OPTIONS EVALUATION REPORT (OER)

Corporate Data Network Refresh 2018-2023

OER 000000001542 revision 3.0

Ellipse project no.: P0008894

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

Approvals

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Change history

Revision	Date	Amendment
1.0	18/10/2016	Initial version for AER submission
2.0	16/11/2017	Revision for resubmission to AER

1. Need/opportunity

Throughout the next regulatory period, IT assets in the Corporate Data Network (CDN) will reach their end of life. The CDN provides switching, routing and load balancing services to enable endpoint devices to connect to enterprise applications. The assets requiring replacement include:

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.	2018 - 2023
Cisco Routers	Provides the ability to connect multiple networks and forward small units of data destined for either its own network or others.	2018 - 2023
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.	2018 - 2023

The above IT hardware includes associated software that will progressively reach end of life that includes:

- Corporate Data Communications, including Core and Campus Switches and Routers, SolarWinds Network Management and Control Room Voice Recorder that are progressively reaching end of life from 2018 onwards;
- Unified Communications applications, including Video Conferencing (VC), Instant Messaging, Desktop Sharing and Electronic Mail that are progressively reaching end of life from 2018 onwards; and
- Communications Configuration Management System, which should be replaced or upgraded through financial years 2021 – 2023.

The IT hardware provides the underlying physical capability to host IT Services that includes unified communication and enterprise application services. To maximise service continuity, minimise business disruption and control maintenance cost, end of life equipment is replaced at the end of their asset life for optimum and cost-effective performance.

2. Related needs/opportunities

- Information Infrastructure Refresh
- Analytics Platform Refresh

3. Options

In assessing how best to address the need outlined above, TransGrid has considered three options:

- Option A – Replace current systems at end of asset life;
- Option B – Extend the life of current systems by 2 years then replace;
- Option C – Extend the life of current systems by 5 years then replace.

The increased costs for Option B and C relate to the capital and operational factors considered in options analysis. The increase has only been applied to implementation labour costs not physical device costs. Physical device costs are not expected to be influenced by these factors.

The risk and cost of these options have been assessed. This assessment is outlined below.

3.1 Option A – Replace current systems at end of asset life

This option proposes to progressively refresh CDN assets as they reach the end life. At this point the hardware and associated software will be out of date and no longer subject to the same level of vendor support.

These pieces of infrastructure support critical business and network systems that will maintain the physical switching environment to enable endpoint device connection to enterprise applications and securely run the unified communications services. Without replacement, there is an increased risk that this infrastructure will progressively fail resulting in IT service interruption, cyber security issues or may impact network operations.

This option minimises the operational risk associated with these hardware and associated software once asset life has expired and re-establishes crucial support arrangements. It has the lowest associated risk cost of all options $0.65m p.a. An inherent benefit of this option is the avoidance of the risk cost associated with delaying the replacement of this business-critical infrastructure. This risk cost is outlined in Options B and C.

It is proposed that these assets are upgraded as they reach end of life throughout the regulatory period to ensure that they remain in mainstream support and operational risk is mitigated.

3.1.1 Estimated Capital Costs – Option A

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

Category	Item	Budget ($m)
Material	Provision of Calendar and Messaging Services	1.30
	Provision of Remote Access and Virtual Desktops	1.10
	Provision of Data transmission – datacentre, campus and substation switching and routing network	4.60
	Provision of Voice Telephony	1.80
	Provision of Videoconferencing	1.30
Labour	Implement Calendar and Messaging Services	0.20
	Implement Remote Access and Virtual Desktops	0.20
	Implement Data transmission systems	0.40
	Upgrade Voice and Videoconferencing systems	0.20
	CAPEX Total:	**11.10**

3.1.2 Estimated Operating Costs – Option A

Category	Item	Budget ($m/p.a)
Labour	Annualised ongoing support for hardware including CDN servers, storage and end user devices.	0.605
	OPEX Total	**0.605**

3.2 Option B – Extend the life of current systems by 2 years then replace

This option proposes to extend the use of CDN hardware and associated software 2 years past end of life then replace as outlined in Option A. The current operating cost for this equipment is $0.605m per annum. When the hardware and associated software are extended past their designated support periods, support costs are expected to increase by a minimum of 20% in the first 2 years after end of life. This option requires $0.034m per annum more opex than Option A. The capex labour cost to implement this option has increased by 50% relative to Option A.

From 2018, parts of CDN infrastructure will progressively become out of date and no longer be eligible for the level of support currently available under vendor support agreements. Continuing to operate these CDN components beyond end of life will increase operational cost and risk by continuing to operate out of date hardware and associated applications.

By extending the life of equipment increases the risk of failure or degradation due to reduced support levels. This risk has an associated risk cost of $1.42m p.a., which is based on a hazardous event of service failure either in hardware, software and data transfers.

3.2.1 Estimated Capital Costs – Option B

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

Category	Item	Budget ($m)
Material	Provision of Calendar and Messaging Services	1.30
	Provision of Remote Access and Virtual Desktops	1.10
	Provision of Data transmission – datacentre, campus and substation switching and routing network	4.60
	Provision of Voice Telephony	1.80
	Provision of Videoconferencing	1.30
Labour	Implement Calendar and Messaging Services	0.30
	Implement Remote Access and Virtual Desktops	0.30
	Implement Data transmission systems	0.60
	Upgrade Voice and Videoconferencing systems	0.30
	CAPEX Total:	**11.60**

3.2.2 Estimated Operating Cost – Option B

Category	Item	Budget ($m/p.a)
Labour	Annualised cost to support the extended asset life of operation.	0.639
	OPEX Total	**0.639**

The estimated operating cost post implementation will be the same as option A.

3.3 Option C – Extend the life of current systems by 5 years then replace

This option proposes to extend current CDN hardware and associated software 5 years past end of life, then replace as outlined in Option A. The current operating cost for these systems is $0.605m p.a. When these applications extend beyond their designated support periods, support costs are expected to increase by 20% in years 6 and 7 then by 40% for years 8 to 10. This option requires $0.097m per annum more opex than Option A. The capex labour cost for this option will increase by 100% relative to Option A.

Extending the life of these systems increases the risk of failure or degradation due to reduced support levels. This is reflected in an increased probability of failure in years 6 to 10 of the system or applications life. This risk has an associated risk cost of $4.01m per annum. The driver of this risk cost is based on a hazardous event of service failure either in hardware, software and data transfers.

3.3.1 Estimated Capital Costs – Option C

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

Category	Item	Budget ($m)
Material	Provision of Calendar and Messaging Services	1.30
	Provision of Remote Access and Virtual Desktops	1.10
	Provision of Data transmission – datacentre, campus and substation switching and routing network	4.60
	Provision of Voice Telephony	1.80
	Provision of Videoconferencing	1.30
Labour	Implement Calendar and Messaging Services	0.60
	Implement Remote Access and Virtual Desktops	0.60
	Implement Data transmission systems	1.20
	Upgrade Voice and Videoconferencing systems	0.60
	CAPEX Total:	**13.10**

3.3.2 Estimated Operating Costs – Option C

Category	Item	Budget ($m/p.a)
Labour	Annualised cost to support the extended asset life of operation.	0.702
	OPEX Total	**0.702**

4. Evaluation

4.1 Commercial Evaluation

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

Option	Description	Capex ($m)	Project Risk Cost ($m)	NPV ($m)	Rank
A	Replace current systems at end of asset life	11.10	0.65	0.28	1
B	Extend the life of current systems by 2 years then replace	11.60	1.42	-1.63	2
C	Extend the life of current systems by 5 years then replace	13.10	4.01	-6.04	3

*Option C risk is considered as the Base case risk (As Is) used in the NPV calculator

The above commercial evaluation is based on the following:

- 10% discount rate;
- An asset life of 5 years;
- In Options B and C, 2 and 5 years of operating expenses before implementation of the new systems.

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear below:

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Replace current systems at end of asset life	1.43	-0.47
B	Extend the life of current systems by 2 years then replace	-1.16	-1.84
C	Extend the life of current systems by 5 years then replace	-7.77	-4.84

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 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

5. Recommendation

It is recommended that Option A – Replace current hardware and associated software at end of asset life

Attachment 1 Commercial evaluation Option of Option A

Project_Option Name	Option A - Replace current systems at end of asset life

1. Financial Evaluation (excludes VCR benefits)

NPV @ standard discount rate	10.00%	$0.28m	*NPV / Capital (Ratio)*	*0.02*
NPV @ upper bound rate	13.00%	-$0.47m	*Pay Back Period (Yrs)*	*3.30 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$1.43m	*IRR%*	*10.99%*

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%	$0.28m	*NPV / Capital (Ratio)*	*0.02*
NPV @ upper bound rate	13.00%	-$0.47m	*Pay Back Period (Yrs)*	*3.30 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$1.43m	*IRR%*	*10.99%*

Benefits

Risk cost	As Is	To Be	Benefit
Systems (reliability)	*$0.00m*	*$0.00m*	*$0.00m*
Financial	*$4.01m*	*$0.65m*	*$3.36m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*
Environment	*$0.00m*	*$0.00m*	*$0.00m*
Reputation	*$0.00m*	*$0.00m*	*$0.00m*
Total Risk benefits	$4.01m	$0.65m	$3.36m
Cost savings and other benefits			$0.00m
Total Benefits			$3.36m

VCR Benefit	*$0.00m*
ENS Penalty	*$0.00m*
All other risk benefits	*$3.36m*
Total Risk benefits	$3.36m
Benefits in the financial NPV*	$3.36m
**excludes VCR benefits*	
Benefits in the economic NPV**	$3.36m
***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	5.00 Yrs	Start of the re-investment period	0.00 Yrs

Attachment 2 Commercial evaluation Option B

Project_Option Name			Option B - Extend the life of current systems by 2 years then replace		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	-$1.63m	*NPV / Capital (Ratio)*		*-0.14*
NPV @ upper bound rate	13.00%	-$1.84m	*Pay Back Period (Yrs)*		*4.00 Yrs*
NPV @ lower bound rate (WACC)	6.75%	-$1.16m	*IRR%*		*2.29%*
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%	-$1.63m	*NPV / Capital (Ratio)*		*-0.14*
NPV @ upper bound rate	13.00%	-$1.84m	*Pay Back Period (Yrs)*		*4.00 Yrs*
NPV @ lower bound rate (WACC)	6.75%	-$1.16m	*IRR%*		*2.29%*
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	*$4.01m*	*$1.42m*	*$2.59m*	*All other risk benefits*	*$2.59m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$2.59m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$2.59m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*	
Total Risk benefits	$4.01m	$1.42m	$2.59m		
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**	$2.59m
Total Benefits			$2.59m	***excludes ENS penalty*	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost	$0.00m
Capital - initial $m			-$11.60m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital	$0.00m
Capitalisation period			5.00 Yrs	Start of the re-investment period	0.00 Yrs

Attachment 3 Commercial evaluation Option C

Project_Option Name			Option C - Extend the life of current sytems by 5 years then replace			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate		10.00%	-$6.04m	*NPV / Capital (Ratio)*		*-0.46*
NPV @ upper bound rate		13.00%	-$4.84m	*Pay Back Period (Yrs)*		*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	-$7.77m	*IRR%*		*Not Measurable*
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%	-$6.04m	*NPV / Capital (Ratio)*		*-0.46*
NPV @ upper bound rate		13.00%	-$4.84m	*Pay Back Period (Yrs)*		*Not measurable*
NPV @ lower bound rate (WACC)		6.75%	-$7.77m	*IRR%*		*Not measurable*
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	*$4.01m*	*$4.01m*	*$0.00m*	*All other risk benefits*		*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		$0.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$0.00m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$4.01m	$4.01m	$0.00m			
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**		$0.00m
Total Benefits			$0.00m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost		$0.00m
Capital - initial $m			-$13.10m	Major Asset Life (Yrs)		5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital		$0.00m
Capitalisation period			5.00 Yrs	Start of the re-investment period		0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Information Infrastructure Refresh 2018

OER 000000001547 revision 3.0

Ellipse project no.: P0008952

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

Approvals

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Date submitted for approval	21 November 2017	

Change History

Revision	Date	Amendment
1.0	18/10/2016	Initial version for AER submission
2.0	17/11/2017	Revision for resubmission to AER

1. Need/Opportunity

1.1 Need

TransGrid's two data centres currently house variety of critical IT assets including 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 workstations, desktops, laptops, tablets and smart phones which are used by employees to access enterprise applications. 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's storage and associated software capabilities currently do not mitigate against the risk of a successful malware attack corrupting the storage platforms in both data centres and destroying the information assets and backups. The geographical concentration of both data centres in Sydney also fails to mitigate against catastrophic natural events affecting the Sydney region.

Whilst in some cases it is possible to extend the asset life beyond the normal period, it is not considered prudent due to reduced level and increased cost of support and maintenance as well as the rapid pace of technological change in the market which reduces the ability for aging assets to meet the needs of the business.

In addition to infrastructure and endpoint devices, TransGrid's Power Systems Analysis system is built on ageing technology and servers. There is a need to redevelop this application and refresh the servers which run this system to reduce the risk of failure and ensure that there are adequate resources available to manage the system.

2. Related Needs/Opportunities

- Corporate Data Network Refresh;
- Digital Field Force;
- Pervasive Security.

3. Options

In assessing how best to address the need outlined above, TransGrid considered three options:

- Option A – Replace current systems at end of asset life;
- Option B – Extend the life of current systems by 2 years then replace;
- Option C – Extend the life of current systems by 5 years then replace.

The increased costs for Option B and C relate to the capital and operational factors considered in options analysis. The increase has only been applied to implementation labour costs not physical device costs. Physical device costs are not expected to be influenced by these factors.

The risk and costs of these options have been assessed. This assessment is outlined below.

3.1 Option A – Replace current systems at end of asset life

This option proposes to progressively replace data centre, end user hardware and associated software as these assets will reach the end of the effective lives in the upcoming regulatory period. At this point, this hardware and software will be out of date and no longer able to be supported at the same level and cost as previously.

If the information infrastructure which currently supports the existing critical business and network systems is not replaced poses an increased risk and will progressively fail resulting in IT service interruptions or impact to network operations. This option will ensure that TransGrid has sufficient capacity to securely deliver IT services in line with *TransGrid's Technology Strategy 2017-2023* and the proposed Programs of Work for the upcoming regulatory period.

This option involves refreshing:

- Cloud based non-production server environment enabling efficient resource utilisation in the pre-deployment activities required to modify or implement an IT Service;
- Cloud based back-up and disaster recovery solution that ensures TransGrid's information assets can be recovered in the event of asset or data centre failure;
- TransGrid Power Systems Analysis and Forecasting solution and associated hardware;
- Workflow Management system – licenses and configuration of workflow and digital forms;
- Microsoft Exchange and Enterprise Vault messaging services, which play a primary role in managing the back end of Microsoft's productivity suite;
- Tier 2 storage to refresh the current end-of-life assets and meet TransGrid's future capacity needs;
- TransGrid's Active Directory capability by creating two new domains which will allow administrators to better manage and store information about the network;
- TransGrid's secure and robust virtualised server farm in the Demilitarised Zone (DMZ), replacing physical servers;
- Endpoint user devices (smart phones, tablets, laptops, desktops and high-performance workstations); and
- Microsoft Office on endpoint user devices to meet Office 365 onshore compliance requirements.

This option minimises the operational risk associated with these systems and re-establishes reliable support arrangements. This option has the lowest associated risk cost of all options, at $1.68m p.a. An inherent benefit of this option is the avoidance of the risk cost associated with delaying the replacement of this infrastructure. This risk cost is outlined in Options B and C.

3.1.1 Estimated Capital Costs – Option A

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

Category	Item	Budget ($m)
Material	Provision of Shared Storage (replacement/augmentation)	2.00
	Provision of Physical Servers	0.60
	Provision of Physical User Devices (workstations, laptops, tablets, smartphones) and MS Office	4.20
	Provision of Data Centre Facilities	1.00
	Provision of Desktop Managed Operating Environment	2.00
	Provision of Structured Data Management	1.50
	Provision of Virtual Server Hypervisor	1.20

Category	Item	Budget ($m)
	Provision of Data Protection – Backup and Recovery	0.75
	Provision of Output Devices	0.75
	Provision of Server Operating Systems	0.90
	Provision of Power System Analysis and Forecast System licences and infrastructure	0.10
	Provision of Workflow Management System licences and infrastructure	0.10
	Provision of integrated service delivery system licences and infrastructure	0.10
Labour	Upgrade Microsoft Office	0.20
	Implement refreshed Power System Analysis and Forecast solution	0.50
	Implement refreshed Workflow Management System	1.20
	Upgrade integrated service delivery system	0.30
	CAPEX Total:	**17.40**

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

3.1.2 Estimated Operating Costs – Option A

Category	Item	Budget ($m)
Labour	Ongoing support for applications and systems (including servers, storage, devices, MS Office*, Power System Analysis and Forecast Solution and Workflow Management System)	0.570
	Total OPEX:	**0.570**

**To support new Microsoft O365 onshore compliance licence fees, an increase in Operating Expenditure of $0.50m for the 2018-2023 regulatory period is required.*

3.2 Option B – Extend the life of current systems by 2 years and then replace

This option proposes to extent the use of the current infrastructure for 2 additional years past end of life then replace as described in Option A. When these applications go beyond their designated support periods, support costs are expected to increase by a minimum of 20% in the first 2 years after end of life. This option requires $0.033m per annum more OPEX than Option A.

By extending the life of these systems increases the risk of failure or degradation due to reduced support levels. This is reflected in an increased probability of failure in the year after end of life. This risk has an associated risk cost of $3.13m per annum. 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.

Delaying the upgrade or replacement of these systems is expected to increase the implementation cost of this option. The labour cost increased relative to Option A is estimated be 50%.

3.2.1 Estimated Capital Costs – Option B

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

Category	Item	Budget ($m)
Material	Provision of Shared Storage (replacement/augmentation)	2.00
	Provision of Physical Servers	0.60
	Provision of Physical User Devices (workstations, laptops, tablets, smartphones) and MS Office	4.20

Category	Item	Budget ($m)
	Provision of Data Centre Facilities	1.00
	Provision of Desktop Managed Operating Environment	2.00
	Provision of Structured Data Management	1.50
	Provision of Virtual Server Hypervisor	1.20
	Provision of Data Protection – Backup and Recovery	0.75
	Provision of Output Devices	0.75
	Provision of Server Operating Systems	0.90
	Provision of Power System Analysis and Forecast System licences and infrastructure	0.10
	Provision of Workflow Management System licences and infrastructure	0.10
	Provision of integrated service delivery system licences and infrastructure	0.10
Labour	Upgrade Microsoft Office	0.30
	Implement refreshed Power System Analysis and Forecast solution	0.75
	Implement refreshed Workflow Management System	1.80
	Upgrade integrated service delivery system	0.45
	CAPEX Total:	**18.50**

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

3.2.2 Estimated Operating Costs – Option B

Category	Item	Budget ($m/p.a)
Labour	Annualised cost to support the extended asset life of operation	0.603
	OPEX Total	**0.603**

3.3 Option C – Extend the life of current systems by 5 years and then replace

This option proposes to extent the use of the current infrastructure for 5 years past end of life then replace as described in Option A. When these applications and systems extend beyond their designated support periods, support costs are expected to increase by 20% in years 6 and 7 then by 40% for years 8 to 10. This option requires $0.075m per annum more OPEX than Option A until the systems are replaced.

By extending the life of these systems increases the risk of failure or degradation due to reduced support levels. This is reflected in an increased probability of failure in the year after end of life. This risk has an associated risk cost of $8.28m per annum. 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.

Delaying the upgrade or replacement of these systems is expected to increase only the implementation labour cost of this option. The CAPEX cost labour for this option will increase by 100% relative to Option A.

3.3.1 Estimated Capital Costs – Option C

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

Category	Item	Budget ($m)
Material	Provision of Shared Storage (replacement/augmentation)	2.00
	Provision of Physical Servers	0.60
	Provision of Physical User Devices (workstations, laptops, tablets, smartphones) and MS Office	4.20
	Provision of Data Centre Facilities	1.00
	Provision of Desktop Managed Operating Environment	2.00
	Provision of Structured Data Management	1.50
	Provision of Virtual Server Hypervisor	1.20
	Provision of Data Protection – Backup and Recovery	0.75
	Provision of Output Devices	0.75
	Provision of Server Operating Systems	0.90
	Provision of Power System Analysis and Forecast System licences and infrastructure	0.10
	Provision of Workflow Management System licences and infrastructure	0.10
	Provision of integrated service delivery system licences and infrastructure	0.10
Labour	Upgrade Microsoft Office	0.40
	Implement refreshed Power System Analysis and Forecast solution	1.00
	Implement refreshed Workflow Management System	2.40
	Upgrade integrated service delivery system	0.60
	CAPEX Total:	**19.60**

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

3.3.2 Estimated Operating Costs – Option C

Category	Item	Budget ($m/p.a)
Labour	Annualised cost to support the extended asset life of operation	0.645
	OPEX Total	**0.645**

4. Evaluation

4.1 Commercial Evaluation

The commercial evaluation of the options is set out below.

Option	Description	Capex ($m)	Option Risk Cost ($m p.a.)	NPV ($m)	Rank
A	Replace current systems at	17.4	1.68	0.61	1

Option	Description	Capex ($m)	Option Risk Cost ($m p.a.)	NPV ($m)	Rank
	end of asset life				
B	Extend the life of current systems by 2 years and then replace	18.5	3.13	-2.68	2
C	Extend the life of current systems by 5 years and then replace	19.6	8.28	-8.90	3

** Option C risk cost is considered as the Base Case (As Is) risk when calculating NPV*

The above commercial evaluation is based on the following:

- 10% discount rate;
- An asset life of 4 years.

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear below:

Option	Description	Discount rate at 6.75% NPV $m	Discount rate at 13% NPV $m
A	Replace current systems at end of asset life	2.46	-0.62
B	Extend the life of current systems by 2 years and then replace	-1.93	3.03
C	Extend the life of current systems by 5 years and then replace	-11.46	-7.10

4.2 Preferred Option

Option A is the preferred option because it is delivers the required capability, minimises risk and has the highest NPV.

4.3 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 of Option A

Project_Option Name			Option A – Replace current systems at end of asset life		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate		10.00%	$0.61m	*NPV / Capital (Ratio)*	*0.04*
NPV @ upper bound rate		13.00%	-$0.62m	*Pay Back Period (Yrs)*	*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	$2.46m	*IRR%*	*11.37%*
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%	$0.61m	*NPV / Capital (Ratio)*	*0.04*
NPV @ upper bound rate		13.00%	-$0.62m	*Pay Back Period (Yrs)*	*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	$2.46m	*IRR%*	*11.37%*
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	*$8.28m*	*$1.68m*	*$6.60m*	*All other risk benefits*	*$6.60m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$6.60m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$6.60m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*	
Total Risk benefits	$8.28m	$1.68m	$6.60m		
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**	$6.60m
Total Benefits			$6.60m	***excludes ENS penalty*	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			-$0.10m	Write-off cost	$0.00m
Capital - initial $m			-$17.40m	Major Asset Life (Yrs)	4.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital	$0.00m
Capitalisation period			5.00 Yrs	Start of the re-investment period	0.00 Yrs

Attachment 2 – Commercial evaluation of Option B

Project_Option Name			Option B – Extend asset life then upgrade in 2 years		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate		10.00%	-$2.68m	*NPV / Capital (Ratio)*	*-0.14*
NPV @ upper bound rate		13.00%	-$3.03m	*Pay Back Period (Yrs)*	*Not measurable*
NPV @ lower bound rate (WACC)		6.75%	-$1.93m	*IRR%*	*2.42%*
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%	-$2.68m	*NPV / Capital (Ratio)*	*-0.14*
NPV @ upper bound rate		13.00%	-$3.03m	*Pay Back Period (Yrs)*	*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	-$1.93m	*IRR%*	*2.42%*
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	*$8.28m*	*$3.13m*	*$5.15m*	*All other risk benefits*	*$5.15m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$5.15m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$5.15m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*	
Total Risk benefits	$8.28m	$3.13m	$5.15m		
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**	$5.15m
Total Benefits			$5.15m	***excludes ENS penalty*	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			-$0.10m	Write-off cost	$0.00m
Capital - initial $m			-$18.50m	Major Asset Life (Yrs)	4.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital	$0.00m
Capitalisation period			5.00 Yrs	Start of the re-investment period	0.00 Yrs

Attachment 3 – Commercial evaluation of Option C

Project_Option Name			Option C – Extend asset life then upgrade in 5 years		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	-$8.90m	*NPV / Capital (Ratio)*		*-0.45*
NPV @ upper bound rate	13.00%	-$7.10m	*Pay Back Period (Yrs)*		*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	-$11.46m	*IRR%*		*Not measurable*
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%	-$8.90m	*NPV / Capital (Ratio)*		*-0.45*
NPV @ upper bound rate	13.00%	-$7.10m	*Pay Back Period (Yrs)*		*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	-$11.46m	*IRR%*		*Not measurable*
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	*$8.28m*	*$8.28m*	*$0.00m*	*All other risk benefits*	*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$0.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$0.00m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*	
Total Risk benefits	$8.28m	$8.28m	$0.00m		
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**	$0.00m
Total Benefits			$0.00m	***excludes ENS penalty*	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			-$0.10m	Write-off cost	$0.00m
Capital - initial $m			-$19.60m	Major Asset Life (Yrs)	4.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital	$0.00m
Capitalisation period			5.00 Yrs	Start of the re-investment period	0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Digital Field Force

OER 000000001689 revision 3.0

Ellipse project no.: P0010086

Project reason: Support IT
Project category: Support - IT

Approvals

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Date submitted for approval	21 November 2017	

Revision	Date	Amendment
1.0	18/10/2016	Initial version for AER submission
2.0	17/11/2017	Revision for resubmission to AER

1. Need/opportunity

1.1 Need

There is a business need to upgrade or replace existing TransGrid built field applications that will reach their end of effective life during the upcoming regulatory period. These systems and applications include:

IT Service	Application	Application Description	End of Life
Vegetation Management (Asset Management)	Vegetation Management System (VMS)	This application is utilised by Field Services staff to perform vegetation assessments and record easement maintenance requirements.	2018
Asset Inspection (Asset Management)	Asset Inspection Manager (AIM)	This application allows Field Services and Asset Management teams to create and perform scripts for asset maintenance and inspections.	2022
Scheduling and Dispatch (Resourcing)	TransGrid Resource Allocation Calendar (TRAC)	TRAC is an online calendar based planning tool for the allocation/planning of resources with interfaces to THEOS and Ellipse to source related work orders and outages. This system also contains a mobile application component.	2021
Labour Costing and Claims (Resourcing)	Labour Costing	A mobile application that allows TransGrid to submit their labour costing, timesheets and allowance claims such as travel time remotely.	2021
Skills Certification (Training)	Authorisation to Work (ATW)	The system ensures that TransGrid staff have the correct authorisation based on their training and qualifications to complete work.	2021
Works Risk Assessment (Safety)	Work and Safety Package (WASP)	An automated system for generating Safe Work Method Statements, associated mandatory forms and checklists which are required to safely perform specific work activities.	2020
Outage Management (System)	The Outage System (THEOS)	THEOS is a custom developed application for the planning, resource scheduling, coordination and statistical tracking of outages of High Voltage equipment and their associated Requests for Access. This system also contains a mobile application component.	2021

This suite of specialised applications and systems were built internally by TransGrid to cater for our unique operating environment. As these systems progressively reach the end of their useful life, there is a business need to upgrade or replace these customised applications.

1.2 Opportunity

Through this upgrade or replacement, there is an opportunity for the refreshed systems and applications to:

- Optimise maintenance costs while maintaining safety through improved planning, scheduling and coordination of mobile resources to improve productivity;
- Continuously improve safety in the field through innovative devices. This includes but not limited to geo-fencing, remote spatial access control, ticket to work and permit management;
- Improve the accuracy and quality of work estimation to manage risks associated with increased number of self-performed capital and project related works that may have been traditionally outsourced;
- Optimise resource availability and allocation to be able to self-perform more capital, constructions and other work; and
- Utilise commercial vendor support agreements.

This will be delivered by prudent investment in commercial systems and applications that are tailored to TransGrid's unique requirements.

2. Related needs/opportunities

- Digital Enterprise
- Pervasive Security

3. Options

In assessing how best to address the needs outlined above, TransGrid considered three options:

- Option A – Replace current systems at end of asset life;
- Option B – Extend the life of current systems by 2 years then replace; and
- Option C – Extend the life of current systems by 5 years then replace.

The risk, cost and benefits of these options have been assessed. This assessment is outlined below.

3.1 Option A – Replace current systems at end of asset life

This option proposes to replace TransGrid's current suite of customised field applications and systems when they reach end of life from financial year 2018/19 to 2021/22. Any use beyond their asset life will increase the operating risk associated with the use of these systems.

TransGrid has identified digital field force as an area that would benefit from optimised, commercial systems and applications to deliver business efficiencies through the deployment of a mature set of digital field force systems.

For the suite of above systems, the current operating costs are as follows:

- Asset Management Systems - $0.018m p.a.
- Resourcing Systems - $0.049m p.a.
- Safety & Training Systems - $0.04m p.a.
- Outage Systems - $0.04m p.a.

Cumulatively, the current support costs for these systems and applications are $0.147m p.a. It is proposed that they are upgraded as they reach end of life from 2018 to 2022. This will enable TransGrid to migrate from internally built to a suitable solution that is commercially supported.

Given the criticality of business functions that these systems cover, there is a business requirement to acquire commercial off-the-shelf solutions to facilitate these systems to minimise operational risk. An inherent benefit of this option is enabling TransGrid to leverage its existing investment in a common Mobile Enterprise Application Platform to deliver field agile solutions at a lower cost and avoid the risk cost associated with delaying the replacement of these business-critical systems.

This option has an associated risk cost of $2.11m p.a. An inherent benefit of this option is the avoidance of the risk cost associated with delaying the replacement of these business-critical systems. This risk cost is outlined in Options B and C.

3.1.1 Estimated Capital Costs – Option A

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

Category	Item	Budget ($m)
Material	Provision of licences and infrastructure for outage management system (Budget is based on a similar project in energy industry).	0.20
	Provision of licences and infrastructure for dynamic scheduling and dispatching system (Budget is based on a similar project in energy industry).	0.10
	Provision of licences and infrastructure for the vegetation management solution (Budget is based on a similar project in energy industry).	0.40
Labour/Contract	Implement refreshed outage management system	1.00
	Implement refreshed digital work orders system	1.00
	Implement dynamic scheduling and dispatching	0.80
	Implement refreshed vegetation management solution	2.50
	CAPEX Total:	**6.00**

3.1.2 Estimated Operating Costs – Option A

Category	Item	Budget ($m)
	Ongoing support for applications (digital work orders, outage management, dynamic scheduling and vegetation management)	0.500
	OPEX Total:	**0.500**

3.2 Option B — Extend the life of current systems by 2 years then replace

This option proposes to extend the use of these customised field based systems and applications for 2 years past their end of life, then replace as described in Option A. From 2018 these bespoke systems and applications will progressively become out of date. Continuing to operate these systems beyond end of life will increase operational costs and risks associated with their use.

The current operating cost for these systems and applications is $0.147m p.a. When these applications go beyond its support period, support costs are expected to increase by a minimum of 20% in the first 2 years after end of life. This option requires $0.008 per annum in OPEX than Option A.

Extending the life of these systems increases the risk of failure and an increase in operating costs. This is reflected in an increased probability of failure in years 6 and 7 of a systems life. This risk has an associated risk cost of $2.11m p.a. The driver of this risk cost is based on a hazardous event of service failure either in security, software or data quality.

Delaying the upgrade or replacement of these systems is expected to increase the cost of this option. Based on TransGrid's experience with deferring previous upgrades, extended delays reduce the availability of an upgrade path and may necessitate a complete reimplementation. The CAPEX labour cost to implement this option has increased by 50% relative to Option A.

3.2.1 Estimated Capital Costs – Option B

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

Category	Item	Budget ($m)
Material	Provision of licences and infrastructure for outage management system (Budget is based on a similar project in energy industry).	0.30
	Provision of licences and infrastructure for dynamic scheduling and dispatching system (Budget is based on a similar project in energy industry).	0.15
	Provision of licences and infrastructure for the vegetation management solution (Budget is based on a similar project in energy industry).	0.60
Labour/Contract	Implement refreshed outage management system	1.50
	Implement refreshed digital work orders system	1.50
	Implement dynamic scheduling and dispatching	1.20
	Implement refreshed vegetation management solution	3.75
	CAPEX Total:	**9.00**

3.2.2 Estimated Operating Cost – Option B

Category	Item	Budget ($m/p.a)
Labour	Annualised cost to support the extended asset life of current systems operation.	0.155
	OPEX Total	**0.155**

Post implementation, this option will incur the same OPEX as Option A.

3.3 Option C — Extend the life of current systems by 5 years then replace

This option proposes to extend the use of current digital field force systems and applications by 5 years past their asset life then replace as outlined in Option A. From 2018 these bespoke systems and applications progressively become out of date. Continuing to operate these systems beyond end of life will increase operational costs and risks associated with these systems.

The current operating cost for these systems and applications is $0.147m p.a. When these applications go beyond its support period, support costs are expected to increase by 20% in years 6 and 7, then by 40% for years 8 to 10. This option requires $0.019m per annum more in OPEX than Option A.

By extending the life of these systems increases the risk of failure and an increase in operating costs. This is reflected in an increased probability of failure in years 6 to 10 of a system life. This risk has an associated risk cost of $4.80m per annum. The driver of this risk cost is based on a hazardous event of service failure either in security, software or data quality.

Delaying the upgrade or replacement of these systems and applications increases the cost of this option. Based on TransGrid's experience with deferring previous upgrades, extended delays reduce the availability of an upgrade path and may necessitate a complete reimplementation. The capex labour cost for this option will increase by 100% relative to Option A.

3.3.1 Estimated Capital Costs – Option C

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

Category	Item	Budget ($m)
Material	Provision of licences and infrastructure for outage management system (Budget is based on a similar project in energy industry).	0.40
	Provision of licences and infrastructure for dynamic scheduling and dispatching system (Budget is based on a similar project in energy industry).	0.20
	Provision of licences and infrastructure for the vegetation management solution (Budget is based on a similar project in energy industry).	0.80
Labour/Contract	Implement refreshed outage management system	2.00
	Implement refreshed digital work orders system	2.00
	Implement dynamic scheduling and dispatching	1.60
	Implement refreshed vegetation management solution	5.00
	CAPEX Total:	**12.00**

3.3.2 Estimated Operating Cost – Option C

Category	Item	Budget ($m/p.a)
Labour	Annualised cost to support the extended asset life of operation.	0.166
	OPEX Total	**0.166**

4. Evaluation

4.1 Commercial Evaluation

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

Option	Description	Capex ($m)	Option Risk Cost ($m p.a.)	NPV ($m)	Rank
A	Replace current systems at end of asset life	$6.00	$2.11	2.01	1

Option	Description	Capex ($m)	Option Risk Cost ($m p.a.)	NPV ($m)	Rank
B	Extend the life of current systems by 2 years then replace	$9.00	$2.11	-0.13	2
C	Extend the life of current systems by 5 years then replace	$12.00	$4.80	-5.95	3

*Option C risk is considered as the Base case risk (As is) used in the NPV calculator

The above commercial evaluation is based on the following:

- 10% discount rate;
- An asset life of 5 years.; and
- In Options B and C, 2 and 5 years respectively of incremental operating expenses before implementation of the new systems.

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

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Replace current systems at end of asset life	3.22	1.19
B	Extend the life of current systems by 2 years then replace	0.72	-0.62
C	Extend the life of current systems by 5 years then replace	-7.43	-4.88

4.2 Preferred Option

Based on the commercial evaluation above, Option A represents the most prudent investment choice for TransGrid. It has the highest NPV and minimum amount of risk.

4.3 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 – Replace current systems at end of asset life.

Attachment 1 – Commercial evaluation of Option A

Project_Option Name			Option A - Replace current systems at end of asset life				
1. Financial Evaluation (excludes VCR benefits)							
NPV @ standard discount rate		10.00%	$2.01m	*NPV / Capital (Ratio)*			*0.33*
NPV @ upper bound rate		13.00%	$1.19m	*Pay Back Period (Yrs)*			*2.23 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$3.22m	*IRR%*			*19.98%*
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%	$2.01m	*NPV / Capital (Ratio)*			*0.33*
NPV @ upper bound rate		13.00%	$1.19m	*Pay Back Period (Yrs)*			*2.23 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$3.22m	*IRR%*			*19.98%*
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	*$4.80m*	*$2.11m*	*$2.69m*	*All other risk benefits*			*$2.69m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits			$2.69m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*				
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*			$2.69m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*			
Total Risk benefits	$4.80m	$2.11m	$2.69m				
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**			$2.69m
Total Benefits			$2.69m	***excludes ENS penalty*			
Other Financial Drivers							
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost			$0.00m
Capital - initial $m			-$6.00m	Major Asset Life (Yrs)			5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital			$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period			0.00 Yrs

Attachment 2 – Commercial evaluation of Option B

Project_Option Name			Option B - Extend the life of current systems by 2 years and then replace		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	-$0.13m	*NPV / Capital (Ratio)*		*-0.01*
NPV @ upper bound rate	13.00%	-$0.62m	*Pay Back Period (Yrs)*		*Not Measurable*
NPV @ lower bound rate (WACC)	6.75%	$0.72m	*IRR%*		*Not Measurable*
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%	-$0.13m	*NPV / Capital (Ratio)*		*-0.01*
NPV @ upper bound rate	13.00%	-$0.62m	*Pay Back Period (Yrs)*		*4.35 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$0.72m	*IRR%*		*9.37%*
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	*$4.80m*	*$2.11m*	*$2.69m*	*All other risk benefits*	*$2.69m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$2.69m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$2.69m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*	
Total Risk benefits	$4.80m	$2.11m	$2.69m		
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**	$2.69m
Total Benefits			$2.69m	***excludes ENS penalty*	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost	$0.00m
Capital - initial $m			-$9.00m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital	$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period	0.00 Yrs

Attachment 3 – Commercial evaluation of Option C

Project_Option Name			Option C - Extend the life of current systems by 5 years and then replace		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate	10.00%	-$5.95m	*NPV / Capital (Ratio)*		*-0.50*
NPV @ upper bound rate	13.00%	-$4.88m	*Pay Back Period (Yrs)*		*Not Measurable*
NPV @ lower bound rate (WACC)	6.75%	-$7.43m	*IRR%*		*Not Measurable*
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%	-$6.54m	*NPV / Capital (Ratio)*		*-0.55*
NPV @ upper bound rate	13.00%	-$5.51m	*Pay Back Period (Yrs)*		*Not measurable*
NPV @ lower bound rate (WACC)	6.75%	-$7.93m	*IRR%*		*Not measurable*
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	*$4.80m*	*$4.80m*	*$0.00m*	*All other risk benefits*	*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$0.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$0.00m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*	
Total Risk benefits	$4.80m	$4.80m	$0.00m		
Cost savings and other benefits				Benefits in the economic NPV**	$0.00m
Total Benefits			$0.00m	***excludes ENS penalty*	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost	$0.00m
Capital - initial $m			-$12.00m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital	$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period	0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Analytics Platform Refresh

OER 000000001690 revision 3.0

Ellipse project no.: P0010088

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

Approvals

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Change history

Revision	Date	Amendment
1.0	18/10/2016	Initial version for AER submission
2.0	17/11/2017	Revision for resubmission to AER

1. Need/opportunity

TransGrid has a need to refresh its current descriptive and diagnostic platforms which will reach end of life during financial years of 2018 and 2023. This need will assist with the capturing and analysing of information across the enterprise for forecasting, analytics and reporting.

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.

IT Service	Application(s)	Application Description	End of Life
Business Reporting	Data Warehouse platform	Data warehouse platform that provides enterprise wide reporting and analytics functions. Reporting function provides a comprehensive set of business reports for users across the organisation. These reports are prescheduled and can be executed on demand. Analytics function provides online analytical processing and data mining capability for users across the organisation.	2022
Data Visualisation	Tableau	Tableau is a visualisation tool that allows a user to analyse and display data in a graphical or dashboard format.	2022
Content Management	Microsoft SharePoint 2010, TRIM version 7.3.4	Microsoft SharePoint is a web-based tool that allows user to store documents and work collaboratively. TRIM is an electronic records management system used as a repository for TransGrid's documents.	2017

2. Related needs/opportunities

- Pervasive Security;
- Intelligent Operations Centre.

3. Options

In assessing how best to address the need outlined above, TransGrid considered three options:

- Option A – Replace current systems at end of asset life;
- Option B – Extend the asset life of current systems by 2 years then replace;
- Option C – Extend the asset life of current systems by 5 years then replace.

The risk, cost and benefits of the three options have been assessed. This assessment is outlined below.

3.1 Option A - Replace current systems at end of asset life

This option proposes replacing the Enterprise Analytics Platform when the applications reach the end of their life. This program of work comprises of two components, they are:

- Enterprise Content Management which consists of SharePoint 2010 and TRIM version 7.3.4, both of these applications are operating past their 5 year asset life; and
- Enterprise Analytics Platform consists of Microsoft SQL Server Reporting Services, Microsoft SQL Server Analysis Services, WhereScape Red and Tableau. The platform was upgraded to the latest software versions in 2017 and should be replaced or upgraded by 2022.

Enterprise Content Management

Enterprise Content Management is in extended support which means the applications no longer receives security updates or newly released products. So if there is an application functionality issue, it will not be fixed and the business will have no choice but to continue working with an inadequate application. Furthermore, this will have an impact on the platform as related products will be upgraded or replaced the platform will no longer function and content will not be accessible.

This option will upgrade SharePoint and TRIM and the associated integration components. The current support cost for these applications is $0.209m p.a. It is proposed that SharePoint and TRIM are upgraded in financial year 2018/19 so the applications are in mainstream support and risk is mitigated.

Enterprise Analytics Platform

Enterprise Analytics Platform has been upgraded in 2017 so the applications are in mainstream support and the platform is operating with minimal risk. However, over the regulatory period of 2018-23, the platform will need to be upgraded or replaced in 2022 because applications will be moving out of mainstream support to extended support and the risk of service failure would have increased.

This option will upgrade or replace the Enterprise Analytics Platform which will improve the reporting capability within TransGrid. The current support cost for these applications is $0.300m p.a. This option of replacing the Enterprise Analytics Platform will benefit TransGrid by reducing the asset failures which will result in a cashable saving of $4.0m per annum and has the lowest risk cost of all options considered at $0.108m p.a.

3.1.1 Estimated Capital Costs – Option A

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

Category	Item	Budget ($m)
Material	Provision of infrastructure and licences for Analytics Platform	3.0
	Provision of infrastructure and licences for Enterprise Content Management	0.1
Labour/Contract	Implement refreshed Enterprise Analytics Platform	3.3
	Implement refreshed Enterprise Content Management	0.9
	CAPEX Total:	**7.3**

3.1.2 Estimated Operating Costs – Option A

Category	Item	Budget ($m pa)
Labour	Ongoing support for Analytics Platform.	0.300
	Ongoing support for the Enterprise Content Management.	0.209
	OPEX Total:	**0.509**

3.1.3 Benefits – Option A

This option of replacing the Enterprise Analytics Platform will benefit TransGrid by reducing the asset failures which will result in a cashable saving of $4.0m per annum.

Benefit	Value ($m p.a.)
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:	**4.0**

3.2 Option B – Extend the asset life of current systems for 2 years then replace

This option proposes to extend the asset life of the Enterprise Analytics Platform for 2 years past their end of life then replace as described in Option A. Continuing to operate these systems beyond end of life will increase operational cost and risk associated with these systems.

The current operating cost these systems is $0.509m p.a. When these applications go beyond their designated support periods, support costs are estimated to increase by 20% for years 6 and 7. This option requires $0.029m additional opex than Option A until the systems are replaced.

Extending the life of these systems increases the risk of failure or degradation due to reduced support levels. This is reflected in an increased probability of failure in years 6 and 7 of system life. This risk has an associated risk cost of $0.508m p.a. The driver of this risk cost is based on the hazardous events relating to a service failure either in software failure or data quality.

In addition to incurring additional operating, risk and eventual implementation costs, Option B will delay the realisation of operational savings.

Whilst this option is technically feasible, it would be less prudent to maintain the current analytics platform due to the additional operating cost, increased risk and need to be replaced in 2 years at a greater expense of $10.95m.

3.2.1 Estimated Capital Costs – Option B

The tables below outline the investment forecast and the potential ongoing costs after the systems have been replaced.

Category	Item	Budget ($m)
Material	Provision of infrastructure and licences for Analytics Platform	4.50
	Provision of infrastructure and licences for Enterprise Content Management	0.15
Labour/Contract	Implement refreshed Enterprise Analytics Platform	4.95
	Implement refreshed Enterprise Content Management	1.35
	CAPEX Total:	**10.95**

3.2.2 Estimated Operating Costs – Option B

Category	Item	Budget ($m/p.a)
Labour	Annualised the support cost for the Analytics Platform and Enterprise Content Management.	0.538
	OPEX Total:	**0.538**

3.3 Option C - Extend the asset life of current systems for 5 years then replace

This option proposes to extend the asset life of the Analytics Platform for 5 years post its asset life and then replace as described in Option A. This will result in the Enterprise Content Management applications having no support and the Enterprise Analytics Platform being in extended support.

The current operating cost these systems is $0.509m p.a. When these applications go beyond their designated support periods, support costs are estimated to increase by 20% for years 6 and 7 then by 40% for years 8 to 10. This additional opex required is $0.081m than Option A until the systems are replaced.

By extending the life of these systems increases the risk of failure or degradation due to reduced support levels. This is reflected in an increased probability of failure in years 6 and 7 of system life. This risk has an associated risk cost of $1.74m p.a. The driver of this risk cost is based on the hazardous events relating to a service failure either in software failure or data quality.

In addition to incurring additional operating, risk and eventual implementation costs, Option C will delay the realisation of operational savings.

In this scenario TransGrid will be incurring additional operating cost for minimal support, risk will be high and the cost to replace or upgrade the assets is expensive at $14.6m.

3.3.1 Estimated Capital Costs – Option C

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

Category	Item	Budget ($m)
Material	Provision of infrastructure and licences for Analytics Platform	6.0
	Provision of infrastructure and licences for Enterprise Content Management	0.2
Labour/Contract	Implement refreshed Enterprise Analytics Platform	6.6
	Implement refreshed Enterprise Content Management	1.8
	CAPEX Total:	**14.6**

3.3.2 Estimated Operating Costs – Option C

Category	Item	Budget ($m/p.a)
Labour	Annualised the support cost for the Analytics Platform and Enterprise Content Management.	0.590
	OPEX Total:	**0.590**

4. Evaluation

4.1 Commercial Evaluation

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

Option	Description	Capex ($m)	Option Risk Cost pa ($m)*	NPV ($m)	Rank
A	Replace current systems at end of asset life	$7.30	0.108	8.50	1
B	Extend the asset life of current systems for 2 years then replace	$10.95	0.508	3.61	2
C	Extend the asset life of current systems for 5 years then replace	$14.60	1.741	-1.33	3

* Option C risk is considered as the Base case risk (As Is) used in the NPV calculator

The above commercial evaluation is based on the following:

- 10% discount;
- An asset life of 5 years;
- In Options B and C, 2 and 5 years respectively of incremental operating expenses before implementation of the new systems.

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear in the table below:

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Replace current systems at end of asset life	11.47	6.37
B	Extend the asset life of current systems for 2 years then replace	6.07	2.00
C	Extend the asset life of current systems for 5 years then replace	-0.37	-1.77

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.

4.1 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 – Replace current systems at end of asset life.

Attachment 1 Commercial Evaluation Option A

Project_Option Name			Analytics Platform Refresh - Replace at end of asset life				
1. Financial Evaluation (excludes VCR benefits)							
NPV @ standard discount rate		10.00%	$8.50m	*NPV / Capital (Ratio)*			*1.16*
NPV @ upper bound rate		13.00%	$6.37m	*Pay Back Period (Yrs)*			*1.30 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$11.47m	*IRR%*			*32.02%*
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%	$8.50m	*NPV / Capital (Ratio)*			*1.16*
NPV @ upper bound rate		13.00%	$6.37m	*Pay Back Period (Yrs)*			*1.30 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$11.47m	*IRR%*			*32.02%*
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	*$1.74m*	*$0.11m*	*$1.63m*	*All other risk benefits*			*$1.63m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits			$1.63m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*				
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*			$5.63m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*			
Total Risk benefits	$1.74m	$0.11m	$1.63m				
Cost savings and other benefits			$4.00m	Benefits in the economic NPV**			$5.63m
Total Benefits			$5.63m	***excludes ENS penalty*			
Other Financial Drivers							
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost			$0.00m
Capital - initial $m			-$7.30m	Major Asset Life (Yrs)			5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital			$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period			0.00 Yrs

Attachment 2 Commercial Evaluation Option B

Project_Option Name			Analytics Platform Refresh - Extend by 2 years and replace			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate		10.00%	$3.61m	*NPV / Capital (Ratio)*		*0.33*
NPV @ upper bound rate		13.00%	$2.00m	*Pay Back Period (Yrs)*		*2.10 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$6.07m	*IRR%*		*19.12%*
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%	$3.61m	*NPV / Capital (Ratio)*		*0.33*
NPV @ upper bound rate		13.00%	$2.00m	*Pay Back Period (Yrs)*		*2.10 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$6.07m	*IRR%*		*19.12%*
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	*$1.74m*	*$0.51m*	*$1.23m*	*All other risk benefits*		*$1.55m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		*$1.23m*
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$5.23m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$1.74m	$0.51m	$1.23m			
Cost savings and other benefits			$4.00m	Benefits in the economic NPV**		$5.23m
Total Benefits			$5.23m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost		$0.00m
Capital - initial $m			-$10.95m	Major Asset Life (Yrs)		5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital		$0.00m
Capitalisation period			$4.00m	Start of the re-investment period		0.00 Yrs

Attachment 3 Commercial Evaluation Option C

Project_Option Name			Analytics Platform Refresh - Extend by 5 years and replace			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate		10.00%	-$1.33m	*NPV / Capital (Ratio)*		*-0.09*
NPV @ upper bound rate		13.00%	-$1.77m	*Pay Back Period (Yrs)*		*3.75 Yrs*
NPV @ lower bound rate (WACC)		6.75%	-$0.37m	*IRR%*		*5.90%*
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%	-$1.33m	*NPV / Capital (Ratio)*		*-0.09*
NPV @ upper bound rate		13.00%	-$1.77m	*Pay Back Period (Yrs)*		*3.75 Yrs*
NPV @ lower bound rate (WACC)		6.75%	-$0.37m	*IRR%*		*5.90%*
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	*$1.74m*	*$1.74m*	*$0.00m*	*All other risk benefits*		*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		$0.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$4.00m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$1.74m	$1.74m	$0.00m			
Cost savings and other benefits			$4.00m	Benefits in the economic NPV**		$4.00m
Total Benefits			$4.00m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost		$0.00m
Capital - initial $m			-$14.60m	Major Asset Life (Yrs)		5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital		$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period		0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Intelligent Asset Design

OER 000000001709 revision 3.0

Ellipse project no.: P0010197

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

Approvals

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Revision	Date	Amendment
1.0	18/10/2016	Initial version for AER submission
2.0	17/11/2017	Revision for resubmission to AER

1. Need/opportunity

1.1 Need

There is a business need to upgrade or replace asset design systems and applications as they will reach end of life during the upcoming regulatory period. The end of life dates below represents the time at which these systems will fall outside of vendor support.

IT Service	Application	Application Description	End of Life
Document Management System	Electronic Document Management System (EDMS)	A drawing management solution for drafting drawings and controlling version control and workflow management	2023
Design	3D Modelling	A 3D drawing application to map and design assets	2023

1.2 Opportunity

There is an opportunity to improve asset design applications and management system with a solution that addresses TransGrid's needs. In addressing these needs, an update to these asset design applications will:

- Improve the efficiency and accuracy of asset design process by removing manual hand-overs and reducing waiting time;
- Improve completeness and quality of current substation design/configuration information to optimise new substation design;
- Further consolidate asset design capability and expand on current initiative on 3D modelling to all asset classes and specifically to embed engineering standards and compliance;
- Integrate asset design with project delivery, specifically to manage change process;
- Integrate commissioning process with asset design; and
- Model asset investments for key components based upon asset data.

This will be delivered by prudent investment in commercial systems and applications that are tailored to TransGrid's unique requirements.

2. Related needs/opportunities

- Pervasive Security;
- Intelligent Operations Centre.

3. Options

In assessing how best to address the needs outlined above, TransGrid considered three options:

- Option A – Replace current systems at end of asset life;

- Option B – Extend the asset life of current systems by 2 years then replace;
- Option C – Extend the asset life of current systems by 5 years then replace.

The risk and cost of these options have been assessed. The assessment is outlined below.

3.1 Option A – Replace current systems at end of asset life

This option proposes to upgrade or replace the asset design systems when they reach end of life in 2023. At this point, they will be out and will no longer be eligible for the level of support currently available under vendor support agreements.

This option proposes to implement the following solution:

- Model-based design through the refresh of the EDMS; 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.

TransGrid will leverage an enhanced 3D modelling application 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. Utilising 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 of which is critical component of the support and design infrastructure within TransGrid.

This option has the lowest associated risk cost of all options $0.08m p.a. An inherent benefit of this option is the avoidance of the risk cost associated with delaying the replacement of these business-critical systems. This risk cost is outlined in Options B and C.

The upgrade will improve the asset design solution within TransGrid and allow enhanced functionality and capability for asset design aspects.

3.1.1 Estimated Capital Costs – Option A

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

Category	Item	Budget ($m)
Material	Provision of an enterprise Engineering Design and Drawing Management System licences and infrastructure	0.50
Labour/Contract	Implement refreshed Asset Design solution	2.00
	Total CAPEX:	**2.50**

3.1.2 Estimated Operating Cost - Option A

Category	Item	Budget ($m)
Labour	Ongoing support for the enhanced asset design solution	0.19
	Total OPEX:	**0.19**

3.2 Option B — Extend the life of current systems by 2 years then replace

This option proposes to extend the use of asset design assets for 2 years past their end of life then replace as described in Option A. This will take the eventual implementation past the end of the 2018-2023 regulatory period. The current operating cost for this equipment is $0.19m per annum. When the hardware and associated software are extended past their designated support periods, support costs are

expected to increase by a minimum of 20% in the first 2 years after end of life. This option requires $0.02m per annum more opex than Option A.

By extending the life of these assets increases the risk of failure or degradation due to reduced support levels. This risk has an associated risk cost of $0.44m per annum. The driver of this risk is based on a hazardous event of out of support either in security, software, component failure, data transfer or quality. Delaying the upgrade or replacement of the assets is expected to increase the cost of this option. The capex cost increase relative to Option A is estimated to be 50%.

3.2.1 Estimated Capital Costs – Option B

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

Category	Item	Budget ($m)
Material	Provision of an enterprise Engineering Design and Drawing Management System licences and infrastructure	0.75
Labour/Contract	Implement refreshed Asset Design solution	3.00
	Total CAPEX:	**3.75**

3.2.2 Estimated Operating Costs – Option B

Category	Item	Budget ($m/p.a)
Labour	Annualised ongoing support for the enhanced asset design solution.	0.21
	Total OPEX:	**0.21**

3.3 Option C – Extend the life of current systems by 5 years then replace

This option is proposes to extend the use of the asset design systems for 5 years past the end of life and then eventually replace as described in Option A. The current operating cost for these systems is $0.19m p.a. When these applications extend beyond their designated support periods, support costs are expected to increase by 20% in years 6 and 7 then by 40% for years 8 to 10. This option requires $0.04m per annum more opex than Option A.

These applications will no longer be eligible for the level of support currently available. Continuing to operate these systems beyond end of life will increase the risk with their use.

This risk of this Option has an associated risk cost of $1.12m p.a. The driver of this risk is based on a hazardous event of out of support either in security, software, component failure, data transfer or quality. Delaying the upgrade or replacement of these systems and applications is expected to increase the cost of this option. The capex cost increased relative to Option A is estimated to be 100%.

3.3.1 Estimated Capital Costs – Option C

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

Category	Item	Budget ($m/p.a)
Material	Provision of an enterprise Engineering Design and Drawing Management System licences and infrastructure	1.00
Labour/Contract	Implement refreshed Asset Design solution	4.00
	Total CAPEX:	**5.00**

3.3.2 Estimated Operating Costs – Option C

Category	Item	Budget ($m/p.a)
Labour	Annualised ongoing support for the enhanced asset design solution.	0.23
	Total OPEX:	**0.23**

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 ($m)	Option Risk Cost ($m)	NPV ($m)	Rank
A	Replace current systems at end of asset life	2.50	0.08	3.14	1
B	Extend the asset life of current systems by 2 years then replace	3.75	0.44	0.84	2
C	Extend the asset life of current systems by 5 years then replace	5.00	1.12	-2.20	3

* Option C is considered as the Base case risk (As Is) used in the NPV calculator

The above commercial evaluation is based on the following:

- 10% discount rate;
- An asset life of 5 years;
- In Options B and C, 2 and 5 years respectively of incremental operating expenses before implementation of the new systems.

Option	Description	Discount rate @ 6.75% NPV $m	Discount rate at 13% NPV $m
A	Replace current systems at end of asset life	4.21	2.40
B	Extend the asset life of current systems by 2 years then replace	1.34	0.53
C	Extend the asset life of current systems by 5 years then replace	-2.72	-1.55

4.2 Preferred Option

Based on the commercial evaluation above, Option A represents the most prudent investment choice for TransGrid. It has the highest NPV and minimum amount of risk.

4.3 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 – Replace current systems at end of asset life.

Attachment 1 Commercial Evaluation Option A

Project_Option Name			Option A - Replace current systems at end of life				
1. Financial Evaluation (excludes VCR benefits)							
NPV @ standard discount rate		10.00%	$3.14m	*NPV / Capital (Ratio)*			*1.26*
NPV @ upper bound rate		13.00%	$2.40m	*Pay Back Period (Yrs)*			*1.96 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$4.21m	*IRR%*			*60.77%*
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%	$3.14m	*NPV / Capital (Ratio)*			*1.26*
NPV @ upper bound rate		13.00%	$2.40m	*Pay Back Period (Yrs)*			*1.96 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$4.21m	*IRR%*			*60.77%*
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	*$1.12m*	*$0.08m*	*$1.04m*	*All other risk benefits*			*$1.04m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits			$1.04m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*				
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*			$1.04m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*			
Total Risk benefits	$1.12m	$0.08m	$1.04m				
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**			$1.04m
Total Benefits			$1.04m	***excludes ENS penalty*			
Other Financial Drivers							
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost			$0.00m
Capital - initial $m			-$2.50m	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

Attachment 2 Commercial Evaluation Option B

Project_Option Name			Option B - Extend the asset life of current systems by 2 years then replace			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate	10.00%	$0.84m	*NPV / Capital (Ratio)*			*0.22*
NPV @ upper bound rate	13.00%	$0.53m	*Pay Back Period (Yrs)*			*3.65 Yrs*
NPV @ lower bound rate (WACC)	6.75%	$1.34m	*IRR%*			*25.65%*
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%	-$0.62m	*NPV / Capital (Ratio)*			*-0.17*
NPV @ upper bound rate	13.00%	-$0.60m	*Pay Back Period (Yrs)*			*6.57 Yrs*
NPV @ lower bound rate (WACC)	6.75%	-$0.62m	*IRR%*			*-3.51%*
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	*$1.12m*	*$0.44m*	*$0.68m*	*All other risk benefits*		*$0.68m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		$0.68m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$0.68m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$1.12m	$0.44m	$0.68m			
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**		$0.68m
Total Benefits			$0.68m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost		$0.00m
Capital - initial $m			-$3.75m	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

Attachment 3 Commercial Evaluation Option C

Project_Option Name			Option C - Extend the asset life of current systems by 5 years then replace			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate		10.00%	-$2.02m	*NPV / Capital (Ratio)*		*-0.40*
NPV @ upper bound rate		13.00%	-$1.55m	*Pay Back Period (Yrs)*		*Not measurable*
NPV @ lower bound rate (WACC)		6.75%	-$2.72m	*IRR%*		*Not measurable*
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%	-$2.02m	*NPV / Capital (Ratio)*		*-0.40*
NPV @ upper bound rate		13.00%	-$1.55m	*Pay Back Period (Yrs)*		*Not measurable*
NPV @ lower bound rate (WACC)		6.75%	-$2.72m	*IRR%*		*Not measurable*
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	*$1.12m*	*$1.12m*	*$0.00m*	*All other risk benefits*		*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		$0.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$0.00m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$1.12m	$1.12m	$0.00m			
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**		$0.00m
Total Benefits			$0.00m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost		$0.00m
Capital - initial $m			-$5.00m	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 3.0

Ellipse project no.: P0010324

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

Approvals

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Approved	Stuart Barber	A/Head of IT
Date submitted for approval	27 February 2017	

Change History

Revision	Date	Amendment
1.0	18/10/2016	Initial version for AER submission
2.0	17/11/2017	Revision for resubmission to AER

1. Need/opportunity

1.1 Need

TransGrid currently uses the ABB Ellipse Enterprise Resource Planning (ERP) solution as well as a number of connected off-the-shelf and bespoke applications to support administrative and operational business functions.

There is a need to upgrade or replace the ERP solution and suite of customised applications which will fall outside support/warranty periods from vendors in the upcoming regulatory period. Ellipse is currently out of date and is no longer being updated with regards to security patching and TransGrid will only receive support from ABB in the event of a major system outage. The solution was due to be upgraded in the current regulatory period, but this was deferred due to the change in ownership in 2015. Further, ABB will end the support entirely for the current version by 31 March 2019.

Service	System/ Application	System/Application Description	Need Date
Enterprise Resource Planning(ERP)	Ellipse, EPPMS, Risk Management, specialist Procurement and HR solutions	The core ERP system in use at TransGrid. It is a product by ABB meant for asset-intensive industry. TransGrid's ERP solution performs financial management, asset management, HR management, procurement, and works delivery.	2019
Integration Platforms	Suite includes Axway, Ventyx, Bespoke (TAF)	TransGrid currently uses different off-the-shelf and bespoke integration platforms. These need complete refresh and is source of many of the current pain points	2018-2019

These systems will fall outside of support/warranty periods from vendors with Ellipse specifically already in extended support. Ellipse is out of date and is no longer being updated, for example with regards to security patches. The support levels have decreased since June 2016 and ABB will now only support TransGrid in the event of a major system outage. The solution was due to be upgraded in the current regulatory period, but this was deferred due to the change in ownership and the associated uncertainties. Further, ABB will end the support entirely for the current version by March 2019.

In case of the Integration environment, TransGrid has approximately 100 applications with many connected point-to-point via bespoke coding, creating a complex tangle which is difficult, time consuming and costly to maintain and integrate additional applications into it. Although there have been previous attempts to simplify TransGrid's integration landscape, shown by the four integration solutions currently in place, however a simplified application landscape has not been achieved. The current solutions do not satisfy TransGrid's future integration needs:

- **Axway** – lacks the required functionality;
- **Ventyx** – requires proprietary product skills leading to vendor dependency and high operating costs;
- **TAF** – is a custom-built integration solution requiring bespoke coding, leading to high integration costs and long integration times; and

- **JNBridge** – is a custom build solution to integrate Ventyx and TAF as each use different technology.

Further lack of appropriate integrations is a major contributor to Ellipse's failure in meeting business needs. Ellipse as a product has limitations in enhancing its integration capabilities.

1.2 Opportunity

Due to new ownership, a new operating model was put in place in late 2016 with a set of initiatives to improve business operations suitable for a privately-owned organisation with stringent license to operate conditions. This new operating model creates gaps between the new ways of working and the current technology currently supporting TransGrid's operations.

Digital Enterprise seeks to provide a reliable and fit-for-purpose administrative and asset management capability by moving to a post-modern ERP solution that is proven and aligned with industry and technology directions.

There is the opportunity to improve the following areas by moving to a post-modern ERP that is aligned with industry and technology directions:

- Back-office and financial management;
- Source-to-pay processes including category spend analysis, invoice data capture and requisition;
- Project and risk management;
- The overall usability of applications to increase productivity and minimise support costs;
- Ensure asset information is available across enterprise systems and organisational functions;
- Decision making by maintaining a single source of truth for all asset information
- A unified integration platform based on a common and integration information architecture, common standards, and secured

2. Related needs/opportunities

- Pervasive Security;
- Digital Field Force; and
- Intelligent Operations Centre.

3. Options

In assessing how best to address the need outlined above, TransGrid considered three options:

- Option A – Replace current systems at end of asset life;
- Option B – Extend the life of current systems by 2 years then replace; and
- Option C – Extend the life of current systems by 5 years then replace.

The risk, cost and benefits of these options have been assessed. This assessment is outlined below.

3.1 Option A – Replace current systems at end of asset life

This option proposes to replace TransGrid's current enterprise applications when they reach end of life in 2019. This option will progressively replace the current ERP solution with a modern core ERP platform that is integrated with specialist applications. This option also assumes no change or upgrade of the current version of Ellipse. While the implementation is in-progress, Ellipse will need to rely on workarounds and small fixes.

This option will address the following business challenges:

- Ellipse does not consistently meet business needs and limits performance and efficiencies across critical business functions. TransGrid has been investing in additional customisation work and development of bespoke applications as a work around the ERP landscape. It is envisaged that this will continue and increase in the next regulatory period;
- Current system of Ellipse does not support the planned growth objectives – the gaps between business needs and system functionalities will continue to widen and the costs increase;
- Current version of Ellipse will be entirely out of support by March 2019 – this means the vendor is not required to support it, increased cyber vulnerabilities, non-compliance, with potential impact of extended downtime or complete unavailability if the software or hardware component fails. The risk of data breach and timely resolutions may be impacted, exposing TransGrid to licensing non-compliance;
- Current levels of support provided by ABB are not substantial and have been degrading lately. There are approximately over 70 incidents of varying criticalities (mostly P1 and P2s) that are pending since November 2016;
- Detailed current state business pain points and its impact on productivity, costs and compliance have been conducted which shows the largest impact of Ellipse lack of performance and capabilities is on Finance, Procurement and Asset Management.

The implementation of a Unified Integration Platform will incorporate:

- 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.

The integration platforms will need to be replaced to meet the growing business needs, changing processes and improved end-to-end process views.

The current operating cost of these systems is $3.2m per annum. It is proposed that the applications are upgraded as they reach end of life in 2019 to ensure the systems remain in mainstream support and operational risk is mitigated. This option has the lowest risk cost, valued at $0.42m p.a. An inherent benefit of this option is the avoidance of the risk cost associated with delaying the replacement of these business-critical applications. This risk cost is outlined in Options B and C.

3.1.1 Estimated Capital Costs – Option A

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

Category	Item	Budget ($m)
Material	Provision of ERP licenses and infrastructure	3
	Provision of hardware and software for the integration platform	1
Labour/Contract	Implement ERP solution	30.4
	Establish integration platform	2
	Integration existing sources with the integration platform	0.5

Category	Item	Budget ($m)
	Total CAPEX:	**36.9**

The capital costs above assume that the refreshed enterprise systems include upgrading or replacing all systems listed under the Need section.

3.1.2 Estimated Operating Costs – Option A

Category	Item	Budget ($m p.a.)
Labour	Ongoing support for the ERP solution	3.00
	Ongoing support for integration platform	0.20
	Total OPEX:	**3.20**

The estimated OPEX cost is based on the existing support costs for the identified systems. The support costs include software and infrastructure monitoring and maintenance, support calls, database management, vendors and a full-time support team.

3.1.3 Estimated Benefits – Option A

Benefit Description	Estimate ($m p.a.)
Cost Reduction Cost savings from elimination of effort (approx.13-15FTEs) due to improved processes.	1.84
Procurement Savings Cost savings due to better supplier negotiation capabilities arising from improved end-to-end process views, timely view of project requirements and better data integration. This has been obtained by working with stakeholders in procurement to understand spend savings possible for TransGrid in a best-in-class procurement function.	4.74
Total Cost Reduction Benefits	**6.58**

3.2 Option B – Extend the life of current systems by 2 years then replace

This option proposes to extend the use of the current enterprise applications for 2 years past their end of life then replace as described in Option A.

The current operating cost for this equipment is $3.20m per annum. When the hardware and associated software are extended past their designated support periods, support costs are expected to increase by a minimum of 20% in the first 2 years after end of life. This option requires $0.18m per annum more OPEX than Option A. The CAPEX cost to implement relative to Option A is estimated be 50%.

Continuing to operate these systems beyond end of life will increase operational cost and risk associated with these applications. ABB Ventyx Active support on Ellipse 8.3 has ceased. TransGrid has now moved to Classic support where ABB will now support TransGrid in the event of a major system outage. Other support services can be procured at additional cost solely at the discretion of ABB. This Classic support will cease on 31 March 2019.

By extending the life of these systems increases the risk of failure or degradation due to reduced support levels. This is reflected in an increased probability of failure in years 6 and 7 of system life. This risk has an associated risk cost of $1.51m p.a. 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.

3.2.1 Estimated Capital Costs – Option B

The tables below outline the investment forecast and the potential ongoing costs after the systems have been replaced.

Category	Item	Budget ($m)
Material	Provision of ERP licenses and infrastructure	4.50
	Provision of hardware and software for the integration platform	1.50
Labour/Contract	Implement ERP solution	45.60
	Establish integration platform	3.00
	Integration existing sources with the integration platform	0.75
	Total CAPEX:	**55.35**

The capital costs above assume that the refreshed enterprise systems include upgrading or replacing all systems listed under the Need section.

3.2.2 Estimated Operating Costs – Option B

Category	Item	Budget ($m p.a.)
Labour	Annualised ongoing support for the ERP solution	3.17
	Annualised ongoing support for integration platform	0.21
	Total OPEX:	**3.38**

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.

3.2.3 Estimated Benefits – Option B

Benefit Description	Estimate ($m p.a.)
Cost Reduction Cost savings from elimination of effort (approx.13-15FTEs) due to improved processes.	1.84
Procurement Savings Cost savings due to better supplier negotiation capabilities arising from improved end-to-end process views, timely view of project requirements and better data integration. This has been obtained by working with stakeholders in procurement to understand spend savings possible for TransGrid in a best-in-class procurement function.	4.74
Total Cost Reduction Benefits	**6.58**

3.3 Option C – Extend the life of current systems by 5 years then replace

This option proposes to extent the use of the current enterprise applications systems for 5 years past their end of life then replace as described in Option A. This option requires $0.51m per annum additional OPEX than Option A until the system is replaced.

By extending the life of these systems increases the risk of failure or degradation due to reduced support levels. This is reflected in an increased probability of failure in years 6 to 10 of system life. This risk has an associated risk cost of $4.88m p.a. 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.

Delaying the upgrade or replacement of these systems is expected to increase the cost of this option. Based on TransGrid's experience with deferring previous upgrades, extended delays in upgrading systems reduces the availability of an upgrade path and may necessitate a complete reimplementation. The CAPEX cost to increased relative to Option A is estimated be 100%.

3.3.1 Estimated Capital Costs – Option C

The tables below outline the investment forecast and the potential ongoing costs after the systems have been replaced.

Category	Item	Budget ($m)
Material	Provision of ERP licenses and infrastructure	6.00
	Provision of hardware and software for the integration platform	2.00
Labour/Contract	Implement ERP solution	60.80
	Establish integration platform	4.00
	Integration existing sources with the integration platform	1.00
	Total CAPEX:	**73.80**

The capital costs above assume that the refreshed enterprise systems include upgrading or replacing all systems listed under the Need section.

3.3.2 Estimated Operating Costs – Option C

Category	Item	Budget ($m p.a.)
Labour	Annualised ongoing support for the ERP solution	3.48
	Annualised ongoing support for integration platform	0.23
	Total OPEX:	**3.71**

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.

3.3.3 Estimated Benefits – Option C

Benefit Description	Estimate ($m p.a.)
Cost Reduction Cost savings from elimination of effort (approx.13-15FTEs) due to improved processes.	1.84
Procurement Savings Cost savings due to better supplier negotiation capabilities arising from improved end-to-end process views, timely view of project requirements and better data integration. This has been obtained by working with stakeholders in procurement to understand spend savings possible for TransGrid in a best-in-class procurement function.	4.74
Total Cost Reduction Benefits	**6.58**

3.4 Commercial Evaluation

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

Option	Description	Capex ($m)	Option Risk Cost ($m p.a.) *	NPV ($m)	Rank
A	Replace current systems at end of asset life	36.90	0.42	2.81	1
B	Extend the asset life of current systems by 2 years then replace	55.35	1.51	-6.74	2
C	Extend the asset life of current systems by 5 years then replace	73.80	4.88	-44.77	3

** Option C risk cost is considered as the Base Case (As Is) risk when calculating NPV*.

The above commercial evaluation is based on the following:

- 10% discount rate;
- Asset life of 5 years; and
- In Options B and C, 2 and 5 years of operating expenses before implementation of the new systems.

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear below:

Option	Description	Discount rate at 6.75% NPV ($m)	Discount rate at 13% NPV ($m)
A	Replace current systems at end of asset life	6.77	-0.13
B	Extend the asset life of current systems by 2 years then replace	-6.66	-6.60
C	Extend the asset life of current systems by 5 years then replace	-56.71	-36.29

3.5 Preferred Option

Based on the commercial evaluation above, Option A represents the most prudent investment choice for TransGrid. It has the highest NPV and lowest risk.

3.6 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

4. Recommendation

It is the recommendation of this report to proceed with Option A – Replace current systems at end of asset life.

Attachment 1 – Commercial evaluation of Option A

Project_Option Name			Option A – Replace current systems at end of asset life			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate		10.00%	$2.81m	*NPV / Capital (Ratio)*		*0.08*
NPV @ upper bound rate		13.00%	-$0.13m	*Pay Back Period (Yrs)*		*3.32 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$6.77m	*IRR%*		*12.86%*
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%	$2.81m	*NPV / Capital (Ratio)*		*0.08*
NPV @ upper bound rate		13.00%	-$0.13m	*Pay Back Period (Yrs)*		*3.32 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$6.77m	*IRR%*		*12.86%*
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	*$4.88m*	*$0.42m*	*$4.46m*	*All other risk benefits*		*$2.90m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		$2.90m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$11.04m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$4.88m	$0.42m	$4.46m			
Cost savings and other benefits			$6.58m	Benefits in the economic NPV**		$11.04m
Total Benefits			$11.04m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost		$0.00m
Capital - initial $m			-$36.90m	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

Attachment 2 – Commercial evaluation of Option B

Project_Option Name			Option B – Extend the asset life of current systems by 2 years then replace		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate		10.00%	-$6.74m	*NPV / Capital (Ratio)*	*-0.12*
NPV @ upper bound rate		13.00%	-$6.60m	*Pay Back Period (Yrs)*	*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	-$6.66m	*IRR%*	*-5.94%*
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%	-$6.74m	*NPV / Capital (Ratio)*	*-0.12*
NPV @ upper bound rate		13.00%	-$6.60m	*Pay Back Period (Yrs)*	*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	-$6.66m	*IRR%*	*-5.94%*
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	*$4.88m*	*$1.51m*	*$3.37m*	*All other risk benefits*	*$3.37m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$3.37m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$9.95m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*	
Total Risk benefits	$4.88m	$1.51m	$3.37m		
Cost savings and other benefits			$6.58m	Benefits in the economic NPV**	$9.95m
Total Benefits			$9.95m	***excludes ENS penalty*	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost	$0.00m
Capital - initial $m			-$54.40m	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

Attachment 3 – Commercial evaluation of Option C

Project_Option Name			Option C – Extend the asset life of current systems by 5 years then replace		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate		10.00%	-$44.77m	*NPV / Capital (Ratio)*	*-0.82*
NPV @ upper bound rate		13.00%	-$36.29m	*Pay Back Period (Yrs)*	*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	-$56.71m	*IRR%*	*Not measurable*
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%	-$37.91m	*NPV / Capital (Ratio)*	*-0.70*
NPV @ upper bound rate		13.00%	-$31.15m	*Pay Back Period (Yrs)*	*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	-$47.21m	*IRR%*	*Not measurable*
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	*$4.88m*	*$4.88m*	*$0.00m*	*All other risk benefits*	*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$0.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$6.58m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*	
Total Risk benefits	$4.88m	$4.88m	$0.00m		
Cost savings and other benefits			$6.58m	Benefits in the economic NPV**	$6.58m
Total Benefits			$6.58m	***excludes ENS penalty*	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost	$0.00m
Capital - initial $m			-$54.40m	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 Operations Centre

OER- 000000001732 revision 3.0

Ellipse project no(s): P10010339

Project reason: Support the business IT

Project category: Support - IT

Approvals

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Date submitted for approval	21 November 2017	

Change history

Revision	Date	Amendment
1.0	18/10/2016	Initial version for AER submission
2.0	17/11/2017	Revision for resubmission to AER

1. Need/Opportunity

1.1 Need

There is a need to upgrade or replace the following IT Services utilised by TransGrid's Asset Monitoring Centre and Asset Management group and the underlying applications in the upcoming regulatory period. The table below outlines the time at which these systems will reach end of life and fall outside of normal vendor support.

Service	System/Application	System/Application Description	Need Date
Asset Monitoring /Control	Online Condition Monitoring	Online Condition Monitoring provides condition information about High Voltage (HV) plant and equipment. The information is used to provide advanced warning of unusual equipment conditions and provide the defect response.	2023
TransGrid Spatial Server	GE Smallworld	GE Smallworld is a geospatial information system that stores the mapping layers for TransGrid's transmission assets.	2021

These systems enable TransGrid to make decisions which directly impact the reliability and performance of the transmission network.

With the development of distributed energy resources, the network becomes more complex as new types of assets need to be monitored and controlled to efficiently operate the network. In response to this development, transmission networks including TransGrid have been equipped with an increasing number of devices which includes sensors, monitoring, controlling and measuring systems to inform effective decision making, control energy flow, maintain stability and manage network performance, reliability and safety.

1.2 Opportunity

Through this upgrade or replacement, there is an opportunity for the refreshed systems and applications to:

- Provide enhanced visibility of assets as new types of devices are added into the network;
- Develop ability for remote interrogation of asset monitoring alarms to better understand problem, cause and remedy;
- Provide capability to perform remote deployment, configuration and patching to ensure security and risk compliance.

This will be delivered by prudent investment in commercial systems and applications that are tailored to TransGrid's unique requirements.

2. Related needs/opportunities

- Enterprise Analytics Platform;
- Digital Field Force;

- Digital Enterprise;
- Intelligent Asset Design.

3. Options

In assessing how best to address the need outlined above, TransGrid has considered three options:

- Option A – Replace current systems at end of asset life;
- Option B – Extend the life of current systems by 2 years then replace;
- Option C – Extend the life of current systems by 5 years then replace.

The risk and cost of these options have been assessed. This assessment is outlined below.

3.1 Option A – Replace current systems at end of asset life

This option proposes to replace TransGrid's current asset monitoring/control and Geospatial Information System (GIS) systems when they reach end of life in 2021 and 2023 respectively to ensure the systems remain in mainstream support and risk is mitigated.

This option involves:

- Refreshing asset monitoring capabilities, including the refresh of the current HV Condition Analysis system, including:
  - Consolidating various asset monitoring systems to minimise energy losses, asset failures and safety issues;
  - Integrating remote asset monitoring capabilities with mobile workforce systems to automate work order creation and dispatch.
- Refreshing asset control capabilities, which include:
  - The ability to deploy patches remotely to solve issues or apply preventive actions across the network;
  - 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.
- Implementing refreshed GIS system
  - Improving the spatial system to provide greater visibility of the network and assets.

This option has the lowest associated risk cost of all options $0.44m p.a. An inherent benefit of this option is the avoidance of the risk cost associated with delaying the replacement of these business-critical systems. This risk cost is outlined in Options B and C.

3.1.1 Estimated Capital Costs – Option A

The tables below outline the investment forecast and estimated ongoing operating costs for this option.

Category	Item	Budget ($m)
Material	Provision of smart devices for asset monitoring and control	1.50
	Provision of HV Condition Analysis solution licences	0.10
	Provision of GIS licences	0.30
Labour/contract	Integrate smart devices with the integration platform	0.50
	Implement refreshed asset monitoring and control solution	2.50

Category	Item	Budget ($m)
	Implement refreshed remote upgrade, patch deployment and remote interrogation solution	0.50
	Implement refreshed GIS solution	1.00
	Implement refreshed HV Condition Analysis solution	0.60
	CAPEX Total:	**7.00**

3.1.2 Estimated Operating Costs – Option A

Category	Item	Budget ($m/p.a)
Labour	Ongoing maintenance of smart devices	0.20
	Ongoing support for asset monitoring and control solution	0.21
	Ongoing support for GIS solution	0.10
	Ongoing support for HV Condition Analysis	0.05
	OPEX Total:	**0.56**

3.2 Option B – Extend the life of current systems by 2 years then replace

This option proposes to extend the use of the current asset monitoring/control and Geospatial Information System systems for 2 years past their end of life then replace as described in Option A.

The current operating cost for this equipment is $0.56m per annum. When the hardware and associated software are extended past their designated support periods, support costs are expected to increase by a minimum of 20% in the first 2 years after end of life. This option requires $0.030m per annum more opex than Option A. The capex cost increased relative to Option A is estimated be 50%.

Extending the life of these systems increases the risk of failure or degradation due to reduced support levels. This is reflected in an increased probability of failure in years 6 and 7 of system life. This risk has an associated risk cost of $1.22m p.a. 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.

3.2.1 Estimated Capital Costs – Option B

The tables below outline the investment forecast and the potential ongoing costs after the systems have been replaced.

Category	Item	Budget ($m)
Material	Provision of smart devices for asset monitoring and control	2.25
	Provision of HV Condition Analysis solution licences	0.15
	Provision of GIS licences	0.45
Labour/contract	Integrate smart devices with the integration platform	0.75
	Implement refreshed asset monitoring and control solution	3.75
	Implement refreshed remote upgrade, patch deployment and remote interrogation solution	0.75
	Implement refreshed GIS solution	1.50
	Implement refreshed HV Condition Analysis solution	0.90
	CAPEX Total:	**10.50**

3.2.2 Estimated Operating Costs – Option B

Category	Item	Budget ($m)
Labour	Ongoing maintenance of smart devices	0.21
	Ongoing support for asset monitoring and control solution	0.22
	Ongoing support for GIS solution	0.11
	Ongoing support for HV Condition Analysis	0.05
	OPEX Total:	**0.59**

3.3 Option C – Extend the life of current systems by 5 years the replace

This option proposes to extent the use of the current asset monitoring/control and Geospatial Information System systems for 5 years past their end of life then replace as described in Option A. This takes the eventual implementation past the end of the 2019-2023 regulatory period.

The current operating cost for these systems is $0.56m p.a. When these applications extend beyond their designated support periods, support costs are expected to increase by 20% in years 6 and 7, then by 40% for years 8 to 10. This option requires $0.09m per annum more opex than Option A. The capex cost increased relative to option A is estimated be 100%.

This risk of this option has an associated risk cost of $3.44m p.a. 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. By extending the life of these systems increases the risk of failure or degradation due to reduced support levels. This is reflected in an increased probability of failure in years 6 to 10 of system life Delaying the upgrade or replacement of these systems is expected to increase the cost of this option. Based on TransGrid's experience with deferring previous upgrades, extended delays in upgrading systems reduces the availability of an upgrade path and may necessitate a complete reimplementation.

3.3.1 Estimated Capital Costs – Option C

The tables below outline the investment forecast and the potential ongoing costs after the systems have been replaced.

Category	Item	Budget ($m)
Material	Provision of smart devices for asset monitoring and control	3.00
	Provision of HV Condition Analysis solution licences	0.20
	Provision of GIS licences	0.60
Labour/contract	Integrate smart devices with the integration platform	1.00
	Implement refreshed asset monitoring and control solution	5.00
	Implement refreshed remote upgrade, patch deployment and remote interrogation solution	1.00
	Implement refreshed GIS solution	2.00
	Implement refreshed HV Condition Analysis solution	1.20
	CAPEX Total:	**14.00**

3.3.2 Estimated Operating Costs – Option C

Category	Item	Budget ($m)
Labour	Ongoing maintenance of smart devices	0.23
	Ongoing support for asset monitoring and control solution	0.24
	Ongoing support for GIS solution	0.12

Category	Item	Budget ($m)
	Ongoing support for HV Condition Analysis	0.06
	OPEX Total:	**0.65**

3.4 Commercial Evaluation

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

Option	Description	Capex ($m)	Option Risk Cost ($m p.a.)*	NPV ($m)	Rank
A	Replace current systems at end of asset life	7.0	0.44	2.02	1
B	Extend the life of current systems by 2 years then replace	10.5	1.22	0.87	2
C	Extend the life of current systems by 5 years then replace	14.0	3.44	-5.41	3

** Option C risk cost is considered as the Base Case (As Is) risk when calculating NPV*

The above commercial evaluation is based on the following:

- 10% discount rate;
- An asset life of 5 years; and
- In Options B and C, 2 and 5 years of operating expenses before implementation of the new systems.

Discount rate sensitivities based on TransGrid's current AER-determined pre-tax real regulatory WACC of 6.75% and 13% appear below:

Option	Description	Discount rate @ 6.75% NPV ($m)	Discount rate at 13% NPV ($m)
A	Replace current systems at end of asset life	3.35	1.12
B	Extend the life of current systems by 2 years then replace	1.44	0.52
C	Extend the life of current systems by 5 years then replace	-7.36	-4.11

3.5 Preferred Option

Based on the commercial evaluation above, Option A represents the most prudent investment choice for TransGrid. It has the highest NPV and lowest risk.

3.6 Regulatory Investment Test (RIT-T)

No RIT-T analysis is required under current rules.

4. Recommendation

It is the recommendation of this report to proceed with Option A – Replace current systems at end of asset life.

Attachment 1 – Commercial evaluation of Option A

Project_Option Name			Option A – Replace current systems at end of asset life			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate		10.00%	$2.02m	*NPV / Capital (Ratio)*		*0.29*
NPV @ upper bound rate		13.00%	$1.12m	*Pay Back Period (Yrs)*		*2.33 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$3.35m	*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%	$2.02m	*NPV / Capital (Ratio)*		*0.29*
NPV @ upper bound rate		13.00%	$1.12m	*Pay Back Period (Yrs)*		*2.33 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$3.35m	*IRR%*		*18.74%*
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	*$3.44m*	*$0.44m*	*$3.00m*	*All other risk benefits*		*$3.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		$3.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$3.00m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$3.44m	$0.44m	$3.00m			
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**		$3.00m
Total Benefits			$3.00m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost		$0.00m
Capital - initial $m			-$7.00m	Major Asset Life (Yrs)		5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital		$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period		0.00 Yrs

Attachment 2 – Commercial evaluation of Option B

Project_Option Name			Option B – Extend asset life then upgrade in 2 years			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate		10.00%	$0.87m	*NPV / Capital (Ratio)*		*0.08*
NPV @ upper bound rate		13.00%	$0.52m	*Pay Back Period (Yrs)*		*3.67 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$1.44m	*IRR%*		*23.97%*
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%	-$3.54m	*NPV / Capital (Ratio)*		*-0.34*
NPV @ upper bound rate		13.00%	-$2.95m	*Pay Back Period (Yrs)*		*#DIV/0!*
NPV @ lower bound rate (WACC)		6.75%	-$4.32m	*IRR%*		*Not measurable*
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	*$3.44m*	*$1.22m*	*$2.22m*	*All other risk benefits*		*$2.22m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		$2.22m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$2.22m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$3.44m	$1.22m	$2.22m			
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**		$2.22m
Total Benefits			$2.22m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	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			4.00 Yrs	Start of the re-investment period		0.00 Yrs

Attachment 3 – Commercial evaluation of Option C

Project_Option Name			Option C – Extend asset life then upgrade in 5 years			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate		10.00%	-$5.41m	*NPV / Capital (Ratio)*		*-0.39*
NPV @ upper bound rate		13.00%	-$4.11m	*Pay Back Period (Yrs)*		*Not measurable*
NPV @ lower bound rate (WACC)		6.75%	-$7.36m	*IRR%*		*Not measurable*
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%	-$5.47m	*NPV / Capital (Ratio)*		*-0.39*
NPV @ upper bound rate		13.00%	-$4.17m	*Pay Back Period (Yrs)*		*Not measurable*
NPV @ lower bound rate (WACC)		6.75%	-$7.43m	*IRR%*		*Not measurable*
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	*$3.44m*	*$3.44m*	*$0.00m*	*All other risk benefits*		*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		$0.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$0.00m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$3.44m	$3.44m	$0.00m			
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**		$0.00m
Total Benefits			$0.00m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost		$0.00m
Capital - initial $m			-$14.00m	Major Asset Life (Yrs)		5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital		$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period		0.00 Yrs

OPTIONS EVALUATION REPORT (OER)

Pervasive Security

OER 000000001691 revision 3.0

Ellipse project no.: P0010090

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

Approvals

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Approved	Stuart Barber	A/Head of IT
Date submitted for approval	21 November 2017	

Change history

Revision	Date	Amendment
1.0	18/10/2016	Initial version for AER submission
2.0	17/11/2017	Revision for resubmission to AER

1. Need/opportunity

TransGrid must invest in cyber security and physical controls to comply with regulatory requirements and ensure continued security of the supply of electricity. TransGrid has implemented tools and technologies providing capabilities designed to mitigate rapidly emerging cyber threats that have directly targeted electrical utilities globally. Additionally, under the Transmission Operator's Licence, TransGrid must ensure that its transmission system can only be operated and controlled from within Australia (condition 6.1(b). It must also ensure that it holds data on the quantum of electricity delivered and personal information solely within Australia, and that this data is accessible only from within Australia (condition 7.1(a) and (b). TransGrid has progressively increased its investment in cyber security to comply with obligations and secure its data network in light of the increased global threat level[1] and the increased risk posed to critical infrastructure[2].

Within the next revenue period, these systems will need to be refreshed or replaced to ensure the risks posed by cyber-attack continue to be mitigated to an acceptable level and allow TransGrid to supply electricity and meet the compliance obligations associated with information security.

IT Service	Application Description	End of Life
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

In addition to enhancing its cyber-security capabilities, TransGrid must also enhance the data monitoring and protection capabilities to ensure compliance with TransGrid's Licence Conditions. TransGrid has

[1] Australian Cyber Security Centre: *Threat Report* October 2016, pp.17-18.

[2] Australian Cyber Security Centre: *Threat Report* October 2017, p. 50.

adopted more stringent, but prudent compliance management processes which include tools designed to prevent unauthorised access resulting from a security breach which could cause TransGrid to not be fully compliant with the License Conditions. These additional tools and instrumentation that are being introduced in the 2017/2018 year provide monitoring of TransGrid's continued compliance and management of the increased compliance environment.

The additional tools and instrumentation include:

The tools that will be implemented in the current financial year will need to be refreshed within the next revenue period to ensure TransGrid remains compliant.

2. Related needs/opportunities

- All programs of work rely on having foundational security systems in place as outlined in this program of work.

3. Options

In assessing how best to address the need outlined above, TransGrid has considered the following three options:

- Option A – Replace current systems at the end of their asset life;
- Option B – Extend the asset life of current systems by 2 years and then replace;
- Option C – Extend the asset life of current systems by 5 years then replace.

3.1 Option A – Replace current systems at the end of their asset life

This option proposes to refresh cyber security systems and refresh capabilities provided by data monitoring and protection tools in the next regulatory period. The replacement or upgrade of these systems will help protect TransGrid against rapidly emerging cyber-attacks and to assist in the maintenance of full licence compliance.


This option has the lowest associated risk cost of all options $0.547m p.a. An inherent benefit of this option is the avoidance of the risk cost associated with delaying the replacement of these business-critical systems. The risk cost is outlined in Options B and C.

3.1.1 Estimated Capital Costs – Option A

The tables below outline the investment and the potential ongoing costs for Option A.

Category	Item	Budget ($m)
[redacted]	[redacted]	1.50
		0.50
		1.70
		0.25
		1.98
		1.00
		0.70
		0.30
		0.75
		0.50
		0.50
	Total CAPEX:	**9.68**

3.1.2 Estimated Operating Costs – Option A

Category	Item	Budget ($m pa)
	[redacted]	0.10
	[redacted]	0.10
	[redacted]	0.50
	Total OPEX:	**0.70**

3.2 Option B — Extend asset life of current systems by 2 years then replace

This option proposes to extend the asset life of cyber security systems and data protection and monitoring systems by 2 years and then replace these systems. TransGrid's cyber environment is only as secure as the system's ability to detect new threats and effectively develop counter measures. By continuing to operate these systems beyond end of life will increase the operational cost and risk associated with these systems.

The current operating costs for these systems are $0.700m p.a. When the hardware and associated software are extended past their designated support periods, support costs are expected to increase by a minimum of 20% in the first 2 years after end of life. This option requires $0.05m per annum more opex than Option A.

By extending the life of these systems, there is an increase to the risk of failure or degradation due to the reduced support levels available. This is reflected in an increased probability of failure in years 6 to 7 of system life. This risk has an associated risk cost of $1.24m p.a. 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.

The cost increase relative to Option A is estimated to be 50%.

3.2.1 Estimated Capital Costs – Option B

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

Category	Item	Budget ($m)
[redacted]	[redacted]	2.25
		0.75
		2.55
		0.38
		2.97
		1.50
		1.05
		0.45
		1.13
		0.75
		0.75
	Total CAPEX:	**14.52**

3.2.2 Estimated Operating Costs – Option B

Category	Item	Budget ($m pa)
Labour	[redacted]	0.11
	[redacted]	0.11
	[redacted]	0.53
	Total OPEX:	**0.75**

3.3 Option C – Extend the asset life of current systems for 5 years then replace

This option proposes to extend the asset life of security and data protection and monitoring systems by 5 years and then replace. As a result, the applications will be out of support and pose a significant security risk as issues with the systems will not receive critical patching or updates to ensure its ongoing capability and functionality.

The current operating cost of these systems is $0.70m p.a. When these applications extend beyond their designated support periods, support costs are expected to increase by 20% in years 6 and 7 then by 40% for years 8 to 10. This option requires $0.12m per annum more opex than Option A.

Extending the life of these systems further increases the risk of failure or degradation due to reduced support levels. The risk has an associated risk of $3.856m p.a. 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.

By delaying the replacement of these systems, it is expected to increase the cost of this option. Based on TransGrid's experience with deferring previous upgrades, extended delays in upgrading systems reduces the availability of an upgrade path and many necessitate a complete reimplementation. The capex cost of increased relative to Option A is estimated to be 100%.

3.4 Estimated Capital Costs – Option C

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

Category	Item	Budget ($m)
Material	[redacted]	3.00
	[redacted]	1.00
[redacted]		3.40
		0.50
		3.96
		2.00
		1.40
		0.60
		1.50
		1.00
		1.00
	Total CAPEX:	**19.36**

3.4.1 Estimated Support and Maintenance Operating Costs – Option C

Category	Item	Budget ($m pa)
Labour	[redacted]	0.12
	[redacted]	0.12
	[redacted]	0.58
	Total OPEX:	**0.82**

4. Evaluation

4.1 Commercial Evaluation

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

Option	Description	Capex ($m)	Option Risk Cost ($m/p.a)*	NPV ($m)	Rank
A	Replace current systems at the end of their asset life	$9.68	0.55	0.56	1
B	Extend the asset life of current systems by 2 years and then replace	$14.52	1.24	-4.42	2
C	Extend the asset life of current systems by 5 years and then replace	$19.36	3.86	-10.40	3

**Option C risk is considered as the Base Case (As is) used in the NPV calculator*

The above commercial evaluation is based on the following:

- 10% discount; and
- An asset life of 5 years; and
- In Options B and C, 2 and 5 years respectively of incremental operating expensive before implementation of the new systems

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

Option	Description	Discount rate @ 6.75% NPV ($m)	Discount rate at 13% NPV ($m)
A	Replace current systems at the end of their asset life	2.03	-0.47
B	Extend the asset life of current systems by 2 years and then replace	-4.60	-3.98
C	Extend the asset life of current systems by 5 years and then replace	-8.68	-12.74

4.2 Preferred Option

Option A is the preferred option because it is the technically feasible option that delivers the required functionality reduces the risk cost and has the highest NPV.

4.3 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 – Replace current systems at the end of their asset life.

Attachment 1 Commercial Evaluation Option A

Project_Option Name			Option A – Replace current assets at the end of their life		
1. Financial Evaluation (excludes VCR benefits)					
NPV @ standard discount rate		10.00%	$0.56m	*NPV / Capital (Ratio)*	*0.06*
NPV @ upper bound rate		13.00%	-$0.47m	*Pay Back Period (Yrs)*	*2.93 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$2.03m	*IRR%*	*11.54%*
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%	$0.56m	*NPV / Capital (Ratio)*	*0.06*
NPV @ upper bound rate		13.00%	-$0.47m	*Pay Back Period (Yrs)*	*2.93 Yrs*
NPV @ lower bound rate (WACC)		6.75%	$2.03m	*IRR%*	*11.54%*
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	*$2.89m*	*$0.41m*	*$2.48m*	*All other risk benefits*	*$3.31m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits	$3.31m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*		
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*	$3.31m
Reputation	*$0.96m*	*$0.14m*	*$0.83m*	**excludes VCR benefits*	
Total Risk benefits	$3.86m	$0.55m	$3.31m		
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**	$3.31m
Total Benefits			$3.31m	***excludes ENS penalty*	
Other Financial Drivers					
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost	$0.00m
Capital - initial $m			-$9.68m	Major Asset Life (Yrs)	5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital	$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period	0.00 Yrs

Attachment 2 Commercial Evaluation Option B

Project_Option Name			Option B — Extend asset life of current systems by 2 years then replace				
1. Financial Evaluation (excludes VCR benefits)							
NPV @ standard discount rate		10.00%	-$4.42m	*NPV / Capital (Ratio)*			*-0.30*
NPV @ upper bound rate		13.00%	-$4.60m	*Pay Back Period (Yrs)*			*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	-$3.98m	*IRR%*			*-2.24%*
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%	-$4.42m	*NPV / Capital (Ratio)*			*-0.30*
NPV @ upper bound rate		13.00%	-$4.60m	*Pay Back Period (Yrs)*			*Not measurable*
NPV @ lower bound rate (WACC)		6.75%	-$3.98m	*IRR%*			*-2.24%*
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	*$2.89m*	*$0.93m*	*$1.96m*	*All other risk benefits*			*$2.61m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits			$2.61m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*				
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*			$2.61m
Reputation	*$0.96m*	*$0.31m*	*$0.65m*	**excludes VCR benefits*			
Total Risk benefits	$3.86m	$1.24m	$2.61m				
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**			$2.61m
Total Benefits			$2.61m	***excludes ENS penalty*			
Other Financial Drivers							
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost			$0.00m
Capital - initial $m			-$14.52m	Major Asset Life (Yrs)			5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital			$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period			0.00 Yrs

Attachment 3 Commercial Evaluation Option C

Project_Option Name			Option C – Extend the asset life of current systems for 5 years then replace			
1. Financial Evaluation (excludes VCR benefits)						
NPV @ standard discount rate		10.00%	-$10.40m	*NPV / Capital (Ratio)*		*-0.54*
NPV @ upper bound rate		13.00%	-$8.68m	*Pay Back Period (Yrs)*		*Not Measurable*
NPV @ lower bound rate (WACC)		6.75%	-$12.74m	*IRR%*		*Not measurable*
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%	-$10.40m	*NPV / Capital (Ratio)*		*-0.54*
NPV @ upper bound rate		13.00%	-$8.68m	*Pay Back Period (Yrs)*		*Not measurable*
NPV @ lower bound rate (WACC)		6.75%	-$12.74m	*IRR%*		*Not measurable*
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	*$0.00m*	*$2.42m*	*-$2.42m*	*All other risk benefits*		*$0.00m*
Operational/compliance	*$0.00m*	*$0.00m*	*$0.00m*	Total Risk benefits		$0.00m
People (safety)	*$0.00m*	*$0.00m*	*$0.00m*			
Environment	*$0.00m*	*$0.00m*	*$0.00m*	Benefits in the financial NPV*		$0.00m
Reputation	*$0.00m*	*$0.00m*	*$0.00m*	**excludes VCR benefits*		
Total Risk benefits	$0.00m	$0.00m	$0.00m			
Cost savings and other benefits			$0.00m	Benefits in the economic NPV**		$0.00m
Total Benefits			$0.00m	***excludes ENS penalty*		
Other Financial Drivers						
Incremental opex cost pa (no depreciation)			$0.00m	Write-off cost		$0.00m
Capital - initial $m			-$19.36m	Major Asset Life (Yrs)		5.00 Yrs
Residual Value - initial investment			$0.00m	Re-investment capital		$0.00m
Capitalisation period			4.00 Yrs	Start of the re-investment period		0.00 Yrs