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► **To cite this version:**

Laura Solimene. Increasing complexity in electricity regulation: to whose benefit?. *European Review of Industrial Economics and Policy* , 2011, 2. hal-03469059

HAL Id: hal-03469059

<https://hal.science/hal-03469059v1>

Submitted on 7 Dec 2021

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Increasing complexity in electricity regulation: to whose benefit?

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After a short description of the evolution of incentive regulation, this paper explores some of the issues that have arisen with its implementation in the electricity sector both in the UK and Italy. It illustrates the challenge facing a regulator in implementing an incentive mechanism under imperfect information, and focuses on some distortions emerging as a result of the design of the incentive scheme itself.

Incentives, Regulation, Electricity

Introduction

During the 1980s, Britain was the first nation to introduce so-called incentive based regulation, in the framework of its broad-ranging programme of privatisation and liberalisation of public utility services. The development and extensive application of the price cap, which constitutes the core of this choice, has been recognised as one of most interesting regulatory innovations of recent decades, although it has not been devoid of criticism both by economists and policy makers. But the overall impact of incentive regulation on public utilities can be assessed only in the long term, as firms need time to adjust to the new context. Furthermore, time must be allowed for the independent regulatory authorities to acquire the necessary experience required for efficient choices.

Today, by virtue of the length of the period of application and the characteristics of the regulatory mechanisms governing utilities in the UK, this experience offers an interesting reference point for other European countries that are currently seeking to reform their public utilities sector. Guidance and stimuli have already been available for some time through the Directives of the European Commission, but a number of nations are still lagging behind in planning their reform proposals. The information now available concerning the accumulated experience facilitates an evaluation of the critical aspects of incentive regulation and the definition of any measures needed to fine-tune its application.

This study focuses on the electricity sector and discusses the main characteristics of the incentive based regulatory systems applied in the UK, highlighting their underlying rationale and the adjustments that have proved to be necessary over time. The paper also analyses some of the choices made by the Italian electricity and gas Authority (Aeeg) in order to examine the efficiency criteria adopted in defining electricity services.

1. Incentive regulation: origins and applications

Starting from the mid 1980s, growing awareness of the mediocre performance of nationalised industries, together with increasing doubts concerning the efficiency of some of the regulatory mechanisms that had been adopted, prompted a

reconsideration of the role of the state and its methods of intervention in the economy¹. This sparked a movement towards reform, with implications on a world-wide level, that began to transform the institutional and operational context as well as the organisation of firms that act as providers of public utility services.

Although economic research has mainly addressed the evolution of deregulated market segments, a large part of the reforms has involved the introduction of incentive-based regulation² for the segments of business that have remained under state control. The latter segments account for a substantial part of the total service price borne by the final consumer, and their level of efficiency affects the general performance of the sector as they supply the infrastructure for service provision.

In particular, in the electricity sector, the above mentioned changes have also included the growth of competition in the generation, purchase and sale of power, as well as substantial increases in efficiency, improvement in services provided, and vertical separation (of ownership or accounting) of activities that were previously conducted in vertically integrated structures. Finally, the new set-up includes a rigorous price fixing mechanism for activities – in this case transmission and distribution – still presenting marked features of a natural monopoly, due above all to geographic limitations on account of which, given the type of technology required, the concomitant activity of different firms within the same area is not feasible.

Behavioural regulation³ deals with the behaviour of firms, and seeks to influence their approach by imposing constraints or offering incentives. In the United States this form of regulation has mainly been applied through a system of constraints, the most important of which is rate of return regulation. In Europe, on the other hand, partly as a result of the inefficiencies observed in the North American experience⁴, preference has been awarded to incentive based regulation. In 1984, after considerable debate and investigation, the British Department of Industry was the

¹ In the early 1980s, public ownership of certain enterprises, above all in the public utilities sector, was considered as the “European answer” to the various types of market failure, such as the existence of public goods, natural monopolies and externalities, while price control and regulation were generally felt to be the “North American solution” to such failures. But the result of either of these approaches was elimination of competition from the market.

² According to Jamasb and Pollit (2007), the first case of application of incentive-based regulation dates back to 1855, with the passing of the *Sheffield Gas Act*, when a sliding scale plan for the city gas supplier was introduced. In this plan, shareholders’ dividends were to be linked to increases/decreases in the price of gas as compared to a pre-defined base level. In the United States the first application likewise referred to the gas sector, and dates back to 1906.

³ The distinction between behavioural and structural regulation is not always clearly delineated, as they do not rule each other out. Generally the information requirements are somewhat less stringent in structural regulation, and this form of regulation also determines which firms or individuals can operate on the market and in what line of business. However, it is usually not sufficient to achieve objectives of technical and allocative efficiency, which are obtainable by means of direct control over firms’ behaviour.

⁴ The effects of fixing an allowable rate of return on capital investment have been extensively studied, and their main defect, in addition to the elevated administrative cost, is the lack of direct incentives aimed at cost reduction. This is because the mechanism in question may induce a firm to engage in distortionary behaviour in order to increase its absolute profit level, without modifying its rate of return on capital investment. In particular, the firm may be induced to over-invest (Averch and Johnson, 1962) and to increase expenditures, that is to say, to refrain from limiting them (X-inefficiency). For an in-depth examination see Littlechild (1983) and Beesley and Littlechild (1989).

first to adopt a price control plan, known as the price cap, which was applied to the telecommunications sector. Subsequently, this was extended, with some variations, to other UK public utility sectors that were privatised between 1984 and 1991⁵.

In the traditional RPI-X system the regulator pursues a clear objective of achieving a balance between the operator's obligation to provide a service and the incentive to reduce the cost of supplying the service. The incentive resides in the fact that firms which succeed in reducing costs are allowed to retain part of the benefits for a given period of time. The effectiveness of the incentive depends on the length of the period during which the benefits can be privatised by the firm, and on their proportion relative to total cost reduction. However, application of this mechanism is not as simple as it may seem at first glance. The price cap is often incorporated within more complex incentive schemes which are intended to influence not only cost efficiency but also other aspects of corporate endeavours (the firm obtains an advantage from cost reduction, but the quest to achieve qualitatively higher levels tends to increase costs). Consequently, the introduction of the price cap must be integrated with these other objectives, also pursued by the regulator. Moreover, the problem of imperfect information cannot be ignored, as it lies at the root of the risk of possible strategic behaviour by the regulated industries.

It follows that an effective application of this type of price control mechanism is substantially dependent on the quality of the information available to the regulator. In order to make appropriate choices concerning capital expenditure, or to engage in benchmark definition for operating costs, and – last but not least – to identify any opportunistic behaviour by firms⁶, it is crucial to have reliable information. Furthermore, economists have recently pointed out that the incentives become less attractive to firms as the end of the regulatory period draws closer, and this is particularly true for capital expenditure (capex), as the incentives to reduce operating costs (opex) act with greater uniformity throughout the entire regulatory period⁷.

The importance of information in applying incentive-based regulation is confirmed by the prominent role of this issue in theoretical research over the past few years. Previous research in the context of regulated firms focused on price models based on the hypothesis of the regulator's perfect information concerning the cost, technology and characteristics of the demand. This approach has more recently given way to studies reflecting the attempt to incorporate imperfect information, which involves all subjects (genuine uncertainty) and also asymmetric information, which affects in particular the relation between the regulator and regulated firms. Theoretical economists have also examined situations in which the regulator's

⁵ In Italy, although the issue had been discussed for many years, it was not until Act of Law nr, 481 dated 14th November 1995, which instituted the Authority for public utility service regulation, that fixing public utility tariffs by means of this method was made compulsory, in Art. 2 Clause 18 of the aforesaid Act.

⁶ In the United Kingdom, for example, initially the importance of the data collection phase and of defining a uniform set of accounting rules both for operating costs and for capital expenditure was underestimated. This limited the efficiency of the incentive-based regulatory systems, and favoured regulated firms, which were able to benefit from their information advantage. Accordingly, in more recent years the regulators themselves have revised their activity and intensified efforts to draw up protocols capable of achieving standardisation of cost accounting.

⁷ See Gilbert and Newbery (1994), Owen and Brauetigam (1978) and Ofgem (2004).

attention may be diverted from pursuit of economic efficiency and may instead tend to favour the industry under its control⁸. Overall, however, until the mid 1980s incentive regulation was only scantily utilized, partly due to a lack of theoretical reference frameworks to support its implementation. The evolution of recent research has helped to overcome this deficiency.

In particular, the theoretical study of incentive-based regulation has developed hand in hand with contract theory and has aimed to formulate a precise definition of the regulator's objectives together with the appropriate tools to achieve such objectives. At the same time, theoretical research has addressed not only the typology of the regulator's knowledge on a regulated firm, both ex-ante and ex-post, but also the manner of interaction between the regulator and the firm. Emphasis has been placed on the dynamic nature of the interaction, as the information obtained from repeated contacts over time will facilitate correction of the regulator's decision. Any necessary corrections can be made at the end of the regulatory period or, by means of adjustment mechanisms, during the period itself.

Entering ex-ante into a binding contract can influence the regulator's credibility; on the other hand, the fact of permitting modifications while the regulatory period is still in progress can provide an incentive for distortionary behaviour by a firm which has come to know that information on its current costs may be used to renegotiate the terms of the contract before its expiry. Thus despite the intensification of theoretical research on incentive-based regulation, its implementation still raises a number of problems and the results of research have not always provided concrete solutions for the regulator.

Joskow (2006) makes a comparative assessment of theory versus implementation problems, reaffirming the importance of the information available to the regulator. In concrete terms, Joskow identifies the informational problem with the need to establish a solid procedure to acquire data on current and future levels of costs incurred by the firm⁹. Such costs include both operative and investment costs, as well as the costs needed to achieve correct accounting systems for multi-year values (depreciation rate) and for values pertaining to the opportunity cost of capital¹⁰.

Since the introduction of incentive-based regulation in the UK and other countries, the portfolio of regulatory mechanisms has expanded, and while the initial

⁸ Many references concerning the traditional approach to regulation and also its more recent evolution are available; see, among the many: Joskow (1974), Posner (1974), Braeutigam (1989), Laffont and Tirole (1993), Armstrong, Cowan and Vickers (1994), Armstrong and Sappington (2005), and Joskow (2006).

⁹ Thus in the UK, in the last phase of the transmission pricing review (2007-2012), the regulatory Authority took certain specific steps designed to acquire information. Between the first consultation and the publication of the second document the regulator sent firms a questionnaire on their historic data (Historic Business Plan Questionnaire, HBQP) concerning the different types of costs, asking how and why such costs were incurred by firms in the past. A second questionnaire on expected future costs (Forward Business Plan Questionnaire, FBQP) was subsequently sent. Between the second and the third consultation, the projected future costs as estimated by the individual license-holders were made available and discussed.

¹⁰ To develop information systems of this kind, the regulators must have considerable resources available: not only must they obtain information on regulated firms, but they must also know the overall characteristics of the industry, its performance levels and its changes over time.

objective aimed at a reduction in operating costs, the focus of attention has shifted more recently towards investments and service quality.

As far as service quality is concerned, the British experience has once again acted as a trailblazer. As early as the 1990s a quality control system was introduced by the regulatory authority, to bring order into the trade-off whereby the definition of a target for capital and operating costs potentially stood in opposition to quality of service. Incentive-based regulation tends to focus operator interest on cost reduction; as a result, in the absence of specific quality control, over time there is likely to be a decline in quality. The present paper, however, will not concern itself directly with service quality, although this is indeed an aspect of paramount importance: the reader is therefore referred to the innumerable studies on this topic¹¹.

With regard to the cost of capital, it is important to underline that this is a key variable in public utility regulation, because the return on invested capital is evaluated by the regulators as a cost component which must be partly or totally transferred to the tariff. At the same time, the rate of return must be able to generate incentives independently of the type of governance that has been established (public, private or mixed) and it must furnish transparent signals to the financial market, in order to favour conditions for development of the sector. The structure of capital in regulated firms and its rate of return are two major aspects that are closely inter-related in the procedure adopted for tariff determination. Definition of the return is in the hands of the regulator, while choices concerning the structure of capital are purely an issue of corporate decision-making. Therefore, once the regulator has made a decision on a given return on capital, this decision is likely to influence the financial structure of a firm and also its investment typologies¹².

Evaluation of the cost of capital plays an important role both in price cap and in the rate of return form of regulation. In particular, in a price cap regime it has to be taken into account that this evaluation constitutes the basis for returns extending over several periods and that it provides a reference point for definition of the efficiency incentive, incorporated in the X factor present in the formula.

In Italy, but also in the majority of industrialised countries, regulators have so far chosen to remunerate the entire invested capital. This avoids the introduction of a discretionary element into the system, as such an element could undermine regulator credibility and, additionally, fail to provide firms with the certainty required for their investment decisions¹³. However, these choices are experiencing a phase of change,

¹¹ Among others see Giannakis, Jamasb and Pollit (2005), Sappington (2005), Frontier Economics (2003), Malaman and Putzu (2007), Lo Schiavo (2007).

¹² The weighted average cost of capital takes into account the cost of equity and the cost of debt in the following manner:

$$\text{WACC} = \text{CR} * \frac{\text{E}}{\text{D+E}} + \text{CD}(1-t) * \frac{\text{D}}{\text{D+E}}$$

where: WACC = weighted average cost of capital; CR = cost of equity; E = equity; D = debt; CD = cost of debt; t = tax rate. As shown by the formula, the financial structure of the firm is given by the weight of equity and of debt compared to the overall economic value. In the above formula, these are given by the expressions E/(D+E) and D/(D+E).

¹³ In the 1980s, some cases were observed in the US in which the investments of regulated firms were not fully recognised; however, such cases generally occurred in a rate of return context. An example of behaviour of this type occurring in a price cap regime is given by Ofwat (the water regulation Authority) in the UK, which in 1994 did not take into account the entire investment

and it is precisely this aspect that makes it interesting to examine the challenge faced by the regulatory process, a challenge which is likely to characterise the action of independent Authorities in the coming years.

At this point, one can properly speak of “new incentive-based regulation”. Built on the conventional regulatory models, the new version is also shaped by the need to identify tools which will stimulate the efficiency of firms operating in segments that are still in a monopoly framework. Application of incentive-based regulation is contributing to continuous modification and evolution of the regulatory system itself, and over time a greater degree of complication has risen.

Through the continuous interaction between regulators and firms, an interesting body of experience has been built up. In addition, the main stakeholders have been encouraged to become involved in the regulatory process by means of various consultative phases, and this has enabled the decision-making process to become more transparent.

Public consultations, which always include presentation and discussion of one or more documents drafted by the regulator, have the specific aim of assessing the various different options available, thereby favouring a continuous exchange of ideas with the stakeholders. Such consultations have become the central moment of the regulatory procedure, as the Authorities often associate the legitimisation of their action with the transparency and accountability of the decision-making process. In particular, the regulator’s specialist expertise in dealing with questions fraught with extreme technological and economic complexity is crucial: a regulator lacking the appropriate expertise would forfeit a fundamental element of legitimisation. A further positive effect of the regulator’s expertise should consist in reducing the risk of regulatory capture.

With a slight generalisation, it can be said that adjustment of the regulatory process began at first by introducing some incentives for cost reduction into the traditional rate of return formula, which, however, did not substantially reduce the possibility of distortionary behaviour by firms. Rather, by complicating the procedure, the measures introduced had the effect of increasing administrative costs. In contrast, the introduction of incentive-based regulation, although not devoid of weak points, has certainly led to a more vigorous drive towards cost reduction, especially of operating costs, but it has also prompted the regulators to introduce incentive and quality control mechanisms, which are not automatically guaranteed by performance based regulation¹⁴. In this phase, “corrective” tools have been introduced to act alongside the pure price cap mechanism, in the attempt to move towards the creation, above all for capital expenditure, of incentives that will have a homogeneous impact throughout the regulatory period. The second section of this study will address this specific point, with a detailed analysis of some of these corrective tools and with an assessment, wherever possible, of their suitability and impact.

expenditure of the regulated firm, with the aim of avoiding excess investments.

¹⁴ See Banerjee (2003).

Finally, in the future – which is not so remote as it might seem – it may become possible to introduce incentives that are tailor-made for a given operator as a function of the operator’s specific characteristics and past behaviour¹⁵.

2. Price control mechanisms: recent experience in the UK and Italy

This section will focus on some distortions springing from application of the pure price cap mechanism, and on some corrective measures introduced by the regulatory authorities of the two countries considered. The analysis will take into account the most recent review of the price control system for electric power and gas transmission in the UK, which came into force on 1st April 2007 (Transmission Price Control Review, TPCR) and will be valid up to 31st March 2012. Whenever necessary, reference will also be made to the review undertaken in the distribution sector (Distribution Price Control Review, 2005-2010, DPCR). For the Italian situation, reference is to the A.I.R. Report (Regulatory Impact Analysis), published by Aeg in 2008 and concerning measures introduced for the regulatory period 2008-2011.

The power of an incentive scheme is evaluated in terms of the firm’s allowable share of the current value of cost savings. As mentioned earlier, this share is determined by two parameters: the length of the period during which the benefit can be retained, and its proportion relative to the total benefit obtained (Frontier Economics, 2003).

In the UK the incentive-based regulation applied to the monopolistic segments of the electric power and gas sectors can be considered as a hybrid incentive system. Operating costs, capital expenditures and service quality are incentivised separately according to different frameworks, although they can all be subsumed under a single overall plan. This system allows the regulator to focus on specific objectives, but it does not clearly highlight the potential links among the various aspects of regulation in the utilities sector. Therefore, when reference is made to the British model, the term ‘segmented regulation’ is used. Application of this model leads to a significant advantage, inasmuch as the degree of complexity involved in a segmented regulatory mechanism is lower than in an integrated model. Furthermore, the segmented model fosters greater transparency of choices made by the Authority. A segmented regulatory mechanism has likewise been introduced in Italy, which provides separate incentives for the different cost components.

In what follows, the analysis will mainly address the question of incentives applicable to operating costs and capital expenditure, in the attempt to ascertain the extent to which the regulator has the possibility or the capacity to induce efficient behaviour on the part of regulated firms.

¹⁵ In Aeg (2007b), points 23.18 and 23.19, Prospects for the Evolution of Distribution Regulation Starting from 2012, Aeg asserts that “this could involve defining a firm-specific constraint on returns and an X-factor, likewise specific, on the basis of the differential observed between actual and allowed costs...”

2.1. Operating costs

In the UK, operating costs are incentivised by best practice benchmarking. During the regulatory period a firm is asked to bridge a given share of the gap between its own costs and the frontier defined by best practice. In addition, each operator is asked to achieve a technical efficiency target which, for instance in the field of distribution, is common to all the firms.

In Italy, for the period 2008-2011 Aee established, in continuity with the treatment applied in the previous period, that the allowable operating cost component should be determined as the sum of effective cost pertaining to 2006 together with the increase in efficiency, calculated as the difference between allowed cost and effective cost, again in reference to 2006. This sum, updated to 2008 through the application of adjustments for inflation and, if necessary, for productivity improvements, constitutes the base level of operating costs for the new regulatory period.

The British model also provides for a benchmarking mechanism, which is absent in the Italian model. This absence is justified by the different structures that have arisen in the distribution sector since liberalisation: in the UK the presence of eight operators makes such a procedure both possible and helpful, while in Italy the existence of a large number of operators (roughly 180) having different market shares makes benchmarking difficult to apply.

Efficiency incentives may, however, be distorted by the way in which the incentive mechanism has been set up. This problem can be observed for both of the regulators considered.

First and foremost, a time distortion problem may arise, as follows. With the traditional price cap mechanism, the operators have an incentive to concentrate cost savings in the initial years of the regulatory period, because such gains will be shared with consumers only at the beginning of the new regulatory period by means of a reduction in the initial price level.

In contrast, if the cost reference level for the new regulatory period is fixed at the same level as the penultimate year of the previous period, then firms have an incentive to keep the cost level high towards the end of the period, to signal that high allowable cost levels will be necessary in subsequent years (ratchet effect). But operators may conceal cost savings or delay them to the beginning of the following period or they may transfer them to other cost categories¹⁶.

The theory suggests that in order to recover the power of the incentivising mechanism, the regulator could enter into a long-term binding contract, undertaking to delay utilisation of the information concerning the efficiency or inefficiency of a firm's actual performance. This suggestion has been taken into consideration by the regulators, who have devised corrective mechanisms. Ofgem (Office of Gas and Electricity Markets)¹⁷ has introduced a mechanism defined as the rolling incentive¹⁸,

¹⁶ See Burns, Jenkins and Weyman-Jones (2005), p. 179.

¹⁷ Offer (Office of Electricity Regulation) was the authority in charge of the electricity sector, whose tasks were transferred to Ofgem in 1999. Ofgem's primary aim is to protect consumers' interests in the energy – electricity and gas – sector, wherever possible, by promoting competition. This aim was defined in the 1989 Electricity Act.

¹⁸ The rolling incentive was introduced for the first time in 1999 in the water sector.

which aims to reduce the level at which the power of incentives may vary during the regulatory period: under the rolling incentive mechanism, efficiency gains may be retained for five years without taking into account the time when the gain was achieved during the price control period (the marginal benefit of cost savings is not influenced by the moment when the savings were actually achieved). This incentive was first introduced in the distribution tariff review document (DPCR4). Based on the good results obtained, the Authority decided to utilise the same incentive for the transmission phase.

In Italy, on the other hand, Aeg has chosen a profit sharing mechanism, whereby operators know in advance that they can keep the efficiency gain – in the extent of 50%¹⁹ – starting from the subsequent regulatory period over a time span that can be up to eight years.

Both solutions can generate further opportunistic behaviour. The operator may declare low or nil levels of recoupment of costs in order to obtain substantial gains for five years (UK) or to be certain of benefiting – in the extent of 50% – from the substantial gains for the following eight years (Italy).

In seeking to ascertain evidence of such behaviour, it is interesting to note a question and repartee exchange that occurred in Italy during consultations held in connection with the 2008-2011 regulatory period. The Italian Authority raised the following question: “Leaving aside the issue of the proposed methodology, what are the productivity improvement levels estimated to be achievable in the various regulated services forming the object of the present document, which refers to the next regulatory period? And based on what reasons?” (Aeg, 2007a, point C13, pag. 24). Almost all the answers indicated that no further margins for an increase in productivity would be possible, and also expressed doubts concerning the introduction of a non-null X-factor, as the firms in the given sector had already achieved optimal efficiency²⁰. The above-cited consultation documents led to publication of the resolution 348/07 (29 December 2007) containing the Authority’s final decisions. Shortly after the appearance of the resolution, namely on 31st January 2008, Terna, the operator of the Italian network, issued a press communiqué that summarised the general lines of the 2008-2012 strategic plan (www.terna.it). The expectation outlined in the plan was of a 4% annual reduction in cost level in real terms, representing a reduction of roughly 60 million euro compared to 2006 levels. This improvement in operating efficiency was attributable to optimisation of insourcing policies and to a reduction of external resources. It should be recalled here that the Authority’s final decisions stated an expected productivity improvement amounting to 2.3% for costs relating to transmission activity, and to 1.1% for dispatching activity, despite the opinions stated by the interviewees during the consultation phase.

At this point, it should be underlined that the problems reside in finding a trade-off between the cost incentives (technical efficiency) and utilisation of benchmarking strategies (allocative efficiency).

¹⁹ The other 50% is for the benefit of consumers.

²⁰ In particular, among the answers to the question, the one identified as Operator 6 stated: “The operator believes that any application of the proposed mechanisms will not result in a further increase in productivity, since an optimal performance level with respect to regulated services has been achieved...” (Aeg 2007a, p. 24).

2.2. Capital expenditure

Capital expenditures are subject to a different treatment regime, on account of the multi-year duration of such expenditures. Normally capital expenditure forms part of a recognised base amount (Regulatory Asset Value, RAV), for which mechanisms of depreciation over time are established and a rate of return is granted. Additionally, firms are compensated for having obtained savings as compared to the RAV. At the beginning of each regulatory period the RAV and the transfer are recalculated on the basis of current investments, and the benefits of all savings are passed on to the consumers. In general, the utilities define their future investment plans, which will then be checked by the consultants working on behalf of the sectoral regulatory authorities. Usually, the consultants propose a downwards revision of the investment levels proposed by the operators.

Although capital expenditure involves sizeable monetary amounts, the methods for determining allowable levels are less well developed in comparison to operating cost levels. Investment flows, which are strongly influenced by the capital stock included in the RAV in the previous period, constitute a crucial variable in the hands of the regulator. This variable is strongly affected, in the determination phase, by the problem of the regulator's asymmetric information. Consequently, it has proved necessary to devise mechanisms to reduce the regulator's position of disadvantage vis-à-vis the regulated firms.

Operating costs and capital expenditure, together with the RAV, form the basis for calculating the allowed return, which in turn acts as the reference for determining the "X" factor and the initial price level to be applied in the regulatory period. During this period, operators must recoup the cost of invested capital, depreciation and operating costs; at the same time, starting out from the current level of revenues, they must, by the end of the year, reach the level of revenues allowed by the regulator. This objective can be reached through various different incentive-based schemes.

As stated earlier, minimisation of costs pertaining to network expansion and maintenance is one of the problems a regulator has to address in a context of asymmetric information. Ofgem has made use of various different statistical analyses to define the operating cost target. Today, these methodologies are widely shared by regulated firms and by third parties involved in the tariff review process. However, the benchmarking method applied to operating costs has not been adopted for determination of the allowed investment level, due to the cyclical nature of such costs and their dependence on innumerable variables (growth rate of demand, age of capital in use and possible need for replacement, quality improvement, etc.)²¹. Rather, as was mentioned, each firm presents its own investment proposal which the regulator, assisted by consultants, must then evaluate. This process has frequently revealed marked differences between the requests advanced by the operators and the hypotheses put forward by the regulator: one need only note that during the last

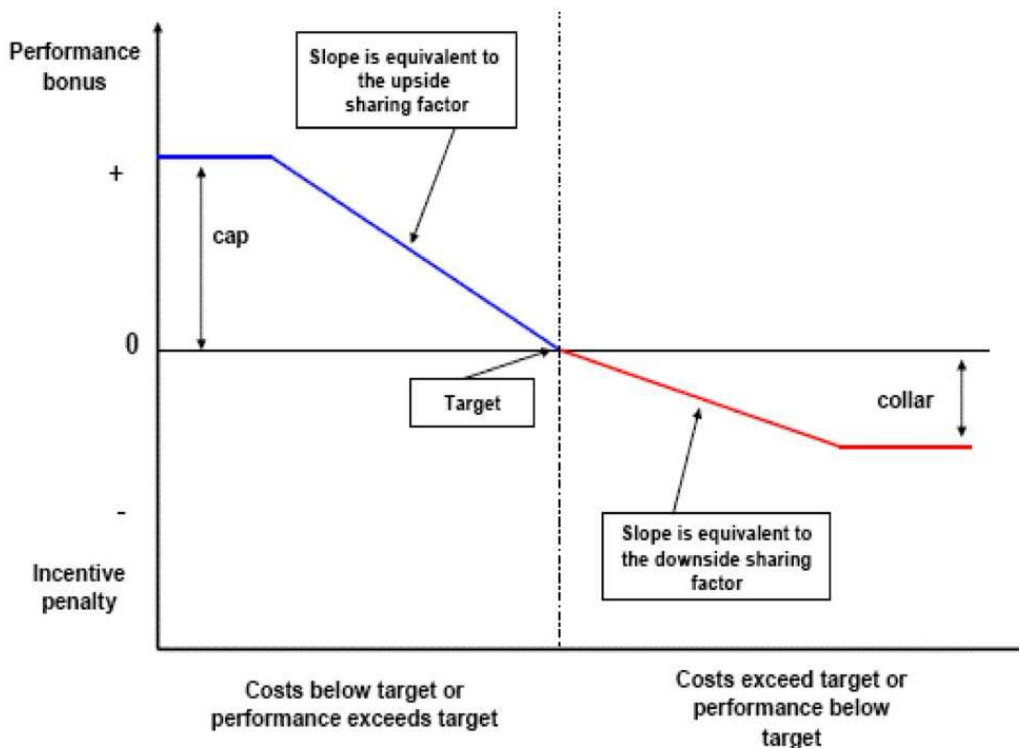
²¹ This different treatment of operating costs compared to capital expenditure could lead to inefficient behaviour, as firms could have an incentive to capitalise part of their operating costs in order to obtain the benefits for their reduction, with the hope that such costs will be included in the RAV at the beginning of the following regulatory period.

distribution tariff review Ofgem had to evaluate investment requests that were 50% higher than the level allowed for the previous regulatory period.

After the investigations launched by Ofgem following the London blackout of the summer of 2003, the so-called sliding scale incentive was introduced for the first time during the electricity distribution price control review (Ofgem, 2004). The aim of the sliding scale was to complement the existing regulatory and legislative framework by giving the network operators financial incentives that would enhance their ability to cope with network demand and, at the same time, to minimise the number and duration of power outages in their respective networks. The sliding scale mechanism was also intended to solve, in part, the long-standing problem of asymmetric information that had frequently created difficulty for the regulator. Specifically, this mechanism is considered appropriate in cases where there exists a substantial level of uncertainty concerning the target cost level: thus instead of estimating a single level, what is provided is a reference interval, the definition of which is generally compatible with a lower level of available information.

In the incentive framework, one or more performance or cost targets are set for the operators; meeting this target forms part of the duties to be fulfilled by the operators in carrying out their appointed tasks. An example of how a sliding scale incentive-based mechanism may be construed is shown in Fig. 1.

Fig. 1. Sliding scale incentives



Source: Ofgem (2006a), pag. 9.

Firstly, a performance target is set, against which to evaluate the actual results achieved by firms. If current costs are found to be below the pre-established target (or if there is over-performance with respect to the target), then the operator has the right to receive a reward, established by a shared factor (the upside sharing factor).

If, on the other hand, costs are found to exceed the target (or if there is underperformance with respect to the target), the operator faces a penalty, established by a shared factor (the downside sharing factor). However, the operator's total gains and losses are generally limited by applying a maximum limit (cap) on rewards and a minimum level (floor or collar) on penalties. Incentive-based mechanisms of this kind can be distinguished into symmetric regimes, where the penalty and reward levels are the same, and asymmetric regimes, where the levels differ²².

In short, Ofgem seeks to reduce the likelihood of firms engaging in strategic behaviour by giving them a choice between a low level of allowable investments, but associated with a high incentive (and one that has a high return) if the firm succeeds in positioning itself below the already low target, or alternatively a higher level of allowable investment, but linked to a lower reward and a lower rate of return on capital if performance exceeds the already fairly high target²³.

Firms that plan more limited investments find it more advantageous to choose a low capex level, while those that expect to have to make more substantial investments will find it more to their advantage to choose a higher allowable capex. Concretely, the functioning of the mechanisms is based on the difference between the target capex chosen by the firm from the proposed menu and the level of expenses actually incurred during the five years of the regulatory period.

The aim of this incentive structure is to provide the network operators with a proper balance between risks and returns. The outcome should be to the benefit of the network users and, in the last analysis, of the final consumers.

Once the investment target has been defined, it must be summed together with the initial value of the RAV. After calculating depreciation on historic costs and on new investments, these values, considered as current expenses, are subtracted from the RAV, to which the rate of return defined by the regulator during the consultation phases is then applied in every year. At this point, operating costs are added to the cost of capital allowed by the regulator, thus obtaining the total cost target for each year. Adjustment of the price level (Retail Price Index, *RPI*) is then applied to this cost level, and the X factor is subtracted.

Joskow (2006) underlines some critical aspects of this incentive mechanism. First of all, the issue of the uniformity of incentives throughout the regulatory period appears once again. Ofgem seems to be aware of this problem and has decided to introduce a rolling incentive for capital expenditure as well. Recently, Ofgem has proposed introducing a penalty-only incentive plan, i.e. a system of incentives that calls for a financial penalty if the pre-established target is not met, but which does not provide a reward if the target level is exceeded. However, this proposal has been contested by the regulated firms; Ofgem has thus decided to postpone for a few years the introduction of such a mechanism, continuing in the meanwhile to use the existing symmetric plan.

In the final proposal for the regulatory period starting 1st April 2007, Ofgem first and foremost reduced by £30 million the amount of estimated costs predicted by

²² In Ofgem (2005), because of the uncertainty associated with definition of the target performance levels or target cost levels, the majority of those who took part in the consultation expressed their preference for symmetric regimes, both of sharing factors and also of cap and collar.

²³ See Crouch (2006) and Ofgem (2004).

National Grid Electricity Transmission (NGET); subsequently, Ofgem identified the values shown in Tab. 1.

In comparison to the previous applications, this proposal contains an interval, defined as the “deadband”, of £15 million, from £430 million to £445 million. If the current NGET cost level falls within this interval, no payment will be made to the operator. During this phase of definition of the incentive-based mechanisms Ofgem has also reasserted the validity of a target adjustment scheme (Income Adjusting Events, IAEs). However, such a scheme must consider only the events the Authority identifies as major structural changes in wholesale markets, namely events which can have an impact in both directions.

Tab. 1. Ofgem final proposal

| | IBC*Target | Upside (reward to NGET if costs are below target) | | Downside (payment by NGET if costs are above target) | |
|----------------|---------------------|---|-----------|--|-------------|
| | £ m | Sharing factor (%) | Cap (£ M) | Sharing factor (%) | Floor (£ M) |
| Final Proposal | 430-445 (dead band) | 20 | 10 | 20 | -10 |

*** Incentivised Balancing Costs**

Source: Ofgem (2007), p. 14.

The sliding scale incentives have made it possible to reduce the likelihood of disagreement with regulated firms over the level of future investments. If there is no uncertainty concerning future investment plans and the operators are risk neutral, this mechanism gives firms an incentive to be conservative with regard to their anticipated capital expenditure. If, on the other hand, there is indeed some uncertainty and the operators are risk averse, then the theory predicts that the mechanism may induce firms to overestimate the value of investments. Since the latter is the more probable case, and since, in this perspective, operators anticipate high levels of investment, firms are induced to position themselves in an interval in which the incentives for better performance are low. This implies that the mechanism may turn out to be less incentivising than expected.

As a further means of favouring efficient investments, Ofgem has identified another two types of incentive, in addition to those described above. The Innovation Funding Incentive (IFI), which was used for the first time in the definition of the DPCR that came into force on 1st April 2005, was subsequently applied to the transmission companies as well. IFI consists in the creation of a series of funds that can be destined to innovation; these funds can be accumulated up to a given percentage of the firm’s total allowable revenue. Beyond this percentage the funds can be used only if the firms put forward proposals that satisfy the established criteria and conform to best practices for management of R&S projects.

The Registered Power Zone (RPZ) is generally cited together with the IFI in relation to incentives destined to innovation. Taken together, RPZ and IFI focus on the connection between generation and the distribution systems. The main aim of their activity is to encourage firms to develop new and more efficient methods of connecting and utilising distributed generation. The system functions as follows. Suppose that a distribution firm introduces an innovation in the way it connects generation to distribution. The firm can then submit a request to Ofgem asking to register this connection mechanism as a Registered Power Zone. It will then be up to

the Authority to decide, on the basis of public criteria, whether the proposed scheme qualifies as an RPZ. If this status is granted, Ofgem will provide additional economic support for a period of five years starting from the beginning of the project. Specifically, the economic support consists in allowing additional financial returns in order to mitigate the risks inherent in innovation.

In Italy, up to the beginning of 2008, incentives for investment were granted basically in an undifferentiated manner. In the final document pertaining to the period 2008-2011, Aeeeg has set up a procedure for devising indicators of investment efficiency (the ratio between the expected value of the overall benefits the investment will bring to the electricity system and the costs required to carry out the work), in order to differentiate the allowable rate of return. For the interim period in the run-up to the introduction of such indicators, the Authority has introduced a scheme that differentiates incentives on the basis of the investment typology. In particular, for transmission the overall rate of return associated with each investment is given by the basic rate of return (6.9% for the period 2008-2011), plus an additional recognised return broken down by investment typology.

The scheme sets up three typologies. The first coincides with renewal investments, and involves no further incentives, whereas investment in expansion of electricity transport capacity, the second typology, provides for an additional return of 2% for 12 years. Finally, the third typology concerns transport capacity development investments that aim to reduce congestion between market areas: for this typology an additional remuneration of 3% for 12 years is granted.

Furthermore, the Italian Authority has not established sliding scale mechanisms, although some signs of a move in this direction can be perceived. In a recent document on the gas sector (Aeeeg, 2008b) Art. 4, point 2, introduces the concept of standard cost of investments, to be applied as from 2010. More specifically, “the Director of the Head Office for Tariffs is given a mandate to proceed to the definition of a pricing policy designed to evaluate, at standard costs, the investments, to be applied as from 2010; the Director also has a mandate to examine the possibility of extending the range of application to sources of income that fall under the typology of the other tangible and intangible fixed assets” (Aeeeg, 2008b, p. 21). In the Authority’s interpretation this could be the first step towards an incentive scheme similar to that applied in the UK, according to which any differences compared to the costs that have been identified are to be rewarded or penalised²⁴. Such a scheme could then be extended, with appropriate modifications, to the electricity sector.

To give an idea of the application of the incentive mechanism to transmission network investments, reference will be made here to the Terna press communiqué cited earlier. The communiqué stated that the forecast of overall investments for the period was 3.1 billion euro (+ 400 million euro compared to the previous plan), of which 2.5 billion for network development (80% of the total). Of these 2.5 billion,

²⁴ In Italy it is the Ministry of Economic Development that defines the Development Plan for the national electricity transmission network, while Aeeeg fulfils the task of providing incentives for investments and ensuring returns on such investments, thereby potentially giving rise to conflicts. In a number of documents (Aeeeg, 2001; Aeeeg, 2005; Aeeeg, 2006) the Italian Authority indicated to the competent organs that there was a need to accelerate investments, not only in order to reinforce the domestic transmission network, but also to increase international interconnections.

60% falls under the typology for which an additional 3% return is allowed, while the remaining 40% belongs to the typology having 2% incentive. It follows that this is a significant incentive-based mechanism for the network operator.

With regard to the five-year 2009-2013 Strategic Plan, Terna forecasts that investments will increase up to 3.4 billion (a 300 million increase compared to the previous plan), of which 2.6 billion for development. Roughly half of total investments (48%) fall under the Aeg typology that allows a 3% additional return, while 29% of total investments belong to the typology with a 2% incentive-based mechanism.

Finally, precisely on account of the presence of uncertainty concerning both the development of the electricity sector and the impact of regulatory mechanisms, it has been pointed out in discussions between the various national regulators and the firms that there is a need to insert flexibility into the price control mechanism. Within the British regulatory system, this has been done by introducing a mechanism termed a re-opener, which consists in the possibility of re-opening the price control phase prior to the end of the regulatory period if unexpected events are observed in the reference context ²⁵.

There are several ways in which a re-opener model can be applied. However, its main characteristic is that the events which may trigger re-opening cannot be defined in advance. By not restricting the range of events that could give rise to a re-opening, the mechanism is capable of reconciling all the exogenous risks that could come into play. However, this could give rise to a moral hazard problem, as the firm is aware that the cost associated with all major risks will be transferred to the consumers; therefore the firm has no incentive to reduce expenses in order to mitigate the likelihood of such risks occurring. But one advantage of this mechanism is that precisely because it does not seek to define the nature of the events that are likely to trigger its utilisation, the difficulty of fixing events of this kind is avoided. However, the problem is merely delayed rather than solved, as the regulator will be called upon to decide on the division into controllable and uncontrollable events and on their impact in terms of costs.

Additionally, there is a tendency for re-openers to require greater involvement by the regulator, which means that routine re-opening would be tantamount to perpetual revision. This, in turn, could lead to a delay in necessary investments and a weakening of cost efficiency incentives. So while the re-opener mechanism does give the regulator considerable discretion in defining the revenue linked to external events, it undermines some of the aspects of certainty around which regulated firms shape their activity. For example, in the UK the current regulatory period for electricity transmission networks has been re-opened to increase the allowed returns, in order to finance network investments and to favour the growth of renewable generation.

In conclusion, Ofgem's opinion on re-openers is that they should be avoided as far as possible; therefore they are not usually considered to represent the best way of protecting consumers' interests. In the context of uncertainty concerning the volume

²⁵ For example, a re-opener, called a "safety net", was inserted into the TPRC 2007-2012: this re-opener will come into force if at any time during the five years of the regulatory period the level of expenditure drops below 20% of allowed capital expenditure for the given year.

of business, Ofgem thus aims to adopt automatic adjustment mechanisms whenever these are feasible, in order to seek to maintain the incentivising properties of ex ante regulation.

In the case of Aeeg, this tool has been part of the Authority's mechanisms since the passing of the law through which Aeeg was set up. In particular, Article 4 of the document concerning the 2009 tariff review provides for a mechanism guaranteeing the level of return allowed for the transmission system, by permitting a re-opener designed to protect against the risks associated with a reduction in power consumption, since Terna's revenue is directly linked to transported electric power (Aeeg, 2008c). The positive impact of the neutralisation of this risk, and the consequent reduction of uncertainty with regard to development investment, is recognized by Terna in a press communiqué released on 6th May 2009:

“The negative trend of electricity consumption will not affect network development activities planned by Terna. The electricity and gas Authority, having recognised the infrastructural nature of the network, has introduced a mechanism by virtue of which the decrease in energy units will have only a very marginal impact on Terna's tariff revenue, through an “exemption” of +/- 0,5%”. (www.terna.it).

3. Complexity, to whose advantage?

It is widely believed that incentive-based regulation has resulted in considerably greater efficiency in the public utilities sector. Ofgem states very clearly that this regulatory mechanism has been successful in reducing tariffs in real terms. In the UK, reductions in the electricity sector of 50% and 40% have been obtained since 1990 in distribution and transmission respectively, while quality of service showed a 15% improvement in the number of interruptions and 19% in duration of interruptions. A very substantial level of investment in transmission can also be observed (£ 1.5 billion per year in the latest regulatory period up to 2012), as well as a corresponding decrease over time in the rate of return on capital investment, which fell from 8% in 1990 to little more than 6% in the last regulatory period (Buchanan, 2008).

In Italy, incentive-based regulation has likewise brought positive results. In particular, network costs have weighed increasingly less on consumers' annual expenditure on electricity. Quality of service regulation has also undergone a significant evolution, as shown by the reduction both in number and duration of unannounced power outages over recent years. This improvement is due essentially to the system of rewards and penalties that Aeeg has applied to electric energy distributors. For the four-year period 2008-2011 the Authority has reinforced this system by taking into consideration not only the duration of interruptions but also an improvement in the number of long and short interruptions (www.autorita.energia.it).

However, despite the above described positive developments, it is undeniable that mere implementation of the price cap mechanism is not devoid of complications, and that the corrective measures designed to reduce the price cap-induced distortions have not always led to a definitive solution of the original problem.

The previous section outlined a few of the mechanisms that mitigate the problems of temporal distortion of incentives and asymmetric information in choosing the

efficient investment level. But while on the one hand such mechanisms reduce uncertainty and the probability of opportunistic behaviour by regulated firms, on the other hand they have introduced greater complexity into regulation, which makes itself felt not only in terms of the complex regulatory mechanisms but also in the increasing number of subjects the authority has to consult with in the decision-making process. To this should be added the mounting range of issues that fall within the scope of the regulatory mandate.

Basically, introduction of incentive-based regulation has not maintained its promise of simplifying the tariff mechanisms. The original price-cap, accepted as a solution both to distortions and to the excessive administrative cost of the rate of return, has given way to the current complex procedure of allowable costs introduced with the aim of reducing uncertainty for firms in order to favour investments.

The growing complexity affecting both the subjects and the range of issues that have recently been included within the scope of the regulatory Authority's mandate is testified by a recent publication of the British regulator (Ofgem, 2008c). The document deals with measures designed to protect consumers if a network operator encounters financial difficulties and is unable to finance the activities specified in its licence. In the publication, Ofgem makes provision for re-openers (points 2.14 – 2.19) if the flow of returns defined during the price control review no longer supplies the operator with adequate funds even though the operator has performed efficiently. But this involvement of the authority calls for specific expertise which the regulators may not always possess, and requires detailed information in order to be able to monitor the operators' activities and assure that their available resources are not directed towards different goals than those specified in the license, or that they are not exposed to unnecessary risks²⁶.

A similar concern is also addressed by the Italian Authority. Point 17.40 of the regulatory impact analysis referring to the period 2008-2011 (Aeeg, 2008a) makes provision for a procedure designed to modify the level of indebtedness of operators, in order to disincentivate speculative behaviour that could undermine the operators' financial stability. In addition, the Authority reserves the right to intervene if the financial situation appears particularly critical.

At this point, it is worth raising the question as to which subject draws advantage from the above described complexity, especially since this complexity appears to be a characteristic element of regulation of the electricity sector throughout the various countries involved. Concern in this regard can clearly be seen in the recent choices made by the British regulator, who has launched an ambitious project of rethinking the regulatory mechanisms, denominated "RPI-X @ 20". In 2010, regulation of the electricity sector was twenty years old, and to mark the celebration Ofgem began a two-year evaluation period to assess the suitability, methodology and effectiveness of the regulatory system²⁷.

²⁶ The document specifies that in no case should the re-opening of the regulatory phase be induced by inefficient management of the firm or by its excessive indebtedness.

²⁷ The date of 23rd March 2008 marked the beginning of the new electricity distribution price control review, which is due to come into effect during the period 2010-2015. This review will follow the methodology applied in the past and will not be influenced by the new project Ofgem has launched.

Ofgem is, on the one hand, well aware of the extreme complexity of the regulatory mechanism currently in force (suffice it to reflect that normally a price control review implies an intense two-year phase of consultations), and has for some time been reflecting on a simplification of the mechanism²⁸. On the other hand, Ofgem aims to ensure that the current system is compatible with the ambitious goals the British government has set itself in terms of the weight of renewable energy sources for 2020²⁹. Moreover, the trends involving the networks, such as the prospect of new nuclear power stations and the promotion of distributed generation solutions, could influence reflection on the appropriateness of the current regulatory regime. It should be borne in mind that, although the regulatory regime has a flexible structure enabling it to address new challenges, the treatment of the different and new objectives is, in the view of Buchanan, the CEO of Ofgem, unlikely to be feasible. Finally, the need to determine how far the British regulatory model is consistent with the EU perspective should not be overlooked, and it should be borne in mind that the EU framework provides for the establishment of a new European-level agency for network regulation.

In Italy, Aeeg has almost always acted as a follower. The British experience has often pointed to the problems that need to be addressed and the possible answers; and whenever the answers had to be revised, this made it possible for Aeeg to avoid falling into the same error. But has acting as a follower been sufficient for the purpose of reducing the cost of the complexity inherent in the current regulatory system? There is no easy answer. As mentioned earlier, with regard to the problem of a reduction in operating costs, the objective difficulty – not ascribable to choices made by the Authority – in introducing benchmarking mechanisms probably gives the Italian operators an information-related advantage, which translates into efficiency gains that are privatised by the firms and only partly passed on to the final consumers. With regard to the evaluation of investments, Aeeg is still searching for an efficient solution; and although the Authority is moving towards mechanisms similar to those introduced by Ofgem (sliding scale incentives), it is not clear how the definition of the standard cost, to be applied only to the gas sector for the time being, will operate in this direction. The current methodology of return on capital investment reveals the abandonment of an undifferentiated rate of return, the latter having probably been one of the main causes of the inadequate investment that characterised recent years. While awaiting the definition of an investment efficiency index, implementation of an incentive mechanism broken down by typology does not limit the effects of the information advantage enjoyed by the operators.

An interesting corollary of the above statement involves the representation of interests within the energy sector. The consultation phases of the regulatory process should guarantee proper representation of the interests both of the firms (those operating in the sector, but also those that constitute major energy clients) and also of the final consumers. Often, however, the complexity of the consultations hampers contributions to the debate by consumer associations, in particular on the subject of

²⁸ See Buchanan (2005).

²⁹ The British government has set itself the objective of an increase in energy from renewable sources (20% within 2020) and has defined the so-called “Renewable obligation” which sets out the various measures designed to achieve the stated objective. For an in-depth investigation see DTI (2007).

tariff definition. And as far as the firms are concerned, recent discussions concerning reform of the Italian Power Exchange, as provided for by the anti-crisis Legislative Decree nr. 185/2008, saw intensification of the clash within Confindustria between producers and consumers (small and medium-sized firms)³⁰ in the electricity sector. During the debate, this decree was regarded by electricity producers as bringing advantages exclusively to the firms, while those representing the demand side, acting as the mouthpiece for the large associations such as Federacciai, Assocarta, Federchimica and the large consortia of power consuming firms, viewed it as an inevitable choice in order to address the current severe economic crisis.

This situation shows that in Italy there is a need for further consideration on the question of which method to adopt in assuring that the subjects involved in regulation are properly represented. This must be assured not only on the occasions of exceptional events such as the definition of the anticrisis decree, but also during the usual consultation phases leading up to the periodic price reviews, where the risk of the pointless costs of rent seeking is always present. Finally, there is a wholly Italian problem consisting in the fact that the independence of the Authority was contested even recently by certain political groups, who aim to erode its power and tasks to the advantage of the Ministry to which they belong.

Who draws benefit from all this? For now, the mechanisms that have been introduced have not succeeded in limiting to any great extent the information advantage enjoyed by firms. There is a concrete possibility that only a restricted number of the interest groups may actively participate in the regulatory process. Consequently, further margins of efficiency certainly do exist, with the resulting possibility of transferring to the final consumer the benefits achieved by regulation.

An intelligent regulator is sensitive to the issue of the efficiency of the regulatory mechanism. As we have seen, Ofgem is endeavouring to respond to a number of questions in this regard, both with the “RPI-X @ 20” project and with regulatory impact analysis (RIA), which has been identified as the most important tool for assessing regulatory activity³¹.

In the Italian context there exists no consolidated experience of regulation, and the existing laws have not endowed regulatory impact analysis with a sufficiently clear legal framework. This suggests that its importance has not been given due recognition within the institutional context. At times, the analysis takes the form of an explicit statement of the expertise and assessments that led to the final decision, thus highlighting the regulator’s expertise rather than regulatory accountability. Despite this, the Italian Authority considers regulatory impact analysis as an extremely important element to strengthen the complex principal-agent relation (the citizens are the original principal while the authority is the executive agent) that characterises the regulatory function. An authority that has to justify its choices on the basis of this type of analysis of regulatory impact is extremely difficult to influence.

In conclusion, and allowing for the differences among countries, the current regulatory systems have certainly brought about some benefits. To obtain the desired

³⁰ In particular, discussion focused on Article 3 (tariff freeze and tariff reductions) and on modification of the set-up of the electricity market.

³¹ Although analysis of the regulatory impact is subject to constant review, the main reference documents are Cabinet Office (2003) and Ofgem (2008b).

benefits, they have had to refine their mechanisms of action, albeit by creating a high degree of regulatory complexity. Yet despite the elaborate system, the problem of information asymmetry between regulator and regulated firms is still present, especially when substantial levels of investment are requested. Moreover, the expansion of the scope of the Authorities' regulatory action means that new expertise must be acquired, for example in the financial sphere, and specific steps must be taken to ensure that the Authorities are in possession of the appropriate professional competence.

Finally, a model that functioned satisfactorily in a world characterised by a lesser degree of uncertainty may prove to be inadequate in the current situation. It is therefore quite right to question whether the regulatory choices made so far have been efficient. In other words, although the stability of a regulatory system is the characteristic most appreciated by the various stakeholders, it cannot be equated with staticity of the system, because the contexts in which the firms operated are anything but static.

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