

Engineering Justification Paper

Application Refresh

Version: Final

Date: December 2019

Classification: Highly Confidential

Reference: SGN IT – 001 AppRef EJPDec19



1 Table of Contents

1 Table of Contents	2
2 Introduction	3
2.1 General Background	3
2.2 Site Specific Background.....	4
3 Equipment Summary	5
4 Problem Statement	5
4.1 Narrative Real-Life Example of Problem	6
4.2 Spend boundaries.....	6
5 Probability of Failure	6
5.1 Probability of failure assurance	7
6 Consequence of Failure	7
7 Options Considered	7
7.1 Baseline - Do Nothing	7
7.2 Refresh SGN Specialist Applications	8
7.3 Options Technical Summary Table	8
7.4 Options Cost Summary Table	10
8 Business Case Outline and Discussion	10
8.1 Key Business Case Drivers Description	10
8.2 Business Case Summary	11
9 Preferred Option Scope and Project Plan	11
9.1 Project Plan Outline	12
9.2 Asset Health Spend Profile	12
9.3 Investment Risk Discussion	12
Appendix A - Acronyms	15
Appendix B - IT Applications	16

2 Introduction

This paper provides architectural justification to support SGN's proposal to spend £2.5 million (over five years starting in April 2021) on maintaining our suite of specialist IT applications. Note this excludes our Core Front Office Systems and Financial systems which are covered under separate justification documents.

Our specialist applications underpin our ability to support our operations in the most effective way causing minimal disruption to our employees, contractors, customers and other utilities ensuring safety is at the heart of what we do.

Specialist applications must be available to support core business processes (including but not limited to asset management, work management, street works, customer experience, asset digitisation, traffic management, contractor management, engineering management, gas quality, gas pressure, network modelling, demand modelling, pressure management)

SGN currently budgets £500k pa for refreshing these services. This ensures we are meeting our operational licence conditions, our business capability remains compliant with the latest industry practice and the underlying software remains supported.

In order to provide continuity of service for critical operation support functions, SGN are looking to upgrade and refresh the current suite of relevant specialist applications. These systems are essential to ensuring our operations run safely on a daily basis, we are able to meet our obligations with the local authorities and other utilities, look after our vulnerable customers and manage the health of our assets.

This paper focuses solely on the investment required to maintain the current level of operation, keeping these applications operating and supported for GD2. The funding will ensure IT software and hardware is kept up to date in line with 3rd party support contracts and internal policy designed to ensure the business can operate with minimal risk of IT failure.

The operation of these systems underpin SGN's ability to run and maintain a safe and reliable network as required to meet the needs of its customers throughout the GD2 period. A failure in the systems could present significant risk to SGN and its customers leading to loss of life or licence.

2.1 General Background

SGN staff use a significant number of specialist applications including with around 4000 users in total utilising the applications:

- digitisation and mapping services (ESRI & Geofield). This ensures that SGN is able to supply the latest details of the asset network to required authorities, engineers and other utilities.
- Noticing and permitry systems (Insight / Clearman) ensure that SGN has the appropriate authorisations in place to conduct operational work and is able to manage 3rd party reinstatement work.
- Asset risk management applications (DNV GL suite) assess asset health and provide schedules for preventive maintenance.
- Mobile services (Kony) ensure vulnerable customers can provide registration details for the Priority Service Register and critical assets can be tracked/managed. To date more than 6700 referrals have been made.

These services need to be refreshed/replaced at required intervals to ensure operations remain supported with the relevant information to deliver these operational services. SGN currently budget £500k pa for refreshing these services ensuring we are meeting our operating licence conditions, our business capability remains compliant with the latest industry practice and the underlying software remains supported.

The risk of failure on these applications becomes critical to our ability to meet our regulatory outputs impacting our emergency activity, repair and replacement, reliability focusing on minimal disruption to the customer as well as overall network and employee safety.

As with all IT systems, the 3rd party suppliers of those systems provide regular patches which must be applied to maintain the support agreement. It is vital that patching and maintenance is up to date to ensure that outages on those systems are minimised.

There are a number of SGN applications which will reach advertised end of life for the application itself or the underlying technology stack during GD2. These applications support the critical front and back office services generally in specialist business areas such as asset health, digitisation, permitry, contractor services etc.

Applications will be replaced or upgraded in accordance with the SGN applications roadmap whilst ensuring architectural principles and security standards are adhered to unless a clear exemption is provided.

In addition to basic maintenance of the Applications, the following changes must be applied:

- Mandatory change to applications driven by legislative or regulatory requirements
- Upgrade or replacement activity due to applications or infrastructure being deemed 'end of life' by 3rd party providers
- Upgrade or replacement activity driven by the need to remain secure against an ever-increasing cyber security threat through standard software and hardware upgrades
- Upgrade or replacement activity deemed critical by SGN to ensure we continue to meet our licence obligations and regulatory outputs

Upon reviewing our plan with the Customer Engagement Group it was clear there was an expectation that SGN get independent validation of their IT investment plans to ensure proposed investment is in the correct areas and the value we are expecting to spend is in line with industry analyst predictions. The IT business plan has been validated by Gartner (report available as part of GD2 submission) and the proposed spend on applications refreshes is slightly above their accepted benchmark range with the variance linked to Opex due to our expectations around migration to SaaS services.

Following our stakeholder workshops it was clear that the areas important to our customers are Acting safely, Keeping the gas flowing and Minimising environmental impact and therefore maintaining our specialist applications is critical for SGN to continue excelling in these areas.

2.2 Site Specific Background

N/A

3 Equipment Summary

Our Applications are provided by a variety of suppliers (including **Security**). The Software is licensed and delivered either as SAAS (Software as a Service) or through perpetual licensing.

A list of some of the applications in scope is provided in Appendix B.

The software resides in either our

Security.

All the software is provided as high availability (99.5% uptime) with the ability to 'fail-over' should the primary service fail.

4 Problem Statement

The Application systems are the way we ensure that:

- we provide up to date asset network data to the required authorities, engineers and other utilities
- we have appropriate permitry and authorisations in place to conduct operational work
- we manage 3rd party reinstatement work
- we appropriately asset risk and apply preventative maintenance
- we understand where we have vulnerable customers (on the Priority Service Register)

If we have outages as a result of software not being maintained we would expect:

- Loss, damage and injury as a result of engineers and authorities not having up to date asset information.
- Field based staff would be put at risk of working on assets without full knowledge of their location in ground. Customers, Stakeholders and their property would also be at risk.
- Other operatives from other companies also to be at risk
- Increased risk of loss, damage and injury as a result of ineffective preventative maintenance

Ultimately this could also see the loss of operational License for SGN.

The investment outlined in this paper is considered mandatory by SGN. It relates to the effort required to maintain our specialist IT Application Systems to continue to provide the current levels of operation.

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

The work is required to ensure that our specialist applications remain in support, and continue to operate to the current levels. If we do nothing, there is a significant risk of loss of our specialist applications for a long period of time. This will result in failure in emergency standards, gas explosion and loss of life (£16m loss of life, up to £100m/10% of turnover fine, unlimited HSE Penalty).

In addition, SGN could receive Penalties from failure to notice Highway Authorities on commencement, extension and finishing of works. There would also be disruption to society and stakeholders through no co-ordination of Streetworks by the Highways Authorities.

What is the outcome that we want to achieve?

Continued robust specialist applications. This will ensure that we continue to manage risk effectively across our asset base, continue to provide appropriate and timely information to the authorities and other utilities, and treat our vulnerable customers appropriately.

How will we understand if the spend has been successful?

Standards met throughout GD2. Retention of our License to Operate.

4.1 Narrative Real-Life Example of Problem

Failure of System Leading to missing standards

Failure of our specialist applications would lead to an inability to meet regulatory outputs in key areas:

- Traffic management
- Risk Management
- Pressure Management
- Leakage and shrinkage

A specific example would be if our Insight systems which handles permitry communication with authorities was to fail. This would prevent SGN attaining appropriate permits before work, hence breaching standards and legislation.

A second example would be the failure of our Security systems, whereby this would render us unable to manage in-day gas demand and supply. This could result on failure to supply gas or result in increased leakage.

4.2 Spend boundaries

In line with Customer and Stakeholder expectations this paper does not seek to justify enhancing or adding to functionality to those Core systems. The paper purely seeks to maintain critical IT applications to ensure they continue to function and are supported.

5 Probability of Failure

SGN are committed to preventing failure of IT assets that underpin critical business services. Probability of failure is linked to technology roadmaps as defined by application and infrastructure providers. If we do not maintain our IT estate as contractually* required, applications become end of life, support becomes unavailable and SGN would be unable to meet its regulatory outputs due to critical process and system failures. SGN predict the probability of failure to be 100% in the GD2 window if we do not maintain our critical systems in line with recommendation from 3rd party suppliers, SGN IT policy and agreed architectural principles. The risk of failure if systems are not maintained will increase with time.

*Contracts expect applications to be upgraded prior to reaching the point where probability of failure indicates systems will fail in one of three ways (functional failure, technical failure or security failure)

5.1 Probability of failure assurance

IT industry bodies such as **Security** recognise the fact that the failure rate of systems increases significantly with time when systems are not maintained; this combined with changing security threats mean that we have no option but to maintain and refresh our applications.

6 Consequence of Failure

The following table outlines the consequence of failing to invest in ongoing support and maintenance of SGN IT assets.

Reason for failure	Consequence of Failure
Failure to deliver mandatory change to applications driven by legislative or regulatory requirements	SGN's licence to operate requires us to be compliant with the Uniform Network Code and the Supply Point Administration Agreement. It is critical that we can comply with legislation in regard to how we manage our organisation and run operations on a daily basis. Failure to comply could lead to a breach of licence conditions leading to significant fines or a failure to comply with the law which could lead to fines and / or legal action being taken against SGN.
Failure to carry out upgrade or replacement activity required within 3rd party contracts to remain in support	Critical process and system failures inability to meet our regulatory outputs and licence conditions ultimately leading to failure in emergency standards, gas explosion and loss of life (£16m loss of life, up to £100m/10% of turnover fine, unlimited HSE Penalty). Loss of licence to operate. Loss of gas supply to customers for extended periods.
Failure to carry out upgrade or replacement activity due to applications or infrastructure being deemed 'end of life' by 3 rd party providers	
Failure to carry out upgrade or replacement activity driven by the need to remain secure against an ever-increasing cyber security threat	
Failure to carry out upgrade or replacement activity deemed critical by SGN to ensure we continue to meet our licence obligations and regulatory outputs	

7 Options Considered

7.1 Baseline - Do Nothing

This option is not viable. This would involve leaving the IT systems to go out of support. This would leave a 100% likelihood of failure on these critical applications.

This would ultimately leave SGN unable to function as a business. Operational and non-operational staff would not be able operate safely. SGN would breach our licence conditions.

7.2 Refresh SGN Specialist Applications

This is the most basic and only viable option. This will simply enable the applications to remain in support and enable SGN to meet our obligations with the local authorities and other utilities. Where applications are end-of-life alternative solutions will be implemented.

Specific solution decisions will be made leading up to point of change based on available technology at the time in line with SGN IT Strategy and Architectural Principles. No additional functionality will be provided.

Robust Cost Benefits Analysis activity will ensure the most appropriate Total Cost of Ownership for the size and scale of the change.

From a technical perspective this will involve assessing and applying appropriate patches and upgrades in line with the 3rd party release, and SGN Architectural Standards. The upgrades typically involve a full Business Impact Assessment (where changes are made to the user interface for example), detailed design, implementation and release planning (allowing for any outages), testing with all other systems, implementation and warranty. A tender may need to be run to select a partner.

In GD1, SGN spent on average, £500k per annum maintaining and replacing specialist Applications. It is expected that this level of investment is required throughout GD2.

The benefit to this option is that it is the cheapest and only option in order to maintain our current levels of service.

7.3 Options Technical Summary Table

Table 1: Technical Options 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
Refresh SGN specialist applications	2022	2026	25	5	2.50

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

Option 1 Assumptions:

- We have assumed that it is possible to refresh all the applications, and that none of the software providers cease support of their products.
- That the spend levels in GD1 are sufficient to fund the level of application refresh required in GD2.
- Asset life is assumed at 5 years, which is on the high end for an IT product.

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 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 (£16m). 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 (£16m), a breach of license conditions (up to £100m) 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

7.4 Options Cost Summary Table

Table 2: Summary of Cost Options

Option	Template	Cost Breakdown	Total Cost (£m)
Refresh SGN specialist applications	IT Capex	Resources	1.13
		Software	0.06
		Hardware	Commercia
		Contingency	Commercia
		Total	1.25
	IT Opex	Resources	Commercia
		Software	Commercia
		Hardware	Commercia
		Contingency	Commercia
		Total	1.25

8 Business Case Outline and Discussion

The Business Case here is based on the need to maintain our Specialist IT Applications so that they operate at our current levels. If we do not maintain these applications, we are predicting a significant risk of loss of our specialist applications for a long period of time. This will result in failure in emergency standards, gas explosion and loss of life (£16m loss of life, up to £100m/10% of turnover fine, unlimited HSE Penalty).

In addition, SGN could receive Penalties from failure to notice Highway Authorities on commencement, extension and finishing of works. There would also be disruption to society and stakeholders through no co-ordination of Streetworks by the Highways Authorities.

By investing in the maintenance of our Specialist IT Applications, we will ensure that they remain in support and in good working order.

8.1 Key Business Case Drivers Description

Table 3 describes the impact of maintaining and refreshing our Specialist IT Applications.

Table 4 compares the options of do nothing (Baseline) to that of refreshing our applications. The result being that investing in the refresh will both enable SGN to continue to operate, and reduce cost and risk to stakeholders.

Table 3: Summary of Key Value Drivers

Option No.	Desc. of Option	Key Value Driver
1	Refresh SGN Specialist Applications	Ability for SGN to respond to incidents Protects our data – customer and asset Enables us to meet our outputs and license conditions

Table 4: Summary of CBA Results

NPVs based on Payback Periods (absolute, £m)								
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	Refresh SGN Specialist Applications Absolute NPV	Y	-2.50	-11.69	-2.79	-4.31	-5.74	-8.19
1	Refresh SGN Specialist Applications NPV relative to Baseline	Y	-2.50	-11.69	114.94	113.42	111.99	109.54

8.2 Business Case Summary

This project is driven by the potential loss for life following lack of preventative maintenance or incorrect mapping and asset data availability.

Table 5: Business Case Matrix

Refresh SGN specialist applications	
GD2 Capex (£m)	1.25
Number of Interventions	25.00
Carbon Savings ktCO ₂ e (GD2)	0.00
Carbon Savings ktCO ₂ e /yr	0.00
Carbon Emission Savings (35yr PV, £m)	0.00
Other Environmental Savings (35yr PV, £m)	0.00
Safety Benefits (35yr PV, £m)	17.73
Other Benefits (35yr PV, £m)	100.00
Direct Costs (35yr PV, £m)	-9.39
NPV (35yr PV, £m)	108.33
High Carbon Scenario	
Carbon Emission Savings (35yr PV, £m)	0.00
High Carbon NPV (35yr PV, £m)	108.33

9 Preferred Option Scope and Project Plan

Further to discussion earlier in the paper, the preferred option is the only viable option and that is to refresh the specialist SGN Applications. This requires the least amount of investment to enable us to maintain our current levels of operation.

This option requires ongoing spend to patch and upgrade our applications throughout the GD2 period. SGN will assess when and how to implement the upgrades and patches once 3rd parties

release their technical roadmaps and bundle the patches into appropriate releases. Each release will be cost justified.

As such, there is no fixed project plan.

9.1 Project Plan Outline

See above – this option requires ongoing patching throughout the GD2 period.

9.2 Asset Health Spend Profile

Table 6: Asset Health Spend Profile

Asset Health Spend Profile (£m)						
	2021/22	2022/23	2023/24	2024/25	2025/26	Post GD2
Refresh SGN specialist applications	0.50	0.50	0.50	0.50	0.50	Spend Profile to continue

9.3 Investment Risk Discussion

As previously discussed the recommended option assumes investment will be required at the same level in GD2 as GD1. This assumes that rates do not increase.

There is a risk that the phasing, effort and costs may change based on changing technology trends and requirements from the 3rd party software providers. This risk will be mitigated through timely analysis and delivery of technology Roadmaps and close engagement with those software providers. Dependent on the requirements, the complexity of delivery may also vary.

Table 7: Risk Table

Risk Description	Impact	Likelihood	Mitigation/Controls	Comments
Impact on Capital Expenditure	Capex expenditure	<=20%	Thorough Project Management, design and testing, risk and issue management. Appropriate budget assigned for delivery taking into account lessons learnt from previous upgrades.	Impact of upgrades on ability to operate business as usual processes and deliver regulatory outputs.
Impact on Capital Expenditure	Capex expenditure	>40% & <=60%	Investment in technology roadmaps, ensuring early sight of any changes.	Changing technology trends including operating systems and applications impact the cost and timelines for delivery of the option.

Impact on Capital Expenditure	Capex expenditure	>40% & <=60%	Investment in technology roadmaps, ensuring early sight of any changes.	Suppliers may alter their roadmaps or completely withdraw their applications from service. The costs are based on suppliers continuing to provide applications and support of existing products. A product replacement would increase costs.
-------------------------------	-------------------	--------------	---	--

Table 8: Sensitivity Analysis

	Low	Mid	High
GD2 Capex (£m)	1.19	1.25	1.88
Number of Interventions	25	25	25
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)	-8.9	-9.4	-14.1
NPV (35yr PV, £m)	14.6	108.3	103.6

SGN believe the preferred option is maintenance and refresh of our Specialist IT Applications. For the purpose of sensitivity analysis, the following has been applied to the preferred option of pre-emptive replacement:

Low Case: SGN have applied a reduction of 5% costs – The assumptions are that low cost assumes a decreased level of rigour e.g. governance, test, risk, but a greater risk of failure and may ultimately lead to increased cost as a result. 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, this is the expected output required for the GD2 time period.

High Case: SGN have applied an additional 50% on the expenditure, as this is believed to be the potential cost increase if SGN are required as a result of the 3rd party's maintenance schedules to increase the number of releases of patches or upgrades.

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 9: Capitalisation Rate Sensitivity Results

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)	112.51	111.72	113.66	
NPV (35yr PV, £m)	108.90	108.33	109.72	
NPV (45yr PV, £m)	107.10	106.70	107.68	
Payback	3.00	3.00	3.00	3.00

Appendix A - Acronyms

Acronyms

Acronym	Description
CBA	Cost Benefit Analysis
CEG	Customer Engagement Group – members of the public who provided feedback into their expectations of SGN
HSE	Health and Safety Executive
SAAS	Software as a Service – Software provided effectively on a rental basis to SGN. The Software provided hosts the software on their hardware.

Appendix B - IT Applications
Security