

Warrington IED Business Case

May 2018

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1 Executive Summary

Warrington compressor station, constructed in 1984, has two identical gas turbine driven compressor units designed to operate independently of each other. The units are affected by the Large Combustion Plant (LCP) elements of the Industrial Emissions Directive (IED) as the nitrogen (NO_x) and carbon monoxide (CO) emission limit values from the units are outside permitted levels.

The station was primarily designed to facilitate Barrow and St Fergus entry by moving large volumes of gas into the south. Since the commissioning of the trans-pennine pipeline between Pannal and Nether Kellet in 2007, Warrington's use has reduced significantly with the station being run for on average 34 hours per year over the last five years. The units are now primarily being used:

- to provide network resilience during planned and unplanned outages at Carnforth, Nether Kellet, Alrewas and Avonbridge compressor stations;
- to facilitate maintenance; and
- to support of entry flows from St Fergus and Barrow.

As part of our May 2015 reopener submission we actively engaged with our stakeholders to get their input into our future compressor strategy. We received stakeholder support in 2015 to make use of the available derogations to comply with LCP. In January 2016, both units were placed on a 500 hour Emergency Use Derogation to maintain network resilience and flexibility for our customers in such an uncertain gas market.

We have continued to review the longer term need of the two units at this station balancing unit asset health costs against the resilience provided by the station. Potential future market developments were also assessed to understand if Warrington would provide future resilience and flexibility for our customers should these changes materialise. Developments such as shale gas in the north-west, entry supply increases to baseline and increases in north-west storage requirements were considered alongside our Future Energy Scenarios. This assessment indicated that the Warrington station may not be ideally located to deal with these future changes and the size of the existing units meant that the station would only be of use for higher flow conditions.

Three options were evaluated for this station:

- **Option 0** – Keep both units on 500 hours EUD for the foreseeable future
- **Option 1** – Decommission the compressor station within RIIO-T1
- **Option 2** – Decommission the compressor station in 2024

We presented all options considered for the station, along with the costs, to our stakeholders as part of our March 2018 consultation. We received one formal response in support of Option 2 to decommission the compressor station. In the stakeholder engagement sessions held in late 2017 our stakeholders were broadly supportive of decommissioning ageing units where it was no longer economic to continue to maintain them. Their main concern related to ensuring that any options considered would not compromise customer flexibility or network resilience longer term.

In assessing the options for this compressor station, we have taken our stakeholder's feedback into account, in addition to the long term expenditure required to maintain these ageing assets and the historic, current and forecast future use of this station. We have considered the suitability of the size of the existing units in relation to our current view of the

future flows forecast on the network. This highlighted that this station would have a limited ability to support potential future developments on the network. Therefore the least worst regrets option for Warrington is to decommission the compressor station in RIIO-T1.

Decommissioning a compressor station is a difficult decision to make however when all future risks are considered in Warrington's case there are several alternative compressor stations which provide a sufficient level of network resilience without Warrington. Therefore it is a more economically efficient decision to decommission the station in RIIO-T1 as this will reduce the ongoing cost on consumer bills for this station. The decommissioning costs form our May 2018 reopener funding request to Ofgem.

Funding Request Summary (09/10 price base)

The Warrington funding request is less than £10m.

RIIO-T1 Output - To decommission the compressor station at Warrington by the end of RIIO-T1.

2 Introduction

Warrington compressor station is located in a rural location near the town of Warrington. The station has two gas turbine driven compressor units; both were commissioned in 1984 to provide network compression to move large volumes of gas from Scotland and the entry terminal at Barrow south.

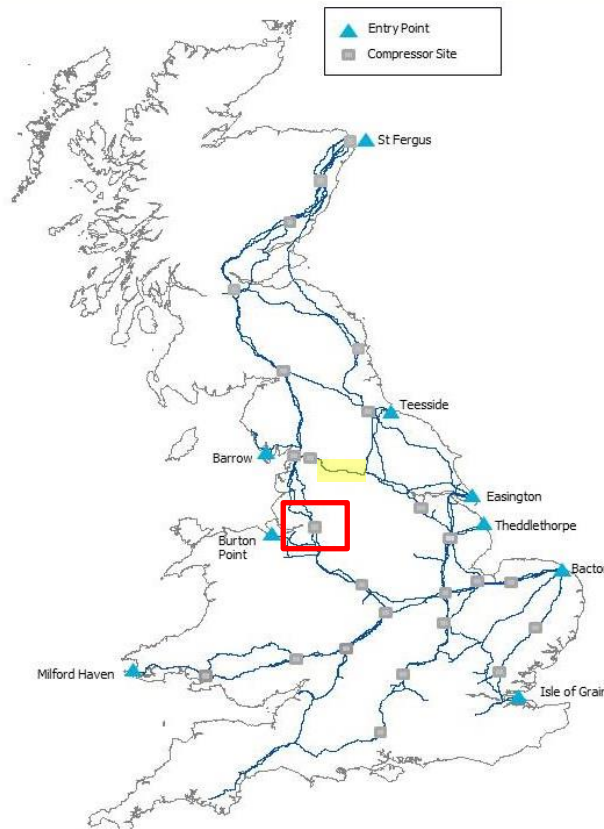


Figure 2.1: Warrington Compressor Station location marked in red, Pannal to Nether Kellet pipeline highlighted in yellow

The use of compression at Warrington has notably reduced since 2008, with the two gas compressor units being run for a combined average of 34 hours per year over the last five years. The main reason for this decline in use has been the commissioning of the trans-Pennine pipeline between Pannal and Nether Kellet at the end of 2007 which meant that compression at Carnforth and Nether Kellet was more ideally positioned to compress gas flows. Historically Warrington had been used to support entry flows from Barrow, however flows have continued to steadily decline since 2002.

The two gas compressor units at Warrington compressor station are currently affected by the regulatory requirements of the Large Combustion Plant (LCP) element of the Industrial Emissions Directive (IED). These regulations require us to comply with limits on the gaseous emissions to atmosphere of oxides of nitrogen (NO_x) and carbon monoxide (CO) to manage local air quality. See our IED Overarching Document for more detail about the IED legislation and its impact on our compressor fleet.

As part of our May 2015 reopener we actively engaged with our stakeholders to incorporate their views into our future compressor strategy¹. We received stakeholder support to make use of the derogations available as part of IED rather than decommissioning stations. Stakeholders felt that keeping compression available using derogations offered more flexibility in such an uncertain gas market. Therefore to comply with LCP, the two compressor units at Warrington were entered onto 500 hour Emergency Use Derogation (EUD) in January 2016. The EUD means that each unit is restricted to operating for less than 500 hours per year; and this restriction on running hours means they are exempt from the LCP emission limit values.

This business case assesses if there is an ongoing need for compression at Warrington and details all credible options considered for this station. Further stakeholder engagement as part of the May 2018 reopener submission summarised the options considered and gauged stakeholder opinion on the future of the Warrington compression.

3 The site: Assets and Operation

3.1 Current Site

Warrington compressor station was constructed and commissioned in 1984 with two identical Rolls Royce RB211 gas turbine driven compressor units (A and B). The units were designed to be operated singly and there is no parallel or series configuration capability at the station as this was not required when the station was originally designed.

There is an above ground installation (AGI) and a multi-junction located within the boundary of the compressor station fencing. There is an ongoing need for both the AGI and multi-junction so the site would still be required even if there was no compression capability at the site.

3.2 Current Asset Condition

Both gas compressor units were installed in 1984 and are approaching their technical asset life of 40 years. The age of the station and assets mean that there are asset condition and obsolescence issues that need to be addressed to ensure continued reliability, safety and environmental compliance at the station. The cost and effectiveness of the various maintenance, repair and replacement options for the compressor assets impact the large items that make up the machinery train (gas turbine, power turbine, gas compressor) but also ancillary systems including the compressor wet gas seals and the auxiliary systems such as the cab infrastructure, cab ventilation systems, exhaust stack and control systems.

3.3 Current Operation

Warrington compressor station was originally designed to provide network compression to move gas from Scotland and the entry terminal at Barrow south. The units installed were sized to deal with moving large volumes of gas south.

¹ <http://www.talkingnetworkstx.com/ied-what-is-ied.aspx>

The station was originally designed to facilitate baseline entry flows from Barrow and St Fergus. It is now predominantly used to provide operational resilience to Carnforth, Nether Kellet and Alrewas compressor stations.

It has also been used:

- to provide very occasional resilience to Avonbridge when Kirriemuir and Moffat are also unavailable / on outage;
- to facilitate maintenance; and
- to support entry flows from St Fergus and Barrow.

Warrington compressor station use has declined in recent years; the following table provides a summary of running hours for the last 12 years.

	Individual Unit Running Hours (<i>financial year</i>)											
	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Unit A	471	1340	144	61	9	27	5	10	28	7	14	60
Unit B	90	23	5	0	12	33	5	7	15	8	8	14
Total	561	1363	149	61	21	60	10	17	43	15	22	74

Table 3.1: Warrington Historic Running Hours

The run hours on the units at Warrington have tapered off since the commissioning of the trans-Pennine pipeline between Pannal and Nether Kellet at the end of 2007. Since this pipeline was commissioned usage at both Carnforth and Nether Kellet (both approximately 100km to the north) has notably increased (see Figure 3.3). The mix of larger units at Carnforth and smaller units at Nether Kellet provides more operational flexibility against the wider range of gas flows we are seeing on the network.

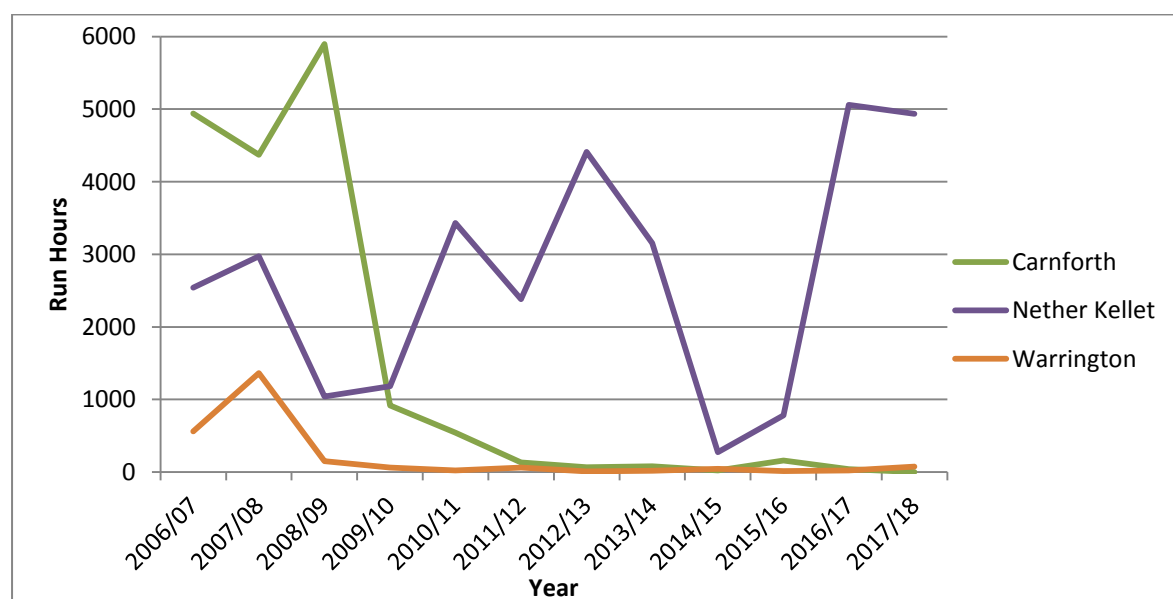


Figure 3.1: Compressor Station Run Hours (financial year)

The run hours at Warrington have been consistently low with a majority of the run hours seen in January or September between 2012 and 2017 (see Figure 3.4). The hours in January have predominantly been to provide short term resilience during outage periods at upstream or downstream compressors. The run hours in September have mainly been to facilitate emissions testing at the station. The higher run hours seen in May 2014 were to facilitate one-off maintenance on one of the Feeders in close proximity to the station. The highest run hours were seen more recently between July and November 2017. This higher usage coincided with higher entry flows in the northern half of the country along with a series of planned and unplanned outages at compression stations upstream which meant that Warrington was used to provide network resilience. Works are ongoing at the upstream compressor stations at Aberdeen, Kirriemuir and Avonbridge to improve resilience so the likelihood of a repeat of this scenario is low.

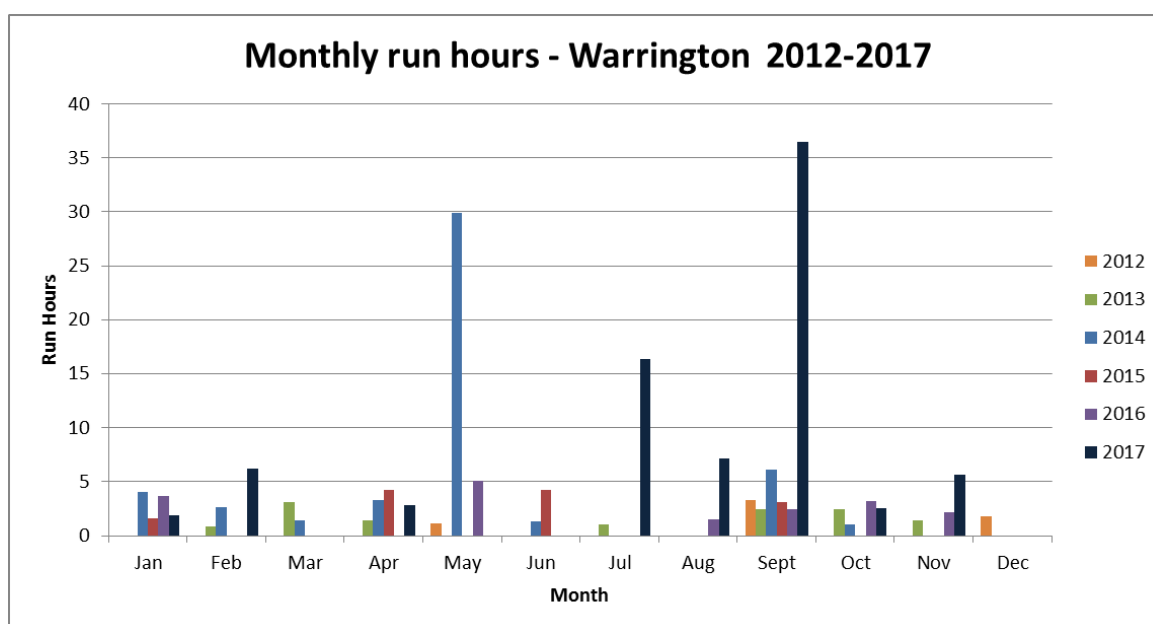


Figure 3.2: Monthly Run Hours for Warrington Compressor Station (2012-2017)

4 Emissions and the impact of IED

Prior to our May 2015 reopener submission we engaged with stakeholders from across the energy industry to capture their views on our future compressor strategy. We received stakeholder support in 2015 to make use of the available derogations to comply with LCP.

In January 2016 a decision had to be made at Warrington as the two compressor units were not compliant with the LCP element of IED. Based on the low usage of the station, the decision was made to put both units on 500 hour EUD to comply with the LCP element of IED. This would ensure that the station was still available to provide resilience in the event of an outage at Avonbridge, Carnforth, Nether Kellet or Alrewas compressor stations.

5 Future Operational Requirements

There have been no recent market signals which would indicate an increased need for the use of Warrington in the near future. Therefore the assumption is that the station will run for no more than 100 run hours per year for the foreseeable future, well within the 500 hour EUD per machine restriction currently in place.

5.1 Future Risks

The potential future need is a consideration at any compressor station, to avoid the cost and time impact on consumers of reversing a decision, however there is an additional factor to consider at Warrington. Since the Warrington compression was constructed, the surrounding area has been designated as a clean air zone. As the compressor station pre-existed the designation, Warrington has been able to continue to receive environmental permits to operate. If the existing compression was to be decommissioned the current permits would be withdrawn and could not legally be re-issued in the future. In the event of any subsequent need to re-commission the station, only electrically driven compression could be installed.

Supply and demand changes

A number of future risks to supply and demand have been identified, the likelihood of each risk occurring and the consequence of Warrington compression not being in place are outlined in the table below:

Risk	Likelihood	Consequence	Comment
Shale gas supply in the north-west (Consumer Power FES indicates that there could be up to 32 bcm/year shale gas supply by 2031)	Medium	Low	Carnforth and Nether Kellet are more appropriately located and sized on the west coast should shale gas connect to the NTS
Supply at Fleetwood entry point (350 GWh/day (approximately 32 mcm/d) sold capacity for one quarter in 2025)	Medium	Low	Carnforth and Nether Kellet are more appropriately located and sized to deal with supply flows from Fleetwood
LNG supply at Barrow	Low	Low	Carnforth and Nether Kellet are more appropriately located and sized to deal with supply flows from Barrow
Significant increase in supply flows at St Fergus (above and beyond FES)	Low	Low	Moffat and Carnforth are more ideally located to move gas out of Scotland. Significant number of alternative compressor stations in Scotland now
Change in storage requirements in the north-west	Medium	Low	Carnforth and Nether Kellet to the north and Alrewas to the south are more appropriately placed to support changes in north-west storage site requirements

Table 5.1: Summary of risks

Under the majority of scenarios above the units at Warrington are not ideally located and the current units are likely to be too large to cope with anything other than high flow scenarios. Depending on the timing, size and location of the above supply and demand changes modifications in other compressor locations, such as Moffat, Carnforth and Nether Kellet, would provide a more suitable solution.

IED Phase 2 works

Options being considered for Carnforth and Nether Kellet² as part of the IED Phase 2 programme of works may result in an increased need for Warrington whilst these stations are on extended outage. Between Avonbridge to the north and Alrewas to the south there is a 400km stretch of pipeline with Moffat, Carnforth, Nether Kellet and Warrington distributed in between. If both Carnforth and Nether Kellet are unavailable, alternative compression would be required to move gas down the west coast. Warrington could provide this capability during periods of outage. However the large size of the units may mean that during periods of low flow it may be difficult to use the compression on site. Moffat, the station to the north of Carnforth and Nether Kellet, is more appropriately located on the network to provide this capability and so would be the station of preference to provide resilience while these works are ongoing.

6 Options Considered

As we outlined in Chapter 3, the use of the compression at Warrington has notably reduced since 2008. Based on the current FES, Warrington is no longer required to support entry flows.

The station is ideally located to provide resilience to Carnforth, Nether Kellet and Alrewas compressor stations which is why both units were placed on 500 hour emergency use derogation in 2016. The decision to retain both units for resilience purposes longer term needs to be balanced against asset health costs associated with ageing units.

A range of options were considered for the station to compare against maintaining the status quo of retaining both units on 500 hours.

All credible options considered must:

- comply with emission legislation,
- minimise cost to the end consumer and
- provide a robust long term solution for the NTS.

6.1 Commercial Options

Several commercial options were assessed to see if they would be suitable alternatives to compression capability at Warrington.

Reduce Obligated Baselines

The obligated entry capacity levels at specific entry points are used to inform our network investment decision making process. Where baselines are significantly higher than the peak physical flows seen via a supply point, this creates uncertainty in the level of investment required. This option could reduce obligated levels at all entry points in the North-West to more closely align with sold capacity. In August 2017, obligated levels were reduced by Ofgem at Fleetwood from 650 GWh/day to 350 GWh/day following an industry consultation. Additional changes of this type would have limited influence on Warrington as its future requirement is predominantly for resilience. Therefore this option has been discounted, although there is a potential increase in constraint risk if the baselines are not reduced.

² Carnforth and Nether Kellet due to their close proximity are essentially viewed as the same site from an operational point of view

Turn up and turn down contracts for constraint management

Bi-lateral contractual arrangements at either entry (e.g. LNG) or exit points (e.g. power stations or industrial customers) can be used to manage network flows to prevent constraints. The low level of expected run hours at Warrington and the interdependencies with the other west coast compressors mean this approach would not be a particularly cost effective alternative, and is therefore not taken forward.

Constraint management scheme

As an alternative to an asset solution at Warrington, we have considered if a capacity buy back “Option Agreement” or “Forward Agreement” would be an appropriate way of managing the risk of future constraints.

To date historic flows have been well below the baseline at St Fergus and Barrow so these Agreements would not be appropriate alternatives for Warrington. There is still unsold capacity in the short term auctions for St Fergus and Barrow so any constraint caused by a reduction in capability would be more appropriately managed using other commercial tools such as day-ahead and on-the-day firm capacity restrictions. Also, an Option/Forward Agreement does not mean that there would be a guaranteed turn down of flows. A Shipper could continue to flow without capacity entitlements if they choose to take the risk in doing so, or could purchase interruptible capacity if this is available to them. Therefore constraint management agreements have not been taken forward.

6.2 Asset Options

The asset options considered for Warrington compressor station are as follows:

- **Option 0** – Keep the station as-is with both units on 500 hours EUD for the foreseeable future
- **Option 1** – Decommission the compressor station within RIIO-T1
- **Option 2** – Decommission the compressor station in 2024

Option 0 – Keep the station as-is (counterfactual)

This option is maintaining the status quo at the station by keeping both units on 500 hour EUD for the foreseeable future. This option represents the minimum intervention required to ensure compliance with the IED legislation. The predominant cost associated with this option relates to the asset health spend required to maintain the compressor units to keep them running for the foreseeable future.

This option offers future flexibility at the station as the environmental permit would be retained therefore should any of the future risks around supply or demand manifest themselves this option would keep this station operational and available for future adaptations if required. This option also ensures that this station remains available to provide resilience for the surrounding compressor fleet and could facilitate future maintenance in and around this area. This option was taken forward into the Cost Benefit Analysis (CBA) as the counterfactual.

Option 1 – Decommissioning the compressor station within RIIO-T1

This option proposes decommissioning the compressor station within RIIO-T1. This would remove the ongoing maintenance costs associated with the ageing plant. Based on the

latest outage plan available for the network the decommissioning works can be accommodated within the RIIO-T1 period. Decommissioning of both units will take two years, with 30% of the work expected to be completed in year one and 70% in year two. In 2015, we commissioned an external party to assess what would be required to decommission the Warrington compressor station. This cost has been used to inform this options development.

This option removes the possibility of future flexibility being provided by the station as all compression capability at the station will be decommissioned within the RIIO-T1 period. In section 5.1, we outlined that Moffat, Carnforth and Nether Kellet provide sufficient network compression so this option would not compromise network resilience. This option was taken forward into the CBA.

The site would still be required as the AGI and multi-junction capability would be retained on site.

Option 2 – Decommissioning the compressor station in 2024

This option proposes decommissioning the Warrington compressor station in 2024. The two existing RB211s would be maintained until 2023 and then the station would be decommissioned in 2024. This option would maintain resilience for the surrounding compressor fleet for several more years before decommissioning.

As with Option 1, the site would still be required as the AGI and multi-junction capability would be retained on site.

6.3 Summary of options taken forward

Options 0, 1 and 2 were taken forward to the cost benefit analysis stage. The table below illustrates the capex costs associated with each of the options out to 2035.

Option	T1 funding request (£m)	Forecast T1 Capex (£m)	Forecast Capex 2021/22 to 2034/35 (£m)	Total (£m)
Option 0	<10	<10	20-30	<40
Option 1	<10	<10	0	<10
Option 2	<10	<10	<10	10-20

Table 6.1: Warrington option cost summary

7 Option Evaluation

Of the options taken forward to the cost benefit analysis (CBA) assessment, Option 0 has been defined as the counterfactual as this is effectively the Do Minimum option. This option ensures that we remain compliant with IED and provides network resilience to surrounding compressor stations.

A high level CBA has been undertaken using the Spackman methodology to calculate the present value for each of the three asset options being considered for Warrington 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).

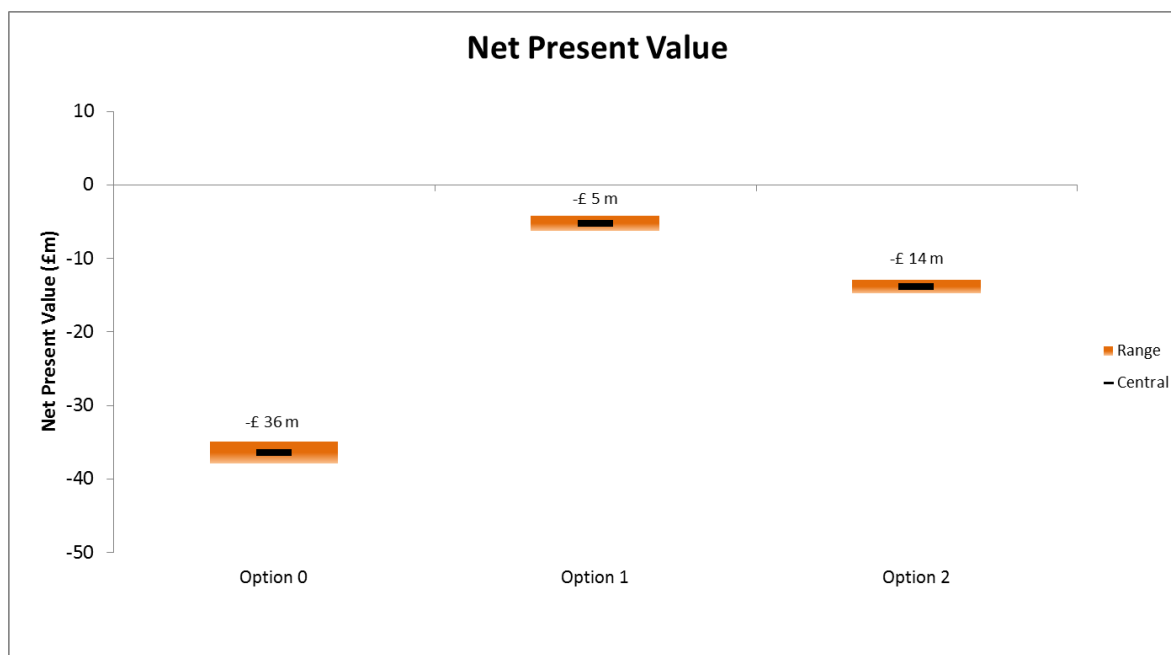


Figure 7.1: Net present value for all of the options considered for Warrington

The relative NPV for Options 1 and 2 when compared to Option 0 is as follows; for Option 1 it is +£31m and for Option 2 it is +£23m. This indicates that Option 1 is the most favourable option from a cost perspective however the benefits provided by the station e.g. resilience are not quantified in this assessment. However Option 1 would remove the need for ongoing maintenance on ageing compressor units on site which is forecast to continue even with the low future running hour requirements. Option 1 is significantly lower cost than the other options considered for the station. Option 2 is the next lowest cost option (+£9.7m) which would provide system resilience out to 2024 and would maintain future flexibility in the short term. However there is a significant amount of asset health spend required to keep both compressor units going until 2024.

We presented all options considered for the station, along with the costs, to our stakeholders as part of our March 2018 consultation. We received one formal response in support of Option 2 to decommission the compressor station. In the stakeholder engagement sessions held in late 2017 our stakeholders were broadly supportive of decommissioning ageing units where it was no longer economic to continue to maintain them. Their main concern related to ensuring that any options considered would not compromise customer flexibility or network resilience longer term.

8 Conclusion

The use of compression at Warrington compressor station has continued to fall over the last ten years. Both compressor units are currently on 500 hour EUD in order to comply with the

LCP element of IED. The decision to retain both units for resilience purposes longer term was balanced against ongoing asset health costs as part of the cost benefit analysis.

In assessing the options for this compressor station, we have taken our stakeholder's feedback into account, in addition to the long term expenditure required to maintain these ageing assets and the historic, current and forecast future use of this station. We have considered the suitability of the size of the existing units in relation to our current view of the future flows forecast on the network. This highlighted that this station would have a limited ability to support potential future developments on the network. Therefore the least worst regrets option for Warrington is to decommission the compressor station in RIIO-T1.

Decommissioning a compressor station is a difficult decision to make, however when all future risks are considered in Warrington's case there are several alternative compressor stations which provide a sufficient level of network resilience without Warrington. Therefore it is a more economically efficient decision to decommission the station in RIIO-T1 as this will reduce the ongoing cost on consumer bills for this station. The decommissioning costs form our May 2018 reopener funding request to Ofgem.

Funding Request Summary (09/10 price base)

The Warrington funding request is less than £10m.

RIIO-T1 Output - To decommission the compressor station at Warrington by the end of RIIO-T1.

Next Steps

For Warrington our next steps are to sanction the decommissioning works. This is currently planned for the July 2018 Investment cycle, with the works currently being scheduled to start in late 2018 based on the latest outage plan. The works will take up to 18 months to complete with completion expected in 2020.