REVIEW OF METHODOLOGY AND APPLICATION OF THE

RESIDENTIAL END-USE SURVEY (REUS)

IN RATE DESIGN

BC hydro ✦

FOR GENERATIONS

November 25, 2014

TOPIC #1

REUS APPLICATION IN RATE DESIGN

PRESENTERS: PAULUS MAU AND MARK SEONG
REGULATORY AND RATES

BC hydro

FOR GENERATIONS

November 25, 2014

VALUE OF REUS IN RATE DESIGN

- REUS provides customer level data that is not available from Billing data, including:

  - Dwelling type

  - Electric heat

  - Low income / non-low income

  - Household size

LINKING REUS WITH BILLING INFO PROVIDES ANALYSIS

- Participants of the REUS survey give BC Hydro permission to link their responses with billing data for aggregate analysis

- Results yield valuable information about the impact on specific customer segments for each rate alternative

BChydro ⚡

FOR GENERATIONS

USING REUS INFORMATION FOR ANALYSIS

Modelling Rate alternatives

- Using billing file, forecasts, and revenue information; **NOT REUS**

REUS Survey

- dwelling type
- electric heat
- Income
- Region …

Billing Data
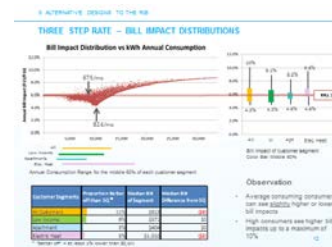
- Annual consumption kWh
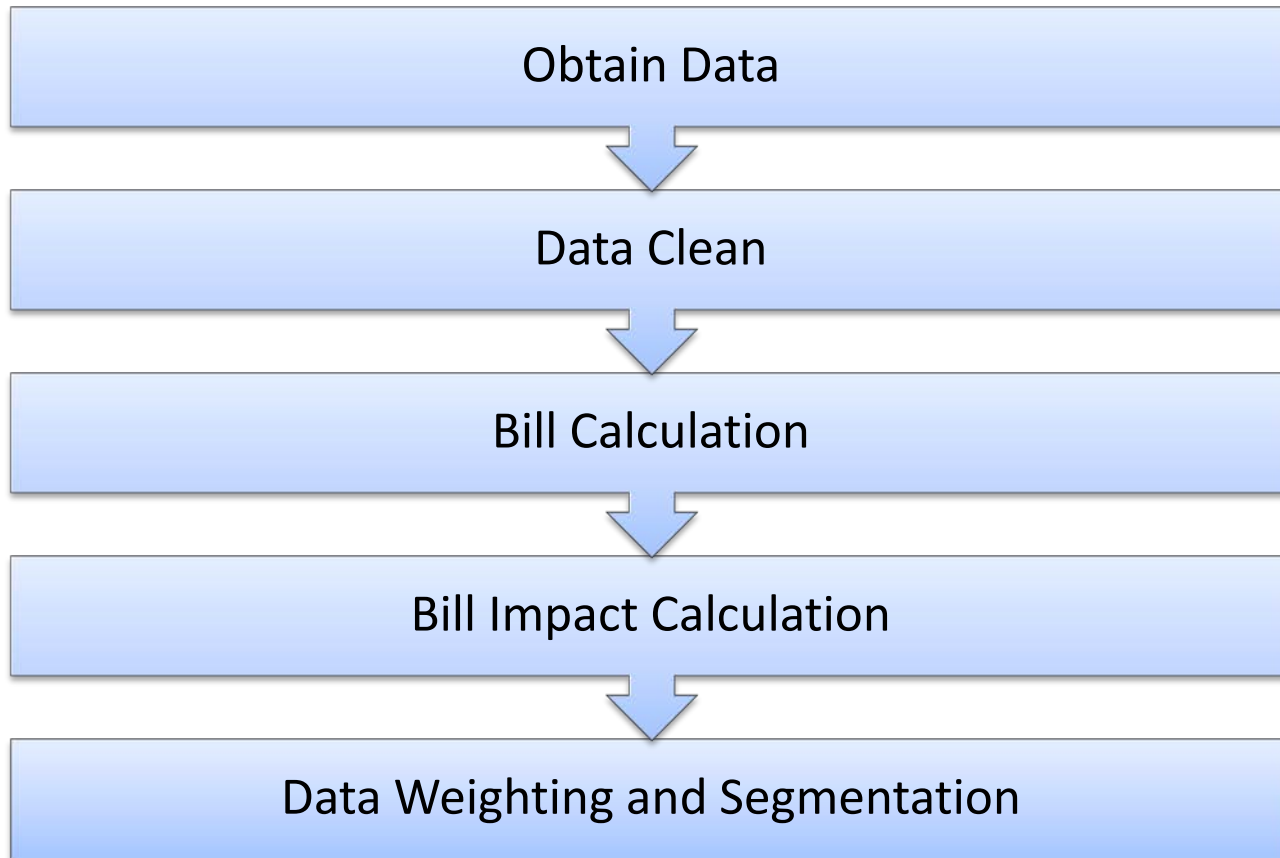- Load Shape

T1 = $$ / kWh
T2 = $$ / kWh

F15 kWh of apartment dwellers
F15 kWh of electric heat cust....

Analyze bill outcomes by customer segment to inform decision making
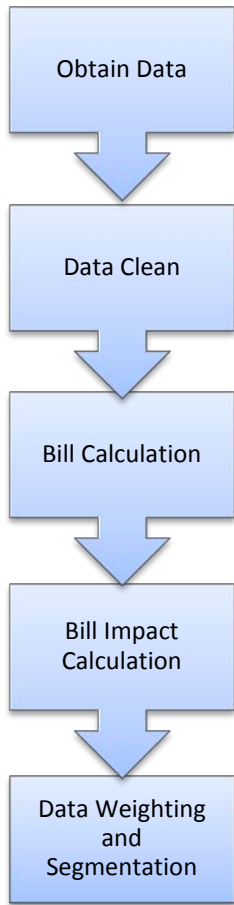
- Bill Impact distribution
- Proportion Better off/worse off

BC hydro
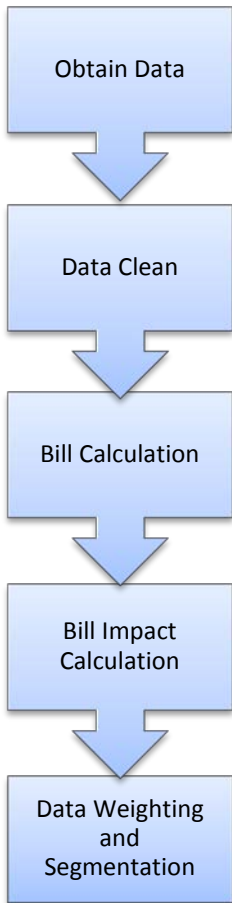**FOR GENERATIONS**

REUS AND ANALYTICS

Obtain Data

↓

Data Clean

↓

Bill Calculation

↓

Bill Impact Calculation

↓

Data Weighting and Segmentation

REUS AND ANALYTICS

Obtain Data

Data Clean

Bill Calculation

Bill Impact Calculation

Data Weighting and Segmentation

REUS Participant

Name	Permission
Jane	Y
Patty	Y
Mike	Y
Gary	Y
Ryan	Y
Denise	Y

Billing System Data

Name	Acct #	Move In	Move Out	Apr kWh
Jane	1	Apr 15, 2011		925
Patty	2	Sep 28, 2013	Feb 1, 2013	566
Mike	3	Nov 19, 2007		217
Gary	4	May 11, 2009		452
Ryan	5	Dec 12, 2012		
Denise	6	Jun 1, 1998		3,570

BC hydro

FOR GENERATIONS

REUS AND ANALYTICS

Obtain Data

Data Clean

Bill Calculation

Bill Impact Calculation

Data Weighting and Segmentation

Billing System Data

Name	Acct #	Move In	Move Out	Apr kWh	May kWh	Jun kWh
Jane	1	Apr 15, 2011		925	877	875
Patty	2	Sep 28, 2013	Feb 1, 2013	566	554	549
Mike	3	Nov 19, 2007		217	115	0
Gary	4	May 11, 2009		452		448
Ryan	5	Dec 12, 2012				
Denise	6	Jun 1, 1998		3,570	3,450	3,313
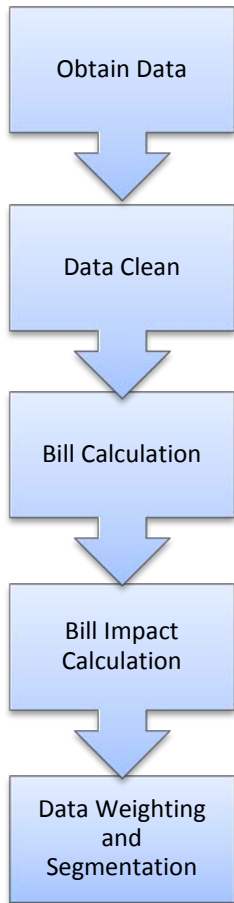
BC hydro
FOR GENERATIONS

REUS AND ANALYTICS

Obtain Data

Data Clean

Bill Calculation

Bill Impact Calculation

Data Weighting and Segmentation

Illustrative Output

Name	Acct #	Apr13 kWh	Apr15 SQ($)	Apr16 SQ ($)	Apr16 RD#1 ($)
Jane	1	925	$$	$$	$$
Mike	3	217	$	$	$
Denise	6	3,570	$$$	$$$	$$$

BChydro

FOR GENERATIONS

REUS AND ANALYTICS

```
Obtain Data
   ↓
Data Clean
   ↓
Bill Calculation
   ↓
Bill Impact
Calculation
   ↓
Data Weighting
and
Segmentation
```

Illustrative Output

Name	Acct #	Apr13 kWh	Apr15 SQ($)	Apr16 SQ ($)	Apr16 RD#1 ($)
Jane	1	925	$	%	%
Mike	3	217	$	%	%
Denise	6	3,570	$$$	%	%

REUS AND ANALYTICS

Obtain Data

Data Clean

Bill Calculation

Bill Impact Calculation

Data Weighting and Segmentation
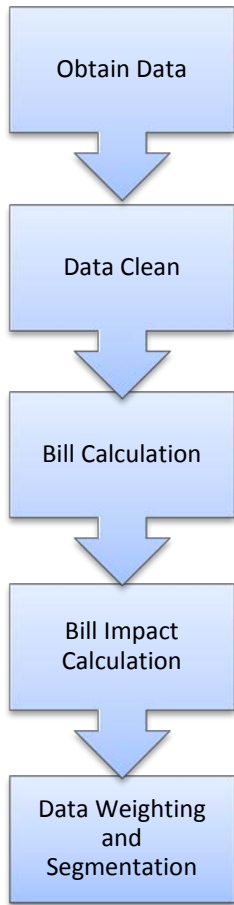
Illustrative Output

Name	Acct #	Apr15 SQ vs. Apr16 SQ (%)	Apr15 SQ vs. Apr16 RD#1 (%)
Jane	1	+/- %	+/- %
Mike	3	+/- %	+/- %
Denise	6	+/- %	+/- %

Name	Acct #	Apr16 SQ vs. Apr16 RD#1 (%)
Jane	1	+/- %
Mike	3	+/- %
Denise	6	+/- %

BC hydro
FOR GENERATIONS

UNDERSTANDING OUR CUSTOMERS – DISTRIBUTION OF CUSTOMERS BY SEGMENT

kWh/year
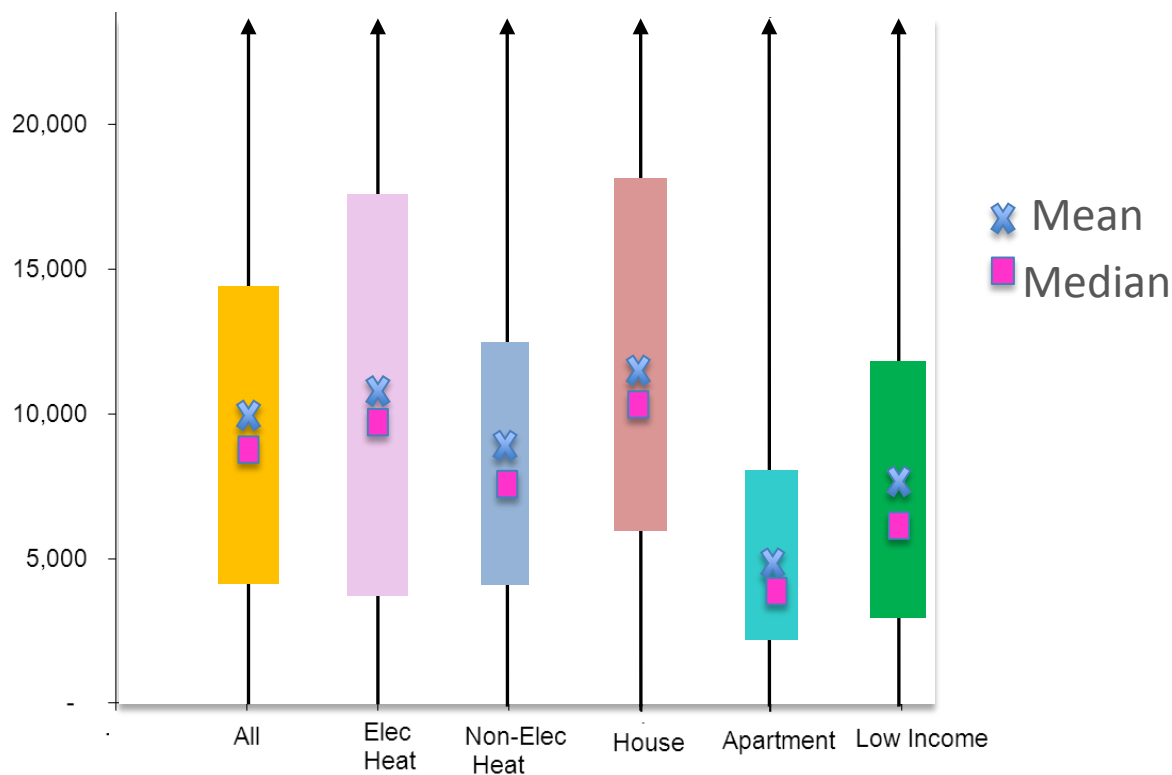
Observations

- Some variance in typical customer consumption between segments (e.g. Apartment)

- Electric heat customers range the widest

- Electric heat median is not that different than BC Hydro service area distribution

- Low income consumption is not distinctive – it's about the same as non-electric heat

- **Middle 60% of customers in each segment are represented by the colour bars**

- **For discussion purposes, the middle 60% is defined as the "Typical" customer group within each segment**

BC hydro
FOR GENERATIONS

ILLUSTRATION: THREE STEP RATE

Step 2/Step 3 threshold set for 10% BI Cap; Step 2 at LRMC
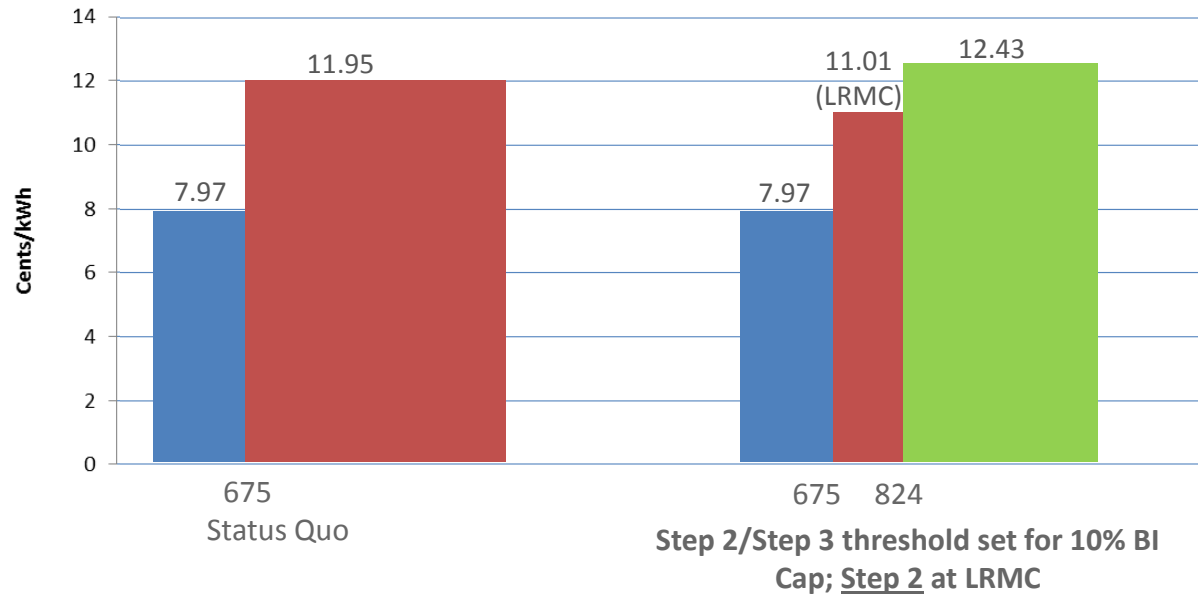
Change from F15	F15 Rates Reference	Status Quo	Three Step Rate
Step 1 Rate	7.52	6%	6%
Step 2 Rate	11.27	6%	-2%
Step 3 Rate			10.3%
Basic Charge ($0.1764/day)	$ 0.1664/day	6%	6%
Inc. Conservation GWh, F15 to F16. (vs SQ)			+13 from SQ

Observation:

- Negligible change in conservation

BChydro
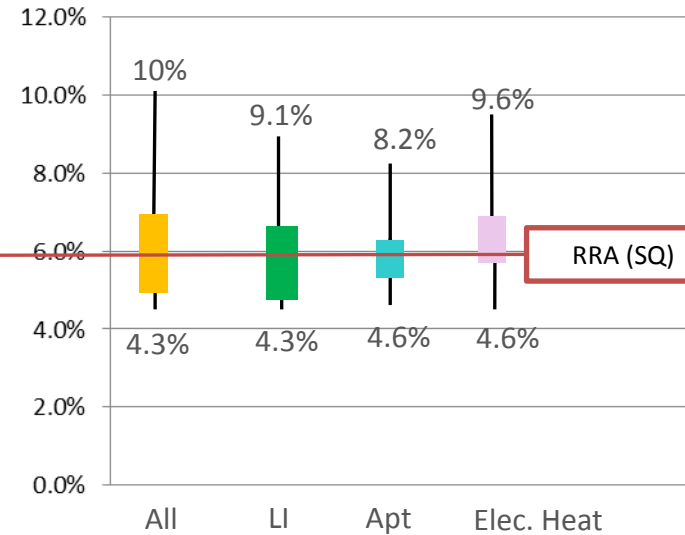**FOR GENERATIONS**

ILLUSTRATION: THREE STEP RATE – BILL IMPACT DISTRIBUTIONS

Bill Impact Distribution vs kWh Annual Consumption
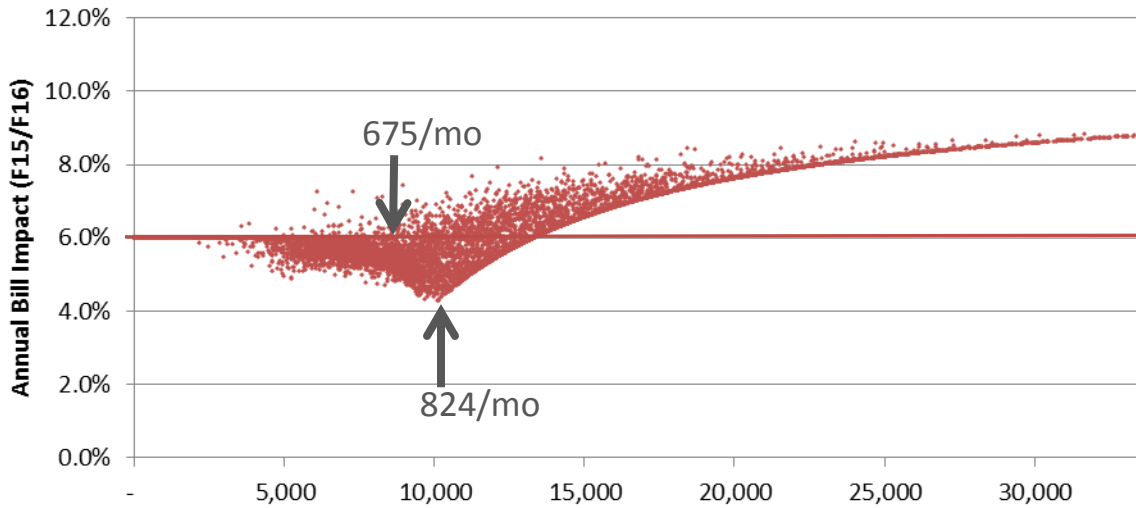
Annual Consumption Range for the middle 60% of each customer segment

Bill Impact of customer segment
Color Bar: Middle 60%

Customer Segments	Proportion Better off than SQ *	Median Bill of Segment	Median Bill Difference from SQ
All Customers	11%	$813	($6)
Low Income	9%	$571	$0
Apartment	3%	$404	$0
Electric Heat	5%	$1,010	($2)

* "Better off" = at least 1% lower than SQ bill

Observation

- Average consuming consumers can see slightly higher or lower bill impacts

- High consumers see higher bill impacts up to a maximum of 10%

13

TOPIC #2: METHODOLOGICAL REVIEW OF REUS

PRESENTER:
MARC PEDERSEN
POWER SMART EVALUATION

BC hydro ✦

FOR GENERATIONS

SURVEY OBJECTIVES

SURVEY TIMING

SURVEY CONTENT

METHOD

DATA COLLECTION LOGISTICS

POPULATION OF INTEREST

SAMPLING

IN-FIELD LOGISTICS

DATA INSPECTION AND WEIGHTING

DATA ANALYTICS

FURTHER DISCUSSION

BChydro
FOR GENERATIONS

Collect – and track over time – detailed information about…

- Characteristics and features of customers' homes

- Saturation of electrical end-uses, as well as non-electrical end-uses

- Attitudes and behaviours as they relate to conservation

- Demographics

Informs…

- Demand Side Management (DSM) program development

- Rate design development

- Codes & standards development

- DSM Program and conservation rate evaluation

- Conservation Potential Review activities

- Load research & Load forecast

FREQUENCY

- Biannually

  o 2001, 2003, 2004, 2006, 2008, 2010, 2012, 2014

- Months to plan

- Months to conduct

- Even more months to analyze the data

TIME OF YEAR

- Typically in the spring, away from summer and winter holiday season

- On the heels of the space heating season

RELATIONSHIP TO THE PROPERTY

- Owner, renter, etc.

- Type of residence (primary, seasonal, vacation, etc.)

- Maintenance fees

HOME STRUCTURE

- Dwelling type

- Basement

- Vintage

- Floor area

- Floors

WINDOWS, DOORS AND INSULATION

- Type and orientation of windows, type of outside doors, insulation

BC hydro
FOR GENERATIONS

HOME HEATING SYSTEMS AND FUELS

- Main and any secondary space heating systems (select from 22)

  o Both a central forced air furnace and electric baseboards

  o Central forced air furnace

  o Electric baseboards

  o Electric portable heaters

  o Electric wall heaters

  o Heat pumps – air source / ground source

  o Natural gas fireplace

  o Wood fireplace

  o Etc.

- Changes in the past 2 years

HOME HEATING SYSTEMS AND FUELS

- Main and any secondary space heating fuels

  - Electricity

  - Natural gas

  - Oil

  - Wood

  - Bottled propane

  - Piped propane

  - District energy fuel

  - Other (specify)

- Changes in the past 2 years

HEATING CONTROLS

Number in use

- Simple switches to turn heat on/off

- Open/close heating valves

- Manual thermostats (these may be a dial or digital, but not programmable)

- Programmable thermostats installed, and how many programmed

HOME TEMPERATURES

- Winter days – when someone is home

- Winter days – when no one is home

- Winter nights – when your household is asleep

BChydro
FOR GENERATIONS

WATER HEATING

- Hot water system

  - o Hot water tank

  - o Tankless, on-demand water heater

  - o Heat pump water tank

  - o Home does not have its own hot water equipment – water is heated centrally

  - o None – this property does not have access to hot water

- Main hot water heating fuel

- Size of tank

- Location

- Changes in the past 2 years

- Water metering

HOME COOLING AND AIR CLEANING SYSTEMS

Number in use, hours per day and age of main for…

- Portable air conditioners

- Room air conditioners

- Central air conditioners

- Portable fans

- Rotating ceiling fans with light fixtures

- Rotating ceiling fans without light fixtures

- Dehumidifiers (in regular use)

- Humidifiers (in regular use)

- Portable electric air purifiers (for air cleaning)

BC hydro 🔆
FOR GENERATIONS

REFRIGERATORS AND FREEZERS

Number in use, age of main and age of secondary for…

- Automatic defrost refrigerators – freezer on the top

- Automatic defrost refrigerators – freezer on the bottom

- Automatic defrost refrigerators – freezer on the side

- Manual defrost refrigerators

- Compact bar fridges (including wine cooler fridges)

- Chest freezers (not part of a fridge)

- Upright freezers (not part of a fridge)

COOKING APPLIANCES

Number in use and age of main for…

- Electric ranges (cook top & oven)

- Gas ranges (cook top & oven)

- Electric cook tops

- Gas cook tops

- Gas cook tops with electric range

- Separate electric ovens (built-in)

- Microwave ovens

DISHWASHERS & LAUNDRY APPLIANCES

Number in use and age of main for…

- Automatic dishwashers

- Clothes washers – top load

- Clothes washers – front load

- Electric clothes dryers

- Natural gas or propane clothes dryers

- Clothing steamers

- Towel warmers

WATER USE ITEMS

Number in use for…

- Bathroom and kitchen faucets that have aerators installed on the taps

- Hot water dispensers

- Water heater blankets

- Showerheads

- Low-flow showerheads

TELEVISIONS AND PERIPHERALS

Number in use, hours left on per day and age of main for…

- Standard (CRT) colour televisions

- LCD flat screen televisions

- LED-LCD flat screen televisions

- Plasma flat screen televisions

- Rear projection televisions

- Digital/cable/satellite set-top boxes with Personal Video Recorder (PVR) functionality

- Digital/cable/satellite set-top boxes without PVR functionality

- DVD players (including Blue Ray units)

- Surround sound systems (used in conjunction with TV viewing)

BC hydro
FOR GENERATIONS

OTHER HOME ENTERTAINMENT

Number in use, hours left on per day and age of main for…

- Component stereos (has separate receiver, CD player, etc.)

- iPod or MP3 music docking systems

- Video game consoles

BC hydro
FOR GENERATIONS

SURVEY CONTENT

COMPUTERS AND PERIPHERALS

Number in use, hours left on per day and age of main for…

- Desktop computers (with separate monitor)

- Laptop/notebook computers

- All-in-one computers (components are built into the monitor)

- Tablet computers

- Computer printers (inkjet or laser)

- Fax machines

- Routers for connecting multiple computers or for connecting wirelessly to the Internet

BC hydro
FOR GENERATIONS

PLUG LOAD POWER MANAGEMENT

Number in use, hours left on per day and left charging per day for…

- Power bars (basic type with on/off switch)

- Smart power bars

- Chargers for cell phones, smart phones, iPods and tablets

POOLS AND HOT TUBS

Have one and how it is heated for…

- Indoor swimming pool

- Outdoor swimming pool

- Indoor hot tub or whirlpool

- Outdoor hot tub or whirlpool

BChydro
FOR GENERATIONS

OTHER ELECTRICAL USES (1)

Have one and if/how it is heated for…

- Water bed

- Aquarium

- Car garage

- Workshop (separate from car garage)

- Solarium

- Personal greenhouse

- Electric toilet/seat

OTHER ELECTRICAL USES (2)

Have one…

- Electric car that can be plugged in for charging

- Electric car block heater

- Electric interior car warmer

- Plug-in bottled water cooler

- Water pump

- Exterior/landscape fountain

- Electric breathing or respiratory medical equipment

LIGHTING

- Matrix for count of 6 bulb types by 10 areas of the home

  - Incandescent bulbs

  - Halogen bulbs and tubes

  - Fluorescent tubes

  - Compact Fluorescent Light (CFL) bulbs

  - LED bulbs

  - Other types of bulbs

- Matrix for count of 6 bulb types used with dimmers, timers and motion sensors by indoor/outdoor use.

BChydro

FOR GENERATIONS

MANAGING ELECTRICITY (BEHAVIOURS)

Overview

- 4-point scale: always, usually, occasionally, never as well as 'not applicable'

- 41 specific behaviours

Lighting

- Only have the minimum number of lights on in a room for what I am doing

- Turn off lights when no one is in the room

- Check that timers are working and set appropriately

- Change timers to reflect daylight savings time

BC hydro
FOR GENERATIONS

MANAGING ELECTRICITY (BEHAVIOURS)

Space Heating

- Have an annual service done on the furnace, including servicing the furnace filter

- Use a programmable thermostat or manually turn down the heat at night

- Use a programmable thermostat or manually turn down the heat when no one is home

- Reduce temperature in unused rooms by closing vents or turning down thermostats

- Dress more warmly in cold weather and reduce the thermostat to 20˚ Celsius (68˚ Fahrenheit) or below

- Check and re-seal air leaks in the home each fall

- If single paned windows, install storm windows in the fall

- Maintain the temperature of your home specifically for your pet(s) when no one is home

BChydro

FOR GENERATIONS

MANAGING ELECTRICITY (BEHAVIOURS)

Space Cooling

- Set the thermostat at 26˚ Celsius (79˚ Fahrenheit) or higher during the summer to save energy

- Draw the window coverings during hot weather to reduce heat in the dwelling

- Clean the air conditioning filter and coils at least once per season

- Use air conditioning only when very hot and natural ventilation is insufficient

BChydro
FOR GENERATIONS

MANAGING ELECTRICITY (BEHAVIOURS)

Laundry

- Only do laundry with full loads

- Use cold water wash & rinse when doing laundry

- Clean the lint filter before drying clothes

- Use the temperature/moisture sensor to turn off the dryer rather than use the timer

- Hang clothes to dry rather than machine dry

Household loads per week

- Clothes washer loads

- Dryer loads

BC hydro
FOR GENERATIONS

MANAGING ELECTRICITY (BEHAVIOURS)

Dishwasher

- Only turn on the dishwasher when it is full

- Air dry the dishes in the dishwasher rather than use the dry cycle

Households loads per week

- Dishwasher loads

BC hydro
FOR GENERATIONS

MANAGING ELECTRICITY (BEHAVIOURS)

Personal Water Use

- Leave water running when washing hands

- Leave water running when brushing teeth

- Leave water running when shaving

Household totals per week

- Baths

- Showers

Other Water Use

- Repair dripping faucets within 1 or 2 days after they are discovered

- Turn off the water heater when no one is in the home for more than 2-3 days

BChydro
FOR GENERATIONS

MANAGING ELECTRICITY (BEHAVIOURS)

Plug Load

- Turn off the TV when no one is in the room or actively watching the program

- Turn off the computer and printer when not in use OR use the power-save mode

- Unplug chargers for cell phones and smart phones from the electrical socket when not in use

- Use power bars to turn on/off home entertainment systems

- Use power bars to turn on/off home computers and related equipment

- Use the smallest appliance that meets my needs

- Check the temperature of the refrigerator to ensure it is not too cold

- Plug cell phone and smart phone into a charger every day regardless of whether or not the battery is low

BChydro
FOR GENERATIONS

MANAGING ELECTRICITY (BEHAVIOURS)

Other Behaviours

- Buy products that are environmentally friendly

- Pay more for products that are environmentally friendly

- Donate time or money to environmental causes/charities

- Think about ways to save energy

- Make an effort to correct any poor conservation behaviours among others I come into contact with

Overall Effort

- Overall effort to conserve electricity

- Change in effort

BC hydro
FOR GENERATIONS

ATTITUDES TOWARD ELECTRICITY AND THE ENVIRONMENT

Overview

- 5-point scale: strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree as well as 'don't know'

- 31 attitudinal dimensions

Awareness and Opinion of Energy Conservation as an Issue

- I am knowledgeable about ways to save electricity around my home

- I have a good understanding of the reasons given for conserving electricity in this province

- I am in support of the reasons given for conserving electricity in this province

- I am tired of hearing about the need to conserve electricity

ATTITUDES TOWARD ELECTRICITY AND THE ENVIRONMENT

Habits around Electricity and Conservation

- I am an active energy conserver who looks for opportunities to save energy in everything I do

- Conserving electricity is second nature to me – I've always done it, and know how to do it

Household Behaviour and Perceived Consumption Level

- Good or bad, others in my household behave generally the same way as I do in terms of conserving electricity

- I believe my household's usage of electricity is currently at or near its lowest possible level

- It matters to me how my household's electricity consumption compares to that of other similar households

BC hydro
FOR GENERATIONS

ATTITUDES TOWARD ELECTRICITY AND THE ENVIRONMENT

Moral Suasion Arguments for Conserving Electricity

- We could all use a lot less energy than we do and if many people conserved, we could all make a big difference overall

- Regardless of whether it makes a difference, everyone has a moral obligation to do the best they can to conserve energy

Conservation Motivators and Enablers

- When buying a new appliance, energy consumption is an important consideration in my decision

- When I do make efforts to conserve electricity at home, it is more about saving money on my bill than helping to save the environment

- I feel guilty if I do not make – or forget to make – an effort to conserve electricity

BC hydro

FOR GENERATIONS

ATTITUDES TOWARD ELECTRICITY AND THE ENVIRONMENT

Perceived Outcomes of Conserving Electricity

- By making my home more energy-efficient, I am helping to do my part for the environment

- I feel good when I do make an effort to conserve electricity

Conserving Electricity to Mitigate Importing and New Generation

- I would be willing to do my part of reducing my usage of electricity if it allows the province to reduce importing electricity into British Columbia

- I would be willing to do my part of reducing my usage of electricity if it allows the province to delay the construction of new electricity generation projects

BC hydro
FOR GENERATIONS

ATTITUDES TOWARD ELECTRICITY AND THE ENVIRONMENT

Conservation Barriers and Dissuaders

- I would <u>not</u> make much of an effort to conserve electricity in my home if it also means having to feel less comfortable in it

- Conserving electricity requires a lot of effort

- I am always on the go with little time to research ways to save energy in the home

- I feel like I have to give up something in order to conserve electricity in my home

- Any potential bill savings related to the conservation of electricity in my home are too small to make the effort worthwhile

BC hydro
FOR GENERATIONS

ATTITUDES TOWARD ELECTRICITY AND THE ENVIRONMENT

Care, Reason and Apathy in Regards to Conservation

- I really do <u>not</u> care much about energy and see little reason to conserve

- There is <u>not</u> very much any individual can do to conserve energy that will have much effect in the long run

ATTITUDES TOWARD ELECTRICITY AND THE ENVIRONMENT

Other Energy Attitudes

- I would like to be able to monitor my household's usage of electricity in real-time

- Electricity in British Columbia is reasonably priced

- I support BC Hydro's installation of smart meters in its modernization of the electricity system

Attitudes toward New Products and Services

- When buying products and services, I always look for the best price

- When I make decisions, I usually take time to research issues thoroughly

- I am usually the first among my family and friends to try new products

BC hydro

FOR GENERATIONS

MORE ON CONSERVATION

- Frequency of having discussions about conservation with…

  o Work colleagues

  o Family

  o Neighbours

  o Other friends

- Conservation messaging

  o Most motivating message

  o Second most motivating message

- Lead role in conserving

BChydro

FOR GENERATIONS

DEMOGRAPHICS

- Age

- Gender

- Education

- Employment status

- Main language in the household

- Household composition

- Household income

- Etc.
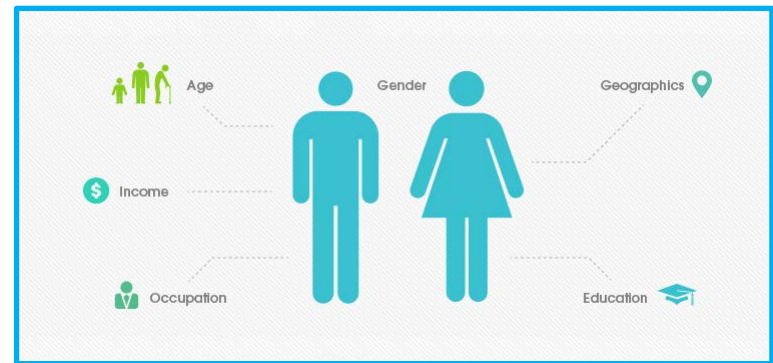
PERMISSION FOR ACCOUNT LINKAGE

- Electricity consumption for current year + past 2 years

BChydro
FOR GENERATIONS

SUMMARY OF SURVEY CONTENT

- Comprehensive / Wide in scope

- Detailed / Deep

- Requires most respondents to walk through their homes

- Requires basic calculations

- Requires reflection (behaviours)

BChydro
FOR GENERATIONS

INTERVIEWER-LED VERSUS SELF-ADMINISTERED METHODS

1. Interviewer-Led

Types

- Telephone surveys

- One-on-one interviews

- Retail intercepts

- In-home / on-site inspections

Pros and Cons

- Comparably greater quality control & completeness ✓

- More proactive sample and quota management ✓

- Typically more expensive ✗

- Time constrained for respondents ✗

- Introduces possibility of interviewer led 'socially desirable' response bias ✗

BC hydro 🔷

FOR GENERATIONS

INTERVIEWER-LED VERSUS SELF-ADMINISTERED METHODS

2. Self-Administered

Types

- Print surveys

- Online surveys / Online panels

Pros and Cons

- More time for respondents to make well-considered responses ✓

- Typically less expensive ✓

- No possibility of interviewer led 'socially desirable' response bias ✓

- Can be more interactive (images, video, etc.) ✓

- Possibly less proactive sample and quota management ✗

- Comparably less quality control & completeness ✗

BChydro 🔷
FOR GENERATIONS

SELECTED METHOD

Print Survey Packages with Option to Complete Online

- Complete 'coverage' of residential customers by service and mailing address (no coverage bias) ✓

- Self-administered approach affords respondents much more time to make well-considered responses on any given question ✓

- Self-administered approach allows much more time to allow the collection of such a vast array of comprehensive and granular information ✓

- Least expensive method given desired large sample size and the amount of content ✓

- No possibility of interviewer led 'socially desirable' response bias ✓

- Quality control & completeness issues mitigated by the presence of the online option ✓

BC hydro
FOR GENERATIONS

BC HYRO'S ROLE

- Content

- Design and layout

- Sampling

- Analysis & reporting

MARKET RESEARCH PARTNER'S ROLE

- Printing services (survey packages and reminder cards)

- Mailing services

- Survey hosting to accommodate online completions

- Key punching (print completes)

- Data integration (print completions with online completions)

BChydro 🔆
FOR GENERATIONS

POPULATION INCLUDES

- Tariff codes

  o 1101 Residential Inclining Block (RIB) Rate

  o 1107 Residential Non-Integrated Area (NIA) Zone 2

  o 1151 Exempt Residential-NIA Zone 1B

  o 1180 Small group of customers in Hyder Alaska through Tongass

- Premise codes 10 through 80

  o 10 - House, Duplex

  o 20 - Apartment Suite

  o 30 - Mobile Home

  o 40 - Non-Taxable Farm

  o 50 - Non-Taxable Seasonal Dwelling

  o 60 - Non-Taxable Miscellaneous Residential

  o 70 - Row housing

  o 80 - Non-Taxable Residential Remote

- Open accounts, regardless of open date, but not closed or set to close

BChydro 🔷

FOR GENERATIONS

POPULATION EXCLUDES

- Tariff code 1111 (common-use)

- Tariff code 1121/1122 (multi-residential)

- Tariff code 1127 (Zone 2 multi-residential)

- Premise codes outside of 10 through 80 range

BChydro
FOR GENERATIONS

DISTRIBUTION OF POPULATION OF INTEREST
Premise Code by Rate

PREMISE CODE (PREMISE TYPE)	Rate 1101	Rate 1107	Rate 1151	Rate 1180	Total	Row percent
10 - HOUSE, DUPLEX	940,689	3,849	1,498	62	946,098	56.4%
20 - APARTMENT SUITE	458,318	124	14	2	458,458	27.3%
30 - MOBILE HOME	65,294	519	162	5	65,980	3.9%
40 - FARM (NON-TAXABLE)	4,781	10	14,439	0	19,230	1.1%
50 - SEASONAL (NON-TAXABLE)	19,668	193	18	3	19,882	1.2%
60 - MISCELLANEOUS RESIDENTIAL (NON-TAXABLE)	14,948	123	246	2	15,319	1.0%
70 - ROW HOUSE	151,368	56	38	0	151,462	9.0%
80 - RESIDENTIAL REMOTE (NON-TAXABLE)	306	5	3	0	314	≈ 0.0%
Total	1,655,372	4,879	16,418	74	1,676,743	100.0%
Column percent	98.7%	0.3%	1.0%	≈ 0.0%	100.0%	

As of September 30 2014

BChydro
FOR GENERATIONS

DISTRIBUTION OF POPULATION OF INTEREST
Region by Rate

PREMISE CODE (PREMISE TYPE)	Rate 1101	Rate 1107	Rate 1151	Rate 1180	Total	Row percent
LOWER MAINLAND	965,692	5	7,254	0	972,951	58.0%
VANCOUVER ISLAND	354,834	14	2,876	0	357,724	21.3%
SOUTHERN INTERIOR	194,846	5	3,060	0	197,911	11.8%
NORTH	140,000	4,855	3,228	74	140,000	8.8%
Total	1,655,372	4,879	16,418	74	1,676,743	100.0%
Column percent	98.7%	0.3%	1.0%	≈ 0.0%	100.0%	

As of September 30 2014

DISTRIBUTION OF POPULATION OF INTEREST
Premise Code by Region

PREMISE CODE (PREMISE TYPE)	Lower Mainland	Vancouver Island	Southern Interior	North	Total	Row percent
010 - HOUSE, DUPLEX	484,469	234,402	128,983	98,244	946,098	56.4%
020 - APARTMENT SUITE	345,579	73,665	23,638	15,576	458,458	27.3%
030 - MOBILE HOME	11,057	17,072	20,376	17,475	65,980	3.9%
040 - FARM (NON-TAXABLE)	8,344	3,069	3,719	4,098	19,230	1.1%
050 - SEASONAL (NON-TAXABLE)	4,249	3,978	7,024	4,631	19,882	1.2%
060 - MISCELLANEOUS RESIDENTIAL (NON-TAXABLE)	1,771	5,676	4,370	3,502	15,319	1.0%
070 - ROW HOUSE	117,463	19,843	9,686	4,470	151,462	9.0%
080 - RESIDENTIAL REMOTE (NON-TAXABLE)	19	19	115	161	314	≈ 0.0%
Total	972,951	357,724	197,911	148,157	1,676,743	100.0%
Column percent	58.0%	21.3%	11.8%	8.8%	100.0%	

As of September 30 2014

BC hydro
FOR GENERATIONS

DISTRIBUTION OF POPULATION OF INTEREST
Premise Code Collapse by Region

PREMISE CODE (PREMISE TYPE)	Lower Mainland	Vancouver Island	Southern Interior	North	Total	Row percent
HOUSE / DUPLEX 10 - HOUSE, DUPLEX 40 - FARM (NON-TAXABLE) 50 - SEASONAL (NON-TAXABLE)	497,062	241,449	139,726	106,973	985,210	58.8%
APARTMENT / CONDOMINIUM 20 - APARTMENT SUITE	345,579	73,665	23,638	15,576	458,458	27.3%
MOBILE HOME / OTHER 30 - MOBILE HOME 60 - MISCELLANEOUS RESIDENTIAL (NON-TAXABLE) 80 - RESIDENTIAL REMOTE (NON-TAXABLE)	12,847	21,138	24,861	22,767	81,613	4.9%
ROW HOUSE / TOWNHOUSE 70 - ROW HOUSE	117,463	19,843	9,686	4,470	151,462	9.0%
Total	972,951	357,724	197,911	148,157	1,676,743	100.0%
Column percent	58.0%	21.3%	11.8%	8.8%	100.0%	

As of September 30 2014

BChydro
FOR GENERATIONS

DRAWING THE SAMPLE

From the corporation's billing system…

- Apply the population criteria: filter-out ineligible accounts

- Draw a regionally disproportionate random sample

  o Typically 23,000 accounts in total; randomly draw 5,750 accounts from each of the 4 regions $\Rightarrow$ affords larger regional samples for reliable 'deep dives'

  o Tariff code and premise code allowed to fall-out naturally within each region

  o Accounts with incomplete service and/or mailing addresses are discarded and replaced

- Draw any requested oversamples

  o Typically 2,000 accounts in total

  o NIA accounts

  o E-Plus accounts

BChydro
FOR GENERATIONS

DRAWN SAMPLE

PREMISE CODE (PREMISE TYPE)	Lower Mainland	Vancouver Island	Southern Interior	North	Total	Row percent
HOUSE / DUPLEX 10 - HOUSE, DUPLEX 40 - FARM (NON-TAXABLE) 50 - SEASONAL (NON-TAXABLE)	2,949	3,904	4,080	4,183	15,116	65.7%
APARTMENT / CONDOMINIUM 20 - APARTMENT SUITE	2,029	1,159	664	576	4,428	19.3%
MOBILE HOME / OTHER 30 - MOBILE HOME 60 - MISCELLANEOUS RESIDENTIAL (NON-TAXABLE) 80 - RESIDENTIAL REMOTE (NON-TAXABLE)	76	367	726	827	1,996	8.7%
ROW HOUSE / TOWNHOUSE 70 - ROW HOUSE	696	320	280	164	1,460	6.3%
Total	5,750	5,750	5,750	5,750	23,000	100.0%
Column percent	25.0%	25.0%	25.0%	25.0%	100.0%	

Actual drawn sample for the 2014 REUS

BC hydro
FOR GENERATIONS

IN-FIELD LOGISTICS

- Surveys printed and delivered via Canada Post

  o Delivered to the mailing address (in most cases, same as the service address)

  o Delivered inside BC Hydro envelopes

  o About 1,500 survey packages also include a translated 'language' insert to acknowledge diversity and promote response rates

- Send reminder cards

  o Exclude responders

  o Promote the online survey (especially useful for those who have misplaced their print survey)

- Key punch print surveys as they flow in, and integrate with online surveys

- Elapsed time

  o Survey deadline communicated as being about 4 weeks, but up to 7 weeks allowed

  o A total of 8-10 weeks for data turnaround back to BC Hydro

BC hydro
FOR GENERATIONS

FINAL SURVEY INCLUSION

- Completeness of surveys for inclusion

  o Must have attempted to complete all survey sections up to the lighting section

  o Accept drop-offs at the lighting section due to its complexity and due to the fact that all other end-use content precedes it

  o Exceptions are permitted whereby 'missing values' can often imply the absence of the end-uses (e.g. space cooling, pools and hot tubs, etc.)

- Removal of duplicates

  o Some customers complete both a print survey and an online survey

- Removal of surveys without survey ids

  o Some customers who complete and return the print survey tear-off the survey id and customer contact address information

  o Prohibits assigning a region and a weight to the survey

- Typically about 2-4 percent of all returned surveys are excluded

BC hydro
FOR GENERATIONS

DATA WEIGHTING

- The returned survey sample must be statistically weighted to account for – at the very least – the regionally disproportionate accounts that were drawn

  o Can only base weights on parameters with known population distributions

  o When there is choice, it is most sensible to choose parameters that may likely have an influence on the study's main target parameters of interest

  o Given this is a longitudinal study primarily of electrical stock, when there is a choice, it is most sensible to choose parameters that are stable over the short to mid-term, rather than parameters that are dynamic or influenced by extraneous factors (e.g. consumption is influenced by weather)

BChydro

FOR GENERATIONS

DATA WEIGHTING

- The REUS utilizes two-stage weighting: premise type (4 categories) by/within region (4 categories)

  - Weighting by region corrects for the disproportionate sample that is drawn, and the accompanying regionally disproportionate completed surveys

  - In doing so, weighting by region also 'pulls' other parameters correlated to region relatively closer to their expected distributions (e.g. customer contact age, education, **household income**, insulation levels, **space heating fuel**, space cooling stock, **electricity consumption**, etc. because these all vary by region)

  - Weighting by premise type (with region) also 'pulls' other parameters closer to their expected distributions (e.g. customer contact age, **household income**, household size, life stage, **space heating fuel**, space cooling stock, **electricity consumption**, etc. because these all vary by premise type)

DATA WEIGHTING

- Verification of premise type for data weighting

  o Corporation's billing system has customer account premise type (premise code), largely based on address algorithms and recently, account open information

  o Leverage an account's premise type as coded in the billing system to inform missing values or inconsistencies in the related survey

  o In the event of irreconcilable differences, a household's reported premise type is always leveraged in the weighting procedure – not the billing system's

  What type of home structure is this?

      □[1] Single detached house
      □[2] Duplex
      □[3] Row/townhouse (3 or more units attached, each with separate entrance)
      □[4] Apartment/condominium
      □[5] Mobile home/manufactured home
      □[98] Other (please specify): _____

BChydro 🔷
FOR GENERATIONS

FINAL 2014 SAMPLE DISTRIBUTION (UNWEIGHTED)

PREMISE CODE (PREMISE TYPE)	Lower Mainland	Vancouver Island	Southern Interior	North	Total	Row percent
HOUSE / DUPLEX	808 (10.8%)	1,524 (20.5%)	1,495 (20.1%)	1,301 (17.5%)	5,128	68.8%
APARTMENT / CONDOMINIUM	542 (7.3%)	355 (4.8%)	168 (2.3%)	103 (1.4%)	1,168	15.7%
MOBILE HOME / OTHER	28 (0.4%)	139 (1.9%)	228 (3.1%)	233 (3.1%)	628	8.4%
ROW HOUSE / TOWN HOUSE	196 (2.6%)	141 (1.9%)	127 (1.7%)	63 (0.8%)	527	7.1%
Total	1,574	2,159	2,018	1,700	7,451	100.0%
Column percent	21.1%	29.0%	27.1%	22.8%	100.0%	

POPULATION DISTRIBUTION

Weight all records in this survey cell by 2.74

PREMISE CODE (PREMISE TYPE)	Lower Mainland	Vancouver Island	Southern Interior	North	Total	Row percent
HOUSE / DUPLEX	497,062 (29.6%)	241,449 (14.4%)	139,726 (8.3%)	106,973 (6.4%)	985,210	58.8%
APARTMENT / CONDOMINIUM	345,579 (20.6%)	73,665 (4.4%)	23,638 (1.4%)	15,576 (0.9%)	458,458	27.3%
MOBILE HOME / OTHER	12,847 (0.8%)	21,138 (1.3%)	24,861 (1.5%)	22,767 (1.4%)	81,613	4.9%
ROW HOUSE / TOWNHOUSE	117,463 (7.0%)	19,843 (1.2%)	9,686 (0.6%)	4,470 (0.3%)	151,462	9.0%
Total	972,951	357,724	197,911	148,157	1,676,743	100.0%
Column percent	58.0%	21.3%	11.8%	8.8%	100.0%	

BC hydro
FOR GENERATIONS

FINAL NOTES ABOUT THE 2014 REUS

- Sample size = 7,451 (excludes E-Plus oversample)

  o Print = 5,489; Online = 1,962

- Response rate = 33% (discounts 361 undeliverable surveys)

- Maximum margin of error ± 1.5%, at the 95% level of confidence

- Number of parameters in a typical REUS data set $\approx$ 1,400 – 1,700

Also note…

- For analytics (post-weighting) involving premise type, duplexes are typically binned with row houses and townhouses

  o Addresses the fact that shared walls impact a household's space heating load

  o And therefore, helps to account for some variance in household electricity consumption

REWEIGHTING FOR RATE DESIGN ANALYTICS

- Must have respondent's permission to link their electricity consumption to their REUS data

  o Exclude non-permissions: 823 (11%) in the 2014 REUS

- RIB analytics to reflect 'up and running' households

  o Exclude newly opened/closed accounts whereby consumption is likely ramping up or ramping down

- For homogeneity, RIB analytics conducted strictly among 1101s

  o Exclude any 1107s, 1151s, 1180s that completed the survey

- Re-weight the eligible RIB sample back to the population of interest

  o The REUS itself is a good proxy of the overall population

  o Can now weight back to not only on known 1) region and 2) premise type population distributions, but also on 3) validated space heating distributions

BChydro
FOR GENERATIONS

SPACE HEATING CODING

- Main and any secondary space heating systems (select from 22)

  Please indicate the Main System you use to heat this home.

  If the home uses more than one heating system, then indicate the one system used to heat most of your home as the Main Heating System and any additional systems as Other Heating Systems

  o Look for and reconcile improbable heating systems (e.g. furnaces, wood stoves, wall heaters in apartments; gas or propane systems where there is no gas or propane distribution or delivery, etc.)

  o If respondents selects multiple mains, then we choose the more substantial infrastructure, or newest infrastructure

SPACE HEATING CODING

- Main and any secondary space heating fuels

  Please indicate the Main Heating Fuel used for the Main Heating System in this home.

  If the home also uses Other Heating Systems, then indicate their corresponding fuels as Other Heating Fuels.

  o Consistency checks between main system and main fuel; secondary systems(s) and secondary fuel(s)

  o Look for and reconcile impossible system and fuel combinations

  o Leverage an account's space heating code in the billing system to inform missing values or inconsistencies in the related survey

BC hydro 🔆

FOR GENERATIONS

LOW INCOME FLAGGING

- In the development of its low income DSM program several years ago, BC Hydro's Residential Marketing Department chose low income cut-offs (LICOs) as the preferred method of defining and measuring low income:

  o Statistics Canada releases LICO updates annually using the consumer price index;

  o LICOs include required spending on a comprehensive set of basic necessities and not just on one specific component such as housing or energy costs;

  o LICOs are sensitive to family and community size;

  o LICOs are used by two of the major low income energy efficiency programs in Canada: Hydro Quebec and the Ontario Power Authority

- BC Hydro chose to use pre-tax rather than after-tax income levels and thresholds in the development and eventual administration of the program:

  o Among other reasons, pre-tax income levels are easier for customers – and survey respondents – to think about and report

BC hydro
FOR GENERATIONS

LOW INCOME FLAGGING

- LICO rate is defined as the percentage of families or households which fall below a low income threshold:

  - …that being, an income level whereby a family is spending a larger share of its total income on the necessities of food, shelter and clothing than does an average family in an appropriate comparison group (the lower a household's income, a greater percentage of the total is tied to the necessities of living);

  - The premise being, that a family spending a substantially larger share of its income on those items would be in strained circumstances

- The threshold is currently set at an income level whereby a family is expected to spend 20 percentage points more of its income on these necessities than the average family in the comparison group

  - There are 35 comparison groups, and thus LICO thresholds, based on 7 household sizes and 5 community sizes (intended to capture differences in the cost of living between rural and urban areas)

BChydro
FOR GENERATIONS

LOW INCOME FLAGGING

2013 Pre-Tax LICO Table

Household size	Community Size (based on Rural, Census Agglomeration and Census Metropolitan Area statistics)				
	Rural	Less than 30,000 inhabitants	Between 30,000 and 99,999 inhabitants	Between 100,000 and 499,999	500,000 or more
1 person	16,426	18,688	20,423	20,550	23,861
2 persons	20,449	23,263	25,424	25,582	29,706
3 persons	25,139	28,599	31,256	31,450	36,520
4 persons	30,523	34,725	37,950	38,185	44,340
5 persons	34,618	39,384	43,041	43,307	50,290
6 persons	39,045	44,419	48,544	48,845	56,718
7 or more persons	43,470	49,453	54,047	54,381	63,147

- For each customer household, LICO flagging draws on 3 parameters

  o 1) Household income, 2) household size, and 3) household's community size

- As an example, a family comprised of 4 persons living in a rural area would be considered to be low income if their total household income is below $30,523

BC hydro
FOR GENERATIONS

LOW INCOME FLAGGING

- For every REUS survey record...

    o Match in the population of its Census Metropolitan Area (CMA) based on its postal code

    o To serve as a surrogate in the event of missing values, also match in the neighborhood's mean and median household income levels

    o Flag the customer account as low income if its total income is below the LICO cut-point corresponding to its household size and its CMA area

    o Consider neighborhood level information should the survey record be missing income and/or household size

    o Consider neighborhood level information should the LICO cut-point be within the household's income bracket

- Every record must be tagged as LICO or not-LICO due to the fact that missing values (flags) will bias the estimation of the overall incidence of low income households

- Flagging is conducted independently by two researchers, then compared. Differences are investigated and reconciled

BC hydro
FOR GENERATIONS

LOW INCOME FLAGGING

- The precision of BC Hydro's low income classification procedure is limited by the reporting and the accuracy of respondents' household sizes and total household incomes

- Precision is also confounded by the fact that the income ranges used in the end-use survey are broader than the relatively smaller distances between thresholds or cut-points in the LICO tables:

☐[1] Under $20,000   ☐[7] $70,000 to under $80,000

☐[2] $20,000 to under $30,000   ☐[8] $80,000 to under $90,000

☐[3] $30,000 to under $40,000   ☐[9] $90,000 to under $100,000

☐[4] $40,000 to under $50,000   ☐[10]$100,000 to under $110,000

☐[5] $50,000 to under $60,000   ☐[11]$110,000 to under $120,000

☐[6] $60,000 to under $70,000   ☐[12]$120,000 or over

☐[99]Prefer not to say

BC hydro
FOR GENERATIONS

LOW INCOME FLAGGING

Keep in mind…

- The estimated incidence of low income BC Hydro customers will measure lower than the provincial incidence published by Statistics BC/Canada because…

  - o BC Hydro estimates the incidence of low income customer <u>households</u> (accounts) whereas Statistics Canada/BC typically reports the incidence of low income <u>persons</u> in the province $\Rightarrow$ two different populations

  - o Those living in low income or subsidized housing in which their use of electricity is included in their rent are not BC Hydro account holders $\Rightarrow$ the corporation's population of residential customers likely excludes some of those having the very lowest of incomes

BC hydro 🔵

FOR GENERATIONS

LOW INCOME FLAGGING

Incidence of Low Income among BC Hydro Residential Customer Households and Incidence of Low Income among Persons in British Columbia[1]
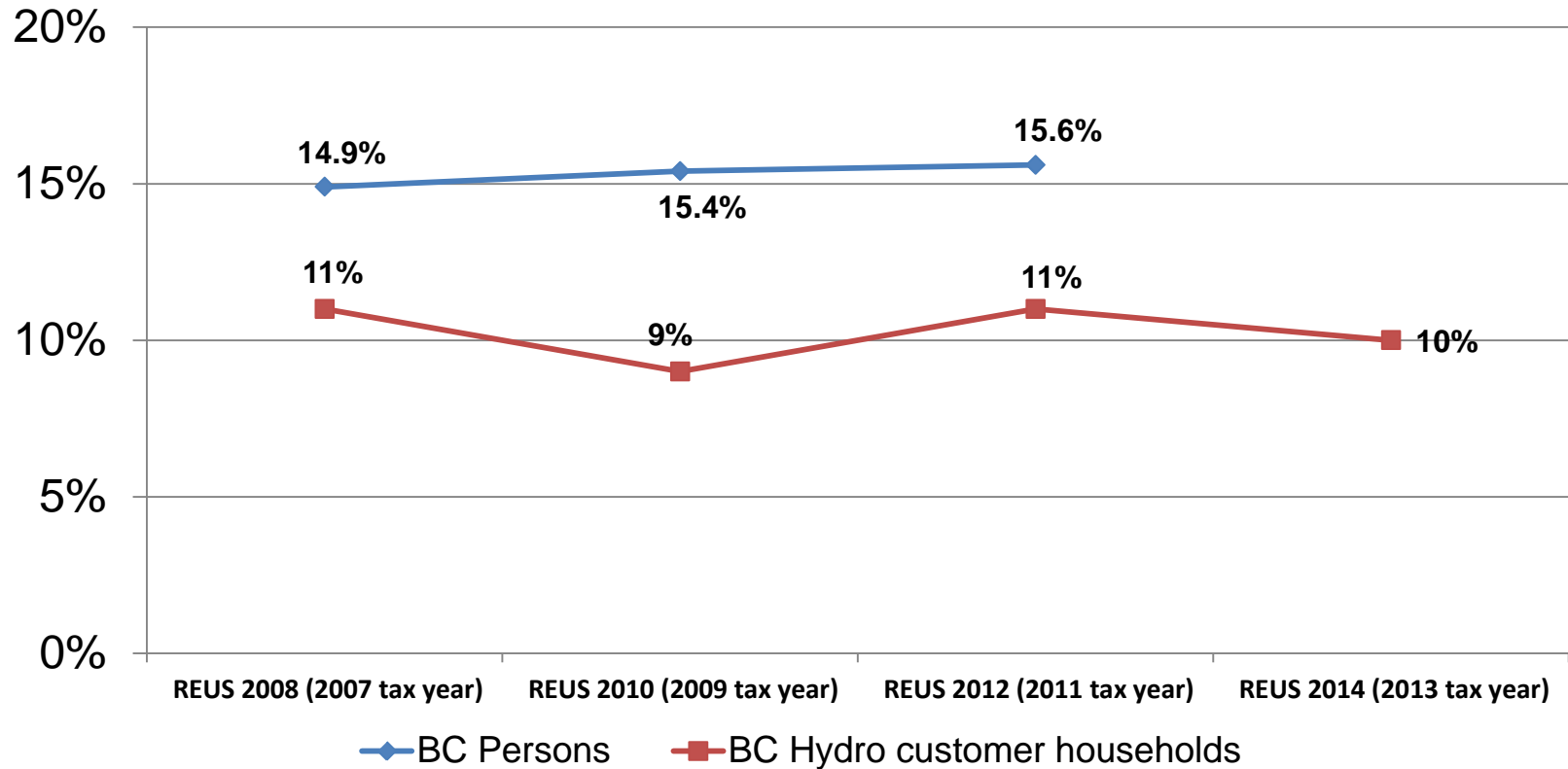
[1] Source: Statistics Canada, CANSIM table 202-0804, based on low-income pre-tax cutoffs, 1992 base.