed historical sites; extensive wetland or floodplain areas; public drinking water intakes; protected groundwater resources; and airports

Locations that appeared to satisfy the above conditions are then examined to identify specific pieces of land with the following characteristics:

- Ground slope across the area not more than 5%
- Minimal contact with wetlands, floodplains, individual residences, and hazardous material pipelines
- As close as possible to water, transmission, and transportation resources
- As far as possible from urban areas; residential developments; public institutions; designated parks, preserves, and recreation areas; listed historical sites; extensive wetland or floodplain areas; public drinking water intakes; protected groundwater resources; and airports

All pieces of land in each Candidate Area that appeared to satisfy the criteria listed above are identified through table-top review. These pieces of land are considered preliminary Potential Sites. A preliminary block-type plant footprint is placed on each of these sites to verify that there is sufficient land to develop an appropriate plant layout. In addition, conceptual off-site corridors are identified to the nearest suitable water source, transmission line, rail line, and primary road. To the extent possible, the off-site corridors are located to avoid sensitive environmental features in the same manner as described for locating the preliminary Potential Sites.

The preliminary Potential Sites and their associated off-site corridors are then examined with regard to how well they satisfied the siting criteria listed above. The site in each Candidate Area that appeared to best satisfy the siting criteria is carried on as a Potential Site. Sites that are less desirable with regard to some criteria and do not have significant advantages with regard to any other criteria are eliminated. However, in cases where one site in a Candidate Area is more desirable with regard to some criteria and another site is more desirable with regard to other criteria, both sites are carried on as Potential Sites. Thus, at least one Potential Site is identified in each Candidate Area, and more than one Potential Site is identified if the sites offered diversity of desirable characteristics.

Properties owned by PSEG that are of sufficient size and located in a Candidate Area are always considered as preliminary Potential Sites. However, these properties are carried on as Potential Sites only if they satisfy the conditions described above.

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. ENV-14, Question ESP EIS 9.0-8:

The NRC staff asked PSEG for information regarding Circulating Water Systems, as described in Subsection 9.4.2 of the Environmental Report. The specific request was:

> *rALT-25: Provide a description of alternative water supplies for the proposed plant. Provide documentation of the evaluation of Salem City water as a source for cooling water.*
>
> *Supporting Information: Under ESRP 9.4.2, The ER contains no description of alternative water supplies for the proposed plant.*

PSEG Response to NRC RAI:

The three potential sources of water for the circulating water system makeup in the vicinity of the PSEG Site are surface water (Delaware River, proposed source), ground water and water reuse. Alternative water supply sources are discussed in ER Subsection 9.4.2.1.3, Water Supply. No viable alternative water supplies are identified that could support the continuous makeup requirement of 78,196 gpm.

Groundwater is not considered a viable source of cooling water for the PSEG Site because the geologic formations in the vicinity of the site generally are not permeable enough to sustain well yields required to support the circulating water system makeup need (78,196 gpm). Groundwater assessments performed for the PSEG Site Early Site Permit application (ESPA) support this assertion (see ER Section 2.3). While fresh water withdrawal requirements are less than the 78,196 gpm brackish water requirement, they still tax the aquifers in the vicinity of the site. As a point of comparison, the entire public fresh water supply (ground and surface water) for all of Salem County is only approximately 4.4 Mgd or 3000 gpm (see ER Subsection 2.3.2.2.1.1). Therefore, groundwater is not an environmentally preferable alternative to the proposed water supply and it was not evaluated further.

Sources of water for reuse come either from the plant itself or from other local water users. Sanitary wastewater-treatment plants are the most ubiquitous sources of water for reuse. Agricultural processing, industrial processing, and municipal water treatment plants also provide significant supplies of water for reuse. Additional treatment (e.g., tertiary treatment, chlorination) is required to provide water of appropriate quality for the specific plant need. The population density in the site vicinity is low, and there is little industry around the PSEG Site, so adequate reliable wastewater sources are not currently available.

Previously, PSEG performed a study (ER Reference 2.3-8) of the feasibility of piping municipal grade water from the City of Salem to the site. The required pipeline is approximately 16 miles long and requires two pumping stations. While this pipeline reduces the withdrawals from the Delaware River, it does not eliminate required withdrawals from the river, due to the relatively small amount of capacity available from the City of Salem. Additionally, installation of the pipeline poses land use concerns and associated environmental impacts over the length of the route. Therefore, water reuse is not an environmentally preferable alternative to the proposed water supply and it is not evaluated further.

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. Env-14, Question ESP EIS 9.0-9:

In Reference 2, the NRC staff asked PSEG for information regarding Environmental Impacts of Alternatives, as described in Chapter 9 of the Environmental Report. The specific request was:

> *rALT-30: Provide additional clarification and details on the basis for the statement in ER Sections 9.2.1.3 and 9.2.1.4 that the alternative of importing power from outside New Jersey is "undesirable." If this alternative is not feasible, provide an explanation as to the basis for such a conclusion. If this alternative is feasible, provide additional details on the associated environmental impacts of such imported power.*
>
> *Also, provide a discussion of PSE&G's proposed Susquehanna-Roseland Power Line Project, which would connect Berwick, Pennsylvania, to Roseland, New Jersey, and the extent to which any such new transmission lines would affect the analyses in ER Sections 9.2.1.3 and 9.2.1.4 regarding the alternative of importing power into New Jersey. Include a discussion of the potential impacts and implications of the proposed Susquehanna-Roseland Power Line Project.*
>
> *Supporting Information: Under ESRP 9.2.1, 9.2.2, and 9.2.3, NRC staff need to consider whether any alternatives identified in the application are both feasible and competitive for supplying the electrical generating capacity proposed in the application.*
>
> *ER Section 9.2.1.3 identifies power that is available from outside the state of New Jersey; however, the ER dismisses this alternative as "undesirable" without further elaboration as to whether this alternative is feasible and/or competitive.*

PSEG Response to NRC RAI:

The following is a summary of the reasons why importing power into New Jersey is undesirable:

- PJM projections are based on NJ continuing to rely on transmission capability to replace retired generation and to meet growth in peak power demand. To assure the reliability of the power grid in congested areas of NJ, transmission congestion caused by imports is relieved by dispatching higher cost intermediate and peaking units in NJ because insufficient baseload capacity with lower dispatch costs is available. This results in higher locational marginal prices (LMPs) in NJ. In addition, the potential for increased future power exports to New York City and Long Island further increases the demand for in-state generating resources and/or transmission capability.

- Construction of new transmission lines and upgrades to existing transmission lines is a long, costly and publicly contentious process that is required to allow the importation of substantively more power into NJ. The Susquehanna-Roseland 500 kV transmission line creates a strong link from generation sources in northeastern and north-central PA, across northeastern PA and into NJ. However, due to lower load growth, the installation of new intermediate and peaking gas fired power plants, and the increase in demand response programs, the PJM Board cancelled the 500 kV circuit Mid-Atlantic Power Pathway (MAPP) and the 765 kV Potomac-Appalachian Transmission Highline (PATH) projects. These projects are designed to increase the capability to transfer power from western PJM into the Eastern Mid-Atlantic Area Council (EMAAC), of which NJ is a part.

- Imports of baseload capacity from western PJM to NJ cannot be substantively increased without causing increased congestion, higher power prices, and potential reliability issues.

- The intermediate and peaking units in NJ that are dispatched due to the lack of baseload capacity are fossil-fueled. Even considering the congestion relief projected by the approved Susquehanna-Roseland transmission project, the types of generating units that supply imported power from the western portion of PJM also are often fossil-fueled and typically coal-fired. These units face increased costs due to pending regulatory restrictions on emissions including CO_2. Nuclear baseload capacity additions planned in areas near NJ displace imports from fossil fueled resources, but they still cause increased grid congestion, higher power prices, and potential reliability issues.

- Increasing the reliance on imported power purchases is not aligned with two of the five overarching goals of the New Jersey Energy Master Plan: 1) to drive down the cost of energy for all customers, and 2) to promote a diverse portfolio of new, clean, in-State generation.

The following is a discussion of PSE&G's proposed Susquehanna-Roseland Power Line Project, including a discussion of the potential impacts and implications of the proposed line.

- The PJM Board approved the Susquehanna-Roseland 500 kV line in 2007 to address overloads on 230 kV circuits across eastern Pennsylvania and northern New Jersey beginning in 2012.

- Regulatory delays associated with the Federal agency review of the routing alternatives of the overhead transmission line portions through the Delaware Water Gap extended the expected in service date of the project until June 1, 2015.

- A majority of engineering work is complete and material contracts awarded. Construction on substation upgrade work is underway.

- PJM conducted additional analyses in 2011 to assess the impact of delays to the construction. The near term solution is to manage flow on constrained transmission facilities in real time operation and adjust generation and implement Demand Side Response (DSR) as required to maintain grid reliability.

- Updated studies also indicate that Hudson Unit 1, previously designated as reliability must run unit, is not required to maintain reliability and will be released. Hudson Unit 1 has been subsequently retired.

- In October 2011, the Susquehanna-Roseland transmission line was listed as one of seven projects to be expedited by the Obama administration's newly formed "Rapid Response Team for Transmission".

- The Susquehanna-Roseland line creates a strong link from generation sources in northeastern and north-central PA, across northeastern PA and into NJ.

ER Chapter 9 will be updated to assure consistency with the update of Chapter 8 as requested in RAI No. Env-13 Question No. ESP EIS 8.0-5 (rNP-08).

Associated PSEG Site ESP Application Revisions:

ER Chapter 9 will be updated as specified in Enclosure 2 of this document.

Response to RAI No. Env-14, Question ESP EIS 9.0-10:

The NRC staff asked PSEG for information regarding the Cumulative Impacts, as described in Subsection 10.5 of the Environmental Report. The specific request was:

> *rALT-33: Provide additional information and an explanation of how the various impact levels from ER Chapters 4 and 5 were aggregated and combined with other cumulative impacts to arrive at the impact levels as reported in ER Section 10.5.*
>
> *Supporting Information: To assist the NRC staff in fulfilling its obligations under NEPA to consider the cumulative effects of the proposed action and the alternatives, PSEG is requested to submit a discussion on how the ER included the cumulative effects of construction and operation of a new nuclear plant at the PSEG site, including actions from any identified private enterprises, and federal, state, tribal, and municipal agencies.*

PSEG Response to NRC RAI:

To address cumulative impacts, the context of the existing environment in the region surrounding the PSEG Site (as described in Chapter 2 of the ER) is considered in conjunction with the environmental impacts presented in Chapters 4 and 5 for constructing and operating a new plant at the PSEG Site. Additionally, the effect of other identified "actions" as described in ER Section 2.8, are also evaluated as part of the cumulative effects analysis.

As described in ER Section 2.8.1.2, PSEG is developing an agreement in principle with the USACE to acquire an additional 85 ac. immediately to the north of HCGS. Because no land exchange properties were previously identified for use as compensation for acquisition of the Corps property, the effects of development of an off-site parcel for use by the Corps as a confined disposal facility (CDF) is not included in the ER. PSEG subsequently identified Site 15G as the potential Corps land exchange property and conducted assessments to evaluate its condition and characteristics (see PSEG response to RAI ESP EIS 2.4.1-7, rTE-15). The application to permit 15G as a CDF is not yet filed with NJDEP and engineering of the CDF is still in progress. Because designs for the development of Site 15G are not complete, impact assessments cannot yet be performed. Potential cumulative effects associated with the development of Site 15G are therefore, not included in this RAI response.

Impacts associated with construction and operation of the new plant are summarized in tabular form in ER Sections 4.6 and 5.10. These tabular summarizations are used in developing the impact summaries in ER Section 10.5. PSEG also received renewal of its operating licenses for Hope Creek Generating Station (HCGS) and Salem Generating Station (SGS) for 20 years beyond the current term of 40 years. The cumulative impacts analysis includes the renewal of the HCGS and SGS operating licenses, and the cumulative impacts of the three plants on the affected environment.

The development of cumulative impact rankings in Chapter 10 are arrived at by assessing the potential for the effects of other identified "actions" to change the prior impact ranking assessed for each resource in ER Chapters 4 and 5. For example, as stated below, the impact rating determined for land use is considered to be SMALL for the PSEG Site, but MODERATE for off-site transmission. In ER Chapter 10, it is stated that "PSEG is not aware of any large projects that may alter or change the predominant land uses in Salem County or the other counties the transmission line corridor crosses." Therefore, because no such projects are known, the potential for such actions to *change* the prior impact ranking assessed for in ER Chapters 4 is SMALL.

Land Use

As described in ER Section 4.1, the impacts of construction on land use are SMALL. Impacts due to potential off-site transmission lines are MODERATE based on the area of lands potentially affected, but do not require mitigation. Lands that are crossed by the potential off-site transmission lines are influenced by past development patterns and are dominated by agricultural uses, deciduous forest, and estuarine wetland types (see ER Subsection 10.5.1.1). If off-site transmission is needed, PSEG will route the new transmission line in or along existing rights-of-way to the extent practicable to minimize land use impacts.

As described in ER Section 4.1, construction impacts are SMALL, with the exception of those due to potential off-site transmission lines, which are reduced by utilizing existing rights-of-way to the extent practicable. As described in ER Section 5.1, operations do not result in additional land use alteration. Consequently, impacts are SMALL, and no further mitigation is warranted.

In addition to the impacts from project construction and operations, the cumulative effects analysis also considers other past, present, and reasonably foreseeable future actions that could affect land use. As described in ER Subsection 10.5.1.1, PSEG is not aware of any large projects that would contribute to additional alterations or changes to the predominant land uses in Salem County or other counties the transmission line corridor crosses. Therefore, the potential for cumulative impacts of other reasonably foreseeable actions changing the land use impact rating is SMALL.

Historic Properties

As described in ER Subsection 4.1.3, the impacts from construction on historic properties are SMALL for the new plant and MODERATE for the proposed causeway. When the specific design for the proposed causeway is complete, Phase II testing and consultation with the Historic Preservation Office (HPO) is required for any archaeological sites that cannot be avoided. Impacts to these archaeological sites are MODERATE, but can be mitigated. A final assessment and any required mitigation are dependent on the outcome of the Phase II testing and HPO consultation.

In addition to the impacts from project construction and operations, the cumulative effects analysis also considers other past, present, and reasonably foreseeable future actions that could affect historic properties. PSEG is not aware of any large projects that may alter or impact historic properties in Salem County or the other counties the transmission line corridor crosses. Therefore, the potential for cumulative impacts of other reasonably foreseeable actions changing the historic properties impact rating is SMALL.

Water Resources

As described in ER Section 4.2, the impacts from construction on water resources are SMALL, and no further mitigation is warranted. As described in ER Section 5.2, the effects of operations on water resources are SMALL, and no further mitigation is warranted.

In addition to the impacts from project construction and operations, the cumulative effects analysis also considers other past, present, and reasonably foreseeable future actions that could affect water resources. Cumulative impacts to water resources from project construction were focused on other projects that may affect the Delaware River and Bay and its associated water resources. The only other project identified which affects the Delaware River is the US Army Corps of Engineers (USACE) Main Channel Deepening Project. In the Environmental Assessment and Supplemental Environmental Impact Statement for this project, USACE indicated that the project does not have a significant impact on the Delaware River (see ER Subsection 10.5.1.2). Minor impacts from the PSEG project in conjunction with the USACE project are not expected to result in a greater incremental impact on water resources. Additionally, there are no other large groundwater users in the vicinity that are affected by construction. Therefore, the potential for cumulative impacts of other reasonably foreseeable actions changing the water resources impact rating is SMALL.

Ecological Resources

As described in ER Section 4.3, the impacts from construction on ecological resources are primarily associated with habitat alteration and are SMALL. However, impacts to wetlands resulting from construction activities on-site and associated with off-site transmission (if required) are considered to be MODERATE. Potential impacts to terrestrial ecosystems (mainly forested lands) are also considered to be MODERATE for off-site transmission (ER Table 4.6-1). Notably however, the commitment to align potential off-site transmission corridors along existing developed rights of way, the relatively minor amounts of land actually impacted by transmission tower footings, avoidance of wetlands and streams during design, and the development of an Avian Protection Plan, collectively minimize effects of off-site transmission on ecological systems. Impacts related to construction warrant mitigation for impacts to upland terrestrial habitats and wetlands. Mitigation of temporary impacts to upland areas and associated wildlife consists of restoration activities to restore temporary use areas to natural cover types. Measures to avoid and minimize potential impacts to wetlands are implemented after the selection of a reactor technology and throughout the site development and design phase. After reasonable measures are explored to avoid and minimize impacts to wetlands, PSEG compensates for unavoidable adverse impacts to wetlands by implementing approved wetland restoration and/or rehabilitation measures. As described in ER Sections 5.3 and 5.6, the effects of operations on ecological resources are SMALL, and no further mitigation is warranted. Because operational impacts to ecological resources are SMALL and primarily associated with impingement and entrainment impacts (rather than habitat alteration), and because the effects of habitat alteration are mitigated, the impacts from both construction and operation are SMALL.

In addition to the impacts from project construction and operations, the cumulative effects analysis also considers other past, present, and reasonably foreseeable future actions that could affect ecological resources. The cumulative effects analysis on aquatic ecosystems and wetlands is discussed in ER Section 10.5 and focuses on other projects that may affect the Delaware River and Bay and its associated water resources. The proposed restoration of the Mad Horse Creek Wildlife Management Area is in the immediate vicinity of PSEG Site. This project has a beneficial and positive effect on tidal wetlands and sensitive species that utilize such habitats (bald eagle-foraging only, northern harrier, osprey) (see ER Subsections 2.8.2.5 and 10.5.1.3). Regarding the potential impacts from intake operations on aquatic biota, the ongoing HCGS and SGS operations do not result in an impact to the aquatic community that destabilizes resident populations (see ER Subsection 10.5.2.3). Estimated impingement and entrainment mortality result in the loss of an insignificant number of aquatic biota relative to the abundance of the standing stocks in the river and bay, and do not adversely affect the stability of the overall community or important species. Construction and operations related impacts to wetlands and marsh creeks are mitigated by restoration and enhancement measures. Therefore, in consideration of the SMALL or MODERATE impacts from construction and operation of the new plant and the potential off-site transmission line and factors that minimize effects of transmission lines to ecological resources (see above), the potential for cumulative impacts of other reasonably foreseeable actions changing the ecology impact rating is SMALL.

Socioeconomic Resources

As described in ER Section 4.4, the impacts from construction on socioeconomic resources are SMALL, and no further mitigation is warranted with the exception of the physical effects of transportation which are considered to be MODERATE. Construction phase traffic impacts result in an impact to environmental justice populations. However, these impacts are mitigated by the commitment to traffic improvements. Completion of transportation improvements concurrent with the onset of construction mitigates the transportation related impacts. Based on the rural location of the construction site, the established adequacy of community infrastructure and public services, effective planning procedures, and sufficient tax revenues generated by the construction activity, potential impacts to environmental justice populations within Salem County are SMALL.

In addition to the impacts from construction and operations, the cumulative effects analysis also considers other past, present, and reasonably foreseeable future actions that could affect socioeconomic resources. The ER's cumulative effects analysis on socioeconomic resources is focused within the 50 mile region around the PSEG Site and the four-county Region of Influence (Salem County, Cumberland County, and Gloucester County in NJ and New Castle County in DE). As described in ER Subsection 10.5.2.4, no other large construction activities are planned in the vicinity (6-mile radius) or Region of Influence that contribute to cumulative effects to the socioeconomic environments of the area. Therefore, the potential for cumulative impacts of other reasonably foreseeable actions changing the socioeconomic impact rating is SMALL.

Human Health

As described in ER Section 4.5, the impacts from construction on radiation exposure to construction workers are SMALL, and no further mitigation is warranted. As described in ER Sections 5.4, 5.6, and 5.7, the effects of radiation, the transmission system, and the uranium fuel cycle as a result of operations are SMALL, and no further mitigation is warranted.

In addition to the impacts from project construction and operations, the cumulative effects analysis also considers other past, present, and reasonably foreseeable future actions that could affect human health. Cumulative effects analysis on human health are focused on the increased occupational radiation doses and the contribution of the PSEG site to the fuel production, storage, and disposal for all nuclear units in the United States. The anticipated occupational dose from the new plant in combination with that from the existing SGS and HCGS is less than the 40 CFR 190 criteria (see ER Subsection 10.5.2.5). The cumulative impacts from the addition of up to two new units on the fuel cycle are SMALL. Therefore, the potential for cumulative impacts of other reasonably foreseeable actions changing the human health impact rating is SMALL.

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. ENV-14, Question ESP EIS 9.0-11:

The NRC staff asked PSEG for information regarding Circulating Water Systems, as described in Subsection 9.4.2 of the Environmental Report. The specific request was:

> *rALT-34: Provide additional information and details for the alternative intake designs (i.e., other than the intake flow velocity cap design) that are discussed in ER Section 9.4.2.1.1. Specifically, provide (1) a description of all alternatives for the intake system considered, and (2) a description of the bases used to reject alternatives other than the proposed intake system.*
>
> *Supporting Information: ER Section 9.4.2.1 describes the alternative intake systems for a new nuclear plant at the PSEG site. The NRC staff needs the requested information to have a complete understanding of all alternatives that were considered and the bases for why some alternatives were rejected (as per ESRP 9.4.2).*

PSEG Response to NRC RAI:

(1) Description of all Intake Alternatives

As discussed in ER Subsection 9.4.2.1.1, the following primary intake alternatives are considered:

- Collector Well System and other Filtration Based Alternatives
- Intake Pipe
- Hope Creek SWIS

The only intake alternative considered in the initial assessment of intake alternatives and not specifically addressed in the ER is an intake structure on an intake canal. An intake canal is designed in such a manner to keep canal velocities below the regulatory limitations associated with EPA 316(b) in an effort to minimize entrainment of aquatic life. However, intake canals are historically linked with a potential increase in entrainment of aquatic life due to the habitat created by the intake canal itself (Reference RAI ESP EIS 9.0-11-2). The aquatic life finds the intake canal structure, particularly riprap slopes, an excellent breeding ground away from the open areas of the Delaware River. These favorable habitat conditions potentially develop larger quantities of aquatic life directly in the path of the intake, eventually leading to higher entrainment quantities. Based on the entrainment concerns, increased land use and the final plant layout, this option is not considered a viable alternative at the PSEG Site.

While investigating the Intake Pipe option for the PSEG Site, end of pipe options are considered. Those options primarily include either a velocity cap or an array of wedgewire type screens.

The utilization of a velocity cap is the preferred choice for a multi-directional flow (flood, ebb, and slack tides) and brackish water environment with seasonally high debris loadings that is experienced at the PSEG Site. This type of intake pipe cap is successfully used at coastal locations (Reference RAI ESP EIS 9.0-11-1).

Two sites along the Delaware River are currently utilizing a wedgewire type screen intake. The Eddystone coal fired plant, located in the primarily freshwater portion of the Delaware River, and the Logan Generating Plant, located at the beginning of the transition zone, are both utilizing this intake system on a once through cooling system. In both cases the sites have deeper river bottom conditions at the shoreline due to provisions made for coal barge access. The U.S. Environmental Protection Agency (Reference RAI ESP EIS 9.0-11-1) provides a review of the performance of wedgewire screens. While successes are noted at Eddystone and Logan in particular, the report notes, "There are no full-scale data specifically for marine environments where biofouling and clogging are significant concerns. In addition, it is important to recognize that there must be significant cross current within the waterbody to carry organisms away from the screens". The report also references field tests performed along the brackish waters of the Chesapeake & Delaware canal. The report notes, "Actual field testing in the brackish water of the proposed intake canal required the screens to be removed and cleaned as often as once every three weeks". Based on this lack of successful performance data in water conditions similar to the PSEG Site, and the anticipated operational issues associated with the screens in these types of conditions, wedgewire screens are not considered a viable alternative for the intake pipe termination.

(2) Description of Evaluation Methodology

The evaluation methodology used for selecting an intake configuration and location includes defining the alternatives, establishing the key factors for evaluation, gathering pertinent information, and scoring the alternatives.

The factors established are based on a review of NUREG-1555, "*Standard Review Plan for Environmental Reports*", to determine which key factors are appropriate for an intake type and location alternatives evaluation. The following factors are selected for evaluation:

- *Technical Feasibility*
  Technical Feasibility evaluates how the intake's design interfaces with the site's characteristic parameters. A higher score indicates the intake technology is better suited for the PSEG site.

- *Capital Cost*
  Capital Cost evaluates the initial construction cost of the intake technology under consideration. A rough order of magnitude (ROM) estimate or input from intake vendors is utilized as an input to this evaluation criterion. A higher score is assigned to intake technologies with lower capital costs.

- *Construction Impacts*
  Construction impacts evaluate how the intake technology is constructed. This includes the amount of land required to construct the intake, difficulty of construction and how the construction interfaces with the site design. A technology requiring less land and causing less construction site impacts scores higher.

- *Regulatory Compliance*
  Regulatory compliance focuses on the intake technologies' ability to meet EPA 316(b) requirements. A higher score is given to technologies that either eliminate or minimize exposure to EPA 316(b) regulations.

- *Land Use Impacts*
  Land use impact evaluates the amount of land required for the operational intake technology. A higher score is assigned to the technology requiring less land.

- *Security*
  Security evaluates the technologies' interface with current and pending waterborne threats. A design that is less susceptible to waterborne threats scores higher.

- *Maintenance*
  Industry operating experience and available vendor information is utilized to qualitatively evaluate the level of maintenance required for a particular intake technology. A higher score is assigned to a technology requiring less maintenance activity. For the purposes of this evaluation, a Nuclear Safety Related (NSR) traditional intake structure is considered the baseline against which the other alternatives are compared.

References:

RAI ESP EIS 9.0-11-1 U.S. Environmental Protection Agency (EPA), 2001. Technical Development Document for the Final Regulations Addressing Cooling Water Intake Structures for New Facilities. Washington, DC.

RAI ESP EIS 9.0-11-2 American Society of Civil Engineers. Design of Water Intake Structures for Fish Protection. Task Committee on Fish-Handling Capability of Intake Structures of the Committee on Hydraulic Structures of the Hydraulic Division of the American Society of Civil Engineers, New York, NY. 1982.

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. ENV-14, Question ESP EIS 9.0-12:

The NRC staff asked PSEG for information regarding the analysis of impacts associated with the potential off-site transmission corridor described in Chapters 4, 5 and 10 of the Environmental Report. The specific request was:

> *rALT-35: Regarding the report GIS Analysis of Potential Off-Site Transmission Macro-Corridors (see rTL-03) that was developed and used to evaluate the potential impacts of the two proposed off-site transmission lines, provide an explanation on how the impacts described in the report were incorporated into the analyses in ER Chapters 4, 5, and 10. The response should explain, among other things, whether the impacts reported in the ER represent the Southern route, the Western route, or some combination of the two transmission line routes. Also, describe the extent of any planned transmission routing and corridor widening activities.*
>
> *Supporting Information: Under ESRP 3.7 and 9.4.3, NRC staff need to evaluate whether the data on the power transmission system are sufficient to describe the system and provide qualitative and quantitative information necessary to assess potential impacts to land use, terrestrial and aquatic ecosystems, and man.*
>
> *The applicant has conducted a study of alternate routings for transmission lines to the proposed site: GIS Analysis of Potential Off-Site Transmission Macro-Corridors. The staff needs the requested information to evaluate the potential impacts identified in Reg. Guide 4.2 and ESRPs 3.7 and 9.4.3.*

PSEG Response to NRC RAI:

Background and Methodology

PSEG performed an analysis of a potential off-site transmission corridor recognizing that there may be a need for off-site transmission for the new plant to address potential transient grid stability limitations. Future needs for off-site transmission for the new plant are dependent on the PSEG reactor technology selection and external factors not under PSEG control (i.e., regional transmission planning processes). Accordingly, a limited Geographical Information System (GIS) study of two potential off-site transmission corridors is performed to provide an assessment of impacts in ER Chapters 4, 5, and 10. Two potential corridors are evaluated in the report entitled: "GIS Analysis of Potential Off-Site Transmission Macro-Corridors, Revision 1" (Reference RAI ESP EIS 9.0-12-1):

1. West Corridor: Generally following existing transmission line corridors, extending from the PSEG Site to Peach Bottom Substation (~55 mile macro-corridor).
2. South Corridor: Generally following existing transmission line corridors and the previous routing of an early portion of the potential Mid-Atlantic Power Project (MAPP) line from the Indian River substation to the PSEG Site (~94 mile macro-corridor).

In order to provide input to the interdisciplinary analysis of the ER, environmental features considered in this analysis include:

- U.S. Geological Survey (USGS) Land Use/Land Cover (LULC);
- Wetlands;
- Floodplains;
- Hydrography (streams, rivers);
- Infrastructure;
- Parklands;
- Nature Preserves/Natural Areas;
- Wildlife Refuges;
- Forest Preserve Lands;
- Historic Properties;
- Prime and unique farmland; and
- Natural Heritage Data

Methods for establishment of each macro-corridor and for the quantification of impacts associated with each resource for each alternative are provided in detail in the report.

Subsequent to the compilation of the available GIS information, each corridor is analyzed to provide a summary of the number and type of each resource within the 5-mile wide corridors and further scaled to a "projected" value representative of a 200-ft wide (typical 500kV) right-of-way potentially located within each macro-corridor. These measurements are compiled separately for the portion of the corridor within a 6-mile radius and within a 50-mile radius of the PSEG Site to support discussions of the "vicinity" and "region" in the ER. An adjustment factor is also applied to the projected value for the hypothetical 200-ft wide right-of-way to account for the actual transmission line length along existing rights-of-way relative to the simplified conceptual route. For example, the length of the simplified conceptual route for the West Corridor is approximately 55 miles; however, the actual length along the existing ROW's is approximately 59 miles. Therefore, the estimated value for each resource within a 200-ft wide right-of-way is increased by 7 percent (percentage increase from 55 miles to 59 miles). Similarly, the length of the simplified conceptual route for the South Corridor is approximately 94 miles; however, the actual length along the existing ROW's is approximately 107 miles. Therefore, the estimated value for each resource within a 200-ft wide right-of-way is increased by 14 percent (percentage increase from 94 miles to 107 miles) to derive attribute values that represent the bounding condition for off-site transmission. The basis for these adjustments is summarized in Table ESP EIS 9.0-12-1.

Table ESP EIS 9.0-12-1. Basis for Adjusted Macro-Corridor Lengths and Impact Values

Macro-Corridor	Macro-Corridor Centerline Length (mi)	Existing Transmission Line Length (mi.)	Adjusted Increases In Impact Values
South	94	107	14%
West	55	59	7%

Incorporation of Macro-Corridor Results in ER

Results of this analysis demonstrated that the South Corridor, by virtue of its greater length (~94 mi.), represents a bounding condition with impacts that, for most resource categories examined, exceed the impacts of the West Corridor (~55 mi.). The total area potentially included within the adjusted 200-ft wide hypothetical right-of-way for the South Corridor is 2,728 ac, as compared to 1,557 ac for the West Corridor. Accordingly, data from the South Corridor, as provided in Tables 3.2 to Table 3.9 of the Macro-Corridor Report, are used for all resources as a basis for assessment of impacts of construction and operation in ER Chapters 4, 5 and 10.

To support the use of the South Corridor as the basis for impact assessment within the ER, PSEG evaluated the representativeness and characteristics of each corridor with respect to various environmental features. For example, both corridors bear similarities in the dominant land uses crossed. Agricultural lands (cultivated cropland, pasture/hay land), forested lands, and wetlands are the dominant land cover types crossed by each corridor. Wetland and stream resources are also similarly represented within each corridor. Perennial streams are slightly more abundant (by percentage) within the West Corridor relative to the South Corridor. However, PSEG also acknowledges that impacts to stream resources are likely to be minor, as pier placement in stream channels are avoided and streams generally are spanned. In contrast, wetlands are represented by a greater percentage within the South Corridor as compared to the West Corridor. Prime and unique farmland is noted to be more abundant (by percentage) within the West Corridor as compared to the South Corridor. Impacts to prime and unique farmland, however, are recognized as being minor regardless of the corridor selected, as actual farmland conversion is limited to the footprints of the support structures and any necessary access points. Conversely, floodplains are noted to be relatively more abundant within the South Corridor as compared to the West Corridor.

Sensitive resources including parkland, refuges, and publicly owned wildlife management areas are also evaluated. Notably, the West Corridor contained a greater number of potential features as compared to the South Corridor. Natural heritage features are difficult to characterize due to the unavailability of site-specific data within publicly available GIS databases. However, PSEG acknowledges in the ER that additional consultation will be undertaken to identify and avoid such resources during formal routing studies. Historic properties are also demonstrated to be low in number within each corridor and are likely avoidable.

Although a specific off-site transmission route has not been developed and there are no detailed design plans in place, the new transmission line is a 500 kV transmission line and has characteristics similar to existing PSEG 500 kV transmission lines. The following characteristics relevant to the macro-corridors under consideration are also used to support assessments of construction and operational impacts in ER Chapters 4, 5, and 10:

- Typical tower spacing of 5 spans per mile (relevant to the assessment of impacts resulting from alterations of land use, wetlands, terrestrial habitats etc.);
- Delaware River Crossing – Assumes five towers located on piers placed parallel to the existing transmission line (relevant to the assessment of impacts to water resources, aquatic ecosystems);
- Susquehanna River Crossing – Assumes a single tower (relevant to the assessment of impacts to water resources, aquatic ecosystems);
- Piers to support towers needed for major river crossings assumed to be co-located (side-by-side) with existing piers (relevant to the assessment of impacts to water resources, aquatic ecosystems);
- Typical 500-kV transmission tower consist of lattice tower or mono-pole construction (relevant to assessment of visual impacts, potential bird collisions, etc.); and
- Typical 500-kV transmission tower have a height of 145 to 180 feet (relevant to assessment of visual impacts, potential bird collisions, etc.).

Extent of Corridor Routing or Widening Activities

PSEG has not undertaken any routing studies in anticipation of the need for potential off-site transmission. In addition, PSEG has no near term plans to perform any transmission related routing studies or corridor widening studies for either potential new transmission lines or along existing transmission line corridors.

References:

RAI ESP EIS 9.0-12-1 MACTEC Engineering and Consulting, Inc. (MACTEC), 2010. GIS Analysis of Potential Off-Site Transmission Macro-Corridors. Revision 1. Prepared for PSEG Power, LLC. Submitted to Sargent & Lundy, LLC. January 26, 2010.

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. ENV-14, Question ESP EIS 9.0-13:

The NRC staff asked PSEG to provide information about the ability to obtain the necessary permit(s) to withdraw water in the amounts required at Alternative Site 4-1 as described in Subsection 9.3.2.1.3 of the Environmental Report. The specific request was:

> *rALT-36: Provide information about the ability to obtain the necessary permit(s) to withdraw water in the amounts required at Alternative Site 4-1. That is, explain the basis for the assumption that permits and the associated water rights can be obtained. Explain the relationship of water impounded in Merrill Creek Reservoir to the availability and obtainability of water for use at Site 4-1.*
>
> *Supporting Information: Under Reg. Guide 4.7, A.7.2: "To evaluate the suitability of a site, there must a reasonable assurance that permits for water use and for water consumption in the quantities needed for a nuclear power plant of the stated approximate capacity and type of cooling system can be obtained by the applicant from the appropriate State, local, or regional agency."*
>
> *The requested information is needed to assist the staff in determining whether reasonable assurance exists in regard to adequate water supplies at Site 4-1.*

PSEG Response to NRC RAI:

With respect to water allocation for the considered Alternative Site 4-1, the two agencies having regulatory oversight and review are the New Jersey Department of Environmental Protection (Division of Water Supply and Geoscience) (NJDEP), and the Delaware River Basin Commission (DRBC). The relevant legal basis for water allocation is not based on water rights, or prior appropriation of the water resources based on land ownership. The NJDEP Water Supply Management Act, and the DRBC Compact, provide for allocation through equitable apportionment. If an applicant demonstrates legitimate demand for the water, and can show by technical supporting analysis that the withdrawal will not result in adverse impacts to the resource, or surrounding users, the regulatory agencies will grant the allocation. These rules are excerpted below:

> WATER SUPPLY MANAGEMENT ACT, N.J.S.A. 58:1A-1
> P.L. 1981, c.262 (as amended 1/4/2008 by P.L. 2007, c.246)
>
> *58:1 A-5.*
> <u>*Supply and diversion of water; rules and regulations (NJDEP)*</u>
>
> *The commissioner shall have the power to adopt, enforce, amend or repeal, pursuant to the "Administrative Procedure Act," P.L.1968, c. 410 (C. 52:14B-1 et seq.) rules and regulations to control, conserve, and manage the water supply of the State and the diversions of that water supply to assure the citizens of the*

State an adequate supply of water under a variety of conditions and to carry out the intent of this act. These rules and regulations may apply throughout the State or in any region thereof and shall provide for the allocation or the reallocation of the waters of the State in such a manner as to provide an adequate quantity and quality of water for the needs of the citizens of the State in the present and in the future and may include, but shall not be limited to:

a. A permit system to allocate or reallocate any or all of the waters of the State, which system shall provide for the issuance of permits to diverters of more than 100,000 gallons per day of the waters of the State, containing at a minimum the conditions required by this act;

b. Standards and procedures to be followed by diverters to ensure that:
(1) Proper methods are used to divert water;
(2) Only the permitted quantity of water is diverted and that the water is only used for its permitted purpose;
(3) The water quality of the water source is maintained and the water standards for the use of the water are met;
(4) The department is provided with adequate and accurate reports regarding the diversion and use of water;

c. Inspection, monitoring, reporting and enforcement procedures necessary to implement and enforce the provisions of this act;

d. Standards and procedures to be followed to determine the location, extent and quality of the water resources of the State and plan for their future use to meet the needs of the citizens of the State;

Delaware River Basin Compact, 1961

http://www.nj.gov/drbc/library/documents/compact.pdf

3.3 Allocations, Diversions and Releases. The commission shall have the power from time to time as need appears, in accordance with the doctrine of equitable apportionment, to allocate the waters of the basin to and among the states signatory to this compact and to and among their respective political subdivisions, and to impose conditions, obligations and release requirements related thereto, subject to the following limitations:

(a) The commission, without the unanimous consent of the parties to the United States Supreme Court decree in New Jersey v. New York, 347 U. S. 995 (1954), shall not impair, diminish or otherwise adversely affect the diversions, compensating releases, rights, conditions, obligations, and provisions for the administration thereof as provided in said decree; provided, however, that after consultation with the rivermaster under said decree the commission may find and declare a state of emergency resulting from a drought or catastrophe and it may thereupon by unanimous consent of its members authorize and direct an

increase or decrease in any allocation or diversion permitted or releases required by the decree, in such manner and for such limited time as may be necessary to meet such an emergency condition.

(b) No allocation of waters hereafter made pursuant to this section shall constitute a prior appropriation of the waters of the basin or confer any superiority of right in respect to the use of those waters, nor shall any such action be deemed to constitute an apportionment of the waters of the basin among the parties hereto: Provided, That this paragraph shall not be deemed to limit or restrict the power of the commission to enter into covenants with respect to water supply, with a duration not exceeding the life of this compact, as it may deem necessary for a benefit or development of the water resources of the basin.

(c) Any proper party deeming itself aggrieved by action of the commission with respect to an out-of-basin diversion or compensating releases in connection therewith, notwithstanding the powers delegated to the commission by this compact may invoke the original jurisdiction of the United States Supreme Court within one year after such action for an adjudication and determination thereof de novo. Any other action of the commission pursuant to this section shall be subject to judicial review in any court of competent jurisdiction.

NJDEP and DRBC review the application for water withdrawal for Alternative Site 4-1 to confirm the demand is appropriate for the use, and to evaluate the potential impacts of the withdrawal on the resource and existing users. PSEG needs to demonstrate that they are able to offset the consumptive use of the water withdrawn, specifically during low flow [drought] conditions on the Delaware River, such that they are able to operate without preventing achievement of the flow target at Trenton, NJ, maintained by DRBC and the USACE.

As noted by DRBC (http://www.nj.gov/drbc/programs/flow/drought/index.html)

The DRBC Water Code sets a minimum flow objective of 3,000 cfs at Trenton, N.J. (head of tide) in order to control the upstream migration of salty water (referred to as the "salt front" or "salt line") from the Atlantic Ocean through the Delaware Bay into the tidal river. The salt front's location fluctuates along the tidal Delaware River as freshwater streamflows traveling downstream increase or decrease in response to hydrologic conditions, diluting or concentrating chlorides in the river. DRBC-directed releases from Blue Marsh Reservoir (located on the Tulpehocken Creek, a tributary of the Schuylkill River) and Beltzville Reservoir (located on the Pohopoco Creek, a tributary of the Lehigh River) to meet the Trenton flow target are used to help repel, or flush back, the salt-laced water in order to protect the drinking water intakes in the downstream urban areas of Philadelphia and Camden. Water supply storage in these two lower basin reservoirs, both owned by the U.S. Army Corps of Engineers, is financed by surface water users under a water charging program implemented by the DRBC.

Storage in Blue Marsh and Beltzville reservoirs is used to trigger drought warning and drought operations in the Lower Delaware River Basin - that portion of the basin downstream of Montague, N.J. This allows for reductions in the Trenton flow target and the New Jersey diversion when lower basin conditions are drier than in the upper part of the basin. Accordingly, lower basin operations are controlled by both basin-wide or lower basin storage triggers, with the most limiting restrictions controlling.

Merrill Creek Reservoir, a pumped storage facility located near Phillipsburg in Warren County, N.J., releases water to replace evaporative water losses ("consumptive use") caused by power generation when the basin is under DRBC-declared drought operations. Releases are made during both basin-wide and lower basin drought warnings and droughts whenever the flow at Trenton drops below 3,000 cfs for at least two consecutive days.

PSEG is currently a 13.906 percent owner in the storage in Merrill Creek Reservoir, and is able to acquire additional storage in the reservoir to allow for additional consumptive use offset for withdrawals required by operation of a plant at Alternative Site 4-1. Merrill Creek Reservoir is a 650-acre reservoir, containing approximately 48,144 acre feet of storage, of which 6695 acre feet are allocated to PSEG uses.

PSEG met with the Water Resources Management branch of the Delaware River Basin Commission. DRBC advised that they have established a comprehensive set of regulations, rules, and procedures outlining the requirements that must be addressed in making an application for any water withdrawal, including any associated with Alternative Site 4-1. DRBC indicated that Alterative Site 4-1 is not in any declared critical areas, and that there are no unconditional restrictions on the ability to obtain allocation in the area contemplated for Site 4-1. They further advised that DRBC would review any future application consistent with the criteria set forth in the DRBC Compact, and Rules of Practice and Procedure.

As noted in Subsection 9.3.2.1.3 of the Environmental Report, in the Site 4-1 area, the Delaware River contains fresh water, which allows the cooling towers to operate at three cycles of concentration or more resulting in an estimated total water withdrawal for Site 4-1 of 40,300 gpm (approximately 58 million gallons per day - MGD). In the vicinity of the potential area to site a withdrawal from Alternate Site 4-1 the Delaware River drains approximately 6,400 square miles. The nearest United States Geological Survey (USGS) gaging station is USGS 01457500 Delaware River at Riegelsville NJ, located at latitude 40°35'41", longitude 75°11'23" NAD83. Based on the sixty-five year period of record, the mean flow measured at this gage is 10,821 cubic feet per second (cfs), or 6,990 MGD (Reference RAI ESP EIS 9.0-13-2). As described in a report jointly authored by the United States Army Corps of Engineers and the DRBC (Reference RAI ESP EIS 9.0-13-1), the 7-day 10-year low flow (7Q10) flow, which is a statistical estimate of the lowest average flow that would be experienced during a consecutive 7-day period with an average recurrence interval of ten years, is 1,633.87 MGD for this approximate location on the Delaware River. Therefore, the proposed maximum water withdrawal to support Alternate Site 4-1 (58 MGD) is 3.5 percent of the 7Q10 flow, and less than 1 percent of the mean daily flow. While a comprehensive technical evaluation, which considers potential impacts to the water resource and existing users, is required, the Delaware River is capable of providing for the water demand needed to support the operation of a plant at the proposed Alternate Site 4-1.

The ability to obtain the allocation is clearly documented through the rules of both NJDEP and DRBC; PSEG has a legal right to make application for the water, and is furthermore already part owner in the principal reservoir above the Alternative Site 4-1 location specifically required for compensating releases during drought conditions. Based on the information provided above, there is reasonable assurance that PSEG can obtain an authorization to withdraw water for Alternative Site 4-1.

References:

RAI ESP EIS 9.0-13-1
http://www.nj.gov/drbc/library/documents/ArmyCorps/MultiJurisdictional-Report-Dec08.pdf

RAI ESP EIS 9.0-13-2
http://waterdata.usgs.gov/nwis/nwismap/?site_no=01457500&agency_cd=USGS

Associated PSEG Site ESP Application Revisions:

None.

Response to RAI No. ENV-14, Question ESP EIS 9.0-14:

The NRC staff asked PSEG for information regarding the Alternative Sites, as described in Subsection 9.3.2.1 of the Environmental Report. The specific request was:

> *rALT-38: Provide an analysis to describe how, if at all, PSE&G's North Central Reliability Project and the proposed Susquehanna-Roseland Power Line Project would change the potential environmental impacts described in ER Section 9.3.2.1 for Alternative Site 4-1 in Hunterdon County, New Jersey.*
>
> *Provide a discussion of the potential impacts and implications for Alternative Site 4-1 that would be associated with PSE&G's North Central Reliability Project to be constructed in New Jersey through West Orange, Livingston, Roseland, Florham Park, Chatam Borough, Chatam Township, New Providence, Berkeley Heights, Watchung, Scotch Plains, Fanwood, Clark, Edison, Metuchen and Woodbridge.*
>
> *Also, provide a discussion of the potential impacts and implications for Alternative Site 4-1 of the proposed Susquehanna-Roseland Power Line Project, which would connect Berwick, Pennsylvania, to Roseland, New Jersey.*
>
> *The discussion should address how (if at all) the existence of these new transmission lines would affect: (1) the feasibility, suitability and/or desirability of Site 4-1; (2) the potential environmental impacts for Site 4-1 as described in ER Section 9.3.2.1 et seq., and; (3) the cumulative effects of construction and operation of the proposed nearby transmission lines on Site 4-1.*
>
> *Supporting Information: Under ESRP 3.7 and 9.4.3, NRC staff need to evaluate whether the data on the power transmission system are sufficient to describe the system and provide qualitative and quantitative information necessary to assess potential impacts to land use, terrestrial and aquatic ecosystems, and man.*
>
> *The staff needs the requested information to evaluate the potential impacts identified in Reg. Guide 4.2 and ESRPs 3.7, 9.3, and 9.4.3, and to fulfill its obligations under NEPA to consider the effects of the proposed action and alternatives, including cumulative effects.*

PSEG Response to NRC RAI:

PSEG's North Central Reliability Project

PSEG's North Central Reliability Project (NCRP) upgrades existing transmission lines and substations from 138kV power to 230kV power in the northern and central regions of the state (Reference RAI ESP EIS 9.0-14-1). The project, which is approximately 35 miles in length, follows an existing PSE&G overhead right-of-way from the West Orange Switching Station in Essex County to the Sewaren Switching Station in Middlesex

County. The line traverses five counties and goes through West Orange, Livingston, Roseland, Florham Park, Chatham Borough, Chatham Township, New Providence, Berkeley Heights, Watchung, Scotch Plains, Fanwood, Clark, Edison, Metuchen and Woodbridge (Figure ESP EIS 9.0-14-1).

The closest part of the NCRP is approximately 30 miles from the Hunterdon site (Site 4-1) (Figure ESP EIS 9.0-14-1). This project has already begun pre-construction and construction work in the right of way and the upgrade is scheduled to be in-service by June 2014. Although an ESP does not constitute a decision or approval to build new units, site preparation activities and construction of the proposed causeway (i.e., preconstruction activities) are scheduled to begin in 2015, whereas construction activities for the new plant are scheduled to begin in 2016. PSEG's response to RAIs rGEN-04 and rGEN-05 in ENV-01 provides clarification as to preconstruction and construction activities and their relative timing for the new plant. If PSEG decides to initiate site preparation activities, such site preparation activities will take 12 to 36 months to complete. New plant construction occurs over an additional 5-7 year period. In consideration of the large temporal space between these projects, cumulative impacts due to construction will be minimal.

Since the NCRP consists predominately of upgrades to increase the voltage of circuits within existing rights of way, impacts related to land use, water resources, ecological resources, visual impacts, habitat fragmentation, and socioeconomics are minimized. Therefore, the construction and operation of the NCRP does not have the potential for additional cumulative impacts relative to those assessed for Site 4-1. Potential off-site transmission lines for the PSEG Site require a capacity of 500 kV, therefore the upgrade of the NCRP line does not pose any substantial benefits to Site 4-1 relative to the potential need for an additional stability line.

Susquehanna-Roseland Electric Reliability Project

The Susquehanna-Roseland Electric Reliability Project (SRERP) is a 500kV transmission line from the Berwick area in Pennsylvania to PSE&G's substation in Roseland, New Jersey (NJ) (Reference RAI ESP EIS 9.0-14-2). PSE&G is building the New Jersey portion of the line, while Pennsylvania Power & Light (PPL) Electric Utilities, is building the Pennsylvania portion. The NJ portion of the line is 45 miles in length, beginning in Hardwick, Warren County, proceeding east to Andover, Sussex County, and on to Jefferson, Morris County. The route continues east to Montville and then turns south to Roseland, Essex County (Figure ESP EIS 9.0-14-1).

The closest point of the SRERP is 38 miles away from Site 4-1 (Figure ESP EIS 9.0-14-1). Site preparation and construction activities have already begun and the project is expected to be in-service by June 2015. As described above, construction of the PSEG Site occurs over a long period of time beginning in 2016. In consideration of the large temporal space between these projects, cumulative impacts due to construction are minimal.

As with the NCRP, SRERP transmission lines are constructed primarily within existing rights of way. Consequently impacts associated with land use alteration, wetland conversion, visual impacts and habitat fragmentation are minimized. Therefore, the construction and operation of the SRERP does not have the potential for additional cumulative impacts relative to those assessed for Site 4-1.

However, unlike the NCRP, the SRERP provides substantial synchronizing energy into that part of NJ, such that it will negate the need for an additional stability line for Site 4-1. Comprehensive stability studies by PJM are required to determine the scope of transmission upgrades necessary to accommodate a new plant. ER Subsection 9.3.2.1.1 states that the land use impact of transmission for Site 4-1 is MODERATE, primarily due to the construction of the transmission line to the Peach Bottom substation for regional stability. If formal PJM impact studies determine that such a line is not needed, the impact will be reduced from MODERATE to SMALL. While this will make Site 4-1 somewhat more desirable than shown in the ER, Site 4-1 is still less desirable than the Proposed Site with regard to several other types of impacts (see ER Tables 9.3-22 and 9.3-23).

Conclusion

PSE&G's North Central Reliability Project does not change the potential environmental impacts described in the ER Subsection 9.3.2.1 for Site 4-1. However, because of the potential effect of providing regional transmission stability, the proposed Susquehanna-Roseland Power Line Project may reduce the potential transmission-related environmental impacts.

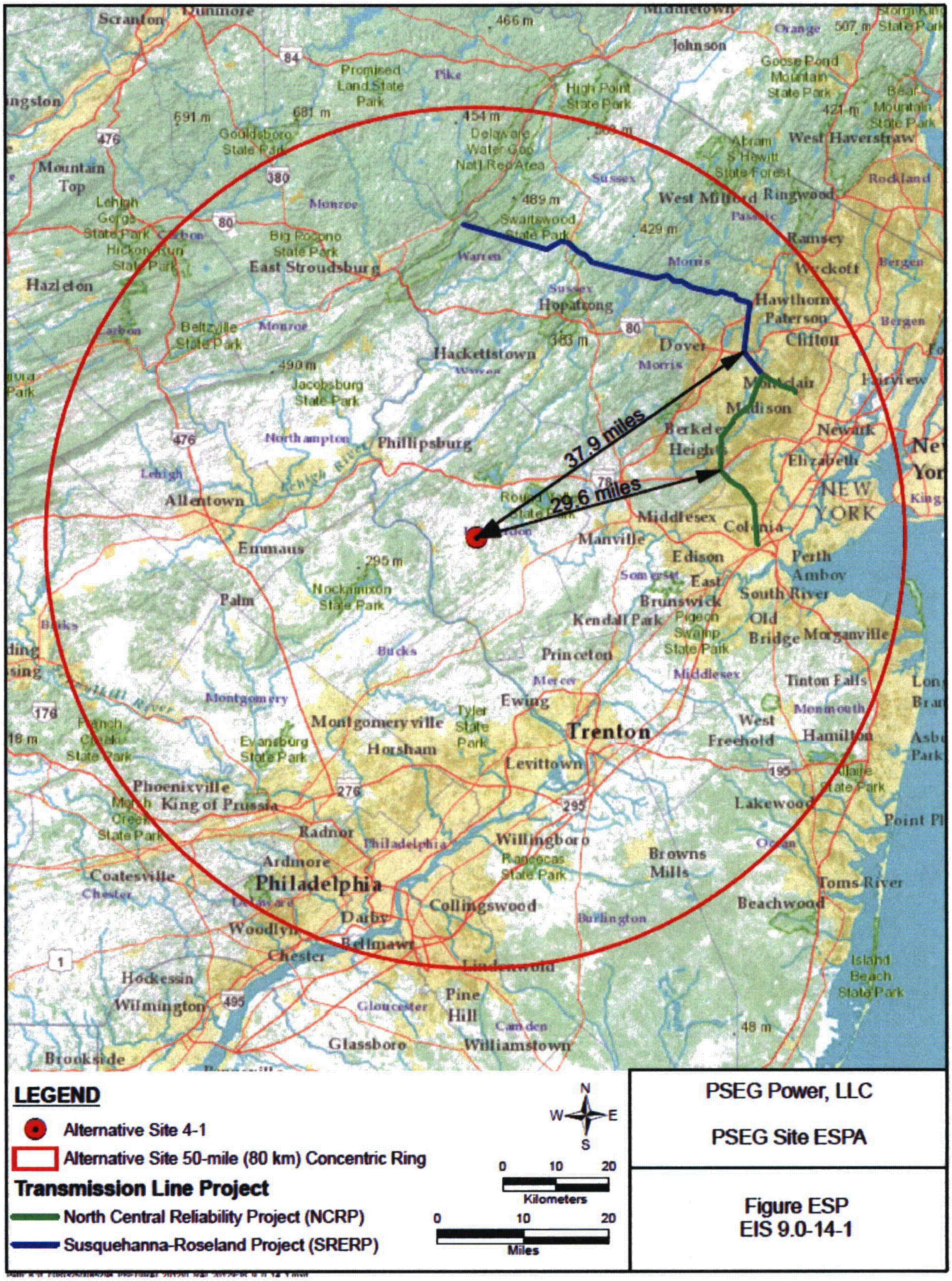
References:

RAI ESP EIS 9.0-14-1 North Central Reliability Project. Website: http://www.pseg.com/family/pseandg/powerline/reliability_projects/north_central.jsp Date Accessed: September 17, 2012.

RAI ESP EIS 9.0-14-2 Susquehanna-Roseland. Website: http://www.pseg.com/family/pseandg/powerline/index.jsp Date Accessed: September 17, 2012.

Associated PSEG Site ESP Application Revisions:

None.


37.9 miles
29.6 miles
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Phillipsburg
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Hopatcong
Dover
Paterson
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Hawthorne
Montclair
Madison
Berkeley Heights
Newark
Elizabeth
Middlesex
Colonia
Manville
Edison
East Brunswick
Perth Amboy
South River
Old Bridge
Kendall Park
Princeton
Ewing
Trenton
Levittown
Montgomeryville
Horsham
Phoenixville
King of Prussia
Radnor
Ardmore
Philadelphia
Coatesville
Darby
Bellmawr
Chester
Collingswood
Willingboro
Browns Mills
Lakewood
Toms River
Beachwood
Freehold
Hockessin
Wilmington
Glassboro
Williamstown
Pine Hill
Brookside
West Milford
Ringwood
Ramsey
Wyckoff
West Haverstraw
Johnson
LEGEND
Alternative Site 4-1
Alternative Site 50-mile (80 km) Concentric Ring
Transmission Line Project
North Central Reliability Project (NCRP)
Susquehanna-Roseland Project (SRERP)
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PSEG Power, LLC
PSEG Site ESPA
Figure ESP
EIS 9.0-14-1

PSEG Letter ND-2012-0059, dated October 3, 2012

ENCLOSURE 2

Proposed Revisions
Part 3 – Environmental Report (ER)
Chapter 9 – Alternatives

<u>Marked-up Pages</u>
9.1-2
9.1-3
9.2-2 through 9.2-6

- Resolution of siting and environmental issues before large investments of financial capital and human resources in new plant design and construction are made
- The ability to bank a site on which a nuclear plant may be located
- The need for power that could be met by the new plant would have to be met by means that involve no new generating capacity. This would result in the loss of up to 2200 megawatts electric (MWe) additional baseload generating capacity that the new plant will provide to the relevant service area (RSA), which is New Jersey (NJ). The RSA is where the majority of the power from the new plant is expected to be consumed.

Although the environmental impacts associated with construction and operation of the proposed plant would not occur under the No-Action Alternative, the following ancillary benefits of the new plant as described in Subsection 8.4.4 also would not occur:

- Reduces the amount of carbon dioxide (CO_2) generating imports needed to meet baseload demand in NJ
- Supports Global Warming Response Act, P.L. 2007, goals for the reduction of greenhouse gas emissions in NJ to 80% below 2006 levels by 2050.
- Reduces emissions from fossil fueled generation in NJ and from imports
- Lowers locational marginal prices (LMP)[a] due to reduced generation from fossil fueled resources in NJ. Fossil fueled resources are projected to have increased generation costs due to costs associated with pending carbon legislation
- Reduces potential for transmission congestion
- ~~Reduces emissions from fossil fueled generation in NJ and from imports~~
- Reduces reliance on imported petroleum to the extent that generation from oil-fired resources is reduced
- Increases the diversity of the NJ generation portfolio, which is currently comprised of 73 percent fossil fuel fired plants (Figure 8.3-1)
- Increases NJ reserve margins to improve the capability of generating resources within NJ to meet the summer peak load with less dependence on imports and their associated challenge to transmission congestion

[a] Transmission constraints are relieved by dispatching higher cost units out of economic order to assure the reliability of the power grid in the congested area. LMPs are the cost of power where power is injected into or obtained from the transmission system, and reflect the higher cost of re-dispatched units. Higher LMPs ultimately result in higher prices to electricity customers.

The following paragraphs describe how selected federal, regional, state and corporate programs would be affected by the loss of the ancillary benefits of the new plant under the No Action Alternative.

PJM Interconnection, LLC, (PJM) is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity and manages the high-voltage electric grid in NJ as part of a broader multi-state region. As discussed in Section 8.3, a number of factors continue to adversely impact system reliability in NJ. These factors include load growth, power exports to New York and Long Island, deactivation and retirement of existing generation facilities, modest development of new generation facilities, continued reliance on carbon-based imports to meet baseload needs and their resulting power flow challenges to bulk transmission facilities managed by PJM (Reference 9.1-1). The new plant at the PSEG Site improves system reliability by providing new baseload generation in NJ and reducing imports and their associated transmission, emissions and carbon challenges. These benefits are not realized under the No-Action Alternative.

Under the No-Action Alternative, the new plant would not be available to help avoid the economic, reliability, and environmental consequences of the business as usual scenario identified in the New Jersey Energy Master Plan (NJEMP). The NJEMP estimates that NJ will use 97,800 gigawatt hours (GWh) of electricity and 542 trillion British thermal units (Btu) of natural gas or heating oil in 2020 if no changes in energy supply and demand trends are made. This total energy consumption will cost consumers more than $30.7 billion in 2020, which is 96 percent more than the total annual energy expenditures in 2005. The NJEMP also indicates that if no changes in energy supply and demand trends are made, greenhouse gas emissions will increase, with CO_2 emissions totaling 84 million metric tons in 2020 (Reference 9.1-4). The new plant at the PSEG Site reduces LMPs and greenhouse gas emissions in NJ. These benefits are not realized under the No-Action Alternative.

If the No-Action Alternative is enacted, the current reliance on electricity produced by fossil-fueled generation would continue for the states participating in the Regional Greenhouse Gas Initiative (RGGI). The RGGI was developed by ten Northeast and Mid-Atlantic States to cap and then reduce power plant CO_2 emissions. ~~New Jersey is one of the ten participating states.~~ Under the RGGI agreement, states must stabilize CO_2 emissions from 2009 to 2014 and then reduce the emissions by 2.5 percent per year from 2015 to 2018 (10 percent total) (Reference 9.1-3). New Jersey was one of the ten participating states, in RGGI, but withdrew in 2011. However, it remains committed to reductions in greenhouse gas emissions through its commitment to renewable energy sources, energy conservation, and development of new, clean generation within NJ.

Under the No-Action Alternative, the new plant would not be available to provide an alternative source of electric generation that produces almost none of the greenhouse gases subject to pending federal regulatory and legislative initiatives. The U.S. Environmental Projection Agency (EPA) has issued a finding that greenhouse gases contribute to air pollution that may endanger public health or welfare. This finding could result in regulations to reduce greenhouse gases under the Clean Air Act (Reference 9.1-6). In addition, the U.S. House of Representatives has passed the American Clean Energy and Security Act of 2009, which sets goals and establishes a cap-and-trade system for reductions in greenhouse gas emissions (Reference 9.1-5). Both the EPA finding and the House bill are indicative of an intention to require reductions in greenhouse gases. The new plant at the PSEG Site can replace generating sources that emit

The overall impact of these programs is not adequate to obviate the need for the new plant. The effect of these programs on future projections of power demand has been incorporated into PJM planning indirectly through the development of the load forecast and directly through the bidding of Energy Efficiency (EE) and Demand Response (DR) resources into the annual Reliability Pricing Model (RPM) auctions. As described in Subsection 8.2.1.1, PJM uses an econometric modeling approach to forecasting of future peak power demand and energy use. The effect of energy efficiency, DSM and distributed generation programs affect the forecast to the extent that the historical data used to develop the econometric model reflects the impact of the programs. As discussed in Section 8.3, the EE and DR resources that clear the RPM auction become part of the regional power supply and reduce the need for additional generation.

After including the impact of conservation programs, Subsection 8.4.2 shows ~~7900~~7300 MWe of additional baseload capacity is still needed by 2021, the expected year of commercial operation of the new plant at the PSEG Site. This means that conservation programs alone cannot replace the need for baseload capacity in NJ and therefore do not satisfy the purpose of the project. Accordingly, energy conservation is not a viable alternative to the construction of a merchant baseload generating facility, because it cannot reduce the use of electricity enough to eliminate the need for additional baseload capacity.

9.2.1.2 Reactivating or Extending Service Life of Existing Plants

This section discusses the alternative of reactivating plants that have been taken out of service, or of extending the service life of units scheduled for deactivation.

Retired fossil-fuel plants and those slated for retirement tend to be plants that have difficulty meeting current restrictions on air emissions or are otherwise uneconomical to operate. Accordingly, plant reactivations and/or service life extensions of fossil-fueled plants are typically not desirable or feasible due to the increasing stringency in state and federal air emissions standards as well as the higher operating and maintenance costs of older plants. In addition, the New Jersey High Electric Demand Day Rule implemented in May 2009 requires additional emissions reductions on days of peak power demand from high emitting fossil-fueled units to aid attainment of the federal 8-hour ozone standard (Reference 9.2-29). In light of increasingly rigorous environmental restrictions, delaying retirement or reactivating plants typically requires major construction to upgrade or replace plant components without increasing plant output, as is the case with PSEG's Mercer and Hudson steam plants. Both of these coal-fired power plants are undergoing significant retrofits to install pollution control technology on some units that result in an overall net decrease in capacity.

Updated 2012 information on deactivation and retirement of generation resources shows an increased number of retirements of fossil and nuclear units. As discussed in Section 8.3, almost 3,000 MWe of existing NJ generating capacity is projected to be retired by 2019. PSEG retired several fossil-fueled units in recent years and has plans to retire several more. Kearny Units 7 and 8 steam plants (150 MWe each) were retired in 2005. Kearney Units 10 and 11 (122 MWe and 128 MWe, respectively) were retired in 2012. Kearney Unit 9 (21 MWe) will be retired in 2013. Hudson Unit 3 (129 MWe) was retired due to generator damage in 2003~~.~~ and Hudson Unit 1 (383 MWe) was retired in 2011. Burlington Units 101-105 (260 MW) were retired in 2004 and the turbine-generators were sold in 2005. Bergen Unit 3 (21 MWe), Burlington Unit 8 (21 MWe), Mercer Unit 3 (115 MWe), National Park Unit 1 (21 MWe), and Sewaren Units 1 through 4 and 6 (558 MWe) are scheduled for retirement in 2015. There are no plans to return any of these units to service. ~~Per Chapter 8 Appendix 8A, no future retirements are identified by PJM in NJ. Hudson Unit 1 is projected to be deactivated by September 2010, but is included in PJM RPM supply for later years and thus has been included in the supply projections in Section 8.3. As of 2009, PJM planning data show that no other fossil-fueled plants will be retired.~~ None of the recently retired or to be retired fossil-fueled units are reasonable candidates for reactivation or life extension. These retirements of fossil-fueled units are predominantly the result of age, high maintenance costs, high cost to reduce emissions, and overall inefficiency resulting in uneconomic operation. In addition to the announced retirements, the potential exists for future deactivations of coal-fired units within PJM due to the expected increase in generation costs from pending carbon legislation.

All four operating nuclear plants located in NJ have ~~either~~ been approved by the NRC for license renewal o~~r have license renewal applications under NRC review (such as PSEG's Salem Generating Station [SGS] and Hope Creek Generating Station [HCGS]) (Reference 9.2-21)~~. The 637 MWe Oyster Creek Nuclear Power Plant however, will be decommissioned starting in 2019.

HCGS Unit 2 is not a candidate for reactivation. PSEG originally planned for a second unit at HCGS and was granted construction permits for both units in November 1974. Construction of HCGS Unit 2, which is structurally contiguous with HCGS Unit 1, was formally abandoned by PSEG in December 1981 due to financial constraints and a reduced demand for power at that time. The reactivation of the HCGS Unit 2 construction permit as an alternative to the new plant is not feasible. The containment shell and reactor vessel planned for HCGS Unit 2 were cut up for salvage as part of the rate case settlement with the New Jersey Board of Public Utilities (NJBPU) for cancellation of the unit. Additionally, HCGS Unit 2 is not a suitable location/alternative for a new nuclear unit for the following reasons:

1) Significant portions of the HCGS Unit 2 turbine building are now utilized for maintenance and administrative office space and laydown support for HCGS Unit 1.
2) The structural components of the HCGS Unit 2 Reactor Building currently provide flood and missile protection for HCGS Unit 1. Alteration of the HCGS Unit 2 Reactor Building to accommodate a new reactor could impact these protective functions, hence impacting the operation of HCGS Unit 1.
3) Constructing a new generation reactor design at the HCGS Unit 2 location is not feasible given the high likelihood that the existing HCGS Unit 2 footprint is not physically able to accommodate any of the standardized reactor designs.
4) Construction activities associated with the completion of HCGS Unit 2 would impact operation of HCGS Unit 1 due to the above described inter-reliance of structures and overall proximity of heavy construction (cranes, ultra-heavy modules, etc.) to critical HCGS Unit 1 structures systems and components.

Given the above negative impacts on the operation of HCGS Unit 1 that would result from constructing a new plant at the HCGS Unit 2 location, reactivation of the HCGS Unit 2 is not a reasonable or competitive alternative to the new plant.

In summary, there are no known plant reactivations or service life extensions identified in PJM long term planning (extending to the sixth year past commercial operating date) in NJ beyond those discussed above. Based on the current state of all active and retired plants in NJ as well as planned retirements, there are no available reactivations or service life extensions that can replace the baseload need that is provided by the new plant.

9.2.1.3 Purchasing Power from Other Utilities or Power Generators

This section discusses the alternative of purchasing power to provide the baseload capacity needed in NJ instead of constructing the new plant at the PSEG Site.

~~As discussed in Subsection 8.4.2, there currently is a need for approximately 5800 MWe of additional baseload capacity in NJ. Hence, NJ already is relying on the alternative of purchasing power through imports to serve baseload demand. The need for baseload capacity via imports or future new NJ generation is forecasted to grow to 7900 MWe by the year 2021.~~

~~As discussed in Section 8.3, PJM expects NJ to continue relying on transmission capability to replace retired generation and to meet growth in demand. Table 8.4-1 shows that reserves in the EMAAC area (of which NJ provides over half of the power) are inadequate to meet summer peak power demand. Consequently, imports are needed to meet the summer peak load.~~As discussed in Section 8.3, PJM expects NJ to continue relying on transmission capability to replace retired generation and to meet growth in peak power demand. Using updated 2012 information, Table 8.4-1 shows a shortfall of over 5,800 MWe in generating resources to meet the peak load in NJ in 2021. Consequently, imports are needed to meet the summer peak load. However, Table 8.4-2 also shows that the need for baseload capacity in NJ is 7300 MWe by the year 2021. The finding of Section 8.4 that the need for baseload capacity in NJ is greater than the need for generating resources to meet the peak load in NJ helps explain why the cost of power in NJ is high. To assure the reliability of the power grid in congested areas of NJ, transmission congestion is relieved by dispatching higher cost intermediate and peaking units in NJ because insufficient baseload capacity with lower dispatch costs is available. This is the cause for higher LMPs in NJ. In addition, the potential for more power exports to New York City and Long Island further increase the demand for instate generating resources and/or transmission capability, as discussed in Sections 8.1 and 8.3 and depicted in Figure 8.1-3. This increased demand challenges bulk transmission facilities and potentially increases congestion, costs and reliability criteria violations in NJ.

~~Per~~As discussed in Section 8.3, construction of new transmission lines and upgrades to existing transmission lines is a long, costly and publicly contentious process that will be required to allow more purchase power imports. ~~Three~~ One major new ~~500 kV~~backbone transmission ~~facilities have~~facility has been approved by the PJM Board to resolve ~~North American Electric Reliability Corporation (~~NERC~~)~~ reliability criteria violations in the ~~Middle Atlantic Area Council (~~MAAC~~)~~ sub-region~~ and will increase the capability to import power into and throughout NJ. Transmission projects in NJ present financial and permitting challenges due to the dense commercial and residential development in congested areas~~. The Susquehanna-Roseland 500 kV transmission line creates a strong link from generation sources in northeastern and north-central PA, across northeastern PA and into NJ. However, due to lower load growth, the installation of new gas intermediate and peaking fired power plants, and the increase in demand response programs, the PJM Board cancelled the 500 kV circuit Mid-Atlantic Power Pathway (MAPP) and the 765 kV Potomac-Appalachian Transmission Highline (PATH) projects. These projects were designed to increase the capability to transfer power from western PJM into the EMAAC, of which NJ is a part.

~~Although construction of grid upgrades and new transmission lines within NJ to increase import capability are feasible, it should be noted that relying on imported power purchases increases power costs to consumers and will likely lead to greater emissions from fossil fueled plants. To assure the reliability of the power grid in congested areas of NJ, transmission congestion is relieved by dispatching regional higher cost units out of economic order. These units are typically fossil fueled.~~Consequently, imports of baseload capacity from western PJM to NJ cannot be increased without causing increased congestion, higher power prices, and potential reliability issues. Transmission projects in NJ also present financial and permitting challenges due to the dense commercial and residential development in congested areas. Increasing the reliance on imported power purchases is therefore not aligned with one of the five overarching goals of the NJ Energy Master Plan (NJEMP)--to drive down the cost of energy for all customers.

The intermediate and peaking units in NJ that are dispatched due to the lack of baseload capacity also are fossil-fueled. Even considering the congestion relief projected by the approved Susquehanna Roseland transmission project~~s planned within NJ~~, the types of generating units that supply imported power from the western portion of PJM also are often fossil-fueled and typically coal-fired. In addition to the environmental impacts of ~~these~~imported fossil-fueled generation~~ resources~~, the prospect of federal limits on power plant emissions of greenhouse gases creates uncertainty about the cost of power from these fossil-fueled sources. The uncertainty arises from the likelihood of paying emissions allowance for CO_2 and/or laws or regulations to remove or reduce CO_2 in the future. This increase in emissions cost of fossil-based generation, especially coal-fired generation, will likely lead to financially-driven deactivations of units that are currently relied on for imports. The Department of Energy's Energy Information Administration projects that 30,000 MW of coal capacity is projected to be retired by the next decade due to age and financial impacts from carbon legislation (Reference 9.2-23).

~~Overall, importing power may be a feasible alternative to construction of the new plant at the PSEG Site, but is undesirable due to significant cost uncertainties and environmental impacts.~~Nuclear capacity additions in the remainder of EMAAC and other areas of MAAC immediately adjacent to NJ could provide baseload capacity to NJ, as discussed in Section 8.4.3. A combined license application (COLA) for the Bell Bend plant in Pennsylvania has been submitted to the U.S. Nuclear Regulatory Commission (NRC) and identifies an RSA that includes all of NJ. The scheduled commercial operation date for the Bell Bend plant, which has a proposed capacity of approximately 1600 MWe, originally was 2018 but is now under review. The only other significant baseload capacity additions anticipated in areas near NJ are 648 MWe of uprates to Limerick and Peach Bottom in PECO, Susquehanna in PPL, and Three Mile Island in METED. The Susquehanna-Roseland 500 kV transmission line could facilitate imports from Bell Bend and the Susquehanna uprates. To the extent that nuclear baseload capacity additions are exported into NJ, they may displace some of the imports from fossil-fueled resources, but they are still imports. Increasing the reliance on imported power purchases, whether fossil or nuclear fueled, is therefore not aligned with a second of the five overarching goals of the NJEMP--to promote a diverse portfolio of new, clean, in-State generation.

Overall, importing power may be a feasible alternative to construction of the new plant at the PSEG Site, but is undesirable due to higher costs to consumers, environmental impacts, and potential reliability issues. It also in inconsistent with the goals of the NJEMP. Accordingly, it is not considered to warrant further consideration.

9.2.1.4 Summary

As discussed in this section, conservation (energy efficiency) programs have already been factored into the need for power analysis, and so are not viable alternatives to building the new plant. The possible options for reactivating or extending the service life of existing plants within NJ are also not viable. Purchasing power from other utilities or power generators may be feasible but has significant undesirable attributes and is inconsistent with the goals of the NJEMP. Accordingly, none of these alternatives are considered to be viable, they do not satisfy the purpose of the proposed project, and therefore they are not considered further.

9.2.2 ALTERNATIVES REQUIRING NEW GENERATING CAPACITY

This section assesses possible alternative energy sources to determine if they are competitive or noncompetitive with the proposed new plant. The following alternative energy sources are considered in this assessment:

- Wind
- Geothermal
- Hydropower
- Solar Power
  - Solar Thermal Power
  - Photovoltaic Cells
- Biomass
  - Energy Crops and Forest Residues
  - Municipal Solid Waste and Urban Wood Residues
  - Methane from Landfills and Wastewater Treatment
- Petroleum Liquids (Oil)
- Fuel Cells
- Coal
- Natural Gas
- Integrated Gasification Combined Cycle

The alternative energy sources are analyzed in the subsequent sections based on the following evaluation criteria:

- The alternative energy conversion technology is developed, proven, and available in the RSA within the life of the new plant.
- The alternative energy source provides baseload-generating capacity equivalent to the capacity needed and to the same level as the proposed nuclear plant. The new plant at the PSEG Site is proposed to serve as a baseload generator; therefore, any feasible alternative would also need to be able to generate baseload power.
- The alternative energy source does not result in environmental impacts in excess of a nuclear plant.

Alternative energy sources are considered to be competitive only if they are able to satisfy all of these criteria. Accordingly, if an alternative energy source is unable to satisfy all of the criteria it