Generation Interconnection Feasibility Study

For

>Omitted Text<

SPP-GEN-2002-004

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Introduction

This report summarizes the results of a Feasibility Study performed for the Southwest Power Pool (SPP) by Westar Energy to evaluate a generation interconnection request by >Omitted Text< for 200 MW of wind-powered generation on the Westar Energy transmission system near Eldorado, Kansas. The projected in-service date of the generating facility is September 2003.

Project Location and Existing Facilities

The project is located south of Beaumont, Kansas, in Butler, Greenwood, and Elk Counties approximately 24 miles southeast of Eldorado, Kansas. Four Westar Energy transmission lines are near the project site: the Altoona – Butler 138 kV transmission line; the Neosho – Rose Hill 345 kV line; the Rose Hill – Wolf Creek 345 kV transmission line; and a radial 69 kV transmission line at the Flint Hills substation. Figure 1 shows the area transmission facilities. Figure 2 shows the proposed site of the project and the estimated location of the project substation ("S").

The 70.62-mile Altoona – Butler 138 kV line is a 1924 vintage line built using double circuit lattice steel towers. The conductor is 266.8 kcmil ACSR and is sag limited to 110 MVA. The line does not have overhead lightning protection and is routinely out of service during storms. One side of the line from Butler is used as a distribution circuit to serve a nearby prison. Conductors on one side of the towers are grounded for a portion to act as a proxy for shielding. The line is 10.6 miles north of the project substation. The point of interconnection would be approximately 20 miles from the Butler substation.

The 114.23-mile Neosho – Rose Hill 345 kV transmission line is a 1972 vintage line built using wood H-frame structures. The conductor is bundled 954 kcmil ACSR conductor. The transmission line is equipment limited to 956 MVA. The line is 8.8 miles south of the project substation. The point of interconnection on this line would be approximately 32 miles from the Rose Hill substation.

The 97.89-mile Rose Hill – Wolf Creek 345 kV transmission line is a 1984 vintage line built using wood H-frame structures. The conductor is bundled 954 kcmil ACSR conductor and is sag limited to 1159 MVA. The line is 9.9 miles north of the project substation. The point of interconnection on this line would be approximately 35 miles from the Rose Hill substation.

The 18.33-mile radial 69 kV line to the Flint Hills substation is a 1939 vintage line built using a variety of single-pole wood structures (vertical and wishbone). The conductor is 2/0 ACSR and #1 CU and is sag limited to 32 MVA. The line is 7 miles northwest of the project substation. Connecting 200 MW of generation at this point not only requires rebuilding the 18.33-mile radial, but also requires rebuilding 21.11 miles of the 69 kV system supplying the feed point to the radial. In addition, substantial upgrades to the substations supplying the 69 kV system and to the system protection systems are required. **Connection to the 69 kV system is not considered a viable option.**

Connection Options

For estimating interconnection costs, line mileage is calculated from the point identified as the project substation ("S") on Figure 2. Connection options considered to integrate the proposed project into the area transmission system include:

Option 1 - Tap the existing Altoona – Butler 138 kV line.
Option 2 - Tap the existing Neosho – Rose Hill 345 kV line with 345 kV delivery to the project.
Option 3 - Tap the existing Neosho – Rose Hill 345 kV line with 138 kV delivery to the project.
Option 4 - Tap the existing Rose Hill – Wolf Creek 345 kV line with 345 kV delivery to the project.
Option 5 - Tap the existing Rose Hill – Wolf Creek 345 kV line with 138 kV delivery to the project.
Option 6 – Construct a new 138 kV radial line from the Butler 138 kV substation to the project.

Westar Energy also maintains its own Facility Connection Requirements, which may be found on our web-site (wr.com). Estimated costs do include both PTs and CTs for interconnection metering located at the project substation. **Estimated costs do not include land for the interconnection substation or for transmission line right-of-way. Estimated costs do not include possible tax consequences that may increase costs by as much as 66 percent.**

Option 1 - Tap the Existing Altoona - Butler 138 kV Line

Because of issues with the performance of the existing Altoona – Butler 138 kV line, Westar Energy will not allow the line to become a simple three-terminal line. The minimum work to tap the 138 kV transmission line requires a new 138 kV three-breaker ring bus interconnection substation. Due to the age of the 138 kV line and its poor lightning performance, simple reconductoring of the Altoona – Butler 138 kV line is not a viable option. Construct a new 138 kV three-breaker ring bus interconnection substation approximately 20 miles from the Butler substation, rebuild the 70.62-mile Altoona – Butler 138 kV line, construct a new 10.6-mile 138 kV line to the project substation, and install 138 kV interconnection metering at the project substation. Line construction would use 954 kcmil ACSR conductor with a capacity of approximately 230 MVA. Lightning protection is added to the entire line with the rebuilding. This option requires replacing the relaying and carrier equipment at the Altoona 138 kV substation and at the Butler 138 kV substation on the line terminals to the interconnection substation. With either 138 kV line out of service at the new 138 kV interconnection substation, the full output of the project could be delivered to the system. The time required for this option is 80 weeks.

138 kV interconnection substation – $2,150,000
Altoona substation work – $90,000
Butler substation work – $90,000
Rebuild Altoona – Butler 138 kV line – $15,790,000
138 kV line to project substation – $3,180,000
138 kV interconnection metering at project substation – $90,000

Total for Option 1 – $21,390,000

Option 2 – Tap the Existing Neosho – Rose Hill 345 kV Line, 345 kV Delivery
Construct a new 345 kV three-breaker ring bus interconnection substation approximately 32 miles from the Rose Hill substation, construct a new 8.8-mile 345 kV line to the project substation, and install 345 kV interconnection metering at the project substation. 345 kV line construction would use bundled 795 kcmil ACSR conductor. This option requires replacing the relaying and carrier equipment at the Neosho 345 kV substation and at the Rose Hill 345 kV substation on the line terminals to the interconnection substation. The capacity of the 345 kV interconnection would be limited by the transformation at the project substation. With either 345 kV line out of service at the new 345 kV interconnection substation, the full output of the project could be delivered to the system. The time required for this option is 68 weeks.

345 kV interconnection substation – $3,330,000
Neosho substation work – $130,000
Rose Hill substation work – $130,000
345 kV line to project substation – $3,800,000
345 kV interconnection metering at project substation – $240,000
Total for Option 2 – $7,630,000

Option 3 – Tap the Existing Neosho – Rose Hill 345 kV Line, 138 kV Delivery
Construct a new 345 kV three-breaker ring bus interconnection substation approximately 32 miles from the Rose Hill substation with a 345-138 kV transformer, construct a new 8.8-mile 138 kV line to the project substation, and install 138 kV interconnection metering at the project substation. 138 kV line construction would use single 954 kcmil ACSR conductor with a capacity of approximately 230 MVA. This option requires replacing the relaying and carrier equipment at the Neosho 345 kV substation and at the Rose Hill 345 kV substation on the line terminals to the interconnection substation. With either 345 kV line out of service at the new 345 kV interconnection substation, the full output of the project could be delivered to the system. The time required for this option is 68 weeks.

345 kV interconnection substation – $3,330,000
345-138 kV substation – $3,100,000
Neosho substation work – $130,000
Rose Hill substation work – $130,000
138 kV line to project substation – $2,620,000

138 kV interconnection metering at project substation – $90,000
Total for Option 3 – $9,400,000

Option 4 – Tap the Existing Rose Hill – Wolf Creek 345 kV Line, 345 kV Delivery
Construct a new 345 kV three-breaker ring bus interconnection substation approximately 35 miles from the Rose Hill substation, construct a new 9.9-mile 345 kV line to the project, and install 345 kV metering at the project substation. 345 kV line construction would use bundled 795 kcmil ACSR conductor. This option requires replacing the relaying and carrier equipment at the Rose Hill 345 kV substation and at the Wolf Creek 345 kV substation on the line terminals to the interconnection substation. The capacity of the 345 kV interconnection would be limited by the transformation at the project substation. With either 345 kV line out of service at the new 345 kV interconnection substation, the full output of the project could be delivered to the system. This option requires close coordination with the operation of the Wolf Creek Generating Station. The new 345 kV interconnection substation cannot be energized until the Wolf Creek Generating Station is shut down for refueling in the fall of 2003. The time required for this option is 68 weeks.

345 kV interconnection substation – $3,330,000
Rose Hill substation work – $130,000
Wolf Creek substation work – $130,000
345 kV line to project substation – $4,290,000
345 kV interconnection metering at project substation – $240,000
Total for Option 4 – $8,120,000

Option 5 – Tap the Existing Rose Hill – Wolf Creek 345 kV Line, 138 kV Delivery
Construct a new 345 kV three-breaker ring bus interconnection substation approximately 35 miles from the Rose Hill substation with a 345-138 kV transformer, construct a new 9.9-mile 138 kV line to the project substation, and install 138 kV interconnection metering at the project substation. 138 kV line construction would use single 954 kcmil ACSR conductor with a capacity of approximately 230 MVA. This option requires replacing the relaying and carrier equipment at the Rose Hill 345 kV substation and at the Wolf Creek 345 kV substation on the line terminals to the interconnection substation. With either 345 kV line out of service at the new 345 kV interconnection substation, the full output of the project could be delivered to the system. This option requires close coordination with the operation of the Wolf Creek Generating Station. The new 345 kV interconnection substation cannot be energized until the Wolf Creek Generating Station is shut down for refueling in the fall of 2003. The time required for this option is 68 weeks.

345 kV interconnection substation – $3,330,000

345-138 kV substation – $3,100,000
Rose Hill substation work – $130,000
Wolf Creek substation work – $130,000
138 kV line to project substation – $2,970,000
138 kV interconnection metering at project substation – $90,000
Total for Option 5 – $9,750,000

Option 6 – Construct a New 138 kV Line to Butler
Install a new 138 kV line terminal at the Butler substation, construct a new 25-mile 138 kV radial transmission line from the Butler substation to the project substation, and install 138 kV interconnection metering at the project substation. Line construction would use single 954 kcmil ACSR conductor and have a capacity of approximately 230 MVA. The full output of the project could be delivered to the system. The time required for this option is 56 weeks.

138 kV line terminal at Butler – $530,000
Construct 25-mile 138 kV line – $5,970,000
138 kV metering at project substation – $90,000
Total for Option 6 – $6,590,000

Conclusion

The entire output of the proposed project can be delivered into the Westar Energy system with suitable system facilities. In order to interconnect with the Altoona – Butler 138 kV line the entire 70.62-mile line must be rebuilt or the output of the proposed project will be limited to 100 MVA for a single-contingency outage. Generally speaking, the time required to complete any option is over 12 months and may run as long as 18 months. **The estimated time to complete any option does not include time to acquire land for the interconnection substation or for transmission line right-of-way.**

Total for Option 1 – $21,390,000 – 80 weeks
Total for Option 2 – $7,630,000 – 68 weeks
Total for Option 3 – $9,400,000 – 68 weeks
Total for Option 4 – $8,120,000 – 68 weeks
Total for Option 5 – $9,750,000 – 68 weeks
Total for Option 6 – $6,590,000 – 56 weeks