

Engineering Justification Paper

Device Refresh

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2 Introduction

This paper provides architectural justification to support SGN's proposal to refresh client devices (ageing laptops, tablets and desktops) in the SGN estate. The scope of this investment covers project activity necessary to ensure that the SGN device estate remains fit for purpose and continues to underpin SGN's ability to run and maintain a safe and reliable gas network to meet the needs of its customers throughout the GD2 period.

2.1 General Background

SGN employs approx. 4,500 staff (permanent and contract) and across the business a mix of devices are used by staff to perform their duties. The provision of effective hardware ensures that our operatives continue to be able to meet their licence requirements around emergency response, leakage investigation, repair and planned maintenance.

2.2 Site Specific Background

Client devices are critical for users to access business applications, to communicate effectively and to collaborate. Office based staff typically use desktops, and field-based or mobile staff use laptops and tablets depending on their role and their technology requirements.

SGN field users are often interacting directly with customers and sharing information from their screen, gathering data from the customer and accessing corporate asset data - credibility for the field user is severely damaged if the technology to support them is not working, obsolete or damaged, resulting in reduced customer satisfaction scores and directly impacting one of our primary licence measures.

3 Equipment Summary

SGN users will either have a laptop, tablet or desktop assigned to them depending on their role. The life of client devices is usually limited to three years, with advances in processing, storage and more importantly security pushing companies to seek upgrades after this time.

The hostile working environment that a lot of SGN field-based staff operate in can also result in a shorter lifespan and higher volumes of break fix. As a result of the above, SGN operates a technology refresh for each device every three years.

4 Problem Statement

Client devices are used by field operatives to receive jobs (emergency or planned), to locate assets and to record data about those assets. Additionally, they are used in customer facing situations such as providing quotations and measuring customer satisfaction. Under the new Priority Services Register legislation it is also important that our operatives have access to the latest information so that they can respond appropriately for the situation.

Why are we doing this work and what happens if we do nothing?

Failure to refresh in a timely cycle would result in SGN's support partners being unprepared to accept contracted SLAs and as a result break-fix of devices would become increasingly difficult and result in devices failing and not being replaced, leaving field users unable to perform their duties, ultimately impacting on safety to both themselves and the public.

Due to the nature of ever more demanding business applications, hardware obsolescence, changing security requirements, and fair wear-and-tear, it is necessary to budget for a complete refresh of the client device estate every 3 years.

Manufacturers are continually embedding security components and solutions into the core of their hardware in conjunction with the operating system vendors, so it is essential that we do not over extend the life of assets that could pose a security risk to our critical national infrastructure.

What is the outcome that we want to achieve?

New digital based solutions around delivery of training, management of competencies, capturing timesheets electronically and delivering policies and procedures online all make it essential that SGN's operatives have reliable and secure up to date hardware to meet these requirements. In a scenario where the hardware is out of date and/or failing, manual processes would be reverted to, introducing risk to operatives and customers, damaging credibility and confidence. This in turn would impact SGN's ability to meet its licence obligations and hit its targets.

How will we understand if the spend has been successful?

We will know if the spend has been successful if we adhere to our service levels and the user experience in the field is acceptable, with devices being safe and reliable.

4.1 Narrative Real-Life Example of Problem

In December 2018 field-user tablet devices were starting to fail at an alarming rate with break-fix calls rising threefold in a matter of a couple of months. Investigation revealed that this was down to a number of items starting to fail on the devices – predominantly screens and batteries – and they were really struggling to handle the recent deployment of the GeoField mobile geographical data capture solution. The impact was that users were having to revert to paper processes for a number of key activities such as leakage investigations, timesheets and work management. The delayed investment in a refresh was realised to be a false economy as the failure rate grew so quickly, and as a result SGN took the decision to maintain a fixed 3-year refresh cycle for client devices. This was also important as some of the current devices in the field at the time were using outdated operating system software, potentially leaving them exposed to security vulnerabilities.

4.2 Spend Boundaries

This paper only covers the capex costs associated with purchasing, implementing and rolling out new client devices. It does not cover any ongoing costs associated with maintaining these devices through GD2. These ongoing costs are covered in our GD2 opex run costs.

It also does not cover spend for peripheral devices such as printers, keyboards, mice etc. This peripheral spend is covered under the BAU Opex & Capex paper.

5 Probability of Failure

Evidence from GD1 suggests the failure rate in year 4 has a material impact on productivity and safety. This then has an impact on credibility with customers, users and productivity and after a period of time we will reach a point where we are unable to perform our licence obligations as the hardware will be incompatible or obsolete and we will have no ongoing support or imposable SLA's. It also does not support changing security requirements.

5.1 Probability of Failure Data Assurance

IT industry bodies such as Gartner recognise the fact that the failure rate of devices in year 4 increases significantly; this combined with changing security threats mean that we have no option but to refresh our client devices every three years.

6 Consequence of Failure

In the event that our devices fail, we would be unable to meet our licence conditions as our field operatives would not be able to receive jobs (emergency or planned), locate assets and record data about those assets. Under the new Priority Services Register legislation it is also important that our operatives have access to the latest information so that they can respond appropriately for the situation.

Failure of devices would also mean that operatives and office-based staff would be unable to minimise travel as is the case today through the use of technology such as Skype. Instead there would be a greater environment impact and also potentially life-threatening delays to respond to emergency repair jobs.

7 Options Considered

It is important to maintain a regular refresh of our client hardware while ensuring good value for money by only buying what is fit for purpose and future proof.

The options outlined below are in line with our current refresh process which aims to ensure best value is achieved from all assets. This device refresh investment should be looked at in conjunction with the BAU Opex & Capex Engineering Justification Paper which covers the purchase of consumables and peripherals (printers, screens, keyboards, phones etc.) and device failure costs outside of this refresh cycle.

7.1 Option 1 - Pre-Emptively Replace - Capital purchase and deployment of replacement, non-ruggedised devices

This option proposes investment in 4,500 standard consumer/business devices. SGN has historically elected not to go for ruggedised models as history has shown that consumer devices still provide a lower total cost of ownership despite the challenges of the hostile environment in which SGN operate.

SGN have recently run a regulated tender to refresh a proportion of their client device estate. The costs within this option are based on the cost options within the tender responses.

SGN have recently appointed a new End User Device partner to roll out these new client devices and the proposed refresh throughout GD2 is in line with current end of life dates for existing assets.

SGN have assumed that the price of devices remains flat throughout GD2. The assumption is that for any index linked cost increases, this would be offset by reductions in cost of technology.

7.2 Option 2 - Pre-Emptively Replace - Capital purchase and deployment of replacement, ruggedised devices

This option proposes investment in 4,500 ruggedised client devices. SGN field operatives work in a hostile environment and therefore ruggedizing devices may increase the life of the asset. The additional cost of purchasing ruggedised devices needs to be weighed up against the short lifespan of these devices to see if it is sensible option when the lifespan of a device, whether it is ruggedised or not is still typically 3 years, although failure rates through damage are typically lower for the ruggedized devices.

SGN have recently run a regulated tender to refresh a proportion of their client device estate. The costs within this option are based on the cost options within the tender responses.

SGN have recently appointed a new End User Device partner to roll out these new client devices and the proposed refresh throughout GD2 is in line with current end of life dates for existing assets.

SGN have assumed that the price of devices remains flat throughout GD2. The assumption is that for any index linked cost increases, this would be offset by reductions in cost of technology.

7.3 Option 3 - Pre-Emptively Replace - Lease model for replacement devices

This option proposes that SGN lease 4,500 client devices rather than purchase them. This would reduce the resource overhead associated with managing the deployment of devices, but this is offset against an increased cost for the managed service.

SGN have recently run a regulated tender to refresh a proportion of their client device estate. The costs within this option are based on a market assessment of the cost to lease client devices.

SGN would need to run a regulated tender for this lease service to select the most cost-effective provider.

SGN have assumed that the price of devices remains flat throughout GD2. The assumption is that for any index linked cost increases, this would be offset by reductions in cost of technology.

7.4 Option 4 – Baseline Option – Replace on Failure - Sweat the Asset

This option is the baseline option and proposes that devices are only replaced when they fail. This option is not viable and has not been costed as it poses a risk to our Critical National Infrastructure. Extending the life of client devices would expose them to security threats and make SLAs with our vendors null and void.

7.5 Options Technical Summary Table

Table 1: Options Technical Summary

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Equipment / Investment Design Life	Total Cost
Baseline - Do nothing	2025	2025	0	0	0.00
Capital purchase and deployment of replacement, non-ruggedised devices	2022	2026	4500	5	6.00
Capital purchase and deployment of replacement, ruggedised devices	2022	2026	4500	5	7.00
Lease Model for Replacement Devices	2022	2026	4500	5	8.00

7.6 Options Cost Summary Table

Table 2: Cost Summary

Option	Cost Breakdown	Total Cost (£m)
Option 1 - Capital purchase and deployment of replacement, non-ruggedised devices	Resources: £0.75m Devices: £5.25m	£6m capex
Option 2 - Capital purchase and deployment of	Resources: £0.75m	£7m capex

replacement, ruggedised devices	Devices: £6.25m	
Option 3 - Lease model for replacement devices	Resources: £0.25m Leasing Service: £7.75m	£8m opex
Option 4 - Extend life of existing devices ('Sweat the Asset')	N/A	Not economically viable

Please note the costs outlined in the Options Technical Summary Table are based on the following assumptions:

- Device life is assumed to be approximately 3 years as has been proven historically within SGN and the wider industry. Gartner research supports this timeline assumption.
- Consumer devices will be more susceptible to damage in the field but the unit cost of a ruggedised device is still sufficiently higher than a consumer device as to make the TCO lower for consumer devices even allowing for the level of break fixes.
- Pricing levels are assumed to remain roughly as at present. This is based on the fact that although there will be some inflation, commoditisation of new technology will keep prices roughly as they are now.
- The project cost for the refresh deployment of devices has been benchmarked against the current live activity underway in SGN in 2019, and so is believed to be accurate. Any change to this approach would have an impact on costs/project timelines.

Baseline Assumptions:

- SGN manage its IT estate in line with the HSEs ALARP (as low as reasonably practicable) risk management principles. On that basis SGN have assumed a failure to invest in required (see engineering justification paper for more detail) upgrade, replacement or refresh activity for safety critical systems, would lead to catastrophic system failure as well as a lack of 3rd party support (based on support contracts, 3rd party roadmaps, architectural standards and internal policies, designed to ensure upgrade, replacement or refresh activity is carried out at the appropriate point in time to in order to prevent a non-recoverable functional, technical or security failure).
- SGN have assumed that a lack of investment combined with a lack of support would prevent the reinstatement of systems should they fail.
- SGN have assumed a catastrophic failure of safety critical systems and an inability to reinstate systems after failure would lead to an inability to respond to gas emergencies, an inability to know where our assets are and an inability to track performance and regulatory outputs.
- SGN have assumed a catastrophic failure of safety critical systems and an inability to reinstate systems after failure would lead to an inability to manage Personal Identifiable Information and would inevitably lead to a significant breach of GDPR legislation (up to £40m fine)
- SGN have assumed an inability to respond to gas emergencies, an inability to know where our assets are and an inability to track performance and regulatory outputs would inevitably lead to a catastrophic incident e.g. explosion and loss of life (£17.73m). This assumption is supported by section 2 of the Health and Safety at work act which identifies scenarios that would result in loss of life.

- SGN have assumed an inability to respond to gas emergencies, an inability to know where our assets are and an inability to track performance and regulatory outputs would inevitably lead to an inability to operate. This would lead to a catastrophic breach of license conditions (up to £100m fine)
- SGN have assumed catastrophic failures in regard to loss of life (£17.73m), a breach of license conditions (up to £100m) and/or a breach of GDPR legislation (up to £40m) will occur within a year of failing to adhere to support contracts, 3rd party roadmaps, architectural standards and internal policies designed to ensure upgrade, replacement or refresh activity is carried out at the appropriate point in time to in order to prevent a non-recoverable functional, technical or security failure.

8 Business Case Outline and Discussion

8.1 Key Business Case Drivers Description

Table 3: Summary of Key Value Drivers

Option No.	Desc. of Option	Key Value Driver
1	Option 1 - Capital purchase and deployment of replacement, non-ruggedised devices	Replacement of obsolete equipment to maintain safe and reliable service, ensure ongoing security and a vendor supported solution.
2	Option 2 - Capital purchase and deployment of replacement, ruggedised devices	Replacement of obsolete equipment to maintain safe and reliable service, ensure ongoing security and a vendor supported solution.
3	Option 3 - Lease model for replacement devices	Replacement of obsolete equipment to maintain safe and reliable service, ensure ongoing security and a vendor supported solution.

Table 4: Summary of CBA Results

Option No.	Desc. of Option	Preferred Option (Y/N)	Total Forecast Expenditure (£m)	Total NPV	2030	2035	2040	2050
Baseline	Do Nothing / Do minimum	N	0.00	-117.73	-117.73	-117.73	-117.73	-117.73
1	Capital purchase and deployment of replacement, non-ruggedised devices Absolute NPV	Y	-6.00	-28.13	-6.81	-10.47	-13.89	-19.77
2	Capital purchase and deployment of replacement, ruggedised devices Absolute NPV	N	-7.00	-32.80	-7.93	-12.20	-16.19	-23.05
3	Lease Model for Replacement Devices	N	-8.00	-37.40	-8.92	-13.80	-18.36	-26.21

Absolute NPV								
1	Capital purchase and deployment of replacement, non-ruggedised devices NPV relative to Baseline	Y	-6.00	-28.13	110.92	107.26	103.83	97.96
2	Capital purchase and deployment of replacement, ruggedised devices NPV relative to Baseline	N	-7.00	-32.80	109.80	105.53	101.54	94.68
3	Lease Model for Replacement Devices NPV relative to Baseline	N	-8.00	-37.40	108.81	103.93	99.36	91.52

8.2 Business Case Summary

This project is primarily driven by SGN's need to ensure safe and reliable devices for its users in offices and out in the field, which in turn ensures they can meet licence obligations. The level of investment requested is in line with what has recently been spent in GD1 to refresh the current estate.

Table 5: Business Case Matrix

	Purchase and deployment of non-ruggedised devices	Purchase and deployment of ruggedised devices	Lease Model for Replacement Devices
GD2 Capex (£m)	6.00	7.00	0.00
Number of Interventions	4500.00	4500.00	0
Carbon Savings ktCO ₂ e (GD2)	0.00	0.00	-
Carbon Savings ktCO ₂ e /yr	0.00	0.00	0
Carbon Emission Savings (35yr PV, £m)	0.00	0.00	0.0
Other Environmental Savings (35yr PV, £m)	0.00	0.00	0
Safety Benefits (35yr PV, £m)	17.73	17.73	0.0
Other Benefits (35yr PV, £m)	100.00	100.00	0.0
Direct Costs (35yr PV, £m)	-22.62	-26.38	0.0
NPV (35yr PV, £m)	95.11	91.35	0.0
High Carbon Scenario			
Carbon Emission Savings (35yr PV, £m)	0.00	0.00	0.0
High Carbon NPV (35yr PV, £m)	95.11	91.35	0.0

9 Preferred Option Scope and Project Plan

9.1 Preferred option

The preferred option is to refresh the estate through capital purchase of replacement devices at the end of a 3-year cycle. This refresh is staggered to ensure capacity for change, so the spend is spread across the GD2 period and is based on end of life timelines for each model used in the estate.

9.2 Asset Health Spend Profile

Table 6: Asset Spend Profile

Asset Health Spend Profile (£m)						
	2021/22	2022/23	2023/24	2024/25	2025/26	Post GD2
Purchase and deployment of non-ruggedised devices	0.50	2.50	1.00	1.00	1.00	Spend profile continues post GD2

9.3 Investment Risk Discussion

The primary risk associated with this investment is that the technology associated with client devices could change significantly once the investment has been made – for vendors launching a new Operating System and terminating support of the legacy one, which would result in a need to expedite further change and shorten the life of the asset. This is a low likelihood risk and experience to date has shown that a three-year refresh window allows SGN to maintain currency around technology and security standards, while not being at the cutting edge and therefore facing higher costs and risks. In other words, SGN's investment approach remains safe and reliable, like the devices themselves.

Risk Description	Impact	Likelihood	Mitigation/Controls	Comments
Change in capital expenditure	Capex expenditure	<=20%	Ensure active engagement with the business before device selection. Use of 'Road Shows' in depots and offices.	Replacement devices do not meet business requirements.
Change in capital expenditure	Capex expenditure	>40% & <=60%	Ensure extensive application compatibility testing is carried out and evaluate replacement apps where legacy ones won't run under latest OS/hardware settings.	There is a risk that selected legacy applications do not run on new hardware. Allow plenty of time/cost in budget for this activity as it can be lengthy. Evergreening approach by OS vendors will minimise future impacts.

Change in capital expenditure	Capex expenditure	<=20%	Ensure rugged cases are used where appropriate and educate staff on how to look after their devices.	Non-ruggedised devices have an unacceptably high failure rate in hostile SGN working environment. However, experience has shown that even with non-ruggedised devices the TCO is better.
Change in capital expenditure	Capex expenditure	>80% & <=100%	Ensure we understand security requirements and replace devices in good time.	Legacy hardware may not meet future security requirements.

Table 7: Capitalisation Sensitivity

	Low	Mid	High
GD2 Capex (£m)	4.80	6.00	7.20
Number of Interventions	4500	4500	4500
Carbon Savings ktCO2e (GD2)	-	-	-
Carbon Savings ktCO2e /yr	0	0	0
Carbon Emission Savings (35yr PV, £m)	0.0	0.0	0.0
Other Environmental Savings (35yr PV, £m)	0	0	0
Safety Benefits (35yr PV, £m)	3.5	17.7	17.7
Other Benefits (35yr PV, £m)	20.0	100.0	100.0
Direct Costs (35yr PV, £m)	-18.1	-22.6	-27.1
NPV (35yr PV, £m)	5.4	95.1	90.6

Low case: SGN have applied a reduction of 20% to the capex and costs which could be achieved by applying less rigour to the development and testing of new devices and by achieving greater cost savings on device purchases. Furthermore, an 80% reduction has been applied to the Safety Benefits associated with the risk of a fatality and Other Benefits associated with the impact of a Breach of Licence Conditions.

Mid case: No changes have been applied.

High case: SGN have applied an increase of 20% to the costs as SGN cannot fix the price that suppliers charge us for devices.

Project payback has not been carried out as part of this analysis due to the effect of the Spackman approach. For a cash-flow traditional project payback period please see scenario 4 of our Capitalisation Sensitivity table.

Capitalisation Sensitivity

Consumers fund our Totex in two ways – opex is charged immediately through bills (fast money – no capitalisation) and capex / repex is funded by bills over 45 years (slow money – 100% capitalisation). The amount deferred over 45 years represents the capitalisation rate. Traditionally in 'project' CBA's the cashflows are shown as they are incurred (with the investment up front which essentially is a

zero capitalisation rate). Therefore, we have developed scenarios that reflect both ways of looking at the investment – from a consumer and a ‘project’.

The scenarios are summarised as follows:

- Scenario 1 - we have used the blended average of 65%, used in previous iterations of this analysis.
- Scenario 2 - we have represented the Capex and Opex blend for the two networks, as per guidance.
- Scenario 3 - addresses our concerns on capitalisation rates whereby Repex and Capex spend is deferred (100% capitalisation rate) and Opex is paid for upfront (0% capitalisation rate).
- Scenario 4 - this reflects the payback period in ‘project’ / cash-flow terms and provides a project payback.

We have taken a view of the NPV in each of the scenarios, with the exception of scenario 4, at the 20, 35 and 45 Year points, to demonstrate the effect of Capitalisation Rate on this value.

Table 8: Capitalisation Rate Variation

Scenario	1	2 SGN	3	4
Capex (%)	65	41	100	0
Opex (%)	65	41	0	0
Repex (%)	100	100	100	0
Output				
NPV (20yr PV, £m)	105.13	103.24	107.87	
NPV (35yr PV, £m)	96.46	95.11	98.42	
NPV (45yr PV, £m)	92.13	91.18	93.51	
Payback	3.00	3.00	3.00	3.00

Appendix A - Acronyms

Acronym	Description
BAU	Business as Usual
CBA	Cost Benefit Analysis
GDPR	General Data Protection Regulation
HSE	Health & Safety Executive
SLA	Service Level Agreement
SGN	Scotia Gas Network