



RUNE Associates

Milford Haven Pipeline Project
Efficiency Review Report by
Rune Associates/Penspen

Ofgem

March/April 2015

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REDACTED VERSION:

Contractor A, B, C etc. names have been anonymised

 **Redacted text**

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REVISION AND AUTHORISATION RECORD

Rev	Date	Description	By	Chkd	PM
1	29/4/2015	Final report for Ofgem	AM/MW	CFW	AM
0	20/4/2015	Final report for Ofgem review	AM/MW	CFW	AM

1.

EXECUTIVE SUMMARY – SUMMARY OF FINDINGS

Ofgem have contracted Rune Associates / Penspen to review the costs incurred by National Grid (NGT) in relation to the Milford Haven scheme and to review the efficiency of its delivery.

The Milford Haven pipeline project is the UK's largest new high-pressure gas pipeline linking the two Liquefied Natural Gas (LNG) terminals (Dragon and South Hook) at Milford Haven, Pembrokeshire with the UK gas transmission network at Tirley, Gloucestershire and includes:

- 320km of new 1200mm diameter pipeline with associated above ground installations (AGIs);
- a new compressor station at Felindre and new units plus modifications at two existing compressor stations, Churchover and Wormington;
- a major Pressure Reduction Installation (PRI) at Tirley and two smaller ones in the pipeline sections.

The works were constructed mainly between 2006 and 2012 at a cost in excess of £1.1bn which exceeded initial expenditure forecasts and allowances by a considerable margin.

The following summarizes the findings of the efficiency review,

- NGT undertook preliminary studies and developed a contract strategy prior to December 2004 to provide new pipeline capacity to connect with existing infrastructure and capable of providing 240GWh/day.
- As a result of the September 2004 Auction, NGT were obliged to provide 350GWh/day by October 2007 and proposed to provide this capacity over an extended pipeline construction period during 2006 and 2007 summer seasons (for the an initial capacity of up to 240GWh/day) and with the remainder deferred until the 2008 summer season.
- Such a strategy should have ensured that capacity was delivered in a cost efficient manner.
- The December 2004 Auction obliged NGT to provide much higher capacity than originally planned, namely 650GWh/day by October 2007 rising to 950GWh/day by January 2009.
- The timescale allowed to provide the additional capacity was further constrained when it became evident that NGT could not allow pipeline construction to extend into 2008 as was originally planned.
- NGT original contract strategy was adapted to meet the revised requirements.
- Preliminary design works (Stage I for the Milford Haven to Aberdulais pipeline) were undertaken by the appointed MWC, Contractor B. NGT sought to accelerate the preliminary design for the whole Milford Haven scheme by instructing Contractor B to perform this additional design work and in March 2005 apparently bowed to pressure exerted by the MWC for a renegotiated Option E cost reimbursable contract (to include also the Stage 2 design and construction works not yet formally awarded).
- The extent of the revised scope of the Milford Haven Scheme was not fully appreciated until July 2005. NGT had identified that the southerly route would take longer to build due to environmental issues and that the longer (and more expensive) northern pipeline route could potentially be constructed in one season.

- Between July and September 2005, NGT lost the opportunity to completely revise its contracting strategy.
- NGT could have rationalised the pipeline routing in the Carmarthen/Swansea/Brecon area with possible savings in the order of up to £100m as described in Section 4.2.2.
- The main Project Services contracts which included project management support, were awarded under a cost reimbursable Option E contract. This meant that there would have been little financial incentive for Contractor G, the relevant Project Services contractor, to recommend any shortening of the pipeline route,
- NGT could have also awarded the 200km northern route pipeline as three separate contracts. NGT had tendered 65km sections of southern route pipeline including Aberdulais to Llanvetherine in June 2005 and had three comparable bids on the table from three qualified contractors.
- Instead, NGT rejected two of the bids and awarded part of the northern route to the only contractor who would commit to construct 100km in one season.
- The remaining portion of the northern route was added to the scope of the MWC for Milford Haven to Aberdulais, Contractor B who was instructed to accelerate the initial 122km Milford Haven to Aberdulais pipeline to be completed in one season (2006) instead of two and then to complete the remaining 89km of the northern route the following season (2007).
- Contractor B had already negotiated for the future Stage II design and construction to be paid under a cost reimbursable Option E contract rather than using Option C target cost. This change naturally allowed costs to increase even if subject to a pain/gain mechanism where no further Fee mark-up was paid once costs exceeded an agreed sum.
- The NGT requirement for Contractor B to accelerate the Option E pipeline construction works facilitated further cost escalation.
- Possible overspend as a result of the lost opportunity to award the northern pipeline route to three separate contractors and avoid acceleration of the initial 122km pipeline construction is described in more detail in Sections 3.5 and 3.6. By simple comparison of MWC outturn cost/km, overspend of more than £100m could be attributed to this lost opportunity.

The magnitude of the potential cost savings as a result of the two lost opportunities identified in this report is considerable and could have accounted for up to £200m of the eventual outturn cost of the Milford Haven pipeline project.

The review has identified that the major cost increases cannot be solely attributed to weather, protestors and consents¹.

It is therefore recommended that NGGT are given the opportunity to provide a formal response prior to any regulatory action being considered by Ofgem

Although beyond the scope of this assignment, in the light of experience on Milford Haven project, Ofgem may wish to consider the operation of the Uniform Network Code system entry capacity arrangements for developments of such a scale.

¹ Refer to Sections 4.8 and 3.6 for details of Compensation Events (CE) where some costs attributed to these causes have been identified for the Brecon to Tirley pipeline contract. Note that there were no Variation Orders/CE's for the other two pipeline contracts as a result of changing to Option E. This prevents a comparative evaluation of cost increases to be made for all three pipeline contracts.

2.

INTRODUCTION

Ofgem have contracted Rune Associates / Penspen to review the costs incurred by National Grid (NGT) in relation to the Milford Haven pipeline project and to assess their efficiency in delivering the project in its entirety and in relation to main assets, e.g. pipelines, compressors, etc.

This report sets out Rune/Penspen's understanding of the efficiency of the work undertaken by NGT on the Milford Haven scheme between 2004 and 2015

The Milford Haven pipeline project is the UK's largest high-pressure gas pipeline linking the two Liquefied Natural Gas (LNG) terminals (Dragon and South Hook) at Milford Haven, Pembrokeshire with the UK gas transmission network at Tirley, Gloucestershire.

The Milford Haven pipeline project includes:

- 320km of new 1200mm diameter pipeline with associated above ground installations (AGIs);
- a new 30MW compressor station at Felindre and new 16MW units plus modifications at two existing compressor stations, Churchover and Wormington;
- a major Pressure Reduction Installation (PRI) at Tirley and two smaller ones in the pipeline sections.

Ofgem are undertaking an ex-post efficiency review of the Milford Haven pipeline project in order to assess whether the expenditure for the scheme was incurred efficiently and subsequently assess the impact on consumers.

2.1

Scope of Milford Haven Project

In 2002, liquefied natural gas (LNG) importation at Milford Haven emerged as a potential new supply source to the UK. In September 2004 and in December 2004 National Grid received instructions to provide the necessary infrastructure to connect two LNG facilities to the UK gas transmission network, with an initial operational delivery deadline of October 2007 leading to delivery of further capacity by January 2009.

The cost of the scheme is in excess of £1.1bn in outturn prices and exceeded initial expenditure forecasts and allowances. NGT has furnished Ofgem with various tables in relation to the project's outturn expenditure, such as Table 1 below:

Milford Haven Project Section	Total Cost (£m) (Outturn prices)
122km Milford Haven to Aberdulais Pipeline	315.03
89km Felindre to Brecon Pipeline	315.49
109km Brecon to Tirley Pipeline	220.00
30MW new Felindre Compressor Station ²	85.17
Churchover Compressor Station modifications & additional 16MW electric drive compressor	41.07
Wormington Compressor Station & additional 16MW electric drive compressor	57.63
Tirley PRI Scheme	77.80
Environmental Monitoring and Aftercare	20.70
Final Cost	1132.90

Table 1. Outturn costs of the Milford Haven Pipeline Project

The pipeline construction phase started in 2006. The programme is now substantially complete and gas has been flowing from the LNG terminals in commercial quantities since April 2009. Works between 2008 and 2012 mostly related to the compressor stations and the Tirley PRI, where construction only started in 2010.

The cost allowances for the Milford Haven project were set during TPCR4 price control period. Ofgem indicated to NGT that a post execution efficiency review would be undertaken once the project was complete, which is now the case. NGT overspent significantly compared to the allowances provided.

The purpose of the ex-post efficiency review is for Ofgem to assess whether the expenditure for the project was incurred efficiently and subsequently assess the impact on consumers.

2.2

Scope of Efficiency Review

Ofgem's post construction efficiency review of the project entails assessment of:

- Planning, e.g. option and route selection, licensing and consenting;
- Execution, e.g. contracting strategy, project management, mitigation of impediments, including high levels of rainfall, protestor actions, licensing, incidents' recovery, etc.;
- Cost, i.e. for the main assets pipeline sections, compressor stations and PRIs;
- Time, i.e. time required to deliver main assets, such as pipeline sections, compressor stations and pressure reduction installations.

In parallel with the Rune/Penspen review, Ofgem have carried out a forensic accounting project to confirm the accurate establishment of the costs involved in relation to the project's sub elements, i.e. pipeline segments, compressors, etc. The conclusions from the accounting project are reported in Section 3.3 of this report.

² 30MW nominal capacity comprising two 15MW gas turbines and a 30MW electric variable speed drive

Ofgem held certain high level annual figures of NGT spend through the annual reporting process which have been forwarded to Rune/Penspen. However, Ofgem did not hold detailed information on individual contracts or of NGT's internal costs and whether these were efficiently incurred.

Specifically, NGT had provided Ofgem with a more detailed version of Table 1 together with:

- A relatively comprehensive list of NG's Board Papers relating to sanctioning and re-sanctioning the project or elements of it;
- A very limited number of Project Manager Reports.

Ofgem did not hold:

- Actual contracts which were used by NGT to deliver the Milford Haven project, i.e. EPC/Services contracts, tender documentation, contract amendments / variation orders / compensation events;
- Cost evidence relating to the W.B.S. codes used by NGT for the project's execution.

All the requests for additional information and the answers provided by NGGT have been passed through Ofgem.

Penspen envisaged two main strands of the review:

1. Assessment of the EPC contracts, including how they were tendered and awarded, how they were controlled and how the contract sums and schedules grew.
2. Assessment of the other costs, for NGT management, for provision of other services to the project.

From this review Penspen have attempted to provide a clear view of the areas of internal and external costs as requested by Ofgem that were:

- a) Higher than anticipated;
- b) Justified or not justified due to the risks and events which impacted the contracts;
- c) Efficiently or inefficiently incurred;

The analysis was made for the main sections of the project as follows:

- Milford Haven to Aberdulais pipeline segment
- Felindre to Brecon pipeline segment
- Brecon to Tirley pipeline segment
- Felindre Compressor Station
- Churchover & Wormington Compressor Stations
- Tirley PRI Scheme
- Environmental Monitoring and Aftercare

2.3

Overspend

Penspen have attempted to identify:

- Where the overspend occurred – specific contracts and assets;
- Why this overspend incurred – what were the reasons and whether this was a direct impact or a consequential cost;
- How high was the overspend –specific contracts and assets;
- Whether the overspend was justified– fully, partly or not at all;
- Any identified underspend.

2.4

Contracting Strategy and Project Management

NGT employed a suite of contracts to deliver the project. Penspen have attempted to provide a clear view of:

- Whether NGT's approach was a sound one;
- Whether the risks borne by NGT for the execution of the works were acceptable given the project's circumstances;
- Whether the incidents that occurred during the project's execution were handled efficiently;
- Whether NGT's approach to managing the project, i.e. utilisation of internal and external resources, decisions, implementation, etc., ensured that the critical path was the optimal one.

2.5

Other Issues

NGT in various communications with Ofgem has consistently justified the overspend and the timescales for delivering the project due to:

- Weather – exceptionally high levels of rainfall;
- Protestor actions – in sections of the pipeline;
- Onerous licensing – the conditions were deemed as unprecedented due to the sensitivity of the environment in Southwest Wales;

Further to these Ofgem is concerned with:

- The efficiency in NGT's efforts for licensing, especially for some of the Above Ground Installations (AGIs) such as Tirley PRI; and
- Incidents that affected the completion of critical assets as was the case of the Wormington compressor station and the timely delivery of compressor stations.

Penspen have attempted to provide a clear view on what was the direct impact of such events and what the consequential impact was, in both terms of time and cost.

2.6

Resourcing and Management

Penspen have resourced the review in two parts.

1. The contractual review was led by its leading contracts engineer, with support from discipline specialists in these areas as needed.
2. The review of other areas was led by an experienced pipeline engineer with input from other disciplines as necessary.

3. COSTS REVIEW

3.1 Information provided by NGGT/Ofgem

The following documentation was requested to be provided by NGGT/OFGEM to enable Rune/Penspen to carry out the efficiency review, full details are given in Appendix 1.

- Correspondence related to the September and December 2004 obligations for NGT to provide Milford Haven pipeline infrastructure.
- Overview of the installed project including large scale (approximate 1:10,000) pipeline route drawings, lists of major crossings and construction type (e.g. HDD, micro-tunnel, etc.), compressor station and above ground installation GA (general arrangement) and P&ID (process and instrumentation) drawings.
- Control estimates prepared for the project in advance against which the outturn costs were controlled, plus the basis for these.
- Actual contracts which were used by NGT to deliver the Milford Haven pipeline project, i.e. EPC construction, Project Management/Services, environmental consultants, land agents, etc.
- Actual orders/contracts for major items including 'free-issue' materials (line pipe) and contractor sourced long lead items (valves, compressors, etc).
- All variation orders and contract amendments together with whatever exists within NGGT to justify acceptance of such Variation Orders and Amendments.
- The successful and the unsuccessful bids submitted for major EPC parts of the project.
- The bid evaluation procedure and reports produced with NGT for all major parts of the work.
- Summary of the costs incurred outside the EPC contract, plus NGT documentation on how the decisions to utilise these personnel/services were made.

These documents were all needed to be able to make any meaningful assessment of the situation and some supplementary questions were raised.

NGGT responded to all requests and queries but some responses remained partial and/or incomplete³. For example, Project Management Monthly Reports covered the period April 2005 to July 2008 only, with no alternative source offered. Only extracts of the main EPC and Service Contracts and material orders were provided. For pipeline AGI's, copy orders included fittings but not valves or other components such as boilers, etc.

The information was provided over a period of approximately seven weeks which gave Rune/Penspen less uninterrupted time than envisaged to prepare this report. The information was provided via Ofgem in electronic format using email and Huddle Secure workspace.

No site visits to NGGT's offices or project sites (e.g. compressor sites) were deemed necessary as NGGT had already presented a comprehensive commentary on the history of the Milford Haven Project.

³ Refer to Appendix 9: Summary Status of NGGT Responses to Requested Information

3.2 **NGT Sanction Papers**

3.2.1 Introduction

Copies of Main NGT Sanction (and re-sanction) Papers dating from August 2003 to September 2012 were provided to Rune/Penspen, ref items #1 to #4 and #6 to #16 listed in Appendix 1.

A graphical timeline representation of the growth in the sanctioned project cost was compiled from the information provided in the sanction papers and is provided in Appendix 2. It has been annotated with extracts from the text of the NGT sanction papers.

The timeline graphic shows a steady cost growth from an estimated £559m forecast in July 2005 to estimated £1040m forecast in October 2007 (at the end of the main pipeline construction) followed by a slower cost growth until the eventual outturn cost of £1133m was reached by end March 2014.

3.2.2 Discussion on Sanction Paper Timeline

The timeline demonstrates how NGT started the sanction process for preliminary (design) works for the Milford Haven to Aberdulaish section of pipeline to link with existing facilities prior to the LTSEC Auctions in September and December 2004.

A required capacity of 350GWh/day (to be provided by October 2007) was signalled by the LTSEC Auction in September 2004 and an initial estimated cost of £358.4m was identified in sanction paper ref #4 dated 5 October 2004. At this time, NGT proposed to provide capacity of 240GWh/day by October 2007 with the Milford Haven to Aberdulaish pipeline and an increased capacity greater than 350GWh/day by extending the pipeline to Llanvetherine by summer 2008.

Two further sanction papers, ref #6 and #7 were issued in January 2005 following the signalling by the LTSEC Auction in December 2004 of the requirement for an increased capacity of 650GWh/day (also by October 2007).

This substantial increase was envisaged to be accommodated by a combination of new pipelines, new compressor station and modifications to existing facilities, further details are provided in Section 3.4.

Feasibility studies were sanctioned and commissioned to provide more detail of what was required and an estimated cost of £559m to provide all of these facilities was first identified in the sanction paper, ref #8, dated July 2005.

By April 2006⁴, construction of the pipeline from Milford Haven to Aberdulaish had only just started and the forecast cost of the Total Reinforcement Scheme had increased to £759m (35.9% higher than the July 2005 estimate). Re-sanction paper, ref #9, attributed the estimated £200m cost increase to changes in scope, acceleration measures, construction and steel price inflation, previous omission of full risk allowances on Felindre to Tirley and other reasons such as feasibility studies, easements and land purchase.

On 3 November 2006, NGT wrote to Ofgem, ref #158 and #159, to explain that the forecast cost to complete the Milford Haven Project had risen to £840m primarily as a result of lessons learnt from the first season's build on the Milford Haven to Aberdulaish pipeline.

⁴ The relevant PM's monthly report dated 31 March 2006 ref #112 identified that Stage II works had commenced as planned on 6 March 2006 but that progress had been inhibited by inclement weather.

With construction of the Felindre to Brecon and Brecon to Tirley pipelines underway, in May 2007, the project was again re-sanctioned at a total forecast cost of £950m, ref #10. The increase of £191m since the previous re-sanction in April 2006 was primarily attributed to changes in design and method plus acceleration measures although more than £37m of the increase was attributed to the direct cost of complying with consents, standing costs due to protestors and additional security costs. A breakdown of the increased forecast cost for individual elements of the Milford Haven Project was also provided in this comprehensive re-sanction paper.

Shortly afterwards on 26 July 2007, NGT again wrote to Ofgem, ref #160, to explain that the forecast cost to complete the Milford Haven Project had risen by £110m to £950m since November 2006. A comparison between the cost increases described in the letters to Ofgem and those described in the re-sanction papers ref #9 and #10 are listed below:

Increased cost due to:	Re-sanction papers April 2006 to May 2007	Letters to Ofgem Nov 2006 to July 2007
Consents	£20.6m	£20.6m
Protestors	£8.8m + £7.9m	£7.9m + £12.7m
Environmental consents + Risk	£74m	£29.8m
Acceleration	£79.6m	£20.0m
>>> HDD's	>>>	£19.2m
Overall Increase	£191m	£110m

The November 2006 letter to Ofgem identified that the recently identified cost increases primarily resulted from realization of risks and lessons learnt from the first season's build on the Milford Haven to Aberdulais pipeline. By deduction (and ignoring the increased £4m allocation to protestors advised to Ofgem) it would appear that roughly £44m of the increase resulted from environmental consents and realization of risk and that roughly £40m of the increase resulted from acceleration measures prior to November 2006 on the Milford Haven to Aberdulais pipeline.

The 26 July 2007 letter to Ofgem did make reference to loss of peak construction time due to exceptionally poor weather in May, June and July 2007 but no increased costs were allocated to this cause.

At the end of the main pipeline build season in November 2007, a further paper, ref #11 sought re-sanction for £1040m. The increase of £90m since the previous re-sanction in May 2007 was attributed £40m to adverse weather and £50m to acceleration and mitigation measures. Mention was also made to a potential claim from Contractor B for £15m additional fee although no other reference to this claim has been found in the documentation provided by NGGT and referenced in Appendix 1.

3.2.3 Weather Event Summer 2007

The additional cost allocated to weather events beyond 1 in 10 year event was elaborated in Sections 15 to 18 of the November 2007 re-sanction paper although the derivation of the £40m additional cost remains unclear. The paper explains that on average, 33 project days were lost over and above what was anticipated and that a further 20 days were lost on the two pipeline contracts let to Contractor B.

The monthly weather data reproduced in Section 17 of the re-sanction paper indicates that July 2007 was wetter than expected both in Swansea and in Pershore (Worcestershire) with three additional rain days above 5mm and with

significantly higher total monthly rainfall particularly at Pershore⁵. The data for May and June 2007 indicates that the weather was only marginally wetter than an expected 1 in 10 year weather event and with only one extra rain day above 5mm. It is also noted that only the Pershore data is included in the table for May and June 2007, presumably the Swansea data being within the expected 1 in 10 year rainfall range.

External publications⁶ record that the summer of 2007 was indeed much wetter than usual, particularly in the area traversed by the Brecon to Tirley pipeline but it remains unclear how the average lost time of approximately 33 days was derived under the terms of contract with the MWC's when only four additional rain days above 5mm were recorded at Pershore during the three months May to July 2007 (as reported in Section 17 of the re-sanction paper).

It is also noted from the NGGT accounts data provided with ref #54 that the monthly pipeline MWC costs peaked during June, July and August 2007 at circa £54.2m, £48.7m and £54.1m respectively see also graphic in Appendix 4. There is a marked dip of circa £5.5m for July 2007 possibly representing lost production due to weather, although the main effect of the weather delays with most of the pipeline already laid would presumably be delays to the reinstatement works.

3.2.4 Further Re-sanction in October 2010

Following a gap of almost three years since the last re-sanction paper, three papers were issued in October 2010, refs #12, #13 and #14. Separate sanction papers were issued for Tirley PRI (£81m) plus Environmental Monitoring and Aftercare (£22m) and these items were excluded from the main re-sanction paper (£1,030m).

In these re-sanction papers, increased costs were attributed to additional contractor costs, consequential cost of delays and additional aftercare costs. Shortly afterwards in January 2011, a transfer of approximately £20m was made in the NGGT accounts, ref #54, from the Brecon to Tirley pipeline tab, to the Tirley PRI tab, to align with the segregation out of Tirley PRI costs proposed in the October 2010 sanction paper.

A final re-sanction paper, ref #16 was issued in September 2012 to refine the costs presented earlier in October 2010 to align with actual outturn costs as evidenced in NGGT accounts⁷.

3.2.5 Cost Source information for Sanction Papers

NGGT provided Rune/Penspen with copies of Monthly Project Managers Reports covering all of the SWEP contracts for the period 20 April 2005 to 31 July 2008, refs #101 to #139 inclusive. The financial sections of these reports provided forecasts of estimated costs and gave some reasons for the increases and appear to have been used by NGT in compiling the sanction papers. From the evidence provided by NGGT and reported in Section 4, it appears that the estimated costs were derived at least in part from MWC predictions of forecast costs.

The cost forecasts each month in these reports have been plotted in Appendix 3 on the same scale as the Appendix 2 cost development timeline and not surprisingly produces a similar shaped development of forecast cost curve

⁵ The Brecon to Tirley pipeline contract data refers to a single weather station at Ross on Wye in relation to Compensation Events. Ross on Wye has a similar summer rainfall average as Pershore (and is located circa 50km to the south west of Pershore). The Option E contracts have different weather station data in the contract data (for reference only), namely that for Mumbles Head and Usk

⁶ For example: The summer 2007 floods in England and Wales by Terry March & Jamie Hannaford published by Centre for Ecology & Hydrology and British Geological Survey

⁷ Refer to next section 3.3. Outturn costs were reviewed by Grant Thornton.

although some peaks followed by plateau are evident and indeed, the last four monthly reports all reflect final forecast costs of £1,058m some £75m short of the final outturn cost.

Two examples of more detailed monthly project status reports produced for each section of the works were also provided to Rune/Penspen by NGGT (ref #89 and #90, both for the month July 2007) but in these reports, no apparent attempt is made to explain the causes of the cost increases for the two Option E contracts.

For example, no comment or recovery plan is indicated regarding the "red traffic light" cost £ per km which has reportedly risen by 114% and 74% respectively. The much smaller percentage increases of 12 to 21% against existing Forms A and D are commented on for one of the Option E contracts but only to note that a re-sanction of the Forms is required.

Whilst the monthly project managers reports do record the magnitude of increased anticipated project costs on a monthly basis, there are limited references to the causes of the increased costs within the reports. It appears that in many reports no reason at all is given for the anticipated monthly increase in anticipated project cost. For example, in the monthly report for January 2006, it is stated that a forthcoming re-sanction paper will explain the increase. Other reports use recently re-sanctioned P(50) values for the ECC estimate.

In an attempt to clarify these observation, Penspen raised further queries with NGGT: These are discussed further in Section 4.

3.3 **Outturn Costs**

3.3.1 Conclusions from Grant Thornton Audit

The draft and final report output from the forensic accounting investigations carried out by Grant Thornton was provided to Rune/Penspen by Ofgem on 9 Feb 2015 and 23 Feb 2015, refs #76 and #93.


The audit concluded that based on the cost information and explanations provided by NGGT, costs are supported by invoices (or other supporting documentation), ledgers and payment information that indicate that they have been incurred and paid and correlate to the relevant cost included within the SAP system and hence the RRP information provided to Ofgem.

In addition, the audit confirmed that the indirect costs appeared to have been the subject of appropriate allocation methods.

It was noted that due to changes in NGT's accounting systems, the sample of directly and indirectly incurred costs that were reviewed by Grant Thornton were limited to costs over £250,000 and those incurred post October 2007. Costs incurred prior to October 2007 were however summarized in the audit report.

The audit provided:

- a) Summaries of the actual outturn costs allocated to each of eight sections of the Milford Haven Project, comprising the three pipeline contracts and the three compressor station contracts constructed primarily 2006 to 2008, Tirley PRI constructed 2010 to 2012 and the on-going Environmental Monitoring and Aftercare works, refer to Summary of Costs Table below, reproduced from para.3.6 of the Grant Thornton report from cost information provided by NGGT;

- b) For each of the eight sections of work, a summary of costs table broken down into elements of work such as Main Works Contractor (MWC), Materials, Project Services, National Grid (NG) Staff, Land Compensation etc.;
- c) Commentary on the cost information provided, NGT's financial processes, and a brief background to each of the eight sections of work;
- d) Commentary and summary of the costs that were not included in the Milford Haven Project accounts essentially comprising £12.2m less £5.5m for the Wormington Incident and £5.4m for 

Summary of costs

	Pre October 2007 £	Post October 2007 £	Total £
Milford Haven to Aberdulais Pipeline	278,919,317	36,129,156	315,048,473
Felindre to Brecon Pipeline	241,634,065	73,905,668	315,539,732
Brecon to Tirley Pipeline	164,902,121	55,143,344	220,045,465
Wormington Compressor Station	25,542,792	32,044,639	57,587,432
Churchover Compressor Station	23,901,744	17,194,574	41,096,318
Felindre Compressor Station	28,709,151	56,460,213	85,169,364
Tirley PRI	-	75,712,756	75,712,756
Environmental Monitoring and Aftercare	-	13,450,581	13,450,581
	763,609,190	360,040,932	1,123,650,122

3.3.2

Individual points identified in Grant Thornton Audit

A selection of costs were tested by Grant Thornton such as the £5,065,670 cost allocated to Commissioning Gas Flow under Tirley PRI, ref para.3.92.

Appendix 9 of the Grant Thornton Report reveals that the majority of this cost comprised two payments made on 20 August 2012 in respect to invoices dated 9 December 2008 related to:



Presumably, the remaining invoices for £176,670 were not tested being of value less than the £250,000 threshold audited by Grant Thornton.

In respect to the MWC contracts, the only reference to "Bonus" in the Grant Thornton Report is found in Appendix 5 where a specific bonus payment of £4m for contract completion in accordance with an auxiliary contract clause was invoiced by Contractor C on 14 January 2008 and paid on 7 March 2008.

3.3.3

Review of SAP accounts data

The Grant Thornton audit was performed on consolidated Milford Haven Project SAP data. NGGT provided a copy of this data to Rune/Penspen on 7 February 2015 ref #54.

The SAP data was already sorted by section of work and the data in each section correlated with the summary data presented in the Grant Thornton audit.

It is noted that there appears to be a lag of nine months between the SAP document reference date and the accounting date for each line item but that the SAP document reference date appears to reflect the actual date of cost expenditure. The SAP data also includes many journal transfers, some of which were specifically remarked upon by Grant Thornton.

Some repetitive transfers where costs were attributed to a cost code only to be debited the following month are prevalent in the MWC coding and appear to relate to the terms of these NEC Option E contracts with agreed forecast costs being replaced by agreed actual costs on a monthly basis.

Penspen have used the SAP data to provide the graphical representation of the development of MWC costs for the Pipeline and Compressor Stations/Tirley PRI with time in Appendix 3 and 4. These graphics are described in more detail below.

It is evident from the Grant Thornton audit and the SAP data that more than 70% of the overall project costs have been allocated to the Main Works Contractor. In response to a query on the Option E pipeline contracts, NGT provided indicative breakdowns of the MWC costs for the Milford Haven to Aberdulais and the Felindre to Brecon Pipeline Contracts, ref #77.

NGT also provided breakdowns of the Materials (and main work packages for Felindre) costs for the three Compressor Station sites as materials were within the supply scope of the MWC, refs #155, #156 and #157.

3.3.4

Development of MWC costs for the Pipeline Contracts

The development over time of MWC costs for the Pipeline contracts is shown in tabular and graphical format in Appendix 4. The data is taken directly from the SAP data provided by NGGT ref #54 and has been compiled on a monthly basis.

The data shows clearly defined peaks in monthly MWC costs during the summers of 2006 and 2007 and troughs in winter reflecting the seasonal nature of pipeline contracts.

During peak production months of May to August 2007, MWC costs averaged nearly £50m per month and overall, more than £610m out of the total outturn cost of the project £1,134m was expended on MWC pipeline costs.

Although substantial completion of the pipeline is reported to have been achieved by November 2007, there is a long tail on each of the pipeline contracts where costs continued to accrue, albeit at a reduced level up to at least July 2009. For the Brecon to Tirley section of the pipeline, costs continued to accrue up to January 2011 when £20m of allocated cost was transferred to the Tirley PRI tab effectively removing all the costs incurred since July 2008.

3.3.5

Development of MWC costs for the Compressor Stations/Tirley PRI

The development over time of MWC costs for the Compressor Stations and Tirley PRI is shown in tabular and graphical format in Appendix 5. The data is taken directly from the SAP data provided by NGGT, ref #54, and has been compiled on a monthly basis.

The data has ups and downs in monthly MWC costs as costs were transferred in and out of the SAP accounts but does clearly illustrate that (with the exception of Tirley PRI) the majority of the MWC costs were incurred between summer 2006

and start of 2009 when an increased capacity provision of 950GWh/day was required.

MWC costs for Tirley commenced with the £20m transfer from Brecon to Tirley pipeline tab in January 2011 up to September 2012 when operational acceptance was reported as having been attained thus lifting the force majeure notice relating to reduced Capacity 750GWh/day in lieu of 950GWh/day.

A SAP transfer of £2.6m from Wormington to Churchover in March 2014 is also evident in the graphic. Overall, more than £208m or 18% of the total outturn cost of the project was expended on MWC cost for Compressor Stations/PRI.

For the project as a whole, MWC costs comprised more than £820m, or 72% out of total outturn cost £1133m. As a consequence, Penspen have concentrated its analysis on MWC costs.

3.4 **Milford Haven to Aberdulais pipeline**

3.4.1 General Discussion – Key Issues – Consolidated Contracts

This first 122.25km length of 94barg diameter 1200mm pipeline was required to connect the proposed Milford Haven LNG terminals with the existing gas transmission pipeline infrastructure to end at Aberdulais (later amended to Cilfrew, ref #70 - PMI/046 dated 27 July 2005) and would provide an estimated capacity of 240GWh/day.

A Key Issues Paper on Procurement Strategy for this pipeline segment was provided to Rune/Penspen, ref #65.

The Paper described in considerable detail how the contract for the design, construction and commissioning of the pipeline and associated AGIs was awarded to Contractor B as MWC in two Stages on 27 May 2004 and on 2 March 2005 following a competitive tender process, the Contractor B bid £91.5m including £13m P(50) risk representing a saving of circa £19.3m compared with the (only other) next best alternative bid.

The timing was such that the Stage I Conceptual Design Contract was awarded in advance of the September and December 2004 LTSEC Auctions, on the basis of best available information from the Terminal Owners, to give NGT sufficient time to build and commission this new section of pipeline within an expected delivery timeframe of three years⁸.

The intended Project/Contract Strategy was for a two-stage award approach whereby early contractor involvement under NEC Option C (Target Cost with Activity Schedule) would produce a more concise and higher quality Environmental Impact Assessment (EIA) and Conceptual Design for planning purposes, and improved cost certainty during NEC Option A (Fixed Price with Activity Schedule) Stage II Detailed Design and Construction.

To minimize the risk of the Contractor over inflating the Stage II price, an 'Opt-Out' clause was included to allow NGT to go back out to market (time permitting) if the developed price and programme was not deemed to be economic and efficient.

Prior to completion of the Stage I Conceptual Design, contract negotiations started with Contractor B in Dec 2004 to confirm and finalise pricing and programme elements for the remainder of Stage I and new Stage II works. Contractor B's benchmark price of £93.5m (inclusive of risk) was accepted by NGT on 02 March 2005, as it was comparable (+£2m) with the initial P50 value (Stage I - May 04).

⁸ A Network Code Regulatory requirement ref #65 page 12 of 20

The Paper goes into some detail to explain the decision to agree to change the Stage II pricing mechanism from an Option A (Lump Sum) to Option E (Cost Reimbursable) contract at the same time dismissing the alternative Option C (Target Price) mechanism (which is normally used when insufficient information is available to provide a lump sum price).

The reasons for adopting an Option E mechanism given in the Executive Summary of the Key Issues Paper were as follows:

invoking the opt-out provision was no longer practicable due to the increased scope, changing project constraints and drive to meet challenging timescales. This resulted in the parties agreeing to change the Stage II pricing mechanism from an Option A (Lump Sum) to Option E (Cost Reimbursable) contract to focus the integrated project team on ensuring completion of the MH-AB works by 17 Sept 2007, and ensure that the overall capacity expansion scheme was completed as required by the Connection Agreements without incurring financial penalties or compromising health, safety, environment, and quality performance. At the time, global market opportunities in this sector were experiencing an up-turn in demand providing further constraints to NGT in its delivery options, and market sector conditions were such that pipeline contractors were increasingly risk averse and contract selective due to the buoyant pipeline market in the UK.

The decision to change to Option E might be seen as premature considering it was made even before Contractor B were instructed to accelerate its planned pipeline construction. In hindsight it is seen as the prime catalyst for the pipeline construction cost to increase from a benchmark cost of £93.5m in March 2005 to an outturn cost of £225m for the construction of this first pipeline segment⁹.

The Key Issues Paper went on to describe in the Executive Summary how:

a substantial capacity increase signalled in the December 2004 LTSEC Auctions fundamentally changed the scope of the South Wales Expansion Scheme, whereby the overall pipeline length increased from 120km to 320km within the same three year delivery timescale, hence presenting a real threat to NGT of not delivering on time and therefore breaking the regulatory contract/licence conditions.

This statement is accepted as being relevant to the overall scope of the Milford Haven Project and is discussed further in subsequent sections of this report including Section 4.1.

The statement is however not considered so relevant for Milford Haven to Aberdulais as this pipeline segment was always required to be completed by October 2007 to provide 240GWh/day out of the initial 350GWh/day capacity signalled in September 2004 and for which preparatory work had already been pro-actively initiated by NGT prior to September 2004.

The Key Issues Paper Executive Summary followed with: *Being cognisant of the limited supply capacity, NGT was forced to negotiate a doubling of an already challenging UK industry recognised 60km build to an unprecedented 120km in a single season.*

The 122km long Milford Haven to Aberdulais pipeline was originally planned to be constructed over two seasons in 2006 and 2007 and Stage II was awarded to

⁹ Although considered the prime catalyst for cost escalation, not all of the identified cost increase can be attributed to change of Options and to subsequent acceleration. Some price escalation from other causes would have been expected under an Option C contract. As an example, in Section 3.6, Compensation Events accounted for £23,35m or 18.8% uplift on net MWC cost for the Brecon to Tirley pipeline. Compensation Events are not applicable under an Option E contract and therefore, the actual causes of the cost increases cannot be readily identified.

Contractor B on this basis in March 2005. Contractor B were first instructed to accelerate the Stage II pipeline construction on 19 July 2005¹⁰ at which time NGT was aware that three other qualified bidders had each submitted priced tenders to complete 65km of pipeline during the 2007 build season, refer to further discussion in Section 3.6.

It would appear that during 2005, NGT actively chose to accelerate the Milford Haven to Aberdulais pipeline works to complete the bulk of the pipeline construction in 2006 leaving MWC resources available for further pipeline construction in 2007 but that NGT were not in fact *forced* to proceed in this manner.

Note. The Key Issues Paper does not describe how the 350GWh/day capacity¹¹ signalled in September 2004 would be delivered in full. Indeed Section 4 of the Paper, repeatedly infers that only 120km of new pipeline was required to meet the September 2004 requirement whereas Preliminary Works Scheme document ND360 Appendix 1, ref #6, reproduced below, indicates that a further 77km length of pipeline from Aberdulais to Llanvetherine was also required to achieve the 350GWh/day capacity signalled in September 2004.

The need for the Aberdulais to Llanvetherine pipeline, running in parallel to existing infrastructure, is reflected in NGT Sanction Paper ref #4 dated 5 October 2005 where an estimated cost of £820,000 was allocated for the FEED design of this pipeline segment. At this time, NGT considered that it would not be possible to provide the additional capacity above 240GWh/day until October 2008¹².

Rather than commission an independent consultant to undertake the sanctioned preliminary design (and FEED) for the Aberdulais to Llanvetherine pipeline with the attendant lead in period required to run a valid OJEC process, NGT instructed Contractor B the MWC on the Milford Haven to Aberdulais pipeline to undertake (subcontract) a feasibility study for the Aberdulais to Llanvetherine pipeline, ref PMI/018 dated 12 Oct 2004.

Although the Contractor B contract contained a somewhat open ended provision for decreases/increases in scope, the addition of this preliminary design work coupled with a newly defined deadline of three years resulting from the September 2004 auction effectively locked NGT in further with Contractor B for the eventual award of the stage II detailed design and construction for the reasons described in Section 4 of the Key Issues Paper.

NGT's lack of preparedness for provision of capacity above 240GWh/day is reflected in a further PMI/025 dated 18 November 2004 which instructed the Contractor B to study an offshore option for the Milford Haven pipeline. Later, on 19 May 2005 another PMI/040 instructed Contractor B to undertake 2nr. feasibility studies re: land pipeline associated with offshore options (actual PMI's not seen).

The situation was compounded in December 2004 when the obligated capacity to be provided by October 2007 was increased from 350GWh/day to 650GWh/day rising to 950GWh/day by January 2009. This increase required that NGT provide yet further pipeline capacity in now less than three years and to implement modifications and new units at existing compression stations, all as identified in the NGT sanction paper ND 360 dated 6 January 2005, ref #6, as follows:

¹⁰ This instruction (ref PMI/043) gave Contractor B more than six months advance notice of the requirement to accelerate the MH to Aberdulais pipeline construction by applying increased resources to complete laying the pipeline in one season instead of two. A £12.5m increase to the target prices was proposed by NGT in October 2005 but the increased resources would not have been deployed or paid for until construction actually commenced in March 2006. The actual cost of the acceleration remains unknown as this PMI was not priced as a Compensation Event.

¹¹ Capacity provision is discussed further in Sections 4.1 and 4.10.

¹² NGGT state in ref #65 page 7 of 20 that the October 2007 deadline was not extended despite consultations with Ofgem

NGT Confidential

ND 360
06 January 2005

Appendix 1 - Current Status of Identified Milford Haven Capacity Schemes

Scheme	Estimated Capacity Provided (GWh/d)	Scheme Status
Milford Haven to Aberdulais (128km 1200mm) + regulator	240	Full Sanction Granted
Aberdulais to Llanvetherine (77km 1200mm)	390	Pre-Works Sanction Granted
Peterstown reverse mods + Warrington reverse mods and new unit	422	Pre-Works Sanction Requested
Peterstown to Tirley (36km 1200mm)	650	Pre-Works Sanction Requested
Llanvetherine to Peterstown (29km 1200mm)	740	Pre-Works Sanction Requested
Churchover reverse modifications	850	Pre-Works Sanction Requested
New compressor station on reinforcement pipeline (30MW)	921	Pre-Works Sanction Requested
Warrington to Honeybourne (11km 900mm)	953	tbc

Obligated capacity from 2004 LTSEC auction signals:

- 650GWh/d from October 2007
- 950GWh/d from January 2009

The timing of the second auction was unfortunate and left less than three years for NGT to design, construct and commission the remaining required pipeline capacity. It appears that NGT had failed in its attempt to convince Ofgem to defer part of the pipeline construction to 2008 and as a consequence from December 2004, NGT's strategy for management of the whole Milford Haven Project favoured programme and minimization of risk of delays/disputes over cost concerns. This is elaborated further in the next Section 3.5.

3.4.2 Risk Review

Section 6.4 of the Key Issues Paper, ref #65 provided details of a Quantative Cost Risk Analysis Workshop facilitated by Voltura Consulting¹³ and reported that this data was used to determine the P(50) Cost Risk Allowance for each evaluated tender.

Thirteen significant risks were identified as having the most significant impact on the Project P50 output and were listed in order of significance. The data was used to produce the Form D, P50 risk for the Main Works Contract. NGT reported that *all of the risks occurred to some extent, with the exception of 'un-foreseen ordnance', but as there was no contractual requirement to record CE's it was difficult to quantify the actual risks which materialised post-award.*

Surprisingly, the Key Issues Paper made no comment on the discrepancy between the total cost of the risks identified in the workshop (circa £16m for the 13 most significant risks), the initial P(50) risk allocation of £13m for this tender and the actual increased cost that occurred, namely £146m (being outturn cost of £225m less baseline cost of £79m).

3.4.3 Comparison of Baseline and Outturn Costs

BASELINE PRICE FOR MWC MARCH 2005 = £78,518,229 PLUS £13M P(50) RISK

OUTTURN COSTS FOR PIPELINE – refer to Summary Table reproduced from para.3.53 of the Grant Thornton Report below:

¹³ report issued 12 May 2004.

Milford Haven to Aberdula Pipeline

WBS Element	WBS Description	Ref ¹⁰	Pre October 2007 £	Post October 2007 £	Total £
TCC/00717-1-03	MILFORD HAVEN-ABERDULAI-MAIN WORKS	1	201,651,222	23,561,852	225,213,073
TCC/00717-1-10	MILFORD HAVEN-ABERDULAI- MATERIALS	2	43,371,103	(4,121,154)	39,249,949
TCC/00717-1-09	M. HAVEN-ABERDULAI-COMPENSATION	3	6,422,633	7,132,668	13,555,301
TCC/00717-1-05	M.HAVEN-ABERDULAI-PROJECT SERVICES	5	6,797,358	1,667,128	8,464,486
TCC/00717-1-15	M.HAVEN-ABERDULAI- INSPECTION SERVICES	6	7,759,125	(179,146)	7,579,979
TCC/00717-1-04	M.HAVEN-ABERDULAI-NGT STAFF COSTS	4	2,379,177	2,692,598	5,071,775
TCC/00717-1-16	MILFORD HAVEN-ABERDULAI- EASEMENTS	3	3,351,027	866,692	4,217,719
TCC/00717-1-08	MILFORD HAVEN-ABERDULAI- MISC	11	2,599,839	558,830	3,158,669
TCC/00717-1-23	M. HAVEN-ABERDULAI- PUBLIC RELATIONS	7	1,076,442	589,433	1,665,876
TCC/00717-1-07	M. HAVEN-ABERDULAI-LAND AGENTS	3	531,903	998,943	1,530,846
TCC/00717-1-12	MILFORD HAVEN-ABERDULAI – OLI	11	262,473	970,140	1,232,613
TCC/00717-1-25	M.HAVEN-ABERDULAI-OFFSHORE STUDY	8	1,211,679	7,164	1,218,843
TCC/00717-1-24	M. HAVEN-ABERDULAI- LEGAL (SOLICITOR)	3	268,920	731,463	1,000,383
TCC/00717-1-35	ENHANCEMENT COSTS	3	-	515,000	515,000
TCC/00717-1-34	CPO ENQUIRIES	11	443,046	1,044	444,090
TCC/00717-1-18	MILFORD HAVEN-ABERDULAI-LAND PURCHASE	3	310,000	-	310,000
TCC/00717-1-36	COMMUNITY GAIN	3	155,629	74,031	229,661
TCC/00717-1-02	MILFORD HAVEN-ABERDULAI- FEASIBILITY	8	210,925	-	210,925
TCC/00717-1-13	MILFORD HAVEN-ABERDULAI- NETWORK COSTS	11	79,408	49,583	128,991
TCC/00717-1-22	M. HAVEN-ABERDULAI-AGI WORKS-BLOCK VALV	11	25,281	-	25,281
TCC/00717-1-21	M. HAVEN-ABERDULAI-AGI WORKS-ABERDULAI	11	1,075	12,889	13,964
TCC/00717-1-06	MILFORD HAVEN-ABERDULAI- QRA	11	7,551	-	7,551
TCC/00717-1-28	OFFSHORE FEAS. TO AVONMOUTH	11	3,500	-	3,500
Total			278,919,317	36,129,156	315,048,473

An indicative breakdown of MWC costs for this Option E contract was provided by NGGT, ref #77 reproduced in Table below. There is a small variance in total cost of MWC most likely due to the timing of the compilation of the two sets of costs. The variance would have been higher without the final negative cost of £6.4m transferred out of “Miscellaneous”:

Milford Haven to Aberdula Pipeline

	Apr-06	Nov-06	Final
1 Stage 1 and design	3,063,177	4,230,724	4,819,219
2 Project Admin - Staff & Consultants	9,332,702	13,237,463	16,302,459
3 Project Admin - Office & Transport	8,071,639	13,206,980	16,098,428
4 Environmental H&S and 3rd Parties	5,010,309	9,395,431	12,626,055
5 Pipe Dumps, Pipe transport and Bending	4,863,274	9,172,072	10,193,085
6 ROW, topsoil strip, excavation	8,592,205	17,890,768	24,810,654
7 Stringing, welding, coating, tie-ins and special sections	19,632,341	28,096,405	29,419,903
8 Lower and Lay and backfill	5,367,378	12,112,114	16,733,130
9 Auger bores and Pipejacks	3,132,653	3,427,367	6,503,280
10 Microtunnels	4,735,104	15,421,694	26,577,870
11 HDDs	1,941,083	0	5,213,131
12 AGIs and permanent materials	10,620,949	13,414,221	21,602,770
13 Cathodic protection, inspection, testing and pre commissioning	6,093,042	6,660,696	10,305,356
14 Drainage and reinstatement	8,141,494	10,356,288	18,721,533
15 Insurance and Fee	9,365,989	12,067,333	15,563,750
16 Miscellaneous	3,941,662	2,991,000	-6,433,190
Totals	111,905,001	171,680,556	229,057,433

NGT's Final Completion Report GTIC 0065 dated 11 October 2013, ref #21 provided some additional background information on the work performed for this pipeline segment. The report identified that the HDD cost of £5m was for crossing the land owned by Elitestone, that there were 50 major tunnels of total length 2.15km constructed (£26.6m cost identified in table above). The AGI cost of approximately £21m was derived mainly for the construction of the PRI at Cilfrew although one pig trap and two block valve AGI's were also constructed.

3.4.4

Conclusion

The outturn costs for the Milford Haven to Aberdulais pipeline MWC (£225.2m) increased by a factor of 2.46 compared to the initial contract award P(50) value (£91.47m).

This factor is very high considering that the overall pipeline length did not change. It appears to be a consequence of the instruction to accelerate the pipeline construction to be executed in a single season instead of two seasons and the adoption of an Option E cost reimbursable contract form.

MWC costs represent 71.5% of the outturn cost for this pipeline segment which also appears very high.

3.5

Felindre to Brecon Pipeline

3.5.1

General Discussion – Key Issues – Consolidated Contracts

The intended routing of this second 94barg diameter 1200mm pipeline was from Aberdulais to Llanvetherine a distance of circa 72km.

Consolidated Contract documentation ref #58 indicates that a meeting was held end January 2005 with Contractor B regarding implementation of this pipeline on a best endeavours basis due to curtailed timescale. This was followed by PMI/033 dated 17 Feb 2005 (issued under the Milford Haven to Aberdulais contract) which instructed commencement of the Stage I preliminary design, in turn formalized by Contract Amendment dated 2 March 2005.

Subsequent PMI/005 (Aberdulais to Llanvetherine) dated 11 July 2005 instructed a revision of the Amendment Contract Data replacing Aberdulais with Felindre and Llanvetherine with Brecon confirming the northern route selection. The length of this new section was 89km and ended where no existing NGT infrastructure existed thus requiring further extension eastwards.

Key Issues Paper on Procurement Strategy provided to Rune/Penspen, ref #64 describes the history of this pipeline segment in further detail although it is not made clear that the northern route selected in July 2005 is much longer than the original planned southerly route.

The formal contract award under NEC Option E with P(50) value of £111.6m was made with Contractor B on 28 September 2006 based on a priced proposal dated April 2006.

In the Key Issues Paper, NGT cited lack of Contractor availability for the decision to award further work to the Contractor B having already run a OJEC compliant competitive tender for the third length of pipeline between Brecon and Tirley. This third length of pipeline was eventually awarded to Contractor C supported by Contractor D (described as a new entrant to the UK market) but also elicited comparatively priced bids from Contractor F and Contractor E, refer to next section 3.6.

The decision to award this contract under NEC Option E is again seen in hindsight as the catalyst for the construction cost to increase from a baseline of £99.1m forecast in April 2006 and incorporated in the contract award in September 2006, to an outturn cost of £240m for the construction of this second pipeline segment.

Indeed, the Key Issues Paper reports an almost 50% increase in baseline cost to £147.1m on 16 October 2006, less than one month following contract award, being the forecast cost to ensure completion by end September 2007 utilising four spreads compared to two spreads proposed in April 2006.

Developments subsequent to October 2006 are not covered in the Key Issues Paper. Contractor B letter of 9 February 2007¹⁴ makes reference to cost mitigation measures including a £1.8m saving resulting from the proposed change from 4 spreads to 3 and also to the NGT instruction not to mobilize additional side-booms from Greece. A revised baseline / benchmark / critical price of £137.2m / £146.2m / £156.2m was reported as agreed and to be detailed in PMI/035.

There is a reference to PMI/035 dated 26 April 2007 in the list of PMIs forwarded to Rune/Penspen ref #69 but only 20 more PMIs were issued in the following 14 months during which time outturn costs rose by more than £90m above the revised benchmark price. (note: NGGT responded¹⁵ regarding lack of evidence of Project Manager involvement in cost control by simply listing extracts from board papers and project manager monthly reports. The reports do demonstrate active mitigation of risk of pipeline delay but there remains very little evidence of control or challenge to the cost increases as they developed).

The Key Issues Paper ref #64 fails to clearly identify the lengths of the original proposed southerly route and the final selected northern route. Lengths extracted from other NGT papers are summarised as follows:

Original Southerly Route to Tirley (as planned prior to July 2005):

Aberdulais to Llanvetherine:	77km	
Llanvetherine to Peterstow:	36km	
Peterstow to Tirley:	29km	total 142km

Selected Northern Route to Tirley (from July 2005)

Felindre to Brecon:	87km (increased to actual 89km)	
Brecon to Tirley:	107km (increased to actual 109km)	total 198km

plus underused Felindre to Cilfrew section: 17km
essentially provides only spare capacity
and flexibility in network as a result of northern
route selection *to best manage environmental concerns*.

The change from southerly to northern route was reflected in the July 2005 sanction paper, ref #8 but appears to include the forecast cost of a somewhat shorter northern route than was actually built.

Nowhere in the Key Issues Paper is it identified that the route change required an additional 56km length of pipeline or that a nominal additional cost to the project of roughly £100m can be directly attributable to the change.¹⁶

¹⁴ In consolidated contract ref #58

¹⁵ Refer Appendix 9: Summary Status of NGGT responses to Requested Information - item 13. Amongst other questions, NGGT were requested to "Please provide any evidence to justify the magnitude of the cost increases including evidence that the increased costs were vigorously challenged both at the working level and in terms of the sanctioning committee at the time"

¹⁶ NGT network Strategy MH Project Board Minutes from 9 June 2005, ref #181 simply identifies that the northern route was environmentally superior although longer and more expensive

It should be noted that the Risk Appraisal section of the July 2005 sanction paper ref #8 does set out that Transco's liability for buy-back costs had been estimated at £298m with one year delay (anticipated to be unavoidable for the southerly route) and that NGT considered the newly selected northern route scheme could be achieved by October 2007 albeit with significant attendant risk.

This estimation of £298m contrasts with that made in Section 6 of the May 2007 Re-sanction Paper for the Total South Wales Reinforcement Scheme, ref #10, that "Should National Grid be unable to provide the capacity signalled through the auctions, it will incur a penalty under the Capacity Buyback incentive scheme. The maximum exposure for late delivery is £36m profiled over time"

3.5.2

Comparison of Baseline and Outturn Costs

BASELINE PRICE FOR MWC SEPT 2006 = £99,138,181 PLUS £12M P(50) RISK

OUTTURN COSTS FOR PIPELINE – refer to Table reproduced from para.3.60 of the Grant Thornton Report below:

Felindre to Brecon Pipeline

WBS Element	WBS Description	Ref ¹²	Pre October 2007 £	Post October 2007 £	Total £
TCC/03114-1-01	MAIN WORKS PIPELINE-MWC1	1	177,121,119	63,189,203	240,310,322
TCC/03114-1-06	MATERIALS	2	39,831,530	(5,236,817)	34,594,713
TCC/03114-1-11	COMPENSATION	3	3,040,250	6,572,805	9,613,055
TCC/03114-1-09	INSPECTION SERVICES	6	7,115,151	2,219,201	9,334,352
TCC/03114-1-02	PROJECT SERVICES-PSC1	5	4,200,958	2,257,302	6,458,260
TCC/03114-1-10	EASEMENTS	3	4,372,749	389,739	4,762,488
TCC/03114-1-16	MISCELLANEOUS	11	2,227,479	1,285,953	3,513,432
TCC/03114-1-14	NG STAFF COSTS	4	993,252	783,383	1,776,635
TCC/03114-1-13	LEGAL SERVICES	3	810,757	415,319	1,226,077
TCC/03114-1-03	LAND AGENTS-LAC1	3	375,973	776,948	1,152,922
TCC/03114-1-12	COMMUNITY RELATIONS	3	644,836	358,431	1,003,267
TCC/03114-1-18	ENHANCEMENT COSTS	3	-	769,770	769,770
TCC/03114-1-15	FEASIBILITY COSTS	8	678,197	-	678,197
TCC/03114-1-17	CPO ENQUIRIES	3	200,112	58,401	258,514
TCC/03114-1-19	COMMUNITY GAIN	3	5,500	111,818	117,318
TCC/03114-1-08	NETWORK COSTS	11	16,200	-	16,200
TCC/03114-1-07	OLI	11	-	(45,789)	(45,789)
Total			241,634,065	73,905,668	315,539,732

An indicative breakdown of MWC costs for this Option E contract was provided by NGT, ref #77 reproduced in Table below. There is a small variance in total cost of MWC, again most likely due to the timing of the compilation of the two sets of costs:

Felindre to Brecon			
	Apr-06	Nov-06	Final
1 Stage 1 and design	6,508,132	9,975,059	13,300,469
2 Project Admin - Staff & Consultants	7,876,215	12,018,295	27,385,661
3 Project Admin - Office & Transport	8,794,386	12,506,335	14,311,925
4 Enviromental H&S and 3rd Parties	1,015,000	7,191,866	18,440,415
5 Pipe Dumps, Pipe transport and Bending	1,317,346	3,150,473	7,478,457
6 ROW, topsoil strip, excavation	15,255,557	17,182,114	26,497,886
7 Stringing, welding, coating, tie-ins and special sections	16,101,086	22,850,585	24,879,983
8 Lower and Lay and backfill	5,116,855	9,283,471	10,058,570
9 Auger bores and Pipejacks	3,734,176	2,000,000	5,192,852
10 Microtunnels	4,881,776	10,684,580	26,565,703
11 HDDs	0	0	7,774,918
12 AGIs and permanent materials	8,299,194	9,729,996	9,788,214
13 Cathodic protection, inspection, testing and pre commissioning	2,705,355	4,201,959	8,085,135
14 Drainage and reinstatement	3,783,010	11,709,156	15,549,190
15 Insurance and Fee	7,924,907	12,289,803	15,528,414
16 Miscellaneous	5,825,448	13,546,309	11,098,253
Totals	99,138,443	158,320,002	241,936,044

NGT's Final Completion Report GTIC 0065 dated 11 October 2013, ref #21 provided some additional background information on the work performed for this pipeline segment. The report identified that there were 47 major tunnels of total length 2.1km constructed (£26.6m cost identified in table above). The AGI cost was approximately £9.7m (for one pig trap and one block valve AGI). No information was provided for the £7.7m HDD cost.

3.5.3 Conclusion

The outturn costs for the 89km Felindre to Brecon pipeline MWC (£240.3m) increased by a factor of 2.15 compared to the initial contract award P(50) value (£111.6m). This factor would reduce to 2.10 to account for the route length actually constructed, up from 87km envisaged in 2005.

This factor is very high and appears to be a consequence of adopting an Option E cost reimbursable contract form.

MWC costs represent 76.2% of the outturn cost for this pipeline segment which also appears very high.

3.6 **Brecon to Tirley Pipeline**

3.6.1 General Discussion – Key Issues – Consolidated Contracts

The intended routing of this third section 94barg diameter 1200mm pipeline was from Llanvetherine to Peterstow and Peterstow to Tirley a combined distance of circa 65km. These sections would have completed the new pipeline connection between Milford Haven and Tirley to provide (with associated AGI modifications) an estimated capacity in excess of the required 650GWh/day by October 2007, ref Appendix 1 of NGT paper ND360, ref #6 reproduced in Section 3.4 above.

In July 2005, the pipeline route was changed to run north of the Brecon National Park and as a result this section of pipeline was relocated to start at Brecon instead of Llanvetherine. The new Brecon to Tirley route had an estimated length of 107km which eventually became 109km.

A Key Issues Paper on Procurement Strategy for this pipeline segment was provided to Rune/Penspen, ref #62.

The paper explains how an OJEC compliant invitation to tender was issued on 31 May 2005 for the Llanvetherine to Tirley pipeline segment. The ITT also included the shorter Honeybourne to Wormington pipeline segment which was intended to

provide capacity up to 950GWh/day by Jan 2009 and was therefore not required to be constructed in 2007 and in fact was subsequently cancelled¹⁷.

The executive summary congratulates the commercial team in securing an “Option C deal” for 107km thus *limiting exposure to Option E for the remainder of the pipeline*. This raises the obvious question as to why more of the northern route pipeline (all of which was constructed in 2007) was not secured under NEC Option C.

This is partially answered in paragraph 6 of the executive summary which reported that:

In July 2005, it was established that Contractor C were the only Contractor (of the two most competitive tenderers) who had demonstrable capacity, and would commit to constructing the whole of the works in a single build season in 2007.

In section 9 of the Key Issues paper it is reported that (second lowest bidder) Contractor C had undertaken to complete 100km by end October 2007 and that the lowest bidder Contractor F were deemed technically non-compliant for limiting the length of pipeline it could construct in one season to maximum 80km.

Contractor C apparently continued to be considered technically compliant when the revised scope increased from 100km to become 107km.

The real consequence of the change from southerly to northerly route in July 2005 required NGT to construct almost 200km of northern route pipeline (from Felindre to Tirley) in one season, 2007 instead of 142km for the southern route¹⁸.

This is not evident from the Key Issues Paper for this Brecon to Tirley pipeline, ref #62. Neither is it evident from the executive summary of the Felindre to Brecon pipeline Key Issues Paper, ref #64 which reports that:

After an extensive routing and consultation exercise the route was ultimately revised to run from Felindre near Swansea to Tirley in Gloucestershire. The revised route best managed environmental concerns and had the potential to be constructed in one construction season.

3.6.2 Contract Strategy¹⁹

Having just received three comparable tenders for 65km of pipeline and with the realization in July 2005 that now almost 200km of northern route pipeline had to be constructed in the 2007 season, it is surprising that NGT did not take the opportunity to split this work into three packages of roughly 66km each.

Instead, NGT actively pursued a two contractor accelerated working pipeline contract strategy by exerting pressure on both its existing pipeline contractor and its preferred alternative bidder to commit to constructing more pipeline in one season than they were comfortable with.

¹⁷ Key Issues paper ref #62 identifies that Contractor C tendered for 10km Honeybourne to Wormington section dia. 900mm together with 55km Llanvetherine to Tirley section dia. 1200mm but that Contractor C were eventually awarded a contract for 107km Brecon to Tirley dia. 1200mm pipeline at an increased target price. Any 1200mm dia. linepipe ordered for the tendered pipeline could have been used for the awarded Brecon to Tirley section. NGGT did not provide any linepipe order details to confirm this but It is suspected that NGT would not have ordered the linepipe for the 900mm Honeybourne to Wormington section as this section was never required to be completed by end 2007. Neither do the NGT accounts spreadsheet information, ref #54 identify individual lengths/diameters of procured linepipe materials. Refer also to Section 4.7 for further discussion on linepipe.

¹⁸ or only 113km as the construction of the 29km new section from Llanvetherine to Peterstow could have been postponed to the 2008 season as it was due to provide a capacity increase from 650 to 740GWh/day and was therefore not required to be completed until January 2009, ref #6.

¹⁹ Contract strategy has been deduced from reading the individual Key Issues and Board Papers. These papers appear to have been written in hindsight and with the aim of justifying the contract strategy decisions that had already been taken.

Section 7 of the Key Issues Paper identified that *Contractor B had advised that they did not have the required capacity for a 2007 build due to their obligations on the Milford Haven to Aberdulais contract* yet NGT continued to actively encourage Contractor B to accelerate this work.

Contractor F had tendered to complete circa 65km in one season and were subject to tender evaluation but their bid was subsequently dismissed as technically non-compliant when NGT decided to adopt the northern route and substantially changed the scope of work required. Presumably Contractor F bid would have remained compliant had the scope remained as 65km equivalent to one third of the northern route.

Neither does NGT appear to have asked the remaining *next lowest compliant tenderer Contractor E* whose price was reported as being less than £3m higher than Contractor C in the Executive Summary, whether it actually had the capacity to construct 65km of pipeline in the 2007 season. (note: Contractor E capacity was queried in the Felindre to Brecon Key Issues Paper but not mentioned in the Brecon to Tirley Key Issues Paper).

Splitting the northern route between the three pre-qualified tenderers (Contractor C, Contractor E and Contractor F) would have required less incentivisation and had the added major benefit that it would not have been necessary to accelerate the Milford Haven to Aberdulais contract already let to qualified main works contractor, Contractor B (initial cost of acceleration, £12.5m agreed on 13 Oct 2005 with PMI/043 but susceptible to cost increases due to conversion from Target Cost Option C to Cost Reimbursable Option E).

The Brecon to Tirley pipeline was awarded on 8 Sept 2005 to Contractor C supported by (subcontractor) Contractor D described as a new entrant to the UK market even though ref #65 reports previous NGT projects completed by Contractor D in 2001 and 2003. Contractor D are reported as qualifying for NGT work on 1 November 2005.

On 15 Sept 2005, one week after the award, letters were sent to the unsuccessful tenderers even though no apparent decision had been made regarding contract strategy for the construction of the missing 87km section of pipeline from Felindre to Brecon.

Key Issues Paper #64 reported that *NGT had no other credible option to ensure delivery* (of the Felindre to Brecon pipeline) *other than to utilize the capacity made free by Contractor B* (at an initial accelerated cost of £12.5m). In October 2005, NGT issued an ITT apparently to Contractor B only, for the missing section, refer also to discussion in previous section 3.5.

It is concluded that a real opportunity was lost between July and October 2005 (and even later) to let the alternative northern route as three separate Option C contracts using the competitively tendered rates received from the OJEC tender.

Instead, NGT effectively let only one new contract for the northern route and doubled the scope of an existing contract which had already been converted to a cost reimbursable Option E. As a result, NGT ended up with a MWC outturn cost of £471.0m for 211km (£2.23m/km) under an extended Option E contract compared to a MWC outturn cost of £147.6m for 109km (£1.35m/km) under an Option C contract, both contracts initially let with identical tendered baseline prices of circa £78m albeit with significant scope changes.

It is not clear from the documentation provided by NGGT what role the assigned Project Manager, Contractor G had in formulating and implementing the contract strategy actually adopted for the pipeline contracts. A simple accelerated two

contract onshore pipeline strategy is reported in the monthly Project Manager reports for 2005, even if precedence is given in the text of the reports to the alternative on-going offshore route investigations²⁰, refs #101 to #139.

3.6.3

Comparison of Baseline, Revised Target and final Outturn Costs

BASELINE PRICE FOR MWC SEP 2005 = £77,876,536 PLUS £8.4M P(50) RISK

REVISED OPTION C TARGET COST FOR MWC FEB 2007 = £138.5M EXCLUDING P(50) RISK

The Key Issues Paper does not provide any explanation for the increased target cost. The timeline of key events does record that Contractor C had submitted a Stage 2 tender price of £141.8m on 16 October 2006. Such a price would reflect a simple pro-rata cost increase to reflect the increased length of pipeline, estimated length of 107km compared to 65 km originally tendered.

Neither does the Key Issues Paper provide any further explanation for apparent reduction in target cost to £138.5m formalized in the supplementary agreement of 1 February 2007 although it is noted that the revised target cost did not include any allowance for P(50) risk.

OUTTURN COSTS FOR PIPELINE – refer to Table reproduced from para.3.66 of the Grant Thornton Report below:

Brecon to Tirley Pipeline

WBS Element	WBS Description	Ref ¹³	Pre October 2007 £	Post October 2007 £	Total £
TCC/03113-1-09	MAIN WORKS PIPELINE-MWC2	1	103,706,392	43,938,671	147,645,063
TCC/03113-1-01	MATERIALS	2	44,476,099	(85,941)	44,390,158
TCC/03113-1-05	EASEMENTS	3	6,381,766	2,758,801	9,140,567
TCC/03113-1-04	INSPECTION SERVICES	6	2,883,961	1,584,204	4,468,165
TCC/03113-1-10	PROJECT SERVICE-PSC2	5	2,210,265	1,941,009	4,151,274
TCC/03113-1-16	MISCELLANEOUS	11	1,545,003	566,261	2,111,264
TCC/03113-1-14	STAFF COSTS	4	1,048,624	929,677	1,978,301
TCC/03113-1-08	LEGAL SERVICES	3	318,695	956,881	1,275,576
TCC/03113-1-18	ENHANCEMENT COSTS	3	-	1,231,552	1,231,552
TCC/03113-1-03	NETWORK COSTS	11	518,864	249,071	767,935
TCC/03113-1-07	COMMUNITY RELATIONS	3	335,662	318,465	654,127
TCC/03113-1-15	FEASIBILITY COSTS	8	569,650	-	569,650
TCC/03113-1-11	LAND AGENTS-LAC2	3	284,057	237,804	521,861
TCC/03113-1-17	CPO ENQUIRIES	3	416,760	100,440	517,200
TCC/03113-1-12	LAND PURCHASE-LP2	3	-	347,152	347,152
TCC/03113-1-19	COMMUNITY GAIN	3	21,513	61,541	83,054
TCC/03113-1-13	AGI WORKS-AGI2	11	74,378	3,419	77,797
TCC/03113-1-06	COMPENSATION	3	63,700	-	63,700
TCC/03113-1-02	OLI	11	46,732	4,338	51,070
Total			164,902,121	55,143,344	220,045,465

No further breakdown of MWC costs was provided by NGGT for this section of work although NGT's Final Completion Report GTIC 0065 dated 11 October 2013, ref #21 provided some additional background information on the work performed for this pipeline segment.

²⁰ These alternative investigations were dropped when it became evident that a longer timescale was required for implementation of an offshore route.

The MWC account does include for a Bonus payment of £4m to Contractor C in accordance with ancillary contract clause, ref Grant Thornton Report, Appendix 5, ref #93. This is the only bonus payment that has been specifically identified in the NGGT accounts.

The report identified that no major tunnels were constructed on this pipeline segment. AGI's comprised Treadow PRS, three pig traps and a new pressure reduction skid at Ross AGI, although no cost information was provided.

The Compensation Event (CE) listings for the Brecon to Tirley contract, ref #97A and #97B identify that £23.35m of the outturn MWC cost of £147.65m, was attributed to agreed Compensation Events. This represents an 18.8% uplift²¹ (on net MWC cost for incurred risks) compared to 10.8% uplift on baseline price for anticipated P(50) risk.²²

In various papers, NGGT have documented several main causes of increased costs and have allocated £40m to adverse weather in summer 2007 and in excess of £15m to protestors up to May 2007.

For the Brecon to Tirley Pipeline, some of these additional costs are identified as Compensation Events including:

- Weather events May, June and July 2007, ref CE's 050, 056, 060 and 061 total sum agreed £4,910,670.47
- Activist damage Oct 2007, ref CE 087, total sum agreed £222,350.55
- 24 hour security at pipe-dumps, ref PMI 043, total sum agreed £1,057,969.12

Contractual Weather "Events" have already been discussed above in Section 3.2 and appear to have been more prevalent in the east of the region co-incident with the Brecon to Tirley pipeline segment yet only a small proportion (~12%) of the overall cost of £40m allocated by NGGT to "Weather" was in fact identified in the list of compensation events for Brecon to Tirley.

Protestor actions and provision of additional security leading to Compensation Events on the Brecon to Tirley pipeline segment also appear to account for only a small proportion of the overall increased cost allocated by NGGT to Protestors.

For the Brecon to Tirley Pipeline it can be concluded that weather, protestors and consents were not the main drivers of project cost increases.

3.6.4

Conclusion

The outturn costs for the Brecon to Tirley pipeline MWC (£147.6m for actual 109km pipeline length) increased compared to the initial contract award P(50) value (£86.29m for 65km pipeline) by a nominal factor of 1.71. This factor reduces to 1.02 if the increased pipeline length is taken into account on a simple pro-rata basis²³ but does not take into account the removal from the scope of the Tirley PRI.

An original baseline cost of the Tirley PRI has not been identified in the documentation provided by NGGT. If a nominal MWC figure of £10m is assumed then the factor increases to 1.15.²⁴

²¹ 18.8% from $100 \times 23.35 / (147.65 - 23.35)$

²² 10.8% from $100 \times 8.4 / 77.88$

²³ Factor 1.02 from $147.6 / 86.29 \times 65 / 109$

²⁴ Factor 1.15 from $147.6 / 76.29 \times 65 / 109$

Nevertheless, it can be concluded that the outturn costs for the MWC on this pipeline segment compared reasonably well with the tendered prices and this can only be due to the use of an NEC Option C contract instead of the cost reimbursable Option E contracts used for the other two pipeline segments.²⁵

MWC costs represent 67.1% of the outturn cost for this Option C pipeline segment which also appears somewhat higher than usual for a pipeline contract but is lower than the percentages for other two pipeline segments identified in Sections 3.4 and 3.5, namely 71.5% and 76.2%²⁶.

3.7 **Wormington Compressor Station & Wormington Incident**

3.7.1 Wormington Compressor Station - General Discussion – Key Issues – Consolidated Contracts

Wormington Compressor Station reverse flow modifications and new unit were required (in conjunction with other works) to provide estimated capacity of 422GWh/day, according to Appendix 1 of ND 360, ref #6.

A Key Issues Paper on Procurement Strategy for this AGI (combined with Churchover, see next Section 3.8) was provided to Rune/Penspen, ref #66.

The Paper described how the modifications were not required until mid-2008, presumably resulting from the anticipated deferment of the Aberdulais to Llanvetherine pipeline to summer 2008.

The contract strategy and tendering history is described in considerable detail leading to the dual award to MWC, Contractor A of the Wormington and Churchover modifications plus new units and the new Compressor Station at Felindre.

Contract award was on a two stage basis, conceptual design under NEC2 Option E and detail design, procurement and main works construction under Option C - Target Cost.

3.7.2 Comparison of Baseline and final Outturn Costs

BASELINE PRICE FOR MWC SEP 2005 = £43,397,333 PLUS £4.1M P(50) RISK INCLUDED FOR CHURCHOVER IN ADDITION TO WORMINGTON.

Assuming a nominal 60% Wormington / 40% Churchover baseline cost split in line with the proportional spend on Procurement of Materials >£50k²⁷, a reduced baseline price including P(50) risk for Wormington only would be approximately £28.5m.

OUTTURN COSTS FOR WORMINGTON - refer to Table reproduced from para.3.74 of the Grant Thornton Report below:

²⁵ Contractual differences between Option C and Option E are described further in Appendix 6

²⁶ In Penspen experience, MWC cost is typically around 45% for a standard pipeline contract. Thus, MWC costs are higher than typical for all three pipeline contracts, even the Option C contract

²⁷ Refs #157 and #155 reproduced in Sections 3.72 and 3.82. Wormington > £12m, Churchover > £9m

Wormington Compressor Station

WBS Element	WBS Description	Ref ¹⁴	Pre October 2007 £	Post October 2007 £	Total £
TCC/03130-1-02	MAIN WORKS CONTRACT	1	19,058,321	28,830,304	47,888,625
TCC/03130-1-09	ELECTRICITY CONNECTIONS	9	4,463,079	2,257,414	6,720,493
TCC/03130-1-03	PROJECT SERVICES	5	998,426	687,722	1,686,148
TCC/03130-1-10	NG COSTS	4	568,355	275,659	844,014
TCC/03130-1-26	MINOR ORDERS	11	-	269,433	269,433
TCC/03130-1-06	COMMUNICATIONS	7	47,117	35,905	83,022
TCC/03130-1-01	FEASIBILITY STUDIES	8	76,521	-	76,521
TCC/03130-1-07	PROJECT MANAGER LIAISON	11	5,425	7,364	12,789
TCC/03130-1-22	INCIDENT INVESTIGATION COSTS	11	-	6,387	6,387
TCC/03130-1-15	UPS & ELECTRICAL	11	325,548	(325,548)	-
	Total costs as provided by NGGT		25,542,792	32,044,639	57,587,432
TCC/20045	Wormington incident costs ¹⁵		-	6,662,904	6,662,904
	Total costs amended for Wormington incident		25,542,792	38,707,543	64,250,336

MWC outturn costs of £47.9m represents an increase by a factor of 1.68 over interpolated baseline MWC cost £28.5m and is quite high for a target cost contract.

MWC costs represent 83.2% of the outturn cost for this Compressor Station works but does include materials procured by MWC including the new compressor.

A listing of the Materials costs greater than £50k, totalling at least £12m and included within the £47.9m MWC cost above was provided by NGT, ref #157 reproduced in Table below:

PROCUREMENT SCHEDULE (Orders over £50k)			
2280B WORMINGTON COMPRESSOR STATION			
Number	Equipment	Supplier	Cost
PO/Enq			Actual
	Compressor		£5,317,841
P0043	Ball Valves		£1,785,102
C9022	Control System inc F+G		£1,631,123
P0035	Carbon Steel Fittings Long Lead		£565,419
P0036	Carbon Steel Pipe (Long Lead)		£474,245
p0138	Flow Control Valves amd 3		£278,641
P0065	Gas/Liquid Separator		£257,625
P0043a1	Ball Valves Interim MTO		£242,035
C9021	Instrument Air Package		£189,604
P0088	Inspection of Compressor parts		£126,667
C9024	Diesel Generator & Fuel Tank		£126,403
P00204	Carbon Steel Fittings + Amd		£92,916
P0107	Metering Skid FT100016		£88,541
P00356	Electrical Cables from Stock		£87,607
P00432	Temp strainers		£79,480
P00708	Check Valves; 900 & 600 - replacements		£78,195
P1983	Actuator change gas to air		£77,951
C9025	Main LV Switchboard		£77,313
C9025	Metering Skid FT 10020		£76,806
C9025	Metering Skid Replace AGI FT 400011		£76,806
C9025	Metering Skid Station import FT 100007		£76,806
P00335	Pirelli Electrical Cables		£74,418
C9021	Nitrogen Generation Package		£69,275
P036a1	Carbon Steel Pipe Long Lead		£65,073
P0032	Carbon Steel Flanges (Long Lead)		£59,368

The Compensation Event (CE) listing for Wormington, ref #96 identifies that approximately £2m of the outturn MWC cost (of £47.9m less £12m materials) was attributed to agreed Compensation Events. This represents less than 6% uplift on net MWC cost and therefore does not fully explain where all the cost increases associated with this contract came from.

The Procurement Strategy Key Issues Paper ref #66 identifies that Form D re-sanctions were requested in March 2008, August 2008, March 2009 and October 2011 to account for the cost increases. There is most likely some further contract documentation issued after 2005 that formalises these cost increases.²⁸

3.7.3 Wormington Compressor Station Conclusion

There is no evidence to suggest that this contract was not performed in an efficient manner.

3.7.4 Wormington Incident

As part of the modifications at Wormington Compressor Station an incident occurred in November 2007 during commissioning of 900mm diameter pipework resulting in failure of a circumferential weld. The immediate result is summarised in the extract from the Project Manager Report 080110 (ref #132) as follows:

During commissioning at Wormington pipe manifold movement was discovered in the AGI laterals area of the compressor station. A detailed investigation is in progress with the HSE actively involved. The HSE have issued a possession order for the damaged pipe. The effect of this is that National Grid are agreeing the methodology for the investigation and removal of the damaged pipe sections at all key stages with HSE. The current plan is for the damaged pipework to be lifted out on Monday 14 January. The forecast completion dates for both Phase 1 and Phase 2 compression at Wormington and Churchover will be impacted as a result and will be dependent on the outcome of the investigation, which is still at an early stage. An updated programme for compression will be provided in mid-January 2008.

This was a serious incident and could have resulted in injury or fatalities however as a full investigation in conjunction with HSE was conducted we have not commented further. The effect on the project is summarised in the extract below from the Project Manager Report 080131 (ref #133).

The Wormington re-build and integrity assurance activities have been reviewed with Contractor A for a number of root cause scenarios. No scenarios return Wormington to service by the time that Churchover needs to go onto outage to achieve Winter 2008/9 completion; Churchover operational availability issues prevent a winter outage extension at Churchover. Strategy meetings with GNI and GNCC have been held to run through the planning interaction between Wormington and Churchover; the outcome being that only non-intrusive work will now take place at Churchover in 2008 and the pipework changes for reverse flow and tie in of the new VSD Compressor will now be scheduled for 2009.

As a result, Wormington Compressor Station was not available in winter 2007/8 due to the incident and on-going investigation and recovery programme and was programmed to be re-commissioned in September 2008. Churchover Compressor Station was planned to be on outage in 2008, however, this was not possible given that Wormington was not due to return to service until September 2008 and hence the Churchover programme was deferred to 2009. Expenditure was sanctioned in

²⁸ The consolidated contract documentation provided by NGGT for this contract, ref #57 dates from 2005 only

Wormington & Churchover Compressor Stations – Incident Recovery TIC 272 (ref #32) at £11.7m in the range £10.6m to £14.7m.

NGT looked to the MWC, Contractor A, or its subcontractor to hold liability for the incident and resultant costs however as a result of legal advice (ref #34, #35 and #36) cost recovery was not pursued further.

The actual outturn cost allocated to the Incident comprised rebuild costs, rescheduling costs, project services costs, investigation costs and (minimal) NG site staff costs which were subsequently removed from the main accounts data and are now included in a separate tab in the NGT Accounts SAP Summary (ref #54)

The Grant Thornton Report, para.3.107, (ref #93) identifies the Wormington Incident costs totalling £12,162,904, including £8,835,543 MWC costs for the rebuild and programme deferment. Grant Thornton, para.3.108, goes on to identify that these NGT extra project costs were reduced by the sum of £5.5m received from insurers.

On the basis that we have not commented on the causes of the incident, the costs of restoration are taken at face value, the rationale to defer works in order to maintain security of supply within the system is accepted and the incident costs have been separated out of the project.

The Grant Thornton Report, para.3.106 concludes that the separated out costs for the Wormington Incident are a matter for discussion between Ofgem and NGGT.

3.8 **Churchover Compressor Station**

3.8.1 General Discussion – Key Issues – Consolidated Contracts

Churchover Compressor Station reverse flow modifications and new unit were required (in conjunction with other works) to provide estimated capacity of 850GWh/day, according to Appendix 1 of ND 360, ref #6 and would therefore be required prior to January 2009.

A Key Issues Paper on Procurement Strategy for this AGI (combined with Wormington, see previous Section 3.7) was provided to Rune/Penspen, ref #66.

The contract strategy and tendering history is described in considerable detail leading to the dual award to MWC, Contractor A of the Wormington and Churchover modifications plus new units and the new Compressor Station at Felindre.

Contract award was on a two stage basis, conceptual design under NEC2 Option E and detail design, procurement and main works construction was under Option C - Target Cost.

3.8.2 Comparison of Baseline and final Outturn Costs

BASELINE PRICE FOR MWC SEP 2005 = £43,397,333 PLUS £4.1M P(50) RISK INCLUDED FOR WORMINGTON IN ADDITION TO CHURCHOVER.

Assuming a nominal 60% Wormington / 40% Churchover split, a reduced baseline price including P(50) risk for Churchover only would be approximately £19.0m

OUTTURN COSTS FOR CHURCHOVER – refer to Table reproduced from para.3.80 of the Grant Thornton Report below:

Churchover Compressor Station

WBS Element	WBS Description	Ref ⁶	Pre October 2007 £	Post October 2007 £	Total £
TCC/03131-1-02	MAIN WORKS CONTRACT	1	18,851,193	15,065,078	33,916,271
TCC/03131-1-09	ELECTRICITY CONNECTIONS	9	3,697,660	404,281	4,101,941
TCC/03131-1-03	PROJECT SERVICES	5	906,324	543,055	1,449,379
TCC/03131-1-10	NG COSTS	4	282,044	890,725	1,172,769
TCC/03131-1-22	MINOR ORDERS	11	-	219,638	219,638
TCC/03131-1-01	FEASIBILITY STUDIES	8	133,627	-	133,627
TCC/03131-1-06	COMMUNICATIONS	7	25,107	70,677	95,784
TCC/03131-1-07	PROJECT MANAGER LIAISON	11	5,148	1,763	6,911
TCC/03131-1-05	LAND AQUISITION	3	380	(380)	-
TCC/03131-1-08	CONTAMINATED LAND	11	8	(8)	-
TCC/03131-1-11	COMPRESSOR	11	254	(254)	-
Total			23,901,744	17,194,574	41,096,318

MWC outturn costs of £33.9m represents an increase by a factor of 1.78 over interpolated baseline MWC cost £19.0m and is quite high for a target cost contract.

MWC costs represent 82.5% of the outturn cost for the Compressor Station works but does include materials procured by MWC including the new compressor.

A listing of the Materials costs greater than £50k, totalling at least £9m and included within the £33.9m MWC cost above was provided by NGT, ref #155 reproduced in Table below:

PROCUREMENT SCHEDULE (Orders over £50k)			
2280A CHURCHOVER COMPRESSOR STATION			
Number PO/Enq	Equipment	Supplier	Cost Actual
	Compressor		£5,224,466
P00042	Ball Valves		£1,093,360
C9029	Control System + F & G equipment		£749,191
P00033	Carbon Steel Fittings (Long Lead)		£294,962
C9021	Instrument Air Package		£189,604
P00037	Carbon Steel Pipe(Long Lead)		£180,810
P0108	Station Flow Meter-900mm		£161,456
P00357	Electrical Cables/Glands		£128,347
P00204	Carbon Steel Fittings + amd 1		£99,406
P00336	Pirelli Cables		£99,073
C9027	30KVA UPS/DC Power Supply		£96,810
P00140	Flow Control Valves+amends to 6		£95,186
P0078	Axial Check Valves		£81,958
P00431	Temp strainer Piping Specials		£75,705
C9021	Nitrogen Generation Package		£70,746
C9025	Main LV Switchboard		£64,927
P00315	Strainer		£58,324
P00282	Concrete Troughs		£54,999
C9025	VSD Comp Switchboard/MCC		£52,543
P00283	Silencers		£51,761
P00031	Carbon Steel Flanges (Long Lead)		£51,530

The Compensation Event (CE) listing for Wormington, ref #96 identifies that approximately £3m of the outturn MWC cost (of £33.9m less £9m materials) was attributed to agreed Compensation Events. This represents 12% uplift on net MWC cost indicating significant scope changes but does not fully explain where all the cost increases associated with this contract came from.

The Procurement Strategy Key Issues Paper ref #66 identifies that Form D re-sanctions were requested in March 2008, August 2008, March 2009 and October

2011 to account for the cost increases. There is most likely some further contract documentation issued after 2005 that formalises these cost increases.²⁹

3.8.3 Conclusion

There is no evidence to suggest that this contract was not performed in an efficient manner.

3.9 **Felindre Compressor station**

3.9.1 General Discussion – Key Issues – Consolidated Contracts

A new build compressor station was required on the reinforcement pipeline route to provide (in conjunction with other works) estimated capacity of 921GWh/day, according to Appendix 1 of ND 360, ref #6 and would therefore not be required until January 2009.

A Key Issues Paper on Procurement Strategy for Felindre Compressor Station was provided to Rune/Penspen, ref #63.

The Paper described how the compressor station was required by mid-2007 which is somewhat earlier than indicated above from ref #6.

The contract strategy and tendering history overlaps with the Wormington and Churchover Paper, ref #66 but describes in considerable detail the dual award to MWC, Contractor A of the Wormington and Churchover modifications plus new units and the new Compressor Station at Felindre.

Contract award was on a two stage basis, conceptual design under NEC2 Option E and detail design, procurement and main works construction was under Option C - Target Cost.

3.9.2 Comparison of Baseline and final Outturn Costs

BASELINE PRICE FOR MWC SEP 2005 = £44,639,885 PLUS £4.2M P(50) RISK.

OUTTURN COSTS FOR FELINDRE - refer to Table reproduced from para.3.86 of the Grant Thornton Report below:

²⁹ The consolidated contract documentation provided by NGGT for this contract, ref #57 dates from 2005 only

Felindre Compressor Station

WBS Element	WBS Description	Ref ¹⁷	Pre October 2007 £	Post October 2007 £	Total £
TCC/03129-1-02	MAIN WORKS CONTRACT	1	25,244,296	50,300,163	75,544,459
TCC/03129-1-03	PROJECT SERVICES	5	1,602,788	1,758,333	3,361,121
TCC/03129-1-09	ELECTRICITY CONNECTIONS	9	365,825	2,774,138	3,139,963
TCC/03129-1-10	NG COSTS	4	579,708	957,524	1,537,232
TCC/03129-1-01	FEASIBILITY STUDIES	8	648,019	446,719	1,094,738
TCC/03129-1-07	PROJECT MANAGER LIAISON	11	139,065	97,202	236,267
TCC/03129-1-04	PLANNING CONSENTS	3	102,323	-	102,323
TCC/03129-1-16	CONTROL SYSTEM	11	-	88,604	88,604
TCC/03129-1-06	COMMUNICATIONS	7	15,992	21,020	37,013
TCC/03129-1-15	CABS & BUILDINGS	11	-	14,500	14,500
TCC/03129-1-17	COMMUNITY GAINS	3	10,000	1,072	11,072
TCC/03129-1-05	LAND ACQUISITION	3	1,135	938	2,072
Total			28,709,151	56,460,213	85,169,364

MWC outturn costs of £75.5m represents an increase by a factor of 1.54 over baseline MWC cost £48.9m and is quite high for a target cost contract.

MWC costs represent 88.6% of the outturn cost for the Compressor Station works but does include materials procured by MWC including buildings and three new compressors.

A listing of the Works Packages and Materials costs greater than £50k at Felindre Compressor Station, totalling over £40m and included within the £75.5m MWC cost above was provided by NGT, ref #156 reproduced in Table below:

MWC Activity Schedule (Activities over £50k)			
FELINDRE COMPRESSOR STATION			
Number	Works Package	Subcontractor	Total Forecast
3.1	Civils (Inc VSD Building)		12,575,000
3.2	Compressor Package (2nr GT)		7,697,358
3.3	Compressor Package (1nr VSD)		6,835,967
3.4	GT Buildings (2nr)		2,644,786
3.5	Scaffolding		1,555,101
3.51	Security Fencing/CCTV & Gate Control		1,047,777
3.41	Site Accomodation		966,639
3.42	Pipework Fabrication		889,992
3.43	Control/Safety Systems		873,451
3.38	VSD & Inst Air/N2 Buildings		650,000
3.10	Craneage		555,471
3.51	Cable pulling and HV Jointing		486,734
3.52	Testing		485,000
3.6	Bolt Tensioning		348,000
3.63	On-Site Security		295,000
3.7	Insulation		267,000
3.8	NDT		205,689
3.84	Flow Metering		180,000
3.9	On-Site Painting		158,000
3.95	Pipe Supports		135,944
3.43	Unit Loading Control System		125,201
3.45	Pipework Preheat		125,000
3.46	Office Cleaning		101,306
3.44	HVAC		96,081
3.45	Continuous Emissions Monitoring		85,000
3.46	Design Consultants - G17 Appraisers		58,912
3.47	Heavy Lifting Transport		53,550

The Compensation Event (CE) listing for Felindre, ref #95 identifies that just over £2m of the outturn MWC cost (of £75m less £40m materials) was attributed to agreed Compensation Events. This represents less than 6% uplift on net MWC cost and does not fully explain where all the cost increases associated with this contract came from.

The Procurement Strategy Key Issues Paper ref #63 identifies that Form D re-sanctions were requested in May 2006, September 2008, March 2009 and September 2011 to account for the cost increases. There is most likely some further contract documentation issued after 2005 that formalises these cost increases.³⁰

3.9.3 Conclusion

There is no evidence to suggest that this contract was not performed in an efficient manner.

3.10 **Tirley PRI**

3.10.1 General Discussion on Costs

The introduction of the northern pipeline route in July 2005 required a new pressure reduction installation (PRI) connection to the existing gas transmission facilities in the vicinity of Corse/Tirley. The PRI was included in the scope of the Brecon to Tirley pipeline (originally tendered as Aberdulais to Llanvetherine).

There was no Key Issues Paper on Procurement Strategy produced for Tirley PRI and neither does the corresponding paper for Brecon to Tirley pipeline, ref #62 provide any cost details for the proposed Tirley PRI, refer previous Section 3.6.

A Supplementary Paper explaining the scope and history of the Tirley PRI scheme was provided to Rune/Penspen, ref #19.

The paper explained how the Tirley PRI scheme was separated from the Main South Wales Reinforcement scheme in November 2010 due to the extended timeline required to complete the planning process before the Tirley scheme could be started.

This part of the project was sanctioned in November 2010 at an outturn cost of £81m with a closure date of October 2013. Part of the sanctioned costs were for commissioning of the gas and electric units at Felindre Compressor Station and for high voltage remedial measures on the new electric drives at Wormington and Churchover Compressor Stations.

OUTTURN COSTS FOR TIRLEY PRI SCHEME- refer to Table reproduced from para.3.92 of the Grant Thornton Report below:

³⁰ The consolidated contract documentation provided by NGGT for this contract, ref #57 dates from 2005 only

Tirley PRI

WBS Element	WBS Description	Ref ¹⁸	Pre October 2007 £	Post October 2007 £	Total £
TCC/20502-1-10	PAC2030 Main Works PRI	1	-	51,820,671	51,820,671
TCC/20502-1-27	Commissioning Gas Flow	10	-	5,065,670	5,065,670
TCC/20502-1-11	PAC2030 Project Services	5	-	3,589,091	3,589,091
TCC/20502-1-16	Main Works Felindre	1	-	2,005,819	2,005,819
TCC/20502-1-18	NG Costs Felindre	4	-	1,982,550	1,982,550
TCC/20502-1-14	PAC2030 NG Staff costs	4	-	1,750,071	1,750,071
TCC/20502-1-21	Project Services Worm/Church	5	-	1,452,898	1,452,898
TCC/20502-1-02	PAC2030 Materials	2	-	1,393,833	1,393,833
TCC/20502-1-20	Main Works Worm/Church	1	-	1,118,155	1,118,155
TCC/20502-1-17	Project Services Felindre	5	-	1,069,624	1,069,624
TCC/20502-1-13	PAC2030 Land Purchase	3	-	984,844	984,844
TCC/20502-1-05	PAC2030 Inspection Services	6	-	787,999	787,999
TCC/20502-1-22	NG Costs Worm/Church	4	-	753,231	753,231
TCC/20502-1-19	Minor Orders Felindre	11	-	452,835	452,835
TCC/20502-1-09	PAC2030 Legal Services	3	-	346,097	346,097
TCC/20502-1-04	PAC2030 Network Costs (MGD)	11	-	343,193	343,193
TCC/20502-1-08	PAC2030 Community Relations	7	-	308,616	308,616
TCC/20502-1-23	Minor Orders Worm/Church	11	-	218,945	218,945
TCC/20502-1-15	PAC2030 Miscellaneous	11	-	111,603	111,603
TCC/20502-1-24	COMMUNITY GAIN	3	-	77,618	77,618
TCC/20502-1-06	PAC2030 Easements	3	-	36,906	36,906
TCC/20502-1-12	PAC2030 Land Agents	3	-	22,249	22,249
TCC/20502-1-07	PAC2030 Compensation	3	-	17,283	17,283
TCC/20502-1-03	PAC2030 ILI	11	-	2,954	2,954
Total costs as provided by NGGT			-	75,712,756	75,712,756
[redacted] costs ¹⁹			-	5,380,425	5,380,425
Total costs amended for [redacted]			-	81,093,181	81,093,181

MWC outturn costs of £51.8m include a transfer of £20.9m from the Brecon to Tirley pipeline account in January 2011 as illustrated in the Appendix 4 and 5 graphics. Included within the overall Tirley PRI Costs are £5.5m for Felindre and £3.5m for Wormington/Churchover.

NGGT provided Rune/Penspen with the first 36 pages of the contract conditions between NGGT and Contractor C that were applicable to Tirley PRI, namely: *Amendment to the Deed of Variation dated 5 November 2009 (of an engineering contract dated September 2005 in relation to the construction of a steel pipeline and associated works between Brecon and Tirley Contract reference no. NGT 10106)*, ref #56.

The Tirley PRI Form of Agreement was formalized on 8 August 2011, some five months after Contractor C commenced construction at Tirley PRI in March 2011.

The Amendment described how the Tirley PRI works would be paid under an "Option A" Activity Schedule sub total value £18.85m plus provisional sum allowance of £2.8m.

The Compensation Event (CE) listing for Tirley PRI, ref #79 only starts in July 2011 and identifies that just under £8m of the outturn MWC cost was attributed to agreed Compensation Events. CE's dated before July 2011 appear in the Brecon to Tirley pipeline CE lists, ref #97A and #97B.

The corresponding MWC costs between July 2011 and March 2014 extracted from NGGT SAP accounts, ref #54, total £23.9m indicating that approximately 33% of these MWC costs were derived from CE's.

Not all the CE's are directly related to Tirley PRI however. Closer review of the individual CE's reveals that significant cost is associated with remedial works at RDX103, refer to Section 4 for further discussion on this topic.

The Amendment also provided Schedule 2 detailing the Final Agreed value for Brecon to Tirley Pipeline Option C works in the sum of £170,873,689. The agreed final contract value differs from the total MWC costs of £147,645,063 summarized in Section 3.6 above although the transfer of £20.9m in January 2011 would account for most of this £23.2m difference.

3.10.2 Commissioning Gas Flow



3.10.3 Conclusion

In reality most of these costs belong to the individual pipeline contracts but there is a valid logic to splitting them out to be identified and sanctioned separately as NGGT has done. There is no evidence to suggest that this work was not performed in an efficient manner.

3.11 **Environmental Monitoring and Aftercare**

3.11.1 General Discussion

A Supplementary Paper explaining the scope and history of the Pipeline Environmental Monitoring and Aftercare was provided to Rune/Penspen, ref #20.

The paper explained how the Aftercare scheme was separated from the Main South Wales Reinforcement scheme in November 2010 due to the extended timeline to comply with consent conditions and to complete post completion surveys that are specific to this project and additional to national requirements.

This part of the project was sanctioned in November 2010 at an outturn cost of £22m with a closure date of December 2017.

A summary of the outturn costs for the Environmental Monitoring and Aftercare activities are reproduced below, from para.3.98 of the Grant Thornton Report:

Environmental Monitoring and Aftercare

WBS Element	WBS Description	Ref ²⁰	Pre October 2007 £	Post October 2007 £	Total £
TCC/20503-1-02	PAC2149 Main Works Environmental	1	-	13,049,965	13,049,965
TCC/20503-1-07	PAC2149 NG Staff Costs	4	-	258,495	258,495
TCC/20503-1-06	PAC2149 Inspection Services	6	-	105,228	105,228
TCC/20503-1-09	PAC2149 Community Relations	7	-	36,894	36,894
	Total		-	13,450,581	13,450,581

These costs do not include forecast expenditure beyond March 2014 estimated in the Supplementary Paper at circa £6.2m.

3.11.2

Conclusion

In reality these costs belong to the individual pipeline contracts but there is a valid logic to splitting them out to be identified and sanctioned separately as NGGT has done. There is no evidence to suggest that this work was not performed in an efficient manner.

4. MILFORD HAVEN PIPELINE PROJECT EFFICIENCY REVIEW

4.1 Capacity Auctions of September and December 2004

4.1.1 Summary

The Outcome of the LTSEC Capacity Auctions and NGT's response has already been discussed in Section 3.3, above but is summarized here as follows:

September 2004:

Original requirement: Capacity 350GWh/day by October 2007

December 2004:

Requirement increased to Capacity 650GWh/day by October 2007

then further to: Capacity 950GWh/day by January 2009

4.2 Contract Strategy

4.2.1 Adopted Contract Strategy

The Contract Strategy adopted by NGT in response to the LTSEC Capacity Auctions is discussed in Section 3.3, above.

NGT had anticipated meeting the September 2004 Auction requirement by providing 240GWh/day with the new section of 1200mm diameter pipeline from Milford Haven to Aberdulais. Preparatory works had already been sanctioned and preliminary contracts awarded leaving three full years to complete the design and to construct the 122km pipeline over two seasons to be completed by October 2007.

Sanction Papers reveal that NGT intended to defer provision of the remaining capacity of 350GWh/day to summer 2008 with the proposed construction of the 77km Aberdulais to Llanvetherine pipeline which was to run in parallel to existing pipeline infrastructure. Preparatory works for this remaining capacity were only sanctioned and started after the September 2004 auction.

The major advantage of this strategy was that 200km of new large diameter pipeline could be constructed over three seasons, 2006, 2007 and 2008, by one or more contractors in an efficient progressive planned sequence and could be supervised by NGT staff augmented by a small Project Services Team.

4.2.2 Changed Contract Strategy resulting from December 2004 Auction

With the near doubling of the requirement for October 2007 capacity signalled in December 2004, NGT were obliged to radically change contract strategy and now had less than three years to provide 235km new pipeline plus modifications and new compressor units at Peterstow and Wormington, as identified in Appendix 1 of the 6 January 2005 Sanction Paper ref ND 360, reproduced above in Section 3.4.

The requirement to provide 950GWh/day by January 2009 put further pressure on NGT to accelerate delivery of the required infrastructure and led to the adoption of a contract strategy that put programme and minimization of the risk of delay/dispute above cost concerns.

Two consequences of this changed strategy have been described in detail in Sections 3.4, 3.5 and 3.6, namely:

- Acceleration of the delivery and expansion of the planned work-scope of the appointed MWC, Contractor B for the Milford Haven to Aberdulais pipeline

which resulted in a change from a target Option C contract to a cost reimbursable Option E contract with attendant cost escalation.

- Lost opportunity to award three target Option C contracts to qualified bidders for the northern pipeline route option adopted in July 2005 which could have averted the need to accelerate the Milford Haven to Aberdulais MWC..

There are probably many other factors affecting the eventual strategy adopted to deliver the Milford Haven Project.

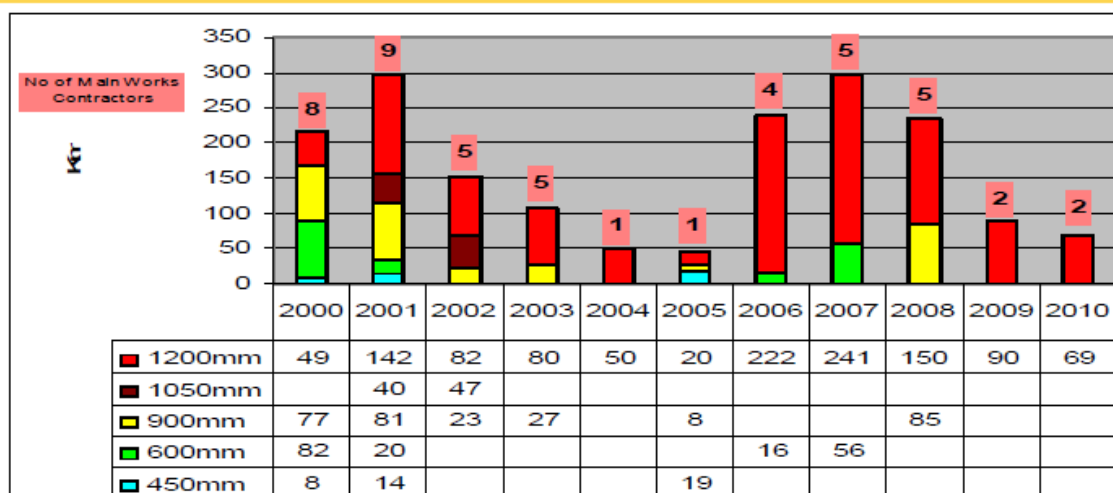
NGGT have, for example cited Uneconomic Supply Chain as a contributing factor, refer to Appendix V extracted from NGT Sanction Paper dated May 2007, ref #10.

Such cyclical trends lead to resource deficiencies and constraints within both Client and Contractor organisations during lean times that tend to be filled with contract or third party resources when work picks up. These factors certainly do not encourage efficient cost expenditure.

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Appendix V: Nature of Gas Transmission Pipeline Construction Market.

Pipeline Construction Km / Year by Diameter 'Uneconomic Supply Chain'



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4.2.3

Opportunities for Cost Reduction of Overall Milford Haven Scheme

Notwithstanding the conclusions made in Section 4.2.1 above, the timing of the LTSEC Auctions and project deadlines for EIA submissions, planning applications and gaining landowner agreements, there may have been opportunities to reduce the overall scope of the works required to meet final capacity of 950GWh/day that were lost.

The Milford Haven to Aberdulais pipeline was conceived to be completed by October 2007 to provide 240GWh/day out of the initial 350GWh/day capacity signalled in LTSEC Auction of September 2004 with future expansion by extension of this pipeline parallel to the No 2 Feeder to Gilwern/Llanvetherine.

In December 2004 the obligated capacity to be provided by October 2007 was increased from 350GWh/day to 650GWh/day rising to 950GWh/day to be provided by January 2009.

By July 2005 the overall scheme was revised to incorporate a major change of route corridor: The Milford to Aberdulais route was retained whilst the corridor following the existing No 2 Feeder (proposed as Aberdulais to Llanvetherine and Peterstow to Tirley) was abandoned in favour of a route corridor running to the north of Brecon Beacons National Park (the Felindre to Brecon to Tirley pipeline).

This resulted in substantial increases in overall pipeline scope but, according to NGT, represented the least risk solution to meeting the commissioning deadline of October 2007.

The sanction papers, project manager reports, etc. do not provide details of any other option or conceptual design studies that may have been undertaken throughout this period or exactly when NGT became aware that the No 2 Feeder corridor was likely to be less favourable than the northern Felindre to Tirley route.

However from the point this was known (circa July 2005), opportunities existed to rationalise the overall scheme and from the evidence provided by NGGT, alternative (onshore) options were not considered.

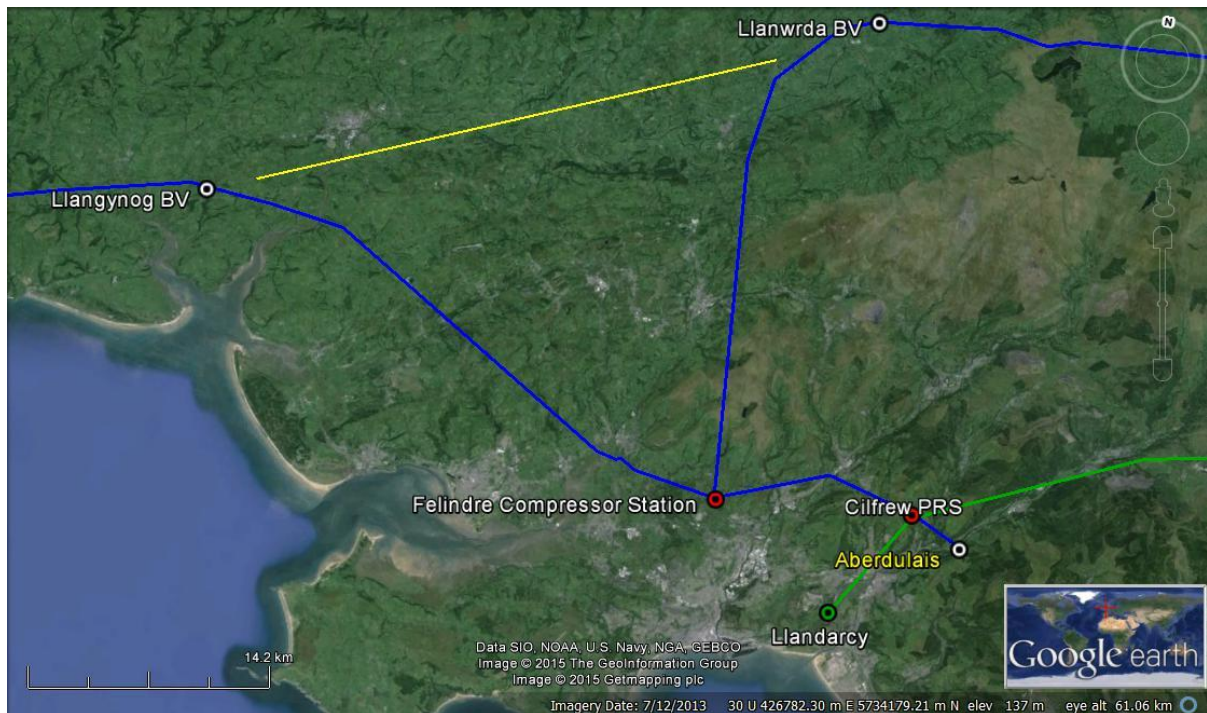
The potential opportunities identified are discussed below and include:

- Potential reduction in the overall length of pipeline needed.
- Potential reduction in diameter of certain lengths of pipeline constructed
- Potential reduction in the number or capacity of PRI's required
- Potential reduction in amount of modification and new units required at Compressor Stations

4.2.4

Pipeline Length

Within the Carmarthen/Swansea/Brecon area the route corridors were revised and defined by July 2005 and are shown in blue on the sketch below.



However as the pipeline ultimately had to reach the existing system in the vicinity of Tirley, not Aberdulais, it would have been possible to construct the pipeline direct from Llangynog to Llanwrda (yellow line in sketch), a distance of 40 km as the crow flies. Hence, a considerable cost savings due to reduced length may have been realised. This direct route also appears, on simple consideration, to be less difficult to construct as it crosses predominantly agricultural land. Whereas the as-built (blue lines in sketch) sections cross through more adverse terrain and include a greater number of difficult crossings including two tidal estuaries, a motorway and several rail crossings.

It is also interesting to note that some locations with particular difficulties which led to overspend were on these (blue) routes including the two CPO's, HDD's, the protestor action at Trebanos and the planning issues associated with Cilfrew PRI, although these were not necessarily foreseeable during the planning phases.

A connection into the South Wales gas supply system may have still been required and would also be advantageous in taking capacity from the Milford Haven pipeline thus reducing the onward flow. If this connection was to be into the No 2 Feeder at Cilfrew then a spur line is required of about the same length as the as-built Llangynog to Cilfrew pipeline. The diameter of the spur line could have been reduced to probably less than 24", thus still providing a cost benefit.

It is also likely that the length and cost of the spur could be further reduced by connecting into a suitable point as close as possible to the Milford Haven route on the Wales and West local transmission network. It is understood that this network runs westwards from Swansea towards Carmarthen and beyond and possibly crosses, or is within a short distance of the Milford Haven route.

The Milford Haven to Aberdulais EIA application was already submitted in April 2005, however it is considered that not constructing or reducing the diameter of the Llangynog to Cilfrew section would not introduce significant delays to consent being granted. Indeed, it may have made consent more favourable. It is not known how far advanced compilation of the Felindre to Tirley EIA had progressed by July 2005. Additional input would have been required for the Llangynog to Llanwrda 'new' route and some work performed to date on the Felindre to Llanwrda EIA would have been abortive. This alternative route opportunity existed from the start

of the EIA works on Felindre to Llanwrda and could have been run in parallel with little or no programme effect.

One potential issue with the opportunity would be the location of the compressor station, presumed to be required to lie between Llanwrda BV and Three Cocks AGI as opposed to the chosen location at Felindre. The initial part of this route lies within the Brecon Beacons National Park where it is assumed it would be virtually impossible to obtain planning permission and elsewhere the route passes through rural areas where the gaining of planning consent may be very difficult and would carry a high risk of rejection, appeals or legal action. However NGT have successfully constructed compressor stations in similar rural locations in the past e.g. Wormington and Peterstow.

The approximate lengths and indicative derived MWC costs (using the unit rates determined in Section 3.6) are as follows:

Section7	Length (km)	Indicative Cost (@ MWC Option E Unit Cost of 2.23 £m./km)	Indicative Cost (@ MWC Option C Unit Cost of 1.35 £m./km)
Llangynog BV to Felindre MJ	40	89.2	54.0
Felindre MJ to Cilfrew PRI	17	38.0	23.0
Felindre MJ to Llanwrda BV	50	111.5	67.5
Alternative Llangynog BV to Llanwrda BV	40	89.2	54.0

The alternative routing could have realised a maximum potential saving in the range £149.5m (MWC Option E unit cost) to £90.5m (MWC Option C Unit Cost) less the cost of the connection to the Wales and the West Local Transmission.

The MWC cost of a reduced diameter spur line between Llangynog and Cilfrew could be in the range £74.75m (MWC Option E unit cost) to £45.25m (MWC Option C Unit Cost) however it is anticipated that this figure could be substantially reduced if a suitable connection point was found on the Wales and West local transmission network close to the Milford to Tirley Pipeline. This is based on a 'rule of thumb' that a reduction in pipeline diameter from 48" to say 24" will reduce the unit cost of construction by typically 50%.

The actual cost reduction achievable would depend on a large range of factors and it would be necessary to look at the particular circumstances and programme issues to determine if such cost savings were viable.

4.2.5 Felindre to Cilfrew PRI - Reduction in Diameter

In the event that feasibility studies concluded that the opportunity to reduce costs by reducing the pipeline length as described above were not realizable, a sub-option still existed to reduce the diameter of the Felindre to Cilfrew leg. Using a factor of 50% as described above this may have realised MWC savings in the range £19.0m (Option E unit cost) to £11.5m (Option C Unit Cost) plus any materials cost savings due to use of smaller diameter pipe.

4.2.6 Number and Capacity of PRI's and Modifications to Compressor Stations

Initially a PRI was proposed at Aberdulais (actually built at Cilfrew) and further PRI's were subsequently proposed and built at Treaddow and Tirley. Although NGGT have not provided the maximum design capacities or required capacities to

meet system loads or actual PRI throughputs achieved since commissioning, it is anticipated that the total installed capacity at the three PRI's is greater than the required capacity to meet entry capacity and that the number of PRI's or their capacities could have been reduced.

For instance, Cilfrew PRI was initially sized to meet the initial LTSEC auction of September 2004 (240GWh/day) but this may now be superseded by the commissioning of Treaddow and Tirley: i.e. Cilfrew PRI may be now required to work at a capacity considerably less than the installed capacity.

A similar argument may exist for the extent of new units and modifications at the compressor stations although detailed analysis of the hydraulic performance for the entire system would be required to establish the requirement for and capacity of both the PRI's and Compressor Stations.

4.3 **Design Development**

4.3.1 Pipeline Isolation Valves

Pipeline isolation valves have been installed at the start and end points of the pipelines and at intermediate points such as BV stations and AGI's in accordance with normal practice and as required by the primary design code: *IGE/TD/1 - Steel Pipelines and Associated Installations for High Pressure Gas Transmission*.

Such valves are required to enable the pipeline to be isolated and to limit loss of inventory in the event of a pipeline leak.

Isolation valves also facilitate commissioning and operations and maintenance activities and the valves themselves also require periodic maintenance. Isolation valves are typically provided with a reduced bore bypass to enable such activities.

It is noted that pipeline isolation valves on the Milford Haven project have been installed with full bore bypasses whilst still having provision of reduced bore bypass for operations and maintenance activities. Full bore bypasses are not required by IGE/TD/1 and Penspen do not have access to the relevant NGT technical standards current at the time which may provide further guidance.

However, whilst the pipeline and AGI isolation philosophy is not known, it appears that up to 20 valves have been installed complete with full bore bypasses which, if not included in the original sanction, represent a significant cost increase.

Typically the installation of a full bore bypass will require the additional purchase and installation of the bypass valve, two equal tees, two equal 90 degree bends, pipe and ancillary fittings plus additional civil works and the site will require a larger footprint with increased land costs. Note that provision of a full bore bypass does not replace the need for a reduced bore bypass as this is still required for operations and maintenance reasons.

NGGT have responded to a query as to the criteria for full bore bypasses as follows, ref email SM/Ofgem to AW/Penspen dated 11 March 2015:

'Feeder 28 is the sole pipeline supporting flows from the Milford Haven entry point. Other entry points feed in to multiple pipelines and the network is inherently more 'meshed'. In the event of a problem with the block valves or when an outage was required for maintenance on feeder 28, we would need to restrict flows from the entry point and buy back the capacity. Therefore a conscious decision was made to install a full bore bypass to mitigate this risk and provide continuity to the customers.'

Whilst acknowledging the requirements for security of supply and the nature of a single feed pipeline we do not consider that the use of full bore valve bypasses, based on the information provided, is fully justified for the following reasoning:

The network entry point stations, Herbrandston AGI and Newton Noyes AGI at the LNG terminals both have twin streams complete with remotely operable isolation valves and manual isolation valves (ref #165 and #170). NRV's are also fitted to prevent back flow to the terminals. Hence both terminals can be isolated or brought on-stream independently and via remote operation. These valves were not the subject of the question raised.

The main valves elsewhere on the system (e.g. at Llangynog BV, Felindre MJ, Cilfrew PRI, Llanwrda BV, Three Cocks AGI, etc.) are relevant to the question raised and this is where full bore bypasses have been installed.

A number of failure scenarios can be identified for valves installed in parallel as is the case here. Failure in this case means the ability of the failed valve to prevent loss of supply (i.e. it must be open) or ability to isolate the pipeline due to a leak or problem (i.e. it must be closed) whilst the other valve, assuming simultaneous failure does not occur, remains operable and able to open or close as required to suit the situation.

The failure scenarios are dependent, amongst other things, upon valve position at the time of failure (i.e. open, closed or in-transit) and the failure mode of the valve actuator (i.e. fail open, fail closed or fail in-position) and also whether the valve is remotely operable (i.e. from a control centre) or locally operable (i.e. requires personnel to visit site). We are not aware of the normal valve positions or failure modes but for many of the envisaged scenarios the presence of a full bore bypass does not increase the security of supply.

The presence of a full bore bypass valve does offer the advantage of being able to complete full open/close valve movements without loss of pressure at full flow. With only a reduced bore bypass it is normal acceptable practice to complete a partial valve movement typically limited to 15 degrees.

The increase in cost for providing additional full bore by-pass valves will vary depending on the actual pipework layout within the AGI and the data provided does not breakdown AGI costs to a sufficient level of detail to enable this. As an example the rough order of magnitude cost of provision of an additional full bore valve at Llangynog or Llanwrda BV sites is shown below:

Ball Valve c/w actuator	£70,000
2 off 48" Equal Tees	£42,000
2 off 48" 90° Bends	£26,000
Pipe and sundry fittings	£10,000
Cost of construction, say	<u>£300,000</u>
Total	£448,000

Hence the provision of up to 20 additional full bore by-pass valves could have added up to £10m additional cost to the project.

4.3.2

Upper Neeston & Blackbridge MOC's

Penspen understand that two MOC's, located at Upper Neeston and Blackbridge near Milford Haven, were required to provide new gas supplies to Total/Murco and RWE Energy Trading respectively and as such design and construction costs should be borne by the promoters of those projects.

It is reasonable to assume that design and construction of the MOC's could be completed more efficiently by the main works contractor as they were already present on site. Procurement of separate contractors for this work would also have created interface issues between potentially leading to delays.

A number of PMI's refer to work on these two off-takes completed as part of the Milford Haven project although costs for the PMI's is not available from NGGT. Also three CE's have been raised as part of the Tirley project with a value of circa £58k (ref #87) and one CE on the Brecon to Tirley Pipeline for £282k (ref #97).

In a written response to query ref email SM/Ofgem to AW/Penspen dated 11 March 2015, NGGT confirmed that:

These were separately sanctioned projects and do not form part of the overall Milford Haven costs. For information:

- Upper Neeston was closed on 6 May 2014 for a final outturn cost of £0.813m.
- Blackbridge was also closed on 6 May 2014 for a final outturn cost of £1.747m.'

We have not been able to confirm that all these costs have been removed from the Milford Haven account.

4.3.3

Felindre Compressor Location

NGGT were asked to comment on whether a compressor optimisation study was undertaken to determine the optimum location for the new compressor station taking into account the ideal and expected compression ratios in relation to the distance from the LNG Terminals and downstream compressors. What was the optimum point for the compressor and how does this equate to the actual location selected at Felindre and finally has the location at Felindre had any effect on the capital cost of compression here or at Wormington and will it have any influence on future operating costs.

NGGT responded as follows, ref email SM/Ofgem to AW/Penspen dated 11 March 2015:

The pipeline route was consented in two stages – Milford Haven to Aberdulais was consented in Dec 2005, but the Felindre to Tirley section was not consented until Feb 2007. Whilst the optimum location for the compressor would be slightly further down the pipeline route from Felindre to Tirley, it was not possible to wait until that pipeline route was consented otherwise the obligated capacity delivery dates could not have been achieved. It was therefore agreed that the compressor station should be located as far along the Milford Haven to Aberdulais pipeline as possible. Siting studies were therefore undertaken on this basis.

If it had been possible to site a compressor nearer the optimum location along the pipeline route, the size of units at both Felindre and at Wormington may have been able to be slightly reduced. However, as there are a limited number of suitable machinery trains available in the market this may not have influenced actual machinery choice and costs.

In consideration of the following points, we are not convinced that the two stage consent for the pipeline was necessarily a deciding factor

- The new compressor was not required until January 2009 to meet an entry capacity of 920GWh/day as identified in the sanction paper of 6 January 2005, ref #7. This paper also identified that pipeline system extension was proposed to follow the existing No 2 Feeder from Aberdulais to Llanvetherine. At this time the Felindre to Brecon to Tirley route corridor had not been identified

- The compressor station would need to be sited on or close to the pipeline route to avoid the need for changes or supplementary pipeline consent applications
- DTI consent for a pipeline is independent of the Planning Consent necessary for a compressor station and it is usual for both consents are pursued in parallel as is the case for the BV's and PRI's on the route
- We are not aware of whether the compressor site at Felindre was chosen before or after Felindre was chosen for the start of the route corridor to Tirley or if all factors were considered together

NGGT have not provided a compressor site selection report but we believe that the acquisition of and likelihood of gaining Planning Consent for a suitable site should have been the deciding factor in determining the compressor location. NGT have not confirmed the costs or options associated with locating the compressor at an apparent less than ideal location.

4.4 **Investigated Alternative Options**

4.4.1 Offshore routing studies

PMI's for offshore routing studies were issued to Contractor B, the appointed MWC on the Milford Haven to Aberdulais pipeline and were undertaken by Contractor B's design subcontractor. No details of these studies have been provided by NGGT and it is understood that that an offshore alternative routing was discounted primarily due to the extra time it would take to gain consents for this option.

4.5 **Licensing and Consents**

4.5.1 Planning Consents

Whilst consent to construct the buried pipeline is achieved through the EIA process pipeline installations constructed above ground require permission from the LPA under the Town and Country Planning Act 1990.

The following consents were granted without significant delay:

- Herbrandston AGI (part of South Hook LNG Terminal consent)
- Newton Noyes AGI (part of Dragon LNG Terminal consent)
- Llangynog BV
- Felindre Multi-junction
- Llanwrda BV
- Three Cocks AGI
- Felindre Compressor
- Wormington Compressor
- Churchover Compressor

Three applications were the subject of considerable public opposition leading to significant delay:

4.5.2

Cilfrew AGI:

Applications for Planning Consent and Hazardous Substances Consent were received by Neath Port Talbot CBC on the 28 November 2005 (Application number P2005/1794) and 13 December 2005 (Application number P2005/1893) respectively as detailed on the Neath Port Talbot CBC planning website.

The applications were granted in September 2006, ref #118 and construction works commenced even though the applications were the subject of much local opposition and were at risk from a Judicial Review. Following a High Court hearing in April 2007, the planning applications were declared unlawful.

Note: this resulted in the application status being undetermined and not refused, with blame being apportioned to Planning Authority procedures. As a result construction work was stopped awaiting resolution and a Force Majeure notice was issued to shippers.

Further consultations and investigations by NGT eventually led to the original applications being withdrawn and two further applications for Planning Consent and Hazardous Substances Consent were received by Neath Port Talbot CBC (Application numbers P2006/0788 and P2006/0845).

The applications were finally approved on 15 May 2007.

4.5.3

Treadow PRI

An application for Planning Consent was received by Herefordshire Council on the 19 April 2006 (Application number DS061308/F) as detailed on the Herefordshire Council planning website.

The application was rejected on 25 August 2006 and an appeal was launched by NGT in October 2006, ref #119 and an alternative application was made 21 December 2006 (Application number DS064162/F).

The alternative application was approved and appeal proceedings for the first application dropped in May 2007, ref #126.

4.5.4

Corse/Tirley PRI

A Planning Application was made to Forest of Dean Council in April 2006 (Application number AP0077/06/REF) to construct the PRI at Corse adjacent to the existing Tirley BV on the No 2 Feeder. Further to extensive local opposition this was refused in October 2006 and an appeal launched leading to a Public Enquiry in April 2007, which was subsequently rejected in December 2007. NGT then undertook extensive site selection and design work eventually leading to proposals for an alternative location some 900 metres from Corse.

An application (Application number 08/1665/FUL) was submitted to Tewkesbury Borough Council in December 2008 for the alternate site which was refused, NGT again appealed and a second Public Enquiry was held in July 2010. Finally the appeal was upheld and Planning Permission obtained in December 2010.

4.5.5

Discussion

The delays affecting Planning Applications had a considerable effect on the project in particular the ability to meet the entry capacity deadlines with Tirley PRI taking over 4 years to gain approval. However from the evidence presented it is apparent that NGT had few alternative options other than to follow the statutory processes of gaining planning consents and that the primary risks involved are largely beyond the control of NGT.

The issue of planning consent for projects of National or Regional importance being determined by Local Planning Authorities was and is subject to much debate.

It is presumed that NGT did not adopt any different procedures for site selection and design to that successfully used before although procedures should, if not already, be reviewed for future projects.

Design changes were introduced to minimise the risk of rejection of the appeals and resubmissions and these appear to have added significant cost to the project. Many of these changes may have been unavoidable, such as landscaping, or the extra 900m of pipeline required for Tirley PRI.

4.5.6 Conclusion

It is not apparent from the information made available by NGGT that expenditure related to Consents was incurred inefficiently.

It is evident that NGT gave their highest priority to programme issues even if increase in cost was treated as a less significant outcome.

The effect of planning delays is discussed in further detail in Section 4.10 below:

4.6 **Project Services / Project Management / Financial Control / Resourcing Strategy**

4.6.1 Project Services

It would appear from the documentation provided by NGGT, that NGT had insufficient in house staff to actively manage the day to day activities anticipated for the Milford Haven Project and sought to augment their own supervisory resources (accounted for under the heading “NG staff costs”) by:

- Awarding a Project Services Contract for the Milford Haven to Aberdulais Pipeline to Contractor G dated 8 December 2003 at a tender price of £2,690,699 for the option to end in 2007 (rather than 2006). Only the 7 page tender award recommendation paper was provided in ref #177 (received on 4 March 2015).
- Awarding a revised Project Services Contract for the Milford Haven to Aberdulais Pipeline to Contractor G at a tender price of £3,029,209 on a cost reimbursable (Option E) basis for phase II with completion by 24 December 2007. Only the 5 page tender award recommendation paper dated 15 February 2005 was provided in ref #183 (received on 14 April 2015). The same tender reference 4614/T/03/LN as the 2003 award was given.
- Awarding a cost reimbursable Project Services Contract for the Llanvetherine to Tirley and Wormington to Honeybourne Pipelines plus new Compressor Station near Aberdulais and modifications to Wormington and Churchover Compressor Stations to Contractor H tendered on 23 February 2005 and priced at £8,211,347.80 through to project close out at the end of 2010. Only the 3 page tender award recommendation paper was provided in ref #184 (received on 14 April 2015). Tender reference was quoted as MASR757/T/05/KP.
- Placing a Framework Agreement with Contractor H dated June 2010 to provide qualified personnel to form a project services team to represent the interests of NGT. Extracts from the Framework Agreement were provided in ref #80 and it is assumed that Contractor H provided the Project Services for Tirley PRI.

NGGT did not provide any further extracts of the Contractor G Contract(s) although in response to a question requesting details of any Variations/Compensation Events, NGGT confirmed that it was administered as an Option E cost reimbursable contract.

Monthly project manager reports, some bearing the Contractor G logo ceased to be issued after 31.07.2008 and presumably, the Contractor G contract ended sometime after this date. It is assumed that the scope of the Contractor G Contract was formally extended at some stage to cover also the Felindre to Brecon pipeline and that an extension to the original 2007 end date was also agreed.

The total cost of Project Services identified in the NGGT accounts summaries presented in Section 3, above, totalled £14,922,746 for the two Option E pipeline contracts awarded to Contractor B and supported/administered by Contractor G. Even considering that the scope of the support work had increased considerably (nearly doubled) with the presumed addition of the Felindre to Brecon pipeline, outturn costs for Contractor G had more than doubled again from the tendered price for the work.

As no further details of the Project Services contracts have been provided by NGGT, it remains unclear how much responsibility Contractor G had in recommending the MWC contract strategy or the most cost effective routing for the pipeline. Certainly, with an Option E contract in place, there would have been little incentive for Contractor G to recommend any shortening of the pipeline route, such as that identified above in Section 4.2.4.

In Section 3.2 some discussion was provided on the content of the monthly project manager reports. It remains unclear how much contractual responsibility Contractor G actually had in performing Project Services. There is certainly very little indication that Contractor G protected NGT from cost increases in the documentary evidence provided by NGGT to Rune/Penspen.

The total cost of Project Services identified in the NGGT accounts summaries presented in Section 3, above, totalled £16,759,535 for the remaining Brecon to Tirley pipeline plus all of the compressor station and PRI contracts presumed to be within the scope of Contractor H contract(s) indicating an overall doubling of the initial tender estimated sum although some of the cost increase is probably covered by the June 2010 Framework Agreement.

In this respect, the total cost of Project Services identified in the Tirley account was slightly over £5m, representing 6.6% of the outturn cost allocated to Tirley PRI.

4.6.2

Option E Cost Reimbursable Contracts

The project documentation provided by NGGT indicates that the Option E MWC provided a forecast of anticipated costs which was updated, reviewed and approved every month by the Project Manager. In the provided documentation there is very little evidence of any challenge to these costs (such as an identified variance in the monthly report or for example a register of disallowed costs).

The following response was received from NGGT regarding the financial controls implemented for the two Option E contracts; Milford Haven to Aberdulais and Felindre to Brecon, ref #162:

4.6.3

Project Structure

Due to the size of the scheme a self-contained accounts department was established in the main project office at Carmarthen, run by a fully qualified accountant and accounts team throughout the active life of the project. All orders

for labour, plant, materials and subcontracts were placed from the project offices and all invoices and applications for payment were subsequently dealt with from the project offices.

Due to the project being set up in this manner it was possible at all times, and for all parties (JV/National Grid/Contractor G), to check and audit the costs being incurred on the scheme.

4.6.4

Application for Payment Procedure

At each month end the JV's accounts department closed the cost ledgers and provided the JV's commercial department with the actual cost that had been incurred on the project as recorded in the accounts software package "Mentor".

National Grid (NG) representatives, Contractor G, would then review the JV's application for payment and inform the JV what NG were prepared to certify and pay. In order for Contractor G to be able to fully audit the cost they required full access to the Mentor accounting database. This was achieved by giving them "read only" access to the Mentor database and allowing full access to all subcontractors' costs held within the commercial department. If the JV had acted in an inefficient manner, or brought in people and equipment not necessary to carry out the construction works, then under the Option E contract NG had the contractual right to disallow these particular costs. Once agreement on allowable costs was reached, the JV then raised an invoice on site which was given to NG for processing and subsequent payment.

As the application for payments were substantial, and during 2007 there were two projects underway simultaneously, audits and reviews of the costs by Contractor G were not restricted to once a month events. Throughout the main construction period Contractor G would approach the JV's commercial team and request the "live" subcontractor files in order that they could undertake even more detailed reviews. These files would contain both the applications for payment from the subcontractors and the amounts the JV had certified to them for payment.

With regards to the hire of plant and equipment from third parties, and the placement of purchase orders for materials, these records were also available to NG & Contractor G in the JV's on site buying department. The process being that all orders were placed on site and then once invoices were received they were checked also on site by the JV's accounts department. Access to both the site orders and the invoices contained in the accounts department being un-restricted to NG and Contractor G made the costs of materials and equipment used on the project fully transparent and easy to audit at any point in time.

Whilst third party orders and subcontractors, were paid for on an actual cost basis, staff and equipment supplied by Contractor B were not. These costs were charged on the basis of rates contained within the Contract. Whilst the process for ordering equipment through the buying department was the same, the process for people was different. For people the secondment of JV partner staff to the project was done through a process of agreement between the senior Contractor B management. Again, for senior positions, National Grid were informed prior to people being brought to the project.

For the purposes of audit and control a full plant list of JV supplied equipment was maintained, and for people a JV staff list was also maintained. Finally, once invoices were received from Contractor B these were checked for correctness against the weekly site records by a member of the commercial team.

As with all invoices, both Contractor G & NG had full access to all of the JV's invoices for people and equipment including the supporting back-up.

4.6.5 Decision Making

4.6.5.1 Procurement – Materials and Equipment

As the contract was Option E it was important that Contractor G & NG not only had access to the actual costs when expended but also were in some cases consulted and as a minimum aware of the procurement processes that had taken place before orders were placed.

For example, the welding on the project was to be undertaken on the project by use of semi-automatic welding equipment, not just stick welding. Welding using semi-automatic “bugs” had not been undertaken by the JV in the UK before on this scale and as such the JV did not own such equipment. Initial thoughts were to hire in this equipment from such suppliers as “CRC Evans”, however on review of the prices it was clear that this was going to be very expensive as the same bugs would be required for two consecutive seasons. As a consequence, and with the full knowledge of NG & Contractor G, prices were obtained for the purchase of such equipment and it was clear that the best option was to buy the equipment. As it transpired the use of the welding bugs was for a greater period of time than originally anticipated, however as they had been bought NG paid no increase in cost.

4.6.5.2 Procurement – Subcontractors

The procurement of subcontractors was generally either made on a fixed lump sum basis or on the basis of an agreed set of rates. The form of subcontract used by the JV was also NEC in accordance with the main contract itself.

When the JV’s commercial team had established a scope of works, or alternatively a required schedule of people and/or equipment, enquiries were sent out to all potential subcontractors. Once these enquiries had been responded to by the subcontractors and prices received back an analysis of the subcontractor tenders was prepared. Coupled with resource availability compliance with the JV’s construction programme, this comparison of subcontractor prices was then the basis on which decisions were made on which subcontractor was taken on to complete the works. With regards to the microtunnels this process was in some instances undertaken on a crossing by crossing basis. The analysis of subcontractor quotations, as well as the individual quotations themselves, was made available to Contractor G & NG as required.

After the initial round of quotations a process of agreeing the terms of the subcontract with the preferred subcontractor took place. For the smaller less critical subcontracts this was generally straight forward, however for the major subcontractors this was a vital to ensure that they were tied into the main construction programme. Once this process was nearing completion, and a draft subcontract was nearing completion, this draft subcontract was issued to NG & Contractor G for their review and approval. It was therefore at this stage, prior to the placement of the subcontract, that both NG and Contractor G had the ability to influence the subcontract that the JV wished to place. With this draft document NG & Contractor G were able to review and consider both the lump sums prices and/or rates and the terms on which the subcontract was to be placed. Essentially the procurement and placement of subcontracts was fully transparent and the JV were obliged to demonstrate and prove that the orders that were being placed were being done so on the best available basis.

4.6.6 Discussion

The financial controls described above are all as expected considering the terms of contract agreed with Contractor B. With an overriding programme constraint, namely requirement to commission capacity by October 2007, costs will always

tend to increase as solutions are implemented to mitigate identified risks. In this scenario there would be limited scope for the Client or Project Manager to influence the gradual cost escalation that materialised on the Option E cost reimbursable contracts.

4.7 Materials Procurement

4.7.1 Line Pipe Materials

For a pipeline project, the main material cost item is usually line-pipe and due to the long lead time required it is often procured by the Employer, in this case NGT. A copy of its line-pipe procurement strategy – key issues paper SWEP 6, ref #92 described the background to the tendering and contract award process adopted for the Milford Haven project.

Some discussion on NGT procured materials costs are included in previous Section 3.

The Grant Thornton report, ref #93, noted that the post October 2007 costs for materials (for example WBS element TCC/00717-1-10) are negative as a result of the majority of expenditure for materials being incurred pre October 2007 (when NGT bought the materials to build the pipeline) and then post October 2007 there was a transfer of nearly £6 million of surplus stock out of the sub-project.

In the lack of further evidence it is assumed that NGT was efficient in its procurement of line-pipe.

4.7.2 Other materials

Some information was provided by NGGT for other materials procured by NGT, refs #67A to F. Again, insufficient details were provided to reach any firm conclusions.

4.7.3 Compressors

Another major cost item on pipeline projects is compressors which are often procured by the Employer due to long lead times, particularly for non-standard configurations.

For the Milford Haven project, compressor supply was included in the scope of the MWC, Contractor A. Cost of compressors and other materials procured by the MWC are identified in Section 3.

NGT provided some detail on the strategy behind procurement of compressors in the Felindre procurement Strategy Key Issues paper, ref #63. There is some evidence in Lessons Learnt that this procurement strategy resulted in a less flexible solution with respect to commissioning the compressors, see Section 4.11, below.

4.8 Issues identified by NGGT to justify overspend

4.8.1 Weather Delays

NGT Paper Final Completion Report Paper GTIC 0065 dated 11 October 2013, ref #21 identified that:

The adverse weather experienced particularly during summer 2007 would have resulted in programme overrun into the summer 2008 construction season without the implementation of innovative solutions to manage run off. Many lessons were learnt regarding which methods were most effective in controlling silt pollution.

Specific actions that had to be taken were:

- Sourcing of specialist equipment
- Utilisation of large volumes of silt fencing, plastic pipes and straw bales
- Construction of siltation lagoons to hold silted waters before being treated prior to release.
- Use of water pumps at most excavations to keep trenches dewatered for access.

Costs associated with this are significant and support continuation of the strategy to avoid conducting construction activities during the winter months. However exceptional summer rainfall will always pose a risk to projects.

4.8.2

Discussion

Any pipeline project in the UK, particularly in the west, should expect periods of wet weather at some stage, especially with a construction programme extended from early Spring 2006 to late Autumn 2007, even with reduced works planned to be undertaken in the 2006/2007 winter period.

The effect of adverse weather conditions outside of the 1 in 10 year ranges defined in the NEC contract terms will be proportional to the additional amount of rain and the additional duration of the rainfall.

It would appear from the details provided in the monthly reports that the majority of pipeline had actually been laid prior to onset of adverse weather in summer 2007.

The practical effect of adverse weather on pipeline construction can be considerable but is limited in its effect to areas of the pipeline spread with active work in progress and will obviously also depend on local ground conditions and drainage.

Under an Option E contract, the full cost of any of the measures adopted to manage run off would be payable under the contract.

Under an Option A or C contract only the additional costs of mitigation measures over and above what would be required to control run off from normal rainfall would generally be payable to the contractor.

NGT appear to have been unfortunate in respect to the adverse weather that was encountered during summer 2007. In adopting Option E contracts for two of the three pipeline segments, NGT probably incurred significantly higher costs than it might have otherwise been responsible for.

For the Option C pipeline contract, Compensation Events related to adverse weather in summer 2007 were evaluated at £4.9m, refer to discussion in Section 3.6.

4.8.3

Protestors

The cost efficiency of the Milford Haven pipeline was undoubtedly adversely affected by Protestors even if quantification of the effect will remain an open issue.

4.8.4

Planning consents and Access

Again, the cost efficiency of the Milford Haven pipeline was undoubtedly adversely affected by delays with planning consents and Access. Further discussion on consents can be found in Section 4.5, above.

4.9 Other issues

4.9.1 RDX103

A number of Compensation Events for the Tirley PRI relate to remedial works at RDX 103 amounting to circa £4m ref #87. However, two RDX 103's can be identified on the as-built strip-maps forwarded by NGGT as follows:

- RDX 103 - Milford Haven to Aberdulais, Strip Map 59 ref #75 is a unclassified road, Glais Road, parallel to the A4067 south of Pontardawe.
- RDX 103 - Brecon to Tirley, Strip Map 36 ref #73 is an unclassified road, Gibraltar Lane, just of the A466 near Llanwarne.

The Compensation Events are described as 'remedial' and 'drainage' works however the mapping gives no indication as to why such a large sum was required over and above the normal reinstatement and post construction costs at either location. Also it is assumed that these costs refer to payments made to the contractor and do not cover any associated legal and compensation costs to the Landowners/Occupiers

NGGT provided the following response, ref email SM/Ofgem to AW/Penspen dated 11 March 2015:

Ahead of commissioning the Tirley PRI, a Close Interval Potential Survey (CIPS) finding was highlighted at RDX103 in early 2011.

The project mobilised in the 2nd quarter 2011 to investigate the issue, closing the road. Upon excavating either side of the road it was identified that the pipeline was sitting within a layer of very dense rock (approx. 50m long) that had been drilled for the original installation. Due to prevailing weather conditions and a water course running parallel to the road, extensive water management mitigation works were required. The project worked on either side of the road up to the rock layer, whilst at the same time investigating and trialling alternative techniques for the safe removal of the rock surrounding the main.

The team demobilised during the autumn of 2011 due to the onset of winter. Partial reinstatement was undertaken either side of the road, the road was re-opened, and due to the complexity and environmental risk involved, the mitigation works were left in place and maintained over the winter period.

During the winter and into the early part of 2012 the deviation for the rock breaking process was pursued and ultimately approved. The project re-mobilised In May 2012, re-closed the road and proceeded to expose the main section by section using the approved technique. The process was extremely slow with the obvious care required whilst working around the live main. The works were completed around mid-2012 with the ongoing removal of environmental mitigation measures, installation of land drainage and final reinstatement to the fields either side concluding in Sept 2012.

Throughout all of this work, whilst the road was closed and the main exposed, 24/7 security was employed to monitor the site'

The following observations are made:

- CIPS interpretation at road crossings is difficult because of the metallised surface but more so if the subsurface is rock. Achieving adequate CP current to flow into solid rock is not reliable because of the high resistivity. If CP current flow to that area is inadequate because of the rock then the potentials will become more positive giving the impression of a coating fault.

- The CIPS survey indications were presumably interpreted as pipeline external coating faults and which may be due to damage during installation of the crossing.
- It is not known if a DCVG survey was undertaken after the CIPS survey and before the remedial works commenced to confirm there was a coating fault.
- The crossing was originally completed by Contractor B and commissioned in late 2007 however the remedial works were identified and completed by Contractor C during the period 2011/12 by which time the defects liability period for Contractor B had expired. We would have expected a CIPS survey to have been completed and any suspect faults investigated and repaired prior to release of the defects liability and in which case repair costs would have been borne by Contractor B.
- It is assumed the crossing was installed by a rock auger bore or similar method. Were appropriate checks for such construction faults completed during construction including an earth leakage test of the pipe after installation?
- Whilst coating defects are undesirable it may have been acceptable to adopt an alternative solution and lower cost options could have been explored such as local boosting of the CP to deal with coating faults thus avoiding the large expenditure on remedial works.

NGT have not demonstrated that the full costs for this remedial work were incurred efficiently or that alternative less costly methods were considered.

4.10 **Delays in provision of Capacity and Shippers use of Capacity**

4.10.1 Planned Capacity

As detailed in Sections 3.4 and 4.1 of this report, NGT were obliged to provide the gas transmission capacity signalled by the LTSEC auction in September 2004 and then to provide a much increased capacity signalled by the LTSEC auctions in December 2004.

NGT identified how this capacity would be provided in Appendix 1 of report ND 360 dated 06 January 2005, ref #6, reproduced above in Section 3.4. Although significant changes have been made to the Milford Haven Scheme the capacity table does not appear to have been updated in any of the reference documents provided by NGGT.

4.10.2 Capacity Build Up

NGGT did however provide in ref #94, the following information on how the actual capacity was made available and the limiting reasons were as follows,:

Capacity made available (GWh/day)	Period	Limiting infrastructure
220	01/10/07-15/12/07	Commissioning of Felindre to Tirley
570	16/12/07-28/02/08	Commissioning of AGIs at Treadow and Corse
610	28/02/08-05/06/08	Commissioning of Cilfrew PRI
650	05/06/08-01/01/09	Commissioning of Corse PRI (Tirley)
750	01/01/09-28/09/12	Commissioning of Corse PRI (Tirley)
950	29/09/12 onwards	

NGGT highlighted that consenting issues had prevented NGT from making this capacity available and led to Force Majeure notices which occurred at:

- Felindre to Tirley pipeline
- Cilfrew
- Treaddow
- Corse/Tirley

Reference to the capacity allocated in the QSEC auctions in September and December 2004 was also made in the Force Majeure notices relating to the late delivery of the infrastructure due to planning consents (copies of these notices were provided by NGGT, refs #140 – #147 inclusive).

NGGT noted that first commercial flows from Milford Haven into the National Transmission System were not seen until 9 April 2009 from South Hook and 4 August 2009 from Dragon and provided a spread-sheet, ref #153 detailing the actual daily commercial flow rates record for the period 9 April 2009 to 20 February 2015. The planned (allocated) and provided (available) capacity and actual daily flow rates data has been plotted in Appendix 7.

4.10.3

Discussion

Assuming that the actual flow rate data, ref #153 is correct then the capacity figures provided by NGGT with ref #94 must be considered as typical or nominal as the graphic indicates actual flows in excess of provided capacity in early 2011.

In addition, NGT's Final Completion Report GTIC 0065 dated 11 October 2013, ref #21 provided additional background information on capacity provision as follows:

Some of this upward pressure was mitigated by the de-scoping of the Wormington to Honeybourne pipeline, which saved £15m of projected costs. This scheme was cancelled based on a risk assessment of the additional capacity provided by the pipeline compared with the potential buy back risk associated with seeing high flows from Milford Haven and unhelpful supply patterns in other parts of the network.

This part of the scheme was planned to provide a capacity increase from 921 to 953GWh/day yet NGGT confirm in ref #94 that an available capacity of 950GWh/day has been provided since 29 September 2012.

It is suspected that the Milford Haven Scheme actually constructed provides slightly higher capacity than when the capacities of the proposed overall scheme was first evaluated in January 2005, ref #6.

4.10.4

Conclusion

The Appendix 7 graphic clearly shows that NGT struggled to provide the initial 450GWh/day allocated capacity required by October 2007 but by June 2008 had provided in full the required 650GWh/day allocated capacity.

Thereafter, during 2009, 2010, 2011 and most of 2012, NGT provided a nominal capacity of 750GWh/day only compared to the 950GWh/day final allocated capacity required from January 2009.

The Appendix 7 graphic also clearly shows that NGT provided capacity approximately 18 months in advance of when the provided capacity was actually used by the shippers and that especially since early 2011 the available capacity of the Milford Haven Scheme has remained underused.

It is also interesting to note that initially, peak flows occurred during the winters of 2009/10 and 2010/11 but thereafter occurred in a somewhat random manner.

Although beyond the scope of this assignment, in the light of experience on Milford Haven project, Ofgem may wish to consider the operation of the Uniform Network Code system entry capacity arrangements for developments of such a scale.

4.11 **Lessons Learnt**

NGT Paper Final Completion Report Paper GTIC 0065 dated 11 October 2013, ref #21 identified the following Best Practice as a result of Lessons Learnt (Key Issues):

4.11.1 Best Practice

Based on the experience of this project the points below are now considered best practice and many of them have been widely employed for a number of years. Some of these points are however only achievable where the overall programme can accommodate them.

- *Multi stage contracting – where possible separation of design and build works to ensure a tight scope is developed against which competitive tenders are sought, thus reducing uncertainty and risk margin.*
- *Multi stage sanctioning – separation of design studies from construction so that the final approval is based on costs informed from the detailed design study.*
- *Direct contracting with compressor OEMs. This is the approach that is being followed for the current IED compliance projects.*
- *Dedicated project office for large projects.*
- *Where large projects have separate elements with very different timescales, create separate schemes, to improve sanctioning and close out efficiency*
- *Full security assessment before any major construction activity.*
- *Our new approach to project / programme risk is based on sanctioning the total cost and identifying the specific elements that comprise a contingency sum. These contingency amounts are then released if these elements arise.*
- *Payment of staff within environmental agencies and planning bodies and planning bodies to be dedicated to our projects to ensure our issues are dealt with in a timely manner.*

4.11.2 Lessons Learnt October 2010

The Final Completion Report Paper avoided any discussion on contract conditions, even though in an earlier re-sanction paper dated 5 October 2010, ref #12, NGT had identified that Option E contracts were to be avoided.

Indeed, Section 11 – lessons Learnt of the October 2010 re-sanction paper, TIC ref No. 1058 specifically identified that *in advance of the extensive project review*:

1. *Implement a management structure to effectively manage all sections of the scheme to provide consistency to the Statutory Authorities.*
2. *Divide the scheme up into deliverable sections.*

3. *Note the variability of weather conditions and terrain in South Wales, make sufficient allowances for this uncertainty.*
4. *Allow increased time for planning more complex schemes.*
5. *Give greater consideration in routeing the scheme to avoid potential constraints.*
6. *Allow sufficient time to build the scheme.*
7. *Consideration should be given to spreading work content across a suitable number of Contractors.*
8. *Do not let any part of a potentially complex scheme under an option E contract.*
9. *Closer supervision should be given to the contractors progress and the effects this may have going forward (especially for MH2A i.e. resource, production rates, methodology and techniques.*
10. *Avoid constraints on that mean that the routing of the pipeline through objectionable landowners.*
11. *Avoid setting precedents with high Landowner payments.*

Many of these lessons learnt in October 2010 were subsequently omitted in the lessons learnt section of the Final Completion Report of October 2013.

NGGT have repeatedly cited weather, protestors and consents to be main drivers of cost escalation. These three occurrences undoubtedly contributed to increased project costs but the real causes appear to have been identified by NGT in October 2010 as lessons learnt.

In particular, items 2, 4, first part of 5, 6, 7 and 8 above, have been identified in this report as the prime causes for the cost escalation associated with the Milford Haven Scheme.

5.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions have been reached as a result of the efficiency review,

- NGT undertook preliminary studies and developed a contract strategy prior to December 2004 to provide new pipeline capacity to connect with existing infrastructure and capable of providing 240GWh/day.
- As a result of the September 2004 Auction, NGT were obliged to provide 350GWh/day by October 2007 and proposed to provide this capacity over an extended pipeline construction period during 2006 and 2007 summer seasons (for the an initial capacity of up to 240GWh/day) and with the remainder deferred until the 2008 summer season.
- Such a strategy should have ensured that capacity was delivered in a cost efficient manner.
- The December 2004 Auction obliged NGT to provide much higher capacity than originally planned, namely 650GWh/day by October 2007 rising to 950GWh/day by January 2009.
- The timescale allowed to provide the additional capacity was further constrained when it became evident that NGT could not allow pipeline construction to extend into 2008 as was originally planned.
- NGT original contract strategy was adapted to meet the revised requirements.
- Preliminary design works (Stage I for the Milford Haven to Aberdulais pipeline) were undertaken by the appointed MWC, Contractor B. NGT sought to accelerate the preliminary design for the whole Milford Haven scheme by instructing Contractor B to perform this additional design work and in March 2005 apparently bowed to pressure exerted by the MWC for a renegotiated Option E cost reimbursable contract (to include also the Stage 2 design and construction works not yet formally awarded).
- The extent of the revised scope of the Milford Haven Scheme was not fully appreciated until July 2005. NGT had identified that the southerly route would take longer to build due to environmental issues and that the longer (and more expensive) northern pipeline route could potentially be constructed in one season.
- Between July and September 2005, NGT lost the opportunity to completely revise its contracting strategy.
- NGT could have rationalised the pipeline routing in the Carmarthen/Swansea/Brecon area with possible savings in the order of up to £100m as described in Section 4.2.2.
- The main Project Services contracts which included project management support, were awarded under a cost reimbursable Option E contract. This meant that there would have been little financial incentive for Contractor G, the relevant Project Services contractor, to recommend any shortening of the pipeline route,
- NGT could have also awarded the 200km northern route pipeline as three separate contracts. NGT had tendered 65km sections of southern route pipeline including Aberdulais to Llanvetherine in June 2005 and had three comparable bids on the table from three qualified contractors.
- Instead, NGT rejected two of the bids and awarded part of the northern route to the only contractor who would commit to construct 100km in one season.
- The remaining portion of the northern route was added to the scope of the MWC for Milford Haven to Aberdulais, Contractor B who was instructed to accelerate the initial 122km Milford Haven to Aberdulais pipeline to be

completed in one season (2006) instead of two and then to complete the remaining 89km of the northern route the following season (2007).

- Contractor B had already negotiated for the future Stage II design and construction to be paid under a cost reimbursable Option E contract rather than using Option C target cost. This change naturally allowed costs to increase even if subject to a pain/gain mechanism where no further Fee mark-up was paid once costs exceeded an agreed sum.
- The NGT requirement for Contractor B to accelerate the Option E pipeline construction works facilitated further cost escalation.
- Possible overspend as a result of the lost opportunity to award the northern pipeline route to three separate contractors and avoid acceleration of the initial 122km pipeline construction is described in more detail in Sections 3.5 and 3.6. By simple comparison of MWC outturn cost/km, overspend of more than £100m could be attributed to this lost opportunity.

The magnitude of the potential cost savings as a result of the two lost opportunities identified in this report is considerable and could have accounted for up to £200m of the eventual outturn cost of the Milford Haven pipeline project.

The review has identified that the major cost increases cannot be solely attributed to weather, protestors and consents.

It is therefore recommended that NGGT are given the opportunity to provide a formal response prior to any regulatory action being considered by Ofgem

Although beyond the scope of this assignment, in the light of experience on Milford Haven project, Ofgem may wish to consider the operation of the Uniform Network Code system entry capacity arrangements for developments of such a scale.

Appendices:

Appendix 1: Information provided by NGGT/Ofgem for Milford Haven Project Efficiency Review

A. Main Sanction Papers - email: 28 January 2015 18.26

Item	Date	Ref	Pages	Title
1	22 Aug 2003	-	3	Re-sanction Milford Haven PWA
2	06 Apr 2004	PSC 407	1+4	Re-sanction Milford Haven PWA2
3	05 Oct 2004	TPSC 476	2+8	Milford Haven to Aberdulais Pipeline
4	05 Oct 2004	ND 308	1+4	Additional Milford Haven PWS2 (FEED)
5*				Does not exist ref NGGT email 17 Feb 2015
6	06 Jan 2005	ND 360	1+4	NTS Pipeline Reinforcement PWS (FEED)
7	06 Jan 2005	ND 359	1+4	NTS Compressor Reinforcement PWS (Contractor G FEED)
8	19 July 2005	-	5	Additional Milford Haven Entry Capacity Infrastructure – Submission to Group Executive
9	25 Apr 2006	Item 7.4	1+5	Re-sanction Milford Haven Total Reinforcement Scheme – Submission to National Grid Board
10	May 2007	-	23	Re-sanction Total South Wales Reinforcement Scheme – National Grid Executive
11	08 Nov 2007	TIC 127A	2+6	Re-sanction Milford Haven Project – Milford Haven Project Board
12	05 Oct 2010	TIC 1058	13	Re-sanction Main South Wales Reinforcement Scheme Transmission , PAC 1747
13	05 Oct 2010	TIC 1059	16	Re-sanction Tirley PRI - Transmission, PAC 2030
14	05 Oct 2010	TIC 1060	8	Re-sanction Environmental Monitoring and Aftercare Transmission, PAC 2149
15	(Nov 2010)	XXX	2	Re-sanction Paper South Wales Reinforcement Scheme
16	04 Sep 2012	AM2077 PAC 1747	9**	Re-sanction Main South Wales Reinforcement Scheme **missing Page 9 of 9 received 3 Feb 2015 ref Section I, below

B. Post 2012 Board Papers - email: 28 January 2015 18.27

Item	Date	Ref	Pages	Title
17	23 Oct 2013	letter	1	Milford Haven Efficiency Review
18	03 Jun 2014	GTIC111	23	Re-sanction Paper Tirley PAC 2030
19	22 Oct 2013	-	4	Tirley PRI (and associated planning delay costs) Supplementary Paper
20	22 Oct 2013	-	2	Pipeline Environmental Monitoring and Aftercare Supplementary Paper
21	11 Oct 2013	GTIC0065	48	Main South Wales Reinforcement Scheme Final Completion Report Closure Paper PAC1747

C. Tirley Licencing - email: 28 January 2015 18.42

Item	Date	Ref	Pages	Title
22	20 Dec 2007	letter	5	Secretaries of State Corse appeal decision 2029294
(10)	May 2007	-	23	Re-sanction Total South Wales Reinforcement Scheme – National Grid Executive
23	13 Dec 2010	letter	9	Final DL Tirley GPRF Tewkesbury 2123550
24	18 Oct 2010	-	121	Inspector's Report Tirley GPRF Tewkesbury 2123550
25	23 Aug 2007	-	89	Inspector's Report Corse Appeal 2029294

**D. Wormington Compressor Station Incident - email: 28 January 2015 18.49
and 29 January 2015 17.01**

Item	Date	Ref	Pages	Title
26	04 Apr 2007	PSC1074	1+8+1	Re-sanction Wormington Control System Replacement Project PAC 0987 plus email dated 29 March 2007
27	03 Oct 2011	TIC 1490 unsigned	4	Re-sanction and Final Completion Report Wormington and Churchover Incident Recovery PAC1949, 1950
28	03 Oct 2011	TIC 1490 signed	4	Re-sanction and Final Completion Report Wormington and Churchover Incident Recovery PAC1949, 1950
29	02 Apr 2008	TIC 223	4	Wormington and Churchover Briefing Note on Delay
30	04 Aug 2009	TIC XXX	6	Wormington and Churchover Control System Replacement PAC0987
31	02 Jun 2009	30187/07	1	National Grid Incident Investigation Summary
32	01 Jul 2008	TIC 272	8	Wormington and Churchover Compressor Stations Incident Sanction PAC 1949, 1950
33	04 Apr 2006	PSC 810	1+4	Re-sanction Wormington Control System Replacement PAC 0987
34	22 July 2013	-	4	Advice Note [REDACTED]
35	31 Aug 2010	Memo	2	Settlement of Insurance Claim v1
36	02 Sep 2008	-	12	Advice NG vs Contractor A
37	17 Nov 2014	email	1+4	Ofgem - Milford Haven update 17112014

E. Financial Information - email: 28 January 2015 18.52

Item	Date	Ref	Pages	Title
38	undated	-	1	Summary annual cost information (excel spread sheet)
39	17 Jul 2014	email	3	National Grid email response to Ofgem queries refers to attached spread sheet (item #38)

F. National Grid Presentation - email: 28 January 2015 18.57

Item	Date	Ref	Pages	Title
40	4 Jun 2014	-	41	NGGT Presentation on South Wales Reinforcement Scheme

G. Questions and Answers - email: 29 January 2015 17.20

item	date	ref	pages	title
41	4 Nov 2014	-	5	NGGT response to Questions 17 Oct 2014
42	7 Nov 2014	-	3	NGGT response to Further Questions
43	7 Nov 2014	email	3	Cover email for two sets of responses (items #41 & 42)
44	16 Jan 2014	VFM2-NG	12	Audit Report Tirley PRI

H. Information Received from NGGT during RIIO-T1 - email: 29 January 2015 17.46

Item	Date	Ref	Pages	Title
45	undated	-	12	Wormington and Churchover Compressor Modifications Project (Note on WCCMP Scope and Costs)
46	03 May 2012	RTI-Ph3-290	2+1	National Grid RIIO-T1 Phase 3 response to request for information – Wormington incident. Includes A3 spread sheet “Basis for Contractor A Settlement” - (One year delay to Churchover but no additional cost

				to SWEP)
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**I. Further Information provided following 2 Feb 2015 update telcon - email:
3 February 2015 16:17**

Item	Date	Ref	Pages	Title
47 ABC	4 Nov 2014	TPCR4	126 +74 +240	The consultants' reports (TPA) during the TPCR4 price control. These are three documents. The most relevant are the A Forward Capex report and B its Appendix;
48	Sept 2014	-	12	The IPP for the financial accountants (Grant Thornton, (GT));
49	11 Dec 2014	email	3	email indicating that GT will scrutinise the post-Oct 2007 invoices – moving forward non-disclosure
50	16 Jan 2014	email	2	email indicating that GT will scrutinise the post-Oct 2007 invoices – Invoice queries
(16)	04 Sep 2012	AM2077	9	Missing last page 9 of 9 of Re-sanction Main South Wales Reinforcement Scheme PAC 1747

J. Further Information provided via Huddle - email: 5 February 2015 17:14

Item	Date	Ref	Pages	Title
51	14 Jan 2005	-	1	Qu 1_MH covering Ofgem letter 140105 - Proposal to offer for sale Incremental Obligated Entry Capacity
52	14 Jan 2005	-	1	Qu 1_Attachment 1 to Ofgem letter 140105

**K. Requested NGGT Information provided via Huddle - email: 7 February
2015 00:04**

Item	Date	Ref	Pages	Title
53*	-	-	-	* Not used – duplicated key issues paper #66
54	undated	-	2604	Copy of Consolidated Milford Haven SAP data with summary sheets for eight sections and overall summary
55	2005 to 2007 & 2009	-	981	Consolidated Contracts – Brecon to Tirley 1200mm Pipeline PAC 1621 & Deed of Variation for Tirley PRI
56	08 Aug 2011	-	112	Consolidated Contracts – Brecon to Tirley Amendment to Deed of Variation to Contractor C
57	Aug/Sep 2005 only	-	500	Consolidated Contracts – Felindre Compressor
58	Feb 2005 to May 2007	-	306	Consolidated Contracts – Felindre to Brecon 1200mm pipeline PAC 1596
59 ABC	Feb 2004 to May 2007	In 3 parts	548+80 2+380	Consolidated Contracts - Milford Haven to Aberdulais PAC 1111
60	5 Nov 2009	-	89	Consolidated Contracts – Tirley PRI
61	Jul to Sep 2005	-	640	Consolidated Contracts – Wormington and Churchover Comp Mods
62	undated	no refs	10	Procurement Strategy – Key Issues – Brecon to Tirley
63	undated	no refs	14	Procurement Strategy – Key Issues – Felindre Compressor
64	undated	no refs	11	Procurement Strategy – Key Issues – Felindre to Brecon
65	undated	no refs	20	Procurement Strategy – Key Issues – Milford Haven to Aberdulais
66	undated	no refs	13	Procurement Strategy – Key Issues – Wormington and Churchover Comp Mods
67 ABC DEF	various	-	46+12+ 39+1+4 +3	Materials Orders – six separate items 67ABCEF for Bends, 67D for Fittings.
68	1/06 to 8/10	-	3	Question 6 – BR-TI PMI Register
69	3/05 to 7/08	-	3	Question 6 – Fe-Br PMI Register (PMI is titled

				Aberdulais to Llanvetherine)
Item	Date	Ref	Pages	Title
70	6/04 to 8/08	-	4	Question 6 – MH – AB PMI Register
71	3/11 to 10/12	-	1	Question 6 – Tirley PRI – PMI Register
72	12/05 to 4/09	-	4	Question 6 – WO-CH PMI Register
73	2007/2008	As-built	57	Brecon to Tirley strip maps
74	2008	As-built	43	Felindre to Brecon strip maps
75	2007	As-built	61	Milford haven to Aberdulais strip maps

L. Draft Forensic accounting report by Grant Thornton - email: 9 February 2015 17:14

Item	Date	Ref	Pages	Title
79A	09 Feb 2005	-	1	Summary Status of requested information as provided by NGGT in Section K above
76	09 Feb 2005	-	77	Draft Forensic accounting investigations of cost information provided by NGGT for the Milford haven pipeline project (ref #93 for final report)

M. National Grid response to Option E query - email: 13 February 2015 10:46

Item	Date	Ref	Pages	Title
77	undated	No refs	1	Option E Contracts Activity Coding and costs Apr 06, Nov 06 and Final
78	28 Sep 2007	FormT024 (NTD143)	2	Form D resubmission 28/9/2007 for Milford Haven to Aberdulais Pipeline PAC1111

N. Second batch requested NGGT Information provided via Huddle - email: 13 February 2015 15:45

Item	Date	Ref	Pages	Title
79B	13 Feb 2005	-	1	Summary Status 2 - requested information as provided by NGGT to date
80	1 June 2010	-	103	Framework Agreement between NGGT and Contractor H for Project Services Support
81	various	-	16	Churchover GA drawings
82	29 Oct 2009	M728x2	1	Cilfrew GA drawing
83	various	-	10	Felindre GA drawings
84	7 Feb 2013	M744x2	1	Tirley GA drawing
85	22 Jan 2009	M731x2	1	Treaddow GA drawings
86	various	-	11	Wormington GA drawings

O. Third batch requested NGGT Information provided via Huddle - email: 20 February 2015 16:14

Item	Date	Ref	Pages	Title
87	-	-	4	Tirley PRI Contractor Initiated Compensation Events (Contractor C Contract June 2011 to July 2014)
88	-	Tabbed xlsx	10	Copy of 03) Contractor B Transaction Report 9 – 12 2007
89	-	Tabbed xlsx	11	Copy of 45 of 48 MPSR MH-A Jul 07 (more detailed version of Project manager's report ref #128 for MH-A)
90	-	Tabbed xlsx	11	Copy of Fe-Br MPSR July 07 (more detailed version of Project manager's report ref #128 for Fe-Br only)
91	-	Tabbed xlsx	10	Copy of Contractor B Transaction Report Periods 7 as at 26-9-2007
92		SWEP6	8	Key Issues Paper – SWEP Line-pipe Procurement
101 -	monthly	each	3-10	Project manager's Report (approx. monthly 20.4.05 to

139				31.07.08 each covering all of the SWEP contracts)
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P. Forensic accounting report by Grant Thornton - email: 24 February 2015 11:03

Item	Date	Ref	Pages	Title
93	23 Feb 2015	-	89	Forensic accounting investigations of cost information provided by NGGT for the Milford haven pipeline project ref #76 for draft

Q. Fourth batch requested NGGT Information provided via Huddle - email: 25 February 2015 11:15

Item	Date	Ref	Pages	Title
94	25 Feb 2015	-	2 + 24	Commissioning and Associated Capacities plus embedded commissioning plan from September 2007
(87)	reissued	-	4	Tirley PRI Contractor Originated Compensation Event Register (Contractor C - June 2011 to July 2014)
95	undated	-	2	Felindre new build Compressor Station Compensation Events (Contractor A – register is undated)
96	undated	-	4	Modifications to Churchover and Wormington Compressor Stations - Compensation Event Register (Contractor A – register is undated)
97A & B	undated	-	3 + 7	Brecon to Tirley pipeline – 2 tabs - Project Manager and Contractor Originated Compensation Events (Contractor C – registers are undated)
98	-	various	42	Felindre P&IDs
99	-	various	22	Wormington P&IDs
100	-	various	23	Churchover P&IDs

R. Tirley information provided by Ofgem - email: 25 February 2015 17:47

Item	Date	Ref	Pages	Title
140	2 May 2007	001743/24	3	Update to Force majeure Notice 10 April 2007 for Cilfrew AGI. Capacity obligation of 650GWh/day likely to reduce to 610GWh/day (and later 880 GWh/day) assuming that only Cilfrew will be not operational)
141	9 Nov 2007	001743/	3	Force majeure Notice giving history of Corse AGI planning application on 2 May 2006, rejection by planning committee on 11 Oct 2006, appeal on 2 Nov 2006, public enquiries on 24 Apr and 18 May 2007, NGG still awaiting outcome of appeal from Secretaries of State. Capacity obligation from 1 Jan 2009 will be reduced by up to approximately 200GWh/day
142	21 Dec 2007	001743 /71	1 + 2	Update to Force majeure Notice 9 Nov 2007 following receipt today of decision to reject NGG's appeal duration of FM remains unknown. NGG will now have to re-apply for planning permission
143	2 Apr 2008	001743 /475	1 + 2	Update to Force majeure Notice 9 Nov 2007 – detailed EIA and engineering design work is being undertaken at two alternative sites considered by inspectors to have merit in preference to original proposal
144	1 Oct 2008	001743/A AD/1892	1 + 2	Update to Force majeure Notice 9 Nov 2007 – two preferred options, Corse and Tirley assessment of alternative locations within 10km radius also underway, planning application to be submitted later this year
145	2 Feb 2009	001743/1 938/AAD	1 + 2	Update to Force majeure Notice – new planning application environmental statement and detailed site investigation has been submitted on 19 Dec 2008
146	24 Dec 2010	001743/F	1 + 2	Update to Force majeure Notice 10 April 2007 -

		SR/3037		planning permission granted and expect pipeline to be operational winter 2012/13
Item	Date	Ref	Pages	Title
147	28 Sep 2012	001743/7755	1	Force majeure Notice 9 Nov 2007 no longer applies as Tirley has been commissioned and put into operation
148A	Application valid 29 Jan 2009	Email link	544 to 576/H	http://minutes.tewkesbury.gov.uk/mgConvert2PDF.aspx?ID=9332&J=1 listing of relevant policies, consultations, background to proposal, analysis, recommendations and details of planning application for Tirley PRI
148B	14 Dec 2010	Email link	1	http://www.gloucestercitizen.co.uk/Villagers-lose-gas-plant-battle/story-11861052-detail/story.html
150	20 Dec 2007	2029294	9	Secretaries of State Refusal for planning permission for Corse PRI
151	13 Dec 2010	2123550	9	Secretaries of State Granting of planning permission for Tirley PRI
(24)	18 Oct 2010	Reissue	121	Inspector's Report Tirley GPRF Tewkesbury 2123550
(25)	23 Aug 2007	Reissue	89	Inspector's Report Corse Appeal

S. Fifth batch requested NGGT Information provided via Huddle - email: 27 February 2015 11:26

Item	Date	Ref	Pages	Title
152	25 Feb 2015	-	1	Milford Haven to Aberdulais Stage 1 Compensation Events
153	undated	-	1	Milford Haven Actual Flow Rates spread sheet (units not specified)
79C	27 Feb 2005	-	1	Summary Status 4 - requested information as provided by NGGT to date

T. Sixth batch requested NGGT Information provided via Huddle - email: 2 March 2015 19:58

Item	Date	Ref	Pages	Title
154	25 Feb 2015	-	1	Transco Contract Data for Stage 2 Project Services
155	-	-	1	Procurement Schedule Churchover Compressor Station (orders >£50k)
156	-	-	1	Procurement Schedule Felindre Compressor Station (orders >£50k)
157	-	-	1	Procurement Schedule Wormington Compressor Station (orders >£50k)
158 & 159	3 Nov 2006	-	2 + 1	Letter and Appendix from NG to Ofgem with update on costs associated with delivering of the Milford Haven project – costs increased by £81m since previous price control forecast of £759.2m in Apr 2006 due to realisation of risks.
160	26 Jul 2007	2607d	3 + 4	Letter and Appendix from NG to Ofgem with update on costs associated with delivering of the Milford Haven project – costs increased by £110m since previous forecast of £840m in Nov 2006. (<i>note - reflects May 2007 sanctioned cost but cost increase allocations differ, no weather cost identified</i>)
161	undated	-	4	Note – Commentary on Exceptional Events extracted from Project Manager Reports
162	undated	-	3	Note on Financial Controls – Felindre to Brecon Pipeline

**U. Seventh batch requested NGGT Information provided via Huddle - email:
4 March 2015 11:26**

Item	Date	Ref	Pages	Title
163	-	-	1	P&ID – Cilfrew AGI
164	-	-	1	Herbrandston AGI GA
165	-	-	1	P&ID - Herbrandston AGI
166	-	-	1	Llangynog BV GA
167	-	-	1	P&ID – Llangynog BV
168	-	-	1	Llanwrda BV GA
169	-	-	1	P&ID – Llanwrda BV
170	-	-	1	P&ID – Newton Noyes
171	-	-	1	P&ID – Three Cocks AGI
172	-	-	1	P&ID – Tirley AGI
173	-	-	1	P&ID – Treaddow PRI
174	-	-	1	Upper Neeston MOC GA
175	-	-	1	P&ID - Upper Neeston MOC

**V. Eighth batch requested NGGT Information provided via Huddle - email: 4
March 2015 16:48**

Item	Date	Ref	Pages	Title
176	-	-	1	Extract from Pipeline data book, Feeder 28 distances
177	8 Dec 2003	4614/T/03 /LN	7	Contract Award recommendation for Project Services

**W. NGGT response to questions raised - email: 9 March 2015 17:10 and
11 March 2015 16:41 (with attached strip map ref item #75 – Milford
Haven to Aberdulais map 59)**

**X. Remaining requested NGGT Information provided via Huddle - emails: 16
March 2015 07:52 and 16:09 and 17 March 2015 17:00**

Item	Date	Ref	Pages	Title
178	-	-	11	NGGT Note on Tirley Pressure Reduction Installation
179	-	-	6	NGGT Note on Cilfrew AGI
180	-	-	5	NGGT Note on Compulsory Purchase Orders
181	9 Jun 2005 – 20 Nov 2007	-	96	NGT MH Project Board Minutes – 30 sets of monthly minutes
182	-	-	8	NGGT Note with extracts from MH Project Board Minutes demonstrating NGT's mitigation of risk with respect to pipeline delay.

**Y. Additional NGGT Information provided via Huddle - email: 14 April 2015
16:48**

Item	Date	Ref	Pages	Title
183	15 Feb 2005	4614/T/03 /LN	5	MH to Aberdulais Pipeline Project Services Award Paper (Contractor G)
184	undated	MASR757 /T/05/KP	3	South West Expansion Project Services Award Paper (Contractor H)

Appendix 2: Milford Haven Project Costs as reported in Sanction Papers

Appendix 3: Milford Haven Project Costs as reported in Project Manager monthly reports

**Appendix 4: Monthly spend and cumulative Main Works Contractor (MWC)
Pipeline Costs**

**Appendix 5: Monthly spend and cumulative Main Works Contractor (MWC)
Compressor Station & Pressure Reduction Installation Costs**

Appendix 6: Brief Description of NEC Engineering Contract Options, A, C and E

The following description has been abstracted from the NEC 3 Engineering and Construction Contract Guidance Notes published by NEC in June 2005. The notes describe the main Engineering Contract Options available to NGT being also relevant to the previous version of NEC 2 specified in the main pipeline construction contracts. NEC has been developed over several years and is designed for and is commonly used for Engineering and Construction Contracts within the UK.

For a particular contract, one main Option is chosen. The optional clauses are then combined with the core clauses (common to all NEC 3 contracts) to provide a complete contract.

There are six types of payment mechanism available in the main Options:

- Option A - Priced contract with activity schedule
- Option B - Priced contract with bill of quantities
- Option C - Target contract with activity schedule
- Option D - Target contract with bill of quantities
- Option E - Cost reimbursable contract
- Option F - Management contract.

Options B and D cover contracts where a list of work items and quantities is prepared in advance by or for the Employer and are not relevant for the design and construct works proposed by NGT. Neither is Option F relevant to the Milford Haven Scheme. In reality, NGT had the opportunity to let the works under NEC Options A or C or E.

Each Option uses different arrangements for payment to the Contractor as each Option allocates risk differently between the Employer and the Contractor.

The extreme cases of risk allocation are the priced Option A on the one hand and the cost reimbursable Option E on the other hand.

The target Option C permits the cost risk to be shared between the Employer and the Contractor.

The following are brief summaries of the main characteristics and uses of each main Option.

Option A: Priced contract with activity schedule

In the priced Option A, the Contractor is paid at tendered prices for the work he has done. He carries all risks other than the Employer's risks stated in the contract and the financial and time effects of compensation events.

An activity schedule is a list of activities prepared by the Contractor which he expects to carry out in providing the Works. The lump sum for each activity is the Price to be paid by the Employer for that activity. The total of these Prices is the Contractor's price for providing the whole of the works, including for all matters which are at the Contractor's risk.

Option C: Target contract with activity schedule

Target contracts are sometimes used where the extent of work to be done is not fully defined or where anticipated risks are greater. The financial risk is shared between the Employer and the Contractor in the following way:

The Contractor tenders a target price using an activity schedule. The target price includes the Contractor's estimate of Defined Cost plus other costs, overheads and profit to be covered by his Fee percentages.

The Contractor is paid Defined Cost plus the Fee. The Prices are adjusted for the effects of compensation events.

At the end of the contract, the Contractor is paid (or pays) his share of the difference between the final target prices and the final total price of the work done to date according to a formula stated in the Contract Data.

Option E: Cost Reimbursable contract

In a cost reimbursable Option E contract, the Contractor is paid the agreed Defined Cost.

A cost reimbursable contract should be used when the definition of the work reimbursable contract to be done is inadequate even as a basis for a target price and yet an early start to construction is required.

In such circumstances, the Contractor cannot be expected to take cost risks other than those which entail control of his employees and other resources. He carries minimum risk and is paid Defined Cost plus his tendered Fee, subject only to a small number of constraints designed to motivate efficient working.

Cost reimbursable contracts have a tendency for costs to escalate over time particularly so if the scope of work changes!

Appendix 7: Milford Haven Capacity Graphic

Appendix 8: Milford Haven Project Schematics

Appendix 9: Schedule of Questions raised and Responses by NGGT ³¹

³¹ updated from ref #79C