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Department of
Communications
Information Technology
and the Arts

Secretary
Neville Stevens

Senator the Hon Richard Alston
Minister for Communications,
Information Technology and the Arts
Parliament House
CANBERRA ACT 2600

Dear Minister

In accordance with Clause 49 of Schedule 3 of the *Telecommunications Act 1997* (the Act), I am pleased to submit to you a report by the Putting Cables Underground Working Group which examines the technical, economic, legal and social issues associated with placing aerial cables underground.

The report has been prepared in an open and consultative manner. The working group had a very broad membership, including representatives of Commonwealth, State, Territory and Local Government, electricity distributors, telecommunications carriers user and consumer groups and commerce and manufacturers' associations. As part of the group's consultation process, a discussion paper was widely circulated for comment in June 1998.

Given the diversity of issues and individual local circumstances which influence any decision to put cables underground, the working group did not consider it appropriate to make recommendations supporting a particular course of action. Instead, the group chose to make a number of findings.

I draw your attention to subclause 49(4) of Schedule 3 of the Act, which requires you to table this report in each House of the Parliament within 15 sitting days of that House after the completion of the preparation of the report.

Yours sincerely

N R Stevens
Chairman
Putting Cables Underground Working Group
24 November 1998

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EXECUTIVE SUMMARY AND KEY FINDINGS

INTRODUCTION

The Putting Cables Underground Working Group has produced this report as a resource to assist informed decisions about the potential costs and benefits of putting cables underground.

The Government established the group in response to community concerns about the impact of overhead electricity and telecommunications cables. Widely regarded as visually unattractive, cables are also susceptible to weather, particularly storm damage, accidents including electrocutions, and motor vehicle collisions with poles which can disrupt services.

As a result, electricity and telecommunications cables are placed underground in central business districts and greenfield sites, particularly new residential developments. There have also been some projects to put existing overhead cable underground, however these have generally been limited in scope.

DEVELOPMENT OF THIS REPORT

The task

The *Telecommunications Act 1997* (Clause 49 of Schedule 3) provides that the Commonwealth Minister for Communications must cause an investigation of options for putting telecommunications and other facilities such as electricity infrastructure underground. The report of the investigation must be tabled in the Commonwealth Parliament.

The working group was established on 16 June 1997 with the task of examining the technical, economic, legal and social issues involved in putting existing aerial cables underground. Details of the group's membership and approach to the task follow, with the terms of reference and key findings on page five.

This report has been prepared by a broadly representative working group in accordance with Clause 49 of Schedule 3 of the *Telecommunications Act 1997.*

Membership

The working group was chaired by the Secretary of the Commonwealth Department of Communications and the Arts[1]. The group's broad membership[2] included

[1] The Department's name has since changed to Department of Communications, Information Technology and the Arts (DOCITA)

[2] A full list of members of the working group may be found in Appendix 1.

representatives of Commonwealth, State, Territory and Local Government, electricity distributors, telecommunications carriers, user and consumer groups and commerce and manufacturers' organisations. The department also provided secretariat support to the working group and its subcommittees.

Funding for the secretariat was provided by the department and additional funding for consultancies and other expenses as agreed by the working group was committed by Optus ($0.5 million) and Telstra ($1.0 million). In addition, there was a substantial commitment of time and travel expenses by participants and organisations involved in the process.

Approach

Responsibility for regulation of the electricity industry generally rests with State and Territory Governments, while the Commonwealth Government is responsible for regulation of the telecommunications industry. The structure of the electricity industries also differs substantially between different States and Territories, ranging from Government ownership and management to corporatisation and privatisation.

Given the different perspective and priorities of these groups, the diversity of issues and individual local circumstances which influence any decision to put cables underground, the working group did not consider it appropriate to make recommendations that may not be applicable in all circumstances. Instead, the group adopted an open consultative approach to the task and set out to:

- gather and present all relevant information in relation to the matter;
- identify and carry out a rigorous analysis of the issues;
- develop a range of resources for governments and others to draw upon as necessary; and
- make findings of fact.

To do this, the working group met seven times including its first meeting on 17 June 1997. It formed subcommittees to examine technical, economic and regulatory issues, and deal with management responsibilities for the group. The subcommittees included many members[3] in addition to those on the core working group.

The working group drew upon existing information as far as possible to plan its program. A review of existing literature on putting cables underground in Australia and overseas[4] indicated that overall the working group's task would not substantially duplicate existing work.

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3 Secretariat of the Putting Cables Underground Working Group, *Membership of Working Group Sub-Committees*, Commonwealth Department of Communications, Information Technology and the Arts, Canberra, 1998

4 Bureau of Transport and Communications Economics, *Literature Review—Putting Cables Underground*, 1997 (a).

While there are a significant number of individual reports on certain technical, costing and regulatory issues, some of which have been helpful to the working group's activities, no single report (nor the body of the literature taken together) appears to draw all these issues together or to cover the field.

The secretariat also investigated regulatory arrangements that operate overseas[5], where there are limited programs to put cables underground. The group therefore believes that its work is making an original contribution to the examination of this issue.

A number of consultants provided expert advice on technical, economic and regulatory matters. A list of consultants' reports appears in the Bibliography and the full text of all reports is contained on the CD ROM version of this report.

Consultation

After the announcement of the working group in June 1997, a world wide website was established, on which all relevant documents were placed. A discussion paper[6] released for comment on 17 June 1998 was also accessible online, together with all the consultants' and sub-committees' reports available at that time.

Members of the working group were responsible for canvassing their own constituents and the secretariat provided around 100 hard copies of the discussion paper in response to requests.

The working group received 41 submissions[7] from a wide range of organisations and individuals. The submissions were by-and-large favourable, however there were also a number of constructive suggestions for change and, as far as possible, these have been incorporated in the report.

SUMMARY OF RESULTS

Using present practices and designs, the working group estimates that the total cost of putting existing overhead electricity and telecommunications cables underground in urban and suburban Australia is about $23.37 billion. This is an average of $5 516 per household.

These figures reflect a range of costs covering different terrain and installation techniques from around the country, and include an averaged component for putting aerial public switched telephony and broadband cables underground.

The group identified a number of innovative ideas which could potentially reduce the cost of putting cables underground by up to 20 per cent in a large project in the first year and up to 35 per cent over five years. This could reduce the average cost of putting

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5 Secretariat to the Putting Cables Underground Working Group, *Overseas Regulatory Experience—Putting Cables Underground*, 1998 (d)

6 Putting Cables Underground Working Group, *Putting Cables Underground Working Group—Discussion Paper*, 1998.

7 A full list of those who submitted comments may be found in Appendix 4 and under Consultation on the CD ROM

cables underground in a future large-scale project (including the public switched telephony network and broadband) to between $3 600 to $4 400 per household.

Benefits

The main quantifiable potential benefits of putting cables underground include possible savings in maintenance costs for telecommunications carriers and electricity distributors, savings in tree pruning costs and reduction in motor vehicle collisions with poles.

The working group estimates that the quantifiable benefits represent around 10 per cent of the total cost. Other benefits, not readily quantifiable, involve improved streetscape aesthetics from the removal of poles and wires and additional tree planting.

Funding options

A detailed evaluation was conducted of four principle funding options, against a number of economic and equity criteria including effects on the overall economy and on the electricity and telecommunications industries in particular, and the degree of alignment between those who benefit and those who pay.

Based on this evaluation, a multi-contributor funding option best meets the criteria set by the working group. This model proposes that any organisations receiving quantifiable benefits as a result of underground conversion would contribute to the cost an amount at least equivalent to those benefits. The gap between the value of benefits and the total cost would be funded by property owners with some limited contribution by governments to reflect the broader community benefits.

The report examines a number of financing options which might assist property owners to make the necessary financial contribution to any program to put cables underground. The possibility of private sector commercial financing is also considered.

Regulatory framework

An outline of the current regulatory and policy frameworks for the electricity and telecommunications' sectors in Australia is presented in this report.

u for government are outlined and in this context, the Constitutional power of the Federal, State and Territory Governments in relation to the supply of electricity and telecommunications is discussed.

Administrative issues

An administrative guide is provided to assist those considering putting cables underground in a particular area. This outlines a number of key consultative and administrative issues, and associated decisions which the working group believes would need to be considered in any program to put cables underground.

CONCLUSION

In concluding its examination the working group notes that it is not possible to provide accurate information for every possible project to put cables underground, and that each project should be considered on its own merits.

The information in the report is best considered in conjunction with the consultants' reports and the small area costing tool on the CD ROM, to provide a reasonable indication of likely costs and benefits in a particular area, taking into account specific local factors.

TERMS OF REFERENCE AND KEY FINDINGS

The terms of reference for the working group (full text at <u>Appendix 2</u>) provide that:

'.... The Report from the Group is expected to provide:

- **authoritative factual information, and**
- **a reasoned framework of recommendations (or options)**

for use by Federal, State and Local Government, industry, community groups, and members of the public. The Report from the Group will also be used to assist in the preparation of the Minister's report to Parliament envisaged by clause 46A of Schedule 3 to the *Telecommunications Bill 1996*.'

In general terms, the report has been prepared to meet these requirements, and includes authoritative factual information and a number of options for consideration by governments and others.

However, the terms of reference also required the group to examine many specific issues. The following findings are grouped under headings which broadly follow those particular terms of reference.

Terms of reference

1. Provide a 'stocktake' of the following:

(a) all aerial cabling in Australia;

(b) underground conduits and ducts in which cabling currently exists, or which could be used to place additional cabling; and

(c) existing State and Territory laws or policies concerning the placement of cabling underground.

FINDING 1

The following table summarises the key results of the stocktake undertaken by the group of electricity and telecommunications cabling, and duct utilisation, for urban and suburban areas having a population of greater than 30 000.

Item description	Quantity
Number of dwellings passed by overhead electricity	3 639 000
Number of dwellings serviced by overhead Public Switched Telephone Network cable	1 060 000
Number of dwellings passed by overhead Broadband	(a)
Number of electricity poles	1 824 000
Number of Telstra poles	147 000
Route Length of existing overhead Low Voltage (LV) electricity (c)	58 000km
Route Length of existing overhead High Voltage (HV) electricity	28 000km
Route Length of existing overhead PSTN	10 761km
Route Length of existing underground LV electricity	5 915km
Route Length of existing underground HV electricity	5 844km
Length of unused Telstra conduits (b)	1 586km
Length of unused Electricity conduits (b)	57km

(a) These figures were supplied to consultants, but are not contained in this document at the request of the telecommunications carriers, which consider the information company confidential.

(b) These lengths are not contiguous and not always accessible. They therefore may not all be suitable for alternative purposes.

(c) Does not include transmission and sub-transmission cabling (≥ 33kV).

FINDING 2

State and Territory planning policies generally require new electricity and telecommunications cables in greenfield residential (and in some States, for example Western Australia, commercial) subdivisions to be installed underground. The Commonwealth, State and Territory Governments between them have the power to require all new cable installations to be underground.

FINDING 3

At present there are no State or Territory requirements for putting existing electricity cables underground, although there are a number of programs to facilitate putting some cables underground in established areas.

FINDING 4

While there are currently no requirements for initiating putting existing telecommunications cables underground, there is a requirement under the *Telecommunications Act 1997* that, where overhead electricity cable is removed, any existing telecommunications cable must also be removed within six months.

FINDING 5

Government policies for the electricity and telecommunications industries have been to promote lowest costs and improved services for consumers, including through use of competition and price regulation.

Terms of reference

2. The technical issues associated with moving cabling of different types underground, including:

a) the main engineering options and issues involved in placing cables underground (or use of a non-cable based technology if appropriate) including:

- **(i) suitability of each of the options for different types of terrain, and hence usefulness in different parts of Australia;**
- **(ii) a breakdown of the costs associated with each of the major options**
- **(iii) operational or safety issues raised; and**
- **(iv) implications for future usage, including potential effects on market structure;**

a) the extent to which co-location of electricity, communications and any other type of cabling is possible in existing or future underground ducting; and

b) assessment and identification of the existing aerial cabling that is feasible to move underground and the assessment criteria in determining such feasibility.

FINDING 6

It is likely that there will be a need for a cable-based electricity grid for the foreseeable future. While there will be increasing deployment of wireless technologies in telecommunications, there will nevertheless continue to be a need for cable-based distribution networks, particularly for the carriage of broadband communications.

FINDING 7

There are only two basic options for replacing overhead with underground cables:

- deploying the cables into a trench (‘trenching’); and
- deploying them into a bore drilled for that purpose by specialist equipment (‘boring’).

There is a range of different trenching and boring techniques which can be used. To date in Australia, trenching has typically been used around 87 per cent of the time, and boring 13 per cent. It is not appropriate to provide any generic ranking of these techniques, given the need to take account of particular circumstances.

FINDING 8

The group estimated typical indicative costs of trenching and boring under different circumstances. To illustrate, the following estimate of indicative costs for these two main construction methods in different terrain types for ‘lead-ins’ to customer premises is shown in the table below.

	Construction method and cost per lead-in ($) (a)						
Lead-in service configuration	**Trench**			**Bore**			**Surface laid**
	Normal (b)	Sand	Rock	Normal (b)	Sand	Rock	
Electricity only	740	680	910	620	670	1 000	560
Electricity plus PSTN	820	770	1 000	700	730	1 070	580
Electricity plus PSTN plus coax.	890	830	1 060	770	800	1 120	660
Electricity plus PSTN plus two coax.	990	930	1 160	840	870	1 170	780

(a) The costs include excavation, cabling, connections at both ends and reinstatement for a typical lead-in of 15 metres. The cost structure for undergrounding main distribution cables is different, and tends to favour trenching.

(b) Refers to normal soil without a significant proportion of rock or sand.

FINDING 9

The relative cost of boring as compared to trenching over a given distance tends to increase as:

- the number of services to be placed underground rises;
- the incidence of subsurface rock increases;
- the housing density increases; and
- the cost of reinstatement decreases.

FINDING 10

The working group identified 28 innovative ideas (Chapter 3) which could, if implemented, potentially reduce the cost of putting cables underground. For a large project this could be by up to 20 per cent in the first year and up to 35 per cent over five years.

FINDING 11

There are potential benefits in terms of costs, innovative network design, and urban planning (through design and location of padmounted substations), and facilitating smaller scale projects to put cables underground by the development of a longer term overall underground network plan for an area.

FINDING 12

The application of innovative underground network design and proper planning can optimise co-location and the efficient use of network resources, which could potentially result in savings on network construction costs.

FINDING 13

Appropriate safety standards are important to maintain, and improve network construction and operating safety.

FINDING 14

Accurate and readily accessible cable location maps for an underground electricity network, and public awareness of their availability, are major factors in reducing the incidence of electrocutions.

FINDING 15

There is a need for appropriate environmental management strategies in any program to put cables underground.

FINDING 16

The main technical issue in relation to future market development is whether there should be an obligation on those putting cables underground to install additional duct capacity at the time any such project is undertaken. The group concluded this should be decided by the participants in any particular program, because it is difficult to predict the future direction of an industry with any certainty, and in particular, the requirement (if any) for future duct capacity; and because the additional cost of providing for possible future expansion or competition would fall to the existing companies and their customers.

FINDING 17

Co-location of different types of cabling represents an opportunity to reduce the cost and disruption associated with putting cables underground in many cases. However, co-location also sometimes presents significant technical, safety, contractual and regulatory challenges which, in some cases, can substantially reduce or even negate the net benefits of co-location.

FINDING 18

Given the number of potential variables which are likely to contribute to the success (or otherwise) of co-location, the decision to enter into particular co-location arrangements is most appropriately left as a commercial matter for the parties concerned, depending on the circumstances of each particular location or project.

FINDING 19

The feasibility of moving existing cables underground is best determined on a case by case basis, and is linked to the funding issues involved (see below).

Terms of reference

3. The benefits of placing existing aerial cabling underground including:

a) the nature of the benefit;

b) the likely beneficiaries and the distribution of the benefits;

c) quantification as far as possible of the benefits to those beneficiaries; and

d) the timeframes within which the benefits are likely to accrue.

FINDING 20

The potential quantifiable benefits of putting cables underground identified by the group include:

- reduced motor vehicle collisions with poles;
- reduced losses caused by electricity outages;
- reduced network maintenance costs;
- reduced tree pruning costs;
- impact on property values;
- reduced electrical transmission losses;
- reduced greenhouse gas emissions (due to reduced transmission losses);
- reduced electrocutions;
- reduced bushfire risks; and
- any beneficial indirect effects on the economy, such as employment.

FINDING 21

The main other benefit of putting cables underground is improved urban amenity, which includes improvements in streetscapes and the visual appearance of a community. The group considered it was not practical to try to place a value on visual amenity.

FINDING 22

The following table presents the group's best estimate of the main quantifiable benefits, on an ongoing annual basis, of placing overhead cables underground in urban and suburban areas of Australia with a population of over 30 000.

Type of benefit	Annual benefits (a) ($ per km of line)	
	Minimum	**Maximum**
Reduced motor vehicle accidents	1 358	2 793
Maintenance costs.	18	1 531
Tree trimming	35	1 120
Reduced transmission losses	0	292
Total	**1 411**	**5 736**

(a) Figures are indicative only of a best case and worst case scenario. Their calculation involved the conversion and comparison of data derived by using widely differing assumptions and methodologies.

FINDING 23

The main quantifiable benefits are likely to accrue principally to electricity distributors, telecommunications carriers, local government and the insurance industry.

FINDING 24

The effects on property values of putting cables underground (where there is the potential for a quantifiable individual benefit) appear to be area and location specific, with variations ranging from negligible to five per cent having been reported by State Valuers-General. It is likely that the effects on property values decrease as underground cables become more widespread.

Terms of reference

4. The costs associated with placing existing and new aerial cabling underground on a progressive basis across Australia including:

a) the nature of the costs;

b) the distribution of the costs;

c) a quantification as far as possible of the costs; and

d) the timeframes within which the costs are likely to be incurred.

FINDING 25

The group's views on the main direct cost factors of placing cables underground, and their relative importance, has been captured in two models which are an important part of this report. The national costing model captures the higher level cost factors and their relative importance and relationships, while the small area costing tool, (on the CD-ROM) provides a more detailed approach, applicable to a local area.

FINDING 26

There are potential indirect costs in relation to coordination and administration of any scheme; environmental costs (although, if a project is properly managed, these should be low); and potential indirect effects on the economy.

FINDING 27

The distribution of costs to different parties depends principally on the funding mechanism used.

FINDING 28

The group's best estimate of the total cost of putting electricity and telecommunications cables underground in urban and suburban areas of Australia was $23.37 billion in present dollar terms. The cost of putting cables underground in particular areas will vary with local conditions.

FINDING 29

Most of the direct costs will be incurred during the planning and implementation phase of any project to put cables underground. However, the group identified several financing mechanisms that can be used to spread the cost of the project over time. The appropriateness of these financing mechanisms depends on the particular circumstances of the project.

Terms of reference

4. The funding options, and associated issues and implications, involved in any scheme for moving cables underground. The options should include:

a) direct or indirect Federal, State or Local Government levies on communications carriers and electricity distributors, including (but not limited to) the following proposal;

b) direct or indirect levies on communications and electricity customers;

c) direct or indirect levies on individuals or communities in affected areas;

d) regulatory compulsion on communications carriers and electricity distributors without any specific compensation;

e) non-legislated industry and/or community funded arrangements; and

f) any other arrangement (including combinations of the foregoing) that the group considers warrants consideration.

The consideration of each option should include an assessment of the effect of the option on, or for:

(i) public and private sector borrowing;

(ii) Federal/State financial arrangements;

(iii) administrative costs and efficiency;

(iv) prices of goods and services, and on business input costs;

(v) economic efficiency; and

(vi) equity and fairness.

FINDING 30

From a list of 48 potential sources, the working group identified four underlying sources of funds which were then subjected to more detailed consideration against the funding principles (see Finding 31). The underlying funding sources are:

- property owners;
- electricity and telecommunications suppliers (and, through them, their customers);
- taxpayers through consolidated revenue; and
- a composite funding source comprising property owners and the taxpayer through consolidated revenue.

FINDING 31

The group identified ten funding principles, which form in its view, the appropriate criteria for evaluating funding issues. The following funding principles are based on the matters specified by the terms of reference, including the requirement to have proper regard for the equity and efficiency implications of funding mechanisms.

1. Decisions on whether to put cables underground should consider all costs, including opportunity costs, against benefits.

2. The community should receive the level of underground cables for which it is willing to pay.

3. Market failures should not be addressed by distorting relative prices.

4. Upstream and downstream effects should be minimised.

5. Where possible, non-distortional (lump sum) taxes and subsidies should be used.

6. Putting cables underground should not create barriers to market entry or otherwise hinder competition.

7. Administration and compliance costs should be kept to a minimum.

8. Payments for putting cables underground should be proportional to benefits received.

9. Payment for putting cables underground should not be used as a redistributive mechanism.

10. Subject to the other nine principles, any funding option should be realistic and should maximise outcomes.

FINDING 32

Based on the funding principles, the group found that any scheme to fund a program to put cables underground should require those who receive quantifiable benefits from such a program to contribute to the funding an amount not less than the value of those benefits. For example, electricity distributors and communications carriers should make a contribution to represent any identified savings in operations and maintenance costs from putting cables underground. The funding approaches assessed by the group relate only to funding the ‘gap’ between the total cost of the project and these quantifiable benefits.

FINDING 33

The group subjected the main funding approaches to a rigorous scrutiny process using the funding principles. On this basis, the group found the approach which most fully meets the funding principles is that under which affected property owners are primarily responsible for the decision to put cables underground and bear most of the costs, but which allows for the possibility of some limited contribution by government to reflect the value to the broader community of putting cables underground. This is followed by having property owners bear the full cost of the remaining gap. The least preferable approach is to require (either through taxation or other means) industry suppliers to meet all of the gap costs.

Terms of reference

4. The regulatory options, and associated issues such as constitutional issues, and possible effects on competition in the industry, for requiring communications carriers and electricity distributors to place cabling in Australia underground.

FINDING 34

The Commonwealth, State and Territory Governments between them have the constitutional power to require all existing overhead electricity and telecommunications cables to be put underground.

FINDING 35

A wide range of issues needs to be considered and different approaches could be taken, in developing practical programs for placing existing cables underground. These include the need for the program to take account of the funding sources; approaches to longer term financing; and the particular legislative and administrative arrangements and policy settings applying in the jurisdiction where the project is planned.

FINDING 36

Governments will need to assess any legislative proposals associated with putting cables underground for impact on competition in the Australian telecommunications and electricity industries in accordance with their commitment to a consistent national competition policy approach. Issues for consideration include the effect of such laws upon:

- existing regulatory arrangements, for example the impact of putting cables underground on price regulation;
- barriers to entry, for example whether a policy to put cables underground for new entrants operates to hinder entry to a market by new competitors;
- access to infrastructure, for example access costs;
- competitive neutrality; and
- government business enterprise pricing.

FINDING 37

There are three broad philosophical approaches available to Government when developing practical programs for putting cables underground:

1. work within the present regulatory environment without further adaptation or intervention;
2. develop an administrative framework for use in local level programs, that is a 'bottom-up' approach; and
3. impose a requirement that cables be put underground according to a timetable and source of funding, that is a 'top-down' approach.

FINDING 38

State and Territory Governments are best placed to choose the type of overall regulatory approach to suit their particular circumstances, in consultation with appropriate bodies including the Commonwealth and Local Government.

Terms of reference

4. **Appropriate consultative mechanisms and processes to assist decision making between governments, affected business enterprises, communities and individuals about whether and when to place cables underground.**

FINDING 39

The group identified the following key generic implementation issues, for which a consultative and decision making process will be required in any project to put cables underground:

- notifying potentially affected persons and organisations (eg residents, carriers, electricity distributors, councils) of the project or program;
- estimating the cost, and communicating this to potentially affected persons and organisations, prior to a decision being taken as to whether to proceed
- making the decision whether to proceed with a project, and managing the decision making process;
- ensuring that there is a process for taking account of other relevant stakeholders and interests (eg heritage and environmental perspectives);
- arranging for the work to be done efficiently, including coordination between councils, carriers and electricity distributors; and
- arranging for contributions towards the cost of the work, including the implementation of longer term financing arrangements if required.

FINDING 40

The group identified a number of ways of addressing each of the practical issues for a regulatory scheme. These are presented in more detail in Chapter 9. The choice of which methods are most appropriate will depend on the particular circumstances of the jurisdiction in which a project is taking place. The choice also depends to some extent on which of the three philosophical approaches in Finding 37 is adopted.

Terms of reference

4. The issues involved in, and feasibility of, the following questions proposed by the Opposition as matters for inquiry during the Senate debate on the *Telecommunications Bill 1996*:

1. Whether the States and Territories should legislate to make provision for and in relation to:

a) the imposition of a levy on carriers in respect of overhead lines located in particular areas; and

b) the application of the proceeds of the levy to fund (in whole or in part):

(i) the permanent removal of overhead lines in those areas; and

(ii) the installation of underground facilities to replace those lines;

so long as the levy is approved in writing by the Australian Communications Authority.

1. **Whether the Commonwealth should legislate to make provision for and in relation to:**
    a) **the imposition of a levy on carriers in respect of particular overhead lines; and**
    b) **the application of the proceeds of the levy to fund (in whole or in part):**
        (i) **the permanent removal of those overhead lines; and**
        (ii) **the installation of underground facilities to replace those lines.**
1. **Whether a law of the Commonwealth, or of a State or Territory, concerning the preceding matters, might be held to be invalid on the grounds of inconsistency with the Constitution.**

FINDING 41

The group obtained specific legal advice on these questions. The group considers it inappropriate to compress the advice, it is presented in full in <u>Appendix 6.</u>

Terms of reference

4. **On the basis of the foregoing, and any other matters the group considers relevant, the group's preferred framework (with alternatives if appropriate) for making decisions about:**

a) **the places where placement of existing and new cables underground should occur;**

b) **the time frames within which such placement should occur;**

c) **the manner in which such placement should occur;**

d) **where responsibility should lie for funding such placement; and**

e) **how consultation should occur.**

FINDING 42

The working group presents its findings to enable those considering whether to put cables underground to make informed decisions. The group makes no recommendations as to whether such a decision is warranted or how it should be implemented. The complete body of research is presented to assist individual jurisdictions to select technical, economic and regulatory options that best suit their needs. <u>Chapter 9</u> presents a systematic methodology for working through these issues.

FINDING 43

The group considers it likely that an effective scheme for putting cables underground could include a combination of a ‘top down’ approach, administered by a State or Territory body (such as government) to achieve proper coordination between different areas and economies of scale, and a ‘bottom up’ approach to provide the necessary responsiveness to, and commitment by, Local Government and residents.

Other issues

FINDING 44

Private sector financing schemes are possible. However the group found no Australian examples of financing schemes specifically directed towards projects to put cables underground.

CHAPTER 1

STOCKTAKE OF EXISTING CABLES AND DUCTS

A major stocktake of overhead electricity and telecommunications cables was undertaken in urban and suburban areas of towns of at least 30 000 people.

A summary of stocktake results is presented in tabular form. There are about 3.6 million dwellings passed by overhead electricity cable in the area surveyed, of which about 1.1 million are also served by overhead standard telephony cable.

1.1 INTRODUCTION

Term of reference 1 for the working group provides, in part, that it should report on a stocktake of all aerial cabling in Australia and of underground conduits and ducts in which cabling currently exists, or which could be used to place additional cabling underground.

The working group, through its Technical subcommittee, formed an expert group to address this issue. Membership of the expert group was drawn from the electricity industry, the telecommunications carriers, Local Government, the Bureau of Transport and Communications Economics (BTCE)[8] and the department. The Electricity Supply Association of Australia Limited (ESAA) provided a facilitator for the group.

1.2 APPROACH TO STOCKTAKE

Overhead electricity networks may broadly be divided into transmission and distribution networks. Transmission networks consist of very high voltage lines connecting electricity generators to distribution networks, while distribution networks use high voltage (HV) and low voltage lines (LV) to connect end users to the electricity grid. The working group decided to restrict its investigation to distribution networks, defined as lines below, but not including, 33 kilovolts (kV) and designated by network components in the dotted box in Figure 1.

Also included in the investigations were telecommunications services, such as leased lines and public switched services. These are traditionally provided to end customers across wire based cable networks, which form part of the public switched telephone network (PSTN). Multimedia broadband services, such as cable television, are predominantly provided to end customers via hybrid fibre coaxial (HFC) cabling, referred to as broadband networks. In Australia, the telecommunications carriers install PSTN and broadband cable network infrastructure both overhead and underground.

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8 The former Communications and the Arts Branch of the Bureau of Transport and Communications Economics (BTCE) has since become the Communication Research Unit (CRU) in the Department of Communications, Information Technology and the Arts.

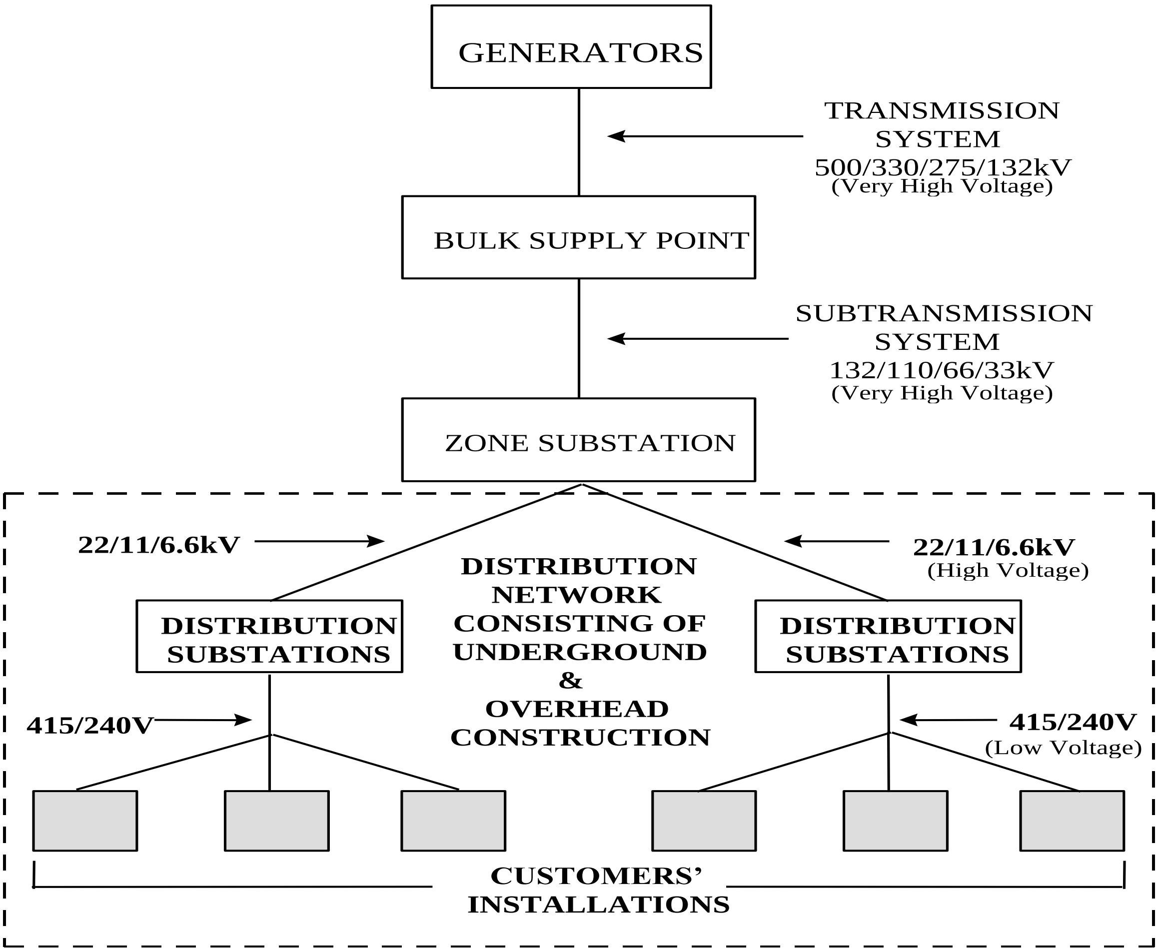

Figure 1—Simplified diagram of a typical electricity distribution network

The working group considered three possible approaches to the stocktake of electrical and telecommunications infrastructure. These were:

- a comprehensive national census;
- an extensive survey; or
- a number of small statistical samples.

The working group assessed these options in the context of the overall information requirements likely to result from addressing all the terms of reference. In addition to term of reference 1, requiring a stocktake of existing infrastructure, terms of reference 3 and 4 deal, respectively, with the benefits and costs of putting cables underground. The working group decided that cost and benefit data should be obtained directly from appropriate industry sources and Local Government authorities. It was therefore agreed that a combined approach to gathering both stocktake and cost and benefit data would be the most effective and efficient.

Of the three options for undertaking a stocktake outlined above, the working group considered that an extensive survey of the telecommunications carriers, the electricity supply industry and Local Government would best meet its total information requirements.

1.2.1 Development of questionnaire

The expert group developed a detailed industry questionnaire which would provide information on the extent of overhead electricity and telecommunications infrastructure in urban and suburban Australia, and the likely costs and benefits of putting it underground.

The group first addressed which areas in Australia should constitute an urban or suburban environment, for the purposes of the survey. This involved striking a balance between two potentially conflicting requirements:

- the task should be confined to a manageable size and reasonable cost; and
- the survey area should be large enough to cover the majority of locations likely to be affected by any large scale program to put cables underground.

It was considered that this balance would best be achieved if the survey targeted the urban or suburban components of towns and cities with a population equal to or greater than 30 000.

The working group agreed that the greatest improvements to the environment were likely to be made from putting cables underground in residential and commercial precincts (many of which also contain light industry). These areas would achieve benefits that may not be possible in industrial areas since the load characteristics of many industrial areas require greater use of transmission or subtransmission lines of 33kV or greater. Putting aerial distribution cable underground in these areas may in many cases still leave substantial very high voltage aerial cabling remaining. The survey questionnaire was therefore targeted at residential areas, commercial areas (such as shops) within residential areas and light industrial areas to the extent that they are combined with residential development.

1.2.2 Distribution of questionnaire

The draft questionnaire was circulated to all members of the working group and the three subcommittees for input before it was finalised. In its final form, the questionnaire contained 93 questions[9]. It was circulated to electricity distributors, telecommunications carriers and relevant Local Government authorities. Table 1 compares the number of questionnaires circulated with the response rate. Since both major telecommunications carriers (Optus and Telstra) and all but one of the electricity distributors responded, the questionnaire is clearly representative of the electricity and telecommunications industries. The response rate of Local Government authorities is also considered to be sufficiently large to ensure that the information gathered is representative.

Organisation	No. Circulated	No. of Responses Received
Telecommunications carriers	4	2
Electricity distributors	22	21
Local Government authorities	127	71

Table 1–Questionnaire response rate

1.2.3 Processing results

The analysis of questionnaire responses was undertaken as a separate project under the guidance of industry specialists drawn from the expert group on the questionnaire and a second expert group[10] formed to examine technical options and cost factors.

The raw information received from industry groups in response to the questionnaire was entered into a database and returned to the appropriate industry specialist to ensure that the information was:

- complete;
- based upon a correct interpretation of the questions; and
- consistent within the possible range of answers expected for each question.

Where anomalies were detected, action was taken either to correct the error through contacting the responding authority or to delete the relevant data from further analysis to ensure that it did not unreasonably bias the end result.

9 Amos Aked Swift, *Putting Cables Underground Working Group—Technical Issues—Stocktake, Technical Options and Associated Costs*, Appendix 5, 1998.

10 There were two expert groups formed by the Technical subcommittee, one to prepare and circulate the stocktake questionnaires and the other to develop technical options and cost factors to be used in the cost models and other cost related work covered in Chapter 4.

Following this basic checking, a range of algorithms was applied to the raw data to produce a national weighted average for each question. The process is described in detail in Appendix 6 of the *Technical Issues* report[11].

The relevant industry specialists have agreed that the output of this process[12] produced representative and reasonable figures for the questions being asked of their members.

1.3 SUMMARY OF RESULTS OF THE STOCKTAKE

There are about 5.6 million dwellings in the whole of the electricity distributor areas surveyed. Of these it is estimated that about 600 000 already have underground electricity. Table 2 provides information on about 3.6 million dwellings, which are within towns and cities of at least 30 000 people in the areas that responded to the survey.

1.3.1 Street lighting

Based on the information in Table 2, there is a total of 1 971 000 electricity power poles and telecommunications carrier poles combined, with 628 000 of these also supporting street lights. In addition, there are 95 500 free standing poles used solely for street lighting. This would indicate that a maximum of 1 438 500 poles, being about 70 per cent of the total number of poles, may ultimately be removed as the result of putting electricity distribution cable underground in the areas covered by the survey.

Currently, a significant number of Local Government areas do not have lighting levels to Australian Standard AS 1158.1[13]. If the overhead infrastructure is placed underground these Local Government areas may take the opportunity to improve the performance of the street lighting to comply with the Australian Standard. The number of poles supporting street lights would increase accordingly. Further, the lighting on arterial roads passing through the Local Government areas might also be improved, adding to the total number of poles.

In these circumstances, industry estimates suggest that between 40 per cent and 55 per cent of the electricity distribution poles, together with all the telecommunications carrier poles in a given area might be removed as the result of a program to put cables underground. The remaining poles may also be replaced with special street light poles or structures.

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11 Amos Aked Swift, *op cit.*

12 Amos Aked Swift, *op cit*, Appendix 11.

13 Standards Australia, AS1158.1, *The lighting of urban roads and other public thoroughfares–Performance and installation design requirements*, 1986, forming part of the AS 1158 Set of Standards, *Road Lighting*, 1997.

Item Description	Quantity
Number of dwellings passed by overhead electricity	3 639 000
Number of dwellings serviced by overhead PSTN	1 060 000
Number of dwellings passed by overhead Broadband	(a)
Number of electricity poles	1 824 000
Number of electricity poles which also have street lights (included in figure above)	628 000
Number of poles with streetlights only (not included in figures above)	95 500
Number of Telstra poles	147 000
Number of pole-mounted electricity transformers	59 600
Route Length of existing overhead LV electricity	58 000 km
Route Length of existing overhead HV electricity	28 000 km
Route Length of existing overhead PSTN	10 761 km
Route Length of existing underground LV electricity	5 915 km
Route Length of existing underground HV electricity	5 844 km
Environmentally sensitive route length of overhead PSTN	58 km
Environmentally sensitive route length of overhead Broadband	169 km
Environmentally sensitive route length of overhead LV electricity	8 960 km
Length of unused Telstra conduits (b)	1 586 km
Length of unused Electricity conduits (b)	57 km
Cost of trenching (Normal)—low density housing (c)	$88 260 per km
Cost of trenching (Normal)—high density housing (d)	$88 460 per km
Cost to underground existing overhead electricity lead-in. Average total	$1 700
Cost to underground existing Telstra PSTN lead-in. Average total	(a)
Cost to underground existing Telstra Broadband lead-in. Average total	(a)
Net cost of dismantling overhead electricity infrastructure	$13 100 per km
Net cost of dismantling overhead Telstra infrastructure	(a)
Percentage variation (from Normal cost) of undergrounding cost for sand—high density housing—Electricity distributor figures	-14%
Percentage variation (from Normal cost) of undergrounding cost for rock—high density housing—electricity distributor figures	+131%
Percentage variation (from Normal cost) of undergrounding cost for sand—low density housing—electricity distributor figures	-13%
Percentage variation (from Normal cost) of undergrounding cost for rock—low density housing—electricity distributor figures	+102%
Percentage route excavation in sand—electricity distributor figures	6%
Percentage route excavation in rock—electricity distributor figures	16%
Average size of pole mounted electricity transformers	300 kVA
Typical LV electricity cable in use	4C Al XLPE/PVC
Typical HV electricity cable in use	3C Al XLPE/HDPE

Table 2–Stocktake summary of results

(a) These figures were supplied to BTCE but are not contained in this document at the request of the carriers who consider the information company confidential.
(b) These lengths are not contiguous and not always accessible. They therefore may not all be suitable for alternative purposes.
(c) ‘Low density’ means up to 1 500 houses per square kilometre.
(d) ‘High density’ means 1 500 or more houses per square kilometre

CHAPTER 2

SURVEY RESULTS AND COST ESTIMATES

The working group undertook a comprehensive survey of the costs to put cables underground, in conjunction with the stocktake of aerial infrastructure.

Average costs per kilometre are presented in tabular form, for a range of different circumstances. Some information on benefits is also provided.

The total cost of putting existing electricity and telecommunications cables underground in urban and suburban areas of Australia, using present practices and designs, is estimated at $23.37 billion, which is an average of $5 516 per household.

2.1 INTRODUCTION

Term of reference 4 provides for an investigation of the costs of putting cable underground, including an assessment of the nature, distribution and magnitude of those costs. An examination of the timeframe within which the costs might be incurred is also required.

2.1.1 The impact of taxation

Costs are in part dependent on the relevant taxation arrangements in place at the time when the costs were calculated. All cost data presented in this report is based on the 1998 taxation structure. No allowances have been made for possible future changes in the taxation system, such as the introduction of a goods and services tax.

2.2 SURVEY OF COSTS

The working group used a survey undertaken as part of the stocktake, together with the report of the expert technical groups, to assess costs. The survey covered urban and suburban areas of Australia with populations equal to or greater than 30 000. It collected cost and benefit data, and provided a stocktake of quantity data for overhead communications networks and electricity distribution networks (below 33 kV) for The survey methodology and the results of the stocktake are summarised in Chapter 1.

The survey sought costing information for trenching and boring in:

- a variety of soil conditions;
- different density of housing; and
- different combinations of cable to be put underground (such as electricity only, electricity and telephone, electricity, telephone and broadband etc).

Information was also sought on the cost of:

- surface reinstatement;
- materials;
- street lighting; and
- dismantling of existing network infrastructure.

Respondents were also asked to provide information on the value of benefits.

The results of the survey, subject to certain qualifications considered below, are summarised in Tables 3 to 11. The estimated costs do not include any upgrading work which might be undertaken in association with a project to put cable underground. This may include work such as taking the opportunity to upgrade the quality of street lighting or to rearrange a customer's installation when appropriate. A comprehensive discussion of all the factors affecting the costs of placing cables underground is contained in the *Technical Issues* report.[14]

2.3 QUALIFICATIONS OF SURVEY RESULTS

The working group draws attention to some important qualifications in interpreting these cost figures. The survey sought information about costs based on the past experience of electricity distributors, telecommunications carriers and Local Government. This experience has in many cases been limited to relatively small projects to put cables underground. Large scale projects could be expected to have economies of scale. New techniques and technologies and competitive tendering could also be expected to reduce costs. For these reasons, the costs derived from the survey responses may be higher than the actual costs incurred in any particular project. These issues are discussed in more detail in Chapter 3.

The information on benefits in Table 11 is not as extensive as the working group would have liked. The issue is considered further in Chapter 4.

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[14] Amos Aked Swift, *Putting Cables Underground Working Group–Technical Issues–Stocktake, Technical Options and Associated Costs*, Sydney, 1998.

Installation conditions			Environmentally sensitive (cost per km – $)	
Type of cable	**Density of dwellings (a)**	**Terrain condition**	**Yes**	**No**
LV only	Low	Normal (b)	106 600	66 200
LV only	Low	Rock	184 300	114 500
LV only	Low	Sand	91 300	56 700
LV only	High	Normal	121 700	66 300
LV only	High	Rock	184 200	100 400
LV only	High	Sand	103 300	56 300
LV & HV	Low	Normal	142 100	88 300
LV & HV	Low	Rock	245 700	152 700
LV & HV	Low	Sand	121 700	75 600
LV & HV	High	Normal	162 300	88 500
LV & HV	High	Rock	245 600	133 900
LV & HV	High	Sand	137 700	75 100

Table 3–Trenching cost summary

Installation conditions		Cost per km ($)
Type of cable	**Terrain conditions**	
LV only	Normal (b)	130 400
LV & HV	Normal	136 400

Table 4–Boring cost summary

(a) ‘Low density’ means up to 1 500 houses per square kilometre and ‘high density’ means 1 500 or more houses per square kilometre.

(b) Refers to normal soil without a significant proportion of rock or sand.

Type of cable	Density of dwellings (a)	Cost per km ($)
Low voltage electricity	Low	38 300
Low voltage electricity	High	53 100
High voltage electricity	Low	47 800
High voltage electricity	High	52 900
PSTN	Low	Note (b) (pit/pipe+cable)
PSTN	High	Note (b) (pit/pipe+cable)
Optus broadband	Low	75 000
Optus broadband	High	105 000
Telstra broadband	Low	Note (b) but cabling costs only where PSTN is aerial. Add pit/pipe where PSTN is underground.
Telstra broadband	High	Note (b) but cabling costs only where PSTN is aerial. Add pit/pipe where PSTN is underground.
Supervisory/pilot cables	Low	3 000
Supervisory/pilot cables	High	3 000

Table 5–Installation/material cost summary

Location (density of dwellings) (a)	Cost per km ($)
Paved footpaths (low)	79 500
Paved footpaths (high)	87 900

Table 6–Reinstatement of trenching cost summary

Density of dwellings (a)	Cost per km ($)
Low	44 700
High	50 400

Table 7–Transformer cost summary

(a) 'Low density' means up to 1 500 houses per square kilometre and 'high density' means 1 500 or more houses per square kilometre.

(b) These figures were supplied to the BTCE, but are not contained in this document at the request of the carriers who consider the information company confidential.

Density of dwellings (a)	Cost per km ($)
Low	25 700
High	26 000

Table 8–Street lighting cost summary

Type of cable	Cost per km ($)
Electricity	13 111
PSTN	Note (b)
Telstra broadband	Note (b)
Optus broadband	3 700

Table 9–Net dismantling and disposal costs

<table>
<tr><th></th><th colspan="7">Construction method and cost per Lead-in ($) (c)</th></tr>
<tr><th rowspan="2">Lead-in service configuration</th><th colspan="3">Trench</th><th colspan="3">Bore</th><th rowspan="2">Surface laid</th></tr>
<tr><th>Normal (d)</th><th>Sand</th><th>Rock</th><th>Normal (d)</th><th>Sand</th><th>Rock</th></tr>
<tr><td>Electricity only</td><td>740</td><td>680</td><td>910</td><td>620</td><td>670</td><td>1 000</td><td>560</td></tr>
<tr><td>Electricity plus PSTN</td><td>820</td><td>770</td><td>1 000</td><td>700</td><td>730</td><td>1 070</td><td>580</td></tr>
<tr><td>Electricity plus PSTN plus Coax</td><td>890</td><td>830</td><td>1 060</td><td>770</td><td>800</td><td>1 120</td><td>660</td></tr>
<tr><td>Electricity plus PSTN plus two Coax</td><td>990</td><td>930</td><td>1 160</td><td>840</td><td>870</td><td>1 170</td><td>780</td></tr>
</table>

Table 10–Summary of various customer lead-in option costs

(a) ‘Low density’ means up to 1 500 houses per square kilometre and ‘high density’ means 1 500 or more houses per square kilometre.

(b) These figures were supplied to BTCE but are not contained in this document at the request of the carriers who consider the information company confidential.

(c) The costs include excavation, cabling, connections at both ends and reinstatement for a typical lead-in of 15 metres in length.

(d) Refers to normal soil without a significant proportion of rock or sand.

Factors related to the calculation of benefits (a)	Cost per km per year ($)
Tree trimming	329
Pole inspection/treatment: electricity	190
Pole inspection/treatment: telstra	(b)
Pole replacement: electricity	235
Pole replacement: telstra	(b)
Repair/maintenance of overhead low voltage mains	410
Repair/maintenance of overhead high voltage mains	408
Repair/maintenance of overhead PSTN cables	(b)
Repair/maintenance of overhead Optus broadband cables	17
Repair/maintenance of overhead Telstra broadband cables	(b)
Repair/maintenance of underground low voltage mains	137
Repair/maintenance of underground high voltage mains	604
Repair/maintenance of underground PSTN cables	(b)
Repair/maintenance of underground Optus broadband cables	Not answered
Repair/maintenance of underground Telstra broadband cables	(b)
Revenue lost as a result of outages: electricity	12
Revenue lost as a result of outages: PSTN	(b)
Revenue lost as a result of outages: Telstra broadband	Not answered
Revenue lost as a result of outages: Optus broadband	250
Cost of electrical losses	10
Avoidance of overhead capital improvement expenditure: electricity	50
Avoidance of overhead capital improvement expenditure: PSTN	(b)
Avoidance of overhead capital improvement expenditure: Telstra broadband	(b)
Avoidance of overhead capital improvement expenditure: Optus broadband	Not answered
Other benefits: electricity	64
Other benefits: Telstra PSTN	(b)
Other benefits: Telstra broadband	(b)

Table 11–Factors related to the calculation of benefits

(a) Data to be read in conjunction with the comments in section 2.4.3, *Reliability of benefit data* and Chapter 4.

(b) These figures supplied to BTCE but not contained in this document at the request of the carriers who consider the information confidential.

2.4 NATIONAL COST AND BENEFIT MODEL

The working group contracted a consultant[15] to develop a national cost and benefit model. The model was based primarily on data collected in the stocktake and cost and benefit survey, together with the advice of the technical expert groups who identified the significant cost and benefit factors to be included.

2.4.1 Cost elements

The national model has two broad cost elements:

- the amount of infrastructure required (lengths of cable, number of padmounted substations, etc); and
- the cost of material and labour used to put the network underground.

Within these two groups there are a large number of factors which could have a significant influence on the total cost predicted by the model. Many of the infrastructure quantities are listed in Table 2 in Chapter 1.

The categories of costs identified in the model are:

- excavation costs;
- installation and material costs for cables and other components of the network not specified below;
- cost of service lead-ins to individual premises, including excavation, reinstatement, materials and all connections;
- reinstatement costs;
- transformer costs;
- streetlight costs; and
- net cost of dismantling and removing existing infrastructure.

The model estimates each of these components separately and takes account of the major factors that impact on the cost. For example, excavation costs depend on factors such as the number and type of cables to be put underground, the nature of the subsurface geology, housing density and environmental sensitivity. Each of these factors has a direct influence on the type and extent of the excavation needed. The model uses estimates of cost rates for each combination of these factors on a per kilometre basis.

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15 The BTCE was originally contracted to do the work. The Communications Branch of the BTCE was transferred to DOCITA and renamed the Communications Research Unit (CRU) while the models were under development. The CRU report on the modelling work provides a full description of their methodology and results, see: Communications Research Unit, *Putting Cables Underground Costing Models*, Commonwealth Department of Communications and the Arts, Canberra, 1998.

The model calculates quantity figures using information on the extent of these cost factors in the areas under analysis. To complete the process the individual cost rates are multiplied by their respective quantities and the resulting products are summed to produce the totals set out in Table 12.

2.4.2 Benefit elements

A process similar to that outlined for costs was also undertaken to calculate potential benefits. The categories of potential benefits identified in the model are:

- avoidance of tree trimming;
- savings on repairs and maintenance;
- reduced revenue loss from outages;
- reduced electrical losses;
- avoidance of overhead capital improvement expenditure; and
- reduced motor vehicle accidents.

Information on the value of these benefits came from the survey and other research, such as the study on the extent of reductions in motor vehicle accidents[16]. The results are summarised in Table 12.

2.4.3 Assumptions and limitations

Inclusions

The total cost to put cables underground, as estimated by the national model includes a cost for aerial:

- HV and LV electricity distribution networks;
- telephony networks (recognising that only a proportion of premises are served by aerial telephony);
- broadband networks (recognising that only a proportion of premises are served by aerial broadband); and
- lead-ins and customer connection to all three network types, to the extent that they are currently connected.

Cities and towns with a population of 30 000 or more

The survey was targeted at towns and cities with 30 000 or more inhabitants. The choice of this number is not a reflection of the potential for cables to be put underground in smaller towns and most of the findings of this report could apply equally well to those areas. This issue is considered further in section 1.2.1. The working group recognises

[16] Bureau of Transport and Communications Economics, *The Extent of Reductions in the Number and Severity of Motor Vehicle Collisions with Power Poles Following an Undergrounding of Cables*, 1998.

that putting cables underground in smaller centres may be a viable option, depending on the local circumstances.

Occurrence of overhead cabling

The national cost and benefit model assumes that:

- the route length of overhead electricity cabling is equal to the route length of LV mains;
- HV mains are always co-located with LV mains where they occur together;
- telecommunications cables are always co-located with LV mains;
- aerial telephony is always located in low density areas; and
- existing light poles would be replaced on a one-for-one basis with less rigid or 'bendable' poles.

Dismantling the old aerial network

The cost of dismantling, removing and disposing of the existing aerial network is a net cost. That is, it takes into account the recovery value of the scrap material.

Commercial and industrial areas

The survey collected information from residential areas and this included commercial and industrial areas to the extent that they were combined with residential areas. This issue is considered further in section 1.2.1.

Replacing like with like

The model assumes that as far as possible the existing overhead networks would be replaced with an identical underground network. Issues such as potential cost savings from network redesign are considered in the discussion of the local costing tool in section 2.5.

Reliability of benefit data

The information provided by the survey on benefits has certain limitations because:

- the data is based on a small sample, as the average response rate to the questions on benefits was considerably less for responses to questions about costs; and
- the principle that stakeholders who will benefit from putting cables underground should contribute an amount at least equal to their subsequent avoided costs, possibly provides an incentive for survey respondents to understate the potential benefits.

Given these potential limitations, the working group commissioned further investigations on benefits. The results of these investigations are presented in Chapter 4 and compare favourably with the output of the national cost and benefit model.

Quantifiable costs	Model cost estimates ($)	Model benefit estimates ($) (a)
Excavation	6 423 072 061	–
Installation and material	5 477 807 680	–
Service connection	3 331 486 582	–
Reinstatement	2 694 973 670	–
Transformers	2 861 364 186	–
Street lights	1 624 886 666	–
Dismantling and disposal	956 990 236	–
Quantifiable benefits (b) (c)	–	–
Avoidance of tree trimming	–	711 651 618
Savings on repairs and maintenance	–	168 083 215
Reduced revenue lost from outages	–	70 860 990
Reduced electrical losses	–	6 489 027
Avoidance of overhead capital Improvement expenditure	–	40 986 708
Reduced motor vehicle accidents	–	1 522 152 977
Other benefits (d)	–	127 594 085
Total quantifiable costs or benefits	**23 370 581 082**	**2 520 224 536**
Total net costs	**20 850 356 546**	–

Table 12–National quantifiable net cost and benefit (based primarily on survey results)

(a) Estimates are based on survey responses and do not include potential savings from network re-design, economies of scale, etc.
(b) A comprehensive examination of benefits can be found in Chapter 4.
(c) Benefits are the value in 1998 dollars of annual benefits discounted at 7.4% over 20 years, thus $1 522 million for motor vehicle accidents represents $148 million per year for 20 years.
(d) The survey did not require respondents to specify the nature of ‘other benefits’.

2.4.4 Discussion of results

The working group recognises that the total national cost figure of $23.37 billion is likely to be in the higher end of the range of actual costs. This is the total cost for putting cables underground for 4 237 000 households, an average cost of $5 516 per household, including an average component for broadband and PSTN cabling.

The level of quantifiable benefits is estimated to be around 10 per cent of total costs. The issue of quantifying benefits is discussed in detail in Chapter 4.

2.5 LOCAL COSTING TOOL

While the national model estimates total costs for a national program, costs in any particular area can be expected to vary from the average national cost depending on how the circumstances of that area vary from the assumed average circumstances. For example, areas with predominantly rocky ground with overhead electricity and telecommunications lines would be expected to have a cost higher than the national average, while a flat area with standard soil conditions and with only electricity, would be expected to cost less. Therefore, in order to estimate the local cost of putting cables underground with a reasonable degree of accuracy, a specialised cost model is required.

The accuracy of any model depends on the degree to which the model reflects the circumstances in the real world. The accuracy of a localised cost modelling tool depends on the accuracy of the input data for the local area concerned and how well the structure of the tool reflects the circumstances in that area.

In an attempt to achieve an acceptable local costing tool which was reasonably accurate in a small area, but general enough to be used anywhere in Australia, the working group commissioned two consultants to examine the problem. One used a top down approach[17] and the other a bottom up approach[18] to develop a large area costing tool (LACT) and a small area costing tool (SACT)[19] respectively.

The working group notes that both of the costing tools are only estimating devices which are capable of producing indicative costs to varying degrees of accuracy depending on the nature of the input data. Accurate costs can only be obtained from a comprehensive underground network engineering design, material listing and labour analysis.

2.5.1 Large Area Costing Tool ~go to the large area costing tool first input screen on the ROM~

The LACT was developed from the data collected in the national stocktake and costs and benefit survey. It uses national averages as default values, with the capacity to insert local data where it is known. It includes cost factors for aerial electricity, broadband and telephony cables. The input data is usually expressed on a per kilometre basis and does not specifically take account of the impact on costs of local electricity network design parameters.

The working group considers that the LACT would be most useful in determining the average cost of putting cable underground in a large area, such as a city, or on a statewide basis. The accuracy of the estimates achieved depends on the degree to which the user can provide local input data in the form the costing tool requires.

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17 Communications Research Unit, *Putting Cables Underground Costing Models*, Commonwealth Department of Communications and the Arts, Canberra, 1998.

18 Max Garner & Associates and Power Business Resources, *Report: Calibrate and 'road test' by means of case studies local area costs and benefits model*, Sydney, 1998 (b).

19 A more detailed description of both costing tools and how they were developed is contained in Appendix 7.

2.5.2 Small Area Costing Tool~go to the small area costing tool first input screen on the ROM~

The SACT was developed making a series of assumptions about local electrical design and network construction techniques. Its accuracy also depends on the amount and accuracy of local data which can be provided by the user. However, reflecting its development philosophy, the local data is required in a form which is usually readily available from the relevant Local Government and utilities. It provides a cost estimate for placing aerial electricity, telephony and broadband cables underground.

The working group considers that the SACT would be most useful in determining the cost of putting cables underground in a smaller area, such as a suburb or block of streets. In testing with local input data, the estimated costs produced by the SACT exceeded actual costs or best engineering estimates by between 0.17 per cent and 14.72 per cent for four locations[20].

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[20] Applecross and Albany in Western Australia, Unley in South Australia and Inala in Queensland. See Max Garner and associates and Power Business Resources, *op cit*, Table 15.

CHAPTER 3

TECHNICAL ISSUES POTENTIALLY INFLUENCING COSTS

Factors affecting the commercial viability of boring compared with trenching are considered.

The potential of innovative underground network design and proper planning to reduce costs by maximising co-location and the efficient use of network resources is assessed.

Twenty eight innovative ideas are identified which could, if implemented, potentially reduce the cost of putting cables underground in a large project by up to 20 per cent in the first year and up to 35 per cent over 5 years.

The importance of appropriate safety standards is highlighted including the need for ready access to accurate plans of underground networks.

Key environmental issues are identified, including the need for appropriate environmental management strategies in any program to put cable underground.

3.1 INTRODUCTION

Term of reference 2 provides for the working group to examine the technical issues associated with moving cable of different types underground. This includes an assessment of the engineering options involved in placing cables underground or the use of non-cable based technology if appropriate. The working group, through its Technical subcommittee, convened a small expert group to examine technical options and cost factors. A consultant was also employed to facilitate the work of the expert group.

The working group recognises that responsibility for management of many of these issues rests primarily at the State and Territory level, or within the industry concerned. It did not consider itself to be in a position to rank, or to provide prescriptive advice on the suitability of individual technical options. Such decisions would best be made taking into account the range of options identified in this report and the specific circumstances of particular projects. The working group believes that its investigations provide a useful source of information to inform these decisions by bringing together a wide range of industry practitioners and independent consultants to discuss the issues in detail.

3.2 MAIN ENGINEERING OPTIONS

3.2.1 Alternatives to distribution

As a starting point, the group of experts considered the viability of a non-cable power or telecommunications supply. It noted that the current trend in power distribution and use is towards increased energy efficiency on the part of consumers, rather than complete self sufficiency. The group agreed that this trend would continue, perhaps with some supply augmentation from customer-based generation systems such as solar panels or fuel cells. While these developments are likely to impact on future network design, the need for a wire-based electricity grid would remain for some time yet.

The delivery of telecommunications services, by contrast, is becoming increasingly diversified through a variety of cable and radio based systems and this trend is likely to continue. This diversification occurs in the context of an expanding telecommunications market as a whole, particularly in mobile telephone services and fixed wide bandwidth services. The expert group considered however that the need for cable-based distribution networks capable of carrying increased bandwidth would remain for the foreseeable future.

The work of the group has therefore focussed on replacing existing overhead cable infrastructure with an equivalent (although not necessarily identical) underground network. The group noted that in an actual program to put cables underground, additional factors such as demand growth, peculiarities of a particular area and technological developments at the time could significantly influence underground network design.

3.2.2 Boring techniques

Within this context, there are only two possible options for replacing overhead with underground cables, these are trenching and boring. Trenching involves considerable excavation and surface disturbance in the process of burying the cable. Boring can be either straight or directional and is undertaken with purpose-built machines. Straight boring, as the name implies, usually uses some type of rotating drill or auger to make a hole through the ground, the inclination and direction of which is determined by the inclination and direction of the drill head at the point of entry into the ground. The operator cannot adjust the direction once the boring has commenced. The boring machine is placed in a pit below ground level and drills a straight hole to another similar pit some distance off. This type of drill is often used to lay cables under roads and can provide a hole of varying diameter depending on the size and type of equipment used. Similar types of boring, using ‘hole punching’ techniques, are employed for small diameter bores in house connections and some road or driveway crossings.

Directional drilling, by contrast, involves drilling a straight or curved hole, the inclination and direction of which can be controlled, within certain limits, by the drilling operator while the drilling is in progress. Directional drilling machines typically sit on the surface of the ground, with the drilling head entering the ground at a shallow gradient, and then curving in a shallow dish shape to surface again some distance from the point of entry. Directional drills can bend in large radius curves in any direction, but cannot go around sharp corners.

3.2.3 Commercial viability of boring and trenching

The factors affecting the commercial viability of boring techniques (either directional drilling or straight boring) as compared with trenching are:

- the hardness of the sub-surface geology. Soft soil can be bored using directional drilling whereas rock requires straight boring using specialised expensive equipment and techniques;
- the length of the average bore, which is a function in part of the property density. High density housing, for example, may require the excavation of more holes for service connections and the digging of pits etc; and
- the type of surface reinstatement required.

Another important factor which influences the decision whether to trench or bore is the degree of co-location of services. On first impression, the use of combined utility installations such as electricity and telecommunications together appears to offer the potential for significant cost savings. However the approach has not been popular to date in Australia. Experience of combined utility conversion to underground services on a large scale is very limited.

This is partly because telecommunications is largely underground already but, more importantly, combined installations may increase costs beyond the expected marginal installation cost because:

- the coordination and spacing of utilities' lines, disconnection and reconnection of services plus trenching activities requires a high level of cooperation and administration between utilities; and
- the burying of additional services tends to favour trenching over boring as the required space under the ground increases.

One of the major limitations of boring is that in order to provide directional capability and to keep the cost down, the diameter of the bore must be kept small, typically 100 mm. Where multiple service lines are to be put underground larger diameter bores or multiple bores are necessary. This increases costs and often open trenching is a cheaper method. Because of the reduced need for surface excavations and the size of the bore hole, drilling, and especially directional drilling, tends to be favoured where surface reinstatement costs are high and the service to be placed underground can be readily placed in a single small diameter hole.

Consideration of the broader issues relating to co-location appears in section 3.3.

Current Australian industry practice relies heavily on trenching for putting electrical cables underground with boring being more common for telecommunications cables. This is reflected in the survey results set out in Table 13. There are a number of reasons for this. Electricity cabling often involves the installation of both high and low voltage cables with greater diameters, and larger separation distances, than is normally required for telecommunications cables. In addition industry advice suggests that the cost of boring, using the equipment and expertise currently available in Australia, is comparable to trenching, a fact confirmed by the costs reported in the Western Australian pilot projects and the survey cost data reported in Tables 3 and 4 in Chapter 2.

Typical Excavation Methods (% used)	
Trenching	87
Boring	13

Table 13–Excavation practices summary

The limited overseas evidence available and advice from the telecommunications carriers suggests that the cost of boring could be reduced considerably given:

- more competitive contractor tendering;
- the use and further development of software to map existing sub-surface utility lines in three dimensions;
- increased experience and training of drilling crews; and
- increased experience in the selection and development of drilling rigs which deliver a superior level of performance.

These factors would tend to become more significant as the scale and number of projects to put cables underground increased. It is likely that costs for excavation reported in the survey could, in a large project, be reduced by perhaps 10 per cent for installations in unpaved areas and 20 per cent in paved areas if boring were used instead of trenching.

3.2.4 Availability of expertise

Western Australian experience suggests that large projects to put cables underground may be adversely affected by a lack of skilled contractors to carry out the work, irrespective of what funding or regulatory approach is used. This is particularly the case in the early stages of a project as industry may not be able to increase its output sufficiently in the short term without significant increases in costs.

The Western Australian experience found that the number of skilled contractors able to undertake the work potentially limits the number of houses that can be converted to an underground power supply system over a given period of time.

3.3 CO-LOCATION AND COORDINATION

For the purposes of putting cables underground, co-location involves two potential areas of activity:

- locating underground services according to some system of fixed physical relationships to each other; and/or
- putting services underground at the same time or in some temporal order in relation to other excavation or construction.

The working group recognised that either or both aspects of co-location could present a considerable opportunity to reduce the cost and disruption associated with putting cables underground. However, with that opportunity come significant challenges which, though resolvable, can substantially reduce or even negate the net benefits of co-location.

Co-location impacts on a wide variety of issues, options and decisions which need to be addressed within the context of the technical, commercial and regulatory aspects of putting cables underground. For it to succeed there needs to be a high degree of cooperation and coordination between the parties involved. As such it has been considered in part under a number of other headings in this report, including:

- commercial viability of boring and trenching (<u>refer 3.2.3</u>);
- developing a network plan (<u>refer 3.4.4</u>);
- future innovative developments (<u>refer Table 14</u>);
- standardisation (<u>refer 3.5.3</u>); and
- safety (<u>refer 3.6</u>).

Other factors to be considered in assessing the viability of a proposal to collocate underground cables with other utility services or construction activity include:

- appropriate construction methods and the technical compatibility between the different networks,
    - for example service spacing, in-ground configuration or the use of conduits;
- appropriate legal and commercial arrangements between the parties in relation to network construction, customer connection, maintenance and replacement;
- appropriate timing, particularly when considered against individual corporate plans and investment schedules;
- the relationship of the additional underground service (such as broadband) to the existing company network; and
- the net financial benefit (or cost) to the parties;

Consideration of these issues may in some circumstances mean that co-location is not a viable proposition. For example, where electricity cables are being placed underground, it may not be practicable to expand a telecommunications carrier's broadband network because of existing company financial commitments, or the relationship between the proposed network and the company's existing network.

Given the number of variables which are likely to contribute to the success (or otherwise) of co-location, the working group considered that it was not appropriate for it to arrive at any definitive conclusions or recommendations, but to identify the issues to be considered. The decision to enter into particular co-location arrangements is ultimately a commercial matter for the parties concerned, depending on the circumstances pertaining to a particular location or project.

3.4 UNDERGROUND NETWORK DESIGN AND PLANNING

In any program to put overhead electricity cables underground in an established residential area, the characteristics of the underground network design, and in particular the number and location of padmounted substations were identified by the industry as very significant issues to the residents and electricity distributor. For this reason the working group engaged a consultant to investigate and report on a range of issues in relation to underground electrical network design and their associated padmounted substations[21].

3.4.1 Underground network design

The conversion of whole localities from overhead to underground supply provides the network designer with the opportunity to design a modern network that will have a life of at least 50 years. Underground networks which are replacing existing overhead networks can be designed with confidence since many of the design parameters can be known with considerable certainty. These include the:

- location of zone substations;
- the nature of the electrical load, including the location of major loads;
- configuration of streets and major roads;
- load growth pattern for the particular area; and
- national and international developments and experience in the application of cables, switchgear, substations and cable terminations in underground residential distribution (URD) networks over the last 30 years.

As a result of these known quantitities the designer of a converted network is in a position to design a better network than were the original designers of the overhead network being replaced, or the designers of modern URD networks in new subdivisions. This permits a new creative design which is cost effective, reliable and takes into account a realistic assessment of risk which is not necessarily constrained by the design philosophy used:

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21 Max Garner & Associates and Power Business Resources, *Study of Padmounted Substations in an Underground Electricity Network*, Melbourne, 1998.

- in the network being replaced; or
- for new URD subdivisions, where many of the parameters are not as well known as in the converted network situation.

3.4.2 Padmounted substations

Industry discussions about the technological options for putting cables underground highlighted the fact that not all of an electricity network is put underground. The items remaining above ground are referred to as street furniture and include street lighting, wire connecting pillars and electrical transformers and switch gear. These latter items are referred to as padmounted substations[22].

The consultant considered a number of possible underground network designs including those based on the American model and on the existing Australian experience. The consultant concluded that the use of transformers with either 300 kVA, 500 kVA or 630 kVA capacity (depending on the individual circumstances at each location) together with an innovative underground network design would deliver the optimum mix of cost, site procurement, environmental considerations, integration into existing HV networks and provision for future development.

Improvements in network design could approximately halve the total number of pole mounted transformers in an overhead network when they were replaced with padmounted substations. In addition, if the proper design philosophy was employed the footprint of new substations could be reduced and their ability to fit in with the urban environment increased. Such design innovations could also result in savings on network construction costs of at least 3 per cent when compared with existing practice. However, even with these improvements, it is considered that about 20 per cent of new padmounted substations in any project to put cables underground would still prove difficult to site.

3.4.3 Additional capacity

The expert technical group considered whether additional network or conduit capacity should be provided when putting cable networks underground, in order to facilitate network expansion or facilities competition. The group concluded that the provision of additional capacity is a matter to be decided on its merits by the participants in a particular program and that requiring such capacity be installed as a matter of course was not appropriate as:

- it is difficult to predict the future direction of an industry with any certainty and in particular the requirement for future duct capacity, if any;
- the additional cost of providing for possible future expansion or competition would fall to the existing companies and their customers; and

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22 Padmounted substations are the generally grey or green painted boxes seen on street verges that sometimes emit a low level hum.

3.4.4 Developing a network plan

While projects to put cables underground will most likely be undertaken on a locality by locality basis, a long term overall plan also needs to be determined. In this way the HV network design can be optimised, the number of substations kept to a minimum and the lowest overall costs achieved. This long term plan needs to be developed through cooperation and consultation between the electricity distributor, Local Government and the community. It will need to consider:

- the reasonable expectations of the stakeholders in relation to an underground electricity network;
- the Local Government planning, rezoning and development permit process in the years preceding the underground conversion of an area to create additional options for substation sites,
  - for example, in conjunction with traffic management plans, private developments and in private residential property;
- other construction or development works being planned or undertaken in an area which could reduce costs by minimising unnecessary street opening;
- the total area between zone substations even though the immediate priority is for only a portion of the area to be converted from overhead to underground; and
- the possible future introduction of emerging technologies for local generation at each dwelling, such as solar cells and, at a later stage, fuel cells.

3.5 FUTURE INNOVATIVE DEVELOPMENTS

Issues such as efficient excavation methods, network design and the location of padmounted substations are part of a larger set of issues which the expert group considered in the context of future innovative developments. The group identified 28 such developments which have the potential to provide significant savings to any large scale project to put cables underground. These innovative developments cover street furniture, underground street cable, customer lead-ins, technological improvements and project implementation, and are summarised in Table 14. The combined expert group considered that innovative developments, when compared with existing practices as identified in the survey, could deliver combined savings on a total project cost of up to 20 per cent in the first year of implementation, rising to 35 per cent over a five year period. Table 15 outlines the implementation timeframes for the 28 innovative developments identified in Table 14.

3.5.1 The effect of innovation on costs

In the previous discussion of the results from the national cost and benefit model (section 2.4.4), the average cost of putting cables underground in over 4 million households was estimated at \$5 516. Including savings which could result from applying the 28 innovative developments, the average net cost of putting cables underground would range from \$4 413 within one year to \$3 585 over five years. These include the cost of lead-ins, and an averaged cost for putting broadband and PSTN cables underground as well as electricity.

3.5.2 Additional influences on cost

The Technical sub-committee could not quantify to what extent the cost figures obtained from the survey results were based on competitive tendering for work. However, given that structural reform in the electricity and telecommunications industries still has a long way to go in some areas the survey data probably does not reflect widespread competitive pricing. Therefore the per houshold costs cited above could possibly be reduced further by the greater use of competitive tendering.

Given the limitations of the estimates made above, the working group recognises that these national average cost figures are indicative only and may vary considerably from area specific costs. As such they should not be compared to the output of the local area costing tool (refer Chapter 2), when applied to a specific area.

Innovation
1. Relocate electricity service pit above the LV cable.
2. Shared pedestals
3. Shared pits (no pedestals)
4. Common street hardware for electricity and telecommunications.
5. Location of transformer & switchgear
6. Reduced electricity/telecommunications separations.
7. Reduced depth of cover in open trench
8. Reaming of existing telecommunications distribution pipe
9. Direct laid electricity cables
10. Shallow 2-partition boxed chase behind kerb (or in front of gutter - ie road shoulder)
11. Bundled conduits prefabricated (webbed or formed)
12. Continuous conduit pipe for electricity installations
13. Pre-cable continuous pipe
14. Common bore holes for electricity & telecommunications cables / conduits
15. Feeding 2 adjacent properties from single lead-in trench/bore.
16. Continue road crossing bores to one house on other side of road
17. Surface laying of lead-ins
18. Reaming of existing telecommunications lead-in pipe
19. Shared broadband infrastructure between carriers
20. PSTN on broadband (or vice versa)
21. Replacement of PSTN cabling by customer radio (area or individual)
22. Development of composite electricity and communications cables
23. Communications services could be carried over electricity Infrastructure in some cases
24. Development of alternative electricity technologies
25. Rationalisation of network design
26. Implementation economies of scale
27. Identification of existing infrastructure–Three dimensional underground mapping
28. Easement issues–better utilisation of existing easements and more forward planning in easement reservation

Table 14–Possible innovative means of reducing the cost of placing overhead networks underground.[23]

[23] A full discussion of the innovative ideas is included in Amos Aked Swift, *Putting Cables Underground Working Group–Technical Issues–Stocktake, Technical Options and Associated Costs*, Sydney, 1998

Innovation		Time frame (years)			
Category	**Item number**	**Now**	**1 to 2**	**2 to 5**	**> 5**
Street hardware	1				
	2				
	3				
	4				
	5				
Underground cable	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
Customer lead-in	15				
	16				
	17				
	18				
Technological improvement	19				
	20				
	21				
	22				
	23				
	24				
Project implementation	25				
	26				
	27				
	28				
Project savings possible		**20%**	**5%**	**5%**	**5%**

Table 15–Implementation timeframes for future innovative developments identified in Table 14

3.5.3 Standardisation

As can be seen from Table 14, many of the developments listed require substantial co-operation and technical standardisation between the various players if any reductions in costs are to be achieved. Current standards of practice and manufacture which may be unique to a utility, telecommunications carrier or Local Government would require redrafting to facilitate co-location, sharing of facilities or economies of scale in manufacture. This process is occurring in some areas already through such things as shared trenching agreements between the telecommunications carriers, and energy and water utilities in NSW[24].

The Technical subcommittee considered what degree of standardisation is desirable and how this should be achieved. Insufficient standardisation potentially increases costs while over standardisation can do the same by reducing flexibility and stifling innovation. A balance is required between these two extremes which is responsive to individual circumstances. For this reason the working group did not consider it appropriate to recommend an overarching standardisation process, or mandatory standards for any particular technical feature in relation to putting cables underground.

3.5.4 Additional services provided in association with existing networks

The technical group considered options like providing telecommunications services over the existing electricity network or utilising sewer pipes as conduits for broadband networks. They concluded that while such ideas may be technically feasible and/or cost effective in some circumstances, they were not broadly applicable to putting significant amounts of overhead cable underground.

3.6 SAFETY

<u>Term of reference 2</u> provides for consideration of safety issues that may be raised in association with putting cables underground. Such issues may be considered in terms of the:

- occupational health and safety (OH&S) of persons working in relation to or near electricity networks;
- safety of the public; and
- safety of electricity consumers.

Occupational health and safety matters relate to both the construction and operation of electricity networks. Current safety requirements covering the construction phase of the underground networks are based on national, State and Territory codes or regulations. These relate to safe methods of:

- undertaking civil construction, trenching or boring; and

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[24] Public Works Engineering Australia, *New agreement on Trench Sharing*, July/August 1998 issue, page 8.

- working with electrical cable and equipment.

Safety in the operation of an underground electricity network relates to the safety of electricity supply maintenance staff and others, such as other utility employees, working near parts of an electricity network. Underground networks generally require less maintenance than overhead networks and this should result in fewer accidents to maintenance staff in the long run, given that underground networks are at least as safe to work on as overhead networks. However, having all utility services underground, especially electricity, requires safe excavation practices by utility staff, contractors and private citizens.

Electrocution is another important issue in relation to OH&S and public safety. The working group commissioned a consultant to study the existing data covering the incidence of electrocutions for overhead and underground electricity networks[25]. The consultant's report found that, while the quantity of data available is limited, the information suggests that the incidence of accidental electrocutions could increase when electricity cables are moved underground.

This finding is at odds with the reported number of electrocutions which occurred in California and Florida in the USA in recent years. In an article on the benefits of urban underground power delivery, Maney[26] compares the average number of reported electrocutions per year per mile of line for overhead and underground electricity systems and concludes that 'underground lines are far safer than are overhead lines'.

Notwithstanding the apparently conflicting research results, the working group considers that all reasonable steps should be taken to reduce the possibility of injury or death from electric shock resulting from contact with electricity lines. In the case of underground cables, such accidents are largely the result of people striking a buried cable during excavation work. Where areas are serviced by underground power distribution networks, it is very important that accurate cable location maps are available and accessible to those carrying out excavation work. Appropriate public education programs should also be in place to advise people on how to avoid making contact with buried cables.

Public safety could be improved by the removal of many roadside electricity posts. This has the potential to reduce the number of fatal road accidents or the severity of injury resulting from such accidents. However, a large number of poles, albeit of different construction, will still be required to support street lighting. This issue is considered in detail in Chapter 4.

The safety of electricity consumers would remain unchanged as a result of putting cables underground.

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25 Bureau of Transport and Communications Economics, *Electrocutions and Underground Cabling*, 1997 (c).

26 Maney, C T, *Benefits of Urban Underground Power Delivery*, IEEE Technology and Society Magazine, Spring 1996.

3.7 ENVIRONMENTAL ISSUES

3.7.1 Environmental management plan

The process of putting cable underground will itself impact in some way on the environment. The working group, through its Technical subcommittee, engaged a consultant to make a detailed assessment of the environmental impact of putting cables underground, including the development of a comprehensive environmental management plan (EMP) which could be applied to any underground conversion project.[27]

The consultant found that, in most instances the level of environmental impact resulting from putting cables underground will not be significant, providing the appropriate environmental controls are in place. The purpose of the EMP is to ensure that this occurs. Most electricity and telecommunications supply organisations have environmental management plans in place and the EMP is intended to complement these plans.

The EMP is not related to a specific construction program, but is based on activities that are likely to be components of any program to put cables underground. As such the EMP relates to the likely environments and land use to be encountered when installing underground cables in an urban situation.

The four different environments that could be affected by putting cables underground are:

- urban areas: roads, footpaths, road verges;
- parks and public open space;
- urban bushland; and
- private property.

When considering the environmental impact, the above environments are dealt with as five land use categories:

- residential;
- commercial;
- special areas;
- urban recreation; and
- environment protection.

The EMP proposes strategies to minimise the impact on the environment. These relate mainly to:

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27 National Environmental Consulting Services, *Environmental Management Plan: Putting Cables Underground*, 1988.

- minimising disturbance to the community;
- protecting significant heritage or natural environmental features;
- minimising water, noise and air pollution; and
- reducing visual impact of street furniture.

The report suggests that, as far as possible, ecologically sustainable development principles should be used in the process of putting cables underground, including rehabilitation of disturbed areas and the proper disposal of existing infrastructure.

The installation of underground cables will require the removal of overhead infrastructure when the below ground system is in place. While some components will be recyclable (such as copper and aluminium cables), others (such as chemically treated posts) will require disposal or remediation in accordance with the relevant waste legislation and regulations.

Area	Environmental factors										
	Flora and fauna	**Soil erosion & sediment control**	**Flooding**	**Water quality**	**Noise and vibration**	**Dust suppression**	**Indigenous heritage**	**Non-indigenous heritage**	**Visual impact**	**Waste**	**Construction traffic & access**
Residential	■	●	●	●	●	●	○	●	●	●	●
Commercial	○	●	●	●	●	●	○	■	■	●	●
Special Use	■	●	●	●	●	●	■	■	●	●	●
Urban Recreation	■	●	●	●	■	■	■	■	●	●	■
Environment Protection	●	●	●	●	■	■	●	■	●	●	■

Table 16–Summary of need for environmental management strategies

Key:

● Management strategies and plans to be implemented

■ Possible strategies and plans to be implemented

○ Unlikely that plans and strategies will need to be implemented

The report identifies how cabling relocation activities may impact on different environments. Strategies and plans specific to particular environments were then developed. These are summarised in Table 16. While the administration of environmental programs and requirements is generally a State and Territory responsibility, the working group considers that the report should be of benefit to these authorities in assisting them to identify and address broad environmental issues associated with putting cables underground. The individual plans for the four identified environments should also be useful at the street level in a broad range of excavation work, covering both retrofit and greenfield programs to put cable underground.

3.7.2 Electromagnetic fields

Of interest to the working group was the impact putting cables underground would have on the magnitude of the associated electric and magnetic fields.

An electric field is produced by a conductor maintained at some voltage above zero and is proportional to that voltage. Since the voltage in overhead lines and underground cables carrying electricity is very close to constant, the associated electric field is also virtually constant. For underground cable an electric field is established across the insulation which surrounds the conductor. Since the earth is a conductor, the earth effectively screens the cable. Thus the electric field outside the body of the underground cable is very small compared with the field from a comparable overhead line.[28]

The magnitude of the magnetic field associated with an overhead transmission line or underground cable carrying electricity depends on the current in the conductor, the distance from the conductor, the number of parallel circuits in the line or cable, the arrangement of the three phase conductors (particular the distance between them) and the degree to which the cables are shielded.

In a report to the Victorian Government in 1998 by W J Bonwick, the variations which might be expected in electromagnetic fields from a 220 kV overhead transmission line and an equivalent underground line were considered in detail. Based on theoretical calculations and field tests Bonwick concluded that the maximum magnetic field strength from an underground three phase cable was reduced by 60 per cent for a single circuit and 15.8 per cent for a double circuit when compared to the overhead equivalent, under the following conditions:

- the field was measured in a plane 1 metre above the ground in both cases;
- the overhead conductors were bare, and separated to provide the necessary insulation between them;
- the conductors in the underground cable were separated by 15 cm;
- the conductors in the underground cable were in a triangular formation; and

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28 Bonwick, W J, *Electric Fields from Overhead Transmission Lines and Underground Cables*, report to the Victorian Government, 1988, page 26.

- the underground cable was buried at a depth of 1 metre[29].

Compared with a 220 kV line, an electricity distribution line below 33 kV may carry a comparable current and therefore the magnitude of any magnetic field measured in the same circumstances may be similar. The relative difference in magnetic fields between overhead and underground installation in the two types of line would also be similar (provided other factors affecting the field strength were also similar).

The burial depth for distribution lines is at about one metre[30] and the conductors in a three phase underground cable are in a triangular or square configuration with a separation in the order of 2.5 cm. Given that reduced separation between the conductors reduces the field strength then, based on Bonwick's work, it would be reasonable to conclude that for distribution lines below 33 kV the maximum magnetic field (measured in a plane 1 metre above the ground) for an underground cable should be less than that for an equivalent bare cable overhead line.

3.7.3 Other environmental factors

Apart from those issues already considered there are other potential benefits and costs of putting cable underground which are of an environmental nature or have an environmental component. For example, benefits such as: improvements to the visual environment, increased tree planting and reduced greenhouse gas emissions; and costs such as, the use of non-renewable resources and increased greenhouse gas emissions in the manufacture of underground network components. The working group decided not to try to quantify or place a value on these factors for reasons which are set out in Chapter 3.

29 Bonwick *op cit*, page 29.
30 Public Works Engineering Australia *op cit.*

CHAPTER 4

BENEFITS OF PUTTING CABLES UNDERGROUND

The main quantifiable potential benefits of putting cables underground are savings in the costs of maintenance, tree trimming and motor vehicle accidents. The working group has explored various methods for quantifying such benefits.

The largest quantifiable potential benefit is a reduction in motor vehicle accidents caused by collisions with poles. These benefits could amount to between $105 and $160 million a year.

The working group also considered how property values may be affected by cables being placed underground.

Another major unquantifiable benefit is improvement to the urban environment, including improvements in streetscapes and the visual appearance of a community. The working group did not try to quantify these benefits.

4.1 INTRODUCTION

Term of reference 3 provides for the working group to report on the benefits of placing existing overhead cabling underground. It also provides an initial list of potential benefits that should be evaluated. Recognising the significant scope of this task, the working group, through its Economic subcommittee, contracted a consultant to identify the full range of potential benefits of putting cable underground and to assess which of these areas required further investigation and quantification[31].

The working group identified and examined in some detail the potential benefits of putting cables underground in terms of:

- quantifiable benefits, being those benefits which can be more readily valued as a cost saving in dollar terms;
- unquantifiable benefits, being those benefits which cannot be readily valued in dollar terms; and
- an assessment of who would receive the quantifiable benefits.

In an attempt to further quantify the potential benefits, the working group included questions on benefits as part of the cost survey[32] (refer Chapter 2), however, as discussed in section 2.4.3, the reliability of the information was somewhat limited. As a

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[31] Bureau of Transport and Communications Economics, *Measuring the Benefits of Putting Cables Underground,* 1997 (b)

[32] Amos Aked Swift, *Putting Cables Underground Working Group–Technical Issues–Stocktake, Technical Options and Associated Costs, Sydney, 1998*.

consequence the working group commissioned a separate study to examine and report on the benefits of putting cables underground and the methodologies used to estimate these[33].

4.2 THE BENEFICIARIES–WHO GAINS THE MOST?

Potential quantifiable benefits identified by the working group would accrue to electricity distributors, telecommunications carriers, Local Government and the insurance industry. This would mean, for example, savings:

- for electricity distributors from lower maintenance costs, reduced interruptions to supply; and reduced transmission losses;
- for insurance companies from reduced motor vehicle accidents;
- for telecommunications carriers from lower maintenance costs and reduced interruptions to supply; and
- for Local Government and others from reduced tree pruning costs.

4.3 QUANTIFYING THE BENEFITS

Potential quantifiable benefits from putting cables underground were identified by the working group as follows:

- reduced motor vehicle accidents caused by collisions with poles;
- reduced losses caused by electricity outages;
- reduced network maintenance costs;
- reduced tree pruning costs;
- increased property values;
- reduced transmission losses;
- reduced greenhouse gas emissions (due to reduced transmission losses);
- reduced electrocutions;
- reduced bushfire risks; and
- any beneficial indirect effects on the economy, such as employment;

Each of these potential benefits are considered below and where possible an attempt is made to quantify them.

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33 Sinclair Knight Merz, *Consultancy to Investigate Potential Benefits from Putting Cables Underground: Report*, 1998.

4.4 REDUCED MOTOR VEHICLE ACCIDENTS CAUSED BY COLLISIONS WITH POLES

A consultant was contracted to examine the total net benefits to be gained from removing poles without street lights on them across urban Australia.[34] Based on available data the report estimates that the net benefits arising from the reduction in motor vehicle accidents caused by collisions with poles would be about $105 million each year. In addition, if the current rigid poles carrying street lights were replaced with 'bendable' poles there would be a further saving of about $57 million a year (in 1997 dollars).[35] The additional expenditure for replacing the light poles would be about $1 billion.

These figures assume that:

- 90 per cent of the value of damage caused by pole accidents would be caused by power and/or telecommunications poles;
- 90 per cent of all power or telecommunications poles would either be removed or replaced with bendable poles;
- 80 per cent of accidents with poles could be avoided if the poles were removed; and
- 65 per cent of all existing power and telecommunications poles do not carry lights.

Significantly the figure of 80 per cent for accidents which could be avoided does not allow for collisions with bendable light poles which would replace existing rigid poles carrying lights. According to Table 2, this would be a minimum of 35 per cent of all poles (based on a one for one replacement). The consultant's study assumes a modest upgrading of lighting such that 40 per cent of all poles would be replaced with bendable light poles. However, the value of damage caused by collisions with bendable poles would be considerably less than that caused by the same number of collisions with the rigid poles they replaced.

It is widely acknowledged that the number of street trees planted would increase when overhead cables are removed. The consultant's study assumes that such trees would not contribute at all to collisions because of the relatively small size of their trunks. To the extent that additional large trunk trees were planted, they would in time contribute to the number and cost of collisions.

Given these additional factors, the maximum saving estimated at $162 million per annum is considered to be on the high side.

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[34] Bureau of Transport and Communications Economics, *The Extent of Reductions in the Number and Severity of Motor Vehicle Collisions with Power Poles Following an Undergrounding of Cables*, 1998.

[35] The original figures in the BTCE report of $100 million and $62 million have been adjusted to reflect a revised estimate of the number of poles that are likely to be removed as reported in Table 2 of this report.

The working group considers that the groups who might benefit financially from these savings would primarily include:

- the insurance industry, from reduced claims. Third party personal insurance is a compulsory component of motor vehicle registration, many vehicles carry comprehensive or third party property insurance and about 30 per cent of Australians have private health insurance;
- Commonwealth, State and Territory Governments, because about 70 per cent of Australians do not have private health insurance and rely on Medicare to fund their medical expenses;
- the electricity or telecommunications company who is responsible for maintaining the network, because they may not recover from another party all the costs they incur from motor vehicle collisions with poles; and
- individuals involved in accidents (or their estates), because they are often responsible for some part of their health costs and/or damage to the pole and the wire it supports.

The working group did not attempt to apportion benefits between these four groups and therefore did not include these potential benefits in funding estimates based on avoided costs. The working group notes however, that the community might expect these savings to be passed on in the form of lower insurance premiums or improved public hospital facilities, or as a contribution to the cost of putting cables underground.

The consultant's estimation of the economic costs of accidents, ranging from $850 000 for a fatality to $20 000 for a non serious injury not requiring medical treatment are based on an average of industry estimates for the value of death and injury[36]. They include components of actual costs, such as medical or funeral costs, and assessed costs such as the value of loss of life. Therefore these figures would not necessarily translate directly into actual costs incurred by one or more of the above groups.

Putting a value on death and injury resulting from accidents is a relatively common practice, particularly for the purpose of determining the value of insurance claims. As such, the total value of reduced motor accidents resulting from putting cables underground is considered as part of the quantifiable benefits for the purpose of this study.

4.5 REDUCED LOSSES CAUSED BY ELECTRICITY OUTAGES

Residential consumers and industry located within or adjacent to built-up residential and commercial areas will benefit from fewer outages. The value of improved power supply reliability is usually measured in terms of a reduction in consumer outage costs. Outage costs depend on a range of factors including:

- type of customer;

[36] Bureau of Transport and Communications Economics, 1998, *op cit*, page 2.

- outage frequency and duration;
- magnitude of the load interrupted; and
- time of day and week outage occurs.

Costs can be direct financial losses or losses of convenience and amenity. Customer surveys are the favoured method for measuring outage costs. These surveys use questions to try to establish the respondents':

- willingness to pay;
- level of preventive expenditures; and/or
- direct cost estimation.

The three alternative methods assess the same issue but from different perspectives and as a result they are likely to produce a range of different cost values.

Monash University has recently completed a study of the cost of disruption to electricity supply[37]. The objective of the study was to calculate the cost to electricity customers of interruptions to electricity supply. This cost, when aggregated up to represent the entire supply system, represents what is known as the 'Value of Lost Load' (VoLL). VoLL is used as the 'cap' or ceiling value placed on the spot electricity price in the national electricity market. In effect it is the maximum price that an electricity generator can receive for a unit of electricity supply.

For non-residential consumers a direct cost evaluation method was employed. The respondents were asked to suppose that a power outage occurred, without warning, at the worst possible time (time of day, day of week, and month). Respondents then estimated the losses to their company arising from outages of various durations. The results of the Monash survey are summarised below.

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37 Kahn, M E, and Conlon, M F, *Value of Lost Load Study for Victorian Power Exchange,* Monash University Centre for Electrical Power Engineering, Melbourne, 1997.

Outage Duration	Value of lost load ($/kWh not supplied)			
	Residential	**Commercial**	**Agricultural**	**Industrial**
2 seconds	–	45 534.06	–	4 902.30
1 minute	–	1 317.94	3 684.19	276.10
20 minutes	–	151.98	266.07	23.96
1 hour	–	88.16	123.35	17.95
2 hours	–	35.48	74.77	7.70
4 hours	1.75	31.64	113.17	7.94
8 hours	2.18	50.79	92.53	10.27
1 day	3.35	22.99	84.75	5.24
2 days	3.87	–	–	–

Table 18–Value of lost load (based on a Monash survey)[38]

The results indicate that there is a wide diversity of values for each kWh of electricity not supplied, with the value depending on both the duration of the outage and the customer type. The data can be converted into costs per outage. Thus a commercial premise with 20 kW of load during a two second outage would incur losses of:

$45 534 x 2/3 600 x 20 = $505

Similarly a residential property which would have demanded 1 kW of load during a 8 hour outage would face a loss of:

$2.18 x 8 x 1 = $17.44

Underground cables outperform overhead lines by an average of 3 to 1 in terms of the frequency of outages[39]. However, customers are likely to be off-supply longer with an underground fault. The survey of utilities found that restoration for an overhead line fault averaged four hours, while the repair time for an underground cable fault could be up to 24 hours. If the underground system had an average outage duration of 24 hours, it would impose a higher cost on consumers than an overhead system with a four hour average outage (measured in terms of average annual costs). These results suggest that from a residential consumer's view the benefits of the improved reliability of underground systems may be outweighed by the costs associated with the extended duration of a typical underground outage.

In terms of the working group's study, the value of this outage information for business is limited, as it examines putting distribution cables underground in principally residential areas. The research would seem to apply to business, only to the extent that

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38 Kahn, M E, and Conlon, M F, *op cit*, page 16.

39 Based on an average of the figures in Table 19 for the number of interuptions for overhead and underground networks respectively.

commercial and industrial premises are within residential areas. To calculate a figure for total annual losses, information would have to be obtained on the:

- percentage of businesses in residential areas;
- average electricity load for those businesses; and
- average duration, frequency and time of occurrence for outages.

In the absence of reasonably accurate figures for these parameters, the working group was unable to estimate annual costs of outages to businesses.

4.6 COST OF MAINTENANCE

The consultant approached the cost of maintenance from a number of different ways, considering:

- reliability;
- actual maintenance costs from utilities;
- a maintenance cost model;
- a tree trimming cost model.

The first three approaches are discussed and the results compared in this section. A separate model for tree trimming costs is considerer in section 4.7.

4.6.1 Reliability

Utility	Voltage	Number of interruptions (per 100 km of line per year)	
		Overhead	Underground
Integral Energy	HV	30.27	2.79
Integral Energy	LV	7.44	7.66
Energy Australia	HV	13	4
Citipower	HV	4	1
Mercury Energy	HV	30.50	7.14
Survey of Aust Utilities (a)	HV & LV	23.6	5.6
France	LV	12.29	7.55
Finland	LV	8.0	4.0

Table 19–Interruptions per 100 km of Circuit[40]

(a) average based on Sinclair Knight Merz Survey.

40 Sinclair Knight Merz, *op cit*, Table 3.2.

The data indicates that the ratio of interruptions between an overhead network and an underground network is about 3 to 1. This data accords with the perceived opinion of most observers that the frequency of interruptions is lower on underground systems than on overhead systems.

However, the data in this table measures frequency of interruption only. Less impressive results are achieved when duration as well as frequency of interruptions are taken into account. For example, data for the United Kingdom averaged over a 10 year period[41] suggests that the ratio of customer minutes lost per year per kilometre of line for overhead verses underground networks is approximately 2 to 1. The variation in data from that presented in Table 19 reflects the fact that faults are much more difficult and time consuming to locate, isolate and repair on underground systems and that many of the temporary improvisations that can be made on overhead circuits are impossible to accomplish on underground systems.

4.6.2 Actual maintenance costs

Total maintenance costs are the sum of preventive maintenance, vegetation management and reactive maintenance. Figures for the non-capital component of maintenance, are presented in the upper part of Table 20. Based on research done by the consultant[42], the maintenance cost would approximately double if the cost of replacement materials (capital costs) were included. These figures appear in the last line of the table.

41 Sinclair Knight Merz, *op cit*, section 3.5.
42 Sinclair Knight Merz, *op cit*, section 5.6

Type of maintenance	Expenditure on maintenance (a) ($ per km of line per year)					
	Low (b)		Medium		High	
	Over-head	Under-ground	Over-head	Under-ground	Over-head	Under-ground
Preventative	282	128	380	158	590	941
Vegetation Management	107	nil	194	nil	285	nil
Reactive	79	102	155	178	527	460
Total (c) (no capital)	**468**	**230**	**729**	**336**	**1 402**	**1 401**
Total (d) (with capital)	**936**	**460**	**1 458**	**672**	**2 804**	**2 802**

Table 20–Average Australian electricity network maintenance costs[43]

(a) Figures are an average of the 1997 and 1998 costs.
(b) Represents the lower 25% quartile, medium and upper 25% quartile of maintenance expenditure from a database of thirteen utilities.
(c) Costs are for urban residential areas, excluding the central business district and lightly populated rural areas and the costs include, labour, contractors, vehicles and materials, but exclude capital costs such as transformers, poles and cable.
(d) Includes capital and non capital components of maintenance costs.

The significant variations between the high, medium and low figures reflects the varying age, rate of deterioration, and maintenance and rehabilitation history of the assets, as well as differences in the operational cost structure of the utilities.

The figures suggest that existing overhead infrastructure is approximately twice as expensive to maintain as existing underground infrastructure. However, the avoided maintenance cost of putting cables underground is not the difference between these two figure ranges, but rather the difference between the maintenance costs of existing overhead systems and new underground cables. The above estimates do, nevertheless, give an indication of the upper limit on current year avoided costs if existing overhead infrastructure were replaced with new underground infrastructure. The upper limit is the difference between the current cost associated with overhead networks and an underground system with zero maintenance costs. Based on the medium data in Table 20, this is $1 458/circuit kilometre/annum or $124 million per annum for the assets identified in the stocktake[44]. However as time progresses and the new underground system ages, the avoided maintenance cost would approach the difference between the figures for overhead and underground presented in Table 20. For the medium data this is $786 per kilometre of line per year.

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43 Data from UMS PACE, an international electricity benchmarking firm. Taken from figures in Chapter 5 of Sinclair Knight Merz, *op cit*

44 It is recognised that there will be some maintenance from day one in a new underground network from such things as cars colliding with padmounted substations or ‘dig-ins’, but the cost of such events would often be recovered from the subject of the accident.

4.6.3 Modelled maintenance costs

The consultant also developed a model for calculating avoided maintenance costs. This model assumes a hypothetical community of 30 000 people and estimates figures for savings in preventive and reactive maintenance based on a number of variables in each case[45].

The model used data on current preventive and reactive maintenance activities obtained from a survey conducted by the consultant of utilities and carriers of outage rates and costs, and other existing available sources. The results are provided in Table 21.

Type of maintenance	**Cost of maintenance ($ per km of line per year)**	
	Overhead	**Underground**
Reactive maintenance		
Repair cause of outage	132	275
Loss of revenue during outage	11	4
Communications	44	16
Preventive maintenance		
Tree care	300	0
Capital replacement	120	10
Capital inspection	20	4
Electrical line losses (a)	240	240
Total	**867**	**549**

Table 21–Summary of maintenance costs associated with putting cables underground (based on modelled data)[46]

(a) Sinclair Knight Merz consider that there would be no net gain from reduced transmission losses resulting from putting cable underground because, although underground cable would be likely to be thicker than overhead cable, and therefore have less electrical resistance, the capacity of substations would be larger and they would be further apart thus increasing the length of LV cable connected to each substation and therefore increasing overall resistance.

For the model community the annual savings in maintenance costs from putting cables underground is estimated to be $318[47] per kilometre of line per annum.

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45 For a full description of the model parameters see Sinclair Knight Merz, *op cit*, Chapter 6

46 Sinclair Knight Merz, *op cit*, Table 6.1.

47 Total for overhead maintenance costs, less the total for underground maintenance costs is 867 – 549 =318

4.7 COSTS OF TREE TRIMMING

The consultant advised that clearance policies and specifications for vegetation in relation to electricity lines varied significantly between states[48]. These specifications may define up to three components of clearance:

- clearance space;
- regrowth space; and
- hazard or management space.

Practice in relation to clearance specifications also varies between areas. Pruning in some locations is carried out to achieve a minimum regrowth space. In other areas streetscape and tree management issues mean that minimum clearance spaces are sometimes compromised.

There are several factors that influence the cost of maintaining adequate clearances for vegetation growing around powerlines. The relative importance of these factors and the nature of interactions between them, mean that there will be considerable variability in the cost of maintaining powerline clearances around Australia. The factors are:

- fire and storm risk;
- type of conductor and voltage carried;
- length of span between power poles;
- tree location in relation to power poles;
- rate of regrowth;
- species and age of tree;
- streetscape values;
- density of trees;
- degree of compliance with clearance standards; and
- presence of other utility cables.

The consultant developed a model of vegetation management costs based on three fixed assumptions;

- pruning principally occurs on the side of the street where power lines are located;
- an average frontage per household of 15 metres; and
- that trees present in the vicinity of powerlines grow or threaten to grow into the clearance space.

[48] Sinclair Knight Merz, *op cit*, Chapter 7.

The variable parameters included in the model are:

- pruning cost–varying between $5 and $80 per tree;
- pruning frequency; and
- tree density.

On the basis of the above assumptions, the annual cost of powerline clearance pruning could vary by a factor of more than 1 000. However, not all of the possible combinations of pruning cost, tree density and pruning frequency are equally or even at all likely. In Table 22 the more likely combinations are indicated by the darker shading. The reason such combinations are more likely is set out below.

4.7.1 Very high pruning cost

High unit costs are likely to be encountered in areas with large trees and well established streetscapes. The size of such trees and nature of the streetscapes suggest medium to low tree densities. Such trees are likely to be pruned on cycles between one and three years in length, with shorter cycles more likely.

4.7.2 High pruning cost

Unit costs of this order are likely to be encountered under broadly similar tree and streetscape conditions as for very high pruning costs. Tree management or powerline access requirements will not be as rigorous as for the very high pruning costs.

4.7.3 Medium pruning cost

This level of pruning is likely to be encountered in environments with smaller trees and/or less demanding streetscapes or tree management requirements. This category could include medium to very low densities of tree cover and (possibly) very long cutting cycles.

4.7.4 Low pruning cost

This is only likely to be achieved where vegetation is quite dense, relatively simple to maintain and therefore pruned quite regularly. It is unlikely to apply outside the tropics, and may even understate the costs there.

	Tree density (households/tree)			
	High–0.5	Medium–2.5	Low–10	Very low–20
Pruning cycle (years)	Very high clearing cost–$80/tree			
1	5 600	1 120 (a)	280	140
2	2 800	560	140	70
3	1 867	373	93	47
5	1 120	224	56	28
Pruning cycle (years)	High clearing cost–$40/tree			
1	2 800	560	140	70
2	1 400	280	70	35
3	933	187	47	23
5	560	112	28	14
Pruning cycle (years)	Medium clearing cost–$20/tree			
1	1 400	280	70	35
2	700	140	35	18
3	467	93	23	12
5	280	56	14	7
Pruning cycle (years)	Low clearing cost–$5/tree			
1	350	70	18	9
2	175	35	9	4
3	117	23	6	3
5	70	14	4	2

Table 22–Annualised cost of clearance pruning (per km of line)[49]

(a) Shaded areas in the body of the table represent the more likely combinations of pruning cycles and tree density.

Actual costs of managing vegetation around powerlines may range between about $2 and $5 600 per kilometre per year, with expected values in the range $35–$1 120 per year based on the medium tree density.

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49 Sinclair Knight Merz, *op cit* Table 7.1

4.8 IMPACT ON PROPERTY VALUES

The consultant's report on measuring benefits suggests that total national property prices may not be increased by a national underground conversion program, on the ground that the value of properties nationally is determined by the total demand and supply of properties[50]. Thus, increases in prices in one area could be at the expense of other areas, so that there would be no overall corresponding national benefit for property prices. In discussing these findings, the working group considered that changes in the overall intrinsic value of property (such as through putting cable underground) may in itself have some effect on overall demand for property, thus affecting overall property prices.

The working group approached five state Valuers-General from: New South Wales, South Australia, Victoria, Western Australia and Queensland with a series of questions about the impact on property values (if any) of putting cables underground. The questions sought to quantify the impact on residential property values of putting cables underground for a typical group of:

- 100 houses, or approximately one street;
- 1 000 houses, or approximately one suburb;
- 10 000 houses, or approximately a suburban area;
- properties adjacent to the areas listed above; and
- properties forming a substantial portion of a city, or in the order of 100 000 houses[51].

The results of the Valuers'-General input are summarised in Table 23.

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[50] Bureau of Transport and Communications Economics, 1997 (a), *op cit*, page 30.
[51] Secretariat to the Putting Cables Underground Working Group (Eds), *Correspondence with Valuers-General from the Mainland States about the Effect on Property Valuers of Putting Cables Underground*, 1998, (c).

		Estimated change in property or land values (%) (for various size areas with underground cables)				
State	Average property values	100 Properties	1 000 Properties	10 000 Properties	Neighbouring areas	Substantial portion or all of city
NSW	not provided	not quantifiable	not quantifiable	not quantifiable	not quantifiable	not quantifiable
SA	$120 000	up to 5.00	up to 5.00	up to 5.00	2.00 to 3.00(a)	2.00 to 3.00(b)
VIC	$100 000 (land value)	3.00(c)	up to 3.00	below 3.00	not quantifiable	generally no impact
WA	$200 000 (land value)	1.00	1.00(d)	1.00	not quantifiable	no impact(e)
QLD	$300 000(f)	negligible	0.10(g)	0.09(g)	Negligible	0.12 (g&h)

Table 23–Changes in property values resulting from putting cables underground

(a) The degree of value shift is highly subjective, an increase of 2% to 3% is estimated.
(b) Slight lowering of the 5% increase (estimated in the other areas) to 2% or 3%.
(c) In a street where there is likely to be only a few houses come on the market during a year it would be expected they would attract possibly $3,000 more, but the influence on neighbouring areas would be small (if any) and dependant on so many variables so as not to be quantifiable.
(d) All else being equal, properties on the side of the road/access on which the above ground service existed would benefit on an average of between $2,500 to $5,000 while those on the opposite side of the road would benefit on average between $200 and $500.
(e) Once all land has equal amenity (all land has underground power available) the value of the amenity will no longer be relevant.
(f) Property value averaged as different values were quoted for different sample areas.
(g) Only 5% of the properties would experience an increase in value because, for example, cables affected their views, and this was averaged over all properties.
(h) The figure is higher than for smaller groups because the sample area had 5% of beachside properties where improved ocean views would increase value by more than views in inland suburbs.

4.8.1 Views of the States

In New South Wales, the Valuer-General considered that it was not possible to provide answers due to a number of factors, among which was the effect of phases of the property market, when prices are rising or falling markedly, as happens periodically in Sydney. It was considered that at such times it was not possible to determine with any accuracy the effects of any variable such as the presence or absence of underground cabling.

The South Australian input was prefaced by the statement that very little formal research has been done on this topic and therefore results are not conclusive. However, it was considered that there could be an increase in property values of up to 5 per cent in the subject area. Based on the median sale price for detached dwellings in Adelaide, this would represent approximately $6 000.

Field analysis was undertaken in Melbourne by the Victorian Valuer-General. The areas selected for analysis were Mt. Martha, Aspendale, Rowville, Glen Waverley, Mt. Waverley and Burwood East. The criteria for selecting the areas were generally a suitably high volume of property sales and a reasonable cross-section for comparison. The Valuer-General considered that hypothetically, for a typical suburb having individual site values of approximately $100 000 there could be an increase of up to $3 000 or 3 per cent of the site value.

The Western Australian Valuer-General suggested that, all else being equal, properties on the side of the road on which the above ground service existed would benefit on average by between $2 500 to $5 000 of site value up to a maximum benefit of $10 000. Properties distant from or on the opposite side of the road to the street wires, would increase by only a nominal value of between $200 and $500. The Western Australian response emphasised that changes in value could vary widely from property to property and area to area. The Western Australian Valuer-General therefore cautioned against averaging results, indicating that this could reduce the measured gain for directly affected properties by one third and unnecessarily boost the gain by less affected properties by up to four times.

The Queensland experience suggests that the impact on property values is the same whether the property is improved or unimproved. Underground power and cables, which are minor variables on Brisbane values, would not affect the value of a dwelling, but would be solely within the province of added value to the land. If 1 000 dwellings were upgraded to underground cables in an area of average to good quality development it was considered that only about 5 per cent of properties would increase in value by about 2 per cent. Spread over all properties, this amounts to $300 per lot or 0.10 per cent of the average property value of $300 000.

4.8.2 Conclusions

Valuers-General indicated that there is expected to be an effect on property values, from putting cables underground but this could vary greatly. Average variations from 0.09 per cent up to 5 per cent were reported with individual property variations outside this range. The effect of putting cables underground on property values would appear to be area specific, and location specific within a particular area. In addition, the potential gain to a property owner in dollar terms would vary substantially depending on the nature of the property market at a particular place and time. It was also suggested that as areas are progressively serviced with underground facilities the effect is accordingly reduced, for once all land has equal amenity, the value of the amenity will no longer be relevant and price factors (based on supply and demand) will have a far greater impact.

Given the variance reported and the range of comments the working group considers that the figures summarised in Table 23 are indicative only and demonstrate no discernible national trend. It would therefore be a matter for individual areas and/or property owners to make their own judgements of how property values might be affected by putting cables underground.

4.9 SAVINGS IN TRANSMISSION LOSS FROM PUTTING CABLE UNDERGROUND

The conductors in electricity lines are not able to be perfect conductors as they have a property called electrical resistance. As current passes through them they heat up due to the resistance of the conductor. This heating effect consumes energy which cannot be delivered elsewhere and which therefore constitutes a 'loss'.

Heating of this nature raises the temperature of the conductor and any associated electrical insulation. In the case of overhead conductors, heating beyond a given temperature causes unacceptable deterioration of mechanical strength of the line and the sag in the line increases to the extent that safety clearances may be compromised. In the case of underground cables, heating of the conductor beyond a given temperature causes unacceptable deterioration of the electrical insulation and may lead to electrical breakdown. Thus the heating effect imposes a limit on the amount of current that an overhead line or underground cable may carry. This limit is described as the rating of the line or cable.

The degree to which heat can be removed from a conductor and transferred to its surroundings limits the increase in temperature and thus increases the rating. For overhead conductors, where usually a bare conductor is exposed to the air, particularly air currents, the heat is easily removed. For underground cables, where the electrical insulation and surrounding ground can act as thermal insulation, the heat is less easily removed. For an underground cable to achieve comparable ratings with an overhead line it would have to be significantly larger, resulting in less resistance and less heat to be transferred away so that it does not exceed its design operating temperature.

In practice, the cross-sectional area (to which resistance is inversely proportional) of an underground cable may be 50 per cent to 100 per cent greater than that of an overhead line of equivalent rating. Therefore, the loss of energy due to heating as current passes through the resistance of a conductor is reduced when an overhead line is replaced with an underground cable of equivalent rating.

The losses caused by the resistance of a conductor are calculated using a formula derived from Ohms Law:

$$P = I^2R \times 10^{-3}$$

where

P = power in kilowatts per kilometre
I = current in amperes
R = resistance of the conductor in ohms per kilometre

The losses measured in kilowatts per kilometre are sustained over time and the product of power and time is a measure of energy which can be expressed as kilowatt hours per kilometre per day.

As an example, take typical HV and LV overhead lines of 7/4.75 aluminium conductor (that is, 7 strands of aluminium each 4.75 mm in diameter twisted together to form a conductor of 125 sq mm cross section) which are replaced with underground cables with 240 sq mm aluminium conductor.

Assuming a typical load (or current) of 250 amperes and a typical domestic load cycle in a major city having off-peak hot water and with a distributed load, the savings of electrical energy through a reduction in losses as a result of putting the lines underground would be of the order of 20 kilowatt hours per kilometre per day for the high and low voltage lines. This represents approximately 0.3 kilowatt hours per day for a typical domestic electricity customer (that is, a 3 kVA domestic installation).

However, this figure is only an indication that there will be reduced electrical loss when overhead cables are replaced underground. The working group has been advised that it should not be used to calculate losses for any particular scheme to put cable underground as the local parameters will vary to a large degree. In particular, the load and loss factors will vary as will the cross sectional area of the cables, the load and the configuration of the load. Nor can the savings in losses be related to a saving in the need for peak generation plant across Australia, as peak load requirements are generally determined by other factors such as climatic influences.

4.10 POTENTIAL REDUCTION IN GREENHOUSE GAS EMISSIONS

The savings in transmission losses considered in Section 4.9 would result in some reduction of greenhouse gas emissions as the requirement to consume fossil fuels in the generation of electricity would be reduced. These reductions would need to be offset against the increased greenhouse gas emissions generated by the initial manufacture and installation of the underground network components. This is particularly the case for aluminium (the conductor in underground cables) which requires large amounts of electricity in its manufacture.

Given this cancelling effect, the net reduction in greenhouse gas emissions from putting cables underground would most likely be small. In addition, the calculation of reduced transmission losses, considered above, is theoretical and should not be applied to a particular scheme without further information derived from a more detailed network design. Taking these factors into account the working group considers that the size of this potential benefit from reduced greenhouse gas emissions did not warrant the expense of a more comprehensive study.

4.11 REDUCED ELECTROCUTIONS

As discussed in section 3.6 dealing with safety, data available to the working group on the incidence of electrocutions for overhead and underground electricity networks is inconclusive. The relative safety of networks depends on a number of factors and the working group does not consider that any potential changes in the number of electrocutions from putting cables underground is quantifiable on the available evidence.

4.12 REDUCED BUSHFIRE RISKS

This relates to the potential reduction in the number of bushfires caused by overhead electricity cable. The scope of this study was confined to cable located in urban Australia and it is most likely that bushfires caused by electricity cable would originate outside urban and suburban areas. The working group considered that it would be difficult to quantify the reduction in bushfires (if any) from removing overhead electricity cable in urban and suburban areas and therefore did not undertake such an analysis.

4.13 ANY BENEFICIAL INDIRECT EFFECTS ON THE ECONOMY, SUCH AS EMPLOYMENT

The indirect effects on the economy are considered in Chapter 5 in detail, as part of the overall assessment of funding options. Section 5.4.1 concludes that putting cables underground would have a negligible impact on aggregate employment.

4.14 CONCLUSION

The working group, in considering all the inputs from consultants, developed Table 24 to give an indication of the range in the value of benefits from putting cables underground. The relative size of this range is an indication of the level of uncertainty in the various methods used to calculate the value of benefits. Potential benefits based on reduced electricity outages were not included as insufficient data was available. Increases in property values were not included to make the figures compatible with those produced by the national cost and benefit model considered in Section 2.4.

Type of benefit	Annual benefits (a) ($ per km of line)	
	Minimum	Maximum
Reduced motor vehicle accidents (b)	1 358	2 793
Maintenance costs.	18 (c)	1 531 (d)
Tree trimming (e)	35	1 120
Transmission losses	0 (f)	292 (g)
Total	**1 411**	**5 736**

Table 24–Indicative range of annual benefits

(a) Figures are indicative only of a best case and worst case scenario. Their calculation involved the conversion and comparison of data derived by using widely differing assumptions and methodologies.
(b) Motor vehicle collision data comes from the work by the Bureau of Transport and Communications Economics.
(c) Based on Sinclair Knight Merz model and includes communications maintenance costs, but does not include tree trimming costs.
(d) Based on the discussion in section 4.6.2 of this report plus 5% for communications maintenance costs.
(e) Figures from Sinclair Knight Merz tree trimming model as presented in Table 22.
(f) Data from Sinclair Knight Merz, reproduced in Table 21.
(g) Derived from data in section 4.9 of this report.

4.14.1 Comparison with national cost and benefit model

The national cost and benefit model discussed in Chapter 2 determined a value of benefits derived from putting cables underground of $4 042 per kilometre of line per annum, in 1998 dollars. To calculate this figure the national model used input data from the stocktake and survey of costs and, for the purposes of comparison, the same four components[52] presented in Table 24. That is:

- motor vehicle accidents;
- maintenance;
- tree trimming; and
- transmission losses.

The figure of $4 042 lies in the third quartile of the range between maximum and minimum benefits identified in Table 24. The working group concludes from this that the benefit figures reported in the national cost and benefit model are reasonable. In that model the net benefit of putting cables underground was estimated to be 10.8 per cent of the total cost.

52 The four components are the most significant of those factors determining benefits, as they represent 96 per cent of the total benefit calculated by the national cost and benefit model.

4.15 UNQUANTIFIABLE BENEFITS

In the main, unquantifiable benefits comprise urban improvements flowing to local property owners, residents and visitors to a local area. These are primarily improved visual amenity stemming from improved streetscape aesthetics, removal of poles and wires, additional tree planting and reduction in the need to prune trees. They could also include issues such as reduction in wind noise or interference to television and radio reception.

The working group considers that these urban improvements are likely to be the primary benefits flowing from putting cables underground. It notes, however, that they are also the hardest to quantify as they are intangible, not separately tradeable, vary greatly from area to area and are dependent on people's individual perceptions.

A range of methods seeking to measure such urban amenity benefits was identified in a consultant's report on assessment of benefits[53]. These include conducting a contingent valuation, which involves the use of surveys to seek information directly from individuals as to their valuation of economic goods. In this case, a survey could be conducted of how much individuals might value the putting of cable underground in their area.

However, the working group has concluded that it would not attempt to undertake a national valuation of these otherwise unquantifiable benefits. The working group considers that, as well as being very expensive, such approaches may not in any case lead to results that would have widespread credibility.

In any case, the potential unquantifiable benefits should be considered in addition to the quantifiable benefits and costs in assessing whether to proceed with putting existing overhead electricity and telecommunications cables underground in any area.

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53 Bureau of Transport and Communications Economics, 1997 (b), *op cit*,

CHAPTER 5

FUNDING OPTIONS FOR PUTTING CABLES UNDERGROUND

From a list of 48 potential sources of funding, the working group has shortlisted four main funding options for further detailed consideration.

Common to the four shortlisted funding options is the concept that any organisations making savings as a result of cables being put underground would contribute accordingly to the costs.

The four shortlisted funding options are funding by:

- **property owners;**
- **electricity distributors and telecommunications carriers;**
- **the taxpayer through consolidated revenue; and**
- **a combination of property owners and the taxpayer through consolidated revenue.**

The four funding options have been evaluated against ten principles developed by the working group.

5.1 INTRODUCTION

Given the large cost involved in putting cables underground, the funding of such an activity is an important consideration. Term of reference 5 provides for the working group to report on the funding options, and associated issues and implications in any scheme for putting cables underground (see Chapter 5.3). It also provides an initial list of options that should be considered and an initial set of principles against which the funding options should be evaluated.

5.1.1 Summary of approach taken by the working group

In summary, the working group, through its Economic subcommittee:

- generated a full range of possible sources of funding;
- developed a number of principles against which to evaluate the funding options;
- shortlisted this to four main funding options, using a number of considerations, including the principles referred to above; and
- evaluated the four main funding options against those principles.

5.2 DEVELOPMENT OF FUNDING OPTIONS

5.2.1 Range of possible funding options

The working group used the list contained in the terms of reference as a starting point for the funding options. Other options have been discussed in public debate or submitted to the working group, and additional options were developed by the working group. This resulted in a wide-ranging list of 48 possible funding options, across the full spectrum of possible approaches, including philanthropy and corporate sponsorship, contributions from benefiting parties, levies and taxes.

5.2.2 Process of shortlisting funding options

A complete list of funding options and the shortlisting process has been documented by the Economic subcommittee[54]. The main considerations used in this process are described below.

Principle 10 states that funding options should be realistic and capable of being successfully implemented. Philanthropy and major corporate sponsorship, for example, were considered to fail this test. Equally, there should be some point to further examining any options shortlisted. It was considered that purely voluntary arrangements, for example, could proceed without the working group.

The working group considered that the shortlist should include any options they would reasonably have been expected to examine. Particular regard was paid to its terms of reference 5 and 8.

Many of the options are similar from an economic point of view. For example, revenue from the sale of Telstra, the Natural Heritage Trust, Work-for-the-Dole funds, the Federation Fund and general tax receipts are all contributions from Commonwealth consolidated revenue and have the same economic impact. The difference between them is regulatory or presentational rather than economic. Accordingly the working group nominated ‘taxpayer funded from Commonwealth Government consolidated revenue’ as a shortlisted funding option. The same is true of State and Territory Government consolidated revenue funding.

Some proposed options were in fact financing mechanisms rather than funding options. While superannuation funds and other investors may be approached to invest money, for example through a build, own, operate and transfer (BOOT) scheme, the scheme must ultimately repay the investor from a funding (rather than a financing) source.

An important principle, Principle 8 in the working group’s list was the desirability, on equity and efficiency grounds, that beneficiaries contribute funds to any program for putting cables underground in proportion to the benefits received by them. On this

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54 Economic Subcommittee of the Putting Cables Underground Working Group, *First Report on Funding Options*, 1997 (a).

basis, the working group determined that for all funding options, any quantifiable benefits from putting cables underground should be identified and paid for by those enjoying the benefits. For example, utilities (that is, electricity distributors or telecommunications carriers) should contribute in proportion to any savings in maintenance costs, Local Government should contribute for savings in pruning of trees and so on. These beneficiaries are discussed in Chapter 4.

This led to the decision that all the funding options should, therefore, be a composite of:

- avoided costs paid by those making the savings; and
- the 'gap' that remains between the cost of putting cables underground and these quantified benefits.

The funding options on the shortlist should, between them, cover the key groups most likely to be involved in, or to benefit from, any program to put cables underground. These are:

- individual property owners and local residents in areas where cables are put underground;
- utilities;
- utility customers, especially those in areas where cables are put underground;
- Local Government for areas where cable is put underground;
- residents of a State or Territory as a whole; and
- Australia as a whole.

5.2.3 Shortlist of funding options

Taking these considerations into account, four main funding options were shortlisted by the working group. Common to all options is that stakeholders each pay their quantifiable avoided costs. The four options for funding the 'gap' that remains between the cost of undertaking the work and the quantified savings or avoided costs are:

1 property owners;

2 national, State or Territory utilities (that is, electricity distributors and telecommunications carriers) levy;

3 Commonwealth, State or Territory tax payer funded consolidated revenue; or

4 property owners, with an additional component of contribution by the relevant Commonwealth, State or Territory Government.

To enable a more detailed analysis, three of the four main funding options were further subdivided as follows:

2a levy on utilities, recouped through higher tariffs for all users in Australia;

2b levy on utilities, recouped through higher tariffs for residential and commercial (but not industrial) users;

3a Commonwealth tax payer funded consolidated revenue;

3b State and Territory tax payer funded consolidated revenue;

4a the additional component by Commonwealth, State or Territory Government to represent only the quantified savings of those Governments. For example, savings in the health budget due to fewer motor vehicle accidents;

4b option 4a, plus any additional contribution which Commonwealth, State or Territory Government may wish to make. For example, as seed funding or to reflect wider community benefits, such as possible macroeconomic benefits or the improved visual amenity enjoyed by visitors to areas with underground cables.

The adoption of this shortlist of funding options by the working group does not imply a commitment by any of the members of the working group to provide funding. Rather, the purpose of the shortlisting is to provide a representative range of funding options for examination against the possible implications.

The working group also recognises that, in practice, some combination of different funding options could occur. For example, funding option 4b could be further extended to include a contribution by electricity distributors or telecommunications carriers that was in excess of the costs that they would avoid from cables being put underground. This is the case, for example, in the pilot program currently being completed in Western Australia (see Chapter 6), where the electricity distributor is contributing one third of the cost in certain areas, this being in excess of their avoided costs.

The analysis below of the separate funding options could also be used as a basis for making an assessment of any hybrid option. The impacts of a hybrid option would generally fall between the effects of the principal options of which it was composed.

5.3 PRINCIPLES AGAINST WHICH TO ASSESS FUNDING OPTIONS

The working group commissioned a report to identify principles which should be taken into account by Government when considering action (if any) in this area[55]. The report proposes nine principles[56] to be taken into account in making a decision about sources of funding for projects of this type.

1. Decisions on whether to put cables underground should consider all costs, including opportunity costs, against benefits.
2. The community should receive the level of underground cables for which it is willing to pay.
3. Market failures should not be addressed by distorting relative prices.
4. Upstream and downstream effects should be minimised.
5. Where possible, non-distortional (lump-sum) taxes and subsidies should be used.

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55 Allen Consulting Group, *Putting Cables Underground: Applicable Principles of Public Finance*, 1997 (a).

56 Allen Consulting Group, 1997 (a), *op cit*, page 15.

6. Putting cables underground should not create barriers to market entry or otherwise hinder competition.
7. Administration and compliance costs should be kept to a minimum.
8. Payments for putting cables underground should be proportional to benefits received.
9. Payment for putting cables underground should not be used as a redistributive mechanism.

The working group considers that these principles provide a useful basis for examination of the funding options. In adopting these principles, however, both the working group and the consultant recognise that two or more of the principles may conflict in some cases, so that trade-offs may be necessary. The working group has therefore adopted a further principle.

10 Subject to the other nine principles, any funding option should be realistic and should maximise outcomes.

5.3.1 Method of evaluation of the funding options against the principles

The working group commissioned three further consultants' reports to assist in evaluating the funding options against the ten principles. The reports set out to:

- establish a methodology to assess funding options[57];
- use the Monash Model to examine the macroeconomic effects of the funding options[58]; and
- determine the economic impact of the funding options, particularly in relation to competition[59].

All funding options were assessed within the framework established in the first consultant's report.

Macroeconomic effects

The second consultant's report uses the Monash econometric model of the Australian economy to analyse the effects of the different funding options on the economy, including effects on employment. The analysis assumed a full program to put cables underground would cost about $20 billion spent evenly over a period of 20 years, it also assumed estimated eventual savings of about 10 per cent or $200 million a year. These

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57 Allen Consulting Group, *Putting Cables Underground: Establishing a Methodology to Asses Funding Options*, 1997 (b).

58 Allen Consulting Group, *The Impact of Funding Options for Putting Cables Underground–Monash Modelling*, 1998 (b).

59 Allen Consulting Group, *Competition and Other Impacts of Funding Options for Putting Cables Underground*, 1998 (a).

estimates were provided to the consultant as indicative figures only, pending the release of processed results from the national costing model.

The total cost of a comprehensive program to put cables underground was subsequently estimated at $23.37 billion (see Chapter 2).~ *section 2.4 'national cost and benefit model'*~ Given that:

- underlying models used are essentially linear; and
- economic impacts identified by the Monash model are small,

the working group considered that the revised input data would not significantly affect the overall analysis of the funding options. Therefore the Monash Model was not run a second time with the new data.

Evaluating the funding options against key principles

The third of these consultants' reports[60] evaluates in detail the funding options against key principles, including:

- competition policy implications;
- administration costs;
- public and private sector borrowing requirements;
- Commonwealth, State and Territory Government financial arrangements; and
- the time cost of capital.

5.4 EVALUATION OF THE FUNDING OPTIONS AGAINST THE PRINCIPLES

The Economic subcommittee evaluated each of the funding options against the 10 principles[61]. Tables 25–28 are adapted from that report and provide a summary assessment of the four funding options against the 10 principles (including the seven funding sub-options). Following is a broad summary of the main findings.

5.4.1 Principle 1–Analysis of costs

Macroeconomic effects

The Monash model was used to analyse the effects on the Australian economy of the use of private funding and various taxation funding or financing options for putting cables underground on a large scale. The model suggests that in present value terms the direct costs of a project to put cables underground over the period 1998 to 2010 are equivalent to 1.97 per cent of a year's household consumption.

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60 Allen Consulting Group, 1998 (a), *op cit*.

61 Economic Subcommittee of the Putting Cables Underground Working Group, *Second Report on Funding Options*, 1998.

If however, extra taxes are imposed to pay for the project changes in economic behaviour occur. Table 24 shows the present values of the costs of the project over the period 1998 to 2010 as a percentage of a year's household consumption, taking account of the effects of the different taxes on employment, investment, capital creation, exports, imports, technology and other economic variables.

Costs of putting cable underground Impact of funding options as a proportion of household consumption (a)		
Option	**Type of tax to raise necessary funds**	**Proportion of year's household consumption (%)**
One–property owner	Municipal rate levy	2.29
Two–Utility levy	Selective levy	2.92
	Broad based levy	3.11
Three– Consolidated revenue	Income tax	2.62
	Payroll tax	2.88
Four– Multi-contributor	Variable depending on type and amount of Govt Contribution	2.29 to 2.88

Table 24–Impact of funding options as a proportion of household consumption

(a) Percentages are calculated as net value in 1998 dollars, assuming a discount rate of 5 per cent

The effect of option 4 will vary between the effect of option 1 and option 3, depending on the level of Government contribution. At one extreme, the multi-contributor option 4 is the same as the private funding option 1, where the consolidated revenue contribution is zero, and at the other extreme it is the same as the consolidated revenue option 3, where the consolidated revenue contribution meets the entire gap between total costs and quantifiable benefits.

Thus, whatever the funding options, a program to put cables underground is estimated to have an effective net decrease in overall household expenditure from what would otherwise have been assumed to be the case in the absence of such a program. The effect would not be large however, since the overall expenditure on the program would be a small proportion of the total domestic economy. Of the different funding options, the effects are lowest for option 1 because it is least distortional, inducing the least overall amount of changed economic behaviour.

The analysis also found that the impacts of putting cables underground on aggregate employment were negligible.[62]

Public and private sector borrowing requirements

62 Allen Consulting Group, 1998 (b), *op cit.*

While debt can be a useful means to bridge gaps between incurred costs and their payment, large amounts of debt can pose problems for economies. In recognition of this, an analysis was undertaken of the effects of the funding options on both public and private sector debt.

The analysis[63] suggests that as all funding options involve only a modest peak increase in public sector debt of $1.5 billion,[64]a program to put cables underground should not be a cause of concern to the financial markets. The peak levels of private debt for the options are:

- option 1, property owner funding–$3.0 billion;
- option 2, utility levy–$0.6 billion;
- option 3, tax payer funded consolidated revenue–$0.6 billion; and
- option 4, multi-contributor–$1.8 billion.

The relatively low levels of total peak debt (compared to a total project of around $20 billion) are due to debtors making repayments over time. While options 2 and 3 have the lowest level of private debt, they assume that the utilities could raise or governments could contribute $760 million per annum, in 1998 dollars, over a 22 year period. The consultant considered that maintaining such payments would substantially increase the risk of peak public debt rising beyond $1.5 billion, to meet any possible shortfall from the utility levy or the tax payer, respectively. As there is a greater level of public sector debt uncertainty directly or indirectly associated with options 2 and 3, options 1 and 4 were ranked above 2 and 3.

The broader question of debt in relation to financing options is considered in Chapter 6.

Commonwealth, State and Territory Government financial arrangements

It is a general principle of Government financing that it is undesirable for one level of Government to collect more taxes than it spends. Currently, there exists what is referred to as a 'vertical fiscal imbalance' in Commonwealth, State and Territory Government financing. That is the Commonwealth collects a greater proportion of total taxes and charges than it spends, while State and Territory Governments spend more than they collect. There is also a vertical fiscal imbalance between the Commonwealth and Local Government. In recognition of this, an analysis was undertaken of the effects on Commonwealth, State and Territory financial arrangements of the funding options.

The analysis[65] indicates that option 1 ranks best on this principle as there is a tight association between the beneficiaries and those who provide the funding. Option 2 ranks next because, although revenue is generally likely to be collected at the same level as expenditure (that is, within a State or Territory) there may still be some effects on the relativities used to determine the distribution of revenue assistance to the States and Territories by the Commonwealth Government’s Commonwealth Grants Commission.

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63 Allen Consulting Group, 1998 (a), *op cit*, page 7.
64 This amounts to about 1 per cent of current household debt levels.
65 Allen Consulting Group, 1998 (a), *op cit*, page 21.

Option 3 ranks least favourably, particularly in the case of Commonwealth revenue, where it would increase the vertical fiscal imbalance. The ranking of option 4 would depend on the extent of the Government component.

Time cost of capital

In regard to putting cables underground, there are two concepts of the 'time cost of capital' that are relevant. These are the required rate of return that:

- the asset has to generate to be a worthwhile investment (the 'hurdle' rate); and
- has to be earned by the asset.

The consultant concluded that these rates of return will be essentially unaffected by the project's method of funding[66].

Although the different funding options have different rates of debt, the consultant considered that such differences will probably not have any effect on the time cost of capital. In addition, as the proportion of quantifiable benefits derived from the project are small, the project would probably not influence the 'hurdle' rate.

The consultant's analysis of the effects of the different funding options on the real discount rate of capital suggests that, while there could be some small macroeconomic effects which would raise the discount rate of capital in the case of options 1 and 2, the effects are likely to be small.

5.4.2 Principle 2 – The community should receive the level of underground cables for which it is willing to pay

A major consideration for Government is that the community pays for any project undertaken only to the extent that it demands such expenditure. The 'user-pays' principle is one method of seeking to maximise achievement of this objective.

Option 1, property owner funding, is preferable in this regard, where those paying for the project make the decision to proceed. Option 4b addresses a shortcoming of option 1, namely, that the broader community, through Government funding, may be willing to make some contribution towards a project on the grounds that it enjoys the wider benefits (such as improved streetscapes) which the local community may not take into account in its decision making process.

Under any option, those individuals who are against the proposal will still be required to participate (and pay) where their local area agrees to proceed. However, options 1 and 4 allow for a greater degree of assessment of willingness to pay than do options 2, utility levies, and 3, taxpayer funded consolidated revenue. Options 2 and 3 run the additional risk that, by making a decision to put cables underground at a national, State or Territory level, there could be more cables put underground than the community as a whole desires.

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66 Allen Consulting Group, 1998 (a), *op cit*, page 61.

5.4.3 Principles 3, 4 and 5 – Impacts on pricing and possible market distortions

These three principles are:

- principle 3–market failures should not be addressed by distorting relative prices;
- principle 4–upstream and downstream effects should be minimised; and
- principle 5–where possible, non-distortional (lump-sum) taxes and subsidies should be used.

The impact of these on the four funding options are closely related. The analysis undertaken by the consultant[67] suggests that options 1, 3 and 4 can essentially satisfy these principles. Option 2, the utility funding option, may mean that levies on electricity and telecommunications services are likely to affect the cost and distort the consumption patterns for those services. This will in turn affect both upstream (those producing the services) and downstream (those using the services) industries. The effect will vary according to the dependence of the producer or user industries on those services.

5.4.4 Principle 6 – Putting cables underground should not create barriers to market entry or otherwise hinder competition

The consultant's analysis[68] finds that, irrespective of the source of funding, putting cables underground could act as a barrier to entry into the electricity and telecommunications industries, if the cost to potential new entrants of installing cables underground were greater than installing aerial cable.

It is therefore desirable on economic grounds, to reduce these effects as far as possible, for example, by:

- providing spare ducting capacity, where appropriate, to enable additional cable to be installed underground more easily (the technical and regulatory issues associated with use of ducts are discussed in Chapters 3 and 8); and
- ensuring appropriate access arrangements to other market entrants (as may be provided for in the regulatory environments for the industries), to avoid the need to install additional cable.

It is generally accepted that duplication of the electricity distribution network is neither necessary nor desirable in promoting competition. By contrast, while access arrangements in the telecommunications industry are important to facilitate competition, the increased future cost of installing underground rather than aerial cable could promote competition by encouraging the use of new or alternative technologies.

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67 Allen Consulting Group, 1998 (a), *op cit*, page 40.
68 Allen Consulting Group, 1998 (a), *op cit*, page 39.

In addition to this potential barrier to competition common to all funding options each, in various ways and to various degrees, would impose competitive restrictions or raise competitive concerns which should be addressed as far as possible in any program. Comparing the different funding options in this respect, the consultant found[69] that the most significant effect on the competitiveness of the electricity and telecommunications industries and those industries which are heavy users of those services would occur with a utility levy, as discussed in principles 3–5 above.

5.4.5 Principle 7 – Administration and compliance costs should be kept to a minimum

It is desirable that the costs to administer any funding mechanism should be small in proportion to the funds obtained. The consultant has found[70] that administration costs are likely to be:

- relatively low for funding option 3 as low cost revenue raising arrangements are already in place for governments;
- relatively high for funding option 2 to the extent that complex usage-based charges, rather than easy and cheaper to administer flat levies on households, are imposed; and
- relatively high for funding options 1 and 4, where property owners have a choice between putting cables underground or not.

5.4.6 Principle 8 – Payments for putting cables underground should be proportional to benefits received

While everyone in a community in which cables are put underground will benefit, some will benefit more than others. For example, property owners will probably receive the direct, private benefit of enhanced visual amenity. This 'horizontal equity' principle proposes that payments made by individuals should reflect the benefits that they receive.

As discussed above, this principle contributed to the working group’s development of the composite funding options, comprising payment by relevant organisations of quantifiable avoided costs and funding of the gap by other sources. In regard to funding of the gap, the following analysis has been made by the working group, on the basis of the consultancy reports.

Option 1 directly aligns the primary beneficiaries with costs. However, there may be some advantages to the broader community from improved visual amenity in those areas where the project has been completed, without the community generally having contributed to the cost.

Option 2 involves a cross-subsidy to:

- those who value the putting of cable underground highly; from

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69 Allen Consulting, 1998 (a), *op cit*, page 59.
70 Allen Consulting, 1998 (a), *op cit*, page 31.

- rural Australians, industry generally and urban communities who do not rate this highly.

Further, even the main beneficiaries do not pay in relation to the benefit received, but in relation to their use of electricity and telecommunications, although there is some reduction of this cross subsidy under option 2b (targeted levy) in respect of non-urban and industry users.

Option 3 also involves a cross-subsidy to:

- those who value the putting of cable underground highly; from
- rural Australians, industry generally and urban communities who do not rate the putting of cable underground as highly as others.

Option 4, particularly 4b, aligns primary beneficiaries with costs, as well as allowing the opportunity for an appropriate level of Government contribution to reflect wider community benefits.

5.4.7 Principle 9 – Payment for putting cables underground should not be used as a redistributive mechanism

This principle means that payment for putting cable underground should not be used as a mechanism to redistribute wealth from high to lower income households (or vice versa). In the case of redistribution of wealth from high to lower income households, there are general mechanisms in place which are more suitable and effective for this purpose, such as the progressive rate of income tax and pension and allowance support systems.

The consultant report on macroeconomic effects found that option 2 could be regressive in its effects (that is, to impact more heavily on low income households, since utility charges are a higher proportion of their household expenditure) whereas option 1, property owner funding, would be distributionally neutral[71]. The distributional effects of funding option 3, taxpayer funded consolidated revenue, would be dependant on the taxation method used. The effects of option 4, multi-contributor funding, would depend on the level of Government contribution.

The issue of redistribution is different from that of affordability. This issue is discussed in Chapter 6, where it is noted that the provision of financing arrangements (to enable the spreading of payments over a period of time) may assist in making programs to put cables underground more affordable.

5.4.8 Principle 10 – Subject to the other nine principles, any funding option should be realistic and should maximise outcomes

The working group considers that, essentially, all the funding options and their hybrids are practicable (regulatory issues associated with implementation of funding options are

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71 Allen Consulting, 1998 (b), *op cit*, page 10.

examined in Chapter 8). The issue of whether funding options are realistic and acceptable involves a judgement by Government.

Principle	Private funding option
1 Decisions on whether to initiate a program of putting cables underground (u/g) should consider all costs, including opportunity costs against benefits.	*Macroeconomic*: Slightly lower *Employment:* *Short Term* Higher *Long Term* Slightly Lower *Public/Private Debt* OK *Time Cost of Capital* Small *Fed/State Fin. Arrgmt* Benign
2 The community should receive the level of u/g that it is willing to pay for	Slightly lower level of u/g may occur than community as a whole desires.
3 Relative prices should not be distorted.	Meets the principle.
4 Up & downstream effects should be minimised.	Meets the principle.
5 Uses non–distortional taxes and subsidies.	Meets the principle.
6 U/g should not create barriers to entry(a) or hinder competition.	Benign
7 Transaction and compliance costs should be kept to a minimum.	Relatively high costs.
8 Payments for u/g should be proportional to benefits received.	Broader community may not contribute for benefits. May be some free-rider effects.
9 Payment for u/g should not be used as a redistributive mechanism.	Distributionally neutral.
10 Subject to other principles option should be realistic & maximise outcomes.	Meets the principle.

Table 25–Summary of assessment of private funding option against principles

(a) Irrespective of the source of funding, putting cables underground could act as a barrier to market entry to the electricity distributors and telecommunications carriers.

Principle	Utility levy option A (all users)	Utility levy option B (residential & commercial users)
1 Decisions on whether to initiate a program of putting cables underground (u/g) should consider all costs, including opportunity costs against benefits.	*Macroeconomic*: Slightly lower *Employment:* *Short Term* Higher *Long Term* Slightly Lower *Public/Private Debt* OK *Time Cost of Capital* Small *Fed/State Fin. Arrgmt* Benign	*Macroeconomic*: Slightly Lower *Employment*: *Short Term* Higher *Long Term* Slightly lower *Public/Private Debt* OK, small risk *Time Cost of Capital* Small *Fed/State Fin: Arrgmt* Medium
2 The community should receive the level of u/g that it is willing to pay for	Higher level of u/g may occur than community as a whole desires.	Higher level of u/g may occur than community as a whole desires.
3 Relative prices should not be distorted.	Does not meet this principle.	Does not meet this principle.
4 Up & downstream effects should be minimised.	Does not meet this principle.	Does not meet this principle.
5 Uses non–distortional taxes and subsidies.	Does not meet this principle.	Does not meet this principle.
6 U/g should not create barriers to entry(a) or hinder competition.	Very problematic	Very problematic
7 Transaction and compliance costs should be kept to a minimum.	Relatively high costs for usage-based charges.	Relatively high costs for usage based charges.
8 Payments for u/g should be proportional to benefits received.	Urban local areas do not contribute fully – cross-subsidies.	Urban local areas do not contribute fully - cross-subsidies.
9 Payment for u/g should not be used as a redistributive mechanism.	Regressive. Impacts more heavily on low income households.	Regressive. Impacts more heavily on low income households.
10 Subject to other principles option should be realistic & maximise outcomes.	Meets the principle.	Meets the principle.

Table 26–Summary of assessment of utility levy funding options against principles

(a) Irrespective of the source of funding, putting cables underground could act as a barrier to market entry to the electricity distributors and telecommunications carriers.

Principle	Taxpayer Funded Consolidated Revenue Option A (Commonwealth)	Taxpayer Funded Consolidated Revenue Option B (State and Territory)
1 Decisions on whether to initiate a program of putting cables underground (u/g) should consider all costs, including opportunity costs against benefits.	*Macroeconomic*: Slightly lower *Employment:* *Short Term* Higher *Long Term* Slightly Lower *Public/Private Debt* OK *Time Cost of Capital* Small *Fed/State Fin. Arrgmt* Benign	*Macroeconomic*: Slightly Lower *Employment*: *Short Term* Higher *Long Term* Slightly lower *Public/Private Debt* OK, small risk *Time Cost of Capital* Small *Fed/State Fin: Arrgmt* Medium
2 The community should receive the level of u/g that it is willing to pay for	Higher level of u/g may occur than community as a whole desires.	Higher level of u/g may occur than community as a whole desires.
3 Relative prices should not be distorted.	Meets the principle.	Meets the principle.
4 Up & downstream effects should be minimised.	Meets the principle.	Meets the principle.
5 Uses non-distortional taxes and subsidies.	Meets the principle.	Meets the principle.
6 U/g should not create barriers to entry(a) or hinder competition.	Benign	Benign
7 Transaction and compliance costs should be kept to a minimum.	Relatively low costs.	Relatively low costs.
8 Payments for u/g should be proportional to benefits received.	Urban local areas do not contribute fully – cross-subsidies.	Urban local areas do not contribute fully – cross-subsidies.
9 Payment for u/g should not be used as a redistributive mechanism.	Distributional effects depend on the taxation method used.	Distributional effects depend on the taxation method used.
10 Subject to other principles option should be realistic & miximise outcomes.	Meets the principle.	Meets the principle.

Table 27–Summary of assessment of taxpayer funded consolidated revenue options against principles

(a) Irrespective of the source of funding, putting cables underground could act as a barrier to market entry to the electricity distributors and telecommunications carriers.

.Principle	Multi-Contributor Option A(a) (Govt pays avoided costs)	Multi-Contributor Option B(a) (extra Govt contribution)
1 Decisions on whether to initiate a program of putting cables underground (u/g) should consider all costs, including opportunity costs against benefits.	*Macroeconomic*: Slightly lower *Employment:* *Short Term* Higher *Long Term* Slightly Lower *Public/Private Debt* OK *Time Cost of Capital* Small *Fed/State Fin. Arrgmt* Benign	*Macroeconomic*: Slightly Lower *Employment*: *Short Term* Higher *Long Term* Slightly lower *Public/Private Debt* OK, small risk *Time Cost of Capital* Small *Fed/State Fin: Arrgmt* Medium
2 The community should receive the level of u/g that it is willing to pay for	Slightly lower level of u/g may occur than community as a whole desires.	Allows for level of u/g may occur that community as a whole desires.
3 Relative prices should not be distorted.	Meets the principle.	Meets the principle.
4 Up & downstream effects should be minimised.	Meets the principle.	Meets the principle.
5 Uses non-distortional taxes and subsidies.	Meets the principle.	Meets the principle.
6 U/g should not create barriers to entry(b) or hinder competition.	Benign	Benign
7 Transaction and compliance costs should be kept to a minimum.	Relatively high costs.	Relatively high costs.
8 Payments for u/g should be proportional to benefits received.	Broader community may not contribute fully. May be some free-rider effects.	Allows for all parties to contribute - broader community to extent Govt considers appropriate.
9 Payment for u/g should not be used as a redistributive mechanism.	Distributional effects depend on size and type of taxation.	Distributional effects depend on size and type of taxation
10 Subject to other principles option should be realistic & miximise outcomes.	Meets the principle.	Meets the principle.

Table 28–Summary of assessment of multi-contributor funding options against principles

(a) A relatively small level of taxpayer funded consolidated revenue (CR) contribution, to reflect wider community benefits, is assumed in this Table. The costs therefore approximate the costs associated with the private funding option. However, as the level of CR contribution rises, the costs move towards those associated with the CR options. At one extreme, the multi-contributor options are the same as the private funding option (where CR contribution is zero) and at the other extreme the multi-contributor options are the same as the CR options (where CR contribution meets entire gap between total costs and quantifiable benefits).

(b) Irrespective of the source of funding, putting cables underground could act as a barrier to market entry to the electricity distributors and telecommunications carriers.

5.5 COMPARATIVE ASSESSMENT OF FOUR MAIN FUNDING OPTIONS

Based on the assessment in this chapter, the working group ranks the funding options, in order of preference against the principles, as:

- first – multi-contributor funding (option 4);
- second – property owner funding (option 1);
- third – taxpayer funded consolidated revenue (option 3); and
- fourth – utility levy (option 2).

The rationale behind the above order is set out below.

5.5.1 Utility levy – funding option 2

As described in section 5.2.3, two sub-options of the utility funding option were examined:

- levy on utilities, recouped through higher tariffs for all users in Australia; and
- levy on utilities, recouped through higher tariffs for residential and commercial (but not industrial) users.

These sub-options are in effect a specific tax on the electricity and telecommunications industries, the utility funding option is likely to affect the cost of production and to distort the consumption of electricity and telecommunications services (principles 3, 4 and 5). This will thus affect the competitiveness of both the upstream (those producing the services) and downstream (those using the services) industries (principle 6). Such impacts would work against the policy directions for the electricity and telecommunications industries, which has been moving towards achieving lower prices for consumers using both competition and price regulation mechanisms.

In terms of equity, the utility funding option involves a cross-subsidy to those who enjoy the primary benefits of cable being put underground (local property owners) from those who do not so benefit, such as rural Australians and industry generally, as well as from urban communities who do not value this highly (principles 2 and 8). It is also regressive in that it impacts more on low income households (principle 9).

The administration costs of a utility funding option are generally satisfactory (principle 7).

In regard to costs (principle 1), the overall economic impact (as assessed by net decline in overall household expenditure), while not large in absolute terms, is greatest for this funding option. It would also impact badly on Commonwealth-State financial arrangements and would involve a slightly increased public debt uncertainty than the private funding option. On the other hand, while there is an estimated short-term negative effect on employment from this funding option, in the long term, the overall decline in employment is slightly less for this option than for the private funding option, although again the effects are not large in absolute terms.

Of the two utility funding sub-options which have been examined, the levy on residential and commercial (but not industrial) users is preferable to the levy on all users in Australia. Where the tax is not imposed on industrial and non-urban electricity and telecommunications users, the disadvantages of the funding option in regard to the effects described above are not as marked.

5.5.2 Taxpayer funded consolidated revenue – funding option 3

As described in section 5.2.3, two sub-options of the consolidated revenue funding option have been examined:

- taxpayer funded through Commonwealth consolidated revenue; and
- taxpayer funded through State and Territory consolidated revenue.

Since this funding option involves general taxation, rather than a levy on a specific industry, it avoids the distortionary impacts discussed above of utility levies (principles 3, 4 and 5). Nor does it have the particular competition policy issues (principle 6) associated with utility levies. However, as discussed earlier in this chapter, there is an impact on industry competitiveness that would arise from any project to put cables underground, regardless of funding source.

The consolidated revenue funding option also has the same drawback as the utility option, namely, that there are cross subsidies from taxpayers in areas where aerial cables remain to those areas where they are put underground (principle 8). A related issue here is that a higher level of cable may be put underground than the community as a whole would wish (principle 2). Distributional effects (principle 9) would be dependant on the taxation method used.

The administration costs of a consolidated revenue funding option are generally satisfactory (principle 7).

In terms of the range of costs assessed under principle 1, while the overall economic impact (as assessed by net decline in overall household expenditure) is not large in absolute terms and is less than that of the utility funding option, it is still greater than the private funding option. Similar to the utility funding option, this funding option would impact badly on Commonwealth-State financial arrangements and would involve a slightly greater public debt uncertainty than the private funding option. The effects on employment are also similar to the utility funding option.

Of the two consolidated revenue funding sub-options which have been examined, the State and Territory is slightly preferred to the Commonwealth funding option in that it provides a closer alignment of those paying with those enjoying benefits and has less impact on Commonwealth-State financial arrangements.

5.5.3 Property owners – funding option 1

A principal advantage of this option over the utility and consolidated revenue funding options is the closer alignment between those who pay and those who benefit (principle 8), together with the corollary (principle 2) that the level of cable put underground is close to the level for which the community is willing to pay. It is also distributionally neutral (principle 9).

While the cost impacts of this option are not large in absolute terms, it is also, on balance, superior in regard to cost (principle 1). Its long term employment effects are estimated to be slightly worse than those of the utility and consolidated revenue funding options (even though the short term employment effects are better). This is outweighed by its superiority in terms of Commonwealth–State financial arrangements and because it involves the least reduction in household consumption.

The property owners funding option is comparable to the consolidated revenue funding option in terms of effects on the electricity and telecommunications industries (principles 3, 4, 5 and 6).

5.5.4 Multi-contributor – funding option 4

As described in section 5.2.3, two sub-options were examined, comprising the property owners funding option, with an additional component of tax payer funded consolidated revenue contribution, either to reflect:

- quantifiable avoided costs, such as reduced motor vehicle accidents; or
- a further additional component to reflect broader community interests, such as the increased amenity enjoyed by visitors to the areas where cables are put underground.

These options are considered to be slightly preferable to the property owner funding option, in that, through the ‘fine-tuning’ provided by the additional consolidated revenue contribution, they effectively allow a closer matching of beneficiaries with those contributing (principle 8). Similarly, there is a closer alignment in regard to principle 2 (matching the level of cable put underground to the willingness to pay).

Of the two, the second sub-option described above is slightly preferable to the first, in that the additional component allows for broader community interests to be reflected and this might not be taken into account by the local community in making its decision.

An important issue in regard to these options is assessing which level of Government might contribute to the funding and the appropriate amount (if any) of that funding. In making these judgements it would be necessary to take into account the:

- current responsibilities of Government in relation to overhead cable;
- disadvantages of taxpayer funded contributions, as discussed in the consolidated revenue funding option above; and
- advantages of reflecting broader community interests in decisions to put cables underground.

CHAPTER 6

FINANCING

Financing issues are examined in the context of the multi-contributor funding option.

Two completed, self financed projects in municipalities in Western Australia are examined.

Access to long term loan arrangements may increase the participation of property owners in projects to put cables underground, but as with any borrowing, there is a cost penalty in the form of interest or other additional payments.

A private sector financing approach was developed by a consultant.

6.1 INTRODUCTION

For the purposes of this report the terms 'funding' and 'financing' have specific meanings:

- funding considers who should be responsible for paying; and
- financing considers how the organisation or individual responsible for paying raises the necessary money to make the payment.

Based on this distinction, this chapter will discuss in general terms financing mechanisms currently in place at Local Government level. Although different State and Territory legislation governs the operation of Local Government in each of their respective States and Territories, similar financing mechanisms apply. A private sector financing approach was developed by a consultant[72] and is described in Appendix 8~go to Appendix 8~. Financing options available to individuals are not discussed, since the process for obtaining personal finance is well understood.

The multi-contributor funding option, described in Chapter 5[73] was considered to be superior to utility or consolidated revenue funding, on the grounds of both economic efficiency and equity. However, the working group recognises that this funding option involves significant financial contributions from property owners in the local area. The working group also recognises that willingness to participate in future schemes by less affluent individuals, or in less affluent areas, is likely to be influenced by property

[72] McDonnell J, *Putting Cables Underground – A Private Sector Funding* International Trade and Data Services, Sydney, 1998.

[73] Under this option organisations that enjoy direct quantifiable benefits from cables being placed underground would contribute to funding an amount at least equivalent to those benefits with the remainder of the cost met by property owners, with possible, limited contribution from taxpayer funded consolidated revenue.

owners' access to longer term financing arrangements. Experience of completed projects[74] to put cables underground is that councils have self financed their share of the costs and subsequently levied property owners to cover these costs. The property owners have either participated in a council based scheme to assist them to pay the levy or organised their own finance.

6.2 FINANCING – TWO CASE STUDIES

The suburb of Applecross in the City of Melville, Perth, and the coastal Town of Albany were part of a pilot scheme in Western Australia for the replacement of overhead power supplies with underground facilities.[75] Both municipalities are relatively high-income areas with significant urban amenity. Applecross has river frontages and Albany is by the sea. Both the City of Melville and the Town of Albany self-financed the project (the Council's contribution was one third of the total cost with the State and Western Power financing the balance) and collected payments from property owners as described below.

6.2.1 Melville

The City of Melville allowed individual property owners to pay their contribution in a number of ways:

- ratepayers were given one year to pay the 'underground' levies without any interest charge and beyond that normal interest was applied;
- those who wished to make a one-off payment of the amount, within 35 days of the rates notice, received a 5 percent discount (approximately half of the ratepayers paid within the first 35 days); and
- eligible pensioners were able to defer payment of the amount without incurring interest until the property was sold. Upon sale of the property the existing owner pays any amount outstanding in connection with the work to put cables underground and the new owner is not required to pay for any of the conversion work.

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74 Allen Consulting Group, *Putting Cables Underground: Applicable Principles of Public Finance*, Melbourne, 1997 (a).

75 In this pilot project the State Government, Local Government, and Western Power each contributed one third of the cost of the project. In future projects the State Government (including Western Power) and Local Government will each contribute half the cost.

6.2.2 Albany

The Town of Albany reduced the number of other projects for the year thereby eliminating the need for a general rate increase to cover the Council's contribution. Half of the Council's contribution was funded from the general rate base and the balance from a specific charge levied on affected property owners. Two payment options were available in relation to this charge:

- four interest free instalments over the first year only; or
- a five year payment program including an interest component.

The majority of funds were collected during the first year. The deferred payment program provided some recognition of varying capacities to pay. Any property owners unable to meet either schedule were dealt with on a case by case basis, and pensioners could defer payment until they sold their property.

6.3 LOCAL GOVERNMENT FINANCING

The working group has found no Australian examples of financing schemes specifically for projects to put cables underground[76]. Consequently, councils would need to use existing mechanisms to raise finance for such projects[77].

Local Government derives its income from:

- Commonwealth and State Government grants, in the form of general purpose grants and identified local road grants;
- rates and charges which are determined by the council[78] and generally constitute half of the council's income; and
- specific consumer charges which generally make up a third of the council's income and would include, for example, charges for services like meals on wheels.

All three sources of income are governed by Commonwealth and relevant State/Local Government legislation[79].

There is also a process by which councils may raise revenue for specific projects by imposing special purpose rates. This process, generally used for capital works, is open to public scrutiny and is appealable (by those affected) to a State level appeals tribunal.

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76 In the Western Australian pilot scheme it was a matter for local councils to organise how their share of the costs would be met.

77 Material in this section was provided by the Federal Treasury, ; and the National Office of Local Government, and discussions with Banyule City Council.

78 Many Local Government authorities are also subject to a range of price-capping structures as part of their charging arrangements.

79 *Local Government (Financial Assistance) Grants Act 1995*; and for example the *NSW Local Government Act 1993*

The tribunal is usually empowered to approve, vary, or refuse special purpose rates schemes. In practice, very high levels of community support[80] would be needed for such rates to be imposed. For instance Banyule City Council consider they would require 80 per cent to 90 per cent support.

There are also State mechanisms in place for councils to borrow for capital works. Generally, the council must satisfy State guidelines on the nature of the works to be funded, and the repayment mechanism to be used (such as the previously mentioned special purpose rates). This financing mechanism is part of the Loan Council process. Accordingly any project to put cables underground would be subject to assessment against other council priorities.

6.3.1 Special rates and charges – example of process and appeal rights

By way of example, in Victoria the process for declaring special rates and charges and the appeal rights available under the Victorian *Local Government Act 1989* (LGA) is outlined below.

Before a Council declares a special rate or charge it must give public notice of its intention at least 28 days before making the declaration (section 163(1A) LGA):

- copies of the proposed declaration of the special rate/charge are to be available for inspection at the Council office for at least 14 days after the publication of the notice (section 163(1B) LGA); and
- any person may make a submission to Council in relation to a proposal to declare a special rate or charge (section 163A LGA).

Once a special rate or charge has been declared by Council the following appeal process applies:

- an owner can apply to the Victorian Civil and Administrative Tribunal (VCAT)[81] for review of a decision by Council imposing a special rate or charge. This appeal right is generally only available to owners as the persons who are liable to pay rates and charges (under section 156 LGA) except in exceptional circumstances; and
- the person must apply to VCAT for a review within 30 days after the date of issue of the special rate or charge (section 185(2)(a)).

Section 185(2)(b) LGA sets out four grounds on which the owner may apply for review of a special rate/charge. They are:

- the works and projects or the period of maintenance for which the special rate or charge was imposed do not or will not provide a special benefit to that person;
- the basis of distribution of the rate or charge amongst those persons who are liable to pay it, is unreasonable;

80 Community support is also discussed in Chapter 9.
81 The Tribunal replacing the old Administrative Appeals Tribunal.

- if the planning scheme for the area contains any relevant policies or specific objectives that are inconsistent with the works and projects proposed for the construction of a road or for the drainage of any land; or
- if the planning scheme for the area does not contain any relevant policies or specific objectives, the works and projects proposed for the construction of a road or for the drainage of any land are unnecessary, unreasonable, excessive, insufficient, unsuitable or costly, having regard to the locality or environment and to the probable use of the road or drainage of the land.

The VCAT has powers to:

- vary the special rate or charge in relation to its application to the applicant;
- set aside the special rate or charge; or
- dismiss the application and confirm the special rate or charge (section 185(3) LGA).

There are also limited appeal rights to the County Court for a "person aggrieved" by a rate or charge, or anything included or excluded from a rate or charge. Section 184 of the LGA deals with the appeal process. It provides that the person must lodge the appeal with the Court within 60 days after first receiving written notice of the rate or charge.

The grounds of appeal are limited to:

- if the land in respect of which the rate was declared was not rateable land;
- the rate or charge assessment was incorrect; or
- the person levied with the rate or charge was not liable to be rated.

6.4 ABILITY TO PAY - SOCIAL ISSUES

As discussed in Chapter 5 and in the report Principles of Public Finance[82] , one of the equity principles which the working group accepted is that funding for putting cables underground should not be used as a mechanism to redistribute wealth from higher to lower income households[83]. This would be more critical in the context of a national scheme, particularly if it were centrally funded. In local area schemes, sufficient well established mechanisms are in place at Local Government level to assist those with lesser means to pay (such as deferred payments until the property is sold). Nevertheless opposition to the additional impost of a special rates scheme could be expected from ratepayers on low or fixed incomes.

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82 Allen Consulting Group, 1997 (a) *op cit*.

83 General mechanisms already in place were seen to be more suitable and effective forms of redistribution–notably the progressive scale of tax rates in the income tax schedule, the pensions and benefits system and related allowances, concessions and rebates (including municipal rates rebates).

It should be noted that there will almost certainly be cost penalties for any financing or deferred payment options. Long term repayment options will attract interest or an equivalent payment for the cost of capital, as in any financing arrangement. Those who can afford to pay up front would potentially be at an advantage over those who make repayments over a longer term. Ratepayers in the City of Melville and the Town of Albany who paid within a specified time received a discount and did not pay additional interest.

Individual rate payers are free to raise their own finance in order to benefit from making an up front payment. Councils generally prefer to organise project finance themselves and recover the cost by means of the rates collection process. The collection of rates is the only legislative mechanism available to Local Government to ensure participation. Consequently, difficulties may arise where contributions are required from non-ratepaying property owners (such as Commonwealth or State/Territory Government organisations) who decline to pay.

Experience in Western Australia is that obtaining contributions from non-ratepaying property owners such as Telstra, water providers (utilities) and educational institutions has proven difficult. In most instances the cost to install underground power to these premises does not equate with the special rate charge being imposed by the local authority. In some cases, the cost exceeds the contribution raised from the special rate charge and in other cases, the cost is considerably less than the charge sought by the local authority.

The Western Australia Underground Power Program has resolved this through direct negotiation between the Underground Power Project Manager and the respective entity. The solution has been for the Project (through Western Power) as opposed to the local authority to charge direct cost of connection to each non-rateable property.

Where councils arrange financing, interest payments could either be passed on to the rate payer or be fully or partially absorbed by the council to assist those less able to pay. In this instance the cost penalty is absorbed by the council on behalf of the property owners. However, it is likely that a council could borrow money at a lower rate of interest than that prevailing on the open market.

The Western Australia State Underground Power Program provides for an interest subsidy from the State Government to Councils with limited financial resources who are required to borrow in order to raise funds for their contributions towards a project. To date no Council has taken up this offer.

6.5 DEBT AND EQUITY

The discussion of financing thus far has been of debt, that is of borrowing to finance a project over a fixed term at an agreed rate of interest. Finance may also be raised by selling equity in a project. This entitles the equity holder to a share of any profits as well as a right to influence the policy decisions affecting the management of the project. An equity holder takes a full share of the financial risk.

Equity is said to be more expensive than debt because equity holders will expect a higher return from their investments, to cover a higher level of risk, than would be sought by a lender. Conversely, lenders of finance attempt to reduce risk as far as possible and have priority in payment over an equity holder in the event of insolvency, consequently making debt less expensive than equity.

6.6 PRIVATE SECTOR FINANCING APPROACHES

The Working Group commissioned a report to explore whether a private sector financing option would be possible. The consultant[84] developed a fully <u>private sector financing model</u> to test one method of using private financing alone to meet the cost of an infrastructure project, such as putting cables underground. The major features of that model are set out in <u>Appendix 8</u> and are discussed in the consultant's report.

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84 Mc Donnell, J, *Putting Cables Underground – A Private Sector Funding Approach,* International Trade and Data Services, Sydney, 1998

CHAPTER 7

LEGAL FRAMEWORK RELEVANT TO PUTTING CABLES UNDERGROUND

State and Territory planning policies generally require new electricity and telecommunications cable to be installed underground in greenfield residential subdivisions, and in some States, like Western Australia, commercial subdivisions.

At present there are no State or Territory requirements for putting existing electricity cables underground, although there are a number of programs to facilitate installing some cables underground in established areas.

The Commonwealth, State and Territory Governments have between them the power to require all existing overhead electricity and telecommunications cables to be put underground.

While there are currently no requirements to initiate a program to put existing telecommunications cables underground, there is a requirement that, where overhead electricity cables are removed, any existing telecommunications cables must also be removed within six months.

Government policies for the electricity and telecommunications industries have been to promote lowest costs and improved services for consumers, including through the use of competition and price regulation.

The commercial impact of taxation legislation is considered.

7.1 INTRODUCTION

Term of reference 1 provides for the working group to undertake a stocktake of existing State and Territory laws or policies concerning the placement of cabling underground and terms of reference 6 and 8 provide for an examination of regulatory issues, including constitutional issues, relating to requiring cables to be put underground.

The working group has gathered material for this task in several ways:

- working group members representing State and Territory Governments provided information on relevant laws and policies;
- consultants were appointed to provide background on industry structure and legal and regulatory issues[85], economic regulation[86]~ and private financing possibilities[87] pertaining to putting cables underground; and

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[85] Australian Government Solicitor, *Background Paper on Industry Structure and Legal Regulatory Issues Pertaining to Putting Cables Underground*, 1997 (a)

[86] Australian Government Solicitor, *Supplementary Information on Price Regulation*, Canberra, 1997 (b).

- advice was obtained from the Commonwealth Office of General Counsel (OGC) on constitutional issues relating to funding[88].

There is considerable variation between the States and Territories in the regulation of the electricity industry and in the administration of planning powers for installation of telecommunications infrastructure. The detailed provisions for the Commonwealth and each of the States and Territories are described in the documents referred to above. Only the key findings are summarised in this Chapter, in four sections:

- existing laws and policies for installing new cables;
- options and constraints for future policies in relation to installing new cables;
- current laws and policies in relation to putting existing aerial cable underground; and
- options and constraints for future policies in relation to putting existing aerial cable underground.

7.2 NEW CABLE–EXISTING LAWS AND POLICIES

In practice, State and Territory planning policies generally require electricity and telecommunications cables to be installed underground in greenfield sites, such as new residential subdivisions. The regulatory frameworks under which these policies are implemented are outlined below.

7.2.1 Telecommunications

Telecommunications is regulated under Commonwealth powers, principally in the *Telecommunications Act 1997*, but responsibility is passed to the States and Territories, with some limited exceptions, for planning and environmental approval of new overhead telecommunications cabling. Under the current State and Territory frameworks, the decision making process rests largely with Local Government. The planning and environmental protection regimes, in many instances, allow for the refusal of the installation of new overhead telecommunications cables.

The exceptions to this process include:

- an exemption, up to 1 July 2000, in relation to certain new subscriber connections;
- the ability to obtain an exemption, through a facility installation permit, in some circumstances where the network involved is of national significance. In such circumstances the Australian Communications Authority (ACA) must hold a public inquiry and the project must meet a list of criteria set out in the *Telecommunications Act 1997* before a facility installation permit may be issued; and

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87 Mc Donnell, J, *Putting Cables Underground–A Private Sector Funding Approach,* International Trade and Data Services, 1998.

88 Office of General Counsel, *Putting Cables Underground–Terms of Reference 8,* Legal advice on Constitutional issues, Canberra, 1997.

- the installation of low impact facilities considered essential to maintaining telecommunications networks, but unlikely to cause significant community disruption during their installation or operation. Low impact facilities are listed in the *Telecommunications (Low Impact Facilities) Determination 1997* and installation is subject to the *Telecommunications Code of Practice 1997*.

States and Territories are also prevented from passing legislation that discriminates against telecommunications carriers, by virtue of Clause 44 of Schedule 3 of the *Telecommunications Act 1997*. Examples of the types of laws which may activate this provision might be a tax on equipment installed by a carrier in a public place which does not apply to similar equipment installed by an electricity distributor, or a law which gives special powers and immunities to selected carriers in relation to the installation of telecommunications facilities which are not given to carriers in general. However, the responsible Commonwealth Minister has the power to exempt State and Territory laws which might trigger the anti-discrimination provisions of clause 44, although at present no exemptions have been granted nor sought by States or Territories.

Underground cable facilities not more that 150 metres long and 150 millimetres wide are currently designated low impact. The installation of underground cabling over 150 metres in length falls outside the list of facilities defined as low impact and must, therefore, comply with the relevant State, Territory or Local Government planning and environmental regulations, or seek an exemption by means of a facility installation permit. This means that installation of underground cabling over 150 metres in length is subject to the State control regime. In some States (eg South Australia), underground installations are generally not subject to control. In most States, however, controls do apply and this may have the effect of inhibiting the installation of underground cables. Modifying the 150 metre limit may assist in removing this inhibition.

7.2.2 Electricity

The electricity industries are generally regulated at State and Territory level. In most States and Territories, electricity installations which are not part of subdivision proposals are generally exempt from Local Government approval processes (apart from restrictions that may arise from heritage and environmental provisions). Cabling in greenfields subdivisions is generally subject to the normal development approval processes.

7.2.3 Electricity Pricing

The price at which electricity is offered to consumers is regulated at the State and Territory level. In New South Wales for example, the price takes into account the cost of providing an efficient service. This includes a factor for ‘return on assets’.

How such a component would potentially affect the price of electricity if the network were to be put underground is uncertain. If the total asset value of an underground network were used in the price calculation, then the price would rise. However, if the network were valued at the amount the utility contributed towards it, (that is 10 per cent of its total value for the multi-contributor funding option) the price would fall. A further factor to consider is that any change in the price of electricity would affect consumers generally, rather than just those benefiting from cables in their area being underground[89].

The working group considers that the impact of State or Territory pricing regulation would need to be clearly defined as part of the commercial analysis for any large scale program to put cables underground which significantly effected the electricity distributor's asset base.

7.3 NEW CABLE–REGULATORY OPTIONS

States and Territories have the power to pass planning and environmental legislation to require all new electricity and telecommunications cables to be put underground in the future. However, as discussed above, under the *Telecommunications Act 1997*, such power is currently subject to the provision that any State or Territory legislation must not discriminate against telecommunications carriers. That is, any State or Territory legislation with the objective of putting telecommunications cables underground must apply equally to other overhead cables such as electricity cables. This provision also applies to retrofitting–see below. However the responsible Commonwealth Minister has the power to allow a potentially discriminatory State or Territory law to operate.

There are no constitutional obstacles to the Commonwealth legislating to require telecommunications carriers and electricity distributors to install new cable networks underground (see section 7.5.2).

7.4 RETROFITTING UNDERGROUND–EXISTING LAWS AND POLICIES

At the time of the working group's report there are no provisions in the *Telecommunications Act 1997* for requiring the retrofitting of existing overhead telecommunications cables underground. State and Territory Governments also cannot require the retrofitting of telecommunications cables that were installed prior to 1 July 1997 if those cables were installed under section 116 of the *Telecommunications Act 1991* (clause 60 of Schedule 3). As stated above, the anti-discrimination clause and exemption under the *Telecommunications Act 1997* (clause 44 of Schedule 3) also applies to retrofitting of underground cables.

However, if electricity distributors relocate cables underground, owners of telecommunications cables are required (under clause 51 of Schedule 3) to remove their overhead cable within six months. In the case of standard telephony services, Telstra, since it is also currently the universal service carrier under the *Telecommunications Act 1997*, would be required to continue to provide a standard telephony service for all residences. Given this, Telstra would effectively be required to replace overhead standard telephony cables with underground cables, or with wireless technologies.

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89 Greenwoods Consulting, *Putting Cables Underground: Commercial and Taxation Implications*, Sydney 1998.

However, because there is no universal service obligation on telecommunications carriers to provide broadband services, there is no legislative obligation for carriers to replace existing overhead broadband cables with underground cables or wireless technologies when electricity cables are put underground.

There is therefore the potential, in law, for telecommunications carriers to simply remove overhead broadband cables and non Telstra telephony cable (if any) as a way of meeting the requirements of clause 51 of Schedule 3.

Clause 50 of Schedule 3 also requires the ACA to monitor and report to the Minister on progress in placing facilities underground.

In relation to electricity, there is currently no State or Territory legislation which requires the retrofitting of electricity cables underground, however, a number of programs are in place to facilitate this process. These include programs of a limited nature, for example underground conversion programs in tourist or heritage areas, or areas of environmental significance, or more general programs such as those in place in Western Australia.

7.5 RETROFITTING UNDERGROUND–OPTIONS AND CONSTRAINTS FOR FUTURE POLICIES

The working group investigated whether the Commonwealth or the States or Territories could impose a levy on overhead cables as a funding mechanism, or whether they had consitutional power to require existing overhead cables to be put underground.

7.5.1 Constitutional power to impose a levy on overhead cable

Term of reference 8 provides for the working group to report on whether the States or Territories, or the Commonwealth, could, or should, impose a levy on overhead telecommunications cables for the purpose of funding a retrofit of that cable underground, so long as the levy was approved by the ACA. The issue of whether such a levy is desirable is considered in Chapter 5. This section addresses the issue of whether the Commonwealth, State or Territory Governments has the power to impose such a levy.

The OGC has found[90] that there is no constitutional barrier to such a levy. In the case of the States and Territories, the opinion of the OGC is that it should be possible to impose such a levy as a tax. The opinion of the OGC is that the Commonwealth would also be able to impose the levy as a tax, and legislation could authorise the ACA to perform the necessary functions to administer it. The only constraints on the Commonwealth are that:

- it could not impose such a tax in respect of overhead lines in a particular State or a particular part of a State (on the grounds that it cannot give preference to States); and

[90] Office of General Counsel, *op cit.*

- it could not impose a tax on property belonging to a State (this would be an impermissible tax on State property).

The full text of the advice of the OGC is at Appendix 6

7.5.2 Constitutional power to require existing overhead cable to be put underground

In summary, the advice provided to the working group is that the Commonwealth, State and Territory Governments have the power to require existing (or new) overhead cables to be put underground. Such powers are derived both from the implication of the power to impose levies on overhead cables for the purpose of funding programs to put cables underground, as well as from more general powers, such as those relating to regulation of trading corporations. These powers are subject only to the constraint that the Commonwealth could not impose different requirements on different States and Territories.

The Commonwealth does not, however, have the constitutional power to establish an authority which has the function of placing electricity cables underground. This would limit the options for administrative structures for any such bodies.

7.6 GOVERNMENT POLICIES

The working group recognises that any decision by Government in relation to putting cables underground will need to be taken in the context of Government policies for the electricity and telecommunications industries generally. A detailed description of the structure of these industries in Australia, and of Commonwealth and State and Territory policies for them is provided in the Australian Government Solicitor's *Background Paper*[91]. However, the following summarises the main features of Government policies.

Generally, Government policy for the electricity and telecommunications industries has been directed towards achieving lowest prices and improved services for consumers. This recognises the importance of electricity and telecommunications both as a major item of consumption in their own right, and as a major input cost for industry and commerce. Telecommunications are also an underlying technology for emerging information-based industries.

Government seeks to achieve these objectives through two major approaches:

- structural change in the industries, including:
  - separation of the electricity industry into generation, transmission, distribution and retail components;
  - introduction of competition, including full competition in the telecommunications sector, and progressive introduction of competition in the electricity industry;

[91] Australian Government Solicitor, *op cit.*

  - corporatisation of electricity authorities and, in the telecommunications industry, of Telstra;
  - privatisation, including partial privatisation of Telstra and progressive privatisation of some electricity distributors;
  - creation of independent electricity and telecommunications regulators and use of the Australian Competition and Consumer Commission regulatory powers; and
- economic regulation, including:
  - price caps and service guarantees at the customer level for electricity and telecommunications services; and
  - regulation of access prices and conditions within the electricity and telecommunications industries.

The impact of alternative funding options upon competition is discussed in the report *Competition and Other Impacts of Funding Options for Putting Underground*[92]. Australian Governments are committed to a consistent national approach to competition related issues and generally assess the impact that their legislation could have upon competition.

The report concludes that programs to put cables underground would need to be considered in light of their impact on:

- existing regulatory arrangements, such as the impact on price regulation;
- barriers to entry, meaning the ability of new competitors to enter a market;
- the cost associated with access to infrastructure;
- competitive neutrality, that is the principle which aims to remove any net competitive advantage or disadvantage to Government owned business enterprises (GBEs) resulting solely from their public sector ownership; and
- the ability of GBEs to amend their prices to reflect costs. GBE pricing is normally overseen by an independent regulator. Where a GBE does not operate in a fully competitive market, the independent regulator may limit the capacity of a GBE to charge higher prices than would be possible under competition.

7.7 COMMERCIAL IMPACT OF TAXATION LEGISLATION

Based on the work in previous chapters, a program to put cables underground would have the following characteristics:

- the relevant stakeholders contribute their avoided costs and the remainder is contributed by the affected property owners, possibly with some contribution from government (refer Chapter 5) ;

92 Allen Consulting Group, Competition and Other Impacts of Funding Options for Putting Cables Underground, Melbourne, 1998 (a), Chapter 5.

- the total of avoided costs is in the order of 10 per cent of the project cost (refer Chapter 4) and;
- the total cost of putting all cables underground would be about $23.37 billion (refer Chapter 3).

These characteristics have commercial consequences which were not intended by the working group.

Under Commonwealth tax legislation the difference between the market value of assets acquired and the costs paid by the entity for the assets is treated as taxable income. If an element of the infrastructure is provided to the utility at no cost then that element will be subject to corporation tax or an equivalent State tax[93] at the current rate (36 per cent) unless the entity has tax losses. In a multi-contributor model the property owner will fund approximately 90 per cent of costs and if this is provided to the utility in the form of a gift, it will be subject to tax, being exempt only if the entity makes a tax loss equal to or greater than the value of the gift. Therefore the utility would potentially:

- be liable for taxation on the value of the gifted asset in any one year, that is an amount approximating $7.5 billion[94] over the course of the project;
- be allowed a deduction for the depreciation only to the extent of the taxable income of the utility in any one year (any balance can be offset against future taxable income); and
- see its financial performance decline, where the extent of this effect would largely depend on the nature of the State or Federal economic regulations to which the company was subject.

The working group did not initially recognise the taxation implications for electricity distributors and carriers arising from payment for infrastructure by others (typically ratepayers). The issue did not emerge in the Western Australian pilot program partly because the bulk of the cost was borne by the State Government and Western Power, and partly due to the waiver of sales tax equivalent payment to the Western Australian Government in respect of materials purchase.

It is the intention of the working group that putting cables underground would be tax-neutral. To achieve such an effect the working group concluded that there are two possible approaches, either amend the appropriate laws and regulations or develop a commercially based tax effective structure for putting cables underground within the current law.

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93 State owned utilities are not subject to income tax, but they may be subject to an equivalent State tax. For example, in NSW the State Tax Equivalency regulations provide that such capital contributions are not subject to tax however the offset to this is that the tax depreciation on the infrastructure is limited to the financial costs to the utility, that is, it excludes the capital contribution element. However, under accounting standards the value is reported as income for financial reporting. Similar arrangements may apply in other States.

94 This figure is based on a 36 per cent corporation tax rate (or State Tax Equivalent) and a total cost of putting cable underground of $23 billion and calculated as follows: 23 X 0.9 X 0.36 = 7.452.

The first of these two options would not be a simple matter. It would involve amendment to Federal and State taxation laws to provide the necessary exemptions for an infrastructure project to put cables underground. Resolution of issues such as: an appropriate level of exemption; classes of infrastructure to which exemption would apply; and the impact of legislative changes on company reporting in relation to financial reporting and good corporate governance.

Given the complexity of the first option, the working group engaged a consultant to explore the second, the possibility of developing tax effective financial arrangements for putting cables underground which would comply with existing laws and accounting principles[95].

Appendix 5 and the consultant's report explore taxation, accounting, financial reporting, ownership and structures which most closely conform to a tax neutral outcome.

95 Greenwoods Consulting, *Putting Cables Underground: Commercial and Taxation Implications*, Sydney 1998.

CHAPTER 8

REGULATORY APPROACHES FOR PUTTING CABLE UNDERGROUND

The working group has identified three main regulatory approaches to putting cables underground which are available to Government:

- **the present regulatory environment without further adaptation or intervention;**
- **develop an administrative framework for use in local level programs, that is, a bottom-up approach; and**
- **impose a requirement that cable be put underground according to a timetable and source of funding, that is, a top-down approach.**

Respective State and Territory Governments could choose the type of overall regulatory approach to suit their particular circumstances, in consultation with appropriate bodies including the Commonwealth and Local Government.

8.1 INTRODUCTION

Terms of reference 6 and 7 provide for the working group to examine the regulatory options for requiring cabling to be put underground and appropriate consultative mechanisms and processes to assist decision making about whether and when to put cables underground.

When it comes to developing practical programs for underground conversion, there is a range of different issues to be considered and different approaches that could be taken. This arises out of the different options for each of the aspects that need to be considered. For example the range of:

- different funding options;[96]
- legislative and non-statutory frameworks; and
- financial arrangements[97].

Given the current range of regulatory structures in different States and Territories, the working group considers that it is probably not appropriate for it to make recommendations in regard to any of the possible options. However, through identifying the possible approaches and the range of issues, the working group hopes it can facilitate consideration of them by Government.

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[96] Chapter 5 describes the range of funding options considered and shortlisted by the working group.

[97] Various financial arrangements and their taxation implications are discussed in Chapter 6 and in Appendix 5.

8.2 THE APPROACHES DESCRIBED

8.2.1 Using the present regulatory and administrative environment

Under this approach, it could be expected that a certain amount of existing overhead cable would be replaced by underground cable. This may be because an electricity distributor decides to do so at its own expense, or a local area may negotiate with the utilities to put the cable underground, essentially funding the program itself perhaps with utilities and Local Government agreeing to make a contribution towards the cost.

This approach is unlikely to lead to a significant amount of cable being put underground:

- given the high cost to electricity distributors of putting existing cables underground, it is likely that only a small proportion of existing overhead cables would be put underground at their invitation; and
- in the absence of any framework to facilitate putting cables underground it is unlikely that a significant number of local areas would do so on their own initiative.

8.2.2 Developing an administrative framework for local area programs

This is a ‘bottom-up’ approach which would comprise an administrative framework under which local areas could choose whether to have cables put underground in their area, on the basis that they were willing to pay to have the work done.

The framework would provide a mechanism for:

- informing property owners of the program;
- estimating the cost;
- deciding whether to proceed;
- arranging for the work to be done efficiently; and
- arranging for contributions towards the cost of the work.

This last point would involve primarily the property owners making their own arrangements, perhaps by means of a Local Government rate surcharge, and a mechanism by which contributions from organisations to reflect the avoided costs could be collected. The framework could also include an element of contribution from State or Territory Government, to reflect any savings it might make (for example, from reduced vehicle accidents) or any other contribution it may wish to make to reflect wider amenity benefits, such as the enhanced visual amenity enjoyed by visitors to the area.

The working group considers that a local area program along these sorts of lines is likely to lead to more cable being put underground than the first approach, of working under the current regulatory environment. The framework would facilitate the process for local areas putting cables underground and would encourage the provision of other contributory funding, such as by utilities and Government.

It is difficult to estimate exactly how much cable would be put underground, as the response rate would depend on a range of factors (such as the level of any supplementary funding, or the type of financing arrangements that could be provided– see Chapter 6). However, it can probably be assumed that in many areas putting cables underground would be poorly supported and consequently a lower priority.

A local area program could be arranged and funded in a number of ways. At its simplest, it could be a form of funding option 1 (discussed in Chapter 5), which provides for property owners to pay for the full cost of putting cables underground, apart from contributions by relevant organisations to cover avoided costs.

Funding option 4 (multi-contributor, see Chapter 5) allows the possibility of Government providing funding to the extent that it considered appropriate. Contributions by utilities additional to their avoided costs could also be considered. For example, a State or Territory Government could impose a requirement on an electricity utility to make a contribution of a certain level to put cables underground. Such an arrangement might also replace the need to make a precise assessment of the actual level of avoided costs for that utility. Nevertheless, even with supplementary funding, such an approach is essentially a local area program, in that the driving decision as to whether to put cables underground would be from relevant residents and property owners.

8.2.3 Government-imposed requirement to put cables underground

This ‘top-down’ approach would involve a mandatory imposition by Government for overhead cables to be put underground. It would be the responsibility of the Government in question (probably the State or Territory Government, since the electricity industry is largely regulated at this level) to develop an approach, taking into account their own circumstances and priorities.

A decision would first be needed as to the source of funding for the project. A Government program could require that funding is provided by:

- property owners;
- utilities;
- Government itself through taxpayer funded consolidated revenue; or
- any combination of these sources.

A second key decision would be to determine the order and rate (number of years for completion of the program) at which cables would be put underground. For example, Governments could develop criteria for selecting the order of areas in which cables were to be put underground, such as:

- areas with relative perceived benefit, those which potentially stand to benefit the most are given a high priority;
- relative cost, in that the least costly areas could be considered first;
- technical feasibility;

- external factors affecting timing such as co-location with other work and necessary replacement of existing infrastructure;
- property owners' willingness or ability to pay;
- a high potential for damage to overhead cable from storm;
- heritage interest;
- high tourist or visitor demand;
- greatest aesthetic impact; and/or
- the oldest existing network.

The importance of having these criteria would increase depending on the projected length of the program. If the intention is that all cables be put underground in, say, 10 years, then order would not matter as much as in a program to put all cables underground in 40 years. The selection of areas could also be delegated to the Local Government level.

Alternatively there could simply be a requirement for utilities to put cables underground over a period of time. This is the approach of the private member *Powerlines and Cables Undergrounding Bill* introduced into the NSW Parliament by Dr Peter MacDonald on 25 September 1997. At the time of writing the Bill has been read a second time and is part of a large number of private members' bills currently waiting further consideration in the lower house.

The Bill requires utilities to put cables underground by the year 2010. With the statutory requirement in place, this essentially leaves the decision about the order of proceeding to the utilities, although there is provision in the Bill for preparation of draft programs to put cables underground by utilities and for public comment on these programs.

A wide range of arrangements is feasible, addressing funding, timing and administrative aspects. A Government contemplating a compulsory underground conversion program would need to consider all these aspects. The extent to which the program proceeds would vary according to the nature of the requirement imposed by Government, depending on its assessment of what was appropriate.

The top down and bottom up approaches both have advantages and disadvantages. The working group considers that some combination of these approaches, ensuring overall coordination of projects together with a high level of community support, which meets the needs of a particular region would seem the most appropriate.

8.3 AUDITING AVOIDED COSTS

All the funding options shortlisted in Chapter 5 require that relevant parties pay towards any program to put cables underground an amount at least equivalent to their avoided costs. This in turn implies that the size of avoided costs can be determined and the body to whom they are attributed can be readily identified. The discussion of quantifiable benefits in Chapter 4 suggests that net quantifiable benefits, which are equivalent to avoided costs, are very difficult to determine with accuracy and not straightforward to attribute.

The simplest option for determining avoided costs and their attribution is to let the industry decide by negotiation how they will apportion costs. Such a negotiated outcome may not bear much relation to actual avoided costs, but this is of little consequence if funding of the underground conversion project is agreed upon.

The problem arises when there is no agreement on apportioning costs and some regulatory body must decide the matter. In these circumstances there appear to be three options. These are, divide the costs:

- evenly between the stakeholders without reference to avoided costs;
- according to some very simple formula based on the perceived avoided costs or ability to pay of the stakeholders;
- using a model which attempts to actually determine avoided costs, and then apportion total cost in accordance with one of the four principal funding options.

Within the telecommunications industry, all telecommunications carriers are required to contribute to the costs of providing the universal service obligation. They do this in proportion to their overall share of the telecommunications market revenues, through a levy arrangement. While participation in the system is mandatory, in recent years universal service levy payments have been determined by agreement between the carriers.

A similar approach could be developed for putting cables underground. If the arrangements were to be mandatory and consistent between States and Territories, this would mean that States and Territories would have to agree individually to a uniform approach, as the Commonwealth does not have the constitutional power to act in this regard.

8.4 CHOOSING AN APPROACH

Given that the electricity industry is largely regulated at the State and Territory level, this would probably be the most appropriate level for the key Government decisions on this matter, although consultation would also be needed with other bodies, including the Commonwealth Government (noting that telecommunications is regulated at that level), Local Government, utilities and key community groups.

Choosing between the three main approaches involves consideration of:

- whether large scale programs would facilitate economies of scale in construction[98];
- funding issues, taking into account the impact of the different funding options assessed in Chapter 5; and
- the preferred type of regulatory framework, taking into account the benefits of putting cables underground and the degree to which compulsion should apply.

98 Amos Aked Swift, *Putting Cables Underground Working Group–Technical Issues–Stocktake, Technical Options and Associated Costs,* Sydney, 1998, Chapter 4, where the issue of minimum efficient size for a project, as well as potential economies of scale are discussed.

CHAPTER 9

AN ADMINISTRATIVE GUIDE

There are a number of key administrative issues which the working group believes would need to be considered in any program to put cables underground.

Most of these issues would appropriately be considered at the State or Territory level, given that circumstances vary between different States and Territories, for example in relation to regulatory environments for the electricity utilities.

9.1 INTRODUCTION

This chapter summarises the main decisions that would have to be taken, and flowing from those decisions, the main processes that would have to occur in a typical program to put cables underground. The issues are generally presented in the order that they would need to occur in the real world, however the order of events is not prescriptive and should be responsive to local circumstances. Some of these events could take place concurrently or in a different order depending on matters like community willingness to participate, the availability of the necessary funds and the availability of resources to construct the new network.

In Chapter 5 a variety of funding options was considered in detail and assessed against ten principles. The multicontributor option rated highly against the principles. This option involves:

- stakeholders paying at least their avoided costs;
- property owners contributing the bulk of the remainder; and
- possible contribution from government to recognise the broader benefits to the community as a whole.

9.2 THE STAKEHOLDERS

Appropriate consultation and involvement of all relevant stakeholders is essential to the success of any program to put cables underground. The stakeholders can be divided into four groups depending on their interest in the project. These are:

- the property owners of an area which is considering putting cables underground, being the group most likely to benefit from the project and those who will ultimately pay for a large proportion of the total cost;
- the organisations or institutions who might provide finance or commercial investment capital, such bodies could include governments, utilities, banks and others with access to investment funds;
- the utilities who currently own and/or operate the existing overhead networks or will be responsible for the operation of the new networks as they will most likely

be involved in developing a practical and efficient means of actually constructing the underground network or networks to a satisfactory standard; and

- the regulators, both industry specific and commercial, who are potentially all levels of government, industry self regulating bodies and the larger industry players in their own right.

Any one individual or organisation may be involved in more than one of these categories, depending on the nature of their interest in the project. For example, a government, ultimately responsible to the residents, may provide funds, set up financing facilities, have input to network design through the utility it owns and be responsible for some industry regulation and for recovering the costs.

9.3 ADMINISTRATIVE FRAMEWORK

Administration must provide the process by which all the components of a program to put cables underground are brought together and are able to occur. Depending on the size of the project, such program administration would probably need to have a mechanism for:

- deciding initially to embark on a program for putting cables underground;
- determining the order of priority for areas to convert to underground services;
- selecting the individual suburbs where cables will be put underground;
- deciding upon the type and timing of consultations with local property owners and residents, and how such consultations might be initiated;
- establishing a fair and equitable way for residents to make decisions and an appropriate means of enforcement;
- effectively addressing potential regulatory difficulties;
- developing and administering appropriate funding arrangements;
- developing and administering appropriate financing arrangements;
- selecting the appropriate network design;
- assessing and selecting tenders for the work; and
- administering the contract process.

Each of these points will now be considered in more detail below.

9.4 THE INITIAL DECISION

Any decision to commence a program to put cables underground will centre on an estimate of how much the project would cost. Two costing tools[99] have been developed to assist interested parties to determine costs in a local area. Once an indicative cost has been established a decision can be made on whether the benefits are worth the estimated cost.

The work presented in Chapters 2 3 and 4 of this report demonstrates that on average the quantifiable cost of putting cables underground far exceeds the quantifiable benefits. Therefore, any reasoned decision to embark on an underground conversion program would be made on the basis of local variations in the quantifiable costs and benefits and/or an assessment of the extent of the non-quantifiable benefits.

Local variations in quantifiable costs and benefits could include:

- access to subsidised labour, through an employment generation scheme for example;
- construction in conjunction with another project, such as urban renewal, which is justified on its own merits;
- adverse weather conditions necessitating very high overhead network maintenance; and/or
- imminent capital expenditure required to replace the existing ageing overhead infrastructure.

The most significant non-quantifiable benefit is the improvement in urban amenity generated by placing cables underground. The level of this benefit, and ultimately much of the justification for any project to put cables underground, depends on the value residents and property owners place on reduced visual pollution. Quantifiable and non-quantifiable benefits are discussed in Chapter 4 of this report.

9.5 THE ORDER OF PRIORITY

Any project to put cables underground over a large area, such as a complete or substantial part of a city, can only be completed in stages over some considerable time. This means that different areas must be given priority to be converted ahead of others. For example coastal areas might be a priority because of the effect of salt and weather conditions on overhead lines. The factors effecting this priority order include:

- relative perceived benefit, in that those areas which potentially stand to benefit the most are given a high priority;
- relative cost in that the least costly areas could be considered first;

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99 The costing tools may be accessed directly on the Putting Cables Underground Working Group CD-ROM or website.

- technical feasibility;
- technical reliability and benefits as a result of selecting areas which complete undergrounding of distribution and feeder lines;
- external factors effecting timing such as co-location with other work and necessary replacement of existing infrastructure (see above);
- property owners' willingness or ability to pay, and/or;
- a high potential for damage to overhead cable from storm;
- heritage interest;
- high tourist or visitor demand;
- greatest aesthetic impact; and/or
- the oldest existing network.

9.6 SELECTING INDIVIDUAL SUBURBS

If an area's requirements can be met, the choice of individual suburbs could be made on the basis of administrative convenience in a top down approach or depend on 'volunteers' in a bottom up approach. The bottom up approach has the advantage that many of the issues relating to consultation and the willingness of property owners to participate in, and make a substantial financial contribution towards, the project have already been considered, if not resolved. This has been the preferred approach in Western Australia where local Councils in designated areas of Perth and country centres have been asked to nominate suburbs for early inclusion in the program to put cables underground.

One possible draw back of selecting areas or suburbs on the basis of their capacity or willingness to participate, is that councils may tend to nominate higher socio-economic areas over lower socio-economic areas in order to improve the council's ability to participate in a program. The gap between rich and poor could potentially increase. The issue cuts across a number of the administrative mechanisms and is considered in more detail below.

9.7 TYPE, TIMING AND INITIATION OF CONSULTATION

Consultations at the local level would most likely be the responsibility of Local Government or perhaps an active local residents' organisation such as a progress association. The people who are the subject of consultations could be residents or property owners. In many areas these two groups may have a considerably different membership because of a high proportion of rented or leased properties. Both groups need to be consulted, possibly about slightly different things depending on decisions principally made in relation to funding.

A decision needs to be taken as to whether the consultation will provide an opportunity to accept or reject an underground conversion program or whether property owners and residents will only be consulted on the details of a program that government has already agreed upon in principle. Such in principle agreement could be in the form of a mandate to proceed with putting cables underground obtained at local government elections. This in turn effects the timing of consultation.

The proposal to put cables underground could be initiated by:

- State, Territory or Local Government;
- the utilities currently owning or operating the overhead networks;
- a group of local residents, property owners or business people; and/or
- any combination of the above.

Irrespective of the initiator, for residents and/or property owners to make informed decisions in regard to putting cables underground they must be provided with the relevant information. For example, the first stage in this process could take the form of a letter to rate payers setting out the proposal and an overview of the estimated costs and benefits.

Consultation between all stakeholders will also be required. In developing an appropriate financial structure, as discussed in Chapter 6, commercial consultations between Local Government, utilities and financiers will be a key aspect of any decision to proceed.

9.8 THE DECISION MAKING PROCESS

The main question to be resolved in deciding on an appropriate decision making process is what constitutes a sufficient level of support. In many cases decision making processes and consultative mechanisms are in place. However where no decision making process exists, the following range of options will have implications in terms of the level of support required for a decision[100]:

- no objection to the development proposal which was available for inspection and public comment at the Council chambers;
- very few objections to a notice of intention to proceed included with rate notices;
- majority support in focus groups, small samples of public meetings;
- a majority of those selected by a statistically sound sampling technique;
- a majority of those who voted in a comprehensive poll, perhaps forming part of a Local Government election;
- a substantial majority in a comprehensive poll, say 60 per cent; and
- a very high majority in a comprehensive poll, say 90 per cent.

Decision making processes usually include the opportunity for objections to be raised and discussed. Once a decision has been made to proceed, mechanisms are in place

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100 Financing issues will also have an effect on the level of support required for an project to proceed, see Chapter 6.

under existing revenue collection legislation to ensure that contributions from ratepayers can be collected[101].

It is essential that any survey to gauge community support for an underground conversion project includes not only whether the concept has support but also whether the community supports the financial arrangements to fund the council's contribution towards
the project.

The Western Australia State Underground Power Program has as one of its main criteria for selection of council proposals to participate in the program, evidence of community support. All councils submitting proposals to participate in the program have provided preliminary evidence of community support through a variety of the measures indicated above. In addition, those councils seeking ratepayer contribution towards the project surveyed ratepayers to determine the level of support, in particular the likely level of financial contribution from ratepayers. Where this was carried out as a sample survey or the response rate was low, the Underground Power Steering Committee sought additional evidence of support to satisfy itself that there was sufficient community support for the project.

9.9 POTENTIAL REGULATORY DIFFICULTIES

9.9.1 Economic regulation

As discussed in Chapter 7, the electricity and telecommunications industries are currently subject to a range of economic regulatory measures[102], such as price control arrangements and regulation of access prices. Many Local Government authorities are also subject to a range of price-capping structures as part of their charging arrangements. Any major program to put cables underground would have implications for this economic regulation.

Another key issue for electricity distributors and telecommunications carriers is the economic consequences of the loss of existing assets, when existing overhead infrastructure is removed.

The sunk investment associated with the existing infrastructure is not avoidable. For the electricity industry, in a number of jurisdictions, these investments are included in the rate bases which in turn drive regulated revenues and ultimately the average cap on prices. Removing assets that have considerable unexpired economic value, could have significant negative financial implications for utilities, depending on the position taken by regulators.

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101 See also Secretariat to the Putting Cables Underground Working Group, *Overseas Regulatory Experience—Putting Cables Underground,* Commonwealth Department of Communications and the Arts, Canberra, 1998 (d) for decision making and objections processes in proposals to put cables underground in States of the USA.

102 Australian Government Solicitor *Supplementary Information on Price Regulation,* Canberra 1997 (b).

This issue would be a matter for relevant regulators to examine in association with any particular program and is discussed in the Greenwoods Consulting report[103] to the working group.

The regulatory regimes vary between the Commonwealth, States and Territories, and any major program to put cables underground would have specific implications for the economic regulation of the area's electricity industry and perhaps Local Government. Regulatory implications for telecommunications carriers are a Federal Government matter. These issues must be addressed in the financial planning stages of the program development.

9.9.2 Technical regulation

Different technical standards and procedures within the industry and unnecessarily complex or duplicated administrative, government or regulatory processes in relation to standards, will increase the cost of putting cables underground. To keep such regulatory compliance costs to a minimum there will need to be a high level of planning and coordination involving the potential stakeholders (refer Chapter 4).

The working group identified three possible approaches to the issue:

- a government based coordinating body with legislated powers at a State or Territory level perhaps with some form of national coordination[104];
- an industry based coordinating body with legislative recognition at the State, Territory or Commonwealth level; or
- an independent industry based initiative.

The arrangement or combination of arrangements chosen in a particular area will depend very much on local circumstances. However, any system of technical regulation will need to strike a balance between over standardisation, which potentially stifles innovation, and too little standardisation, which could lead to inefficiency.

9.9.3 The possible need for new legislation

Powers to create new legislation are discussed in the Australian Government Solicitor's regulatory background paper[105]. In setting up an administrative framework the need for new legislation would vary between States and Territories, depending on their particular circumstances and approach. Legislative amendment may also be required to develop a tax effective financial structure.

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[103] Greenwoods Consulting, *Putting Cables Underground: Commercial and Taxation Implications*, Sydney 1998.

[104] The Commonwealth has no Constitutional power to establish an authority whose function it would be to put cables underground.

[105] Australian Government Solicitor, *Background Paper on Industry Structure and Legal Regulatory Issues Pertaining to Putting Cables Underground*, Canberra, 1997 (a).

9.9.4 Contributions from non-ratepaying property owners

Collecting rates is the only legislative mechanism available to Local Government to ensure participation. Consequently, difficulties may arise where contributions are required from non-ratepaying property owners (such as Federal or State/Territory Government organisations) who decline to pay.

Obtaining contributions from non-ratepaying property owners such as Telstra, water providers (utilities) and educational institutions has, from experience in Western Australia, proven difficult. In most instances the cost to install underground power to these premises does not equate with the rate charge being imposed by the local auuthority. In some cases, the cost exceeds the contribution raised from the rate charge and in other cases, the cost is considerably less than the rate equivalent charge being sought by the local authority.

The Western Australia Underground Power Program has resolved this through direct negotiation between the Underground Power Project Manager and the respective entity. The solution has been for the project (through Western Power), as opposed to the local authority, to charge the direct cost of connection to each non-rateable property.

The working group is advised that in some States and Territories reforms are being examined by the State/Territory and Local Government, to explore ways State Government entities might make payments to Local Government for services.

9.10 FUNDING ARRANGEMENTS

It is assumed that a multicontributor funding model would be employed, based on the analysis in Chapter 5. Within that model a number of issues must be decided before a project to put cables underground can proceed.

9.10.1 Auditing avoided costs

The multicontributor model assumes that the principle stakeholders would make a contribution at least equivalent to their avoided costs of putting cables underground. A process would be needed to equitably calculate the size of this contribution and a mechanism put in place to ensure that the agreed amount was provided. The practice followed is likely to depend on the regulatory environment of each State and Territory.

9.10.2 Financially disadvantaged people

Local Governments currently offer direct subsidies or special payment arrangements to people who are financially disadvantaged. For example, some pensioners receive a subsidy in the form of reduced Local Government rates and charges, while special payment arrangements could include allowing more time to pay accounts. Subsidies are a funding issue, and special arrangements are discussed under financing.

A decision is required as to how far (if at all) this principle of subsidising the financially disadvantaged is to be carried over into the funding arrangements to put cables underground. This is a matter for State, Territory and Local Governments, and the community to decide.

9.11 FINANCING ARRANGEMENTS

For the funding options short listed in Chapter 5, the way in which finance is raised could significantly influence the total cost of a project to put cables underground. This is particularly the case for the multicontributor funding option outlined above, where the affected land owners would contribute most of the funds needed for the project.

Under existing State, Territory or Federal taxation legislation, the legal owner of the new underground facilities, for example a corporatised utility, could be liable for taxation on the value of the portion of the asset which was acquired through contributions from the property owners. This could amount to a tax liability of up to 90 per cent of the total cost of the project. This issue is discussed in the Greenwoods Consulting report[106]. Ownership of the new facilities is therefore a key consideration.

9.12 SELECTING A NETWORK DESIGN

It is not efficient and often not practicable to transfer the existing configuration of overhead network into an underground network. Once a decision is made that cable should be put underground in a particular area, an appropriate design and construction method must be selected for the new underground network. Key considerations are:

- redesigning the underground network to minimise cost and maximise the electrical efficiency while maintaining or enhancing the quality of service; and
- whether the underground network should be upgraded to provide improved functionality, such as spare capacity or better street lighting.

9.12.1 Design

The working group considers it inappropriate to attempt to be prescriptive about preferred technical design options.

Engineering options for putting cable underground are discussed in Chapter 3. These present a range of options, including use of ducts, and trench and boring techniques. Each approach has its own advantages and disadvantages. Decisions on these matters are best made taking into account the specific circumstances of each project.

9.12.2 Spare capacity

At the time of designing a new network, the opportunity could be taken to install extra capacity (whether in the form of extra or larger capacity duct space or in the form of extra or larger capacity cables) against possible future demand.

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106 Greenwoods Consulting, 1998, *op cit*

This could facilitate future efficiency by providing for additional demand at a time when the cost of such provision is lowest. However, this in itself raises issues such as:

- having present users pay for future capacity installation or its maintenance; and
- the ability to predict future requirements with any accuracy, and the possibility of installing capacity that would never be used.

These issues need to be resolved at the time of planning the network.

9.12.3 Upgrading

A program to put cable underground provides an opportunity to consider additional reinstatement beyond the original level. One of the significant areas where upgrading would be likely to occur is better quality street lighting. As these issues are primarily a responsibility for Local Government, consideration of these issues would be a matter for the relevant Council.

It may be efficient to upgrade as part of an underground conversion project. The extent the upgrading increases the cost of the project should be identified as additional to the cost of putting cables underground, and treated accordingly in any funding proposal.

The Western Australian Underground Power Program endeavours to resolve this issue at the time of implementation of a particular project. The upgrade and placement of lighting is negotiated with the local authority and the cost of any additional lights or non-standard fittings borne by the local authority. This issue also requires very careful public liaison.

9.13 ASSESSING AND SELECTING TENDERS

The use of competitive tendering in network design, installation and reinstatement could be considered as a mechanism to encourage efficiency. Issues such as which particular technology is used and whether ducts, trenches, boring and so on should be used, can be resolved at least in part by comparing the different proposals in the competitive tender process. This could also mean that work perhaps traditionally undertaken solely by Local Government, is opened up to public tender to reduce costs.

When it is considered to award tenders on other than a competitive basis, methods for promoting lowest cost and/or the best practice could include:

- a mechanism for auditing stated costs of utilities for putting cable underground;
- requiring utilities to justify their costs and level of service against accepted best practice, with the additional possibility of adjusting costs against best practice; and
- requiring councils to justify their reinstatement costs against accepted best practice.

These may be appropriate responsibilities for State or Territory utility regulators.

9.14 ADMINISTRATION OF CONTRACTS

Projects to put cables underground could involve contracts for very large sums of money, a significant proportion of which could come from the public, in the form of contributions from property owners. Proper public accountability of how such money is spent is very important.

Some options for contract administration with appropriate accountability are:

- existing government finance and administrative structures, such as currently operate in State, Territory or Local Government;
- existing utility based administrative arrangements such as an electricity distributor;
- an independent government body to oversight the project, possibly in the form of a statutory authority; or
- an independent privately funded organisation, such as a large accounting firm.

Deciding which of these options might be appropriate depends on the cost and level of service and accountability provided. Any option relying on the services of the existing electricity distributor could cause the perception of a conflict of interest, as the organisation may be a contractor as well as contract administrator.

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APPENDIX 1

MEMBERSHIP OF THE WORKING GROUP

Chair

Neville Stevens	Department of Communications, Information Technology and the Arts (Commonwealth)

Members

John Rotherham	Department of Energy (NSW)
Peter Bettess	Department of Infrastructure (Vic)
Mara Bun	Australian Consumer Association
Kerry Burns	Department of Premier and Cabinet (Tas)
John Filippone	Office of Energy (WA)
Alan Graham	Australian Council of National Trusts
John Gronow	Department of Lands, Planning and Environment (NT)
Allan Horsley	Australian Telecommunications Users Group
Kevin Lupton	Electricity Supply Association of Australia
Pamela Martin	Department of Premier and Cabinet (SA)
Bruce Meagher	Optus Vision
Gerry Morvell	Department of Environment (Commonwealth)
Heather Neil	Australian Local Government Association
Vince Pizzica	Telstra Corporation
Bert Johnston	Department of Finance and Administration (Commonwealth)
Pravendra Sharma	Department of Economic Development and Trade (Qld)
Neville Smith	ACTEW Corporation
Peter Vandenheuvel	Australian Chamber of Commerce and Industry
Gavin Williamson	Sydney Cables Down Under
Bruce Williamson	Australian Electrical & Electronic Manufacturers
Susan Wishart	Department of Primary Industries and Energy (Commonwealth)

Secretariat

Department of Communications, Information Technology and the Arts (Commonwealth) staff: Philip Allnutt, Lyn Browne, Chris Cheah, Mark Dunstone, Garth Hartley, Anna Jepson, Maria Mandic, David Prestipino, Karen Price, Heather Rolinson, Anna Rudic, Anthony Wing.

APPENDIX 2

TERMS OF REFERENCE

(June 1997)

Working Group for Placing Aerial Cabling Underground

The Working Group has been established by the Minister for Communications and the Arts on behalf of the Federal Government to examine comprehensively the technical, economic, legal and social issues associated with placing aerial cables of all types underground. The Report from the Group is expected to provide:

- authoritative factual information, and
- a reasoned framework of recommendations (or options)

for use by Federal, State and Local Government, industry, community groups, and members of the public. The Report from the Group will also be used to assist in the preparation of the Minister's report to Parliament envisaged by clause 46A of Schedule 3 to the *Telecommunications Bill 1996*.

In particular, the Group is to report on each of the following:

1. A 'stocktake' of the following
   - (a) all aerial cabling in Australia
   - (b) underground conduits and ducts in which cabling currently exists, or which could be used to place additional cabling
   - (c) existing State and Territory laws or policies concerning the placement of cabling underground.

2. The technical issues associated with moving cabling of different types underground, including
   - (a) the main engineering options and issues involved in placing cables underground (or use of a non-cable based technology if appropriate) including
     - (i) suitability of each of the options for different types of terrain, and hence usefulness in different parts of Australia
     - (ii) a breakdown of the costs associated with each of the major

options

(iii) operational or safety issues raised

(iv) implications for future usage, including potential effects on market structure.

(b) the extent to which co-location of electricity, communications and any other type of cabling is possible in existing or future underground ducting

(c) assessment and identification of the existing aerial cabling that is feasible to move underground and the assessment criteria in determining such feasibility

3. The benefits of placing existing aerial cabling underground including

(a) the nature of the benefit

(b) the likely beneficiaries and the distribution of the benefits

(c) quantification as far as possible of the benefits to those beneficiaries, and

(d) the timeframes within which the benefits are likely to accrue.

4. The costs associated with placing existing and new aerial cabling underground on a progressive basis across Australia including

(a) the nature of the costs

(b) the distribution of the costs

(c) a quantification as far as possible of the costs, and

(d) the timeframes within which the costs are likely to be incurred.

5. The funding options, and associated issues and implications, involved in any scheme for moving cables underground. The options should include:

(a) direct or indirect Federal, State or local government levies on communications carriers and electricity distributors, including (but not limited to) the following proposal

(b) direct or indirect levies on communications and electricity customers

(c) direct or indirect levies on individuals or communities in affected areas

(d) regulatory compulsion on communications carriers and electricity distributors without any specific compensation

(e) non-legislated industry and/or community funded arrangements

(f) any other arrangement (including combinations of the foregoing) that the Group considers warrants consideration.

The consideration of each option should include an assessment of the effect of the option on, or for :

(i) public and private sector borrowing

(ii) Federal-State financial arrangements

(iii) administrative costs and efficiency

(iv) prices of goods and services, and on business input costs

(v) economic efficiency

(vi) equity and fairness.

6. The regulatory options, and associated issues such as constitutional issues, and possible effects on competition in the industry, for requiring communications carriers and electricity distributors to place cabling in Australia underground.

7. Appropriate consultative mechanisms and processes to assist decision making between governments, affected business enterprises, communities and individuals about whether and when to place cables underground.

8. The issues involved in, and feasibility of, the following questions proposed by the Opposition as matters for inquiry during the Senate debate on the *Telecommunications Bill 1996*

(1) Whether the States and Territories should legislate to make provision for and in relation to

(a) the imposition of a levy on carriers in respect of overhead lines located in particular areas; and

(b) the application of the proceeds of the levy to fund (in whole or in part):

(i) the permanent removal of overhead lines in those areas; and

(ii) the installation of underground facilities to replace those lines;

so long as the levy is approved in writing by the Australian Communications Authority.

(2) Whether the Commonwealth should legislate to make provision for and in relation to

(a) the imposition of a levy on carriers in respect of particular overhead lines; and

(b) the application of the proceeds of the levy to fund (in whole or in part):

(i) the permanent removal of those overhead lines; and

(ii) the installation of underground facilities to replace those lines.

(3) Whether a law of the Commonwealth, or of a State or Territory, concerning the preceding matters, might be held to be invalid on the grounds of inconsistency with the Constitution.

9. On the basis of the foregoing, and any other matters the Group considers relevant, the Group's preferred framework (with alternatives if appropriate) for making decisions about

(a) the places where placement of existing and new cables underground should occur

(b) the time frames within which such placement should occur

(c) the manner in which such placement should occur

(d) where responsibility should lie for funding such placement

(e) how consultation should occur.

APPENDIX 3

ABBREVIATIONS

ACA	Australian Communications Authority
AGS	Australian Government Solicitor
Al	Aluminium
ALGA	Australian Local Government Association
BOO	build, own and operate
BOOT	build, own, operate and transfer
BOT	build, own and transfer
BTCE	Bureau of Transport and Communications Economics
Coax	coaxial cable
CR	consolidated revenue
CRU	Communications Research Unit (formerly the Communications Branch of the BTCE)
DCA	Department of Communications and the Arts (now Department of Communications, Information Technology and the Arts)
DOCITA	Department of Communications, Information Technology and the Arts
EMP	Environmental Management Plan
ESAA	Electricity Supply Association of Australia Limited
GBE	Government business enterprise
HDPE	high density polyethylene
HFC	hybrid fibre coaxial cable
HV	high voltage—6.6 kV, 11 kV or 22 kV
km	kilometre
kV	kilovolt
kVA	kilovolt amperes
kW	kilowatt
kWh	kilowatt hours
LACT	large area costing tool
LGA	*Local Government ACT 1989*, Victoria
LV	low voltage—240 volts or 415 volts
Minister	Commonwealth Minister for Communications, Information Technology and the Arts

mm	milimetres
OGC	Office of General Counsel
OH&S	occupational health and safety
PSTN	public switched telephone network
PVC	polyvinyl chloride
SPFV	special purpose finance vehicle
SACT	small area costing tool
sq	square
utilities	generally used in the discussion paper to mean both electricity distributors and telecommunications carriers
URD	underground residential distribution
V	volts
VCAT	Victorian Civil and Administrative Tribunal
VoLL	Value of Lost Load
XLPE	cross linked polyethylene
3C	three core
4C	four core

APPENDIX 4

LIST OF SUBMITTERS

The following organisations and individuals made submissions to the working group on the June 1998 *Discussion Paper*, as part of the consultation process:

AUSTAR Entertainment Pty Ltd
Australian Electrical and Electronic Manufacturers' Association Limited
Australian Local Government Association
Banyule Civic Improvement Group
Bleazard, E
Burton, S
Centre for International Research on Communications and Information Technology
City of Melbourne
City of Unley
Commerce and Trade—Western Australian Department of
Electricity Supply Association of Australia Limited
Energy—New South Wales Department of
Energy Australia
Integral Energy
Ku-ring-gai Municipal Council
Lake Macquarie City Council
Lane Cove Council
Lightowlers, J
Marchandeau, V
Marshall, P
Martyn, R
Moonee Valley City Council
Moreland City Council
Muir, D K
Nilsen Electric (SA) Pty Ltd
Northern Sydney Regional Organisation of Councils
Office of Energy, Western Australia
Parriwi Road Group—Mosman
Premier and Cabinet—Tasmanian Department of
Prosser-Roberts, D
Shellharbour City Council
Slegers, L
Sutherland Cables Downunder
Sydney Cables Down Under
Thevenin, L
Transport and Regional Development (now Transport and Regional Services)
—Commonwealth Department of
Underground Cables Action Group—Unley Branch
United Energy Ltd

Vaucluse Progress Association
Western Power
WorldCom Australia Pty Ltd

APPENDIX 5

COMMERCIAL AND TAXATION ISSUES

Introduction

Based on the work in chapters 1–9, a program to put cables underground would probably have the following characteristics from a commercial perspective:

- use the multicontributor option, whereby the relevant stakeholders contribute their avoided costs and the remainder is contributed by the affected property owners, possibly with a small contribution from government (refer Chapter 5
- the total cost of the project is about $23.37 billion (refer Chapter 2); and
- the total of avoided costs is in the order of 10 per cent of the project cost (refer Chapter 4).

In States where the electricity utilities are subject to Federal Income Tax law (or State tax equivalents) and in the case of the telecommunications carriers, these characteristics have far reaching implications in relation to tax and commercial outcomes for all the stakeholders, particularly the electricity distributors and telecommunications carriers.

Assumptions

In order to properly consider the commercial and taxation issues in relation to an underground conversion program a number of assumptions have to be made. For the purposes of this appendix these assumptions are:

- funding to enable the project to proceed is provided by utilities and Local Government to the extent of their avoided cost, and the property owner (ratepayer) will provide the balance;
- 10 per cent of the costs would be provided by the utilities and local Council and 90 per cent would be provided by the property owner;
- no direct subsidy is to be made to the costs of putting cables underground by any level of government;
- no new laws or regulations or changes to existing laws and regulations;
- potential changes to taxation legislation for a goods and services tax and its impacts both on income tax and the funding relationships between the Commonwealth, States and Territories has not been considered; and
- the material assets to be the subject of the funding are all of the electrical and telecommunications assets currently above ground which would be replaced (mostly below ground) in an underground conversion program, including the trenching, cables, control systems, transformers etc.

These assumptions are consistent with the body of work presented in the main body of the report.

Taxation issues

Under Commonwealth tax legislation the difference between the market value of assets acquired and the costs paid by the entity for the assets is treated as taxable income. If an element of the infrastructure is provided to the utility at no cost, then that element will be subject to corporation tax or an equivalent state tax[107] at the current rate of 36 per cent. This taxable income could be offset against any tax losses of the entity. As noted above the property owner will fund approximately 90 per cent of costs and if this is provided to the utility in the form of a gift, then it will be subject to tax (tax will only not become payable if the entity has tax losses equal to or greater than the value of the gift). Therefore the utility would potentially:

- be liable for taxation on the value of the gifted asset in any one year, that is a total amount approximating $7.5 billion[108] over the course of the project;
- have the depreciation of that asset for taxation purposes limited to the total of the otherwise taxable income of the utility in any one year; and
- see its financial performance decline, where the extent of this effect would largely depend on the nature of the State or Federal economic regulations to which the company was specifically subject.

In order to overcome these problems there are two possible approaches, amend the appropriate laws and regulations or develop a commercially based tax effective structure for putting cables underground within the current law. The first of these two options would not be a simple matter. It would involve amendment to Federal and State taxation laws to provide the necessary exemptions for an infrastructure project to put cables underground. A number of difficult questions would need to be faced and resolved, including:

- what would be the appropriate level of exemption that government would be prepared to accept, given the potential negative impact on the collection of revenue;
- what classes of infrastructure projects would be exempt and why, possibilities include just underground cable projects, projects meeting some form of 'in the national interest' criteria or all infrastructure projects; and
- what impact would such changes have on the ways in which companies are required to report their dealings for the purposes of accounting and good corporate governance?

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107 Although State owned utilities are not subject to income tax they may be subject to an equivalent State tax. For example, in NSW the State Tax Equivalency regulations provide that such capital contributions are not subject to tax however the offset to this is that the tax depreciation on the infrastructure is limited to the financial costs to the utility, that is, it excludes the capital contribution element. However, under accounting standards the value is reported as income for financial reporting. Similar arrangements may apply in other States.

108 This figure is based on a 36 per cent company tax rate (or State Tax Equivalent) and a total cost of putting cable underground of $23 billion and calculated as follows: 23 X 0.9 X 0.36 = 7.452.

Given these and other difficulties, the working group decided to pursue the second option and engaged a consultant to explore the possibility of developing tax effective financial arrangements for putting cable underground which would comply with existing laws and accounting principles[109]. This is a common approach when developing large expenditure undertakings and is not unique to projects to put cables underground.

Ownership of assets

For accounting and taxation purposes the ownership of assets, such as an underground cable network, is central to determining an appropriate and tax efficient commercial structure. Taxation is based on a legal definition of ownership. If legal title has been transferred to a tax paying entity then, if those assets are used to generate income, tax depreciation allowances are available.

For accounting purposes the definition of ownership in relation to an asset depends on the capacity of the 'owner' to benefit from the asset and to deny or regulate the access of others to that benefit[110]. Situations can therefore arise whereby assets, paid for by one entity can become the assets of another entity for financial reporting purposes.

The distinction in the definition of ownership of assets provides the basis for developing a possible tax effective financial structure to put cables underground. Two such structures are considered by Greenwoods Consulting.

Scrapping the existing network

It is not legally possible for a utility to retain the value of the old overhead asset for tax or commercial purposes[111]. The written down value of the overhead asset can be written off for tax purposes in the year that the asset is replaced. This write off can only be recovered up to the value of the utility's income for that year, any balance can be offset against future taxable income. This latter restriction has implications for the rate at which cables might be put underground as, in order to gain the maximum depreciation benefit a utility may prefer to only scrap overhead assets up to the value of its profit for a given year.

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109 Greenwoods Consulting, *Putting Cables Underground: Commercial and Taxation Implications,* Sydney 1998.

110 See the Institute of Chartered Accountants of Australia Members' handbook, June 1998.

111 Greenwoods Consulting, *Putting Cables Underground: Commercial and Taxation Implications*, Sydney 1998.

APPENDIX 6

AUSTRALIAN GOVERNMENT SOLICITOR

PUTTING CABLES UNDERGROUND - TERMS OF REFERENCE 8

Introduction

This paper addresses the constitutional issues relating to reference 8 ('TOR 8') of the Working Group's terms of reference.

TOR 8 requires the Working Group to report on:

'The issues involved in, and feasibility of, the following questions proposed by the Opposition as matters for inquiry during the Senate debate on the Telecommunications Bill 1996 :

1. Whether the States and Territories should legislate to make provision for and in relation to

    a) the imposition of a levy on carriers in respect of overhead lines located in particular areas

    b) the application of the proceeds of the levy to fund (in whole or in part):

        i) the permanent removal of overhead lines in those areas; and

        ii) the installation of underground facilities to replace those lines;

    so long as the levy is approved in writing by the Australian Communications Authority.

2. Whether the Commonwealth should legislate to make provision for and in relation to

   a) the imposition of a levy on carriers in respect of particular overhead lines; and

   b) the application of the proceeds of the levy to fund (in whole or in part):

      i) the permanent removal of those overhead lines; and

      ii) the installation of underground facilities to replace those lines.

3. Whether a Law of the Commonwealth, or of a State or Territory, concerning the preceding matters, might be held to be invalid on the grounds of inconsistency with the Constitution.'

A. Legislation by the States and Territories

Levy is a Tax

A levy imposed on carriers in respect of the mere use or ownership of overhead lines would be a tax. It would be a compulsory exaction of money by a public authority for a public purpose, and would not be a fee for a service or a fee for a privilege. Subject to the Australian Constitution, a State has power to impose taxation in relation to any matter of relevance to the State. The Legislative Assemblies of the Northern Territory and the Australian Capital Territory also have broad powers of taxation under their respective Self-Government Acts.

Excise - Section 90 of the Constitution

For present purposes, the main potential impediment to the proposed levy comes from s.90 of the Constitution. Among other things, s.90 confers exclusive power on the Commonwealth Parliament to impose taxes of excise. Section 90 prohibits the Territories as well as the States from imposing taxes of excise - see *Capital Duplicators Pty v Australian Capital Territory (No 1)* (1992) 177 CLR 248.

An excise is a tax on goods. It follows that s.90 is only relevant to the extent that the overhead lines are involved in the supply of goods such as electricity. In this respect, the High Court takes the view that a duty of excise for the purposes of s.90 is a tax on any step in the production, manufacture, distribution or sale of goods - *Ha and Lim v*

New South Wales (1997) 147 ALR 1. (A majority of the Court in *Ha and Lim* expressly left open the question whether a tax on the consumption of goods is an excise.)

Beyond this general formulation, it has not proven possible to formulate an acceptable definition of 'duties of excise' which 'enables the question whether an impost is a duty of excise to be answered by application of the syllogism of formal logic' - *Hematite Petroleum Pty Ltd v Victoria* (1982-83) 151 CLR 599, at 664 per Deane J.

Despite this, it is clear that there are several arguments of substance to support the view that a tax on the ownership or use of overhead lines is not a duty of excise because it is not a tax on or in respect of goods. The principal argument is that the amount of the tax would not bear any disclosed relationship to the quantity or value of the goods (e.g. electricity) supplied by the overhead lines; as a matter of form at least, the tax would be payable regardless of the extent to which the relevant goods were supplied.

However, in light of the High Court's decision in *Hematite* this consideration is not, in itself, necessarily conclusive. In *Hematite* a majority of the Court held that a fixed annual fee for a licence to operate a pipeline used to produce oil and gas was a duty of excise (as a tax on the oil and gas) despite the fact that the fee on its face bore no relationship to the quantity or value of the goods produced. There, Mason J noted that it is not necessary that there should be an arithmetical relationship between the tax and the quantity or value of the goods produced or sold. In his Honour's view, to find that the tax is upon or in respect of particular goods, 'it is enough that the tax is such that it enters into the cost of the goods and is therefore reflected in the prices at which the goods are subsequently sold'.

Although *Hematite* is generally regarded as the high water mark in the Court's traditionally generous interpretation of what constitutes an excise, the recent decision in *Ha and Lim* does not suggest that a majority of the present High Court would necessarily take a narrower view on this issue.

However, even if this be the case, there are several possible grounds for distinguishing the licence fee in *Hematite* from the proposed levy. Perhaps most significantly, the licence fee in *Hematite* was imposed at the stage of manufacture or production of the goods whereas the proposed levy would be imposed at a stage where production or manufacture of the relevant goods had been completed. In *Hematite*, Deane J (at 668) noted that the absence of any clear relationship between the tax and the value or quantity of the relevant goods 'is of comparatively less importance in a case where the tax is imposed at the stage of manufacture or production of goods than in a case where what is claimed to be an excise upon the manufacture or production of particular goods is imposed at a stage where production or manufacture has been completed' - see also *Logan Downs Pty Ltd v Queensland* (1977) 137 CLR 59 at 77 per Mason J. The fact that the levy would have something of a regulatory purpose, rather than a purely revenue-raising purpose, might also assist in distinguishing it from the licence fee in *Hematite*.

In summary, we would not think the doubts over the constitutional validity of the proposed levy would be so great as to prevent a State from imposing the levy if the State were so minded.

Role of the Australian Communications Authority

The State legislation imposing the levy would specify that the levy is to be approved in writing by the ACA. In performing this role, the ACA would be exercising State power, so the limitations on Commonwealth power (discussed below) would not be relevant. In addition to the State Parliament conferring the relevant function on the ACA, the Commonwealth Parliament would need to legislate to authorise the ACA to perform the State function. In this respect, it is established that the Commonwealth can give one of its authorities or office-holders a capacity to receive additional powers and functions as may be conferred by a State legislature - *Re Duncan; Ex parte Australian Iron and Steel Pty Ltd* (1983) 158 CLR 535.

B. Commonwealth Legislation

The Commonwealth Parliament has a general power to impose taxes including duties of excise. Taxes imposed by the Commonwealth cannot 'discriminate between States or parts of States' (s.51(ii)), nor can they 'give preference to one State or any part thereof over another State or part thereof'.

It follows that the Commonwealth could not impose a tax in respect of overhead lines in a particular State or a particular part of a State. Any tax would need to apply uniformly throughout Australia. The fact that such a law in its practical application might impose a greater tax burden in some States or areas than others (because there are more overhead lines in some States or areas) would probably not, in the present case, result in an impermissible discrimination or preference. It follows that the Commonwealth could probably impose a tax on all overhead lines within Australia.

The one significant qualification on Commonwealth power is that, under s.114 of the Constitution, the Commonwealth cannot impose a tax on property belonging to a State. Generally speaking, any tax on the ownership of a State's overhead lines would be an impermissible tax on State property for the purposes of s.114.

The tax revenue raised by the levy would, of course, need to be credited to the Consolidated Revenue Fund in accordance with s.81 of the Constitution. The Commonwealth could appropriate a corresponding amount for the purpose of making grants to the States under s.96 of the Constitution or grants to other bodies, such as the carriers, under s.81 so as to fund the removal of the overhead lines and the installation of the underground cables.

Office of General Counsel
29 October 1997

APPENDIX 7

DESCRIPTION OF AREA COSTING TOOLS

Introduction

In an attempt to achieve an acceptable localised costing model which was reasonably accurate in a small area, but general enough to be used anywhere in Australia, the working group commissioned two area costing models, based on different design philosophies.

The large area costing tool (LACT)[112] was developed from the data collected in the national stock take and costs and benefit survey and uses national averages based on historical information as default values, with the capacity to insert local data where it is known.

The small area costing tool (SACT)[113] was developed making a series of assumptions about local electrical design and network construction techniques. Its accuracy depends on the amount and accuracy of localised data which can be provided by the user.

Large area costing tool

The LACT provides for three types of user input in the form of data on the infrastructure, costs and benefits for the area to which the model is being applied. The infrastructure data must be supplied by the user and defines the relevant features of that area, including the amount and type of electricity, telephony or broadband infrastructure, the soil conditions for excavation and the number of households. The cost and benefit data can be supplied by the user or the default values, based on the national survey results, can be applied.

As part of the cost data input it is possible for the user to enter information which takes account of all aspects of the area under consideration. This is usually in the form of a cost per kilometre and/or a percentage variation from a standard cost. To take maximum advantage of the model, the user would be required to know how various electricity network characteristics effect the relevant costs per kilometre for construction and/or materials. Often, costs in this format are not readily available at the estimating stage of a project. In such circumstances the default values must be used and this can reduce the accuracy of the output. Telephony and broadband aerial cables only occur in some areas and the relevant infrastructure costs tend not to be as area sensitive as electricity.

The survey data on which the LACT is based, was collected for areas serviced by the various electricity distributors.

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112 Communications Research Unit, *Putting Cables Underground Costing Models*, Commonwealth Department of Communications and the Arts, Canberra, 1998.

113 Max Garner & Associates and Power Business Resources, *Report: Calibrate and 'road test' by means of case studies local area costs and benefits model*, Sydney, 1998 (b).

These areas are so large that in many cases any internal differences which would affect the cost of putting cable underground are not adequately represented in the area data[114]. As a consequence , the output from the LACT when the default survey cost data is used is considered by the consultant who developed it to be only indicative of the actual costs applying to any particular area[115].

Table 29 provides a comparison of the cost of putting cables underground as predicted by the LACT, based on national default cost rates, and actual costs or detailed estimations for four areas.

The reasons for the relatively high costs estimated by the LACT are that the model used national survey data which:

- is not broken down sufficiently by local area;
- is historical cost data, particularly in relation to the proportion of boring as compared to trenching[116];and
- makes no allowance for the impact on costs of underground network design and the local demand for electricity.

Given the difficulty in obtaining all the necessary cost input data for the LACT in a form which accurately reflects the local situation, default cost values are likely to feature prominently in any calculation. The working group considers the LACT is therefore more suited to estimating costs for large areas such as cities, States or Territories.

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114 The expert groups advising the Technical subcommittee were not able to cross reference the data from electricity distributors to the often smaller Local Government areas because of concerns that this would effectively breach the confidential nature of the individual electricity distributors survey responses.

115 Communications Research Unit, *Putting Cables Underground Costing Models*, 1998, page 12.

116 Historically, the survey reported that 13 per cent of excavations were bored and 87 per cent trenched, however recent advances in boring technology would suggest that a higher use of boring would be employed in the future—see Chapter 3. In the case of Western Australia, particularly Applecross, boring represented a very high proportion of the excavation method.

Locality	Number of households (a)	Type of ground	Actual cost ($) (b)	LACT estimated cost ($) (b) & (c)	Variation (%)	SACT estimated cost ($) (b)	Variation (%)
Applecross—WA	2 100	1% rock 99% sand	3 178	4 41	+30	3 383	+6
Albany—WA	885	70% rock (d)	3 763	6 361	+69	4 317	+15
Unley—SA	803	normal (e)	3 525 (f)	4 113	+17	3 531	0
Inala—Qld	474	1% rock (d)	3 290 (g)	4 695	+43	3 602	+9

Table 29—Comparison of modelled and actual or estimated costs[117]

(a) This assumes that the number of lead-ins is equivalent to the number of households, that is, there are not a significant number of multi-occupancy premises in the area concerned.
(b) The cost figures are for putting electricity only underground and include project management costs.
(c) Estimate derived from national default cost rates unadjusted to reflect local conditions or potential savings from adopting new network designs, construction techniques and technologies. For an indication of the level of the potential savings, refer to Section 3.5.
(d) For Albany and Inala the remaining ground type, 30 per cent and 99 per cent respectively, is assumed to be ‘normal’.
(e) Refers to normal soil without a significant proportion of rock or sand.
(f) Figure based on an Unley tender for putting cables underground and an underground network design developed by the consultant[118] .
(g) Figure based on a detailed estimate by Energex.

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117 Max Garner & Associates and Power Business Resources, 1998 (b), *op cit*, based on Table 15.
118 Max Garner & Associates and Power Business Resources, *Study of Padmounted Substations in an Underground Electricity Network*, 1998.

Small area costing tool

The SACT is able to more accurately reflect local conditions that have a significant effect on the cost of putting cables underground. It includes allowances for changes in electricity network design and an estimate of the ratio of boring and trenching, based on current technology and the type of ground in the area.

The electricity network design feature is not intended to replace a detailed engineering design, however, when combined with a number of empirically derived ratios it is sufficient to determine a 'bill of quantities' for substations, high voltage cable, low voltage cable, public lighting, reinstatement and lead-ins. Using commercially valid rates, an estimate of costs is then derived for the electrical, telecommunications and civil engineering components of the proposed underground network. Localised input is possible in the design and estimating phases, through variation of allowable voltage drop, average customer demand for electricity, type of ground and labour rates etc.

The local area model includes cost allowances for:

- stores and logistics;
- reinstatement of hard surfaces, based on competitive commercial rates currently available;
- project management costs;
- commercially based material and labour costs; and
- an estimate of the cost of PSTN and broadband underground conversion, where these aerial networks are present.

Items that do not have a cost component in the local area model are:

- sales tax on materials required to build the networks; and
- net dismantling costs, as they are considered to be close to zero after the old network's scrap value is taken into account.

Table 29 provides a comparison of the cost of putting cables underground as predicted by the SACT and actual costs or detailed estimations for four areas.

The working group considers that, in light of the comparison tests, the LACT would be most useful in determining the cost of putting cables underground in a smaller area, such as a suburb or block of streets.

APPENDIX 8

PRIVATE SECTOR FINANCING APPROACHES

The Working Group commissioned a report to explore whether a private sector financing option would be possible. The consultant[119], developed a fully private sector financing model to test one method of using private financing alone to meet the cost of an infrastructure project, such as putting cables underground. The model developed by the consultant is based upon the creation of a special purpose finance vehicle (SPFV) and might have the following major features:

- the shareholders of the SPFV could include a range of stakeholders such as Local Government, the relevant utility companies, other community based groups and financial investors;
- the SPFV could own both the trench and its contents, that is, the electricity and telecommunications ducts and cables and related equipment such as transformers and switching equipment;
- revenue might come from a hybrid pricing approach which would levy part payment from the property owner and part payment from utilities by way of an electricity or communications haulage rate;
- the majority of the SPFV's capital could be provided by a major domestic or international investor, or specialist infrastructure investor;
- it is not envisaged that Local Government would make a net financial investment in the SPFV, nor be required to provide any form of guarantee for equity or debt,
    - however, it is possible that it could acquire equity by transferring easements over land on which the common trench would be constructed;
- Local Government could have a role in facilitating the financial relationship between property owners, utilities and financiers, and in obtaining the necessary clearances from the appropriate planning and regulatory authorities;
- a suitably qualified independent party would be required to manage the trench over the term of its investment,
    - however, the utility providers may seek to have some control over the facilities while providing some form of guarantee as to system performance and some mechanism for operational and financial risk management; and
    - an internal company structure which minimised the taxation liabilities of the participants[120]

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119 Mc Donnell, J, *Putting Cables Underground - A Private Sector Funding Approach,* International Trade and Data Services, Sydney, 1998

120 An examination of the potential tax liability of the utilities in such schemes is discussed in Greenwoods Consulting, *Putting Cables Underground: Commercial and Taxation Implications,* Sydney 1998

Build/Own/Operate/Transfer Financing schemes

The option of Build/Own/Operate (BOO); Build/Own/Transfer (BOT), or Build/Own/Operate/Transfer (BOOT) schemes was considered by the working group while developing funding options and was recognised to be a source of up front finance rather than of ultimate funding. Such schemes are included in the private sector commercial financing model, described above, since these schemes are usually joint ventures between State or Territory Government, and/or Local Government and the private sector in which an SPFV is created to build and own infrastructure.

Regulatory issues

An SPFV may be required to be set up under specific State or Territory legislation with the possibility of complimentary Commonwealth legislation. In this context a primary aim in designing the financing structure is to ensure that the SPFV has maximum access to the depreciation provisions of relevant taxation legislation.

The SPFV would be constructed to allow current owners of the various utilities to free their balance sheets from significant asset holdings while retaining certainty as to long term ownership and control commensurate with Australian accounting standards. Utility participation in the management and pricing policy of the SPFV would also need to be examined with regard to statutory and other regulatory considerations.

Feasibility of the private financing model

Based on the private sector finance model outlined above, the consultant concluded that it is theoretically possible to attract private sector finance capital to fund a project to put cables underground. Where the project was subject to full taxation under current law it would be a marginal investment, but would meet the bench marks of some (particularly institutional) investors. There is limited interest in such projects among investors unless the SPFV provides substantial tax concessions or other regulatory incentives such as guaranteed minimum utilisation levels for infrastructure. In addition, private sector commercial financing is extremely complex and expensive to set up.