PJM Generator Interconnection Request
Queue #H24
Forest (East Wind) 230 kV
Feasibility Study Report

October 2002
DMS# 187387

Confidential

Forest 230 kV Feasibility Study

General

The interconnection customer (IC).has proposed installation of a 535 MW gas fired combined cycle plant consisting of two (2) GE 7FA combustion turbines and one (1) steam turbine generator to be constructed on Willamette Industries property, Parcel # 8312, in Ridgeway, Elk County, Pennsylvania. The proposed service date for the generation is June 30, 2006.

The intent of the feasibility study is to determine ballpark cost and construction time estimates of system reinforcements required to facilitate the addition of the new generating plant to the PJM system. The reinforcements include the direct connection of the generator to the system and any network upgrades necessary to maintain the reliability of the PJM system.

Direct Connection

This facility will be connected to the transmission system by a radial 230 kV transmission line approximately three miles in length that will be attached to the existing Forest substation (see Figure #1). Based on this design, FirstEnergy has developed the following Feasibility Study cost and time estimates for the installation of the direct connection facilities that will be required for this project:

1. Expand the Forest 230 kV substation to a four breaker ring bus, by adding two new 230kV circuit breakers, to accommodate the new connection (see Figure #1)

The estimated cost of this reinforcement is **$3,000,000** and it is expected to take 1.5 years from the execution of an interconnection agreement with FirstEnergy to the in-service date.

2. Construct a 3 mile 230 kV line (1590 Kcmil ACSR conductor) to attach the Developer's substation to the Forest 230 kV substation.

The estimated cost of this reinforcement is **$2,000,000** and it is expected to take 1.5 years from the execution of an interconnection agreement with FirstEnergy to the in-service date.

Note that the East Wind Power Partners, Ltd will be fully responsible for acquiring all right-of way, easements, and acquisitions required for this project. This includes all 230 kV right-of ways and the additional property required for the expansion of the Forest substation.

Figure #1

Network Impacts

The **#H24 project was studied as total of 535 MW capacity** injection into the Forest 230kV Substation. Project # H24 was evaluated for compliance with reliability criteria for summer peak conditions in 2006. Potential network impacts were as follows:

Generator Deliverability

1. The Forest – Elko 230 kV circuit is overloaded at **120%** of its normal rating (426 MVA). It is also contingency overloaded at **143%** of the emergency rating (505 MVA) for the outage of the Glade – Warren 230 kV circuit and Warren 230/115 kV transformer 2. The H24 project contributes approximately **329** MW to the normal and **448** MW to the contingency loading on this circuit.
2. The Milesburg – Dale 230 kV circuit is overloaded at **101%** of its normal rating (382 MVA). It is also contingency overloaded at **122%** of its emergency rating (478 MVA) for the outage of the Shawville – Shingletown 230 kV circuit. The H24 project contributes approximately **71** MW to the normal and **115** MW to the contingency loading on this circuit.
3. The Ridgway – Whetstone 115 kV circuit is contingency overloaded at **154%** of the emergency rating (159 MVA) for the outage of the Forest – Elko 230 kV circuit. The H24 project contributes approximately **138** MW to the loading on this circuit.
4. The Whetstone – Harvey Run 115 kV circuit is contingency overloaded at **144%** of the emergency rating (159 MVA) for the outage of the Forest – Elko 230 kV circuit. The H24 project contributes approximately **136** MW to the loading on this circuit.
5. The Ridgway – Forest 115 kV circuit is contingency overloaded at **127%** of the emergency rating (210 MVA) for the outage of the Forest – Elko 230 kV circuit. The H24 project contributes approximately **173** MW to the loading on this circuit.
6. The Dubois – Harvey Run 115 kV circuit is contingency overloaded at **122%** of the emergency rating (179 MVA) for the outage of the Forest – Elko 230 kV circuit. The H24 project contributes approximately **138** MW to the loading on this circuit.
7. The Forest 230/115 kV transformer is contingency overloaded at **110%** of the emergency rating (242 MVA) for the outage of the Forest – Elko 230 kV circuit. The H24 project contributes approximately **173** MW to the loading on this circuit.
8. The Glade – Warren 230 kV circuit is contingency overloaded at **104%** of the emergency rating (540 MVA) for the outage of the Forest – Elko 230 kV circuit. The H24 project contributes approximately **347** MW to the loading on this circuit.
9. The Two mile Run – Farmers Valley 115 kV circuit is contingency overloaded at **109%** of the emergency rating (146 MVA) for the outage of the Forest – Elko 230 kV circuit. The H24 project contributes approximately **46** MW to the loading on this circuit.
10. The Rockton Mt. – Shawville 115 kV circuit is contingency overloaded at **100%** of the emergency rating (146 MVA) for the outage of the Forest – Elko 230 kV circuit. The H24 project contributes approximately **129** MW to the loading on this circuit.

11. The Warren 230/115 transformer is contingency overloaded at **123%** of the emergency rating (261 MVA) for the outage of the Erie South – H22 230 kV circuit. The H24 project contributes approximately **94** MW to the loading on this circuit.
12. The Shingletown – Dale 230 kV circuit is contingency overloaded at **111%** of the emergency rating (478 MVA) for the outage of the Shawville – Shingletown 230 kV circuit. The H24 project contributes approximately **115** MW to the loading on this circuit.
13. The Elko – Ridgeway 138 kV circuit is contingency overloaded at **100%** of the emergency rating (112 MVA) for the outage of the Lewistown – Shingletown 230 kV circuit. The H24 project contributes approximately **35** MW to the loading on this circuit.
14. The Lewistown – Raystown 230 kV circuit is contingency overloaded at **102%** of the emergency rating (554 MVA) for the outage of the Lewistown – Shingletown 230 kV circuit. The H24 project contributes approximately **31** MW to the loading on this circuit.

Multiple Facility Contingency – Tower Line Outages (MAAC Criteria IIC)

15. The Forest – Elko 230 kV circuit is overloaded at **102%** of the emergency rating (505 MVA) under several tower outage conditions. The most severe overload occurs for the outage of the Mountain – Susq T10 230 kV circuit, Mountain 230/69 kV transformer, Stanton – Susquehanna 230 kV circuit and Stanton 230/69 kV transformer. The H24 project contributes approximately **329** MW to the loading on this circuit.

Short Circuit

Short circuit analysis was not performed due to the magnitude of reinforcements required to eliminate the identified problem. Any required breaker replacements are not expected to materially alter the total network reinforcement cost.

New System Reinforcements

A specific system reinforcement to resolve each of the overloads #1 through #15 was not developed, however, PJM expects that, the cost estimate to resolve the identified problems to **exceed $50 million with a lead time of over 5 years.**

The following facilities have been identified as requiring reinforcement. The facility loading reported, the conductor rating of the facility, and the likely action to resolve the problem is also indicated.

	Contingency Loading (MVA)	Normal/4-Hour Conductor Rating	Resolution
Seward – Tower 51 115 kV	395	178/226	Add second 8.3 mile circuit
Glory – Dixonville 115 kV	149	165/233	Replace conductor drop loop
Tower – Hooversville 115 kV	180	140/197	Replace 1 CB, 1 switch, 3 CTs
Homer City – Quemahoning 230 kV	559	653/793	Replace 1 disconnect switch
Hooversville - Scalp Level 115 kV	299	178/226	Rebuild 6.9 mile circuit

Scalp Level – Rachel Hill	289	178/226	Rebuild 2.7 mile circuit
Rachel Hill – Hillclay Jct 15 kV	262	178/226	Rebuild 3.1 mile circuit
Rosedale – Cooper 115 kV	183	204/264	Replace 1 CT
Johnstown – G31 230 kV	598	499/617	Replace 1 line trap
Rosedale – Prospect 115 kV	196	178/226	Replace 1 line trap
Prospect – Johnstown 115 kV	190	178/226	Replace 2 line traps
Lewistown – Raystown 230 kV	573	499/617	Replace 1 CB, 1 switch, 1CT
D21/D22 – Hunterstown 500 kV	2055	3004/3733	No Upgrade Required - DRTLL
Garrett Tap – Garrett 115 kV	203	115/151	Rebuild 1.9 mile circuit
Garrett 138/115 kV	203	69/88	Install second bank
Rockwood – Pen Mar 115 kV	210	129/168	Rebuild 14.7 mile circuit
Hillclay – Hilltop 115 kV	400	210/263	Rebuild 4.8 mile circuit
Somerset – Rockwood 115 kV	172	129/168	Rebuild 8.1 mile circuit
Garrett – Pen Mar 115 kV	217	129/168	Rebuild 15 mile circuit
Hooversville – Somerset 115 kV	212	178/226	Replace 1 line trap, 2 CTs
Hooversville – Ralphton 115 kV	184	210/263	Replace 1 CT

A complete analysis of the underlying system was not completed due to the number and severity of the identified bulk system problems.

If this project proceeds to the Impact Study stage, a complete analysis of the underlying system along with all cost estimates will be provided.

Contribution to Previously Identified System Reinforcements

The H24 project will share the cost of the reinforcements to correct the following previously identified problems.

16. The Homer City – Shelocta 230 kV circuit is overloaded at **136%** of the normal rating (294 MVA). The Homer City – Shelocta 230kV circuit is also overloaded for several contingencies and the worst was at **132%** of the emergency rating (854 MVA) for the outage of the Homer City – Watercure Road 345 kV circuit. The H24 project contributes approximately **58**MW to the normal and **52**MW to the contingency loading on this circuit.
17. The Keystone – Shelocta 230 kV circuit is overloaded at **122%** of the normal rating (694 MVA). The Keystone – Shelocta 230 kV circuit is also contingency overloaded at **125%** of the emergency rating (854 MVA) for the outage of Homer City – Watercure Road 345 kV circuit. The H24 project contributes approximately **77**MW to the normal and **70**MW to the contingency loading on this circuit.
18. Both Keystone 500/230 kV transformers are overloaded at **108%** of the normal rating (430 MVA). Both Keystone 500/230 kV transformers are also overloaded for several contingencies the worst is at **133%** of the emergency rating (499 MVA) for the outage of the other Keystone 500/230kV transformer. The H24 project contributes approximately **39**MW to the normal and **60**MW to the contingency loading on this circuit.
19. The Keystone – G09 500 kV circuit is contingency overloaded at **112%** of the emergency rating (3013 MVA) for the outage of Juniata – Keystone 500 kV circuit. The H24 project contributes approximately **76**MW to the loading on this circuit.

20. The Conemaugh – G09 500 kV circuit is contingency overloaded at **135%** of the emergency rating (3013 MVA) for the outage of Juniata – Keystone 500 kV circuit. The H24 project contributes approximately **76**MW to the loading on this circuit.
21. The Juniata – Keystone 500 kV circuit is overloaded for several contingencies and the worst is at **119%** of the emergency rating for the outage of the Conemaugh – G09 500 kV circuit. The H24 project contributes approximately **61**MW to the loading on this circuit.
22. The Carlisle Pike – Gardners 115kV circuit is contingency overloaded at **157%** of the emergency rating (109 MVA) for the outage of the Juniata – Lewistown 230 kV circuit. The H24 project contributes approximately **28**MW to the loading on this circuit.
23. The Roxbury – Shade Gap 115kV circuit is contingency overloaded at **143%** of the emergency rating (151 MVA) for the outage of the Juniata – Lewistown 230 kV circuit. The H24 circuit contributes approximately 28MW to the loading on this circuit.
24. The Carlisle Pike – Roxbury 115kV circuit is contingency overloaded at **107%** of the emergency rating (146 MVA) for the outage of the Juniata – Lewistown 230 kV circuit. The H24 project contributes approximately **38**MW to the loading on this circuit.
25. The Lewistown – Shingletown 230 kV circuit is overloaded at **129**% of the normal rating (426 MVA). The Lewistown – Shingletown 230 kV circuit is also contingency overloaded at **134%** of the emergency rating (512 MVA) for the outage of the Altoona – Raystown – Lewistown 230 kV circuit. The H24 circuit project contributes approximately **140**MW to the normal and **129**MW to contingency loading on this circuit.
26. The Lewistown – Juniata 230kV circuit is overloaded at **143%** of the normal rating (499 MVA). The Lewistown – Juniata 230 kV circuit is also contingency overloaded at **124%** of the emergency rating (617 MVA) for the outage of the Juniata – Keystone 500kV circuit. The H24 circuit project contributes approximately **117**MW to the normal and **39**MW to the contingency loading on this circuit.
27. The Warren – Falconer 115 kV circuit is overloaded at **135%** of its normal rating (82 MVA). It is also contingency overloaded at **182**% of the emergency rating (116 MVA) for the outage of the Erie South – H22 230 kV circuit. The H24 project contributes approximately **29** MW to the normal and **54** MW to the contingency loading on this circuit.
28. The Erie South – H22 230 kV circuit is contingency overloaded at **107%** of the emergency rating (554 MVA) for the outage of the Glade – Forest - Lewis Run 230 kV circuit. The H24 project contributes approximately **217** MW to the loading on this circuit.
29. The Altoona – Raystown 230 kV circuit is contingency overloaded at **105%** of the emergency rating (554 MVA) for the outage of the Lewistown – Shingletown 230 kV circuit. The H24 project contributes approximately **30** MW to the loading on this circuit.
30. The North Meshoppen 230/115 kV transformer 1 is contingency overloaded at **124%** of the emergency rating (155 MVA) for the outage of the East Towanda – North

Meshoppen 230 kV circuit and North Meshoppen 230/115 kV transformer 2. The H24 project contributes approximately **31** MW to the loading on this circuit.

31. The Shawville – Shingletown 230kV circuit is contingency overloaded at **122%** of the emergency rating (505 MVA) for the outage of the Milesburg – H15 230kV circuit. The H24 project contributes approximately **115**MW to the loading on this circuit.

The network reinforcement identified is to build a new 500 kV west to east circuit (or comparable alternative). The details of the new 500 kV circuit will be identified during Impact studies but the cost is estimated at over **$100 million with a lead time exceeding 5 years.** Cost allocation will be completed during the Impact Study.

There is also a potential that an SVC will be required for voltage support at the Juniata 500kV substation. This will be determined in the Impact Study evaluation. **The cost is estimated at $24.5 million with a lead-time of 2 years.**

If the developer requests an Impact Study, individual system upgrades will be identified and construction estimates defined. Cost allocation will also be completed during the Impact Study.