BC hydro

Energy Policy Implementation Process

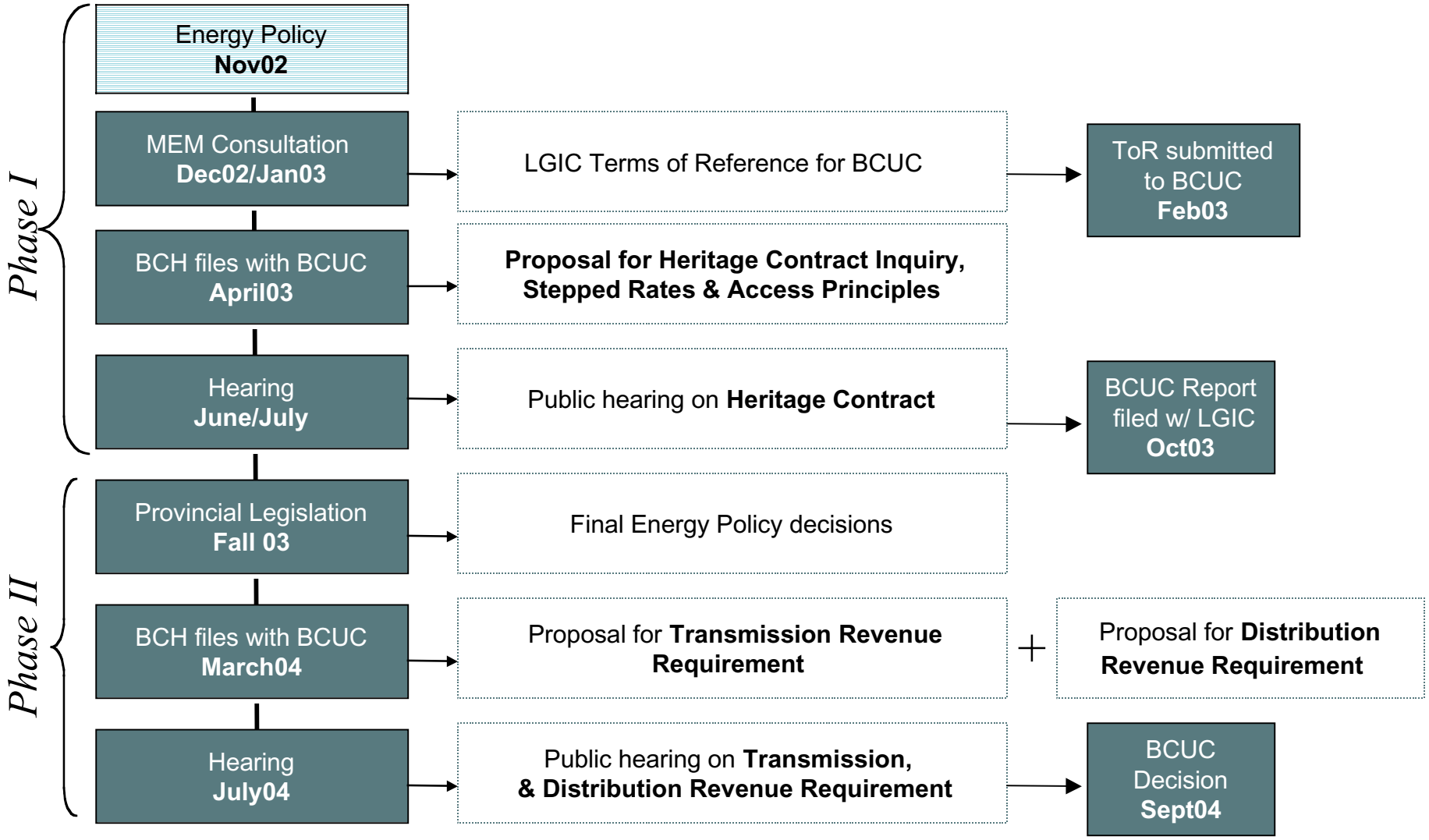
BC Hydro Information Session and Workshop on Stepped Rates and Access Principles

March 5, 2003

Goals of the Workshop

- Present a number of rate design parameters that meet the goals and objectives of the Energy Plan.
- Identify some key implementation issues.
- Solicit input from customers and other interested parties to assist BC Hydro frame its Stepped Rates proposal.

Energy Policy Implementation *Proposed*



Direction from the Energy Plan

Energy for our Future: A Plan for BC

British Columbia needs to make some changes to the energy sector to encourage new investment and increased trade, while ensuring continued low power rates And environmentally responsible energy development. A series of policy actions will be implemented, or are already underway, to achieve these objectives.

Policy Action #1	A legislated **heritage contract** will preserve the benefits of BC Hydro s existing generation.
Policy Action #2	BC Hydro ratepayers will continue to benefit from **electricity trade**.
Policy Action #5	The **BC Utilities Commission** will once again regulate BC Hydro rates.
Policy Action #9	Electricity distributors will **acquire new supply on a least-cost basis**, with regulatory oversight from the BCUC.
Policy Action #13	The **private sector** will develop new electricity generation, with BC Hydro restricted to improvements at existing plants.
Policy Action #14	Under new rate structures, large electricity consumers will be able to **choose a supplier** other than the local distributor.
Policy Action #16	The BCUC will determine the terms and rates of the **BC Hydro Transmission Company**.
Policy Action #21	New rate structures will provide **better price signals** to large electricity consumers for conservation and energy efficiency.

Energy Plan Policy Actions - a closer look

Policy Action #14: Under new rate structures, large electricity consumers will be able to choose a supplier other than the local distributor.

New stepped pricing will provide an incentive for large industrial or transmission rate customers to purchase from IPPs, or to self-generate, when they can do so less expensively than the utility s cost of new supply. These larger customers will be able to meet all or a portion of their consumption from private generation. This policy change introduces retail competition for large BC Hydro customers.

Energy Plan Policy Actions - a closer look

Policy Action #21: New rate structures will provide better price signals to large electricity consumers for conservation and energy efficiency.

The BC Utilities Commission will conduct a hearing to develop new stepped and time-of-use pricing for BC Hydro s industrial and large commercial customers. As a principle, for stepped rates, the last block of energy consumed should reflect the cost of new supply. This will encourage these customers to meet part of their electricity needs through conservation and energy efficiency, or from other sources (self-generation or IPP purchases), where they can do so cost-effectively. To keep rates low overall, the stepped rate structure will be revenue-neutral. Time-of-use rates will encourage customers who can manage the timing of their electricity use to shift consumption to low-priced off-peak periods.

Note that our interpretation of this Policy Action is that the new stepped rate is mandatory.

Introduction to Stepped Rates and Access Principles

New stepped rate design to implement Policy Actions

- Stepped rate design marries the twin policy goals of preserving the benefits of low, 1821 rates while providing better price signals for marginal consumption decisions.
- A stepped rate design features different rates for different blocks of energy consumption. For example, consumption up to *X* MWh is priced at Tier 1 rate, consumption above *X* MWh is priced at Tier 2 rate.
- Rate designed to meet the following objectives and constraints:
  1. To preserve benefits of low-cost hydro power, the Tier 1 rate must be set at low, embedded cost (1821) rate.
  2. To provide customers with an appropriate price signal for conservation, the Tier 2 rate must be tied to an estimate of the market value of energy.
  3. To avoid shifting costs among customers, the rate design must be revenue neutral for each customer at historical consumption levels.
  4. To provide meaningful customer choices, the rate design must be neutral with respect to customer s choice of energy supplier (BCH, IPP or marketer), self-generation, or DSM.
  5. To avoid unnecessary implementation expense, the new rate design must be easy to understand and implemented with minimal regulatory process.

New stepped rate design to implement Policy Actions

Idea of stepped rate design is to provide incentives for new investment that is beneficial to the province. However, some rate designs can provide unexpected or undesirable incentives.

Desirable Incentives

- Customers invest in cost-effective conservation and self-generation.
- Customers engage in cost-effective load growth.
- Customers and IPPs make mutually beneficial direct access arrangements that do not harm non-participating customers.
- IPPs invest in cost-effective new merchant generation.

Undesirable Incentives

- Customers shut down facilities and receive financial benefits as if they had invested in conservation.
- Customers continually switch back and forth between rate designs or suppliers depending on which one provides immediate gain.
- Customers choosing direct access shift costs onto other 1821 or non-1821 customers.

New stepped rate design to implement Policy Actions

The set of objectives and constraints is fairly restrictive and circumscribes the available rate design choices.

Rate Designs that are in-bounds

- Tiered rate with Tier 1 rate applied to a fraction (e.g., 60%) of historical use
- Tiered rate with Tier 1 rate applied to 100% of historical use
- Tiered rate with Tier 2 rate set at long-run incremental cost
- Tiered rate with Tier 2 rate indexed to wholesale market prices
- Tiered rate with RTP-type mechanism that credits conservation at market prices regardless of Tier cutoffs

Rate Designs that are out-of-bounds

- Tier 1 rate set at market value of energy (i.e., mandatory retail restructuring)
- Tier 2 rate set lower (or higher) than market value
- Punitive entry and exit requirements that prevent meaningful retail choice
- Increased costs to other customers as a result of retail choice
- Complete redesign of 1821 rate structure
- Growing demand met at 1821 rate
- Substantial changes to WTS design

Stepped rate design parameters

- The objectives and constraints leave a number of rate design parameters about which choices must be made:
  1. Cutoff point between Tier 1 and Tier 2 and credit for reducing load served by BC Hydro
  2. Design of Tier 2 rate
  3. Method of implementing direct access
  4. Treatment of transmission

- We present here some options that are thought to meet the objectives and constraints. This is not necessarily an exhaustive list — additional suggestions are welcomed!

Stepped Rate Design Parameters

1: Tier 1 Cutoff Point

2: Design of Tier 2 Rate

3: Customer Direct Access

4: Transmission

Design Parameter 1: Tier 1 cutoff point

A stepped rate design requires a choice of where to place the cutoff between tiers.

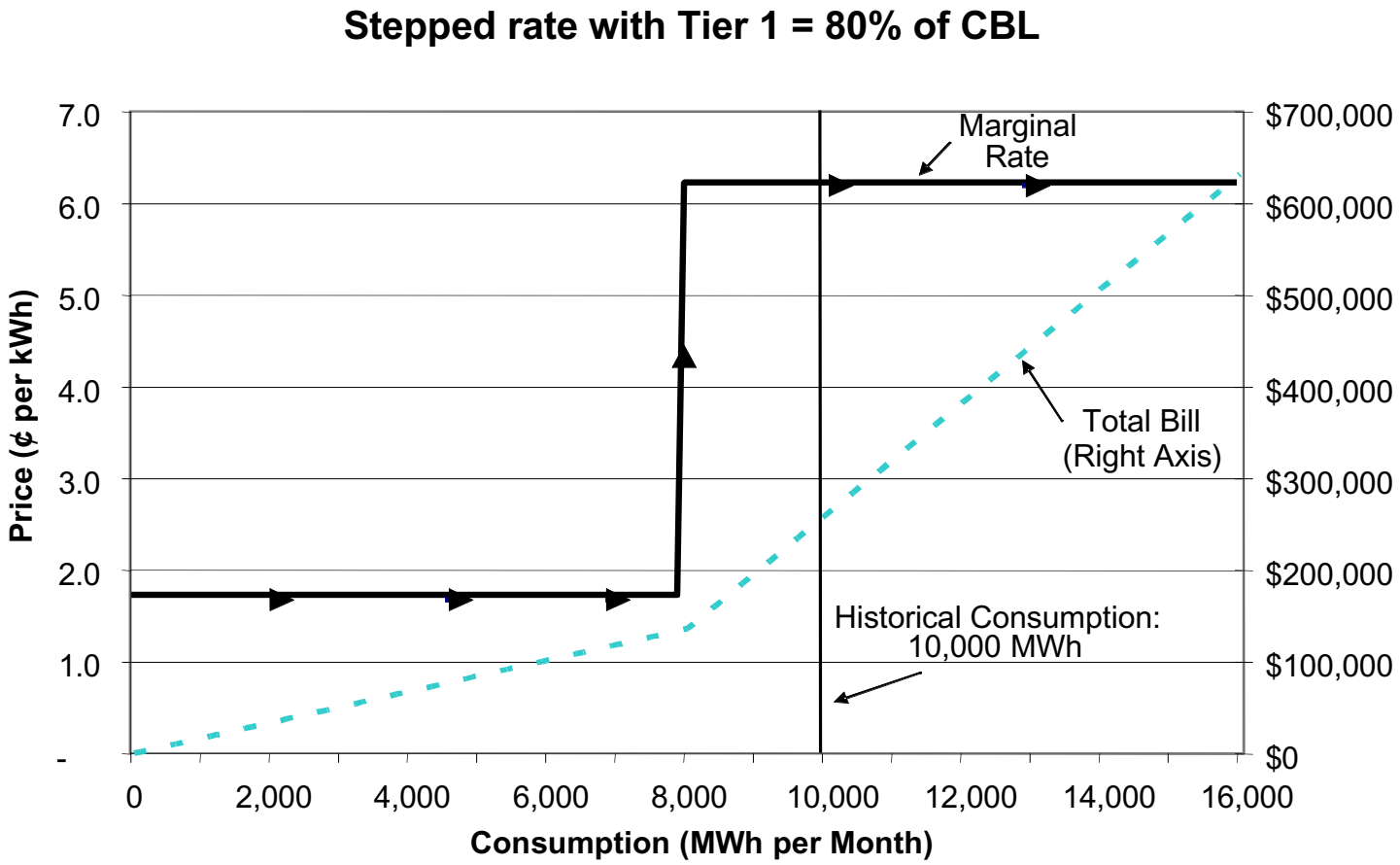
- Customer baseline (CBL) established for each customer based on some estimate of historical consumption (e.g., average 2000-2002 consumption).
- Cutoff set at *Y*% of CBL. Consumption below *Y*% charged Tier 1 rate, consumption above *Y*% charged at Tier 2 rate.
- *Y* can range from a small number (e.g., 60%) to a large number (100%).
  - The smaller *Y* is, the lower the Tier 1 rate and the steeper the jump up to Tier 2.
  - At *Y*=100%, the Tier 1 rate is the same as the 1821 rate.
- Additional option to reward all conservation at Tier 2 rate through RTP-type credit mechanism.

Stepped rate examples: varying cutoff points and Tier 1 rates

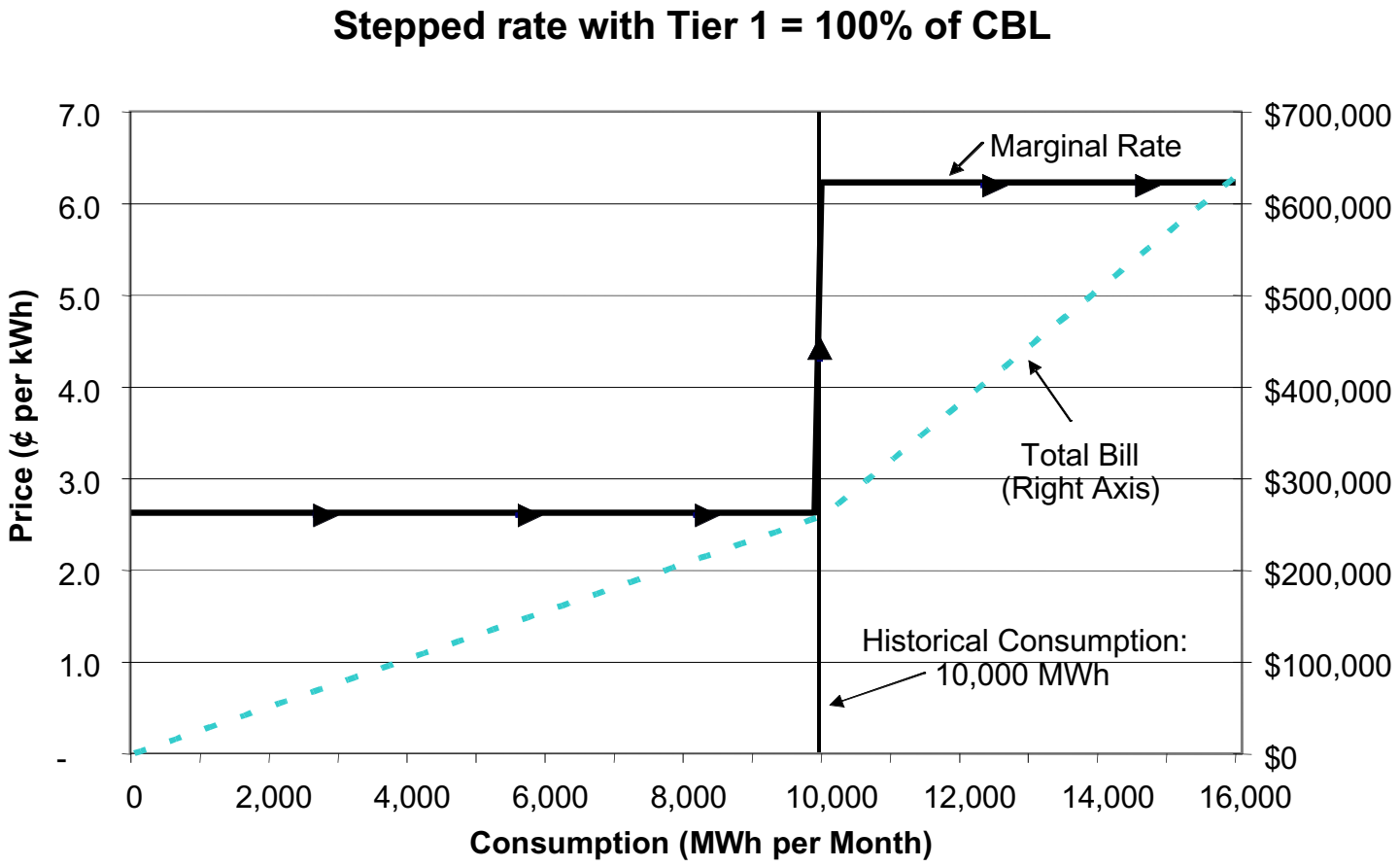
Three stepped rate examples: fictional customer with historical consumption of 10,000 MWh per month. Given Tier 2 rate set at market-based price of 6.2¢/kWh, the three examples show different price and quantity combinations that achieve revenue neutrality.

	Tier 1 Cutoff: 60%	**Tier 1 Cutoff: 80%**	**Tier 1 Cutoff: 100%**
1821 class average rate (¢/kWh)	2.599	2.599	2.599
Monthly consumption (MWh)	10,000	10,000	10,000
Tier 1 (lower tier), MWh up to:	**6,000**	**8,000**	**10,000**
Tier 1 monthly consumption (MWh)	6,000	8,000	10,000
Tier 1 rate (¢/kWh)	0.198	1.699	2.599
Tier 1 monthly bill	$11,900	$135,900	$259,900
Tier 2 (upper tier), MWh greater than:	**6,000**	**8,000**	**10,000**
Tier 2 monthly consumption (MWh)	4,000	2,000	-
Tier 2 rate (¢/kWh)	6.200	6.200	6.200
Tier 2 monthly bill	$248,000	$124,000	$0
Total under new rate design			
Tier 1 + Tier 2 monthly bill	$259,900	$259,900	$259,900
Average rate for all consumption	2.599	2.599	2.599

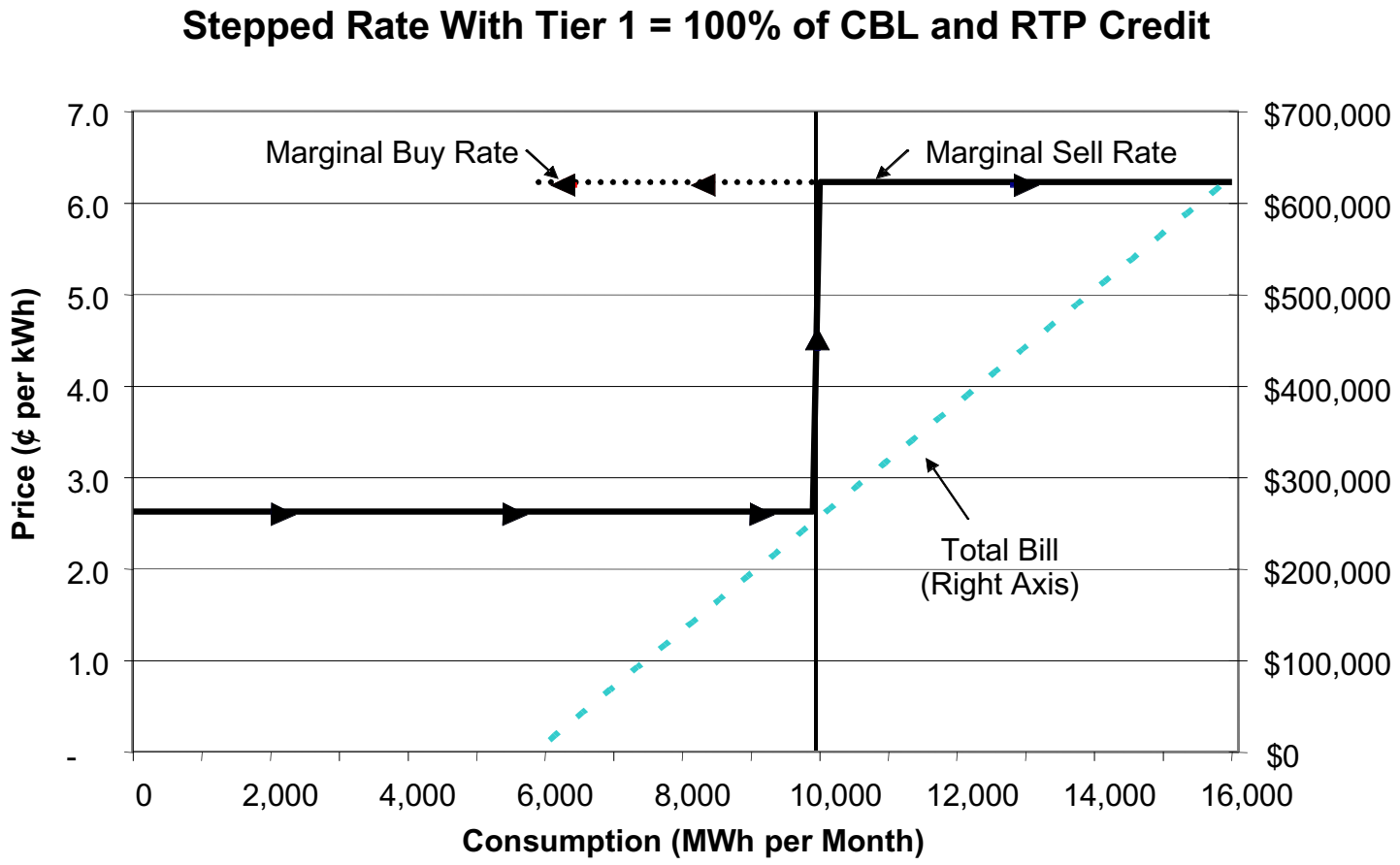
Stepped rate design illustration



Stepped rate design illustration



Stepped rate design illustration



Customer incentives: credits for reduced consumption

- Reduced consumption can be the result of three different causes:
  1. Energy efficiency —same or greater production with less energy consumption.
  2. Self-generation —customer installs behind-the-meter generation or combined heat and power system.
  3. Partial or full shutdown — customer reduces energy consumption by reducing production.
- Economic development goals may require distinguishing (3) from (1) and (2) and reducing or eliminating the credit in case of permanent shutdown.
- This problem is self-limiting with Tier 1 < 100% of CBL; reduction below Tier 1 cutoff rewarded at Tier 1 rate.
- Under RTP credit option, there would need to be a lower limit, e.g., *Z*% of CBL, below which a procedure is required to determine eligibility for further credits.

Design Parameter 1: Summary

- Stepped rate design without RTP-type credit requires careful choice of Tier 1 cutoff:
  - Setting Tier 1 cutoff too low results in ridiculously low Tier 1 rate —at the extreme, Tier 1 power would be free!
  - Setting Tier 1 cutoff too high means the savings available may not be sufficient to justify large investments.
- Stepped rate design with RTP-type credit provides stronger incentives, but requires administrative safeguards:
  - Incentive to conserve, self-generate or choose direct access for entire customer load.
  - Could implement RTP-type credit regardless of choice of Tier 1 cutoff.
  - However, need limit on customer savings to avoid rewarding permanent plant shutdown.

Stepped Rate Design Parameters

1: Tier 1 Cutoff Point

2: Design of Tier 2 Rate

3: Customer Direct Access

4: Transmission

Design Parameter 2: Tier 2 rate

A stepped rate design that meets the policy objectives requires a Tier 2 rate based on an estimate of the value of energy. Two possible methodologies:

A. Based on an administrative estimate, e.g., long-run incremental cost (LRIC).

- Provides stability and predictability for customer investment.
- However, customer investments expose BC Hydro to risk, because it is forced to credit long-term load reductions at LRIC, even during times when LRIC is a poor estimate of BC Hydro s opportunity costs.
- Customer-specific rate based on customer load *factor*.

B. Indexed to wholesale market prices.

- Provides market-based price signals, leading to better short-term demand response and more efficient consumption decisions.
- However, wholesale market price volatility may discourage long-term investment.
- Customer-specific rate based on customer load *profile*.

Both methodologies require the use of access rules to prevent arbitrage and strict accounting/procurement procedures to insulate all other customers from the costs and risks of Tier 2 rates.

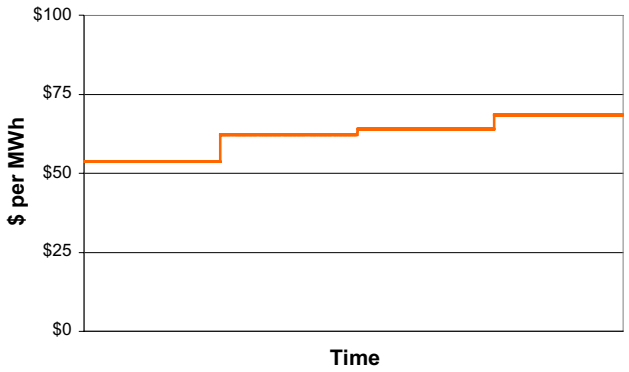
Design Parameter 2: Tier 2 rate

Tier 2 rate must be updated periodically to reflect changing market conditions.

- LRIC adjusted monthly or annually to reflect changes in fuel prices.
- Market-indexed rate could be updated more frequently, e.g., daily, monthly.
  - More frequent updates provides better price signals. Daily or monthly updates may be based on forward prices from a liquid trading hub, e.g., Mid-C.
  - Less frequent updates mute daily and seasonal price signals, but provide stability and certainty. Suppliers will likely require a risk premium to lock in prices for longer terms.
- Frequency of update could be a customer choice parameter. Customers with ability to vary consumption may favor a daily update; risk-averse customers may favor updates on an annual or longer basis.
- If longer-term price quotes are not available, or if forward markets are illiquid, BC Hydro could facilitate price discovery by, for example, conducting auctions for forward products.

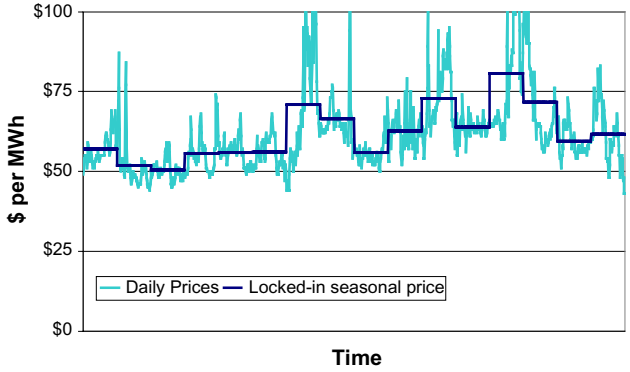
Design Parameter 2: Tier 2 rate

LRIC or Market Rate Updated Annually



- Infrequent updates provide stable, long-term price signals for investment.
- LRIC rate determined through administrative process, updated for changes in fuel prices.
- Easy to calculate and administer, however, does not provide accurate short-term price signals.
- Annual market rate probably higher than daily rate because suppliers charge risk premium to lock in prices in advance.

Market Rate Updated Seasonally or Daily



- More frequent updates provide better price signals about the current value of energy.
- Opportunity for customers who can vary their consumption to earn revenues during high-priced times.
- Customers protected from market volatility for consumption up to CBL.
- More complicated structure — based on market index, e.g., Mid-C, or auction price.

Design Parameter 2: LRIC Option

The LRIC is a calculated number based on a traditional long-run avoided cost methodology, using a hypothetical resource. For example, the LRIC could be based on the fully allocated cost of a natural gas-fired, combined-cycle, combustion turbine (CCGT).

- CCGT Capital and Site Costs: US $450-550 per kW, based on costs of CCGTs built or permitted in California.
- Fuel Cost: US $4.14 as of early February 2003, average NYMEX Henry Hub futures prices between 2003 and 2008. Adjusted to reflect price appropriate for Pacific Northwest.
- Heat rate: 6800 kWh per MMBtu, based on specs from GE and Westinghouse as reported by the California Energy Commission.
- Variable O&M: US $2-3 per MWh, based on data from units already in service as reported by the California Energy Commission.
- Capacity Factor: 60-80%, depending on customer load factor.
- Fixed Charge Rate: US $10-20 per MWh depending on capital and depreciation assumptions.

Result: CDN 6.2 — 7.9 ¢ per kWh.

Design Parameter 2: LRIC Option

The LRIC will vary depending on the duration of the locked-in price estimate.

- Natural gas prices are currently higher for the near-term than for the long-term. As a result, prices are lower for longer duration estimates.
- Methodology combines administrative estimates of capital and O&M costs with forward market estimates of fuel costs.
- Customer specific based on load factor of load served by BC Hydro.

	Duration of price estimate			
	6 months	1 year	3 years	8 years
Natural Gas Futures (US$ per MMBtu)*	$5.04	$5.01	$4.44	$4.14
BC Hydro Retail Rate (CDN ¢/kWh)				
70% Load Factor	7.37	7.27	6.73	6.38
80% Load Factor	7.15	7.05	6.51	6.16
90% Load Factor	6.97	6.88	6.33	5.99

*NYMEX Henry Hub February 2003

Design Parameter 2: Market Option

The market option for calculating the Tier 2 rate is more complicated than the LRIC approach, but provides additional flexibility and a market-based price signal. Market-based rate requires independent estimates of the market value of energy:

- **Price indexes** for products that are traded in liquid markets. For example, daily and monthly on-peak (6x16) blocks are traded at the Mid-Columbia trading hub, and price indexes are published by a number of sources.
- **Auctions** for forward products that are not widely traded. BC Hydro hires an auctioneer to solicit bids from IPPs and conduct an auction for various blocks per customer election. Because BC Hydro executes a forward contract at the auction price, the auction accomplishes both price discovery and risk management goals.

Design Parameter 2: Market Option

Market prices would also vary depending on the duration of the locked-in price estimate.

- Daily rates valid only for a single day.
- Rates for monthly and longer products locked in at some point ahead of time.
- Longer-term/non-standard products available through auction process.
- Market rate indexed to market located outside of BC adjusted for delivery to the BC border.

	Duration of price estimate			
Frequency of price update	Daily (2/18/2003)	Monthly (March 2003)	Quarterly (Q2 2003)	Annually (CY 2004)
Mid-C Forward Indexes, US $/MWh	$47.23	$46.25	$42.75	$43.75
Daily Retail Rate CDN ¢/kWh	7.48	-	-	-
Monthly Retail Rate CDN ¢/kWh	7.45	7.33	-	-
Quarterly Retail Rate CDN ¢/kWh	7.60	7.60	6.80	-
Annual Retail Rate CDN ¢/kWh	8.36	8.36	8.36	6.95

Note: based on 2/17/03 price indexes from Platts, plus BPA transmission charge and exchange rate of 1.52.

Design Parameter 2: Summary

- LRIC-based rate provides simplicity but no choice:
  - LRIC rate is calculated based on agreed-upon formula.
  - LRIC is unrelated to actual market prices at any given time.
  - Some additional cost because either BC Hydro or third-party supplier takes on price risk.
- Market-based rate provides choice but is complicated to administer:
  - Market prices will vary over time, and will be different for each customer depending on load characteristics and selected update frequency.
  - May require BC Hydro to facilitate price discovery by conducting auctions for products with insufficient liquidity.
  - If customers have choices, need administrative safeguards against potential for arbitrage among available rate designs. This most likely means a sign-up period with commitments of a fixed duration.
- The two approaches probably converge in the long run; long-term deals (e.g., 7-10 years) in the market are probably priced using an LRIC-type method.

Stepped Rate Design Parameters

1: Tier 1 Cutoff Point

2: Design of Tier 2 Rate

3: Customer Direct Access

4: Transmission

Design Parameter 3: Direct Access

Policy Action #14 introduces retail competition for large BC Hydro customers . Direct access means that customer purchases energy from third-party supplier. Stepped rate design can facilitate direct access by some customers while mitigating cost and risk impacts to others.

- Tier 1 rate will probably be too low to allow for significant competition from third-party supplier.
- Under stepped rate with no RTP credit, customers could take direct access for load priced at Tier 2 rate while continuing to take Tier 1 portion from BC Hydro.
- This provides a modest but efficient incentive for third party suppliers to recruit large retail customers.

Design Parameter 3: Direct Access

RTP-type credit for incremental load reduction allows customer to take direct access up to its total energy demand without losing benefit of low 1821 rate, through a shopping credit from BC Hydro.

- The shopping credit would be equal to the Tier 2 rate times the amount of load served directly by a third-party supplier.
- Remaining customers would be held harmless if the Tier 2 rate is equal to BC Hydro s opportunity cost — the value BC Hydro can reap by reselling the power on the wholesale market.
- However, because accurate calculation of opportunity cost is problematic, this poses some risk for remaining customers.
- Direct access customers would benefit:
  - If third-party price is more attractive than BC Hydro s Tier 2 rate.
  - If taking full load to market gets a better price than a smaller increment.
  - If other services such as energy management are bundled with third-party energy supply.

Direct Access example

- Bill comparison demonstrates one way to design revenue-neutral retail access.
- Assumes Tier 1 cutoff set at 100% of CBL with RTP-type credit, no Tier 2 bill due.
- Customer takes direct access for entire historical load.
- Customer pays BC Hydro for CBL quantity.
- Customer also pays IPP for energy delivered to BC Hydro.
- Example assumes IPP rate equal to BC Hydro Tier 2 rate. Customer benefits if IPP rate lower.
- Shopping credit equal to BC Hydro Tier 2 rate.
- Shopping credit quantity equal to quantity served by IPP.
- Rate is revenue neutral if Tier 2 rate is equal to BC Hydro s opportunity cost.

Direct Access comparison

	BC Hydro	Direct Access
Monthly customer baseline amount (MWh)	10,000	10,000
Monthly consumption taken from BC Hydro (MWh)	10,000	-
Monthly consumption taken from IPP (MWh)	-	10,000
Total monthly consumption (MWh)	*10,000*	*10,000*
BC Hydro Bill		
Tier 1 (lower tier), MWh up to:	**10,000**	**10,000**
Tier 1 monthly consumption (MWh)	10,000	10,000
Tier 1 rate (¢/kWh)	2.599	2.599
Tier 1 monthly bill	$259,900	$259,900
Tier 2 (upper tier), MWh greater than:	**10,000**	**10,000**
Tier 2 monthly consumption (MWh)	-	-
Tier 2 rate (¢/kWh)	6.200	6.200
Tier 2 monthly bill	$0	$0
Total monthly bill from BC Hydro	*$259,900*	*$259,900*
IPP Bill		
IPP monthly consumption (MWh)	-	10,000
IPP rate (¢/kWh)	6.200	6.200
Total monthly bill from IPP	*$0*	*$620,000*
Shopping Credit		
Shopping credit quantity	-	10,000
Shopping credit rate	(6.200)	(6.200)
Total shopping credit	*$0*	*($620,000)*
Total Monthly Bill		
Monthly bill before shopping credit	$259,900	$879,900
Shopping credit	$0	($620,000)
Monthly bill after shopping credit	$259,900	$259,900
Average rate for all consumption	2.599	2.599

Stepped Rate Design Parameters

1: Tier 1 Cutoff Point

2: Design of Tier 2 Rate

3: Customer Direct Access

4: Transmission

Design Parameter 4: Transmission

Existing 1821 rate is a bundled rate that includes allocated share of transmission fixed costs. Three major options for structuring demand charge under stepped rate design:

Option 1: Customer continues to pay 1821 demand charge of $4.411/kVa-month for metered demand served by BC Hydro.

- This option preserves sharing of costs that is in place today.
- Conserving customer can reduce both demand and energy payments.
- IPP pays WTS rate for deliveries to BC Hydro on behalf of direct access customer. To the extent that WTS and 1821 demand charges are different, this option is not entirely revenue-neutral.

Design Parameter 4: Transmission

Option 2: Customer pays 1821 demand charge times CBL demand, but receives a credit based on the WTS rate.

- Conserving customer can reduce both demand and energy payments.
- This option is revenue-neutral for direct access customer.
- Since the WTS and 1821 demand charges are not identical, this option is not exactly revenue-neutral for a conserving customer.

Option 3: Customer pays 1821 demand charge times CBL demand, regardless of actual metered demand.

- This option provides price signals that are more reflective of BC Hydro s incremental costs related to customer demand changes.
- Conserving customer does not reduce CBL demand payment.
- Results in double-billing for direct access customer if IPP pays WTS rate for deliveries to BC Hydro.

Design Parameter 4: Transmission

- For self-generating customers, Options 1 and 2 require resolution of issues related to net vs. gross billing and appropriate charges for occasional transmission use due to on-site plant outages.
- Key policy choice:
  - Options 1 and 2 result in rates that are roughly comparable for all 1821 customers, but affect short-term price signals and are not 100 percent revenue-neutral.
  - Option 3 sends price signals based on incremental generation costs, but double-bills direct access customers and results in different effective rates among customers with similar demand (since demand charges are based on historical demand).

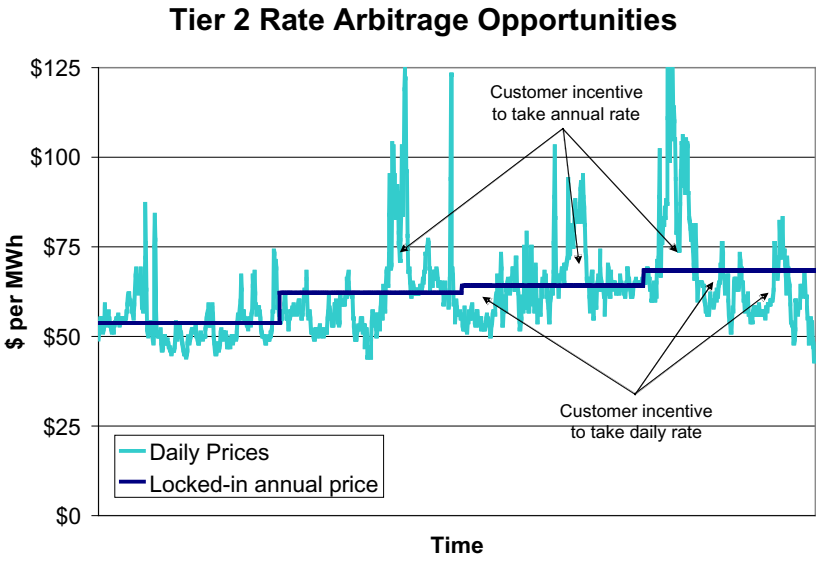
Implementation Issues

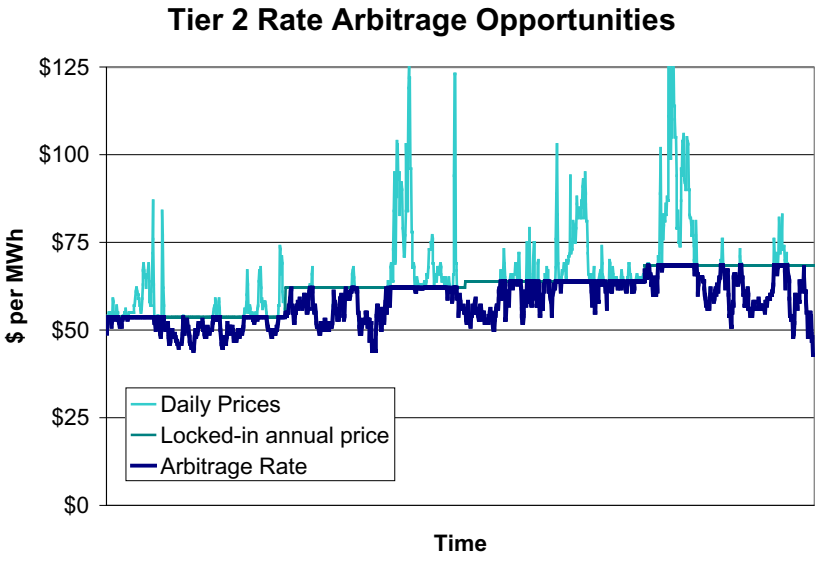
Implementation Issues

Some of the rate design choices discussed have the potential to increase the financial risk for BC Hydro and its customers. Sources of risk include:

- Customer or marketer arbitrage between daily and annual rates.
- Customer arbitrage of choices based on load factor.
- Tier 2 rate that is not a good estimate of BC Hydro s opportunity cost.
- Insufficient safeguards against issuing credits for plant shutdown.

Implementation Issues: Arbitrage of daily vs. annual rates

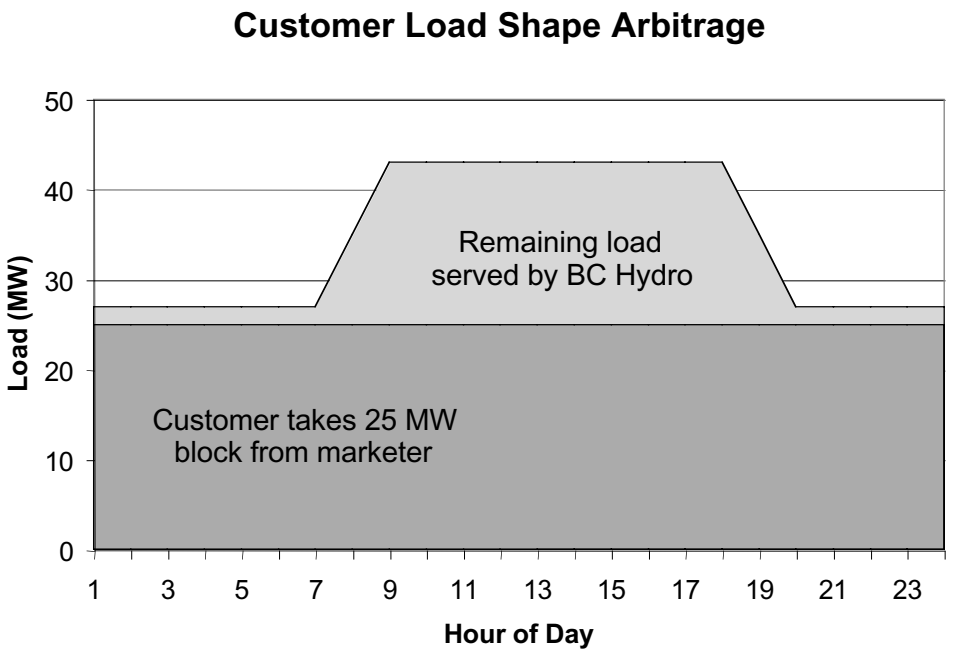




- If given a choice, customers will want daily rates when daily price is lower than annual price, and annual rates when the daily price is higher. Result is lower of rate, which is not revenue-neutral.
- May need administrative mechanisms to prevent cream-skimming and arbitrage. These could include fixed terms of Tier 2 rate choices, accounting mechanisms to ensure that risk management costs are allocated appropriately.
- Balancing energy presents an arbitrage opportunity even with limitations on rate design choices.

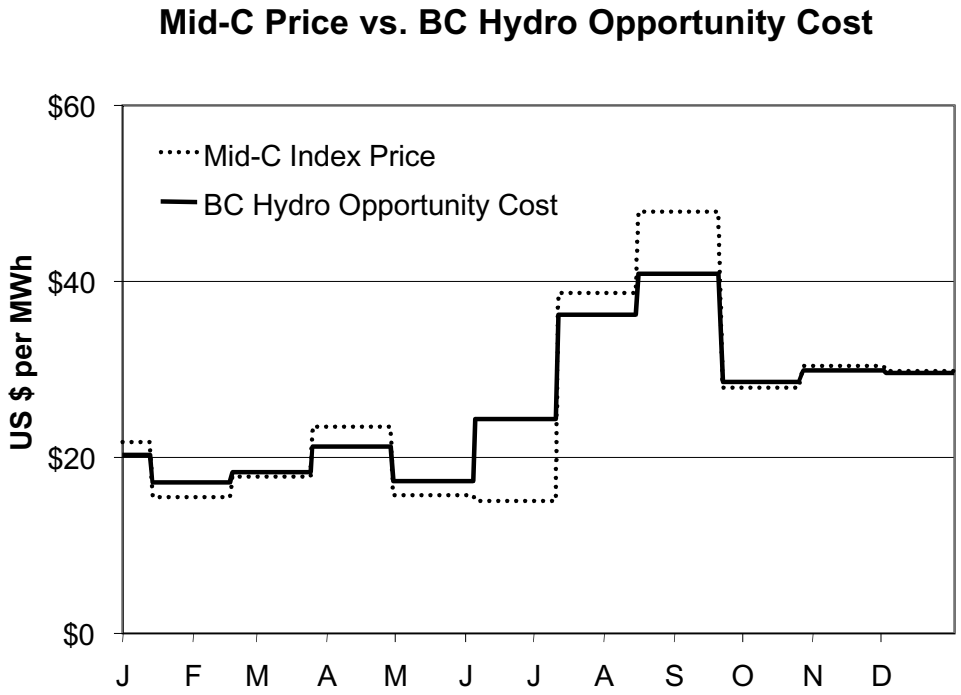
Implementation Issues: Arbitrage of load shape

- Marketers will be more interested in serving flat loads.
- If customers are allowed unrestricted choice of market instruments, BC Hydro may be left with undesirable load.
- This increases the per MWh cost of serving 1821 load.
- Tier 2 rate will need to reflect shape of load still served by BC Hydro.



Implementation Issues: Market Index

- The most liquid market hub with long-standing price indexes is Mid-Columbia in Washington.
- However, Mid-C is not always a good proxy for BC Hydro opportunity costs.
- BC Hydro purchases energy from the U.S. in the spring to take advantage of reservoir storage, and re-sells it during the summer.
- This problem is exacerbated by transmission constraints that limit imports during the spring and exports during the summer.
- This difference represents risk to BC Hydro and other customers.



Implementation Issues: Potential Fixes

- Fixed annual terms for any rate design choice, with limited sign-up period.
- Create revenue neutral balancing energy provisions to prevent over-reliance on BC Hydro when market prices are high.
- Well thought-out risk management policies by BC Hydro Distribution to hedge market risks.
- Spread between buy and sell prices to recover risk management costs.
- Strict accounting procedures to allocate risk management costs appropriately.
- Vary Tier 2 rate to reflect cost to serve the profile of load remaining with BC Hydro.
- Limitation on RTP credit for each customer absent verification of investment.
- Global limit on participation in RTP credit program with phase-in period.

Departure Points for Discussion

Discussion Question 1

Based on what you heard today, what is your initial reaction at the effectiveness of the stepped rate to induce you to modify the amount of power that you purchase from BC Hydro?

Discussion Question 2

What are the characteristics of the stepped rate design that would prevent you from modifying your purchases from BC Hydro?

Discussion Question 3

How can the stepped rate be used to:

a) incent investment in conservation OR self generation?

b) contract directly with an IPP for incremental supply?

c) modify your plant operation?

Discussion Question 4

If you are a marketer / IPP developer,
do the parameters of the stepped rate
create an opportunity to sell power in BC?