Response to "Regulating Energy Networks for the Future: RPI-X Principles, Process and Issues

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On 27 February OFGEM issued a consultative document laying out its high level views on why it now is appropriate to undertake a fundamental review of the structure of network regulation and what the substance of such a review should be. The stated purpose of the paper is to provoke commentary from stakeholders, experts and other parties. The focus of the paper, and the suggested subject matter of comments, is visioning, not specific detailed proposals for changing network regulation. The OFGEM paper is supported by considerably more detailed background papers that were published at the same time and which it references and draws upon.

As the paper recounts, there are several reasons for undertaking this fundamental review. The first is "good housekeeping". There has not been a full scale review of network regulation since privatisation. However, the various price control reviews have responded to evolving experience and changed circumstances, making the structure of regulation and, still more so, the content of the reviews increasingly complex. As noted below, the need for reconsideration of the current regulatory regime also arises directly from the two "themes" of the review.

The first such theme is the perceived need for greater consumer focus on the part of OFGEM and the network companies and potentially more substantial consumer input into the regulatory process. This theme in fact covers a quite disparate set of topics. Among those that stand out is a perception that network companies are not sufficiently focused on either their direct customers (e.g. suppliers and shippers) or final consumers. Another is a recognition that regulation needs to be informed as to what customers want and will pay for, as well as tradeoffs between, for example, network charges and security of supply. A third is the question of whether regulation needs to more fully concern itself with the structure of charges and the relative costs for different classes of customers.

The second theme arises from the recognition that the EU's and Government's climate change policies will fundamentally alter the electric and gas industries, and potentially the roles of the networks and their regulation. Related to this point, demand growth and capital requirements may be altered significantly, with the latter certain to increase. Also related is an increase in uncertainty regarding throughput volumes and capital requirements that impinges on viability of the five-year fixed term of RPI-X regulation.

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As with the consumer focus theme, the sustainability theme masks disparate separate topics. Among them is a concern with capital investment and its financing; efficient investment incentives; and the locus of and basis for investment decision-making. Another topic is innovation; there is a perception that innovation has not been emphasized in the post-privatisation networks.

The first three questions contained in the paper solicit opinions concerning the rationale for the review, its scope and the two themes that will guide it. The OFGEM paper, together with the supporting papers from which it draws, fully and articulately describes the rationale for the review. While there inevitably are nuances of emphasis, the rationale appropriately draws upon the history of network regulation, perceptions of its current status and that of the networks and network companies, and, most importantly, perceived changes in the environment in which the network companies will operate in the future and possible changes in the missions of the companies and the regulator.

The scope defined in the paper is appropriately wide-ranging and open-ended and properly acknowledges that narrowing will be required when it becomes time to consider operational changes to the price controls and other aspects of regulation. One topic bearing on the scope of this review is its relationship with other OFGEM and governmental initiatives. This particularly is true of environmental objectives. As the paper recognizes, the role of the networks in executing on the environmental objectives is currently uncertain and not wholly within the reach of either OFGEM or the network companies. Thought should be given to soon narrowing the focus of this review to matters that can be implemented within the regulatory scheme in the near term (e.g., the next round of price cap reviews or, in the case of electricity distribution, the next but one).

Concerning the themes, it is not disputable that consumer focus and delivering on environmental objectives are valid themes. Our concern is that important issues that do not fit easily within these themes will attract insufficient focus. We have noted that these themes in fact mask subtopics that are not closely related. Had we wished to emphasize this point, we could have listed a dozen separate ideas in the paper that have been shoe-horned into each of the two themes. A particular concern in this regard is with changes in regulation arising from "good housekeeping" – those that arise from cumulative regulatory experience and changed circumstances, not from a heightened interest in consumer responsiveness or climate change.

The balance of this response to the OFGEM invitation to comment will focus on five issues raised in its paper. The issues are:

1. Should RPI-X be retained as the primary network revenue regulation control, or should it be substantially modified?
2. In view of the uncertain but likely increasing capital expenditure requirements of the network companies, how should regulation support needed expenditure while retaining incentives for economy and efficiency?

3. What incentives are needed for efficiency in loss reduction, congestion management and location of customers and supplies?
4. As part of the price control, is there a continuing need for incentives for customer care and quality of service?
5. Does OFGEM need to become more involved in cost allocation and tariff design and to what end?

In keeping with OFGEM's stated intent that this is the "vision" phase of the RPI-X@20 process, we do not seek to provide or to justify a fully developed proposal with respect to any of these five issues. Rather, our intent simply is to contribute to the ongoing dialogue concerning future changes in the price control. In so doing we draw upon both our historic involvement in RPI-X regulation and our international experience in a variety of regulatory regimes including, in particular, North America.

Our suggestions are evolutionary in nature. Unlike Rip Van Winkle, the Great Britain network regulatory authority has not slept for 20 years. The price controls that exist today, while superficially similar to those of 1990, are in fact very different. To a substantial degree, they already reflect lessons learned from operation of the post-privatisation networks and weaknesses in earlier forms of regulation. Moreover, they already have substantially begun to respond to the challenges embodied in the two themes that underlie this review. This particularly is true of the aspects of the current transmission price controls in relation to the new challenges arising from climate change initiatives and to DPCR5. Finally, we are mindful that RPI-X@20 is only one of several ongoing OFGEM initiatives. Other initiatives will develop outcomes closely related to the goals of RPI-X@20, particularly the transmission access review (TAR) and the analysis of incentives that is part of it.

If there is a theme to these comments, it is that the way forward consists of merely evolutionary changes to the current RPI-X regime rather than a major shift or new departure. The reason that only evolutionary changes are warranted is that RPI-X regime already has migrated far from its simple roots. The numerous "bolt-ons" already adopted and additional ones contemplated in, for example, TAR and the ongoing distribution price control review already have compensated very substantially for what otherwise might be fatal infirmities of the RPI-X regime on a going-forward basis.

Is RPI-X the Proper Regulatory Tool Going Forward?

RPI-X was adopted for the networks at the time of privatization for a variety of reasons. First, the government of the day (and to a lesser degree most British experts and parties of interest) were strongly in favor of "light-handed regulation." RPI-X was seen as the least intrusive option available, yet it still protected consumers from monopoly abuse whilst providing a strong incentive for efficiency. It had a track record, particularly in telecoms where it was seen to have been a success. The earliest network price cap periods were three or four years and (since the formula protected against uncertainty in unit growth and inflation), there was reasonable confidence that revenues would be adequate without being grossly excessive.

The price levels and structures were primarily carried forward from pre-privatisation. X values were set with reference to anticipated requirements to invest in network infrastructure, primarily renewal, under-grounding and new attachments to the network and to relatively modest projections of achievable efficiencies.

Almost immediately, the regulator began to learn the lessons that on a roughly coincident basis were being taught also in North America where, for a variety of reasons, there were very few base rate cases and hence a regulatory lag period that is some instances lasted for more than two decades. The first such lesson was that the adopted form of RPI-X, while set with expectations about the need for renewal investment, does not actually require that the investments be made. By the time of the first distribution price cap review, it was clear that some of the regional utilities were materially under spending relative to the capital budgets contemplated when X was set, thereby increasing earned returns. Networks composed of long-lived assets age gracefully and while non-replacement may lead to some degradation in reliability and somewhat higher out-of-pocket maintenance costs, it generally is possible to materially defer expenditure. Eventually, regulatory measures were taken to partly incent making the capital expenditures contemplated in setting X, but these remain somewhat weak.

A second issue that arose quickly was that, while there were licence conditions concerning service quality, there was no read through to profitability arising from higher or lower service quality. It is possible to under spend on network renewal and on expensed maintenance without an immediate and noticeable effect on service quality.[2] Both carrot and stick measures concerning some elements of service quality were introduced subsequently, but there remain questions concerning whether they are strong enough and whether they cover a sufficient range of activities.

A third issue that soon arose related to the incentive to take out costs as the price cap review date neared. Initially, many of the network companies did not anticipate that P_0 values would be reset during reviews. Hence, the value to the companies from savings undertaken late in the cycle would persist (albeit at a diminishing rate) throughout the next cycle. When P_0 values were in fact reset substantially downward in 1995, it became clear that expenses (e.g., for redundancy) taken to reduce costs late in a review cycle would be uncompensated and, more broadly, that it would be more profitable to make cost reductions early in the cycle. Subsequently, OFGEM moved to a rolling 5-year retention of cost-savings. This addressed the problem, but added yet another complication to RPI-X.

The foregoing suggests that there are at least partial solutions to perverse incentives in a simple RPI-X regime. However, they are only partial and, more to the point, require complicating the initially simple RPI-X mode of regulation.

[2] A notorious example from North America is that long stay-outs created an incentive to under spend on trimming trees under power lines. This was without noticeable effect for many years but eventually resulted in both the California blackout and the blackout that began in Michigan and involved much of the northeast US and central Canada.

The background paper on the history of RPI-X regulation of the electric and gas sectors also is instructive. In the 1990s, the rate of decline in achieved and allowed costs was quite large, particularly for electricity distribution. However, in the current decade, and still more so the current price cap periods, the rate of decline has slackened and in some cases even reversed. In part, this is due to higher investment requirements which in turn is partly due to higher costs for materials. However, it also reflects the fact that the pre-privatisation inefficiencies have largely been washed away, so that the ability of RPI-X to induce still further operating cost reductions in the future is limited.[3]

It also is useful to contemplate what currently happens in a price cap review. As described in OFGEM's background papers, the basic steps are to begin with a recent historic period in terms of base capital and base operating costs, forecast the need for capital expenditures net of depreciation, develop a cost of capital to multiply against the forward capital assets, and forecast the rate of change in operating costs. This then is used to develop a revenue requirement for each year. Depending on the nature of the RPI-X control (e.g., per MWh, per MW or total revenues) it may also be necessary to forecast units. The final step is to convert the present value of the five years of revenue requirements into a P_0 and X value.[4]

The point of this brief description is that these are the same steps as occur in a U.S. network utility's rate case up until the revenue requirement is converted into an RPI-X.[5] Thus, while RPI-X regulation is commonly considered to be substantially simpler and less intrusive than rate of return regulation, they are in fact quite similar.[6]

A key fact looking forward is that capital expenditure requirements, particularly those used to connect renewables to transmission and/or distribution grids are quite uncertain.

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[3] The resetting of P_0 values that was the vehicle for much of the allowed revenue reduction in the 1990s has ceased to occur. X values have declined somewhat; this masks a still greater reduction in the rate of decline when the latter is measured in real pounds sterling. With allowed costs down by roughly half, a given value of X implies a year-on-year reduction that is only half of the reduction it would have meant in 1990/1.

[4] A given present value of revenue requirements can be achieved by many different combinations of P_0 and X. Indeed, in Queensland, all of the distribution companies have the same X; changes in relative prices are accomplished through changes in the starting values. More typically, a combination of changes in P_0 and X will be chosen to most closely track the five year revenue requirement forecast for each regulated entity or group of entities.

[5] Another difference is that RPI-X regulation benefits from an explicit forecast of revenue requirements for each year in the fixed period of the price cap whereas a U.S.-style rate case relies on a single test year (forward or historic). Persistence in the price level in the U.S. relies (with attendant efficiency incentives) on the purely fortuitous outcome that various future developments (e.g. inflation, unit growth, capital expenditure, depreciation, the nominal cost of capital and so forth) net against each other such that the same per-unit revenues continues to yield the market-required cost of capital. A further difference is that for distribution sectors, OFGEM is able to use benchmarks derived from comparing the companies it regulates, a tool not commonly available to US regulators who only regulate utilities in a single state.

[6] The similarity of functions does not, however, imply a similarity of process or of the cost of reviews. The quasi-judicial nature of U.S. rate regulation and the open-ended opportunities for intervention result in a slow, complex and expensive process even though the majority of rate cases ultimately are settled rather than fully adjudicated.

Recent experience also teaches that the unit cost of a particular project also is uncertain due to large swings in commodity prices. This means that forecasting capital expenditure requirements six years into the future is hazardous and subject to large error.

While the needed level of capital expenditure is uncertain, it clearly is in the public interest that needed investments be made. Simple RPI-X regulation creates a disincentive to invest, at least at the margin. This is positive feature in that it creates an incentive for economic investment but a negative feature to the extent that it curtails economic investments or causes them to be deferred.

Renewables-related investments are primarily, though not solely, an issue for electric transmission. In the last price cap review, and subsequently, important changes were made to the RPI-X regime to at least eliminate some disincentives to make the investments required to connect renewable generation, to recognize the uncertainty surrounding such investments and to reasonably assure revenues sufficient to recover the costs actually incurred. The tripartite funding method in the three TO's price controls responds to the uncertainties that arise primarily from climate change policies by providing separate funding streams for business as usual (baseline funding), known events of unknown magnitude (revenue drivers) and the TIRG mechanism for unknown-unknowns.

At the other end of the network chain, the achievement of carbon objectives will certainly require substantial increases in energy efficiency by end users. So long as gas and electric distribution companies have unit-based price controls, they will have incentives to undercut and disincentives to promote reductions in end user consumption.

Even setting aside these incentive effects, it is clear that forecasting unit growth will be substantially more uncertain at least until the policy and technology responses to carbon reduction mandates are better understood. These developments are largely beyond the control of network companies and regulatory mechanisms that cause them to gain or lose depending on unit growth outcomes should be avoided.

Putting all of these facts together results in a strawman proposal for a main form of price control going forward:

1. Price controls should separate allowed costs into three components: a) fixed and semi-fixed costs of operation, including base capital, maintenance capital expenditure and depreciation; b) costs that vary with some form of units (which may be a very small subset of costs); c) intra price cap period new capital expenditure cost recovery (return and depreciation including interest during construction).

2. Standard form RPI-X would apply only to the first category with new capital charges recovered on an ex post, as incurred basis.

3. With the exception of the unit-variable category of costs, all other allowances would be total revenue allowances.

This suggested taxonomy and set of cost streams closely accords with the current transmission price control. As we understand it, this price control already has separated out most new capital financing and cost recovery from the costs subject to RPI-X. Previously, RPI-X regulation required an that the regulator net off the effects of efficiency improvements against the effects of new capital expenditure in setting the price cap parameters for the 5 year period. This no longer is practicable given the uncertain quantum of investment requirements. Among other consequences of the change is that it enables both the quantum of investment and the expected increase in efficiency more transparent.

There well may be meritorious variants on this proposal and the closely-related current practice. For example, it may be that the suggested dichotomy between baseline and new capital investment is too hard to police, in which case renewal investment could be removed from the first category of costs and all investment included in the third category. Second, if incorporating a best-guess forecast of total capital requirements (including those covered both by revenue drivers and TIRG) into the tariffs set at the time of the price cap review is regarded as useful, this forecast could be made and related revenues incorporated in the price cap. The second and third categories would then be reduced to an ex post true up of over and under investment relative to the forecast.

Regulation of New Capital Investment: Removing Investment Disincentives and Retaining Efficiency Incentives

The OFGEM consultative paper and supporting papers discuss a number of issues concerning new investment. Mostly, these relate to new connections to the transmission grid and (for distributed generation), the distribution grids. In addition, Chapter 5 enumerates numerous issues arising from anticipated network investments relating to the environment. As a core position, it is useful to begin with the assumption that the carrying costs of new network investment are automatically funded under the proposed price control with no lag and with no uncertainty. Provided only that the weighted cost of capital at which investment is reimbursed is at least equal to the market-required rate, the disincentive to invest will essentially disappear.[7]

Of course, the difficulty with this concept is that there is no incentive for efficiency in selecting and executing investment projects. Indeed, it has long been observed that if the

[7] The precise level of the market-required cost of capital is of course somewhat uncertain. In the U.S., the Federal Energy Regulatory Commission has a policy of granting an enhanced rate of return on transmission investment. While we are not fully certain of the motive, it may be that FERC perceives a bonus rate of return to be necessary to overcome the reluctance of transmission companies to engage in the prolonged, uncertain and difficult process of gaining rights of way and local planning permissions. The Great Britain transmission price controls appear to provide a similarly enhanced rate of return for investments subject to the TIRG mechanism.

allowed rate of return on incremental investment exceeds the market required rate, there is an incentive for inefficient investment.

The current transmission price control contains incentives for under spending budgets, with a 25 percent retention of associated savings by the transmission owner, subject to a collar of a 20 percent under spend. Proposals made by transmission companies in the TAR could broaden incentives still further. Inclusion of incentives to be economical with capital investment arise from the same desire to provide efficiency incentives that is part of the RPI-X regime more generally. However, in view of the ability to defer investment and/or to economize on investment by sub-optimal quality actions, the value of this incentive with respect to capital investment is questionable. This is particularly true in view of the fact that a current off-setting policy concern is whether the regulatory regime provides disincentives to make environmentally-linked investments.

In considering investment efficiency issues, it is useful to distinguish between two kinds of efficiency: efficiency in planning and deciding upon investments and efficiency in execution (procurement and/or construction). Planning efficiency likely is the more important quantitatively since planning failures can lead to network insufficiency or needlessly wasted or stranded investment.

Incenting efficient planning is an issue that dovetails with issues raised in Chapter 5 of the OFGEM paper concerning the roles of various actors (the transmission and distribution system operators, OFGEM, the government, joint working groups) in making decisions that relate to sustainable energy. These include decisions concerning investments relating to loss reduction, smart metering, connecting new non-carbon and low carbon generation, and stability management investments to allow larger amount of generation from intermittent resources to name a few. Since decisions concerning such matters almost certainly are part of a larger European Union and national climate change programme they necessarily will involve decisional participation from policy-related entities. This might be OFGEM based on a delegated quite specific remits from government, or it might be government itself. The concept of a government/industry working group is attractive, though at the end of the day there needs to be a decision-maker. Insofar as the decision includes the recovery of investment costs in allowed revenues, this necessarily will involve OFGEM. What is clear is that given the centrality of climate change to government energy policies, decisions concerning appropriate investments cannot reasonably be left solely to the business interests of the network companies.

The fact that officials external to the network companies necessarily will be involved in approving or requiring the predominant amount of new network investment this suggests a process for agreeing a plan of investment. One possibility would be something like having a working group draw up requirements plans that then are delegated to the network companies to turn into specific investment programmes, notionally of moderately long duration, for example 10 years. Ultimately OFGEM would pre-approve a set of investments over an appropriately short period. A short period (one to three years) is warranted due to inherent uncertainties. In order to preserve long lead-time

options, approvals could cover long lead time investments needed to permit future investments to be made on a timely basis (e.g., pre-construction costs). This could, for example, include early steps in building transmission to remote wind areas somewhat ahead of an actual need to transmit power.

The investment plan preapproval process outlined above would provide reasonable assurance that the investments being made are sensible and consistent with policy objectives. Pre-approval coupled with the cessation (at least on a project-by-project basis) of current incentives to utilize new investments fully (and concomitant disincentives to build ahead of demand and build to a size that optimally takes advantage of economies of scale) gives appropriate control over planned investment . From the perspective of the network companies, pre-approval would reasonably assure cost recovery, mitigating the risk of regulatory second-guessing after the investments were made and the risk that recovery of the costs of stranded investments would be disallowed.[8] This will both improve the network companies' willingness to make the investments and the ease with which the investments can be financed.

Turning to the issue of efficiency in executing the planned and approved investments, it is difficult and often fruitless for regulators to audit construction activities in the search for inefficiencies. While there may be a limited role for benchmarking as an aid, the most promising approach is contracting out the execution of the investment. This is not a panacea, since complex investment programmes often end up as "cost plus" contracts; there may be scope for incentives for the network companies to seek to constrain cost growth for such projects. Allowing the network company itself to bid to execute the project could be permissible, but it generally is not a good idea to have the network company guarding the purse strings for a project where it is doing the construction.

The Need for Incentives for Loss Reduction, Congestion Management and Supplier Locations

Both as a matter of general efficiency and as part of the networks' response to climate initiatives, it is important that the network companies have significant incentives to minimize losses. Loss minimization is one example where RPI-X style regulation continues to be valid without complexity. Loss reduction is subject to year-on-year targets. There also may be scope for benchmark comparisons. Since the substantial majority of losses arise at lower voltages, loss reduction is primarily an issue for distribution regulation.

[8] One of the less happy aspects of U.S. utility regulation is that regulators have been known to disallow the recovery of investments on the grounds that they were improvidently planned or executed, (a finding of "imprudence") or on the grounds that the investment is not needed to provide service or is not in fact providing service. This latter finding, that the investment is not "used and useful" can cause prudent expenditures on projects that are not completed to be disallowed, and also can cause investments that are stranded before their full depreciable life is completed to be removed from rate base. A result of the roughly $50 billion in write-offs primarily associated with nuclear power in the 1980s is that a number of environmentally important investments will only be made if regulators expressly commit to cost recover on an ex ante basis.

Care must be taken to balance properly the rewards for loss reduction and the treatment of incentives to invest. Loss reduction principally involves capital expenditure and if all such expenditures are fully recoverable, the need for incentives is correspondingly less.

Congestion management is another way to increase efficiency. It also may become increasingly important to environmental objectives since congestion forces the use of generation closer to load. In Great Britain, this will tend to be fossil generation. Congestion management is primarily a transmission issue, although the fact that relatively high voltage lines are within the distribution companies means that it also is a distribution issue.

If Great Britain were to move to a full set of locational marginal prices, this would also have the effect of creating incentives for generation to locate within congested areas and for load to locate outside of them. The existing structure of charges, based on long run incremental cost, already provides a locational signal, but it is not clear that it fully reflects congestion costs.

The Need for Continuing Customer Care and Service Quality Incentives.

Chapter Four of the OFGEM paper discusses the customer care theme of RPI-X@20. A close reading indicates that there are at least three relatively separate issues subsumed within this theme:

1. A need for regulation to give network companies an incentive to focus on quality of service and customer care;
2. Assuring that OFGEM's and the network companies' decisions and actions properly reflect and balance the needs and desires of customers and end use consumers by, among other things, obtaining better information from them;
3. A possible change in regulatory procedures to make them less opaque to consumers and the public and potentially to allow their greater participation in the process.

Current versions of RPI-X regulation already contain some incentives for service quality and customer care. These have proven necessary since: 1) RPI-X regulation without such provisions allows network companies to earn higher profits by reducing spending on service quality and customer service and 2) network monopolies inherently lack the incentives of competitive companies to be customer friendly and provide excellence in service and service quality. It quite properly is within the ambit of RPI-X@20 to ask:

- Are the existing incentives strong enough (or too strong) such that they result in appropriate quality levels?
- Do existing incentives cover all of the right areas of service? Candidate areas extend beyond outages and outage duration to such areas as call center response

times, billing accuracy, energy efficiency information, and so forth. This is a fruitful area for benchmark regulation.[9]

- What is the appropriate form of incentive? Should they be positive or negative or both? Should they be payments on a per event basis as with some of the current quality of service incentives, a more general adjustment to the allowed rate of return?

Regarding the balancing of objectives, the OFGEM paper details substantial new actions being carried out as part of DPCR5 that will provide OFGEM and the network companies with substantially enhanced information for use in balancing objectives and identifying areas of consumer dissatisfaction. This is laudable and should provide important information and, as important, transparency concerning the information on which OFGEM is acting. We caution, however, that consumer panel and survey information must be taken with a grain of salt. For example, willingness to pay surveys seem to indicate that consumers value a very high level of service quality, whilst revealed preference suggests a greater emphasis on price.

The paper also considers whether there should be an enhanced role for consumers in the regulatory process itself. To this end, it also questions whether the price control setting process needs to be simplified to make it more transparent. Beginning with this latter point, while transparency in regulation is very valuable and a key ingredient of legitimacy, simplifying the price control is not in prospect. Indeed, the previous sections of this response suggest that it needs to become more complex, or at least that it's inherent complexity needs to become more overt.

Regarding the role of customers and end consumers in the regulatory process more generally, our view is that the level of involvement discussed in the OFGEM paper concerning DPCR5 actions strikes the right balance. Clearly, a regulatory regime whose ultimate purpose is the protection of consumers needs to be informed of consumers' desires and concerns. However, experience in the U.S. where the representatives of consumers are very active in rate setting[10] is not encouraging. The positions of parties become predictable and self-serving. A cottage industry of law firms and consultants representing these groups becomes institutionalized. Most importantly, it must be recognized that this level of participation in the actual decisional process is a substitute for, and competes with, actions of the regulator and its advisory staff.

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[9] In the U.S. there are annual customer satisfaction surveys covering each of the distribution utilities. This information sometimes is taken into account by regulators in rate cases. Interestingly (but of no relevance to Great Britain), there also are league tables of perceptions of the quality of regulation for each of the states, where the respondents are financial analysts covering the utility sector.

[10] U.S. rate cases grant participation rights to anyone with even a remote interest in the outcome of the proceeding. This includes any customer or group of customers or entities purporting to represent them, environmental lobby groups, electrical workers' trade unions and so forth. The costs for some of these participants is, in some jurisdictions, assessed against the utility being examined. Some of the participants are state agencies, separated from the regulators' advisory staffs. In a few jurisdictions, there are multiple agencies within the state government representing different types of consumers.

This is not to say that customer and end consumer participation in regulation does not have value. Plainly, it does and openness to such participation is a guard against an insularity encompassing both the regulator and regulated that misidentifies or ignores important consumer interests. Our intent here is simply to urge consideration of the form that consultation takes and circumspection concerning the extent to which participation rights become institutionalized.

Regulatory Involvement in Cost Allocation and Tariff Design

Our perception is that historically RPI-X regulation has focused on allowed revenues and given far less emphasis to how those revenues are allocated to and collected from different classes of customers. This may reflect the fact that RPI-X regulation began with a pre-existing set of tariffs and tariff setting principles inherited from British Gas, the CEGB and the Electricity Council, and no one was keen to engage in extensive rebalancing.

Nonetheless, appropriate cost allocation is a key to fairness in the relative treatment of customers and therefore a key to regulatory legitimacy.[11] At least as important, tariff design is a major weapon in the arsenal available for dealing with climate change objectives.

Beginning first with impacts on the network companies, tariff design creates incentives and disincentives relevant to climate change.[12] If revenues rise more than costs when units increase as is characteristic of much of RPI-X regulation (and rate of return regulation), network companies will not be eager to support actions that cause consumers to use fewer units. Yet very substantial reductions in energy use are absolutely critical to achieving climate change objectives.[13] At a minimum, keeping network companies at worst neutral toward such measures requires that profitability be fully decoupled from levels of end use consumption.

The need for decoupled profits is not just an issue of network company incentives. As government programs (e.g., carbon taxes, energy efficiency standards and subsidies) take hold, throughput of electricity and gas may decrease at rates that are difficult to forecast. This creates a potential revenue shortfall against that projected in the price control that impairs the network companies' ability to carry out needed investment. In the alternative, government fuels switching programmes that markedly increase the demand for electricity (e.g. via electric cars) could result in a needless windfall for network companies if profits are unit-responsive, particularly if the sales are primarily off-peak and entail little new network investment.

[11] At the extreme, tariff issues also create EU state subsidy issues.
[12] We abstract here from tariff design elements (i.e. subsidies, rewards and penalties) that are directly designed to promote climate change objectives.
[13] The LENS project indicates that electricity use might actually increase under some scenarios due to substitution of electricity for the direct burning of natural gas and petroleum. Even in these scenarios, end use efficiency still is vital and the incentives on the network companies still important.

Turning from the network companies to the customers, tariff design also is a key element of achieving critical policies. We focus here on only two of the many elements of tariff design. First, the marginal price of energy needs to reflect the marginal cost of its production, including the shadow price of climate effects. To the extent that government policy has not fully incorporated such costs in the price of wholesale energy (i.e, via carbon taxes), it could be recovered as part of the network tariffs in the form of higher charges for marginal units.[14]

Second, both efficiency in the use of the networks (and assets downstream of the networks) and environmental objectives make it valuable to shift load away from peaks to off-peak periods. The efficiency benefits are self-evident, but become still larger if the share of consumption that can be time-shifted as a result of storage increases. It is difficult to conceive that climate objectives can be met without such an increase in distributed storage.

The direct environmental benefit of leveling consumption relates to the types of resources that will become critical sources of electricity in the future. To point to the two most obvious ones, nuclear energy is inherently baseload. Wind is a somewhat intermittent resource that is not dispatchable and is on average approximately randomly distributed in comparison to load levels. To the extent that load is leveled, it becomes more economic to provide a higher share of energy from these resources. Conversely, peaking energy is best served by gas-fired power resources, at least under current technology.[15]

Price-based incentives to shift consumers' off-takes from the networks to off-peak periods take the form of tariffs that materially vary the price of delivered power over the day or even the week. Thus, in the first instance, this is a tariff design issue. However, to the extent that tariff design requires more sophisticated metering, this also is a metering, and hence network investment issue.[16]

Conclusion

OFGEM's RPI-X@20 consultative paper asks 30 questions of respondents. Our response touches on only a few of them. We look forward with great interest to the progress of the project which is of great value, not only to Great Britain, but to other

[14] The possible use of network tariffs to collect the revenues to subsidize end use efficiencies, as is becoming common (albeit at modest levels) in other countries is beyond the scope of this response and likely beyond the current remit of OFGEM.

[15] Even it technology evolves such that storage, particularly dispersed storage, becomes the potential primary source of peaking capacity, rate designs that incent shifting off-take from the networks to off-peak periods are an incentive to install and use such technologies.

[16] Time shifting of consumption does not necessarily require "smart metering", but can be accomplished using time of use meters. However, it is foreseeable to government policy may seek to vary the end use price of gas and electricity as a function of the type of use as a part of a combination of social and environmental policies. In that case, smart meters that can reflect the end-use pattern of consumption become vital.

countries struggling with the same challenges. We will monitor activities in the working groups and on-line both for our own better understanding of how best to respond to these challenges and to determine if there are future topics to which we usefully can make a contribution.