Price regulation to remove EE-DSM disincentives and pressure for increased energy sales in monopoly segments of restructured electricity and gas markets
The Multiple Drivers Target (MDT) tariff scheme

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1. SYNOPSIS

For the remaining monopoly segments of liberalised electricity and gas markets, the Multiple Drivers Target scheme for price regulation provides the possibility for supporting both economic efficiency and environmental efficiency.

2. ABSTRACT

Even in restructured markets a part of the energy business remains a monopoly and should be correctly regulated. We present an analysis which reveals common structures in tariff schemes enacted in UK, Norway, Portugal, New South Wales (Australia) and recently in Italy. The identified structure, which we named Multiple Drivers Target (MDT) regulation, is a performance-based regulation scheme, which provides incentives for greater economic efficiency, without creating biases against environmental efficiency. The method relies on a statistical analysis of the correlation of utility costs and a few 'cost drivers' (e.g. number of customers served, grid length, sold or transported energy). We discuss how MDT can be used to set price levels and their evolution over time in such a way to more correctly match the evolution of costs and reduce unwanted signals to the regulated companies. At the opposite, pure Price Cap regulation provides artificial incentives to energy companies to increase energy sales beyond the predicted levels used as a reference to set prices in year zero of the Rate Case, even if this is not economically efficient[1] for the customers nor for society.
We show that under MDT regulation the reduction in profits due to reduced sales as a consequence of EE-DSM can be avoided. In so doing this procedure removes one of the most important disincentives for regulated energy companies to implement EE-DSM programmes (lost profits due to reduced sales can be - in a short term perspective - substantially higher than direct costs of EE-DSM programmes). Once MDT regulation is in place, also direct costs can be recovered through a small part of the tariff.

3. SHORTCOMINGS OF TRADITIONAL REGULATION SCHEMES

This paper draws upon two SAVE studies, [Politecnico di Milano *et al.* 2000] and [Wuppertal Institute *et al.* 2000] and other research activities undertaken by the Italian authors under auspices of the Italian Ministry for the Environment, all meant to analyse the effects of energy sector restructuring and to propose ways to integrate end use energy efficiency in the ongoing reform.
We focus here on:

1. the options to integrate end-use energy efficiency in the reform through appropriate tariff regulatory schemes, and
2. the need for removal of incorrect signals which are often present in the regulatory schemes and which can create strong and unnecessary barriers to the choice of the optimal mix of supply and demand side resources.

During the historical period when the most important objectives of energy policies were the diffusion of the networks over the territory and the increase of service quality and reliability, the Cost of Service (COS) or Rate

of Return (ROR) scheme was largely used in the tariffmaking for the electricity business. This scheme allowed energy companies the funds needed for the expansion and the upgrade of the system, eliminating any financial risk[2]. At the same time it created incentives to overinvest in generation capacity and other infrastructures (Averch-Johnson effect) and to actively promote the expansion of energy sales.
In the present phase, the industrialised countries energy policies' priorities are the reduction of prices for final customers as a result of increased economic efficiency and the reduction of negative environmental impacts. In order to achieve these objectives, the more common Performance Based Regulation (PBR) schemes (that is Price Cap and Revenue Target / Cap) present a number of advantages over COS-ROR and a few shortcomings. Another ongoing change is the introduction of competition in the generation segment and in part or all of the retail sale segment. Hence tariff regulation is being applied to the remaining monopoly parts of the business, that is transmission, distribution, and retail sale to captive customers.

Within the class of PBR schemes, Price Caps have received attention in the last decade, being judged able to promote costs reduction and productivity increase. In fact a Price Cap is set at year zero in such a way to cover energy company costs and provide a fair rate of return. Then for a certain number of years (regulatory lag) the Price Cap P_{lim} is driven by an inflation index I minus a productivity factor X established by the regulator, without explicit connection to costs, according to the formula $P_{lim\ t} = P_{lim\ t-1} * (1+I-X)$.

Under this arrangement utilities are allowed to increase their profits by reducing costs for all the duration of the regulatory lag. This is the most important positive feature of price cap schemes as well as of all other performance-based regulation schemes, including the MDT scheme presented later. All these schemes give incentives to companies to become more efficient in economic terms over time. At the beginning of the following regulatory period the regulator can transfer (partially or completely) those efficiency gains to customers in form of price or bill reductions.

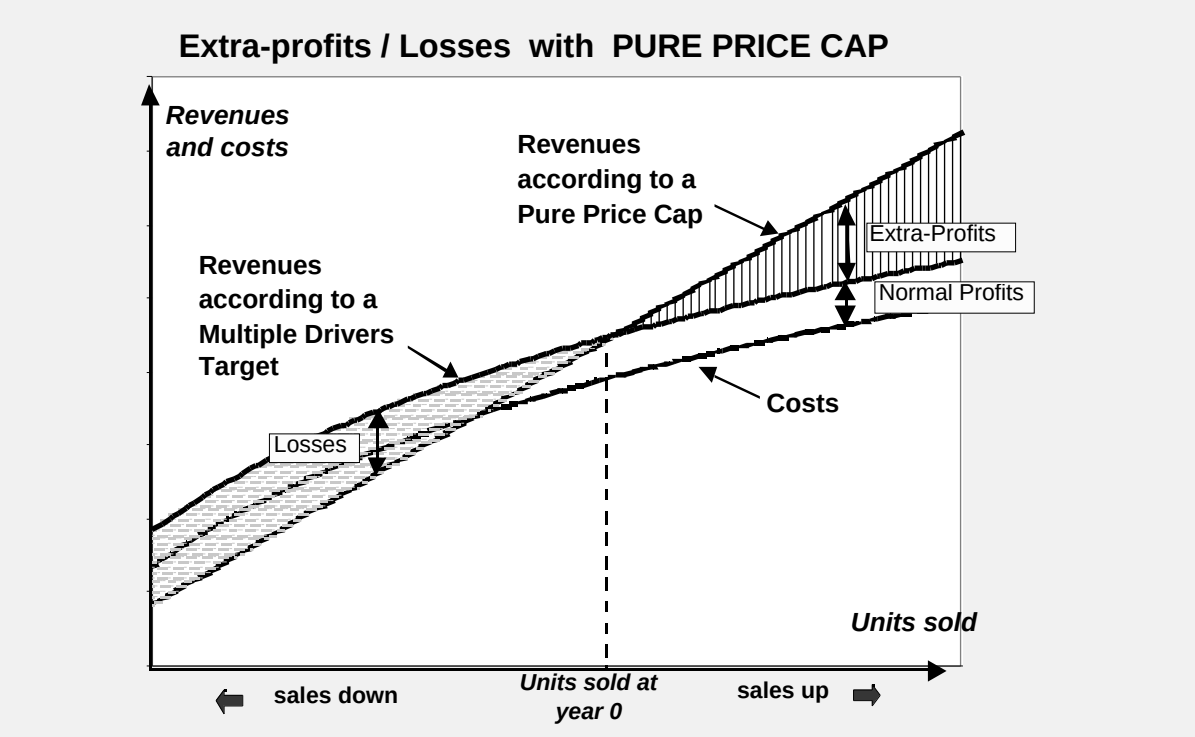
However, in their pure form, Price Caps provide even stronger disincentives to utilities to promote energy efficiency than ROR regulation. There are two reasons:

- It is advantageous to the utility to minimise all costs associated with the core activity (including elimination of activities not necessarily associated with the core activity, such as energy efficiency programs or higher cost renewable). For example during the '94 - 95 process for the revision of the Price Cap mechanism introduced a few years earlier, the Office of Electricity Regulation (UK) wrote:
  "My proposals also include two new energy efficiency measures. One will encourage companies to reduce electricity losses[3]. The other will **remove any artificial disincentive to the companies promoting schemes to help customers use electricity more efficiently."** [OFFER, 1994, p.84].
- It is additionally advantageous to expand sales whenever marginal cost of production is less than the Price Cap (exactly as in the case of ROR discussed above); lowering sales (e.g. through improved end-use efficiency) generates less revenues and profits (see Figure 1).

In the segments of Transmission, Distribution and Retail Sale, costs are not directly proportional to sales volume, but are connected to a various degree to other variables (see section "The Multiple Drivers Target Schemes" for more detail). Hence a pure Price Cap, which establishes a pure proportionality between sales volumes and revenues (the proportionality coefficient being the price of a single unit of energy sold), produces higher profits than allowed by the Regulator (normal profits) when during the regulatory lag sales grow higher than the forecasted level used by the Regulator to establish the year zero price. Conversely, if sales volume end up being lower than forecasted, the energy company would suffer financial losses. This creates a very strong incentive to increase sales, even when this is not economic for customers and society, that is in cases when other alternatives, like reducing end use consumption through energy efficient technologies, prove to be a cheaper way to deliver the services required by customers and society.
See for example [OFFER, 1993, pag. iv]:

> "There has been some concern that the present form of price control[4] provides **an artificial incentive to the RECs** (Regional Energy Companies) **to sell more units, when in fact a more economic way of meeting customer's requirements might be through investments to reduce the amount of energy required**. The changes I propose reduce to about one fifth the unit-related term".

Figure 1. Changes in revenues and profits due to changes in sales volume with respect to predicted levels, under a pure Price-Cap regulation



This "artificial incentive" to increase sales can produce a non optimal allocation of capital between the supply and the demand side, and an unnecessary increase of energy consumption and of the national energy bill (also when unit prices decrease), which in turn may result in excessive profits of energy companies. Therefore the Price Cap does not satisfy either the objective to reduce "total cost" of energy supply nor the environmental objectives that can be reached in general with a reduction of energy consumption.

For this reason often additional mechanisms have been introduced to correct the Price Cap: profit sharing, Energy Efficiency Demand Side Management (EE-DSM) cost recovery, EE-DSM obligations and/or incentives. These mechanisms, however, even though they can mitigate some negative aspects of Price Cap regulation, and reduce the bias against EE-DSM activities, still cannot eliminate the incentive to increase sales. Under these mechanisms a company can find profitable to perform EE-DSM programmes targeted to increase efficiency in certain end-uses, and at the same time engage in marketing efforts to promote the expansion of energy consumption in other end uses.

Some Regulators have, instead of the Price Cap, introduced a Revenue Cap (or Revenue Target) regulation, achieving not only the elimination or reduction of incentives to increase sales, but also a positive signal to the realisation of EE-DSM actions and to the stabilisation of the national bill (cf. figure 1).

Regulations setting a target are constituted of:

- A formula which describes the evolution with time of the allowed revenues or prices,
- and a mechanism for reconciling the actual revenues to the revenue target in a certain year, through a change in tariffs the following year.

In practice, under target regulation energy companies will have to slightly reduce tariffs in year x+1 if in year x they collected more revenues than allowed by the target, and will slightly increase tariffs in year x+1 if in year x they collected less revenues than allowed by the target. This reconciling mechanism is what distinguishes a target regulation from a cap regulation where the mechanism works only in the direction of reducing excessive revenues.

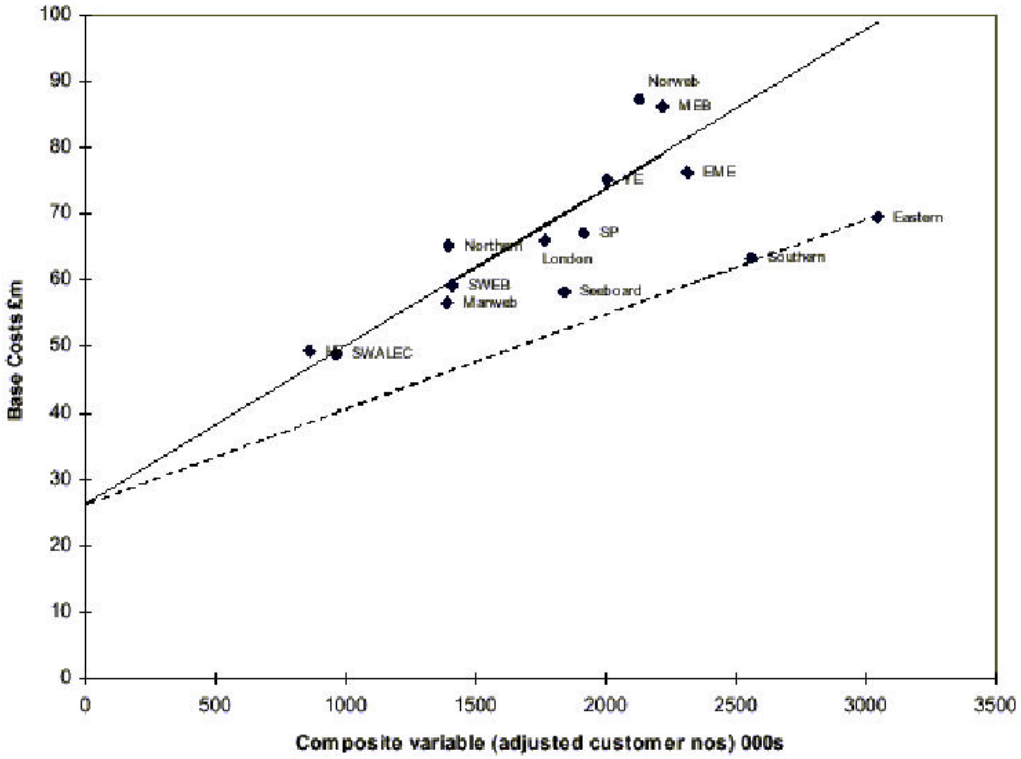
However, the practical application of Pure Revenue Caps/Targets can introduce a new problem, that is the possibility of higher prices and profits fluctuations when sales level varies under events which are not under control of the energy company.

4. THE MULTIPLE DRIVERS TARGET SCHEME

One main reason for the drawbacks of the Price Caps and Revenue Caps/Targets is the fact that the formulas and the ways they are revised annually are too simple in either cases. Simplicity is advantageous on one hand but limits on the other hand the extent to which price or revenue evolution can reflect unit or total cost evolution over time.
The statistical analysis carried out in [Politecnico di Milano, *et al.* 2000], as well as other recent studies (e.g. [OFGEM 1999], see figure 2), have investigated the evolution of costs over time for network companies and identified that this evolution is correlated with a number of variables (typically energy sales or peak load, number of served customers, grid length) and not only with sales volume. Hence if the goal is to obtain a price or revenue evolution over time which reflects the costs evolution, it is necessary to link the modification of the level of allowed price or revenues to all of these variables[5].

Both on the basis of these analyses and because of the objective of removing the undue incentives to increase sales, a number of Regulators have introduced new regulation schemes which are based on the use of a larger set of variables to determine the evolution of a price or revenue cap/target over time. These new regulation schemes have been introduced in **UK** in '94, and later on in **Portugal, Norway, New South Wales** (Australia). Most recently (December 1999), and also as a consequence of the analysis conducted by the authors, this new scheme has been adopted in **Italy** for distribution and retail to non domestic captive customers[6]. The State of **Oregon (USA)** also adopted in 1998 a MDT scheme for Distribution tariffs, which is not analysed here.

Figure 2. Relationship between base operating costs for a number of Distribution companies in UK and a composite variable attaching a weight of 0.7 (or 70 per cent) to the number of customers, 0.15 to the number of units distributed and 0.15 to the length of network (Ofgem, August 1999)



In spite of sharing the feature of setting a target (instead of a cap) and linking its evolution to additional variables (beyond inflation index I and required productivity increase X, and eventually sales volume) these new schemes have been presented under old names which no more reflect with accuracy their features. The scheme introduced in UK in '94 continues to be called Price Cap and so does the Italian scheme, while the Norway and New South Wales schemes are presented as Revenue Caps.

In the following we will use the expression "**Multiple Drivers Target schemes**" which we first proposed in [Politecnico di Milano *et al.*, 2000] to indicate these new generation of tariff regulations schemes.
We present below the general expressions of a Multiple Drivers Target which describe the evolution with time of the allowed revenues or prices (we omit here the reconciling mechanism) during the regulatory lag.

	General Multiple Drivers Target (MDT)
In the form of Price target	$P_{lim\,t} = (P_{lim\,t-1}\ E_{t-1})\ (1+I-X+...)\ (1/E_t)\ (1 + \beta\ \Delta N\% + \gamma\ \Delta E\% + \delta\ \Delta G\% + ...)$ or $P_{lim\,t} = (P_{lim\,t-1}\ E_{t-1})\ (1+I-X+...)\ (1/E_t)\ (\alpha + \beta\ N_t/N_{t-1} + \gamma\ E_t/E_{t-1} + \delta\ G_t/G_{t-1} + ...)$
In the form of Revenue target	$R_{lim\,t} = (R_{lim\,t-1})\ (1+I-X+...)\ (1 + \beta\ \Delta N\% + \gamma\ \Delta E\% + \delta\ \Delta G\% + ...)$ or $R_{lim\,t} = (R_{lim\,t-1})\ (1+I-X+...)\ (\alpha + \beta\ N_t/N_{t-1} + \gamma\ E_t/E_{t-1} + \delta\ G_t/G_{t-1} + ...)$

Where:

N_t, E_t, G_t	are the *Number of Customers*, the *Sales*, the *Grid Length*, for the current time period
N_{t-1}, E_{t-1}, G_{t-1}	are the *Number of Customers*, the *Sales*, the *Grid Length*, for the previous time period
$R_{lim\,t}$, $R_{lim\,t-1}$	is the *Target Revenue* for the current time period and for the previous time period
$P_{lim\,t}$, $P_{lim\,t-1}$	is the *Allowed Maximum Price* for the current time period and for the previous time period
I, X	are an inflation index and a productivity increase index for the previous time period

and where, for a generic variable A, we indicate with "ΔA%" the percent variation of A at year t with respect to the year t-1:

$$\Delta A\% = (A_t - A_{t-1}) / A_{t-1}$$

If the rating regulation has the objective that during the regulatory lag the course of allowed revenues or prices will follow the course over time of the costs (at least the course expected according to past correlation between costs and cost drivers), it becomes necessary that the yearly statement of the accepted revenue or price takes into account, in the appropriate proportions, variations of the cost drivers N, E, G[7]. This will not be a cost-based regulation, but give incentives to reduce costs over time and hence increase economic efficiency. With MDT regulation, this incentive will be more precisely reflecting the cost structures than with just one parameter as in price or revenue cap schemes.
In practice, regulation formulas as actually implemented are more complex because:

- The yearly revision formula in most of practical implementations contains parameters binding the cap/target to specific company performance indexes (quality of service provided, amount of network losses, ...);
- Automatic mechanisms of rating adjustment are often included in addition to the basic rating schemes, to recover outside the target/cap particular costs which the Regulator does not want to include in the cap (costs due to unexpected events, direct costs for the management of demand, fuel costs[8],…);
- The presence of the already mentioned mechanism for reconciling the actual revenues to the target in a certain year through a change in tariffs the following year (in cases where this mechanism is absent we are in presence of a cap regulation rather than a target regulation).

The coefficients α, β, γ, δ, ... (whose sum is equal to 1 by definition of α) represent a kind of "weights" for the different Drivers, i.e. the higher the coefficient the more important the variations in the target.
From a theoretical point of view, the Multiple Drivers Target rating scheme can be considered a "combined scheme" of the main rating schemes as follows:

- The closer α is to 1, the closer is the scheme to a *Revenue Target* (achieved when at the limit α = 1),
- The closer β is to 1, the closer is the scheme to a *Revenue Per Customer Target* (achieved when at the limit β = 1),
- The closer γ is to 1, the closer is the scheme to a pure *Price Cap* (achieved when at the limit γ = 1).

5. ADVANTAGES OF MDT SCHEMES

During the study [Politecnico di Milano, *et al.* 2000] a number of advantages of a Multiple Drivers Target regulation over a Price Cap regulation have emerged from the analyses. We briefly schematise these advantages in the following.

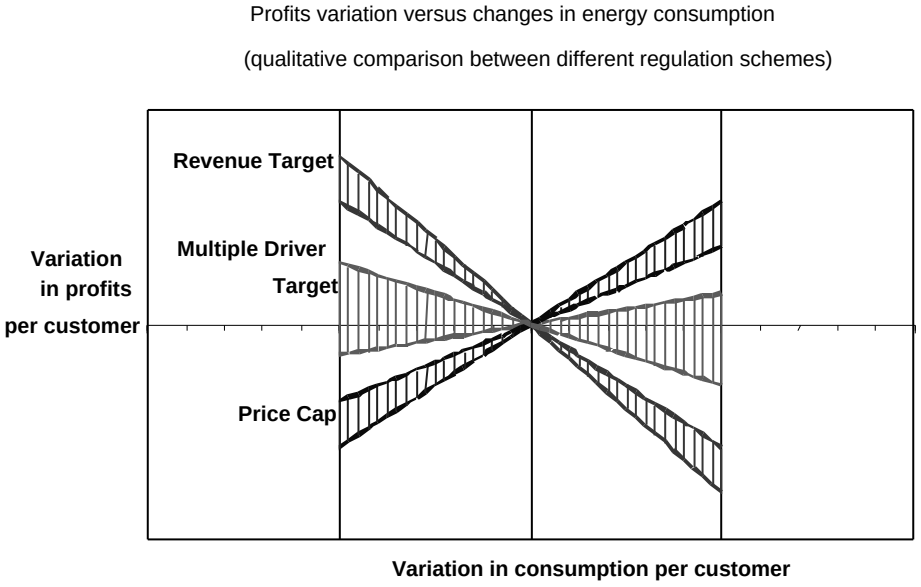
Advantages in respect to Performance inducement

- Incentives to reduce costs, and increase economic efficiency are the same or better as with Price Caps and Revenue Target/Caps. This is due to the presence of the productivity increase index, X, and the absence of a link between real costs incurred during the time lag and the target value for revenues. The target is linked to the evolution of cost drivers according to the correlation observed in the past; the company has an incentive to change this correlation in the future towards greater economic efficiency since the efficiency gains during the regulatory lag will translate into profits. (see figure 4).
- Other performance indexes (for quality of service, grid losses, …) can be introduced, as in the case of Price Caps and Revenue Targets/Caps.

Advantages in respect to Energy Companies' profits

- Higher stability of profits with respect to changes in total energy sales due to EE-DSM actions performed by the company itself or due to external causes (i.e. reduction in sales due to energy efficiency actions of other actors), compared to other PBR regulation. Thus the MDT regulation reduces also the risks of obstructionism by energy companies towards energy efficiency actions carried out by other actors (public as national or local governments or private) and allows for the possibility of co-operation (see figure 3).

Figure 3. Variations in profits versus variation in consumption per customer, under different regulation schemes



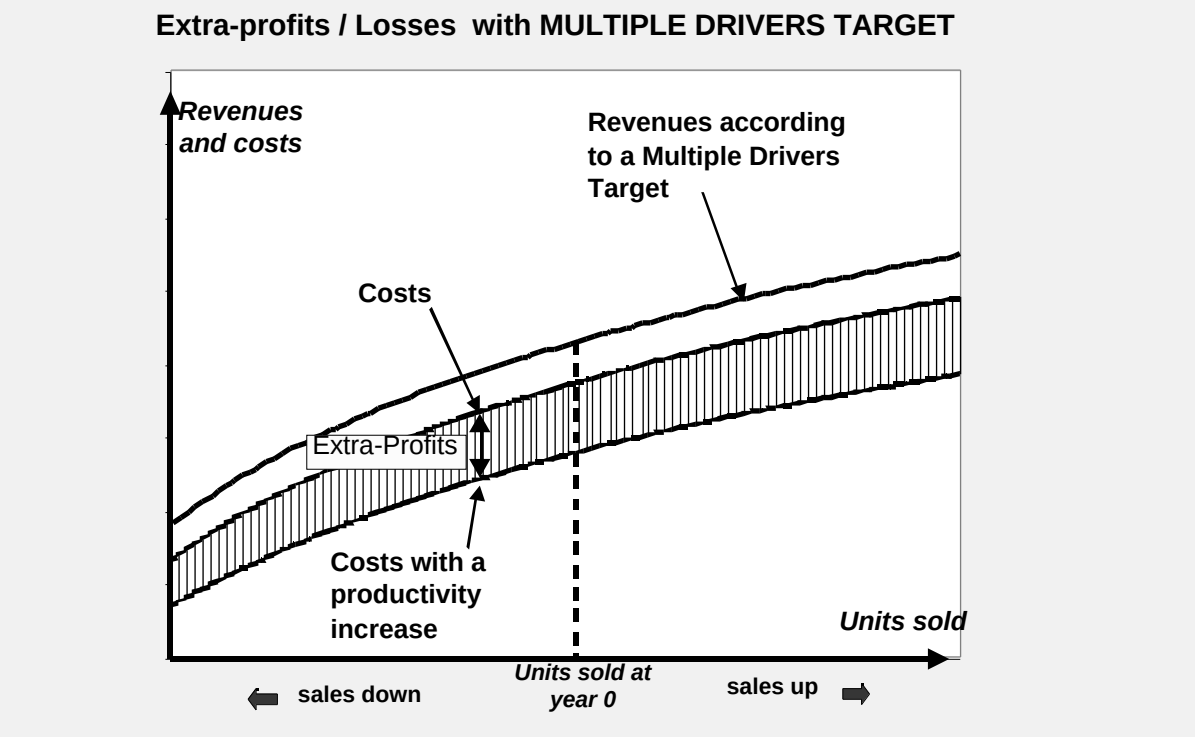
Advantages in respect to Energy Efficiency promotion

- Reduction of artificial disincentives to promote Energy Efficiency Demand Side Management embedded in the pure Price cap regulation.
- Increase of the range of Demand Management and Energy Efficiency options which are commercially feasible, compared to Price Cap.
- Reduction of artificial incentives to sell more, embedded in the pure Price Cap regulation.

These effects are illustrated in figure 4. During the regulatory lag under MDT regulation revenues will evolve in line with the expected evolution of costs, plus a "reasonable" profit allowed by the regulator. The expected evolution of costs is the evolution which would take place according to the correlation among costs and cost drivers (not only kWhs, but also number of customers, grid length,…) as observed in the past. If the correlation has been correctly calculated and remains unchanged during the regulatory lag, the company will earn the profit level allowed by the regulator both in the case that sales would be higher or lower than expected. This ensures that the company has no incentive to increase sales beyond expected levels in order to enjoy higher profits, and no disincentive to reduce sales through EE-DSM.

But, importantly, the company has an incentive to reduce costs below what is predicted by past correlation with cost drivers, that is has an incentive to increase its economic efficiency compared to past performances, in order to obtain additional profits.

Figure 4. During the regulatory lag, under MDT, the evolution of allowed revenues follows the evolution of costs expected through the correlation with cost drivers; the difference between the two represents the allowed profits.



Advantages in respect to bills

· Promotes stabilisation or decrement of National bill and single customer bill through increased end-use energy efficiency.

Advantages in respect to Energy Companies' market strategies

· Higher flexibility for Energy companies in the choice and integration of profit-maximising strategies, since the Companies to increase their profits can mix:
  - Reduction of costs compared to past performances.
  - Action for energy efficiency in some end-uses, which are not restricted to end uses mainly concentrated during peak times as it happens under a pure Price Cap regulation.

Figure 5. Variation of Profit with sales versus marginal cost of energy

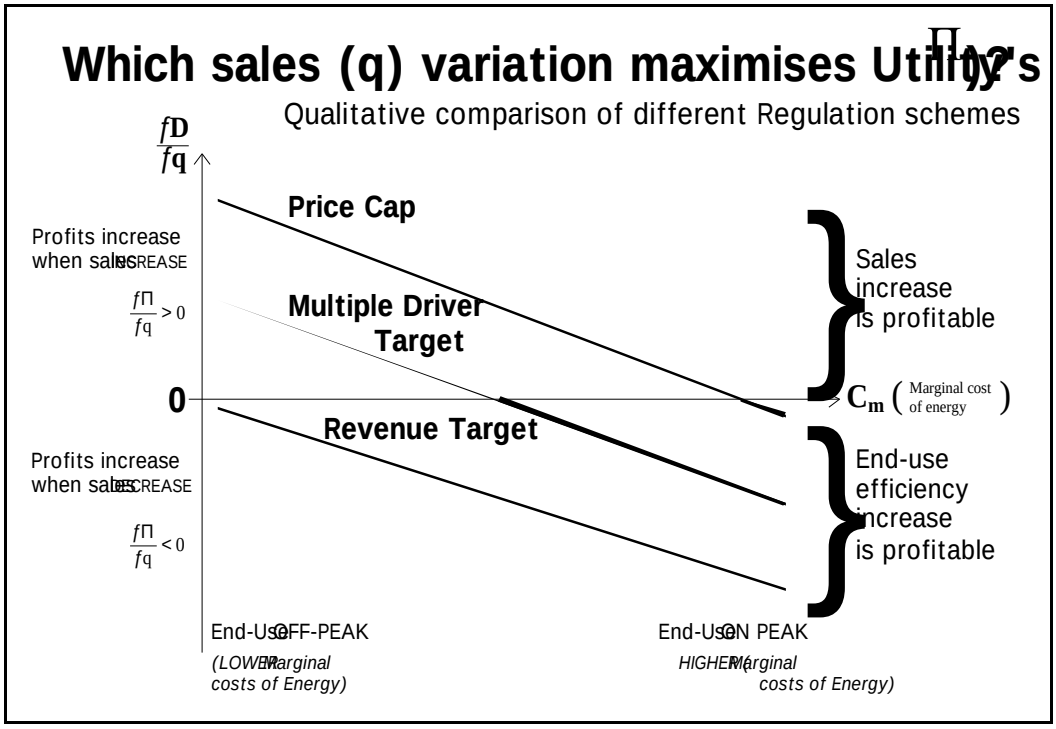
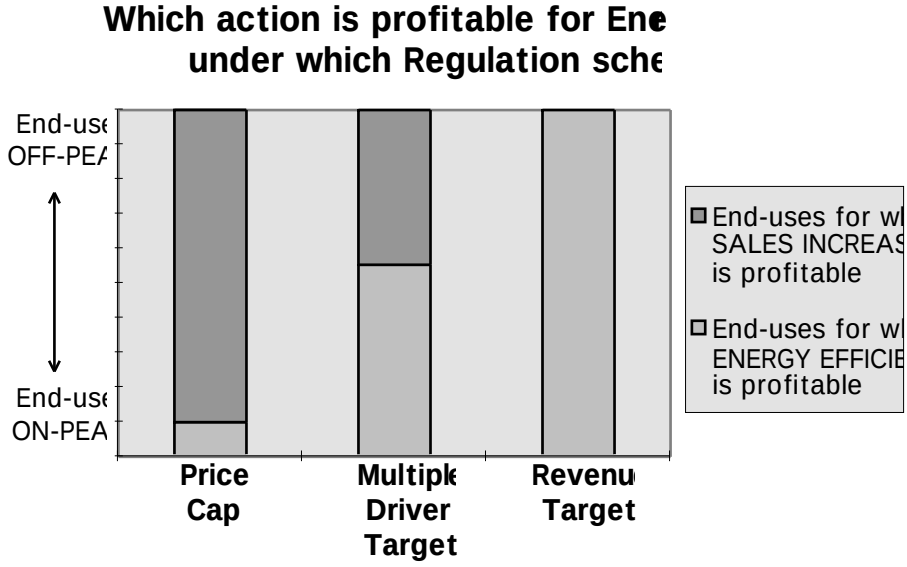


Figure 6. The range of end use energy efficiency actions which are profitable for a company increases when switching from a price cap to a Multiple Drivers Target or a Revenue Target



Multiple Drivers Target schemes can ease the implementation of obligations to implement EE-DSM (mandated savings targets are in place in a number of countries: e.g. England and Wales, Denmark, and since April 2001, Italy). When both obligations and MDT are present energy companies have "the duty and ability" [OFFER 1993] to activate cost-effective Demand Side Resources (and thus contribute to reduce the national energy bill and negative environmental impact) without decreasing their profits, and in some cases increasing them.

6. IMPLEMENTATION ISSUES

Multiple Drivers Target schemes are in general simple to understand and realise, since they can be obtained through a modification of the Price Cap basic formulas. The annual application requires the knowledge of very simple parameters in addition to the requirements of pure Price Cap regulation, like the customers' number (total or split into different classes) and/or the grid length of the different energy companies.
During the rate case, it will be necessary to identify the value of different cost drivers and their coefficients, e.g. by means of statistical analysis and/or data envelopment (benchmarking) analysis [P. Burns *et al.* (1999): Benchmarking von Netzkosten – Data Envelopment Analyse (DEA) am Beispiel der Stromverteiler in Großbritannien, Zeitschrift für Energiewirtschaft, 4, 285-301]. These coefficients could be equal for all utilities or different, depending on the result of the analysis. The calculation of annual variation of the authorised revenues will then be straightforward, requiring only the estimate of the values of some cost drivers. For example if β is equal to 0.5 and the annual variation in the number of customers is 10%, other quantities being equal, the company will be authorised to collect revenues which are 5% higher than in the previous year.

7. EXPERIENCES

England and Wales

Following some of the suggestions which came during the tariff revision process, in 1994 the electricity Regulator OFFER has set a “maximum average charge per unit distributed”. Since “average charge per unit distributed” is described in the same text as “the distribution revenue in the relevant year divided by the regulated quantity distributed in that year”, we can see that in effect it has been fixed a maximum level to the total distribution revenue. The formula gives a weight of 50% to the number of customers and a 50% to the number of electricity units distributed, so in practice we have here a Multiple Drivers Target even though written in the form of a Price Cap.

> “Price controls can be designed so that the permitted level of total revenue varies with changes in volume as well as being indexed to the Retail Price Index. Under the original distribution price control, allowed revenue increased in proportion to units distributed. The last distribution price control review concluded that the weight of units distributed in the revenue driver of the price control should be halved, from 100 per cent to 50 per cent. The remaining 50 per cent was fixed by relating it to a predetermined projection of customer numbers.”, [OFGEM 1998].

As we have already mentioned (see Figure 2), recently OFGEM (electricity and gas Regulator) has carried out a new study showing a rather close correlation between distribution costs and a a composite variable attaching a weight of 0.7 (or 70 per cent) to the number of customers, and 0.15 to each of the number of units distributed and length of network (OFGEM, August 1999).
This result (which is confirmed in a study carried out by the Monopolies and Mergers Commission, during an inquiry on Northern Ireland Electricity, an electricity distribution company) shows that the weight given in the MDT formula to the number of distributed energy units could still be lowered from the present 50% value.
Actually the formula (introduced by OFFER in 1994 in conjunction with a term which permitted the recovery of the costs of EE-DSM programmes) has induced the Electricity companies to drop the emphasis previously given to marketing programmes to expand sales. However it didn't yet succeed in enlarging the realisation of EE-DSM programmes. In fact the Electricity companies carried out programmes just as much as it is needed to fulfil the minimum level set in the Standard of Performances imposed by the Regulator.

Norway

The Regulator (NVE) in establishing the new system, has tried to incorporate a few very essential factors, including the incentives to improve efficiency.
The regulation formula (which is applied for market sectors characterised by the presence of natural monopolies) is a Multiple Drivers Target where the annual allowed revenues change only proportionally to 50% of the variations of the distributed electricity units.

Italy

In December 1999 the Italian Authority for Electricity and Gas has set the new tariff mechanism that companies should comply with when determining prices for *captive* customers. All the prices for *non domestic captive customers* must meet a Multiple Drivers Target on revenues which, for the part to cover the Distribution costs, attaches a weight of 75% to the number of customers and of 25% to the number of units distributed; the part to cover the Retail Sale costs is regulated through a Revenue per Customer Cap, that is revenues are independent from the number of units sold. Also the tariff for domestic customers is set with the same scope, but the electricity companies have the possibility to offer free tariffs completely unregulated, and then they can skip the cap.

New South Wales (Australia)

As part of its March 1996 Electricity Pricing Determination, the Independent Pricing and Regulatory Tribunal (IPART) introduced a MDT regulation (albeit indicated with the name of Revenue regulation) for the distribution and retail supply industries. In fact IPART explains to have chosen this form of regulation because it "…better reflect the industry's cost drivers. The fixed costs within networks mean that, with the exception of areas of congestion, additional costs caused by increases in the volume of electricity transmitted are much lower than average costs. By better matching the cost drivers, the risks from variations in volumes and the incentives for gaming forecasts of future volumes are reduced." [IPART, 1998]
Also*:*

> "Setting a cap on overall revenue or margins rather than average prices greatly reduces the link between revenues and sales of electricity and dampens incentives for increasing electricity sales. Instead, **greater returns** … will be achieved **by productivity improvements rather than increasing electricity sales**. The objective is to reduce the bias against potential demand management initiatives." [IPART, 1996].

The Tribunal has also placed constraints on maximum increases in customer prices to reduce rate shock concerns.

We now summarise the values of the coefficients in the Multiple Drivers Target formulas which have been adopted in the different countries.
We remind here that the general formulation is:

$$R_{\lim (t)} = R_{\lim (t-1)} \left[(1 + I - X) + \alpha + \beta \frac{N_t}{N_{t-1}} + \gamma \frac{E_t}{E_{t-1}} + \delta \frac{G_t}{G_{t-1}} + \ldots \right]$$

England and Wales (Distribution):
$\beta = 0.5$ $\gamma = 0.5$

New South Wales (Distribution and Retail Sale):
$\alpha+\beta+\delta = 0.75$ $\gamma = 0.25$ (ca.)

Norway (Distribution):
$\alpha = 0.5$ $\gamma = 0.5$

Portugal, (Distribution):
$\alpha, \delta = 0$ $\gamma = 1$ (roughly) plus a profit sharing mechanism
(Retail Sale):
$\beta = 0.5$ (roughly) $\gamma = 0.5$ (roughly) $\alpha, \delta = 0,$ plus a profit sharing mechanism

Italy (only for non domestic captive customers, presently about 40% of total consumption):
(Distribution): $\beta = 0.75$ $\gamma = 0.25$
(Retail sale): $\beta = 1$ $\alpha, \gamma, \delta = 0$

8. CONCLUSIONS

In conclusion Multiple Drivers Target Schemes, when properly applied:

- Give powerful incentives for economic efficiency on the supply-side,
- Ensure customer protection and satisfaction ,
- Decrease the artificial incentives to increase sales and the bias against EE-DSM,
- Allow the inclusion of direct costs of EE-DSM programmes in the rates,
- Are slightly more difficult to administer compared to PCR, and at least initially cause more or less the same costs of the regulatory authority as ROR.

So Multiple Drivers Target schemes can harmonise the pursuing of energy companies economic interests, of cost reduction and of end use energy efficiency, while at the same time keeping the regulatory burden reasonably low.

Our results indicate that MDT regulation for monopoly segments of electricity and gas sector should be part of every package of actions meant to incorporate energy efficiency into the restructuring process. In order to achieve a large-scale implementation of the cost-effective EE-DSM programmes, we recommend to include the Multiple Drivers Target regulation into a wider mix of policies, such as those described in Wuppertal Institute *et al.* (2000).

Finally it's worth to remark that the regulation of average prices or total revenues for energy companies according e.g. to a MDT, does not determine the specific form of tariffs (prices) for final customers. For example, while revenues to a network company can be correctly made relatively independent from sales volume, prices to final customers can be made directly proportional to consumption (no or small fixed and per kW charges) or even progressive with consumption (see for example [Pagliano, Alari, 1999b]), and such to reflect marginal costs of energy supply, including possibly "external costs".

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10. GLOSSARY

COS:	Cost of Service
EE-DSM:	Energy Efficiency Demand Side Management, that is demand side programmes aimed at increasing end use energy efficiency
DSM:	Demand Side Management activities which can include both promotion of end use efficiency and load management which does not reduce energy consumption
IPART:	Independent Pricing and Regulatory Tribunal of New South Wales
MDT:	Multiple Drivers Target
OFFER:	Office of Electricity Regulation
OFGEM:	Office of Gas and Electricity Regulation
PBR:	Performance Based Regulation
ROR:	Rate of Return

11. END NOTES

[1] That is in cases when other alternatives, like reducing energy consumption through end use energy efficient technologies, prove to be a cheaper way to deliver the required services to customers and society.

[2] Sometimes the COS-ROR regulation has been flanked by public subsidised investments both for building new plants and for the establishment of energy "political prices".

[3] Resistance losses on the grid.

[4] Which was a pure Price Cap at that time (Note of the authors).

[5] Pure Price Cap regulation links the revenues only with the volume of sales; the Pure Revenue Cap/Target regulation breaks down the link between revenues and all previous variables; the Revenue Per Customer Cap/Target regulation links the revenues only with the number of customers.

[6] It would have been advisable to use this scheme for all the distribution tariffs, that is the tariffs for the use of the distribution grid both by eligible and non eligible customers.

[7] The traditional PBR schemes, can all be generalized to the Revenue Target (or Cap) scheme, considering particular target revenues updating procedures (in addition to automatic adjustment parameters I and X):

- In the Price Cap the target revenues are updated considering exclusively variations in the quantity of energy sold (updating of R_{lim} proportionally to E_t/E_{t-1}),
- In the Revenue Target there is no additional updating factor,
- In the Revenue Per Customer Target the target revenues are updated considering exclusively variations in the number of customers (updating of R_{lim} proportionally to N_t/N_{t-1}).

[8] It must be noted that excluding fuel costs from the target/cap may lead to unwanted incentives, see Moskowitz 1989, since for each element which is recovered as a pass through there is no incentive to reduce its costs.