



**MARBEK**  
Resource Consultants Ltd.

# Typical Electricity End Uses and Costs in the Home



4 November 2009

OPA Energy Efficiency Technology Symposium  
*Energy Efficient Housing*

# Outline

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- Energy use in the home
- Where to find electricity savings
- Promising measures
- Opportunities for collaboration
- Conclusions

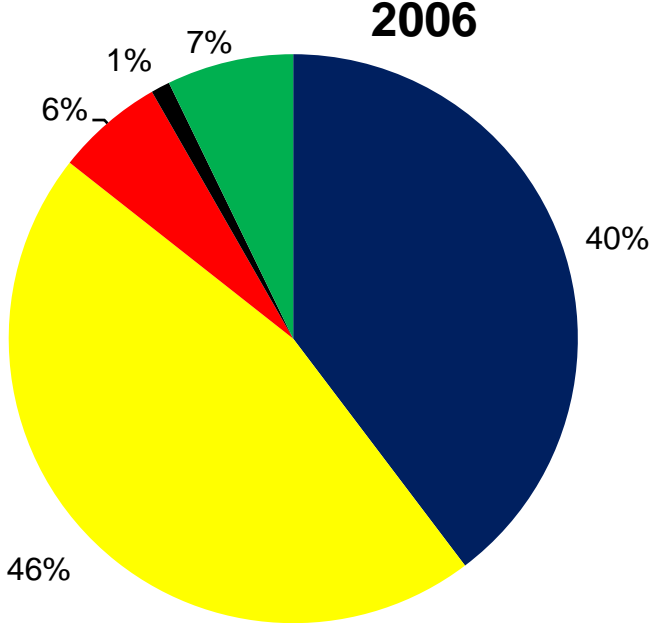
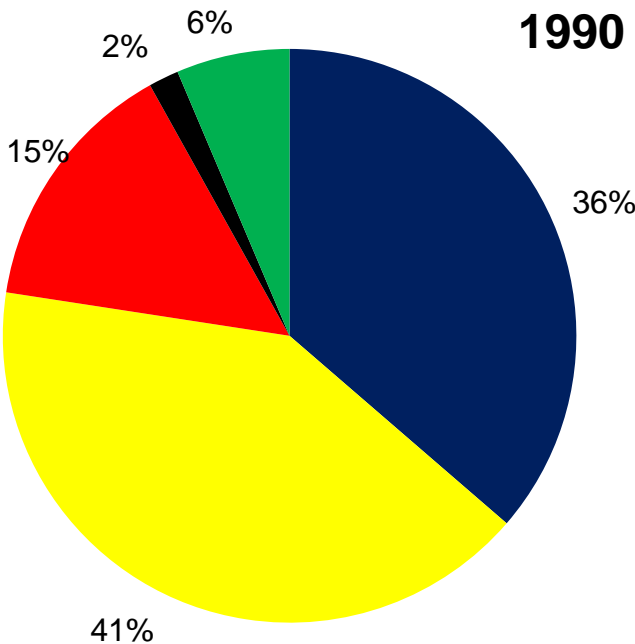
# The Big Picture

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- Data from NRCan's National Energy Use Database, 2006
- Some from Statistics Canada surveys, some from energy modeling developed by NRCan
- All fuels, 4 dwelling types, 5 end uses
- All reported energy is "secondary"

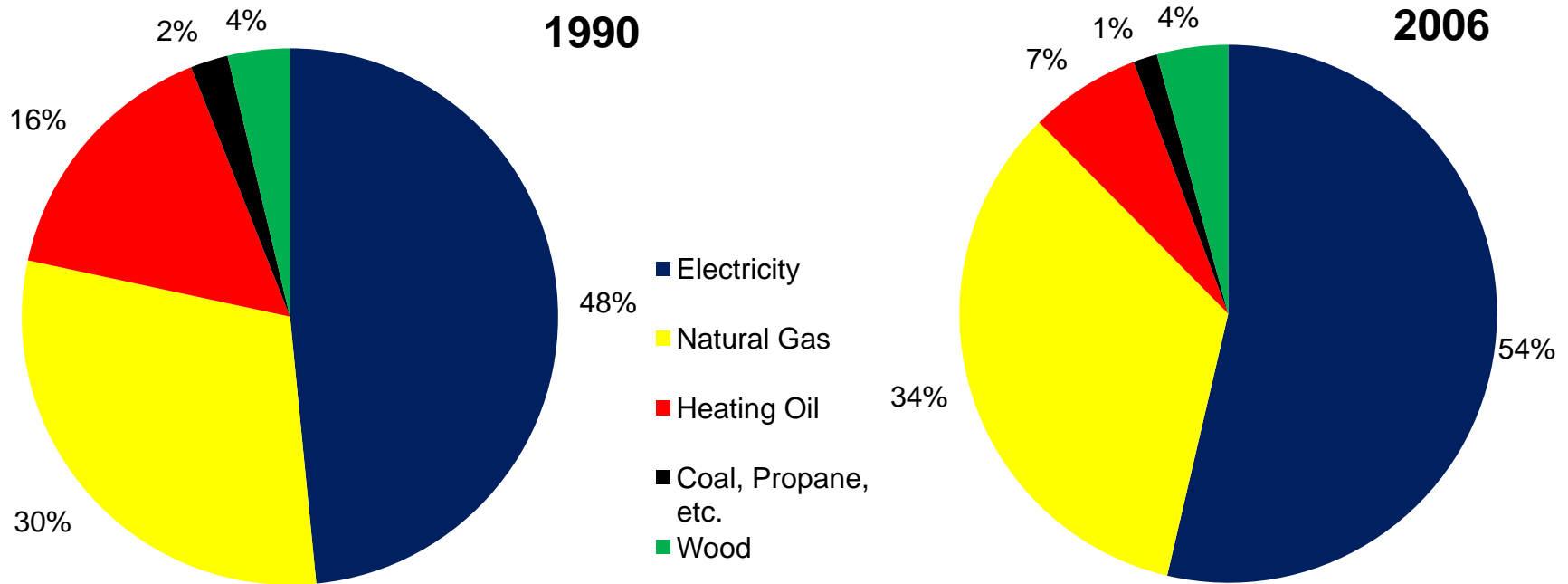


# Residential Fuel Percentages

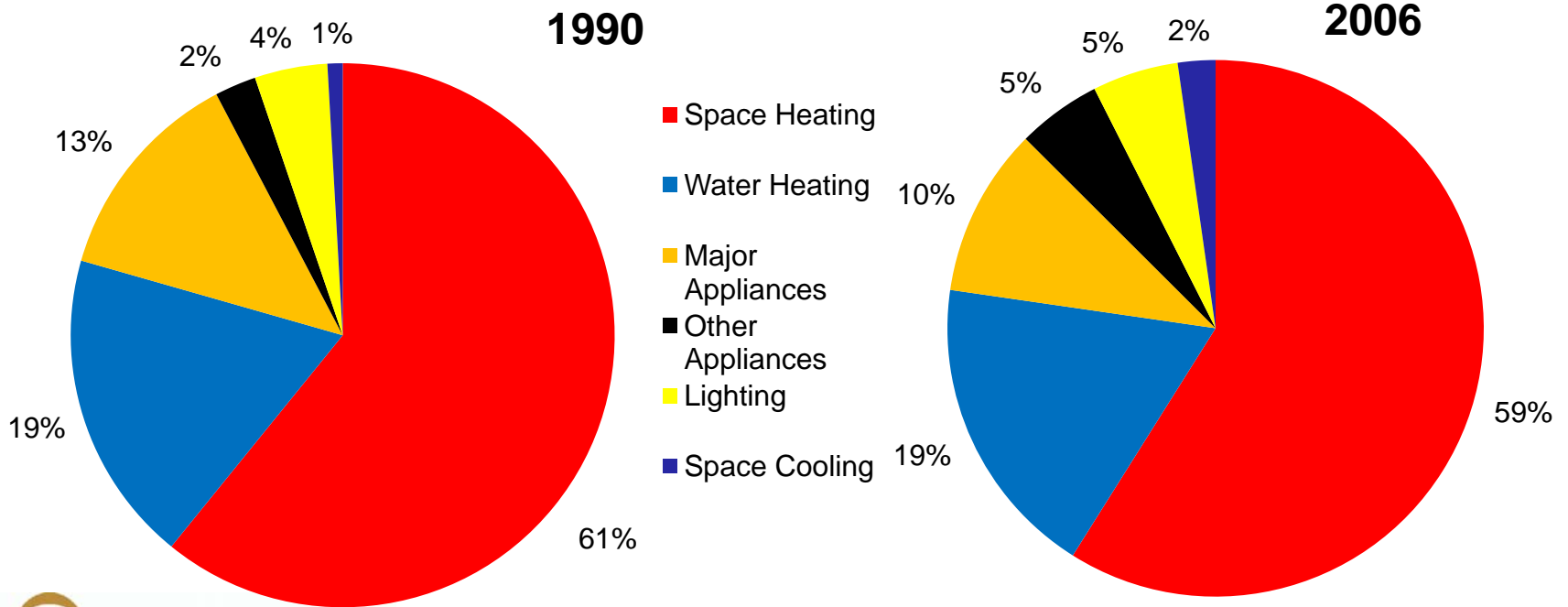


- Electricity
- Natural Gas
- Heating Oil
- Coal, Propane, etc.
- Wood

# Residential Fuel Cost Percentages

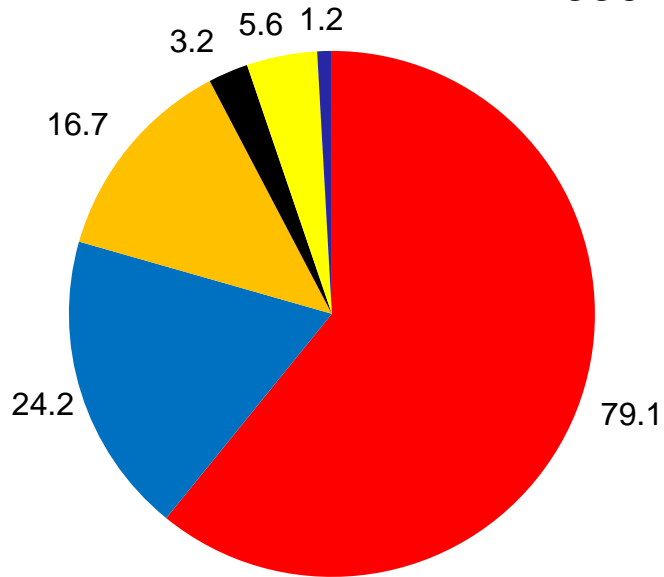


# Residential End Use Percentages

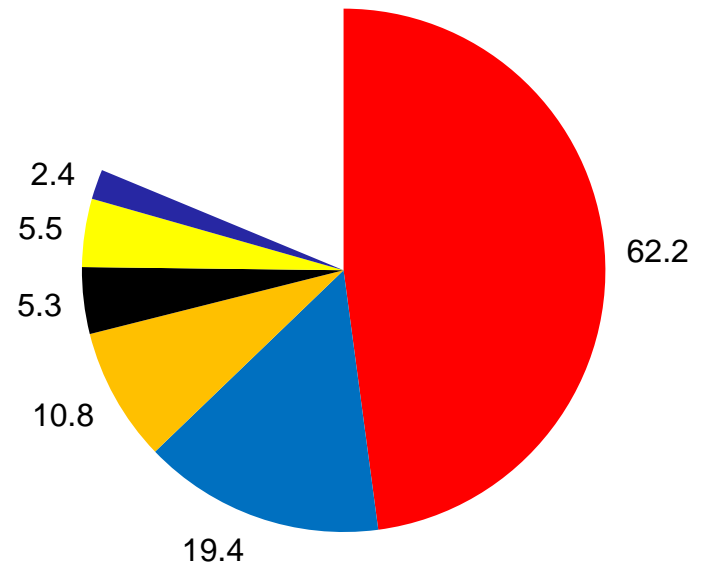


# Residential End Use Consumption (GJ/yr/dwelling)

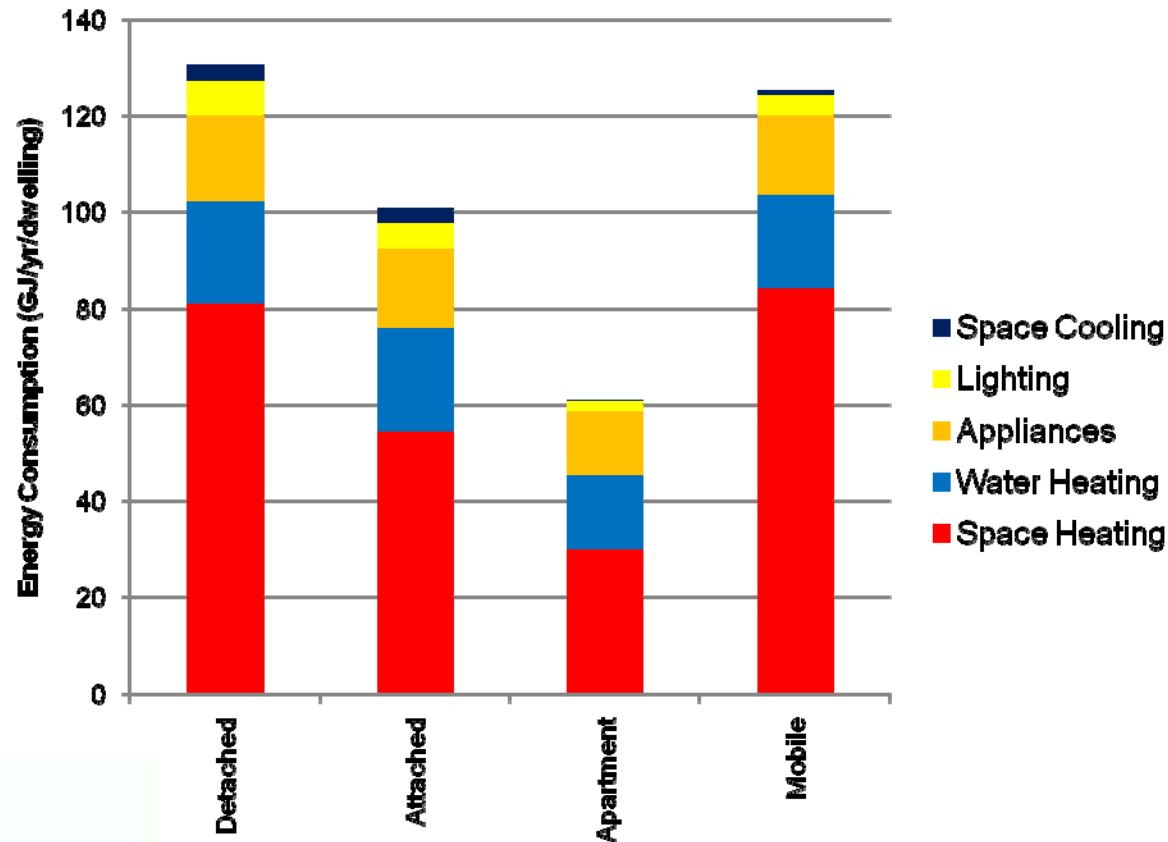
1990



2006



# End Use Consumption by Type of Home

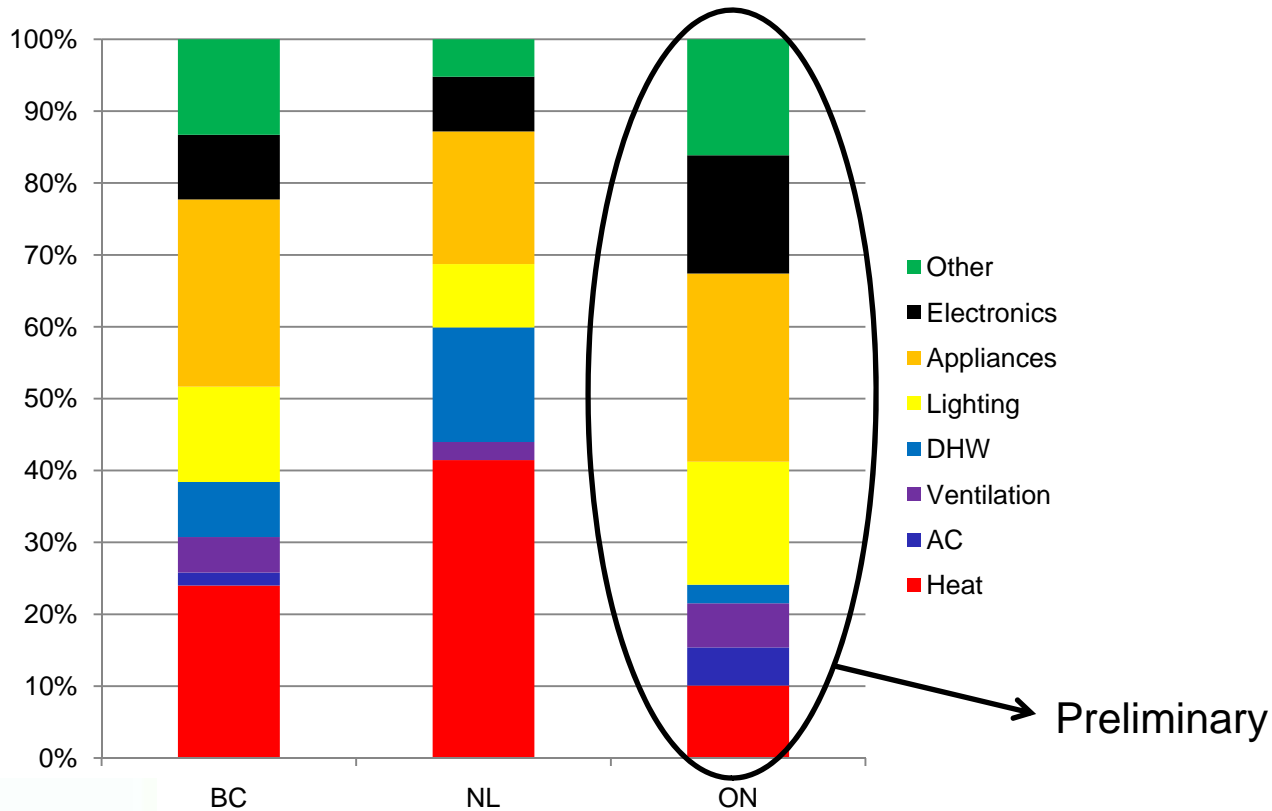


# Electricity

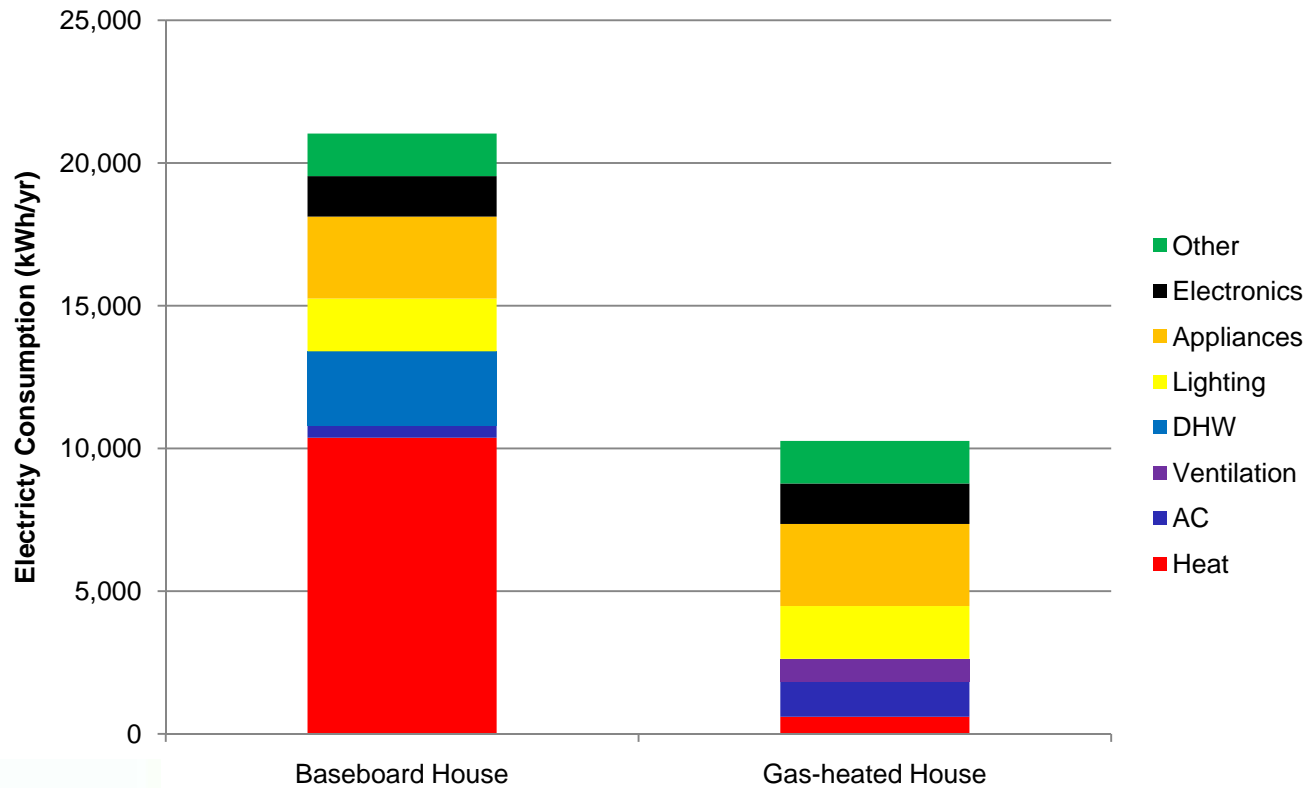
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- Model being developed for OPA still a work in progress
- Recent studies for BC and NL are completed and may lend insight
- Differences between provinces are significant

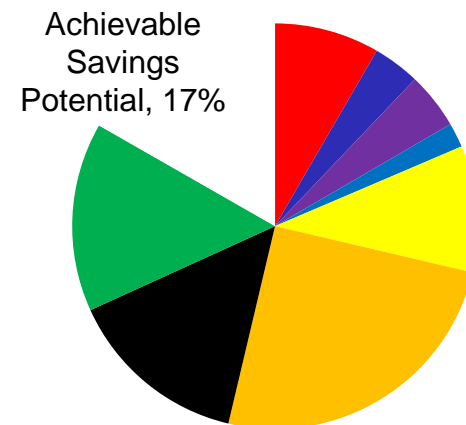
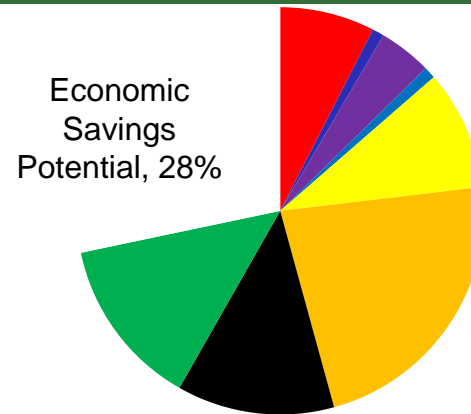
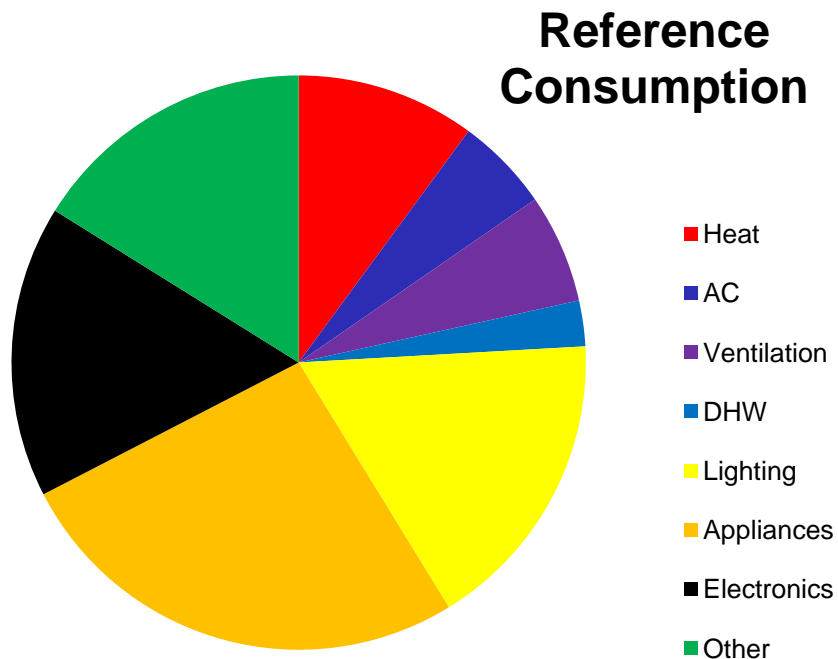
# Electric End Use Consumption by Province – Detached Homes



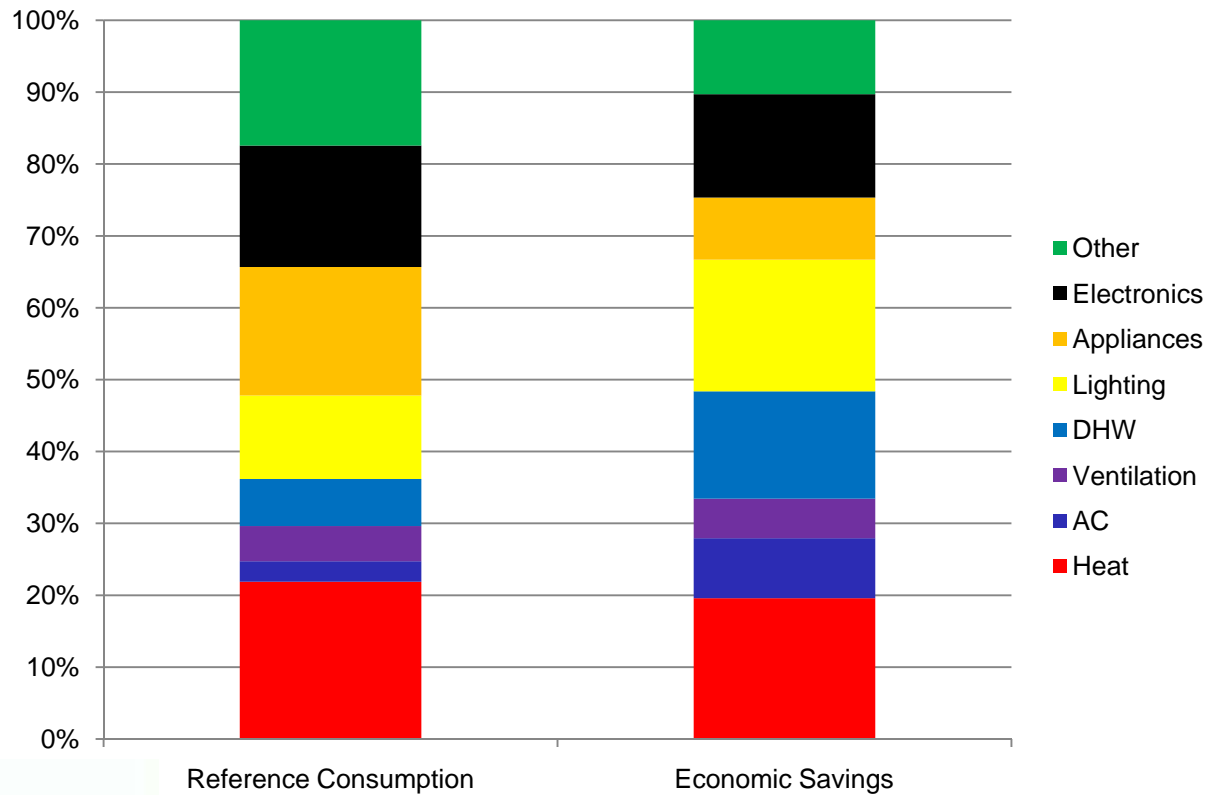
# All Electric Homes vs Gas-Heated Homes



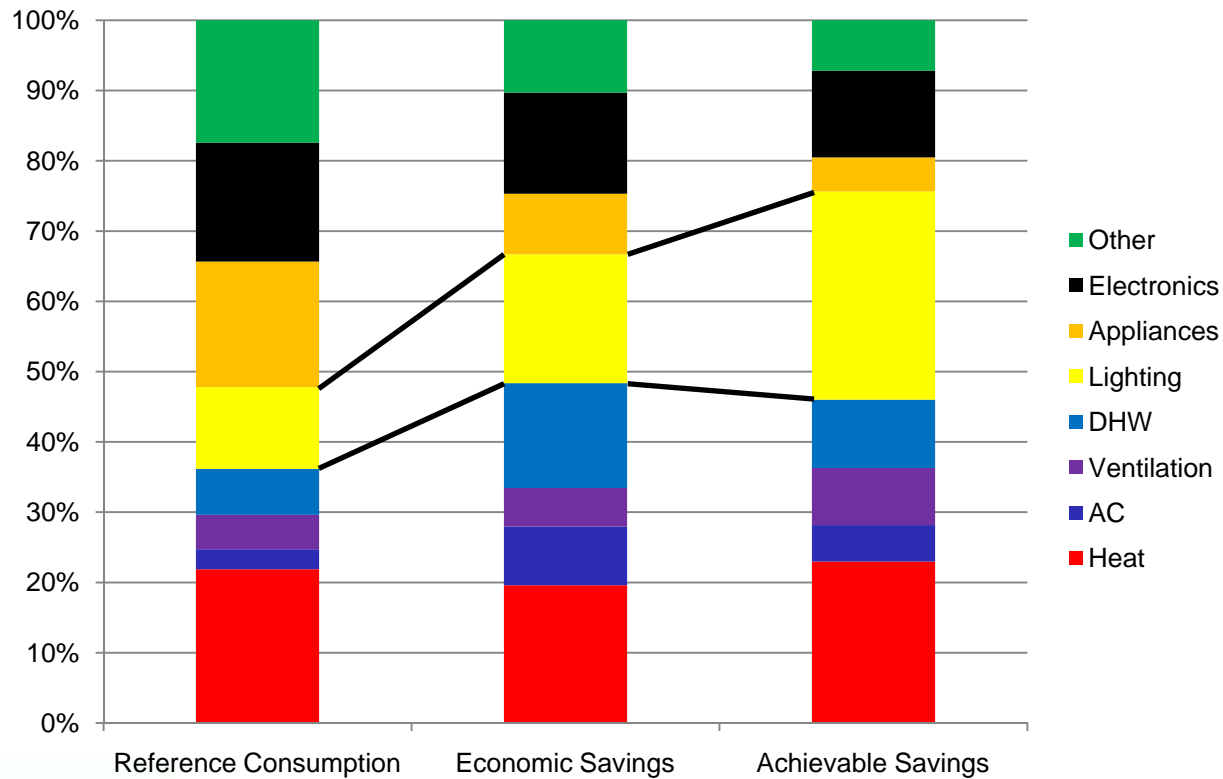
# Savings Potential\*



# Consumption vs Savings (BC)



# Consumption vs Savings (BC)



# Types of Measures

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- “Full cost” measures: worth doing now, e.g., compact fluorescents, low flow showerheads
- “Incremental” measures: do only at time of replacement, e.g., window upgrades
- “Early replacement” measures: may be worthwhile to replace before failure, e.g., old refrigerators



# Types of Measures (continued)

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- Lighting
- Heating
- Envelope
- Cooling
- Ventilation and distribution
- DHW
- Appliances
- Electronics
- Pools
- New homes

# Lighting Measures

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- Standard CFLs still have huge potential
- Specialized applications require more types of CFLs – dimmable or 3-way, small base, different shapes, colours, etc.
- Timers and motion sensors
- T8 fixtures mostly economic only in apartment common areas
- LED holiday lights – Yes, but only outside!

**Why?**



# Interaction with HVAC

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- Saving electricity inside the house increases heating load and decreases AC load
- Heating effect ranges from around 40% in the BC Lower Mainland to 80% in Labrador
- Depends on length of heating season, NOT severity (NB has bigger factor than Manitoba)
- Outdoor holiday lights have no effect on heating, but for indoor holiday lights, used only in winter, >90% of waste heat is useful!



# Heating Measures – Forced Air

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- About 20% of electrically heated Ontario homes
- Programmable thermostats (central systems)
- Heat pumps
  - cold climate versions are coming
  - ducts need to be big enough
  - ground source HP are expensive, require land
- Envelope measures – later slide...



# Heating Measures – Baseboard

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- About 80% of electrically heated Ontario homes
- Programmable thermostats more difficult
- Heat pumps
  - No ducts!
  - But wait – ductless minisplits are coming!
- Envelope measures – next slide...

# Envelope Measures

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- Good for all homes, most save both heating and cooling, but **niches are important**
- Windows when being replaced – Energy Star and even better
- Wall insulation when siding being replaced
- Attic insulation in older homes where it has not been upgraded
- Air sealing in old, leaky homes



# Cooling and Ventilation/Distribution

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- Envelope measures reduce cooling and fan energy
- Energy Star AC systems, at time of replacement
- Whole house fans
  - Neglected technology in Canada, but widely used in the US in similar climates
  - Can be used instead of AC
  - Require sophisticated user or control system
- Furnace fan motors
  - When (gas?) furnace is replaced



# DHW Measures

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- Low flow showerheads and faucet aerators
- Pipe wrap (\$1 of insulation on first metre of pipe)
- Insulating blankets for older tanks
- Niche: wastewater heat recovery where there are lots of long showers (teenagers?)
- DHW from washers and dishwashers – see later slide



# Appliance Measures

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- At time of replacement (or maybe early)
- Energy Star refrigerators
- Chest freezers without defrost
- Energy Star washers
  - Careful of maintenance issues with low-end front loaders
  - There are Energy Star top loaders now, but not many
- Energy Star dishwashers

# Electronics Measures

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- Energy Star televisions and other electronics (at time of replacement)
- Energy Star computers and peripherals (at time of replacement)
- Smart power strips
  - Some have timers
  - Some have sensors on one outlet to control several other outlets



# Pool Measures

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- 7% of Ontario homes have pools and/or spas
  - Over half are heated
  - Most spas heated electrically
  - Most pools heated by gas; electric heaters usually heat pumps
- Insulating pool covers still not used in about 30% of pools
- There are much more efficient pool pumps available
- Solar pool heating is less expensive upfront than regular heaters, but doesn't heat 100% of the season



# New Homes

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- Important not to miss structural opportunities, which are otherwise lost for 30-50 years
- Standards are moving up to EGH 80 (the performance of an R2000 house) and it will be more challenging to push savings beyond that level
- Expect some markets to move – premium windows will likely drop in price as Energy Star windows become the standard model
- The near-zero energy home (e.g., the Factor 9 House in Regina) offers a way forward



# Collaboration

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- ecoENERGY Retrofit program
  - Collaborate on envelope and HVAC equipment
- Development in progress for an electrical home audit to go with the ecoENERGY
- Collaborate with gas companies on envelope programs, appliance programs, DHW measures, new homes, even pool measures
- Leverage the Energy Star brand name

# Conclusions

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- Achievable potential at least 15% of electrical consumption in average homes
- Understand both which end uses are important and how easy it is to get savings in them
- Niche markets are important
- Leverage opportunities for collaboration
- OPA model for estimating potential is coming – its effectiveness for individual LDCs will be improved with more detailed customer data

# Questions

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