TAS78 Gen-Lite and DD-Lite Investigation and ROM: Product Concept Document

System Operator

Transpower New Zealand Limited

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Keeping the energy flowing




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IMPORTANT

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TABLE OF CONTENTS

DOCUMENT PURPOSE

The Electricity Authority ('Authority') have developed a Technical Advisory Services (TAS) Statement of Work (078) requesting Transpower prepare a concept paper for Dispatch-lite products, and an associated Rough Order of Magnitude (ROM) estimate of the effort and cost required to implement such products. This document delivers on this request.

INTRODUCTION

BACKGROUND

The New Zealand electricity spot market is settled on final prices that are published at least two business days after electricity is consumed. Currently, the spot prices published in real-time are only indicative. The Electricity Authority ('Authority') is undertaking a programme of work to introduce Real-Time Pricing (RTP). In the RTP proposal, a new 'Dispatch-lite' category of demand-response i.e. Dispatchable Demand lite ('DD-lite'), has been conceptually introduced as part of the RTP design, with the intention of:

- facilitating greater demand-side participation by providing an alternative to the existing Dispatchable Demand product for smaller consumers;
- allowing smaller consumers to indicate the maximum price they wish to pay for their flexible load and the opportunity to engage in the wholesale electricity market and set the price;
- improving price efficiency through balancing of power between demand and supply side;
- enabling readiness for a more technology-enhanced future by allowing greater flexibility to consumers.

The Authority developed a Technical Advisory Services (TAS) Statement of Work (078) requesting Transpower develop a concept paper for Dispatch-lite products and an associated ROM. This TAS078 work primarily focusses on DD-lite but also extends the 'Dispatch-lite' concept to cover generation i.e. Dispatchable Generation lite ('DG-lite'). Therefore, the high-level Dispatch-lite product description consists of both DD-lite and DG-lite.

The Dispatch-lite product options will only be possible either as part of RTP or post RTP and following completion of Transpower's Dispatch Services Enhancement (DSE) project (Dispatch-lite participants will need the enhanced dispatch capability that DSE will introduce).

THE OPPORTUNITY

An opportunity has been identified to leverage the potential introduction of RTP for a more dynamic and inclusive wholesale electricity market. RTP on its own provides current non-participants the opportunity to react to price once the market has moved to a point where they want to change their behaviour. Providing a less onerous mechanism for smaller participants (on both the demand and supply side) to signal their intentions ahead of time would allow for better forecasting, contribution to price setting and certainty of outcome.

Whilst this is not a *requirement* for the implementation of the RTP project, there is potential to improve efficiency of price setting in the wholesale electricity market by including more participants' price sensitivities in the discovery of the market price. Assuming the delivery costs, delivery risks and interproject dependencies with the RTP project are manageable, there is also a benefit to be considered related to making this type of change whilst the 'hood is up' on the market tools.

It should be noted that as the spot price for electricity is set by the marginal bid and offer, there is an argument that a very small number of additional participants can have a material impact.

TARGET MARKET

Potential participants who may be interested in Dispatch-lite products are identified below:

- Wholesale consumers who are direct connected:
- Examples of mid-sized consumers who are not direct connected:
    - Large scale food and beverage manufacturers
    - Irrigators
    - Vineyards
    - Future battery users
    - Smart controlled consumers
    - Airports
    - Cold stores
    - Aggregators (potentially new aggregator opportunities e.g. EDBs and retailers)
    - Offer of price capped new retail products from retailers/new retailers.
- Participants invested in new technologies and business models

ASSUMPTIONS

The assumptions made in this TAS are listed in Table 1.

ID	Description
A-001	The current Market System can only handle positive quantities e.g. negative DD-lite bids cannot be interpreted as DG-lite offers.
A-002	WITS changes would be required to handle the new bid/offer types for the Dispatch-lite products. The need to differentiate DD-lite and DG-lite from the standard equivalents of each is likely to be required to allow efficient compliance processes, correctly identify participants that should and should not receive constrained on/off payments and trigger whether a dispatch instruction or a dispatch notification is to be sent.
A-003	Telemetry from Dispatch-lite participants may not be available as the provision of telemetry to Transpower will incur ongoing costs to Dispatch-lite participants.
A-004	Dispatch-lite aggregation across different GXPs may be restricted even if telemetry is available i.e. the adjustment to GXP load calculation can only be made at a single nominated GXP where all the Dispatch-lite bids/offers can be submitted against. This aggregation will introduce inaccuracy in the load apportioning between GXPs within a MTLF region.
A-005	There is a Code amendment (13.20) to prevent calling Transpower for trivial bid/offer quantity changes.
A-006	The incidence rate of non-compliance with dispatch notifications will be very infrequent.

Table 1: TAS 78 Assumptions

LITE PRODUCT DESCRIPTION

Any participants who want to participate in Dispatch-lite need to be approved by Transpower, with approval based on the existing approval process for participation in Dispatchable Demand. The current process for acceptance of new generators will need to be reviewed and most likely updated for DG-Lite participants. It is anticipated the final process will be similar to the DD-lite approval process but with some specific conditions related to generation.

DD-lite participants without telemetry would need to be smaller consumers, otherwise they would participate in full DD with the benefit of receiving constrained on and off payments.

DD-lite participants must:

- be able to bid at both conforming and non-conforming nodes for all trading periods;
- be able to receive electronic dispatch 'notifications' from Transpower, rather than dispatch instructions as with Dispatchable Demand[1];
- electronically acknowledge dispatch 'notifications'[2];
- have some limited flexibility to advise immediately if they need (and wish) to decline dispatch 'notifications', and update all applicable trading periods as soon as they know (e.g. change DD-lite bids to non-dispatchable for the rest of the day).

  Note: there will be a regime for assessing compliance with dispatch notifications which if breached will result in suspension from the scheme;
- comply with notifications during Grid Emergency, load shedding in the wholesale electricity market;
- participants must provide half hourly metering data for compliance assessment;

  Note: Potential participants for these products may already be providing this information.
- not receive constrained on and off payments due to the less onerous compliance obligations that the Dispatch-lite products are proposed to be subject to in comparison to full DD;
- manage delivery of both products themselves if they already (or wish to) participate Interruptible Load (IL). This is because DD and IL products are currently not co-optimised. Note that DG-Lite participants would not be able to also provide Instantaneous Reserves (IR).

All the above applies equally to DG-lite participants.

[1] Under RTP it is proposed dispatch for Dispatchable Demand will move from NRSS (via WITS) to the dispatch schedule (via EDF) i.e. a 5min periodicity. Dispatch lite would also be dispatched on this time-frame. The differentiation between a dispatch instruction and a dispatch notification relies on enhancements delivered as part of the DSE project.

[2] Code amendment is proposed as part of the DSE project to provide the options for participants to acknowledge notifications.

EVALUATION

The Dispatch-lite product has been evaluated from various perspectives, including system security, market and compliance.

SYSTEM SECURITY IMPLICATIONS

Transpower's discretion to approve would consider the security risk of the participant to the system, including:

- DG-lite participants may be required to go through a commissioning process to ensure its generating plant stays connected during an under-frequency event. There will not be a requirement for existing excluded generating stations to go through commissioning to become a DG-lite participant. Where it is relevant is that if this inspires new generation or if system conditions change, Transpower reserves the right to impose performance obligations;
- Dispatch-lite participants are expected to comply with notifications during Grid Emergency and load shedding.

With no telemetry provided, Transpower has no visibility in real time if Dispatch-lite participants have followed dispatch notifications. Therefore, a MW limit at each GXP plus a cumulative limit at each region for Dispatch-lite participation are required to maintain the system security and current accuracy of the real-time schedule. DD-lite and DG-lite dispatch non-compliance may have an adverse impact on provision of stable frequency. A possible mitigation would be to increase frequency keeping reserve quantities.

The proposed limit would need to be determined if Dispatch-lite is to be implemented. The limit would be dependent on the size of the defined region and therefore wouldn't be a single number applicable for all the different regions.

MARKET IMPLICATIONS

Transpower's discretion to approve would also consider market implications of the Dispatch-lite participant, including:

- DG-lite participants could be restricted from the Ancillary Services market (security products) due to the option of not complying;
- rebidding to decline dispatch notifications will be treated as non-dispatchable at least until the end of the trading period;
- The need to differentiate DD-lite and DG-lite from the standard equivalents of each is likely to be required to allow efficient compliance processes, correctly identify participants that should and should not receive constrained on/off payments and trigger whether a dispatch instruction or a dispatch notification is to be sent. New bid and offer types for the Dispatch-lite products will result in costs to both Transpower and NZX[3] to implement the Dispatch-lite solution.

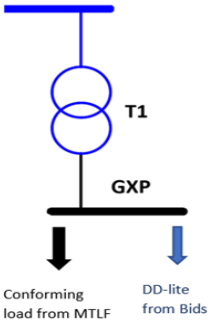
In the absence of telemetry (e.g. SCADA indication), the functionality to adjust the MTLF output values using bids and offers as inputs into the GXP level load used by the schedules does not currently exist in the Market System and represents a significant change to the current process. This is in line with the findings of previous investigations. Adjustments are necessary so the load (or generation) represented by the DD-lite bid (or DG-lite offer) is not double-counted in the market

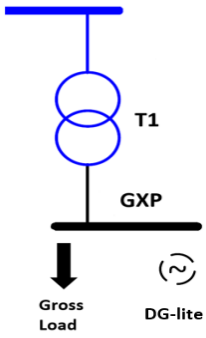
[3] As the WITS manager.

schedules e.g. DD-lite load included within the MTLF output values and as a bid. If no changes are made, then the quantities involved must be limited to levels which will not materially impact schedule accuracy.

Figure 1 shows the adjustments required to schedule data inputs to accommodate Dispatch-lite products in the absence of telemetry. In both examples, a DD-lite bid or DG-lite offer needs to be used as a substitute for missing SCADA indications.

If SCADA telemetry is available, the GXP load value can be adjusted to be T1 minus DD-lite load and T1 plus DG-lite generation respectively. These changes can be made via BAU processes.

<table>
<tr><td colspan="2">Currently GXP Load = loading on T1, meaning T1 SCADA value is used for MTLF</td></tr>
<tr>
<td> 

In the absence of SCADA indication for DD-lite, GXP Load = Loading on T1 minus DD-lite bids. Therefore, adjustments are required to exclude DD-lite from GXP load values coming from the MTLF. This depends on assumption A-006.</td>
<td> 

In the absence of SCADA indication for DG-lite, GXP Load = Loading on T1 plus DG-lite offer, i.e. gross load. Therefore, adjustments are required to GXP load values coming from the MTLF to forecast Gross load. This depends on assumption A-006.</td>
</tr>
</table>

Figure 1: Data input adjustments to accommodate Dispatch-lite products in the absence of telemetry

ALTERNATIVE TO ADJUSTING THE GXP LOAD CALCULATION

Forecasting load is key to managing the power system, ensuring that the system operator preserves system security by dispatching sufficient generation to meet demand and providing accurate forecast price signals allows the market to organise itself in an optimal way through offers and bids. Like all the system operator tools the load forecasting tool can only be as good as the data the goes into it.

Load forecasting accuracy is a critical contributor to the accuracy of forecast prices. Demand-side price responsiveness (changing demand in response to price), including operation of distributed generation, is so far not explicitly forecast in the market system. For the most part this price-responsiveness from consumers is currently below the threshold of forecast accuracy, and therefore has no impact on forecast prices. We anticipate that development of 'smart' technologies, supported by the projects on the Authority's work programme, will increase price-responsiveness to an extent exceeding our forecast accuracy. Initiatives such as DD- and DG-Lite will enable price-responsive participants to signal their intentions to the system operator in the forecast time frame, which should improve the accuracy of our load forecasts. Previous work has identified the system changes necessary to enable using these new data streams as part of our load forecasting.

To help meet the *"less onerous"* objective for the lite products it is proposed that the requirement for existing participants to provide SCADA data should not apply. This would remove the barrier to entry of qualifying participants being required to have SCADA systems with secure ICCP connections to Transpower as the system operator. No investigation has been undertaken to determine the amount to which MW quantity would need to be limited at any GXP to avoid the need for SCADA telemetry.

Lack of telemetry also has an impact to load forecasting in the short and medium term. Two methods have been proposed to mitigate this impact: improve the load forecast tools to account for the estimated response of the DD- or DG-Lite resource (based on their bid or offer as applicable), or institute business rules that limits the quantities of DD- and DG-Lite offers/bids.

Managing load forecast error resulting from “Lite” product bids and offers by limiting quantities has several difficulties, resolution of which would come at considerable effort and cost:

- The magnitude of load forecast error is different in different regions.
- Overall system security is affected disproportionately from load forecast error in some GXPs compared with others (for instance, errors in Bunnythorpe GXP load can significantly affect Palmerston North regional load).
- Multiple participants in the same region would have a cumulative effect on the load forecast error, even if individual participant limits were imposed.
- Multiple participants in the same region would result in limited capacity that could be allocated. This would have an implication on competition.

Transpower believes that the dispatch-lite product implementation requires making recommended adjustments to the GXP load inputs. This would remove a barrier to participation by smaller consumers and generators in the wholesale market, without either unacceptable degradation of schedule accuracy or significant dilution of any benefits of those products due to the likely limitations on the quantities able to be bid or offered.

COMPLIANCE REQUIREMENTS

Table 3[4] illustrates the expected impact to various sections of the Code. The table uses a Red-Amber-Green metric of qualitative measurement, where Red denotes a major change is expected, Amber denotes a minor change, and Green indicated no change is expected. Grey indicates the provisions are largely revoked by the proposed RTP amendment.

Section	Code Clauses (based on proposed RTP amendment)	Extent of Change	Reason
Part 8 – indications	8.21 etc	Minor	Review obligations of excluded generating stations, default no requirement for real time indications
Bids and Offers (Energy)	13.4 - 13.27	Major	In addition to RTP amendments to date, clarify bid and offer requirements for Dispatch Lite participants Review bona fide physical reasons for bid and offer changes Review requirements for unoffered generators
Grid Exit Points	13.27A - K, 13.28	None	
Information from Grid Owners	13.29 - 13.36	None	
Offers (Instantaneous Reserve)	13.37 - 13.55A	None	
Scheduling	13.56 - 13.67	None	
Dispatch	13.69A - **13.87C**	Minor	Review proposed dispatch notification regime, application to DG (pending DSE project) Review acknowledgement requirements
Real time prices	13.88 - 13.96	None	Revoked under RTP
Grid emergencies	13.97 - 13.101	Minor	Review requirements for DD / DG Lite stations to comply with dispatch instructions in grid emergencies
Publishing and reporting	13.102 - 13.106 **Schedule 13.3B**	Minor	Review publishing requirements for dispatch schedules
Must-run dispatch auction	13.107 - 13.130	None	
Pricing calculation and provisional prices	13.131 - 13.166A	None	*Largely revoked under RTP*

[4] The bolded Code entries in Table 3 relate directly to new Code clauses proposed under RTP.

Interim and final prices, Pricing Errors	13.167 - 13.191	Minor	Review pricing error process
Calculation of constrained amounts	13.192 - 13.212A	Minor	Clarify no constrained amounts payable for DD / DG Lite participants, review RTP drafting for application to DG
Pricing Manager reporting	13.213 - 13.216	None	
Hedge arrangement disclosure	13.217 - 13.236	None	
Spot price risk disclosure	13.236A – I	None	
Financial Transmission Rights	13.237 - 13.255	None	
Schedule 13.3		Minor	Review schedule inputs
Schedule 13.8		Major	Insert compliance obligations for DD / Gen Lite participants based on comparison of half-hourly metering with dispatch instructions
Other schedules		Minor	Update Schedule 13.1 offer form

Table 2: Expected impact to sections of the Code

ROUGH ORDER OF MAGNITUDE (ROM) COST ASSESSMENT

The ROM for implementing Dispatch-lite products is provided as a range of likely costs, accuracy will improve as the product specification and detailed requirements are clarified.

1. Further solution definition – IPLC Define Market Outcome and Develop Solution Approach phases.
2. Technical solution specification - IPLC Initiate and Delivery phases system solution component
3. Business changes within the system operator function – IPLC Delivery phase business change component.

The approach to the delivery of this change will have an influence on the delivery cost. Should the approach be to deliver these 'Lite' products independently of the RTP project the costs are likely to be at the mid-point or above of the estimated cost range, however if this is done in concert with or as part of the RTP project efficiencies gained would put the likely costs at the midpoint or lower of the estimated cost range. Whilst there are significant efficiencies to be gained by including this change into the scope of the RTP project and completing the work in parallel the ability of Transpower to achieve this will need to be confirmed as the required technical and subject matter experts be will heavily utilised by the RTP project at that time. In addition, consideration will need to be given to the required Code changes that will also need to be introduced at a time where the code is being heavily revised for the RTP project.

The estimated costs provided relate to the further specification and delivery of the "Lite' products described in this paper include:

- more detailed specification of the concept (i.e. stakeholder and solution requirements);
- technical design, delivery build, testing and deployment;
- the adjustments required to GXP load calculation to accommodate Dispatch-lite products in the absence of telemetry (as shown in Figure 1);
- SPD changes for the new bid/offer types for the Dispatch-lite products, and SPD Audit;
- business process updates;
- operator training to cover the changed processes;
- project and change management; and communications.

Phase / Item	Cost Estimate ($) Low (Optimistic)	Cost Estimate ($) Expected	Cost Estimate ($) High (Pessimistic)	Duration Estimate
Invex	$145,176	$161,678	$178,182	3 months
Opex Totals:	**$145,176**	**$161,678**	**$178,182**	3 months
Capex - system delivery including IDC	$343,135	$676,264	$1,035,384	9-11 months
Capex – Business change (system operator)	$59,339	$66,757	$74,174	
Capex Totals:	**$402,474**	**$743,021**	**$1,109,558**	**9-11 months**

Table 3: ROM Costs and Timeframes

Where a ROM estimate at this point in the IPLC process would have an estimated cost with a range of -25%/+75% the cost range for this is closer to plus/minus 50%. This has been done as there is potential to incorporate this project into the RTP project which will further reduce overheads and bring significant efficiencies and the concept is well understood and it is considered unlikely costs will be greater than 50% of the estimate.

The ROM estimates are based on the scope as currently understood and will undergo further refinement when the high-level design and detailed design phases are completed. There is no provision in the estimates for costs incurred by any party other than Transpower e.g. NZX may incur costs for handling new bid/offer type for Dispatch-lite products, changes to the participant's systems and provision of metered load for compliance assessment.

One of the benefits of implementing the necessary changes to the GXP load calculation for the Lite products is that it resolves a problem common to at least three initiatives that are being investigated by the system operator for the Authority;

- DD and Gen-lite products (this investigation)
- Aggregated Dispatchable Demand
- Evaluating Options to Improve System Load Forecast