OPTIONS EVALUATION REPORT (OER)

Corporate Data Network Refresh 2018-2023

OER 000000001542 revision 0.0

Ellipse project no.: P0008894
TRIM file: TBA

Project reason: Support the business IT
Project category: Support - IT

Approvals

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Approved	Stuart Barber	Acting Chief Information Officer
Date submitted for approval	31 October 2016	

1. Need/opportunity

There is a need to replace the Corporate Data Network (CDN) IT assets that have reached their end of life during the regulatory period. The CDN provides switching, routing and load balancing services to enable endpoint devices to connect to enterprise applications.

The CDN comprises Cisco switches, routers and F5 load balancers. The CDN is monitored and managed using the SolarWinds network management software.

IT Hardware	Hardware Description	End of Life
Cisco Switches	Provides the ability to connect devices together on a network. A switch will receive, process and forward data to the destination device.	2022
Cisco Routers	Provides the ability to connect multiple networks and forward small units of data destined for either its own network or other networks.	2022
F5 load balancers	A load balancer is a device that is used to distribute network or application traffic across a number of servers. Load balancers are used to increase capacity and the reliability of applications.	2022

Data communications also enables unified communications services including video conferencing, instant messaging, desktop sharing and electronic mail.

These assets have a life of five years, and if not addressed it introduces additional risk and cost to TransGrid.

2. Related needs/opportunities

The information infrastructure refresh and enterprise applications refresh are related and will be considered as part of the scoping and requirements definition for the information infrastructure replacement program.

3. Options

3.1 Base Case

The option proposes operating ‘As Is’.

This option increases the likelihood of lengthy service outages as a result of increased hardware failure and incompatibility of software updates on aging hardware. The risk of failure to these systems without replacement has been estimated at $3.18m from the financial year of 2021/22. The driver of this risk cost is based on a hazardous event of service failure either in hardware, software and data transfers which is required to run the unified communications applications. Key inputs into the risk cost are:

- Probability of failure estimated at 50% is based on the rate of change of the external environment specified by vendors. This includes software version updates and hardware replacements to enable compatibility across the network;
- Major consequence from these failures is the potential service interruption for 72 hours and affecting 1,000 users is based on the CDN hardware recovery timeframe; and
- Likelihood of the consequence is moderated by "N-1" which applies 5% likelihood on the consequence. This is based on the failure mode for full redundancy that is in place for the CDN.

The CDN assets provide the underlying physical capability to enable unified communication and enterprise application services.

3.2 Option A — Refresh Corporate Data Network

This option proposes to refresh and augment the CDN hardware and associated software to support the current critical business and network systems. The program will establish the physical switching environment to enable endpoint device connection to enterprise applications and securely run the unified communications services.

This option will ensure that TransGrid has sufficient capacity to securely deliver IT services in line with the Technology Strategy and the proposed Programs of Work for the regulatory period.

3.3 Estimated Capital Cost

The tables below outline the investment forecast and the potential ongoing costs.

Table 1 – Estimated Capital Costs

Category	Item	Budget
Material and Labour	Provision of Calendar and Messaging Services	$1.5m
	Provision of Remote Access and Virtual Desktops	$1.1m
	Provision of Data transmission – datacentre, campus and substation switching and routing network	$5m
	Provision of Voice Telephony	$2m
	Provision of Videoconferencing	$1.5m
	Total CAPEX:	$11.1m

The estimated capital costs are based on previous project costs for replacing CDN hardware and software.

3.4 Estimated OPEX

Category	Item	Budget
Labour	Ongoing support for CDN servers, storage and end user devices.	$0.175m

The estimated OPEX cost is based on existing CDN support costs.

3.5 Benefits

The ongoing support cost for the existing systems is estimated at $0.175m and if a 50% increase is applied in 2021/22 an additional $0.09m will be incurred in the first year. This value is doubled in the second year. There may be further increase in subsequent years but this has not been considered at this stage because it is an unlikely scenario.

Investing in Option A will result in a cost avoidance saving of $0.09m for the first year and $0.175m for subsequent years which is a saving of $0.788m over a 5 year asset life.

4. Evaluation

4.1 Commercial Evaluation

The commercial evaluation of the options is set out in the table below.

Table 2 – Commercial Evaluation of Options

Option	Description	Capex ($m)	Incremental net Benefits p.a ($m)*	Project Risk Cost ($m)	NPV ($m)	Rank
Base Case	Do Nothing			$3.18	N/A	2
A	Refresh Corporate Data Network	$11.1	$3.27	$0.0	$1.40	1

** Includes risk savings $3.18m and opex savings $0.09m (Year 1).*

The above commercial evaluation is based on the following:

- 10% discount rate; and
- Analysis period of 6 years (construction is 1 year, and asset life is 5 years).

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear in Table 3.

Table 3 – Sensitivities on discount rate

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Refresh Corporate Data Network	$2.50	$0.55

4.2 Preferred Option

Option A is the preferred option because it is the technically feasible option that delivers the required capability and has the highest positive NPV.

4.3 Capital and Operating Expenditure

Options above consider the incremental net benefits (additional Opex offset by reduction in operating costs). The preferred option considers capital investment.

4.4 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

5. Recommendation

It is recommended that Option A – Refresh Corporate Data Network be the preferred option to progress to the next phase.

Attachment 1 Commercial Evaluation Option – NPV

Project_Option Name	Corporate Data Network Refresh

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	$1.40m	*NPV / Capital (Ratio)*	*0.13*
NPV @ upper bound rate	13.00%	$0.55m	*Pay Back Period (Yrs)*	*0.15 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$2.50m	*IRR%*	*15.27%*

2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)

NPV @ standard discount rate	10.00%	$1.40m	*NPV / Capital (Ratio)*	*0.13*
NPV @ upper bound rate	13.00%	$0.55m	*Pay Back Period (Yrs)*	*3.33 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$2.50m	*IRR%*	*15.27%*

Benefits

Risk cost	As Is	To Be	Benefit
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*
Financial	*$3.00m*	*$0.00m*	*$3.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*
Environment	*$0.00m*	*$0.00m*	*$0.00m*
Reputation	*$0.18m*	*$0.00m*	*$0.18m*
Total Risk benefits	$3.18m	$0.00m	$3.18m
Cost savings and other benefits			$0.09m
Total Benefits			$3.27m

VCR Benefit	*$0.00m*
ENS Penalty	*$0.00m*
All other risk benefits	*$3.18m*
Total Risk benefits	$3.18m
Benefits in the financial NPV*	$3.27m
**excludes VCR benefits*	
Benefits in the economic NPV**	$3.27m
***excludes ENS penalty*	

Other Financial Drivers

Incremental opex cost pa (no depreciation)	$0.00m	Write-off cost	$0.00m
Capital - initial $m	-$11.10m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment	$0.00m	Re-investment capital	$0.00m
Capitalisation period	1.00 Yrs	Start of the re-investment period	0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Information Infrastructure Refresh 2018

OER 000000001547 revision 0.0

Ellipse project no.: P0008952
TRIM file: TBA

Project reason: Support the business IT
Project category: Support - IT

Approvals

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Approved	Stuart Barber	Acting Chief Information Officer
Date submitted for approval	31 October 2016	

1. Need/opportunity

There is a need to refresh all physical devices and associated software, which will progressively reach the end of asset life during the upcoming regulatory period. TransGrid has many IT assets that are located in their two data centres which include physical servers, storage arrays and associated software which runs the portfolio of enterprise applications. In addition TransGrid has a fleet of managed endpoint devices comprising of workstations, desktops, laptops, tablets and smart phones which are used by employees to access enterprise applications.

If TransGrid does not have a replacement program there is an increasing risk of the existing hardware will fail which will interrupt the service availability for the enterprise applications.

2. Related needs/opportunities

The data communications refresh and enterprise applications refresh are related and will be considered as part of the scoping and requirements definition for the information infrastructure replacement program.

3. Options

3.1 Base case

The option considers operating 'As Is'.

In this option, TransGrid does not invest in refreshing the infrastructure identified as reaching the end of its serviceable life. The risk of failure to these systems without replacement has been estimated at $4.5m from the financial year of 2019/20. The driver of this risk cost is based on a hazardous event of service failure either in hardware, software or component failure. Key inputs into the risk cost are:

- Probability of failure estimated at 50% is based on the rate of change of the external infrastructure environment specified by vendors this includes software version updates and hardware replacements to enable compatibility across the network;
- Major consequence from these failures is the potential service interruption for 150 hours and affecting 1,000 users is based on the infrastructure recovery timeframe; and
- Likelihood of the consequence is moderated by "N-1" which applies 5% likelihood on the consequence which is based on the failure mode for full redundancy is in place for the infrastructure.

The Information Infrastructure assets provide the underlying physical capability to host IT Services. Whilst in some cases it is possible to extend the asset life beyond five years, it is not considered prudent due to the high cost of maintenance and the rapid pace of technological change in the market.

In the case of storage on magnetic disk and even solid state technology, there is physical deterioration over time that degrades performance and places a higher level of risk of failure on the supported services.

3.2 Option A — Refresh Information Infrastructure

This option proposes refreshing the infrastructure that reaches its end of asset life within this revenue reset period. This information infrastructure supports the existing critical business and network systems and will be replaced in a cost effective manner. Without this replacement program there is an increased risk that the hardware will progressively fail leading to a service interruption to the availability of the IT services portfolio.

This option will ensure that TransGrid has sufficient capacity to securely deliver IT services in line with the Technology Strategy and the proposed Programs of Work for the regulatory period.

3.3 Estimated Capital Costs

The tables below outline the investment forecast and the potential ongoing costs.

Category	Item	Budget
Material and labour	Provision of Shared Storage (replacement/augmentation)	$2m
	Provision of Physical Servers	$0.6m
	Provision of Physical User Devices (workstations, laptops, tablets, smartphones)	$4.2m
	Provision of Data Centre Facilities	$1m
	Provision of Desktop Managed Operating Environment	$2m
	Provision of Structured Data Management	$1.5m
	Provision of Virtual Server Hypervisor	$1.2m
	Provision of Data Protection – Backup and Recovery	$0.75m
	Provision of Output Devices	$0.75m
	Provision of Server Operating Systems	$0.9m
	CAPEX Total:	$14.9m

The estimated capital costs are based on previous project costs for replacing hardware and software.

3.4 Estimated OPEX

Category	Item	Budget
Labour	Ongoing support for servers, storage, devices, data centre facilities, operating environment and data protection.	$0.4m

The estimated OPEX cost is based on existing infrastructure support costs.

3.5 Benefits

The ongoing support cost for the existing systems is estimated at $0.4m and if a 50% increase is applied in 2019/20 an additional $0.2m will be incurred in the first year. This value is doubled in the second year. There may be further increase in subsequent years but this has not been considered at this stage because it is an unlikely scenario as an option.

Investing in Option A will result in a cost avoidance saving of $0.2m for the first year and $0.4m for subsequent years which is a saving of $1.8m over a 5 year asset life.

4. Evaluation

4.1 Commercial Evaluation

The commercial evaluation of the options is set out in the table below.

Table 1 – Commercial Evaluation of Options

Option	Description	Capex ($m)	Incremental net Benefits p.a ($m)*	Project Risk Cost ($m)	NPV ($m)	Rank
Base Case	Do Nothing			$4.5	N/A	2
A	Refresh Information Infrastructure	$14.9	$4.7	$0.0	$3.49	1

** Includes risk savings $4.5m and opex savings $0.2m (Year 1).*

The above commercial evaluation is based on the following:

- 10% discount rate; and
- Analysis period of 6 years (construction is 1 year, and asset life is 5 years).

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear in Table 2.

Table 2 – Sensitivities on discount rate

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Refresh Information Infrastructure	$5.14	$2.16

4.2 Preferred Option

Option A is the preferred option because it is the technically feasible option that delivers the required capability and has the highest positive NPV.

4.3 Capital and Operating Expenditure

Options above consider the incremental net benefits (additional Opex offset by reduction in operating costs). The preferred option considers capital investment.

4.4 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

5. Recommendation

It is the recommendation of this report to proceed with Option A – Refresh Information Infrastructure.

Attachment 1 Commercial Evaluation Option – NPV

Project_Option Name	Refresh Information Infrastructure

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	$3.49m	*NPV / Capital (Ratio)*	*0.23*
NPV @ upper bound rate	13.00%	$2.16m	*Pay Back Period (Yrs)*	*0.19 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$5.14m	*IRR%*	*18.74%*

2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)

NPV @ standard discount rate	10.00%	$3.49m	*NPV / Capital (Ratio)*	*0.23*
NPV @ upper bound rate	13.00%	$2.16m	*Pay Back Period (Yrs)*	*3.08 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$5.14m	*IRR%*	*18.74%*

Benefits

Risk cost	As Is	To Be	Benefit
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*
Financial	*$4.00m*	*$0.00m*	*$4.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*
Environment	*$0.00m*	*$0.00m*	*$0.00m*
Reputation	*$0.50m*	*$0.00m*	*$0.50m*
Total Risk benefits	$4.50m	$0.00m	$4.50m
Cost savings and other benefits			$0.20m
Total Benefits			$4.70m

VCR Benefit	*$0.00m*
ENS Penalty	*$0.00m*
All other risk benefits	*$4.50m*
Total Risk benefits	$4.50m
Benefits in the financial NPV*	$4.70m
**excludes VCR benefits*	
Benefits in the economic NPV**	$4.70m
***excludes ENS penalty*	

Other Financial Drivers

Incremental opex cost pa (no depreciation)	$0.00m	Write-off cost	$0.00m
Capital - initial $m	-$14.90m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment	$0.00m	Re-investment capital	$0.00m
Capitalisation period	1.00 Yrs	Start of the re-investment period	0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Digital Field Force

OER 000000001689 revision 0.0

Ellipse project no.: P0010086
TRIM file: TBA

Project reason: Capability - Asset Replacement for end of life condition
Project category: Support - IT

Approvals

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Approved	Stuart Barber	Acting Chief Information Officer
Date submitted for approval	31 October 2016	

1. Need/opportunity

There is a need to replace and/or upgrade a range of TransGrid custom built applications before they reach the end of the life period. The following field based mobile applications will reach end of life in the period 2018-2023:

- The Outage Management System (THEOS) and its accompanying mobile application;
- Vegetation Management System (VMS);
- TransGrid Resource Allocation Calendar (TRAC);
- Asset Inspection Manager (AIM);
- Authorisation to Work (ATW);
- Work and Safety Package (WASP); and
- Portal Switching (PS).

There is also an opportunity to improve data quality and decision making leading to optimise maintenance costs and improve network reliability.

This will be delivered by prudent investment replacing existing and investing in a number of emerging field force technologies.

2. Related needs/opportunities

- Digital Enterprise – embedded mobility capabilities will depend on the solution chosen for the ERP refresh; and
- Pervasive Security – mobility solutions will need to comply with TransGrid's security requirements.

3. Options

3.1 Base case

This option is about operating 'As Is'.

By not enhancing the digital work force, this option will result in a higher risk profile in the execution of field work due to the growing unreliability of the systems as they age. Current solutions are delivered using iPhones and other software technologies that are likely to change significantly over the next five years with the rapid change in end point devices driven by consumer technology.

Given the criticality of business functions such as Asset Inspection, Vegetation Management, Outage Management and HV Switching, if these systems are not appropriately maintained it would lead to increased corporate and public risk to the safe and reliable electricity supply. The increased operational risk that would be incurred is $7.92m. The risk cost drivers are based on a hazardous event of service failure either in security, software or data quality.

It is not considered prudent to extend the asset life of these systems until 2023.

3.2 Option A — Make prudent investment in new field force technologies.

This option proposes refreshing a number of systems which will reach the end of life during the next regulatory period. Through prudent investment in new technologies, it is proposed that there will be an

increase in safety and efficiency in the field, which will improve the overall performance and reliability of the network.

In this option, TransGrid will leverage its investment in a common Mobile Enterprise Application Platform in order to deliver mobile solutions with agility and at a lower cost.

These solutions will also be integrated with the relevant data sources and analytics in order to provide insightful information on the teams on the field, depending on their location.

Solutions that TransGrid consider investing into include:

- An outage management system as the current system will become obsolete;
- A vegetation management system as the current system will reach end-of-life;
- A solution to manage field works including scheduling, work orders and safety management as the current systems will reach end-of-life;
- Augmented reality solutions;
- Location-based services;
- Dynamic Scheduling and Dispatching; and
- Track and Trace Inventory for IoT devices.

3.2.1 Estimated Capital Costs

The table below outlines the investment forecast and the potential ongoing costs.

Category	Item	Budget
Material	Introduction of augmented reality devices. Provide a pilot solution.	$0.5m
	Provision of licences and infrastructure for outage management system (Budget is based on a similar project in energy industry).	$0.2m
	Provision of licences and infrastructure for dynamic scheduling and dispatching system (Budget is based on a similar project in energy industry).	$0.1m
	Provision of barcode scanners to enable IoT track and trace	$0.1m
	Provision of licences and infrastructure for the track and trace solution	$0.1m
	Provision of licences and infrastructure for the vegetation management solution (Budget is based on a similar project in energy industry).	$0.4m
Labour/Contract	Integrate augmented reality devices with the integration platform (Budget is based on a similar project in energy industry).	$0.8m
	Implement refreshed outage management system	$1m
	Implement refreshed digital work orders system	$1m
	Implement dynamic scheduling and dispatching	$0.8m
	Implement track and trace solution	$0.5m
	Implement refreshed vegetation management solution	$2.5m
	Implementation of location-based services	$0.2m
	CAPEX Total:	$8.2m

3.2.2 Estimated OPEX

Category	Item	Budget
Labour	Ongoing maintenance of augmented reality devices	$0.1m
	Ongoing support for digital work orders	$0.1m
	Ongoing support for dynamic scheduling and dispatching	$0.1m
	Ongoing support for outage management	$0.1m
	Ongoing support for vegetation management	$0.2m
	OPEX Total:	$0.6m

Based on the assumption that:

The integration layer will be implemented and supported as part of the Intelligent Operations Centre Program of Work.

3.2.3 Estimated Benefits

Benefit	$m p.a.
Reduction in effort to configure and manage the fleet of sensor and monitoring devices associated with the HV network because Field Services will have augmented reality solutions to improve the management of TransGrid's HV vehicles. (Based on 400 fleet vehicles x average SP 18 $44.27/hr x 40 minutes savings for each vehicle/wk x 48wks/yr = $566,656/yr)	0.57
Improved efficiency on field work as instructions and asset information are easier to access through augmented reality solutions and/or remote expert support. This can include improvements to WASP and VMS processes. (Based on 524 Field Services staff x average SP 18 $44.27/hr x 30 minutes savings/wk x 48wks/yr = $556,739/yr)	0.56

** Please note benefit calculations will be refined when each of the projects are scoped in detail.*

4. Evaluation

4.1 Commercial Evaluation

The commercial evaluation of the options is set out in the table below.

Table 1 – Commercial Evaluation of Options

Option	Description	Capex ($m)	Incremental net Benefits pa ($m)*	Project Risk Cost ($m)	NPV ($m)	Rank
Base Case	Do Nothing			$7.92	N/A	2
A	Make prudent investment in new field force technologies.	$8.20	$8.45	$0	$27.02	1

** Includes productivity benefits $1.12, risk savings $7.92 and additional opex ($0.60).*

The above commercial evaluation is based on the following:

- 10% discount rate; and
- Analysis period of 6 years (construction is 1 year, and asset life is 5 years).

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear in Table 2.

Table 2 – Sensitivities on discount rate

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Make prudent investment in new field force technologies	29.02	25.37

4.2 Preferred Option

Option A is the preferred option because it addresses the business need and opportunity and the identified benefits will be realised.

4.3 Capital and Operating Expenditure

Options above consider the incremental net benefits (additional OPEX offset by reduction in operating costs). The preferred option considers capital investment.

4.4 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

5. Recommendation

It is the recommendation of this report to proceed with Option A – Make prudent investment in new field force technologies.

Attachment 1 – Commercial evaluation of options

Project_Option Name	Digital Field Force

1. Financial Evaluation (excludes VCR benefits)				
NPV @ standard discount rate	10.00%	$27.02m	*NPV / Capital (Ratio)*	*3.30*
NPV @ upper bound rate	13.00%	$25.37m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	$29.02m	*IRR%*	*99.77%*

2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)				
NPV @ standard discount rate	10.00%	$27.02m	*NPV / Capital (Ratio)*	*3.30*
NPV @ upper bound rate	13.00%	$25.37m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	$29.02m	*IRR%*	*99.77%*

Benefits					
Risk cost	As Is	To Be	Benefit	*VCR Benefit*	*$0.00m*
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*	*ENS Penalty*	*$0.00m*
Financial	*$7.00m*	*$0.00m*	*$7.00m*	*All other risk benefits*	*$7.92m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$7.92m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$9.05m
Reputation	*$0.92m*	*$0.00m*	*$0.92m*	**excludes VCR benefits*	
Total Risk benefits	$7.92m	$0.00m	$7.92m		
Cost savings and other benefits			$1.12m	Benefits in the economic NPV**	$9.05m
Total Benefits			$9.05m	***excludes ENS penalty*	

Other Financial Drivers			
Incremental opex cost pa (no depreciation)	-$0.60m	Write-off cost	$0.00m
Capital - initial $m	-$8.20m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment	$0.00m	Re-investment capital	$0.00m
Capitalisation period	1.00 Yrs	Start of the re-investment period	0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Analytics Platform Refresh

OER 000000001690 revision 0.0

Ellipse project no.: P0010088
TRIM file: TBA

Project reason: Support the business IT
Project category: Support - IT

Approvals

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Approved	Stuart Barber	Acting Chief Information Officer
Date submitted for approval	31 October 2016	

1. Need/opportunity

TransGrid has a need to refresh its current descriptive and diagnostic platforms which will reach end of life in the period 2018-2023. The IT services reaching asset end of life are business reporting and data visualisation in 2022. This need will assist with the capturing and analysing of real-time information across the Information Technology (IT) and Operational Technology (OT) which will in turn improve forecasting, analytics and reporting capabilities.

The IT services reaching asset end of life are summarised in the following table. These applications will be upgraded or replaced based on the business requirements and the suitable products available in the market.

Table 1 – IT services reaching asset end of life.

IT Service	Application(s)	Application Description	End of Life
Business Reporting	Microsoft SQL Server Reporting Services, Microsoft SQL Server Analysis Services and WhereScape Red	Microsoft SQL Server Reporting Services provide a set of canned reports to users. These reports can be executed on demand. Microsoft SQL Server Analysis Services delivers online analytical processing and data mining functionality for business intelligence applications. WhereScape Red is a tool that provides a framework for the development and ongoing support of an enterprise data warehouse.	2022
Data Visualisation	Tableau	Tableau is a tool that allows a user to analyse data and display the data in a graphical or dashboard format.	2022

TransGrid's intention is to build on the existing analytical platform to expand analytics capabilities across IT and OT and will include Master Data Management Framework and other diagnostics and descriptive applications listed in section 3.3.

2. Related needs/opportunities

- Pervasive Security – as information and insights will need to be secured; and
- Intelligent Operations Centre – as the integration platform will support the seamless flow of data between the different systems.

3. Options

3.1 Base case

The option proposes operating 'As Is'.

Whilst this option is technically feasible, it would be less prudent to maintain the current analytics platform given the expected technology advances in this area over the next reset period. Analytics capability is expected to transition from primarily software-based to hardware-based capability and maintaining the current software-based systems would pose not only a service failure risk, but not allow TransGrid an opportunity to realise substantial operational benefits.

The increased operational risk that would be incurred unless these systems are replaced or upgraded is calculated at $3.24m from the financial year of 2022/23. The driver of this risk cost is based on the hazardous events relating to out of support either in security, software failure or data quality.

3.2 Option A — Refresh Enterprise Analytics Platform

This option proposes building on the outcomes of the Information Management program of work and delivering an enterprise wide (IT and OT) information governance, structures and tools. Market trends including the use of Big Data demonstrate the growing importance of information management to improve operations of transmission businesses.

The technology components delivered by this option will address the need to replace or upgrade the current descriptive and diagnostic applications, and will include:

- The implementation of an Enterprise Analytics Platform to refresh and enhance the current solution;
- The refresh of the current Enterprise Content Management solution;
- The development of and enterprise wide master data management framework based on the common IT/OT data model;
- The refresh of centralised analytics dashboards; and
- The implementation of distributed Analytics-as-a-Service to enable the building of real-time advanced analytics capabilities across the business.

The specific technology solutions are subject to revisions based on further analysis performed as part of the project development stages.

3.3 Estimated Capital Costs

The tables below outline the investment, the potential ongoing costs and associated benefits.

Category	Item	Budget
Material	Provision of infrastructure and licences for Analytics Platform (data lake and integration layer)	$3m
	Provision of infrastructure and licences for Enterprise Content Management (ECM)	$0.1m
	Provision of infrastructure and licences for KPI dashboard	$0.1m
	Provision of infrastructure and licences for real time advanced analytics (analytics-as-a-service) refresh	$0.3m
Labour/Contract	Implement Master Data Management framework	$0.4m
	Implement Enterprise Data Lake and integration layer with source systems	$3.3m
	Implement refreshed Enterprise Content Management (ECM)	$0.5m
	Implement refreshed KPI dashboard	$0.1m
	Implement real time advanced analytics (analytics-as-a-service)	$0.2m
	CAPEX Total:	$8m

3.4 Estimated OPEX

Category	Item	Budget
Labour	Ongoing support for Analytics Platform	$0.3m
	Ongoing support for the ECM solution	$0.05m
	Ongoing support for KPI dashboard	$0.01m
	Ongoing support for real time advanced analytics	$0.01m
	OPEX Total:	$0.37m

3.5 Benefits

Benefit	$m p.a.
Improved reporting capability across the business which results in better decision making and a reduction in the time required to generate the reports. An estimated non- cashable cost saving of $0.830m per annum which is based on Operational Reporting and Analytics – Stage 3 reports to be delivered in 2017.	$0.83
Reduced asset failures will result in a reduction in associated costs. The cashable costs savings is $4m based on 4,000 fixed assets (November 2016 fixed assets report) and $1,000 saving per asset.	$4.0
Benefit total:	$4.83m

** Please note benefit calculations will be refined when each of the projects are scoped in detail.*

4. Evaluation

4.1 Commercial Evaluation

The commercial evaluation of the options is set out in the table below.

Table 1 – Commercial Evaluation of Options

Option	Description	Capex ($m)	Incremental net Benefits pa ($m)*	Project Risk Cost ($m)	NPV ($m)	Rank
Base Case	Do Nothing			$3.24	N/A	2
A	Refresh Analytics Platform	$8.00	$7.70	$0.0	$19.26	1

*includes risk savings of $3.24m and cost saving benefits of $4.83m, offset by increased opex of ($0.37m).

The above commercial evaluation is based on the following:

- 10% discount; and
- Analysis period of 6 years (construction is 1 year, and asset life is 5 years).

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear in Table 2.

Table 2 – Sensitivities on discount rate

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Refresh Analytics Platform	$22.28	$16.89

4.2 Preferred Option

Option A is the preferred option because it is the technically feasible option that delivers the required functionality to provide the estimated benefits, and has the highest positive NPV.

4.3 Capital and Operating Expenditure

Options above consider the incremental net benefits (additional Opex offset by reduction in operating costs). The preferred option considers capital investment.

4.4 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

5. Recommendation

It is the recommendation of this report to proceed with Option A – Refresh Enterprise Analytics Platform.

Attachment 1 Commercial Evaluation Option – NPV

Project_Option Name	Analytics Platform Refresh

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	$19.26m	*NPV / Capital (Ratio)*	*2.41*
NPV @ upper bound rate	13.00%	$16.89m	*Pay Back Period (Yrs)*	*0.93 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$22.28m	*IRR%*	*92.62%*

2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)

NPV @ standard discount rate	10.00%	$19.26m	*NPV / Capital (Ratio)*	*2.41*
NPV @ upper bound rate	13.00%	$16.89m	*Pay Back Period (Yrs)*	*1.04 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$22.28m	*IRR%*	*92.62%*

Benefits

Risk cost	As Is	To Be	Benefit
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*
Financial	*$0.87m*	*$0.00m*	*$0.87m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*
Environment	*$0.00m*	*$0.00m*	*$0.00m*
Reputation	*$2.37m*	*$0.00m*	*$2.37m*
Total Risk benefits	$3.24m	$0.00m	$3.24m
Cost savings and other benefits			$4.83m
Total Benefits			$8.07m

VCR Benefit	*$0.00m*
ENS Penalty	*$0.00m*
All other risk benefits	*$3.24m*
Total Risk benefits	$3.24m
Benefits in the financial NPV*	$8.07m
**excludes VCR benefits*	
Benefits in the economic NPV**	$8.07m
***excludes ENS penalty*	

Other Financial Drivers

Incremental opex cost pa (no depreciation)	-$0.37m	Write-off cost	$0.00m
Capital - initial $m	-$8.00m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment	$0.00m	Re-investment capital	$0.00m
Capitalisation period	1.00 Yrs	Start of the re-investment period	0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Pervasive Security

OER 000000001691 revision 2.0

Ellipse project no.: P0010090
TRIM file: TBA

Project reason: Compliance - Security
Project category: Support - IT

Approvals

Author	Guillaume Leroux	Litmus Group
Endorsed	Michael Milne	Planning and Architecture Manager
	Azil Khan	Investment Analysis Manager
Approved	Stuart Barber	Acting Chief Information Officer
Date submitted for approval	31 October 2016	

1. Need/opportunity

1.1 Need

There is a need to invest in security as the network of the future will rely on new technologies that will increase the vulnerability to cyber-attacks. Security is paramount to successfully integrate and operate Information Technology (IT) and Operational Technology (OT). The traditional OT networks were built to work autonomously whereas the IT networks are by nature more open.

TransGrid's security infrastructure is comprised a number of hardware and software infrastructures which are as follows:

- Security Monitoring systems (Enterprise Security Splunk);
- Security control systems (McAfee Application Control);
- Identity Management System (Mimecast);
- Enterprise Security Gateways (Mimecast, Content Keeper);
- Information Management Systems (required to comply with the *Privacy Act* and NSW Electricity Networks license to operate) (Content Keeper); and
- Physical security management systems (Insight).

All of these systems will need to be refreshed in the next revenue period to mitigate against emerging cyber security threats that have the potential for catastrophic failure of high voltage network assets and/or major loss of supply.

2. Related needs/opportunities

- All Programs of Work rely on having foundational security systems in place as outlined in the Pervasive Security Program.

3. Options

3.1 Base case

This option proposes operating 'As Is'.

The option proposes TransGrid not invest in replacing and/or the identified security applications and controls, which will reach the end of life in the period of 2018-2023.

This option is considered not technically feasible as not investing in security would pose a corporate risk estimated to be $7.28m.

Key inputs to the risk are the following:

- The major consequence of failure has been conservatively estimated at $31 million which is based on service interruption of 1,000 users up to 72 hours and data confidentiality of more than 50 thousand records;
- Likelihood of the consequence for IT service interruption is moderated by "N-1" which applies 5% likelihood of the consequence based on the failure mode of full redundancy in place for all of these systems; and

- Probability of Failure (POF) for intrusion is the probability that security system may fail (to perform their intended tasks) per year, is 10.0% (pre investment) and 1% (post investment). Post investment POF is based on experience that defect rate of replaced electronic device is very low.

3.2 Option A — Develop Pervasive Security Capabilities

This option proposes to improve the technology security capabilities of TransGrid by implementing new technologies and capabilities to address cyber-risks to the business and maintaining the effectiveness of existing controls to protect the transmission networks against a dynamic and rapidly changing cyber-threat environment.

It is proposed that this option will deliver:

- The implementation of security policies and procedures which will allow TransGrid to establish, operate and maintain an enterprise cybersecurity management program to identify, analyse and mitigate cybersecurity risks. This will include the development or refresh of security plans and procedures to create a culture of cybersecurity and to ensure the ongoing suitability and competence of TransGrid personnel. This will also cater for the management of the cybersecurity risks associated with the services and assets dependent on external parties. Security policies and procedures will also get integrated into the change and configuration management for all IT and OT assets.

- The implementation of security controls and measures will refresh TransGrid's identity management to improve access control to the organisation's assets and information. TransGrid will also establish and maintain plans and procedures to identify, analyse, manage and respond to cybersecurity threats and vulnerabilities and to sustain operations in case of cybersecurity attack.

- The implementation of security monitoring and control systems will further improve the security control systems to detect, collect, analyse and diagnose cybersecurity information, with the objective to incrementally implement automatic response or appropriate response preventive action based on security diagnostic.

The risk cost is expected to be reduced to 1% post investment which is based a low defect device rate. The risk cost has been estimated to be $0.728m.

3.3 Estimated Capital Costs

The tables below outline the investment forecast and the potential ongoing costs.

Category	Item	Budget
Material	Provision of security monitoring systems	$1m
	Provision of security control systems	$0.5m
	Provision of Identity Management System licences	$0.5m
	Provision of Enterprise Security Gateway	$1.7m
Labour/Contract	Implement security monitoring and control systems	$1m
	Implement refreshed Identity Management solution	$0.7m
	Implement refreshed Enterprise Security Gateway	$0.3m
	Implement Security Operation Centre	$0.5m
	Implement refreshed Physical Security Management System	$1.0m
	Total CAPEX:	$7.2m

3.4 Estimated OPEX

Category	Item	Budget
Labour	Ongoing support for the Identity Management solution	$0.1m
	Ongoing support for the Enterprise Security Gateway	$0.1m
	Ongoing run of the Security Operation centre	$0.5m
	Total OPEX:	$0.7m

The estimated CAPEX and OPEX costs are based on previous application implementations and the existing support costs.

4. Evaluation

4.1 Commercial Evaluation

The commercial evaluation of the options is set out in the table below.

Table 1 - Commercial Evaluation of Options

Option	Description	Capex ($m)	Incremental net Benefits pa ($m)*	Project Risk Cost ($m)	NPV ($m)	Rank
Base Case	Do Nothing			$7.28	N/A	2
A	Develop Pervasive Security Capabilities	$7.20	$5.85	$0.73	$12.09	1

** Includes risk savings $6.55m and additional opex ($0.7m).*

The above commercial evaluation is based on the following:

- 10% discount rate; and
- Analysis period of 7 years (construction is 2 year, and asset life is 5 years).

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear in Table 2.

Table 2 – Sensitivities on discount rate

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Develop Pervasive Security Capabilities	$14.67	$10.11

4.2 Preferred Option

Option A is the preferred option because it is the technically feasible option that delivers the required functionality to provide the estimated benefits, and has the highest positive NPV.

4.3 Capital and Operating Expenditure

Options above consider the incremental net benefits (additional Opex offset by reduction in operating costs). The preferred option considers capital investment.

4.4 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

5. Recommendation

It is the recommendation of this report to proceed with Option A – Develop Pervasive Security Capabilities.

Attachment 1 Commercial Evaluation Option – NPV

Project_Option Name	Pervasive Security

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	$12.09m	*NPV / Capital (Ratio)*	*1.68*
NPV @ upper bound rate	13.00%	$10.11m	*Pay Back Period (Yrs)*	*0.57 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$14.67m	*IRR%*	*56.62%*

2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)

NPV @ standard discount rate	10.00%	$12.09m	*NPV / Capital (Ratio)*	*1.68*
NPV @ upper bound rate	13.00%	$10.11m	*Pay Back Period (Yrs)*	*1.23 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$14.67m	*IRR%*	*56.62%*

Benefits

Risk cost	As Is	To Be	Benefit
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*
Financial	*$7.00m*	*$0.73m*	*$6.27m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*
Environment	*$0.00m*	*$0.00m*	*$0.00m*
Reputation	*$0.28m*	*$0.00m*	*$0.28m*
Total Risk benefits	$7.28m	$0.73m	$6.55m
Cost savings and other benefits			$0.00m
Total Benefits			$6.55m

VCR Benefit	*$0.00m*
ENS Penalty	*$0.00m*
All other risk benefits	*$6.55m*
Total Risk benefits	$6.55m
Benefits in the financial NPV*	$6.55m
**excludes VCR benefits*	
Benefits in the economic NPV**	$6.55m
***excludes ENS penalty*	

Other Financial Drivers

Incremental opex cost pa (no depreciation)	-$0.70m	Write-off cost	$0.00m
Capital - initial $m	-$7.20m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment	$0.00m	Re-investment capital	$0.00m
Capitalisation period	2.00 Yrs	Start of the re-investment period	0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Intelligent Asset Design

OER 000000001709 revision 0.1

Ellipse project no.: P0010197
TRIM file: TBA

Project reason: Support the business IT
Project category: Support - IT

Approvals

Author	Guillaume Leroux	Litmus Group
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	Michael Milne	Planning and Architecture Manager
Approved	Stuart Barber	Acting Chief Information Officer
Date submitted for approval	31 October 2016	

1. Need/opportunity

1.1 Need

There is need to replace asset design applications, Electronic Document Management System (EDMS) and 3D modelling, as they will reach their end of life in the period 2018-2023.

These two applications are critical to the design, management and storage of TransGrid's library of documents and drawings of the transmission network and assets. The increased operational risk which would be incurred unless these applications are replaced or upgraded is $4.41m in the financial year of 2023/24. The driver of this risk cost is based on a hazardous events of out of support and software failure either in security, software failure and data quality. The key inputs into the risk cost are:

- Probability of failure estimated at 20% is based on the rate of change of the external software environment starting from 2023/24. It is expected that the support cost risk will increase to 30% in 2024/25 and 50% in 2025/26 as the vendor will not support obsolete technology which is aligned with their support agreements;
- Major consequence from these failures is the potential service interruption for 300 users for 7 hours and a data confidentiality breach for up to 50 thousand records;
- Likelihood of the consequence is moderated by "N-0.5" which applies 55% likelihood of the consequence which is based on the failure mode of half redundancy as full redundancy is not in place for all systems.

2. Related needs/opportunities

- Pervasive Security – the future asset design solutions will need to comply with TransGrid's security requirements, specifically when enabling collaboration with external parties.
- Intelligent Operations Centre – implementing the integration technology to leverage data sets from other systems and external sources.

3. Options

3.1 Base case

This option proposes operating 'As is'.

If TransGrid does not invest in enhancing the asset design applications then the probability of failure will increase to 20% in 2023/24, then 30% the following financial year and 50% in 2025/26. The performance of these applications will be low and particular functionality will not work because of the expensive support costs.

In addition, the operation of unsupported and outdated software would increase the probability of lengthy system outages for a critical system used to maintain TransGrid's master engineering drawings used regularly for design and support functions.

3.2 Option A — Further enhance asset design capability

This option proposes that TransGrid further enhance its asset design capability.

This option proposes improving the asset design capability by providing enhanced 3D modelling capability within the organisation. TransGrid will leverage applications such as the Light Detection and Ranging (Lidar) and point cloud technology, to assist with the mapping and design of TransGrid's assets and provide a platform for analysing data and creating scenario models. Using this technology will ensure 3D models become the centralised reference document for all primary and secondary designs. This capability will give context to substation-based design, construction and operations decisions.

Two key initiatives have been identified to enhance asset design:

- Model-based design through the refresh of the Engineering Design and Drawing Management System; and
- Collaborative Asset Design by building upon the Model-based Design capability and enabling collaboration with internal and external stakeholders during the asset design and implementation process.

3.3 Estimated Capital Costs

The tables below outline the investment forecast, the potential ongoing costs and associated benefits.

Category	Item	Budget
Material	Provision of an enterprise Engineering Design and Drawing Management System licences and infrastructure	$0.5m
Labour/Contract	Implement refreshed Asset Design solution	$2m
	Enhance Asset Design Solution to enable collaboration	$0.5m
	Total CAPEX:	$3m

3.4 Estimated OPEX

Category	Item	Budget
Labour	Ongoing support for the enhanced asset design solution	$0.2m

The estimated project budget is based on previous implementations of engineering design and drawing management and modelling systems.

3.5 Estimated Benefits

Benefits comprise efficiency savings and cost avoidance savings associated with additional software support required after EDMS and 3D modelling applications reaching their end of life.

No.	Non-cashable benefits	Savings (Per Annum)
1.	Reducing asset design effort by removing some manual work. (Based on 300 users x average SP 18 $44.27/hr x 24 minutes savings for each user/wk x 48wks/yr = $254,995/yr)	$255,000
2.	Improving the completeness and quality of asset design, hence reducing the amount of rework required to complete a design. (Based on 300 users x average SP 18 $44.27/hr x 47 minutes savings for each user/wk x 48wks/yr = $499,366/yr)	$499,000

No.	Non-cashable benefits	Savings (Per Annum)
3.	Reducing the time spent in designing assets that comply with network performance and reliability requirements, as quality information becomes available. (Based on 300 users x average SP 18 $44.27/hr x 46 minutes savings for each user/wk x 48wks/yr = $488,741yr)	$489,000
4.	Improving the efficiency of downstream processes by integrating asset design with maintenance plans. (Based on 300 users x average SP 18 $44.27/hr x 24 minutes savings for each user/wk x 48wks/yr = $254,995/yr)	$255,000
5.	Improving compliance by integrating engineering and regulatory standards with asset design, resulting in reduced time spent on meeting compliance obligations. (Based on 300 users x average SP 18 $44.27/hr x 24 minutes savings for each user/wk x 48wks/yr = $254,995/yr)	$255,000
	Non-cashable benefits total:	$1,753,000
No.	**Cost avoidance**	**Savings (Per Annum)**
6	Additional software support in the first year (increases by 20% from the normal operating cost of $0.2m per annum). *Note: This will increase by 30% in the second year and 50% in subsequent years.*	$40,000

4. Evaluation

4.1 Commercial Evaluation

The commercial evaluation of the options is set out in the table below.

Table 1 – Commercial Evaluation of Options

Option	Description	Capex ($m)	Incremental net Benefits pa ($m)*	Project Risk Cost ($m)**	NPV ($m)	Rank
Base Case	Do Nothing			$4.41	N/A	2
A	Further enhance asset design capability	$3.00	$6.20	$0.00	$32.77	1

* The incremental benefits figure is for the first year (2023/24) only and includes cashable benefit of $1.75m, cost avoidance benefit of $0.04m and risk savings of $4.41m. Benefits will increase in subsequent years based on different drivers.

** Risk cost shown is for the first year. This will increase to $6.61m in the second year, and $11.01m from the third year onwards as old technologies become obsolete and unsupported by the vendor.

The above commercial evaluation is based on the following:

- 10% discount rate; and
- Analysis period of 6 years (construction is 1 year, and asset life is 5 years).

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear in Table 2.

Table 2 – Sensitivities on discount rate

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Further enhance asset design capability	$37.47	$29.12

4.2 Preferred Option

Option A is the preferred option because it is the technically feasible option that delivers the required functionality to provide the estimated benefits, and has the highest positive NPV.

4.3 Capital and Operating Expenditure

Options above consider the incremental net benefits (additional opex offset by reduction in risk costs). The preferred option considers capital investment.

4.4 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules

The selection of the preferred option was based on the opportunity to improve asset design efficiency and network reliability and performance and enhance compliance justification.

5. Recommendation

It is the recommendation of this report to proceed with Option A – further enhance asset design capability.

Attachment 1 Commercial Evaluation Option – NPV

Project_Option Name	Intelligent Asset Design

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	$32.77m	*NPV / Capital (Ratio)*	*10.92*
NPV @ upper bound rate	13.00%	$29.09m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	$37.44m	*IRR%*	*240.35%*

2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)

NPV @ standard discount rate	10.00%	$32.77m	*NPV / Capital (Ratio)*	*10.92*
NPV @ upper bound rate	13.00%	$29.09m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	$37.44m	*IRR%*	*240.35%*

Benefits

Risk cost	As Is	To Be	Benefit		
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*	*VCR Benefit*	*$0.00m*
Financial	*$4.00m*	*$0.00m*	*$4.00m*	*ENS Penalty*	*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	*All other risk benefits*	*$4.41m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$4.41m
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$6.20m
Reputation	*$0.41m*	*$0.00m*	*$0.41m*	**excludes VCR benefits*	
Total Risk benefits	$4.41m	$0.00m	$4.41m		
Cost savings and other benefits			$1.79m	Benefits in the economic NPV**	$6.20m
Total Benefits			$6.20m	***excludes ENS penalty*	

Other Financial Drivers

Incremental opex cost pa (no depreciation)	$0.00m	Write-off cost	$0.00m
Capital - initial $m	-$3.00m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment	$0.00m	Re-investment capital	$0.00m
Capitalisation period	1.00 Yrs	Start of the re-investment period	0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Digital Enterprise

OER- 000000001727 revision 1.0

Ellipse project no.: P0010324
TRIM file: TBA

Project reason: Support the business IT
Project category: Support - IT

Approvals

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	Michael Milne	Planning and Architecture Manager
Approved	Stuart Barber	Acting Chief Information Officer
Date submitted for approval	21 November 2016	

1. Need/opportunity

There is a need to refresh the current enterprise resource planning and associated systems, to develop an integrated enterprise solution which will enable a secure connection with the wider industry, businesses and customers. This will be achieved by investing in fit-for-purpose enterprise solution and new technologies enabling operational excellence and better efficiencies.

The following table summarises key areas that have been identified for improvement.

Areas for improvement	Applications
Back-office and financial management capabilities	Ellipse, Enterprise Portfolio and Project Management System (EPPMS) Project Server, Success, Resource Utilisation Tool, TM1-Financial Budgeting, Finance Journal and Reconciliation and Finance Estimating Tool
Source-to-Pay processes in particular category spend analysis, invoice data capture and requisition	Ellipse, TM1-Financial Budgeting, Finance Journal and Reconciliation and Finance Estimating Tool
Project and risk management capabilities	Ellipse, Investment Risk Management Tool, Wynyard Risk Management, Legal Compliance Tool and Matter Register
Ensure asset information is available across enterprise systems and organisational functions	Ellipse, Legal Compliance Tool and Matter Register, EPPMS Project Server, Success, Resource Utilisation Tool, Fleet-Vehicle and Mobile Plant, Equipment Register Manager and Asset Information System and Stakeholder Engagement Tool
Decision making and unlock value of data by maintaining a single source of truth for all asset information	Ellipse, Legal Compliance Tool and Matter Register, EPPMS Project Server, Success, Resource Utilisation Tool, Fleet-Vehicle and Mobile Plant, Equipment Register Manager and Asset Information System, Waste Management System, Electronic Stock Taking Tool, Savve -Online Learning, Stakeholder Engagement Tool, Tender Management System and Supplier Performance Manager Tool
The overall usability of applications to increase productivity and minimise support costs	Ellipse, EPPMS Project Server, Success, Resource Utilisation Tool, Waste Management System, Electronic Stock Taking Tool, Tender Management System and Supplier Performance Manager Tool

The Enterprise Resource Planning (ERP) refresh will deliver better integration across enterprise applications and greater efficiencies across the business. It will also refresh and upgrade the following main program of works:

- Demand Forecasting and Power System Analysis System;
- Workflow Management System and Microsoft Office; and
- Integrated Service Delivery System.

2. Related needs/opportunities

- Pervasive Security – The Digital Enterprise Program of Work assumes that security foundation is in place.

3. Options

3.1 Base case – 'Do nothing'

TransGrid does not invest in any Enterprise Applications.

This option will limit TransGrid's financial capability given its new and ongoing financial and regulatory obligations. Ellipse provides minimal information management capability, therefore there is limited scope for acquiring the advanced features, automation and analytics TransGrid needs to meet its strategic objectives.

The Demand Forecasting and Power System Analysis and Workflow Management systems can be maintained, however the maintenance costs will continue to increase each year.

TransGrid's changing workforce profile makes continuation of the current Microsoft Office toolset limited in its ability to work in "anywhere- any device" mode and is currently not feasible with the current product set.

If TransGrid does not invest in any Enterprise Applications then the probability of failure is estimated at 50% in 2018/19 which will result in the risk cost of $25.5m, and increase by 25% each year in subsequent years. The performance of these applications will be low and particular functionality will not work because of the expensive support costs.

3.2 Option A — Refresh Enterprise Solutions

The ERP will be upgraded in 2018 and its end of life will be extended until modern ERP solutions gain maturity. TransGrid will then be able to prudently invest in these solutions and obtain better return on investment.

The Demand Forecasting and Power System Analysis and Workflow Management systems will be refreshed and enhanced as they reach end of life. Microsoft Office will be upgraded as new versions are released.

The specific technology solutions will be identified based on further analysis performed as part of the project feasibility study and full business case development.

3.3 Estimated Capital Costs

The tables below outline the investment forecast and the potential ongoing costs.

Category	Item	Budget
Material	Provision of ERP licences and infrastructure	$3m
	Provision of Power System Analysis and Forecast System licences and infrastructure	$0.1m
	Provision of Workflow Management System licences and infrastructure	$0.1m
	Provision of integrated service delivery system licences and infrastructure	$0.1m
Labour/Contract	Implement refreshed ERP solution	$30.4m
	Implement refreshed Power System Analysis and Forecast solution	$0.5m
	Implement refreshed Workflow Management System	$0.2m
	Upgrade Microsoft Office	$0.2m
	Upgrade integrated service delivery system	$0.3m
	Total CAPEX:	$34.9m

The capital costs above are based on the assumption that:

- The refreshed enterprise systems include upgrading or replacing the following systems:
  - Ellipse (ERP);

- Investment Risk Management Tool;
- Wynyard Risk Management (GRC);
- Legal Compliance Tool and Matter Register (GRC);
- Enterprise Portfolio and Project Management System (EPPMS) Project Server, Success, Resource Utilisation Tool;
- TM1 (Financial Budgeting);
- Finance Journal and Reconciliation;
- Estimating Tool (Finance);
- Fleet (Vehicle and Mobile Plant);
- Enterprise Register Manager (ERM) and Asset Information System;
- Waste Management System;
- Tender Management System;
- Supplier Performance Manager Tool;
- Electronic Stock Taking Tool (Warehousing);
- Stakeholder Engagement Tool; and
- Savve (Online Learning).

The estimated cost to perform the ERP refresh is $34.9m which is based on the $26m spent in implementing Ellipse 8.3 plus the other identified systems which have an estimated upgrade cost of $8.9m. The project is assumed to include a similar level of business transformation.[1]

3.4 Estimated OPEX

Category	Item	Budget
Labour	Ongoing support for the ERP solution	$3m
	Ongoing support for the Power System Analysis and Forecast solution	$0.05m
	Ongoing support for the Workflow Management System	$0.02m
	Total OPEX:	$3.07m

The estimated OPEX cost is based on the existing support costs for the identified systems. The support costs include software licensing, maintenance, server, vendors and a full-time support team.

3.5 Benefits

In order for IT to maintain their current standards TransGrid would need to spend capex to avoid the increasing support costs. The ongoing support cost for the existing systems is estimated at $3.07m and if a 25% increase is applied in 2018/19 an additional $0.77m will be incurred each year. By the fourth year TransGrid will be paying twice the opex in support costs which is $6.14m.

Investing in Option A will result in a cost avoidance saving of $0.77m per annum which is a saving of $7.68m over a 5 year asset life.

[1] Please refer to 6888 Symphony Board Paper for more detail about the business transformation activities in PDGS.

4. Evaluation

4.1 Commercial Evaluation

The commercial evaluation of the options is set out in the table below.

Table 1 – Commercial Evaluation of Options

Option	Description	Capex ($m)	Incremental net Benefits pa ($m)*	Project Risk Cost ($m)	NPV ($m)	Rank
Base Case	Do Nothing	-	-	$25.50	N/A	2
A	Refresh Enterprise Solutions	$34.90	$26.23	$0.0	$69.46	1

*Includes risk savings of $25.5m and cost savings of $0.77m

The above commercial evaluation is based on the following:

- 10% discount rate; and
- Analysis period of 6 years (construction is 1 year, and asset life is 5 years).

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear in Table 2.

Table 2 – Sensitivities on discount rate

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Refresh Enterprise Solutions	$78.90	$61.82

4.2 Preferred Option

Option A is the preferred option because it is the technically feasible option that delivers the required functionality to provide the estimated benefits, and has the highest positive NPV.

4.3 Capital and Operating Expenditure

Options above consider the incremental net benefits (additional Opex offset by reduction in operating costs). The preferred option considers capital investment.

4.4 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

5. Recommendation

It is the recommendation of this report to proceed with Option A – Refresh Enterprise Solutions.

Attachment 1 Commercial Evaluation Option – NPV

Project_Option Name	Digital Enterprise

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	$69.46m	*NPV / Capital (Ratio)*	*1.99*
NPV @ upper bound rate	13.00%	$61.82m	*Pay Back Period (Yrs)*	*0.72 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$78.90m	*IRR%*	*72.32%*

2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)

NPV @ standard discount rate	10.00%	$69.46m	*NPV / Capital (Ratio)*	*1.99*
NPV @ upper bound rate	13.00%	$61.82m	*Pay Back Period (Yrs)*	*1.32 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$78.90m	*IRR%*	*72.32%*

Benefits

Risk cost	As Is	To Be	Benefit
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*
Financial	*$25.00m*	*$0.00m*	*$25.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*
Environment	*$0.00m*	*$0.00m*	*$0.00m*
Reputation	*$0.50m*	*$0.00m*	*$0.50m*
Total Risk benefits	$25.50m	$0.00m	$25.50m
Cost savings and other benefits			$0.77m
Total Benefits			$26.27m

VCR Benefit	*$0.00m*
ENS Penalty	*$0.00m*
All other risk benefits	*$25.50m*
Total Risk benefits	$25.50m
Benefits in the financial NPV*	$26.27m
**excludes VCR benefits*	
Benefits in the economic NPV**	$26.27m
***excludes ENS penalty*	

Other Financial Drivers

Incremental opex cost pa (no depreciation)	$0.00m	Write-off cost	$0.00m
Capital - initial $m	-$34.90m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment	$0.00m	Re-investment capital	$0.00m
Capitalisation period	1.00 Yrs	Start of the re-investment period	0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Intelligent Operations Centre

OER- 000000001732 revision 0.0

Ellipse project no(s): P10010339
TRIM file: TBA

Project reason: Support the business IT
Project category: Support - IT

Approvals

Author	Guillaume Leroux	Litmus Group
Endorsed	Azil Khan	Investment Analysis Manager
Approved	Stuart Barber	Acting Chief Information Officer
Date submitted for approval	18 November 2016	

Change history

Revision	Date	Amendment
V0.1	18/10/2016	Received Initial draft from Litmus
V0.2	18/11/2016	Updated benefits and NPV

1. Need/opportunity

1.1 Need

There is a need to upgrade or replace the following IT Services utilised by the Asset Monitoring Centre as they will no longer be supported and the underlying applications will reach end of life in the upcoming regulatory period. These applications include:

- Enterprise Service Bus/Axway (Need Date: 2019)
- Online Condition Monitoring (Need Date: 2020)
- GE Smallworld (2021)

1.2 Opportunity

There is an opportunity to improve the efficiency and effectiveness of asset decision making through automation utilising prescriptive analytics built on the current and planned analytics repositories.
There is also an opportunity to reduce costs associated with the maintenance of the monitoring and control devices by implementing centralised automated deployment capability for configuration management of the application suite.

This will be delivered by prudent investment to enhance the integration of asset information from multiple sources, Asset Monitoring and Control and refresh the current Geospatial Information System (GIS) solution.

2. Related needs/opportunities

- Pervasive Security – as security will be a key risk with the expansion of IT/OT services
- Enterprise Analytics Platform – the Enterprise Analytics Platform will establish the foundation to enable analytics required for this Program (asset predictive and prescriptive analytics).
- Digital Field Force – Field Systems in this program will have real-time data from the Intelligent Operations Centre made available to them.
- Intelligent Asset Design – 3D Models created from the Intelligent Asset Design program will further developed to act as a navigation tool for monitoring and asset data.

3. Options

3.1 Base case

The option proposes operating ‘As Is’.

By not replacing the Asset Monitoring Centre systems, this option will result in the systems running to failure. The increased operational risk that would be incurred is $7.38m. The driver of this risk cost is based on a hazardous event of out of support either in security, software, component failure, data transfer or quality.

In addition, TransGrid will not be able to obtain any efficiency benefits or cost savings if they do not invest in improving the Asset Monitoring environment.

3.2 Option A — Enhance operational capabilities

This option proposes focusing on enhancing operational capabilities by integrating data from IT and OT sources as well as geospatial and external factors such as weather, in order to build a 'common operating picture' which will be available to the centre and the field force. Ultimately asset decisions and asset problem resolution will be automated where relevant.

The enhanced operational capabilities will be delivered through various investments including:

- Implementation of a Unified Integration Platform which incorporates:
  - Establishing a common and integrated information architecture;
  - Adopting common standards including data models and protocols to gather and reconcile data from different sources and enable automated actions over the communications network;
  - Defining and implementing a security model for this unified platform so devices can communicate and interact securely between themselves;
  - Establishing common software configuration practices;
  - Defining and implementing protocols for over-the-air upgrade of firmware and software; and
  - Implementing the Integration platform itself.
- Implementation of Asset Monitoring capabilities, including the refresh of the current HV Condition Analysis system. The implementation will include:
  - Consolidating various asset monitoring systems (surveillance cameras, substation monitoring, etc.) to minimise energy losses, asset failures and safety issues;
  - Developing the ability for remote interrogation of asset monitoring alarms in order to accelerate the root cause analysis and remedy process so assets get back to normal condition faster and at a lower cost;
  - Integrating remote asset monitoring capabilities with mobile workforce systems to automate work order creation and dispatch;
  - Development of Asset intelligence and self-learning so recommended actions can be generated automatically (prescriptive maintenance); and
  - Enhancement of Intelligent Asset Design 3D models to navigate monitoring and asset data.
- Implementation of Asset Control capabilities which includes:
  - Deploying patches remotely to solve issues or apply preventive actions across the network; and
  - Upgrading firmware and software of smart devices remotely across the network, in adherence with the configuration management framework and in compliance with the security requirements.
- Implementation of GIS, refreshing and enhancing the current system.

The Asset Monitoring and Control solutions will be rolled-out progressively across the network, starting with critical assets or high maintenance costs assets to ensure a high return on investments.

3.2.1 Estimated Capital Costs

The tables below outline the investment forecast, the potential ongoing costs and estimated benefits.

Category	Item	Budget
Material	Provision of smart devices for asset monitoring and control	$1.5m
	Provision of hardware for the integration platform	$1m
	Provision of HV Condition Analysis solution licences	$0.1m
	Provision of GIS licences	$0.3m
Labour/contract	Establish integration platform	$2m

Category	Item	Budget
	Integrate smart devices with the integration platform	$0.5m
	Integrate existing sources with the integration platform	$0.5m
	Develop visualisation layer to monitor assets with the common operating picture	$0.2m
	Develop analytics for asset predictive maintenance	$0.5m
	Develop analytics for asset prescriptive maintenance	$0.5m
	Implement capability for remote interrogation	$0.8m
	Pilot and develop asset intelligence and self-learning capabilities	$0.5m
	Implement capability for remote upgrade and patch deployment	$0.5m
	Implement refreshed GIS solution	$1m
	Implement refreshed HV Condition Analysis solution	$0.6m
	CAPEX Total:	$10.5m

3.2.2 Estimated OPEX

Category	Item	Budget
Labour	Ongoing maintenance of smart devices	$0.2m
	Ongoing support for integration platform	$0.2m
	Ongoing support for visualisation layer	$0.01m
	Ongoing support for remote control	$0.2m
	Ongoing support for GIS solution	$0.1m
	Ongoing support for HV Condition Analysis	$0.05m
	OPEX Total:	$0.76m

3.2.3 Estimated Benefits

Benefit	$m p.a.
Reduction in effort to maintain the transmission network through better asset decision making due to the automation of utilising prescriptive analytics. (Based on 250 staff x average SP 18 $44.27/hr x 2hrs/wk x48 wks/yr = $1,062,480/yr)	$1.06

** Please note benefit calculations will be refined when each of the projects are scoped in detail.*

This is based on the assumption that the analytics platform will be established and maintained as part of the Enterprise Analytics Platform Program of Work.

4. Evaluation

4.1 Commercial Evaluation

The commercial evaluation of the options is set out in the table below.

Table 1 – Commercial Evaluation of Options

Option	Description	Capex ($m)	Incremental net Benefits p.a ($m)	Project Risk Cost ($m)	NPV ($m)	Rank
Base Case	Do Nothing	-	-	$7.38	N/A	2
A	Enhance operational capabilities	$10.50	$7.68		$21.53	1

** Includes productivity benefits $1.06, risk savings $7.38 and additional opex ($0.76).*

The above commercial evaluation is based on the following:

- 10% discount rate; and
- Analysis period of 6 years (construction is 1 year, and asset life is 5 years).

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear in Table 2.

Table 2 – Sensitivities on discount rate

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Enhance operational capabilities	$23.35	$20.03

4.2 Preferred Option

Option A is the preferred option because it addresses the business need and opportunity and the identified benefits will be realised.

4.3 Capital and Operating Expenditure

Options above consider the incremental net benefits (additional Opex offset by reduction in operating costs). The preferred option considers capital investment.

4.4 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

5. Recommendation

It is the recommendation of this report to proceed with Option A – Enhance operational capabilities.

Attachment 1 – Commercial evaluation of options

Project_Option Name	Intelligent Operations Centre

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	$21.53m	*NPV / Capital (Ratio)*	*2.05*
NPV @ upper bound rate	13.00%	$20.03m	*Pay Back Period (Yrs)*	*0.68 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$23.35m	*IRR%*	*67.64%*

2. Economic Evaluation (includes VCR benefits but excludes tax benefits from non-cash transactions, ENS penalty and overall tax cost)

NPV @ standard discount rate	10.00%	$21.53m	*NPV / Capital (Ratio)*	*2.05*
NPV @ upper bound rate	13.00%	$20.03m	*Pay Back Period (Yrs)*	*1.37 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$23.35m	*IRR%*	*67.64%*

Benefits

Risk cost	As Is	To Be	Benefit
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*
Financial	*$7.00m*	*$0.00m*	*$7.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*
Environment	*$0.00m*	*$0.00m*	*$0.00m*
Reputation	*$0.38m*	*$0.00m*	*$0.38m*
Total Risk benefits	$7.38m	$0.00m	$7.38m
Cost savings and other benefits			$1.06m
Total Benefits			$8.44m

VCR Benefit	*$0.00m*
ENS Penalty	*$0.00m*
All other risk benefits	*$7.38m*
Total Risk benefits	$7.38m
Benefits in the financial NPV*	$8.44m
**excludes VCR benefits*	
Benefits in the economic NPV**	$8.44m
***excludes ENS penalty*	

Other Financial Drivers

Incremental opex cost pa (no depreciation)	-$0.76m	Write-off cost	$0.00m
Capital - initial $m	-$10.50m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment	$0.00m	Re-investment capital	$0.00m
Capitalisation period	1.00 Yrs	Start of the re-investment period	0.00 Yrs