Dr T. Parry
Chairman
IPART

W.R Williams

14/04/2002

OVERVIEW

Summary of attached comments invited by IPART an Interim Report on Undergrounding S9-6 April 2002

Dear Sir,

Whilst the Report **S9-6** is a noteworthy preliminary approach to a costly, complex and wide-ranging public issue- that has been variously addressed over the past 30 years, it has significant omissions and simplifications.

The projected loss of widespread public assets in scrapping existing, carefully designed, viable O.H. metropolitan supply systems on such a scale proposed must surely be based on firm, realistic costing when public funding of the order of 5-10 billion dollars is possible, involving U.G. replacement construction over a time frame of the order of 50 years.

Given also that the lives of U.G. power systems are <u>finite</u> and many times the cost of equivalent O.H. systems, then relative advantages and disadvantages of both systems need to be spelt out in detail for the public to judge the benefits- before being committed to lifetime funding imposts by law.

The Report Methodology is based on some assumptions and projections that have not led to definitive funding recommendations and suggests that only by the D.N.S.P's responsible for the project areas providing detailed acceptable network designs that can integrate with their respective existing systems, procedures, organisation etc can accurate, firm estimates be relied on to judge benefits.

It is submitted that based on the substance of the Report proporting to justify undergrounding of the project areas, with such massive public expenditure in question for minimal tangible benefits, that the proposition as it stands would constitute a reprehensible waste of existing supply systems and a serious misallocation of scarce resources.

W R Williams
Ex Electricity Supply Engineer

Dr T. Parry
Chairman
IPART

W.R Williams

14/04/2002

Dear Sir,

Comment on the IPART
Interim Report **S9-6** April 2002
Electricity Undergrounding in NSW

General Comments

A. In response to the published request by IPART inviting submissions on the above referenced Interim Report **SO-6,** the following observations are offered from both an experienced distribution engineering viewpoint, as well **as** that of a ratepayer faced with a potentially substantial mandatory lifetime cost surcharge on rates.

1.0 In an electricity supply system there are essentially six overlapping sub-systems that have **to** be individually designed, constructed and maintained- whether 0.1I. **or** U.G.- including corriponents of substations, control centres etc. There are:

- Customer Service Construction
- L.V. Distribution Networks
- H.V. Distribution Networks
- Sub-Transmission Distribution Networks
- Street Lighting Distribution Networks
- Communication/Control Distribution Networks

Before any meaningful cost estimating on constructing such systems can be provided, the operating, method of installation and maintenance policies in particular locations must be spelt out right from the start- including standardization of components and compatibility with existing U.G. systems, if any. Such basic engineering requirements are not identifiable in the Report. The references to "optimal" based estimates on a generalised per square kilometre basis could be variable by orders of magnitude considering the variables involved in standards chosen and terrain variations throughout the project areas.

1.1 Whilst the Report is a noteworthy attempt to examine and simplify such complex issues across broad cost/benefit conclusions, based on so many variables across costly and emotive issues, the scale of the project is such that to arrive at **firm** costs for the Sydney Metro area undergrounding, the only practicable approach is to have detailed estimates prepared by both Energy Australia and Integral Energy. For actual designs embracing all sub-systems and components compatible with their existing systems and standards. However long term that may take, covering the range of different factors, having a bearing on installation costs in their areas. Anything less is speculative and open to error of a high order.

With regards to the Report Methodology and the terms of reference, two important omissions immediately stand out from the reader's viewpoint. These are:

B. The Methodology assumes that O.H. construction has a finite life- with no mention of U.G. construction life limitations.

In reality O.H. construction, properly maintained in accordance with O.H. Line Construction Regulations, has an infinite life. The very nature of O.H. construction requires a unit replacement approach ongoing to keep the construction in sounds condition, which is a factor that adds to maintenance costs.

Whereas with U.G. cables and associated street components, these definitely have a finite life of 50 years or less, and so require TOTAL, replacement from time to time, with all that means.

Such difference can markedly distort the funding options in any comparison.

C. Whilst the Terms **of** Reference and Report have concentrated on the advantages of U.G. construction (Tables 3.1, 4.1 etc.) there is no section listing the disadvantages peculiar to U.G. construction.

These are numerous and should be stated and explored in any balanced comparison. Such Items are:

- Higher Capital and Installation costs
- Long lead times
- High augmentation costs
- Long repair times
- Hazards to **staff** and public (unseen)
- Total replacement costing- finite life
- Critical load monitoring
- Back-up design considerations

The higher the operating voltage the wider the range of disadvantage issues.

D. Nor are the advantages of O.H. systems laid out for comparison

1.2 Dealing with each of the sub-systems in turn the following comments are offered expanding on issues only touched on in the Report.

(i) House Service Construction

Past experience in conversion showed that this is a significant cost component and can be in excess of $1000 per customer, as well as being inequitable between customers. Policy issues concerning individual points of service, location **of** U.G. service cables on private property, upgrading problems, maintenance responsibilities, safety issues etc. mean individual negotiations for each customer to their satisfaction is required.

With the order of one million customers involved in the project areas costing for this component could exceed one billion dollars alone, plus substantial organizational on-costs.

(ii) O.H L.V. 240/415V Networks

These are the heavy current carrying components and result in more visual impact than other components.

However, given the engineering fact that placing an aerial conductor underground reduces its rating by approximately 35%, then a U.G. equivalent must not only be insulated, but also of larger cross section conductor- hence less efficient use of material resources. The same principle applies, even more so for H.V. cable. This point is only given passing reference in report, but is a significant cost factor in U.G. installations.

Whilst the street layout with O.H. L.V. systems enables mains construction on one side of a street to readily service both sides of the street this is not always practicable with the more costly U.G. systems.

Assuming the main L.V. distributor cable is laid on one side, then a service has to be installed across roadway for every four homes or so (i.e. at every second house boundary). With some one million services in the project area this means probable 250,000+ road crossing (and associated street connection pillars if typical U.R.D. type construction is employed) with substantial administrative recording costs etc.

Such costs could also easily equate to $1000 per installed/completed road crossing- amounting to $250million or more. (See also comment regarding street lighting service costs which could be additional to those service crossings).

(iii) IIK.V. Distribution Networks

These constitute the second major cable component- converting them to U.G. raises specific design issues not extant with O.H. The type of cable and substation designs chosen determines cost and service life, bears on public safety issues, future maintenance and operative procedures.

If armoured direct laid cables are used, as is necessary in many circumstances, then initial installation and later augmentation costs are high.

If duct laid cables are used then thermal ratings are limited further and installation costs increased.

Obviously fault damage repair times are high with such construction to have to be designed for at additional cost.

Derating of conductors placed underground is more important for H.V. then L.V., because thermal stability is critical and so ongoing load monitoring is a more stringent requirement- hence higher administrative costs.

(iv) Once voltages exceed 1lK.V. then in general such H.V. cables cannot be accommodated in footpaths and need to be installed in road shoulders.

The nature of 66K.V. and 132K.V. U.G. cables necessarily means high installation costs, high capital costs, high maintenance costs and high repair costs with long outages. Close ongoing load monitoring for thermal stability is critical.

Therefore on routes that involve sub-trans mission circuits, separate installations in footpaths and carriageways are necessary in any given street.

Given the detailed system design and development of the existing systems in the Sydney area over the past 50 years, together with the huge irrecoverable cost/worth of the existing combined O.H. H.V systems- integrated as they are with Bulk Supply Point and Zone Sub-systems, it is surely naïve to strongly recommend that a whole new "optimised" redesigned system be implemented. Such a radical recommendation emphasizes the foregoing referee to the variables involved in arriving at realistic firm estimates, and how essential it is for DNSP's involved to decide on fixed designs and estimate for real situations across a range of areas, <u>before</u> any major decision should be taken on such an issue.

On the basis of some 600km of O.H. Transmission lines in the Sydney area alone then conversion costs of this component could equate to several hundred million dollars.

(v) Street Lighting Networks

If existing poles were removed then Street Lighting standards in footpaths are necessary in lieu whilst few statistics are quoted in report, a broad estimate of street lamps in the project area is of the order of 200,000.

Hence this order of new Street Lighting standards would need to be erected- with associated individual cabling connected to either separate Street Lighting supply cables or L.V. distributors.

The scrapping of so many existing pole mounted Street Lights would be a waste of tens of millions worth of assets, with replacement Street Light standard costs running into several hundred million dollars, which in turn involves more road crossing and replacement vehicle hazards in place of poles.

(vi) Communication/Control Cables

On supply systems protection and signalling cables generally form a small proportion of overall construction and would not be a major cost variable in estimating for conversion. However, the enforced scrapping of two aerial C.T.V. systems would be a major waste of resource of 50+ million and all it entails with customer negotiations.

3. It is noted from the Report that Optus now pay some 4.2 million p.a. rental to D.N.S.P's for their pole mounted C.T.V. networks. No doubt Foxtel also pay rental for their similar pole networks.

This revenue to D.N.S.P's would thus be lost, being of the order of 150 million over project avoided O.H. maintenance costs of 107 million quoted in Report.

4. The assumed savings from reductions in vehicle collisions with poles is highly subjective and surely not a compelling factor in any decision on the project. The assumptions outlined imply that if poles are removed there will be virtually no crashes- surely not a realistic assumption, when not only will tens of thousands of street light standards be erected in lieu of poles, but experience shows that some cars are low flying when they collide with poles- which raises the questions of what do they hit in lieu of poles removed?

In this regard the Report refers to some Councils intending to replace poles with large trees to create lush corridors etc. If the argument for removal of poles to avoid vehicle collision is justifiable at massive cost to the community, then surely the same principle should apply to the removal of all street trees- hundreds of which are actually in road shoulders, unlike poles in footpaths.

As one experienced line supervisor said to me " I have never yet seen the crash case where a pole jumped out in front of the vehicle.''

5. On the question if assessing energy loss gains the U.G conversion this is so dependant on load densities in specific network segments, particularly the design and spare capacity of networks, that the order of accuracy in such a complex calculation is low and could readily be offset by the amortized cost components of larger conductors required for the same load in any given U.G. conversion.

6. The aspect of fundraising options for the Project, S.C.C. records would show that in the 70's and 80's the S.C.C introduced a policy of offering to underground construction in Sydney Council areas- if Councils were prepared to pay. "Nobody **was** prepared to pay" over the period.

7. Conclusion

Whilst the majority of the community is likely to concede that universal undergrounding of all services is "desirable", the funding required on such a scale and waste of resources involved over 50 years or so ongoing, are such as to be of major community concern once the facts are presented, especially possible projected costs of **5-** 10 billion dollars and likely individual surcharges.

The overall engineering benefits arising from the project involving the virtual scrapping of a long established, carefully redesigned and effective O.H. supply system, appear speculative, marginal and inconclusive.

The likely implementation program of 50+ years, involving widespread disturbance in close suburban areas, traffic restrictions, private premises etc. means that due to finite life of U.G. cables of the same order the disturbances (and funding requirements) would have to go on for lifetimes ad nauseum.

The tentative secondary benefits of lower car crashes, less bat and possum electrocutions, less tree trimming etc. are not compelling reasons for such misallocation of resources. The projected and possible inflation of costs clearly do not warrant the benefits claimed.

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