

Annex 6

Real Price Effects & Frontier Shift

GD17

Final Determination
15 September 2016



About the Utility Regulator

The Utility Regulator is the independent non-ministerial government department responsible for regulating Northern Ireland's electricity, gas, water and sewerage industries, to promote the short and long-term interests of consumers.

We are not a policy-making department of government, but we make sure that the energy and water utility industries in Northern Ireland are regulated and developed within ministerial policy as set out in our statutory duties.

We are governed by a Board of Directors and are accountable to the Northern Ireland Assembly through financial and annual reporting obligations.

We are based at Queens House in the centre of Belfast. The Chief Executive leads a management team of directors representing each of the key functional areas in the organisation: Corporate Affairs; Electricity; Gas; Retail and Social; and Water. The staff team includes economists, engineers, accountants, utility specialists, legal advisors and administration professionals.

Our Mission

Value and sustainability in energy and water.

Our Vision

We will make a difference for consumers by listening, innovating and leading.

Our Values

Be a best practice regulator: transparent, consistent, proportional, accountable, and targeted.

Be a united team.

Be collaborative and co-operative.

Be professional.

Listen and explain.

Make a difference.

Act with integrity.

TABLE OF CONTENTS

1	Introduction	4
2	Real Price Effects	5
	Weights.....	6
	Input prices – Labour	7
	Input Prices – Materials.....	9
	Input Prices – Equipment & Plant.....	12
	Input Prices - other.....	13
	Retail Price Index Projections	13
3	Productivity	15
	Productivity Growth.....	15
4	Frontier Shift Conclusions	20

1 Introduction

- 1.1 In this Annex we give further detail of our analysis and considerations under the areas of real price effects and frontier shift.
- 1.2 The concept of frontier shift is wider than simple productivity assumptions. Within this report, we have adopted the methodology we first introduced at PC13 for NI Water¹, which aligns closely with the Competition Commission (CC) determination for Northern Ireland Electricity at RP5 and more recent Competition and Markets Authority (CMA) decisions.
- 1.3 This process combines nominal input price forecasts with productivity expectations and RPI inflation. The frontier shift in real terms can be represented in a simple way as follows:

$$\begin{array}{lcl} \text{Frontier shift in real terms} & = & \text{input price increase} \quad \text{minus} \\ & & \text{forecast RPI (measured inflation)} \quad \text{minus} \\ & & \text{productivity increase} \end{array}$$

- 1.4 In reply to our draft determination (DD) consultation we received responses from various interested parties, including the NI GDNs. We address the key points that relate to real price effects, productivity and frontier shift within the responses received.

¹ [http://www.uregni.gov.uk/uploads/publications/ANNEX_D - Rate of Frontier Shift - PC13_FD.pdf](http://www.uregni.gov.uk/uploads/publications/ANNEX_D_-_Rate_of_Frontier_Shift_-_PC13_FD.pdf)

2 Real Price Effects

- 2.1 The price of a company's various inputs may differ over time. Price controls have normally been indexed by the Retail Price Index (RPI) to account for broad changes in prices. However, being a measure of general inflation, not all types of cost changes will be reflected in the range of prices used to calculate the RPI. To account for this it is common practice to calculate and make adjustments for the difference, either positive or negative, between particular input price changes for a company or industry and the RPI measure of inflation. This is described as *real price effects* (RPEs).
- 2.2 In the detailed business plan submissions FE provided forecast nominal RPEs for specific input cost categories over the GD17 period. These forecasts were accompanied by an explanatory commentary and analysis.
- 2.3 Part of FE's business plan submission was a report on benchmarking and efficiency assessment by their advisors, Oxera. The report gave an overview of possible approaches to benchmarking FE. It also noted the range of RPEs applied to gas and electricity transmission and distribution companies in recent regulatory decisions. However caution was advised as NI GDNs may differ from their GB counterparts.
- 2.4 As part of PNGL's business plan submission nominal forecast RPEs were provided. This was in turn accompanied by a paper setting out statistical analysis undertaken by their advisors, NERA. In summary this analysis used two distinct methods: long term trend growth and 'ARIMA'² time series modelling. The different methodologies gave a range of results for predicted RPEs across the GD17 period. A simple average of forecasts using models from a (p,1,q) and (p,0,q) time series process was adopted using the Bayesian Information Criterion within the sample to identify the preferred ARIMA specifications. However, we note no *ex post* forecasting accuracy test was employed by NERA. The outcome provided results for both preferred ARIMA specifications and compared these to the forecast of RPEs across GD17 using a simple OLS time series approach.
- 2.5 The NERA work forecasts that input costs for PNGL's opex were expected to increase above RPI by between 5.6% or 7% in total by 2020, depending on the calculation method chosen. For capex the predictions were between 7.1 % or 8.3% by 2020.
- 2.6 SGN were successful in a 2014 competitive application process for the award of a new low pressure gas conveyance (distribution) licence to take gas to the west (GttW) of Northern Ireland. Construction of the SGN network is expected to begin during the GD17 period.
- 2.7 In their business plan submission for GD17, SGN provided high level forecast yearly RPEs of 1.4% for opex (contract labour) and 2.75% for capex. The forecast RPEs for capex consisted of 1.4% for contract labour and 1.35% for materials. We noted in our DD we did not propose applying RPEs for the opex cost element of the GD17 price control (paragraph 1.17). We did however propose to apply RPE's to SGN's capex costs during GD17. We therefore do not address RPEs for SGN opex costs in detail within the individual cost category sections that follow.
- 2.8 We proposed certain input cost categories in our overall approach for the GD17 price control. As noted at that time, they would form the categories for GD17 as a minimum.

² 'ARIMA' or autoregressive (AR) of order p plus data made stationary via integration or differencing plus a moving average (MA) term or order q is the name used for a particular type of time series model used to predict or forecast future values. Such models are often described as mean reverting as by lengthening the forecast horizon they will tend to bring forecasts into line with the long term mean or average growth rate of the variable under examination, whilst cycles are maintained via inclusion of an AR process.

We carry these categories forward for use in GD17, maintaining continuity with GD14 cost categories for efficiency benchmarking, and our detailed reasoning follows below.

Weights

- 2.9 To estimate RPEs we first separate a company's costs into various categories of opex and capex. This is a necessary step as input prices in different cost categories may vary for each component of opex and capex.
- 2.10 Nominal price inflation for each category of cost is then calculated. Finally, accounting for RPI and applying weights to each cost category we calculate an overall value, or weighted average, of RPEs in each year of the price control.
- 2.11 As part of their business plan submissions, the three GDNs were asked to submit what they thought were the appropriate cost category weights for both opex and capex.
- 2.12 FE had relatively similar proportions to those adopted at GD14 for opex, although labour was separated into manpower and contracted elements. FE did not have a separate capex category for materials, but had a significant weighting for contractor costs instead, which would have materials costs included.
- 2.13 PNGL's submission used the same weights as was adopted by the UR in GD14 and proposed in our overall approach for GD17. SGN's proposed weights were quite markedly different to the other GDNs.
- 2.14 For GD17, we considered the adoption of weights specific to each company. However, having given this due consideration, we have decided not to adopt this approach. We are concerned that if we were to do so, we may be inconsistent with the principal objective of RPEs – estimating the likely shift in the industry *frontier*. Thereby avoiding risk that our frontier shift approach may pass through company costs partially or otherwise via a RPEs assessment which mirrors a company's actual proportion of costs rather than proportional weights applying to an *efficient company at the frontier*.
- 2.15 It is also important to note that company weights may change over time more readily than the broader approach of using notional weights. In addition, by adopting such an approach it would be necessary to determine each company's specific price inputs. This would not be practical or beneficial for the 'notional company' approach adopted.
- 2.16 Therefore for the GD17 final determination we confirm our position on weights, as set out at DD stage. Our chosen weights are the same as used in GD14 and are based on the notional structure weights of the different cost categories of a GDN as determined by Ofgem.
- 2.17 The weights adopted do not differentiate between direct and contract labour. We carry this approach forward to avoid any unintentional influence on GDN decisions on labour supply when choosing the type of labour. The weights we use for both opex and capex are shown in Table 1 below.

Table 1 - Cost categories and weightings for opex and capex

Cost category	Opex	Capex
Labour (direct and contract)	52%	56%
Materials	6%	19%
Equipment/plant	1%	4%
Other	41%	21%

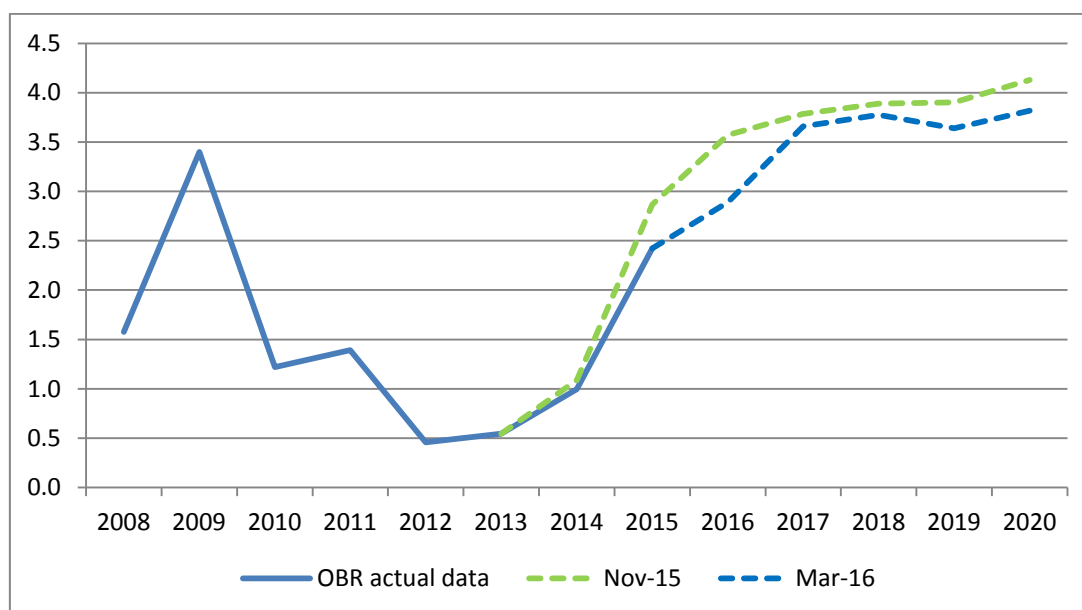
Source: UR, Ofgem

Input prices – Labour

- 2.18 As the cost category of labour makes up over half of the opex and capex, it is important that the figures used for these input prices are fair and reasonable.
- 2.19 The three GDNs were asked to provide their estimates of labour costs for the GD17 period in their business plan submissions.
- 2.20 FE forecast slightly more moderate increases in labour costs, with a somewhat flatter profile than PNGL. The Oxera benchmarking paper provided an overview of recent potentially relevant regulatory decisions on labour RPEs.
- 2.21 PNGL adopted forecasts from NERA which estimated a relatively sharp increase in the cost of labour in the short-term, with the increases slowing towards trend rate after 2019. NERA adopted ARIMA modelling analysis which incorporates significant mean reverting behaviour within the modelled time series, resulting in their forecast being materially above that predicted under a simple OLS time series approach.
- 2.22 SGN provided forecasts for direct and contract labour separately. The forecasts were of more moderate increases, peaking in 2018 for both labour components and remaining flat thereafter to the end of GD17.
- 2.23 For our analysis of labour RPEs in GD14 we used data provided by the Office of Budget Responsibility (OBR). OBR is a body which is independent of government that provides authoritative analysis on a range of economic issues
- 2.24 Although PNGL and NERA preferred the ARIMA modelling approach, it is important to note that OBR's analysis will also be empirically based and also takes into account the continued prospect of recovery, the extent and timing thereof for the UK economy, as part of a world view.
- 2.25 While NERA say our method results in a downward bias, by extension the NERA chosen method may appear to display an upward bias when compared to other techniques. Hence some judgement is required on preferred methodology, and as we indicated at DD, choice of appropriate data can help address concerns (see paragraph 2.24 of Annex 6 of the GD17 DD).
- 2.26 For GD17 we consider continued use of OBR data beneficial, and given the data source, reliable and consistent with our other data series. This includes continuing as in GD14 with our approach of taking an initial number drawn from actual data which is then lifted toward the long term average of index/indices.
- 2.27 In their DD response PNGL also made the argument that as GDNs were private companies their wage costs are better reflected by private sector wage growth than by whole economy data as we used at DD.
- 2.28 To investigate the difference this may make to labour we carried out further analysis and revisited regulatory literature. We note examples of the use of private sector wage growth by other regulators, but with some scope for differing approaches/combinations of indices. We note Ofgem used a mix of private sector and economy wide data for their RIIO T1/GD1 RPEs/frontier shift calculations.
- 2.29 In addition, PNGL asserted that the number of hours being worked varies over time. This may have the effect of masking an increase in the average hourly rate being paid if the average number of hours is simultaneously reduced.
- 2.30 In response, for FD we have applied actual private sector wage growth to our RPE and frontier shift calculations and assessed the results. Specifically, for FD we have applied private sector wage growth in our calculations where we have actual data (to 2015). Thereafter we apply an estimate of economy wide (OBR) wage inflation.

- 2.31 However, given the question of varying hours worked, we have employed the OBR data for *average hourly earnings*. This is to account for changes in hours worked for the period up to and including 2020. With 2020 being the limit of available forecast data – set out in Figure 1 below.
- 2.32 Beyond the 2020 point we assume the last available year's forecast is suitable as an estimate for the remaining 2 years of GD17 given the uncertainty at that point. This is an approach similarly used at GD14.
- 2.33 On a more general point, PNGL proposed that we revise our assumptions around the rate at which our various chosen indices revert to trend growth. That is, at DD our assumption was for a more modest return to trend, than would be the case using the 'ARIMA' method.
- 2.34 For GD17 we are mindful of the projections from OBR on inflation and their expectation of wage growth ramping up, rather than seeing an immediate recovery to expected level.
- 2.35 We have reflected on the discussion with GDNs, on responses received to our DD and the points above and sought a reasonable balance between the factors. We noted at DD that the ARIMA approach for instance has advantages, but is not without alternatives that also have their particular advantages.
- 2.36 On balance our preference remains for the more holistic approach anchored on OBR sentiment rather than the more mechanistic/deterministic approach of NERA (which has not been tested against short term forecasts for accuracy).
- 2.37 Since the economy entered recession around 2009, earnings growth remained quite low. However, as economic output has increased and the unemployment rate has fallen, the OBR are predicting a return to nominal earnings growth of between 3 and 4 per cent over the next 5 years or so. As RPI inflation is forecast to be relatively low, this translates into a forecast of a real terms increase in labour costs during the period of GD17.
- 2.38 Finally we note we had indicated our intention to update our analysis after DD with latest data available. Latest data from OBR indicates an expected downward revision of wage growth expectations going into the GD17 period, settling into a smaller expected effect through the period. Being the most up to date, we adopt the OBR figures from their March 2016 forecast
- 2.39 Overall the result is only a slight change to the forecast. We have nevertheless applied the new data, being more up to date, to our RPE/frontier shift calculations.

Figure 1: Average Hourly Earnings Growth (% yearly) - OBR



Source: OBR Economic and Fiscal Outlook: Economy supplementary Table 1.6, March 2016 and November 2015 (used for DD), UR analysis. Solid line is actual data, dashed lines are forecast data.

Table 2: Economic and Fiscal Outlook – Labour Market

Labour market	Percentage change on a year earlier, unless otherwise stated					
	Out turn	Forecast				
	2015	2016	2017	2018	2019	2020
Employment (millions)	31.2	31.6	31.7	31.9	32.0	32.1
Productivity per hour	0.8	1.0	1.7	2.0	2.0	2.0
Wages and salaries	4.1	3.6	4.2	3.9	3.8	3.9
Average earnings	2.3	2.6	3.6	3.5	3.4	3.6
LFS unemployment (% rate)	5.4	5.0	5.0	5.2	5.3	5.3
Claimant count (millions)	0.80	0.75	0.78	0.84	0.86	0.87

Source: OBR Economic and Fiscal Outlook, Table 3.8 March 2016

Input Prices – Materials

- 2.40 The next category we assess is materials, which make up almost a fifth of capex costs. Materials costs carry less weight for opex, but are still an important consideration of RPEs.
- 2.41 SGN signalled in their business plan submission that materials price inflation was not relevant to their opex, but rather to their capex costs. We note this point and considered it against our proposal to seek to apply a ‘notional efficient company’ approach to RPEs, including weights for all the GDNs.

- 2.42 We noted FE's cost category proposed in the 'Weights' section above. The outcome of their proposal was that no separate materials category was included.
- 2.43 PNGL provided business plan forecasts for material prices that show an increase throughout the GD17 period.
- 2.44 Our analysis for this area in GD14 drew on price indices published by the Department for Business Innovation & Skills (BIS). This analysis resulted in applying the long term average of the NOCOS³ and FOCOS⁴ indices over the GD14 period as the materials price input inflation assumption.
- 2.45 We considered indices available to estimate the price changes for materials during GD17. The Office of National Statistics (ONS) assessment of the indices used in GD14 was that they provided an important tool to multiple users and were a needed resource. However the methodology for calculating the indices was deemed in need of updating. The indices used for GD14 were subsequently discontinued⁵. Given the usefulness of the discontinued indices, the ONS have produced a short-term replacement solution known as the interim construction Output Price Indices (I-OPIs).
- 2.46 The I-OPIs offer a time series of only 2 full years of data however, and therefore we did not consider drawing conclusions from these indices alone as appropriate. The NOCOS and FOCOS indices by contrast offer a time series of data of over 25 years.
- 2.47 Subsequently we estimated the level of material price inflation for the GD17 period using the data indices above. To do this we first took the current 'snapshot' of inflationary indications provided by the I-OPI. We then estimated possible growth scenarios which increase toward the long term average of the NOCOS and FOCOS indices.
- 2.48 We noted at DD that price levels in materials can be quite volatile, and have not seen sustained increases in recent years. Rather, evidence points to a weakened demand in global markets of late. The Bank of England's May 2016 Inflation Report continues to note "weak global price pressure"⁶ as a contributory factor to lower than expected general UK inflation.
- 2.49 Mindful of this and reports referenced at DD on commodity inventories⁷ for example, suggests continued downward pressure on cost inputs may be expected. On consideration, we suggest the most likely scenario is that any price growth will be more modest in the short-to-medium term, and subject to economic conditions, there is the potential for perhaps negative growth.
- 2.50 We also continue to consider a reversion to long term trend growth as a reasonable approximation for future growth in material costs.
- 2.51 Reflecting on the above we maintain our approach of applying a 'medium' growth scenario from our estimates of materials price inflation. This scenario is positive, draws on recently regulatory practice and increases towards the long term average whilst expecting in the near term a more modest growth rate in light of current market conditions.

³ i.e. 'NOCOS' - Resource Cost Index of Building Non-Housing, See §14.21
http://www.uregni.gov.uk/uploads/publications/2013-12-20_GD14_Price_Control_for_NI_GDNs_2014-2016_Final_Determination.pdf#page=166&zoom=90,69,770

⁴ i.e. 'FOCOS' Resource Cost Index for Infrastructure, Materials. See §14.21
http://www.uregni.gov.uk/uploads/publications/2013-12-20_GD14_Price_Control_for_NI_GDNs_2014-2016_Final_Determination.pdf#page=166&zoom=90,69,770

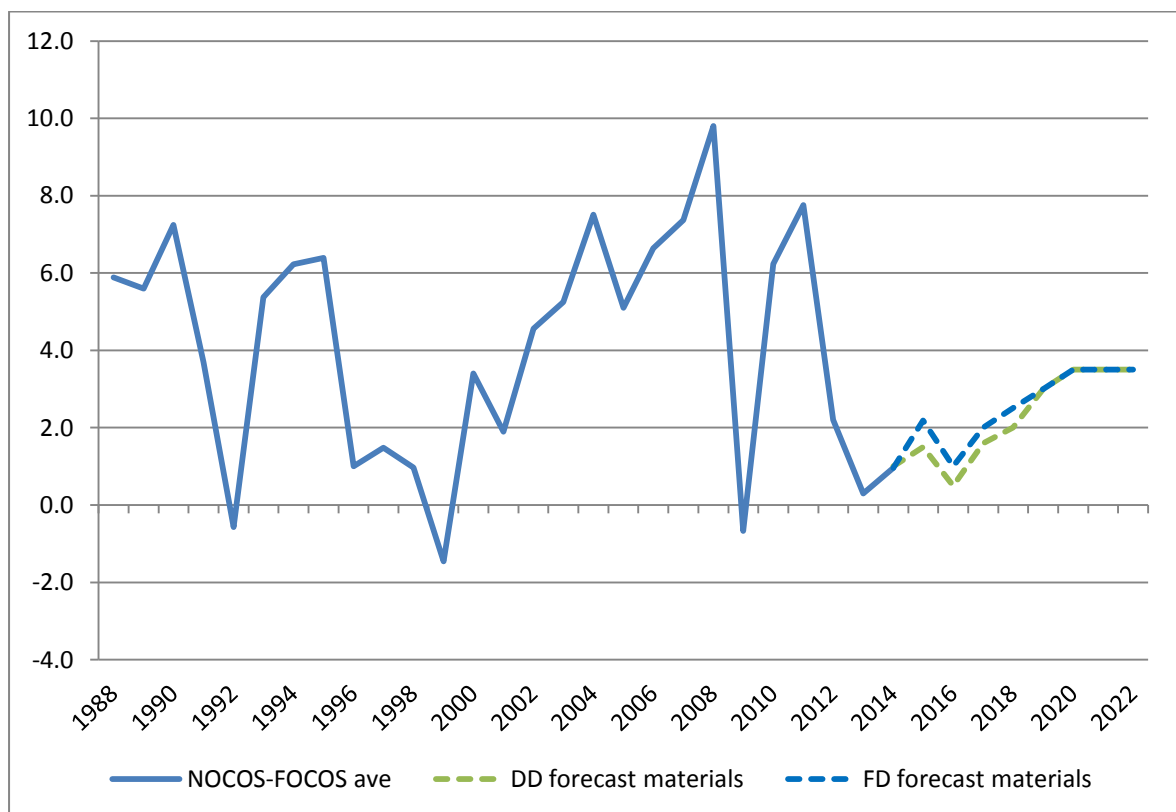
⁵ <https://www.gov.uk/government/collections/price-and-cost-indices#history>

⁶ Monetary Policy Summary section -
<http://www.bankofengland.co.uk/publications/minutes/Documents/mpc/mps/2016/mpsmay.pdf>

⁷ For example: Platts (London) report <http://www.platts.com/latest-news/metals/london/investec-cuts-base-metals-forecasts-sees-disincentive-26343325>

- 2.52 Some additional data is available for 2016, however with just partial data available at the time of writing, its use is limited. This choice allows for the scenario we describe in the previous paragraph while still permitting some additional flexibility in material price movements.
- 2.53 We have therefore carried forward our methodology from the draft determination. We have also reviewed the latest data available for the I-OPI. The latest data indicates a materials growth forecast that is slightly stronger than the data available at DD indicated. We have applied this observation to our analysis of RPEs, rolling forward the higher growth observed in the updated 2015 actuals for our selected data. This has the effect of raising our 'medium' growth scenario by approximately +0.5 percentage points until 2018. Thereafter we expect trend towards the long term average of the NOCOS/FOCOS indices to continue. Figure 2 shows our estimate for materials growth at DD and our updated estimate for FD. Figure 3 shows the latest data for the ONS I-OPI series.

Figure 2: Materials price inflation (% yearly)



Source: BIS Construction Resource Indices: NOCOS' - Resource Cost Index of Building Non-Housing, Material and 'FOCOS' Resource Cost Index for Infrastructure, Materials, OBR Economic and Fiscal Outlook, March 2016, ONS and UR analysis.

Figure 3: ONS Interim Construction Output Price Indices (% change over 12 months)



Source: ONS Interim Construction Output Price Indices (OPIs), Quarter 1 2016, Table 2 and UR analysis

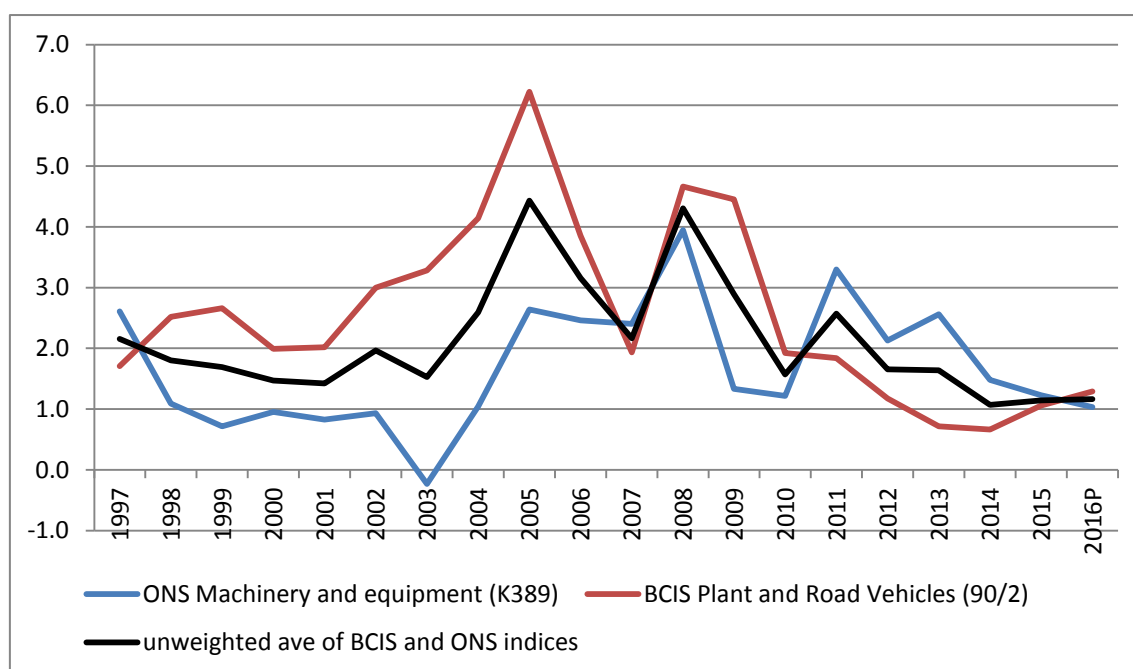
Input Prices – Equipment & Plant

- 2.54 In terms of relative importance the plant and equipment category has a relatively small weighting for both opex and capex (1% and 4% respectively).
- 2.55 PNGL provided forecasts in their business plan submission for equipment and plant prices that show an increase to a peak in 2019, followed by a turn towards a slight downward trajectory until the end of GD17.
- 2.56 At DD, to establish how equipment and plant costs are expected to change over the next few years we examined data from ONS. We relied upon data from the Machinery & Equipment component (K389) of the Producer Prices Index (PPI).
- 2.57 PNGL and NERA in their response to our DD suggested we include an additional index for Equipment & Plant: the BCIS Plant and Road Vehicles (90/2) index. This was a useful suggestion and we assessed the inclusion.
- 2.58 Subsequently we took the latest version of this BCIS index and incorporated it into our RPE analysis for the GDNs.
- 2.59 As we have done for other input cost categories, we took an unweighted average of the ONS and BCIS indices. This also provided an initial actual figure. Using actual data, and in the absence of any forecast for the chosen indices, we assumed an increase toward the long term average of the both indices, maintaining our estimate for 2016 from DD stage.
- 2.60 The up to date and additional data provided a useful bolster to the analysis. However this has resulted in only a marginal change to the RPE for Equipment & Plant. With the

latest data available the long term average of both indices stands at 2.2%. This is down only slightly from the 2.3% indicated with the latest data available at the time of the DD.

- 2.61 Figure 4 below illustrates the changes in the ONS and BCIS indices 1997-2016. It can be seen that the indices have shown a convergence to lower growth of late. However in keeping with our expectation at DD, we expect the current growth to trend towards the long term average growth rate throughout the GD17 period.

Figure 4: Equipment and Plant price indices (ONS/BCIS) % annual growth



Source: ONS Producer Price Indices, Machinery and Equipment (K389) and BCIS Plant and Road Vehicles (90/2)

Input Prices - other

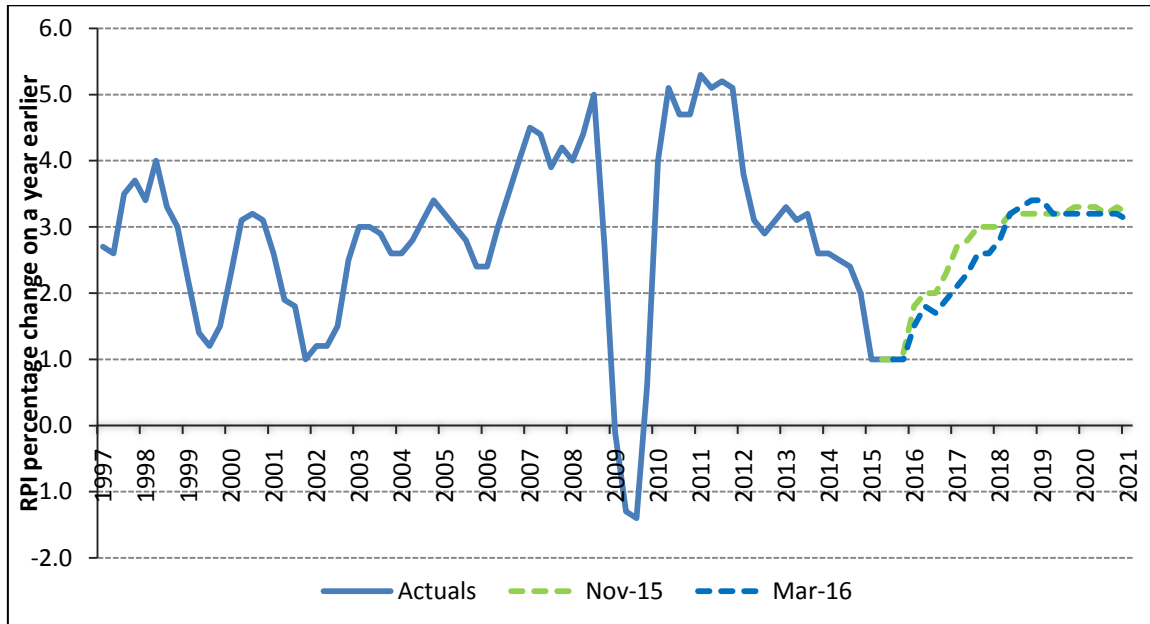
- 2.62 As was the case in our last GDN price control (GD14), for the “other” category, in the absence of a suitable index for this cost category we assume that prices increase at the same nominal rate as the Retail Prices Index (RPI). This in effect leads to a nil RPE applying to “other” costs.
- 2.63 More detail on the RPI values is provided below.

Retail Price Index Projections

- 2.64 As the input prices above are in nominal terms, it is necessary to apply an RPI discount in order to transform the calculated price effects into real terms.
- 2.65 In line with a number of recent price controls we have based our RPI values on forecasts made by the OBR.
- 2.66 As with the other data we used at DD we have sought out any updates available. The latest OBR RPI data (March 2016) indicates a slight weakening of expected inflationary pressure from the forecast available at DD stage (November 2015 OBR forecasts). This is illustrated in Figure 5 below.

- 2.67 The March 2016 figures show a moderate increase in RPI until around late 2017, before it levels off somewhat, to slightly above 3%. This represents a similar, albeit generally slightly weaker rise in RPI than expected by OBR at the November 2015 OBR publication.
- 2.68 The update is incorporated in our analysis below.

Figure 5: RPI since 1997



Source: OBR, Economic and Fiscal Outlook, Chart 3.21 March 2016 and Chart 3.19 November 2015. Solid line denotes actual data, dashed line is forecast.

- 2.69 As a sense-check we have compared OBR estimates with latest HM Treasury independent forecasts.⁸ These estimates are slightly more recent, however they offer only slight variation and so are in line with what was forecast by the OBR in March 2016.
- 2.70 For consistency we are therefore content to use the OBR RPI forecasts in our calculation of real price effects.
- 2.71 The detailed annual figures for all input price categories are set out in Table 5: Opex Frontier Shift and Table 6: Capex Frontier Shift.

⁸ Forecasts for the UK economy: a comparison of independent forecasts, August 2016
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/546720/2016_08_forecomp_august_2016.pdf

3 Productivity

- 3.1 A company can become more efficient over time and so close the gap between its efficiency level and that of the economic frontier. Equally, the industry's overall efficiency or frontier can change over time. It is possible the most efficient company in an industry can find new or improved ways of using less input volumes to maintain current output levels.

Productivity Growth

- 3.2 In addition to real price effects, it is necessary to apply a productivity assumption to opex and capex so as to take account of continuing efficiencies which the industry can achieve over the price control period. This is a base level of efficiency which even frontier companies would be expected to achieve as they continually improve their business over time (for example with new technologies, new working practices or other mean).
- 3.3 FE stated they had built productivity growth into their business plan submission. Hence the company did not propose a distinct level of productivity improvement within the GD17 business plan templates.
- 3.4 In response to our DD, FE submitted a paper on frontier shift prepared by their advisors Oxera. In this paper Oxera noted further EU KLEMS data is available for 2008-2009. In addition the paper suggested we may be able to review the classifications used in the data to more accurately map to the NI GDNs. That is, rather than using economy wide data we could use more specific data.
- 3.5 The data relied on for our DD analysis period was 1970 – 2007. We recognise availability of the additional 2008/9 data in a separate release with a reduced number of industry categories. And at face value more data may provide useful further insight. As part of the paper, Oxera referenced previous analysis they had carried out that used the additional years of data.
- 3.6 We welcomed the opportunity to look into the analysis cited, carried out on behalf of Dutch regulator ACM⁹.
- 3.7 From our review of the analysis in the ACM commissioned paper we observe that the analysis appears to draw on the additional 2008-2009 period and begins from 1988. While this has the effect of 2 additional years of data at the end of the dataset, it also reduces the overall length of the series analysed by some 16 years. While we haven't used the 2008-2009 period (and indeed do not rule out its use in any future analysis) we are of the view that the longer data set we relied on at DD provides a reasonable balance to the analysis on the data series.
- 3.8 In regards mapping the EU KLEMS data to the GDN activities, and of being more specific to the NI GDNs activities we are conscious of the exercise undertaken by Ofgem in their analysis (which we draw on). Ofgem in their analysis reviewed the industry categories and excluded certain classifications in arriving at their calculated ranges. It was after this exercise they determined their productivity assumptions for the GB GDNs.

⁹ <https://www.acm.nl/nl/publicaties/publicatie/15537/Agendapunt-5-Study-on-ongoing-efficiency-for-Dutch-gas-and-electricity-TSOs/>

- 3.9 FE also noted in their DD response that productivity estimates which use economy wide data may require (downward) adjustments to accurately calculate the applicable frontier shift.
- 3.10 We recognise the concerns highlighted in respect of effects on productivity from other factors. As our range is drawn from Ofgem and CMA analysis we are mindful of the scrutiny the calculations and ranges provided have been subjected to. In particular we would draw attention to the “Respondents’ comments and our decisions” section of Ofgem’s RIIO T1/GD1 final decision document for RPEs and ongoing efficiency¹⁰. This section addresses and sets out the thinking on some of the suggested adjustments to Ofgem’s calculations. Given our use of the same core Ofgem analysis we expect the reasoning will continue to hold for the EU KLEMS data and analysis.
- 3.11 FE also asserted we had not calculated our productivity assumption from a comprehensive measure but from only partial factor productivity.
- 3.12 Our range of course was drawn from recent CMA reviewed Ofgem analysis, who subjected the analysis to suitable scrutiny as referenced above.
- 3.13 Ofgem explain their analysis and the ranges they calculated from EU KLEMS data in their RIIO T1/GD1 RPEs and ongoing efficiency initial proposals document¹¹. The calculations were drawn from both total and partial factor productivity. It is useful to note the ranges calculated suggested higher potential productivity than the 0.5 – 1.5 range they drew from for T1/GD1 (as do we for GD17). That is: 0.5 – 2.8 for opex and 0.5 – 2.3 for capex/replex.
- 3.14 However on balance of all the relevant circumstances Ofgem decided to use narrower ranges. We would suggest that this and the above, along with other checks including against regulatory precedent, provide a suitable counter balance to over estimation concerns of the GDNs productivity assumptions for GD17.
- 3.15 In direct reference to the final Ofgem determination for GB GDN productivity, FE suggested that we have departed from the Ofgem determination of 1% opex and 0.7% capex. It is accurate to say that we have not simply reproduced the Ofgem determination. We have drawn from it and used the Ofgem analysis in drawing our conclusions. While we used the Ofgem analysis, we have however drawn our own conclusions for the NI GDNs.
- 3.16 Ofgem set their 1% opex/0.7% capex productivity target based on their chosen derivation method¹². In particular they gave weight to construction industry productivity (for GDNs capex and repex activities). It is useful to note NI GDNs do not perform the repex programmes apparent in GB.
- 3.17 While Ofgem elected for a different target based on their own rationale, there remains an element of judgement. Our range of productivity is likewise drawn from the Ofgem analysis of EU KLEMS data (subsequently CMA reviewed during RP5). Moreover our GD17 DD productivity target of 1% opex & capex is the same as we set at GD14 (and as CMA set for NIE at RP5).
- 3.18 PNGL proposed an annual increase in productivity of 0.8% for opex and 0.6% for capex in their business plan submission. These figures were the midpoint of NERA analysis results using the EU KLEMS productivity data.
- 3.19 EU KLEMS offers both gross output (GO) and value added (VA) measures of total factor productivity. NERA in their analysis for PNGL opted for the GO measure solely, as they

¹⁰ <https://www.ofgem.gov.uk/ofgem-publications/48159/5riiogd1fprpedec12.pdf#page=16>

¹¹ <https://www.ofgem.gov.uk/ofgem-publications/48211/riiot1andgd1initialproposalsrealeffects.pdf#page=21>

¹² <https://www.ofgem.gov.uk/ofgem-publications/48211/riiot1andgd1initialproposalsrealeffects.pdf>

did not consider VA relevant to PNGL. In addition NERA said Ofgem and the CMA have both commented on the suitability of the VA measure.

- 3.20 We considered NERA's position on use of GO and/or VA measures. During our considerations we noted that a significant body of work has already been carried out on EU KLEMS data. Specifically with regards the issue of whether to use VA or GO we consider relevant the Competition Commission's (CC) recent deliberations and conclusions on the matter in their recent NIE RP5 determination.
- 3.21 The CC took a balanced view of both productivity measures. They noted that neither measure perfectly captures the productivity changes that could be expected in a company's cost base. In addition the CC noted changes in GO have been systematically smaller than changes in VA. However they subsequently concluded while there were some disadvantages, that it was their view that both GO and VA measures are useful¹³.
- 3.22 On that basis they produced a range of possible productivity improvement. Table 3 shows the CC's figures for aggregate average annual productivity growth rates (i.e. for the UK economy as a whole) based on the different measures of productivity.
- 3.23 The CC applied this rationale in their final determination of the NIE Networks price control. The CC considered that the aggregate EU KLEMS data could support a range of estimates of productivity of between 0.5 and 1.5 per cent. It is worth noting that Ofgem RIIO-GD1 and T1 analysis underpinned the CC's range produced for the table below.

Table 3: Average annual TFP growth rates for different sectors using EU KLEMS, 1970 to 2007

Sector/group	per cent				
	TFP (VA)	Labour & intermediate input productivity (VA) at constant capital	TFP (GO)	Labour & intermediate input productivity (GO) at constant capital	Labour & intermediate input productivity (GO)
Unweighted average all industries	1.3	1.5	0.5	0.5	0.8

Source: EU KLEMS/Ofgem RIIO—T1/GD1: Real Price Effects and ongoing efficiency appendix, p15, 17 December 2012.

Notes:

1. The averages used by Ofgem exclude the following industries: real estate, public administration, education, health and social services.
2. VA = value added measure.
3. GO = gross output measure.

Source: Competition Commission [final determination of the NIE RP5 price control](#), Table 11.2

- 3.24 As part of the price control process, it is necessary to ascertain the level of productivity improvement likely to be achievable by the GDNs. To do this we consider various ways that we may establish or cross check an improvement amount applicable.
- 3.25 A reasonable barometer of potential productivity improvement calculations is that which has been observed in industries similar to the GDNs and/or has been applied to other GDNs.
- 3.26 In terms of available observation data we agree with the CC/CMA and consider the EU KLEMS data provides a useful data source over a reasonably long time series. From the material set out above, and the range summarised in Table 3 we consider it reasonable

¹³ See appendix 11.1 of the CC's NIE RP5 final determination, §§ 3 - 10 <https://assets.digital.cabinet-office.gov.uk/media/534cd4b4ed915d630e000041/appendices-glossary.pdf>

to conclude that continuing productivity is relatively small. That is, the above estimated range provides a suitable choice for productivity improvement.

- 3.27 However while relatively small, over time this is material enough to indicate continued efficiencies since their cumulative effect amounts to our anticipation that companies shall deliver further efficiencies into the long term, even if residing at the frontier for the industry.
- 3.28 Table 4 below has been taken from the CC's determination and updated for more recent price control decisions. It shows a summary of the various regulatory assumptions that have been made regarding productivity per annum. In GD14, we applied a 1.0% productivity assumption for both opex and capex. These previous productivity assumptions provide a useful comparison but are not intended to act solely as a range estimate for GD17.
- 3.29 PNGL indicated in their response to our DD (in the NERA paper) that our productivity assumption was at the upper end of precedent.
- 3.30 Our range of productivity is drawn from CMA reviewed Ofgem analysis of EU KLEMS data. It is not drawn from, for instance, an average of the examples we provided as background information.
- 3.31 We noted these examples of previous productivity assumptions as a "barometer" or sense-check of potential improvement, not as a definitive list of scale points for improvement.
- 3.32 Our chosen productivity assumption for GD17 is more mid-range, rather than at the upper end. It should however be noted this is mid-point for the 0.5 – 1.5 range. But it is less than mid range of the full potential ranges calculated by Ofgem at RIIO T1/GD1 (see 3.12 – 3.15 above in response to FE comments).

Table 4: Recent regulatory assumptions on productivity

Opex productivity	
UR—Water and sewerage	0.9
PPP Arbiter—underground infracos, central costs	0.7
PPP Arbiter—underground infracos, opex	0.9
Ofgem—GB DNOs	1.0
Ofgem—Transmission & Gas Distribution	1.0
ORR—Network Rail, opex	0.2
ORR—Network Rail, maint	0.7
CC – NIE RP5 opex	1.0
CMA – Bristol Water PR14 ¹⁴	1.0
UR – GD14 opex	1.0
Capex productivity	
PPP Arbiter—underground infracos	1.2
Ofgem—GB DNOs	1.0
Ofgem—Transmission & Gas Distribution	0.7
ORR—Network Rail	0.7
CC - NIE RP5 capex	1.0
CMA – Bristol Water PR14 ¹⁵	1.0
UR – GD14 capex	1.0

Source: UR, CC analysis.

¹⁴ Applied to totex

¹⁵ Applied to totex

- 3.33 By way of background, in their final determination of RP5 for NIE, the Competition Commission, in assessing all the available evidence, considered a productivity assumption of 1% as reasonable in their case:

“To reach our decision on productivity, we considered the evidence provided by other regulatory decisions, the EU KLEMS data and the recent business plans of the GB DNOs. We considered that the recent business plans of the GB DNOs and Ofgem’s recent decisions in respect of the GB DNOs and Transmission & Gas Distribution were particularly relevant. This was because these businesses overlapped significantly with NIE’s business activities.

Based on this evidence, we considered that we should expect NIE to make an incremental efficiency improvement of 1 per cent a year for each of opex and capex.

We therefore determined that we should apply a productivity assumption of 1 per cent a year to NIE’s costs (ie to each of opex and capex).”

- 3.34 Further CMA based evidence from recent regulatory analysis and determinations are available in relation to Bristol Water. The CMA in their Bristol Water final determination applied a cost trend adjustment for RPI–1% (efficiency and input price inflation).
- 3.35 We considered the evidence presented by other regulatory decisions on productivity improvement. The CC/CMA range of 0.5% - 1.5% appears reasonable in the broad circumstances of a regulated monopoly network company. Subsequently we also consider a midpoint productivity assumption of 1.0% per annum to be a reasonable assumption for the GDNs. Therefore we shall adopt a 1.0% per annum productivity assumption for the GD17 price control period.

4 Frontier Shift Conclusions

- 4.1 The frontier shift in real terms is calculated by applying the average annual productivity figure (1.0%) to the real price effects result. The real price effect figure is computed from discounting RPI from the weighted impact of nominal input prices.¹⁶
- 4.2 In a simplified calculation however, frontier shift can be determined as follows:
- $$\text{Frontier shift in real terms} = \text{input price increase} \text{ minus } \text{forecast RPI (measured inflation)} \text{ minus } \text{productivity increase}$$
- 4.3 The respective net impact of frontier shift for both opex and capex is shown in the tables 5 and 6 below. Please note numbers may not sum due to rounding.
- 4.4 For the GD17 final determination we are assuming a cumulative frontier shift of 4.4% for opex (around 0.6% per annum) and 4.2% for capex (around 0.5% per annum) for the period assessed.
- 4.5 In our DD we had proposed cumulative figures of 4.7% for opex and 4.9% for capex based on the best available data at the time of the DD.

Table 5: Opex Frontier Shift

		<u>Opex</u>							
<u>UR final determination</u>		GD14		GD17					
Opex	Weight	2015	2016	2017	2018	2019	2020	2021	2022
Labour (direct and contracted)	52%	2.8	2.9	3.7	3.8	3.6	3.8	3.8	3.8
Materials	6%	2.2	1.0	2.0	2.5	3.0	3.5	3.5	3.5
Equipment/Plant	1%	1.1	1.6	2.2	2.2	2.2	2.2	2.2	2.2
Other	41%	1.0	1.7	2.4	3.2	3.2	3.2	3.2	3.2
Total nominal input price inflation		2.0	2.3	3.0	3.4	3.4	3.5	3.5	3.5
RPI		1.0	1.7	2.4	3.2	3.2	3.2	3.2	3.2
Productivity growth		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Frontier shift		0.0	-0.4	-0.4	-0.8	-0.8	-0.7	-0.7	-0.7
Frontier Shift (%)		0.0%	0.4%	0.4%	0.8%	0.8%	0.7%	0.7%	0.7%
Frontier Shift (Cumulative %)		0.0%	0.5%	0.8%	1.6%	2.4%	3.1%	3.7%	4.4%

Table 6: Capex Frontier Shift

		<u>Capex</u>							
<u>UR final determination</u>		GD14		GD17					
Capex	Weight	2015	2016	2017	2018	2019	2020	2021	2022
Labour (direct and contracted)	56%	2.8	2.9	3.7	3.8	3.6	3.8	3.8	3.8
Materials	19%	2.2	1.0	2.0	2.5	3.0	3.5	3.5	3.5
Equipment/Plant	4%	1.1	1.6	2.2	2.2	2.2	2.2	2.2	2.2
Other	21%	1.0	1.7	2.4	3.2	3.2	3.2	3.2	3.2
Total nominal input price inflation		2.2	2.2	3.0	3.4	3.4	3.6	3.6	3.6
RPI		1.0	1.7	2.4	3.2	3.2	3.2	3.2	3.2
Productivity growth		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Frontier shift		0.2	-0.5	-0.4	-0.9	-0.8	-0.7	-0.7	-0.7
Frontier Shift (%)		-0.2%	0.5%	0.4%	0.9%	0.8%	0.7%	0.7%	0.7%
Frontier Shift (Cumulative %)		-0.2%	0.3%	0.7%	1.5%	2.3%	3.0%	3.6%	4.2%

¹⁶ For example for 2016 the opex frontier shift is calculated as follows: $(1.023/1.017) \times (1 - 0.01) - 1 = -0.4\%$. When applied to gross opex and capex these numbers are transformed into a *frontier shift multiplication factor* by subtracting from 100% i.e. 4.4% becomes (100% minus 4.4%) = 99.956% or a factor of 0.99956.