**Specification for the provision of research on the impacts and institutional implications of UK gas grid future scenarios**

Tender Reference Number: JH/0216

**Specification of Requirements**

Invitation to Tender for the provision of research on the impacts and institutional implications of UK gas grid future scenarios

Tender Reference Number: JH/0216

Deadline for Tender Responses: 21st March, 9 am

**Contents**

1. Preamble 3

2. Background 3

3. Aims of the project 7

4 Description of work for consultants 7

5 Outputs Required 12

6 Ownership and Publication 12

7 Quality Assurance 12

8 Timetable 12

9 Working Arrangements 13

10 Skills and experience 13

11 Consortium Bids 13

12 Budget 14

13 Evaluation of Tenders 14

# Preamble

The Committee on Climate Change (CCC) was set up as part of the Climate Change Act. CCC is an independent body tasked with providing advice to Government on climate change issues, and particularly the setting of carbon budgets, and the monitoring of progress towards meeting those budgets. CCC’s past reports are available here: <http://www.theccc.org.uk/reports/>.

# Background

The Committee made recommendations on the level of the first three carbon budgets in December 2008, and the 4th carbon budget in 2010, reviewing that advice in 2013. In 2015, the Committee advised on the level of the 5th budget period (2028-2032).

Meeting the 2050 target has implications for the future of the gas transmission and distribution networks, which the Committee wishes to characterise and assess in this project.

Gas distribution and transmission companies are regulated by Ofgem, with costs recovered through consumer bills. An overview of the current institutional and regulatory landscape relating to the UK gas distribution grid is set out in **Figure 1**.

The next price control review will be crucial to determining whether the gas network is prepared for low-carbon transition. The CCC wants to understand what issues we need to be aware of going into that review. The issues are likely to include: how assets get incorporated into the regulated asset base, how depreciation of existing assets works and implications of assets becoming “stranded”.

This research is being undertaken as part of a broader 2016 work programme on heat and energy efficiency policy, with a report planned in the second half of the year.

**Carbon budget scenario analysis**

The Committee have developed a number of scenarios for power and heat decarbonisation to 2050 which are consistent with meeting the target GHG reduction of 80% on 1990 levels.[[1]](#footnote-1) Scenarios are not prescriptive, but inform development of a range of cost-effective options for meeting the carbon budgets:

1. **Transmission network**. Most scenarios see a continued role for the gas transmission network, particularly where CCS technology is available, though a reduced demand for gas for power generation and heat suggests that this role could be reduced over time. At the extreme however, a high electrification and no CCS scenario could mean no requirement for usage of the high-pressure network. This would not necessarily preclude some gas (including biomethane) being piped through the low-pressure network.[[2]](#footnote-2)
2. **Distribution network**. Most scenarios see a reduced role for natural gas for heat. The CCC 5th carbon budget scenarios have central scenario estimates of around 90 TWh of demand from buildings in 2050, and 120 TWh of demand from industry.[[3]](#footnote-3) This compares to 405 TWh in buildings[[4]](#footnote-4) in 2014 and 128 TWh in industry. In an alternative scenario we considered, the distribution network converted to transporting hydrogen, effectively displacing all natural gas demand by 2050.[[5]](#footnote-5) Finally, the distribution network could be maintained in order to manage peaks in heating demand in conjunction with hybrid heat pumps, if this is economic.

The CCC are interested in exploring the regulatory and institutional challenges for four possible scenarios for the future of the gas grid:

1. Gas use declines as in the CCC central scenario, but most of the gas grid is still required to service the remaining demand. This would include areas where the pipes are kept in place in order to meet peaks in demand, in conjunction with hybrid heat pumps.
2. Gas use declines more rapidly and significant portions of the gas grid are decommissioned prior to 2050. This is a no-CCS pathway.
3. The grid transitions to carry hydrogen instead of methane, and continues to service a large amount of demand.
4. Patchwork: parts of the distribution grid are decommissioned, parts are converted over to carry hydrogen and parts service the remaining demand for gas.

Currently all of those scenarios are possible on the least cost path to a low-carbon economy in the UK, for example depending on the level of emissions in other sectors of the economy, success of rolling out heat pumps, heat networks and energy efficiency and the development of CCS as a route to low-cost hydrogen.

**Impact on future gas network costs**

The Committee produces regular assessments of the impact of low-carbon policies on energy prices and bills, most recently in the 2014 publication.[[6]](#footnote-6) This includes estimates of the current transmission and distribution costs:

* Gas transmission costs are associated with building, running and maintenance of the high pressure gas infrastructure. Annual costs are expected to rise from £600m in 2013 to £1.1bn in 2020 and remain constant to 2030. This would add 0.1 p/kWh to gas prices to 2030.
* Gas distribution costs were projected to remain at today’s level of around £3.5bn p.a.

There will generally be a per-unit cost for transmission and distribution of energy as well as fixed costs of operating and maintaining networks. In our carbon budget analysis, we have used estimates of Long Run Variable Costs[[7]](#footnote-7) for gas produced by DECC. These include assumptions on the proportion of transmission and distribution costs that are fixed and variable.[[8]](#footnote-8)

To 2050, the network unit costs will vary as a function of the total volume of gas demanded, the costs of maintaining and renewing the pipes, and the decisions made around any extension or decommissioning of sections of the network. Energy efficiency across the stock and fuel-switching affect the total demand, which impacts on unit costs. If many existing customers switch to other technologies in an uncoordinated way, then the total length of distribution pipe could remain the same, driving up the length of pipe per customer. If switching occurs in clusters or is otherwise coordinated regionally, then this may allow sections to be decommissioned.[[9]](#footnote-9)

**Further context**

The H21 Leeds Citygate project is a feasibility study looking at converting Leeds city region from natural gas (methane) to hydrogen. This project is led by Northern Gas Networks (NGN) and the Project Manager has now been seconded into DECC. In addition to the project, NGN have produced a ‘H21 roadmap’ looking at what would be required to proceed with the conversion, with a view to then continuing across the rest of the UK. The roadmap includes specifications for 16 work packages comprising 57 projects covering the strategic, technical/engineering, regulatory, governance and consumer aspects of the work. The Report on the H21 Leeds City Gate project is due to be at the end of Q2 2016.

Another project is currently underway within DECC looking at the feasibility of three low-carbon heat solutions for small towns, using a case study approach.[[10]](#footnote-10) The options examined include heat networks, heat pumps and hydrogen for heat. The work includes a review of barriers and planning requirements.

Figure 1 Gas distribution network regime schematicSource: Adam Bell, DECC, draft version.

# Aims of the project

The project has three main aims:

1. To review the current regulatory and institutional framework relating to the gas network, and assess the extent to which it is capable of both managing, and adapting to different decarbonisation scenarios.
2. To determine the key issues going in to the next gas network price control review in order to prepare for low-carbon transitions, along with the immediate implications for Government.
3. To establish what is required over the next 5-10 years in order for Government to be in a position to set out a strategy for the future of the gas grid to 2050, including the role of hydrogen for heat.

The project involves three tasks:

1. **Review and characterise the current regulatory and institutional framework related to the UK gas grid.** Review the incentives for the main stakeholders, along with the framework for economic regulation. Review the costs involved in maintaining, renewing, extending and converting the gas grid. This task should set up the evidence base for the remainder of the project.
2. **Assess the extent to which the current regulatory and institutional framework is capable of managing decarbonisation trajectories, including hydrogen conversion.** Assess four different scenarios for the future of the gas grid, including the impact on unit transmission and distribution costs for natural gas. Evaluate the regulatory and institutional challenges with regards to the capacity of the current institutions and in light of the opportunities for change.
3. **Draw out key strategic lessons for government policy including the implications for the next price control review.** Draw out the key lessons for Government. This covers both the immediate implications going in to the next price control review, and the broader strategic implications, including low-regrets actions, areas of contention, critical decision-points, and the regulatory/institutional changes required to keep options genuinely open.

# Description of work for consultants

Bids should set out separate pricing for each task/sub-task. Proposals from individual parties and consortia bids would both be welcomed.

Consultants should outline their understanding of the brief; if there are significant issues which are seen as important to our objectives but which are currently missing, then this should be highlighted, and set out alongside a proposed approach for how these will be addressed.

We envisage that the work will involve the following tasks:

**Task 1. Review and characterise the current regulatory and institutional framework related to the UK gas grid.**

The purpose of this task is to establish the strategic context and quantitative evidence base for the following tasks. The output should be a succinct high-level review, with use of diagrams to synthesise information where relevant.

It is expected that stakeholder consultation will be central to the evidence gathering for this project, and the consultant should set out in the proposal how this will occur. This should make provision for 2-3 evidence gathering meetings organised by the CCC, which could for example include attending a session with the Energy Network Association Gas Futures group.

*1a. Review the current stakeholder landscape pertaining to the gas grid, with roles, responsibilities and key incentives of the main actors. (national/local)*

This task is to provide a quick synthesis of the relevant actors at a national and local level and how these relate to the infrastructure, to prepare for the analysis in task 2. It should build on (rather than duplicate) **Figure 1** by providing high-level insights in to the incentives of the main actors.

*1b. Review the current regulatory framework regarding the operation, maintenance and investment in the gas grid and map the high-level flows of investment into the gas grid, along with current forecast investment.*

This task is focused on the economic regulation of the gas grid. It should set out clearly how price controls are set, that is both timescales and process. This includes, *inter alia*:

* How capital plans are developed and approved
* Asset valuation--
  + How the regulatory asset base is determined
  + What counts as allowable investment
  + What the process is for incorporating new assets
  + Asset depreciation and “writing off”.

Whilst the main focus is on the price control and financial regime, other areas with relevance include the safety and reliability regime, the consumer protection regime and new connection regime, as established under the Gas Act (1986 & 1995), the Pipeline Safety Regulations (1996), Gas Safety (Management) Regulations (1996) and the Utilities Act (2000).

Consultants should cover the Iron Mains Replacement project and Ofgem’s gas network innovation competition. They should comment on the range of projects currently supported under the latter, and the extent to which this is meeting current innovation requirements.

*1c. Review the main costs associated with extending, maintaining/renewing and decommissioning the gas grid.*

This task is to review the main costs which determine the network and distribution charges for consumers, based on data from Ofgem and any other relevant sources, including industry estimates. We assume that the costs are those related to the distribution of natural gas, although costs estimates for hydrogen may be included for comparison or reference if this is useful.

The costs should be analysed on/across the relevant unit basis/es, e.g. per km of pipe or per connection, and disaggregated to a level which facilitates comparison with other sources. Where there are ranges or uncertainty estimates in the original sources, this must also be clearly documented and assessed during the review. Sensible scales should be used, for example, estimates should be given to connect a single property to an existing gas grid, to put in connections for a new development of 5-10 homes, and a larger development of 100 homes, as well as a commercial and industrial estate. Consideration should be given to the impact of distance from the high-pressure main and distance between properties. Where different estimates of scale are not provided, some estimate of any economies of scale should be given.

All sources and assumptions used to derive the costs - including assumptions on any distributions - must be clearly documented. This means that it should be possible to easily recreate any costs derived from the original sources using the supporting documentation. The outputs should be in a limited number of tables within the report, along with more detailed supporting spreadsheets.

Consultants should set out the key uncertainties in the data and capture relevant contextual information. For example, the costs of laying new pipework will increase as a function of the depth at which they need to be buried. Estimates therefore of the average depth should be set in the context of how this might increase in a built-up city area, and what the impact on the costs would be.

Consultants may wish to draw on their own cost database for the work. Another option is to use the Infrastructure Cost Calculator tool developed by the Energy Technology Institute, which is currently sub-licenced to the CCC and which could be sub-licenced to the contractors for use on this project. This is a cost database, so it requires an understanding of how networks are constructed and operated in order to be used, rather than presenting ready-made and costed network specifications. Provision for several weeks’ time should be made to set up the sub-licence if this option is taken up.

**Task 2. Assess the extent to which the current regulatory and institutional framework is capable of managing decarbonisation trajectories, including hydrogen conversion.**

This is the core analytical task.

The CCC wishes to examine the following scenarios, although the consultants may propose an alternative approach:

*Task 2a/ Scenario 1. Gas use declines as in the CCC central scenario, but most of the gas grid is still required to service the remaining demand.*

*Task 2b/ Scenario 2. Gas use declines more rapidly and significant portions of the gas grid are decommissioned prior to 2050. This is a no-CCS pathway.*

*Task 2c/ Scenario 3. The grid transitions to carry hydrogen instead of methane, and continues to service a large amount of demand.*

*Task 2d/ Scenario 4. Patchwork: parts of the distribution grid are decommissioned, parts are converted over to carry hydrogen and parts service the remaining demand for gas.*

The CCC will provide gas and hydrogen demand projections to 2050 for each of the four scenarios at the start of the project.

For each of these scenarios, the following should be undertaken.

* *Characterise the scenario and set out the main impacts on different stakeholders.* Describe the impacts of the scenario to 2050 on the operation and economic viability of the gas grid, and on its key institutional stakeholders. The scenario characterisation should cover questions such as how disconnection occurs (rate of drop-off, whether and how this is coordinated), and whether and how parts of the gas grid are decommissioned.
* *Calculate the impact on the unit costs for T&D for natural gas to 2050.* This builds on the costs review exercise in task 1c. Results should be set out in an excel spreadsheet, with all assumptions clearly documented (gas demand and individual costs). Results should be given for 2030 and 2050 at the minimum.
* *Review the institutional and regulatory challenges implied by the scenario with regard to the existing institutional capacity.* This builds on the assessment of incentives and regulations in task 1, and considers additional aspects such as capacity and resources at a local authority-level, consumer protection and choice, safety, affordability and fuel poverty.

Consultants should assess, *inter alia*:

* + What business models and regulatory frameworks are likely to be effective
  + What levers exist for changing incentives and when would they best be exercised
  + The adaptive capacity within the existing institutional framework (i.e. decision-making ability)

In the case of **hydrogen**, it should include a high-level review of key evidence gaps for Government in assessing the viability of a future hydrogen grid base, drawing on the outputs from the Leeds Citygate project and other existing work.

A key question for the economic regulation in the hydrogen scenarios includes whether the system costs would be spread across all gas consumption (i.e. CH4 and H2). Consultants should make the case for an approach. Other hydrogen-related challenges for consideration include whether it locks out other paths and the potential risk of long-term lock-in to fossil fuel consumption.

* *Next steps, including how the regulatory framework needs to change (timescales, legal considerations).* This includes a detailed description of practical steps to address the challenges, with a focus on the implications for the next price control period (2021-2027). The consultants should determine what is within the remit of Ofgem, and what requires input from other stakeholders (including DECC and HM Treasury).

Examples of measures could include reorganising the stakeholder roles and responsibilities, other restructuring of incentives, information campaigns, additional R&D and demonstration projects. Consultants should set out the characteristics of the required measures in detail, including where appropriate the scale at which they should be implemented, their duration, and their cost.

In the case of **hydrogen**, the consultants should review current proposals to address information gaps and comment on any remaining gaps.

*Task 2c and 2d. Hydrogen scenarios (break clause)*

We envisage that these two scenarios will significantly benefit from reviewing the Hydrogen H21 project outputs. We expect to have these outputs by May. However, in case of delay, there is a break clause between the first two scenarios and the hydrogen scenarios in order to accommodate that delay. The work would then recommence once the outputs are ready for review.

**Task 3: Draw out key strategic lessons for government policy including the implications for the next price control review.**

Draw out the key lessons for Government. This covers both the immediate implications going in to the next price control review, and the broader strategic implications.This should include:

* What happens in the absence of strategic policy
* Low-regrets actions that should be undertaken in all credible scenarios
* Areas of contention
* Critical decision-points
* A timeline upon which changes should occur and situations to avoid
* An assessment of the level of flexibility within this.

In the proposal, the consultant should clearly set out how they intend to involve stakeholders (in particular, gas distribution companies, which we expect to be very important in building the evidence base) in the work and access information to inform the evidence base for costs.

In parallel to the consultancy project the CCC is establishing an expert advisory body of non-industry stakeholders to help guide and advise on the broader heat and energy efficiency work programme. The CCC will coordinate feedback from the advisory panel, and any meeting with members of the panel will be as part of the project meetings set out below.

# Outputs Required

The key deliverables for this project will be agreed at the project meeting but include a summary report, slides, supporting spreadsheets and minutes from project meetings.

# Ownership and Publication

The key deliverables will be handed over to the CCC, who may choose to publish these as supporting evidence on their website. Spreadsheets should be open access and unrestricted, to enable full QA of results and assumptions.

# Quality Assurance

This project must comply with the ‘CCC – Quality Assurance of Evidence and Analysis’ guidance and bidders must set out their approach to quality assurance in their response to this ITT.

All research tasks and modelling must be quality assured and documented. Contractors should:

* Include a quality assurance (QA) plan that they will apply to all of the research tasks and modelling,
* Specify who will be responsible for quality assurance and ensure that this is done by individuals who were not directly involved in the research, analysis or model development,
* Provide QA log to demonstrate the QA undertaken, including who undertook the QA and the scope, type and level of QA that has been undertaken (e.g. a log entry only stating ‘the data was checked’ will not be sufficient)

Sign-off for the quality assurance must be done by someone of sufficient seniority within the contractor organisation to be able take responsibility for the work done. Acceptance of the work by the CCC will take this into consideration. The CCC reserves the right to refuse to sign off outputs which do not meet the required standard specified in this invitation to tender.

The successful bidder will be responsible for any work supplied by sub-contractors and should therefore provide assurance that all work in the contract is undertaken in accordance with the quality assurance expectation agreed at the beginning of the project.

For primary research, contractors should be willing to facilitate CCC research staff to attend interviews or listen in to telephone surveys as part of the quality assurance process.

# Timetable

The proposed timetable for the project is set out in the following table. The project is expected to kick off in early April 2016, with final report and outputs in July.

In addition to the formal reporting points, the CCC would expect to have regular scheduled discussions to ensure the work is progressing as expected.

|  |  |
| --- | --- |
| **Date** | **Action** |
| 21st March, 9 am | Deadline for response to ITT |
| 29th March (pm) | Interviews |
| w/c 4th April | Kick-off meeting (identify key sources of information, agree methodology & timelines) |
| w/c 2nd May | Interim meeting (present and discuss initial results and findings) |
| w/c 30th May | Final project meeting (present and discuss results and findings) |
| w/c 13th June | Circulate full draft report |
| w/c 11th July | Final report |

# Working Arrangements

The successful contractor will be expected to identify one named point of contract through whom all enquiries can be filtered. A CCC project manager will be assigned to the project and will be the central point of contact.

# Skills and experience

CCC would like you to demonstrate that you have the experience and capabilities to undertake the project. Your tender response should include a summary of each proposed team members experience and capabilities.

Contractors should propose named members of the project team, and include the tasks and responsibilities of each team member. This should be clearly linked to the work programme, indicating the grade/ seniority of staff and number of days allocated to specific tasks.

Contractors should identify the individual(s) who will be responsible for managing the project.

# Consortium Bids

In the case of a consortium tender, only one submission covering all of the partners is required but consortia are advised to make clear the proposed role that each partner will play in performing the contract as per the requirements of the technical specification. We expect the bidder to indicate who in the consortium will be the lead contact for this project, and the organisation and governance associated with the consortia.

Contractors must provide details as to how they will manage any sub-contractors and what percentage of the tendered activity (in terms of monetary value) will be sub-contracted.

If a consortium is not proposing to form a corporate entity, full details of alternative proposed arrangements should be provided. However, please note CCC reserves the right to require a successful consortium to form a single legal entity in accordance with Regulation 28 of the Public Contracts Regulations 2006.

CCC recognises that arrangements in relation to consortia may (within limits) be subject to future change. Potential Providers should therefore respond in the light of the arrangements as currently envisaged. Potential Providers are reminded that any future proposed change in relation to consortia must be notified to CCC so that it can make a further assessment by applying the selection criteria to the new information provided.

# Budget

The budget for this project is **£50,000 to £70,000** excluding VAT.

Contractors should provide a full and detailed breakdown of costs (including options where appropriate). This should include staff (and day rate) allocated to specific tasks.

Cost will be a criterion against which bids which will be assessed.

Payments will be linked to delivery of key milestones. The indicative milestones and phasing of payments can be adjusted and agreed with the contractor and Project Manager. Please advise in your tender response how this breakdown reflects your usual payment processes.

In submitting full tenders, contractors confirm in writing that the price offered will be held for a minimum of 60 calendar days from the date of submission. Any payment conditions applicable to the prime contractor must also be replicated with sub-contractors.

The CCC aims to pay all correctly submitted invoices as soon as possible with a target of 10 days from the date of receipt and within 30 days at the latest in line with standard terms and conditions of contract.

# Evaluation of Tenders

Contractors are invited to submit full tenders of no more than 50 pages, excluding declarations. Tenders will be evaluated by at least three CCC staff.

CCC will select the bidder that scores highest against the criteria and weighting listed below, see the ITT for further information.

**EVALUATION CRITERIA AND SCORING METHODOLOGY**

|  |  |  |
| --- | --- | --- |
| Criterion | Description | Weighting |
| 1 | **RELEVANT EXPERIENCE / DEMONSTRATION OF CAPABILITY** | 15% |
| 2 | **MANAGING YOUR RELATIONSHIP WITH THE CCC** | 5% |
| 3 | **QUALITY ASSURING THE SERVICES YOU PROVIDE** | 5% |
| 4 | **MANAGEMENT STRUCTURE** | 5% |
| 5 | **PROJECT TEAM – SKILLS AND KNOWLEDGE** | 20% |
| 6 | **METHOD, ABILITY AND TECHNICAL CAPACITY** | 20% |
| 7 | **UNDERSTANDING OF REQUIREMENTS** | 20% |
| 8 | **RISK AND CHALLENGES** | 10% |
|  |  |  |
|  | | 100% |

**Scoring Method**

Tenders will be scored against each of the criteria above, according to the extent to which they meet the requirements of the tender. The meaning of each score is outlined in the table below.

The total score will be calculated by applying the weighting set against each criterion, outlined above; the maximum number of marks possible will be 100. Should any contractor score 1 in any of the criteria, they will be excluded from the tender competition.

|  |  |
| --- | --- |
| **Score** | **Description** |
| 1 | Not Satisfactory: Proposal contains significant shortcomings and does not meet the required standard |
| 2 | Partially Satisfactory: Proposal partially meets the required standard, with one or more moderate weaknesses or gaps |
| 3 | Satisfactory: Proposal mostly meets the required standard, with one or more minor weaknesses or gaps. |
| 4 | Good: Proposal meets the required standard, with moderate levels of assurance |
| 5 | Excellent: Proposal fully meets the required standard with high levels of assurance |

**Structure of Tenders**

Contractors are strongly advised to structure their tender submissions to cover each of the criteria above and supply a price schedule specifying the daily rates (ex-VAT) you will charge for each level of your staff.

**Evaluation for Interviews, if held**

CCC reserves the right to award the contract based on applicants’ written evaluation only if one candidate emerges from the evaluation stage as significantly stronger than the others.

Should interviews go ahead, CCC will shortlist the top suppliers with the highest marks from the written proposals. Interviews are provisionally expected to be held on the afternoon of 29th March. If this date changes, CCC will notify applicants.

The areas to be covered in the interview, and markings allocated to each topic area will be sent to the shortlisted supplier prior to interview.

Further details of interviews will be sent to successful applicants on selection.

1. CCC, 2015. *Sectoral scenarios for the 5th Carbon Budget*; CCC, 2012. *2050 target: achieving an 80%*

   *reduction including emissions from international aviation and shipping* [↑](#footnote-ref-1)
2. The fifth carbon budget scenarios include 20-40 TWh of biomethane in 2050 (AEA 2010, SKM 2011). [↑](#footnote-ref-2)
3. Industry here includes final demand and autogeneration, but does not include upstream oil and gas extraction. This is total demand, which may include some portion of gas demand connected directly to the transmission network. The scenarios are described in detail in CCC,2015. *Sectoral scenarios for the Fifth Carbon Budget.* [↑](#footnote-ref-3)
4. DECC, *DUKES 2015*. This includes 26 TWh of heat generation and 1 TWh of demand in agriculture. [↑](#footnote-ref-4)
5. This fifth carbon budget scenario was based on analysis by E4Tech et al, 2015. *Scenarios for deployment of hydrogen in meeting carbon budgets*, available online at: <https://www.theccc.org.uk/publication/e4tech-for-ccc-scenarios-for-deployment-of-hydrogen-in-contributing-to-meeting-carbon-budgets/> [↑](#footnote-ref-5)
6. CCC, 2014. *Energy prices and bills - impacts of meeting carbon budgets* [↑](#footnote-ref-6)
7. DECC, 2015. Valuation of energy use and greenhouse gas (GHG) emissions <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/483279/Background_documentation_for_guidance_on_valuation_of_energy_use_and_greenhouse_gas_emissions.pdf> [↑](#footnote-ref-7)
8. The LVRCs assume that 90% of transmission costs are variable in the long-term, but only 10% of distribution costs are. However, if a policy requires linking new users to distribution networks, the guidance states that 100% of distribution costs should be included in the LRVC. [↑](#footnote-ref-8)
9. Dodds and McDowall looked at a number of scenarios using the MARKAL model in their 2013 paper, *The Future of the Gas Grid*, which considered the impact through pricing on demand. Other relevant scenario analysis includes the 2010 Redpoint study for the Energy Networks Association, *Gas Future Scenarios Project*. [↑](#footnote-ref-9)
10. *Delivery of Alternative Heat Solutions to a Typical Town in the UK*, draft reports for DECC. [↑](#footnote-ref-10)