EL PASO ELECTRIC COMPANY
STUDY OF AN INTERCONNECTION WITH
UTILITIES IN EASTERN NEW MEXICO OR TEXAS

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## C. Capital Costs - DC Transmission

The generation and transmission system operated by El Paso Electric Company is connected to and synchronized with the utilities who comprise the Western Systems Coordinating Council (WSCC). The large region embraced by the WSCC is shown in Exhibits 5 and 6. The members of the WSCC, including those in the Arizona-New Mexico region, have a generating capability of about 98,000 MW representing roughly 17% of the total electric generating capability in the contiguous United States. This generation is totally interconnected but operates asynchronously with respect to the electric systems located generally east of the 105th meridian. See Exhibit 6.

Beginning in 1956-1957, the electric utilities operating on both sides of the 105th meridian conducted a series of tests in which the existing transmission ties connecting east and west closed. These tests were continued in 1962, 1963 and 1967. The tests indicated that the existing, low voltage transmission lines would be subject to large inadvertent power flows and were not siz d for this duty. The utilities located at the boundary between east and we also experienced unacceptable line loadings and voltage control problems. Based on these tests, the AC transmission lines connecting WSCC with the rest of the United States have been operated since 1968 in a normally open condition. In 1976, however, a small, 100 MW tie was energized between east and west at Stegall, Nebraska. This interconnection, made through back-to-back, AC-DC converters, operates asynchronously; i.e., scheduled power flows are achieved but the AC systems in east and west are isolated from one another and can operate without being synchronized. The AC-DC-AC converter at Stegall effectively blocks the inadvertent power flows that would occur on an AC line.

The absence of strong transmission ties between WSCC and he utility systems east of the 105th meridian has resulted from the natural evolution of the utilities along this meridian. The zone is marked by a small population, vast stretches of arid land, and small electric loads which could be served from east or west without building high voltage transmission lines over the long distances involved. Both the utilities and the Federal Government, however, have had a continuing interest in the technical and economic benefits that might be realized by stronger interconnections between east and west. References 1 through 9, shown in the Bibliography, indicate the scope and findings of past and on-going studies addressed to increasing the interconnection capacity between east and west. In general, these large scale studies have shown that alternating current (AC) interconnections between east and west were technically feasible provided that:

1. The tie lines were of sufficient rating (greater than 1500 MW) so that both scheduled capacity transactions and large, inadvertent power flows could be handled, and

2. The tie lines were of sufficient length (1000-2000 miles) so that they could be terminated in regions where the existing AC transmission networks could be used both to collect and to distribute the several gigawatts of power that would flow on these large east-west interconnections.

The economic feasibility of large scale, east-west tie lines has not been resolved by the studies to date, and remains an outstanding issue which the Department of Energy is again studying.[10] The feasibility of an interconnection with any member of the Electric Reliability Council of Texas (ERCOT) is also uncertain due to Docket 14 issued by the Texas Public Utilities Commission which effectively precludes any ties between ERCOT and a utility, like EPEC, that is selling electric power in interstate commerce. Nevertheless, we have proceeded with this study of an interconnection of modest rating under the assumption that regulatory constraints could be lifted or modified.

The 200-400MW interconnections studied herein are less than 30% of the rating suggested by other studies for a feasible AC interconnection between WSCC and the utilities to the east of the 105th meridian. For this reason, we have deferred any analysis of an AC interconnection and proceeded instead to use direct current (DC) technology.

A DC line linking El Paso to the utilities in eastern New Mexico or Texas would permit controlled power deliveries between east and west even though the two AC systems were not synchronized. The converter valves at each end of the line would block inadvertent power flows due to the failure of generation or transmission components in east or west. The DC line we have considered here would have a nominal length of 300 miles reaching east from El Paso, Texas, into the service territory of Southwestern Public Service Company (SPS), Texas Electric Service Company (TESCO) or West Texas Utilities Company (WTU). Exhibit 8 shows the radius that would be swept by the 300-mile-long line.

A bipolar DC line with AC-DC converter terminals at each end and no intermediate taps was evaluated. Exhibit 13 shows the capital cost estimates for the alternative lines rated 200 MW and 400 MW and for two alternative in-service dates, 1983 or 1990. The same information is summarized in Table 13.

Table 13
Capital Cost Estimates for a 300-Mile DC Interconnection

| | --EPEC Investment - $ Millions-- Plans IA, IB (1983) | | Plans IIA, IIB (1990) | |
|---|---|---|---|---|
| Circuit Rating | 200 MW | 400 MW | 200 MW | 400 MW |
| DC Terminals (Two) | $40.0 | $ 60.0 | $ 64.3 | $ 96.6 |
| Miscellaneous AC Improvements | 3.6 | 6.0 | 5.8 | 9.7 |
| Bipolar DC Line | 23.0 | 39.0 | 36.9 | 62.6 |
| Allowance for Funds Used during Construction | 7.3 | 11.3 | 11.7 | 16.6 |
| TOTAL | $73.9 | $116.3 | $118.7 | $185.5 |
| Investment in Dollars Per Rated kW | $370 | $291 | $594 | $464 |

Table 13 shows that a 200 MW DC interconnection completed in 1983 would cost an estimated $73.9 million including escalation, rights-of-way and interest capitalized. Said another way, the 1983 capital costs for a 300 mile DC line would be about $370/kW if rated 200 MW and $291/kW at a rating of 400 MW. Clearly, there are economies of scale in the DC system with the 400 MW line exhibiting a lower per-unit cost than the 200 MW circuit. It is also apparent that the interconnection costs are significant and would offset part of any savings that might be realized by purchasing capacity and energy in Texas.

D. Fixed Charges

For this study we compared plans on the basis of revenue requirements. One component of the revenue requirements calculation is the annual ownership cost associated with any investment in utility plant. The annual ownership costs are defined as those expenses which arise solely from the ownership of property, and which generally continue from month to month or year to year regardless of whether the plant is in use or idle. Ownership costs, also called fixed charges, were defined for this study to include:

- Book Depreciation
- Ad Valorem Taxes
- Property Insurance
- Cost of Money
- Income Taxes

Exhibits 14, 15 and 16 present both the assumptions and the results of our fixed charge calculations for nuclear generation, coal-fired generation and transmission plant, respectively. The fixed charges in the three exhibits are expressed as percentages applicable to the incremental capital costs outlined in Subsections A-C above. For this report, it was convenient to express the fixed charge percentages as present worth values summed over selected periods, and these are summarized in Table 14.

Table 14
Present Worth of Annual Fixed Charges
Stated as a Percent of Initial Investment
(Cost of Money @ 12.0%)

| | ---Present Worth Period-Years--- | | |
|---|---|---|---|
| Plant | 10 | 30 | 35 |
| Nuclear Generation | 100.85 | 133.94 | N/A |
| Coal-Fired Generation | 105.67 | 135.20 | N/A |
| Transmission | 104.20 | 134.74 | 135.87 |

Note that Exhibits 14, 15 and 16 all reflect a cost of money equal to 12.0%, and this figure was used throughout the study as the discount rate.