Section 1: Substation Equipment Systems Engineering

The coursework prompt requires that a suitable asset-type combination is determined for five electrical substations to be installed to provide traction supply for a railway. The expected lifetime of the system is 40 years. The asset types are as follows: Rectifier transformers (RTx), High Voltage (HV) switchboards, DC switchboards, Auxiliary transformers (ATx) and Electrical protection systems. Each asset has a type A and B available, with different costs and specifications. A single asset combination, i.e. BAAAA will be selected and used for all five substations in order to optimise spares holdings, documentation, familiarisation and training. Notation BAAAA represents the A/B type choices for each asset, in the order listed above (i.e. BAAAA has RTx type B, HV switchboard type A, etc.).

To determine the most suitable asset combination, the following method will be used:

1.1 Asset Analysis: A RAMS analysis of each asset type (A/B) will be conducted in the accompanying spreadsheet, calculating comparable values such as maintenance hours and costs, capability index, CAPEX, OPEX and net lifecycle costs (LCC).

1.2 Permutations Analysis: The calculated values will then be compared to determine which asset permutations are most suitable, and best fulfil the budget requirements set out in prompt. These top 3-4 choices will be shortlisted and further compared.

1.3 Final Priority choice and Alternative option: The shortlist from 1.2 will be further analysed to arrive at a final priority choice and alternative recommendation.

1.1 Asset Analysis

This section will describe the asset analysis table used on spreadsheet sheet 1 “Substation SE Figures.” Each example calculation will use values from the Rectifier Transformer A asset from the spreadsheet.

1.1.1 Asset general information and requirements

Contains general values given by the prompt, such as unit manufacturing cost, the number of assets required per substation and the man-hour rates, which is the cost of labour per hour for all maintenance-related activities. The capability index (CI) is also given, which quantifies the contribution each asset makes compared to both current and alternate equipment. This can be used to gauge performance.

1.1.2 Repair hours and costs per substation

Avg. Repairs/year: The mean time before failure (MTBF) is given at 22,000 operating hours. It is known that the station will operate for 8,000 hours per year. Thus, the average failures and thus repairs required per year is given by $\frac{operating\ hours\ /\ year}{MTBF} = \frac{8{,}000}{22{,}000} = 0.364$ repairs per year.

Man-hrs/repair: The mean time to repair (MTTR) is given at 3 hours, requiring 2 men for the duration. As such, the total man-hours required per repair of one asset is $3\ hours \times 2\ men = 6$ man-hours. Since 3 assets are required per substation, the net man-hours per substation is $6\ hours \times 3\ assets = 18$ man-hours. This will be used to calculate the labour costs associated with the asset.

Avg. Repair hours/year: Seeing as the asset is repaired on average 0.364 times a year, for a repair time of 18 hours, the average repair hours per year is $0.364 \times 18 = 6.55$ repair man-hours / year.

Avg. Repair cost/year: The man-hour rate for repairs and service is given as £75/hour. Seeing as they are hired for on average 6.55 hours a year, the average repair cost per year is $6.55 \times £75 = £490.9$ / year.

1.1.3 Service hours and costs per substation

Avg. Services/year: Follows the same maths as above. A given mean time before service (MTBS) of 10,000 operating hours gives an average service rate per year of $\frac{operating\ hours\ /\ year}{MTBS} = \frac{8{,}000}{10{,}000} = 0.8$ services per year.

Man-hrs/service: A mean time to service (MTTS) of 3 days (24 hours using 8-hour workdays) is given for 2 men. As such, the man-hours for one service is $24\ hours\ \times\ 2\ men \times 3\ assets = 144$ man-hours per service.

Avg. Service hrs/year: The system is serviced on average 0.8 times a year. For a service duration of 144 man-hours, the average service duration per year is $0.8 \times 144 = 115.2$ service man-hours / year.

Avg. Service cost/year: For an average of 115.2 service man-hours per year at a rate of £75/hour, the average service cost per year is $115.2 \times £75 = £8640$ / year.

1.1.4 Maintenance hours and costs per substation

Maintenance hours and costs are defined by the sum of repair and service hours and costs. As such:

Avg. MTCE hrs/year: Sum average service and repair hours per year to get $6.55 + 115.2 = 121.75$ man-hours / year.

Avg. MTCE cost/year: Sum average service and repair cost per year to get $£490.9 + £8640 = £9130.9$ / year.

1.1.5 Miscellaneous Costs

This section covers additional costs assets bear outside of maintenance and manufacturing, such as subsystem environmental control, crane loading upgrades or part replacements. The misc. costs for type A and B of each asset will be explained.

RTx Transformers: From table 1 on the prompt, it can be seen that each substation from 1-5 has an environmental rating of harsh/good, and an overhead crane capacity of either 10 or 15 tonnes.

- Type A (Cast-resin transformers):

  Weigh 9 tonnes, so can be lifted by existing overhead cranes at all substations. However, they are not suited to harsh conditions, so will require substation environmental improvements to be used for substations 1 and 4. This will cost £250k initially in capital expenditure (CAPEX) and an additional £5k each year in operating expenditure (OPEX) for energy costs.

  As defined earlier, choosing type A or B assets will apply to all substations to optimise spares holdings, trainings, documentations etc. Thus, choosing RTx type A will require environmental improvements at 2 substations, which over the service lifetime of 40 years will cost $£250k \times 2\ count = £500k$ in CAPEX, and $£5k/year \times 40\ years \times 2\ count = £400k$ in OPEX.
- Type B (Oil-filled transformers):

  Are resistant to harsh environments, but weigh 15 tonnes which exceed the crane capacity at substations 1, 3 and 4. A substation crane upgrade costs £400k in CAPEX, but has no operational costs. To upgrade this in 3 substations, the CAPEX is $£400k \times 3\ count = £1{,}200k$.

HV Switchgear: The Vacuum isolating bottles containing the main contacts on each HV circuit breaker have a recommended lifetime of 10 years (type A) and 15 years (type B). There are 3 bottles per breaker, and must all be replaced together. A typical substation has 8 circuit breakers each.

- Type A (HV switch):
  Cost of replacement, including manufacturing and labour per bottle is £3k every 10 years. Each replacement will require 3 $bottles/breaker \times 8\ breakers/substation \times 5\ substations = 120$ bottles. For a system lifetime of 40 years, the bottles will need to be replaced $\frac{40}{10} - 1 = 3$ times, as the first set of bottles is included within the original switchboard.
  Thus, the lifetime OPEX is $120\ bottles \times 3\ replacements \times £3k = £1{,}080k$.
- Type B (HV switch):
  Costs £8k to replace every 15 years. Following the above process, lifetime OPEX is given by
  $120 \times 3 \times £8k = £1{,}920k$.

<u>DC Switchgear:</u> Lifetime is not limited by no. of switching operations, but the system load at each trip. Type A switchgear are limited at 150 overload trips, and type B at 200 overload trips. On average, breakers are subjected to 50 overload trips per year. There are 4 DC breakers per substation.

- Type A (DC switch):
  At 50 overload trips per year, a type A switch average lifetime is $150/50 = 3$ years. Each replacement costs £2.5k. For a lifetime of 40 years, $40/3 - 1 = 12.33 \rightarrow 13$ switches is required, rounding up to ensure the 40 year lifecycle is accounted for. Thus, the net lifetime OPEX is
  $13\ switches\ \times 4\ breakers \times 5\ substations \times £2.5k = £650k$.
- Type B (DC switch):
  Average lifetime is given by $200/50 = 4$ years, with each replacement costing £2.5k. Following the above: $40/4 - 1 = 9$ switches is required to meet 40 year lifecycle. Net lifetime OPEX is thus
  $9\ switches \times 4\ breakers \times 5\ substations \times £2.5k = £450k$.

<u>ATx Transformers:</u> In order to optimise CAPEX and OPEX, both the RTx and ATx will be of the same type (both A or both B). The requirements for ATx transformers follows that of RTx transformers, although ATx transformers are a fraction of the weight. As a result, any substation upgrades made for RTx transformers will benefit the ATx transformers as they are of the same type, at no additional cost.

<u>Protection System:</u> There are no miscellaneous costs.

1.1.6 Total Costs

<u>Net CAPEX</u>: Includes the initial unit manufacturing costs, as well as any additional miscellaneous CAPEX. For RTx A, the unit manufacturing cost is £300k each, requiring 3 units per substation. The manufacturing CAPEX is thus $3\ units \times\ 5\ substations \times £300k = £4.5m$. The miscellaneous CAPEX was determined at £500k, bringing the net CAPEX to £5.0m.

<u>Net OPEX:</u> Includes all maintenance costs and miscellaneous OPEX costs. The average maintenance cost for RTx A was determined at £9130.9 per year per substation. Thus, the net maintenance OPEX is
$5\ substations \times 40\ years \times £9130.9/year = 1.82m$. For a misc. OPEX of 400k, the net OPEX is £2.23m.

<u>Net LCC:</u> The net lifecycle cost. Sum net CAPEX and OPEX to get $£5.0m + £2.23m = £7.23m$.

With the base hours, costs and capability index for each asset determined, it is now possible to look at different combinations of options, i.e. AAAAA and compare associated costs and CI with other combinations as well as the pre-set budget.

1.2 Permutations Analysis

Seeing as each choice of type A or B will be selected for all substations, there are $2^5 = 32$ possible permutations. However, only the same types of RTx and ATx transformers will be chosen, i.e. only AxxAx or BxxBx combinations are allowed. This reduces the possible permutations to 16.

With this in mind, the CI, net CAPEX and net OPEX was calculated for each of the 16 permutations. This was done by referencing the individual asset values from section 1.1, and summing the values from each option. For example, type A options have CI values of 105 (RTx), 108 (HV), 120 (DC), 110 (ATx) and 175 (Prot.). The net CI for permutation AAAAA is the sum, 618. Please see the 'Permutations Analysis' sheet.

1.2.1 Capability Index comparison

An allocated systems engineering budget of 750 cumulative CI was set for the system. The cumulative CI was summed for all possible permutations, and those with a CI ≥ 745 were highlighted in green to allow a slight tolerance. The permutations BBBBB, BBABB show outstanding performance indexes of 795, 785 respectively, while other options BBBBA, BAABB, BABBB fulfil the requirement CI ≥ 745.

1.2.2 CAPEX, Comparison

The cumulative CAPEX for each permutation was calculated similarly to above. For an allocated budget of £13.5m, permutations of CAPEX ≤ £13.75m were highlighted in green. Although this may lead to some overbudget selections in terms of CAPEX, the net OPEX and CI may still be favourable enough to be within net LCC and provide acceptable performance. As such, a flexible highlighting system was favoured.

14 of 16 permutations ran within the CAPEX budget (with tolerance), with three permutations fulfilling both the CI and CAPEX requirements: BAABB, BABBB and BBBBA. Of these choices, BABBB runs overbudget but within the stated tolerance at £13.68m.

1.2.3 OPEX Comparison

For a net OPEX budget of £5.0m, cumulative OPEX ≤ £5.25m permutations were highlighted using the same reasoning as above. All of the options BAABB, BABBB and BBBBA run within budget.

1.2.4 LCC Comparison

All 16 possible permutations run within the £18.5m allocated budget.

1.2.5 Shortlist Selection

Seeing as only 3 permutations fulfilled all budgeting requirements when considering the CI, CAPEX, OPEX and net LCC: BAABB, BABBB, BBBBA, these were selected for the shortlist for further analysis and comparison. However, an additional option of BBBBB was included due to the exceedingly high CI score of 795, opposed to the scores of 753, 763, 745 from the other shortlist options. This gives a roughly 5.15% increase in comparison while still falling within the overall LCC budget, although it uses a larger portion of the budget, leaving a budget remainder of £0.53m opposed to the £1.87m, £1.87m and £1.13m left from the other options. As such, the BBBBB option can be considered as a high-performance alternative for if a 5.15% increased performance is to be considered a higher priority than setting aside some of the budget for contingencies.

1.3 Final Priority Choice and Alternative Option

The shortlisted permutations of BAABB, BABBB, BBBBA and BBBBB were further compared in the shortlist analysis table on sheet 'Substation SE Figures.' Along with the CI, CAPEX, OPEX and LCC costs, budgets were also given for the average mean time before failure (MTBF) of the entire system at 4600 operating hours, as well as the average maintenance hours per year for all substations at 485 operating hours / year. As such, these values were also calculated and compared within the table for each shortlist option. The values staying within the budgets are highlighted in green. The final priority choice of BABBB will be used as example calculations below, where the choice reasoning will be explained further below.

1.3.1 Costs and Hours Comparison calculations

Avg. MTBF: The average MTBF of a system composing of assets of varying MTBFs is given by summing the failure rates of each individual asset, where the failure rate λ per million hours is given by $\lambda = \frac{1 \, milion \, hours}{MTBF}$. For permutation BABBB, the failure rates for each asset is calculated below:

- $\lambda_{RTx(B)} = \frac{1 million \, hours}{32{,}000 \, hours} = 31.25$ failures / million hours
- $\lambda_{HV(A)} = \frac{1m}{25{,}000} = 40$ failures / million hours
- $\lambda_{DC(B)} = \frac{1m}{8{,}000} = 125$ failures / million hours
- $\lambda_{ATx(B)} = \frac{1m}{80{,}000} = 12.5$ failures / million hours
- $\lambda_{PS(B)} = \frac{1m}{120{,}000} = 8.33$ failures / million hours

The failure rate for the system is attained by summing that of the individual parts, giving $\lambda_{BABBB} = 217.08$. The system MTBF can now be determined via $MTBF = \frac{1m}{\lambda_{BABBB}} = 4606.5$ operating hours.

Avg. MTCE hrs/year: Seeing as the average maintenance hours per year per substation was already calculated in the asset analysis table, the BABBB asset values were summed and multiplied by 5x substations to get:

$(33.72 + 24.51 + 20.70 + 4.37 + 8.93) \, hours/year \times 5 \, substations = 461.1 \, hours/year.$

Net MTCE hours: Calculated by multiplying MTCE hrs/year by lifetime of 40 years, $461.1 \times 40 = 18{,}445.6$ hours.

Net MTCE cost: The average MTCE cost/year per asset per substation was also calculated in asset analysis. This value was summed for all BABBB assets, and multiplied by 5x substations and 40x years to get

$(£2{,}529.0 + £1{,}838.1 + £2{,}040.0 + £327.5 + £893.3) \times 5 \, substations \times 40 \, years = £1.53m.$

Net CAPEX: The same process is done for net CAPEX, although an additional cost of £25k is added, accounting for the five commissioning engineers required to oversee the final testing and commissioning for each substation.

Net OPEX, LCC: Values attained from summing asset OPEX, LCC from asset analysis.

1.3.2 Budget Consumption calculations

An additional method of comparison was to consider the proportion of the budget used for each permutation, as the budget remainder is an important factor when considering adaptability to contingencies. The % consumption of the £18.50m LCC budget was calculated, as well as the remaining funds subtracted from the budget. Options BAABB, BABBB spend the least of the budget at 89.9%, BBBBA spends 93.9% and BBBBB spends the most at 97.1%.

1.3.3 Replacement Delay Costs

Although the intended lifetime of systems is 40 years, the equipment must be capable of running for an additional 2 years as contingency for any delays in replacing it. Although the LCC will not be calculated explicitly for 42 years, the additional cost of extending the lifetimes by 2 years will be calculated to determine whether this can be accounted for with the budget remainder after the original lifecycle.

Add. MTCE cost: For permutation BABBB, the net maintenance cost over 40 years had already been calculated at £1.43m. Dividing this by 20 gives the maintenance OPEX for 2 years, at $£1.43m/20 = £0.07m$.

Add. Misc. cost: Referring to the "Replacement Cost Notes" section of the asset analysis table, for BABBB, it can be seen that an additional $£3k \times 120\ count = £360k$ is required to extend the type A HV switchboard's lifetime from 40 years to 50 years. This is the minimum extension duration, as each switchboard lifetime is 10 years. An additional $£2.5k \times 20\ count = £50k$ is required for the DC switchboard B, extending the lifetime from 40 to 44 years. As such, the net additional miscellaneous cost is £410k.

With the replacement costs determined, the remaining budget after the delay period can be calculated. Referring to the shortlist table, it can be seen that all listed permutations can afford the extended period costs, although options BAABB and BABBB have the highest remaining budget at £1.43m, £1.39m. Option BBBBA places third with £1.00m, and option BBBBB leaves only £0.41m.

1.3.4 Shortlist elimination process

From the shortlist analysis figures, the permutation BBBBA was first removed from the shortlist. With a capability index of 745, its performance was already on the lower tolerance bound of the 750-CI budget, the worst out of the shortlisted options whilst costing the second most at 93.9% of the budget. In addition, it does not fulfil the MTBF budget of 4600 operating hours or the average maintenance hours per year budget of 485 hours per year. In conclusion, this option provides below-average performance compared to the shortlist at an above-average cost, and was removed.

The final choice option was selected as BABBB, which provides well-rounded analytic metrics while requiring among the lowest cost. It provides an acceptable CI at 763, MTBF at 4606.5 hours, maintenance hours at 461.1 hours/year which are all within budget requirements, as well as using 89.9% of the allocated £18.50m, leaving £1.87m after the original lifecycle and £1.39m considering replacement delays. The budget remaining is among the highest out of the 4 shortlist options, and yet produces the second highest CI apart from BBBBB, which is an option that delivers high capability but runs tight on the LCC budget at 97.1% consumption. Leaving a higher remainder is beneficial as this leaves funding to account for possible contingencies or unseen changes in system requirements, allowing for more system flexibility and reliability. As such, this option is recommended as the standard answer, as it fulfils all required specifications whilst providing the best cost efficiency.

The option of BAABB runs similarly on the budget at 89.9%, however, delivers a lower CI of 753 opposed to 763, and is far outperformed by the first choice option in terms of MTBF (-34%) and average maintenance hours per year (+6.6%). As such, this option is not considered.

Finally, the option of BBBBB is recommended as an alternative performance option. It will mostly be compared to the recommended choice BABBB as the other shortlist options have been ruled out. As previously mentioned, this option provides an exceedingly high CI of 795, a 4.2% increase from BABBB. However, this increase comes at the cost of using 97.1% of the LCC budget, a 7.2% increase in cost from the 89.9% used by BABBB. That being said, this option still falls within the overall LCC budget, and the MTBF metrics of 4752.5 hours and average maintenance hours of 459.9 hours/year both are within the requirements. Although the remaining LCC budget is less, it is still enough to account for an additional 2 years of operation to account for replacement delays. However, the final remaining value of £0.41m is £1.34m less, only 28.3% that of the budget left by BABBB, leaving far less funding to account for contingencies etc. As such, this alternative option is suggested for cases where the client prioritises capabilities over budget, and is willing and able to supply additional funding if needed for contingencies.

Section 2: Key 'in-service' RAM Engineering and Management Actions

2.1 People

Personnel are an important factor to consider regarding operations. Competent and well-communicated personnel can demonstrate high-quality work and decision-making, reducing risk of human error and increasing the level of safety, reliability and quality of operation. As such, a main objective of both the initial and in-service phase is to ensure that personnel are suitably competent, trained, correctly instructed and supervised.

2.1.1 Staff Induction Training Programme

To ensure new staff are suitably competent and familiarised, an induction programme can be considered to establish a base-level competency. This will initiate staff on possible risks and appropriate risk control measures, as well as the appropriate skills to ensure smooth equipment operation. Although this may result in an additional initial cost, and ongoing cost for any new staff, this will ensure that failures do not occur more than necessary due to human incompetence, and will likely reduce overall expenditure across the 40-year lifecycle period.

2.1.2 Personnel development Programme

Employees will also feel more motivated and appreciative if they feel a sense of improvement over time. As such, a personnel development programme can be considered, which can expand the capabilities of staff beyond the scope of their own responsibilities within the station, allowing them to become more flexible. This has the added benefit of superior decision making if staff are more knowledgeable overall, reducing safety risks.

2.1.3 Modes of Communication

Both formal and informal modes of communication between staff and management should be encouraged, as both provide different benefits. Whereas formal meetings with sett times and agendas can convey much important information regarding the station and operation, it is a more distant form of interacting and may not encourage effective two-way communications between staff and managers. As such, staff may withhold their true feelings or thoughts during appraisal or may not feel as welcome within the company, reducing their productivity. Informal communication, like manager check-ins, may not convey as much useful information. However, the casual and carefree atmosphere introduced can encourage more open communication between managers and staff.

As such, formal meetings, as well as informal check-ins and conversations should both be encouraged. This will emphasise a more well-communicated work culture and thus reduce potential operator errors due to miscommunications or poorly informed staff, increasing the safety and reliability of the station.

2.2 Plant

Smooth operation of the plant is also vital to achieve the set availability and cost goals. Delays in maintenance or excess equipment failures can reduce the plant availability and increase operating cost. As such, on top of following an approved Maintenance Regime and operating and Maintenance (O&M) procedure, the following points will be considered:

2.2.1 Reliability-centred Spares Holding

In order to maintain plant availability, adequate spares and tools should be immediately available when failures occur to ensure no delays are made to the repair time. However, stocking spares for all possible failure points of the station may be costly to both purchase and store. As a result, a reliability-centred spares holding approach can be considered, which uses predictive techniques with root cause analysis (RCA) to identify the most likely points of failure and thus spare parts to prioritise stocking. This strategy will ensure station availability does not fall below expectations but also reduce costs associated with storing more spare parts than necessary.

2.2.2 Reliability-centred Maintenance

Although a reactive and preventive maintenance type is already used for the project, reliability-centred maintenance can be considered if recurring issues appear within existing equipment at a higher rate than expected. A reliability-centred approach will evaluate RCA, and consider equipment re-design or modification to avoid or eliminate said issue. If such a recurring issue is identified and eliminated early in the system lifecycle, this may save substantial costs over the entire system lifetime. However, as this option will alter the planned operational and capital expenditures of the system, factors such as severity of the recurring issue, as well as remaining system lifecycle should first be considered.

2.2.3 Failure-adaptation System

Although system failures across the station lifecycle are inevitable, it is important to identify causes of failure in order to avoid such issues going forward. This will reduce the overall number of failures experienced by the plant, and thus increase plant reliability and reduce operating expenditure across the lifetime. As such, failure points should be identified, and communicated to all personnel to take measures and avoid the particular failure cause.

2.2.4 Plant Improvement

Similarly to reliability-centred maintenance modifying equipment to reduce points of failure, the same could be done to increase equipment efficiency. Equipment performance and efficiency can be assessed at regular intervals to identify and evaluate possible improvements to efficiency and/or operating costs, which, if identified early on in the project, can provide substantial benefits over time.

2.3 Processes

In addition to the plant itself running smoothly, the external processes supporting the plant should also be well-maintained.

2.3.1 Equipment Suppliers & Warranty

It is important to communicate effectively with equipment suppliers, especially warranty providers to ensure that the planned maintenance strategy and regime follow the manufacturer's requirements. This will allow the warranty period of the equipment to be used as an opportunity to verify the actual operating reliability of the equipment, and identify any deviations from manufacturer sources. This is important to identify early on as this will alter the forecasted operating costs for the remainder of the lifecycle. Values such as operating capabilities, maintenance scope, hours, labour cost, and spares usage can be refined across this time. This will allow a more comprehensive and accurate prediction of operating costs as well as equipment performance going forward.

2.3.2 Asset Management System

It is also recommended to maintain accurate plant records, using an Asset Management System that plans and details maintenance undertaken, performance data and failure modes and trend data. At the beginning of the lifecycle, an agreed maintenance programme should be established with equipment manufacturers. This should outline the expected failure modes, as well as proposed level of repair. The preventative servicing and husbandry, i.e. cleaning, painting and adjusting, should also be established to maximise the equipment lifetimes.

Over time, particular failure modes specific to the station environment may be discovered, or may cause failure rates to deviate from the given values. As such, it is important to maintain accurate maintenance records, in order to identify trends and take appropriate measures to reduce operating cost and increase reliability.

Finally, RAM data should also be shared with manufacturers to receive insight as well as allow for better-developed, or better-tailored equipment in the future.

2.4 Contingency Planning

In order to ensure safe and reliable operation of the station, it is recommended to include a contingency plan outlining a general plan of action in case of unexpected circumstances. Such a plan should be communicated to all employees.

2.4.1 Emergency Procedures

The possible risks and hazards associated with equipment failures should be identified, and accounted for in step-by-step emergency procedures for staff tailored to each possible outcome. This should also include possible risks from external sources, such as natural disasters and security risks. This will ensure employees will follow a coherent and though-out protocol and avoid making rash decisions during crisis. Staff should be well-informed of evacuation routes, as well as actions to take to isolate hazardous locations within the plant if necessary. In order to reinforce these steps, training drills should be conducted at regular intervals.

2.4.2 Contingency Budget

Budget remainders from the net life cycle cost of the system can be used to band-aid costs incurred during contingency. For the recommended option of BABBB, the remaining LCC budget after 40 years is £1.87m. Although this is not enough for a substation overhaul, this fund may be able to account for smaller contingencies and not affect budgeting elsewhere.