The Systems Regulation Model

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1. Introduction

There is widespread dissatisfaction with many of the privatised utilities. In the rail sector, despite gaining from much higher revenues from a doubling of demand and significantly higher real prices, performance has been subject to repeated criticisms. In the case of mobiles, coverage is patchy and sometimes awful. In energy, the Competition and Markets Authority (CMA) estimated loyal customers have overpaid some £1.4 billion, a price cap on supply has been introduced and there have been failures to implement the smart meter programme. In water, issues of corporate governance and financial structures have excited the attention of regulators, and ministers have threatened legislation to support the regulator if behaviours are not substantially improved.

The debate goes beyond the companies, and feeds into a bigger question about whether Britain's core infrastructures are, as a result, fit-for-purpose. The *prima facie* evidence is not encouraging. It is hard to argue that any international business would choose Britain because of the quality of its infrastructure. Notwithstanding the lobbying to defend the deep vested interests that privatisation has inevitably created, the state of the railways, despite major public expenditure, is lamentable. Britain lags behind on broadband and fibre. Its postal services are far from ideal. Its roads are congested and under-invested. Airport capacity is inadequate, and there are big questions about the state of the river catchments, groundwater and the resilience of water and sewerage infrastructures. Britain shares with the US a poor overall infrastructure.

These criticisms have resulted, for the first time since the major privatisations of the 1980s and 1990s, in the Labour Party adopting an explicit policy of comprehensive renationalisation of all the main utilities. Opinion polls suggest

that this would be popular. The Labour Party claims that nationalisation would result in lower financing costs, by replacing private finance with government bonds, and that there would be no need for dividends, and profits would instead would be reinvested or used to reduce bills. Executive salaries would be cut at a stroke and financial engineering would end.

An underlying assumption behind the renationalisation proposals is that the private companies have failed. Yet the assumption that it is ownership *per se* rather than regulation that is at fault is questionable. Private owners will expect their managements to maximise profits. That is the point. Expecting managers to pursue the public interest is a category mistake. Defining the public interest is for government and regulators, not managers. It is simply implausible to argue that this is all down to poor management and the failure of the companies to invest, not least because the investment requirements and business plans are set ultimately by government and adjudicated on by regulators.

If one option is renationalisation, a second is the one taken by the current government, to push the regulators to toughen up their interventions to "prove" the existing regime works. This approach is effectively "more of the same", squeezing the cost of capital, lowering gearing, putting profit sharing or capping measures in place, and putting pressure to address the boardroom excesses.

The immediate results can be seen in the proposals for the water and the energy periodic reviews. Both pile up more complexity onto the existing regulatory scaffolding, adding one bit of sticking plaster after another. In the water case, the initial consultation on the methodology for this periodic review was about 3000 pages long, and both OFWAT and OFGEM cannot resist the temptation to add a couple more mechanisms on top of the existing ones – following a pattern that has been going on at every periodic review since privatisation. In the rail case, given that Network Rail is already renationalised, the Williams Review is charged with taking a fundamental look at the structure of the industry. The risk in the "more of the same" model is that the regulators will push back too hard,

and cause investment to suffer, as happened in the public sector under nationalisation.

The current political debate between the main parties assumes there are just two models to compare: the current immensely complex one, and nationalisation. This paper proposes a third model, the System Regulation Model (SRM), and shows in outline how it can be applied in each of the main sectors. Its merits are in the setting of prices through markets *and* the provision of the public goods of security of supply and the public interest in the Universal Service Obligation (USO) through system plans. It draws the economic borders of the state precisely where they should be, and allocates risks to those best able to manage them. It can, in principle, be delivered by either private or publicly-owned companies, and hence is broadly ownership neutral, leaving competition between public and privately owned businesses to sort out which is most efficient. It places the public controls with system operators and not the utilities themselves, and as a result it cuts away many of the criticisms of the existing model and the behaviours of the companies. It allows much of the regulatory bureaucracy to wither away.

Here, the SRM is set out, together with a summary of its application to each of the main utility sectors. Whilst this paper cannot provide a detailed blueprint for each sector, the aim is to establish the SRM's generic properties, show why it is superior to the existing regulatory model, and indicate how it would work in water, energy, rail and communications. It also makes some initial suggestions of applications to airports. Subsequent iterations of this paper will include other areas, such as waste and coordination aspects of financial services. It is, in an important sense, work-in-progress. It will be revised and developed to provide more detail over the coming months. The paper is deliberately reference-light. An academic paper will also follow, to show how the concept is embedded in the voluminous literature on regulation that has built up over a century.

The structure of the paper is as follows. Section 2 critiques the existing regulation model as it has evolved since privatisation. It establishes why it is

broken, and why it needs fixing. Section 3 looks at the alternatives of rate of return regulation and state ownership, and shows why these, either separately or combined, do not provide comprehensive answers. Section 4 sets out the SRM. Section 5 shows how the SGM provides the two main public interest requirements for any system – the security of supply and the USO. Section 6 focuses on implementation of these two public interest requirements. Section 7 looks at the auctions and contracting by system operators. Section 8 brings in the regulatory asset bases (RABs), protection of fixed and sunk costs, and develops the concept of tradable RABs. Section 9 focuses on the duties of system operators and shows how the existing regulators' functions can be carried over to the public system operators. Section 10 addresses the winding up of the exiting regulatory offices. Section 11 looks at each of the main utilities in turn – water, energy, rail and communications, and makes some tentative suggestions about applications to airports in the south-east. Section 12 looks at broader implementation issues and section 13 concludes.

2. What's wrong with the existing regulatory regime?

Some 30 years ago, Britain pioneered a new form of utility regulation in the 1980s, known then as RPI-X. The central idea was deceptively simple. The regulator would try to proxy the competitive market, by setting prices and leaving the regulated businesses to maximise profits by minimising costs. The utilities would be price-takers.

In order to mimic the incentives of the market, the prices would be set *ex ante*, for a fixed-period, typically 5 years (even though in a competitive markets prices change all the time to reflect changes in costs). These fixed-price contracts would solve another core regulatory problem. The regulator would not need to work out what the price at future periodic reviews should be, but rather could take the outcome of the cost minimisation process at the end of each period as the baseline, and then apply some general assumption about the future course of cost efficiencies. Since the economy might manage RPI-2, this could simply be

read across to the utilities. It might be ratcheted up a bit, on the assumption that the previously nationalised industries had a bit more fat on them.

The advocates of RPI-X contrasted their preferred model against rate of return regulation, which was assumed to be an *ex post* approach, with prices increased in line with out-turn costs. It was argued that US-style rate of return regulation led to both operating cost inefficiency and to excess capital expenditure to pack the rate base. The advocates therefore would expect a clear difference in cost efficiency between the two models: RPI-X should produce much more efficient businesses, and these efficiencies should be great enough to offset the higher cost of capital, reflecting the equity risk, that fixed-priced contracts would bring to these RPI-X regulated businesses. Efficiency should also be much higher compared to nationalised industries, which were also subject to *de facto* rate of return regulation.

30 years later we would expect to see the results. The regulatory world has turned out rather differently than the RPI-X advocates expected. The privatised companies have indeed profit maximised, but it is far from obvious whether the forms that profit maximisation have taken, notably the widespread M&A and associated financial engineering, have all been in the public interest. The managements of the companies have also profited, with significant increases in salaries and other benefits. Whether the returns to shareholders and executives, together with the higher cost of capital, have been a price worth paying for the assumed greater efficiency in both capital expenditure (CAPEX) and operating expenditure (OPEX) and in the quantity and quality of the infrastructures that resulted is what is now the subject matter of a major public debate.

The old adage "*if it ain't broke, don't fix it*" is a good one. The hurdle for any proposed regulatory reform is a high one: the current system has to be sufficiently bad to outweigh the costs of intervention. Further, tweaking what we have is always an option – which OFWAT, OFGEM, OFCOM and the CAA keep trying – and is going to be less disruptive than starting from scratch.

So is RPI-X broke? The surprising answer is that, with one exception, it has never really been tried, and what now goes under the name is a world apart from what its architects Michael Beasley and Stephen Littlechild had in mind in the early 1980s.

For the pure RPI-X model to work, it is critical that regulators keep their hands off and avoid any and all interventions between the periodic reviews. They have to fix the contract outputs and prices in advance, and then keep out until the next periodic review. All they then need to do when the price cap comes around again to re-fix is to pick a new X, and preferably a simple and crude one, like RPI-2 or RPI-3, and to fix the new capital and operational output requirements. In this pure world, they should spend the rest of their time on promoting competition, so the residual activities covered by RPI-X are reduced to a minimum.

The only sector to which this elegantly simple model was seriously applied was to the regional electricity companies (RECs), and it was here that Littlechild was the regulator. He could put his theory into practice. If RPI-X was going to work, the RECs were in the 1990s the most simple and basic of the utilities to try it out on.

It proved untenable, and the failures indicate much of what is wrong with the model. The first collision of the theory with the practical context that utilities found themselves in resulted in the periodic review having to be redone. Unfortunately the remedial measures were wholly inadequate and the companies exploited what followed to the hilt.

The RECs, privatised in 1990, combined distribution, supply, and retail. Compared with the other utilities back then, they were very simple businesses. They were sold at £2.40 a share. Within just 4 years, they had invested only half of the assumed amount required when the price caps were set. Littlechild's model required that regulators take no notice. He did not, and when it came to resetting the cap, he limited himself to a fairly crude banding of the X factors of the companies. The result was a further rise in the share prices, and the

beginning of the great takeover wave. The RECs were to change hands several time over, first as a result of American purchases, then vertically integrating generators, then a host of infrastructure funds. This M&A is still going on today. Quite what benefits customers gained from these multiple and repeated takeovers has never been demonstrated, but it was undoubtedly a bonanza for financial advisers and institutions. It would, and should, make a very interesting research project.

The first big M&A case was the bid for Northern Electric by a construction company, Trafalgar House. This bid (at £11 a share against the £2.40 paid at privatisation) indicated just how wrong the original price cap had been and how much value would be left on the table after the first periodic review. But it was Northern Electric's defence that really illustrated the inadequacy of the deceptively simple pure model. What Northern Electric proposed was to mortgage its assets, borrow the equivalent of £5 a share against these assets, and pay this out straight to shareholders, not customers. (The company was eventually sold for around £7 a share, though not to Trafalgar House which went bust). This mortgaging is behind the problems of high gearing today.

This was not what the public and their MPs had in mind at privatisation. It was financial engineering of core assets, leaving them with geared balance sheets – balance sheets, which were supposed to support the necessary investment, and give Britain world-class infrastructure. The financial engineering excitement quickly spread to water, where the investment argument had been much more prominent in the case made for privatisation. Indeed, at privatisation, the water companies were given a green dowry to aid investment. Sold for less than £8 billion, with debt written off, the green dowry meant that the companies had a gearing of minus 20%. By 2018, several had gearing of plus 70-80%. The difference had little relation to extra CAPEX not paid for by customers, net of what should have been normal rates of returns.

The regulatory response was to try to patch up the model with a "tougher" outcome. It did not work. For the financial engineering, and the associated

stripping out of the balance sheets, was caused not only by the sheer scale of value that privatisation had left on the table, but by the absence of any serious attention to the financial parameters in the price setting process. Indeed, this was exactly the sort of thing that the pure RPI-X model required the regulators to keep out of, and leave to the market.

The regulators quickly realised that to determine the *ex ante* price cap they needed to fix a cost of capital and a valuation of the assets to which it would apply – in other words to do many of the things the rate of return regulators had been doing in the US. And in doing so, the pure model was undermined. It quickly became rate of return but with a five year lag.

British regulators got both wrong. In the case of the asset bases, the mistake was to assume the companies were worth whatever the investors thought they were after privatisation. The mispricing of the companies (for example the £2.40 above for the RECs) led to an instance share price appreciation, which the regulators then accepted as the starting value of the regulated asset bases they determined. They baked in the initial shareholder gains – around 30% for water and 50% for the RECs. Customers are still paying it for today.

This mistake paled into insignificance against the mistake made on the cost of capital. They got it wrong on two counts. First, they set a weighted *average* cost of capital (WACC), blending the cost of debt with that of equity. The result was that the cost of capital was too low to reflect the equity risk, and too high in respect of debt. The obvious profit maximising thing to do was to replace equity with debt – to gear up the balance sheet. Add in the early tax advantages of debt over equity in the treatment of interest, and the stage was set for more financial engineering.

The final mistake was not to index the cost of debt and hence pass through the interest rate. Arguing that companies are better at speculating on interest rates and managing them than the market, the regulators failed to address the exogenous falls in interest rates. The interest rate always turned out to be lower

that the regulators had assumed *ex ante*. It was a major source of profits, arguably greater than efficiency gains in most if not all cases. Shareholders, not customers, benefitted from the repeated mistakes. It is an interesting question as to whether rate of return regulation, even with blunter efficiency incentives, would have produced a better deal for customers, given the gap between allowed and actual interest rates. The calculation should be done.

These mistakes could have been avoided. They required an opening value equal to the floatation share price, a split cost of capital between equity and debt, a capturing of tax benefits, and indexing the cost of debt. All were proposed in the 1990s (including by the author), and eventually regulators got around to clawing back the tax gains and then indexing debt, though in the latter case OFWAT held out for nearly 30 years. Yet even if all of this had been addressed early on, the regulators are unlikely to get it right. As we shall see, the SRM has the great merit that much of this is not needed under the bidding processes to be run by the system operators at the core of the new model.

The exercise in promoting competition largely ignored two key features of the infrastructure networks. The first is that the marginal costs are well below the average, and it is the sunk and fixed costs which matter most. The second is that these are *systems,* and therefore not amenable to disaggregation of the functions of coordination of the assets and the planned capital maintenance and enhancements.

One of the starkest examples of failing to understand the system nature of these infrastructures emerged again in electricity distribution. Littlechild was determined to start the process of unpeeling the onion rings of the monopolies. He began with meters and separated them out. Meters were to be treated as commodities not integral parts of the systems. This sowed the seeds for the current debacle over smart meters. Whereas almost every other country treated these as parts of the networks, Britain decided to put these into the competitive supply businesses. The result are not only high costs, limited switching capability baked into the first meters (SMETS1), and delays, but probably more seriously

even than these mistakes is the inability to properly operate the systems and therefore bring in the demand side, storage and other options. Contrast Norway, Sweden and Finland, all of which have close to 100% coverage already, with the sorry state in Britain where there will be a big legacy of SMET1 first generation meters and big legacy costs and big additional problems in electrifying transport.

These considerations reflect the two endemic problems for the RPI-X model as it developed – it doesn't properly address the financial side; and it undermines the system properties. Both of these, as we shall see, are solved in the SRM.

3. Would rate of return and public ownership be any better?

The Labour Party argues that these (and other problems) would be solved through a return to public ownership. Understandably, the details of the nationalisation structures have not yet been specified, and there are clearly several models. There is full public ownership with public-only finance on a pay-as-you-go-basis (the status quo in the period from 1945 to 1979). But there are other models too. Transport for London (TfL) has private debt and public finance. Overseas, there are models where all the debt is private, with equity publicly owned (like Statnett) and then there are numerous examples in Europe of part-public and part-private equity and debt ownership structures (like EDF and Equinor (previously called Statoil). In Europe, municipal ownership has, and continues to, play a significant role, especially in water.

Rather than try to work out how each and every one of these would work, let's start with a simple case. It is rate of return regulation without dividends, as set out in the last White Paper to appear on nationalised industries in 1978. The idea, as with RPI-X, is deceptively simple. The utility passes through its costs to customers. It then earns a specified rate of return. In the case of private rate of return regulated utilities in the US, these cost pass throughs are typically subject to an efficiency test. In the public sector, there can be no credible efficiency penalty, as the state owns the company, and therefore it would be in effect

penalising itself (the absurd pretence of the regulators fining Network Rail notwithstanding).

In the "no dividends" model, the rate of return is effectively the interest paid on the debt plus a rather arbitrary provision. This could be government debt, or it could be on private debt. The prices are then the sum of: OPEX plus CAPEX plus interest.

But why pay interest? In a purely pay-as-you-go model, current customers pay for current investment, even where they do not benefit from it. The infrastructures are assets-in-perpetuity, and each generation has a duty to maintain and enhance these assets for the next generation. So interest only arises where current customers are not paying for part or all of current investment. There is no need to borrow: it is cash-in, cash-out, with any shortfall coming from taxpayers.

Do nationalised industries then need to earn a rate of return? It can be argued that there needs to be a cost of capital, because there is equity risk. Projects may go wrong. But then if the equity is public not private then the equity risk lies with taxpayers. Why should people pay twice – a rate of return for the equity risk they in any event hold *and* for the costs of any failures? Paying a cost of capital is essentially paying themselves.

Labour states that what would have been dividends will now be split between lower bills and more investment. If this is accepted, then the ownership issue is about whether the public sector cost of capital (implicit in the taxpayer and customer equity risks) is sufficiently low enough to compensate for the loss of efficiency because of cost pass through *ex post*, assuming there is in fact a loss of efficiency. Yet even this apparent trade off is less than it seems. The efficiency incentives in RPI-X are not quite as clean cut as the pure model suggests. For the regulators have not (and arguably cannot) keep their hands off. They keep interfering in ways that undermine the efficiency incentives. So we are left with an empirical question. Is it really true that after 30 years, British privatised

utilities are more efficient than public ones? There are lots of potential comparisons. Almost all water utilities globally are in public hands. There are ready comparators in Europe. Statnett can be compared to National Grid. There are public utilities in the US – indeed in almost every country in the world - to make comparisons against.

There are several interesting things to say about these comparisons. First, at the macroeconomic level, it is not at all clear that British infrastructure, as the most privatised in the world, is the best and most efficient. Second, in network infrastructures, it is capital costs that matter overwhelmingly, less so the operating costs. The marginal cost is way below the average cost. Third, there appear to be some really efficient public sector companies around.

It turns out that what matters for efficiency is not so much the exact overarching ownership structure, but how much competition there is to do the works. Almost all the actual operating, maintenance and capital projects are carried out by competing private sector providers to the utilities, whether the utilities are publicly or privately owned. Private companies under contract to the utilities, for example, provide HS2, Crossrail, and new trains.

The really interesting questions about rate of return regulation turn out to be about their contracting: whether the contracting is carried out competitively, and whether the results are efficient. Contracts themselves can be fixed-price *ex ante*, or they can have elements of cost pass through. They can be pay-when-delivered, or pay for assets-in-the-course-of-construction. In the latter case, they can just be pay-as-the-money-is-spent, or pay-when-contract-milestones-are-met. The choice of ownership in itself is not the primary determinant of the outcome. The pure rate of return regulation model does lack incentives. It turns out that this problem is best solved by making contracting central, and opening up the bidding process to as many bidders as possible. That is what the SRM does.

4. The SRM

The SRM separates out the system planning and system coordination from the delivery and the day-to-day running of the networks. It places decisions which are for government in the public domain, and leaves the delivery of capital projects and services to the market, and therefore for private, public and not-for-dividend companies.

For each infrastructure network a system operator is created. Its primary duties are to ensure that: security of supply of the required services; the core assets are properly maintained in perpetuity (where relevant); and investment is planned and executed with due regard to the system requirements. The system operator needs a plan, which is continuously revised. The services must be delivered, the assets must be maintained, and the system must be enhanced in line with the overall public objectives.

The domain of the system operators depends, as we shall see below, upon the nature of the different systems. In the case of water, it is best organised on a catchment-by-catchment basis. In communications, it takes on some of the role of Openreach and the various government initiatives to deliver communications services and enhance mobile, fibre and broadband roll out. In railways, it coordinates the various regions of the networks, plans enhancements and ensured that common services like ticketing are delivered. In electricity, in addition to the functions carried out by the existing system operator in National Grid, the new system operators coordinate the secure supply of services, including the networks, local generation, local storage and local demand-side responses. These models are further detailed below.

The system operator carries out a public function, concerned with the public goods that systems provide. Networks are systems. They are not amenable to disaggregation into a set of discrete bits. Any change to one part of the system affects all the other parts. The system operator concentrates on the system as a whole.

5. What is the public interest the SRM should pursue?

The public requirements have two main features: the public good of security of supply of the services; and the public interest of universal service, the USO.

Security of supply is a public good because it is provided on a system-wide basis. It is either provided or not by the system. The benefits of access to the system are broadly non-excludable and non-rival, unless explicitly made so. The marginal cost is effectively zero: the average cost is what matters. The extent and domain of the public good varies across the utility networks. An electricity customer could in principle self generate and be off grid. But this will entail either much higher costs or the willingness to have self-interruption (a disguised cost by quantity constraint rather than price).

Security of supply typically requires excess supply relative to the mean expected demand. The reason is that there is an asymmetry between too little and too much supply. Too little supply results in multiple costs. Interruptions to water supplies quickly leads to the costly alternative of bottled supplies, and risks to health. Rail interruptions disrupt not only the traveller but also workplaces. Congested roads raise costs, and both roads and rail have excess capacity. They are both largely empty for parts of the day and night. Electricity blackouts bring economic activities to a halt. Broadband and mobile network failures result in widespread disruption.

Too little capacity is asymmetrically more costly than too much, and for this reason there needs to be a supply margin as insurance. No rational capitalist oversupplies a market relative to mean expected demand, because excess supply depresses prices. The system operator decides how much excess supply there should be and ensures it is provided.

The USO arises not just because the core network services are essential to economic activity, but because of the need for people as *citizens* rather than just *consumers* to participate in society. It may, for example, be uneconomic to extend

broadband networks to remoter rural locations, to extend the electricity network to the peripheries and to provide universal mobile coverage. But without these services it is increasingly hard for citizens to function in society, from banking to broadcasts.

Citizens need these basic capabilities to participate in society, and a functioning democracy needs to treat citizens on an equal basis, and not purely on an ability to pay. The principle of democracy is one person, one vote. It is not based on incomes, and the ability to pay. The USO has gradually been expanded since the nineteenth century to include clean water, sewerage, postal services, and access to electricity networks, basic communications and transport. It is being extended to broadband, as this new essential service becomes a general enabling technology not only directly but also for all the other utility services too. Put simply, the universal provision of these core utility services is a necessary condition for a decent society and a productive economy, alongside universal healthcare and education.

Since the USO is the provision of services not necessarily related to marginal costs, it has to be imposed onto the systems and paid for. The market will not provide the USO. It has to be provided on the basis of a monopoly charge, either as a use of system charge or through the exercise of monopoly and market power (or though subsidies from taxpayers). In the period after the Second World War, statutory monopoly ensured a charge base. As competition is introduced, the defining and protection of the USO changes. A recent example is the USO for postal deliveries, now at serious risk as the demand has fallen away.

The system operator is charged with defining what the USO means for each system and ensuring that it is paid for. Most likely, Parliament would define the broad parameters, and the system operator would fill in the detail.

With the security of supply and the USO duties placed upon the system operators, the next step is to set out how these are achieved. What do these system operators need to do to ensure these are provided efficiently?

6. How can the two public interest requirements be implemented?

To meet the two requirements, the system operators need to establish the security margin and to define the USO. The system operator needs to make sure first that the mean demand is being met (including the USO requirement) and then add on the security of supply margins. It requires the contracting of the various components to companies. Someone has to be practically responsible for delivery. This might be a single provider, as with the Distribution Network Operators (DNOs), the Royal Mail and the railway companies. But typically there are a number of options. It could be that several different companies can deliver bits of the requirements. It might be that different structures could deliver. For example, an integration of rails and trains in a regional company might be better than two separate parts, as at present. In communications, there might be a number of companies delivering future networks.

The USO and the security of supply necessitate that there is a *plan* for the system. It is this plan that the system operator is implementing. It can be a centralised top down model. Or it can be bottom up, with the utilities making proposals as to what it might contain. Perhaps best, it can be a combined approach, with the system operator setting out its proposed high level outputs (possibly guided by Parliament), and then the companies commenting and criticising.

Note that the current requirement for the development of business plans submitted to the regulators at periodic reviews, as for example in the water company periodic review processes, is now replaced by a more cooperative approach, iterating towards a final plan. The crucial difference is the *plan is owned by the system operator, and not the companies.* They are strictly contractors to deliver outputs that the system operator requires. Note too that this is not a franchise model, for two reasons: the assets need not and probably in most cases should not be owned by the system operator (see below), and concessions are not granted for fixed periods.

7. How should the system operator award the contracts for the services?

In the RPI-X and the rate of return models, the companies submit plans, together with their proposed asset valuation and costs of capital. In the SRM, much of this requirement is replaced by the use of competition and markets. Once the plan is determined, the system operator opens it up to bidding from interested parties. It is the bids that yield the costs and hence form the basis of prices. The asset value and cost of capital are embedded in these bids. It will have an equity component and a debt component. There is no need for the system operator to apply a WACC, with all the distorting incentives which gave rise to the great financial engineering noted above, and the deadweight welfare losses that went with this process.

The system operator contracting approach has the further merit of opening up the utility network services to lots of entrants and more innovation. Because the duty to supply and the USO ultimately lie with the system operator, much more exciting competitive options can be introduced. These can come from other private companies, public companies and public authorities and not-for-profit organisations. Water companies would face competition from each other, from contracting companies and specialist providers, and the Environment Agency would face competition for flood defences from lots of other parties. In regional electricity systems, distributors would face challenges from storage and the demand side, as well as embedded generation. The greater the technical change and innovation, the greater the range of options to meet the security of supply and USO obligations. Ironically, the system operator model allows for the very competitive challenges to the utility monopolies that Littlechild was so keen on. The system operator promotes competition through the auctioning process.

The SRM does not need to follow the rigid fixed periods used in periodic reviews. Nor does it have to always follow the same auctioning format. Discretion, and the flexibility it brings, allows for the different time horizons for CAPEX projects and to adjust the contracts to reflect changing circumstances. The five-year fixed-priced monopoly contracts are arbitrary, and have no reflection in conventional

competitive markets. They distort by not reflecting the time structure of the costs and the asset lives. They are therefore inefficient.

The advantages of this flexibility are perhaps most obvious in the electricity case, where supply has to instantaneously meet demand, everywhere and always. The national system operator cannot know the precise requirements several years ahead for capacity. Economic growth may disappoint so that less capacity is needed. More fast response short-term generation technologies may improve the picture too. On the other hand, there might be generic failures in the nuclear power stations, necessitating more capacity than anticipated.

This need for discretion is less apparent in other utilities where storage and demand side responses are greater. But the problem of the forecasts and reality diverging remains.

Granting discretion does not mean that anything should go. The more predictable the auctions, the deeper and more intense the competition is likely to be; the more unique each auction, the thinner the bidders.

The system operators are bound by the duties placed upon them, and discretion has to be necessary to best meet these. In auctions, the rules matter, and the system operators would be vulnerable to judicial review if competitors believed that they had favoured one bidder unfairly. Auctions make capture more difficult.

There are some elements of the networks that will remain natural monopolies, and conventionally one monopoly supplier has been and probably will continue to be designated. This monopoly approach to systems has enabled the system operator functions to be internalised in the privatised utility company monopolies.

The problems with this approach are the familiar ones of monopoly. In the post second world war period, the solution adopted was to try to align the objectives

of the management of the monopoly companies with those of the public by nationalisation. Privatisation opened up a wider gap, and there is little doubt that the privatised monopolies have exploited this gap. From the start, as noted above, management sharply increased their salaries and other remuneration, and shareholders exploited each and every opportunity, notably the financial engineering possibilities. Regulators had to play catch up to try to align management interests with the public interest. They have largely failed.

This problem is reduced under the SRM, though not altogether solved. Two steps are important: that the plan, and hence the functions, are determined by the system operator and not the company; and the residual contract, as a whole, or in any parts, is offered for competitive bids. It is a much more open and transparent process. The usual game of trying to set out a business plan that meets the interests of the shareholders and managers is replaced by one that meets the public interest. The games of over-bidding CAPEX and OPEX, and then "negotiating" these with regulators are somewhat ameliorated. For the residual monopoly contract, there can be competitive bid for the contract as a whole, and there can be requirements to demonstrate internal bidding.

The auctioning of these contracts can take a variety of forms. Specific large CAPEX projects can be offered for bids (as in the direct contracting model adopted in water). There can be two and more stage bidding processes, with initial expressions of interest to help the system operator gauge the likely costs. Then there can be bids of the large-scale residual contracts, encouraging other utility companies in the sector and from outside to bid.

8. How does the RAB fit into the SRM?

How do the bidders know that the system operator will honour the contracts? Might they not change the specification as they go along? The problem of commitment is well known and it plagues many core utility and infrastructure projects. Examples abound, from nuclear power stations to the Public-Private Partnerships (PPPs) for the London Underground.

Failure to commit arises for two main reasons. One is that there are reasons to change requirements because new information becomes available or exogenous circumstances arise. The longer the project takes to complete the more likely such changes. In very long-lived projects, technology changes are more likely. Too rigid a contract, to establish credibility, leads to the loss of the advantages of changes along the way.

The way to handle this is to recognise in advance that such issues may arise, and to put in place the mechanisms for the *ex post* adjustments. In nuclear projects, for example, new safety issues lead to regulators continually upgrading requirements. In the case of London Underground PPP, changes were an endemic problem. The system operator is vulnerable to binding itself to the mast by assuming that there will not be the need for flexibility, and ending up with onerous terms for changing specifications. Many PFI projects suffer from excessive rigidity.

There is no right answer to this flexibility problem in the specification. It is widespread and there are lots of good and bad examples across the economy. The system operator will have the advantage of being in the business of repeatedly contracting and should build up expertise to handle this inevitable dimension of its role. The current regulators, tried to fixed-price, fixed-period contracts, do not have this experience. Instead they are repeatedly forced into *ad hoc, ex post* interventions, undermining the RPI-X incentives.

The second credibility problem arises from time inconsistency, and it is a problem that the Regulatory Asset Base (RAB) is peculiarly well designed to address. Time inconsistency arises because the fixed costs are typically much greater than the variable costs, making a large gap between the average and marginal costs. Since it is always worthwhile to operate the assets if the price is even just above the marginal costs, there is an incentive *ex ante* to promise to pay the average costs, but then *ex post* to screw the contractor back towards the

marginal costs. Where that contract is set by a government, a regulator, or a system operator, the temptations are obvious.

The solution is to credibly contract, to commit to pay the average costs. The RAB represents the past investments, and the commitment to honour the RAB is relied upon by investors. In the RPI-X model, the RAB is updated each period, to include efficiently completed CAPEX.

There are some technicalities around the RAB. If the assets are treated as in perpetuity, then depreciation is not relevant, and instead capital maintenance is required. The RAB, as a representation of these assets-in-perpetuity, cannot therefore decline. In other cases, the RAB is paid back by historic cost depreciation.

The RAB could in principle lie with the system operator. This however is neither necessary nor desirable, and would in practice be close to the franchising (and therefore asset-owning) model or a form of nationalisation (in which case the system operator might be integrated into the state-owned company). It could be a system operator "account" with the claims assigned to the private companies that built the assets. It could be part of the contracts that the system operator auctions, and including a return on these assets. Finally, it could be traded in any of these options. Whatever approach is taken, the RAB is a claim on customers as a whole and should be charged through the use of system charges. Because it is a legacy charge, the allocation between the customers of these RAB costs through the use of system charge is ultimately a political matter, since the use of system charge is collected on a monopoly base, and customers cannot switch from such use of system charges.

The RAB is a financial number, backed by the commitment from regulators. Utilities and infrastructure projects managers might argue that a switch to a system operator model risks undermining that commitment. The RAB has no equity risk, other than a failure on the part of the regulator to honour the commitments. It is therefore in principle debt backed.

One way of handling these past commitments is to make the RABs themselves tradable. This is just a generalisation to the RAB as a whole of the tradability of the underlying debt, which backs the RABs. The system operator could in principle ask for bids for the RABs as part of the contracting process where there are residual monopolies.

The backing for the RABs is that customers pay through use of system charges the interest on the debt. Given that the general case for indexing the cost of debt in the RPI-X regulatory regime is already largely accepted, the auction of the RABs is really the indexing of debt to market values, and these will be largely determined by actual and expected interest rates. If the auctioned RABs come with indexation (in effect as RPI or CPI indexed bonds), and the guarantee is credible, then they should trade very close to the value of government bonds. Tradable RABs therefore minimise the cost of debt and sterilise the commitment, separate from the cost of equity and debt in the project finance and operating working capital of the businesses. New bits of RAB assets can be similarly traded, and the system operator could make them part of the auctioning process and the resulting contracts.

9. What are the detailed duties of the system operators?

There are a number of generic duties and obligations that are currently embedded in the regulatory offices, in the licences and in general legislation. Most of the regulatory offices have duties in respect of pursuing the interests of customers and ensuring that the regulated companies can finance their functions. In the early days after privatisation, most too had a duty to promote competition.

Since privatisation, the duties have proliferated, to include social and environmental concerns. Duties are sometimes divided into primary and secondary. In practice, the regulatory bodies have been left to decide for themselves what duties to prioritise, and judicial review has so far proved a very

weak safeguard. In effect, regulators have been deciding what are key political and democratic priorities, behind the facade of independence and their technical functions.

There is no easy answer to this. These are not ultimately matters for technocrats. In the nationalised industries, the utilities were ultimately responsible to ministers, and ministers were responsible to Parliament. For the few that remain, this accountability has shifted somewhat. The Mayor of London is responsible for Transport for London (TfL), but the Secretary of State for Transport is responsible for Network Rail.

In the SRM, the obligations are simplified. Above, two of these were stressed: the security of supply and the USO. The system operators are public, not private. From these two core duties, the system operator has to have a plan – a catchment plan in water; a capacity and network plan in electricity; a rail delivery plan; and a plan for fibre and broadband.

This system plan is a public and not a private matter, and it is a significant switch of obligations from the utilities. It is a transfer of an obligation from the privatised utilities' licences to the system operators. The private companies bid for the contracts to fulfil these public obligations. The contracts will include the delivery of the necessary infrastructures to ensure that the public interest and hence the public plan is implemented. Indeed this is already the case for the system operator in National Grid. It is not the bidder for a generating plant that has the duty to supply. What the contractor has is a contractual obligation to make the capacity available that it bid for. Take water, and the obligation to deliver wholesome water. In the SRM, the Catchment System Operator (CSO) has this obligation, carried over from the general law. The contractor, say an incumbent utility, inherits this obligation as a contract requirement. The practical effect is not great: the obligation is in a contract not a licence.

A corollary of the above is that the operator licences as a currently constructed can and should be radically simplified. Instead of endlessly updating the licences

and making them more and more complicated, and in the process blurring the line between the public interests and the private incentives, the licence is now generic, and in effect a fit-and-proper entity test.

Take the electricity distribution example. In the *Cost of Energy Review* I proposed that the different supply, distribution and generation licences could be collapsed into a general licence. There is no need in the SRM to confine companies to specific activities only. In regional electricity system, with regional system operators, the security of supply obligation translates into options to do it via distribution network enhancements, more local embedded generation, storage and batteries and the demand side. Each and all the businesses currently ring fenced off by their licences can join in and compete.

The system operators do not draw up system plans in isolation. They are public bodies, which will be required to take the existing framework for infrastructure and environmental policies into account. This includes: the sector planning frameworks that have developed; legal obligations; and local and community interests.

The planning regime that has evolved since 2010 has had at its heart the aim of setting a national planning framework for each of the main infrastructures and to provide this plan as the basis for what then happens on the ground. The intention was to back this up with an independent, statutory National Infrastructure Commission (NIC). The NIC would produce a long-term plan, Parliament would debate and underpin, and then this would be fed into the sector plans. This clear institution framework was watered down (the NIC is advisory only), but the broad outlines and purposes remain.

The SRM fits neatly into this institutional framework. The national infrastructure plan, via the sector planning statements, would be passed to the system operators, and they would draw up more detailed plans, and then auction them out, as described above. The attraction of this framework is that it creates a

coherence to the development of Britain's infrastructure in a forward looking way over several decades to come. It is designed to be long term.

In the SRM, the national plan forms a key input to the system operators. The NIC and the national infrastructure plans should focus on the high level outputs. These include the climate targets, the infrastructure needs for population growth, the spatial issues about housing and so on. The system operator focuses on the details.

The other dimension of the system operator plans comes from the legal frameworks. Some of these have come from Europe, like the Water Framework Directive. But others are home grown. The Climate Change Act is a leading example. The job of the national infrastructure plan is to focus on which sectors should do what to achieve the overall targets – though an economy-wide carbon tax solves some of the need to do this sort of disaggregation.

In moving to the SRM, there are other general statutory dimensions that could be added to create the framework for the system operator planning. The *25 year Environment Plan* could (and should) be put on a statutory basis, supported by the principles of public money for public goods, the polluter pays principle and the net environmental gain.

The system operators will need to draw up plans consistent with the national infrastructure plans and the legal requirements. This places the public decisions where they should be. The system operators should be open to judicial review as to whether they have fulfilled this remit.

Other duties that might be carried over from the utility licences and from the regulators include the duty to ensure the contractors can finance their functions in respect to the RABs, and hence ensuring that these are included in the use of system charges. This duty would not apply to the OPEX and CAPEX in the contracts: this would be covered by the special administration duty. The system operator could terminate the contracts in specified circumstances, and then re-

let to a party capable of delivering the functions. There would need to be a process in the event of contractor failures, as there are in all major contracts in the private sector.

10. What happens to the existing regulators?

The SRM is an alternative to RPI-X and rate of return regulation. Because the principal public function is the drawing up of the plans and then the contracting through auctions and negotiated agreements with private companies to deliver the outcomes, the SRM does not need to have all the apparatus of the Office model, with the leading examples of OFWAT, OFWAT, OFCOM and ORR. There are no periodic reviews to conduct. The system operator auction processes replace these.

The existing Offices do of course have lots of other functions, and many of these will not go away. These include environmental ones, competition and the issuing and monitoring and enforcement of licences. These functions have accumulated, as the fashion has been to delegate the general legal frameworks to sectoral regulators. The SRM allows this process to be reconsidered and somewhat reversed. Competition law is the job of the competition authorities and in particular the CMA. Environmental regulation is the job of the Environment Agency (EA) and to clarify this role further, consideration should be given to splitting out an Environment Protection Agency from the EA. Health and Safety regulation was integrated into ORR, and experience indicates this has at best not made much difference. It should be separated out again.

The granting of licences remains to be determined, including adjudicating on whether applicants are fit-and-proper. In the case of electricity supply, it is not clear that this has been particularly well done by OFGEM. Lots of other areas of the economy are subject to licencing and government can either carry out these functions directly, or through a number of agencies. They can be conducted by the new system operators, if sectoral expertise is required, and whatever administrative approach is taken, there can be a common database.

The net result of closing down the existing offices would be considerable. These Offices all have their own staff, and each and every regulated body has its matching teams to deal with the regulators. The form of the Offices and the existing regulatory model encourages lots of lobbying and rent-seeking behaviours, which competitive auctions significantly reduce. The system operators will be much harder to capture than the Offices. For example, capturing the capacity auctions conducted by the system operator in National Grid is a tough challenge, though even here a number of large incumbents campaigned and lobbied over the terms offered to embedded generators. They will always try to influence the auction design, but they will struggle to influence the outcomes once the terms are set, and competition law will curtail some of the most blatant examples.

11. How is the SRM applied to each of the main utilities?

It is well beyond the scope of this paper so set out a detailed blueprint for all the utility and infrastructure sectors. Each of the four main ones – water, electricity, transport and communications – are appropriate candidates to roll out the SRM, and by explaining some of the high level applications, the SRM model can be shown to be a marked improvement on RPI-X regulation and the way it has evolved over the last three decades.

In this section, particular attention is paid to water and electricity. In part this is because they are both examples with very clearly defined networks, and because the way forward has already been defined at least in outline. For railways, the application is complicated by the public ownership of Network Rail and its combination of functions and also the badly designed train operating franchises. Yet for rail, the case for a system operator is a necessary condition for allowing the industry to regionalise on an integrated basis, and at the same time to maintain coordination between these regions. In communications, the recent debates about Openreach, and the role of infrastructure competition for broadband and fibre have confused the provision of these investments and services, from their allocation and financing. Again the SRM helps to clarify,

simplify and enhance competition. In both the rail and the communications cases, the issues are set out, but not to the level of details provides for water and electricity.

(i) Water and Catchment System Operators (CSOs)[1]

The water industry is organised largely on the basis of catchments. These are quintessentially systems: what happens in a river depends upon what happens in the whole system, and groundwater is also a system. Rivers are also waste disposal systems: they carry soil, chemicals, waste water and sewerage to the sea. Estuaries too are part of these systems.

The privatised water companies, after the break up of the functions of the public sector Area Boards and the creation of the National Rivers Authority (NRA), became one quite narrow dimension of the water systems. As they are configured, and with their licence obligations and the narrow focus of OFWAT, they act as silos within their catchments. They are not responsible for flooding, for land management, soil erosion or chemical run offs, and these are only important to them to the extent that they impact on the licence functions. Indeed parts of the industry are fragmented further by being water-only companies, separate from sewerage.

This is inefficient and results in excess costs and inferior outcomes. The public subsidises farmers rather than making them as polluters pay. As a result, water pollution from land management is excessive. Water companies then face higher costs to remove these pollutants, and water bills are higher than they need be. Similarly, flood defences take the activities of water companies as given, and in the main also take farmers' conduct as exogenous.

A catchment plan starts with the catchment system as a whole, builds models of its behaviour, and focuses on optimising the joint water-sewage-floods-land use

[1] Helm, D. (2015) Catchment management, Abstraction and Flooding: the case for a catchment system operator and coordinated competition. Paper 2.

as well as bringing the biodiversity elements into play, as enshrined in the *25 Year Environment Plan*.

No system is entirely ring fenced, and there are some problem cases in this specification of the domain. The south-east depends more on ground water, and the origins of ground water, and its quality and pollution can stretch across catchments. There is no precise and discrete division to be made. What is needed is something practical and workable, rather than theoretically precise.

The obvious way to do this is to go back to the original Areas Board domains, which were largely carried over in privatisation. This provides around fourteen major catchments. For the rest, some tidying up may be appropriate, and some further integrating of sewage and water services might be appropriate. But broadly the structure of the water companies follows into the systems domains.

There are border issues with the uplands and the National Parks and with marine bodies in estuaries where there are impacts from the quality and quantity of water flows. These need to be pragmatically handled. They might be subject to MOUs and other agreements.

Duties and function of the CS0s

The CSO is a public and not private body. It is responsible for developing and maintaining a systems model, covering water, sewage, flooding and pollution from land into water systems. It should include the main relevant goals within the *25 Year Environment Plan.* The systems approach is the basis for the catchment plans.

The CSO has the duty to ensure that all (or technically almost all) those within the domain of the catchment have access to clean drinking water and to take away sewage. It has a security of supply and a USO duty. In addition, it has a duty to ensure that flood risk is managed, and to ensure that farming and industry in the catchment are managed in line with the polluter pays principle.

On agriculture, the CSO could administer the subsidies to meet the public goods for public money principle and to advise in respect of planning on net environmental gain. Both would require the application of its modelling capabilities to inform on the most efficient outcomes.

With these primary duties, in part carried over from the current water company licences and in part taken over from the EA and from the Rural Payments Agency (RPA), the CSO then has the duty to ensure that these functions are carried out. Where possible these should be achieved by invitations to bid, auctions and the awards of contracts (see below).

The EA would be shorn of its flood defence responsibilities, and these would be handled on a catchment basis by the relevant CSOs. Flooding is a catchment phenomenon and the CSOs are best placed to address it.

Coordination between CSOs

With say fourteen CSOs, there are a limited number of areas where coordination between them is required. An obvious example is for bulk water transfers. To meet this requirement, a national system operator could be created, though in the water case largely as a college of the CSOs, and with a limited role to share resources, and focus on those aspects that affect all of the catchments.

It is effectively a water council, and it could take on some broader public responsibilities, notably in respect of advising government on policy, and R&D. Depending on how environmental protection is handled more generally across the whole economy, the national water council could also integrate the Drinking Water Inspectorate (though this would be better placed in a national Environment Protection Agency, as a successor part of the EA after the flood defence functions had been taken away from it.)

Auctions and contracts

How would the CSOs ensure that the functions are carried out (largely by other parties) and hence its duties are met? The answer is that the CSOs act as procurement bodies, and use the various tools of procurement to achieve the desired objectives and outcomes in the catchment plans.

There is no presumption that this will involve lots of providers. It might, but the starting point is the existing major companies, and the water companies are by far the largest and have the greatest capabilities. Initially, until a larger procurement market arises (which the SRM would encourage), it is likely that the CSO will contract with water companies for many of the catchment requirements. At the limit, this is what OFWAT and the privatised companies do at present: OFWAT agrees a five-year contract at periodic reviews with the companies, setting prices and a host of ancillary incentives and outputs.

Note one difference immediately. In the CSO case, the duties that are currently in the water company licences are formally with the CSO. The CSO discharges then by contracting. By contrast at present the water companies have the duty to do these, and OFWAT has the task of agreeing the price.

In the early days of the CSO model, the differences are unlikely to be that great. But over time they will diverge and perhaps markedly. The reason is that there is no duty on the CSO to give the contracts to the water companies in whole or in part. In theory anyone can bid for parts or all of the required works. Water companies will also have a potentially larger market to engage in. They will, for example, be able to bid to carry out flood defences.

The wider set of competitors has many advantages. It allows not only a direct challenge to costs, but also to technologies and system wide approaches. Natural capital approaches can bid against hard concrete, farmers can bid to hold flood water or to enhance the holding and absorption of water and reduce pollutants. Note that many of these approaches are already being experimented with, but

within an institutional and contracting framework that makes them more difficult and costly to achieve. The CSO is therefore an engine for competition, integration and innovation.

Auctions work best when the outputs are neatly defined, and there are many bidders. For some activities in the catchments this condition is met. The contracts let by the CSO might be framework contracts, allowing the contractors to subcontract. This is what effectively happens at present through the periodic review. Not knowing which route to pursue at the outset is a frequent problem confronting larger projects across the economy. The obvious way to tackle this is to start with expressions of interest, and to engage with potentially interested parties, allowing the CSO to refine its contracting and auctioning approaches. It can also learn-by-contracting, starting with bundled contracts closely following the periodic reviews approach and then experimenting with new options.

Ownership of the assets and the RABs

Privatisation transferred ownership of the assets to the new private companies. In practice, these became in large measure transferred to pension and life funds and infrastructure funds. The core part of this ownership value in the assets is represented in the RABs. In other ownership models, the assets remain in the hands of the state or the local municipalities, and their use is franchised out. In the UK, railways follow this pattern, as we shall discuss below.

How does the RAB model fit into the CSO contracting model? The answer lies with the nature of the RABs themselves. As noted above, they comprise two parts: the value of the assets the investors initially purchased at privatisation, plus additional CAPEX not paid for out of current customers' bills. The former is strictly a legacy asset, and can be sterilised and isolated. Under Labour's approach it would be bought back by the state and replaced with government bonds. But it could remain a charge on customer bills through the use of system charge.

For new CAPEX on a pay-when-delivered basis, it represents what in any other contract would be a long-term contractual commitment to meet the average rather than the marginal costs. For example, the contract to build the Thames Tideway is rewarded through a RAB in Thames Water. A contract to build a hospital or a school similarly needs a commitment on the part of the purchasers to remunerate efficiently incurred capital cost. The RAB is just a particular – and very important – long-term capital contract.

For all new flood defence and water capital contracts (and these include contracts for investments in natural capital too), the RAB-related capital components can be met with in the auctioned or otherwise let contracts. For contracts on a larger basis for existing water companies, the framework contract could contain the capital commitments, which the RAB represents. Alternatively, as in the franchise and also Labour's model, the assets and the RAB could be carried over to the CSO. This has some advantages, not least for the cost of capital, but it makes the CSO a substantial financial player, and moves away from the small, tight and focussed system operator model.

The RAB reduces the risk of stranding assets. Minded through the duty to finance functions that lies with OFWAT, it makes stranding of investment efficiently entered into and assessed through the periodic reviews all but impossible, since in principle at least the owners of the RABs have significant legal protection. For the past and future assets, the CSO can replicate this, provided there is an inescapable charge that system users have to pay – a use of system charge. RABs can be carried over to the CSO model in whole or in part, and the problem the RABs address can be dealt with through contracts, which mimic the RAB commitment. They can even be traded, as suggested above.

The systems charge and raising revenue

Where would the CSO get its monies from to pay for the auctions and negotiated contracts? The answer is from a use of system charge, a common feature of all

infrastructure system charging regimes, whether explicit or implicitly recognised.

A use of system charge recovers the fixed and sunk costs of that system. These costs are non-marginal. In order to be provided with water and sewage services, there typically needs to be a river and treatment works and a sustainable system ecology. In this sense, given the existing systems and their assets, the marginal cost is zero, whilst the average costs are much higher. A system is therefore, in effect, a public good in the economic theoretic sense.

In the existing catchment systems, this use of system charge is recovered from multiple sources – from taxpayers financing the EA, from water customers bills, and from taxpayers subsidising farmers. Multiple payment channels do not make the costs go away: in the end individuals end up paying in their various ways, and notably as customers and taxpayers.

The total system costs of a catchment should be brought together under one revenue requirement by the CSO. This establishes the "facts". Subject to its duties to secure supplies and the USO, the CSO aims to minimise this number. There is then a secondary issue about from whom to raise this sum. This has significant political elements, as it does at the moment. The government, and in particular the Treasury, through the Comprehensive Spending Reviews (CSRs), decides how much taxpayers' monies will be made available to the various players. The CSO takes this on board, and then sets the remaining use of system charge as part of the bills for catchment customers and for catchment services.

There will remain some marginal costs, and some catchment users will be non-discrete and large, such as large farmers using intensive irrigation and requiring large scale effluent treatment, and larger industrial water users. The road bodies, both nationally and locally, will also have pollution and flooding non-marginal impacts. These can be charged directly and the CSO could have a duty to recover these costs too.

Abolition of OFWAT and periodic reviews

In the CSO model, there is no role for OFWAT. The periodic reviews are abolished. The CSOs takes on the catchment planning, and the business plans of the companies become the bids of the companies for the contracts from the CSO.

The time consuming and costly periodic review processes are reduced. The bids summarise the companies' take on the costs, including the cost of capital. These are market outcomes, and do not need to be set by the regulator. The catchment plan shapes the requirements, and the business plans are replaced with bids, and these will not in due course be single bundled ones.

In the evolution of the new CSO model, the initial contracts are likely to be won by the incumbents. It can then be argued that some of the periodic review functions will need to be retained, notably on the RAB and cost of capital. These will be done by the CSO. There is no need to retain OFWAT for this. Furthermore, even in such areas as the cost of capital, it will be possible early on to invite other water companies to bid in each catchment, and it will also be possible to encourage tradable RABs.

The efficiency gains from the abolition OFWAT will be considerable. It has developed a large bureaucratic regulatory process. The companies have all developed parallel regulatory teams, and employed armies of consultants, lawyers and other advisors. As noted, the first consultation of the current periodic review ran to 3000 pages. It has, like all such bodies, grown its scale and size. It has engaged in trying to shape corporate governance, in the vetting of non-executive directors, and in trying to determine gearing. Some of this remains for the CSO, but the great merit of using auctions and competition is that much of this can simply disappear. In a competitive framework the regulator does not need to fix the cost of capital or the governance of the companies. These are outcomes of the bids themselves.

(ii) Electricity and the National System Operator (NSO) and the Regional System Operators (RSOs) [2].

It is easy to see the electricity network as a system, or rather a set of regional systems linked into a national grid, and into other countries' grids too through interconnectors. The system nature is all the more essential because until very recently electricity could not be stored, and even now it remains the case that large-scale storage is the exception rather than the rule.

The electricity system comprises a high voltage network, run by National Grid, and a series of regional or local distribution networks, all connected to the national grid.

At the national level, there is already a national system operator, owned by National Grid, but with internal separation within National Grid. The national system operator (NSO) runs the capacity auctions, to ensure that the security of supply is met with sufficient generating capacity. It does not have a national system plan, and the grid itself and its investments are determined through the business plans of National Grid, subject to the periodic reviews conducted by OFGEM.

In the SRM, the NSO would be separated from National Grid and be in the public and not private sector. It would be the holder of the system plan, both for generation and networks. It would auction both. In the case of the former, the competition is already intense; in the case of the latter competition is limited to enhancements, bits of discrete networks and for ancillary services, including system balancing, system level storage and large-scale demand management.

RSOs do the same things at the local level, but here the scope for competition (and innovation) is much greater. To meet the security of supply requirements,

[2] The description below draws on the framework set out in the *Cost of Energy Review* 2017.

local systems can draw on small-scale generation, local storage and batteries and local demand side management. Indeed the rapid development of all these technologies means that the very definition of distribution becomes unclear. Therefore at the local level the need for separate licenses and separate regulation of distribution, generation and supply breaks down.

The scale issue arises at the regional level. There is no right answer, but as the networks have developed around first the nationalised Area Electricity Boards, and then the Distribution Network Operators (DNOs), the existing domains are the right ones upon which to build the Regional System Operators (RSOs).

Coordination between system operators

There needs to be coordination between the NSO and the RSOs, since the capacity auctions are organised at the national levels, and RSOs will need to take the outcomes of these auctions as given.

In the pre-privatisation world, there was an Electricity Council to coordinate the industry and something similar would be appropriate in the SRM. This need be little more than a meeting place and to ensure information is made available. In practice, the smart meter data will help to identify any problems of domain overlap and Artificial Intelligence helps to identify the best coordination of the systems.

Auctions, contracts and RABs

The NSO currently runs a capacity auction, with the Feed in Tariffs (FiTs) and the Contracts for Differences (CfDs) being determined by the government. In the *Cost of Energy Review*, I proposed that this capacity auction be expanded to include all capacity and be conducted on an Equivalent Firm Power (EFP) basis.

For the NSO this is an extension and formalisation of what already happens, but with powerful incentive impacts on the intermittent technologies. Currently, the

NSO first de-rates the renewables, and then auctions the non-renewables. In the EFP auctions, all technologies bid in, with their associated de-rating factors. The job of the NSO is then to make sure that the bids add up to the least cost way of achieving the desired capacity – to meet its obligation to provide security of supply.

For the intermittent, de-rated technologies, there is now a powerful incentive to try to find offsetting opportunities to raise their degree of firmness. They can invest directly in back-up technologies, do deals with standby peaking plants, with storage and with the demand side. The neat feature of the EFP approach is that it places the incentives on those who cause the intermittency.

It remains necessary to make sure the auctions add up to the carbon budgets, and here there are two approaches: a constrained auction; or an unconstrained one but with a full carbon tax set at the level necessary to meet the carbon budgets.

At the RSO level, the responsibilities in auctions are to ensure both local security of supply and the USO. To meet these requirements, the RSO has networks, and local generation and local storage and local demand-side measures to draw upon. Thus the local EFP approach is much richer, and brings all the components of decentralised electricity systems into play.

Eventually the RSO will simply auction the security of supply in the form of the EFP required, adjusted for the USO. But the path from here will need to be evolutionary, and the starting point is to address the DNOs and their monopoly on network provisions. The licence conditions will have passed largely to the RSO, and hence the RSO can auction the network periodic review as a whole, or better in parts. It can invite bids from local generation, storage and demand-side where and when these can offer alternatives to enhancing the local networks.

Abolition of OFGEM and periodic reviews

The NSO and RSO models get rid of the need for OFGEM to carry out periodic reviews. Instead of OFGEM going through an intense process every five years to design a forward looking fixed-price contract for the next period, the NSO (for the national networks) and the RSOs take on the roles of ensuring the objectives are met, where possible through the auctions.

It is already apparent that the periodic reviews coming up are all but impossible to do in the conventional fixed format. OFGEM recognises that there is considerable uncertainty, and this is indeed a core feature of the next decade, as technological change, decentralised energy systems and electric vehicles provide significant disruption. There is little point in a five year fixed-priced contract. The auctions allow the RSOs to respond as they go along, as indeed the NSO already runs annual capacity auctions of varying timescales into the future.

OFGEM like the other sector regulators of the utilities has grown and grown since privatisation. Regulation is not a static activity: each intervention throws up unintended consequences, which leads to more regulation. Institutions get bigger, and their managers and employees benefit from this growth process. In turn, this encourages more capture by the incumbents, and it is not surprising that the results are as they are.

The NSO and the RSOs are a great simplification. They define what is required on regulation. They shift as much as possible to auction, and they unwind three decades of growing intervention. Better still, by focussing on the exact problems that require intervention, they are likely to be better at doing the job.

Use of system charges, customers and revenues

The NSO/RSO model, like any regulatory model, requires that the costs are met, and in particular the costs of the auctions (which now include distribution as well). The charging base is the use of system charge, and we already have in place a regime for recovering the costs of the networks and the NSO capacity auctions.

Cost recovery is thus assured. What is less determined is who across the customer base should pay what proportion of the fixed and sunk costs, given that the marginal and average costs are far apart. The answer is, as it always is for networks, a matter of choice. It can be by the market, which will result in some form of Ramsey pricing. The Ramsey rule has the great merit of ensuring that the incentives to defect from the system are reduced to the marginal costs. (They are clearly much greater at present). The disadvantage is that it punishes those who are loyal, and inelastic in demand. This is where the USO comes in, which if broadly defined is providing access to citizens at prices they can afford. In other words, the USO may point in exactly the opposite direction to that of the Ramsey rule.

This tension has to be resolved. Someone has to decide. It is obviously that this is not a choice that should be left to the private sector. It is a public interest question, and this is an additional reason why the system operators should be in the public and not the private sectors.

(iii) Opportunities to use the SRM in rail[3]

The rail industry is widely viewed as having failed to deliver at reasonable costs the level of services that can reasonably be expected. In most industries, if the demand doubles, and yet it is serviced by quite a lot of the existing assets, this would be deemed a very attractive economic situation. The stations, the tracks and the signalling are not that dissimilar two decades after privatisation and the prices have increased significantly in real terms, and yet the industry is repeatedly in crisis. This ought to be a situation of falling prices and self-financing investment. Instead it is one of ever growing (and unsustainable) debts for Network Rail (NR), and repeated failures by TOCs. No one seriously thinks NR is going to replay the roughly £40 billion it has borrowed.

[3] See Helm, D. (2015) What to do about the railways? Cross Regulation Network. Paper 2.

The response to the repeated crises has been to launch one review after another, and to tinker with the framework. With the Treasury explicitly trying to move the costs of the railways from taxpayers to customers, there has been a reluctance to abandon the train operator franchises, and to address the high customer prices. NR has been repeatedly pressured to cut costs, and it has had a series of bruising project failures, the most recent and terrible example of which is the electrification of the Great Western Line.

The tinkering approach has failed and it will go on failing. The problem is not one that needs a bit of fine-tuning to sort the railways out. The problem is fundamental to the industry architecture.

The National Rail System Operator (NRSO)

The starting point is to set up a NRSO and split it out from NR. The NRSO would perform the coordination functions between the regional networks, and it would make sure that elementary things like national ticketing are in place. It would develop the network plan to set out what system is to be supplied, conditioned by the USO as defined by Parliament. It would be the owner of the timetables.

The NRSO would be responsible for auctioning the franchises and the operation and enhancing of the rail networks. This would at a stroke open up NR to competition, and it would enable the TOCs to explore other business models, including vertical integration. This would replace the periodic reviews for NR, which are at present really the state telling a state-owned industry what it should charge, against the guaranteed funds, with competitive bidding to do substantial parts of the network services and enhancements. It would free up the TOCs to bid to do some of this work, alongside others who may want to enter this market.

This would sidestep the nationalisation issues. It would be the state, acting through the NRSO that decided what the system should look like, and NR would be able to bid for the works alongside others. If nationalised companies are more

efficient than private ones, then they would win. But if not, then others could step in. Consider for example the GWR network. Is it better for NR to do the electrification and the associated signalling and the upgrading of stations, or would GWR better placed? Or is some other rail company better?

The neat feature of the SRM applied to rail is that no one has to make a black-and-white choice of preferred structure: it emerges from the bidding processes.

The NRSO would let these contracts on appropriate timetables. There would be an abandonment of the NR periods. The GWR example above might be for a much longer period. Other dimensions, like managing tickets, could be on much shorter periods.

Many of the features of the rail system operator model have features in common with the previous Strategic Rail Authority (SRA). The NRSO would auction the franchises as the SRA was supposed to do (or perhaps parts of them, whatever proves the best way of achieving the overall objectives of the railway system). It would do this alongside the replacement for the periodic reviews in respect of the core networks. The previous SRA and ORR were kept separate, and in practice there was an element of regulatory competition between them. (This is reminiscent of the battles between the NRA and OFWAT in water).

Unlike water and electricity there would remain an element of public subsidy for the railways. This is because the USO as currently defined is a binding constraint, interpreted as providing access at the periphery especially and at prices people can afford to pay. The USO is bound to lead to a network extended beyond the profit maximising level, and with some subsidised customers. This tension goes back to Beeching Report – how far and to what extend should the periphery of the railway network be retained and indeed extended.

Yet even in the territory of the subsidies, there are more efficient ways in which they could be deployed. The costs of the railways arise in a system context. The connectivity of the system enhances the value to each bit, the marginal costs are

below the average most of the time, and the beneficiaries are national, given that the existence of a network provides everyone with options even if they do not always take them up. In addition, the railways have wider externality and public good benefits, and some downsides too. They underpin the wider economy and its productivity, and they can at least in theory play a part in reducing emissions. Finally, the railways pass through their track charges, whereas motorists pay a vehicle licence fee, so there is no common and level playing field between road and rail.

Once the total subsidy has been added, the question then is who should pay the fixed and sunk costs of the network, especially for periods when the marginal costs are very low. This, like the allocation of these system costs in water and electricity, is one with important public dimensions, not least when the USO comes into play. It is not a decision for the private companies: it so for government, moderated through the NRSO.

Once the NRSO is in place, there is an important question about the systems operation for the regions, and here a regional rail system operator (RRSO) is again appropriate – or a regional transport system operator. These would have regional rail plans, just as there are road plans, and they would auction out as much as possible of the required functions not already covered by the NRSO.

There would need, as with water and electricity, to be a coordination between the RRSOs and the NRSO, and some form of Rail Council would be appropriate.

(iv) Possibilities for the SRM in communications[4]

Whereas water, electricity and rail are examples of existing systems that need to be managed and enhanced at the margin, communications is largely about new and emerging networks, notably for 5G, broadband and fibre. Even mobiles are

[4] See Helm, D. (2016) The new broadband utility and the Openreach debate, Cross Regulation Network. Paper 4.

still far from comprehensive networks. Communications is about infant infrastructures being grafted on top of existing ones.

Just as what the Victorians put in place for water and sewage, and what the public Central Electricity Board from 1926 and the subsequent fully nationalised electricity industry created in 1947, has shaped everything that has followed; so decisions about the provision of 5G, broadband and fibre will live with us for decades to come.

In creating new network systems, there is a tension between letting companies get on with whatever they think is appropriate and setting out the national requirements. The private sector, left to its own devices, will for example roll out fibre to those customers it thinks can pay, and especially where those customers may be forced to pay as a consequence of the creation of new monopolies.

New infrastructure takes time to scope and then define the USO. David Cameron proposed a broadband USO back in 2011. A fibre USO is some way off, and may be partial for possibly all of the next decade. What is important here to recognise is that the private and the public definitions of the networks will not be identical, and because communications are vital to a modern economy, and because good access to fast broadband is increasingly essential for citizens to participate in society, there is an inevitable public element.

In creating the water, electricity and rail networks, this national definition was imposed through nationalised industries with statutory monopoles. They could decide what would be built, and they could decide who could pay. There was no competition.

One answer for broadband and fibre would be to follow the same monopoly (and even the nationalised model). It is what BT did as part of the GPO for fixed line services. The government could specific the USO, draw up a plan for investment and designate a company to do this. At times this model was toyed with, considering Openreach as part of BT as the vehicle.

For a variety of good and some bad reasons, this is not the model that has been chosen. Instead Britain has adopted a halfway house. It is neither a full blown competitive free for all, with little or no regulation, nor a monopoly model. It is in between. The result is considerable confusion about the role of Openreach, about what access to Openreach assets should be provided to all participants in the market and at what cost, and about who and how the uneconomic parts of the network enhancements should be provided.

One way of cutting through this confusion is to recognise that neither corner solution is appropriate. The deregulated liberalised competitive investment model cannot meet the USO, and would result in lots of local quasi monopolies, duplicated investments and higher costs. A liberalised competitive market does not sit well with essential networks systems. On the other hand, few consider that a monopoly for Openreach would work well. The inherent problems with the monopoly model are compounded in the case of BT because BT is constrained by its dividend policy and its pensions deficit. In effect, the level of investment would be limited by these two constraints, not the public interest. Worse still, BT has an interest in protecting revenues from its fixed lines and copper wires.

If neither of these corner solutions is attractive, how should broadband and fibre proceed? Can competition for the provision of networks be combined with creating the optimal public networks? The answer is to utilise the system operator concept to define and plan what is required, auction the contracts, and ensure that the systems that result are coordinated. Access to the existing ducts and poles would be required.

In this context, the competing private companies – from BT to Cityfibre, Gigaclear, Virgin and so on – would bid for the contracts to roll out the networks, to meet the overarching plan. Much of this is in fact in place, though overly complex in form and application. There are some auctions for subsidies to roll out broadband and some largely implicit subsidies for fibre, but these are far from well designed. There is no prohibition on others rolling out networks on

top of those created by winning bidders. Indeed so threatening is this possibility, that it can be a serious deterrent to bidding.

The further difference between a system operator model and the current one is that it cuts through the complex and detailed problems of regulating Openreach. Arguably with a fully functioning system operator, the split of Openreach and BT and all the problems of trying to pretend they are separate businesses could be much reduced. What is separated is the system operator functions, and with them the planning of the system as a whole. This is a public not a private activity. It remains to provide open access to Openreach's assets, and make sure that the bidding process for the new enhancement is open to all. Open access should be made a condition for not only Openreach but also of all contracts.

(v) Coordinating airport investments through the SRM

The nationalised structure for airports bundled the south-east airports – Heathrow, Gatwick and Stanstead – into a single BAA, with a single overarching planning framework for the operation and development of aviation in the south-east.

Privatisation led to the break up of BAA. There is no significant planning or coordination in this wider sense now between the three airports. Each tries to maximise its own profits. Cross subsidies, such as those that underpinned the early development of Stanstead, have gone.

Competition between the airports has arguably increased efficiency well beyond what would have happened if they had remained in the public sector. But it has not solved the problem of increasing capacity to meet increased demand. Heathrow and Gatwick are competing to build new runways. Stanstead has not entered into this game, although it has considerable excess capacity.

Since airport expansion is about much more that the concrete for a runaway, and includes surface transport, an airports plan should incorporate a national

perspective on where roads and rail links should be added. One option is to patch in some enhancements to the M4 and to the Heathrow Express, Crossrail 1 and HS2 into Heathrow. A second is to build a substantial surface transport set of links to Gatwick. A third is to build a new railway to Stanstead, and align this with major housing developments to the north east of London. Finally, a very bold plan would be to take HS1, link it to HS2 and develop the south side of the Thames to the east, and incorporate a new airport.

This is not the place to examine the merits and demerits of each or any of them. It is rather to note that under the BAA south-east airports model, the location of new roads, rail and airport capacity would have been part of the south-east system plan, and that in turn would have been integrated with the spatial planning for new houses and other developments.

In the absence of a systems plan, it is unsurprising that airport enhancement has become a mess, with the failure to execute any of the options, and little progress with the surface infrastructure. If ever there was a need for a broad system plan, this is it. A south-east system airports operator (SSAO), taken out of the CAA, would have been responsible for coming forward with an integrated plan, and we would not have been through the Airports Commission and numerous other exercises which have yet to produce much by way of results.

National Air Traffic Control (NATS) runs air traffic control and is of necessity an integrated service. Under the air SRM, NATS would fit into the airports plan, developed in line with the airports system enhancements.

10. How can the general SRM be implemented?

There are two ways of going about implementing the SRM: to do it via primary legislation; and to evolve the system operators within the existing framework, and then eventually legislate.

There are good reasons for doing the job properly from the outset. After 30 years, a thorough reform of the utilities legal framework is in any case due. The Labour Party has put substantial reform at the core of its next manifesto and it plans to legislate not only to renationalise the water, rail, post and parts of the energy industries, but in each case it is developing far reaching proposals for their subsequent structures, finance and regulation. The government is toying with the merging of the regulators together.

Strictly the SRM can accommodate any and all forms of ownership, and in most cases there is already mixed ownership. Water has a not-for-dividends Welsh Water, and nationalised companies in Scotland and Northern Ireland. Rail has the nationalised Network Rail, and directly contracted franchises, many of which are European state-owned railway companies. Electricity has some community owned small ventures and there are a variety of ownership structures for specific smaller generators.

A core argument of this paper is that the problems that have arisen, and the overall poor state of Britain's infrastructure noted at the outset, are not primarily caused by private ownership, but rather by serious and persistent failures in regulation. The choices facing the government in challenging Labour are about not only the ownership, but also about regulatory models. The attempts to persist with the RPI-X legacy model, and doctor and patch it up with ever more sticking plasters, are unlikely to work. They are neither economically nor politically convincing.

The SRM separates out ownership from control, and places with government those things which only government can do, whilst maximising competition to ensure that what government and therefore the public interest requires is delivered as efficiently – and therefore as cheaply – as possible.

Some of the architecture for the SRM is already in place, developed in a piecemeal fashion since 2010, and in many cases building on what was already developing under Labour prior to the 2010 general election. Government has

gradually taken a more proactive role in planning infrastructure. The big early steps have been in developing a National Infrastructure Plan, and translating this into sector planning statements.

The missing bit is how these plans are translated into the CAPEX and OPEX for each of the systems – how the high level objectives are translated into plans that actually get delivered. Most regulators are required to take account of "guidance" and in practice all listen carefully to government and the relevant departments. But none on the government side has come up with serious and effective system plans, for the very good reason that they need data and understanding of the sector detail to do this.

This leaves a gap. At present the companies come up with the plans against their licences and statutory duties, and the regulators have the reactive job of reviewing them, and deciding on the basis of the companies' plans what the prices should be for the periodic review fixed-price fixed-period contracts.

This is the wrong way around: the SRM places the duty to come up with system plans with the system operators not the companies. They will of course consult them, take advice and go through a process of refining them. But the principle guiding hand is the public interest and, as the key intermediaries, the system operators should be in the public and not the private sector. If government wants control, then the system operators cannot be private, and in particular cannot be owned by the very companies who will be bidding to do the works.

The best way to implement is to set out the system operators in statute with clear statutory duties to deliver security of supply of the services and the USOs. This in turn requires a recasting of the licences, and these should be reduced largely to fit-and-proper requirements, including rigorous accounting standards, reporting and, where relevant, bonds and other sureties in the case of breach of contracts.

The legislation would either abolish the current regulatory offices altogether or, where appropriate restructure them. Thus OFCOM's functions would be significantly reduced in scope, as would those of the CAA. For OFGEM and OFWAT, it might be appropriate to merge them into a single small network office, but it may be better and simpler to transfer the competition functions to the CMA and the analytical and empirical expertise to the relevant system operators.

The second route is the one that superficially appeals, because it requires the least immediate effort. It is however fraught with the danger of capture, and it will not reap the full benefits of the SRM nor take away the wider political and public pressures on the utilities themselves. Crucially it will not address the Labour Party's challenge.

As the path of least resistance, the second path starts by setting up system operators *within* the existing private utilities. We already have the system operator inside NG, running the capacity auctions. The DNOs are rushing to create DSOs, to head off the separation of this function and hence their loss of control over the processes and the exposure of some of their networks to challenge and competition. Water companies have started to engage in auctioning with other catchment players, notably farmers by paying them not to so grossly pollute the water supplies. EnTrade, set up by Wessex Water, is the leading example. NR has set up an internal system operator to address ticketing. Openreach incorporates a number of system operator functions. The Airports Commission has tried to do some airport planning, and we have had numerous rail reviews as well as energy policy reviews.

What this weaker path could achieve is to set up shadow system operators, and carry out their functions within the existing regulatory regimes. The existing regulators might like this: it provides the opportunity for them to morph into system operators themselves and hence avoid the fate of being abolished. This creates an unholy alliance of interests to capture the SRM proposals: the Offices survive and adapt, and the incumbents capture the practice of system auctions.

Some point out that the internal separation model has been tried in the past, and over time morphed into formal separation. The usual example given is the splitting up of British Gas and the divestment of networks within vertically integrated businesses. The argument is then extended to NG and BT. Over time, it is argued that regulators will make the internal separation of functions so onerous that National Grid and BT will respectively divest the NSO and Openreach. Similarly if DNOs set up DSOs they can eventually be split off.

The problems with this approach are many and obvious. First, the incumbents will shape the system operators, which are then divested. Any organisation is a product of its history, and these system operators will be no different. They will have been internally captured before being set free. Second, the divestment needs to be to a public body not a private one, and this needs to be established by statute. Even if they are transferred to the Offices (which for a number of reasons is actually unlikely) there will have to be a change in the functions and duties of the Offices, and this will require legislation.

But it is the third problem that dominates. The evolution inside the existing companies and existing regulators will take time, and there is not much of it. Not only is the clock ticking down on the next general election and Labour's challenge, but there are urgent system decisions which need to be taken quickly. Britain needs to sort out its airports, it needs to roll out universal broadband and fibre (and indeed complete mobile networks), it needs to re-integrate its railways, it needs to address both the closure of coal power stations and now the capacity gap left by less nuclear, and deal with electric transport and decentralised and digitalised electricity systems. Finally, it needs to urgently get on with integrating farming and other land use, flood defence and the provisions of water and sewerage services as the population and the housing stock rise. The costs of delay are real and immediate.

For Labour, nationalisation will not solve the system planning requirements and it will not obviously improve efficiency. Indeed, by reducing competition to deliver the services it may actually drive costs up. Labour will need to address all

the issues that the SRM does, and it will discover that the regulation issues are not solved by ownership.

11. Conclusion

This paper has set out an alternative regulatory model to that of RPI-X and its various subsequent incarnations, and rate of return regulation. The SRM is much more pro-competitive, and it gets regulation and regulators out of many of the absurdly complicated periodic review processes. Over time regulation can stop trying to micro manage the companies, get out of the boardrooms and trying to second-guess capital markets.

In place of the detailed minutiae of current regulation, with its armies of regulators and company regulatory teams engaged in the regulatory game, the SRM goes back to basics. It focuses on what are public interest matters and does this in the public sector, and uses the private sector to deliver the required CAPEX and OPEX. It is strictly neutral on ownership models. Instead of reams of duties, functions and licence conditions, it focuses on just two: security of supply (making sure the services are delivered now and in the future) and the USO. Environmental and social factors are all integrated into these two duties: what is securely provided has to be sustainable and consistent with the *25 year Environment Plan* and the *Climate Change Act* for example; and the USO incorporates the needs of less well off and more geographically remote citizens.

Above all these considerations, the SRM provides the best chance of getting Britain's infrastructure into reasonable shape, so it can underpin the broader economy and its productivity, and ensure that all its citizens can fully participate in society, from internet banking, to engaging with the state, to being able to reap all the benefits of a decentralised energy and electric transport systems. Britain does not have to have poor infrastructure, but it will not fix itself of its own accord. Government needs to decide what is required, and then it needs the mechanisms to translate its overall infrastructure plans into planning statements

and into actions in each of the systems. This last step cannot be done effectively without system operators.

The reforms proposed here would be more competitive and less bureaucratic than what is currently in place. Failure to follow the SRM is likely to result in this gap between public policy and practical delivery getting ever wider, and because of the widespread and often justified criticisms of the current performance and the conduct of the utilities in their monopolistic positions, it makes simple panaceas like renationalisation more attractive to the electorate. The emergence after 30 years of a serious campaign to renationalise is not an accident: it reflects deep unease about the failures of the existing regulatory regimes. The SRM makes ownership a subsidiary issue, and gets to the heart of Britain's problems with its infrastructure.