

DEVELOPMENT OF DEMAND RESPONSE AS A TRANSMISSION ALTERNATIVE

RCP2 PROPOSAL

JUNE 2014

Keeping the energy flowing



Contents

1.	Introduction.....	3
1.1	Purpose	3
2.	Proposed RCP2 funding.....	3
2.1	Submissions on proposed funding.....	3
3.	DR as a transmission alternative	4
3.1	DR in the Market.....	6
3.2	Why develop DR as a transmission alternative now?.....	6
4.	Scope of DR as a transmission alternative	7
4.1	DR Programme.....	7
4.2	DRMS.....	7
4.3	Outside scope of RCP2 DR programme	8
5.	DR programme operating principles	8
6.	RCP2 DR programme plan	9
6.1	Barriers to Entry	9
6.2	Target Participation	10
7.	Costs and benefits.....	11
7.1	Costs.....	11
7.2	Benefits	11
7.2.1	Transmission deferral benefits.....	11
7.2.2	Additional market benefits	12

1. Introduction

1.1 Purpose

The purpose of this document is to describe our rationale for the continued development of demand response (DR) as a transmission alternative in New Zealand. It has been prepared in response to the Commission's draft decision on our RCP2 proposal, specifically paragraphs 5.80 through 5.89.

It explains why the continued development of DR capability for use as a future transmission alternative within New Zealand will deliver long term benefits to consumers.

2. Proposed RCP2 funding

Our submission to the Commission's RCP2 Issues paper included a request to increase our base capex allowance by \$10 million over RCP2 to develop DR capability for use as a future transmission alternative. The \$10 million was made up of internal staff costs, DR programme costs and the costs of operating and developing the Demand Response Management System (DRMS).

In its draft decision on our RCP2 submission, the Commission concluded that only the DRMS operating and development costs should be included in the opex allowance for RCP2.

While we agree that the staff costs were double-counted and should be excluded, we are of the view that there is a strong case for including the DR programme costs (\$6.5 million).

As a result, our funding request has been amended to \$8 million made up of \$1.5 million DRMS operating and development costs and \$6.5 million DR programme costs.

\$8m is a relatively small amount over RCP2 to ensure DR is available as an economic transmission alternative when required. While in the short term, demand has flattened it is not unreasonable to expect investment in added capacity into and through Auckland over the next 30 years as it continues to grow and likewise into the upper South Island. There are also likely to be some regional opportunities to use DR.

2.1 Submissions on proposed funding

MEUG cross submitted on the Commission's RCP2 Issues paper:

The discussion on demand response (pages 18-19) provides information on the expected scale of ongoing work at approximately \$2m per year. Still missing are "details¹ of the proposed work programme" and "how that expenditure links with service delivery and compliments or not other work by Transpower" noted in MEUG's response to Q.19 of the Commissions' issues paper. Without that information we remain unable to take a view on whether the \$2m per year demand response should be part of base capex, a recoverable item or under a new "allowance for contingent expenditure" category.

¹ For example it is unclear if the \$2m per year is a fixed overhead cost irrespective of demand response implemented to reduce other transmission costs or an estimate of variable costs that are project specific and hence can then be allocated

to those individual projects.

This paper provides the detail of the DR work programme in section 6, and addresses the concerns raised by MEUG.

Additionally, there were concerns raised by the Electricity Authority (Authority) in its letter to the Commission of 14 April 2014. We recently met with Authority staff to discuss the DR programme and the role of the DRMS. From our discussions, it appears that these concerns have arisen from a misunderstanding of the scope of our development of DR as a transmission alternative and the Grid Owner's role in that development.

This paper seeks to clarify our respective roles in section 4 and provide the Authority with the assurance that we are of the same view that the Grid Owner, has no role in developing DR products for the wholesale electricity market. We also provide assurance that the DR programme will not inefficiently crowd out existing uses of DR or reduce competition between DR providers, but in fact provide choice for participants and incentivise competition.

In its letter, the Authority proposed 3 measures which would mitigate their concerns. In summary:

1. Obtaining Authority's approval prior to using its DR programme, including for deferral of transmission investment, supported by a published protocol on its overall approach to the use of its DR management tool;
2. Reporting of DR in its monthly report to the Authority
3. Transpower to work with the Authority during RCP2 to develop a mechanism to incorporate its DR programme into the spot market.

We agree with the Authority that the process could be improved through the development and publication of a protocol on our approach to and use of DR. Section 5 of this paper describes the DR programme operating guidelines which form the basis of such a protocol and we will actively work with the Commission and the Authority to further develop this. We also appreciate the concerns outlined in the Authority's letter and, in addition to public consultation through the MCP process, we commit to consulting directly with the Authority before first using DR.

On the second point, we are more than happy to provide regular updates to the Authority and Commission on the progress of our DR programmes.

On the third point, as indicated in section 4.3, any market design involving DR will fall to the Authority to determine, and as such, is outside the scope of this proposal which is to develop DR as a transmission alternative. However, we are more than happy to support any market developments incorporating DR into the spot market.

3. DR as a transmission alternative

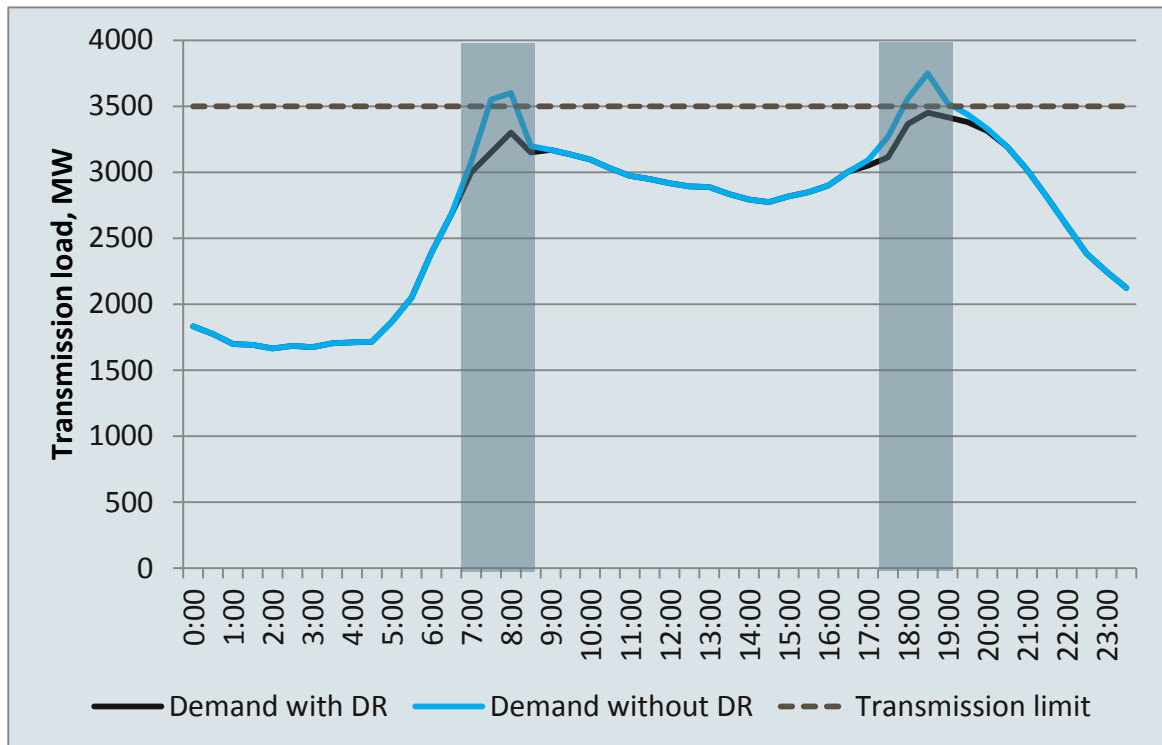
Transmission alternatives are means of deferring investment in transmission assets such as transformers or transmission lines.

When a need to invest in the transmission grid is identified, we consider using both transmission solutions and transmission alternatives which come in two main forms, generation and demand response.

Electricity demand varies throughout each day, typically peaking in the morning (between 7-9am) and in the evening (between 6-8pm). These peaks tend to be short but they drive the capacity requirements of the electricity system. To maintain a secure supply of electricity we need to ensure the capacity of the transmission grid is sufficient to meet those few peak periods.

Since transmission assets are often expensive it can be lower cost to reduce the demand at those peak times and maintain demand within the capacity of the existing assets.

The following chart shows how DR can support system security.



In the chart above, the use of DR has reduced peak demand below the capacity limit of the transmission assets.

In the context of DR as a transmission alternative there are also other potential uses, including:

- Reducing demand during construction outages to ensure continuity and security of supply with the reduced capacity.
- Reduce demand in the event that construction is delayed (i.e. “plan B”).
- Mitigating the uncertainty in demand growth.
Demand growth is currently quite flat, but the outlook is increasingly uncertain. This is leading to a growing gap between the forecast expected demand and forecast prudent demand which is used to determine the timing of new build. There is potential for DR to be used a risk mitigation tool to lower the cost of building to a prudent forecast whilst maintaining reliability of supply.
- Provide optionality when faced with uncertainty about the need for transmission investment. For example, if new generation might replace the need for investment in transmission, but is uncertain at a point in time, DR may buy time for the uncertainty to resolve itself.

3.1 DR in the Market

More generally, DR has uses beyond being just a transmission alternative. In other jurisdictions price responsive DR² is used for many purposes and delivers benefits because DR can enhance price discovery in the wholesale electricity market.

An efficient electricity market is premised on the supply side (generators) offering supply at their marginal cost and the demand side (consumers) reacting to those offers. This results in electricity consumers adjusting their electricity consumption as the wholesale electricity prices go up and down – and in that manner, the optimal social outcome is achieved.

However, only a few electricity consumers are actually exposed to wholesale electricity prices. Other than large industrial consumers, most consumers do not monitor real-time prices let alone adjust their consumption in response to changing prices.

With advances in modern technology, there is potential for a wide range of demand-side consumers to become more price responsive thereby improving market efficiency. However, this is outside of the scope of our development of DR as a transmission alternative, but as discussed below, our development of DR for transmission alternatives will contribute to enabling other “market” uses.

As discussed in section 4, development of DR products in the wholesale market is outside the scope of our development of DR as a transmission alternative.

3.2 Why develop DR as a transmission alternative now?

Over the time that we have been actively investigating DR as a transmission alternative, demand growth has flattened and the need to invest in the transmission grid has diminished or at least been deferred.

Based on the planned investments which could utilise DR as a transmission alternative out to 2040, the value of a two year transmission deferral is estimated to be around \$36 million, (see section 7.2). Our regulatory settings transfer the bulk of any such capex deferral benefits to consumers.

We need to continue with the development of DR capability for the following reasons:

- Our experience to date has demonstrated that development of DR capability well ahead of the need is essential to keeping the cost of DR down. The alternative is to procure “just in time” which potentially limits the pool and drives a high risk premium as was the case in 2011
- There are still barriers to entry for a large proportion of the potential DR capacity in NZ and it is highly desirable to understand the cost of removing these so we can understand how to access a large pool of low cost resource when it is required.
- The provision of DR programmes now will provide value to commercially funded DR aggregators as well as direct DR suppliers, thus increasing competition and driving DR costs down.

² Commonly, when DR is used as a transmission alternative, the demand respondents are contracted such that they must respond (reduce demand) to the signal provided. With price responsive DR, the signal is usually a price and the demand respondents can choose whether to respond or not.

- Demand forecasts are not static, demand growth could pick up just as quickly as it went away. Continuing the DR programme provides a relatively low-cost mitigation of this risk.
- The development of DR as a transmission alternative enables the use of it in any future market or distribution company programmes (outside the scope of our RCP2 plan to develop DR as a transmission alternative) which could lead to lower costs and higher consumer benefits.

4. Scope of DR as a transmission alternative

The Authority raised a number of concerns about the uses of DR in its letter to the Commerce Commission of 14 April 2014. We recently met with Authority staff to discuss the DR programme and the role of the DRMS. From our discussions, it appears that these concerns have arisen from a misunderstanding of the scope of our development of DR as a transmission alternative and the Grid Owner's role in that development.

We think this has arisen for two main reasons:

- 1) Our own language. When we talk about our development of DR, we are referring to our development of DR as a transmission alternative³. Transpower, the Grid Owner, has no role in developing DR products for the wholesale electricity market.
- 2) There also appears to be a misunderstanding of the differences between the Demand Response Management System (DRMS) and the DR programmes that we are proposing to undertake to build DR capability for use as a transmission alternative in the future.

To promote better understanding this section details what is in scope for our RCP2 funding proposal and, importantly, what is out of scope.

4.1 DR Programme

The DR programmes that Transpower, as Grid Owner, has been running since 2007, are concerned with investigating and building DR capability for use as a transmission alternative.

A DR programme, in the context of our RCP2 proposal, relates to the targeted development and growth of DR capability for use as a transmission alternative. We believe that building such DR capability well ahead of the need for its use as a transmission alternative will reduce the cost over time. It will also ensure we have the most appropriate contracting arrangements in place to allow participation from the largest range of potential participants.

The DR programme funding proposals **do not include** funding to actually defer any particular transmission investment.

4.2 DRMS

The DRMS is the software platform which enables the co-ordination and management of DR. We have implemented a relatively basic version of the same software that is used by PJM (a

³ Also, in describing our two programmes we used the terms "security" and "economic" as shorthand for "security – call by source" and "security- call by price". This led some to believe that the second programme was a market rather than security programme.

Regional Transmission Operator serving fifteen states in the US) for co-ordinating the largest DR resource in the world – approximately 15 GW.

While the DRMS could potentially be used in support of the delivery of any new market DR developments⁴, this will be up to the Authority and the System Operator (SO) to determine – it **is outside the scope** of the DR programme funding proposal in RCP2.

Recognising its potential for other DR uses though and recognising the effect the use of DRMS had on our 2013 DR programme in lowering the barriers to participation, we intend to transition operation of the DRMS platform to the SO within the next few years. The cost of this transition is yet to be determined, but **is outside the scope** of our RCP2 DR programme development.

Transferring the DRMS to the SO will align the centralised DR coordination with other jurisdictions around the world that use the SO to coordinate DR as a part of its role of ensuring supply and demand is balanced.

If and how the DRMS is used for alternative DR programmes will be up to the Authority and the SO to decide.

4.3 Outside scope of RCP2 DR programme

The DR programme funding will only be used to develop DR as a transmission alternative. It will **not be used** to develop existing market uses of DR such as interruptible load products or any market related products that allow participants to respond to energy prices.

Our wholesale electricity market is designed and developed by the Authority through the Electricity Industry Participation Code (Code) acting under its statutory objective, and implemented by the SO through its systems and procedures. Transpower, as Grid Owner, recognises that any market design involving DR will fall to the Authority and SO to determine.

5. DR programme operating principles

To provide assurance that the development of the DR programme and use of the DRMS is within the scope outlined above, we have developed some operating principles to guide the development of our DR programme through RCP2.

Our goal is to deliver consumer benefits by improving access to operable, efficient and competitive demand response for use as a transmission alternative for developing the transmission grid.

Operating principles

- Our DR development will be open and transparent – we will regularly publish updates of programme plans and results.
- We will always consider the use of transmission alternatives in our investment decision-making.
- We will endeavour to contract for transmission alternatives in a manner that limits unintended impacts on the wholesale electricity market.
- We will work to ensure that transmission alternative costs are as competitive as possible.

⁴ For example a capacity market for generation deferral, deferral of investment in distribution company networks, price responsive DR for end-use consumers, etc.

-
- We will work to lower barriers of entry for potential transmission alternatives proponents to participate in the transmission alternatives market.
 - The DRMS will not be used for any market based DR programmes unless agreed with the Electricity Authority.

6. RCP2 DR programme plan

We are proposing to continue development of DR as a transmission alternative throughout RCP2. Our plan is to:

- continue development of DR as a transmission alternative, by:
 - further understanding the barriers to entry for potential participants
 - reducing barriers to entry where it is cost effective to do so
 - further understanding the costs that make up the DR supply chain
 - simplifying the way in which we tender and contract for DR
- develop DR as a transmission alternative
- investigate how best to manage the snap-back effect which was observed in our 2013 DR programme
- improve the usability of the DRMS platform within the constraints of our DR programme.

International DR programmes demonstrate that diversity of resources is one of the defining characteristics of successful DR regimes. Therefore, if we aim to create a sustainable DR capability for New Zealand then we must encourage and enable the expansion of DR beyond established capabilities such as hot water. While our programmes to date have had some success in this regard, there is a significant resource that is largely untapped.

6.1 Barriers to Entry

The success of the 2013 DR programme has demonstrated that removal of barriers will encourage growth, however to further grow DR in New Zealand a number of other barriers need to be addressed:

- Limited access to meter data by consumers. Meter data is essential for participation in DR programmes as it forms the basis for measurement, verification and billing. If consumers choose to participate in DR programmes, they either have to negotiate access to their meter data or install an additional meter at their own cost.
- High cost of some enabling technologies. Automation is key to sustained participation in DR programmes; however, most consumers will have to purchase new equipment or appliances to achieve the level of automation required.
- Lack of customer awareness. While many consumers have the potential to participate and benefit from DR, most are unaware of DR as an opportunity.
- Measurement and verification challenges for 'non-conforming' consumers, eg irrigation.
- High cost to synchronise embedded generation and thus realise benefits beyond DR programme participation.
- Multiple DR regimes operating in relative isolation. This poses a potential risk to system operators at both a transmission and distribution level.

- Optimum time to procure DR prior to need date is uncertain, however experience has shown through the recent Alpine DR programme that the shorter the lead time, the higher the cost to procure.

It is essential to understand how we overcome these barriers to participation if we are to realise the full benefits of DR as a transmission alternative in the future. We also hope that through increasing the pool of participation via extending our DR programmes, we can demonstrate the value of DR participation, thus encouraging participation and innovation from commercially funded DR providers, such as aggregators and retailers.

This in turn should encourage private investment in DR technology and infrastructure.

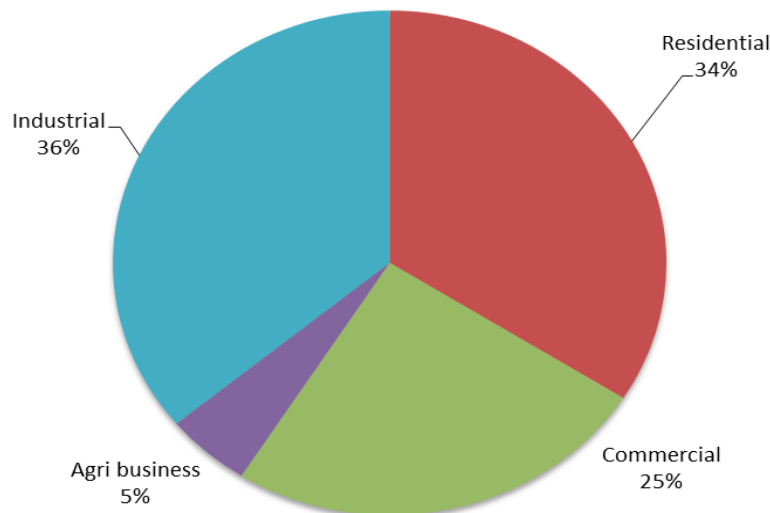
It is worth noting that participation in our DR programmes only commits the DR resource for the contracted time. The establishment of DR resources for our programmes enables providers to use this resource for other purposes once our programme has ended.

6.2 Target Participation

Electricity consumers can be divided into four high level segments.

- Residential: includes all residential consumers.
- Commercial: commercial consumers with peak demand less than 20 kilowatts (kW).
- Agri business: agricultural business, such as dairying and irrigation.
- Industrial: commercial and industrial consumers with peak demand greater than 200 kW.

Electricity Consumption



While the residential consumer class represents most untapped potential for demand response, the incremental changes needed to enable small to medium commercial and industrial consumers' participation in DR is comparatively minor.

With this in mind, we intend to focus on the Commercial and Agri Business sectors during RCP2 for our DR programme development.

We plan to run annual programmes throughout RCP2 targeting different consumers, starting with a commercial building programme in 2014. In subsequent years, this will be extended to

include larger facilities, such as supermarkets and university/school campuses. We also want to investigate the potential for agri business involvement as the growth in demand in this area remains strong despite the underlying downturn in forecast demand.

7. Costs and benefits

7.1 Costs

Given each DR development programme will target new DR, it is difficult to forecast the budget for these programmes, but based on previous experience, we anticipate we can reasonably deliver the programmes at the following annual cost.

	DR Annual Costs (\$m)
DRMS operating and Development Costs	0.3
Programme Costs (paid to participants in our programme)	1.3
Total	1.6

Note we have removed the \$0.5 million staff costs as these costs were unintentionally double counted and already included in our proposed departmental costs for RCP2.

On this basis we revise our proposal to \$8 million through RCP2.

7.2 Benefits

To support our proposal to continue development of DR as a transmission alternative we have undertaken analysis to determine the benefits of DR.

Given that the RCP2 DR programme is a development programme and, as such is not intended to provide benefits in its own right, this section describes:

1. Potential to realise transmission deferral benefits
2. Additional market benefits arising from establishing a DR resource which could ultimately be used in the wholesale market.

We have included the additional market benefits as we believe that DR development as a transmission alternative will contribute to the establishment of any market based DR products in the future. However, as clearly stated in section 4, the design and implementation of such market based products is outside of the scope of our DR programme development and up to the Authority and SO to implement.

7.2.1 Transmission deferral benefits

In order to illustrate the potential benefits of DR as a transmission alternative to defer transmission investment, we have reviewed the investments included in our RCP2 proposal.

The RCP2 proposal includes approximately \$1.25 billion of capex, of which approximately \$1.0 billion is related to grid equipment (transmission lines, transformers, etc).

Of that \$1.0 billion, approximately \$0.9 billion relates to replacing and refurbishing existing equipment and \$0.1 billion relates to enhancing grid assets.

If we assume that only the enhancement projects can potentially be deferred using DR and by inspection eliminate those projects where DR would not assist, we are left with approximately

\$34 million of capex over RCP2. For the purposes of this analysis, we assume a 2 year deferral which is a conservative assumption when faced with low demand growth forecasts. This results in the following:

Project	Capex estimate \$m	2 year deferral benefit \$m
OTA-WIR transmission	18.5	2.6
Timaru transformer	7.1	1.0
UNI reactive support	8.0	1.1
Total	33.6	4.7

The potential benefit from using DR as a transmission alternative for deferring ongoing E&D projects is approximately \$5 million over RCP2, or \$1 million per annum. We will not be in a position to know what projects can be deferred until closer to the need date when we go out and tender for DR.

The RCP2 list does not include major capex projects, where transmission alternatives are likely to have significant value. The first project where transmission alternatives are likely to defer major capital investment is the upper South Island project. It currently has a need date of 2022 and a forecast cost of \$77 million, hence a deferral benefit of around \$5 million a year.

It is not unreasonable to expect that we would have to spend a similar amount on enhancing and adding capacity to the grid as on major capex as we have over the last ten years within the next 30 years, although the timing will depend on demand growth. Conservatively assuming around a third of this future spend could be deferred by the use of DR. This is equivalent to \$2 million deferral value per annum.

Therefore, the total potential transmission deferral benefits are approximately \$3 million per annum. Over a longer time period, 2014-2040, this is equivalent to \$36 million on a present value basis.

This does not include the cost of procuring DR to defer the actual investment, however our expectation is that this cost to be significantly less than the transmission investment if DR capability is developed well ahead of need. To maximise the net deferral benefit requires an established DR capability – enough to see competition amongst providers and therefore access to low cost DR.

As such, we believe this figure is conservative and provides justification for continuing to develop DR as a transmission alternative.

7.2.2 Additional market benefits

As discussed throughout this paper, we plan to build DR capability through RCP2 for use as a transmission alternative. Any development of DR by way of wholesale market products is outside the scope of our DR plan.

However, should there be further demand side products developed in the future, any establishment of DR capability through our DR programme will contribute to the realisation of any future market benefits when it is incorporated in the wholesale market. A significant market benefit that could arise from increased demand side participation is the deferral/replacement of peaking generation capacity.

Should DR be incorporated into the wholesale market in the future, there is potential to reduce the demand peaks that drive investment in peaking generation. Some preliminary

analysis conducted using the Generation Expansion Model (GEM) have revealed that for a mid-range DR scenario, the reduction in capital and operating costs of peaking generation required out to 2040 has a net present value of around \$280 million.

Further analysis on the wholesale price impacts of incorporating DR in the wholesale market have been shared with the Authority but excluded from this paper as we have not yet reached a consensus of what these impacts represent in terms of consumer benefit. We look forward to further work with the Authority to develop a common understanding of these consumer benefits.