Yukon Rate Stabilization Fund:
An Economic Analysis

Prepared for:

Energy Solutions Centre
Whitehorse, Yukon

Prepared by:

Paul Kishchuk, MA
Vector Research
Box 31126 Whitehorse, Yukon Y1A 5P7
paul@vectorresearch.ca
867.668.3164

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1.0 Preface

Prior to 1987, the bulk of electricity generation assets located in the Yukon were owned by the Northern Canada Power Commission (NCPC), a federal Crown Corporation. Much of the electricity generation and transmission infrastructure developed by NCPC was built in support of mining activities in Elsa, Faro and Whitehorse. Indeed, the Yukon's three major hydro-electric facilities were each built to service mine-related loads.

The assets of the Northern Canada Power Commission were transferred to the Yukon Energy Corporation (YEC) in 1987. A wholly owned subsidiary of the Yukon Development Corporation, the Yukon Energy Corporation is a public utility. Electricity prices charged by the Yukon Energy Corporation are regulated by the Yukon Utilities Board under provisions of the *Public Utilities Act*. Price regulation is required given YEC's high degree of market power in electricity generation; YEC enjoys a near-monopoly in the Yukon electricity generation market.[1]

Mining sector production, once a pillar of the Yukon economy, is now sustained only by output from approximately 115 placer gold mines[2], almost all of which are located off-grid. No hard rock mines are currently in operation. Similarly, demand for electricity by mining sector operations, which once accounted for more than 40 percent of YEC's customer base, has dwindled to near-zero.

Were it not for the isolation of the Yukon's electricity system, the loss of a significant portion of YEC's customer base could be mitigated by selling electricity into other markets. The absence of a grid-interconnection means, however, that the impact of structural changes in the mining sector must be borne within the territory.

Electricity price regulation in the Yukon is accomplished using a Rate-of-Return (or Cost-of-Service) approach. Under such an approach, the Yukon Utilities Board (YUB) makes a determination of YEC's appropriate expenses, value of invested capital and the allowed rate of return on invested capital[3]. Rate-of-Return price regulation works both ways. That is, the regulator both sets the maximum price that can be charged and ensures that the utility has an opportunity to earn its regulated rate of return.

Thus, in the face of changes in its operating environment which impair its ability to earn the regulated rate of return (such as mine closures), YEC may apply to the YUB for rate increases. Known as "riders" the rate increases are billed to customers on top of the regulated rate of return. For example, as a result of the final closure of the Faro mine in 1998, electricity consumers in the Yukon currently pay a "revenue

[1] The Yukon Energy Corporation owns 88% of the electrical generation capacity in the territory. The remaining 12% is owned by The Yukon Electrical Company Limited, a private utility owned by ATCO Electric Limited. Since 1987, the Yukon Utilities Board has set integrated power rates for both the Yukon Energy Corporation and The Yukon Electrical Company Limited.
[2] *Yukon Exploration and Geology 2002*, Department of Indian Affairs and Northern Development, page 27.
[3] See chapter 4 of *Electricity Economics: Regulation and Deregulation* (Geoffrey Rothwell and Tomas Gomez, eds., 2003) for a full discussion of electricity regulation. A description of rate regulation specific to the Yukon Energy Corporation may be found in Note 2 to the Yukon Energy Corporation's 2002 Audited Financial Statements published in the *Yukon Energy Corporation Annual Report 2002*.

shortfall rider" of 14.93 percent.[4] In conclusion, it is Yukon ratepayers who stand poised to bear the electricity rate impacts of structural changes in the Yukon economy.

In a larger jurisdiction, the fits and starts of operations at the Faro mine would have had little impact on overall system operations. The small size of the Yukon electricity market[5] and the large volume of electricity required for Faro mine operations, however, has left Yukon electricity consumers facing a significant exposure to electricity rate changes. The exposure has been felt by Yukon electricity consumers in two ways -- 'bill instability' and 'rate shock'. Bill instability means that electricity customers cannot be sure from month to month how much their electricity bill will be when it arrives. Rate shock means that the size of the electricity rate changes (almost always increases) are large.

Electricity is a crucial feature of the day-to-day lives of virtually the entire Yukon voting population. As a result, the exposure felt by Yukoners to bill instability and rate shock is also exposure keenly felt by the level of government responsible for electricity matters -- the Government of Yukon. The policy response by successive territorial governments since 1991 has been to institute a series of *ad hoc* rate relief measures. While none of the measures have been intended as permanent solutions, their repeated implementation has effectively lead to the creation of an ongoing subsidy program. While the financial unsustainability of the current rate relief program is not in dispute, removal of the subsidy represents a political hot potato.

A long-term solution to the rate relief dilemma will require an understanding of the broad set of the economic factors at play in the Yukon electricity generation market. Accordingly, the purpose of this paper is to identify and describe implications of the current approach to rate stabilization from an economic policy perspective.

2.0 Background

Before an economic analysis of electricity rate stabilization in the Yukon can be laid out, some background perspectives on electricity and rate stabilization are required. Accordingly, this section of the paper begins with a look at the economic characteristics of electricity; it is followed by an assessment of electricity's share of household spending in the Yukon and three selected jurisdictions. The section concludes with a description of Rate Stabilization Fund mechanics.

2.1 Economic Characteristics of Electricity

According to Steven Stoft, "electricity is a peculiar product" because:

- it is the only product consumed continuously by essentially all customers;
- it is consumed within a tenth of a second of its production; and

[4] The revenue shortfall rider is also known as Rider J. A second rider, the "fuel adjustment rider" (Rider F), is also currently billed to electricity customers at a rate of 0.5867 cents per kW.h.
[5] Total electricity generation capacity in the Yukon (both Yukon Energy Corporation and The Yukon Electrical Company) is approximately 130 MW.

- less than a tenth of a second of power can be stored as electrical energy in the system.[6]

The supply of electricity must be continuous and precise in terms of frequency and voltage. Electricity producers must supply exactly the amount of electricity customers are demanding at any given point in time. Since a typical customer can instantaneously increase or decrease their demand load without prior warning to the electricity supplier, it falls entirely at the feet of the electricity supplier to accommodate ever-changing demand loads.

Electricity's peculiar physical properties means that it also has some distinctive economic characteristics. "These physical properties result in a product whose marginal cost of production fluctuates rapidly and, thus, whose delivered cost also fluctuates rapidly."[7] In a competitive market, changes in the marginal cost of production would be translated directly into price changes.

In a regulated electricity market, however, consumers are completely shielded (at least in the short-run) from changes in the marginal cost of production on the supply side of the market. In economic terms, the price elasticity of demand for electricity is perfectly inelastic; consumers are completely unresponsive to price signals in the short-run. In other words, while the supply side of the market is making continuous price signals, those signals are in effect unseen. As a result, while consumers may wish to alter the amount of electricity they consume in response to a electricity price changes, they are not receiving the information that would lead them to alter their consumption behaviour.

Two other features of electricity are also worth noting. First, electricity has no close substitutes. By way of example, consider what happens to the demand for butter when the price of margarine increases. Consumers will substitute butter for margarine since butter is a close substitute. Electricity, in contrast, has no close substitutes. Another commodity cannot be substituted for electricity in response to a price increase as only electricity will power electrical apparatus and appliances. Electricity is electricity is electricity.

Second, electricity is a complement to many other goods. This means that the demand for quantities of goods used in combination with electricity varies with the price of electricity. The degree to which demand varies is, of course, largely dependent upon how much electricity is needed to power the good in question.

2.2 Electricity's Share of Household Spending

Like food and shelter, electricity is essential to everyday life in the Yukon. That said, some perspective on the relative share of electricity costs in terms of household spending would perhaps be useful. The Survey of Household Spending is undertaken on an annual basis by Statistics Canada and asks a representative sample of Canadians in each provincial and territorial jurisdiction about their spending habits. The most recent year for which data is available is 2001.

[6] Steven Stoft, *Power System Economics: Designing Markets for Electricity,* page 14.
[7] Ibid.

As shown in Table 1, average annual household spending on electricity at the national level is $978. Electricity expenditures are lower than the national average in British Columbia ($933) and higher in the Yukon ($1,216) and the Northwest Territories ($1,241).

Table 1: Average Annual Household Spending - Selected Jurisdictions 2001

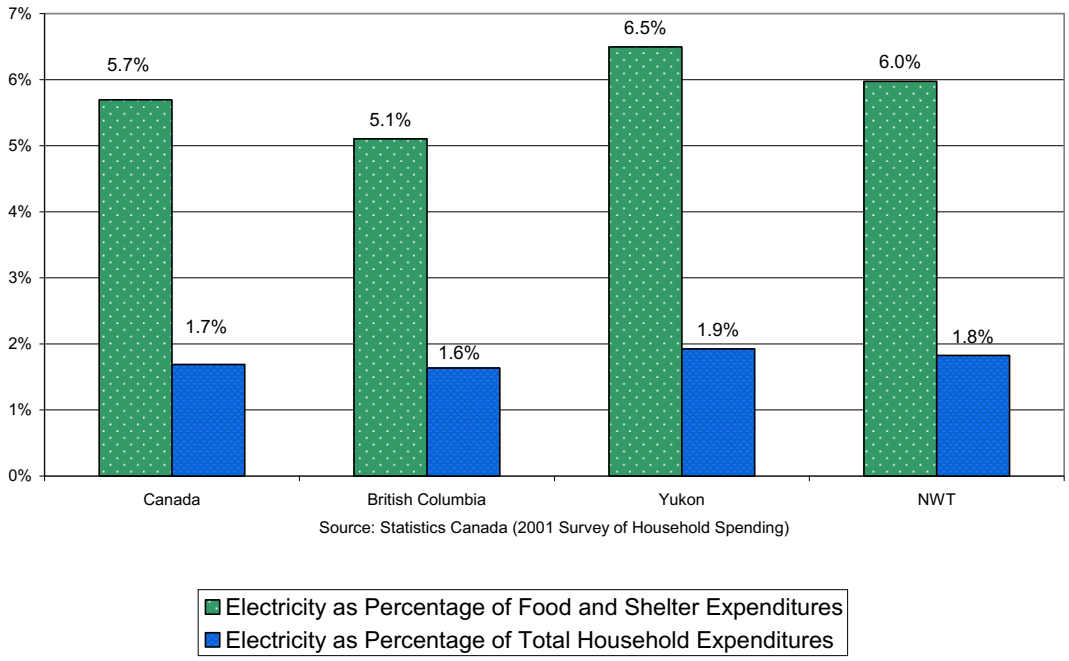
	Canada	British Columbia	Yukon	NWT
	-- dollars --			
Electricity	978	933	1,216	1,241
Food and Shelter	17,176	18,275	18,719	20,769
Total Household Expenditures	57,946	57,138	63,258	67,993

Source: Statistics Canada *(2001 Survey of Household Expenditures)*

Food and shelter expenditures, which averaged $17,176 at the national level in 2001, were higher in each of the three jurisdictions selected for comparison. Total average annual household expenditures were lower than the national average ($57,946) in British Columbia and higher in the Yukon and the Northwest Territories.

Chart 1 shows that in the four selected jurisdictions, Yukoners recorded the highest percentage of annual average spending on electricity relative to food and shelter expenditures. In 2001, 6.5% of food and shelter expenditures made by Yukoners were for electricity. In comparison, electricity accounted for 5.7% of annual average food and shelter expenditures at the national level and 5.1% and 6.0% in British Columbia and the Northwest Territories, respectively.

Chart 1: Electricity as a Share of Average Annual Household Expenditures
Selected Jurisdictions - 2001



Source: Statistics Canada (2001 Survey of Household Spending)

Chart 1 also shows that electricity spending accounted for 1.9% of total annual average household expenditures in the Yukon in 2001, the highest share among the four selected jurisdictions. In comparison, electricity accounted for 1.7% of total annual average household expenditures at the national level and 1.6% and 1.8% in British Columbia and the Northwest Territories, respectively.

In summary, notwithstanding the prevalence of electricity use, spending on electricity relative to spending on food and shelter and total household expenditures is low in all four jurisdictions selected for comparison. The relative share of electricity expenditures in the Yukon, while slightly higher than in other jurisdictions, is in line with spending in other jurisdictions in terms of both spending on food and shelter and total household spending.

While on one hand it is true that almost the entire Yukon population is highly reliant upon electricity for day-to-day living, it is equally true, on the other hand, that electricity's share of total household spending is, on average, relatively insignificant. Thus, the design of rate stabilization measures in the Yukon face a difficult public policy challenge. Not only must rate stabilization measures mitigate the negative impacts of bill instability and rate shock exposure in an efficient and equitable manner but they must do so in an environment which political and economic objectives are diametrically opposed.

2.3 Rate Stabilization Fund Mechanics: What's in a name?

In order to properly outline the economic fundamentals of RSF relief it is necessary to understand how the current Rate Stabilization Fund (RSF) measure works. To illustrate the mechanics of the Rate Stabilization Fund relief measure the analysis which follows is based on the supposition that, for three distinct reasons, RSF relief as currently implemented could be better named. The first reason relates to the difference between rates and bills and the second reason concerns twin objectives of RSF relief, rate stabilization and rate shock relief. The third reason considers the population segment which RSF relief is intended to benefit. Each reason is discussed in turn below.

Electricity Rates *vs*. Electricity Bills

Rates are the amounts charged to customers for consumption of electricity on a per unit basis. Different rates are charged to different types of consumers and each rate is approved by the Yukon Utilities Board (YUB). Rates are set by the YUB in order to allow YEC and YECL to recover costs and to provide an opportunity to earn a specified rate of return on invested capital. In summary, rates are the regulated prices which the regulator (YUB) allows the Yukon's monopoly electricity generator (YEC) to charge its customers.[8] With reference to economic theory, the approved rates attempt to maximize social surplus (consumer surplus plus producer surplus) under a monopoly constraint.

[8] By circumstance of integration, the Yukon Utilities Board also requires the Yukon's other electricity producer, The Yukon Electrical Company Limited, to charge the same regulated prices (i.e., rates) as the Yukon Energy Corporation.

Bills, in contrast, present the dollar amount demanded by the Yukon's two electricity utilities, YEC and YECL, for electricity consumption during a given period of time.[9] The regulated price of electricity is but one part of one element of a typical non-government residential bill. The amount of electricity consumed (measured in kW.h) is multiplied by regulated price of electricity and is denoted as the energy charge. Other elements on a typical non-government residential bill include:

- basic customer charge[10]
- YEC revenue shortfall rider (Rider J)
- fuel adjustment rider (Rider F)
- Yukon rebate of territorial income tax (credit)[11]
- rate stabilization fund (credit)
- federal goods and services tax

The most recent incarnation of the Rate Stabilization Fund is described in the Government of Yukon Order-in-Council 2001/147 (17 October, 2001):

> *(a) Relief for non-government residential customers throughout Yukon for bills issued during each winter month shall include a reduction in the revenue collected from the fixed monthly customer charge and the first block energy charge as required in order that each of these charges does not exceed an amount equal to the 1997 bill for each of these charges plus 9%.*
>
> *(b) Relief for non-government general service and municipal general service customers throughout Yukon for bills issued during each winter month shall include a reduction in the revenue collected from the first block energy charge as required in order that this charge does not exceed an amount equal to the 1997 bill for this charge plus 9%.*

While several of the phrases used in paragraphs (a) and (b) have specific meanings, all of which are defined in the same Order-in-Council, the essence of Rate Stabilization approach currently in use can be summed up as follows:[12,13]

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[9] To avoid administrative duplication the billing function is carried out by only one of the two electrical utilities, The Yukon Electrical Utility Company Limited. As a result, all electricity customers receive a bill bearing YECL's logo, whether or not they actually received electricity generated in a YECL facility.

[10] The basic customer charge is a flat rate charged to all customers monthly regardless of the amount of electricity consumed. The current basic customer charge for non-government residential customers is $11.90 per month.

[11] Utilities owed by provincial and territorial governments are typically exempt from income tax while the income of privately owned utilities is generally liable for income tax. To maintain a level playing field between publicly owned and privately owned utilities, longstanding practice of the federal government was to rebate the bulk of federal income taxes paid by privately owned utilities to the provincial and territorial governments according to the jurisdiction of operation under authority of the *Public Utilities Income Tax Transfer Act*. The Government of Yukon has passed on the federal rebate as well as its share of YECL income taxes to non-government residential and non-government general service customers since 1989. While the federal government no longer makes such rebates, the Government of Yukon has continued to rebate its share of YECL income taxes. The rebate is calculated as 2% of the sum of the basic customer charge and the energy charge.

[12] For example, the term "1997 bill" is defined in OIC 2001/147 as meaning , "…the amount resulting from applying to the current month the rate approved by the Yukon Utilities Board for bills issued during January 1997 less any income tax rebate applicable during January 1997 and less any rate relief applicable during January 1997 pursuant to Order-in-Council 1996/200."

RSF Relief: A Simplified Example

RSF relief during the winter (October to March) is calculated as:[14,15]

A. the portion of a customer's bill (including rate riders) which relates to the first 1,000 kW.h of electricity consumption for the current month

less

B. the portion of a customer's bill which relates to the cost of the first 1,000 kW.h of electricity consumption in the current month calculated using the regulated prices in effect in January 1997, multiplied by 9%

To illustrate how RSF relief works consider the following hypothetical example for a winter month. Bob owns and lives in a house in the community of Watson Lake. Suppose that during the month of October 2003 he consumed 1,100 kW.h of electricity. Further suppose that the regulated price of electricity in October 2003, including rate riders J and F, was 15¢/kW.h. If the regulated price of electricity was 10¢/kW.h in January 1997, Bob's RSF relief is calculated as follows:

A
1,000 kW.h
x 13¢/kW.h
= $130.00

B
1,000 kW.h
x 10¢/kW.h
= $100.00

$100.00
x 0.09
= $9.00

A = $130.00

B = $109.00

RSF relief = A - B
= $130.00 - 109.00
= $21.00

[13] Similarly, the term "First block energy charge" is defined in OIC 2001/147 to mean "…the first block energy rate approved by the Yukon Utilities Board from time to time for the first 1,000 kW.h per month purchased by non-government residential customers and the first 2,000 kW.h per month purchased by non-government general service and municipal general service customers, plus any rate rider then applicable to such charge, and less any income tax rebate then applicable to such charge."

[14] The calculation of RSF relief for non-government residential customers is based on both the fixed monthly customer charge and a value of electricity consumption. Because the fixed monthly customer charge of $11.90 per month is the same now as it was in January 1997, the customer charge part of the calculation is ignored here for purposes of illustration.

[15] For a reason similar to that which applies to the fixed monthly customer charge, the income tax rebate is not considered here for purposes of illustration.

Note that while Bob consumed 1,100 kW.h of electricity in October, only the first $1,000 is eligible for RSF relief in a given month. It is also worth noting that RSF relief is a use-it-or-lose-it measure. In winter months when Bob's electricity consumption happens to be less than 1,000 kW.h, the RSF relief that would apply to the difference between actual consumption and 1,000 kW.h cannot be "saved" for use in a future month when consumption exceeds 1,000 kW.h.

Under current provisions of the RSF relief measure, non-government general service (i.e., commercial) customers and municipal general service (i.e., municipal government) customers are also eligible for RSF relief. The mechanics of the calculation of RSF relief for these customers is identical to that of non-government residential customers except that RSF relief applies to the first 2,000 kW.h of electricity consumed in a given month instead of only the first 1,000 kW.h.

To encourage energy conservation, RSF relief for non-government residential, commercial and municipal government customers is reduced during the summer months of April through September. For non-government residential customers, RSF relief is reduced only for those who consume more than 1,000 kW.h in a given summer month; non-government residential customers who consume less than 1,000 kW.h do not face a reduction in RSF relief. The reduction in RSF relief for a given customer is calculated by multiplying the number of kilowatt hours in excess of 1,000 times 0.2% of the amount of "residential maximum rate relief".

With maximum rate relief for non-government residential customers equal to $31.71 in September 2003, RSF relief in that month would be reduced by 6.34¢ per kilowatt hour for each kilowatt hour of electricity consumed in excess of 1,000. While not immediately obvious, the mathematics of the calculation dictate that all RSF relief for non-government customers is "stripped off" by the time consumption reaches 1,500 kW.h in a summer month.

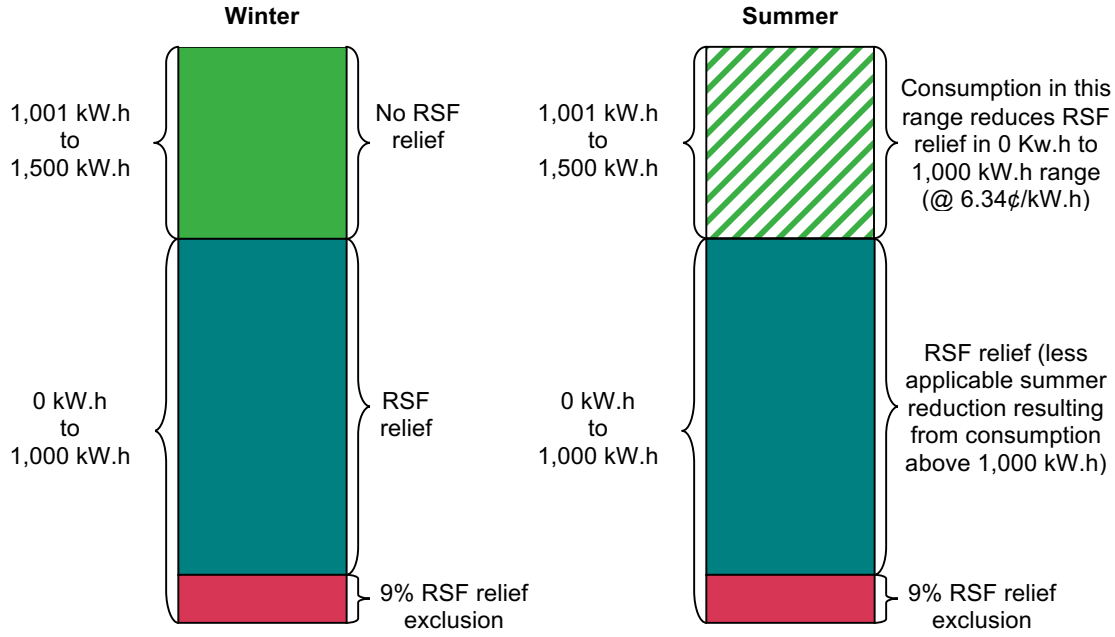
To pick up again with our example of Bob in Watson Lake, suppose that he consumed the same volume of electricity but instead in the summer month of September. With consumption of 1,100 kW.h of electricity (i.e, 100 kW.h more than 1,000 kW.h) Bob will face a reduction in RSF rate relief of $6.34 calculated as 100 kW.h x 6.34¢/kW.h. Bob's net amount of rate relief for September will be equal to $14.66, reduced by $6.34 from $21.00.

For commercial and municipal customers, RSF relief is reduced only for those who consume more than 2,000 kW.h in a given summer month; commercial and municipal customers who consume less than 2,000 kW.h do not face a reduction in RSF relief. The reduction in RSF relief for a given customer is calculated by multiplying the number of kilowatt hours in excess of 2,000 times 0.1% of the amount of "general service maximum rate relief".

With maximum rate relief for commercial and municipal customers equal to $21.89 in September 2003, RSF relief in that month would be reduced by 2.19¢ per kilowatt hour for each kilowatt hour of electricity consumed in excess of 2,000. Similar to the calculation for residential customers, the mathematics of the calculation dictate that all RSF relief for commercial and non-government customers is "stripped off" by the time consumption reaches 3,000 kW.h in a summer month.

Diagrams 1 and 2 below provide a summary of the key elements of the current form of the RSF relief measure for non-government residential and commercial/municipal customers.

Diagram 1: Rate Stabilization Fund Relief
Non-Government Residential Customers

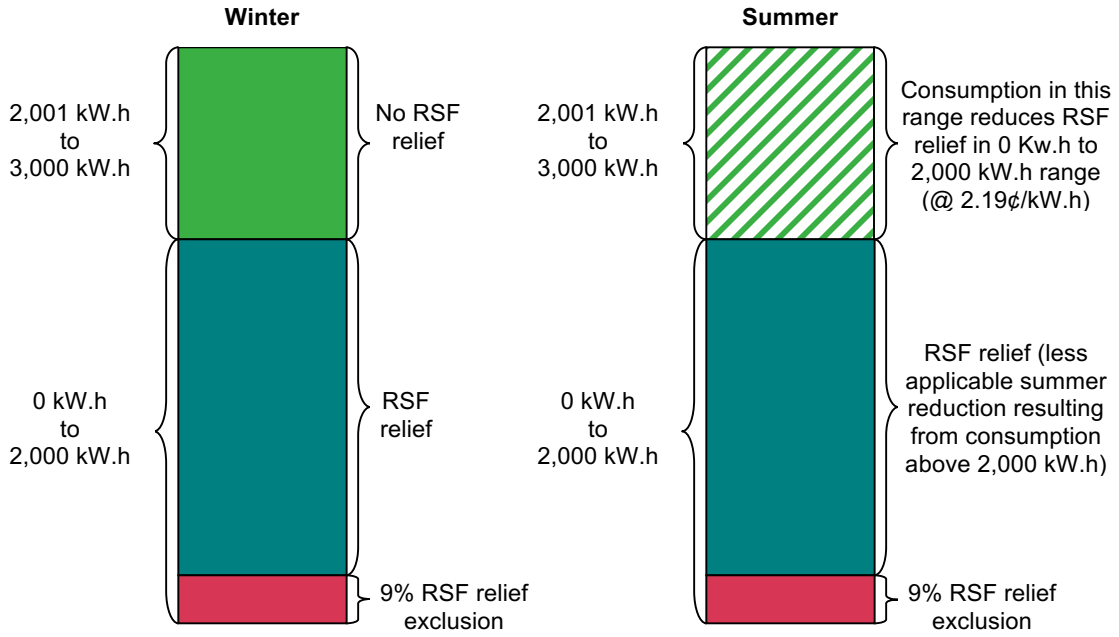


Now, getting back to why the Rate Stabilization Fund could be better named, it is hopefully clear from the foregoing that RSF relief is applied to customers bills and not to regulated electricity rates. Thus, the first reason why the Rate Stabilization Fund could be better named is because it is the bill amount that is of interest in the calculation of RSF relief and not the regulated price of electricity. Regulated electricity prices (i.e., rates) for non-government residential, commercial and municipal customers are still determined using the Cost-of-Service methodology and approved by the Yukon Utilities Board. Accordingly, a better name for the RSF might be the ***Bill Stabilization Fund***.

Bill Stabilization *vs*. Rate Shock Relief

As noted earlier, the fits and starts in operations at the Faro mine, which culminated with its final closure in early 1998, left Yukon electricity consumers facing exposure to electricity rate changes in the form of both bill instability and rate shock. To refresh, bill instability means that electricity customers cannot be sure from month to month how much their electricity bill will be when it arrives. Rate shock means that the size of the electricity rate changes (almost always increases) are large.

Diagram 2: Rate Stabilization Fund Relief
Commercial and Municipal Customers



The Yukon's Rate Stabilization Fund is designed to address the impacts arising from both bill instability and rate shock; the RSF relief program has twin objectives. The first objective, stable electricity bills for customers, is achieved by partially anchoring the calculation of a customer's bill in the current month to the calculation of the bill amount in a stated reference month. The reference month is fixed; it does not advance as time passes.

The reference month for Yukon RSF relief is January 1997. Bill amounts in the current month are adjusted by a RSF relief calculation which ensures that charges for the fixed monthly customer charge and the first block energy charge "… [do] not exceed an amount equal to the 1997 bill for each of these charges plus 9%."[16] Thus, billing amounts still vary with consumption and changes in the regulated price of electricity, but are stabilized through a relief calculation which references the bill amount calculation at a fixed past point in time.

The second objective of RSF relief is to provide relief to customers from changes in the regulated price of electricity which result from shifts in the composition of the Yukon Energy Corporation's customer base. Specifically, the RSF relief program provides relief to non-government residential, commercial and municipal customers faced with significant electricity rate increases as a result of the closure of the Faro mine.

[16] O.I.C 2001/147 (17 October, 2001).

While much of the electricity sold to the Faro mine was produced with diesel generators which were taken off-line when the mine closed, a similar amount of electricity was produced from hydro-electric sources. As hydro-electric generation capacity cannot be 'shut down and shipped down the highway', the associated capital costs have to be covered whether the customer base is in place or not. The scale of the impact of the Faro mine closure can be evidenced in the value of revenue shortfall rider "J" which has ranged between 14.93%[17] and 18.74%[18] in the years since the final closure of the Faro mine.

Bill relief provided through the Rate Stabilization Fund is not total relief as the entire impact of the Faro mine closure on electricity bills is not offset by RSF relief. The partial nature of rate relief is demonstrated in Diagram 1 and Diagram 2 where only a "middle chunk" of electricity consumption is eligible for relief. On the bottom end, electricity consumption which corresponds to the first 9% of the value of a customers bill is excluded from RSF relief. At the top end, rate relief is terminated for consumption levels by non-government residential customers in excess of 1,000 kW.h and for consumption levels by commercial and municipal customers in excess of 2,000 kW.h. During summer months, RSF relief is reduced for non-government residential customers if consumption exceeds 1,000 kW.h and for commercial and municipal customers if consumption exceeds 2,000 kW.h. In summary, the relief from rate shock provided by the RSF is applies to only part of the consumption by non-government, commercial and municipal customers.

In conclusion, the purpose of the RSF relief measure is to stabilize customer bills and offset part of the rate shock impacts of the Faro mine closure. As a result, instead of the Bill Stabilization Fund, an even more accurate name for RSF relief might be the ***Bill Stabilization and Rate Shock Moderation Fund***.

Universality of the Rate Stabilization Fund Relief Measure

In its current formulation, RSF relief in the Yukon is "universal" for eligible customers.[19] Relief is universal because, provided that a customer is classified as non-government residential, commercial or municipal, eligibility for the program is not restricted by any measure of need. Thus, RSF relief is provided to a very broad segment of the combined customer base of the Yukon Energy Corporation and The Yukon Electrical Company Limited. To phrase it another way, beyond excluding government and industrial customers from eligibility, RSF relief is non-targeted. Indeed, approximately 12,500 non-government residential, 2,100 commercial and 200 municipal customers received some amount of rate relief in 2002.

[17] Per non-government residential bill issued by The Yukon Electrical Company Limited for the billing period August 20, 2003 to September 19, 2003.
[18] *Yukon Energy Corporation 1999 Annual Report*, Note 14 to the Audited Financial Statements, page 54.
[19] Customer classes eligible for Rate Stabilization Fund relief include: non-government residential, non-government general service (commercial) and municipal classes. Customer classes not eligible for RSF relief include: government residential, government general service (including street and space lights), industrial and wholesale. Note that since 1995, the definition of 'government' has been specified to include "only federal and territorial departments, agencies or non-profit bodes that derive all or substantially all their funding from such departments or agencies" (from *Technical Background Paper on Electrical Rates and Relief*, Cabinet Commission on Energy, 1998, p. 23).

The absence of a targeting mechanism for RSF relief, as is typically used with universal subsidy programs (often in the form of an income test), carries with it three significant implications. The first is that RSF relief is expensive for government to fund since the number of eligible recipients is also relatively high.[20] The second implication, which follows from the first, is that because such a broad segment of the total customer base is eligible for RSF relief, cost pressures will tend push down the value of the subsidy for any one customer. In other words, cost pressures will tend to spread RSF thinly among all that are eligible. The third implication, which in turn follows the first two, is that because the subsidy must be thinly spread, those customers most in need are may not be receiving an appropriate proportion of RSF relief.

Thus, tradeoffs exists between 1) the cost to government for providing RSF relief, 2) the amount of RSF relief received by a given customer and 3) the amount of RSF relief that is provided according to need. The approach currently in use tends more towards universality than towards targeting according to need; in essence, RSF relief tries to be all things to most people. As are result, the most accurate moniker for the RSF relief measure might be the ***Universal Bill Stabilization and Rate Shock Moderation Fund***.

3.0 A Brief Economic Evaluation of RSF Relief

The effectiveness of public policy measures such as RSF relief are often examined from two basic perspectives. The first, fairness, considers how a measure is targeted and whether the value of relief provided is sufficient according to the needs of those individuals considered most in need.[21] The second perspective, efficiency, looks at the degree to which resources are diverted from their most efficient use as a consequence of government intervention in the economy. The focus of this section, and indeed this paper, is efficiency. The economic efficiency of RSF relief in the Yukon will be examined through two lenses: resource allocation impacts and price signal dilution.

3.1 Resource Allocation Considerations

By definition, because YEC is a near-monopoly, some amount of economic inefficiency is endemic to the generation and sale of electricity by the utility. The baseline inefficiency associated with the production of electricity by YEC is in fact a fundamental reason why YEC is regulated. The role of the regulator is to minimize the amount of inefficiency which inherently accompanies production by a monopoly utility. Since price is a key determinant of economic efficiency, YEC's regulator, the Yukon Utilities Board, focuses on setting an appropriate regulated price (or, rate) for electricity.

[20] It bears noting that the current version of RSF relief is no longer financed directly in its entirety by the Government of Yukon. As of April 1, 2002, 35% of RSF relief is financed by the Government of Yukon and 65% is provided by the Yukon Development Corporation with total RSF relief capped at $12 million over the three-year April 2002 to March 2005 period. The earliest incarnations of rate relief were funded by the Yukon Energy Corporation.

[21] The rationale for a curious feature of Yukon RSF relief, namely, the provision of an electricity subsidy to commercial and municipal government customers (in addition to non-government residential customers) would be hopefully be considered as part of an examination of fairness.

In terms of economic theory, the objective of the rate setting exercise is to determine the price of electricity which minimizes the deadweight loss associated with monopoly production. An alternative description of the objective of the rate setting exercise is that it seeks to maximize total social surplus, the sum of consumer surplus plus producer surplus, under a monopoly constraint.

As noted earlier in this paper, RSF relief is not actually about altering the price of electricity for the benefit of consumers faced with bill instability and rate shock. RSF relief is a subsidy measure. In consequence, the economic efficiency of the RSF relief measure, as measured by deadweight loss (or total social surplus) may be considered separately from the economic efficiency of regulated electricity prices in the Yukon.

In general, government may intervene to improve a market outcome using one of three mechanisms: price controls, subsidies and direct grants. Given that the price of electricity is already optimized for economic efficiency through rate regulation by the Yukon Utilities Board, the imposition of a price control (i.e., a price ceiling) would conflict with the price setting efforts of the regulator. In fact, if set low enough, a price ceiling could cause YEC to shut down and exit the market. Thus, from an economic efficiency perspective it is appropriate that Yukon RSF relief is not delivered in the form of a price control.

Accordingly, the number of electricity market "improvement" mechanisms from which the Government of Yukon may choose is essentially limited to two: subsidies and direct grants. In terms of economic efficiency, which mechanism is better? According to Harvey S. Rosen *et al,* a direct grant is more efficient than a subsidy:

> *One often hears proposals to help some group of people by subsidizing a commodity that they consume heavily. We have shown that this is an inefficient way to aid people. Less money could make them as well off if it were given to them as a direct grant.*[22]

The key difference between a subsidy and a direct grant is that the payment of a direct grant requires a demonstration of need which in turn (in effect) allows for the calculation of an individual's willingness-to-pay. Because individual willingness-to-pay (i.e., need) can be better matched to the actual amount of the grant than is possible with a subsidy approach, the direct grant mechanism is considered to be more efficient. Thus, while Yukon RSF relief is currently delivered in the form of a subsidy, basic economic theory suggests that it would be more efficient to deliver it in the form of a direct grant.

Another way to explain why a direct grant to electricity consumers would be more efficient is to note that a direct grant mechanism would permit much more accurate targeting of RSF relief according to some measure of need. With a subsidy measure, all customers within each RSF-eligible class receive, according to consumption, the same subsidy. For example, if two non-government residential customers consume equal amounts of electricity in a given time period, each receives the same amount of subsidy regardless of any difference in household income. In contrast, a grant

[22] Harvey S. Rosen *et al*, *Public Finance in Canada, 1999, p. 473.*

approach would likely consider household income making fewer customers eligible for RSF relief.

So, that said, here's a pickle for government. Recall that electricity is a commodity for which there are no close substitutes and that is consumed by the virtually the entire Yukon voting population. While greater efficiency could be achieved by switching from a subsidy mechanism to a direct grant mechanism, the improvement in efficiency which results from more accurate targeting means that a narrower span of the voting base will benefit from RSF relief. All put together, a rather unpalatable pickle from a political perspective.

The source of the funds used to pay for RSF relief also figures into the degree of inefficiency associated with government intervention via subsidy measures. For example, if a subsidy like RSF relief is financed with tax revenues, because the raising of tax revenues is in itself distortionary in terms of economic efficiency, aggregate inefficiency is not limited to the impacts of the subsidy measure. The complexity of the inefficiency calculation is demonstrated by the fact that in the Yukon a relatively small proportion of the tax revenues spent in the territory are actually raised here. Sub-national governments in the Yukon are for the most part financed, directly or indirectly, by federal transfers. Thus, part of the burden of inefficiency associated with of tax-financed electricity bill subsidies is borne outside the Yukon.

3.2 Price Signal Dilution

As was described in section 2.1, the peculiar physical properties of electricity bestow it with some distinctive economic characteristics. Key among those characteristics is that because the price elasticity of demand for electricity is perfectly inelastic, consumers are completely unresponsive to changes in the price of electricity *in the short-run*.

Electricity customers in the Yukon receive electricity price information in the form of a bill from The Yukon Electrical Company Limited at the end of each billing period, typically every 30 days. Within that 30-day period consumers do not receive price information which might cause them to alter their electricity consumption behaviour. Thus, it might be argued that electricity's characteristic of perfect price inelasticity is the irrelevant since customers do not receive price information via bills in the short-run anyways. Maybe true, but what about electricity price signals in the long-run?

To illustrate how the short-run differs from the long-run, suppose that instead of being billed on a monthly basis, customers were billed on daily basis. Further suppose that the Yukon Utilities Board also began to "re-regulate" electricity rates on a daily basis in response to changing supply-side costs. The price elasticity of demand for electricity would become more elastic; customers would become responsive to changes in the price of electricity. In line with the *law of demand,* the quantity of electricity demanded would decrease in the face of a price increase. Or would it? The answer depends on whether or not there are other measures muting, or diluting, the price signal being sent by the market.

As it turns out, several measures serve to dilute the electricity price signal as it tries to make its way from the supply side of the electricity market to the demand side.

Chief among them is, of course, the subsidy provided via the Rate Stabilization Fund. The other obvious measure, made so by its appearance on monthly bills, is the rebate of territorial income tax paid by The Yukon Electrical Company Limited.

Two additional not-so-obvious measures which dilute electricity price signals also at play in the Yukon electricity market are 1) residential rate cross-subsidization and 2) rate equalization.[23] The practice of residential rate cross-subsidization regulation involves using revenues collected in one customer class to reduce the cost of service and the corresponding regulated price of electricity in another customer class. As a result of rate cross-subsidization, residential class customers pay regulated prices for electricity which are 25% below what they would be in the absence of cross-subsidization. The lower rates for residential customers are subsidized by commercial and government-class customers. Because residential customers are not required to pay the full cost of service associated with their customer class the price signal which should guide their consumption behavior is diluted.

In contrast to rate cross-subsidization which operates *between* rate classes, rate equalization operates *within* two specific rate classes (non-government residential and commercial) to ensure that electricity rates are the same throughout the Yukon. A long-standing measure first introduced in March 1989, rate equalization ensures that residential and commercial customers in one Yukon community pay the same rate for electricity as residential and commercial customers on their "first block energy charge". For example, a residential customer in Old Crow is charged the same rate on their first 1,000 kW.h of electricity consumption as a residential customer in Whitehorse on their first 1,000 kW.h of electricity consumption. Similarly, a commercial customer in Haines Junction is charged the same rate on their first 2,000 kW.h of electricity consumption as a commercial customer in Watson Lake who consumes an equivalent amount of electricity.

For electricity consumption in amounts which exceed "basic service levels" (e.g., the first block energy charge amounts of 1,000 kW.h for residential customers and 2,000 kW.h for commercial customers) the rate equalization measure is terminated. The rates applied to consumption above the first block energy charge amount are adjusted to reflect the actual cost of supplying electricity in the community in which the customer is located.[24] Known as "run-out rates", the adjusted rates serve to "undilute" the electricity price signal so that heavy-use customers are encouraged to consume electricity in an effcient manner.

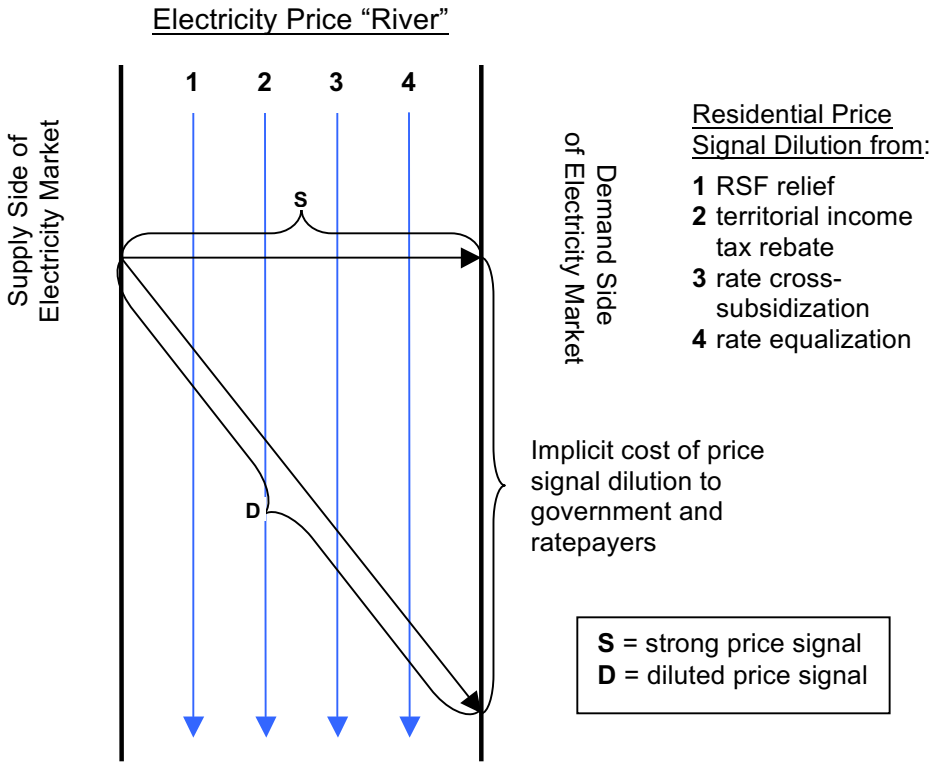
In terms of price elasticity, dilution of the price signal results in a price elasticity of demand higher than would be the case if there were no price-signal diluting measures

[23] Two other measures with decidedly more limited impact on the strength of the electricity price signal are not included in the analysis. The first measure, a provision of the Yukon *Social Assistance Act,* results in the payment of social assistance recipients' electric bills by the Government of Yukon. The second measure, the Pioneer Utility Grant, "provides financial assistance to help seniors and elders with the high costs of home heating, including wood, propane, oil and electric heat" and is worth $750 per year for eligible individuals. (Government of Yukon News Release #03-216, *Pioneer Utility Grant Applications Now Being Accepted,* October 7, 2003.

[24] Yukon communities are divided into four zones in which three distinct run-out rates are applied. The zones are delineated by community size and whether or not they are located on the Whitehorse-Aishihik-Faro (WAF) grid distribution system and in the case of Old Crow, the fact that fuel used in electricity generation must be flown into the community.

in place. To phrase it another way, in the absence of any price-diluting measures, the demand for electricity would be more elastic in the long-run (i.e., over several billing periods) than in the short-run (within a billing period). Consumers would be able to see, interpret and respond to price signals in the electricity market. Measures like RSF relief, however, cloud the consumers' view of the market and impede rational consumer responses. Thus, in a sense, measures like RSF relief keep the Yukon electricity market in a kind of perpetual short-run where demand side responses which might inform long-term supply-side investment decisions get 'washed down the river'.

Diagram 3: Electricity Price Signal Dilution: Residential Customers



Given that Yukoners are consistently provided with a safe and stable supply of electricity it may appear, on the surface, that the current approach to electricity supply and pricing in the Yukon is fine as it is. This would be true but for two important considerations. The first, as we have already seen, is that measures which dilute the electricity price signal trying to pass from the supply side of the market to the demand side also make for weak signals going back across from the demand side to the supply side of the electricity market. A strong two-way link between the demand and supply sides of the electricity market supports supply-side efficiency in the long-run.

The second consideration is that the practice of diluting electricity price signals (i.e., intervening in the market) is not cost-free for government and ratepayers. For

example, the cost of RSF relief for residential customers was approximately $3 million in 2002. Thus, in terms of RSF relief, the implicit costs of market intervention may appear small in any given year relative to the perceived political benefit. From an economic policy perspective, however, aggregate RSF relief costs are adding up over time with little to show for it in terms of a long-term structural response to the structural change in the Yukon economy which precipitated the introduction of RSF relief at the outset.

4.0 Concluding Observations

While the primary purpose of this paper has been to outline the economic fundamentals underlying the current version of the Yukon RSF relief program, this final section offers some brief concluding observations:

1. Electricity spending constitutes a relatively small share of total household spending in the Yukon, a result consistent with other jurisdictions. This would remain true in the absence of RSF relief.

2. The RSF relief measure dilutes the electricity price signal in part because it is a bill subsidy and in part because it is overly complicated. For example, even when the measure attempts to improve the strength of the price signal, such as through a reduction in relief in the summer months, it is not obvious from looking at a typical bill that electricity customers are being encouraged to consume less electricity.

3. The RSF relief measure is very broadly targeted; all residential, commercial and municipal customers are eligible for some amount of RSF relief. Taken together with the fact that the measure is delivered in the form of a subsidy this suggests that costs to government could be reduced and/or relief improved for some customers through better targeting.

4. While RSF relief is better delivered via subsidy rather than by price controls, improved economic efficiency could likely be achieved if the RSF relief measure was delivered in the form of a direct grant rather than a subsidy.

5. Measures which intervene in the Yukon electricity market, of which RSF relief is but one, serve to keep the market in a "perpetual short-run". As a result, price signals which might guide rational consumer behavior in both the short-run and long-run are being lost. The benefit of rational consumer behaviour, which would improve long-term supply-side efficiency, is also being lost.

6. The aggregate cost to government of RSF relief is continuing to grow. Notwithstanding this fact, the RSF relief measure remains an ineffective approach to addressing the long-term structural issues which led to the initial introduction of the measure since it dilutes the market-based price signals which could potentially lead to a market-based solution.

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