"Energy Research for a Sustainable Future"

Incentive Rate Regulation and Integrated Resource Planning

A Critique of Gaz Métropolitain's proposed PBR in the context of the legislative mandate of the Régie de l'énergie

testimony of

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on behalf of the

Regroupement national des Conseils régionaux de l'environnement du Québec (RNCREQ)

R-3397-98, SCGM 1999 rate proposal

Régie de l'énergie

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Foreword

The Helios Centre was retained by the Regroupement national des Conseils régionaux de l'environnement du Québec (RNCREQ) to provide expert advice and testimony regarding *Société en commandite Gaz Métropolitain*'s 1999-2000 rate proposal.

In the context of a rate case, there are two fundamental issues that have significant environmental implications: **(1) the level and structure (design) of rates**, which affect the consumer's purchase choices and efforts toward using energy more efficiently, and **(2) the comprehensive regulatory approach to ratemaking** which, through its rewards and penalties (incentives), affects primarily the utility's marketing strategies and efforts toward helping its customers use energy more efficiently. These are, in essence, the two sides of the regulatory coin as regards ratemaking and environmental concerns.

The mandate we have received is limited to the latter issue, although we would like to emphasize that this in no way should diminish the importance of rate design options. More specifically, we were asked to evaluate SCGM's proposal in the broad context of the Régie de l'énergie's legislative mandate and its general underlying principles, including notions of sustainable development, integrated resource planning and minimizing economic, social and environmental costs to society.

In order to fulfill this mandate, the Helios Centre in turn retained the services of the Tellus Institute, which collaborated fully in the preparation of the present testimony.

About the Authors

Philippe DUNSKY

Philippe Dunsky is a founder and Director of the Montreal-based Helios Centre, an independent research and consulting group specializing in a host of energy-related topics. Dunsky has worked on energy issues since 1991, both as a consultant and internal analyst. In these capacities, he has worked on such issues as Integrated Resource Planning, incentive rate regulation, electric industry restructuring and competitive market design, energy efficiency strategies and policies, new renewable energy technologies and public participation processes, among others. His clients have included utilities, environmental groups, consumer organizations, First Nations, private power producers, governments and industrial groups.

Dunsky's articles have appeared in the Energy Studies Review and Canadian Energy Markets, as well as in a variety of conference proceedings, including those of the American Council for an Energy Efficient Economy's Summer Study. He has also authored chapters in successive books on Hydro-Québec, the role of energy in society and worldwide electric industry market restructuring. Dunsky has been a guest speaker at numerous energy-industry conferences in Canada and the United States, including those of the ACEEE, the International Research Institute, Hydro-Québec and the Canadian Electricity Association. Philippe has also been a member of the boards or advisory committees of a variety of community-, utility- and government-sponsored organizations.

David NICHOLS

David Nichols is a vice-president of the Tellus Institute, and Manager of the Demand-Side Management (DSM) Program in the Energy Group. A Tellus co-founder, he has been engaged in energy efficiency studies and program development since 1977. In the 1990s, Nichols has worked on DSM development and evaluation related issues for electric and gas utilities, utility

commissioners and commission staffs, environmental organizations, consumer advocates, and others.

In addition to his work in the United States, David has provided assistance to and testimony on behalf of The Consumers' Gas Company of Ontario in designing and implementing all of its DSM plans from 1994 through the present, in addition to providing testimony regarding the Company's regulatory treatment of energy efficiency options. He was also recently invited by the Régie de l'énergie's IRP Working Group to present and discuss the fundamentals of integrated resource planning.

Nichols' articles have appeared in the Electricity Journal, the UN's Industry and Environment Review, the American Council for an Energy-Efficient Economy's Summer Study Proceedings, and in conference proceedings published by Electric Power Research Institute and other organizations. David received his A.B. from Clark University and his Ph.D in political science from MIT. Before joining Tellus, he was associate professor at the State University of New York (Albany).

Sommaire en français

La Société en commandite Gaz Métropolitain (SCGM) a proposé une approche de réglementation incitative pluriannuelle devant s'étendre de 1999 à 2003. La proposition est censée offrir à la SCGM l'occasion de profiter de réductions de ses coûts (gains de productivité), d'une part, et d'une croissance des volumes de gaz vendus (essentiellement mais pas uniquement par l'ajout de nouveaux clients qui auraient autrement consommées soit de l'électricité, soit du mazout), d'autre part. Suivant cette proposition, la performance globale de l'entreprise serait mesurée en fonction de sa capacité de minimiser les tarifs relativement à ceux de l'année précédente, en tenant compte de l'inflation et du volume des ventes. Ainsi, la proposition fournirait à la SCGM un incitatif financier important pour minimiser les coûts et accroître la consommation de gaz, puisqu'elle retiendrait alors les 2/3 des gains mesurés selon la formule proposée, jusqu'à concurrence d'un boni de 400 points de rendement sur l'avoir propre.

La SCGM a aussi reconnu le nouvel encadrement de planification intégrée des ressources (PIR) qui résulte du mandat législatif de la Régie de l'énergie. Ce nouvel encadrement oblige les distributeurs d'énergie à répondre aux besoins de services énergétiques dans une perspective de développement durable, celle-ci devant plus spécifiquement tenir compte des considérations économiques, sociales et environnementales. De plus, la SCGM reconnaît que ce nouvel encadrement et les objectifs mentionnés exigent l'exploitation du potentiel d'efficacité énergétique qui contribue à minimiser le coût total pour la société de ses services énergétiques, en fonction du « test du moindre coût social ». Enfin, l'entreprise reconnaît que l'efficacité énergétique, quoique présentant souvent des bénéfices économiques ou environnementaux nets importants, peut ne pas être rentable pour le distributeur selon le mode actuel de réglementation.

La proposition d'encadrement réglementaire de la SCGM fait fi, toutefois, de ces objectifs de développement durable, de planification intégrée des ressources et d'efficacité énergétique. Son unique objectif est de permettre à l'entreprise de bénéficier d'une croissance de la consommation et de réductions de coûts. Elle ne contient aucune modalité pour atténuer le fait que les mesures de minimisation des impacts environnementaux ou d'amélioration de l'efficacité énergétique peuvent ne pas être rentables pour l'entreprise. Pire, la proposition

rendrait elle-même les options d'efficacité énergétique inutilement, voire artificiellement coûteuses pour la SCGM. Le fait de présenter en ce moment un puissant mécanisme d'incitatifs à la croissance des ventes, tout en remettant la réalisation des objectifs d'efficacité énergétique et de planification intégrée des ressources à une date ultérieure, ne peut qu'élargir encore davantage l'écart actuel entre les intérêts financiers de la SCGM et les intérêts de la société québécoise touchant une plus grande efficacité énergétique et la minimisation des coûts environnementaux.

Au chapitre I du présent témoignage, nous expliquons en quoi chaque forme de réglementation des tarifs crée des incitatifs financiers d'une sorte ou d'une autre pour l'entreprise. Nous ajoutons qu'une large gamme d'incitatifs différents peuvent être appliqués selon les objectifs du régulateur. Le choix d'un mécanisme incitatif approprié dépend des objectifs et du mandat du régime de réglementation.

Au chapitre II, nous passons en revue rapidement le mandat de la Régie de l'énergie, en décrivant en particulier les différences clés entre ce mandat et celui qui guidait auparavant la Régie du gaz naturel. Nous indiquons dans quelle mesure le nouveau mandat est basé sur les principes de base du développement durable et de la planification intégrée des ressources, les deux concepts se traduisant, pour ce qui est de la réglementation énergétique, par l'objectif de « minimiser les coûts à la société ».

De plus, nous expliquons la relation intrinsèque entre le processus de réglementation des tarifs et celui de planification des ressources tel qu'établi à l'article 72 de la loi sur la Régie de l'énergie. Alors que l'encadrement tarifaire indique les types d'investissements et choix de marketing que doit poursuivre l'entreprise afin de maximiser ses profits, c'est dans le plan de ressources qu'on définit les choix précis nécessaires pour maximiser les bénéfices nets pour la société. L'entreprise privée n'étant pas une œuvre de charité, l'objectif de la réglementation incitative des tarifs est donc de marier ces deux intérêts de façon à ce que la voie la plus profitable pour l'entreprise le soit également pour la société.

Au chapitre III, nous étudions en détail certains des effets pervers qui suivraient si la proposition de la SCGM devait être adoptée et si, toujours selon sa proposition, le choix de mécanismes pour traiter de l'efficacité énergétique, par exemple, était remis à une date ultérieure. À cette fin, nous décrivons les différents « tests de rentabilités » largement reconnus dans le milieu énergétique et utilisés dans le cadre de la PIR, et les comparons avec les repères décisionnels que devrait utiliser l'entreprise si sa proposition devait être retenue. Mettant l'accent sur les deux options clés de la gestion de la demande, soit l'efficacité énergétique et la subsitution, nous concluons que la proposition de la SCGM aurait entre autres les conséquences négatives suivantes :

- Récompenser la SCGM pour des efforts de marketing qui résulteraient en des factures pour les consommateurs ou la société inutilement élevées.

- Pénaliser la SCGM pour des efforts en matière d'efficacité énergétique qui résulteraient en une diminution nette des factures des consommateurs ou des coûts pour la société.

- Récompenser la SCGM pour des activités de marketing qui augmenteraient les ventes sans égard à leur bénéfice ou coût environnemental net.

- Retrancher, à l'intérieur de la SCGM, un biais institutionnel défavorable à la plupart des mesures ou programmes d'efficacité énergétique pourtant rentables pour la société.

- Tenter la SCGM de s'opposer ou de faire obstacle, avant ou pendant le futur processus de planification des ressources, à l'application de la planification intégrée des ressources telle que prévue à l'article 72 de la loi sur la Régie de l'énergie.

- Créer des incitatifs pervers, même si des mécanismes spécifiques à l'efficacité énergétiques étaient « ajoutés » à la présente proposition à une date ultérieure, pour que la SCGM vise à minimiser la performance réelle de tout programme d'efficacité énergétique autorisé par la Régie de l'énergie.

- Obliger la Régie de l'énergie, face aux résultats d'un régime réglementaire conflictuel, à « micro réglementer » les activités de marketing et d'efficacité énergétique de la SCGM.

- Créer de façon générale un conflit fondamental et artificiel entre les intérêts de la SCGM et ceux de la société.

Nous concluons de plus que les remèdes possibles que la SCGM pourrait proposer à une date ultérieure sont insuffisants pour renverser la dislocation fondamentale entre les intérêts de l'entreprise et ceux de la société, ce qui est au cœur des problèmes mentionnés ci-dessus.

Au chapitre IV, nous offrons à la Régie plusieurs options de réglementation incitative pour simultanément (1) récompenser les économies de coûts (gains de productivité), (2) récompenser la croissance des ventes lorsque celle-ci est rentable d'un point de vue social et (3) récompenser la mise sur pied de programmes d'efficacité énergétique lorsque ceux-ci sont également rentables pour la société, le tout en respectant les principes fondamentaux de tarifs justes, raisonnables et basés sur les coûts. En particulier, nous décrivons une approche en trois étapes pour l'efficacité énergétique, qui consiste en (a) le recouvrement des coûts, (b) le recouvrement des revenus perdus et (c) des incitatifs basés sur le partage des économies. Pour ce qui est des programmes de substitution, nous présentons un exemple d'indice de la qualité de l'environnement (IQE) qui pourrait se joindre à l'indice de la qualité du service (IQS) plus traditionnel, et qui fonctionnerait de la même façon.

Dans ce même chapitre, nous regroupons six options décisionnelles qui se présentent à la Régie de l'énergie, incluant à la fois l'adoption ou le rejet de la proposition de la SCGM, avec ou sans modifications. Nous discutons ensuite des avantages et inconvénients de chaque option selon le mandat de la Régie et le principe plus général de la cohérence réglementaire, avant de présenter notre option préférée.

Enfin, au chapitre V, nous présentons nos conclusions et recommandations. En particulier, nous insistons sur l'importance de retenir des incitatifs à la réduction des coûts et aux gains de productivité, lesquels doivent être jumelés à des incitatifs relativement à l'environnement et la qualité du service, le tout en s'assurant de placer l'efficacité énergétique sur un pied d'égalité avec les options du côté de l'offre, préférablement par le biais d'un mécanisme global et intégré. À cet égard, nous recommandons à la Régie de rejeter la proposition de la SCGM et de lui ordonner plutôt d'examiner les approches que nous décrivons au chapitre IV, et d'élaborer par la suite une approche globale de la réglementation incitative à la fois plus équilibrée et respectueuse du mandat de la nouvelle Régie, le tout pour examen lors de la prochaine cause tarifaire.

Entre temps, nous suggérons que le régime actuel de réglementation des tarifs de la SCGM soit maintenu de façon intérimaire, ce régime permettant à l'entreprise de tirer profit des réductions de coûts relativement au coût de service de l'année témoin, selon sa capacité d'atteindre des objectifs de qualité du service. Nous recommandons également que la Régie décourage la poursuite par la SCGM de programmes de substitution visant le marché de l'électricité, tant que l'entreprise n'aurait soumis une analyse de l'impact environnemental net d'une telle activité. Enfin, nous proposons à la Régie d'indiquer à la SCGM qu'elle portera un regard favorable au remboursement des coûts supplémentaires associés à des programmes d'efficacité énergétique que l'entreprise pourrait mettre en place dès cette année et qui engendrerait un bénéfice net selon le test du moindre coût total en ressources.

À terme, il sera important de passer de ce genre d'approche annuelle à une approche globale incitative pluriannuelle et visant des objectifs multiples, conformément à l'esprit de la loi sur la Régie de l'énergie. Toutefois, ce processus ne doit pas se faire à la hâte ; nous devons prendre le temps requis pour bâtir un encadrement réglementaire viable et pleinement en mesure de refléter et d'appuyer les objectifs de la nouvelle Régie de l'énergie. La proposition de SCGM est un échec à cet égard.

English Summary

SCGM has presented a five-year incentive ratemaking proposal to run from 1999 through 2003. The proposal is intended to provide SCGM with an opportunity to profit from both cost-cutting and load building. Cost-cutting refers to improving productivity and delivering gas energy services to customers at lower cost. Load building refers to increasing the volumes of gas sold, primarily though not solely through the addition of customers who would otherwise have used fuel oil or electricity. Under SCGM's proposal, performance would be measured by the utility's ability to minimize rates relative to the previous year's level adjusted for inflation and volumes of gas sold. The utility would have a strong incentive to cut costs and increase sales, since it would retain 2/3 the gains measured by the proposed formula, up to a full 400 basis point bonus rate of return.

SCGM has also acknowledged the new integrated resource planning (IRP) framework that follows from the Régie de l'énergie's legislated mandate. The new framework requires energy distributors to provide services in ways that are consistent with sustainable development, and which balance economic, environmental and social considerations. Further, SCGM acknowledges that the new framework implies the pursuit of demand-side energy efficiency which contributes to minimizing society's total costs of energy services, based on the "societal cost test". SCGM acknowledges that pursuit of energy efficiency, while it has important net economic and environmental benefits, may not be profitable to the utility under current ratemaking practices.

SCGM's new ratemaking proposal neglects, however, to address these goals of sustainable development, integrated resource planning and demand-side efficiency. Its sole objective is to allow the Company to benefit from sales growth and cost-cutting. It contains no provisions to mitigate the unprofitability to the utility of pursuing environmental improvement and societally cost-effective energy efficiency. Indeed, it would itself make such efficiency options artificially costly and financially unattractive to SCGM. To introduce a strong growth incentive at this time, while waiting to implement IRP and efficiency objectives at a later date, is to shift SCGM's financial interests even further away from energy efficiency and environmental protection than they already are.

In chapter I of our written testimony, we explain why every form of rate regulation provides financial incentives of one form or another to the utility. We further explain that a variety of incentives can be applied according to the regulatory objective to be met. The choice of a proper incentive mechanism depends on the regulatory goals and mandate.

In chapter II, we review the Régie de l'énergie's mandate, describing in particular the critical differences between this mandate and that of the Régie's predecessor, the Régie du gaz naturel. We describe the extent to which the new mandate is based on the fundamental tenets of sustainable development and integrated resource planning, which is translated in regulatory language into the objective of "minimizing cost to society".

We further explain the intrinsic relationship between the ratemaking process and the resource planning process set out in article 72 of the Régie's law. The ratemaking framework informs the utility of the types of investment and marketing choices it needs to make to maximize its profits, while the resource planning process under article 72 assesses which such choices are needed to maximize net benefits to society. The objective of ratemaking incentives is thus to link these two interests by ensuring that the utility's most profitable course of action is equally the most profitable one for society.

In chapter III, we delve at some length into the variety of adverse effects that are likely to follow if SCGM's one-sided incentive mechanism is adopted, and other ratemaking innovations specific to energy efficiency, for example, are left to some future time. To do this, we describe the traditional benefit-cost analyses performed under integrated resource planning, and compare them with the benchmark analyses that will result from adoption of SCGM's proposal. In focusing on the two main types of demand-side option, i.e. energy efficiency and fuel switching, we find that adoption of SCGM's proposal would, among other negative results:

- Reward SCGM for marketing efforts that result in unnecessarily high consumer bills or societal cost.
- Penalize SCGM for energy efficiency efforts which resulted in lower consumer bills or societal costs.
- Reward SCGM for marketing activities that build sales without regard to their net environmental benefit or cost.
- Encourage, within SCGM, an institutional bias against many societally cost-effective energy efficiency measures and programmes.
- Tempt SCGM to oppose, prior to or during the future resource planning process, the proper application of IRP as called for under article 72 of the Régie's law.

- Provide perverse incentives, even with efficiency mechanisms being "tacked on" to the current proposal at a later date, for SCGM to minimize the actual performance of any energy efficiency programmes authorized by the Régie de l'énergie.

- Oblige the Régie de l'énergie, faced with the results of conflicting regulatory signals, to "micro-manage" SCGM's efficiency and marketing activities.

- Generally create a fundamental and unnecessary conflict between the utility's interests and those of society.

We further find that the types of remedies SCGM says it may propose at a later date are insufficient to reverse the fundamental dislocation of its and society's mutual interests which lies at the heart of the problems noted above.

In chapter IV, we offer a number of suggestions for incentive ratemaking frameworks which can simultaneously (1) reward cost-cutting, (2) reward sales growth that is based on pursuit of load-building that is societally cost-effective and (3) reward efficiency programs which likewise are societally cost-effective, all the while respecting the traditional touchstones of fair, reasonable and cost-based rates. In particular, we describe a three-step approach to energy efficiency, which allows for (a) cost recovery, (b) lost revenue recovery and (c) shared savings incentives. For fuel switching, we present a sample Environmental Quality Index (EQI) which could be joined to a "traditional" service quality index, and function in the same manner (as a screen for productivity-based rewards).

In this same chapter, we group together a series of six possible decisions that the Régie de l'énergie may examine, including approving or rejecting SCGM's proposal with or without a series of modifications. We further describe the advantages or disadvantages that we see in each option from the point of view of the Régie's mandate and of regulatory consistency, before presenting our preferred approach.

Finally, in chapter V, we present our conclusions and recommendations. In them, we insist on the importance of retaining incentive measures for economic performance and productivity gains and coupling them with environmental and quality service incentives, as well as with the necessary mechanisms to ensure that demand-side options are measured on a level playing field with supply-side ones, the whole preferably in a comprehensive regulatory package. As such, we urge the Régie to reject SCGM's proposal, and instead direct the utility to examine the several incentive ratemaking mechanisms we describe in chapter IV, and then to craft a new, more balanced and comprehensive incentive ratemaking proposal for consideration in the next rate case.

In the meantime, SCGM's existing ratemaking mechanism can be maintained on an interim basis, thus allowing the utility to share in cost reductions below the test year cost of service, depending on its ability to meet quality of service objectives. We also recommend that the Régie discourage SCGM from

promoting fuel switching from electricity to gas until such time as it submits an analysis of net environmental impacts associated with this type of switching. Finally, we urge the Régie to indicate to SCGM a willingness to look favourably upon providing additional cost recovery for new energy efficiency initiatives that the utility may put forth within the coming year, to the extent they pass the total resource cost (TRC) test.

In the long run, it is important to move from this year-by-year incentive mechanism, to a multi-year, multi-objective PBR framework, in line with the Régie's mandate. But the process should not be rushed; the time must be taken to craft a framework which reflects the full range of the Régie's goals and which shall itself prove sustainable in the future. SCGM's proposal fails in this regard.

I. Introduction: All Regulation is Incentive Regulation

But incentives to do what?

A. Traditional Rate Regulation

Every form of rate regulation provides incentives to the regulated utility. Traditional cost-of-servce / rate-of-return (COS/ROR) regulation sets the rates energy distribution utilities may charge on the basis of accounting costs in a test year. Using test year sales data, rates are set to allow the utility to recover its operating expenses, depreciation expense, tax expense, and a return on its investment on useful plant and equipment. The rate of return is set by the regulator to earn a fair return for utility investors and allow the utility to attract needed investment capital from the market. In Quebec, SCGM's rates are re-established, based on COS data, each year. In many jurisdictions in North America, rates are not set on such a regular schedule, but rather are changed only when the utility or some other party petitions the regulator for a new rate case.

Because rates are set to assure the utility of full recovery of all prudently incurred costs and to provide the opportunity for the utility to earn its allowed rate of return, the regulated utility may, at very low risk, undertake both the short-term expenditures and the long-term investments needed to assure reliable and high-quality services to all of its customers. Its expenses and its investments will be recovered in rates as they are changed over time. This rate-setting approach appears to provide an incentive to emphasize quality of service, rather than to maximize efficiency in the delivery of service. The utility provides monopoly services, and there are no direct competitors in its franchise area, so if its rates are somewhat higher than they might be if the enterprise were as efficient as possible, the resulting competitive risk is nevertheless still limited to some degree.

Thus, traditional regulation provides implicit incentives to over-investment and operational inefficiency. Competition among providers of different forms of energy — gas, oil, and electricity — may provide an indirect counterweight to the implicit incentive toward investment, for the effect of rate levels on market share is always a concern among energy providers. Nevertheless, regulated firms have been found to tend to invest more capital than is economically optimal, a tendency first identified by Averch and Johnson (1962).

B. Next Generation Incentive Ratemaking

(1) Cost-cutting incentives

It is sometimes argued that under traditional regulation, the utility has an incentive to be efficient by cutting its operating costs below the levels of operating expenses that were included in the COS when rates were set, thus increasing earnings. However, as SCGM points out in its filing in this case, the operating efficiencies achieved will be reflected by the regulator in a new, lower COS when rates are next set. The present mechanism for sharing SCGM's operating cost savings between the utility and the customers was designed to create an incentive for the utility to cut operating costs in a regulatory regime in which rate cases recur annually. Another way to increase the incentive for utilities to cut costs is to increase the *regulatory lag* — the period of time between rate cases — such that the utility can keep all or some of the savings for a longer period of time before passing them on to consumers.

Performance based ratemaking (PBR) has been put forward in several jurisdictions. One of the objectives of PBR is to create stronger incentives for operational efficiency over time. This is often done by increasing regulatory lag, and by providing for rates to be readjusted within that longer time frame on some basis that allows the utility to profit from efficiency improvements. Another objective of PBR is to afford utilities the flexibility to cut prices to some customers so long as they do not raise them to others.

The most commonly proposed PBR mechanism is the rate cap, which sets maximum prices over the entire PBR period. PBRs generally include provision for adjustments for price inflation and a baseline level of productivity improvement[1]. If the utility can operate more efficiently than is required by the baseline productivity assumption, it can keep the savings as profit, or use them to reduce prices to customers whose load is felt to be at risk, or a bit of both. Rate cap mechanisms may be combined with profit/loss sharing schemes to balance the risks to shareholders and ratepayers.

Revenue cap PBRs are based on the same general approach as rate caps, except that they focus on controlling total energy bills (revenue) rather than prices. Under a revenue cap, either total revenue or revenue per customer, may be set over the entire PBR period. **The key difference between the revenue cap and**

[1] This is commonly known as the "CPI-X" formula (the CPI being the Consumer Price Index and X being the productivity factor).

the rate cap is this: rate caps reward sales growth and productivity improvements, while revenue caps reward only productivity improvements. Since increased sales cannot boost revenues above the revenue cap, revenue caps remove the financial disincentive to the utility's promotion of energy efficiency.

SCGM's proposed PBR mechanism is somewhat akin to a rate cap; we will call it a *"rate target"* approach. This approach sets target prices over the entire PBR period. It includes a sharing of profits between the utility and the ratepayers if rates fall below the rate targets during the PBR period. If rates exceed the target, the ratepayers are responsible for the entire loss (though these losses can be recouped from potential gains in future years).

(2) Service quality incentives

But cost-cutting is not the only objective of regulation, nor is it the only indicator of "performance". For example, regulators certainly do not wish to reward cost-cutting efforts taken at the expense of reasonable service quality. For this reason, most regulators use any of a variety of "carrots and sticks" to ensure that the utility has every reason to maximise the quality of the service it offers to customers, not just to minimise costs.

There are many different configurations of service quality indices (SQIs), and many ways of linking the performance they measure to the utility's interests. For example, the SQI adopted by the *Régie du gaz naturel* and currently in use focuses on meter reading, telephone response time, emergency response time, and preventive maintenance. The sharing of the cost savings that the utility achieves is linked to its ability to reach both absolute and relative performance on these indices (SCGM-16)[2]. Elsewhere, SQIs may focus more on customer complaints, customer satisfaction, repair time, customer outreach and education or employee safety (see Alexander 1996 and Comnes et al. 1995, page 48). One thing is certain though: incentive regulation is not limited to cost alone, and almost always includes incentives to reach or exceed quality of service thresholds.

(3) Environmental incentives

Similarly, a good PBR would create incentives to achieve environmental goals as well, depending on the policies of the regulator and/or the legislator. Where environmental protection is either implicitly or explicitly part of such policy, regulators must ensure that the utilities they regulate are given the right signals —

[2] Performance must meet or exceed 85% on the SQI to trigger benefit sharing, which increases gradually from 50% to 100% between the 85% and 95% SQI marks.

the right mix of rewards and penalties — **to ensure that environmental protection is as much in their private interest as it is in the interests of the society they serve**.

Once again, a number of incentive mechanisms and approaches are available to the regulator seeking to send a signal to the utility that environmental performance is in the utility's own interest. One approach consists of penalties or rewards for performance relative to specific environmental targets (for example emissions, use of renewable resources by electric utilities, etc.).

(4) Energy efficiency Incentives

Another goal of regulatory policy may be to encourage the distribution utility to promote end-use efficiency, that is, to increase the productivity with which customers consume energy in order to decrease the total costs of energy-related services. This goal may be pursued to reduce the total economic cost of providing energy, or to reduce the environmental impacts of energy use, or both.

If promotion of energy efficiency (EE) is a goal, then this goal, too, has implications for ratemaking incentives. Under traditional ratemaking it is not in the financial interests of the utility to promote greater end-use energy efficiency, for greater efficiency generally means lesser sales and slower growth. A variety of ratemaking mechanisms, including both specific options (lost revenue adjustments and sharing of savings) and comprehensive approaches (revenue and revenue-per-customer cap), have been developed to ensure that utilities pursue of cost-effective EE on an equal footing with energy supply.

(5) Balancing and aligning multiple objectives

Ratemaking is at the heart of the regulatory process. It determines the revenues and profits that the utility can make, thus exerting a powerful influence on actions the utility will take after rates have been set. When ratemaking talks, the utility listens.

For this reason, it is essential that the ratemaking process — including in particular the determination of a model for incentive regulation — reflect policy and regulatory objectives. If the incentives in ratemaking give a disproportionate weight to one objective, it is only with considerable difficulty that subsequent actions by the regulator will be able to fully correct the initial signal. From its top management on downward, the utility will respond to the incentives provided for in the regulator's ruling on ratemaking. The regulatory approach will affect everything from where capital and resources are allocated within the utility to what employees and managers have to achieve to earn end-of-year bonuses.

If energy efficiency is to be pursued when cost effective to society, or if service or environmental quality are to be attained, **such objectives must be reflected in the utility's guidebook to profit-making: its ratemaking régime.**

II. The Régie and IRP: A New Mandate, A New Framework

The 'Act Respecting the Régie de l'énergie'
represents a major change from its predecessor

A. From the RGN to the Régie de l'énergie: A Significantly Expanded Mission

(1) The new Régie's mission

Since all rate regulation provides utilities with incentives to achieve certain goals, it is critical to first determine the regulator's and society's goals. In the case of the *Régie de l'énergie*, these goals are expressed clearly in its enabling legislation:

> "Dans l'exercise de ses fonctions, la Régie favorise la satisfaction des besoins énergétiques dans une perspective de développement durable. À cette fin, elle tient compte des préoccupations économiques, sociales et environnementales ainsi que de l'équité au plan individuel comme au plan collectif. Elle assure également la conciliation entre l'intérêt public, la protection des consommateurs et un traitement équitable des distributeurs." (Assemblée nationale, 1996a, art. 5)

Article 5 mandates the Régie to ensure that needs are met through sustainable development. To this end, economic, social and environmental issues are to be considered. Applied to the choice of regulatory incentives in Gaz Métropolitain's rate case, **this would imply that the Régie should ensure a balance between economic, social and environmental objectives**, all the while ensuring that the utility is able to earn a reasonable return on investment. We discuss further the implications of the Régie's act as they apply to the SCGM rate case throughout the current chapter.

The previous Régie du gaz naturel was established by the earlier *Loi sur la Régie du gaz naturel*. Though similar in content to the new act, the Régie du gaz's act was a fundamentally different piece of legislation in terms of the key mission guiding the regulators. Indeed, that Act had no article comparable to article 5 of the Régie de l'énergie's legislation; no basic mission statement and no reference to environmental considerations or sustainability objectives.

(2) An explicit and intentional change

To a certain extent, the *Régie de l'énergie*'s act simply extends to electricity the power of the original *Loi sur la Régie du gaz naturel*. However, the legislator — the National Assembly — clearly sought a fundamental change by explicitly requiring that customers' needs be met through sustainable development, and by specifying that sustainable development meant at a minimum taking into account

environmental and social considerations, apparently on an equal footing with economic ones. The recurring use of this language in a number of articles throughout the law confirms the legislator's intent.

In fact, the government's energy policy is explicit about this change from the past:

> "Pour le gouvernement, la mission confiée à la Régie de l'énergie est double. Comme tous les organismes de ce type, elle doit assurer la conciliation entre l'intérêt public, la protection des consommateurs et un traitement équitable des distributeurs. De façon plus globale, le Régie devra favoriser la satisfaction des besoins énergétiques dans une perspective de développement durable." (Gouvernement du Québec 1997, 22).

Richard Carrier, director for Ratemaking and Finances at the Régie, and previously with the Régie du gaz naturel, explains the change in the regulator's mandate in the following terms:

> **"La Loi de la Régie est, en un certain sens, avant-gardiste par le fait d'inscrire la notion de développement durable au cœur même du mandat qui est confié à cette dernière. De plus, les préoccupations d'ordre social ou environnemental sont traitées sur le même pied que les préoccupations d'ordre économique, ce qui n'a pas nécessairement toujours été le cas dans le passé."** (Carrier 1998)

Furthermore, in summarizing the legislator's intent, he notes four objectives, the first two alluding directly to this new *encadrement*:

> "Il faut cependant rappeler qu'en créant la Régie de l'énergie, le gouvernement du Québec visait divers objectifs :
>
> - **Assurer la satisfaction des besoins énergétiques dans une perspective de développement durable**;
> - **intégrer les effets économiques, sociaux et environnementaux dans la prise de décision**;
> - adopter au niveau de la fixation des tarifs d'électricité un processus décisionnel transparent, équitable, indépendant et impartial où la participation de multiples intervenants de différents milieux de la société contribuera à atteindre la protection des intérêts de tous dans la recherche de l'intérêt public;
> - accorder un traitement tarifaire uniforme et équitable aux compagnies distributrices de gaz naturel et d'électricité." (Ibid.)

This expansion of the legislative mandate has clear implications for the regulatory process and its underlying decision-making framework. **It signals a change in the regulatory and ratemaking approaches that previously were applied to Société en commandite Gaz Métropolitain.** Recognizing these changes should be fundamental to any new incentive ratemaking proposal.

B. IRP and Minimizing Total Cost to Society

In adding article 5 to the Régie's act, the legislator sought to provide the Régie with a mandate to apply integrated resource planning (IRP). In its energy policy, the government explains this relationship as follows:

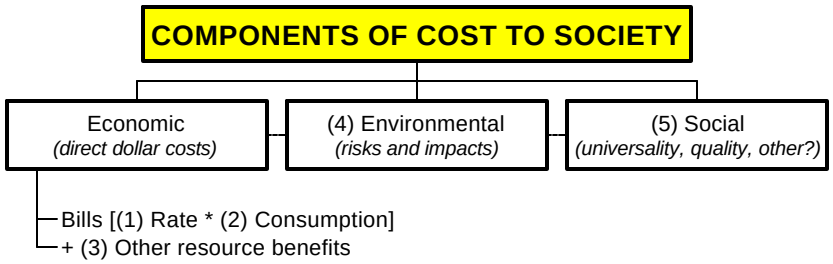
> "Pour examiner les plans de ressources qui lui seront soumis, la Régie utilisera une approche qui correspond à la méthode de la planification intégrée des ressources" (Gouvernement du Québec 1997, 27).

According to IRP principles, the regulator's objective is to *minimize total cost to society* — including economic, social and environmental costs and impacts — of meeting consumers' energy service needs. This is clearly consistent with the wording of article 5, and is further made explicit in the government's energy policy:

> "Le projet de loi créant la Régie de l'énergie prévoit les mécanismes permettant l'utilisation de la **planification intégrée des ressources.** La Régie de l'énergie aura ainsi tous les outils et l'autorité nécessaires pour s'assurer que **le coût total à la société des choix énergétiques soit minimisé.**" (Ibid., 21)

This understanding of the Régie's mandate is critical, as the term *"minimize total cost to society"* has specific implications (in addition to being a defining description of the very notion of IRP). Applying IRP and least societal cost criteria means ensuring that all investments and other decisions made by the regulated utility minimize, compared to all other possible options, the combination of economic costs (i.e. society's total bill), environmental impacts, and other social considerations. **This is referred to as a societal cost test, whose components are the following:**

Components of Total Cost to Society



As the chart above illustrates, applying the societal cost test prescribed by IRP means comparing all of the costs of alternative strategies for meeting energy-

related needs. These include social "costs", or considerations, environmental costs and impacts, and economic costs. Economic costs include both the total bill paid by consumers (approximated by the utility's rates multiplied by customers' consumption) as well as other resource benefits associated with energy-efficiency (EE) measures and programmes. For example, if an EE measure results not only in gas savings but also water or electricity savings, these must be included from a societal perspective, since they result in real dollar savings that accrue to consumers over time.[3]

Under IRP, then, these criteria must be carefully applied and the combined cost or impact of a utility's strategies must be minimized from a societal standpoint. **As we will explain, this is an essential consideration in determining the appropriateness of a mechanism for determining rates, since ratemaking and resource planning are intrinsically related.**

[3] There are, of course, a variety of specific issues related to the application of the societal cost test. For example, in order to properly assess the net benefits or costs of a given EE measure from the SCT standpoint, it is important to consider applying a societal discount rate — as opposed to the utility's (cost of capital) or individual's discount rates — for measuring the value of the benefit stream from future years (see, for ex., Fulmer and Biewald, 1994, 14-15). The societal discount rate is generally lower than that of the utility. These issues, while important, are outside the scope of our mandate.

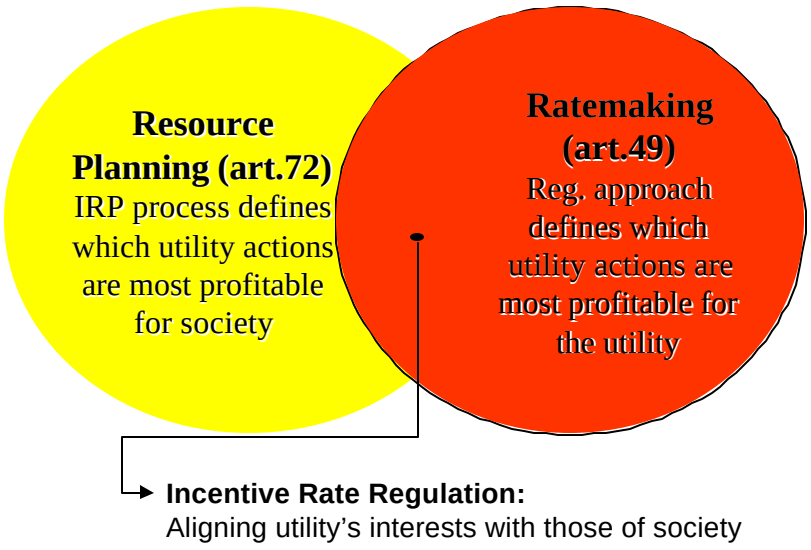
C. Applying Article 5 : Resource Plans and Ratemaking

While the overall mandate of the Régie is stated in art. 5, it is through the other provisions of its Act that this mandate is carried out. With respect to regulated electricity and natural gas distributors, the key provisions in this regard are those concerning ratemaking (chapter IV) and those concerning the distributors' obligations (chapter VI, section II). In this last section, it is the obligation to produce a resource plan for approval by the Régie (art. 72) which stands out as the central provision.

(1) An intrinsic relationship

The ratemaking and resource plan provisions of the Act affect each other significantly. As the following graph illustrates, it is the resource planning process which assesses a wide range of specific possible utility actions — particularly investment and marketing decisions — and identifies which ought to be pursued

Schematic Relationship between Ratemaking and Resource Planning



to minimize net costs to society. The goal of IRP is to ensure that all possible options are studied and the most beneficial options are selected.

Ratemaking establishes the framework within which the distribution utility incurs costs, collects revenues, and makes profits. The ratemaking framework affects multiple objectives — both traditional, such as providing for cost-based non-discriminatory rates and authorizing a fair rate of return, and newer objectives,

such as encouraging environmentally and socially responsible resource planning and procurement. Ideally, therefore, the ratemaking framework promotes the achievement of multiple objectives in a self-consistent way.

(2) Resource planning objectives

According to the Régie's Act, utilities must submit resource plans for approval, and the Régie must study these plans in accordance with article 72, which clearly describes the process of integrated resource planning (IRP). Of course, art. 72 is not yet in force, the regulation describing how it is to be applied has not yet been adopted, and the working group laying the groundwork for that regulation is only now finalizing its report. The present rate proposals cannot prejudge these decisions which have yet to be made. Nevertheless, given the fact that SCGM's five-year PBR proposal extends well into the period in which the implementation of article 72 is likely to occur, and given the intrinsic relationship between incentive rate regulation and IRP, SCGM's proposal should at a minimum be compatible with the general principles of IRP.

Integrated resource planning begins with a forecast of the demand for gas services in the distribution utility's service area. It then analyzes supply side options in order to identify the least-cost methods of providing for expansion of the distribution system over time, and for assuring adequate capacity to the extent the utility provides firm service. Modifications to demand-side energy-use patterns are then evaluated—energy efficiency, load management options such as interruptible service, and fuel switching—to determine their costs relative to the costs of supply-side options they can substitute for. The ultimate objective is an integrated plan consisting of a mix of demand-side options and supply-side options that promises to minimize total societal costs over the planning period. Whatever the ultimate form of the Article 72 regulations, it is prudent to allow for the likelihood that they will require integration of demand-side options in the distributors' resource plans.

(3) Ratemaking imperatives

As we have indicated earlier, all ratemaking creates incentives, and it is thus implicit in the Régie's ratemaking powers that it must create incentives that are concordant with the principles expressed in art. 5, ie. with sustainable development and the consideration of economic, social and environmental concerns (implicitly then, with the basics of IRP). The Régie's ratemaking powers also allow the government to indicate specific concerns for consideration (art. 49, 10°), but this appears to be in addition to — not instead of — the Régie's own obligation in this regard. Whether or not the government indicates specific

concerns, the Régie still must take into consideration economic, social and environmental concerns in its ratemaking process, in the context of the goal of minimizing total cost to society[4].

This principle was recently upheld in the Régie's decision on Hydro-Québec's electricity supply ratesetting proposal:

> "La Régie a pour mandat de favoriser la satisfaction des besoins énergétiques dans une perspective de développement durable, dans l'exercise de ses fonctions. Ainsi, il est reconnu dans la société québécoise que:
>
> > *'le développement durable englobe les préoccupations économiques, sociales et environnementales, et prend en compte la notion d'équité, sur le plan individuel comme sur le plan collectif' (Politique énergétique, p.11)*
>
> [...] **C'est l'approche qu'adopte la Régie dans l'exercise de ses fonctions, lesquelles consistent, entre autres, à réglementer les activités monopolistiques des distributeurs d'énergie.**
>
> **Pour la Régie, le choix d'un mode de réglementation approprié consiste à déterminer quelle est l'approche réglementaire, en matière de production d'électricité, qui favorise le mieux la satisfaction des besoins énergétiques dans une perspective de développement durable."** (Régie de l'énergie 1998, p.62).

As we noted earlier, applying this principle to a gas distribution utility like SCGM raises two newly critical issues: (1) fuel switching and (2) energy efficiency.

a) Fuel switching

One of the most important ways that the ratemaking process can affect the environment is through the incentives provided to the utility to help consumers choose the least costly energy option for society. For a utility like SCGM, this means, at a minimum, targeting the utility's marketing activities toward potential customers whose current energy source is more costly to society than is natural gas. By encouraging these customers to schoose natural gas, SCGM helps to

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[4] The applicability of art. 5 to ratemaking *in the absence* of governmental orders under art. 49, 10º was clarified by the Minister Chevrette during the reading of Bill 50 in Parliamentary Commission. In response to a question from the opposition Liberals, Mr. Chevrette made clear that, **as a matter of course, economic, social and environmental considerations ('externalities') were to be taken into account in the ratemaking process, regardless of whether or not the government used its power under 49, 10º to indicate *specific* concerns of its own.** See Assemblée nationale du Québec, 1996b, for the full passage.

minimize the environmental impact of society's energy needs. In some cases, this can also mean asking the utility to promote fuel switching *away* from its own product, though this practice is more controversial and difficult to implement (see discussion on p.36).

The ratemaking process affects fuel switching primarily through the incentives, ie. the rewards and penalties, that it provides — or fails to provide — to the regulated utility. In order for incentive ratemaking to ensure that fuel switching in fact occurs according to least societal cost criteria, it is essential that the utility be rewarded or penalized according to its performance in this area as measured from a societal perspective. Thus, the PBR mechanism should ensure that the utility benefits when consumers shift from more societally costly fuels to natural gas, and that it is penalized when the opposite occurs.

b) Energy efficiency

A resource plan designed under IRP guidelines must ensure that the utility pursues energy efficiency measures where they are less costly to society than the alternative (additional sales of gas). This, of course, is the domain of the resource planning process, ie. the process established under art. 72 in which EE (also known as "DSM") options are to be judged on a level playing field with new supply-side ones.

However, as we have stated earlier, the resource planning process does not take place in a vacuum. Indeed, ratemaking interfaces directly with resource planning, affecting energy efficiency decisions included in the resource plan in two ways: (1) through the level and structure (design) of rates and (2) through the incentives for utility energy efficiency performance[5].

Indeed, once a resource plan has been approved, it falls upon the utility to implement the plan. But since the performance incentive mechanism to be adopted under art. 49 defines the utility's primary interests (profit opportunities), it is critical that any incentive regulation proposal be consistent with a future SCGM resource plan that would include societally cost-effective energy efficiency measures. **If an incentive regulation mechanism does not encompass incentives for cost-effective demand-side EE — or worse, if it penalizes the utility for pursuing cost-effective EE — then it is fundamentally flawed from an IRP perspective.**

The utility may endeavor to promote energy efficiency and environmental improvement, but those charged with such efforts within the utility will find themselves pursuing objectives that are contrary to the business interests of their employer. **Indeed, there can be no separation between the utility's resource**

[5] The first topic mentioned, ie. the effects of rate levels and structures, is beyond the scope of the mandate we have received.

planning interests and the signals provided to it through the ratemaking process. Goldman et al., in their seminal volume on integrated resource planning for natural gas utilities, prepared for the *National Association of Regulatory Utility Commissioners (NARUC)*, are clear on this matter:

> "Despite the cost-effectiveness of certain DSM resources, managers of gas utilities may not seriously consider DSM unless they expect it will bring financial benefits. **Thus, a serious attempt to treat DSM as a resource requires a review of, and possible modifications to, traditional ratemaking mechanisms.**" (Goldman et al., 1993, p.227).

In a more recent NARUC-sponsored report, this time on incentive regulation, this conclusion is yet again repeated:

> "The ratemaking mechanisms and policies applied to distribution utilities **will clearly affect** the extent to which they successfully implement DIRP [Distribution utility Integrated Resource Planning]." (Biewald et al., 1997, 58)

> "Care should be taken to **ensure that the incentive structure of PBR supports, rather than undermines, distribution utilities' resource planning initiatives**...". (Ibid., 64)

Performance-based ratemaking must be comprehensive and integrated, and must support all of the objectives pursued by the Régie, including the IRP objectives described so clearly in article 72. In the following chapter, we assess SCGM's proposal in the light of this requirement.

(4) Applicability of article 5 to rate regulation

Since every approach to rate regulation provides fundamental incentives to the regulated utility — incentives that will guide it in every major decision it takes thereafter, including efforts reduce the environmental impact associated with its product or to help its clients use energy more efficiently — it is imperative that the chosen approach to rate regulation be aligned with the demand-side objectives that follow from the legislative mandate given to the Régie. **Incentive rate regulation must ensure that the utility's most profitable path is the one in which it invests in energy efficiency or fuel switching measures *when they are the most societally cost-effective options*, that is to say when their total benefits — economic, social and environmental — outweigh their total costs.** Incentive regulation cannot allow the utility's most profitable path to be investing in such measures when they are not cost-effective for society, nor to avoid investing in them when they are.

This alignment is essential. If the adopted incentive mechanism tells the utility that a non societally cost-effective investment is in its best interest, the ability of

the regulator to effectively apply IRP or sustainability criteria at other stages will have been seriously compromised.

(5) SCGM's acknowledgment of the new Régie mandate

Société en commandite Gaz Métropolitain is to be acknowledged for having revised the performance incentive that is currently applied to it, and for having proposed a new mechanism. While our evidence is focussed on the shortcomings of that proposal, SCGM is to be commended for having set forth a mechanism which, whatever its failings, is a multi-year framework instead of an annual one, and which has the objective of continuing with incentives to reward cost-cutting and quality of service. Multi-year, multi-objective PBR is clearly a direction that is mandated by the new Regie law.

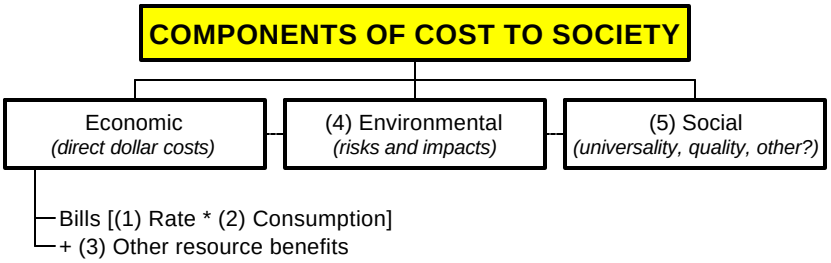
In addition, SCGM has shown that it is fully aware of the broadened mandate of the Regie. In SCGM-3, Document 4, Regie witness Michel Roy describes the Society's intent to develop a comprehensive plan to consider all aspects of demand-side efficiency: energy management practices, efficient equipment, and fuel switching. Moreover, M Roy states that the plan will have the objective of reducing the true societal costs of providing energy services. Building on its past EE efforts and informed by this new comprehensive plan, SCGM will then pursue those new demand-side initiatives which are societally cost-effective and which can be successfully marketed to its customer base. Moreover, SCGM will seek cost recovery provisions to the extent needed to support its new demand-side efforts. **Our critique in this evidence is not directed against these promising plans. It is aimed solely at the serious disjunct between these plans and the PBR mechanism that has been put forward in this case.**

III. SCGM's Proposal: in Conflict with the Régie's Mandate

SCGM's proposal fails to respond to the new regulatory context

A. Basic Framework

Integrated resource planning encourages the provision of energy services at the least risk and cost to society. At the same time, utility rates must be set at fair and affordable levels. But providing energy at least societal cost does not necessarily equate to providing it at the very lowest possible unit price. Indeed, rates are a key component, but not the only component, of consumers' bills, and consumers' bills are in turn a key but not sole component of the total cost to society. Sustainable development and consideration of economic, social and environmental concerns means focusing on reducing the total cost to society.



SCGM's proposal unfortunately focuses strictly on rates, without apparent regard for either consumption (energy efficiency), other resource benefits or environmental externalities (it does however take into account service quality, which one could assimilate to "social considerations"). As we have said earlier, this notion of "least societal cost" is clearly established by the Québec government, in its energy policy, as a key objective for the Régie de l'énegie. The following outlines the major components of the total cost of energy services.

(1) Economic considerations

We begin with direct economic considerations, focussing first on the total economic cost of gas for the utility's customers. This direct economic cost of gas is reflected in the sum of the bills paid by the utility's customers. The customers' bills are, in turn, based on rates and consumption.

a) Rates

SCGM's proposal places nearly all its emphasis on natural gas rates. We see this throughout the proposal and again in SCGM's responses to intervenor questions. For example:

> "L'encadrement réglementaire proposé est basé sur une évaluation de la performance de Gaz Métropolitain *mesurée à*

> *travers l'évolution des tarifs réels*." [*emphasis added*] [SCGM-16, doc.1.6, p.2]

> "Comme nous l'avons mentionné précédemment, l'essentiel du potentiel d'amélioration de la productivité *et donc de la réduction des tarifs* pour Gaz Métropolitain se situe sur le plan de l'accroissement rentable des ventes." [*emphasis added*] [SCGM-15, doc.1, p.12]

> "Pour bénéficier du mécanisme incitatif proposé, SCGM doit réduire ses tarifs" [SCGM-15, doc. 1.5 c)].

Indeed, as SCGM makes abundantly clear, its entire proposal is centered around rates as a measurement of performance.

b) Consumption (energy efficiency)

The level of gas consumption, on the other hand, receives little or no consideration in SCGM's proposed mechanism. In fact, not only does SCGM's proposal ignore energy efficiency as one of the criteria for understanding and maximizing customer and societal benefit-cost ratios, it in fact creates significant *disincentives* for the utility to invest in cost-effective energy efficiency measures.

This neglect of the "other half" of consumers' bills may arise from a confusion between rates and bills:

> "... le partage des gains de productivité ne sera possible pour la Société [SCGM] que si, globalement, elle réussit en même temps à réduire ses *tarifs* en termes réels. Il s'agit en fait de l'indice financier par excellence pour le client : sa *facture*." [emphasis added] (SCGM-16, doc.1, p.3, l.16-18).

This confusion is unfortunate, especially since the government's energy policy is more than clear on this matter:

> "La notion de service énergétique est une des idées qui a émergé graduellement, au cours des dernières années, en Amérique du Nord. **Elle suppose d'être à l'écoute des consommateurs et d'envisager l'utilisation de l'énergie comme un tout**, y compris les efforts visant l'efficacité énergétique. Ce service énergétique doit être assuré au **meilleur coût possible, afin de limiter au maximum la facture** que le consommateur doit finalement acquitter, pour satisfaire ses besoins en énergie." (Gouvernement, 1997, 11)

To better understand the effect of SCGM's proposal on otherwise cost-effective energy efficiency measures and programmes, we have simulated the effect that three (3) hypothetical EE measures would have on SCGM's bottom line under its current proposal. As we will see in section B. below, SCGM would, under its

proposed "incentive" mechanism, lose money from pursuing such societally cost-effective energy efficiency measures and programmes. This issue arises because SCGM ignores the "consumption" side of consumer bills in developing its proposal.

c) *Sum of rates * consumption (gas bill)*

On the whole, SCGM's proposal would reward the utility for minimizing rates, on the one hand, and maximizing consumption (to the extent allowed by price elasticity), on the other. This creates a conflicting incentive. In fact, dependent on the circumstances, ***Gaz Métropolitain*** **could well be rewarded for actions which lead to unnecessarily high utility bills for its consumers as well as for society at large.** This would clearly be contrary to the basic principles described in the energy policy, through which the total cost of energy services, not just rates, is to be minimized.

d) *Other resource benefits*

For simplicity, the above discussion of direct economic considerations focusses solely on the total costs of gas. Other direct economic considerations include non-gas resource benefits that may result from gas EE measures – for example, reductions in the cost of water supply and treatment for a municipality. Such other resource benefits do, in fact, need to be taken into account in the IRP process.

(2) Environmental considerations / impacts

SCGM's proposal creates no incentives whatsoever for the utility to minimize the environmental impacts associated with its activities. This means that for the utility, there is no real financial difference between, for example, aggressively pursuing sales that will result in net emissions *increases*, and aggressively pursuing sales that will result in net emissions *decreases*. The absence of environmental criteria in the proposed performance incentive mechanism means that ***Gaz Métropolitain*** **can be rewarded for actions which significantly increase the environmental impact of meeting consumers' energy needs.**

(3) Social considerations

The definition of "social" considerations is open to interpretation. Many social considerations are covered by both the economic (minimizing bills) and environmental (minimizing impacts that can affect human health and welfare) considerations discussed briefly above. As for employment impacts, there exists a technical debate regarding its inclusion in the definition of social "externalities".

One type of social consideration which clearly needs to be addressed independently of economic (rate * consumption) and environmental ones is the universality and quality of service provided to captive customers. By linking its ability to profit to its achievement of predetermined levels of service quality, **these social considerations *may* be properly addressed in SCGM's proposal** [6].

As we can see, SCGM's proposed mechanism links the utility's ability to profit from its actions to its rate and service quality performance,

> "La *seule* contrainte, et non la moindre, est que les résultats ne soient pas obtenus au détriment de la sécurité du réseau ou de la qualité du service" [*emphasis added*] (SCGM-15, doc.1, p.33)

but not to its performance in minimizing environmental impacts or consumers' total bills. These are serious lapses that run contrary to the legislator's intent as expressed in article 5 of the Régie's law, and as clarified in its energy policy. SCGM's mechanism would reward the utility for rate results that come at the expense of consumers' total bills (through inefficient use of gas), as well as for results achieved at the expense of the environment. Indeed, Gaz Métropolitain, under this proposal, would have no business incentive — and, in some cases, would be penalized — for giving due regard to these important regulatory and societal objectives.

The following section describes in more detail the implications for these two neglected elements — energy efficiency and environmental protection — of SCGM's proposal.

[6] We emphasize the word *may* because we only mean to suggest that SCGM's proposal deals with the issue of a service quality index (SQI). Not having been mandated to review SCGM's proposed SQI, we cannot comment on the particular choices made, both in terms of indicators (there are many indicators of service quality, of which SCGM has chosen 4 specific ones) and the specific details linking the SQI with the utility's ability to profit from cost savings (threshold levels, lack of penalties, etc.).

B. Deficiency #1: Consumption (Energy Efficiency)

The untapped potential for demand-side energy efficiency in the SCGM service area is undoubtedly substantial enough to warrant serious attention to the relation between incentive ratemaking mechanisms and the promotion of EE. Citing American studies, SCGM suggests that about 17% of gas consumed in Quebec could potentially be saved at an economic cost that is less than the costs of gas supply (SCGM-3, doc.4, p.4). SCGM has not, however, conducted its own studies of the economic potential for gas EE.

Why does this untapped potential exist? Energy savings that are cost-effective based on a societal discount rate — the utility's cost of capital is sometimes used as a proxy for such a discount rate — may not be pursued by consumers because their individual discount rates are quite high, resulting in a substantial untapped EE potential. When businesses or households exhibit higher discount rates for investments in EE than they do for other financial or business investments, this suggests the presence of market barriers to EE which distribution utilities can attempt to overcome through pricing, education, information, financing, or incentive programs.

In light of the likely economic potential for EE, an energy distributor's performance incentive mechanism must at a minimum *support* the identification and subsequent pursuit of societally cost-effective EE, pursuant to an eventual resource plan. The design of EE initiatives must first be informed by analysis of the costs and benefits of the available options from a technical and economic perspective. The purpose of ratepayer funding for gas energy efficiency programs is to secure the societal benefits of EE initiatives. To assess societal benefits in economic terms means to measure them from a societal perspective. In other words, the benefits to society from a contemplated EE initiative must be compared with its costs to society.

From a societal perspective, benefits include not just the value of the primary resource saved — in this case gas, itself comprised of several different avoided supply cost components — but also other benefits which are capable of ready quantification, such as water savings, other energy savings, and environmental impact savings. From a societal perspective, costs include not just the ratepayer funds invested in the initiative, but all other cost components that are readily quantifiable, such as costs expended by energy users (customers) or contributed by third party funders such as governments.

Other impacts than those just cited may constitute either benefits or costs depending on the particular effects of an EE initiative. For example, a material reduction in out-of-pocket maintenance costs for facilities is a readily quantifiable benefit.

(1) Energy efficiency benefit-cost tests

The societal perspective was given its classic operational formulation in the societal cost test (SCT) developed in the California Public Utilities' Commission's "Standard Practice Manual" for *Economic Analysis of Demand-Side Programs* (CPUC, 1987). Most of the North American jurisdictions in which ratepayer-funded gas energy efficiency is pursued today utilize a societal perspective.

The SCT test, though often the threshold test for EE, is one of five standard cost-effectiveness tests commonly employed in evaluating EE (see box).[7] Measures pass each test if their net benefit (NB) is greater than zero.

Benefit-Cost Tests for Evaluating EE Options

- The **Societal Cost test (SCT)** compares all costs to society with all benefits to society:

  Net Benefit = (Utility's avoided costs + all externalities) - (utility's costs + participant costs)*

- The **Total Resource Cost test (TRC)** compares all costs to all benefits for consumers as a whole, ignoring externalities‡.

  NB = Utility's avoided costs - (Utility's costs + participant costs)

- The **Utility Cost test (UCT)** measures the utility's direct costs to the costs the measure will avoid for the utility.

  (NB) = Utility's avoided costs[1] - Utility's costs

- The **Participant Cost test (PCT)** measures the direct cost to a participating customer (his share of total costs) compared to that customer's bill savings.

  NB = Participant's savings - Participant's costs

- The **Rate Impact Measures (RIM) test** (or TNT in French) measures the impact the measure or programme would have on unit costs (rates), ignoring both overall bills and externalities.

  NB = Utility's avoided costs - (Utility's costs + utility's lost revenues)

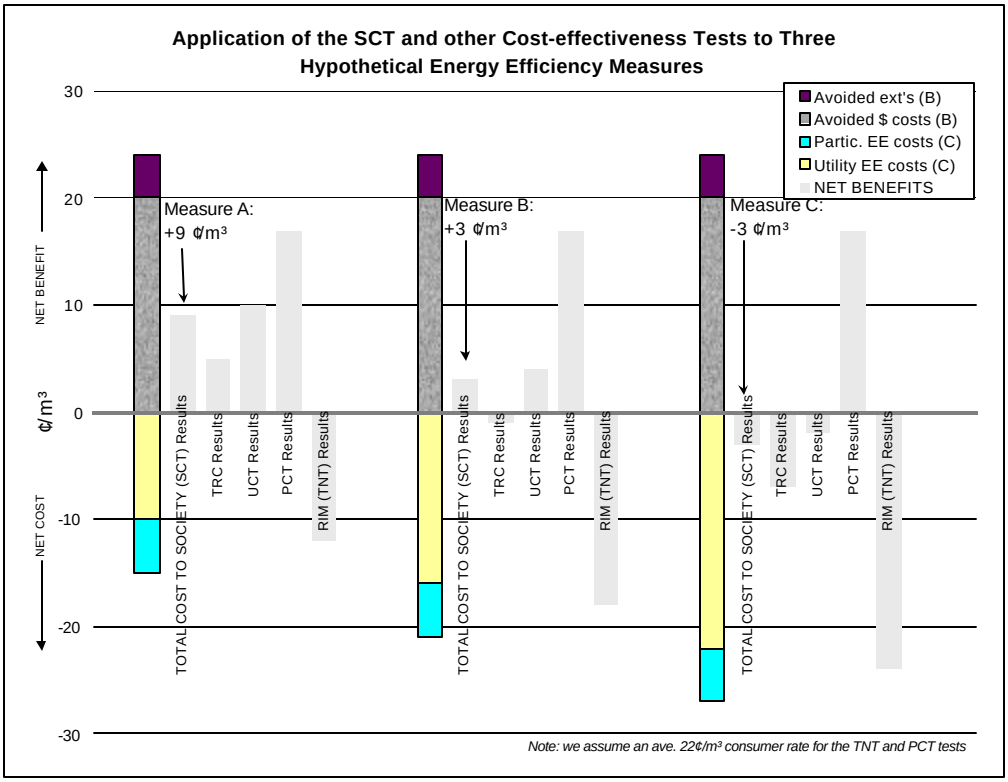
* primarily other resource benefits and avoided environmental costs

‡ In principle, the TRC test ought also to incorporate "additional resource benefits". As discussed earlier, and for reasons of simplicity only, we neglect these benefits in our use of the test in this report.

Of these tests, the societal cost test (SCT) is the only one to fully integrate economic and environmental considerations in a societal perspective. The TRC test, while not incorporating environmental costs, does at least look at overall direct economic cost-effectiveness for consumers in general. The other tests should primarily be used for specific information such as expected participation rates or the effect of EE on rate levels, but not as threshold tests, i.e. not to determine which measures should be considered.

The following chart illustrates the importance of using the right cost-effectiveness test: It compares three hypothetical energy efficiency measures, each of which provides the same benefits in terms of energy savings, avoided

[7] For a more detailed description of these tests, see Goldman et al. 1993. See also Tellus 1993, 30-33, as well as CPUC 1987.



economic costs and avoided externalities. However, the measures – A, B, and C – are progressively more costly to implement.

In this chart, the first bar for each of the three measures indicates both the benefits (above the axis) and the costs (below the axis) of each one. The actual benefits of each program include avoided economic costs and externalities; the costs include costs paid directly by the participants and those assumed by the utilities.

The bars that follow each measure indicate its net benefit according to each of the five cost-effectiveness tests just described. These five bars respectively measure (a) the net benefit or cost to society, taking externalities into account (SCT), (b) the direct economic benefit or cost to society, without externalities (TRC)[8], (c) the measures' net benefits to the utility and participants (UCT and PCT) and (d) its net benefit for unit costs, or rates (RIM).

From the societal (SCT) perspective, the benefits of measures A and B outweigh their costs. Their pursuit would reduce total costs to society, whereas measure C is not cost-effective and would have the reverse effect. Were the utility to make its decisions based on the RIM test, all measures would be rejected, despite this resulting in higher costs to society. Using the PCT would lead to the adoption of

[8] In our case, because we ignore additional resource benefits, this also measures net benefit for consumers as a whole.

all three measures, even measure C, whose costs outweigh its benefits. The TRC test does better, but would still exclude measure B, because it fails to take into account the societal benefits of reduced environmental impacts, or externalities. **In other words, were the utility to use any threshold test other than the SCT to screen its EE investment decisions, these decisions would be societally inefficient and would unnecessarily increase the costs of meeting customers' energy service needs,** as defined in article 5**. Only the application of the SCT test would result in the proper decisions being made**; that it to say that measures A and B would be considered further, while measure C would be rejected as unnecessarily costly.

Though the tests are based on theoretical considerations, their application is based on practical considerations. Specifically, a regulated energy utility will tend to choose the tests it uses in its decision-making process based on the ones that its regulator has designated — *through the ratemaking process* — to be in its interests. **The goal of the regulator in choosing an incentive ratemaking scheme is therefore to ensure that the utility's most profitable path lies with the use of the SCT test**, so as to align the utility's and society's interests.

(2) Gaz Métropolitain's incentive proposal vs. its energy-efficiency plans

a) *Theoretical approach to energy efficiency*

In its evidence, SCGM explains that it is appropriate to use the SCT test as the basic measure of cost effectiveness:

> "Un premier ciblage des programmes devrait se faire en fonction des résultats du "test du coût social": ce test identifie les programmes d'économie d'énergie dont le coût total des ressources, incluant les externalités est inférieur aux alternatives du côté de l'offre, ce qui permet de réduire la facture énergétique globale de la société; il est bien entendu que les externalités doivent être pris en compte pour toutes les formes d'énrgies si nous voulons qu'un choix éclairé soit fait" (SCGM-3, doc.4, p.13).

However, SCGM then goes on to state that the final choice of measures should be determined by the RIM test:

> "Le choix final se ferait en fonction des résultats du 'test de la neutralité tarifaire' " (SCGM-3, doc.4, p.13)

While we agree that the RIM should have some weight in reviewing measures, it cannot be allowed to outweigh societal costs and benefits as analysed by the SCT. Unfortunately, SCGM provides no clear description of how it would address a discrepancy between what ought be done based on SCT results, and

what would be done based on RIM results, choosing instead to leave the issue to a future regulatory proceeding. In SCGM-3, doc.4, p.14, l.3-8, however, SCGM notes the option of aggregating fuel switching and EE programmes together so that the whole still passes the RIM test.[9]

The possibility that fuel switching and EE programmes be combined so that the total aggregate effect passes the RIM test, assumes that fuel switching gains be equal or greater than the RIM-based losses of EE programmes that pass the societal cost test[10]. Certainly, if the potential for cost-effective fuel switching is outweighed by the magnitude of energy waste and thus the potential for societally cost-effective efficiency improvements, then this approach translates into a refusal to implement results of the SCT test, despite its obvious benefits as noted by SCGM.

b) Practical approach to EE

Whatever SCGM's final theoretical approach to screening EE measures for cost-effectiveness turns out to be, its incentive ratemaking proposal raises serious questions about the practical approach it will adopt. SCGM's incentive ratemaking proposal has been developed with a view to rewarding the utility for two types of actions: cost-cutting and increasing sales. The former goal is noncontroversial and should, of course, be a part of any incentive ratemaking plan; we focus on the latter.

SCGM states that its performance-based (PBR) mechanism will allow it to benefit from aggressively pursuing increases in sales which are deemed "cost-effective". According to SCGM, "cost effective" new sales are those which result in minimizing rates to consumers. In economic regulatory language, this suggests that SCGM might in practice apply the RIM test discussed earlier to screen potential measures for meeting customer needs, whether demand- or supply-side[11].

Indeed, under the proposed PBR mechanism, SCGM would retain two-thirds of the CBT-based benefit[12] and, inversely, lose two-thirds of negative CBT results. In other words, it would receive recovery of only 1/3 of the costs of programmes which fail the RIM but pass the SCT test. As we have explained

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[9] The same passage also mentions the possibility of applying a special rate under article 49, 10º, to allow full cost recovery for EE programmes. We address this option on page 30 below.

[10] In this sentence, we use the term "RIM" as a simplitying proxy for SCGM's proposed measurement, the "contribution à la baisse tarifaire (CBT)". In reality, the RIM's analysis extends over a longer period of time.

[11] This was clarified in the Régie's D-97-25, a decision rendered by a bench (presided by J-P Théorêt) from the previous Régie du Gaz Naturel, and which followed an earlier 1996 decision (Régie de l'énergie, 1997, p. 15-16).

[12] "Contribution à la baisse des tarifs", or CBT, is the term used in SCGM's proposal.

previously, this means rewarding the utility for following an inappropriate measure of cost-effectiveness from an IRP perspective. Conversely, it means penalizing SCGM for pursuing measures that would nonetheless provide net benefits to society, i.e., those that pass the SCT test.

At the practical level, then, we are left with the fact that SCGM's proposed PBR mechanism provides strong incentives to the utility for fuel switching programs and equally strong disincentives for EE programs. Whatever SCGM might say, as a theoretical matter, about pursuing cost-effective EE up to the point where its rate impacts offset the gains from fuel switching, as a practical financial matter the proposed incentive mechanism strongly discourages doing enough EE to reach that point in the first place.

c) Implications for sample EE programmes

In order to better comprehend the asymmetric impact of the incentive ratemaking proposal, let us look in detail at the three hypothetical energy efficiency programmes described and presented earlier (see chart following p.24). We assume that each programme could result in energy savings of 250 million m³ of gas, equivalent to less than 4% of projected 1999 sales (SCGM-2, doc.5)[13]. As noted above, the three programmes each create the same benefits (energy savings and avoided costs, both economic and environmental), but entail progressively higher costs[14], as detailed in the following table:

Table 1. Basic Data for 3 Hypothetical Energy Efficiency Programme Options

Programme	Energy Savings	Costs			Benefits			Average Rate
	(10^3 m³)	Utility's share (¢/m³)	Participant's share (¢/m³)	Total Programme cost (¢/m³)	Avoided $ costs	Avoided Enviro. costs	Total Avoided Costs	¢/m³
	1	*2*	*3*	***4** (2+3)*	*5*	*6*	*7 (5+6)*	*8*
A	250 000	10,0	5,0	15,0	20,0	4,0	24,0	22,0
B	250 000	16,0	5,0	21,0	20,0	4,0	24,0	22,0
C	250 000	22,0	5,0	27,0	20,0	4,0	24,0	22,0

Table 2 illustrates the net benefits of each programme for **consumers who participate** in the programmes. Not surprisingly, to the extent their initial contribution is limited to a small portion of total costs, all three programmes provide net economic benefits to participants. This table only describes economic impacts, excluding environmental and social costs.

[13] In all likelihood, there would, in reality, be a much larger number of measures, each with smaller energy savings potential.

[14] In each of our samples, participants are asked to assume a small portion (5¢/m³) of the programme costs upfront.

Table 2. Net Benefits for Participating Consumers (PCT test)					
Programme	1 Regular Rate (¢/m³)	2 Participants' Cost (¢/m³)	3 (1-2) Participants' Net Benefits (¢/m³)	4 Potential Energy Saved (10³ m³)	5 (3*4) Participants' Potential Net Benefits ($)
A	22,0	5,0	17,0	250,000	$42,500,000
B	22,0	5,0	15,0	250,000	$37,500,000
C	22,0	5,0	13,0	250,000	$32,500,000

The next table provides the same information, but for all consumers as a class[15]. It demonstrates that, if we look at economic impacts only, programmes B and C are not cost-effective from the consumers' perspective.

Table 3. Net Direct Economic Benefits (TRC test) for Consumers					
Programme	1 Avoided Direct Costs (¢/m³)	2 Total Programme Costs (¢/m³)	3 (1-2) Consumers' Net Benefit (¢/m³)	4 Potential Energy Saved (10³ m³)	5 (3*4) Consumers' Potential Net Benefit ($)
A	20,0	15,0	5,0	250,000	$12,500,000
B	20,0	21,0	[- 1,0]	250,000	[- $2,500,000]
C	20,0	27,0	[- 7,0]	250,000	[- $17,500,000]

Unlike the previous two tables, the following one reflects not only economic costs and benefits, but also environmental ones. As noted in Table 1, all three programmes result in avoided environmental costs of 4 cents/m^3. Taking this environmental benefit into account, we see in the following table that both programmes A and B are cost-effective *from a societal point of view*, producing net benefits of $22.5 million and $7.5 million, respectively. Programme C, on the other hand, is not cost-effective, resulting in a net loss to society of $7.5 million.

Table 4. Net Total Benefits for Society (SCT test, key IRP principle)							
Programme	1 Total Avoided Costs (¢/m³)			2 Total Programme Costs (¢/m³)	3 (1-2) Society's Net Benefit (¢/m³)	4 Potential Energy Saved (10³ m³)	5 (3*4) Society's Potential Net Benefit ($)
	Direct	Ext's	Total				
A	20,0	4,0	24,0	15,0	9,0	250,000	$22,500,000
B	20,0	4,0	24,0	21,0	3,0	250,000	$7,500,000
C	20,0	4,0	24,0	27,0	[- 3,0]	250,000	[- $7,500,000]

Thus, while all three programmes are economically beneficial to participants, only programme A is beneficial to consumers as a whole (assuming they are

[15] This already assumes full cost recovery from all consumers.

asked to reimburse the utility's costs), from the strict economic perspective of their pocketbooks. However, when environmental considerations are taken into account (Table 4), we see that programme B is also in society's interest. It is important to note that when combined, programmes A and B are not only cost-effective to society, but to consumers as well, procuring net benefits of some $10,000,000 (still assuming 100% cost recovery for the utility).

As we saw earlier, the goal of an incentive mechanism is to align SCGM's private interest with the public interest. The question at hand, then, is whether or not SCGM's performance-incentive proposal would lead the utility to pursue A and B yet reject C, which would be the least-cost option to meeting consumers' energy needs, once environmental considerations are taken into account. The answer is that ***none* of the three measures would be in the interests of SCGM, were its incentive ratemaking mechanism to be adopted**. In the following table, we assume that SCGM would meet the 95% threshold on its proposed service quality index (SQI) and would have future gains to lose.

Table 5. Net Total Benefits for SCGM (according to proposed incentive mechanism)

Programme	1	2			3 (1-2)	4	5	6 (3*4*5)
	Benefits (Avoided $ Costs) (¢/m³)	Costs (¢/m³)			SCGM's Net Benefit (¢/m³)	Pot. Energy Saved (10³ m³)	SCGM share of benefits (losses)	SCGM's Pot. Net Benefit ($)
		SCGM's program share	Lost Revenues (rates)	Total				
A	20,0	10,0	22,0	32,0	[- 12,0]	250,000	2/3	[- $20,000,000]
B	20,0	16,0	22,0	38,0	[- 18,0]	250,000	2/3	[- $30,000,000]
C	20,0	22,0	22,0	44,0	[- 24,0]	250,000	2/3	[- $40,000,000]

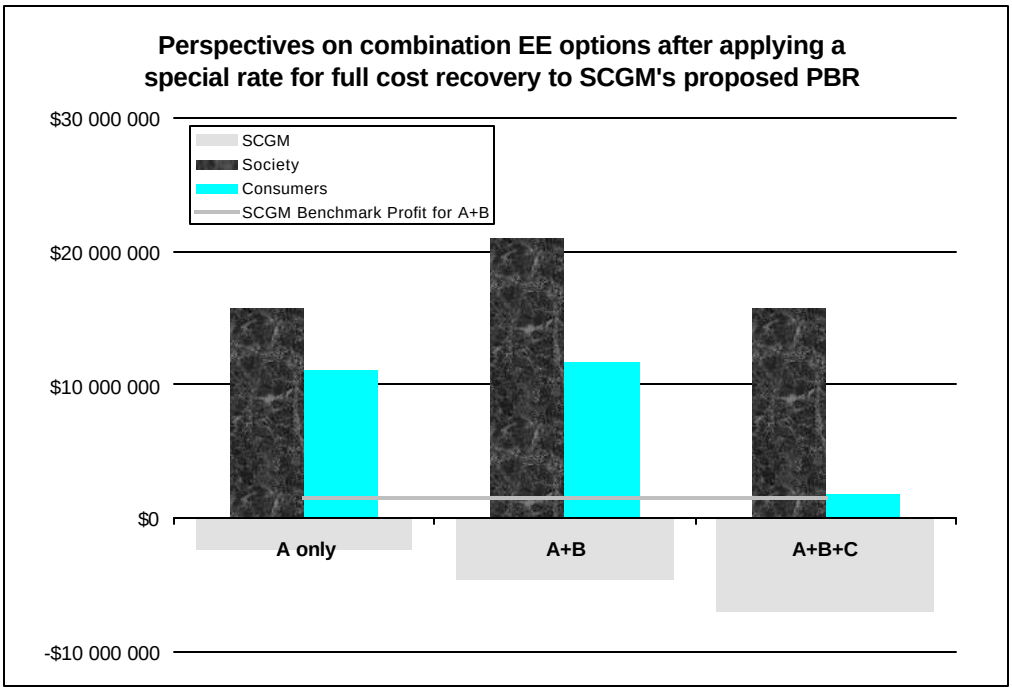
As we have seen, programmes that would minimize net costs to consumers and society *would*, under SCGM's proposal, result in significant losses for the utility, a certain deterrent to programme implementation.

d) Possible adjustments and their implications

In its evidence (see SCGM-3, doc.4, p.15, l.20-22), SCGM acknowledges that its comprehensive proposal would eventually have to be modified to at least allow full cost recovery for EE programmes (though it also indicates no interest in a lost revenue recovery mechanism). In particular, it mentions (though fails to propose) the possibility of using article 49, 10º to ensure full recovery of the costs associated with EE programmes (Ibid., p.14, l.5-8), as opposed to the 1/3 it would receive for most programmes under its proposed general incentive approach.

While we remain convinced that a comprehensive incentive ratemaking scheme should incorporate all of its objectives consistently from the outset (as opposed to applying corrective measures or micro-regulation at a later date), we nonetheless sought to analyse the effects that a variety of adjustments to SCGM's proposal could have on the objective of aligning interests.

Annex A presents the results of this analysis, which are striking. As we see from the following chart, **even if SCGM's proposal were modified to include full cost recovery from a special rate under article 49, choosing to invest in energy efficiency programmes A and B would still yield a net loss to SCGM of $5 million,** despite procuring net benefits to society and consumers of upwards of $10M and $20M, respectively[16].



SCGM is not a public charity, and cannot be expected to sacrifice its private interest for society's benefit. It is precisely the responsibility of the Régie, through the rate regulation approach, to **fix incentives that align SCGM's interests with those of society as a whole,** thus creating signals leading SCGM toward investment choices that result in minimizing the costs to consumers and society of meeting their energy needs. SCGM's proposal, even with the types of corrective measures the utility alludes to in its evidence, fails in the pursuit of this objective.

[16] The reader should note that the designation of a specific cost recovery mechanism affects the ultimate sharing of costs and benefits between market players (utility, participants, non-participants). This explains the differences between the earlier tables and the following one, which specifically follows SCGM's proposal and takes into account probable participation rates.

e) Implications for the IRP process

Whereas the ratesetting process is used to provide the utility with a decision-making framework for the profitability of future investments, including in energy efficiency, it is in the resource planning or IRP process where specific energy efficiency programmes would be assessed and adopted. In other words, **specific programmes would be approved in the IRP process, while their implications for the utility would be established through the broader choice of rate regulation mechanisms.**

It might be tempting to suggest that SCGM could be ordered at a later stage, through the IRP process for example, to pursue those EE programmes which are found to be cost-effective for society. While true in theory, this ignores the fundamental reality that, as explained earlier, it is in the incentive mechanism where the utility's key interests are to be found; any later attempt to *oblige* the utility to meet certain societal goals which are inconsistent with its financial goals will run up against opposition.[17]

This would apply whether SCGM's proposal were left intact or adjusted to include a special rate for full cost recovery, for the reasons we described previously. Furthermore, even if SCGM was somehow led to pursue the appropriate measures, and even if full cost recovery and even lost revenue recovery were authorized, it could still be in the utility's interests to minimize EE *results*, ie. actual energy savings. This is one possible outcome of combining a sales growth incentive with an energy savings mechanism and attempting to apply the two simultaneously. To offset this contradiction, and contrary to modern regulatory objectives of efficiency and "leanness", the Régie could be required to "micro-regulate" SCGM's EE activities. Obviously, **being rewarded for under-achievement of a regulator's objectives would be counterproductive and antithetical to the very notion of *performance incentives*.**

Finally, there is the question of timing. Currently, SCGM management is preparing for a context in which it is rewarded for maximizing, not minimizing, sales growth. If the Régie were to accept the proposed regulatory approach, or simply if it were to leave intact the existing approach which still favours load growth over savings, it would in fact **enhance and institutionalize an unnecessary chasm between the utility's interests (sales growth vs. EE decisions determined by the RIM test) and those of society (determined by the SCT test).** If in two years time the Régie attempted to apply some

[17] It is interesting, though perhaps only academic, to note that if future mechanisms were incapable of "undoing" the anti-EE incentives provided by SCGM's current proposed mechanism, the utility could appeal any IRP-led EE order by virtue of art. 49, alinéa 5. This could be done on the grounds that any order to pursue societally cost-effective EE measures within the adopted ratemaking mechanism would make achieving a reasonable return on investment unduly difficult or impossible, thus rendering such a decision illegal.

corrective measures such as those described in greater detail in chapter IV.B. (lost revenue recovery, shared savings), through its IRP process or in a subsequent rate case, the utility's institutional interests will have already been mobilized around an opposite agenda, one that will become quite difficult to change as a result.

SCGM sees no contradiction between its proposed incentive mechanism and the pursuit by it of societally cost-effective EE. Indeed, in its response to FNACQ question 92, the Company states that the special rate (tariff rider) that we discussed earlier could be excluded from the comparisons between the "expected" and "required" costs of service (which determines whether there are savings to be shared between SCGM and its customers). Thus, SCGM would not be penalized by pursuit of EE. Even if this were possible, it still would not outweigh the strong incentive for sales growth embedded in SCGM's proposal.

Furthermore, even if an eventual IRP process *ordered* SCGM to pursue societally cost-effective EE programmes, and even if the Régie later adopted a host of mechanisms to mitigate the disincentives inherent in SCGM's current proposal, the utility's institutional bias toward sales growth will have been reinforced by the time passed between adoption of the current proposal and the completion of the gas resource planning process, which may still be two or three years down the road.

Thus, it would be counterproductive to approve SCGM's proposed new regulatory approach today, with the thought that at some time in the future, EE-related mechanisms will simply be tagged on as an effective counterweight to the disincentives created today. Rather, it is essential that a coherent message be given regarding EE simultaneously with the message provided regarding rates.

f) Conclusion: SCGM's proposal would render IRP inoperative or inefficient as regards EE

Adopting SCGM's proposal would place the framework for EE investment foreseen under art. 72 on a collision course with the incentive mechanism at the heart of the utility's newfound interests. While some creative approaches could be used to minimize the extent of this problem, none could fully mitigate the key signals that this proposal would give to utility managers and decision-makers, and that, with time, would be institutionalized within the organization.

At best, the utility could be brought to grudgingly agree to develop and invest in societally cost-effective EE programmes, though with perhaps an incentive to underperform, exaggerate results or both. At worst, the utility could be led to oppose societally cost-effective EE programmes at every level, since the proposed mechanism would mean that these programmes, though cost-efficient for society, would result in significant lost revenues and lost profits for the utility.

In any case, it would be counterproductive to establish a regulatory régime today that it can reasonably be predicted will run counter to the proper and efficient

application of Integrated Resource Planning — as regards energy efficiency —, to the extent of course that the regulator is set on applying IRP to the utility's resource planning procedures.

The probable result of adoption of SCGM's performance incentive proposal would therefore be to render inoperative or inefficient the application of basic IRP principles to the selection of energy efficiency programmes and measures and, as such, to create significant obstacles to effectively dealing with the "consumption" element of consumers' bills and of society's total cost for its energy services.

C. Deficiency #2: Environmental Considerations (Fuel Switching)

SCGM has proposed an incentive mechanism whereby it expects to profit by adding gas loads that would otherwise have been served by other fuels. Much of its focus would be on space heating load. In evaluating the use of alternative fuels from a societal perspective, for example for alternative space heating systems, at least the following factors must be considered:

- The cost of the alternative heating system including the heating element or furnace itself, any wiring or plumbing that is required, and the distribution systems. From an SCT perspective, the typical market price of the alternative installed systems may be used to represent this cost component.
- The cost of the alternative fuels required over the expected lifetime of the heating systems. The long-run marginal costs of alternative fuels may be used to represent this cost component.
- The projected maintenance costs for the alternative systems.
- The projected environmental impacts of the systems. Environmental impacts such as emissions of air pollutants and GHGs are currently external to the economy. Therefore the alternative physical impacts must be quantified, then either given a monetary value, or some type of weight, in order to take them into account from an SCT perspective.

The total life-cycle costs of alternative systems, considered from an SCT perspective, may vary considerably as a function of the cost components identified above. **A mechanism which simply encourages the addition of all gas space heating load, such as proposed by SCGM, is blind to the question of whether the addition of the new load will increase or decrease the societal costs of meeting energy service needs.**

In Annex C, we present a summary analysis of just the air emissions trade-offs associated with four space heating systems serving a representative Quebec space heating load. This analysis shows that there are very different air emissions implications from promoting gas space heating in lieu of oil heat, on the one hand, versus promoting gas space heat in lieu of electricity, on the other.

Obviously the implications of these and other[18] environmentally significant differences must be explored in depth, as one component of an IRP approach, before a mechanism such as SCGM's that rewards all load building is approved.

(1) Fuel switching under IRP

From an IRP perspective, fuel switching should be promoted only when its total costs to society are less than its total benefits.

A regulated utility that chooses to pursue fuel switching must decide what strategies to pursue. There are generally two types of strategy that a utility can pursue in a an IRP-based fuel switching context:

(1) pursuit of new customers when their existing or likely source of fuel is more costly to society ("LOAD CAPTURING"), and

(2) encouragement of its own customers to choose other energy sources when they are less costly to society ("LOAD LOSING").

LOAD CAPTURING. Under IRP, the regulator can determine that it would be in society's interests for a gas utility to "capture" load, ie. To attempt to convert a consumer to gas, when, for example, that consumer is using oil for space heating. The reasonableness of promoting such a conversion would be demonstrated by a positive net present value under the societal cost test (SCT). **This does not mean *telling* the consumer where to purchase his energy. Rather, it means ensuring that the regulated utility is rewarded (or inversely penalized) for aggressively marketing its product where such market gain minimizes cost to society.** The consumer, in every case, remains free to choose among all available sources.

Load capturing will tend to reduce the utility's rates over time, but that is not the basis for its pursuit in an IRP context. Rather, the regulator must ensure that the utility's marketing strategy rests not on the basis of the RIM test, but on the basis of the SCT test. Practically speaking, this can be done through orders in the resource planning process and more generally through incentives in the ratemaking process. So long as the incentives are right, the utility will likely accept pursuing this objective because it falls within its natural tendency toward growth in market share.

LOAD LOSING. Under the same IRP principle, the regulator can also determine that it would be socially preferable that some end-uses served by the regulated utility be served instead by a competitor source. The regulator can then try to

[18] Of course, air emissions are not the only environmental issues to consider when comparing fossil fuel use to hydroelectric power.

order the utility to "lose load", that is to convince some of its customers that for some end-uses, they would be better off with an alternative energy source.

Load losing orders are highly controversial and generally meet with fierce resistance from the regulated utility. Of course, to the extent the utility already sells a range of fuels, which is a growing trend, load losing becomes in effect load switching within the utility, and opposition is likely to be lessened[19]. But for single source utilities, the notion of enticing customers to switch to competitors is counter-intuitive, running up against the fundamental notion that companies should work to keep and increase their customer base and market shares. For this reason, load losing orders have been rare, and where they have occurred, utilities have vigourously opposed them. For example, Maine's regulatory commission repeatedly deferred a 1991 State law, fiercely opposed by utilities, requiring electric utilities to assist households in moving toward alternative energy sources (Tellus 1993, 33).

(2) Fuel switching under SCGM's proposal

a) Load capturing will be blind to societal costs and benefits

SCGM's proposal seeks to reward the utility independently of the environmental costs, impacts or considerations associated with its activities. More specifically, the utility's proposal aims to provide rewards for capturing new loads, so long as the new loads are "cost effective" according to the rate impact measure(RIM) test.

> "Nous sommes d'avis que le contrôle à long terme des tarifs passe par de nouvelles ventes rentables et que le régime incitatif proposé encouragera l'entreprise en ce sens" (SCGM-1, doc.1, p.17, l.19-20).

> "[...] l'essentiel du potentiel d'amélioration de la productivité et donc de la réduction des tarifs pour Gaz Métropolitain se situe sur le plan de l'accroissement rentable des ventes." (SCGM-15, doc.1, p.12, l.29-30)

> "Les nouvelles ventes seront assurées par la poursuite du développemenet des secteurs commercial, industriel et institutionnel et par de nouvelles opportunités de pénétration du marché résidentiel. Ce développement se réalisera sur nos réseaux

[19] In this regard, it may be important to examine the implications of the substantial equity position in SCGM's parent company Noverco recently acquired by Hydro-Québec. However, such an examination is outside the scope of this testimony.

> existants et fera également appel à certains projets d'extension de réseau qui rencontreront les critères usuels de rentabilité." (SCGM-3, doc.2, p.7, l.25-30 et p.8, l.1)

> "[...] la croissance du secteur résidentiel est au bénéfice de l'ensemble de la clientèle existante tant pour son apport en terme d'impact tarifaire que pour sa contribution à l'amélioration de la stabilité des revenus, et c'est pourquoi nous proposons l'ensemble de ces éléments à la Régie." (SCGM-3, doc.3, p.13, l.16-19)

Indeed, SCGM forecasts a sales volume increase of 3.5 Bcf thanks in large part to these new sales (SCGM-1, doc.1, p.10, l.12-15). This increase, however, will be achieved thanks to targeted marketing programmes aimed at sales growth wherever the RIM test proves a net benefit[20]. This growth is what we referred to earlier as "capturing load".

The problem here lies not with SCGM's efforts to capture load from other energy distributors per se. Rather, it is with the utility's determination of *whose* load should be targeted. In some markets, load capturing will provide a net benefit to society; in others it will provide a net loss. In other words, without using the SCT test, no distinction will be made between marketing efforts that minimize total costs to society, and those that unnecessarily increase society's costs. As a result, under SCGM's proposal, marketing programmes aimed at load capturing that is not in society's interests will, ironically, result in the utility being rewarded for its efforts. This, once again, would be contrary to the Régie's mandate and to basic principles of regulation[21].

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[20] SCGM does attempt to deviate from this rule for a specific residential development project in which new loads that will not meet the RIM test will nonetheless be pursued, requiring that all existing customers absorb a relative rate increase (SCGM-1, doc.1, p.11, l.19-21). Even in this case, however, the requested rate increase and targeted new sales are independent of total cost to society.

[21] Ironically, SCGM does seem to consider the total cost to society of one particular fuel switching effort: oil to natural gas for vehicles (GNV). While SCGM does not specifically present the results of an SCT benefit-cost test, it does make clear, in the prepared evidence of Robert Tessier, that its reasons for pursuing this sector are based primarily on environmental objectives:

> "Vu sous l'aspect impact environnemental, le gaz naturel est préférable à certaines autres formes d'énergie, comme par exemple les produits pétroliers. *C'est pour cette raison* que nous annonçons un programme modeste de développement du marché du GNV." [*emphasis added*] (SCGM-1, doc.1, p.12, l.25-27).

While not yet supported by benefit-cost evidence, this is the type of reasoning that, under IRP, should be performed to determine which fuel switching opportunities should be pursued, not just for transportation, but also for its core markets such as space heating and other end uses.

b) Load losing is excluded

Under SCGM's proposal, utility attempts to transfer load to more societally cost-effective energy sources are for all intents and purposes excluded. Indeed, since the SCGM proposal is aimed at providing incentives to load capturing without regard to societal costs, it also includes provisions to penalize the utility for load losses (to the extent they fail the RIM test). Once again, these penalties are applied blindly, ie. independent of the total cost or benefit to society.

As we mentioned earlier, load losing is controversial, particularly for single-source utilities. Also, it may be that the institutional barriers to load losing are so strong that even specific regulatory attempts to promote such actions would fail. Given this portrait, we feel that a measured response to the option of load losing is called for, one in which the utility is neither obliged to make efforts at losing load, nor totally indifferent either. SCGM's proposal, in creating blind rewards and penalties, fits neither of these imperatives and, as such, fails in ensuring that a reasonable effort is made toward minimizing total cost to society.

c) Conclusion: SCGM's proposal is unable to minimize total costs of marketing options

On this basis we conclude that SCGM's proposal is unable to ensure that, faced with a range of possible fuel switching options, the utility will encourage customers to choose the path of least cost to society. Rather, the utility is clearly proposing to be rewarded and penalized for efforts which would be entirely indifferent to total cost imperatives. As such, SCGM would be allowed to profit from fuel switching efforts made at the expense of the environment, human health, public spending or other components of the total cost to society. Once again, this would run contrary to the basic principles of IRP, as well as to the legislator's objectives in adopting the *Loi sur la Régie de l'énergie*, as reflected in art. 5 of the Act (see chapter II, in particular p.10 above).

IV. Allowing SCGM to Profit from Least-Cost Choices

Incentive ratemaking can be a powerful force for ensuring that the utility voluntarily works to minimize total cost to society.

A. Introduction

We have previously described the need for the incentive ratemaking process to provide the right rewards and penalties in order to align the utility's interests with those of society. We have also explained why the specific incentives contained in SCGM's proposal — while approaching two of the key indicators of society's interests — run counter to all others, particularly the cost-efficient use of energy and the cost-efficient practice of fuel switching. These deficiencies are serious and would serve to reward the utility for societally inefficient behaviour.

Fortunately, a number of incentive approaches can be used which, together, can address the fuller spectrum of society's interests, namely:

(1) minimizing energy bills (rates * consumption), [22]

(2) minimizing environmental costs and impacts, and

(3) ensuring a solid level of service quality.

As we will explain, it is essential to pool together the appropriate mix of such incentives and, through an integrated, comprehensive approach, ensure that the signal provided to SCGM is one in which profit maximization passes through careful attention to each of these components and to overall minimization of costs to society.

[22] As well as additional resource benefits.

B. Energy Efficiency

Energy efficiency (EE) takes advantage of the energy distributor's skills and access to customers to promote energy efficient technologies and practices in the market. EE measures improve economic efficiency. By saving gas, they reduce customer energy bills. EE also improves the environment. Many electric and gas utilities in North America have demonstrated, based on EE results documented in their evaluation and cost-effectiveness studies, that EE can produce substantial net societal benefits which flow as a direct result of utility efforts.

(1) Identifying barriers

From a utility business perspective, however, EE does not contribute to growth in sales. It does not bring in revenues to the utility. Further, because it reduces gas sales and adds to utility O&M expenses, EE adds to utility revenue requirements per unit of gas sold. For reasons such as these, EE will largely be neglected by most gas distributors unless there is regulatory intervention.

To explore the business disadvantage of EE further, let us assume a framework of traditional rate-of-return regulation. Periodically, the rates of the distributor are established based on a test year. The rates are designed to collect the revenues needed to recover test year expenses and the cost of capital. The cost of capital includes a fair return on shareholder investment included in the rate base. After the rates are put in place, the utility has an opportunity to earn the return on investment allowed in the rate-making decision.

In the short term, before the next rate case that re-sets the rates, the distributor has two business incentives that are directly antithetical to promoting EE. First, the distributor has an incentive to reduce its operating expenses below the levels that were included in the test year. The lower the expenses, the greater the earnings of the distributor. But reduction of expenditures for EE will generally reduce its benefits. The public interest lies in having the utility treat EE expenses *differently* from its other expenses, so that EE does move forward, and is not reduced in order to increase company earnings.

Second, the distributor has an incentive to increase the sales of energy above the levels that were assumed when rates were set. That is because one component of rates is fixed costs which were considered when rates were set, but which generally do not increase materially with short-term increases in sales. Thus the higher the sales, the greater the earnings of the distributor.

In addition to the two short-term issues just identified, the distributor has a long-term business incentive that is antithetical to promoting EE. Management

generally likes to do those things which produce growth in the total size of the enterprise. However, under traditional regulation, EE reduces the growth of the distributor, whether measured in terms of sales, revenues, rate base, or earnings. The greater the amount of EE, the lower the rate of growth in the business.[23]

(2) Leveling the playing field

a) *Introduction*

Regulators concerned with distributor promotion of EE have designed regulatory mechanisms to address each of the three distributor business incentives described above --the incentives to minimize operating expenses, to maximize short-term sales, and to promote long-term business growth. These mechanisms are targeted to EE, so that the benefits of energy distributor promotion of EE may be realized.

From an IRP perspective, it is important that some form of each of these mechanisms be applied. As such, there are three essential steps, or types of mechanisms, that require consideration. First, there are mechanisms which allow the utility to recover from ratepayers only the actual amount it spends on approved EE programmes or activities. These mechanisms are designed to eliminate the incentive to underspend on EE.

Second, there are EE mechanisms which allow utilities to recover from ratepayers all of the fixed costs — costs that do not vary directly with sales — that they would have recovered had they not promoted sales reductions through EE. These mechanisms are designed to eliminate the incentive to minimize savings from EE.

Third, there are EE mechanisms which provide shareholder rewards to energy distributors based on the effectiveness of their pursuit of EE that is cost-effective or otherwise societally beneficial. By its nature, EE cannot be a force for increased revenues for the utility. What shareholder incentives can do, however, is compensate for EE's inability to contribute to total revenue growth, by providing an opportunity to increase the rate of earnings that would otherwise be unavailable within the framework of rate of return regulation. These EE incentives are rewards to influence the behavior of utility managements over time.

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[23] Some distribution utilities, SCGM among them, see energy efficiency services to large-volume customers as part of an overall load retention strategy. The aboce considerations suggest, however, that there are limits to the amount of EE that the utility will pursue as a simple matter of enlightened self-interest.

The following describes each of these steps to placing EE on a level playing field with supply-side options. We also urge the reader to refer to Annex B for a table of incentives currently in effect in sample North American jurisdictions.

b) Step 1: Program cost recovery

The most common type of incentive for energy distributor pursuit of EE is program cost recovery. All of the jurisdictions whose policy and regulatory framework encourages energy distributors to promote EE do provide EE program cost recovery, which is intended to make the utility "whole". These mechanisms assure the distributor of EE program cost recovery only for its expenditures pursuant to EE plans that were approved by regulators. The energy distributor's costs are not subject to challenge if spent on approved types of EE activities. Distributors are still theoretically subject to review of the managerial prudency with which their EE expenditures were made.

This type of mechanism removes the utility's incentive to spend as little as possible on EE. In most jurisdictions, it also allows for some flexibility for the energy distributor to go above the EE spending levels included in an approved EE plan, within various limits, and still recover its full EE program costs. In some cases all of the distributor's EE costs are collected through a special tariff rider. In others, a rider is used to reflect variations from a level of EE expenditures that was included in the cost of service when rates were set. In a few cases there is no rider at all, but the distributor tracks variations from the level of EE expenditures in the last rate case for deferred recovery in a future rate case. Whatever the specific design of the mechanism, interest is charged on all under- or over-recoveries, often at the utility's weighted cost of capital.

It is important to explain that program **cost recovery is only a first and most basic step in removing the disincentives to EE**, and does not relieve the regulator of the necessity of applying additional mechanisms (see the following sections) to ensure that EE is placed on a level playing field with supply-side resources. It is also worth pointing out that SCGM's proposal makes mention of the utility's intention to request full cost recovery for EE spending, presumably following the IRP process.

Annex B lists jurisdictions in which at least one energy distributor is receiving full EE cost recovery in 1998.

c) Step 2: Lost revenue recovery

Because it decreases the amount of energy required to satisfy a given level of required energy service or comfort, EE reduces the volumes of energy sold by the distributor. Some portion of the resulting lost revenue is offset by a reduction in variable costs that are avoided --for example, the commodity costs of gas. The remaining portion of lost revenue, that which is not offset by variable cost reductions, represents pure earnings losses to the utility.

■ Lost Revenue Adjustment Mechanisms (LRAMs)

The most common type of lost revenue adjustment mechanism (LRAM) is based on the calculation of the amount of the reduction in an energy distributor's sales of energy that is due to its own EE initiatives. This must be calculated net of any EE trends that are occurring independently of the energy distributor's EE programs, for sales losses due to other factors would have been experienced even in the absence of any distributor EE activities. The utility's lost revenue is then calculated, net of non-utility EE effects and net of variable cost reductions from its own EE. Lost revenue recovery is usually effected through the same procedure as is used for program cost recovery.

An LRAM removes a distributor's short-term disincentive to decrease its own sales levels through effective EE. The calculation of the amount of net lost revenues in connection with an LRAM is not as straightforward as is the simple accounting for expenditures that is required for program cost recovery mechanisms. In some jurisdictions independent measurement and verification is required to establish lost revenues for purposes of an LRAM. In others, the utility's recovery of lost revenue is constrained by an earnings test, such that the return on equity cannot increase more than some number of basis points above the allowed rate of return. In some jurisdictions there have been disputes over the correct amount of net lost revenues. With some exceptions, however, energy distributors have completely recovered the net lost revenues claimed by them under existing LRAMs.

■ Full decoupling (revenue caps)

With an LRAM in place, a distributor still benefits if he can increase his sales after rates are set. **Because the LRAM is narrowly targeted to EE, it does not remove the increase in earnings from sales gained through other activities of the distributor.** Some jurisdictions have, however, put into place **mechanisms which fully "decouple" revenues from sales levels between rate cases**. In California, this was done through a mechanism enabling distribution utilities to recover the levels of non-fuel revenue requirements that were authorized in the base rate case — not more, and not less. Annual proceedings, incorporating mechanical adjustments, have been made to modify tariffs so as to collect the authorized levels of revenues until the next general rate case. Other jurisdictions have experimented with revenue-per-customer decoupling mechanisms, which periodically adjust rates between general rate cases on the basis of customer growth. Decoupling mechanisms, unlike LRAMs, remove the short-term utility incentive to increase sales.[24]

Today, mechanisms which decouple revenues from sales volumes are generally called revenue caps. Revenue caps may be used in the context of multi-year PBR mechanisms. The essence of revenue caps is to determine an allowed level of revenues over the PBR period and to adjust rates periodically in order to

[24] See Dunsky et Raphals (1998) for a basic description of the revenue cap formula.

reconcile the actual and allowed levels of revenue. PBR mechanisms with revenue caps may also account for price inflation, expected productivity improvements, and quality of service indices.

In his response to our questions on this issue, SCGM's expert witness, Dr. Roger Morin, implies that revenue caps are not currently applied.

> "Au meilleur de mes connaissances, il n'existe pas de régime intégré du type plafonnement des revenus (PR) ou du type plafonnement des revenus par abonné pour les entreprises réglementées de gaz/électricité." (SCGM-15, doc. 2.31, p.1)

This is simply not correct. In fact, revenue caps are applied to a number of electric and gas utilities, both in North America and elsewhere in the world. The approach can be illustrated by a five-year program for the *San Diego Gas & Electric Company*'s base rates that was approved by the California Public Utilities Commission in 1994. Operation and maintenance (O&M) costs, an important part of revenues, were to be allowed to increase as follows:

$$O\&M_{n,t} = O\&M_{n,t-1} \times (1 + I - P + G_t)$$

where I is an index of industry-wide input prices, p is a productivity index, and G is the growth of customers in class of service n (Hill, 1995, page 11). Because it is tagged to G, this approach allows the utility to benefit from growth opportunities associated with capturing new load from competitors, but does not allow it to benefit from marketing efforts that increase an existing customer's total consumption. As such, it is commonly referred to as a "revenue-per-customer cap".

Recently *The Consumers Gas Company of Ontario, Ltd*., proposed a similar revenue-per-customer cap for O&M costs. This proposal is pending before the Ontario Energy Board. Under Consumers' three-year PBR proposal, O&M revenues would be allowed to increase as a function of Ontario inflation, a productivity index, certain uncontrollable ("Z") cost factors, and customer growth. The absence of a sales volume term in Consumers' proposal, making it a revenue cap, was intended to ensure that the PBR is consistent with that Company's DSM objectives, including its proposal to receive performance-based incentives based on EE achievements. (Consumers Gas, 1998)

LRAMs or, preferably, revenue caps, are essential second steps to bringing EE closer to a level playing field with supply options. Annex B contains a broader list of jurisdictions in which an LRAM or a revenue decoupling mechanism (revenue cap or revenue-per-customer cap) is in place in 1998 for at least one energy distributor.

d) Step 3: Shareholder incentives

Mechanisms to assure EE program cost and lost revenue recovery by the energy distributor do not, however, create any positive incentive for energy distributors to promote EE. Similarly, neither LRAMs nor decoupling mechanisms (ie. revenue caps) eliminate a management's interest in long-term growth, nor provide any positive incentive for EE. At best, these mechanisms address short-term disincentives to promotion of EE. Even if both types of mechanism are in place, the regulatory board may need to micromanage or micro-regulate the utility's efforts toward acquiring necessary and beneficial levels of EE. For this reason, a number of jurisdictions have put a third type of incentive, shareholder rewards for EE, into place. The purpose of shareholder incentives is to provide distributors with a positive incentive to continue to build and pursue EE in the way they would normally be enticed to pursue sales growth. A detailed description of shareholder incentives for EE that are in place in North America in 1998 is provided in annex B.

Shareholder incentives are intended to counter the inherent institutional business disincentives to EE by making it a source of revenue and profit. While a wide variety of shareholder incentives have been used over the past decade, the most common type is a shared savings mechanism (SSM). **SSMs make EE profitable to the extent — and only the extent — that EE creates demonstrable net benefits for a jurisdiction's economy or society.** SSMs aim to create a business incentive for sustainable DSM initiatives that promote energy efficiency on an evolving, adaptive, multi-year basis.

Unless the *Régie de l'énergie* wishes to promote EE through threats of penalties and the type of micro-management that has occurred in a few jurisdictions, performance-based shareholder incentives are likely to prove necessary to the effective mobilization of energy distributors as a force for EE in Québec. For this reason our discussion of shareholder incentives is somewhat more extensive than the prior discussion of the program cost recovery and LRAM/decoupling incentives.[25] Next we address three major questions. These are:

- Why are shareholder incentives needed?
- Are shareholder incentives likely to enhance energy distributors' EE efforts over time?
- What are the main types of shareholder incentive

[25] Much of this discussion parallels the evidence of David Nichols filed by the Consumers' Gas Company of Ontario, Ltd., with The Ontario Energy Board in EBRO 497-01, August 1998.

The need for shareholder incentives

By making EE an important new area of business opportunity, shareholder incentives can counter the business disincentives to EE that were discussed above. It is worth reviewing these disincentives in order to understand why shareholder incentives may be so critical.

An argument can be made that the utility should pursue EE without positive incentives, as a matter of regulatory compliance, customer relations, or public benefit. In fact, some utilities actively assist large-volume customers to save energy in order to build long-term relationships with them.

On the other hand, however, EE cannot contribute directly to utility revenues or profits under traditional regulation, nor can it do so under SCGM's proposed incentive mechanism. Beyond the obvious lack of any direct positive cash incentive for pursuing EE, a number of analysts have argued that there are "hidden costs" to a utility in pursuing DSM. In their report on shareholder incentives, for example, Stoft et al. indicate that the "hidden costs" to EE are real but difficult to quantify (Stoft et al., 1995).

One of the hidden costs of EE is the additional managerial effort that is required to integrate EE into the organizational structure, to track it, and to provide regulatory accounting for it.

Of course the utility's direct expenses for all management compensation are recovered in rates, and are not hidden costs. Rather, hidden costs lie in the addition of a further priority service activity, EE, to the already crowded "plates" of senior managers, accounting and technical managers, and regulatory/legal managers. As the span of control of senior managers is increased, EE must compete for quality attention with the other priority business activities.

Below senior management, the marketing challenges of EE require the assignment of skilled program managers and marketers. The need for marketing skills in EE can be met by assigning tested managers and marketers to it. It can also be met by recruiting and training new marketing personnel. The additional hidden cost here is simply this: **assigning such staff to develop and implement EE means that they are not available for marketing activities aimed at increasing the market penetration of gas supply services. The need to put human capital to work in an area which cannot be expected to increase revenues or profits, at the opportunity cost of assigning talent to activities that do add customers and volumes and contribute to profit, points to the need for a shareholder incentive.**

It is sometimes suggested that an LRAM alone, which assures a utility of fixed margin recovery whatever the fluctuations in DSM's impacts on its sales revenues might be, fully eliminates the business disincentive to effective, ongoing pursuit of EE. As important and beneficial as the LRAM is, however, it does not fully address the hidden costs we have been discussing. Indeed, as the cumulative effect of EE on gas volumes grows from year to year, it will eventually have impacts on rate base growth. For example, one can expect that some capital

investment will be delayed as the sales effects of EE begin to accumulate. The amount and timing of distribution system reinforcement, for example, bears some relation to the rate of growth in load. **Even with an LRAM, if EE has any impacts on profitability under current regulation, they are negative, whereas EE ought to be profitable.**

Despite its contributions to societal welfare, EE does not currently provide growth potential for the energy distributor. **Even a shareholder incentive cannot turn DSM into a force for increased revenues for the utility. What such an incentive does is compensate for EE's inability to contribute to revenue growth, by providing an opportunity to increase the rate of profit that would otherwise be unavailable within the framework of rate of return regulation**[26]**.** It is a reward, in short, to influence the behavior of utility managements over time.

The aim of a shareholder incentive is to help effect an alignment between the societal benefits of EE and the utility's growth and profit objectives. This is consistent with the aim of regulation, as expressed by economist Kenneth Train:

> **"[E]ffective regulation establishes a situation in which the outcome that is socially optimal also generates the most profit for the firm, such that the firm chooses it voluntarily. Creating this consistency between social welfare maximization and the firm's profit maximization is the crux of regulatory economics." (Train, 1991)**

■ The effect of shareholder incentives

Are shareholder incentives likely to enhance distributors' EE efforts over time? While it may seem obvious that performance-based cash incentives will act to strengthen a utility's EE efforts over time, it is useful to review the indications that this is indeed a likely result. Information on the effects of shareholder incentives is available from the U.S. electric utility industry, where such mechanisms were first put into place.

Back in 1990, the Chief Executive Officer (CEO) of New England Electric Systems (NEES), a $2-billion dollar electric utility, argued that "utilities, like other businesses, ought to have an opportunity to earn independently of their existing rate base when they are asked (...) to undertake activities not within their traditional business." John Rowe explained that:

> "We requested shared-savings incentives to create the profit opportunity which had been missing (...) The amount the company would earn would be a share of the value created. Our

[26] This applies equally to SCGM's proposal.

> earnings would grow only if the customers' benefit grew." (Rowe, 1990)

NEES has three retail electric distribution companies. The program initiatives, customer participation, and net societal benefits achieved through EE by the NEES companies all increased after EE cost recovery systems, including shareholder incentives, were put into place. Today, the three NEES distribution utilities are recognized as having among the most effective and cost-effective electric EE programs in the U.S. And today, as they have since 1990, the NEES Companies receive performance-based incentives for EE, which we summarize in the accompanying annex B.

In California, the shareholder incentives implemented by the California Public Utilities Commission (CPUC) in 1990 were evaluated in 1993. The researchers conducting the evaluation found that EE commitment and activity increased following the implementation of the incentives. Not only did savings increase, but estimates of savings became more reliable. The evaluators concluded that:

> "shareholder incentives were a major contributor to the observed turnaround and increase in utility DSM activities." (Schlegel, 1993, page E-2)

Based on both the California experience as well as that of NEES, we should expect positive EE results from shareholder incentives.

Today, California is moving toward a new approach to promoting energy-efficiency, one that will collect EE funds from ratepayers for distribution through a California Board for Energy Efficiency created by the CPUC. But in maintaining "transitional" shareholder incentives at this time (as described in annex B), the CPUC stated:

> "Our adoption of shareholder incentives has always been to offset the inherent disadvantages to a utility of promoting energy efficiency (...) Shareholder incentives are still required during the utilities' continued administration of energy efficiency programs into 1998 because gas and electric utilities have significant disincentives to promoting energy efficiency in the new competitive environment." (CPUC, 1997)

In 1994, Oak Ridge National Laboratory (ORNL) conducted a study of the effects of state regulation on U.S. electric utilities' pursuit of EE. The ORNL researchers reported:

> "States that awarded financial incentives were found to have greater utility DSM usage than other states (...) The simple fact of whether or not a state provided incentives accounted for over 27% of the variance in projected 1997 energy savings...." (Schweitzer, 1994)

Types of Shareholder Incentive

One mechanism that has been adopted in some jurisdictions is the inclusion of EE expenditures in the rate base. In this way these expenditures are transformed into investments that earn a return for the shareholder. One analysis of the rate-basing of EE summarized its advantages as follows:

> "[M]ore regulatory commissions should consider adopting a ratebasing approach, because it:
>
> - Promotes better matching of program costs and benefits, and thus improves intergenerational equity.
>
> - Provides an additional signal to utilities that all resource options are to be considered in a balanced manner.
>
> - Makes more practicable the undertaking of large-scale 'conservation construction programs'." (Reid, 1988)

While there are advantages to ratebasing, there is also an important disadvantage: to invite energy distributors to develop earnings by rate-basing their EE expenditures is to incent increased spending on EE.

The most widely adopted shareholder incentive is the **shared savings mechanism (SSM)**. In contrast to ratebasing, the SSM approach provides the energy distributor with a share of the net benefits — that is, benefits after all EE costs including its program costs have been deducted — and thus avoids the inducement to "gold-plating" EE. The SSM sends the signal to maximize the resource savings per distributor dollar expenditures.

SSMs usually provide for a small share of life-cycle benefits, as a potential reward to shareholders, as may be seen from inspection of the shareholder incentives summarized in annex B. The SSM approach requires that both energy savings and the resource benefits flowing from those savings be quantified. Quantification of benefits is a feasible and desirable objective for most EE efforts, and ought to be done through the societal cost test (SCT), as described earlier in this testimony. Still, there will be some EE efforts whose benefits are more diffuse or difficult to quantify.

SSMs are usually designed so that the utility receive its share of benefits up-front. The benefits are calculated over the lifetimes of the EE measures put into place. The utility receives a share of the total net present value of these life-cycle benefits. If future benefits turn out to be less than was estimated at the time the incentive was paid, the shareholders have been overpaid. However, this risk is not one-sided. In the late 1990s, estimates of future EE benefits are being made more conservatively, based on utilities' knowledge that early DSM estimation methods proved over-optimistic, and their understanding of why this was so. As a result, there is also a risk that future benefits will turn out greater than was estimated at the time the incentive was paid.

SSMs are often sensitive to the energy distributor's achievements relative to EE goals or targets. Targets may involve volumes saved, cost-effectiveness, or both. **The presence of an EE achievement threshold in an SSM could create an incentive for the distributor to set an easy, low-side EE target, which would then be readily surpassed. This perverse incentive cannot be avoided, but it can be controlled.** One method for controlling it is to have a supplementary shareholder incentive component, which provides rewards for sheer volumetric achievement. A simpler method for limiting any potential effects from this perverse incentive is for regulators to pay attention to the adequacy of the EE target in their periodic reviews of EE plans.

Finally, beyond (1) ratebasing EE and (2) the use of SSMs, there also exist an eclectic variety of specific incentives that have been used over the years in various jurisdictions. Briefly, these are:

- Increased overall rate of return based on EE achievement.
- Overall rate of return penalty due to failure to follow regulatory directives on EE.
- Bonus rate of return on rate-based EE expenditures.
- Specific dollar rewards tied to particular EE program milestones.
- Payments per unit of energy or demand saved.
- Distributor can purchase energy savings from its own for-profit subsidiary.
- Net lost revenue recovery increased above 100% based on performance thresholds.

Each of these mechanisms, including the shared savings and ratebasing approaches described previously, share a common goal: ensuring that the utility can earn a return on its energy efficiency activities. They are therefore essential to placing demand-side options on a level playing field with their supply-side counterparts.

e) Summary

In order to place energy efficiency on a level playing field with supply-side options, three types of mechanisms must be put in place: cost recovery, lost revenue recovery and shareholder incentives. Within each of these general steps a number of specific choices must be made. Table 6 summarizes the steps and the specific issues and options they present.

Table 6. Level Playing Field for EE Options: Steps and Choices

Bias	General Response	Specific Issues and Options
INCENTIVE TO REDUCE EE SPENDING *(independent of net ben't)*	**Step #1 - Cost recovery** Ensure the utility can recover costs of authorized.	(a) Level of recovery: - Recovery strictly limited to authorized amount, or - includes flexibility where spending is slightly lower or higher. (b) Method of recovery: - Costs recovered through rates (with variations deferred to future rate case), or - through a tariff rider (ie. art. 49 10º), or - both (ie. rider for variations only)
INCENTIVE TO INCREASE SALES *(independent of net benefit)*	**Step #2 - Lost revenue recovery.** Allow the utility to recover lost revenues associated with EE results.	(a) Scope of recovery: - Limit recovery to EE-created lost revenues, through a lost revenue adjustment mechanism (LRAM), or - Make recovery comprehensive, applied to all lost revenues through a decoupling mechanism (ie. revenue cap or revenue-per-customer cap) (b) Requirements: - Subject to independent verification or not (c) Level of recovery: - Full recovery to ensure level playing field, or - Recovery capped by arbitrary ROE limit

INCENTIVE TO FOCUS ON GROWTH OPPORTUNITIES *(inability of EE to generate growth or earnings)*	**Step #3 - Shareholder incentives.**
	Allow utility to earn a return on energy efficiency investments
		(a) Incentive method:
		- Place approved EE program costs in ratebase (ie. treating costs as investments to which return is applicable), or
		- Create shared savings mechanism (SSM) to link utility's profits to net present value (NPV) of benefits its programmes provide to society, or
		- Other options, including:
		  - ROR premium/penalty for EE over-/under- performance
		  - ROR premium on ratebased EE costs
		  - dollar rewards for specific EE programmes
		  - payments per unit saved
		  - enable utility to purchase savings from affiliate
		  - recovery of >100% of lost revenues
		(b) Threshold values:
		- Target volumes saved, cost-effectiveness or both
		- careful attention to specific target, or
		- Add target-independent volumetric SSM

In section D. below, we will discuss how these steps could be applied in a performance-incentive scheme for SCGM's ratemaking process.

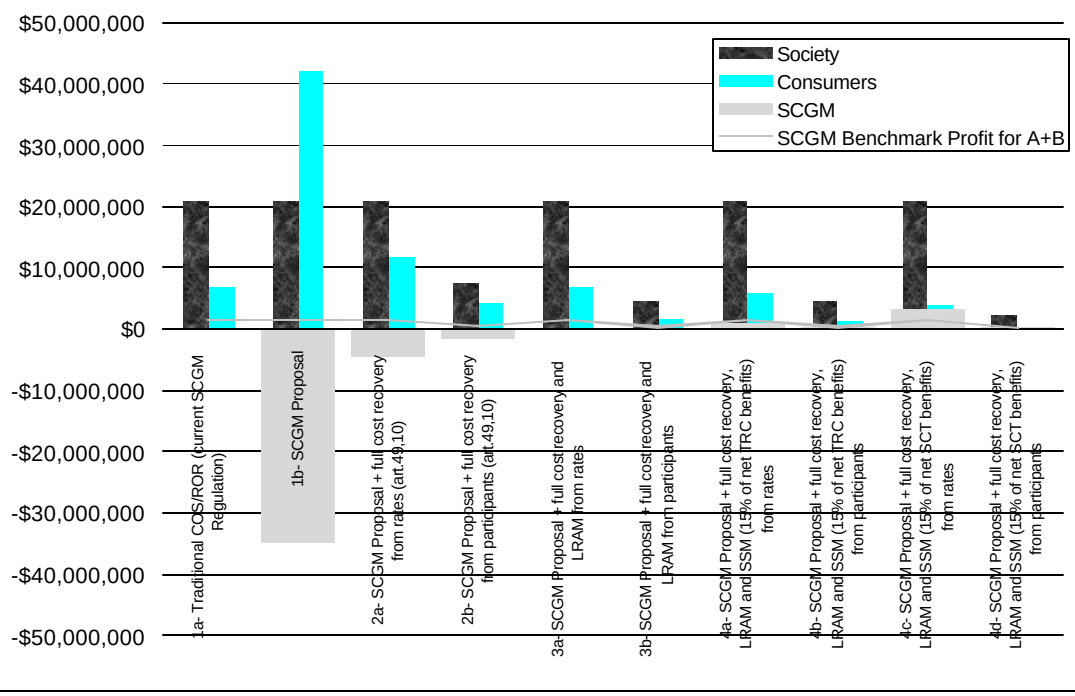
(3) Sample results for SCGM

To give a more concrete idea of the ways in which these three steps can place EE on a level playing field with supply-side options, we have simulated the

results of applying some or all of these steps to SCGM's proposed incentive ratemaking scheme. Results of the full analysis, conducted for the three sample EE programmes described in chapter III(1) B. , are presented and discussed in Annex A.

The following chart summarizes, for each option reviewed, the relative benefits for SCGM of pursuing options A and B, the most cost-effective combination of options from a societal perspective (resulting in a net benefit of more than $20 million to society). The horizontal line represents the benchmark profit, ie. the profit SCGM would receive for *not* pursuing programmes A and B. A reasonable regulatory option would ensure that SCGM's benefit of pursuing these programmes is at least equal to this benchmark.

Impact of Changes to SCGM's Proposal for Aligning SCGM's Interests with those of Society



C. Fuel Switching

(1) Missing link

As we have previously explained, under both traditional regulation and SCGM's proposed incentive rate regulation, the utility is rewarded for increasing market share where such efforts meet the RIM (TNT) test, as opposed to the SCT test. As such, SCGM could be rewarded for efforts at load capturing that would serve to increase *net* environmental impacts, without due regard for such impacts or for society's interests.

As indicated above, fuel choice initiatives are best evaluated from a societal perspective, in which all cost trade-offs are identified and weighed. In this section, we suppose that the Regie, in its future IRP rulemaking and deliberations, decides that fuel choice initiatives should result in, at a minimum, no net increase in the emission of harmful air pollutants or GHGs, or in other types of environmental impacts. This is purely an analytical assumption that we make to further underscore what we hope is, by now, obvious: SCGM's proposed incentive mechanism could readily increase the level of pollution, GHG emissions and other environmental impacts associated with meeting Quebec consumers' energy service needs.

It is possible, though not an optimal approach, to modify SCGM's PBR design in order to reflect environmental concerns. In this section we outline two approaches that might be used to so modify the mechanism as concerns the issue of fuel switching. These are a volumetric adjustment and an index of net environmental impacts[27].

(2) Volumetric adjustment

SCGM's proposed mechanism would calculate the actual cost of service (COS) for each year of the PBR period, and compare it with the expected COS to determine whether utility service is being delivered at less than projected cost. Increases in volumes of gas delivered by SCGM will be included in the calculation of the actual COS and will help to reduce the actual COS below the

[27] The latter option is equally applicable to other forms of rate regulation, traditional and incentive, including the approach currently in place for SCGM.

level of expected COS.[28] This means that sales increases will be rewarded independently of their environmental impacts, positive or negative.

If it were the desire of the regulator to encourage fuel switching with positive net impacts and discourage fuel switching with negative environmental impacts, it would be possible, as a technical matter, to adjust SCGM's PBR mechanism to accomplish this goal. The portion of the COS attendu that is based on costs SCGM can control is projected by multiplying one year's volumes times the prior year's rates, with adjustments to credit customers for any rewards due them under the mechanism. SCGM's response to RCNREQ Question 23 provides the PBR formula which shows that this is the case. If the regulator were to exclude from the volumes used to establish the COS attendu those increases in volumes derived from fuel switching that has negative environmental consequences, the incentive to build such load would be removed. New load from environmentally harmful fuel switching would be included in the COS requis, but not in the COS attendu, and thus such load would reduce the possibility for the latter to exceed the former. This would require a specific determination of which general types of switching are viewed positively or negatively.

(3) Composite index of net environmental impacts

A second approach would be based largely on a standard Service Quality Index (SQI). SQIs have become "standard fare" for incentive mechanisms, the principle being that while the utility is able to maximize profit from cost cutting or cost minimization, its ultimate access to the additional margins is linked to its service quality performance as measured by a set of indices. An SQI is currently in place for SCGM, and is included with only slight modifications in the utility's current proposal (see SCGM-15, doc.1 and SCGM-16). To the extent the environment also should not be negatively affected from a utility's actions (and, as with service quality, should indeed be improved), the same principle could apply.

[28] SCGM explains in its evidence that because its marginal costs are below its average costs, increases in usage will tend to reduce average costs. Under the PBR proposal, such volumetric increases will be reflected in the COS requis. But whatever the growth in sales, the growth in the COS requis will be slower, Thus, increases in volumes sold will not affect the COS attendu in the same way as they will the COS requis, because the COS attendu is established on the basis of base year costs and sales levels. Expected volumetric increases will be applied to the existing rate level, so that the COS attendu will not reflect the moderating influence of sales growth on rates during the multi-year PBR period. The greater the rate of growth in sales, the greater will be the gap between the COS attendu and the COS requis.

a) How would an EQI work?

A composite index of net environmental impacts (we will call it an Environmental Quality Index, or EQI) would be fashioned along similar lines, and could be geared particularly to the issue of fuel switching. For example, an EQI could be a composite comprised of three main measures, for example (1) net greenhouse gas (GHG) emissions, (2) net emissions of pollutants (NOx, SOx and VOCs) and (3) net land and water impacts (flooding, etc.).

Each index would measure net total emissions or impacts prior to the test period, and would do so only for emissions related directly to SCGM's activities, either marketing or more broadly to all activities. For example, if SCGM's marketing activities allowed it to capture market share from heavy oil, and in so doing *net emissions* (increase from gas minus decrease from oil) were reduced, this would show up as positive on the GHG and pollutant indices of GazMet's EQI. If, on the other hand, its activities allowed it to capture market share from electric generation, measurement of net impacts would include the net increases in GHG and pollutant emissions as well as the net decreases in land and water impacts. Depending on the specific setting of the index and the specific end-use that SCGM captured, its EQI could be negatively affected. The EQI would be linked directly to SCGM's activities, and could in no way be affected by external factors affecting net emissions of non-gas energy sources.

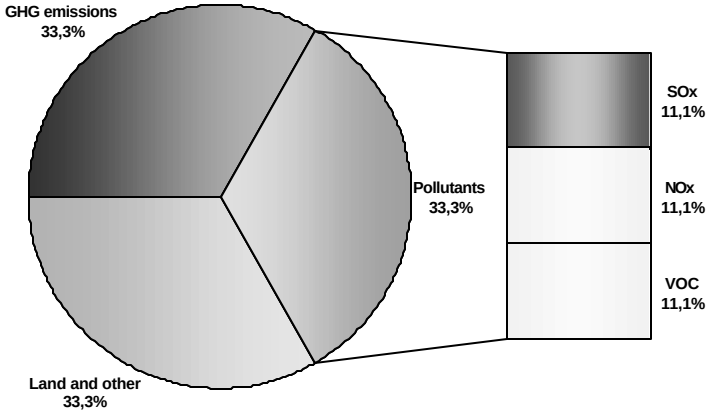
The EQI would therefore measure the net environmental impacts of Gaz Métropolitain's marketing and load capturing activities over a given period. Measurements would be translated into percentage improvements or declines from the base year, and then linked to the utility's ability to retain any additional earnings allowed under its cost-, price- or bill-oriented incentive mechanism. In keeping with the SQI currently in place for SCGM (and most SQIs, for that matter), there would be multiple thresholds allowing various levels of bonus earnings retention (see below). Also, SCGM's profit maximization opportunities would not be linked only to the EQI, but to a combination of the EQI and SQI.

b) Application of a sample EQI to SCGM

The following describes a sample EQI and its links to utility performance and rewards:

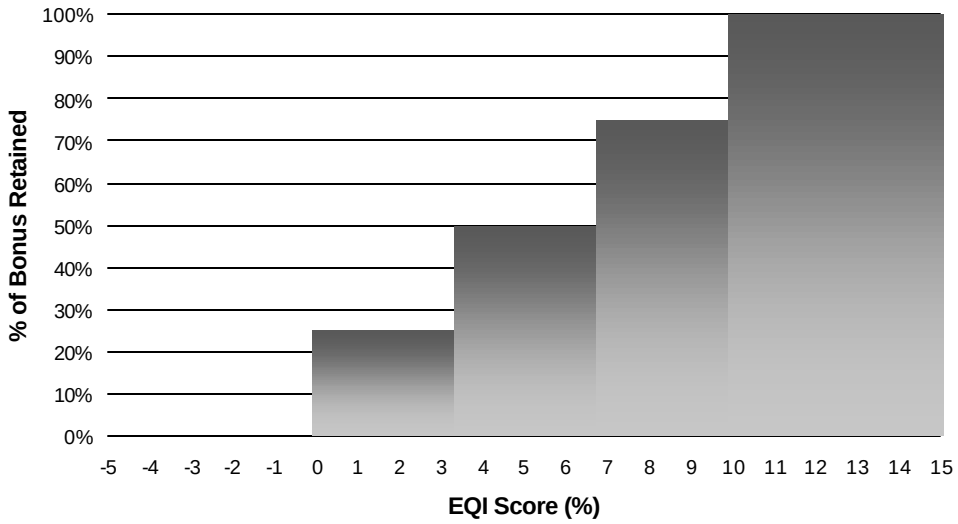
First, for simplicity, we will imagine that each index is given equal weight, as follows:

Sample Composition of the EQI



Second, we will link SCGM's ability to retain bonus earnings to its net environmental performance in the following way: For example, if the goal is to entice SCGM to gradual improvements in net environmental impacts, we would apply the following: where the score is negative (relative to previous year or time period), 0% bonus; where 0% to +3.3% improvement, 25% bonus; where +3.4 to +6.6%, 50% bonus; where +6.7% to +9.9%, 75% bonus and where ➽ +10% change, 100% bonus (see chart below). The specific numbers should depend on a performance level that would be reasonable to expect.

Sample EQI Scale
Retention of Bonus Earnings According to EQI Score



Third, we will allow for 50% of SCGM's potential reward to be linked to the EQI, while the other 50% would be linked to performance under the proposed SQI.

Let us imagine now that SCGM is under an incentive scheme by which, whether for cutting costs, cutting prices or cutting energy bills, it is allowed to retain a portion of the benefits. Under the proposed EQI, 50% of those benefits would be tied to SCGM's environmental performance as measured through its EQI score. In other words, if the total economic performance would save $3 million for customers, and if SCGM was allowed to retain 2/3 of that performance, subject to its SQI and EQI, then its performance under the EQI would be worth $1 million. Assuming that the utility's proposed SQI is retained, the following table describes several possible sample scenarios for SCGM:

Table 7. Maximum Earnings Bonus on Hyp. $3m Economic Performance Gains

SCGM efforts		Sample Results		Sharing of Performance Gains	
Effort at service quality	Marketing considers envir. impact	SQI Score	EQI Score	SCGM share (Bonus earning) (max. $2m)	Consumers share (Credit on bill) (max. $3m)
HIGH	HIGH	95%	+15 %	$ 2 000 000	$ 1 000 000
LOW	MOD.	80%	+3 %	$ 750 000	$ 2 250 000
HIGH	LOW	90%	-12 %	$ 900 000	$ 2 100 000
MOD.	HIGH	85%	+10 %	$ 1 850 000	$ 1 150 000

If an EQI were applied, SCGM would likely perform modelling along the lines of the above table in order to determine its most profitable course of action[29]. The EQI would ensure that the net environmental impacts of such actions are taken into account prior to determining the nature of its marketing efforts.

c) Benefits of the EQI

The EQI follows a standard model for incentive regulation and would ensure that SCGM is rewarded for providing net benefits to society and not for creating net costs. The EQI could be applied to any incentive mechanism, whether one that focuses on rates (ie. a rate cap or SCGM's proposal), bills (ie. a revenue (or revenue-per-customer) cap or an LRAM) or costs (ie. the current ratemaking approach).

With an EQI, the utility would suffer no loss in incentives to cut costs. Indeed, the EQI would only benefit SCGM to the extent it managed to cut costs or

[29] Unfortunately, it was impossible, through the questions-and-answers period allowed in the regulatory process governing this case, to obtain from SCGM a disaggregation of its marketing targets according to energy source (SCGM-3, doc. 2.23). For this reason it was impossible for us to simulate the effect of incorporating an EQI to SCGM's actual target performance for the coming years.

otherwise enhance its economic performance above an expected level. The EQI would simply ensure that the utility is not tempted to do so *at the expense* of net environmental costs to society.

(4) Conclusion

Before adopting an incentive mechanism that provides a simple incentive to increase gas load independent of environmental considerations, we suggest that SCGM conduct an analysis of the environmental impacts of different types of fuel switching. The results of this analysis could be considered by the Regie in order to determine whether there is an unnecessary risk of negative environmental impact in an undifferentiated incentive to build gas load. If necessary, an incentive to build gas load could be directed away from environmentally problematic markets, if any, as suggested by the two sample modifications to SCGM's proposal that we have just presented, the volumetric adjustment or the EQI.

D. Discussion of Options Available to the Régie

If SCGM's profit maximization opportunities are to be linked to its performance from a societal standpoint, ie. to its ability to minimize total cost to society of its energy services, then its current proposalmust either be deferred or fundamentally changed. The following describes the pros and cons of each of the following options faced by the Régie:

(1) Accept the proposal
  (a) ... as is
  (b) ... and add EE mechanisms at a later date
  (c) ... but modified to include EE and fuel switching (FS) mechanisms now

(2) Reject the proposal
  (a) ... and replace it by a comprehensive IRP-based approach
  (b) ... and allow the existing mechanism to continue, but with immediate modifications for EE and FS mechanisms
  (c) ... and allow the existing mechanism to continue, applying EE mechanisms at a later date

(1) Accept SCGM's proposal ...

a) Option #1: As is

Accepting SCGM's proposal “as is” would create a direct tension between the Régie's mission as expressed in article 5 and the business incentives provided to SCGM. It would penalize SCGM for any future attempts to pursue energy efficiency measures which are cost-effective from a societal standpoint as well as from a consumer bill perspective, and as such would result in unnecessarily high costs to society as well as to consumers, contrary to the principles outlined in both articles 5 and 72. It would also reward the utility for marketing choices that could lead to unnecessary increases in environmental impacts, in addition to the unnecessary increases that would result from not pursuing cost-effective EE. **This option should be rejected outright.**

b) Option #2: Adding EE and FS mechanisms at a later date

The Régie could adopt SCGM's proposal, but with a view to applying some of the types of mechanisms we described, at a later date, ie. in a rate case to follow the close of the future hearings on SCGM's resource plan.

This option would be counterproductive. In adopting the proposed plan, the Régie would be sending a clear signal to utility managers that SCGM's primary interest lies in increasing gas sales according to the societally inefficient RIM test. This would then set in motion an institutional process which would be difficult to reverse at a later date (it is unlikely that a resource plan will be approved before the year 2000 or 2001 at best). It could mean that SCGM would come to the IRP process with an entrenched interest to oppose EE efforts which go beyond the mere RIM test[30]. Furthermore, the types of mechanisms that one could adopt under a resource planning process to allay this problem, if the current proposal is already adopted and in place, would be weakened by the opposing incentives in SCGM's proposal.

For example, an LRAM could be applied, but would have no effect on the underlying sales-growth message given to the utility. If, under a future IRP process, only cost recovery is offered, as SCGM seems to suggest, then the utility's interests would lie in the worst of both worlds: it would be rewarded for sales growth that meet the RIM test and would also be rewarded for EE spending. The utility's interest then would lie in spending as much as possible on EE and achieving the least possible EE results. This would also be the result of other variations on the same theme.

In the year or two until then, SCGM would continue to be rewarded for societally-inefficient actions, ones that would unnecessarily increase consumers' total energy bills and which could result in net increases in environmental impacts, without any due regard for the Régie's mandate of sustainable development and its commitment to integrated resource planning.

This counter-productive option should also be rejected outright.

c) Option #3: Modified to include EE and FS mechanisms now

The Régie could accept a modified version of SCGM's proposal, that would include the types of mechanisms we have described for aligning energy efficiency and utility marketing choices with the societal interest.

More specifically, the Régie could adopt the SCGM proposal with the following immediate modifications:

(1) create a separate account, under art. 49, 2º or 3º, for recovery of the utility's EE expenditures that meet the societal cost test (SCT);

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[30] Or, alternatively, to propose counterweight mechanisms that could lead the utility to see an interest in maximizing spending, but minimizing actual results, as we have previously explained.

(2) put into place a lost revenue adjustment mechanism (LRAM) to compensate, through the separate account, any net lost revenues associated with verifiable EE expenditures that meet the SCT test;

(3) create, again within the same account, a shared savings mechanism (SSM), through which SCGM could retain a percentage of verifiable net benefits — as measured by either the societal cost (SCT) or total resource cost (TRC) tests — created by its EE expenditures; and

(4) apply one half of SCGM's proposed share of performance gains to its score on a composite index of net environmental impacts, otherwise referred to as an Environmental Quality Index, or EQI[31].

While efficiently countering much of the wrong signals SCGM's proposed incentive mechanism would create, this approach could also create a confusing signal to utility managers, whereby one part of their performance is measured in their ability to pursue all societally cost-effective options (both in EE and marketing), and another part measured according to their ability to pursue RIM-based cost-effective options. In addition, SCGM's demand-side plans require more development and review than is possible in the present case. Most importantly, it would be better to order SCGM itself to return with a more comprehensive and balanced incentive mechanism, rather than imposing this modification on it from above at this time. **Thus we consider option #3 an approach of last resort to correct the SCGM proposal.**

(2) Reject SCGM's proposal ...

a) Option #4: Replace it with comprehensive, IRP-based approach

Alternatively, the Régie could also reject SCGM's proposal and replace it with a comprehensive incentive approach toward societally cost-effective performance. For example, the Régie could apply a revenue cap (RC) or revenue-per-customer cap (RCC) approach, combined with a shared savings mechanism to ensure that SCGM earns a return on EE spending. If it chose to apply a revenue-per-customer cap — which would reward the utility simultaneously for pursuing cost-effective EE *and* for marketing to new customers —, the Régie could further apply some provision — for example, the EQI described earlier — to ensure that the utility is rewarded for marketing which provides a positive, not negative, net benefit to society.

In reality, an RC or RCC is like any other comprehensive performance incentive mechanism, in that it requires a significant level of detailed determinations,

[31] The other half would remain linked to a service quality index (SQI).

regarding such things as the choice of inflation indices, productivity offset (X) factors, uncontrollable costs (Z factors), a deadband and sharings bandwidth, the period of regulatory lag, basket ceilings, price floors and fluctuation limits, and EE and environmental impact targets, penalties and rewards (see Dunsky and Raphals 1998). As such, it would be highly imprudent to suggest that the Régie adopt a specific mechanism at the close of the present case, even if certain elements were to have been discussed.

Rather, the Régie could, in rejecting SCGM's proposed mechanism, order it to return next year with a new, comprehensive incentive mechanism which would directly address the central objective of minimizing total costs — economic, social and environmental — to society from a sustainable development perspective. The Régie could in so doing express a clear preference that SCGM return with a revenue cap-based approach, or simply that EE concerns, along with net environmental impacts, be central to the proposal, without more direction. In the meantime, the existing régime could operate as is or with minor modifications.

b) Option #5: Pursue with existing approach, modified by EE and FS mechanisms

The Régie could also, in rejecting SCGM's proposed method, simply apply the existing method of regulation, modified to include the types of mechanisms we have described. This too would not be the best approach, in that the utility could find conflicting messages, although it would certainly be preferable to options 1, 2, 6 and even 3[32].

Pursuing this option would follow similar lines as described under option 3, the modifications being applied, of course, to the existing approach as opposed to SCGM's proposal. To the extent these modifications could be determined at the close of the present rate case, this option could be combined with option #4, in such a way as to apply temporary mechanisms immediately while asking SCGM to return next year with a revised approach.

c) Option #6: Pursue with existing approach, to be modified by EE and FS mechanisms at a later date

Finally, the Régie could choose to reject the proposal, retain the approach currently being practiced, and expect to adopt modifications, at a later date to follow the IRP process, to deal with the energy efficiency and environmental imperatives we've already discussed. This option is, for all intents and purposes,

[32] It is worth mentioning, as SCGM has itself pointed out, that from an EE and least-cost perspective, it is preferable to allow a cumulative accounting of results and rewards, so as to facilitate medium-term EE investments. For this reason, it is preferable to pursue the *concept* of a multi-year PBR (though not SCGM's proposal), rather than simply abandon the process and revert to an annualized approach.

similar to option #2, and would also be counterproductive, entrench and institutionalize the wrong signals and interests, and unnecessarily render more difficult the eventual application of IRP. In the meantime, it would entice SCGM to continue rejecting societally cost-effective EE options, a path which would lead to lost opportunities and therefore unnecessarily high energy bills and total costs for society and consumers. It would also, through the existing end-of-year true-up and benefit-sharing mechanism, reward SCGM for activities that result in unnecessarily high environmental impacts.

This option, as with options #1 and #2, should be rejected outright.

(3) Our preferred approach

Our review provides a sound basis for excluding the possibility of adopting SCGM's proposal, with or without modifications. Furthermore, the existing approach also incorporates perverse incentives which are contrary to the new regulatory mandate.

For these reasons, we believe it would be preferable to reject SCGM's proposal, termporarily modify the existing approach to be applied on an interim basis, and order SCGM to return at the next rate case with a redesigned, comprehensive incentive ratemaking proposal which would encompass incentives for the full breadth of objectives set out by the concept of sustainable development as defined in the Régie's enabling legislation. This new approach would have to provide incentives for productivity gains, on the one hand, and application of the societal cost test to both energy efficiency and marketing choices.

V. Conclusions and Recommendations

SCGM's proposal should be rejected in favour of an approach that provides incentives for performance to society

A. Conclusion

(1) Ratemaking, IRP and SCGM's proposal

We have established, as it is widely recognized in the literature, that there is a direct and undeniable link between the resource planning process and the ratemaking process. The latter informs the utility of the types of investment and marketing choices it needs to pursue to maximize profits, which then play out in the resource planning forum.

SCGM has argued that IRP be left to a later stage, when resource plans are to be studied and adopted. We concur. The ratemaking process is inappropriate to determine the specific types of investments the utility should make, ie. the specific energy efficiency programmes or pipeline extensions that it should pursue. However, it would be illogical and absurd to take a step too far, as SCGM attempts to do, and suggest that the ratemaking process need not be aligned with the basic tenets of IRP, if this method is to be practiced at a clearly foreseeable later date. Indeed, such an alignment is essential for a coherent regulatory régime to be in force.

We have explained the extent to which SCGM's proposal would run contrary to the fundamental tenets of IRP; how it could institutionalize resistance to applying IRP at a later date; and how , independently of future IRP cases, it would result in SCGM's interests being not simply indifferent but contrary to those of society, as expressed in article 5 of the Régie's law. The proposed incentive ratemaking scheme would incite the utility to use the wrong cost-effectiveness tests in both its energy efficiency and marketing choices, and, ultimately, would result in society paying an unnecessarily high price for its energy services. This is counter to the letter and the spirit of the law, as well as to the energy policy behind it.

For all of these reasons, SCGM's proposal must be rejected.

(2) A more balanced approach to incentive ratemaking

There are, however, a number of methods for aligning the interests of the utility with those of society as a whole. These have largely been developed and used in those jurisdictions committed to least societal cost, sustainable development and integrated resource planning principles. These are fundamentally sound, economically desirable approaches to meeting customers' energy service needs at the least possible cost. These mechanisms, whether lost revenue recovery and

shared savings mechanisms for energy efficiency, or approaches to link environmental performance from marketing with the ability to retain profits from productivity gains, are necessary to ensuring the alignment that is so fundamental to the regulatory process.

It is important here to put these mechanisms and approaches into perspective. Having read through a document limited largely to discussion of energy efficiency and environmental imperatives, the reader could mistakenly believe that such mechanisms give no weight to economic considerations. This would be wrong.

Indeed, each of these mechanisms is based upon the fundamental need to entice SCGM to minimize economic costs. For example, use of the EQI would mean that SCGM would have to meet certain environmental requirements in order to benefit from the results of cost-cutting, which remains the first incentive. If the utility does not achieve economic performance gains through cost cutting, there simply is no bonus to be had, environmental performance or not. The EQI only serves to ensure that the fundamental incentive toward cost cutting does not lead to increases in total environmental costs and impacts.

Similarly, a shared savings mechanism (SSM) for energy efficiency measures also depends first and foremost on the utility's ability to minimize costs. Indeed, if the utility is to benefit, it must minimize the costs of its EE programmes relative to their total benefits. The more SCGM manages to minimize the dollar costs of its EE programmes, the more it benefits under an SSM. Note also that the bonus the utility can earn is only a portion of the net benefits it provides to society or to consumers, so there is no concern that consumers would be bearing the brunt of incentives to the utility.

As for an ERAM, this simply compensates the utility for lost revenues associated with programmes whose verifiable outcome results in net economic gains for society. In the case of the LRAM then, this mechanism simply nullifies a disincentive to cost-effective performance.

In sum, the mechanisms we define as essential to ensuring a balanced ratemaking approach are in addition to, not at the expense of, fundamental cost-cutting incentives. As such, the utility is rewarded for cutting costs and lowering society's energy bills simultaneously. This is the type of reward scheme that should follow from the Régie's law[33].

The following describes in more detail our specific recommendations.

[33] We have focused our attention in this report on rewards. It is also common, under incentive ratemaking, to include penalties for below par performance, whether from an economic, social or environmental perspective. We do not deny the merits of such penalties being applied in conjunction with rewards, so long as the overall signal to the utility remains one by which its most profitable path is the one that is also least costly to society.

B. Recommendations

For the reasons discussed earlier, we make the following recommendations to the Régie de l'énergie :

- Reject SCGM's proposed incentive ratemaking scheme.
- Order SCGM to return at the next rate case with a comprehensive, multi-year incentive proposal that is (1) consistent with the Régie's mandate to ensure that energy needs are met through sustainable development, as expressed in article 5 of its Act, and (2) compatible with the fundamental tenets of integrated resource planning, as well as (3) in line with a continuing emphasis on sharing the profits from utility productivity improvements.
- Retain the existing ratemaking approach as an interim measure only.

Furthermore, and on an interim basis only, we suggest the Régie adopt two additional positions:

- Discourage SCGM from promoting fuel switching from electricity to natural gas until such time as it submits an analysis of the net environmental impacts of such activities to the Régie; and
- Indicate that if SCGM wishes to expand its energy efficiency activities during the coming year, the Régie will look favorably to providing additional cost recovery for new EE initiatives that would at least pass the Total Resource Cost test, ie. the societal cost test minus any environmental considerations (until such time as the Régie establishes values for environmental externalities).

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Annex A:
Benefit-Cost Analyses for Sample EE Programmes
(according to regulatory treatment)

by **PHILIPPE DUNSKY**

Introduction

Integrated Resource Planning requires, among other things, that energy efficiency options be judged based on their cost-effectiveness for society. In order to make this determination, the « societal cost test (SCT) » was developed to compare all costs with all benefits. If a potential energy efficiency measure or programme passes this test, ie. results in a positive net benefit, it should be pursued. If it fails the SCT test, it should be abandoned.

The SCT test (as with its cousin the total resource cost (TRC) test) is dependent on the « fundamentals » of the measure, ie. its core costs and benefits. Within those fundamentals, costs and benefits can be shifted and shared among parties, ie. among consumers and between consumers and the utility. Determining the overall impact for consumer bills, then, as well as for the utility itself, requires additional analyses, this time dependent on the regulatory regime as well, ie. the way in which the utility recovers costs and is rewarded or penalized, through the incentives in its ratemaking approach, for achieving certain results.

For a coherent ratemaking policy to be in place, it must ensure that the utility's interests are aligned with those of society; ie., that the adopted ratemaking régime results in the utility profiting from efficiency measures that also pass the SCT test, and inversely losing money from pursuit of measures and programmes which fail the SCT test. The régime can also be designed to ensure that consumers as a whole must benefit in order for a combination of measures to be implemented. In these ways, the utility will have the right incentives to pursue the appropriate measures in the common public interest. When choosing among incentive ratemaking schemes, one should be careful to analyse the impact of each approach on the objective of aligning the utility's interests with those of society.

Methodology

This annex attempts to compare the interests of (a) society, (b) consumers as a group and (c) SCGM in three hypothetical energy efficiency programmes and according to a variety of regulatory options. We use the same programmes as described in our main report, as follows:

Three Hypothetical EE Programmes: Basic Data										
Programme	Savings Potential (10^3 m^3)	Programme Costs (¢/m^3)			Programme Benefits (¢/m^3)					Ave. Rate (¢/m^3)
		Utility's share	Participant's share	Total cost	Avoided capital costs	Avoided variable costs	Subtotal: Utility Avoided Costs	Avoided environmental costs	Total: Societal Avoided Costs	
	1	*2*	*3*	*4 (2+3)*	*5*	*6*	*7 (5+6)*	*8*	*9 (7+8)*	*10*
A	250 000	10	5	15	4	16	20	4	24	22
B	250 000	16	5	21	4	16	20	4	24	22
C	250 000	22	5	27	4	16	20	4	24	22

We then define the regulatory options under which the net benefit of each EE programme is to assessed: For the purposes of this annex, and with the sole exception of the current COS/ROR approach, our starting point is the specific incentive ratemaking proposal that *Société en commandite Gaz Métropolitain* (SCGM) has proposed. Within this overall incentive approach, we analyze a series of modifications that could be made with regard to the treatment of energy efficiency resources, as follows:

Incentive Regulation and EE Treatment Options					
Option #	Basic regulatory approach	Full cost recovery	Lost revenue recovery	Shared Savings Mechanism	Method of recovery
1a	Current (COS/ROR)	Yes	Yes[34]	No	Rates
1b	SCGM's Proposal	No	No	No	Rates
2a	SCGM's Proposal	Yes	No	No	Rates
2b	SCGM's Proposal	Yes	No	No	Participants
3a	SCGM's Proposal	Yes	Yes	No	Rates
3b	SCGM's Proposal	Yes	Yes	No	Participants
4a	SCGM's Proposal	Yes	Yes	15% of net TRC benefit	Rates
4b	SCGM's Proposal	Yes	Yes	15% of net TRC benefit	Participants
4c	SCGM's Proposal	Yes	Yes	15% of net SCT benefit	Rates
4d	SCGM's Proposal	Yes	Yes	15% of net SCT benefit	Participants

[34] Under traditional cost of service / rate of return (COS/ROR) regulation, rates are set at a level necessary to meet the utility's revenue requirements. The "yes" here assumes that the revenue requirement would be established as a whole, thus implicitly including both EE costs and "lost revenues".

In the table above, we define cost recovery as recovery of 100% of SCGM's direct costs associated with the EE programme. We define lost revenue recovery as recovery of 100% of the net loss to SCGM, ie. lost revenues minus avoided costs, in addition to direct costs. Finally, our shared savings mechanism provides SCGM with a 15% share of the net benefits created from its EE investments, as measured by either the TRC or SCT tests[35].

An important element for determining the total net benefits of a measure or programme is the method of cost recovery. Normally, costs are recovered through rates, much as for the utility's other investments. However, it is also possible to allocate costs strictly to participants, in which case unit costs would be considerably higher, thus reducing the cost-effectiveness of measures for individual consumers, inhibiting participation rates and reducing, perhaps significantly, the total net benefits for society (ie. unnecessarily increasing societal costs). Since our analysis does include this cost recovery option, we use the following grid to approximate expected participation rates:

Participation Rate Assumptions	
Participant's Return on Investment	Participation Rate
300% +	70,0%
200% - 300%	55,0%
150% - 200%	40,0%
100% - 150%	30,0%
75% - 100%	25,0%
50% - 75%	20,0%
25% - 50%	15,0%
1% - 25%	7,5%
<1%	0%

[35] As we mentioned in the main report, this is only one of several possible shared savings approaches.

This is an iterative process which explains the much lower net societal benefits achievable under options 2b, 3b, 4b and 4d, ie. those options where costs are recovered from participants only and hence where participation rates suffer[36].

Finally, we estimate the net benefit for SCGM of not pursuing EE programmes A and B (which represents the least societal cost option). This is done by applying a 10.75% return on the avoided capital costs (20% of estimated total avoided costs) of these options. This represents the true profitability benchmark for SCGM: if an EE measure's net benefit is lower than the avoided return on investment, then the utility will not want to pursue that measure, even if its net benefit is greater than zero.

Discussion of results

The results of this analysis demonstrate the importance of the regulatory régime in determining which EE options the utility will want to pursue from a profit-maximization perspective. We find, for example, that were SCGM's proposal to be adopted, SCGM would face the prospect of losing some $35 million if it pursued programmes that would reduce total costs to society by upwards of $20 million (option #1b)[37].

We also find that, if full cost recovery were eventually to be allowed through a special rate, authorized for example under article 49, 10º of the Régie's law, and spread throughout the customer base, SCGM would still face losing nearly $5 million for providing society with more than $20M in net benefits (ie. including SCGM's loss) (option #2a). If this same approach were applied but with costs paid only by participants, participation rates would drop and with them, both losses for SCGM and profits for society, the proportions remaining equal (option #2b). Since SCGM cannot be expected to act as a charity, it is extremely unlikely, to say the least, that management would approve spending on such programmes, despite their ability to minimize costs to society.

The following chart summarizes the results as applied to the combination of programmes A and B, ie. the most cost-effective combination from an IRP perspective:

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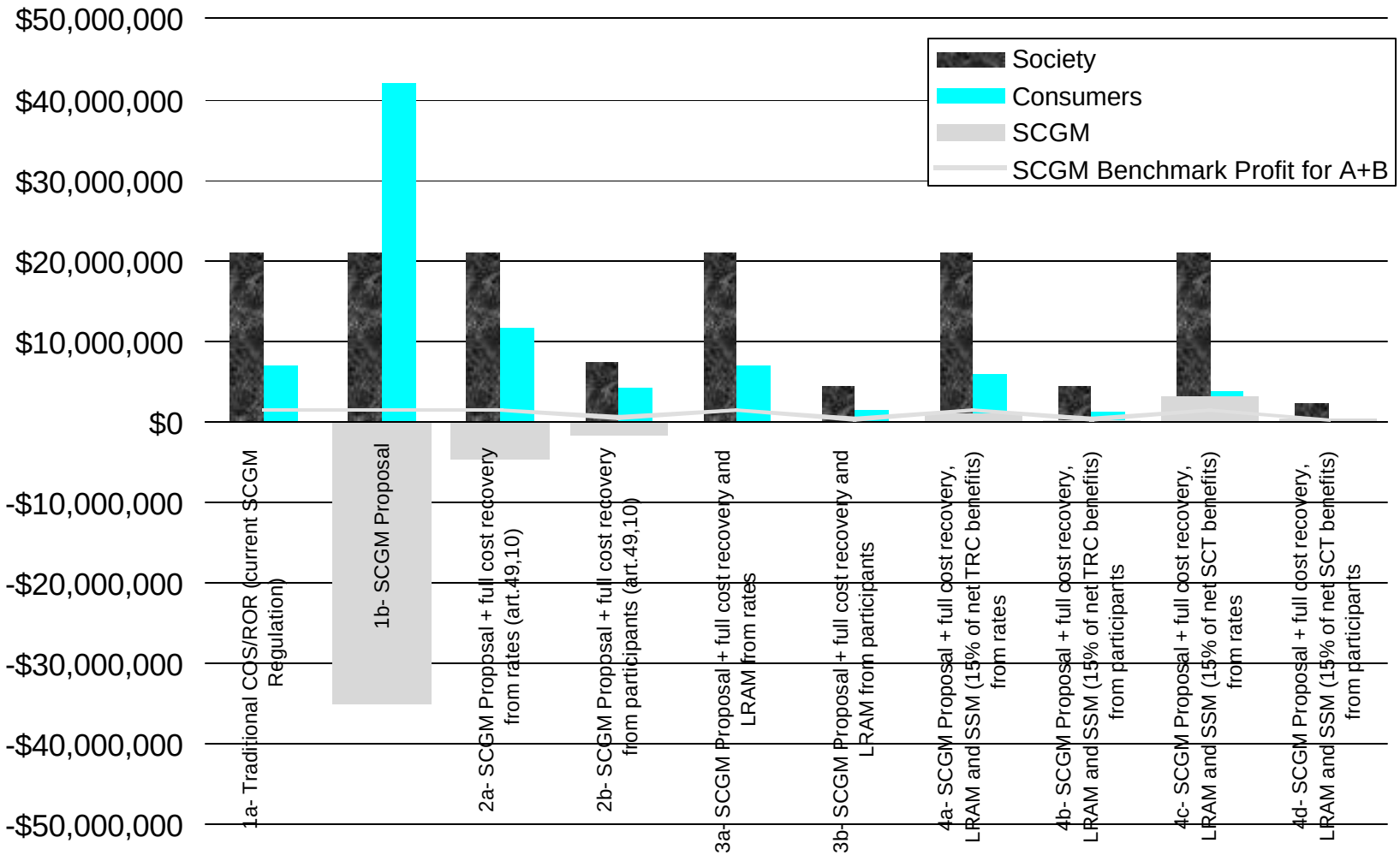
[36] Since a primary goal of IRP is to level the playing field between supply- and demand-side options, it is important to treat EE cost recovery in the same way as for any other utility investments. Given that SCGM's costs are recovered equitably by all members of a customer class, this should also be the method of cost recovery for EE programmes.

[37] SCGM's loss would be on top of lost profit opportunities of an additional $1,505,000.

Net Benefits (Costs) of Implementing Programmes A + B: Summary of Results According to 10 Regulatory Options



1

We specifically mention the results of options #2a and #2b because, from our reading of SCGM's evidence, it appears that the utility is looking toward applying "corrective" EE treatment similar to that assessed in these options. If this were the case, as we can see, SCGM's interests would still remain radically different from those of society, and it is hard to imagine how any coherent decision-making framework could then be applied to energy efficiency programmes and measures.

It could be possible, as we mentioned in the main report, to "tweak" SCGM's proposal by applying additional EE incentives such as an electric revenue adjustment mechanism (LRAM) and a shared savings mechanism (SSM). We find that, for the purposes of the sample EE programmes we have assessed, an LRAM combined with an SSM providing 15% of either net TRC or SCT benefits, with cost recovery applied throughout the customer base (options #4a and 4c), could approximately suffice to place EE on a level playing field with the supply-side option, although using the SCT as a basis for shared savings is preferable in that it better aligns overall interests[38]. More specifically, these would result, still using the sample measures described earlier, in net benefits to SCGM of $1.05 million and $3.15 M, respectively, compared with a benchmark (avoided profits) of $1.51 M.

Limits of the analysis

This analysis only reviews possible modifications to SCGM's proposal. It fails to review other more comprehensive options, such as rate caps, revenue caps and revenue-per-customer caps. A more complete analysis would include all possible options.

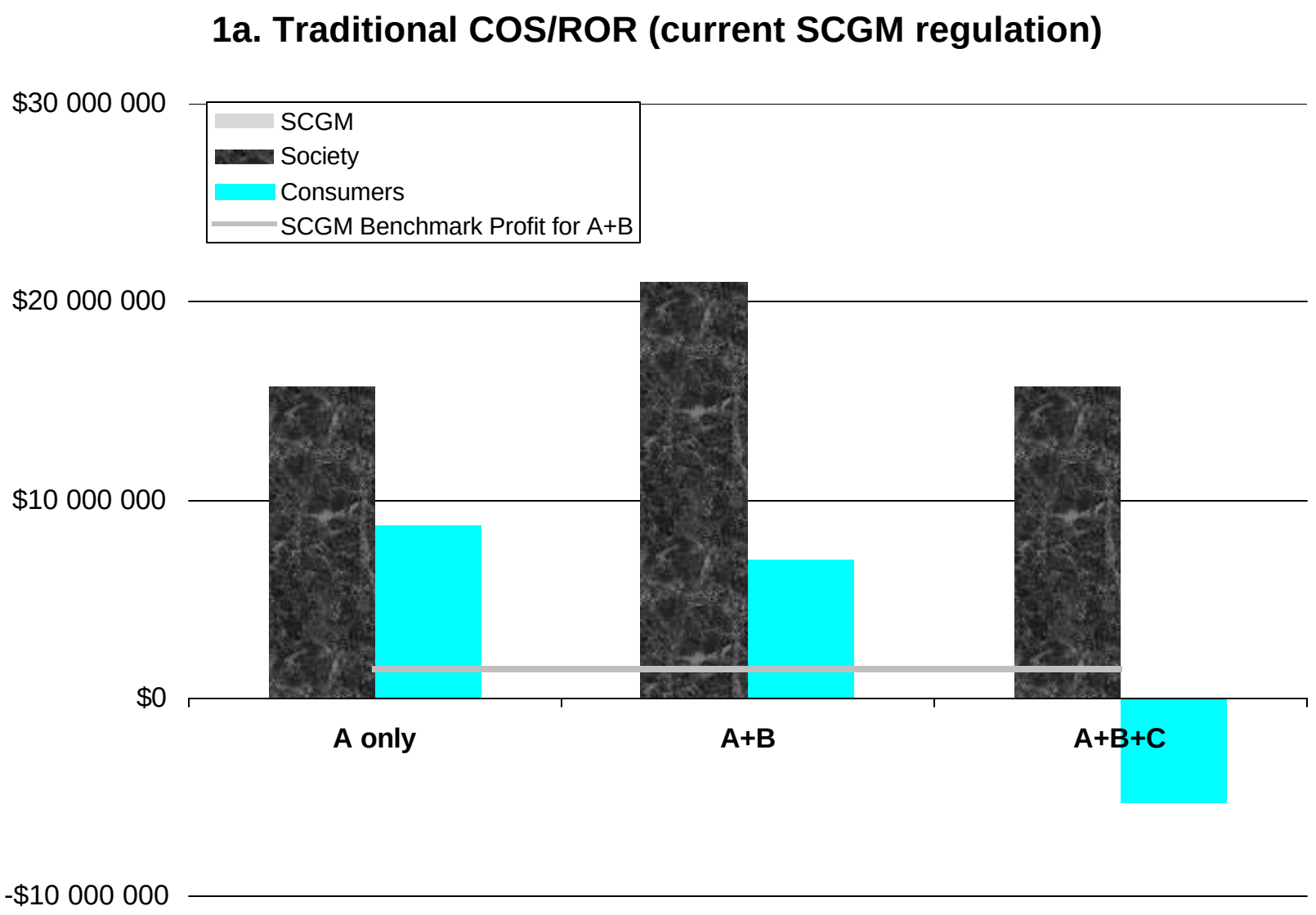
The current analysis is also limited to only one scenario for the participant's share of the overall cost of measures. In a full IRP process, one would want to include more iterations. Furthermore, we have simplified somewhat in ignoring certain time issues. In particular, the analysis ignores the issue of using a societal discount rate for EE measures instead of the utility's cost of capital, and also assumes that all avoided capital costs would occur within the regulatory time frame of five years.

Finally, and not least of all, the current analysis does not take into account the institutional barriers and effects of having conflicting signals compete within the utility. This would be the real but difficult-to-quantify result of adopting a sales-growth incentive mechanism (SCGM's) while attempting, simultaneously, to tack on a conservation-incentive scheme. As explained in our main report, the difficulties with this scenario would be enhanced were the Régie to follow SCGM's suggestion that no EE incentives be applied until after the end of an eventual IRP process.

[38] Put differently, it would be better to provide sharing of a smaller portion of SCT benefits rather than a portion of TRC benefits resulting in equal dollar values. This is because, as can be noticed in the individual charts that follow, basing sharing on the SCT will ensure that the utility's interests more closely approximate those of society from an IRP perspective.

More detailed results

The following charts present, for each regulatory option described earlier, the net benefit or cost to society, consumers and SCGM. Results are presented for programme A alone or the combination of either programmes A and B or A, B and C.

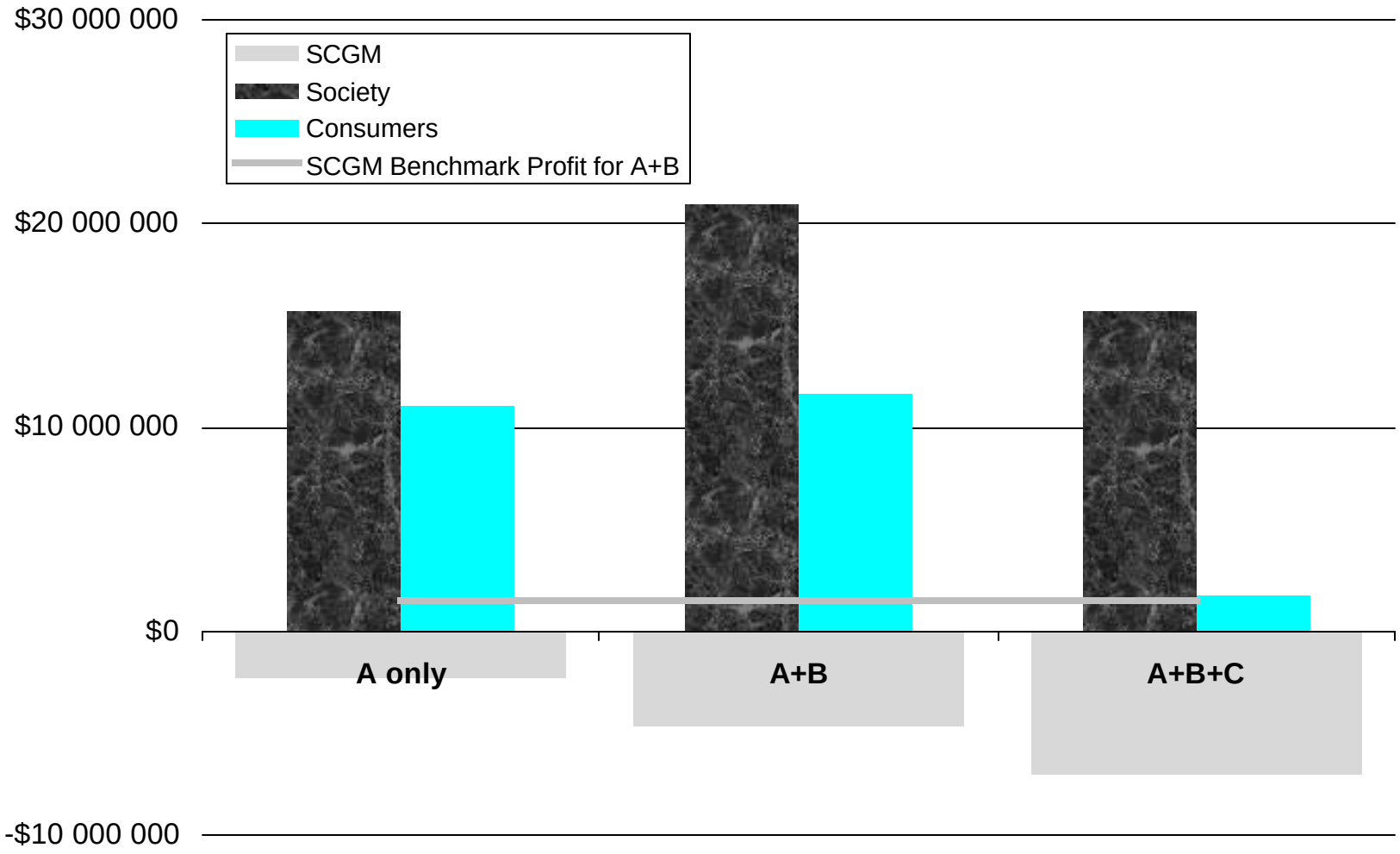

1a. Traditional COS/ROR (current SCGM regulation)
$30 000 000
$20 000 000
$10 000 000
$0
-$10 000 000
SCGM
Society
Consumers
SCGM Benchmark Profit for A+B
A only
A+B
A+B+C

1

1b. SCGM Proposal

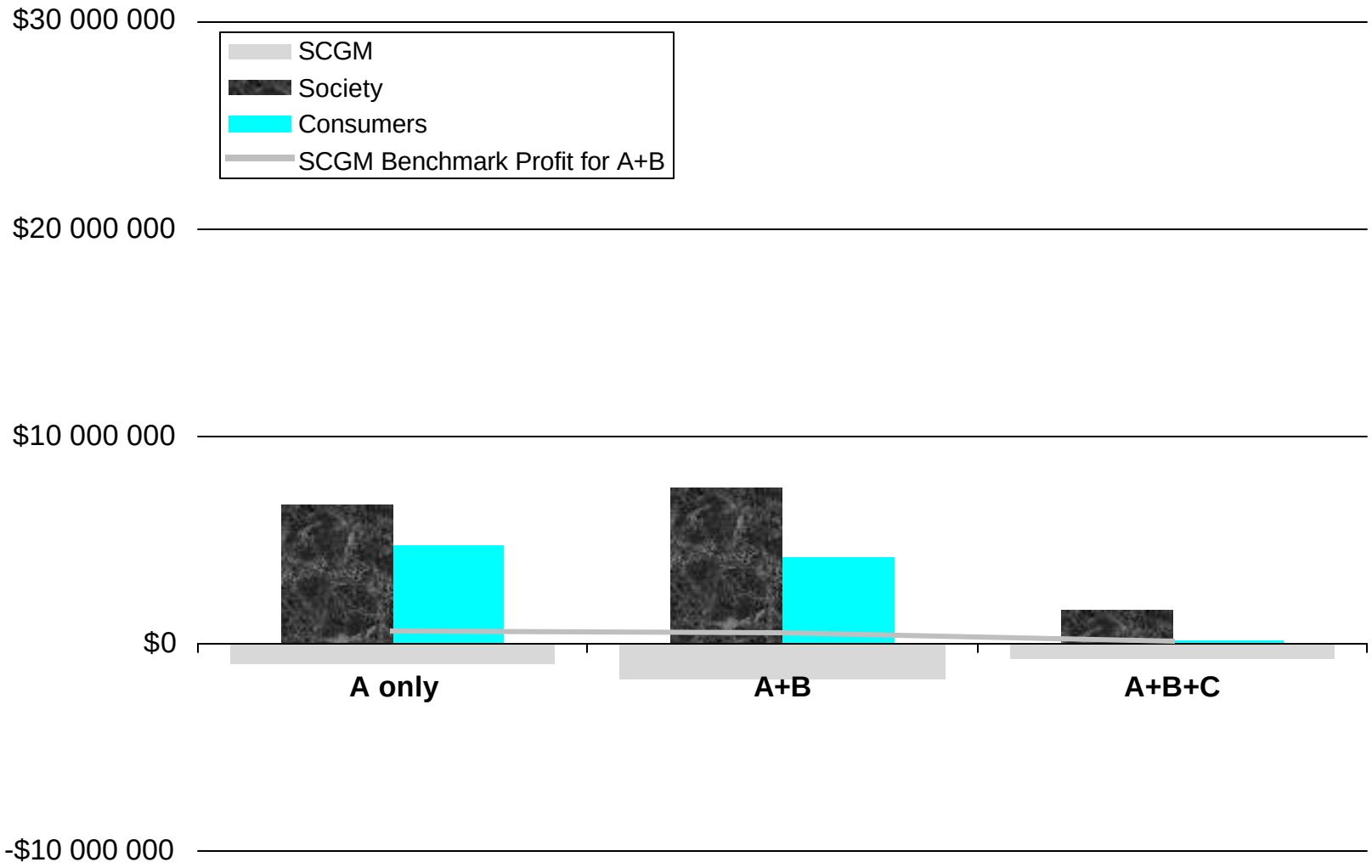
1

2a. SCGM Proposal + Full Cost Recovery from Rates



1

2b. SCGM Proposal + Full Cost Recovery from Participants



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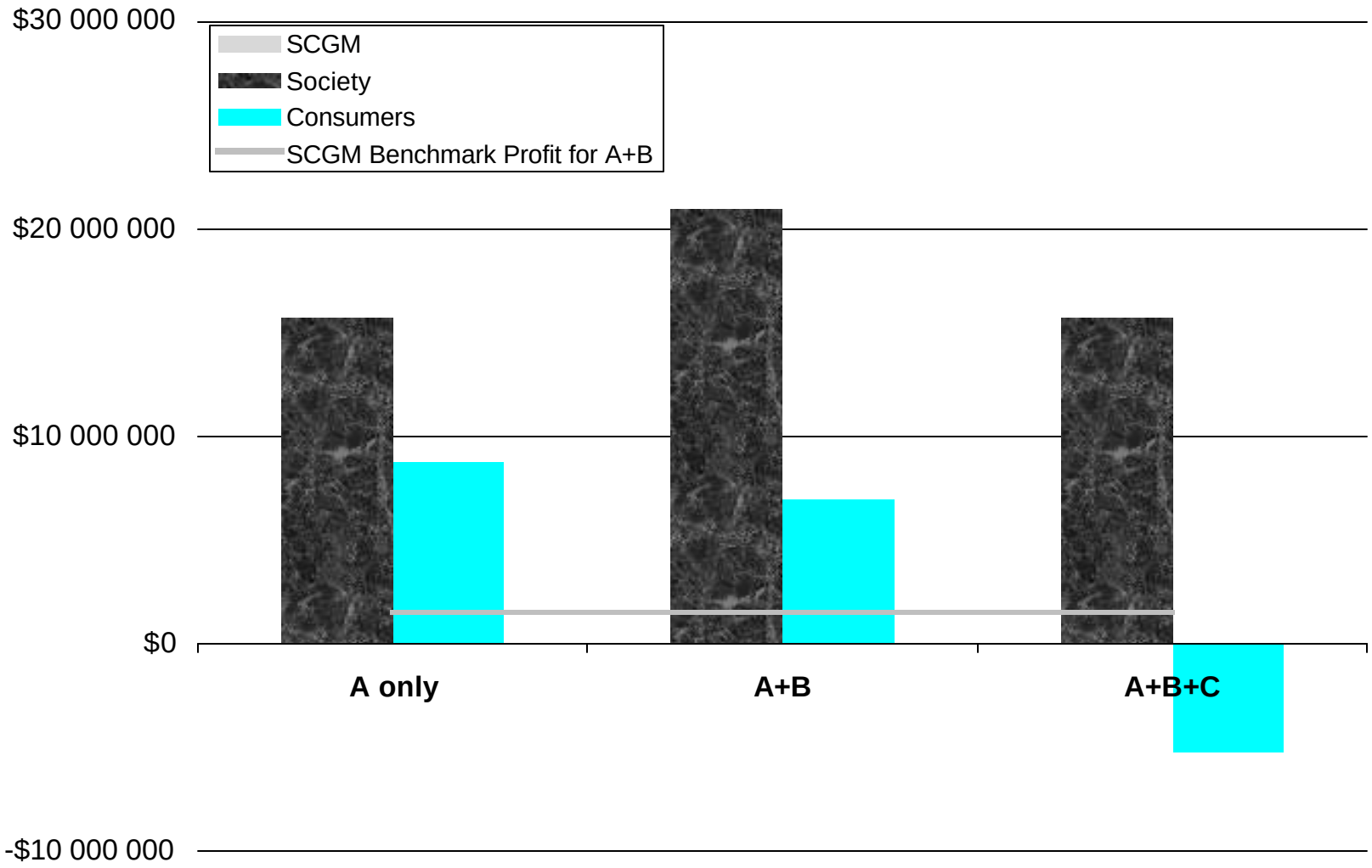
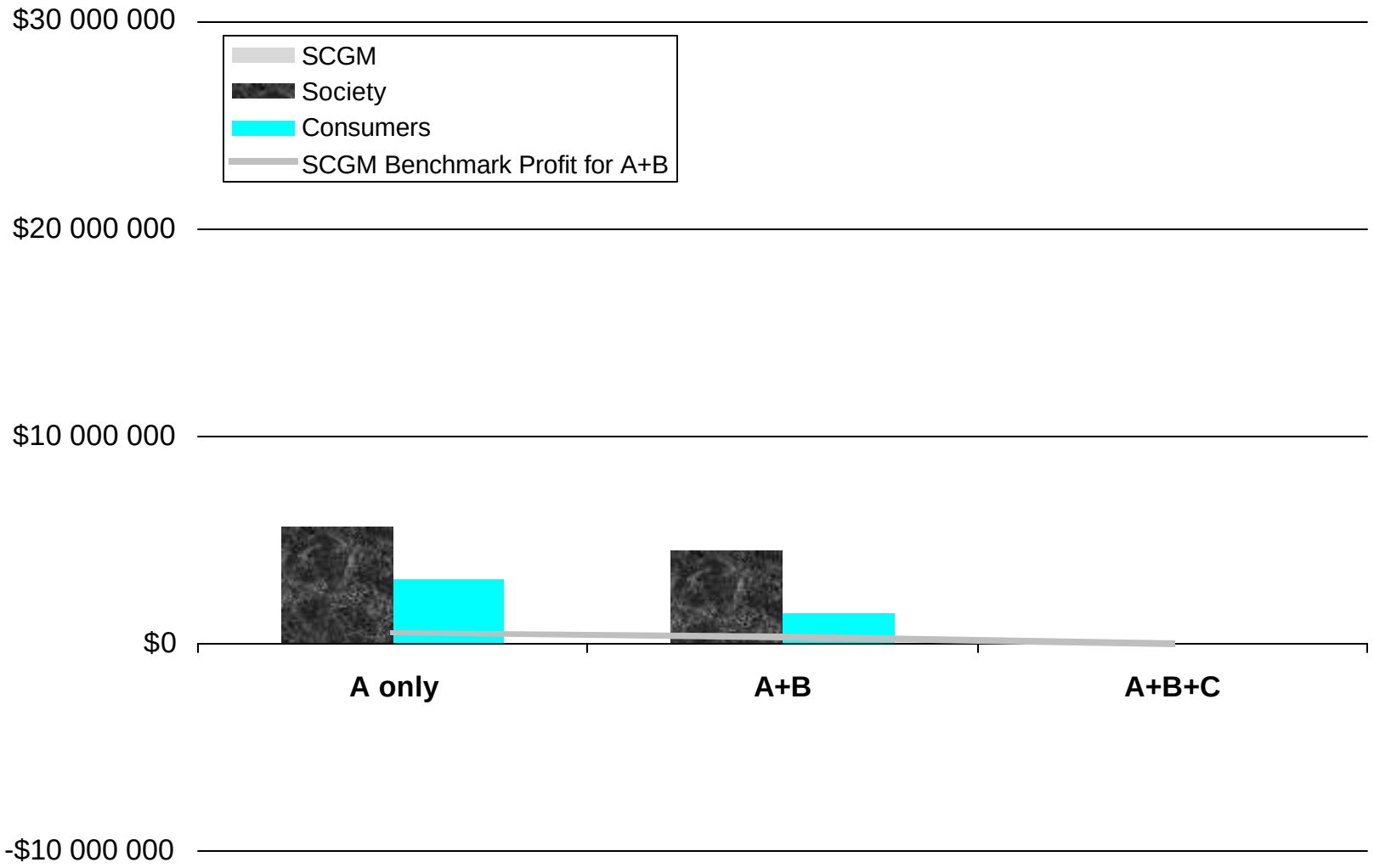
3a. SCGM + Cost Recovery + LRAM from Rates

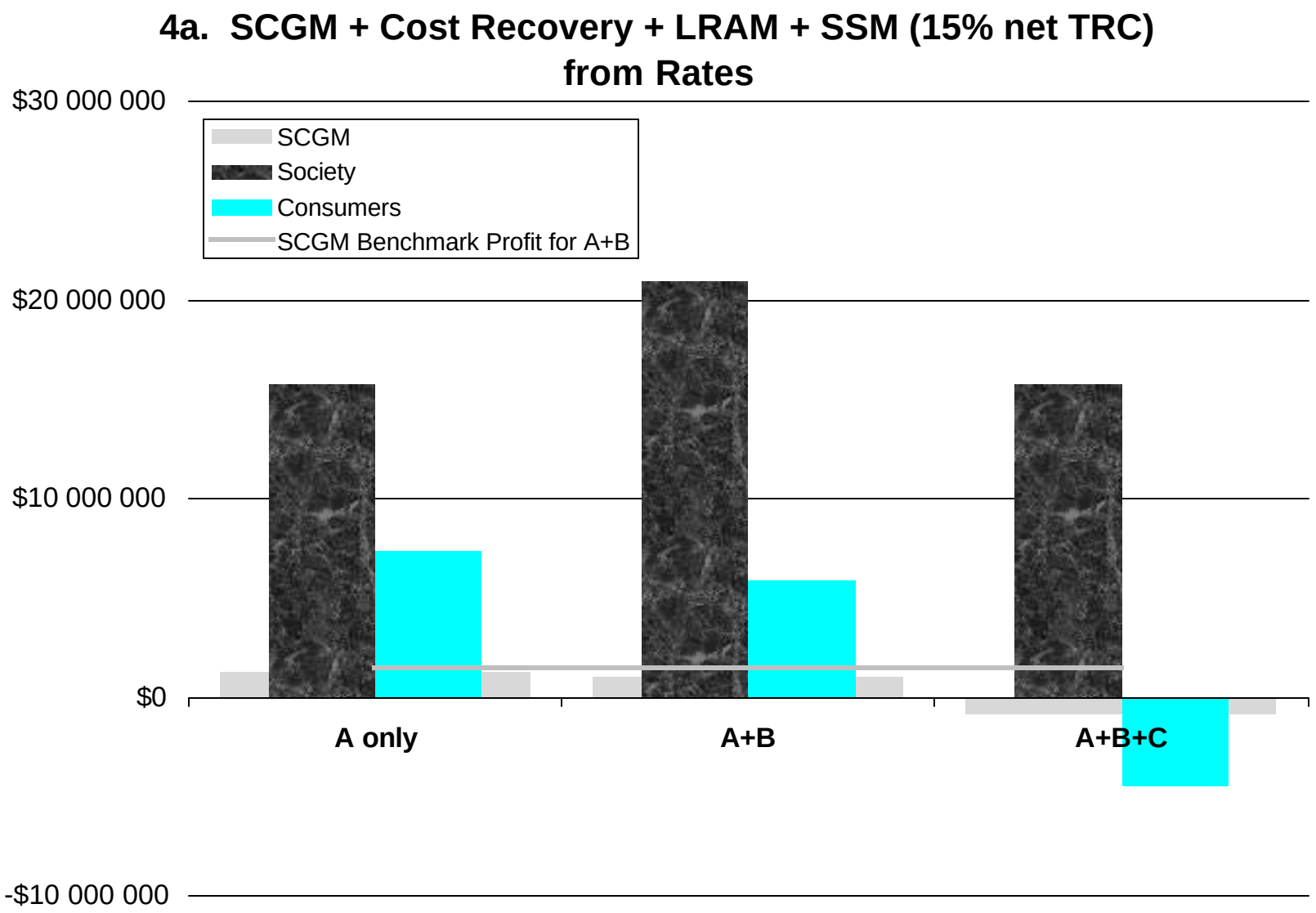


1

3b. SCGM + Cost Recovery + LRAM from Participants

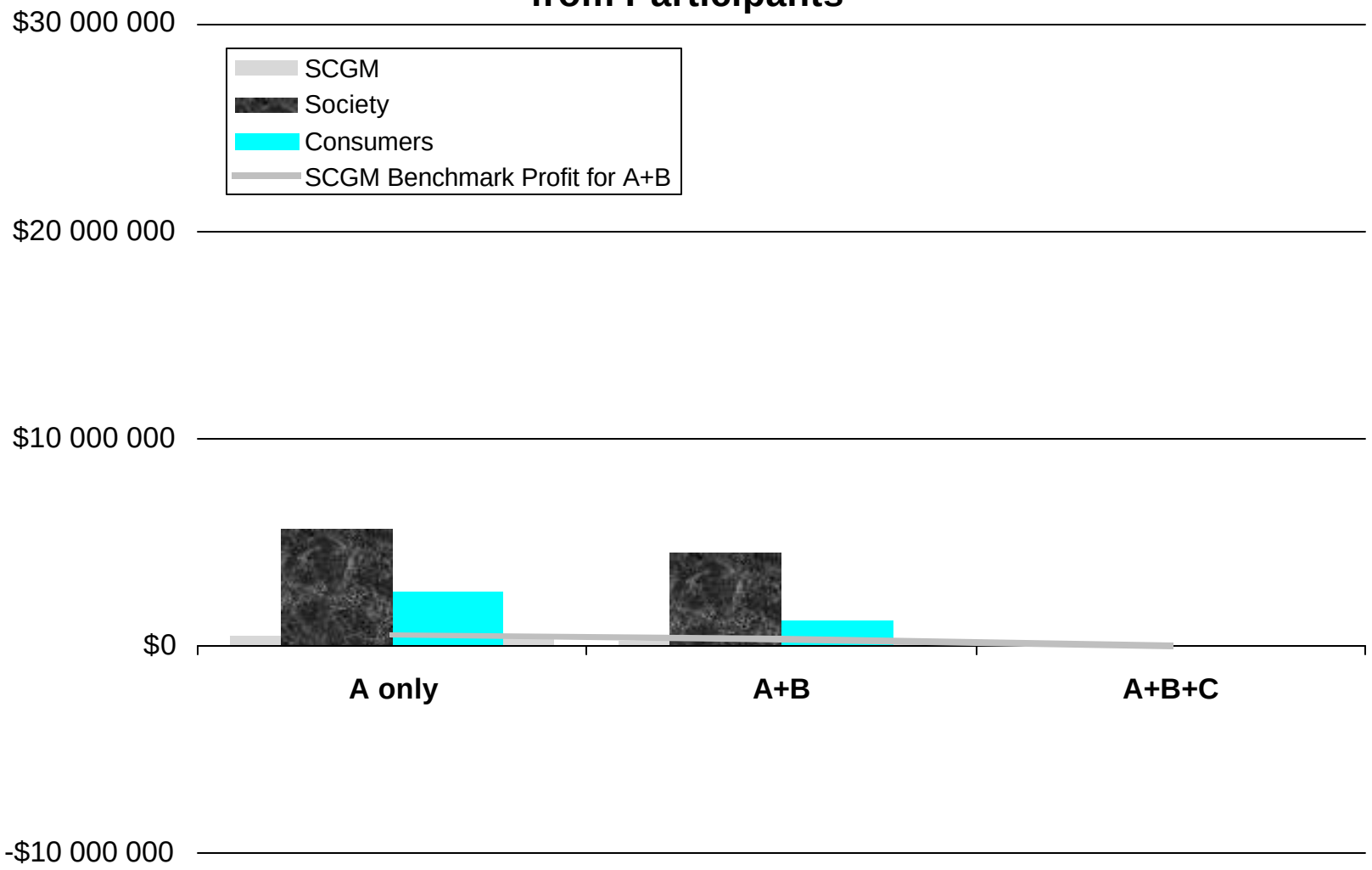


1

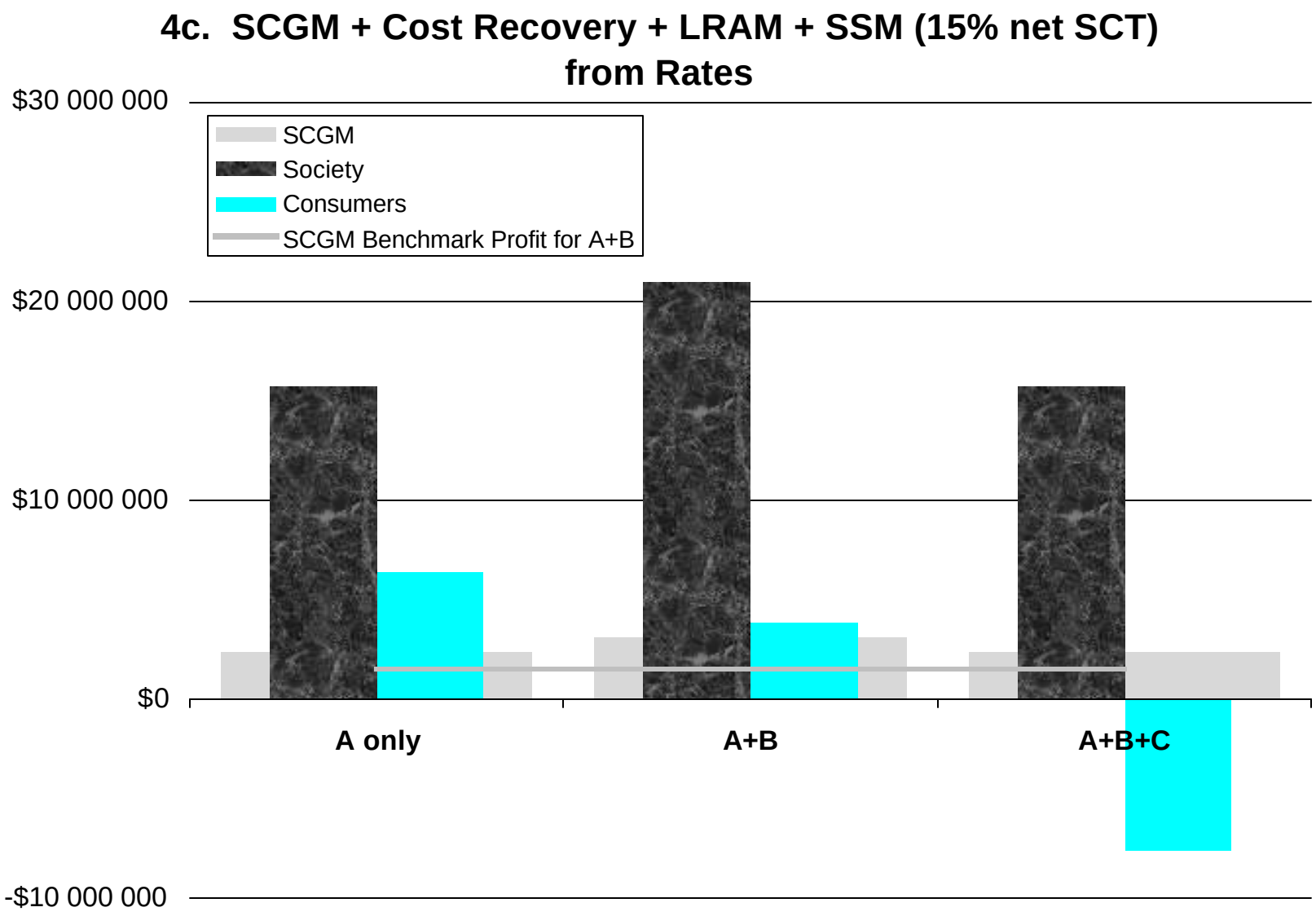

4a. SCGM + Cost Recovery + LRAM + SSM (15% net TRC) from Rates
$30 000 000
$20 000 000
$10 000 000
$0
-$10 000 000
SCGM
Society
Consumers
SCGM Benchmark Profit for A+B
A only
A+B
A+B+C

1

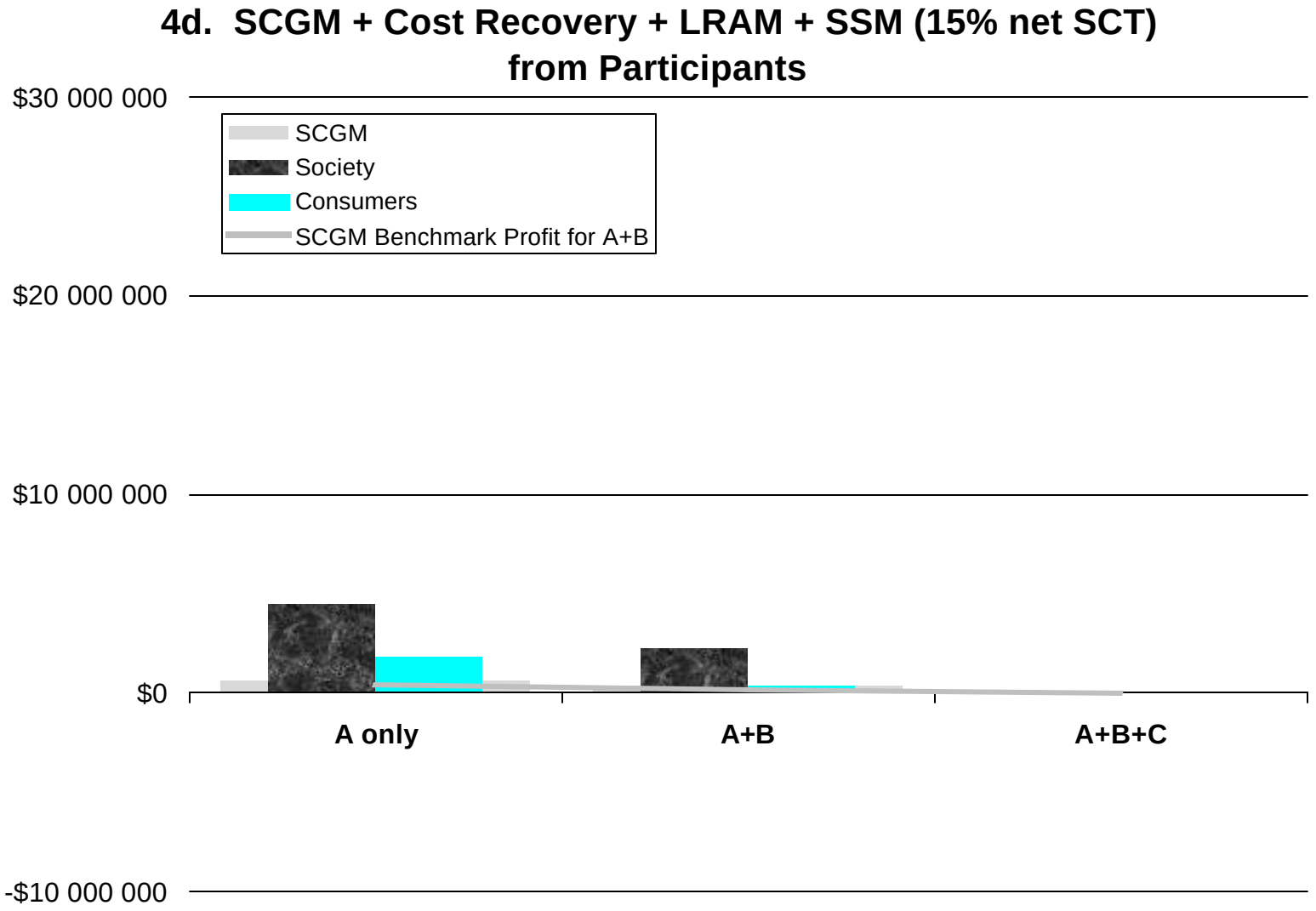
4b. SCGM + Cost Recovery + LRAM + SSM (15% net TRC) from Participants



1


4c. SCGM + Cost Recovery + LRAM + SSM (15% net SCT) from Rates
$30 000 000
$20 000 000
$10 000 000
$0
-$10 000 000
SCGM
Society
Consumers
SCGM Benchmark Profit for A+B
A only
A+B
A+B+C

1


4d. SCGM + Cost Recovery + LRAM + SSM (15% net SCT) from Participants
$30 000 000
$20 000 000
$10 000 000
$0
-$10 000 000
SCGM
Society
Consumers
SCGM Benchmark Profit for A+B
A only
A+B
A+B+C

Annex B: Regulatory Treatment of Energy Efficiency in Various Jurisdictions

by **DAVID NICHOLS**

A. Summary of EE Treatment

A number of jurisdictions in North America have utilized cost recovery and incentive provisions specifically aimed at encouraging the pursuit of cost-effective demand-side management. This table lists jurisdictions in which three types of provisions are currently being applied to at least one investor-owned utility in 1998. These provisions are:

- **Program cost recovery**, referring to full recovery of utility expenditures for approved demand-side programs.
- **LRAM or RevCap**, referring to lost revenue adjustment mechanisms which make the utility whole with regard to fixed costs lost through sales reductions from energy efficiency, or revenue caps, which provide for a maximum level of revenues during a multi-year period, during which revenues are decoupled from changes in sales.
- **Shareholder incentive**, referring to profits provided to the utility generally based on demonstrated demand-side management performance. The cost recovery and incentive provisions for jurisdictions in this category are described in more detail in the section following this table.

The following table indicates the use of these mechanisms in a variety of North American jurisdictions.

Jurisdiction	Mechanism		
	Program Cost Recovery	LRAM or RevCap	Shareholder Incentive
Arizona	X	X	X
California	X	X	X
Colorado	X		X
Connecticut	X		X
District of Columbia	X		
Florida	X		
Hawaii	X	X	X
Idaho	X		
Iowa	X		
Kentucky	X	X	X
Maine	X		
Maryland	X	X	X
Massachusetts	X	X	X
Minnesota	X	X	X
New Hampshire	X		X
New Jersey	X	X	X
New York	X		
North Carolina	X	X	
Ohio	X	X	
Oklahoma	X		
Oregon	X	X[39]	
Rhode Island	X		X
South Carolina	X		
Wisconsin	X		
British Columbia	X		X
Ontario	X	X	X[40]

[39] Pacificorp has a revenue cap which is applied to distribution level revenues only. See OPUC, 1998.

[40] Consumers Gas has proposed an SSM in its current 1999 rate case. Hearings are pending.

B. Shareholder Incentives for Energy Efficiency Performance

Introduction

EE incentives should be designed based on the policy and regulatory framework, utility structure, and economic and energy situation, that obtain within the jurisdiction considering the incentives. Inevitably, however, the nature of EE mechanisms that have been employed elsewhere is a matter of background interest. Therefore, this final section of this annex synopsizes EE incentives currently in place in several North American jurisdictions. These summaries are restricted to jurisdictions where there is some type of shareholder reward for EE in place, based on the premise that shareholder incentives are a critical element in a regulatory approach to sustaining an effective long-term energy distributor role in promoting EE.

British Columbia

General Treatment of Energy Efficiency / DSM and its Costs: Recovery of program costs and shareholder incentives are currently in effect for investor owned utilities.[41] These are BC Gas Utility, Ltd. And West Kootenay Power, Ltd. (BC Gas and WKP).

Energy Efficiency Funding: DSM expenditure levels are proposed by the distribution utilities and established by the BCUC when it approves the utilities' DSM Plans.

Recovery of Program Costs: Full DSM program cost recovery is allowed. The amortization period for the outstanding balance of deferred DSM costs for WKP is 8 years.[42]

Lost Revenues: There is no lost margin recovery for BC Gas or WKP.

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[41] British Columbia Utilities Commission, *In the Matter of BC Gas Utility Ltd. Revenue Requirements Application 1998-2002*, July 23, 1997.

[42] Grant, W. J., BCUC, *Re: Proposed Settlement of Issues Concerning the February 26, 1996 Revenue Requirement Application of West Kootenay Power Ltd.* May 3, 1996.

Shareholder Incentives: BC Gas Utility Ltd. BC Gas receives a share of the net present value of benefits from DSM, based on the Total Resource Cost Test. If the quantity of energy saved is 75% up to 100% of that forecasted at the start of a DSM plan, the share of savings to the utility is 3%. If the quantity of energy saved is 100% or more, the share is 5% of net benefits.

The BCUC states that results "from programs developed within the utility but which at some point are moved outside the utility will be included in the DSM calculation where those program results are tracked by the utility".[43]

Shareholder Incentives: West Kootenay Power Ltd. WKP's incentive plan has the objective of achieving cost-effectiveness (based on variable costs) while also encouraging the attainment of DSM energy savings targets. If the variable costs of providing DSM programs are lower than forecasted, while still achieving forecasted kWh savings, then the difference between actual and forecasted variable costs is shared equally with customers. The maximum incentive for 1998 ($150,378) was calculated by multiplying the actual kWh savings for 1997 times the difference between the 1997 target and actual variable costs, and then dividing this product by two. WKP will receive this incentive if 90% of its forecasted energy savings (13.4 GWh) are achieved.[44]

Low Income: No separate requirement for Low Income programs or funding.

California

General Treatment of Energy Efficiency/DSM and its Costs: For electric utilities 1998 is a transition year after which energy-efficiency will be implemented by the California Board for Energy Efficiency with funds collected at the distribution level through a Public Goods Charge (PGC) that is now in effect. Recovery of program costs and shareholder incentives are currently in effect.

Energy Efficiency Funding: Funding levels are specified by Law for San Diego Gas and Electric Company, Southern California Edison Company, and Pacific Gas and Electric Company.

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[43] Consolidated Settlement Document, *ibid*., page 5.

[44] *W. Kootenay Power Ltd. Semi-annual DSM Report*, December 31, 1997.

Recovery of Program Costs: Electric utilities collect 1998 costs through the PGC. Gas utility DSM program costs remain fully recoverable through rates until the Public Utilities Commission (PUC) imposes a PGC for gas.[45]

Lost Revenues: California utility revenues have been decoupled from sales through adjustment mechanisms that reconciled utility revenues to the amount authorized in the last rate case (adjusted annually for certain cost changes in an attrition proceeding). These made LRAMs unnecessary. Electric decoupling is being phased out, but gas utility revenues are still decoupled from sales and reconciled to the amount authorized in the prior rate case (adjusted annually for certain cost changes).

Shareholder Incentives: The PUC approved similar structures of shareholder incentives for 1998 for all four investor-owned utilities in the state.[46] San Diego Gas and Electric's follows.

1. For programs that produce quantifiable streams of resource benefits, 5% of program expenditures plus a 15% share of net benefits, based on utility avoided costs only.

2. For programs that provide information and technical assistance, or promote market transformation without the benefits being readily quantifiable, 5% of program expenditures.

3. For Standard Performance Contract programs[47] there are two types of performance incentives. One is a fixed set of dollar awards based achievement of program roll-out and management milestones. The other provides a share of net benefits provided that actual SPC activity yields at least 20% of expected benefits. The share ranges from 16 to 26%.

The total of all types of incentives is capped at 14% of SDG&E's total DSM program budget.

Low Income: Low-income energy efficiency, both gas and electric, is separately funded through the utilities, pursuant to a prior statute.

[45] The forthcoming, centralized approach to energy -efficiency was established by an electric restructuring statute known as Assembly Bill 1890.

[46] Public Utilities Commission of the State of California, Decision 97-12-103, December 16, 1997.

[47] SPC programs pay fixed prices for verified and measured energy savings as they are delivered over a multi-year contract period.

Colorado

General Treatment of Energy Efficiency/DSM and its Costs: A demand-side cost recovery mechanism that includes recovery of utility costs and shareholder incentives is in effect for the Public Service Company of Colorado (PSCO).[48] PSCO is the only utility in Colorado currently with DSM programs. Other utilities are still in the process of getting DSM programs underway.[49] Costs are recovered from ratepayers as a whole.

Energy Efficiency Funding: Colorado encourages DSM to be procured through all-source or DSM-only bids to procure electric resources or their DSM equivalent. Approved DSM program costs consist largely of payments to successful bidders, plus the net costs of developing and administering bids.

Recovery of Program Costs: DSM program costs may be fully rate-based and recover a return while being amortized over 7 years.

Lost Revenues: There is no lost margin recovery for PSCO.

Shareholder Incentives: In addition to the return on rate-based DSM, a shareholder incentive applies. A base annual incentive is calculated as 5% of the price per kW of a representative supply-side investment displaced by DSM. This base incentive is then adjusted to reflect two factors. These are changes in the expected lifetime of DSM projects implemented, and deviations in the cost of DSM contracts signed from a target price per kW of DSM. This yields an adjusted DSM incentive which may be claimed as follows:

35% of the incentive may be claimed based on demonstrated efforts to establish the actual effects of DSM on the Public Service system.

65% of the incentive is available if actual DSM project performance turns out to be at least 90% of expected; below 90% the 65% portion is itself scaled back.

Low Income: There is a separate low-income program for which the utility receives full cost recovery plus a shareholder incentive per household treated.

Connecticut

General Treatment of Energy Efficiency/DSM and its Costs: Utility expenses for approved costs (called conservation and load management, or

[48] Public Utilities Commission of Colorado, *Decision No. C90-1551*, November 28, 1990.

[49] Schmitz, G., Colorado PUC, phone interview, July 21, 1998.

C&LM, in CT) are fully recoverable from ratepayers through a C&LM Adjustment Mechanism. Provisions for the largest utility, Connecticut Light and Power Company (CL&P), are described here.

Energy Efficiency Funding: The Department of Public Utility Control approves annual budgets for C&LM programs.

Recovery of Program Costs: A portion of CL&P's C&LM expenditures have been placed in rate base where they earn a return based on the weighted cost of capital.

Lost Revenues: No lost margin recovery is in place for CL&P.

Shareholder Incentives: The Company is eligible for a bonus rate of return on its rate-based DSM. The bonus is based on a performance ratio which compares actual to budgeted life-cycle energy savings. Budgeted energy savings are those projected from the C&LM activity in the approved plan, while actual energy savings are those projected from the level of C&LM participation realized by the end of a year. CL&P's additional return on rate-based C&LM varies with 1998 performance ratios as follows:[50]

Ratio	Bonus
<.75	0 %
≥.75 < 1.1	1 %
≥1.1 < 1.25	2 %
≥1.25	3 %

The bonus rate of return does not take into account cost-effectiveness because cost-effectiveness was demonstrated in prior years.

Low Income: There are no separate requirements for low income programs.

Hawaii

General Treatment of Energy Efficiency / DSM and its Costs: Recovery of utility expenses for approved DSM plans, lost margins, and shareholder incentives have been available since 1994, and are enjoyed by the major electric

[50] Connecticut Department of Public Utility Control, Docket No. 97-10-23, *Decision*, March 25, 1998.

utilities.[51] Provisions for the largest utility, Hawaiian Electric Co. (HECO), are described here.

Energy Efficiency Funding: DSM expenditure levels are proposed by the distribution utilities and established by the Public Utilities Commission when it approves the utilities' DSM Plans.

Recovery of Program Costs: DSM costs for residential programs are fully recoverable from HECO's residential rate classes, and costs for non-residential programs are fully recoverable from the non-residential rate classes.

Lost Revenues: Full recovery of net lost margins is provided for.

Shareholder Incentives: Hawaiian Electric Co. HECo's shareholder incentives are, for most of its DSM programs, 10 percent, *post-tax*, of all electricity cost savings (measured from the utility perspective) expected to accrue over the lifetime of the DSM measures installed under HECo's programs, net of the direct costs of the programs themselves. This is equivalent to about 13.3% pre-tax. For a service program with less readily quantifiable resource benefits, the Company receives 5 percent, *post-tax*, of program costs as a shareholder incentive. The shareholder incentives are collected annually based on completed DSM activity. As with other DSM costs, shareholder incentives for residential programs are recovered from HECO's residential rate classes, and incentives for non-residential programs are recovered from the non-residential rate classes.

Low Income: There are no separate requirements for low income programs. HECO does not offer a low income program of its own, but is working with the state on one.

Kentucky

General Treatment of Energy Efficiency/DSM and its Costs: Recovery of utility expenses for approved DSM plans, lost margins, and shareholder incentives have been available since 1994.[52]

Energy Efficiency Funding: Utilities may apply to the commission to implement a DSM Adjustment Tariff in order to recover costs and net lost revenues, and to receive incentives for the implementation of DSM programs.

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[51] The cost recovery and incentive provisions were approved by the Public Utilities Commission in Decision and Order No. 14638, approved April 22, 1996, and Decision and Order No. 14730, approved June 5, 1996.

[52] Pursuant to 1994 Kentucky Acts, chapter 238, section 2.

DSM costs, lost revenues, and incentives are collected from the customer classes that benefit from the programs.

Recovery of Program Costs: DSM program costs are fully recoverable through the DSM cost recovery mechanism.

Lost Revenues: Net revenues lost by implementing commission approved DSM programs are allowed to be recovered.

Shareholder Incentives: Louisville Gas & Electric Co, American Electric Power, and Cinergy. Each of these utilities currently receives a shareholder incentive. The incentive is computed by multiplying the net resource savings expected from the approved programs which are to be installed during the upcoming 12-month period by 15%.[53] Net resource savings are defined as program benefits less the cost of the program, where program benefits are the present value of the utility's avoided costs over the expected life of the program, and include both capacity and energy savings.

The DSM incentive amount is divided by the expected sales for the upcoming 12-month period and included in the DSM cost recovery mechanism. Reconciliation occurs subsequently. DSM incentive amounts are assigned for recovery purposes to the rate classes whose programs created the incentive.

Low Income: There are no separate requirements for low income programs.

Maryland

General Treatment of Energy Efficiency / DSM and its Costs: Maryland law stipulates that utilities must try to come up with cost-effective, appropriate DSM measures, though current levels of DSM are very limited. Electric utilities are recovering program costs, lost revenues, and shareholder incentives, largely for past DSM measures. Provisions for Potomac Edison Company are described here. [54]

Energy Efficiency Funding: Potomac Edison applies an Energy Conservation Surcharge (ECS) to designated Rate Schedules in order to recover eligible DSM program costs applicable to the customer classes served by those Rate Schedules. Eligible costs are approved by the Public Service Commission (PSC) and are based on project descriptions as filed by Potomac Edison to the PSC. They are reconciled annually.

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[53] There are no penalties in the shareholder incentives.

[54] Maryland Public Service Commission, *Electric P.S.C. Md. No. 53*, Approved Sept. 3, 1997.

Recovery of Program Costs: All program costs are deferred and amortized over seven years.

Lost Revenues: Full recovery of net lost revenues is provided for.

Shareholder Incentives: Potomac Edison can earn a "performance-based shared savings incentive" if it attains specified goals. Achievement is based on aggregate energy saved by all active, approved DSM programs. The amount of the incentive will be based on a share of the net savings from each program as calculated using the Total Resource Cost Test (TRC) filed by Potomac Edison and approved by the Commission. The aggregate goals and Potomac Edison's shared savings amounts, after tax, are:

% Goal Achieved	% TRC
Less than 80%	0%
80%-99%	6%
100%-119%	7.5%
120% & Over	10%

The pre-tax incentive rate for the 7.5% TRC level is 12.41%. The highest percent incentive determined above applies uniformly to the aggregate total of all net savings of all of the programs used in establishing the goal. Recovery of any incentive awarded through the ECS will be based on the actual amount earned in the previous year.

Low Income: No separate requirements for low income programs exist.

Massachusetts

General Treatment of Energy Efficiency/DSM and its Costs: The Massachusetts Division of Energy Resources (DOER) is to annually file a report with the Department of Telecommunications & Energy (DTE) on proposed funding levels for energy efficiency programs. The DTE will review and approve energy efficiency expenditures after determining that implementation of such programs will be cost-effective. There are several investor-owned utilities in Massachusetts. This description focuses on the two largest electric utilities and the largest gas utility.

Energy Efficiency Funding: A per kWh charge (SBC) was established by law to fund electric utility energy efficiency programs. The 5-year SBC schedule is as follows:[55]

SBC Level	Duration
3.3 mills/kWh	3/1/98-12/31/98
3.1 mills/kWh	1999
2.85 mills/kWh	2000
2.7 mills/kWh	2001
2.5 mills/kWh	2002

For gas utilities, DSM expenditure levels are proposed by the distribution utilities and established by the DTE when it approves the utilities' DSM Plans.

Recovery of Program Costs: Electric utilities receive full program cost recovery for approved programs. The DSM budget is based on the mandated SBC charges multiplied by projected kWh sales. If revenues collected are over or under the actual spending in any one year, that difference is reconciled in subsequent years. Gas utilities also receive full cost recovery for approved programs, generally through a non-bypassable per therm charge to all distribution customers that is subject to annual reconciliation. At Boston Gas Co., low income program costs are recovered from all customers, while other Residential, C/I, and Multi-family program costs are recovered on a sector specific basis.

Lost Revenues: Boston Edison and Massachusetts Electric Company do not collect lost margins. Boston Gas receives net lost margin recovery for three residential DSM programs.

Shareholder Incentives: Massachusetts Electric Co.[56] For programs resulting in measured savings, if MECO achieves at least 50% of targeted savings it receives a fixed incentive per lifetime kWh and kW saved. In addition, the amount of that volumetric incentive (at 100% of targeted savings) is scaled by the ratio of the target benefit-to-cost (B:C) ratio to the actual B:C ratio realized. This further amount is added to the volumetric incentive, unless the B:C ratio is under 1.0. If all targets and performance thresholds are met for program year 1998, the Company receives an amount equivalent to 7.5% of net benefits, after tax, with a maximum benefit of 8%.[57] On a pre-tax basis the target incentive is equivalent to a 12.8% share of net benefits. There is no penalty. For programs less susceptible to measured savings, such as new construction, support for

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[55] *Electric Utility Restructuring Act*, November 25, 1997.

[56] MECO is one of three NEES electric distribution utilities. The others, in New Hampshire and Rhode Island, receive shareholder incentives of similar design.

[57] Calculated from NEES, *Five Year Energy Efficiency Plan: Offer of Settlement*, March 18, 1998.

market-transforming technologies, and support for building codes, a variety of fixed dollar rewards are tied to program-specific performance indices such as the number of program participants.

Shareholder Incentives: Boston Edison Co. BECO seeks to earn incentives on all of its energy efficiency programs. The maximum incentive BECO can earn for 1998 is $2 million. This is based on 11.5% of eligible planned program expenses.

For 1998, if BECO's achievement of individual program metrics exceeds a performance threshold of 85%, then the maximum incentive for that metric will be earned. If less than 50% of the performance metric is achieved, then no incentive will be earned for that metric. If 50% of the performance metric is achieved, then 50% of the maximum incentive will be earned. If between 50% and 85% of the performance metric is achieved, then the incentive earned will be prorated between 50% and 100% of the maximum incentive for that metric. This incentive structure applies to all programs, whether performance is measures based on actual kWh savings or by a proximate indicator (such as the number of rebates awarded or completing a market assessment study).[58]

75% of BECO's energy efficiency programs are traditional installation ("retrofit") programs where success is measured based on kWh savings. The remaining 25% of programs are new programs where proximate indicators are used to measure success. In the long run, the measure of success for these programs is expected to switch from the proximate indicators to actual energy savings.

Shareholder Incentives: Boston Gas Co. For residential and non-residential DSM programs where lost margin recovery is not allowed, BG instead receives performance incentives. These incentives are based on a variety of indices of program activity and documented impacts on the market. Receipt of the full incentive for each indicator depends on actual vs. targeted results, as follows:

Actual v. Target	Portion of Full Incentive
<65%	0
65-85%	75%
>85%	100%

The maximum performance incentive for 1998 is $600,000.[59]

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[58] Boston Edison Company, *Five Year Energy Efficiency Plan*, July 1998. (Note: BECO's Plan has not yet been approved by the DTE. A ruling is expected in September 1998.)

[59] Boston Gas Company, *Offer of Settlement*, March 19, 1997. The settlement was subsequently approved by the regulator.

Low Income: Electric Utilities The Electric Utility Restructuring Act of 1997 stipulates that 0.25 mills/kWh be a minimum annual expenditure for low income programs for all electric utilities, including years after 2002.

Low Income: Boston Gas Co. A low income residential program was approved by the DTE and will operate from 1997 through 2001. It will be funded at $2.6 million per year. In addition to full program cost recovery, net lost margin recovery is allowed for this program.

Minnesota

General Treatment of Energy Efficiency / DSM and its Costs: Utilities file 2-year Conservation Plans with the Department of Public Services (DPS). The DPS makes recommendations on the Plans to the Public Utilities Commission (PUC), which ultimately acts on the Plans. Full recovery of program costs for approved DSM plans, recovery of 75-100% of lost margins, and shareholder incentives are currently in effect for investor-owned utilities. Incentives vary by utility; three examples are given here.

Energy Efficiency Funding: The 1991 Omnibus Energy Act requires gas utilities to spend 0.5% of gross revenues on Conservation Improvement Plan (CIP) programs. Investor-owned electric utilities must spend 1.5% annually.

Recovery of Program Costs: Utilities are allowed full recovery of DSM program costs for approved DSM programs.

Lost Revenues: Minnegasco and Great Plains Natural Gas Company both recover 100% of lost margins. Northern States Power Company recovers 75% of lost margins.

Shareholder Incentives: Minnegasco and Great Plains Natural Gas Co. Minnegasco and Great Plains both enjoy the same stepped bonus mechanism.[60] The bonus allows the gas utilities to claim an additional 10% of their actual lost margins if their annualized savings are 75% to 100% of their DSM program savings goal. If annualized savings exceed 100% of the program goal, the utilities may claim an additional 25% of lost margins as a bonus.

[60] Memo entitled "Gas Utility DSM Financial Incentive Work Group Report and Recommendations." November 20, 1995.

Shareholder Incentives: Northern States Power. Northern States Power receives a shared savings incentive of 10% of the first 20% of actual net benefits in excess of 100% of planned benefits.[61]

Low Income: No separate requirements for low income programs exist.

New Hampshire

General Treatment of Energy Efficiency/DSM and its Costs: Currently Granite State Electric Company (GSE) is the only utility in New Hampshire with conservation and load management (C&LM) programs. GSE has been allowed C&LM program cost recovery and shareholder incentives since 1990.

Energy Efficiency Funding: Granite State is entitled to recover prudent direct costs of DSM programs which are demonstrated to be cost-effective and consistent with least-cost integrated resource planning principles.

Recovery of Program Costs: GSE recovers DSM program costs through a per-kWh charge, allocating the costs of specific C&LM programs to the customer classes eligible to participate in those programs. Under- and overcollections are reconciled annually.[62]

Lost Revenues: No LRAMs are currently in place.

Shareholder Incentives: GSE's shareholder incentive is a two-part shared savings mechanism. The first part, the maximizing incentive, is calculated separately for residential and commercial and industrial (C&I) C&LM programs. GSE may earn 5% of the total adjusted program value created by the utility's residential programs and 3.5% for C&I programs. Total adjusted program value is program value net of program evaluation costs and customer direct costs.

The second part, the efficiency incentive, is equal to 10% of total adjusted program value less the costs associated with producing those savings and less the amount of the maximizing incentive. The total program value created by GSE's DSM programs depends on both the number and type of kW and kWh saved by the programs.

GSE's incentives are subject to a threshold equal to 50% of projected value of C&LM program net savings. Once the utility has achieved the threshold, it may

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[61] Northern States Power, *CIP Adjustment Rate, DSM Incentive, 1997 CIP Status Report*, April 1, 1998.

[62] NARUC, *Incentives for Demand-Side Management*, October 1993.

earn the incentive based on the entire value achieved. GSE recovers incentives in the year following the year during which they were earned.

Low Income: No separate requirements for low income programs exist.

New Jersey

General Treatment of Energy Efficiency / DSM and its Costs: Recovery of utility expenses for approved DSM plans, lost margins, and shareholder incentives have been available under the NJ DSM rule since 1992.

Energy Efficiency Funding: DSM expenditure levels are proposed by the distribution utilities and established by the Board of Public Utilities when it approves the utilities' DSM Plans.

Recovery of Program Costs: Full program cost recovery is effected through DSM cost recovery riders that are periodically reconciled.

Lost Revenues: Net lost revenue recovery is allowable for "performance-based" programs as discussed below.

Shareholder Incentives: Utilities may offer "performance based" DSM in two forms.[63]

1. Shared savings. The utility may propose a share of net resource benefits. The state's second largest utility, GPU Energy, chose the shared savings alternative. That utility received a 25% share of all net benefits from performance-based programs under its first DSM Plan.[64] No share is included in its second Plan, now in effect, because of the very small expected net resource benefit. Performance-based programs have been the greater portion of the Company's DSM budget.

2. Standard pricing offer (SPO). Under the SPO, the utility pays a price to customers and ESCOs for verified DSM savings. This price is somewhat less than avoided costs plus environmental externality benefits. The utility's opportunity to profit comes from its ability to procure saved m^3 of gas or kWh of electricity through its own for-profit conservation subsidiary. The largest utility, Public Service Electric & Gas Co., chose the SPO, depending on

[63] N.J. also requires utilities to deliver certain "Core" public benefit DSM programs such as low-income services and new construction programs, for which no incentives are available.

[64] NJAC 14:12, Chapter 3. There are no penalties in the NJ rule. If net resource benefits are negative the utility receives its share of negative benefits using the shared savings percentage in its approved plan.

contracts with its energy conservation subsidiary as a source of shareholder profit from DSM. Expenditures for the SPO have been the greater part of the Company's DSM budgets.

Low Income: New Jersey requires utilities to deliver low income programs as part of their overall DSM.

Ontario

General Treatment of Energy Efficiency / DSM and its Costs: The Ontario Energy Board requested each gas distribution utility to implement the demand-side aspects of IRP in 1993. [65]

Energy Efficiency Funding: DSM budgets are set annually by the Board in the context of rate cases.

Recovery of Program Costs: Variance accounts are provided for utility program cost variations from budgeted levels included in rates.

Lost revenues: An LRAM was approved in 1997 for the Consumers Gas Company of Ontario, Ltd.

Shareholder Incentives: None have been provided for as of 1998.

Low Income: There are no requirements for low income programs.

Rhode Island

General Treatment of Energy Efficiency / DSM and its Costs: Recovery of program costs and shareholder incentives are currently in effect for investor owned utilities.

Energy Efficiency Funding: By law, an SBC of 2.3 mills/kWh is to be collected by all RI electric utilities to fund energy efficiency and renewables. The

[65] ONTARIO ENERGY BOARD. 1993. A Report on the Demand-Side Aspects of Gas integrated Reource Planning. E.B.O. 169-III.] It has approved program cost recovery, an LRAM for one utility, and is considering shareholder incentive proposals.

charge is to be collected for a 5-year period, which began January 1, 1997.[66] In 1998, the SBC is expected to raise $19.9 million, of which $1.3 million is to go towards renewables. The remaining $18.6 million will go towards energy efficiency.[67]

Recovery of Program Costs: Full recovery of costs for approved DSM programs is provided for.

Lost Revenues: No LRAMs are currently in place.

Shareholder Incentives: Shareholder incentives have been in existence since 1990. There are no gas utility incentives. Incentives for Narragansett Electric, the largest electric utility, are very similar in design to those of its sister companies, Massachusetts Electric and Granite State Electric (New Hampshire), described above.

Low Income: No separate requirements for low income programs or funding exist. Currently there is one low income program being carried out by CAP agencies.

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[66] *An Act Relating to the Utility Restructuring Act of 1996*, Approved August 7, 1996.

[67] Kilmarx, Mary, RI PUC, Phone interview, August 14, 1998.

Annex C: Air Emissions from Fuel Switching Options

An Illustrative Example Based on Residential Space Heating

by* DAVID NICHOLS *and
HANNAH SARNOW

Introduction

Many end-use services can be met by different kinds of equipment using different kinds of fuel. Here we examine some of the air emissions implications of the consumption of natural gas or alternative fuels. We assume a typical single-family home in the SCGM service area whose space heating needs can be met using one of four heating systems:

- A natural gas furnace of typical efficiency
- A natural gas furnace of high efficiency
- An oil furnace of typical efficiency
- Electric resistance heating

The "base case" is the first alternative listed. This assumes heating with a gas forced hot air furnace of typical fuel conversion efficiency. Typical efficiency is taken to be an AFUE (Annual Fuel Utilization Efficiency) rating of 82%.

Key air emissions

Several combustion-related air emissions can arise from space heating, depending on the heating system and the type of fuel used. These emissions and their negative consequences are as follows:

- Carbon dioxide (CO_2): This is the major greenhouse gas ("GHG"), and contributes to increases in global temperatures.
- Nitrogen oxides (NO_x): These emissions have adverse effects on human respiratory health. They contribute to ozone formation and acid rain.
- Sulfur oxides (SO_x): These emissions contribute to acid rain that damages lakes, forests, structures. They contribute to human respiratory problems.
- Methane (CH_4): Methane is another GHG.
- Carbon monoxide (CO): This is a local air pollutant with respiratory impacts. It also increases GHG concentrations in the atmosphere.
- Particulate emissions: Particulates contribute to respiratory health problems and impair visibility.

In our analysis, we estimate the annual levels per household of these key emissions for the base case and the three alternative cases. This information permits comparisons of some of the environmental consequences of (1) conserving energy by promoting high-efficiency equipment, (2) encouraging residential energy users to choose gas for space heating instead of oil, and (3) encouraging the choice of gas heating instead of electric space heating.

These comparisons are important because SCGM states that it is interested in the promotion of gas heat instead of oil or electric heat, particularly in the residential market. SCGM also states that it is interested in promoting high efficiency gas furnaces.

Analysis: results and implications

Our analysis estimated the base case levels of air emissions per household, and the levels of emissions for each of the three alternative cases. The results are summarized below and in chart form on the final page:

Relative Emissions from Alternative Heating Options

Pollutant	Annual Emissions per Household (pounds per year)				
	Base Case Gas	Alternative Cases			
		Gas HEF	Oil	Electricity	
				Low	High
CO_2	12,148.88	11,068.98	18,571.56	5,125.14	48,688.84
NO_X	6.91	6.30	7.30	11.55	109.76
SO_X	0.10	0.10	23.40	38.22	363.06
CH_4	0.21	0.19	1.29	0.05	0.45
CO	1.78	1.62	3.22	1.04	9.85
Particulates	1.57	1.43	2.04	2.01	19.14

We found that substituting a high-efficiency furnace (HEF) for a standard efficiency furnace would reduce CO_2 emissions from 12,149 lbs/year to 11,069 lbs/yr, a reduction of 9%. (Put another way, use of standard efficiency furnace instead of a HEF increases CO_2 emissions by 10%.) Similarly, because of its higher fuel conversion efficiency, the HEF reduces emissions from all of the pollutants.

Switching from oil to a standard efficiency gas furnace would reduce carbon dioxide emissions by 35%. As well it reduces all of the other emissions listed. Note, however, that the emissions reductions realized by going from typical

efficiency oil to the gas HEF are greater, ranging from 14% for NO_x to 100% for SO_x.

Fuel switching from electricity

Analysis of the emissions trade-offs in switching from electricity is difficult to accomplish without modelling the generation system in some detail, which we have not done. What is presented here is a very preliminary analysis which is more an indicator of the importance of doing detailed environmental analysis than a final result, for it shows how much depends on one's assumptions about the electricity system.

It is sometimes considered that there are no significant combustion-related emissions associated with the H-Q system because it is so dominated by hydro-power. However, when one is talking about reducing electricity usage, one expects the generation that is most costly to operate to be reduced first. We infer that H-Q's Tracy oil-fired unit is the, or one of the, more costly units to operate, as it has been little-used in recent years, but is currently being used at or near its full capacity of 600MW.

For this reason we based our estimation of emissions from providing space heating through electricity on the assumption that the Hydro-Quebec's Tracy station is the marginal generation unit. In the recent past Tracy operated a small number of hours per year, a usage pattern typical of peaking units with high operating costs. At the current time, the station is being run continuously, in the fashion of a baseload unit. There is some other fossil fuel fired generation on the H-Q system, but we chose to perform this illustrative calculation based on assumptions for the future operation of Tracy, the largest such unit. In the "High" case we assumed that 95 percent of space heating load is met by Tracy, corresponding to its "baseload" pattern of usage, and in the "Low" case 10 percent, corresponding to its "peaker" pattern of usage, with the balance met by non-fossil generation. We assumed that H-Q is a closed system and made no allowance for exports or imports.

In the "High" case the emissions reductions from displacing generation from Tracy are very substantial, ranging from 53% (Methane, High case) to 100% (sulfur oxides). In the "Low" case the picture is more mixed, with reductions in some emissions and increases in others.

A fuel switching program could shift many thousands of homes from electricity before the cumulative load reduction would surpass the generation that can be supplied from Tracy. Eventually, however, the load reduction could surpass Tracy's capability, and other generating resources would be avoided instead.

Note that the air emissions we have calculated are those from the combustion process at an oil-fired generating station burning residual oil, and do not include

any air emissions impacts, such as methane from reservoirs, associated with any hydro generation at the margin. In addition, there are other environmental impacts besides air emissions, such as the impacts of hydro generation on terrestrial and aquatic ecosystems. A complete analysis of the environmental implications of shifting from one fuel to another would take into account such effects. **What our comparison of combustion-related air emissions impacts does suggest is the importance of identifying and quantifying the environmental impacts of any fuel switching programs, preferably before they are launched.**

Analysis methods and data

This section of Annex C details the methods and data used in the analysis of the emissions impacts for the four alternative cases.

We began by assuming a heating load for a home in the SCGM service area. The load we assumed, 85.88 million Btu/year, was based on an estimate from SCGM of the amount of electricity used to heat all-electric homes. Though the resulting heating load is fairly large, and not necessarily an average load, it is useful for making our emissions comparisons, and thus was used as the annual output to be satisfied by an 82% AFUE natural gas furnace[68], a 90% AFUE high-efficiency gas furnace, an 80% AFUE oil furnace, and electric generation.

To calculate the input necessary for electric resistance heating, 100% AFUE conversion efficiency at the point of end use was assumed. The input necessary for electric resistance heating was therefore assumed to be the same as the output. This input was then multiplied by (1+line loss factor) to determine the kWh necessary to be generated to satisfy the output required. This in turn was multiplied by the percent of heating hours that were provided with electricity by the Tracy oil-fired generation unit (10% for the low case, 95% for the high case). This was then multiplied by the heat rate of 11,000 Btu/kWh to give the input requirements to satisfy the heating load of the house. Finally, the oil-fired generation input was multiplied by the emission factors for electricity to yield total emissions in pounds per year.

Next we analyzed the emissions resulting from on-site combustion of natural gas or fuel oil for home heating.[69] The annual emissions per household for each of

[68] According to SCGM, "second generation" systems in Québec have an AFUE 82% (SCGM-3, doc. 4.55)

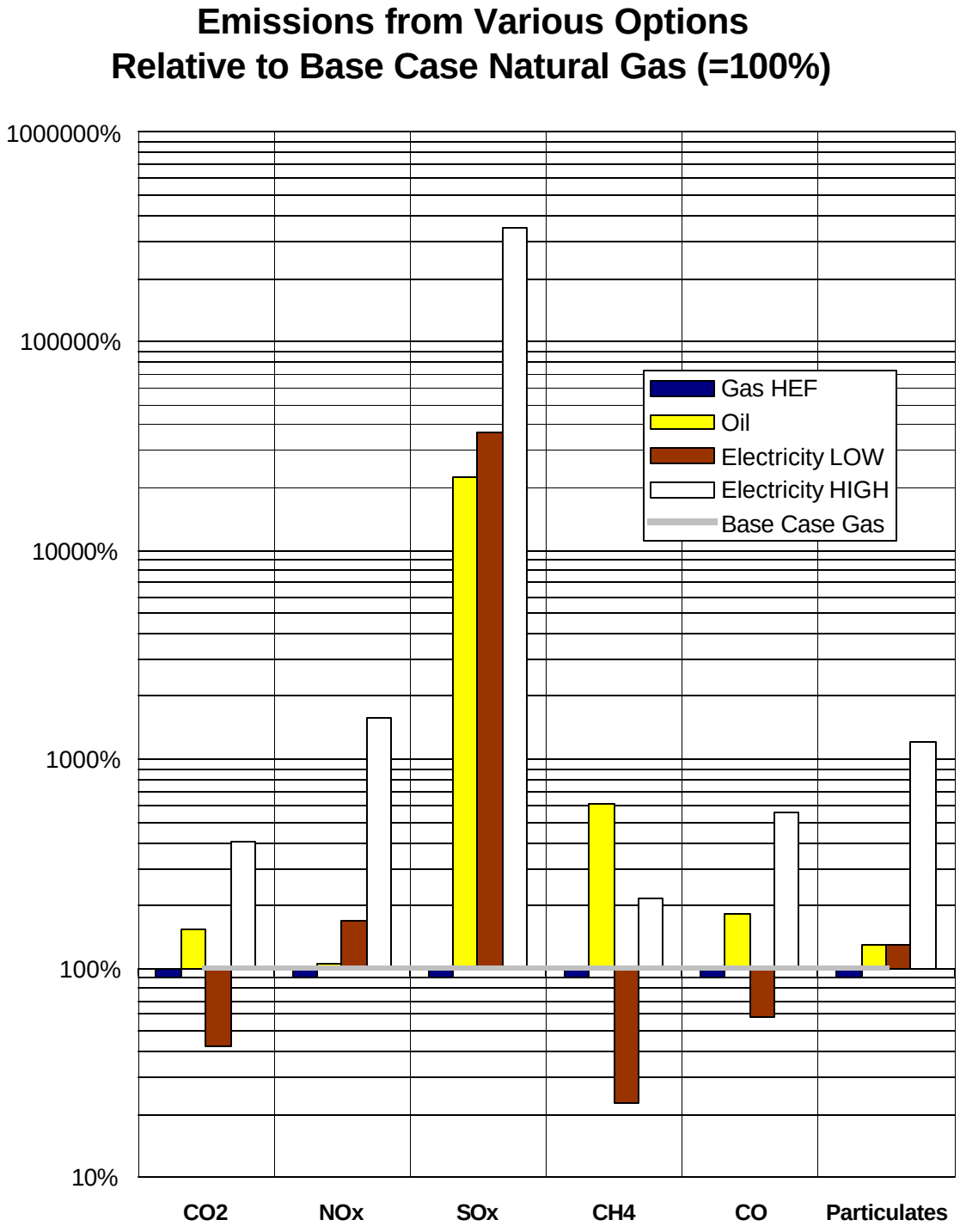
[69] Note that fuel oil used for home heating is more refined than fuel oil used for electric generation. Therefore, while some emissions rates per unit burned are the same for the two fuels, carbon dioxide for example, other emissions rates are much lower for home heating oil, such as that for NO_x.

the six different pollutants was calculated by multiplying the emission coefficient for that pollutant (in lbs/Mbtu of input) by the annual input necessary for the given heating system (in Mbtu). The emission coefficients for each pollutant/heating system combination were taken directly from a previous Tellus Institute study.[70] The coefficients for natural gas and oil are given in lbs/Mbtu of input in this study.

Limits of the Analysis

Finally, it is important to note that this analysis is only illustrative, since a number of data are taken from U.S. sources. Specific emissions data from Québec sources, such as we requested of SCGM through the discovery (question and answer process) in this case, would be required to ensure that results correspond more precisely to the Québec context.

[70] Natural Gas and Oil emission coefficients from: Tellus Institute, *Environmental Impacts of Long Island's Energy Choices: The Environmental Benefits of Demand-Side Management*, September 1990.


Emissions from Various Options
Relative to Base Case Natural Gas (=100%)
1000000%
100000%
10000%
1000%
100%
10%
Gas HEF
Oil
Electricity LOW
Electricity HIGH
Base Case Gas
CO2
NOx
SOx
CH4
CO
Particulates

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Annex D:
Excerpts from Related Works

NARUC's "Primer on Gas Integrated Resource Planning"

The following is chapter 9 of Goldman et al.'s seminal report on integrated resource planning for gas utilities. The chapter is entitled "Financial Aspects of Gas Demand-Side Management Programs", and describes at some length the link between ratemaking and IRP.

TELLUS' "La Planification intégrée des ressources en électricité en Amérique du Nord"

The following is chapter V of volume I of the Tellus Institute's extensive three-volume report on integrated resource planning prepared for a joint committee composed of representatives of Hydro-Québec and Québec public interest organizations. The chapter is entitled "Enjeux de la réglementation: recouvrement des coûts et incitatifs financiers", and describes in more detail the series of ratemaking choices related to IRP-based energy efficiency and fuel switching options.

HELIOS' "La réglementation des tarifs d'électricité"

The following is a summary report prepared by the Helios Cente on comprehensive incentive rate regulation for electric utilities. The report describes the basic options of rate caps and revenue caps, and briefly discusses their general implications for energy efficiency.