The Inverted Block Rate:
An Alternative to Flat Rate Billing

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Introduction

- Modern societies rely on electrical energy
- Utilities need to recover costs of production and generate income
- This requires billing and revenue collection
- Metering and Rate Models facilitate collection

Rate Models

A Rate Model is a mathematical formula used to calculate a customer's utility bill.

- Rate models do more than generate revenue
- Type of model can influence consumption patterns
- Models may add benefits or penalties

Rate Models

- There are various rate models used in the industry

Basic Rate Model: $y = dx + ez + c$

\$ = Demand Rate x (Demand) + Energy rate x (energy) + Constant Charge

Real-Time Model: $y = Se_t z_t + c$

\$ = Total Energy / Interval x (Energy Rate for Interval) + Constant Charge

Flat Rate model: $y = ez + c$

\$ = Total Energy Consumption x (Energy rate) + Constant Charge

Rate Models

- The **y= ez + c** Flat rate model is used for residential billing in Nova Scotia
- Flat rate models have a number of limitations:
  - They restrict the ability to create price signals
  - They create cross-subsidization between non-peak coincident and peak coincident customer
- Flat rate models are unfair and inefficient

Price Signals and Cross-subsidies

Under a Flat Rate model:

- Any change in price affects all customers, regardless of level of energy consumption
- Methods of influencing consumption are limited
- Non-peak demand customers are *overcharged*
- Peak demand customers are *undercharged*

Cross-subsidies

	Demand during system peak	
	Disproportionately lower	Disproportionately higher
Small customer	Paying too much	Paying too little
Large customer	Paying too much	Paying too little

The Inverted Block Rate Model

An alternative to the flat rate model is the:
Inverted Block Rate (IBR) model

- Block rate models divide usage into several blocks
- Each block has distinct pricing
- A block rate with an increasing price structure is said to be *inverted*
- IBR has several advantages over a Flat Rate model

Inverted Block Rate

A Simple Example:

Block	**Price ($/unit)**
0 to 2,000 units	0.09
2,001 to 4,000 units	0.10
Greater than 4,000 units	0.11

Inverted Block Rate

3 customers: 1500, 2500, and 4500 unit consumptions

Customer consumption	Block 1 ($0.09 /unit)	Block 2 ($0.10 /unit)	Block 3 ($0.11 /unit)	Total charges	Price /unit
1,500	1,500	0	0	$135.00	$0.090
2,500	2,000	500	0	$230.00	$0.092
4,500	2,000	2,000	500	$435.00	$0.097

Inverted Block Rate

- IBR encourages conservation with price signals
- Allows use of existing metering technology
- Improves on cross-subsidization:

	Demand during system peak	
	Disproportionately lower	Disproportionately higher
Small customer	Lower charges	Lower charges
Large customer	Higher charges	Higher charges

The Inverted Block Rate Model

- Implementation of the IBR involves
  - Selecting the number of blocks
  - Assigning consumption limits to each block
  - Assigning prices to each block
  - Calculating revenue from Utility’s customer database
  - Repeating process until desired revenue is obtained

NSPI's Residential Sector

- Are their alternatives to NSPI's 8.61 to 9.49 ¢/kWh (10.22 percent) residential rate increase?
- NSPI's residential consumption supplied by NSPI:

Range (kWh)	Number of Customers	Total Consumption (kWh)
1,900-2,000	2,943	4,742,965

- Divide customers and consumption into *quintile groups*: five (5) divisions representing 20% of the customer base

Customer quintile groups

Quintile group	Consumed kWh	Percentage of residential consumption	Average kWh	Quintile (kWh)
1	137,354,326	3.48%	1,639	3,400
2	397,083,031	10.07%	4,739	6,300
3	630,272,845	15.99%	7,522	9,100
4	953,057,741	24.18%	11,375	14,000
5	1,823,690,416	46.27%	21,766	

Consumption quintile groups

Quintile group	Number of customers	Percentage of customers	Maximum kWh
1	199,997	47.74%	7,400
2	89,128	21.28%	10,900
3	62,468	14.91%	15,700
4	42,222	10.08%	23,000
5	25,116	6.00%	1,643,900

A Residential IBR for Nova Scotia

- Create the Inverted Block Model by:
  - Assigning Blocks
  - Evaluating the required revenue
  - Other issues

Assigning Blocks

Block	Limits (kWh)	Customer Quintile-groups	Total consumption (kWh)
1	3,400	1, 2, 3, 4, 5	1,276,971,748
2	6,300	2, 3, 4, 5	851,447,294
3	9,100	3, 4, 5	582,858,750
4	14,000	4, 5	584,479,202
5		5	645,701,365

Revenue with IBR block rate

A revenue neutral IBR generates the same $ as a flat 10.22 percent increase

Block	**Consumption** (kWh)	**Rate** ($/kWh)	**Rate Increase**	**Revenue** ($)
1	1,276,971,748	0.08710	1.16%	$111,224,222
2	851,447,294	0.09194	6.78%	$78,281,106
3	582,858,750	0.09678	12.40%	$56,407,766
4	584,479,202	0.10162	18.02%	$59,392,819
5	645,701,365	0.10646	23.64%	$68,738,487
Totals	*3,941,458,359*			*$374,044,398*

Implementing the IBR Model

- Create suitable IBR rate structure
- Educate consumers of new rate structure
- Obtain billing software
- Implement model

Discussion

- The IBR model distributes a rate increase:
  - Low consumption energy users are rewarded
  - Moderate users have a modest increase
  - Large users pay more but have incentive to decrease use, or move to another rate class

- In this scenario 80% of users will pay less per kilowatt-hour than the under the proposed Flat-Rate model

- NSPI revenues equal those of Flat Rate increase

Concluding Remarks

- NSPI's proposed residential rate increase is unfair, sends wrong message to customers.
- An IBR model is an improvement that:
  - Introduces Price-Signaling
  - Addresses Cross-Subsidization
  - Uses existing meter-technology
  - Generates equivalent revenue for the Utility
- The UARB should require NSPI to adopt an IBR for its residential customers in place of its existing flat rate model.

Thank You

Copies of the complete report supporting this presentation can be found at:

www.dal.ca/~lhughes2/environment/nspi_ibr