

Compensation for transmission infrastructure

Report to Federated Farmers New Zealand

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Preface

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Authorship

This report has been prepared at NZIER by Peter Bailey and Peter Clough and reviewed by Jean-Pierre de Raad. The assistance of Transpower, landowners and managers and land valuers is appreciated.

Key points

Easements create a surplus by lowering the costs of transmitting electricity

Transpower uses easements to build and maintain transmission infrastructure across private property where it is less costly to do so relative to alternatives, such as running lines beside public roads or purchasing land corridors. Such savings create an economic surplus for Transpower.

Transpower pay part of this surplus to landowners in compensation for the costs imposed on them by easements

Compensation is provided in recognition that easements lower the value of land, and that transmission towers and power lines increase the costs of normal farmer operations. Transpower also provides for some or all of the transaction costs facing the landowner during easement negotiations. New Zealand law requires that compensation is enough to leave the landowner no better or worse off due to the easement.

Easement purchases are not standard transactions, however. Transpower has the option of compulsory purchase and (although rare) can force unwilling landowners to sell easements. This distorts the market's ability to set prices.

A number of factors limit the accuracy of easement value estimates

Easement values and compensation amounts are estimated because easement prices are not set or observed in a readily observable market. Landowners can not simply refuse to sell and a number of factors make it difficult to accurately estimate easement values;

- Transpower require confidentiality agreements from parties selling easements, so there is a lack of publically available information, or precedents, on easement prices
- There is a degree of uncertainty on the operational costs imposed on landowners from towers and lines
- There are limited land market data for determining how easements change properties' values.

The final price paid for an easement is determined during negotiations between Transpower and landowners. A lack of transparency over previous settlements and the imperative of settling at some point skew the negotiations in Transpower's favour.

Easements run the risk of being inefficient if compensation does not at least fully cover the costs imposed on landowners

If the full opportunity costs of easements are not considered, then Transpower will be encouraged to use under-priced easements when another option may involve less real resource cost. Not fully considering the costs imposed on landowners, for

example, may encourage Transpower to run lines a shorter route over dairy land rather than over hill or high country where transmission towers impose significantly lower operational costs on farmers.

Understating easement prices and the associated inefficiency issues may be addressed by providing a margin over estimated costs or periodic payments

If settlements under-estimate the land value change imposed by easements, providing in compensation a margin above the estimated change could eliminate under-pricing and generally create more efficient outcomes. The appropriate amount of additional compensation would be impossible to determine, however, without detailed case studies to establish the extent of understatement in practice.

A second option would be to provide a means for agreements to be re-visited and compensation amounts to be periodically adjusted. Although this would not provide more accurate easement price assessments a priori, it would require Transpower to allow for any potential change in future easement price before construction. This may reduce the extent of easement under-pricing.

A number of utilities provide compensation greater than estimated easement costs and periodic adjustable payments

Dissatisfaction with compensation for easements is widely reported in countries similar to New Zealand. The issue of inefficiency is dealt with in Canada, Finland and the United Kingdom as utilities are required to provide compensation greater than the estimated costs imposed on landowners from easements. Landowners have the option of receiving payments periodically with adjustments, rather than a lump-sum only.

Other findings

Practices in other countries

There is a degree of similarity in how easement values are calculated in all of the countries we reviewed. Although details and amounts appear to be largely determined by relative negotiating strengths, compensation is generally based on:

- Easement area and land value
- Operational costs
- Injurious affection (i.e. permanent change in land value after an easement is created)
- Disturbance.

We found several examples of compensation greater than estimated values and landowners being given the option of receiving compensation annually rather than in a lump-sum.

The costs of providing the option of rental payments

A number of landowners in New Zealand would like the option of receiving some compensation in annual rents rather than a one-off payment. This would also help encourage efficiency. We estimated what it would cost to provide landowners with the option of receiving compensation in a lump-sum or annual payments.

- We estimated that it would cost Transpower an extra \$0.83 million in net present value terms, or less than \$50,000 per year.
- The biggest increase in cost would be due to periodic reviews of land values and operational costs. These costs would be borne by Transpower
- Lower dispute related costs are assumed with periodic payments, benefiting both Transpower and landowners as a group
- The net effect, considering costs and benefits to Transpower and landowners is an increase in costs of about \$29,000 per year.

Efficiency: Valuing easements

We spoke with landowners and managers of forestry, dairy, crop and hill/high country farms, and two land valuers, about the costs imposed by transmission lines and structures.

- Dairy and crop farmers faced the largest increase in operational costs, over \$5,000 per structure per year, largely due to the additional time needed for irrigation and working around towers
- Forestry owners faced additional costs of over \$2,000 per structure per year, in part due to the cost of controlling pests and weeds, in part due to the cost of insuring themselves against any damage to transmission towers or lines
- Hill and high country sheep and cattle farmers face few additional costs, these are mainly due to extra time controlling weeds and pests, amounting to about \$500 per structure per year.

Equity and negotiating power

Landowners could balance, to some extent, the negotiating power of Transpower by acting collectively. Additionally, Transpower could reduce some of the uncertainty that plagues negotiations by releasing more information about the range of compensation payable on different types of land, in ways that do not breach privacy of individual settlements or create undue expectations for future settlements.

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1. Background

New Zealand electricity is generated at hydro, thermal, geothermal and wind power stations scattered throughout the North Island and hydro and wind power stations in the South Island. Load is at highly populated areas, generally in the North Island while generation capacity is in lightly populated areas, with hydro storage mainly in the South Island. As a consequence there is approximately 12,000 kilometres¹ of transmission infrastructure in New Zealand linking generation capacity and storage with commercial, industrial and residential end users. The majority of transmission towers and lines are on and over private property, predominantly land used for farming.²

Transpower was established as a State Owned Enterprise in 1987 to own and operate the national electricity transmission grid, having been mandated the responsibility of transmitting electricity in New Zealand. Transpower ownership of and access to transmission infrastructure on private land is covered under statutory provisions, in effect an eminent domain³ for lines built prior to 1988 (about 95% of all lines), and easements or similar rights for lines constructed post 1988.⁴ Pre 1988 infrastructure was built by the public sector with rights of ownership and access transferred to Transpower in 1988. Transpower's rights to both pre and post 1988 infrastructure include ownership or, where it does not own land, access for inspection, operations and maintenance. These rights bind successive title holders.⁵

1.1 Compensation

Anecdotal evidence suggests that there was no standard approach to compensating farmers for transmission infrastructure built on their land prior to 1988. It appears that in some cases landowners received a small financial or other one-off payment in kind (such as having an access track built). In other cases landowners received no compensation for the infrastructure built on their property.

Currently when Transpower wants to build new infrastructure and cannot or does not wish to purchase the required land, it is obliged to negotiate an easement with the landowner. In the event that negotiations are unsuccessful the enterprise can apply to acquire land under The Public Works Act 1981. This option of compulsory purchase is seen as necessary, partially because of the national interest function of transmission lines and partially to prevent landowners from attaining monopoly powers and stopping a line from being completed or excessively inflating costs.

¹ Transpower at <http://www.transpower.co.nz/transporting-power>

² In urban areas transmission infrastructure is often beside roads rather than being built on private land.

³ Eminent domain is a power provided by the State to utilities allowing them to expropriate or take a citizen's property rights with compensation.

⁴ An easement is a "non-possessory" right to use another party's property.

⁵ Transpower landowner's manual.

Some authors suggest that the option to compulsorily acquire land strengthens a utilities' bargaining position, possibly distorting the sales price of easements.⁶ Although Transpower is required to compensate landowners for compulsory purchases and has seldom exercised this right,⁷ it is seen by some as a 'backdrop' to negotiations. Once Transpower have been cleared to build an easement across a landowner's property that landowner must either sell Transpower the easement or sell their land.

On top of this, easement sales' prices may be influenced by the effect of asymmetric information on negotiations. Transpower is a repeat player in the negotiation process with considerable institutional knowledge from previous negotiations with other landowners. Landowners, on the other hand, are generally fragmented and infrequent players in easement negotiations. They are not as well informed as Transpower, in part due to Transpower's requirement that confidentiality agreements are signed when easement settlements are reached.

How easements are priced has implications for not only the affected landowners but also the electricity market and all New Zealanders. Underestimating easement values could lead to inefficient choices on how to transmit electricity. Overvaluing easements would also impact on the wider community, as end users would pay more than necessary for electricity. Overvaluing may be more efficient than undervaluing easements, however. Being able to spread the costs of the wrongly estimated portion of easements over millions of end users, rather than a few hundred landowners, would probably lead to fewer inefficient decisions.

1.2 Report structure

Federated Farmers and landowners would like a better understanding of whether appropriate prices are paid for easements. They have asked NZIER to consider how landowners are compensated for Transpower infrastructure from an economic perspective. The problem is defined below in section 1.3. We consider easements in the context of efficiency and equity, described in section 2. To provide a benchmark, in section 3 we review international literature to look at how compensation is determined and awarded in countries similar to New Zealand. Section 4 looks at the key components for accurately assessing easement costs in New Zealand. Section 5 looks at the costs and benefits associated with re-negotiating easements with periodic as opposed to lump-sum payments. We consider transparency and collective bargaining in section 6 and summarise the issue in section 7.

⁶ See for example Hutchison and Rowan-Robinson 2000.

⁷ According to Transpower staff during a meeting mid 2009.

1.3 Problem definition

Many landowners are unhappy with the amount of compensation, and payment methods, for transmission infrastructure built on their land.⁸ Three key issues have been identified by landowners and Federated Farmers:

- Compensation for transmission infrastructure does not accurately reflect the cost of land and additional financial and time costs on farming imposed by the infrastructure (or negative externalities such as impact on views and health concerns)
- Easements benefit Transpower by reducing the cost of transmitting electricity, yet landowners, who have their property taken for these easements, do not benefit (and are possibly left worse off)
- Transpower only pays compensation in a lump-sum whereas some landowners would prefer to receive rental or periodic compensation which adjusts with changes in land value or operational costs.

These issues are concerned with both the efficiency and equity of compensation. An accurate appraisal of all relevant easement costs is needed for the sake of efficiency (the first of the above three issues). How any surplus is shared between Transpower and landowners, and the option for periodic payments are equity arguments, although outcomes to date appear to have been determined by relative negotiating powers.

⁸ See for example, Kissun. *S Pylons cloud dairy future* in Dairynews June 2009 pg 5.

2. Easements

An easement is a right of access for specified uses over another's property, registered as an interest on the land title. As it creates rights and obligations on both parties it has value to a utility gaining the easement, and also restrains and diminishes land uses and value for the landowner, for which compensation is paid.

Transpower's easement compensation is based on advice from independent registered valuers who assess the value of the property before and after the easement is established. The difference in estimated values is the basis for negotiations on the price of the easement. Transpower pays landowners' reasonable costs of obtaining their own independent valuations and legal advice.

Transpower requires an estimate from a registered valuer to record the easement in its regulatory asset base. As it is entitled to recover a return on its full Weighted Average Cost of Capital (WACC), adding the value of easements to the asset base enables Transpower to pass the cost on to its customers through the transmission pricing system. With Transpower's WACC higher than its probable cost of capital the utility has at least one incentive not to minimise the amount it pays for easements.

On the other hand, expressed dissatisfaction from landowners with the current process raises questions about whether in principle compensation is hindering efficient and equitable outcomes, and also whether in practice it is fully reflecting the costs of easements.

2.1 Efficient compensation

Compensation is not just about equitable or fair treatment, but also has efficiency implications in the proper pricing of the easement options. Efficiency considers the benefits of an action relative to its costs. The more efficient an outcome is the larger the total net gains from that action. To compare options for transmitting electricity so as to select the most efficient option, therefore, requires an accurate assessment of costs under the different options.⁹

The costs of an easement for the landowner include the:

- Change in value of a property, before and after the easement is put in place
- On-going inconvenience of working around the structures and restrictions created by the easement
- Transaction costs in negotiating and reaching an agreement.

Efficiency requires that an activity faces the full opportunity cost of all inputs. For easements to be efficient, compensation should at least cover the full cost imposed on the landowner by transmission infrastructure. If easements are underpriced then

⁹ The net gain to the wider community from transmission infrastructure is large, yet this benefit may be further improved with accurate pricing of alternatives and choosing the option with the lowest net costs.

there will be an incentive for Transpower to use them in situations where other options involve less real resource cost. This would lower long term net welfare.

From a transmission utility's perspective easements are worthwhile if they are less costly than alternative options for routeing and locating transmission lines and facilities. The saving relative to the next best alternative creates an economic surplus for the utility. From a national perspective, however, the true surplus is over and above the full cost of the easement, including the compensation paid for it.

2.2 Equity - splitting the surplus

Equity is concerned with how efficiency gains or rents from economic activity are distributed between parties. Beyond covering the full cost of land occupancy, easements also create some economic rent in savings relative to the next best alternative. In New Zealand the total surplus appears to accrue to Transpower, as it is legally required to provide compensation equal only to what the easements cost landowners. In other countries, however, landowners share in the surplus created by easements.¹⁰

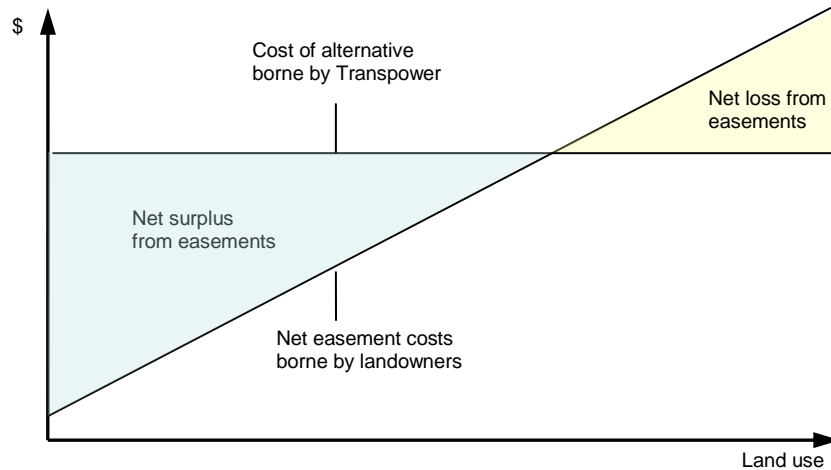
Other than identifying the distribution of costs and benefits (both direct and indirect) across the parties, economics has little to say about equity, perceptions of which are determined in each community according to factors such as social and political considerations. On the other hand, although splitting a surplus may be considered purely a distributional issue, there are situations in which it affects efficiency as well (see 2.3.2 below).

2.3 An economic framework

As discussed above an accurate assessment and comparison of the total costs for transmission infrastructure is needed so as to identify the most efficient option for transmitting electricity. The net cost of an easement includes the impact of transmission lines on the value of the affected land, incorporating any change to future sales value and the net present value of revenue streams. These costs are borne by landowners in the first instance and are represented by the upwards sloping line in Figure 1. (The line slopes up as landowner easement costs vary with land-use). This line represents, if all costs are known, the minimum price a landowner would be willing to accept for an easement.

¹⁰ In Canada, Finland, and the United Kingdom for example, see Nuuja and Viitanen 2007; Hydro-Quebec 2000 and Hamer and O'Brien 2007.

Figure 1 Infrastructure surplus



Source: NZIER

As illustrated in Figure 1 the cost of the next most efficient alternative for transmitting electricity is assumed to be constant (the line is flat) and borne by Transpower. An alternative to building easements over dairy farmland could, for example, be running lines longer distances over less productive land (also possibly requiring easements). Transpower would have to fund the additional cost of running lines over the longer route. The cost savings between the two routes is thus the maximum price that Transpower would be willing to pay for the easement.

The relative preference for easements or alternatives varies with circumstances and over time. In the past, for instance, transmission lines have commonly been run across Crown land or along public road corridors, even where this is not the most direct route, as this reduced the transaction costs of dealing with multiple owners. When new lines are required and such options are less readily available, options with easements become more attractive. And if an option with easements would achieve big savings over the next best alternative, it would be in Transpower's interest to pay more to secure the access, in effect sharing with the landowner some of the surplus that the route would provide.

In several countries landowners are given compensation greater than the estimated value of the easement. In Québec, for example, the total easement area is compensated for at market value of land, in effect providing payment considerably greater than estimated costs (see section 3.4.1). Easements in New Zealand, however, are compensated for at cost. There is some concern that, at times, these costs may be understated. If this is the case it is possible that easements would be constructed when they are not the most efficient option for transmitting electricity.

2.3.1 Estimated easement costs and efficiency

If the cost of an easement is under-stated, and acquired at that cost, then an easement may be constructed when it is the more expensive option for transmitting electricity. This would create a net loss or “negative surplus” for society at large (the true costs are greater than the cost of the next best alternative, see ‘net loss from easements’ in Figure 1). In these cases the underestimated portion of easement costs is borne by landowners. An easement should be created only if it is the cheapest and hence most efficient alternative (the sloping line is beneath the flat line in Figure 1).

Transpower may be faced with, for example, the option of running lines over land that is predominantly used for dairy farming or alternatively a longer route over land mainly used to graze sheep (as discussed in section 4.2, transmission infrastructure imposes significantly higher costs on dairy relative to sheep farms). If the additional costs imposed on dairy relative to sheep farmers from transmission infrastructure are not considered properly then the shorter route may appear to be the cheaper option. This would create a net loss.

The full costs imposed on the landowners as well as on Transpower in both situations need to be considered when choosing the appropriate route. It may be cheaper for Transpower to run lines the shorter distance over dairy farm-land, yet this option would impose greater total costs when the costs imposed on dairy landowners are included in the calculation.

2.3.2 Splitting the surplus efficiently

In theory, compensation equal to the costs imposed on the landowner from an easement would be efficient, as would compensation slightly less than the cost of the next best alternative to Transpower. If Transpower is required to transfer the full surplus created by a given easement to the landowner, however, then it will be indifferent between creating that easement and alternatives. Thus, an alternative less efficient route may be the outcome if too much of the easement surplus is required to be paid to landowners.

For purpose of illustration, consider a hypothetical example where Transpower has the option of running lines over farmland or over a longer route beside a public road. The route over farmland would be \$50 million cheaper than the alternative, considering fully the costs of easements. If Transpower are required to pay the entire \$50 million surplus to landowners then it would be indifferent between choosing either route and may choose the less efficient option.

For efficiency purposes compensation must be somewhere between the costs imposed on the landowner from the easement, and slightly less than the next best alternative facing Transpower. Legally Transpower is required to compensate landowners an amount equal to the cost of the easement. This would still be efficient if easements are accurately priced. The option of compulsory purchase, asymmetric

information and the method by which easements are valued, suggest that the prices paid for easements may not always be equivalent to easement costs.

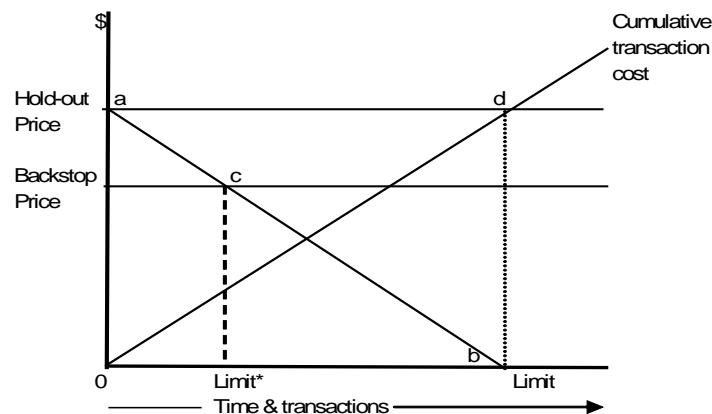
2.3.3 How compulsory purchase changes negotiations

It might be argued that if landowners reach agreement on compensation with Transpower they should just accept the consequences. Landowners' perceptions that compensation does not cover the full cost of easements, or their realisation later (with information about the costs of working with easements obtained after they are created) that that decision was less than optimal, is no different from "post-purchase regret", that can arise in any number of transactions. While similar situations occur in other market transactions without redress, the element of compulsion means that landowners cannot simply decline the invitation to negotiate. Additionally, the information asymmetry between landowner and Transpower with its knowledge of previous settlements, gives easements a distinct characteristic.

Sale and purchase transactions and land valuation are usually based on there being a willing buyer and willing seller who reach mutual agreement on the price. In the case of easements for transmission facilities Transpower has the legal option of pushing for compulsory purchase which, although it prefers not to use it, can still change the dynamic of the negotiation, as illustrated in Figure 2 below.

If a landowner has a value in mind for compensation for granting the easement and bearing the on-going inconvenience of accommodating transmission facilities, this might be termed the "hold-out price". The landowner's expectation of the price realised through compulsory purchase – the "back-stop price" – will be below the hold-out price (otherwise the landowner will not hold out but settle immediately). The landowner's interest in pursuing the hold-out price will then depend on the margin of hold-out over expected back-stop price, and the transaction costs incurred by the landowner in the negotiations.

Figure 2 The effect of compulsory purchase on negotiations



Source: NZIER

In Figure 2 the transaction costs are depicted as a cumulative line (i.e. the critical issue is the vertical position of points on the line, not the area under the line). The mirror image of that cumulative transaction cost line – ab – represents the value obtained from realising the hold-out price after increasingly protracted negotiations: at zero transaction cost the full hold-out price is received, but the net return then diminishes as transaction costs rise. In the presence of a back-stop price it is the difference in the net hold-out price and the back-stop that determines the limit to which it is worthwhile to pursue the hold-out price. In Figure 2 that limit is determined by point c when there is a back-stop price and by point d when there is no back-stop. So the threat of compulsory purchase can be expected to shorten landowners' willingness to negotiate and result in them settling for less than they would prefer in a negotiation unconstrained by compulsion.

How much that happens in practice is a moot point. Transpower depends on its relationships with the owners of lands it crosses over the long life of its infrastructure, and it is not in its interests to treat them badly in the negotiations: aggrieved landowners can be an irritant on the smooth running and maintenance of lines for a long time (e.g. by obstructing access with inadvertently locked gates or frisky bulls in paddocks that maintenance personnel must use). As Transpower can pass on the cost of its easements to its customers and still recover its Weighted Average Cost of Capital it has another incentive not to minimise easement payments.

The possibility that Transpower may pay generously to secure easements, or purchase them earlier than would be required for an optimal acquisition programme, is recognised in recent rule changes. Now Transpower is required to obtain approval before an easement can be introduced in its capital base, from the Electricity Commission (on major new investments), the Commerce Commission (for minor investments) or a client (to pay the bill for an easement).

Landowners feel, however, that Transpower is trying to restrict the amount it has to pay for easements. That is compounded by a lack of transparency around easement settlement prices, due to Transpower's insistence on confidentiality.

To the extent that Transpower covers landowners' costs for independent valuation and legal advice, the transaction costs borne by landowners will be reduced, but there is still potential for substantial landowner time to be used up in negotiation. Landowners still face uncertainty, however, over the prices paid in compensation in other settlements which may cause them to settle early on a price that is less than they would settle on in an unconstrained transaction. Expanding Figure 2 would show that the lower the transaction costs and the greater the difference between hold-out and back-stop price, the longer it takes for transaction costs to eliminate the benefit of holding out. If landowners expect the backstop price to be lower than they want, but are uncertain as to how much lower it will be, they may decide to cut their losses and settle before transaction costs make a deeper dent in what they receive.

Beyond this, in considering whether Transpower cover the full cost of easements, the components of landowners' costs are:

- Transaction costs in negotiating an agreement: Transpower covers reasonable costs of landowners in obtaining valuation and legal assistance, but the landowners' management time in negotiation is unlikely to be covered
- Value of easement: this is a registered valuer's opinion and based on the difference between the property value before and after the easement, and may reflect assumptions, discount rates and risk that differ from the owners'
- Value of inconvenience of working around easements once they are in place: this may be reflected in the value of easement, but the specific impositions on particular properties may not be fully apparent until after the easement is in place, raising the possibility of actual impact greater or less than that anticipated.

The 2006/07 Financial Review of Transpower New Zealand¹¹ noted that Transpower claims to make generous judgements of appropriate compensation within its legally prescribed limits. Transpower said in the review that it would be easier if it was allowed to pay a premium over the compensation levels set out in legislation, which suggests that in at least some situations the current prescriptions are inadequate. As Transpower moves to install new lines on bigger structures and over tracts of higher value land where it is more disruptive of land uses (such as dairying or cropping) the approaches to compensation that have worked in the past on lower value hill country pasture and forest are less likely to provide adequate compensation.

¹¹ Available online at http://www.parliament.nz/NR/rdonlyres/745C276F-75A3-49D1-B9EA-EFD19603D8AC/81980/DBSCH_SCR_4031_5909.pdf

3. Literature review

In this section we summarise the most relevant points in the international literature on easements. The literature review has two main functions:

- To summarise how compensation is calculated and awarded in countries similar to New Zealand
- to identify, based on international practices, an efficient and equitable approach to calculating and awarding compensation in New Zealand.

Easements are heavily influenced by national or state statutes, enactments and laws, and we have therefore, focused largely on countries with similar property rights and basic legal structure as in New Zealand. Due to the availability of reports and information we have included literature from Australia, Canada, the United Kingdom¹², parts of Europe and the United States. As well as reports and articles the following is based on information from utility and landowner representative websites, and emails from utilities and landowner groups.

Among the countries we looked at there is, to some extent, a standard set of base factors used to calculate compensation. How things are done in practice, however, appears to vary somewhat between countries and, at times, by utility. Often compensation details are based on legislation and finalised in negotiations. The often private nature of negotiations has limited our ability to include details on exactly how or why outcomes were reached.

3.1 Structure of review

The literature review starts by providing some context on land access rights and the basis of compensation and then discusses in turn each of the three issues listed above in the problem definition (section 1.3).

Most of the literature focuses on how the costs of easements (or wayleaves) are determined and calculated for compensation purposes. As discussed above it is essential for the sake of efficiency to accurately calculate easement costs. Under efficiency we therefore cover:

- Equivalence of loss compensation
- Standard features of compensation
 - area of the easement and land market value
 - injurious affection
 - disturbances

¹² Utility access to infrastructure is often in the form of wayleaves in the United Kingdom, as opposed to easements in New Zealand and the other countries. The wayleaves literature from the UK is still relevant, however, for much of our discussion on compensation for transmission infrastructure.

The remainder of the literature review looks at the two equity related factors listed in the problem definition:

- Payment formulas and timing
- Splitting an easement surplus.

We finish the review with a brief summary of what the literature says about negotiating strengths.

3.2 Land access and the basis of compensation

3.2.1 Utilities' rights to land

Transmission companies tend to seek land access rights which reflect both the permanence of their infrastructure and their only occasional need to access it. Utilities in the countries we considered usually purchase the land they need and create new rights (typically easements) so they can build and access infrastructure and run lines and pipes. Many governments have deferred powers of eminent domain or compulsory purchase to utilities in recognition of the importance of such infrastructure (see, for example, Viitanen and Kakulu 2009, Nuuja and Viitanen 2007 or Hutchison and Rowan-Robinson 2000).

Governments typically try to balance the need for transmission and similar infrastructure with the rights of individual landowners. Utilities are generally required to negotiate with landowners before exercising compulsory purchase powers, and are required to compensate the landowner when land is taken. Compensation is usually based on the financial equivalence of the landowner's loss (see, for example, Hutchison and Rowan-Robinson 2000).

3.3 Efficiency

3.3.1 Equivalence of loss

Equivalence of loss compensation is payment equal, in theory, to the cost imposed on the landowner from having infrastructure on their land. This includes the cost from loss of productive land, increased operational expenses and damages from construction.

The principle of equivalence of loss is embedded in legislation in all of the countries we looked at. The New Zealand Public Works Act 1981 states that the landowner is entitled to full compensation for acquisition, taking, injurious affection, or damage.¹³ The English Compulsory Purchase Act 1965 states that compensation should be awarded for loss of land value and for injurious affection (in Hamer and O'Brien 2000). In Finland compensation is based on assessing and compensating for all economic losses suffered (Act on the Redemption of Immovable Property and Special Rights 1977 in Nuuja and Viitanen 2007).

¹³ Public Works Act 1981 <http://www.legislation.govt.nz/act/public/1981/0035/latest/DLM45427.html>

There are a number of authors who argue that compensation greater than equivalence of loss should be awarded (Beesley 2008; Hutchison and Rowan-Robinson 2000; Hutchison et al 1998), but much of the debate focuses on how to determine the financial equivalence of loss. Generally loss is calculated by considering the area of the easement, market land values and factors such as lost revenue and additional operating expenses. These factors are covered separately below in 3.4.

3.4 Standard features of compensation

3.4.1 Easement area

The area of an easement is central to compensation calculations (easement area multiplied by land value usually accounts for a significant share of total compensation). Within each easement some land is used exclusively by the utility and is typically compensated for at 100 percent of the land market value. The rest of the land is still able to be used for normal farming operations and is generally compensated for at less than 100 percent of land value. The extent to which the easement area can be used in a similar fashion as surrounding land generally determines the degree of compensation.

The ground level dimensions of towers and other transmission structures, or the infrastructure ‘footprint’, is considered to be used exclusively by the utility (in practice an area slightly larger than the base of the infrastructure is usually included in the footprint for compensation purposes). As far as we are aware, in all of the above countries compensation for land which is used exclusively by the utility is at least 100 percent of the market value of that area of land (see, for example, Hamer and O’Brien 2007).

Compensation for the rest of the land needed for the easement is generally awarded at a percentage of the land market value of the total area. The corridor of land which transmission lines run over is often used in much the same manner as surrounding land, with crops or pasture grown under power lines. When there is little change to the earning capability of the land, utilities tend to pay only a share of the total land market value as compensation (see, for example, Munneke and Trefzger 1998).

A 1989 United Kingdom study found that temporary and permanent easement compensation ranged from as little as 0 to as much as 100 percent of market land values, depending on how land could be used post the infrastructure being built (Corey 1989 in Munneke and Trefzger 1998). More recent studies suggest it is rare for compensation to be less than 20 percent (see, for example, NFU 2009; Hydro-Québec 2000). One author discussed the use of a standard rule of thumb valuation of 25 percent of the quantity of land used for the easement (in the United States, see Munneke and Trefzger 1998).¹⁴ Canada’s Hydro-Québec provides compensation at 100 percent of the market value of the land covered by the easement, regardless of

¹⁴ The authors argue against rule of thumb valuations as many relevant factors are ignored, including, for example, the non-linear relationship between land value and parcel size.

the degree of sterilisation (Hydro-Québec 2000). This was the only example we found, however, of blanket compensation at 100 percent of market value for the whole easement area (other than for forestry as discussed below).

At times none of the land under transmission lines is able to be used in the same manner as surrounding land. The prime example of this is when easements are built through commercial forests. Trees are unable to be grown on easements because of the risk of damage to power lines from mature trees growing taller than such wires. Hutchison and Rowan-Robinson (2000) refer to this as a 100 percent sterilisation rate, as the earning capability of the affected land is reduced to zero. In the case of forestry, landowners usually receive compensation at 100 percent of the market value of the land for the total easement area (see, for example, Beesley 2008, Hamer and O'Brian 2007, Hydro-Québec 2000, or Hutchison et al 1998).

There is an argument, however, that even in the case of 100 percent sterilisation, such as with commercial forests, the utility gets less than full ownership of the land and as such should not pay full land market price. Hutchison et al (1998) mention a United Kingdom based electrical company paying compensation at 85 percent of open market value for easements across forestry for this reason. This was, however, an old example, and the only one we found of forestry compensation at less than 100 percent of the market value of the total easement area. It appeared to be driven by the utilities bargaining strength rather than efficiency or equity.

As discussed above in section 2, only by assigning the appropriate cost to an easement can the most efficient decision be made about how to transmit power.

3.4.2 Land market value

In the countries we looked at the market value of land for pricing an easement is generally based on recent market sale prices of similar types of land (see for example Hutchison et al 1998). The value of land is multiplied by the area needed for the easement and the appropriate sterilization rate, as discussed above.

In practice, as noted by Beesley (2008), Hutchison et al (1998) and Solum (1985), land valuations generally suffer from a degree of inaccuracy. Quite often there is only a very small amount of open market sales evidence to base values on. Additionally the property market reacts only slowly to changes in underlying fundamentals and, as such, prices do not always reflect all available information (Hutchison et al 1998). According to Solum (1985) land values, as estimated by real estate appraisers, are influenced by opinion.

One of the landowners we spoke with provided an example of Transpower wanting to purchase land during a dip in land prices. There was a general reluctance to sell as landowners were of the opinion that they would receive more per area if they waited. This behaviour is common across all types of property owners. When house sales prices decline, for example, there is a decrease in the number of people selling houses as they wait for prices to improve. There is some concern, however, that

when Transpower are purchasing easements landowners are not always able to postpone selling until prices reflect their idea of worth.

The Natural Gas Corporation of New Zealand addressed the issue of changing land-use effect on land value. It provided landowners with the option to claim additional compensation for land taken if their land was rezoned within ten years of the easement being purchased (Mitchelmore 2009).

Some authors argue that allowance should be made, at the time the easement is created, for potential future land use effect on land value (Beesley 2008; Hutchison et al 1998). Hutchison and Rowan-Robinson (2000) suggest that compensation should be adjusted by assigning probabilities to possible future land uses. Beesley (2008) agrees, suggesting that compensation should be based on, among other things, the value of land under different land-use scenarios, weighted by the probability of land being put to that use in the future.

In theory, however, the probability of land being put to a different use in the future is reflected in current market price. Identifying and valuing alternative uses risks double counting price determinants (as the influence of these factors may already be incorporated in actual land market price).

On the other hand, using market data to price easements does have its problems, such as missing location specific factors. The issue may be better addressed by providing a share of compensation for easements as a rent rather than outright land purchases, discussed further in section 5.

3.4.3 Injurious affection

Injurious affection refers to the permanent depreciation in the value of retained land due to an easement.¹⁵ Injurious affection is described in the literature as including the permanent nuisance and inconvenience as well as the loss of scenic value caused by the infrastructure (Alberta Surface Rights Board 2009; Nuuja and Viitanen 2007).

These descriptions suggest that injurious affection has an element of operational costs (inconvenience to normal farming functions caused by infrastructure), and externalities (loss of scenic value). Each of these is discussed separately below.

3.4.4 Operational costs

For intensively farmed land particularly, infrastructure can impose significant operating costs. Overhead lines and structures increase the time and financial costs of applying fertiliser or controlling pests (Hutchison and Rowan-Robinson 2000), impede the movement of machinery to prepare or harvest crops (NFU 2009) and restrict the ability of farmers to run metal fences parallel with lines due to the possibility of induced current (Hamer and O'Brien 2007). Hydro-Québec provide a form of operational cost compensation which takes into account, among other things,

¹⁵ See for example Land Information New Zealand at <http://www.linz.govt.nz/crown-property/public-works/guide/compensation/index.aspx>

the cost of driving around support structures and maintaining uncultivated space (Hydro-Québec 2000). Operational costs include compensation for restrictions on development within proximity of the transmission infrastructure, considered by Hamer and O'Brien (2007), to be the single largest imposition of such infrastructure.

In most of the cases we looked at (Australia, Canada, Finland, New Zealand and the United Kingdom) operational costs resulting from transmission infrastructure are calculated and compensated for (see, for example, Hamer and O'Brien 2007).

Operational costs are more of a concern to landowners than the infrastructures' effect on land values. Solum reports the findings from a mid 1980s survey of 180 landowners in Wisconsin with transmission infrastructure on their land (including 127 agricultural landowners). The survey found that more agricultural landowners were concerned about the costs imposed by the infrastructure hindering farming operations than on decreasing property value (Solum 1985). This is to be expected given the change to land value is only realised if a property is sold and hence will be discounted, whereas operational costs are current.

In some cases, operational cost compensation recognises that when infrastructure is spaced close together it places greater restrictions on farming operations. The UK's National Grid's compensation increases by 50 percent when the supports of two separate electricity lines are within 30 metres of each other (Hamer and O'Brien 2007). Hydro-Québec allows for an increment of 50 percent over and above 100 percent of market value compensation "in consideration of the small surface area used" (Hydro-Québec 2000 pg 64). Beesley points out how cost to the landowner is, in part, a function of how the transmission infrastructure is installed over the land. The author suggests additional compensation may be needed when, for example, lines dissect productive land diagonally increasing the time cost of working land (Beesley 2008).

There appears to be a large degree of consensus on the factors which are considered as causing additional operating costs. Exactly how compensation is calculated, however, is not clear in the literature. From what we can gather operational costs are generally based on additional cost estimates as provided by industry experts.

3.4.5 Externalities

There were two negative externalities from transmission infrastructure commonly discussed in the literature; the aesthetic impact of infrastructure, and the perceived effect of transmission lines on health through Electro Magnetic Fields (EMFs). A number of authors thought that these externalities should be compensated for (Beesley 2008; Hutchison and Rowan-Robinson 2000). In some countries (for example, Australia, Finland and the United Kingdom) payment appears to be in part intended to compensate landowners for their loss from externalities (see, for example, Hamer and O'Brien 2007). Although how externalities were priced was not

clear. Compensation was not awarded for externalities in a smaller number of cases, such as in Québec (Hydro-Québec 2000).

Some authors argue that compensation should be awarded to people who have had their views upset by transmission lines, regardless of whether or not they own the land that the lines run over (Beesley 2008). In Finland compensation for disturbance to view extended to people who suffered due to transmission infrastructure running across neighbouring property (Nuuja and Viitanen 2007). With the exception of Finland, however, we found no evidence of anyone being compensated, other than the landowner who had towers and lines across their land. In New Zealand such effects on third parties are dealt with through the Resource Management Act and are not part of easement agreements between utilities and landowners.

A number of researchers have considered how power lines impact on land sales values (see, for example, Colwell 1990). Some studies conclude that power lines do reduce neighbouring land sale prices while others suggest there is little relationship. When there is an effect on property value it tends to decrease rapidly with distance from the transmission infrastructure. Properties immediately adjacent to land with wires bear the brunt of any price effect.

Although robust evidence linking adverse health effects with EMFs is lacking, it has been argued (and stated by the Finnish Supreme Court – see Nuuja and Viitanen 2007) that the perceived health risk is enough to lower land values and hence should be compensated for (see also, Bolton and Sick 1999). In theory, by allowing for how easements change the value of land, compensation in New Zealand allows for externalities for directly affected landowners.

3.5 Damages

The damages element of compensation is relatively straightforward. In all of the countries we looked into compensation was provided to cover all of the damage done during construction of the infrastructure (see, for example, Hydro-Québec 2000). It was the responsibility of the utility to either replace or provide financial compensation for the likes of damaged crops and broken fences or other equipment.

The payment of damages in New Zealand appears to be of little concern to affected landowners or Transpower. The landowners we spoke with were largely satisfied with Transpower's efforts to replace damaged property or provide financial compensation.

3.6 Payment methods

Easement compensation was provided as a one-off lump-sum capital payment, in annual payments or as a combination of lump-sum and annual payments. In Canada (Alberta and Québec) and the United Kingdom landowners had the option of choosing lump-sum or annual or a combination of the two types of payment (Atlanta SRB 2009; Hydro-Québec 2000; NFU 2009). Wisconsin law requires that for 100kV or larger lines, one or more miles long, compensation for agriculture land is both

lump-sum and annual payments (PSC 2009). In Australia and Finland compensation is in a single lump-sum capital payment only (Harrison 2002; Nuuja and Viitanen 2007; Crighton 2009).

When compensation was paid annually it was also periodically reviewed. Hydro-Québec annual payments are reviewed every five years, with payment values and adjustments based on land use. Landowners had the option of changing from annual rents to a lump sum payment at these reviews. Annuities were transferrable when ownership of the land changed (Hydro-Québec 2000). Annual payments in Alberta were also able to be reviewed every five years (Alanta SRB 2009). Compensation amounts are also re-evaluated periodically in the United Kingdom (NFU 2009).

It was standard practice for compensation to be paid annually in the United Kingdom. The United Kingdom is somewhat unique in that infrastructure rights are more often in the form of a wayleave rather than an easement (see, for example, Hamer and O'Brien 2007). Wayleaves are personal to the parties and so do not run with the land, although, as summarised by Hutchison and Rowan-Robinson (2000) "it is not clear that in effect there is much difference between the two" (wayleaves and easements).¹⁶ One of the consequences of wayleaves, however, is that compensation is generally provided in annual rents rather than lump-sum payments (Hutchison and Rowan-Robinson 2000).

Some authors argued that annual payments provide an advantage to landowners, as compensation amounts can be periodically adjusted to allow for changes in land values (Beesley 2008; Hutchison et al 1998). If an easement's land value is accurately estimated, however, and an appropriate discount rate used, then there should be no difference, to the landowner or the utility, between a lump-sum capital payments and amortised periodic payments. Preference for one over the other may reflect time preferences (whether someone prefers money in the hand now or an income for a period of time).

Empirical evidence suggests that many landowners prefer lump-sum compensation for easements. The United Kingdom's NFU points out that wayleaves are often converted to easements under agreement of both landowners and utilities. Compensation for easements is generally assessed at 20 times the annual wayleave payment (NFU 2009). Based on anecdotal evidence it appears that many New Zealand rural land owners also prefer lump-sum capital payments for wind-farm infrastructure, although these are for finite access periods (up to 35 years).

Preference for one type of payment over another may also reflect differences in willingness to bear risk. By paying compensation in a lump-sum the utility is certain of the total cost of that easement. Periodic payments introduce an element of risk that prices will change by more (or less) than anticipated at the time the easement is constructed. Lump-sum payments shift this risk to the landowner.

¹⁶ N.E. Hutchison and J. Rowan-Robinson 2000 page 6.

3.6.1 Payment per structure

In several countries compensation was partially or fully calculated based on the number of transmission line structures on an easement (in conjunction with land value based on use). The United Kingdom's National Grid has a standardised payment structure. The amount of compensation varies by type of tower, of which there are 13 categories, and land use (arable or grassland). Separate amounts are awarded for overhead lines and underground wires.¹⁷ Altalink in Alberta provide payment based on the number of transmission line support structures on the landowner's property,¹⁸ and land use (Beesley 2008). In Québec payment for infrastructure is attached to several factors, including the number of infrastructure support structures on the landowner's property (Hydro-Québec 2000).

The system of allocating payment based on land use and infrastructure appears easy to apply and transparent. According to some, however, it is too simplistic. Crighton (2009) points out that if compensation is based solely on transmission line support structures a landowner with two towers beside their house will receive the same compensation as a landowner with two towers in the furthest corner of their property. This could be avoided by assigning different per area values to land within a property, however. Alternatively, supplementary amounts could be awarded when towers are within 50, 100 and 150 metres of housing, for example.

3.6.2 Splitting the surplus

The shift of utilities, from providing an important service to the nation at cost to generating profits, has changed the attitudes of some landowners towards easement compensation. Hutchison et al (1998) point out that equivalence of loss compensation is based on the assumption that transmission lines are provided for the good of the wider community. Now that utilities are generating profits, in part due to the savings they make by using easements, it seems reasonable to provide more than the equivalence of loss to landowners.

Compensation greater than the equivalence of the landowner's loss is provided in Finland, Canada and the United Kingdom (Nuuja and Viitanen 2007; Hydro-Québec 2000; Hamer and O'Brien 2007).

Hutchison and Rowan-Robinson (2000) suggest that providing an element of consideration over and above financial loss may provide a net benefit to the utility by speeding up settlements. In 2008 Altalink increased the amount of compensation they were offering for a new 500 kV line, from C\$160 to C\$945 / \$1,155 per pylon for a single / double circuit (Beesley 2008). As reported by Beesley, the motivation for this substantial increase in compensation was to minimise the costs and delays associated with landowners taking Altalink to the Alberta Surface Rights Board (SRB). Prior to the increase in offered compensation Altalink had said that they

¹⁷ See <http://www.nationalgrid.com/uk/LandandDevelopment/LO/ElectricityAgreements/> Payments are the latest available on the website, for the period 1 April 2008 to 31 March 2009.

¹⁸ See Altalink Transmission in Alberta at <http://www.altalink.ca/Default.aspx?DN=119578d9-8dc7-4d47-a64f-9a30b8ef30b1>

thought approximately 90 percent of landowners affected by the new line would take them to the Alberta SRB (Beesley 2008).

This highlights two things. First, an increase in compensation may decrease net easement costs to the utility by lowering transaction costs and decreasing the time required to reach settlement. Second, the presence of a powerful landowners' advocate can significantly improve the outcome for landowners. This in turn shows that compensation amount is a function of relative negotiating strengths.

3.7 Negotiations

How a surplus is split between landowners and utilities (and payment method) appear to be more a matter of negotiating strength than fairness. Generally, countries with more powerful landowner representative groups have significantly better easement outcomes for landowners. Alberta and Québec both have strong bodies representing landowners' rights in easement negotiations and generous compensation packages relative to many other countries (see Hydro-Québec 2000 and the Alberta Surface Rights and Land Compensation Board).¹⁹

Elsewhere landowners negotiate largely as individuals with utilities who, in these circumstances, have significant bargaining advantages. Utilities are larger, better able to afford legal costs, more experienced at negotiating easements and have the threat of compulsory acquisition. Even though compulsory purchase powers are seldom exercised the presence of such powers is thought to be enough to sway negotiations (Hutchison et al 1998).

Kalbro and Lind (1999) use experiments to examine how surpluses are split between dominant and servient estates. Their findings suggest that compulsory acquisition powers result in infrastructure owners getting, on average, two thirds, of the surplus. Dominant estates tend to start the bargaining process by offering compensation for damages only, whereas the servient estate starts with an equal split plus some bargaining margin, generally around 0.6 to 0.8 (Kalbro and Lind 1999). This supports our earlier comment that how a surplus is split is determined by relative negotiating strengths.

¹⁹ Alberta Surface Rights and Land Compensation Board at <http://www.srbclcb.gov.ab.ca/>

3.8 Summary of literature key points

Efficiency: calculating easement costs

- Compensation is usually a function of:
 - easement area and land value
 - operational costs
 - injurious affection
 - disturbance.
- Easement area is compensated at land market value for 100 percent of the 'footprint' and for 100 percent of easement area through commercial forests. Other land uses are usually compensated based on how remaining easement land can be used for normal farming operations.
- Land value is generally based on market data, although the accuracy of such data is disputed by some authors.

Equity: payment methods

- We found examples of lump-sum one-off payments; lump-sum together with periodic and reviewable payments; and periodic payments only. In theory the current value of a lump-sum payment is the same as periodic payments, with preference for one or the other reflecting time preference or willingness to bear risk.

Equity: splitting the surplus

- The same base factors are generally used to determine operational costs in different countries, although exactly how compensation is calculated in practice is not always clear.
- Some countries award compensation for damage to views and perceived damage to health from EMFs, although again it is not clear how compensation is calculated.

Other

- Damages - In all cases compensation is awarded for one-off direct damages caused during the transmission lines construction.
- Negotiating strength - Utilities are usually in better bargaining positions than landowners due to compulsory acquisition powers, greater size, experience and awareness of the compensation process. Landowners' positions are strengthened by joining forces and hold-out possibilities.

Table 1 Compensation summary

Country (utility, state)	Payment covers				Payment method		Pay basis
	Damages	Production loss	Operating cost	Externalities	Lump-sum payment	Annual payment	No. support structures
Australia (Victoria)	x	x	x	x	x		
Australia (Queensland)	x	x	x	x	x		
Canada (Altalink Alberta)	x	x	x		x	x	x
Canada (Hydro-Québec, Québec)	x	x	x		x	x	x
Finland (Fingrid Oyj)	x	x		x	x		
United Kingdom (National Grid)	x	x	x		x	x	x
United States (Wisconsin)	x				x	x	
New Zealand (Transpower)	x	x	x		x		

Source: NZIER

4. Efficiency: Valuing easements

Central to the issue of efficiency is how to value or price easements when sales prices are influenced by the option of compulsory purchase (and information asymmetry). Generally prices in capitalist economies are determined by free market transactions. If someone wishes to purchase a good or service they find a willing seller and the two parties negotiate a price. Either party can refuse to enter into the transaction if the price is too low (or too high). Price, or the market value of a good or service, is thus determined by willing buyers and sellers. This is the basis for the vast majority of land and other transactions around the world.

The market for easements, on the other hand, is made up of, at times unwilling, monopoly sellers and a monopolist buyer with the power to force sales. This and the lack of transparency around previous sales, severely constrains price signals. Geographical factors and the requirement that transmission lines are linear determine where transmission lines can practically be built. It would be prohibitively expensive if not impossible to build all transmission lines along-side public roads rather than over farmland, for example. Nor would it be feasible to criss-cross lines over private land according to which landowners are most willing to sell easements.

Typically, as discussed in the literature review, the different costs imposed by transmission infrastructure are considered separately and summed to estimate the value of an easement. Careful consideration needs to be given to calculating fully the costs of all inputs, including land, in order for transmission to be allocatively and dynamically efficient. Although running all lines over longer distances over less productive land may be impractical, there may be occasions where these are the more efficient options.

4.1 Calculating the cost of easements

As argued throughout this report accurate appraisal of easement costs is crucial for efficient placement of transmission infrastructure. Without the benefit of a price setting market to value the stream of expected future benefits, including sale price (discounted to present values) easement values need to be estimated. This is difficult to do accurately, not least because different people place different values on separate non-productive aspects of land, such as views or anticipated future sales value.

Standard practice for pricing easements, as identified in the literature, includes consideration of:

- Land value
- Easement area
- Operational costs
- Disturbance
- Externalities

4.1.1 Market value of land

Estimations of land market value have a degree of inaccuracy. Although land market value at a point in time theoretically reflects all possible future uses, there are limited open market land sales data to base values on and these data are not necessarily location specific. Some authors suggest adjusting market value to allow for potential future uses of each easement. This risks increasing inaccuracy, however. Estimating and valuing possible uses and then adding this amount to land market prices risks double counting price determinants (as these factors may have already been included in land market price).

To some extent the issue of inaccurate land price data may be addressed by providing part of compensation periodically with options for rental amounts to be adjusted.

At the time of creation of an easement, however, for want of a better alternative, land price should be based on the market value of the best possible use of the land. The most appropriate market data should be used, with consideration given to the location specific factors of the easement area. This approach is in agreement with Crighton (2008).

4.1.2 Easement area

As discussed in the literature review the area of the easement can be separated into land used exclusively by the utility and land still able to be used by the landowner. The standard approach is for land used exclusively by the utility, such as under and within a close radius of transmission support structures, to be compensated at 100 percent of its market value. This is logical and appears to be standard practice in New Zealand (Crighton 2008).

The rest of the easement area is generally valued based on its productive worth to the landowner once the infrastructure has been built and, as such, is more open to debate. Easements impose greater costs on forestry owners, for example, as none of the land under lines can be used for growing trees. Sheep farmers, on the other hand, use the land under easements in much the same manner as surrounding land.

Forestry should be compensated at 100 percent of the land market value for the whole easement area. The easement area should include the land that the first row of trees are grown on beside the easement, as these trees bend towards sunlight and are not good for timber.

Our understanding is that the main concern facing forestry owners is their liability for damage to Transpower infrastructure on their land from, for example, falling trees damaging structures or lines. This could, to some extent, be addressed by Transpower widening the easement corridor to minimise the possibility of damage from trees. The required width for forestry easements needs to not only ensure mature trees are not able to contact infrastructure or lines, but should be wide

enough to allow for machines to harvest trees safely on each side of the easement.²⁰ Transpower needs to minimise the possibility of damage in the first instance by setting an adequate easement width.

Dairy and crop land can, to a somewhat lesser extent, be used in the same manner as surrounding land. The key issue facing these landowners is in higher operational costs as discussed below in 4.2. The sheep and cattle farmers we spoke with were relatively unconcerned about transmission infrastructure on their land (provided it was away from housing). Land under transmission lines is typically as productive as surrounding land. Compensation should, however, be enough to reimburse for restrictions on land use and any decrease in the sales price of the land.

In some countries unease with how easement values are estimated has led to requirements that utilities provide more than estimated costs to landowners. In Québec, as mentioned above, this is done by providing 100 percent of the land market-value of the easement for the whole easement (100 percent sterilisation in spite of most the land still providing a return to the landowner).²¹ Also in Québec compensation is adjusted upwards depending on how the lines dissect land. The recent six to seven fold increase in compensation in Alberta suggests an element of compensation somewhat greater than costs.²²

4.2 Operational costs

We spoke with New Zealand landowners and managers, and two land-valuers to get an indication of the main operational costs imposed on landowners by transmission infrastructure. We consider separately costs for four different types of land use:

- Commercial forests
- Crops
- Dairy
- Hill or high country sheep or cattle farming

There is a degree of commonality in the costs imposed by transmission infrastructure for different land uses. Crops and dairy farmers both commonly face additional irrigation costs for example. All landowners have some additional expenses for controlling pests and weeds around towers. There are also some costs unique to particular land-uses. As we understand it the main concern facing forestry

²⁰ Liabilities for damage facing forestry owners is discussed under operational costs.

²¹ Hydro-Québec 2000. Agreement on the siting of power transmission lines on farms and woodlands.

²² Beesley, S 2008. *Electricity #4 Compensation for Affected Landowners*. CABREE School of Business working paper Surface Rights and Land Compensation Board at <http://www.srbccb.gov.ab.ca/>

landowners is to do with the requirement that they are liable for damages to transmission infrastructure on their land.²³

Generally the main cost imposed by transmission infrastructure is on the time of farmers and farm workers. Standard operations, such as cropping or controlling for weeds, can take significantly longer when people have to work around towers. The electricity lines themselves can make it dangerous to touch or shift fences running parallel with power lines. Additional pesticides are often needed around support structures.

We spoke with 12 landowners and two land valuers. The following is based on their assessments of the additional costs imposed by transmission infrastructure. As such, these figures should be considered as indicative rather than precise. We welcome further information that would help us to refine these estimations.

There was a large variation in cost assessments between landowners even, at times, when they were using land for the same purpose. This highlights the difficulty of accurately assessing easement costs and supports the argument for providing a means of adjusting compensation for the sake of efficiency.

4.2.1 Key operational costs

Irrigation

For many landowners the main imposition and additional costs resulting from transmission infrastructure is caused by towers' impact on irrigation. Centre-pivot irrigation systems are, according to many, the most time and water efficient means for irrigating flat land. As such, they are used by many crop and dairy farmers.

The main saving from using centre-pivot systems is in time. They can largely be set and left. They do not require constant supervision or adjustment. The next best alternatives for irrigating land are significantly more labour intensive and generally require higher operational skill and awareness. According to one landowner operator mistakes are common when alternative methods are used to irrigate land with towers, due to such methods being less robust than centre-pivot irrigators.

There are other significant advantages of centre-pivot irrigation systems. They are considerably more efficient at applying water and nutrients largely due to reduced evaporation or exposure to wind, (centre pivot systems release water directly above crops or pasture). This in turn reduces the cost of water and minimise crops drying out. Alternative systems require more water pressure, in turn requiring more power.

When there is a transmission tower in a field, centre-pivot irrigation generally can-not be used.²⁴ The alternative for the farmer is to use a more time intensive less efficient

²³ All landowners, as we understand it, may be held liable when they damage transmission infrastructure. Forestry owners are particularly concerned as in many cases they are large enough to be held accountable whereas a small landowner would not be.

²⁴ Centre-pivot irrigation systems rotate around a field from a centre point. Generally they are not able to be used in fields where there is an immovable object.

system (such as hard-hose or travelling irrigators) or to not irrigate at all (we had examples of both). Each of these options imposes costs on the landowner.

Irrigation operational costs in Table 2 are based on:

- An additional half hour per day of labour to irrigate fields with structures, at \$23 per hour for an average of 150 days per year for crops and dairy (\$1,725 per structure per annum)
- Higher cost for power / nutrients / equipment breakages (\$1,000 per structure per annum)
- Less productivity due to more drying out of crops and pasture (\$1,000 per structure per annum).

Pest and weed control and fertilisation

The presence of pylons makes weed and pest control more difficult through several channels. Some weeds are best controlled through repeated cultivation and close grazing of the exposed roots which can be difficult under pylons. The area of land under transmission towers is often not controlled through usual spray regimes making it more susceptible to weeds and pests, which can establish and spread out from the area under the pylons. A further concern is that Transpower staff vehicles at times can carry unwanted seeds onto land. Forestry easements, particularly, are potentially home to a range of weeds or noxious plants that would not otherwise grow on forestry land.

Applying fertilisers and sprays with top dressing for example, takes longer and as a consequence costs more. Helicopters are unable to be used to the same extent, in part because transmission lines place the pilot in danger and partly because the coverage is inadequate close to towers. There are many other in themselves small impositions caused by towers. For example stock congregate and rub on transmission structures, spreading disease, damaging grass and increasing soil compaction around tower bases.

Pest / weed and fertiliser costs in Table 2 are based on:

- An additional 1 hour of labour per month to control pest and weeds around structures at \$23 per hour (\$276 per structure per annum)
- An additional 1 hour of labour per month to apply fertiliser around structures at \$23 per hour (\$276 per structure per annum)
- An additional 1 hour of labour per week to control noxious and other weeds in forestry easements at \$23 per hour (\$1,196 per structure per annum).

Working around structures

The requirement to work around towers puts more pressure on equipment and soil structure (due to tight turns) but primarily increases the time needed to perform many basic farming operations. Whenever the ground is being prepared or crops harvested the area around the pylon is worked from all four sides requiring the operator to re-

cross already worked ground. As an example a team making silage adds an additional half an hour (at \$1,300 per hour) to the time required when they need to work around a pylon.

The threat of electrocution and induced current also increase the time cost (and risk) of working close to lines. It is time consuming to don the necessary protective gear when spraying around infrastructure for example. It is common to shift or use temporary electric fencing to allow grazed land to recover. Shifting fences under power lines requires extra care and time with earthing, and even then shocks from induced current are common.²⁵

A further issue is that there is a greater risk of farm equipment being damaged. Even experienced operators occasionally hit towers or support cables, damaging both farm equipment and Transpower infrastructure.

The costs of working around structures in Table 2 are based on:

- An additional half hour of labour per year for silage making (\$650 per structure per annum)
- An additional 30 hours of labour per year, on average, for harvesting crops at \$23 per hour (\$690 per structure per annum)
- An additional 10 hours of labour, on average, for working around forestry easements when pruning or harvesting trees at \$23 per hour (\$230 per structure per annum)
- Damage to equipment, repair and time out of operation on average per structure per year (\$250 per structure per annum).

Impact on technology

While not a cost as such, transmission infrastructure can prevent the farmer from benefiting fully from new technologies. Evidence suggests that transmission lines interfere with some GPS technology (although this appears to be less of an issue with newer technology). GPS allows farmers to, for example, spray at night to benefit from lower winds and moisture loss.

Technology related costs in Table 2 are based on:

- The cost of up-grading GPS equipment to models not affected by transmission lines (\$1,500 one-off cost).

Other

If forestry owners (or other landowners) are required to insure against damage to transmission infrastructure on their property, the cost of insurance should be borne by Transpower. Such insurance is a cost imposed by the infrastructure and, under

²⁵ The pregnant farm manager of one of the landowners we spoke with had been shocked while moving a fence. Neither the farm manager nor owner wanted to risk a further shock while she was pregnant, effectively removing her from performing that duty around transmission lines.

the requirement that landowners are provided full compensation for “acquisition, taking, injurious affection, or damage” should form part of compensation.

There are a number of additional factors, such as freeing stock that get stuck in towers, that in isolation are largely insignificant. These do, however, impose additional costs on the farmer and should be accounted for. Possibly the easiest way to cover all costs is to provide compensation somewhat greater than estimated easement value, as suggested above.

4.2.2 Quantifying operational costs

Table 2 Operational costs estimates

Per structure per year for different land uses

	Forestry	Dairy	Crops	Sheep / cattle
Irrigation	0	3,725	3,725	0
Pests / weeds / fertiliser	1,196	552	552	552
Other working around	480	900	940	0
Technology cost	0	103	103	0
Insurance	500	0	0	0
Totals	2,176	5,280	5,320	552

Source: NZIER

4.3 Disturbance

There seems to be little argument in the international literature, or in New Zealand, around payment for disturbance or damages to crops, fences and other property when easements are built. The current approach of Transpower replacing or providing full compensation for whatever is damaged helps with efficiency and is equitable.

4.4 Externalities

Evidence suggests that transmission lines do have aesthetic and health impacts, lowering the value of affected properties, but the effect is very variable with circumstances. It appears that these effects diminish the further lines are from buildings or similar. The appropriate amount of compensation will vary by height of structures and distance from buildings so should be determined on a case by case basis. Realistic assessment of these costs, including recognition that they will increase as towers get taller and closer to buildings, is important for efficiency.

In a number of countries the effect of externalities is recognised in compensation. In Alberta, for example, scenic intrusion is recognised as a valid cost on the property where the easement is located.²⁶

²⁶ Alberta Surface Rights and Land Compensation Board at <http://www.srbxcb.gov.ab.ca/>

5. Periodic payments

Some landowners would like to have the option of receiving a portion of their compensation periodically rather than in one lump-sum. Transpower are concerned that shifting from lump-sum to periodic payments would be too costly. In this section we consider the costs and benefits to Transpower and landowners of Transpower providing a share of compensation periodically with adjustments, as opposed to lump-sum payments only. Our figures should be considered as indicative as the required time and other resources were estimated rather than determined empirically. We are happy to make adjustments if provided with the relevant information.

The lump-sum payment for an easement is, in theory, an amount which capitalises the earning capability and value of the affected land (transforms all future income streams and final sales price into current value using a discount rate). If easement land value and operational costs are accurately priced and an appropriate discount rate is used, then there should be no difference between a lump-sum capital payment and amortised periodic payments. The price of a piece of land at a point in time, in theory, considers all known information about the future use of that piece of land. Land located beside a town will be more expensive than land with little chance of being sub-divided, for example. In practice, however, land values change by more or less than anticipated, and operational costs are difficult to accurately access a priori.

Leaving to one side the difficulty of accurately estimating land price and operational costs, the key difference between lump-sum and periodic payments is in who bears the risk of a change in these values not anticipated at the time the easement price is calculated. There is a risk that prices may increase or decrease by more than estimated. Some landowners have said that they would prefer to receive compensation which adjusts with changes in land value. International evidence and New Zealand wind-farm experiences suggest that some landowners prefer lump-sum payments.

Moving to annual payments would shift some of the risk of future cost changes to Transpower, which may be willing to pay less for the periodic option. It also shifts payments out of capital and into operational expenditures, reducing easements' contribution to the return on investment. This may also have cost implications for Transpower not accounted for in the following analysis.

Periodic payments are considered by some landowners as a way of countering any inaccuracies in the estimates behind Transpower's offer of compensation. According to Mitchelmore (2009), the Natural Gas Corporation of New Zealand addressed the issue of changing land values over time by providing landowners with the option to claim additional compensation for land taken if their land was rezoned within ten years of the easement being purchased. In the United Kingdom, Québec and Alberta compensation is provided annually with periodic reviews to compensation amounts (see section 3.6).

5.1 Costs of periodic payments

We start with the assumption that, in present value terms, lump-sum payments are equal to the net value of all future periodic payments. This may not always be the case, but it is the best approach to valuing future revenue streams at a point in time. Trying to consider additional factors may lead to double counting and increased variability.

Transpower pays compensation based on the assumption that there is no difference between lump-sum and rental payments. In other words there will be no increase in the amount of compensation that Transpower is required to pay if it shifts from lump-sum to periodic payments.

As such, the main additional costs of renegotiating easements and awarding payment annually with periodic adjustments will be for setting up processes and administration. These include:

- Development costs – additional costs to Transpower of designing and establishing a process for managing the new compensation arrangements
- Management costs – additional costs to Transpower of administering, reviewing and amending payment amounts every five years
- Dispute costs – a reduction in the ongoing negotiation costs to Transpower and landowners of resolving compensation disputes
- Uncertainty costs – increased cost to Transpower of bearing the risk of easement rental costs increasing by more than estimated, currently a cost to landowners.

Labour costs in the following have been estimated at \$1,400 per week, somewhat more than the average weekly earnings of \$1,110 for male professional, technical, administrative and support services staff (larger companies tend to pay higher than average wage rates).²⁷ A further 20 percent, or \$1,200 per month, is added for non-wage labour costs, for offices, equipment, technical support, kiwi-saver etc.²⁸

Legal labour costs have been estimated at an average of \$1,850 per week, somewhat greater than the New Zealand in-house counsel wage of \$85,000 per year.²⁹ \$1,600, 20 percent of this amount is added as non-wage labour cost for legal advice services per employee per month.

5.1.1 Development costs

The following development costs are based on the assumption that both parties have agreed in principle to annual payments and are willing to reach settlement. The following costs are for developing a process that is applicable to as many or as few landowners as require compensation.

²⁷ Statistics New Zealand infoshare at <http://www.stats.govt.nz/infoshare>

²⁸ According to Statistics New Zealand non-wage labour costs make-up approximately 20% of total labour costs.

²⁹ Trademe New Zealand salary guide at <http://www.trademe.co.nz/Trade-me-jobs/Salary-guide/index.htm>

Annual payments indexed and adjusted every five years will require the design of a method for paying landowners. There will be a labour cost for deciding when payments will be made and how to index compensation amounts. There will be a cost associated with getting landowner agreement. Time per task is estimated based on our experiences performing similar tasks. We assume that Transpower would manage the process in-house with the following key costs:

- determining payment parameters:
 - three months labour at \$7,300 per month
- establishing system for making payments:
 - three months labour at \$7,300 per month
- legal drafting of methodology:
 - three months labour at \$9,600 per month
- presentation of methodology and discussion with landowner representatives:
 - presented by a Transpower employee and attended by 10 landowner representatives
 - 1 week of Transpower employee labour per meeting, including preparation and travel time \$1,700
 - labour cost of \$1,000 per landowner representative participant per meeting based on a full day participating in the meeting and two days labour preparing for the meeting
 - travel cost of \$600 per participant for 6 of the 10 participants, to cover return flights from regional centres to Wellington, taxi and other travel costs

We assume that consensus will be reached with three meetings.

5.1.2 Management costs

Once new compensation payments are developed and established, their management and oversight would incur additional ongoing costs to Transpower. A key expense will be every five years when the amount of compensation payment is reviewed.

For modelling purposes we assume that annual payments will be indexed to land price inflation with compensation amounts reviewed every five years based on changes in land value and operational costs. For each five year review land will need to be valued for a range of uses and in a number of locations. Time per task is estimated based on our experiences performing similar tasks.

- Annual management of accounts:
 - one month labour per year at \$7,300 per month
- Annual indexing of payments to inflation:
 - one month labour per year at \$7,300 per month
- Land value reappraisals every fifth year:

- for four different land uses (forestry, dairy, crops, sheep / cattle farming)
- valuations of each land type in 20 regions of New Zealand
- average labour cost of \$3,000 per valuation³⁰
- Operational cost reappraisals every fifth year:
 - \$15,000, based on what NZIER understands, from its own experience commissioning and undertaking surveys, the market price to be for designing and undertaking a short survey of farm managers and other experts

5.1.3 Dispute costs

The perception of fairer compensation for easements, under an annual compensation scheme, is assumed to reduce the number of disputes and shorten the time needed to resolve disputes that do arise. The net impact on dispute costs will depend, in part, on landowner support for any changes. Fewer disputes will reduce the litigation costs to Transpower and landowners, and reduce the amount of time required to complete transmission infrastructure projects.³¹

We assume that one in twenty landowners approached by Transpower currently disputes the easement process and that this will reduce to one in fifty. For modelling purposes we have based our assessment on the Whakamaru to South Auckland grid project which crosses 314 properties.³² Disputes are assumed to currently take three years to settle on average, reducing to one year with the annual payment option. We assume two new disputes on average per year in perpetuity post the Whakamaru project reducing to one per year with annual payments.

- Costs of on-going negotiations:
 - Transpower labour cost of \$16,900 per year per dispute based on one month of in-house counsel labour costs and one month of support staff labour costs
 - travel costs of \$1,200 per year per dispute based on the cost of return flights and the requirement that Transpower representatives attend two meetings away from Wellington for each dispute each year
 - landowner time cost equivalent to \$10,000 per year per dispute based on labour costs of landowners preparing for and attending meetings and any legal or other professional advice purchased

5.1.4 Uncertainty costs

If Transpower shift to periodic from lump-sum payments it will face more uncertainty about the final amount to be paid in easement compensation. It may want to discount the price accordingly, depending on its risk assessment and risk preference.

³⁰ Tim Crighton personal communication.

³¹ The forestry issue of liability is not addressed by shifting from lump-sum to annual payments so forestry disputes costs are assumed to be the same under both options.

³² Electricity Commission of New Zealand website.

Landowners opting for periodic payments would also face increased income uncertainty due to the possibility that rental payments may reduce. A number of landowners, however, expect this option to provide them with greater returns.

In theory the net risk is the same for lump-sum and periodic payments, the difference is in who bears the risk. This, in turn, will influence the cost of the risk.

Whereas Transpower currently bears the full risk of easement values depreciation by more than anticipated, this risk will be shifted to landowners who opt for periodical payments. Transpower will, instead, bear the risk of easement prices appreciating by more than anticipated for these cases.

Providing landowners with the option of periodic or lump-sum payment allows them to select the option that suits their willingness to bear risk. This in turn would be expected to reduce the net cost to landowners of easement income uncertainty. For the same reason Transpower would face additional costs if payments were made periodically. It is difficult to estimate these costs but there is no evidence to suggest that they would be large. We have not, therefore, tried to quantify how a change to periodic payments changes the costs of uncertainty.

5.2 Results

For modelling purposes we assume that annual payments would take effect from 2010 into perpetuity. We consider the net present value of continuous payment costs and benefits using a discount rate of six percent (the long run risk free rate) and eight percent (the Treasury rate). The total additional costs to Transpower and landowners of switching from annual lump-sum payments are shown in Table 3.

Note that we considered costs based on 314 landowners only. Including more landowners would have little impact on development, management and review costs. Uncertainty costs facing Transpower would increase but dispute costs would reduce. The net effect would be small.

These costs, while based on available information and our best judgement, should be taken as indicative. We can only estimate a priori what the net cost of developing periodic payments will be, for example.

Table 3 Cost of periodic payments

Net present value to Transpower and landowners at 6% and 8% discount rates

Costs	6%		8%	
	Transpower \$'000	Landowners \$'000	Transpower \$'000	Landowners \$'000
Development	119	0	119	0
Management	258	0	198	0
Review	1,246	0	987	0
Dispute	-794	-352	-674	-308
Total costs	829	-352	628	-308
Total net cost both parties	478		320	

Source: NZIER

With adoption of the assumptions outlined above and a six percent discount rate, it will cost Transpower an extra \$829,000 to give landowners the option of receiving periodic payments with adjustment every five years, approximately \$50,000 per year. Landowner costs, on the other hand will reduce by \$352,000 in net present value terms, about \$21,000 per year.

The effect, considering landowners' reduced costs along with the increased costs facing Transpower, will be a net increase in costs of \$478,000, or roughly \$29,000 per year. The biggest increase in cost is due to periodic reviews of land values and operational costs. These costs are borne by Transpower. Costs are reduced due to assumed lower dispute related costs, benefiting both Transpower and landowners as a group.

It is possible that Transpower would value the above costs differently than we have, or include cost items not listed above. We have, for example, possibly overestimated

the dispute costs savings or underestimated management costs. Transpower probably assigns a value to lump-sum payments reflecting their value to the group for accounting purposes. Lump-sum payments would allow Transpower to record easements as an asset whereas rentals would need to be accounted for as an expense. We are happy to make adjustments if provided with relevant information.

On top of this, and not considered in the above calculations, is Transpower's reaction to the above listed changes. Taking on the additional risks of future land value changes, for example, could change its negotiation stance and offset some of the savings in transaction costs and disputes outlined above.

We have, on the other hand, estimated at the high end of the range the costs to Transpower, including the major cost of reviewing land value. The above review cost estimate is based on the assumption that land-values need to be updated for the entire country each five years. Unless periodic payments are made available right across New Zealand this amount will be less than estimated.

6. Transparency and collective bargaining

We found several examples of farmers' groups negotiating on behalf of landowners. The Union des producteurs agricoles, negotiated easements with Hydro-Québec on behalf of landowners in Québec (Hydro-Québec 2000). Compensation in the United Kingdom is based on a national agreement in part negotiated between landowner groups and the electricity industry (Hutchison and Rowan-Robinson 2000). Negotiations in these examples have led to the development and dissemination of frameworks for considering easement compensation. Greater landowner awareness of the compensation process appears to counter, to some extent, utility bargaining strength.

Standardising some key aspects of the compensation process and making it more transparent would provide efficiency by reducing the time and money required for negotiations in the medium to long term. A comprehensive framework, with examples, applicable to a range of common situations could be established and made widely available. Once a formula had been developed Transpower and individual landowners would have a base for contracts rather than having to start negotiations from scratch each time an easement was needed. If landowners perceive that the initial negotiations were fair and balanced, and acceptable to other landowners, they would be much more likely to accept the outcomes.

The goodwill generated with a transparent and standard process could be of significant benefit for Transpower. Our impression has been that landowners are not opposed to infrastructure on their land per se. Contention is created as many landowners feel they are being forced to give up their land so that Transpower can generate revenue. Improving perceptions of fairness would go some way towards encouraging landowner buy-in and improving the efficiency of negotiations.

6.1 Costs of standardisation

A standardised process will reduce the time and money spent on later negotiations, but is unlikely to remove the need for negotiations entirely. On top of this, such an approach may create problems by encouraging rent seeking behaviour by landowners. If landowners are aware, for example, that growing crops rather than pasture provides greater compensation then this may cause them to shift towards growing crops. A sheep farmer may be encouraged to switch to growing crops in those areas of their land where the easement corridor is planned.

We believe there would be efficiency gains from introducing a standardised process with open negotiations and wide dissemination of both the process and results. Care would need to be taken, however, to manage landowners' expectations and minimise rent seeking behaviour.

7. In summary - efficient compensation

The amount of compensation paid for easements for transmission facilities across private land is not just a matter of fairness. If landowners are paid less than the costs they incur, easements will be under-priced and may lead to inefficient choice of routes for new lines.

In a freely functioning market of willing buyers and willing sellers negotiations between the parties should lead to efficient settlements, but there are a number of factors that make easement purchases an unusual transaction:

- Transpower is aware of the prices paid for previous settlements but landowners are not, due to Transpower's requirement that confidentiality agreements are signed when landowners sell easements
- Easement values and compensation amounts are based on estimated valuation changes formed with limited comparable sales data to draw on
- Transpower has the power, although seldom exercised, to force unwilling landowners to sell easements which changes the dynamics of negotiation and can distort the settlements reached.

These factors combined skew negotiations in Transpower's favour, suggesting that the prices paid for easements may be less than the full costs easements impose on landowners.

If easement prices are under-stated then Transpower will be encouraged to use easements where there may be alternatives that involve less real resource cost. To illustrate, if Transpower are trying to minimise the cost of easements they will run lines over productive dairy farm-land rather than less productive land, if it is a shorter route and they can ignore the costs imposed on land-users.

This issue of inefficient compensation for transmission routes is not unique to New Zealand. The international literature suggests that it is dealt with in different countries through two channels. A number of countries require utilities to provide compensation that is greater than the estimated costs of easements. As well as this, in many of the same countries compensation is paid periodically with options for the amount to be adjusted. Both of these features address the possibility of easement prices being understated and the related issue of inefficient transmission infrastructure.

It is also possible to overstate the price of easements, although this would not create the same inefficiencies. In the event prices were overstated and compensation provided accordingly, then the overstated portion of compensation would be spread thinly across millions of electricity users (as transmission charges) or across taxpayers at large (as lower dividends to government). If easements are undervalued, however, a relatively small group of landowners would bear the whole cost difference, possibly encouraging inefficient behaviour changing and forgoing of productivity improvement.

In conclusion we think that easements could be made more efficient by:

- Providing compensation greater than estimated value change caused by the easement; and
- Providing for periodic payments with the option of adjustments to payment amounts.

Increasing the amount of compensation could be done within the current legal requirement that compensation leaves the landowner no better or worse off. The degree of uncertainty around how much is needed to leave the landowner no better off suggests that increasing payment amounts is not the same as paying more than costs. Ideally, however, the extent of understatement (or overstatement) could be determined in case studies. Although this may be problematic given the sensitivity of this information to Transpower.

Providing for periodic payments, by our calculations, would impose about \$50,000 per annum additional costs on Transpower. This is not a significant amount when compared to the net cost of easements and it may improve the efficiency of electricity transmission.

Providing more than estimated costs in compensation and periodic payments may also improve efficiency by encouraging landowner support for easements thereby reducing the transaction costs of securing them.

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