Appendix I

Optimised Replacement Cost

Expert Opinion By

Venton & Associates Pty Ltd

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Worley Limited

Venton & Associates

12 October 2000

Epic Energy South Australia Pty Ltd
PO Box 2450
DRY CREEK SA 5094

Attention: Mr Ashley Kellett

Dear Ashley:

RE: MOOMBA - ADELAIDE PIPELINE
OPTIMISED REPLACEMENT COST

This letter is in response to your request for an opinion of the estimate prepared by Epic Energy on the current cost of constructing the Moomba to Adelaide Pipeline, and its laterals.

In particular, to comment on:
- The unit construction cost used.
- Inclusions and omissions, and a reasonable valuation of them

I have assumed that the technical design of the pipelines presented in the document is appropriate, and that these represent designs that satisfy a load growth forecast selected for the period over which the pipeline system is being optimised.

Pipeline Designs (Relevance of Unit Cost)

Epic have applied a common unit cost to each of the pipeline Options. This unit cost is an "all in" rate that incorporates costs for all facilities constructed as part of the pipeline (scraper station to scraper station). Compressor stations and meter - regulating stations are costed separately.

"All In" Costs

The "all in" approach is appropriate when comparing like for like designs, however it has some limitations when applied to designs at substantially different pressures. A long distance pipeline cost is 30-40% steel, 30-40% construction. Low pressure pipelines require less steel that is less costly to haul, handle and weld than that for high pressure pipelines. For example, the steel component of a 22" 8 MPa, X65 pipeline is approximately $5,200 /inch.km, while for a 22", 15 MPa, X80 pipeline, the steel component is approximately $8,490 /inch.km. The difference in the construction cost component of the "all in" cost is not as great as that of the steel, but it is significant.

Consequently applying a common cost basis to each Option can have a significant limitation on the quality of the estimate. I note that Epic constructed a 756 km, DN 350 (14") ANSI Class 900 pipeline in 1996, and as a result, have access to recent costs for this design. The reported cost of that pipeline is $20,200 /inch.km in 1996 dollars.

Diameter Impact on "All In" Costs

Experience has shown that the unit cost varies with the pipeline diameter. There is insufficient Australian data to allow a reasonable relationship to be developed, but some USA research has shown that using a DN 300 pipeline as the base, the unit costs increase for increasing and decreasing diameters. For example, the unit cost of a DN 550 (22") pipeline is approximately 24% higher than that of a DN 300 pipeline, and approximately 21% higher than that of a DN 350 (14") pipeline.

Simply applying this factor to the DN 350 pipeline above, suggests a unit cost of about $24,500 /inch.km.

Another recent ANSI Class 900 pipeline constructed in Australia is the Ballera to Mt Isa pipeline. The unit cost for this DN 300 pipeline was approximately $17,850 /inch.km. This cost, scaled up to a DN 550 pipeline is $22,100 /inch.km in 1997 dollars.

Included Equipment

The designs for Options B, C and D have fewer in-line facilities than for option A. Assuming all else remains the same, I would expect the additional facilities in Option A would increase its mainline unit costs by $800 - 1,000/inch.km compared with Options B.
Note that this is approximately the same as the difference in the cost of the steel in the "all in" cost noted above.

Costs of Included Equipment

The design pressure for Options A, C and D each requires ANSI Class 600 valves, flanges and fittings. The design pressure for Option B requires ANSI Class 900 valves, flanges and fittings. The base Class 900 equipment is more costly than that of Class 600 equipment, and the associated fabrication, transportation and installation cost of the Class 900 valves and scraper stations will be higher than those of the lower pressure designs.

Use of API 5L X80 Pipe Steel

The designs are based on the use of API 5L Grade X 80 steel. This is the modern engineering standard for natural gas pipelines, but it has not been used in Australia, and in 1999 (the date of the ORC), had very limit use worldwide.
This steel was proposed in the Eastern Gas Pipeline, but there was no cost driver that was sufficiently compelling to overcome the perceived risk. The risk is the potential cost impact associated with training Contractor's labour to use the product, or alternatively to establish construction spreads using automated welding and inspection equipment that would minimise the technical risk, but would reduce productivity typically achieved in remote areas of Australia.

API 5L Grade X 80 reduces the steel tonnage by approximately 12%, but the additional alloying and other quality and processing costs increases the pipe cost by about 5% compared with the conventional Grade X 70. The extent to which the remaining 7% saving flow on to the construction cost is difficult to predict without a detailed knowledge of the contracting philosophy and the construction approach.

I consider that for an ORC analysis of the first X80 pipeline in Australia, the net benefit of X80 should be considered as nil (because there is no experience to demonstrate the benefit).

ACCC Estimate

Like the Epic estimate, the ACCC estimate relies on unit costs. Their estimate is more detailed, and allows the impact of the design assumptions to be more closely modelled than the "All In" unit rate approach. However its estimates require accurate current estimates of a number of unit rates.

ACCC have assumed a rate of $234 /mm.km (or $5,944 /inch.km). This is at the low end of the Australian construction cost range of "typical" remote ANSI Class 600 pipelines.
Epic has in the past provided me with information in confidence for the Ballera - Wallumbilla pipeline. This pipeline (constructed in 1996) is similar in length, is the same pressure rating (relative thickness and mass), and traverses roughly similar country as the Moomba to Adelaide pipeline. The unit construction cost was $306 /mm.km ($7,766 / inch.km).

This difference, if applied to the ACCC estimate would add $31.3 million to their cost, raising it from $M 527 to $M 559, or within 2% of the Epic estimate.

Other Costs

Epic has made a separate provision for costs that may not be generally included in the unit cost of a pipeline. These include:

- Compressor Stations, valued at $2,000/kW for a large station, $2,500/kW for a medium station and $5,000/kW for a small station. I consider that these costs are at the low end of the cost band, and reflect a minimum installation in a remote area. The current cost of a facility with 10,000 installed kW is approximately $3,000/kW. The current cost of a small, remote area station is approximately $8,000/kW.
- Meter regulating station unit costs used by Epic reflect the lower end of the cost band for those facilities, particular ones designed to operate at 15 MPa. These costs are impacted by the higher pressure rating for valves, regulators and associated equipment, together with increased heating costs.
- The provision for communications and SCADA costs is considered high, if only for the main pipeline, but adequate to low if it provides for all of the sites included in the MAP network.
- The cost impact of Native Title on pipeline projects is difficult to forecast without a detailed knowledge of the country traversed by it. In recent pipeline projects, the cost associated with acquiring Native Title rights has been surpassed by the cost associated with cultural heritage matters, including construction monitors and route relocations. The provision made in the Epic estimate is considered reasonable for a brownfields site.

Conclusion

My initial assessment of the unit cost used by Epic was that it was at the high end of the project cost band.

Further consideration of historic data for similar pipelines strongly suggests that the unit cost of $22,000 applied by Epic to the ORC estimates of the trunk pipeline, while somewhat simplistic, can be sustained for Option B for the following reasons:

- The historic cost projected from records of the Ballera to Wallumbilla and the Ballera to Mt Isa pipelines, both of which are ANSI Class 900 designs, and traverse country that is similar to that of the Moomba to Adelaide pipeline.
- The unit construction cost assumed by the ACCC is at the low end of the historic construction cost band in Australia. This is borne out by Epic's experience on the Ballera to Wallumbilla pipeline. When the historic unit construction cost of the Ballera to Wallumbilla pipeline is applied to the ACCC estimate, it increases their estimate to within 2% of the Epic estimate.

On the balance of probabilities, I consider that the cost estimate presented by Epic is more likely to represent the actual cost of this pipeline than that suggested by ACCC, or by other Consultants.

I consider that a careful analysis of the detailed costs of new compressor and meter-regulator stations for a Class 900 pipeline will show that the unit costs used for these items are low, and if applied to the estimates, would increase their cost by $M 12 – 18.

Sincerely
Venton and Associates Pty Ltd,

Philip Venton

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Mr Ashley Kellett
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Dear Sir

MOOMBA TO ADELAIDE PIPELINE - ACCESS ARRANGEMENT CALCULATIONS

Thank you for your enquiry seeking Worley's opinion on the reasonableness of the broad assumptions behind the ACCC calculation of the Optimised Replacement Cost for Epic Energy's Moomba to Adelaide pipeline.

Worley maintains a position as the largest pipeline consulting engineering company in Australia and offers all services from concept design to construction management, commissioning and operations. Cost estimating is one of the many services Worley has provided over many years to pipeline companies such as AGL, Boral Energy, Duke Energy, Epic Energy and Gas & Fuel Corporation of Victoria, and to pipeline industry legislators such as the WA Office of Energy, Department of Resource Development and the Queensland Government. Worley's ongoing involvement in the pipeline industry has enabled it to develop accurate estimating tools to service the pipeline industry. It is worth noting that as a consequence of accurate cost estimating tools pipeline construction companies regularly report their projects as being on time and on budget. This process has also been aided by organizations such as the Australian Pipeline Industry Association, which has worked with pipeline construction and operating companies to provide industry average information to the pipeline industry for estimating and evaluation purposes.

Worley have reviewed the broad assumptions contained within the documentation you provided to us. We consider the $234/mm dia.km length construction cost low. Worley would consider $330/mm dia.km length a typical industry average figure. We note for information that Philip Venton in his 1998 Australian Pipeline Industry Association presentation on Australian Transmission Pipeline Costs indicates from his analysis pipeline construction costs trend towards $320/mm dia.km length as pipeline length increases. We note also that no allowance appears to have been made in the ACCC Optimised Replacement Cost calculations for Native Title and Environmental considerations, unless they are included in the Land & Easement rate they are using.

Yours faithfully
WORLEY LIMITED

Bevan DICKERSON
Director Pipelines and Terminals