nationalgrid

Peterborough IED Business Case

May 2018

Contents

1 Executive Summary

Peterborough compressor station has three similar gas turbine driven compressor units which were commissioned between 1973 and 1978. The units can run independently or as a parallel pair with any other unit.

Peterborough is predominantly used for bulk transmission of gas to support offtake pressures in the south east and south west. It is also a critical compressor site to support 1-in-20 peak demand obligations in the south east and south west.

The compressor station is one of the highest usage sites on National Transmission System (NTS). The age and type of units installed and the high run hours means it is also one of our most polluting sites. The units at Peterborough are captured by the Integrated Pollution Prevention Control (IPPC) element of the overarching Industrial Emissions Directive (IED) which imposes a requirement for a continuous reduction in emissions to land, air and water. As part of our ongoing IPPC programme of works we had already identified the need to install one unit as part of IPPC Phase 3 in 2012.

In 2013/14 we re-assessed the compressor run hours and forecast emissions as part of our IPPC Phase 4 need case analysis. This showed that the installation of one new unit as part of IPPC Phase 3 would significantly reduce emissions as intended. However due to the very high run hours at this station, and the enduring need to run one of the existing Avons in addition to the new IPPC Phase 3 unit, Peterborough remained one of the most polluting sites on the NTS. Against all our future energy scenarios there is an enduring need for the site beyond 2040 to maintain extremity pressures in the south east and south west. To comply with IPPC further options needed to be assessed and implemented at this site.

Eight options were evaluated in 2014 at Peterborough. These options also took another element of IED into account, the Medium Combustion Plant Directive (MCP), which in 2014 was in draft, with an anticipated compliance date of 31st December 2024. In late 2015, National Grid secured an extension on compliance until 31st December 2029. The eight options considered for the site have been run through our latest cost benefit analysis (CBA) approach as part of our preparation for this May 2018 reopener submission.

Based on the CBA assessment, Option 3 was identified as the most economic solution to comply with the legislation as part of IPPC Phase 4. This option proposes installing a new unit at the site by 2021, and maintaining the existing Avons on site with the intention of rolling these units onto 500 hours per year Emergency Use Derogation to comply with MCP from 2030. This option ensures compliance with IPPC as the new unit will significantly reduce the NOx emissions associated with two units operating in parallel on site. This option has no impact on site capability which means it can continue to maintain pressures in the south east and south west during winter and peak demand conditions for the foreseeable future. A further assessment will take place as part of the RIIO-T2 business plan to determine if any further works are required to comply with MCP at the Peterborough site.

Funding Request Summary (09/10 price base)

The Peterborough funding request is between £20-40m.

RIIO-T1 Output - To install one new unit at Peterborough by the end of RIIO-T1 in accordance with IPPC Phase 4 requirements.

2 Introduction

Peterborough compressor station is located near Peterborough city centre, in a rural location. The station currently has three gas compressor units; two units were commissioned in 1973 while the third unit was commissioned in 1978. The compressor station is a key strategic asset located at a critical point of the network where five pipeline Feeders converge. This means that the station can be used to effectively and efficiently move gas in multiple directions to meet a variety of supply and demand patterns.

Figure 2.1: Peterborough Compressor Site Location

Peterborough is predominantly used for bulk transmission of gas to support offtake pressures in the south east and south west. It supports Bacton, Easington, Milford Haven and north west storage entry onto the network. It is also a critical compressor to support 1-in-20 peak demand obligations in the south east and south west.

During the winter months the requirement for compression at Peterborough is high which results in it being one of the highest usage sites on the NTS. Due to the age and type of units installed at the site and the high run hours, this means it is also one of our most polluting sites. The units at Peterborough are captured by the IPPC element of the overarching IED which imposes a requirement for a continuous reduction in emissions to land, air and water. Through our annual Network Review process, we have agreed with the Environmental Agency (EA), Scottish Environment Protection Agency (SEPA) and Natural Resources Wales (NRW) to develop an investment plan which preferentially targets our most polluting sites (see chapter 4 for more detail). It was not feasible or economic to comply with the legislation in one go so the IPPC compliance works are being implemented in phases. Phases 1 and 2 are complete and Phase 3 is in progress with one new low emission

gas turbine driven compressor being installed at Peterborough as part of this programme of works.

The principal aim of the IPPC phased works is to maximise the emission reduction at the most polluting sites on the network either through installing new compression plant which can be demonstrated to represent the best available technology (BAT) solution. This business case considers the status of the existing equipment on the site, the future usage of the site and the impact of another element of the IED, the MCP, to propose the most efficient and effective solution that is in the best interest of consumers.

As part of our May 2015 reopener we actively engaged with our stakeholders to incorporate their views into our future compressor strategy[1]. We received stakeholder support to implement the most efficient and effective solutions to reduce emissions while maintaining future network operability and resilience. As part of our preparation for the May 2018 reopener we have continued to engage with our stakeholders.

3 The Site: Assets and Operation

3.1 Current Assets

Peterborough compressor station comprises three similar Rolls Royce Avon gas turbine driven compressor units (A, B and C). Units A and B were commissioned in 1973 whilst unit C was commissioned in 1978. All units can be used in single configuration or in parallel configuration with any other unit. The site was originally equipped with two further compressors powered by Orenda gas turbines but these were decommissioned once the Avons were operational. All associated Orenda above ground equipment was removed between 1975 and 1979.

3.2 Current Site Operation

Peterborough is one of the most critical compressor stations on the National Transmission System (NTS) as it located at a strategic multi-junction for five pipeline Feeders that conveys gas in multiple directions to meet demand.

The site is predominantly used for bulk transmission of gas to support extremity pressures in the south east and south west, particularly during winter demand (>250mcm/d) and peak 1-in-20 demand (460 mcm/d) conditions.

The central location of the site means it can also be used for a wide range of other purposes, such as:

- facilitating baseline entry flows at Bacton by moving gas away from the terminal;
- moving gas towards Bacton under high Interconnector (IUK) export conditions;
- moving gas away from south Wales under high Milford Haven flow conditions;
- moving gas towards south Wales under low Milford Haven flow conditions;
- moving gas away from the north west and west midlands under high north west storage import flow conditions;

[1] http://www.talkingnetworkstx.com/ied-what-is-ied.aspx

- moving gas towards the north west and west midlands under high north west storage export flow conditions;
- supporting movement of gas from the north east into the southern part of the network
- providing network resilience by acting as a back-up station in case there are operational issues at Hatton or Huntingdon;
- facilitating maintenance and planned outages in the central and southern parts of the network.

The wide range of uses of the site means that it is one of the highest usage sites on the NTS with 5,945 average annual run hours at the station over the last six years. The table below illustrates the annual run hours per unit.

	Unit Running Hours *(financial year)*					
	12/13	**13/14**	**14/15**	**15/16**	**16/17**	**17/18**
Unit A	3,227	2,911	2,370	522	30	2,143
Unit B	2,626	2,186	1,443	1,426	2,450	3,417
Unit C	2,007	2,076	1,576	482	3,220	1,558
Total	**7,860**	**7,173**	**5,389**	**2,430**	**5,700**	**7,118**

Table 3.1: Peterborough historic running hours

The lower run hours in 2015 were as a result of an extended outage on site between October – December as part of a trial to assess the impact on network operability if both Huntingdon and Peterborough were unavailable during winter conditions which is when historically both sites are most used (see Figure 3.1). The aim of the trial was to assess whether outages at the sites could be extended into the autumn/winter period to facilitate IPPC compliance construction work on site. The trial ended in January 2016 as the gas demand level increased and there was a need for both sites during the peak winter months.

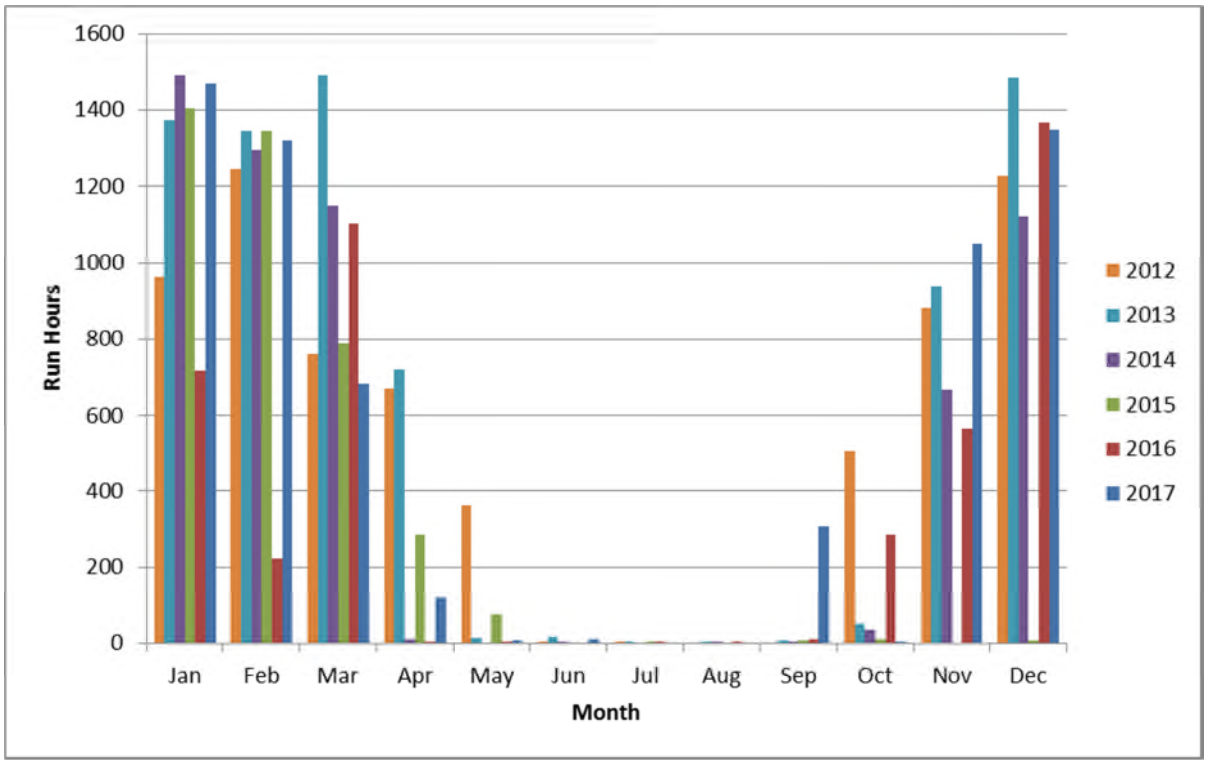

Figure 3.1: Monthly run hours for Peterborough compressor station (2012-2017)

Figure 3.1 illustrates that Peterborough is predominantly used during periods of high demand between October and March with minimal use during the summer months when national demand is lower (see Figure 3.2).

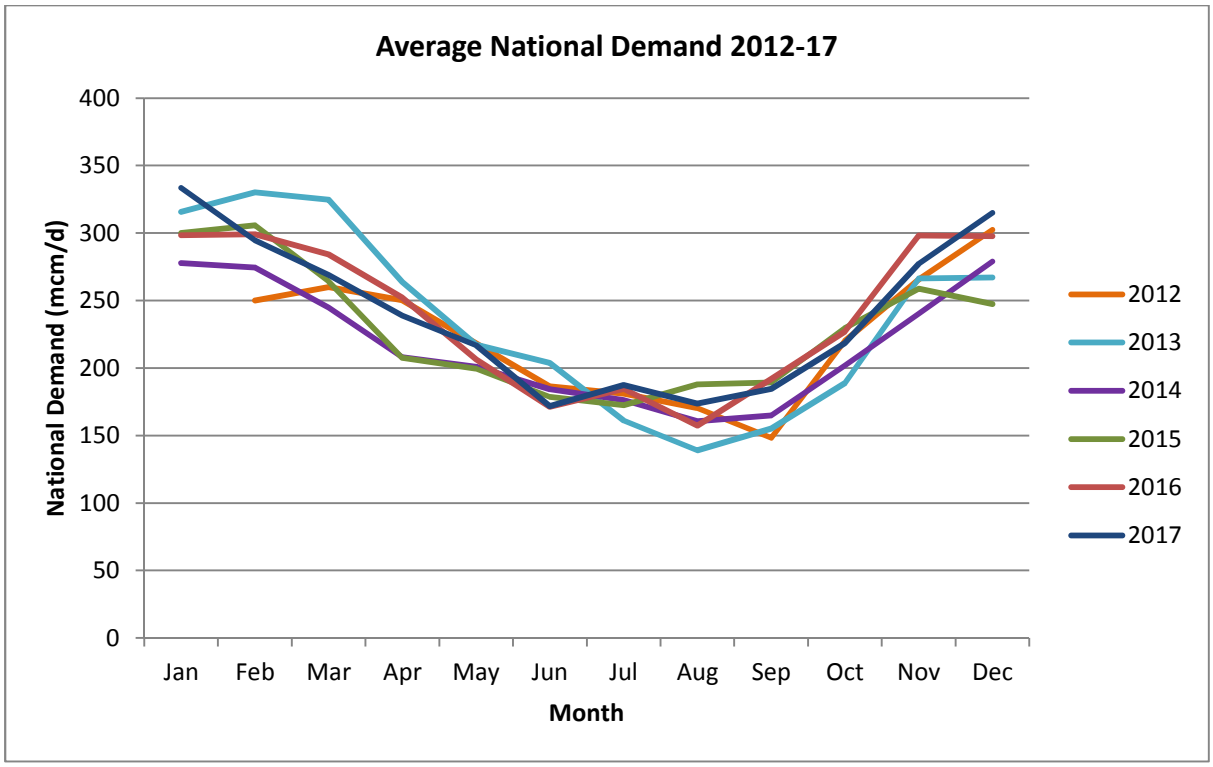

Figure 3.2: Monthly average national demand (2012-2017)

The following chart shows the number of single and parallel run hours at Peterborough between December 2012 and September 2017 compared with national demand levels.

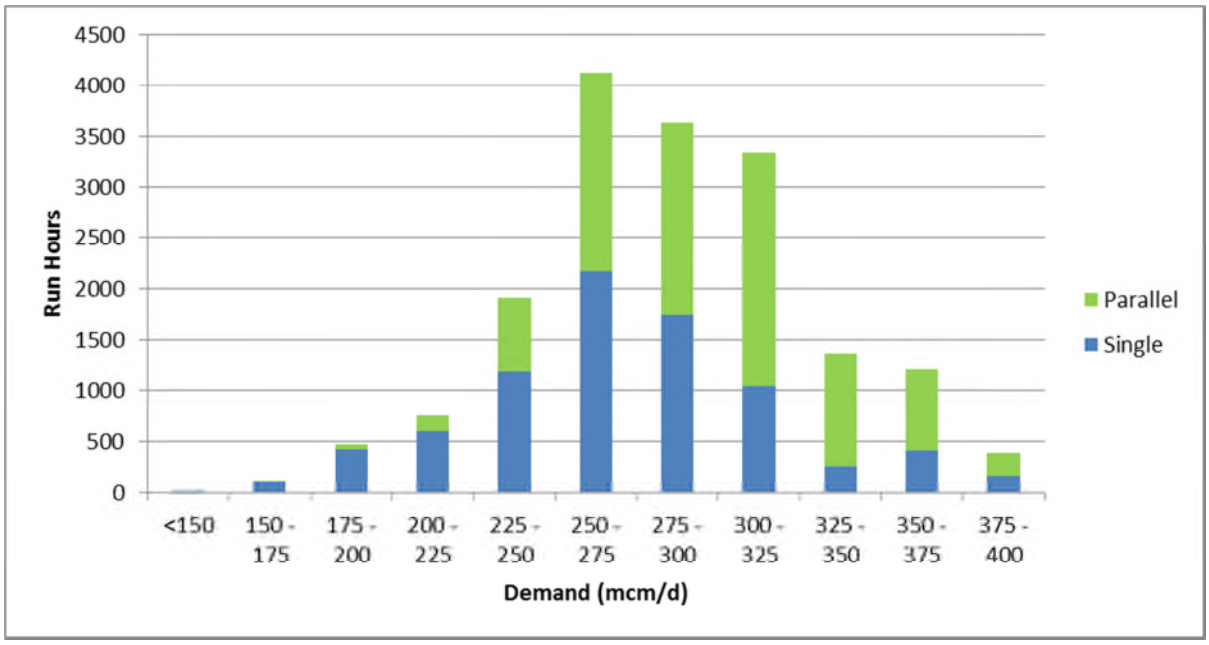

Figure 3.3: Compressor run hours at Peterborough compared to national demand (1 December 2012 – 30 September 2017)

The chart above shows that a majority of the run hours at Peterborough were when demand was over 250 mcm/d with a significant proportion of the compressor hours being with two units run in parallel. Over the data assessment time period there were no demand days higher than 393 mcm/d.

4 Emissions and the impact of IED

The Industrial Emissions Directive (IED) has been introduced to reduce pollutants which are responsible for damage to the environment. A more detailed overview of this legislation is contained in the overarching IED document.

As part of the IED legislation, based on the IPPC requirements, all relevant installations need to have a permit and the permit conditions should be based on BAT. If these conditions are not met the UK environment agencies will remove our site permits which would mean our compression activities would have to cease. It is recognised and understood by the three UK environment agencies that it is not feasible or economic to comply with the BAT requirement across our whole fleet immediately. Therefore we have agreed with the environment agencies to develop an environmental investment strategy through an annual Network Review, which is embedded within the permit conditions.

The priority of sites targeted for investment is reviewed annually through the Network Review process which documents our environmental investment strategy, together with historical and forecast compressor utilisation and NOx emissions. The Peterborough compressor site is affected by the requirements of the IPPC element of IED as it is one of the highest run hour and NOx emitting sites on the network (Figure 4.1). The compliance requirements of IPPC were incorporated into the IED in 2014 with the same permitting and BAT requirements for highly polluting sites. The Phases of works required on the highest polluting sites were identified prior to IPPC being incorporated into IED which is why the works are still referred to as IPPC phases within this document.

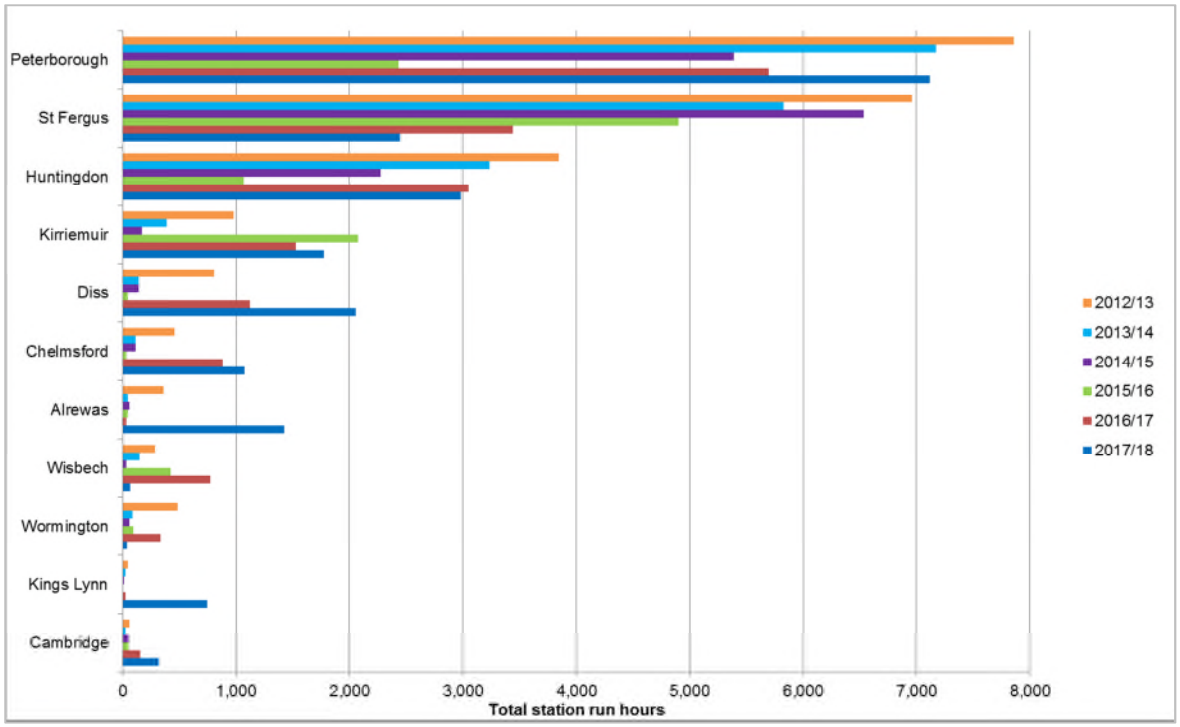

Figure 4.1: Ranked run hours for IED non-compliant compressor units by station 2012-2018

IPPC Overview

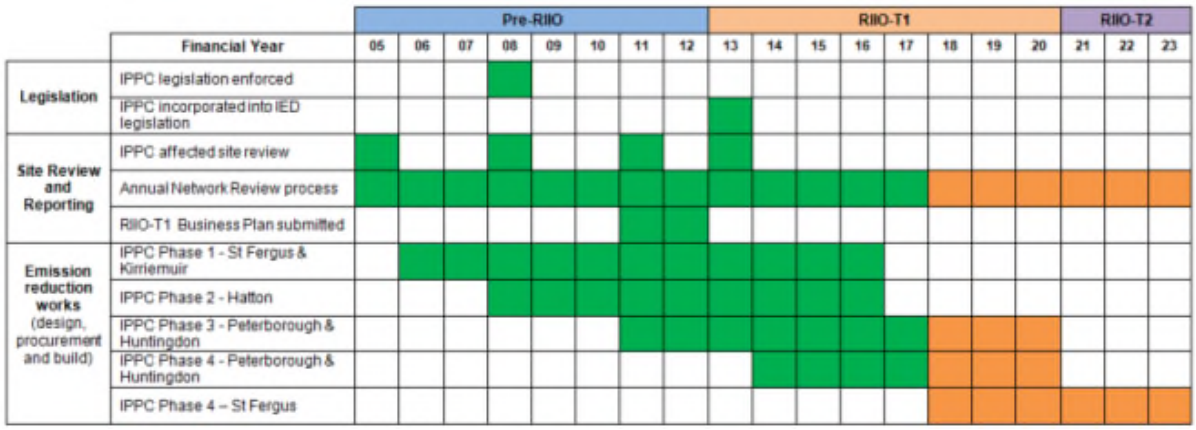

Figure 4.2: IPPC timeline – orange indicates future activities to be completed

IPPC Phase 1 and 2

To reduce our fleet NOx emissions we have completed two phases of investment as part of our IPPC programme of works. The first phase focused on St Fergus and Kirriemuir with the installation of three new electrically driven compressors, two at St Fergus and one at Kirriemuir. The second phase focused on the installation of an electrically driven compressor at Hatton. All of the units installed as part of the IPPC Phase 1 and 2 works are now the lead units at these compressor stations.

IPPC Phase 3

IPPC Phase 3 formed part of our RIIO-T1 business plan in 2012. This focused on reducing emissions at Peterborough and Huntingdon, the sites with the next highest levels of NOx emissions with the intention of significantly reducing NOx emissions from both sites by 2021.

The IPPC Phase 3 works proposed the installation of a single large electric drive compressor unit at each site within RIIO-T1.

The IPPC Phase 3 single large electric units proposed for installation at both Peterborough and Huntingdon were designed to mitigate emissions from a proportion of the parallel operation on site. However the analysis in 2013/14 showed that these works would only partially mitigate the emissions from both sites as there was an ongoing requirement for the use of a single Avon sized unit (based on the 5 year average figures in Table 4.3 below, 24% of the time at Huntingdon and 31% of the time at Peterborough). The high single unit run hour requirement on the existing Avons at both sites would mean that they would still remain the most polluting on the network.

Following completion of an OEM tender and BAT assessment the size of the unit for IPPC Phase 3 compliance was determined as a 15.3MW gas turbine for the site. This decision was supported by the EA as part of the 2015 Network Review process. This solution reduced emissions across a broad range of operating scenarios; specifically:

- the majority of single duty operating hours (new machine run solo as lead machine whenever available,) and
- a significant number of parallel duty operating hours (new machine run as lead whenever available, supplemented by existing Avon operating in parallel).

IPPC Phase 4

We provisionally identified Alrewas, Diss and Wormington compressor sites in our RIIO-T1 business plan for inclusion in the IPPC Phase 4 programme of works. These sites were identified based on prevailing and forecast future network flows in 2011/12. Due to a number of uncertainties baseline funding was not provided for IPPC Phase 4, but funding was provided as part of the RIIO-T1 settlement to develop an integrated plan for IED and IPPC Phase 4, which forms the basis of this reopener submission.

In 2013/14, we re-assessed the compressor station run hours as part of our IPPC Phase 4 site need case analysis. All three of the provisionally identified stations were found to have declining run hours and similar future operating requirements expected.

Compressor station	Units	Running Hours					
		2009	2010	2011	2012	2013	5 year average
Alrewas	A and B (Avon 1533s)	221	1061	305	258	146	398
	C (Solar Titan DLE)	222	1091	1209	28	120	534
Diss	A, B and C (Avon 1533s)	108	432	15	19	918	298
Wormington	A and B (Avon 1533s)	456	3746	5053	541	81	1975
	C (Electric VSD)	907	1098	2021	961	926	1183

Table 4.1: Run hours of sites initially identified as part of IPPC Phase 4

The focus of the IPPC Phase 4 works shifted to other sites with units not captured by LCP that had significantly higher current and forecast future running hours. This identified the remaining units at St Fergus, Huntingdon and Peterborough as priority sites.

Compressor station	Units	Running Hours					
		2009	2010	2011	2012	2013	5 year average
St. Fergus	**5 Avon 1533 Units**	**6397**	**6346**	**8816**	**6987**	**6902**	**7090**
	2 RB211 Units	7527	8645	2916	4255	5893	5847
	Electric VSD Unit	N/A	N/A	N/A	N/A	N/A	N/A
Peterborough	A, B and C (Avon 1533s)	5559	8268	4958	6621	7448	6571
	Single Avon Operation	**1660**	**1803**	**2501**	**3442**	**884**	**2058**
Huntingdon	A, B and C (Avon 1533s)	2964	6201	1444	842	4586	3207
	Single Avon Operation	**1190**	**643**	**441**	**425**	**1235**	**787**

Table 4.2: Run hours of IPPC Phase 4 priority sites

The IPPC Phase 1 works at St Fergus were designed to mitigate the emissions from the RB211s on site; however the Avons were still shown to be required for a significant number of run hours in order to meet the variable flow profiles required from the site. Therefore further options needed to be assessed and implemented to comply with IPPC at this site.

In 2014, as part of our May 2015 stakeholder engagement process, we presented the IPPC Phase 4 analysis and our future compressor strategy[2]. We received positive feedback from our stakeholders that St Fergus, Peterborough and Huntingdon were the most appropriate sites to take forward as part of IPPC Phase 4.

As part of the 2015 Network Review process we presented our IPPC Phase 3 and Phase 4 strategy to the EA and SEPA for Peterborough, Huntingdon and St Fergus. They supported the proposed IPPC strategy for all three sites.

For further information about St Fergus and Huntingdon please refer to their individual IED business cases. The options considered as part of IPPC Phase 4 are presented in section 6 of this business case.

5 Future Operational Requirements

As has already been highlighted Peterborough is one of the highest utilisation sites on the NTS. The multiple uses of the site and its central network location mean that its high usage is likely to continue into the future. The Future Energy Scenarios (FES) indicate that peak demand is likely to remain high out to at least 2040 (Figure 5.1).

[2] http://www.talkingnetworkstx.com/ied-what-is-ied.aspx

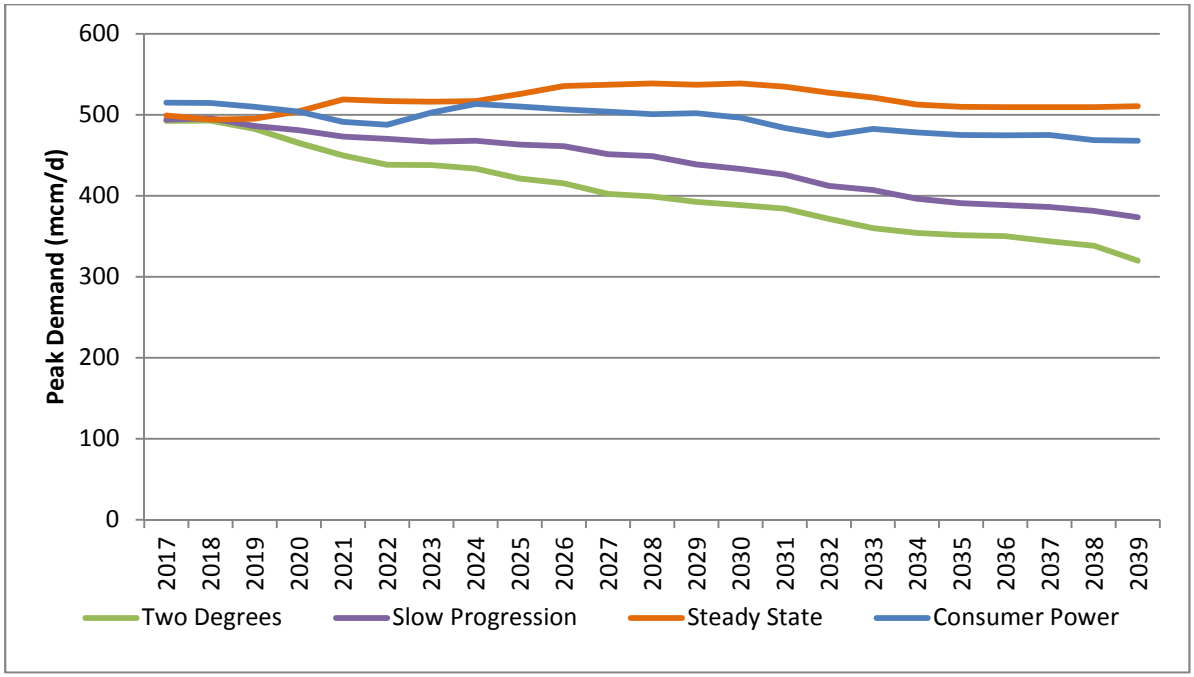

Figure 5.1: FES 2017 - Peak Gas National Demand

Even with the Two Degrees peak reduction the critical location of the Peterborough site means that it is likely to be required to provide compression capability beyond 2040. The site is ideally placed to respond to a wider range of supply and demand patterns in the future, particularly within day.

Bulk Transmission and Extremity Pressures

As was outlined in Chapter 3, Peterborough's predominant role is as a bulk transmission site, moving gas from the north, east and west into the southern part of the network. Network analysis based on FES gas years 2023 and 2035 indicate that without compression capability at Peterborough it is not possible to maintain the extremity pressures in the southern half of the network when national demand is above 280 mcm/d. This demand level is approximately 60% lower than a peak 1-in-20 demand day.

The 2017 FES indicates that the national seasonal demand range out to 2039 would mean that compression capability at Peterborough will be needed for bulk transmission of gas (Figure 5.2). The winter demand levels out to 2035 may even increase as gas-fired power generation continues to replace coal and will be relied on more heavily to fill any renewable generation gaps. This means the potential increased use of Peterborough compression during this period.

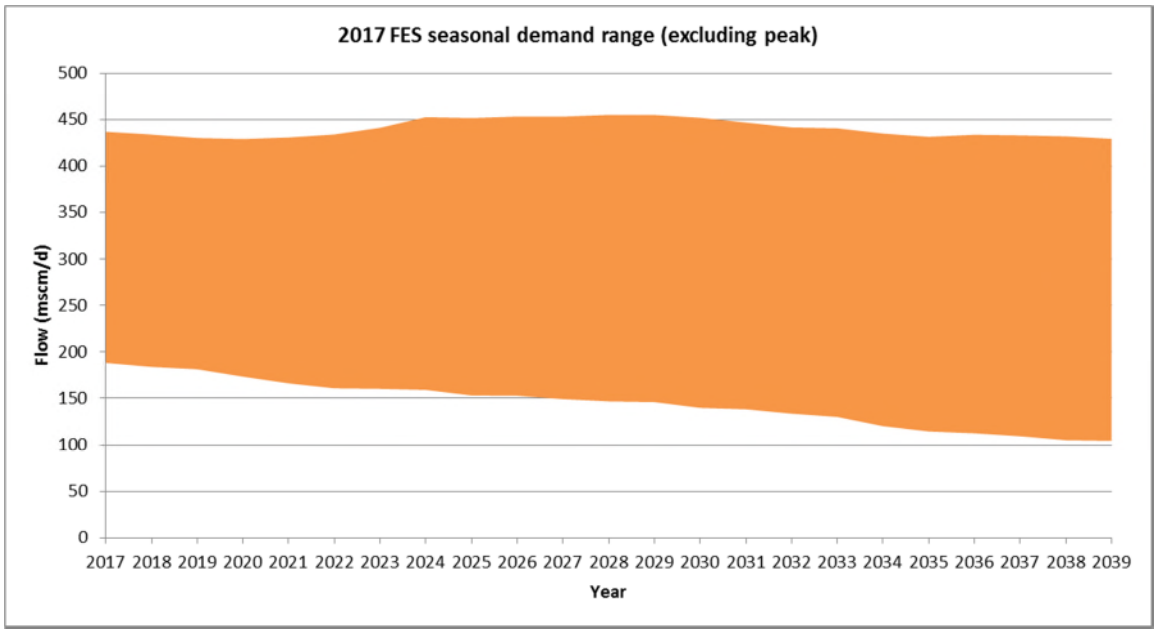

Figure 5.2: FES 2017 – Seasonal gas demand range excluding peak across all four scenarios

As was outlined in Table 3.2 in Chapter 3, Peterborough operated for on average 5,945 hours over the last six years. Figure 3.5 illustrated that a majority of the historic Peterborough run hours were when demand was above 250 mcm/d with a majority of these compressor hours being with two units run in parallel. Based on the FES demand levels there will be an ongoing need to maintain the sites capability to operate in parallel.

6 Options Considered

As outlined in the Chapter 4, although the new unit being installed as part of IPPC Phase 3 delivered a significant reduction in emissions as planned, Peterborough remained one of the highest NOx emitters on the network due to the ongoing requirement for parallel operation. Therefore additional options were assessed in 2014 to determine how to effectively further reduce emissions from site. All credible options considered must:

- comply with the IPPC / IED legislative requirements;
- minimise cost to the end consumer; and
- provide a robust long term solution for the NTS.

At Peterborough another element of IED was also taken into consideration in the options considered, the Medium Combustion Plant Directive (MCP), which in 2014 was only in draft form. This sets strict NOx emission limit values on all plant with a net thermal input <50MW, therefore all three of the current Avon units at Peterborough are affected by this directive. In 2014 the draft proposal stated that to comply with MCP all plant must either be replaced or abated to meet the NOx emission limit values by 31st December 2024. If this is not met the units must either be decommissioned or entered into the Emergency Use Derogation which will result in their use being limited to 500 operational hours per machine per annum on a five year rolling average basis. In late 2015, National Grid secured an extension on compressor unit compliance with MCP to 31st December 2029. This EU directive was transposed into UK law in 2018.

When these options were considered in 2014, emission abatement technology (e.g. selective catalytic reduction technology) was not proven as a viable alternative to new

compression on the NTS, therefore this was not considered as part of the optioneering process for this site. In 2015/16 this technology was assessed in more detail via the Network Innovation Allowance (NIA) SCR project. This project concluded in April 2017 and deemed that SCR may be viable at several of our compressor sites however by this point the Peterborough and Huntingdon projects had progressed into detailed design and the compressor units had already been ordered.

6.1 Assets

Eight asset options were considered for Peterborough compressor station as part of IPPC Phase 4, these are as follows. Where possible the options were designed to benefit from cost efficiencies which would be realised by bundling the IPPC phase 3 and 4 works together. This meant opportunities were identified to deliver the works in parallel using the same Main Works Contractor (MWC). All of the options include installing one new unit by 2020.

Options	Description	Reason for option choice
Option 0 (Counterfactual)	1 new unit by 2020 2 Avons decommissioned by 2023 1 Avon on 500hrs post 2030	Minimum intervention to comply with IPPC legislation to install one new unit to provide parallel compression capability at the site
Option 1a	1 new unit by 2020 1 new unit by 2030 3 Avons decommissioned by 2033	This option assesses the impact of installing a second new unit to replace the remaining Avon by 2030. The decommissioning of the existing units is postponed until the 2030s
Option 1b	1 new unit by 2020 2 Avons decommissioned by 2023 1 new unit by 2030 1 Avon decommissioned by 2033	This option assesses the impact on cost and capability of decommissioning the Avons in two batches
Option 2	1 new unit by 2020 Decommission all Avons by 2030	This option assesses the impact on capability of removing the capability provided by the third unit at the Peterborough site by 2030
Option 3	1 new unit by 2020 3 Avons on 500hrs post 2030	This option assesses the cost impact of maintaining the three existing units at the site
Option 4	1 new unit by 2020 Decommission all Avons by 2023	This option assesses the impact on capability of removing the capability provided by the third unit as soon as the new units are operationally accepted
Option 5	1 new electric unit by 2020 Decommission 2 Avons by 2023 1 Avon on 500hrs post 2030	This option is the same as option 0 but proposes the installation of one new electric unit instead of gas
Option 6	2 new units by 2020 Decommission all Avons by 2023	This option assesses the viability of installing two new units as soon as possible at the site

Table 6.1: Asset option summary

Option 5, the electric unit, was discounted at the optioneering stage for Peterborough. In order to provide a 132 kV supply to the site the line would need to cross the East Coast main line and the A1 which was estimated to cost between £8 – 10m. It would require a Supergrid transformer to be installed to support the connection which would significantly add to the connection cost. There was also insufficient space on site to accommodate the transformer and associated switchyard. The high cost and constrained site meant this option was not suitable for this site.

6.2 Rules and Tools

As the main driver to do something at Peterborough is the IPPC legislation, which aims to significantly reduce emissions from the site, there was only one viable contractual solution considered for Peterborough. No other appropriate commercial or regulatory options were

deemed suitable alternatives to an asset solution to mitigate the risk of constraints. The section below considers measures from 2021 onwards.

Turn up and turn down contracts for constraint management

Bi-lateral contractual arrangements at either entry or exit points can be used to manage network flows to prevent constraints. This option was considered viable for Peterborough as a turn up contract could be implemented to provide gas in the South East as an alternative to additional compression capability at the site particularly for 1-in-20 peak compliance.

Network analysis was completed to assess the contractual turn up volume that would be required based on the asset options considered in the previous section. The level of contract (high, medium, low) has been determined by the probability of the maximum volume required.

The contractual prices calculated are based on current Operating Margin tenders. This approach does not take into account a potential escalation in contract prices that might be expected if high levels of constraint are experienced.

Options 2 and 4 require a medium level contract to manage constraints in the South East. These options propose decommissioning all of the Avons on site which would result in a reduction in site capability. In addition Option 0 would require a medium contract, this option proposes decommissioning two of the Avons with the remaining unit limited to 500 hours from 2030. Given the high utilisation of the site this would also result in a reduction in capability. Contracts of this type have not typically been a core part of our compressor strategy so inherently these medium contracting levels introduce a higher degree of uncertainty and risk than the asset based solutions.

7 2014 Option Evaluation

In 2015, we proposed installing two additional units at Peterborough as part of IPPC Phase 4 (which is option 6 in this business case). This proposal was presented to and supported by our stakeholders as part of our May 2015 reopener engagement process. Based on Ofgem's feedback in September 2015 we have progressed with a minimum intervention solution for the site and continued to evolve our cost benefit analysis (CBA) approach. In addition, clarity on the implementation date for compliance with MCP was provided in late 2015 which has impacted upon the option analysis for this site.

All of the asset and contractual options considered in 2014, as described in the previous section, were run through our latest cost benefit analysis (CBA) assessment approach as part of our preparation for the May 2018 reopener submission. These options were adapted to reflect the later compliance date for MCP.

Option 0 has been defined as the counterfactual as this is effectively the do minimum option which ensures that we are compliant with IPPC. The aim of the CBA assessment is to ensure the identification of an optimal solution that balances option cost versus network operability, environmental and end consumer impact.

7.1 Constraint and Contracting Costs

For the CBA, when assessing the costs of constraints, the supply points are used to resolve the constraints through established methods to calculate volumes and costs. At supply

points, current constraint management actions include NTS Entry Capacity buybacks (prompts, forwards or options) and locational sells. Each action has an assumed cost associated with it and this is reflected in our model. Due to the location of the constraints in the Peterborough analysis, constraints have been resolved with the use of supply turn-up for Options 0, 2 and 4. All constraints have been costed as a locational buy with an associated locational sell. The cost of a buy, at a premium to the NBP on the day, is consistent with the action price of the contract. The locational sell, at a discount to NBP, ensures the network remains balanced.

7.2 Net Present Value

The CBA assessment uses the Spackman methodology to calculate the present value for each of the asset options being considered for Peterborough compressor station. This method uses the weighted average cost of capital (WACC) to calculate the cost of capital investments, these are then amortised over the full assessment period. All the costs and benefits are then discounted using the social time preference rate (STPR) to allow comparison of costs and benefits being accrued during different time periods. The total of these present values results in the Net Present Value (NPV) for each option as outlined in the chart below. The CBA assessment is over a 45 year period and the price base is 2017/18. All of the costs and benefits are calculated for the first 30 years, and then discounted over a 45 year period in accordance with the RAV (Regulatory Asset Value).

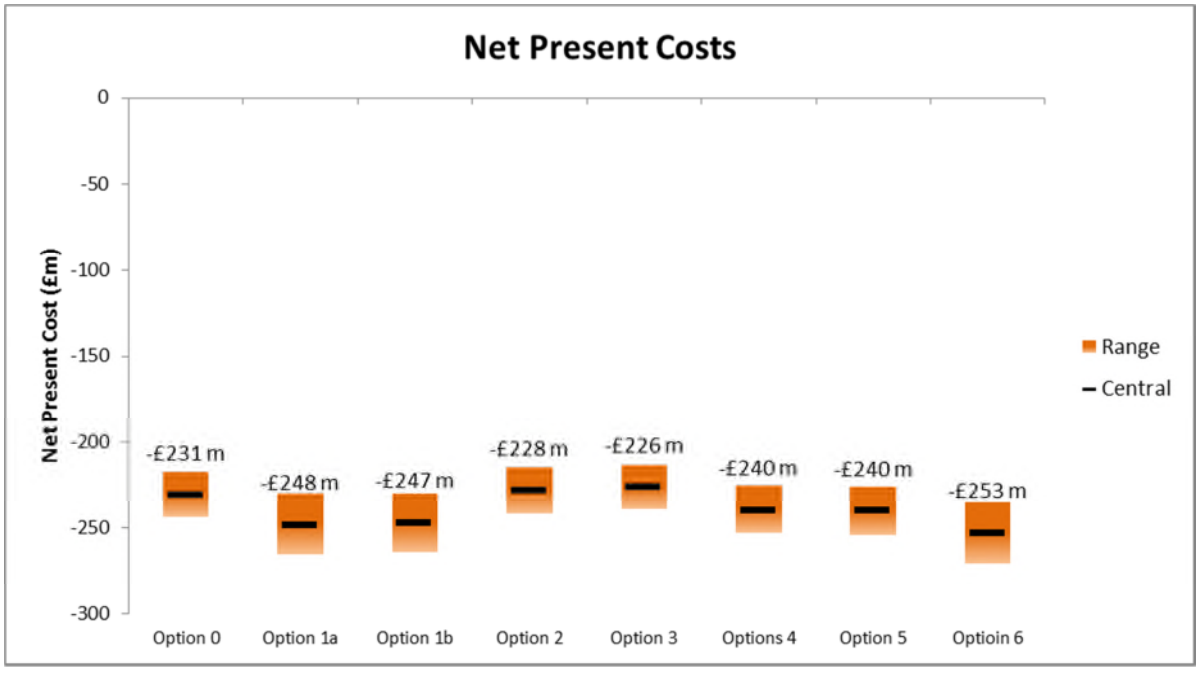

Figure 7.1: Net Present Value for all of the options considered for Peterborough

The NPV for each option is then compared against the Counterfactual (Option 0) and a Monte Carlo assessment is performed to produce a relative NPV, this indicates which of the options provide the greatest benefit to the consumer. As the elements used in this calculation are subject to cost uncertainty e.g. investment and fuel, there are upper and lower ranges to the NPV representing the 5th percentile and 95th percentile NPV.

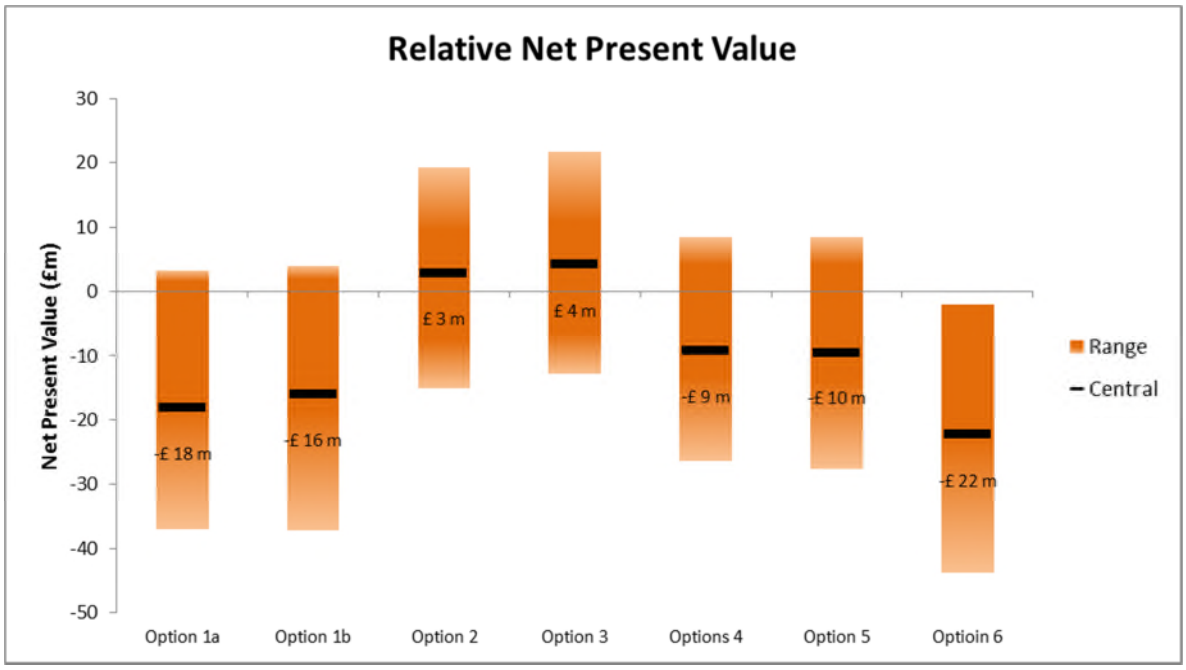

Figure 7.2: Relative net present value for all of the options considered for Peterborough compared to the counterfactual

Options 2 and 3 result in slightly positive NPV compared to the counterfactual. With the upper range of all but option 6 would produce a positive relative NPV, however the range of these option NPVs are significant which suggests a high level of uncertainty in the cost range for these options.

Options 2 and 4 have the lowest investment and asset health costs when compared to the other options. However as these options involve the decommissioning of all three of the Avons, this leads to a lower compression capability level at Peterborough which results in an increased risk of constraints. To manage the risk of constraints, particularly associated with meeting 1-in-20 peak demand, both of these options require a turn up contract to ensure compliance.

Option 0 retains a single Avon on a 500 hour EUD, due to the high utilisation of the site this options also increases the risk of meeting 1-in-20 peak demand and would require a turn up contract. Option 3 retains all three Avons on a 500 hour EUD, this avoids the requirement for a contract but incurs higher asset health costs.

Options 1a, 1b, and 6 provide the highest compression capability but the higher investment costs make these less favourable options from a cost perspective.

The biggest difference between the options is the level of investment on site and the level of contracting requirement. While fuel usage is a significant cost for all options there is little difference between them.

7.3 Emissions

In order to calculate emissions, we have developed a method which applies the forecast station run hours across all options to allow for a comparison between the different compressor technologies in use for each option. While this does not account for occasions where run hours would be reduced due to low availability, this has a minor impact on

emissions and is accounted for in the constraints/contract costs. The split of compressor unit run hours are determined by the following principals:

- compliant units (DLE/Electric) are run in preference of non-compliant units by 2021;
- to allow flexibility with outages, in the options where the Avons are available, they are used, but sparingly beyond 2021 (<400 hours per annum);
- beyond 2030 any restricted Avon units (on 500 hours EUD) are limited to cover for emergencies only so have minimal run hours (<200 hours per annum).

All of the options considered result in a significant reduction of NOx as a majority of the run hours are allocated to the lowest emission units at the site.

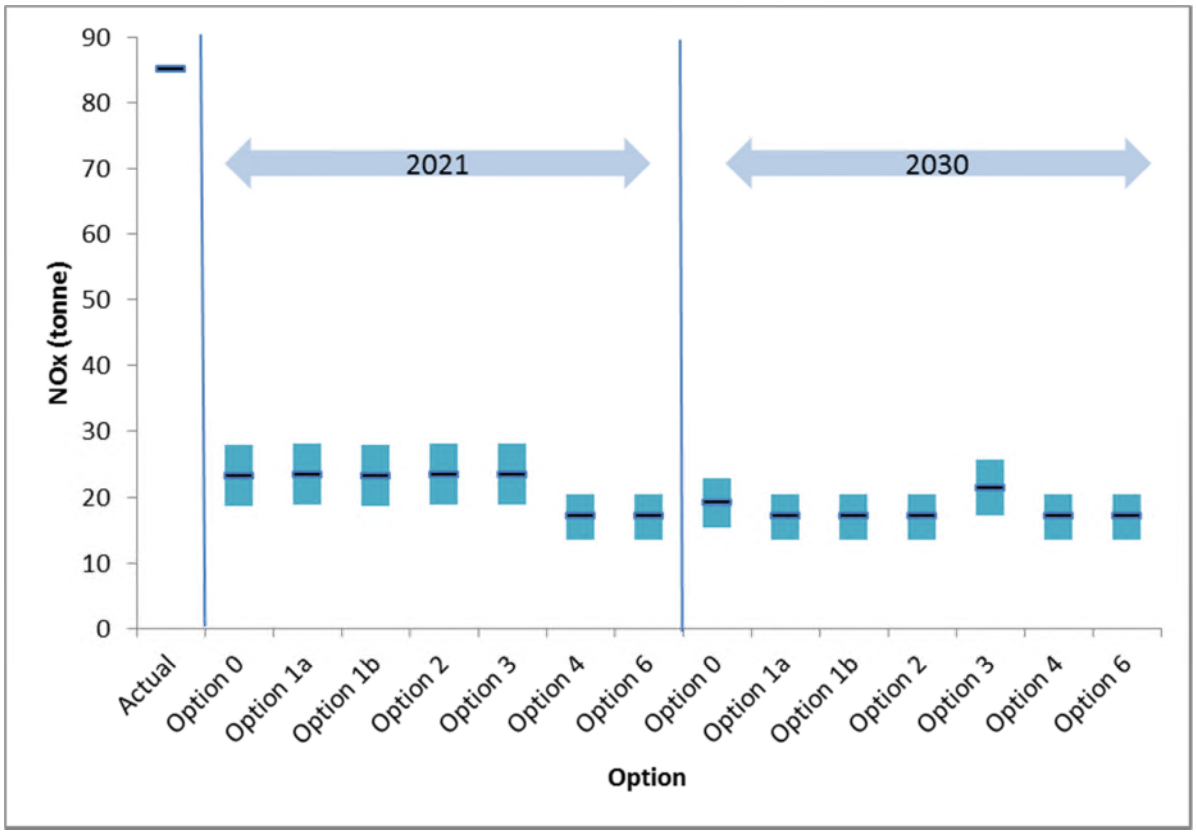

Figure 7.3: NOx emissions

In 2021 there is minimal difference in the NOx emission reductions between Options 0, 1a, 1b, 2 and 3 as they will all result in a similar station configuration by 2021 with one new DLE unit as part of IPPC Phase 4 in addition to the one new unit already being delivered as part of the Phase 3 works.

Options 4 and 6, the one new unit and two new DLE unit options offer the biggest decrease in NOx emissions at the site as they propose decommissioning all three Avons on site by 2023 so they would no longer be operational in 2021. By decommissioning all of the Avons, Option 4 would increase the risk of a capability shortfall at the site, particularly under 1-in-20 conditions, so a contract would be required to prevent constraints in the south east.

In Option 3, the three Avons on site are maintained on 500 hours EUD beyond 2030 which means that there is a minimal change in emissions in this option across the time horizons assessed.

In 2030, there is a further reduction in NOx emissions across all of the Options as the existing Avons are either largely decommissioned or are limited to a 500 hour rolling derogation so their use would be restricted to emergency use only.

7.4 CBA Summary

The latest CBA assessment of the IPPC Phase 4 options considered in 2014 has identified that Option 3 is the most appropriate option for the Peterborough site as it offers the most favourable NPV and the greatest consumer benefit. This option ensures compliance with IPPC as the DLE unit is a BAT solution which will significantly reduce the NOx emissions associated with two units operating in parallel on site. This option has no impact on site capability which means it can continue to maintain pressures in the south east and south west during winter and peak demand conditions for the foreseeable future.

While Options 0 and 2 both have similar NPVs these options would decommission the existing Avons on site and therefore close off the option of placing these on a 500 hour EUD in 2030, which may be the most efficient long term option.

In our May 2015 reopener submission we proposed installing two DLE units as part of IPPC phase 4, Option 6, at Peterborough. The reasoning behind this decision was the initial draft of the MCP legislation indicated that we would have to ensure our affected compressor fleet are compliant with this legislation by 2025 or enter them onto the 500 hour rolling average derogation. In September 2015 we successfully lobbied the European Parliament to extend the date for MCP compliance to 2030 for our affected compressor fleet. Once this was ratified we reviewed our compressor options at Peterborough and reduced the number of units that needed to be installed at this stage. Further assessments will take place as part of the RIIO-T2 business plan to assess if any additional works are required to comply with MCP at the Peterborough site.

8 Conclusion

As part of IPPC Phase 4 a new DLE machine will be installed and commissioned by 2021. This option ensures compliance with IPPC as the new unit will significantly reduce the NOx emissions associated with two units operating in parallel on site. This option has no impact on site capability which means it can continue to maintain pressures in the south east and south west during winter and peak demand conditions for the foreseeable future. A further assessment will take place as part of the RIIO-T2 business plan to determine if any further works are required to comply with MCP at the Peterborough site.

Funding Request Summary (09/10 price base)

The Peterborough funding request is between £20-40m.

RIIO-T1 Output - To install one new unit at Peterborough by the end of RIIO-T1 in accordance with IPPC Phase 4 requirements.