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Financing heat networks and protecting consumer interests

1. What is district heating?

District heating is a system that distributes heat generated by a centralised plant for mass residential and commercial heating requirements such as space and water heating. In this way sources of waste or low grade heat − from dedicated CHP plant, power or industrial plant or waste incinerators − can be linked to strategic users of heat (including residential, public and commercial property or light industrial plant). Such systems deliver cost-effective heating, displace fossil fuel use and cut CO_2 emissions. In the UK enough heat is wasted in central power stations (cooling towers) to heat every building in the country.

Once heat has been generated it is distributed to customers via a network of insulated pipes. The heating system consists of feed and return lines and the pipes are usually installed underground (though occasionally may be over ground). Within the system there may be heat stores to even out peak demand. Water is commonly used to distribute heat (although sometimes steam is used). At the customer level, the heat pipes feed normal central heating systems, but heat exchangers replace gas boilers.

District heating is more efficient, and therefore produces fewer carbon emissions, than a distributed system of electrical or gas-based heating because it uses sources of heat that would otherwise be wasted[1]. It also offers superior opportunities for pollution control compared to a gas-based distributed system of boilers. Finally, if the financing for the infrastructure can be structured appropriately, if offers cheaper heat services compared to individual gas boiler-based systems.

2. Heat is too expensive to distribute in the 'short-term world'

District heating is a long-term commitment that is at odds with competitive energy markets where the focus is on short-term returns on investment. A dedicated CHP plant with a heat network, for example, will have very high capital costs (from ~£2,000-£4,000 per kWe depending on the scale). A proposed scheme must

[1] Some district heating systems, however, do you heat-only boilers, from which heat is the product – not a by-product.

therefore focus on delivering at scale to large numbers of properties and also for those properties to be of medium to high heat density in order to reduce costs per household supplied. To be competitive the business models must be based on a low (5-10%) but long-term return for 20 years or more to gets costs to consumers down and make the heat offering attractive. This will rely on a contracts-based system – and is at odds with a competitive energy market predicated on the ability of consumers to switch suppliers.

3. Can the competitive energy market to deliver the lowest cost solution?

Competitive energy markets tend to deliver a short-term approach to decision making by investors in energy network assets. Investors tend to focus on assets to meet marginal increments of new demand, and are generally unable to focus on the larger 'wedges' of new generation or large network investments, even though these might deliver larger economies of scale. Incentives in private finance (e.g. performance bonuses) may also be more consistent with the need to favour projects that deliver a return on capital in the shortest amount of time possible. Overall returns[2] will also need to be high to balance the risk inherent in these markets. In these sorts of markets, investors will *not* focus on delivering the lowest cost option to the consumer but, rather, on the option that is more easily or more cheaply financable.

As an example, since deregulation, energy assets such as gas-fired power stations have been easily financed: the technology is conventional and well understood, and the size of the kit is modest (perhaps up to 400MW). As a result the cost of capital to finance such investment is low, and payback periods short and consistent with investor appetite for returns of around 15%. By contrast, the kind of investment required in network assets such as heat has not been forthcoming. Such assets are generally associated with larger scale investment, and are subject to risk of stranding, and to greater regulatory risk, e.g. price control. In summary, competitive markets when applied to network-reliant industries such as district heating, will deliver those assets that are the easiest to finance, not necessarily the lowest cost options overall.

[2] Although the retail arm of an energy business may lose money, overall the vertically integrated energy companies make money in this space

4. Why heat networks will not be delivered in competitive markets

Heat networks suffer a competitive disadvantage to the more conventional assets for two key reasons. (i) They have very high upfront costs that must be amortised over long time periods of 20 years or more in order to compete. (ii) They are a natural monopoly not currently recognised by, (nor within the mandate of) the regulator Ofgem. This creates a huge amount of investment risk, particularly associated with the "sunk" nature of the investment. (iii) They currently compete with gas networks which were built by the public sector and sold off relatively cheaply. These networks are thus operated at near marginal cost, resulting in a significant barrier to entry for heat network providers.

Set at the right level the Government's proposed renewable heat incentive may incentivise investors, including energy suppliers, to invest in microgeneration heat technologies, such as solar thermal. However, technologies with a more significant impact such as CHP plant (which would be also supported by the renewable heat incentive[3]) will still need heat networks to be financed to provide the hot water needed to deliver the heat at scale. A renewable heat incentive designed only to reward the marginal unit of production will not assist in the development of networks, except perhaps a few exceptional locations as a result of championing by local official. Cherry-picking may result, but the full potential of renewable heat will not be reached.

Therefore to deliver heat networks at scale the regulatory environment will need to be amended to create additional certainty for potential investors in heat networks so that they become an attractive investment opportunity.

5. Incentivising heat network investment

Government will need to start by creating visibility around the heat investment opportunity by concretely identifying the need for investment in heat networks to the private sector. This could be delivered through heat mapping process to identify areas of high and medium heat density and sources of waste heat, combined with an announcement of a new investment opportunity. This investment would involve creating geographic 'concession' areas for heat networks, with the private sector invited to bid to operate these networks on a least-lifetime cost model. Government can assist in de-risking this investment in a number of ways. Government would need

[3] Although only renewable fuel stocks would be incentivised. Investment in low carbon heat is not incentivised in this scheme.

to make it a requirement that local authority buildings/government estate buildings connect to heat networks to provide a baseload for the heat network developer. The connection of local housing to the network would not need to be mandated but would instead rest on the economics of the offering which would therefore need to be competitive with gas. The provision of land for energy centres, granting of planning permission and political sponsorship at local level could all be provided by local government. Estimates are that this could be delivered with a >1 MW_e (~1000 homes) system – but only if the investment is protected over 15-20 years by designating it a regulated asset base[4].

Interested companies could then enter a competitive tendering process to provide heat networks in those areas. It is at this point that competition is introduced into the process, i.e. upstream in procurement, to assist with the protection of consumer interests. In the bid companies would provide details of their estimated costs and also set out their required 'fair' rate of return (RoR).

The return would come from the customers who pay for the heat supplied: the return could be set to cover the costs of providing heat to the baseload provider (local authority public buildings and council houses/government estate) and then linked to the number of additional sales gained (providing a clear incentive for suppliers to minimise costs so that they can sign up as many customers as possible and improve their RoR).

The guaranteed RoR from this system would make heat network investment and attractive opportunity, because it was protected over the long period needed to make the investment attractive. Such projects would be able to access relatively cheap debt and equity quite easily because project risk is mitigated through having customers for the heat product and a contractual agreement on returns received. This type of project would be classed as a 'green investment' and there are many funds out there looking to place capital in these types of assets. For example Credit Suisse/Global Infrastructure Partners ($3.5bn) and Goldman Sachs Infrastructure Funds ($3bn).

6. Ensuring a fair deal for customers and managing price creep

While regulated assets bases would be delivered by what is clearly a very directional approach by Government, Government should initially go for a 'light touch' in

[4] Analysis by London First

monitoring the returns received by the investors through the pricing of heat services to customers. If customers are charged a fair prices for the heating services they receive, which will be reflected in the number of customers the heat provider has (a strong incentive to keep returns down and prices competitive), then the arrangement should be allowed to continue as it is. If charges start to creep upwards – so that the RoR received by the developer looks to be higher than in the initial bid, reflecting customer overcharging - the regulator would issue a warning to the heat provider. If this situation continues for more than, say, 3 years, the regulator would start to 'watch' the heat provider to determine what the RoR currently is.

The lead of setting the RoR would have been taken by the developer – and probably set at around 10% - and will of course be a key factor is determining the success or failure of any bid to build a project. The RoR able to be earned by the investor could be based on the Optimised Deprival Value (ODV) of the network. This methodology is an approach used to set expectation about returns on network assets in countries such as New Zealand. See appendix for some detail on the calculations used.

The aim of applying the ODV methodology is to give a value to the monopoly assets at the level at which they can be commercially sustained in the long term, and no more, and to provide a light touch monitoring regime – essentially it looks at the cumulative returns being made by a company over a period of years. Small unders and overs should even out, but excessive charging becomes obvious. The resulting value should be equal to the loss to the owner if they were deprived of the assets and then took action to minimise their loss. In other words, you look at the 'true value' (rather than accounting value) of the asset, including the opportunity cost of that investment, and how risky the investment is to determine the owner's real costs. The revenues minus costs should be equal to the agreed fair RoR (e.g. 10%).

After 5 years of overcharging customer an inquiry would be launched – probably through the Office of Fair Trading – and a price control review initiated.
OFGEM could also enforce minimum levels of service, as per the electricity and gas networks, and require companies to step in to act as heat supplier of last resort in the event of failure of the system developer/operator.

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3 December 2008

Appendix. The ODV methodology

The ODV of system fixed assets is the minimum of Optimised Depreciated Replacement Cost (ODRC) and Economic Value (EV). The ODRC is the replacement cost of the existing system fixed assets at Modern Equivalent Asset (MEA) value, which have been optimised from an engineering standpoint and depreciated according to their age. In the context of a new network, this would mean that returns would be generally based on the total cost of the network investment. However, the investor would remain the party at risk for any poor investment decisions, or unnecessary 'goldplating', as this would simply be written down to economic value[5].

The value of assets derived in this way may differ from their 'current book value'. Book value is typically based on expenditures made and may bear little resemblance to the ODV value.

The ODV methodology involves the following steps:

a. Calculation of Optimised Depreciated Replacement Cost (ODRC)
    i. preparing a detailed asset register
    ii. calculating Replacement Cost (RC) using Modern Equivalent Asset values
    iii. assessment of depreciation (DRC)
    iv. system optimisation
    v. determination of Optimised Depreciated Replacement Cost (ODRC)
b. Determination of Economic Value (EV)
c. Determination of the ODV as the lesser of the ODRC and the EV.

You can read more about the process in the ODV handbook – online at http://www.med.govt.nz/upload/23526/odv04.pdf

[5] For example, for a high heat density network under a simple valuation regime the network developer would be incentivised to build additional pipes to low density heat areas in order to gain additional value in the form of greater returns overall. Under the ODV regime, that portion of the piping would be disregarded in calculations and so would not be built. So ODV avoids 'gold plating'.