www.pwc.co.nz

TPM Change Impact Assessment

Responding to the Electricity Authority's consultation papers
- A report for Transpower
July 2016

pwc

pwc

Jeremy Cain
Regulatory and Pricing Manager
Transpower House
96 The Terrace
PO Box 1021
Wellington

21 July 2016

Dear Jeremy

Review of the impact of the Transmission Pricing Methodology (TPM) changes

In accordance with the terms of our contract dated 7 June 2016, our Terms of Business and the stated Restrictions & Disclaimers, we attach our final report summarising the results of our review of the impact of the TPM changes proposed by the Electricity Authority.

If you require any clarification or further information, please do not hesitate to contact me.

Yours sincerely

Grant Dennis
Partner

PricewaterhouseCoopers, 113-119 The Terrace, PO Box 243, Wellington 6140, New Zealand
T: +64 4 462 7000, F: +64 4 462 7001, pwc.co.nz

Restrictions and disclaimers

This paper has been prepared solely for the purposes stated herein and should not be relied upon for any other purpose.

To the fullest extent permitted by law, PwC accepts no duty of care to any third party in connection with the provision of this paper and/or any related information or explanation (together, the "Information"). Accordingly, regardless of the form of action, whether in contract, tort (including without limitation, negligence) or otherwise, and to the extent permitted by applicable law, PwC accepts no liability of any kind to any third party and disclaims all responsibility for the consequences of any third party acting or refraining to act in reliance on the Information.

We have not independently verified the accuracy of information provided to us. Accordingly, we express no opinion on the reliability, accuracy, or completeness of the information provided to us and upon which we have relied.

The statements and opinions expressed herein have been made in good faith, and on the basis that all information relied upon is true and accurate in all material respects, and not misleading by reason of omission or otherwise.

The statements and opinions expressed in this paper are based on information available as at the date of the paper.

We reserve the right, but will be under no obligation, to review or amend our paper, if any additional information, which was in existence on the date of this paper was not brought to our attention, or subsequently comes to light.

This paper is issued pursuant to the terms and conditions set out in our engagement letter of 7 June 2016 and the Terms of Business attached thereto.

Table of contents

Executive Summary

Executive summary

Background

The Electricity Authority (EA) is currently reviewing the Transmission Pricing Methodology (TPM) and has issued a consultation paper that proposes a number of changes:

– The *Transmission pricing methodology: issues and proposal: second issues paper* (17 May 2016) proposes guidelines for Transpower to follow in developing a new TPM to allocate Transpower's costs to its customers.

The EA has requested feedback on this proposal by 26 July 2016.

The purpose of this report is to assess the impact of the proposal on Transpower's systems and business processes.

Terms of reference

We have been asked to:

– Assess the impacts of the EAs proposed changes to the TPM on Transpower's current systems and business processes;

– Assess the timeframe and costs to implement a new TPM, in three scenarios (high complexity, medium complexity, and lower complexity);

– Estimate the overall cost to achieve and operate the future state.

Our approach

We have assessed the impacts of the proposed TPM changes as follows:

– Reviewed proposed changes to the TPM;

– Documented the business processes and systems involved in the current TPM;

– Assessed the impact of changes to the current state;

– Assessed changes to develop three complexity scenarios;

– Developed an indicative implementation roadmap and timeline.

All cost estimates developed in this report are indicative. They may vary by +/- 50% due to the level of design and impact assessment able to be performed at this stage of the consultation process. As a more detailed TPM is developed, further design activities and refinement will be possible.

The additional material and evaluation that could not be included directly within the report can be shared and/or presented separately towards the EA.

Executive summary

The TPM proposal

The EA proposes a suite of changes to the TPM, including:

- A new Area-of-Benefit charge;
- An expanded Prudent Discount Policy;
- A residual charge for remaining unrecovered revenue.

The EAs proposal prescribes the method or a selection of methods that Transpower is to use in some cases, and provides some discretion for Transpower to select a method in other cases. We developed three scenarios to account for the different impacts of each of these options.

The three scenarios for the TPM

The following scenarios were defined:

- Implementing the full scope of the EA guideline including the vectorised Scheduling, Pricing and Dispatch (vSPD) method to assess beneficiaries of transmission is the high complexity scenario;
- Using the discretion provided in the guideline and removing the net benefit approach is the medium complexity scenario;
- The lower complexity scenario includes a significant simplification of the draft guidelines requiring limited system implementation efforts.

Each scenario is associated with different implementation costs, operating costs, and implementation timelines.

High complexity scenario:

Implementing the full scope of the EA guidelines would have a significant impact on the TPM business process, technology, and organisation requirements within Transpower. Additional FTEs would be required for the new TPM process and capital expenditure consultation and dispute resolution processes as customer charges become more complicated. Technology systems would need to be updated and added for new calculation rules, and additional data would need to be collected and incorporated into existing systems.

Medium complexity scenario:

Using discretion available within the proposed guideline would allow simpler assessment and benefit accounting procedures, particularly using physical capacity and average injection as an allocator instead of vSPD, and developing a long-run marginal cost (LRMC) charge. This scenario has a substantial reduction in implementation technology costs and maintains a similar ongoing FTE impact.

Lower complexity scenario:

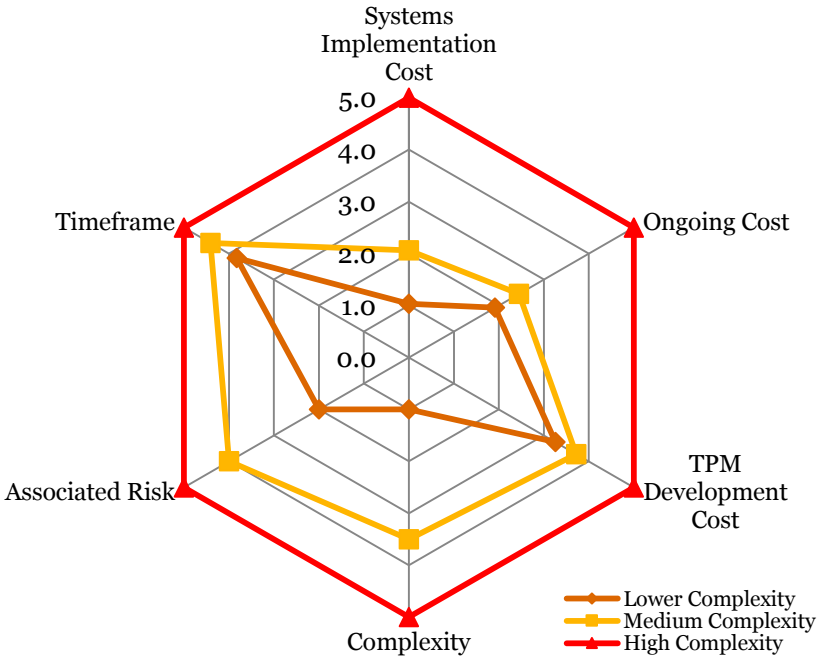
Reassessing the current guidelines for practicality would focus on the main business change drivers within Transpower. Transpower would use the TPM code drafting phase in cooperation with the EA to address alternatives to high impact change areas, such as including the entire asset register in the Area of Benefit charge, allocating by a generalised regional approach and using consistent benefit accounting treatment. It is to be confirmed whether this approach would be considered sufficient to meet the intended goals of the TPM review.

Executive summary

Summary of scenario impacts

The table below summarises the additional costs of each scenario over the current state. Transpower has indicated that for the high complexity scenario it would incur code and policy development costs of $4.3M over 12 months from internal and external specialists which scales down accordingly for the less complex scenarios. The timeframe for the high complexity scenario, including the code and policy development phase and a 16 month implementation phase is estimated to be 34 months. The less complex scenarios are assumed to entail less effort for the TPM development and system implementation, thus reducing the timeframe by up to 6 months.

The current sequential approach to TPM development and system implementation with iterative rounds of internal and external consultation renders completing the proposed changes in time for the 2019 pricing year improbable (especially for the high complexity scenario). Staging the medium complexity scenario (which includes less overall design and implementation effort) would allow for overlapping TPM development and implementation by subdividing requirements into bundles and thus would significantly lessen the overall timeframe required.



Note: The High scenario was normalised to a 5 rating on a 0-5 scale per axis (less is better). All cost axes reflect the relative effort estimates from the table below. Non-cost axes reflect stakeholder discussions.

Scenario	*TPM development ($M)*	*Systems implementation ($M)*	*Hard-/Software & Support ($M)*	*Operational Implementation ($M)*	*Ongoing costs ($M)*	*Systems implementation & 5 year operation ($M)*
2012 Proposal	*not assessed*	*12.5-13.4*		*1.1*	*0.8*	*16.8-17.7*
High complexity	4.3	8.2	1.5	1.5	0.8	14.4
Medium complexity	3.2*	2.0-4.0*	0	0.7	0.4	4.5-6.5
Lower complexity	2.8*	0.5-2.0*	0	0.6	0.3	2.3-3.8

*) Note: The sensitivities for TPM development and systems implementation are estimated based on complexity reductions from the High scenario. The underlying assumptions are that 20-100% of efforts could be avoided on a per change basis.

Background & Approach

Background

Transmission Pricing Methodology

The Electricity Authority (EA, the Authority) is reviewing the current Transmission Pricing Methodology (TPM). The EA considers there are a number of efficiency, price signal, and decision making participation issues with the connection charge, interconnection charge and HVDC charge. The EA proposes to address these concerns by publishing guidelines for a new TPM that would contain the following components:

- Connection Charge;
- Area of Benefit Charge;
- Residual Charge;
- Prudent Discount Policy;
- Potential Additional Components.

The EA is consulting on its proposals for the TPM and has requested responses from market participants and others by 26 July 2016.

Terms of Reference

The EA has proposed guidelines for Transpower to follow in developing a new TPM. The draft guidelines require varying degrees of complexity for each of the proposed TPM components. In some areas, the TPM guidelines will leave considerable discretion for Transpower to develop a methodology.

Assuming the EA's proposal is progressed, Transpower would need to develop the new TPM processes, systems and industry reporting to meet the new TPM requirements.

Transpower has sought advice on the timeframes and associated costs for the establishment of the TPM (based on the three development paths: high complexity, medium complexity and lower complexity), as well as areas of material risk (implementation and dispute) to assist in its submission and ongoing discussions with the EA.

The EA has proposed that the amended TPM be in place for the April 2019 pricing year. Transpower has sought advice on the achievability of these timelines and has requested an assessment of the implications of the development of the new TPM. This is the basis of this report.

Approach

Our approach

Our assessment of the impact of the Authority's proposed changes to the TPM on Transpower's operations is based on:

- Reviewing the Authority's consultation papers and other documentation provided by Transpower;
- Information provided by key stakeholders at Transpower (See **Appendix** for a full list of stakeholders).

We used this information to:

- Document Transpower's current state business processes, organisational involvement and supporting systems delivering the TPM;
- Assess the impact of the changes on the current state outlined in the corresponding consultation papers;
- Identify potential future state options of implementing the proposed changes and evaluating their overall complexity;
- Estimate the overall cost to achieve and operate the future state.

Structure of report

The report has been structured as follows:

Background & Approach. Sets out the context of the report and how we approached the review.

The current TPM process. Outlines the current state organisational set-up, business processes and supporting systems that help deliver the TPM.

The Authority's proposal. The proposed changes of the TPM proposal are summarised, classified in light of their impact on processes, people, technology and industry consultation and presented with their potential future state implementation options. The complexity of these individual options is expressed and related, leading to the indicative implementation timeframes, cost to achieve and cost to operate.

Additional material supporting conclusions and detailing assumptions is provided within the **Appendix**.

The current TPM process

Components of the TPM

Purpose of the TPM

The Transmission Pricing Methodology sets out how the revenue that Transpower is entitled to recover is allocated amongst its transmission customers. The methodology is administered by Transpower.

Components of the current TPM

The current TPM comprises three charges – a connection charge, an HVDC charge and an interconnection charge. It also includes a prudent discount policy that may reduce the costs of an eligible customer.

Connection charge. This recovers the costs of assets connecting transmission customers to the grid. It is paid by the customers who use those assets.

High voltage direct current (HVDC) charge. This recovers the costs of the link between the North Island and the South Island. It is paid by South Island generators.

Interconnection charge. This recovers the remainder of Transpower's revenue. It is paid by distributors and direct consumers.

Prudent Discount Policy. This discounts the charges for a customer who would otherwise not connect to the transmission grid or would disconnect from the grid, according to a set of criteria. These costs are recovered from the interconnection charge.

Considerations by the EA

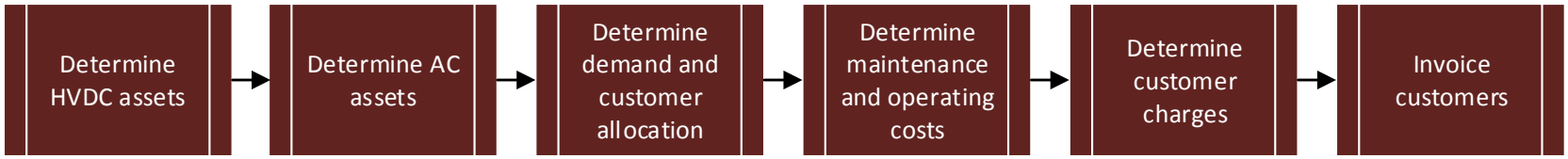
The EA has identified a number of issues with the existing charge components of the TPM. The main concern being the operation of the interconnection charges:

- The EA considers the current interconnection and HVDC charges create poor price signals that incentivise inefficient use of the interconnected grid and subsequent investment, and inefficient participation in decision making related to transmission investments.

Current State Processes

Note: The detailed current state can be found in the **Appendix**.

Process Overview



Process Description

Transmission Pricing Methodology

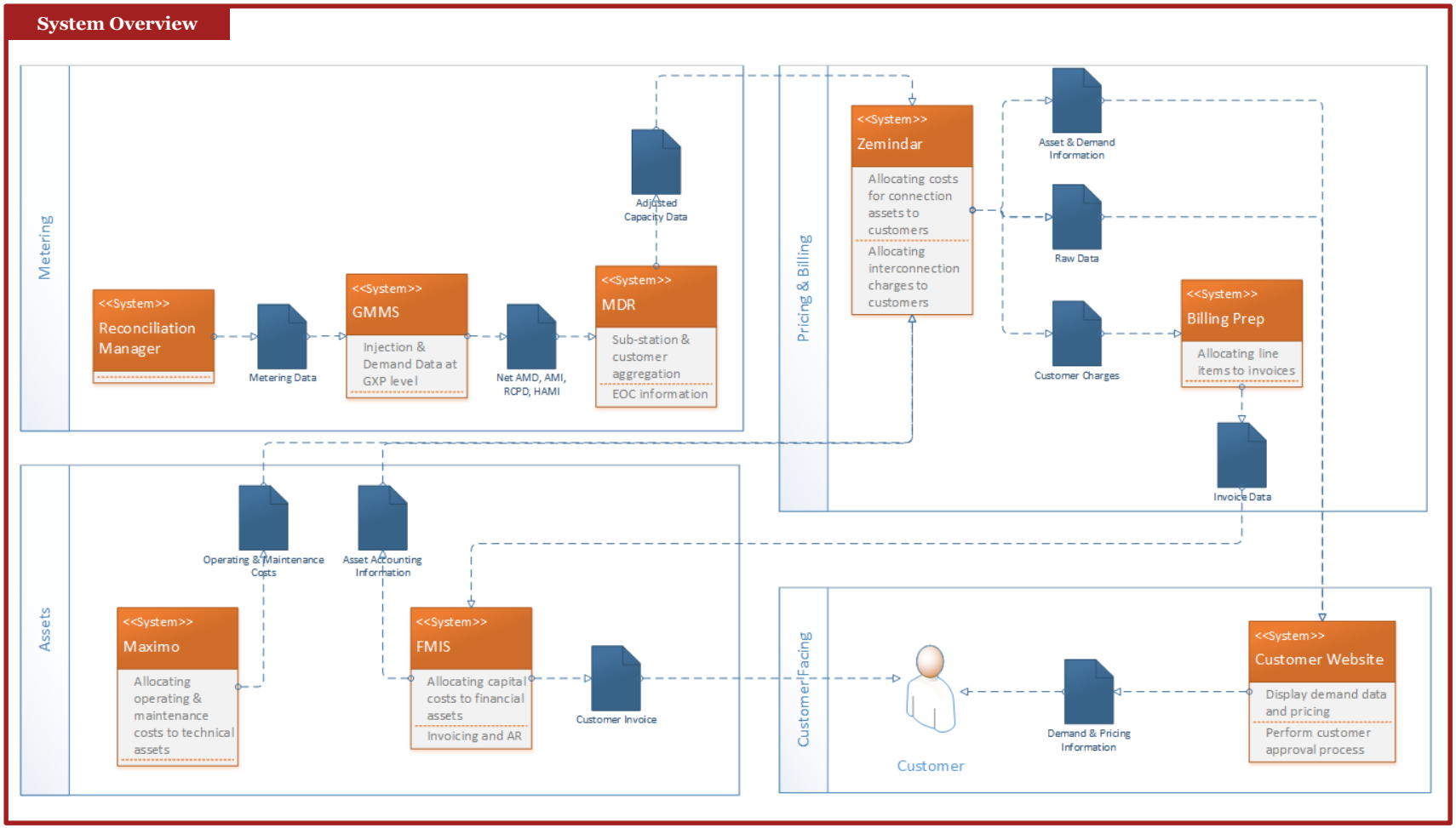
The annual pricing process is completed over a seven month period (typically June – December). The 2015 Operational Review changed some aspects of the TPM calculation (e.g. the HVDC calculation was changed from maximum to average injection), but there have been no substantial process changes since the 2012 review. Each process step except for Determine HVDC assets has been mapped in greater detail in this report.

The TPM process involves manual interfaces with a number of systems. Where systems are used they are indicated in brackets within the step. The teams involved with executing and supporting the current process are the pricing, finance, customer solutions, business enterprise, reporting and billing, and metering teams.

The level of FTE support required for the TPM is annualised at 5.5 FTE. There is a dedicated focus during the peak of the pricing round (June – December). FTE numbers reflect the average level of support to the process throughout the year as they also undertake other functions.

Current State Systems

Note: The detailed current state can be found in the **Appendix**.



Current State Organisation

Effort estimates

The current TPM process involves a number of teams within Transpower. While these teams may be involved in the process year round, the bulk of the process occurs during a seven month pricing period. As a result the FTE effort is concentrated and the people involved in the TPM process do conduct other functions throughout the year. We have annualised the effort required for the TPM process and as a result it reflects an allocation rather than the total number of people involved from each team.

The current annualised effort for the TPM process is 5.5 FTEs.

Annualised FTE by Process Step

Team	*Determine HVDC assets*	*Determine AC assets*	*Determine interconnection demand and customer allocation*	*Determine maintenance and operating costs*	*Determine customer charges*	*Invoice customers*	*General Support*	*FTE equivalent effort*
Pricing and finance	0.25	1.25	0.25		0.5	0.25		**2.5**
Customer solutions						0.4	1	**1.4**
Business enterprise							1	**1**
Consultation								**0**
Reporting and billing						0.1		**0.1**
Metering		0.5						**0.5**
System planning								**0**
Total	**0.25**	**1.75**	**0.25**	**0**	**0.5**	**0.75**	**2**	**5.5**

The Authority's proposal

Proposed changes

Overview of proposed changes

The EA proposes the following changes:

Connection Charge. The EA's proposal is that this will be set on the same basis as the current connection charge, subject to possible inclusion of additional components.

Area-of-Benefit (AoB) Charge. The EA's proposal is that the AoB charge would be applied to load and generation to recover the costs of each "eligible investment" asset based on an assessment of the benefit derived by the customer from the asset.

An eligible investment asset would be defined as:
- base capex and major project capex commissioned after the publication of the new guidelines,
- specified investments approved after May 2004 and exceeding a value at time of commissioning of $50m,
- pole 2 of the HVDC link,
- any payment made by Transpower in respect to a non-transmission solution,
- but excluding any connection asset.

A standard assessment method is intended to apply to "high value investments", i.e. eligible investments valued in excess of $5m, and a simplified assessment method is intended to apply to "low value investments", i.e. eligible investments valued less than $5m. The EA proposes that Transpower would develop the methodology for identifying beneficiaries of eligible assets – there are a range of approaches of varying cost and complexity for doing this.

The EA's current view is that the Replacement Cost (RC) valuation approach should be used to value new eligible investments and the Depreciated Historical Cost (DHC) valuation approach should be used to value existing eligible investments.

Residual Charge. The EA's proposal is that this charge would be used for Transpower revenue not recovered through the AoB or connection charge, and would apply to load customers only based on the physical capacity of the customer's connection to the grid. The physical capacity would be determined by transformer capacity, line capacity or Gross Anytime Maximum Demand (AMD).

Proposed changes (contd.)

Prudent Discount Policy (PDP). The EA's proposal is to extend the existing PDP to provide discounts in more circumstances and adding additional discount tools in the form of credible commitments and optimisation. In particular the extended PDP would:

- ensure prudent discounts are available for the expected life of the relevant asset,
- make prudent discounts available to a load customers if it is privately beneficial but socially inefficient for them to build and operate generation in order to disconnect from the grid,
- make prudent discounts available to direct connect customers facing a material risk that their allocation of transmission charges would cause the customer to close down/disconnect from the grid,
- make prudent discounts available where a customer faces transmission charges exceeding the standalone costs of connection to the grid,
- allow transmission customers to request Transpower to reduce the value of "area-of-benefit assets" if there has been a material reduction in the use of the assets. This process is called optimisation.

Additional components. The EA's proposal is that Transpower would consider including potential additional components within the TPM. These additional components are:

- clarifying the treatment of assets that are subject to a staged commissioning,
- charging for assets when other grid investments join them in a loop,
- allocating operating and maintenance costs on an actual cost basis,
- introducing a Long Run Marginal Cost (LRMC) charge to complement/augment the price signals provided by nodal prices,
- a kvar charge to recover the cost of static reactive investments.

In some areas, the TPM guidelines will leave considerable discretion for Transpower to develop its own methodology (e.g. the method for identifying beneficiaries of eligible assets). Transpower may also have responsibility for approving applications for prudent discounts, but this responsibility could sit with the EA or another party.

Impact summary – Approach

Method of assessing EA requirements

The detailed change requirements that were derived from the EA's proposed guidelines were grouped into a set of change requirements based on contextual patterns and dependencies recurring throughout these requirements. Each change defines the triggers (EA requirements) it relates to and each trigger can relate to multiple changes (m:n relationship).

Each change has been assessed regarding its expected impact on Transpower's operations with four different lenses: Processes, Technology, Organisation and Consultation. Within each of these lenses the impact has been specified, potential mitigation options outlined (utilising discretion granted within the proposed EA guidelines) and an expected complexity scenario assigned to each option.

The following scenarios have been defined:

- The full scope of the proposed EA guideline (including the vSPD net benefit assessment) describes the high complexity scenario (H);
- Utilising the discretions provided in the proposed EA guideline (especially removing the net benefit approach and developing a LRMC charge) demarks the medium complexity scenario (M);
- Minor changes to the current state guidelines define the lower complexity scenario (L).

Presenting the results of the assessment

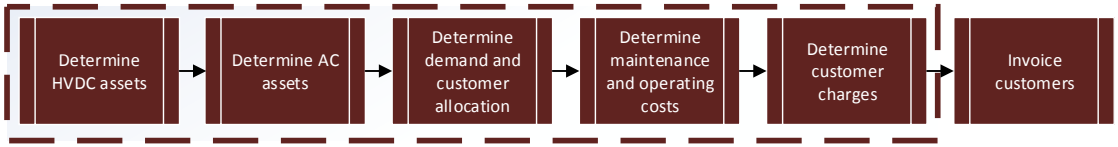
The following slides summarise the expected impact of the high complexity scenario on Transpower's operations, discussing the lenses Processes, Technology and Organisation in detail. The impact assessment of Consultation has been included within the Processes and Organisation lenses. The detailed foundation for this assessment is included within the **Appendix**. The impact assessment of the high complexity scenario is complemented by the concluding implementation effort (estimated bottom-up) and resulting consultation and implementation timelines.

The sensitivity analyses of the medium and lower complexity scenarios, also based on the detailed assessment within the **Appendix**, and a comparison of all three scenarios complete this chapter. For benchmarking purposes, the high-level results of the 2012 TPM assessment have been included. Hence the ongoing costs after implementation have identically been aggregated over a 5 year period.

Impact summary – Processes

Note: The detailed impact analysis can be found in the **Appendix**. All impacts for the high complexity scenario are discussed.

Area of Process Impact



Other Area of Process Impact

Other impacted processes

- Capex consultation process
- Dispute resolution process

Process Description

Discussion of changes

The impacted areas of the Transmission Pricing Methodology are shown above. These areas remain the same whether the complexity of the mitigation is high, medium or low, although the degree of impact changes. In particular, the complexity level chosen for the area of benefit charge has a large impact on the degree of change required for processes that involve asset or component costing and allocations.

Much of the impact of the Area of Benefit charge is driven by potential data requirements and segmentation of the asset registers in the Determine AC assets process and the Determine demand and customer allocation process. If the high complexity options are chosen this will drive major changes to these processes in order to collect and use highly granular data. How customer charges are determined will be affected in any of the complexity levels, as the proposed charges differ from the current TPM in all scenarios. There are no substantial changes to the invoicing process in any scenario although a number of explanatory additions would be needed for the new TPM charges on invoices and other customer facing material.

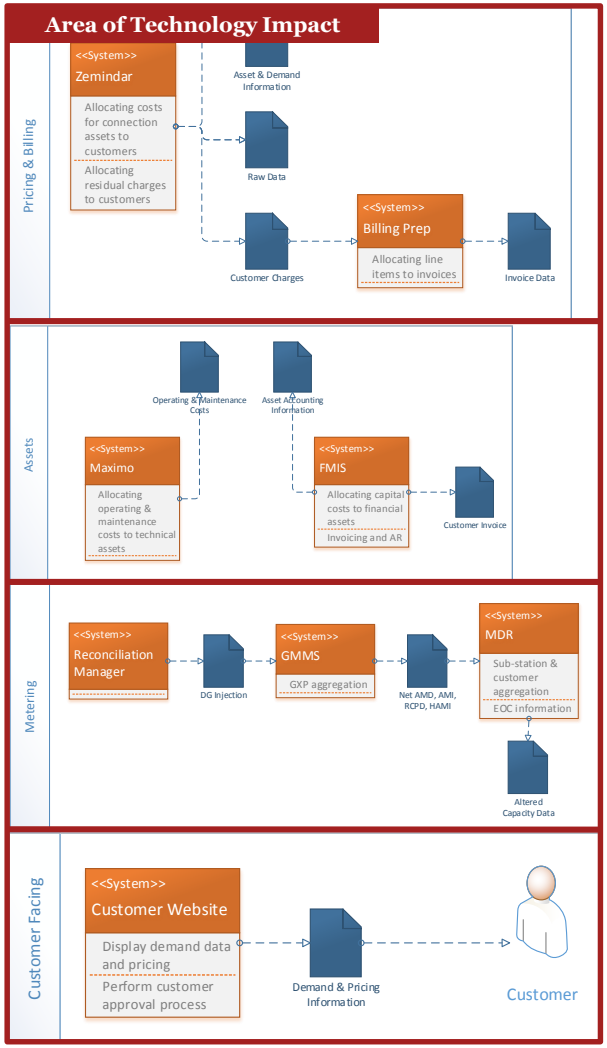
In addition to the TPM process, there are impacts upon other process areas within Transpower. The capex consultation process for investment over $5m and dispute resolution process are likely to be impacted with an increase in volume and a change in the types of disputes that arise. This is due to the direct association of area of benefit calculations with future costs for identified parties, and the relatively opaque and difficult to understand mathematical operations of the vSPD model for the average affected party.

The changes to each aspect of the process are described in the **Appendix**.

Impact summary – Technology

Note: The detailed impact analysis can be found in the **Appendix**. All impacts for the high complexity scenario are discussed.

Area of Technology Impact



Impact Summary

Pricing & Billing

The Pricing and Billing systems will either need to expand Zemindar or add a separate Rules Engine to allocate interconnection assets and charges to customers. This will be either based on a vSPD solver benefit calculation or load/injection capacity information and the allocated amounts are forwarded to BillingPrep. Additionally, either solution will need to include PDP exceptions and processing of kvar data for connection charges.

Assets

Maximo and FMIS will need to exchange information on asset lifetimes, project costs associated to more than one asset and maintenance & operating costs. Additionally, rates, management fees, residual values and future cost estimates of assets on an agreed level of granularity (either per-site or individual component basis) have to be exchanged.

Metering

The Metering systems will need to include interconnection asset usage (complex scenario) and kvar metering data from RM (distributed through GMMS and MDR) in addition to Transpower meters. Additional data on DG injection and distribution load control based on existing total network load calculations for dispatched DGs needs to be included.

Customer Facing

The Customer Website needs to enable customers to write future demand forecasts as capacity data back to Zemindar. Enhanced self-service reporting and data provisioning have to be included to clarify AoB (and other) charges and underlying model assumptions in case of the vSPD scenario.

Impact summary – Organisation

Note: The detailed impact analysis can be found in the **Appendix**. All impacts for the high complexity scenario are discussed.

Additional FTE's will be required to support the new TPM process

The complexity of the proposed changes will require an increase to the resources available to the teams that support and execute the TPM. Specifically, the increase in ongoing resourcing will support:

- Increased communication with customers as their charges will gain significant complexity. The first year is expected to require a higher level of engagement with both load and generation customers as they develop their understanding of the allocation process;
- Added complexity for the pricing and finance team in executing the TPM process as new data is added to the process and granularity changes;
- Additional reporting and raw data sets will need to be uploaded to the customer website to enable customers to validate their charges;
- The changes to the technology systems and interfaces means that additional resources will be required for Corporate Applications to support and maintain the systems. Post-Go-Live support after the ramp-down of the implementation project is reflected by the increased FTE demand for the Corporate Applications team in the first year after implementation;
- Additional industry sector interaction (including PDP assessments, optimisation, material change, etc.) will increase the demand for consultation processes;
- Costs are in 2016 dollars and exclude GST.

For the full list of assumptions, please refer to the **Appendix**.

Team	*Operational Implementation*		*Ongoing Costs*	
	FTE Increase	*Cost ($000)*	*FTE Increase*	*Cost ($000)*
Pricing & finance	5	540	3	320
Customer solutions	1	120	0.5	50
Business enterprise	1	100	1	100
Consultation	5	540	0.5	50
Reporting & billing	0.5	50	0.1	10
Metering	1	100	0.5	50
System planning	0.75	75	0.25	25
Vendor Support	0	0	1	200
Total	**~14**	**1,525**	**~6**	**805**

Impact summary – TPM development

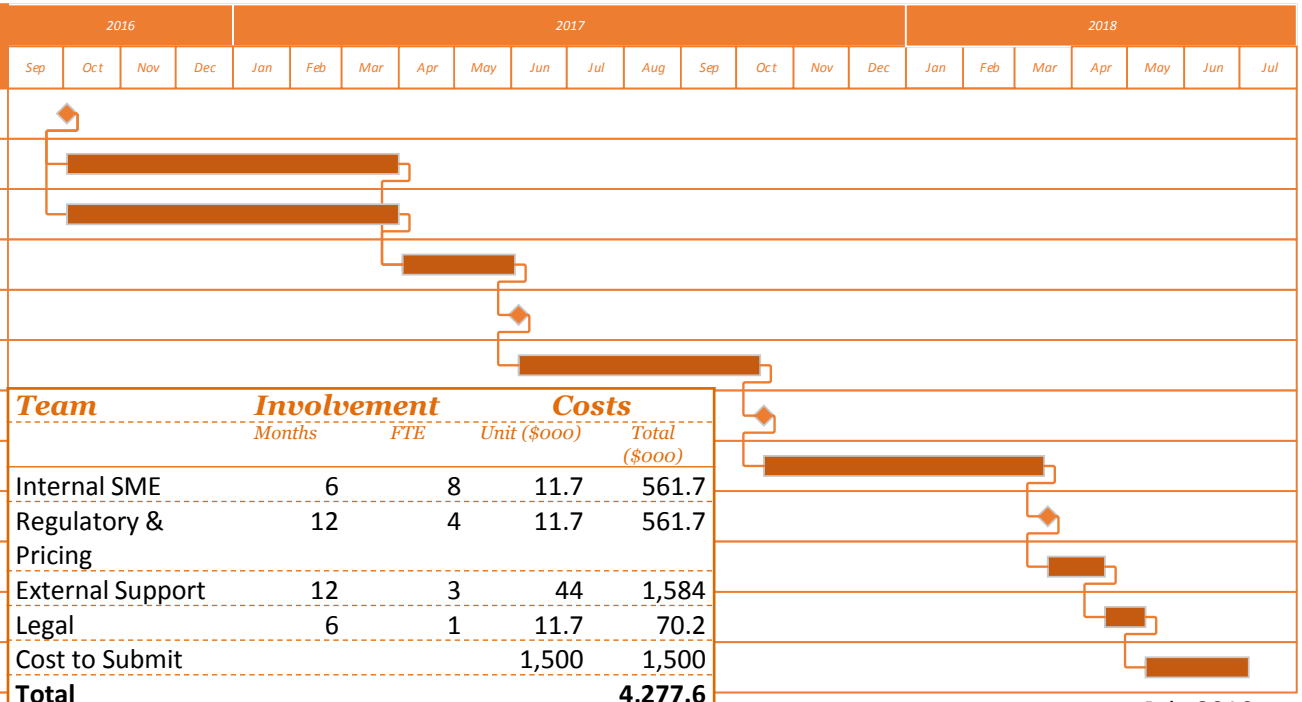
Note: All impacts for the high complexity scenario are discussed.

Policy definition

Transpower will engage in policy definition where the EA has delegated specific details. The required internal and external consultations are estimated by Transpower to involve a number of internal FTEs and external specialist support. At the end of this stage Transpower will submit a proposed TPM to the EA.

Depending on the duration of the EA's industry consultation, potentially required rework on the code draft and additional iterations deemed necessary, the EA could gazette the required code changes by July 2018. The final timing is subject to uncertainty based on the EA's decisions and actions.

ID	Task	Responsible
1	Final TPM guidelines published	EA
2	Policy definition on details delegated by EA	Transpower
3	Internal SME consultation on policy definition	Transpower
4	External industry consultation on policy definition	Transpower
5	Definitions defined	Transpower
6	Code drafting	Transpower
7	Draft code submitted to EA	Transpower
8	Industry consultation on code draft	EA
9	Decision on code draft	EA
10	Optional: Rework on code draft	Transpower
11	Optional: Re-assessment of code draft	EA
12	Gazetting of final code update	EA



Team	Involvement		Costs	
	Months	FTE	Unit ($000)	Total ($000)
Internal SME	6	8	11.7	561.7
Regulatory & Pricing	12	4	11.7	561.7
External Support	12	3	44	1,584
Legal	6	1	11.7	70.2
Cost to Submit			1,500	1,500
Total				**4,277.6**

Impact summary – Implementation costs

Note: The detailed impact analysis can be found in the **Appendix**. All impacts for the high complexity scenario are discussed.

Indicative cost to implement the proposed changes is ~$9.7M

The indicative implementation cost has been estimated using the information provided by Transpower and our experience with large programmes of work.

The table below shows the estimated implementation costs across the major work streams. The total effort estimate could be spread across a team of approximately 15 FTE for an implementation timeframe of 16 months.

Work Stream	*Effort (days)*	*Cost ($000)*
Technology	3,423	6,125
Business Process	247	494
Change Management	342	685
Sector Engagement	102	173
Project Management/ Governance	342	684
Hardware/Software	0	1,500
Total	**4,456**	**9,660**

A number of key assumptions have been made

To establish the estimates, we have made a number of assumptions. The key assumptions are noted below, and the full set can be found in the **Appendix**.

1. Costs exclude GST;
2. The level of effort accuracy in the implementation estimates is +/- 50%;
3. To implement the changes, it is expected that Transpower will utilise its external support partners;
4. Costs reflect the preferred implementation options. Further due diligence is required to confirm these options and costs may change depending on the outcome of this further investigation;
5. Transpower will lead the engagement with the sector once the TPM guidelines have been developed;
6. Hardware costs, software license fees and initial 12 months of vendor support have been derived from average contract terms offered by industry standard vendors (rf. to assumptions within the **Appendix**). A vendor selection process and due diligence based on detailed requirements will be required to confirm costs.

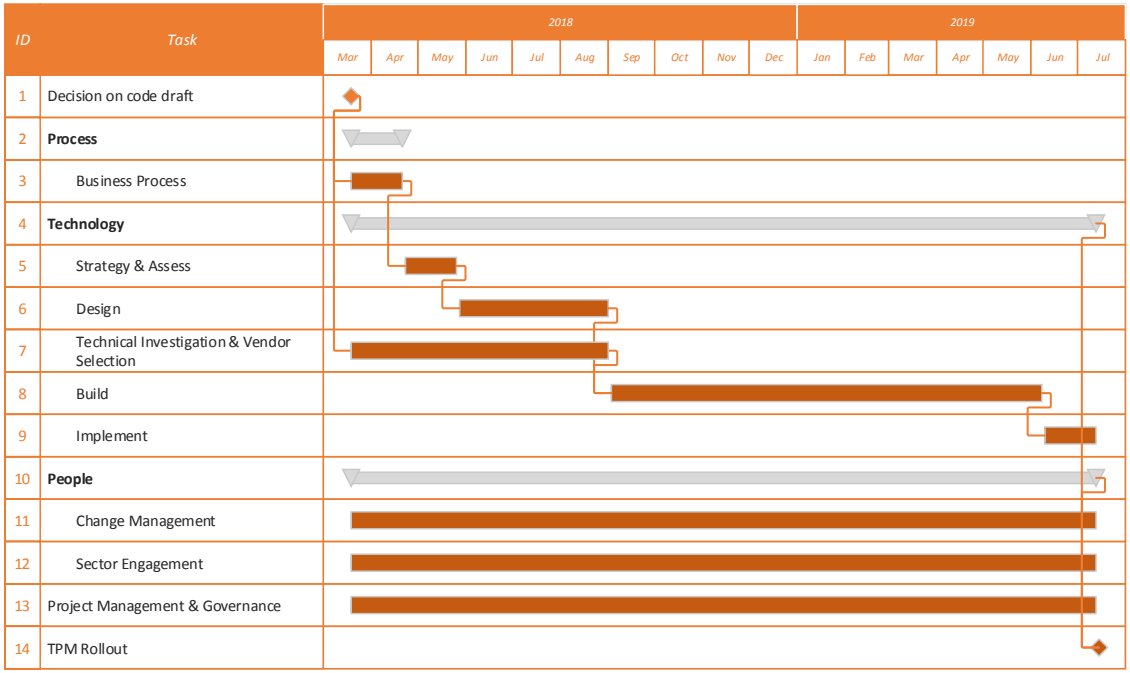
Impact summary – Timeframe: Implementation

Note: The detailed impact analysis can be found in the **Appendix**. All impacts for the high complexity scenario are discussed.

Elapsed time between the EA's decision on the code draft and the actual TPM rollout is estimated to be 16 months

Based on the High implementation scenario, large-scale changes to Transpower's systems and processes will require a programme of work to be executed within a time-frame of approximately 16 months. The timing of the programme depends heavily on the EA's final approval of the code draft and the complexity scenario chosen.

It would be possible for a portion of the implementation work to occur prior to the final conclusion of the EAs approval process (based on a staged approval of draft policy/code). However such an approach would be subject to additional risk of rework and sunk costs if the final approval of the EA did not match the implementation design work.



Alternative scenarios – Medium complexity

Note: The detailed impact analysis can be found in the **Appendix**.

The medium complexity scenario utilises discretion available within the proposed guideline

The main deviations from the high complexity scenario, which forms the basis for the preceding impact, timeline and cost analysis, are:

- Simplifying the approach for assessing line and transformer capacity shared between customers;
- Substituting GAMD with AMD for capacity assessments;
- Utilising site-based expected asset lifetimes instead of component-based granularity;
- Leaving the Connection Charge unchanged;
- Developing an LRMC components charge;
- Utilising physical capacity and average injection instead of net benefit as an allocator (thus not implementing a vSPD model);
- Extending Zemindar instead of adding a rules-based pricing engine for AoB asset allocation;
- Avoiding the allocation of project costs to specific non-connection assets;
- Avoiding the inclusion of customer commitments for future demand;
- Not separating the accounting procedures for the assets within the register (by not combining DHC, RC, Optimisation and M&O effects for separate segments simultaneously);
- Not extending the existing PDP options.

The estimated costs of implementation and ongoing costs of this alternative scenario are described within the following tables.

Initial Set-Up Costs

Work Stream	*Effort (days)*	*Cost ($000)*
Technology	849-1,698	1,529-3,058
Business Process	61-122	121-242
Change Management	85-170	170-340
Sector Engagement	29-58	48-96
Project Management/ Governance	85-170	170-340
Hardware/Software	0	0
Total	**1,108-2,218**	**2,038-4,076**

Increase in ongoing costs

Team	*Operational Implementation*		*Ongoing Costs*	
	FTE Increase	*Cost ($000)*	*FTE Increase*	*Cost ($000)*
Pricing & finance	4	420	2	220
Customer solutions	1	120	0.5	50
Business enterprise	0.5	50	0.5	50
Consultation	1	100	1	100
Reporting & billing	0.1	10	0.1	10
Metering	0	0	0	0
System planning	0	0	0	0
Vendor Support	0	0	0	0
Total	**~6.5**	**700**	**~4**	**430**

Note: The additional assumptions for this scenario can be found in the **Appendix**.

Alternative scenarios – Lower complexity scenario

Transpower proposes to reassess the guideline for practicality

The main change drivers requiring a large scale transformation project and additional business capacity within Transpower are:

- The segmentation of assets for the newly introduced AoB charge;
- Changes to the assessment of customer capacity (load & injection);
- A lowered consultation threshold and additional consultation requirements (including PDP changes).

In the lower complexity scenario, Transpower would use the TPM code drafting phase in cooperation with the EA to assess the feasibility of alternative approaches compared to the current guideline proposal. Some of the potential high-impact alternatives to assess are:

- Including the entire asset register into the AoB charge (instead of limiting this to eligible investments) and allocating these to benefiting customers using a generalised approach;
- Using a single accounting treatment for the entire asset base;
- Develop LRMC charge and locational pricing for generators;
- Evaluating other allocators.

It is to be confirmed whether this type of approach would be deemed sufficient to achieve the intended goals of the transmission pricing review. These proposed alternatives could reduce annualised FTE requirements relative to the high and medium complexity scenarios.

Initial Set-Up Costs

Considering the effort estimates for the high and medium complexity scenarios, the implementation efforts have been scaled down to accommodate for the removal of complexity. This estimate has not been validated bottom-up and is indicative only due to the high level scope of this scenario.

Increase in ongoing costs

Team	*Operational Implementation*		*Ongoing Costs*	
	FTE Increase	*Cost ($000)*	*FTE Increase*	*Cost ($000)*
Pricing & finance	4	400	2	200
Customer solutions	1	100	0.5	50
Business enterprise	0	0	0	0
Consultation	1	100	0.5	50
Reporting & billing	0.1	10	0.1	10
Metering	0	0	0	0
System planning	0	0	0	0
Vendor Support	0	0	0	0
Total	**~6**	**610**	**~3**	**310**

Note: The additional assumptions for this scenario can be found in the **Appendix**.

Scenario Comparison

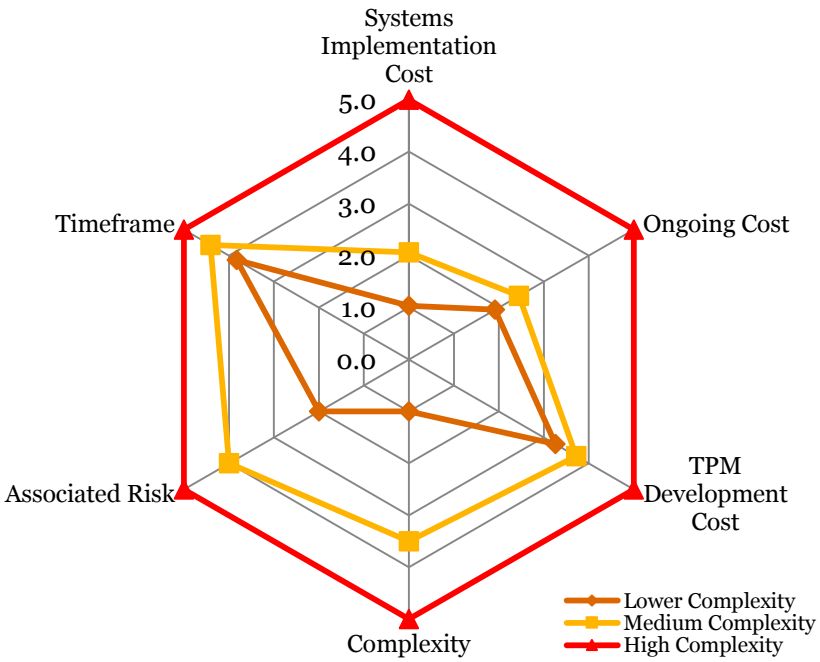
All three scenarios should be closely compared to assure the expected net benefit compares favourably with anticipated implementation cost, timeline and practicability of the solution

The 2012 assessment of proposed TPM changes and their impact on Transpower's systems and processes concluded an implementation effort of between $12.5M and $13.4M for the high complexity approach resulting in an 18 months transformation project and a 5 year aggregate of between $16.8M and $17.7M.

In 2016, the high complexity implementation of the new guideline would entail indicative system implementation costs of $9.7M (including hard- and soft-ware expenses), a prospective system implementation timeline of 16 months duration and a 5 year total for system implementation and process execution of $14.4M.

Using available discretion within the guidelines could potentially reduce the indicative system implementation costs to between $2.0M and $4.0M. Additionally, the 5 year aggregate would be reduced to between $4.5M and $6.5M as outlined in the medium complexity scenario. If the draft guidelines were amended to allow for an approach as outlined in the lower complexity scenario, this would enable Transpower to apply a lower-cost approach.

We have indicated a variety of these factors (timeframe, implementation cost, ongoing cost, TPM development cost, complexity and associated risk) in the diagram to allow a comparison between the three scenarios. This allows the expected net benefits to be considered against other implications of the highlighted scenarios.



Note: The High scenario was normalised to a 5 rating on a 0-5 scale per axis (less is better). All cost axes reflect the relative effort estimates included in this report. Non-cost axes reflect stakeholder discussions.

Appendices

Major risks identified

Major risks identified

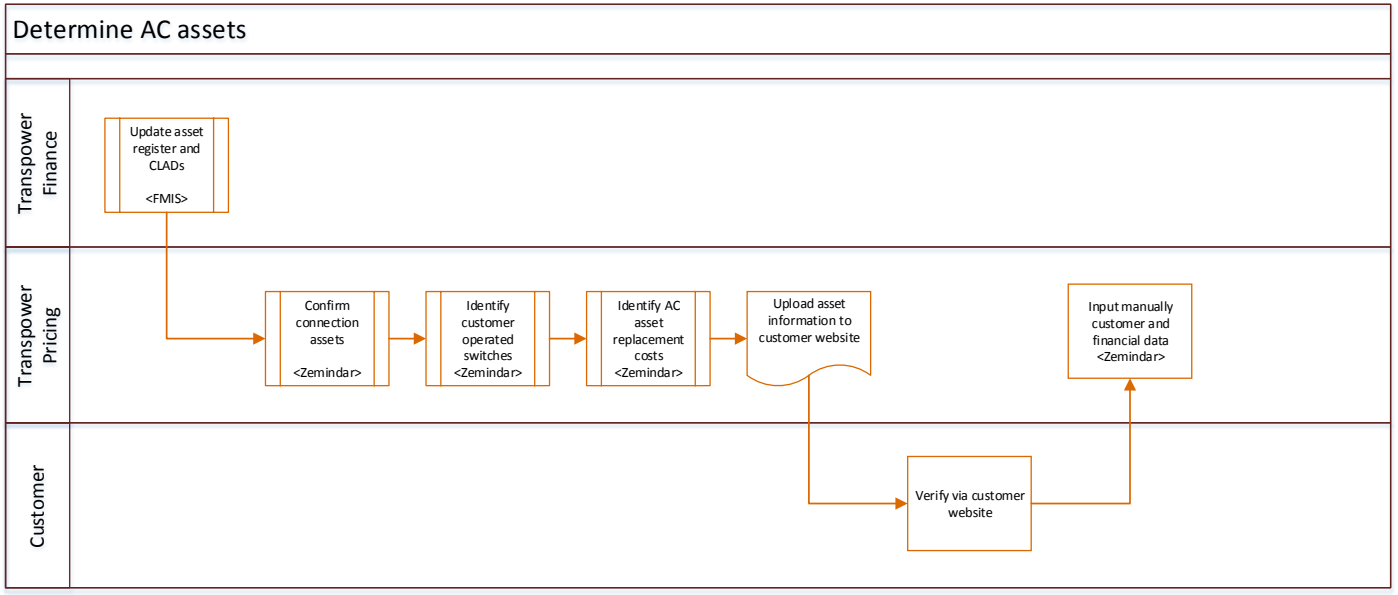
No.	Impact Area	Risk
1	Implementation	Implementation of the new TPM may create disputes with customers, potentially including litigation, risking increased costs and delays.
2	Implementation	The complexity of the new TPM may be such that it becomes impracticable to implement in the way the guidelines require.
3	Uncertainty	The complexity of the new TPM may lead to unforeseen outcomes that result in further regulatory intervention or amendments to the TPM guidelines.
4	Resourcing	The extent of resources required (e.g. to process Prudent Discount Policy applications) may be more than anticipated, leading to increased costs and/or delays in implementing the new TPM.
5	Timeline	Significant risk of delay to the start of the implementation phase, dependant on the amount of rework and consultation associated with the initial policy/code drafting phase and the EA's assessment.
6	Uncertainty	Update of forecast model for distributed generation and thus network load relies heavily on assumptions regarding generation profile alteration and reaction to price signal incentives.
7	Implementation	All scenarios discussed rely on the future availability of the pricing engine Zemindar after the recent tech refresh. Should the application reach its limits sooner than anticipated, replacing or upgrading the engine would have a severe impact on anticipated cost and timeline.

Appendices

Detailed Current State Analysis

Current State Processes – Detailed 1/5

Detailed View



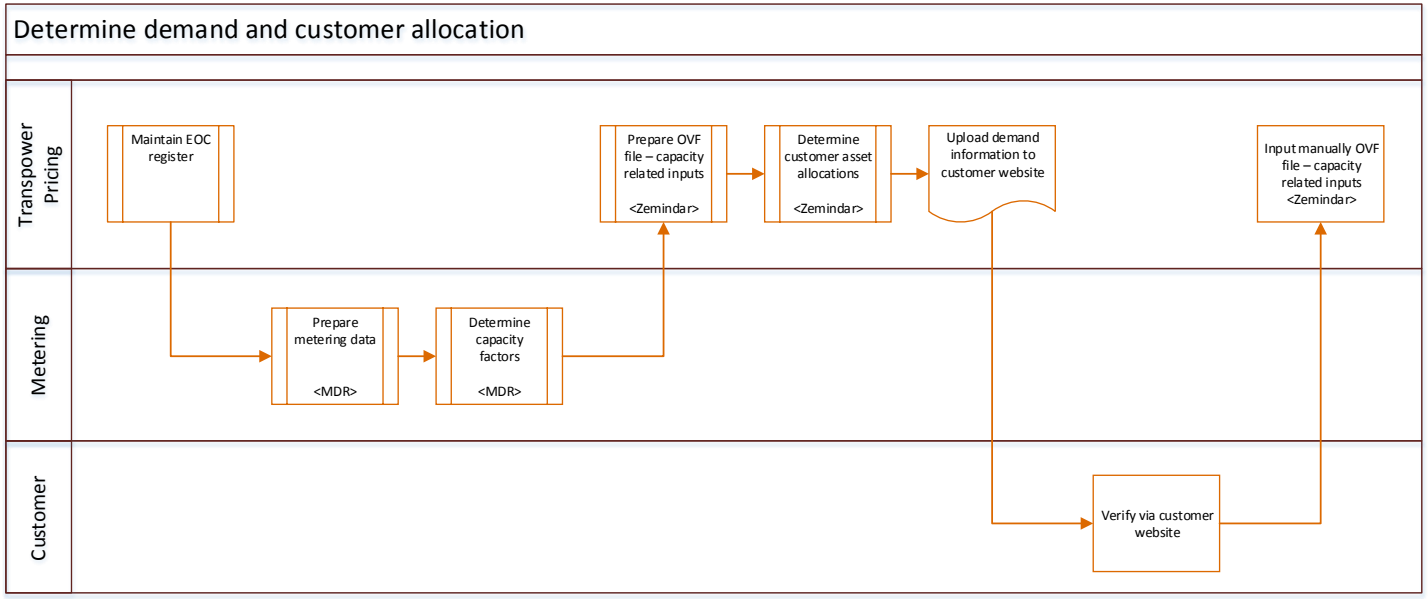
Process Description

Determine AC assets

This part of the process identifies all grid assets which are not HVDC assets. This allows connection assets to be allocated to customers where applicable. Once connection assets have been identified and allocated, customers verify this allocation online through a customer facing website.

Current State Processes – Detailed 2/5

Detailed View



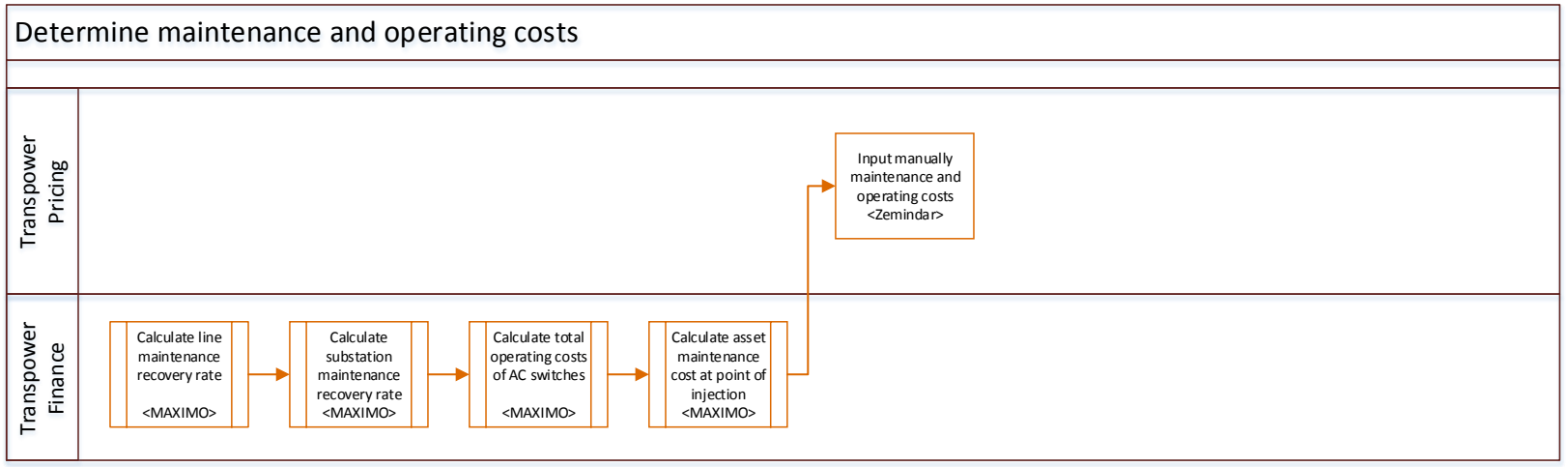
Process Description

Determine demand and customer allocation

This part of the process assesses each customer's demand and capacity from Transpower metering data. Customers verify this information online through a customer facing website.

Current State Processes – Detailed 3/5

Detailed View



Process Description

Determine maintenance and operating costs

This part of the process involves internal Transpower financial systems and does not involve interaction with customers. A portion of the process is conducted in Microsoft Excel in order to categorise maintenance to FMIS assets.

Current State Processes – Detailed 4/5

Detailed View

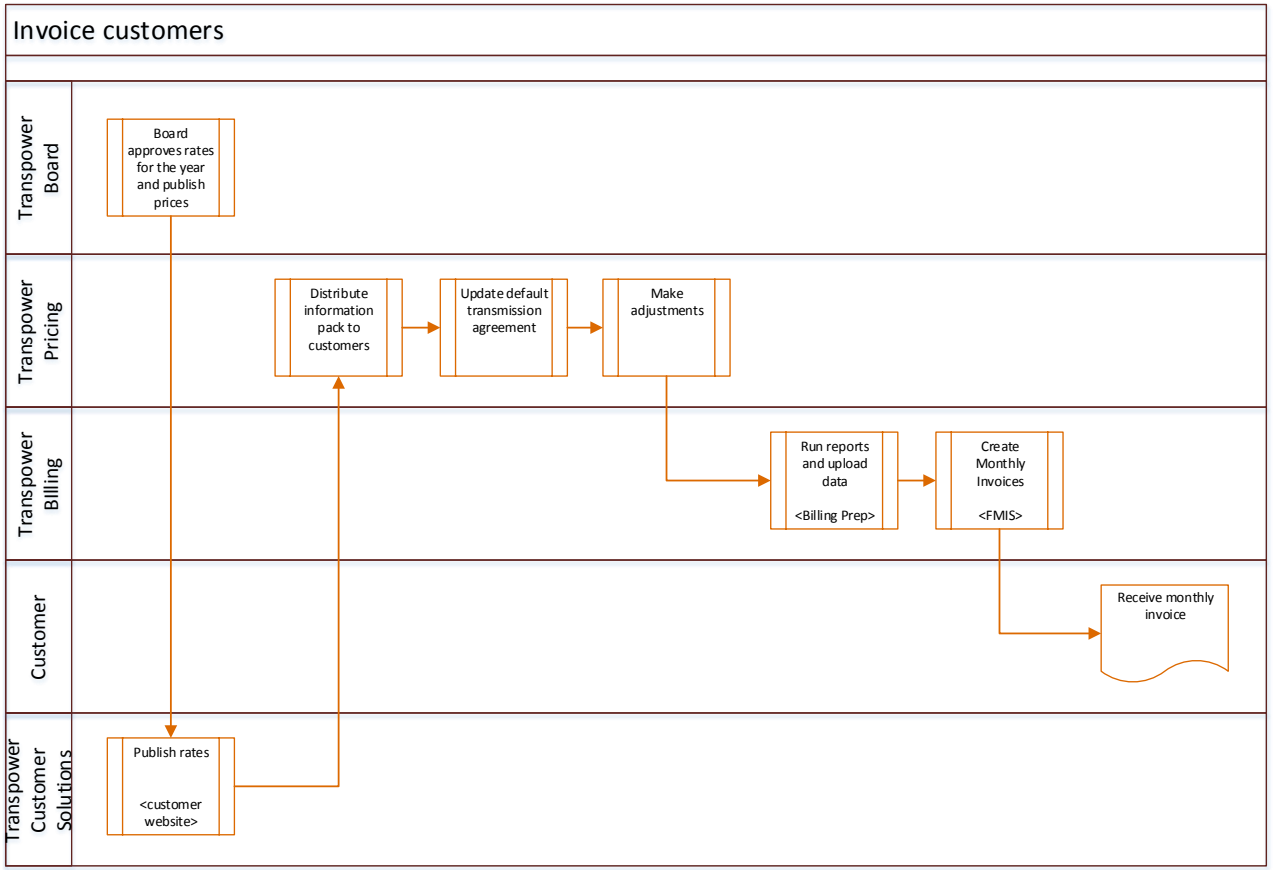
Process Description

Determine customer charges

This part of the process uses the inputs collected earlier on connection assets, other assets, maintenance and operating costs and customer metering data to develop the charge amounts for each customer according to business rules within the system.

Current State Processes – Detailed 5/5

Detailed View



Process Description

Invoice customers

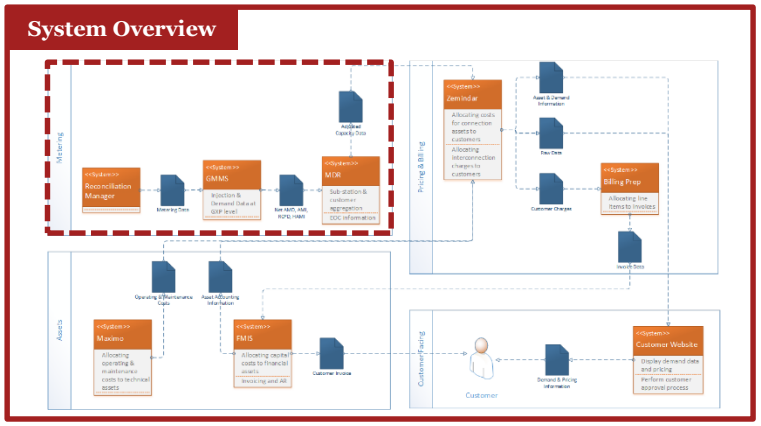
This part of the process approves and then communicates final yearly pricing to customers.

The approval and communication portion occurs annually, and the subsequent invoicing portion occurs monthly.

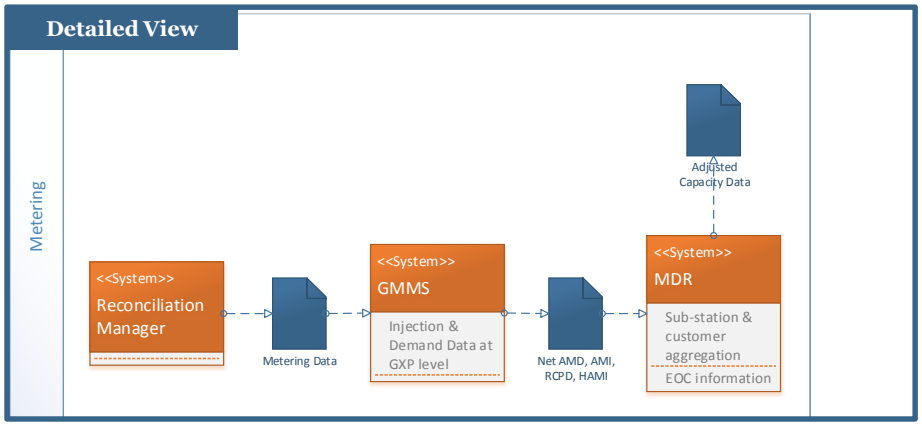
Invoice questions go to the Billing or Customer Solutions team first and are subsequently escalated to Pricing if the request relates to allocations.

Current State Systems – Metering

System Overview



Detailed View



System Description

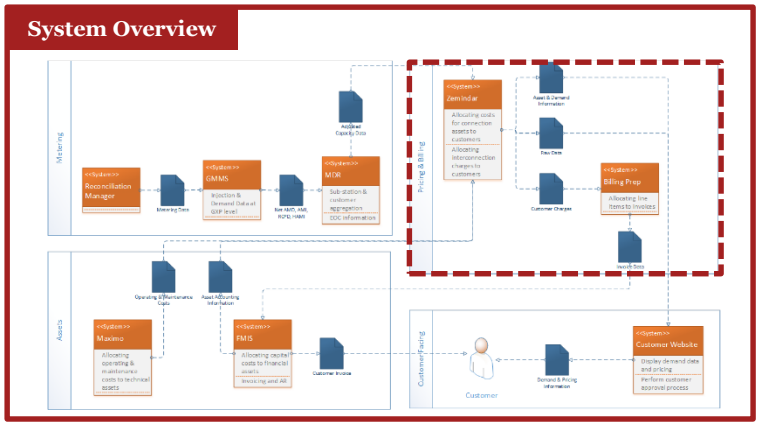
Metering Systems

The market Reconciliation Manager currently provides meter data for GIPs and specific generators provide daily injection data for Distributed Generation embedded in their distribution networks into GMMS - if the data relates to a large-scale generator subject to dispatching (e.g. transmission customers) – where it is stored with GXP based half-hourly increments of metering data. The capacity data sent from GMMS to MDR contains net anytime maximum demand/injection (AMD/AMI) for apportioning connection charges of shared assets aggregated from metering points to GXP nodes and measured in kWh.

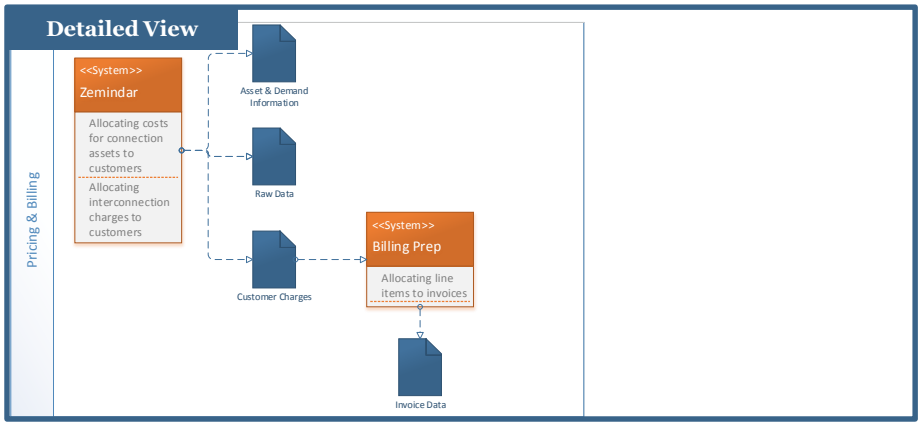
MDR contains business rules to aggregate the GMMS capacity data by sub-station location and customer to determine interconnection charges, apply HVDC charges, allocate connection charges for shared connection assets, convert the kWh measurements to MW and stores information on regional coincident peak demand (RCPD), historic anytime maximum injection (HAMI) and Exceptional Operating Circumstances (EOC). EOCs are services provided by a customer at the request of Transpower and include for example, a request by Transpower to provide temporary additional generation. The charges incurred in these scenarios are overridden so the customer is not paying for providing additional services.

Current State Systems – Pricing & Billing

System Overview



Detailed View



System Description

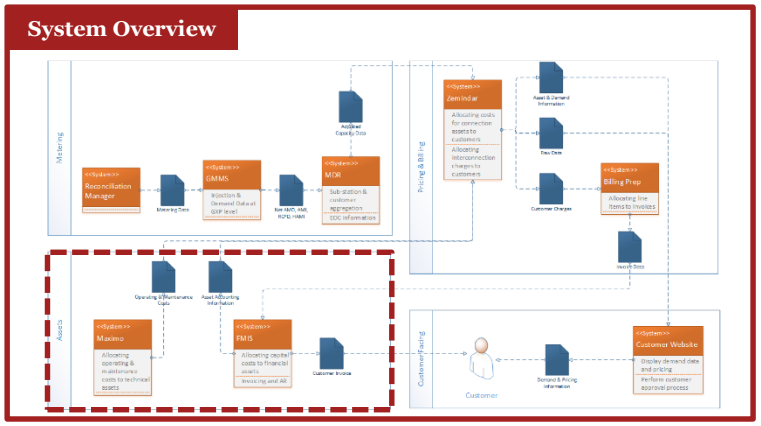
Pricing & Billing Systems

Zemindar is the pricing engine for current transmission prices. Utilising capacity data, operating & maintenance costs and financial asset information, the application currently allocates connection charges for connection assets to customers and produces annual customer rates for connection, interconnection and HVDC (allocated based on a customer's share of RCPD). The resulting asset and demand information for a pricing year is sent to the customer website together with the underlying raw data for verification purposes.

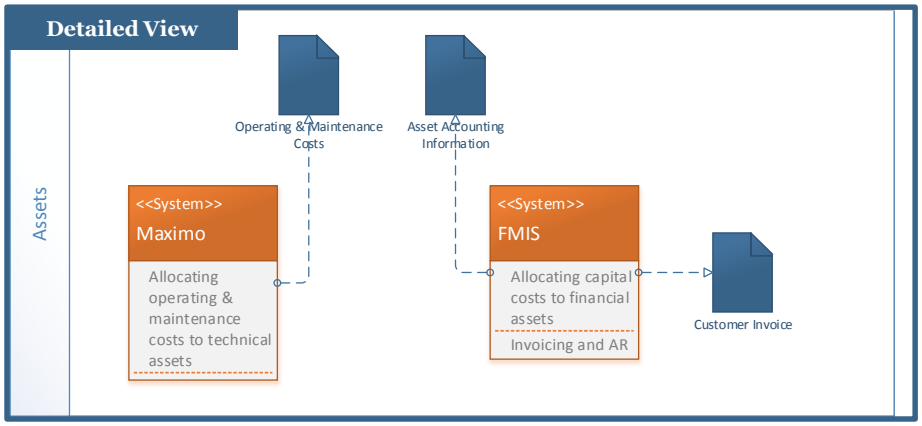
The pre-allocated amounts per customer and charge type (currently connection, interconnection and HVDC charges) are manually extracted from Zemindar, combined and converted to a flat file (CSV) format accepted by the Billing Prep inbound interface, where these line items are assigned to invoicing entities based on pre-defined business rules. The resulting invoice data is sent to FMIS for processing.

Current State Systems – Assets

System Overview



Detailed View



System Description

Asset Systems

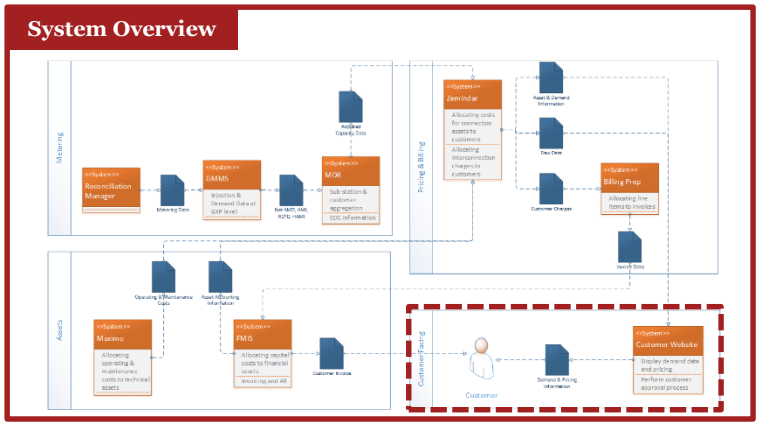
Technical asset information is currently held within Maximo, accounting information on assets is available within the Financial Management Information System (FMIS). Due to the different focus of both systems, asset information is held at different levels of granularity: FMIS focusses on sites and parents, Maximo on components.

Maximo currently allocates direct operating & maintenance costs on asset component granularity to technical assets and provides this information to Zemindar as an input into cost allocation to customers. However, indirect expenses such as rates and management service fees are not included within Maximo.

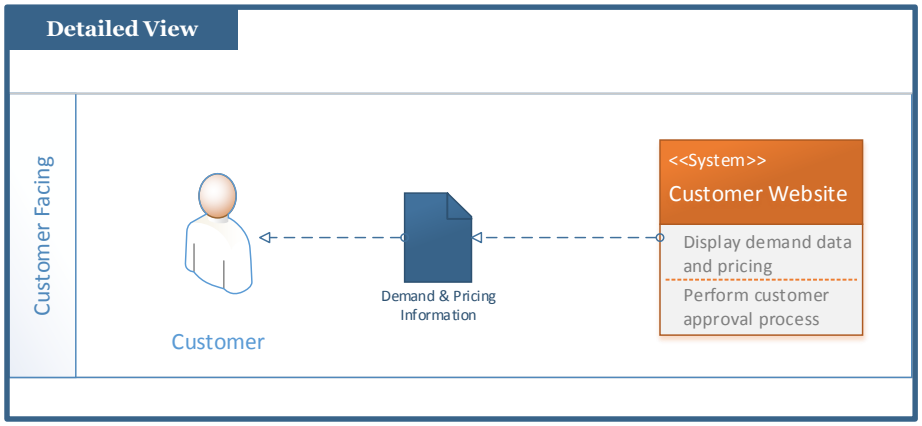
FMIS currently allocates capital costs to financial assets, stores relevant information on transformer- and line-capacity (not allocated to customers), expected life of a financial asset class, historical costs at commissioning (no future costs) and residual value of an asset. Additionally, FMIS processes invoice data from Billing Prep and creates the final invoice to be sent to the customer. Accounts receivable and GL postings related to these invoices are handled directly by FMIS.

Current State Systems – Customer Facing

System Overview



Detailed View



System Description

Customer Facing Systems

In addition to the final invoice being sent to the customer directly from FMIS, additional demand and pricing information may currently be retrieved from a dedicated customer section on Transpower's website. Upon completing the annual pricing process, raw and aggregated data on historical asset usage, historic capacity demand (which formed the basis for billing) and future billing rates is published to the website. The monthly invoice reflects the previous month's demand for connection assets and 1/12 of the pre-determined share of inter-connection asset demand.

Unlike the other applications supporting the current TPM process, Corporate Applications only supports the customer website at a platform and operational level, whilst configuration of the underlying Content Management System (CMS) is currently performed outside of IST subject to the responsibility of Customer Solutions.

Appendices

Detailed EA Requirements & Impact Analysis

Detailed change requirements

Trigger ID	Guideline Section	Requirement
Loss and Constraint Excess Rebate		
LCE01	n/a	Develop LCE rebate
Connection Charge		
CC01	5	Retain the current charge, but Consider some additional components (below)
Area-of-Benefit Charge		
AoB01	8a	Develop a standard method, applying to investments valued at >$5m
AoB02	8b	Develop a simplified method, applying to investments valued at <$5m
AoB03	9a	Identify the areas of benefit (the areas in which at least one designated transmission customer is expected to receive a positive net benefit from an investment)
AoB04	9b-c	Develop methodology to identify the positive net benefits from each eligible investment and the customers that receive that benefit
AoB05	9d	Develop a method to apportion the AoB charge between eligible investments if a project or programme replaces or refurbishes more than one eligible investment
AoB06	10a, 11d	Allocate charges to customers in proportion to their share of the aggregate positive net benefit of each eligible investment
AoB07	10b, 11e	Where it is not practicable to allocate charges to each customer based on their share of the positive net benefit, develop methodologies to: – Charge customers based on the physical capacity of load customers [see residual charge section for details on how to calculate this] – Charge customers based on the average injection of generation customers

Detailed change requirements

Trigger ID	Guideline Section	Requirement
Area-of-Benefit Charge		
AoB08	10f	Develop process to adjust charges for any future eligible investment (ie assets commissioned after the date of these guidelines) where a customer credibly commits to reducing or increasing its demand for transmission services and this results in Transpower changing its investment plans. This will include: – Process for customers to make a “credible commitment” and for Transpower to review and confirm this – Process for Transpower to determine how much this credible commitment has affected its costs and to adjust prices to reflect this
AoB09	10g	Consult with interested parties about its proposed approaches for implementing the AoB charge
AoB10	11a-c	For the simplified method only, identify whether the methodology to identify the customers that benefit from an eligible investment (as above) would be unduly complex or difficult to understand, in which case only the customers expected to receive the “majority of the benefits” would need to be identified. This implies: – Transpower deciding what the threshold is for being unduly complex or difficult to understand – Charges applied for these assets only applying to customers who receive the majority of the benefits This is to be implemented after the standard method is implemented.
AoB11	13	Identify the remaining life of all eligible investments
AoB12	14a	Develop a depreciated historical cost valuation of all existing eligible investments
AoB13	14b	Develop a replacement cost valuation of all new eligible investments
AoB14	15c	Develop a process for adjusting the remaining life of an asset that suffers a force majeure event

Detailed change requirements

Trigger ID	Guideline Section	Requirement
Area-of-Benefit Charge		
AoB15	16	Capitalise any replacement, refurbishment or renewal expenditure that extends the expected life of an asset
AoB16	17-20	Provide a process for customers to apply to optimise the value of eligible investments and for Transpower to review these applications and carry out optimisation analysis, including removal of optimisation where it is no longer justified
AoB17	21a	Provide a process for Transpower to review the AoB charge where a material change in circumstances occurs
AoB18	21b	Determine when a "material change in circumstances" has occurred, including consultation with stakeholders about whether there has been a material change in circumstances
AoB19	22	Include an allocation of maintenance and operating expenses that is "at least broadly cost-reflective", meaning Transpower will need to identify these expenses and determine how to allocate them in a cost-reflective way.
Residual Charge		
RC01	23	Identify all costs not recovered through the connection and AoB charges
RC02	23	Have a process for deciding whether to recover a lesser amount
RC03	23	Once the measure of physical capacity is chosen, identify how to measure this for each load customer and ensure billing system can apportion charges on that basis
RC04	24	Determine how to specify physical capacity (ie whether it is measured by transformer capacity, line capacity or gross anytime maximum demand)

Detailed change requirements

Trigger ID	Guideline Section	Requirement
Residual Charge		
RC05	25-26	If the measure of physical capacity is gross anytime maximum demand: a) determine how to measure it using one of the specified options b) include the quantity of electricity generated by distributed generation on the customer's network (this will need to be measured) c) include the volume of demand-side management and demand response on the customer's network (this will need to be measured) d) but only do points b and c if they are practicable and would not involve prohibitive transaction costs
RC06	27-29	Adjust the time period in which the physical capacity is recalculated
Overheads		
OH01	30-31	Overheads to be recovered on substantially the same basis as the status quo
New Customers		
NC01	33	Develop a method for allocating AoB and Residual charges to new customers, based on a proxy of physical capacity
Prudent Discount Policy		
PDP01	36	Develop methodology to identify if it is privately beneficial for a load customer to disconnect from the grid, but would not be efficient for this to occur
PDP02	37a	Develop methodology to identify if a customer's transmission charges are a material portion of their costs or profits
PDP03	37b	Develop methodology to identify if there is a material risk that the customer could shut down due to transmission charges

Detailed change requirements

Trigger ID	Guideline Section	Requirement
Prudent Discount Policy		
PDP04	37c	Develop methodology to identify if the customer's business profits have been heavily affected by market conditions
PDP05	37d	Develop methodology to identify the steps taken by the customer to cut costs and remain in business (and determine if these steps are reasonable and significant)
PDP06	38	Develop methodology to identify if transmission charges would cause a distributor's customer to exit the network
PDP07	39b	Develop methodology to reduce or eliminate the prudent discount if circumstances change (so circumstances will need to be kept under review)
PDP08	40	Develop methodology to identify whether transmission charges for a customer fall below the incremental cost or above the standalone cost of connection
Additional Components		
AC01	43	Determine whether each additional component is practicable and consistent with clause 12.89 of the Code and, if they are, include them in the TPM
AC02	43a	Define assets subject to staged commissioning as connection assets while they meet the definition of a connection asset
AC03	43b	Develop a methodology for ensuring charges for connection assets are not affected by a person other than Transpower connecting to Transpower's assets
AC04	43c	Develop a methodology to allocate maintenance costs according to actual cost, not a proxy allocator

Detailed change requirements

Trigger ID	Guideline Section	Requirement
Additional Components		
AC05	43d, 45	Develop a LRMC charge, but only if the charge is necessary to promote efficient investment in the grid
AC06	43e, 46	Develop a kvar charge, but if a kvar charge is included Transpower must specify the circumstances and regions in which it would apply
Other Costs/Considerations		
OCC01	n/a	Increased stakeholder participation in major capex and Individual Price-Quality Path reset processes
OCC02	n/a	Increased disputes with customers over judgements regarding implementation of new TPM, potentially leading to litigation

Cooo

Triggers	AC02, AoB01, AoB02, CC01, LCE01, RC01, RC02, OH01

Only indirect impacts

The impact analysis has shown, that the following triggers only indirectly impact Transpower's TPM implementation and are embedded within the additional triggers discussed in this report:

- AC02: Define assets subject to staged commissioning as connection assets while they meet the definition of a connection asset
- AoB01: Develop a standard method, applying to investments valued at >$5m
- AoB02: Develop a simplified method, applying to investments valued at <$5m
- CC01: Retain the current charge, but Consider some additional components
- LCE01: Develop LCE rebate
- RC01: Identify all costs not recovered through the connection and AoB charges
- RC02: Have a process for deciding whether to recover a lesser amount
- OH01: Overheads to be recovered on substantially the same basis as the status quo

C001

Triggers A0B07, RC03-04, RC06, NC01

Processes

Impact	Mitigation	Complexity (H/M/L)*
Capacity for lines & transformers that are shared between customers need to be allocated.	Identify shared lines and distribute capacity evenly amongst customers.	M
	Identify shared lines and distribute capacity by usage amongst customers.	H

Technology

Impact	Mitigation	Complexity (H/M/L)*
Transformer and line capacity is only available on asset building block level in FMIS and is required to be allocated to customers.	Expand or duplicate Zemindar to allocate non-connection assets to customers.	H
Usage of interconnection assets is not currently measured.	Expand MDR to measure asset usage between GXPs.	H

Organisation

Impact	Mitigation	Complexity (H/M/L)*
The Finance team currently does not allocate capacity of interconnection assets to individual customers.	Additional resources within the Finance team will be required to calculate capacity allocations.	M

Consultation

Impact	Mitigation	Complexity (H/M/L)*
There is currently no sector incentive to share interconnection assets as this has no direct pricing impact.	For future investment evaluations, customer consultation could involve planning shared interconnection assets to specifically distribute costs.	H
Distributors disclose estimated transformer capacity regularly which is not currently collected.	Collect and audit transformer capacity information directly from distributors to verify internal assessment.	M

*) Please refer to the introductory scenario definition for a description of complexity options.

C002

Triggers	RC05, AoB07

Processes

Impact	Mitigation	Complexity (H/M/L)*
Injection for DGs counting towards GAMD is currently only assessed for large DGs subject to dispatch for the approximation of the Total Network Load volume of distribution networks.	Map injection measurements for all substantial DGs and load control measures by distributors to GAMD.	H
	If not practicable, use existing net AMD measures.	M

Technology

Impact	Mitigation	Complexity (H/M/L)*
Currently only net AMD data plus injection data of generators who are transmission customers and net injection data of direct connect and distribution lines (SIMI/HAMI for HVDC charges and AMD/AMI for apportioning connection charges of shared assets) is available in MDR. GMMS already holds RCPD/RCPI information from RM for dispatched DGs.	Include data sets on injection by DGs and load control by distributors directly into RM and forward via GMMS to MDR for calculation going forward (phased mixed approach).	H

Organisation

Impact	Mitigation	Complexity (H/M/L)*
System Planning team is currently only required to map injection data for major DGs subject to dispatch.	Additional resources will be required for the System Planning team to include additional DGs (depending on threshold) and load control analysis from distributors.	H

Consultation

Impact	Mitigation	Complexity (H/M/L)*
Reconciliation manager currently only includes DGs subject to dispatch.	Exchange metering data with all DGs (subject to a threshold) utilising the RM by creating an obligation on customers to supply information from behind the meter.	H

*) Please refer to the introductory scenario definition for a description of complexity options.

Co03

Triggers AoB11, AoB13-15

Processes

Impact	Mitigation	Complexity (H/M/L)*
Expected life of an asset is currently only assessed from an accounting perspective based on asset class. Additionally, 'Assets' constructed by projects are made up of a large number of different individual assets with different expected life.	Assess expected technical life for every component separately.	H
	Calculate weighted average expected life for composite assets based on defined assumptions.	M

Technology

Impact	Mitigation	Complexity (H/M/L)*
Accounting asset lifetimes are currently stored in FMIS (for asset classes). Maximo currently stores no technical lifetimes. Both registers deploy disparate granularity and cannot currently be combined on component level.	Store component lifetimes in Maximo.	H
	Distribute site-based lifetimes from FMIS down to components in Maximo.	M

Organisation

Impact	Mitigation	Complexity (H/M/L)*
Finance and System Planning teams currently do not assess component lifetimes.	Significantly more resources will be required for both teams to assess component lifetimes.	H

Consultation

Impact	Mitigation	Complexity (H/M/L)*
There is a substantial time delay between commissioning investments, recording site information within the repositories and breaking this information down into components. This already impacts billing discussions with customers and would potentially increase scrutiny for future consultation.	Coach customers on distribution assumptions for existing and recently commissioned assets.	M

*) Please refer to the introductory scenario definition for a description of complexity options.

C004

Triggers AC01, AC03-04, A0B19

Processes

Impact	Mitigation	Complexity (H/M/L)*
Substantial time delay between commissioning investments, recording site information within the repositories and breaking this information down into components already impacts billing process.	Add resources to speed up manual asset breakdown into components.	M

Technology

Impact	Mitigation	Complexity (H/M/L)*
Maintenance & Operating Expenses are captured at a different granularity within Maximo from FMIS capital information.	Capturing maintenance and operating information on a per site basis rather than a individual asset basis.	M
	Alternatively, define allocation algorithm to combine data sets.	H
Rates and Management Service Fees are not included in Maximo.	Create a new allocation procedure based on a set of defined assumptions.	H

Organisation

Impact	Mitigation	Complexity (H/M/L)*
The Finance team currently focusses on breaking down connection assets first.	Additional resources in Finance are required to speed up interconnection asset breakdown.	M

Consultation

Impact	Mitigation	Complexity (H/M/L)*
The existing scrutiny from customers regarding asset decomposition in billing will increase with interconnection asset charges.	Additional customer dialogues will be required aiming to clarify cost allocations.	M

*) Please refer to the introductory scenario definition for a description of complexity options.

C005

Triggers AC05-06

Processes

Impact	Mitigation	Complexity (H/M/L)*
The existing obligation to provide data that is required for pricing to the grid owner currently only covers kWh information.	Extend data provisioning obligation to kvar information and include in pricing process.	H
Price signals in Demand Response are currently based on historical prices from comparable trading windows.	Calculate Long Run Marginal Cost (LRMC) based on indicative cost of planned transmission projects and use as a Demand Response price signal.	H

Technology

Impact	Mitigation	Complexity (H/M/L)*
Data on reactive power throughout the transmission and distribution systems (kvar) is currently only available in GMMS for Transpower owned and operated meters. Third-party data sets attained from reconciliation currently only include kWh measurements.	Collect available kvar information from metering systems throughout the distribution networks via RM and process through GMMS and MDR to Zemindar.	H

Organisation

Impact	Mitigation	Complexity (H/M/L)*
The kvar charge is not currently assigned to a team.	The Planning and Regulatory team will be required to execute the kvar charge.	H

Consultation

Impact	Mitigation	Complexity (H/M/L)*
Currently no consultation is undertaken in regard to this charge.	Additional communication and reporting towards customers is required to clarify the charge.	H

*) Please refer to the introductory scenario definition for a description of complexity options.

Co06

Triggers	A0B06, A0B09-10, A0B16

Processes

Impact	Mitigation	Complexity (H/M/L)*
Interconnection charges are currently calculated by share of total RCPD.	Calculate share of eligible investments based on physical capacity/average injection and expected remaining life of asset.	M
	Calculate share of eligible investments based on net benefit utilising vSPD model.	H

Technology

Impact	Mitigation	Complexity (H/M/L)*
The customer website currently offers no in-depth reporting for non-connection asset cost allocation and pricing.	Add enhanced self-service reporting and data provisioning to clarify calculation of the Area of Benefit charge and include underlying model assumptions.	H
The SPD solver is currently only available within the Market Systems with a focus on market clearing (predicting the immediate future demand and supply) and runs daily.	Create a separate instance of a vSPD solver in addition to the current market system to run at least every 5 years – matching the RCP phases – or annually, ad-hoc in the event of optimisation effects and predicting a time horizon of 30 years.	H

*) Please refer to the introductory scenario definition for a description of complexity options.

Co06 (contd.)

Triggers	AoB06, AoB09-10, AoB16

Organisation

Impact	Mitigation	Complexity (H/M/L)*
Customer solutions team currently coaches customers on changes greater than 10%, and passes on to pricing team where customers do not currently understand the structure of their charges. The demand for clarification will likely increase significantly with the AoB introduction.	Redirect initial customer inquiries to self-service reporting solution.	M
	Increase capacity for customer inquriy resolution in customer solutions and pricing teams for annual pricing rounds.	H

Consultation

Impact	Mitigation	Complexity (H/M/L)*
There is currently no consultation process defined for planned capex forecasted between $5m and $20m.	Standardise as per existing >$20m process.	M
	Continue with no consultation under $20m.	L
	Develop a new form of consultation for investment between $5m and $20m.	H
There is currently no consultation process defined for retroactive assessment of investments (optimisation).	Reallocate existing investments using the vSPD model.	H
	Reallocate existing investments using a simplified approach.	M
The current consultation process for major capex focusses on inserting alternative design ideas (options) and testing the assumptions in the investment test application. This approach currently only evaluates lowest delivered energy cost (production plus transport) for each option.	Calculate net benefit for optimal option and align market benefits with a cost allocation based on private benefits pricing information.	M
	Calculate net benefit for all assessed options and align market benefits with a cost allocation based on private benefits pricing information.	H

*) Please refer to the introductory scenario definition for a description of complexity options.

C007

Triggers A0B03-06

Processes

Impact	Mitigation	Complexity (H/M/L)*
Interconnection charges are currently manually entered into Billing Prep.	Add the to be defined allocation engine as a source to the manual process and harmonise data stream with connection asset charges.	M
	Automate the process for allocating charges to customers.	H

Technology

Impact	Mitigation	Complexity (H/M/L)*
Zemindar – the pricing engine – currently only allocates connection assets to customers.	Extend Zemindar to allocate connection and AoB assets to customers.	M
	Create an additional rules-based pricing engine focussed on AoB assets.	H
Billing Prep is currently manually supplied with allocated interconnection charges.	Manually include export of AoB asset engine into Billing Prep.	M
	Create automated interface for AoB assets.	H

Organisation

Impact	Mitigation	Complexity (H/M/L)*
The Billing team currently processes preallocated interconnection, connection and HVDC charges.	The Billing team will receive preallocated connection, AoB (for eligible investments including HVDC) and residual charges (for interconnection assets not covered through the AoB charge). The residual charge is expected to account for a significant share upon commencing the new billing process and to decline over time.	M

Consultation

Impact	Mitigation	Complexity (H/M/L)*
General distribution of interconnection charges currently is very transparent in customer dialogues.	Additional dialogue will be required to clarify the complex allocation of interconnection assets and charges. A signficant increase in dispute and litigation is expected.	M

*) Please refer to the introductory scenario definition for a description of complexity options.

Coo8

Triggers	AoB04-05

Processes

Impact	Mitigation	Complexity (H/M/L)*
Currently there is no need to assign project costs (commissioning costs of assets, excluding ongoing maintenance costs) to specific non-connection assets.	Allocate costs to assets utilising the originally commissioned investment cost.	H

Technology

Impact	Mitigation	Complexity (H/M/L)*
Identifying situations where eligible investments target more than one non-connection asset is possible by utilising the FMIS data.	Extract data on targeted non-connection assets from FMIS.	H

Organisation

Impact	Mitigation	Complexity (H/M/L)*
The Finance team currently does not allocate project costs to specific non-connection assets.	Additional resources will be required for the Finance team to allocate project costs.	H

Consultation

Impact	Mitigation	Complexity (H/M/L)*
General distribution of interconnection charges currently is very transparent in customer dialogues.	Additional dialogue will be required to clarify the allocation of project costs to interconnection assets and subsequently customers.	H

*) Please refer to the introductory scenario definition for a description of complexity options.

C009

Triggers	A0B08

Processes

Impact	Mitigation	Complexity (H/M/L)*
Demand forecast are currently exclusively based on historical demand and extrapolated forecasting models.	Include customer commitments into forecast model assumptions.	H

Technology

Impact	Mitigation	Complexity (H/M/L)*
Currently only historical demand data is published to the customer website to be verified and there is no write-back connection.	Enable customers to write future demand forecast values to the customer website and pass data to Zemindar.	H

Organisation

Impact	Mitigation	Complexity (H/M/L)*
Customer solutions and pricing teams are required to facilitate an additional consultation process.	Add capacity for additional consultation during annual pricing process.	H

Consultation

Impact	Mitigation	Complexity (H/M/L)*
The current pricing process does not include consultation on customer-specific model assumptions.	Include an additional consultation process during annual pricing rounds to assess and include "credible commitments".	H

*) Please refer to the introductory scenario definition for a description of complexity options.

C010

Triggers AoB12-13, AoB15-16, AoB19

Processes

Impact	Mitigation	Complexity (H/M/L)*
The AoB charges are determined by combining the Depreciated Historical Cost (DHC) (for historic assets) , Replacement Cost (RC) (for new investments after guidelines are issued), Optimisation effects and Maintenance & Operating Expenses.	Create segmentation of the asset registers and maintenance costs to calculate combined charges for all assets and components.	H
	Create segmentation of the asset registers and maintenance costs to calculate combined charges subject to pragmatic guidelines on materiality.	M
Assets are constantly changing, with replacements and refurbishments. After the initial cost of the asset has been determined, it becomes progressively far more difficult to isolate DHC costs of certain assets to particular projects.	Allocate refurbishment costs and value adjustments to individual components and create new assets for individually extended lifetimes.	H

Technology

Impact	Mitigation	Complexity (H/M/L)*
Assets in eligible investments to be valued utilising the RC approach require information on the expected life of an asset at time of commissioning, cost of the asset and capital cost over the full expected life (including future costs) which is currently only available for asset classes and investment projects in total.	Include future cost estimates of assets in FMIS.	H
Residual values are stored on site-level in FMIS.	Allocate residual values to component level in Maximo.	H

Organisation

Impact	Mitigation	Complexity (H/M/L)*
The Finance team will incur significant additional effort to create a corresponding segmentation of the asset registers and calculate the costs retrospectively and going forward. Especially replacements and refurbishements will drive efforts.	Add significant additional capacity to Finance team.	H

Consultation

Impact	Mitigation	Complexity (H/M/L)*
The current set-up for interconnection charges requires minimal customer dialogue for billing inquries.	Clarifying the blend of charges allocated through AoB will require intensive dialogue after initial set-up and going forward.	H

*) Please refer to the introductory scenario definition for a description of complexity options.

C011

Triggers A0B09, A0B17-18, PDP01-08, OCC01-02

Processes

Impact	Mitigation	Complexity (H/M/L)*
The Customer Solutions team is currently the first point of contact for customers to raise a PDP claim. Subsequently, the customer solutions team will assign a project manager who will coordinate with the customer's and distributor's experts to assess the validity of the claims with the possible outcome of determining a set of individual pricing conditions for this exception customer.	Establish a formalised assessment & contracting process for the anticipated increased volume of exception claims.	H
Knock-on effects for exceptions are currently not being assessed.	Analyse knock-on effect of extended PDP exceptions towards exception criteria for other customers.	H
In the current state, once an exception is defined, a separate contract with individual pricing options has to be established for the assessed customer and the PDP exception will remain valid for up to 15 years with no intermittent reassessment.	Establish re-assessment process at fixed intervals to verify ongoing validity of exception criteria.	H

Technology

Impact	Mitigation	Complexity (H/M/L)*
The PDP exceptions result in individual pricing agreements which are already incorporated in Zemindar (for connection assets) and will have to be included in the rules engine for interconnection assets.	Include individual PDP pricing arrangements in rules engine calculating interconnection charges.	H

Organisation

Impact	Mitigation	Complexity (H/M/L)*
The few existing PDP exceptions have been handled as a side of desk activity by customer solutions and contracting teams.	A significant broadening of exception criteria may yield sufficient increase in exception claims to warrant a dedicated PDP assessment resource/team.	H
Additional PDP exception criteria require expertise in financial assessment of direct and indirect customers.	Create in-house financial assessment expertise.	H
	Hire external expertise for each case assessed.	M

Consultation

Impact	Mitigation	Complexity (H/M/L)*
Current consultation is limited to major investment, other disagreements are managed within customer solutions or other avenues.	The development of the future TPM and code drafting (prudent discount policy approach) may create an avenue for consultation as directed by EA.	H

*) Please refer to the introductory scenario definition for a description of complexity options.

Appendices

Assumptions

Assumptions

General assumptions

Many assumptions are also indicated within the relevant sections of the report. The following general assumptions apply to the entire report.

- Costs exclude GST and are in 2016 dollars (except when stating 2012 estimates);
- The daily rates used in the calculation of the implementation costs reflect the current fees paid by Transpower to its IT support partners or current market rates. The daily rates are:
  - $2,000 for project teams involved in strategy, design, business process optimisation or change & project management activities;
  - $1,700 for all other project teams.
- The annual FTE salaries were provided by Transpower. They are:
  - $100,000 per annum for an analyst
  - $140, 000 per annum for a team leader/manager
- The technology work stream includes costs for system/interface changes and testing effort;
- Applications will be on hosted on Transpower's virtualised environment;
- Any costs relating to the implementation of system changes for Transpower's customers have not been included;
- Transpower will lead the engagement with the sector once the TPM guidelines have been developed;
- The programme is expected to follow Transpower's standard Software Delivery Life Cycle and associated stage gates;
- The Board approval and independent audits of the TPM process will continue on an annual basis.

Phase Definitions

The following definitions and associated activities have been used:

Strategy & Assess. Focuses on mobilising the project team and assessing the current state. Specifically the activities are:

- mobilisation of the project team and governance
- covers base-lining of existing processes/systems/information.
- building the initial business case and benefits management
- undertake stakeholder/organisation impact analysis

Design. Focuses on developing the target state view of the systems/processes/requirements and the change management activities required. Specifically the activities are:

- design target system architecture
- define target process map (down to level 4)
- define functional/non-functional system requirements and integration requirements
- design change management/training approach
- design migration approach.

Build. Focuses on building/customising or configuring the systems and interfaces and the respective testing required.

- build/configure systems, reports and interfaces
- undertake unit/system/integration/user acceptance testing
- build reports.

Implement. Focuses on the activities required to deploy the system into the production environment, the associated training and business acceptance as well as the 1st month of support for the new systems.

- implement systems/interfaces into production
- undertake data migration
- deliver training
- business acceptance
- deliver sector communications.

Assumptions

Specific assumptions

The following specific assumptions have impacted effort and timeline estimates:

- Increased customer scrutiny & support demand is anticipated for the first year after the pricing adjustments take effect;
- An allocation engine for non-connection assets (either an extended Zemindar or an alternative Rules Engine) is a pre-condition for all AoB related changes. Resulting hardware, software and implementation efforts are assumed to be only incurred once;
- kvar data is generally available within non-Transpower metering systems and can be provisioned by RM;
- The technical investigation and vendor selection process (RfP) required by Transpower's procurement process for tenders in excess of $500k will run in parallel to the implementation project, will be completed in time for the implementation phase and costs are covered through IST BAU costs;
- The implementation project can start immediately after the draft code is submitted and accepted by the EA. No additional rework and re-assessment is required;
- The high complexity scenario is chosen for implementation. Lesser complexity scenarios reduce the effort and implementation timeline as discussed within the report but also decrease the expected benefit of outcomes;
- Hardware and Software costs for an alternative Business Rules Engine have been estimated based on vendor inquires towards IBM Operational Decision Manager, FICO Blaze Advisor and Pega 7 BPM.
- Internal and external consultation for code drafting by Transpower is assumed to be required and can be covered within a 6 months time-frame;
- The timeline for build and implementation efforts includes a 20% contingency;
- Hardware costs and software license fees have been derived from average contract terms offered by industry standard vendors (see above). A vendor selection process and due diligence is required to narrow these vendors down based on detailed requirements and request a confirmative quote;
- The overall effort for solution architecture definition is estimated at a total of 4 PM (88 PD) and is evenly distributed across all change requests;
- Definition and requirements analysis per interface (independent of point-to-point versus ESB approach) is estimated at 10 PD on average, whereas implementation averages 15 PD;
- The ratio between implementation and test (SIT/UAT) effort averages 1:1;
- Prolonged Post Go-Live Support after project end is covered through additional FTE in the Corporate Applications team;
- The vSPD module will use existing hardware (potentially shared with the rules engine) and all licensing fees are already covered through the Market Systems;
- RM will be extended to provision load control and injection metering data automatically to Transpower.

Assumptions

Scenario assumptions

The following additional assumptions have impacted the medium complexity scenario:

- The reduction in automated IT supported processes creates an offsetting effect in manual process execution going forward;
- Customer scrutiny in the first year is not expected to significantly increase;
- Changes C001-002, C004-006, C008-011 are reduced by 50-100% compared to the effort estimate of the high complexity scenario;
- Zemindar is technically capable of being upgraded to allocate non-connection assets to customers without rendering the execution performance unfeasible.

The following additional assumptions have impacted the lower complexity scenario:

- Potentially, an incremental change of the current state can be handled without a dedicated transformation project, within the current technology and (manual) business process scope and yielding similar improvements in allocating charges to beneficiaries. Due to the high uncertainty of changes to be included in this scenario, a relative reduction in effort estimates was applied in relation to the high and medium complexity scenarios;
- Only minor staff augmentation is required to handle the additional, simplified and manual allocation processes.

Appendices

Glossary

Glossary (A-E)

Abbreviation	Definition
AC asset	A Grid asset which is not an HVDC asset. Includes for example – switches, transformers, substations, lines
ACOT	Avoided cost of transmission
Act	Electricity Industry Act 2010
AMD	Anytime maximum demand
AMI	Anytime maximum injection
AoB	Area-of-benefit
Asset replacement costs	The cost of replacing an asset with a modern equivalent that has the same service potential. If an asset has to be replaced with a higher quality asset, the customer does not currently incur the extra amount
CLADs	Connection location asset diagrams are technical diagrams of the entire network
CMIS	The Customer Management Information System holds customer contract information
CMS	Content Management System
Connection charge	The connection charge recovers part of Transpower's AC revenue by charging customers for the cost of providing connection assets (so they are able to connect to the national grid). The customer's monthly connection charge is calculated as 1/12 of the annual connection charge which is calculated by Zemindar
CSV	Comma Separated Values file
Customer asset allocations	All connection assets are allocated to the customer or customers that use them. If only one customer utilises an asset then it will be allocated to them at 100%. If more than one customer utilises the asset to connect to the national grid, the allocation will be dependent on the usage of each of the customers
Customer operated switches	A switch which is being operated by the customer or customers using it. As Transpower do not pay operating costs for these switches, customers pay a discounted operating component for them
DG	Distributed generation
DGPP	Distributed generation pricing principles
DHC	Depreciated Historical Cost
DRMS	Demand Response Management System
EA, Authority	Electricity Authority
EDB	Electricity Distribution Business
EOC	Exceptional Operating Circumstances are services provided by a customer at the request of Transpower and include for example, a request by Transpower to have more power pumped into the national grid. The charges incurred in these scenarios are overridden so the customer is not paying for providing additional services

Glossary (F-K)

Abbreviation	Definition
FMIS	The Financial Management Information System holds financial information on assets
FTE	Full Time Equivalent
GL	General Ledger
GMMS	The system used by EMS to store and deliver the RCPD/RCPI and kvar information to MDR
GXP	Grid Exit Point
HAMI	Historical anytime maximum injection
HVDC	High voltage direct current
MDR	Meter Data Repository is a capacity calculation system which holds metering data and TPM related aggregation business rules. It is used to calculate the capacity measurements for each customer by location to determine the correct allocation of connection assets based on usage
MMS	The Maintenance Management System holds operating and maintenance cost information
HVDC charge	The High Voltage Direct Current charge recovers Transpower's HVDC revenue. The customers monthly HVDC charge is calculated for all HVDC customer at each South Island generation location. The monthly HVDC charge is 1/12 of the annual HVDC charge
Interconnection charge	The interconnection charge recovers the remainder of Transpower's AC revenue. Monthly interconnection charges are paid by offtake customers for each connection location at which they have assets connected to the national grid
IST	Information Systems Technology
kvar	Kilovolt ampere reactive
kWh	Kilowatt hour
HVDC charge	The High Voltage Direct Current charge recovers Transpower's HVDC revenue. The customers monthly HVDC charge is calculated for all HVDC customer at each South Island generation location. The monthly HVDC charge is 1/12 of the annual HVDC charge
Interconnection charge	The interconnection charge recovers the remainder of Transpower's AC revenue. Monthly interconnection charges are paid by offtake customers for each connection location at which they have assets connected to the national grid
IST	Information Systems Technology
kvar	Kilovolt ampere reactive
kWh	Kilowatt hour

Glossary (L-Z)

Abbreviation	Definition
LCE	Loss and constraint excess
LRMC	Long-run marginal cost
LSI, LNI, USI, UNI	Lower South Island, Lower North Island, Upper South Island, Upper North Island
Market System	The current Market System refers to a group of applications including the SPD model which act as the electricity wholesale market clearing engine
MW	Megawatt
OVF file	The Offer Volume Forecast file contains anytime maximum demand (AMD), anytime maximum injection (AMI), regional coincident peak demand (RCPD) and historical anytime maximum injection (HAMI) data and is manually uploaded into Zemindar
PDP	Prudent discount policy
PM/PD	Person Month/Person Day
RC	Replacement Cost
RCP(2)	Regulatory Control Period (2)
RCPD	Regional coincident peak demand
RCPI	Regional coincident peak injection
RfP	Request for Proposal
RMT	When the HVDC link is removed the system reserve requirements would change. These reserve requirements are calculated during market operation by the Reserve Management Tool
SFT	The Simultaneous Feasibility Test is a model to calculate the security constrained transmission branch capabilities
SIMI	South Island Mean Injection
SPD	The Scheduling, Pricing and Dispatch model is part of the Market System which forecasts the electricity demand for the country and allocates resources to satisfy the demand
Switch	Connects customers to the national grid and controls the flow of power
TPM	Transmission Pricing Methodology
vSPD	The vectorised Scheduling, Pricing and Dispatch model is based on the published formulation of the market clearing engine (SPD). It has been developed by the Authority and provides a simplified version of the SPD system run by Transpower
Zemindar	Zemindar is the pricing engine for current transmission prices. It is used to produce annual customer rates for the connection, interconnection and HVDC

Appendices

Key stakeholders

Key Stakeholders

Team & roles	Person within Transpower
Regulatory	Jeremy Cain Micky Cave
Pricing	Rodrigo Nocete George Sproule
Finance	Helen Deane John Coulter
Customer solutions	Rebecca Mehrtens Carolyn McArthur
Business enterprise	Matt Tebbs Nigel Partridge Derrick W
Consultation	Michael Parker
Reporting & billing	Robynne Purdy Tony Seabrook
System planning	Nikki Newham Brian Moore Gerk Chen
Counsel	Chris Browne
Metering	Ian Martin

Stakeholder involvement

We met a number of stakeholders within Transpower in a series of ten initial interviews from 8 June to 29 June 2016. These stakeholders were selected for their involvement in the TPM process and exposure across systems, processes, and regulatory change that may be required as a result of the proposals.
Their feedback was captured as a set of memos, reviewed by the corresponding counterparts and formed the basis for our impact analysis within this report.