

City of Cornwall
Social Housing Division
Top 10 Energy & Water Saving Tips

in
Multi-Unit Residential Buildings



Duncan Hill

Canada Mortgage and Housing Corporation

Andrew Pride

Minto Developments Inc.

Energy Use in Apartment Buildings

- Most apartment buildings constructed in 1960's - 1970's
- poorly insulated, poor sealed building envelopes
- inefficient mechanical-electrical systems

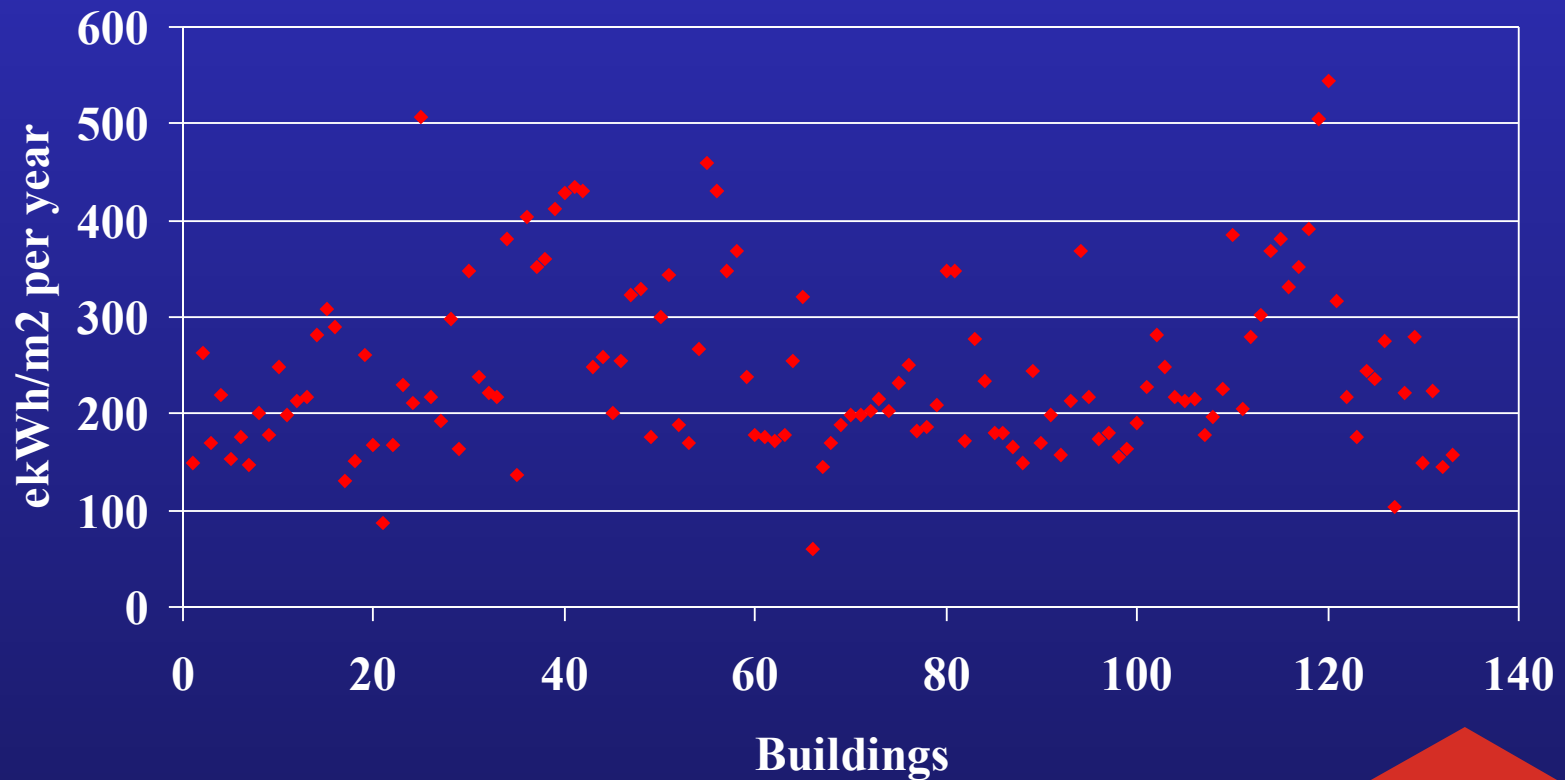
First CMHC Study on Annual Energy Use in MURBs

- 20,665 kWh per apartment
- 222 kWh/m² (± 60 kWh)
- 0.04885 kWh/m²/degree-day
- As intensive as single family houses

More Recent CMHC Study

Energy Use - 133 bldgs

Average = 238 ekWh/m²/year



Energy Use Trends (per m²)

- Family buildings consume more than seniors
- Older buildings consume more than newer
- Larger buildings consume more than smaller
- Metro Toronto buildings generally consume more than those in other locations
- Toronto space heat about 100ekWh/m²

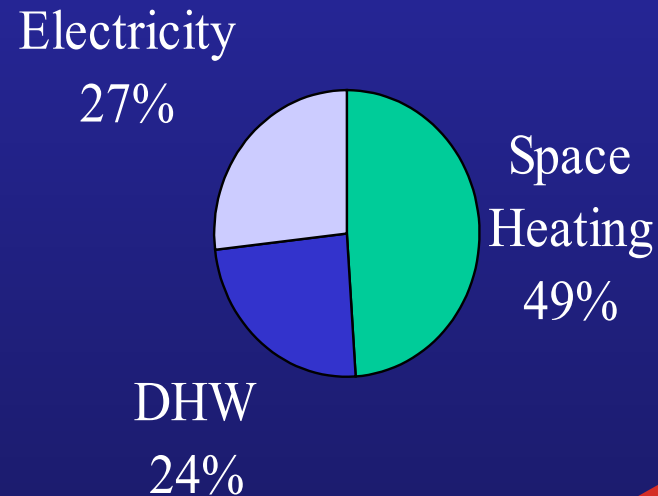
Annual Energy Use by Source

- For Gas Heated (space & dhw) Buildings

Electricity 27% of overall building energy use

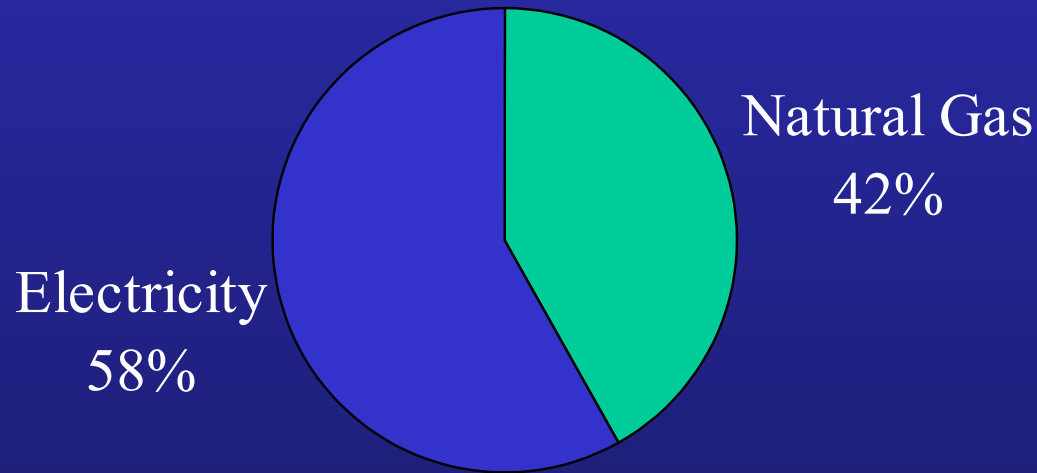
In-suite electricity use - 73% of total building electricity use

Natural Gas and Electricity
proportion

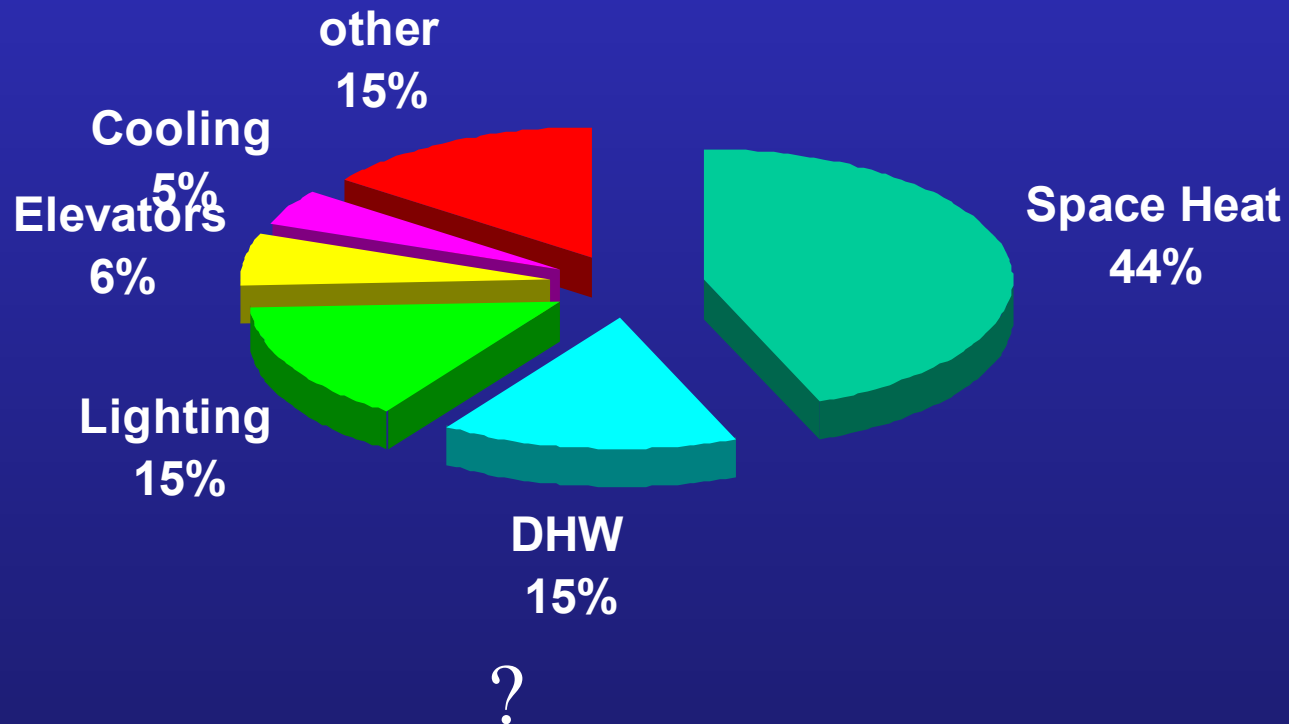


Annual Energy Use by Source

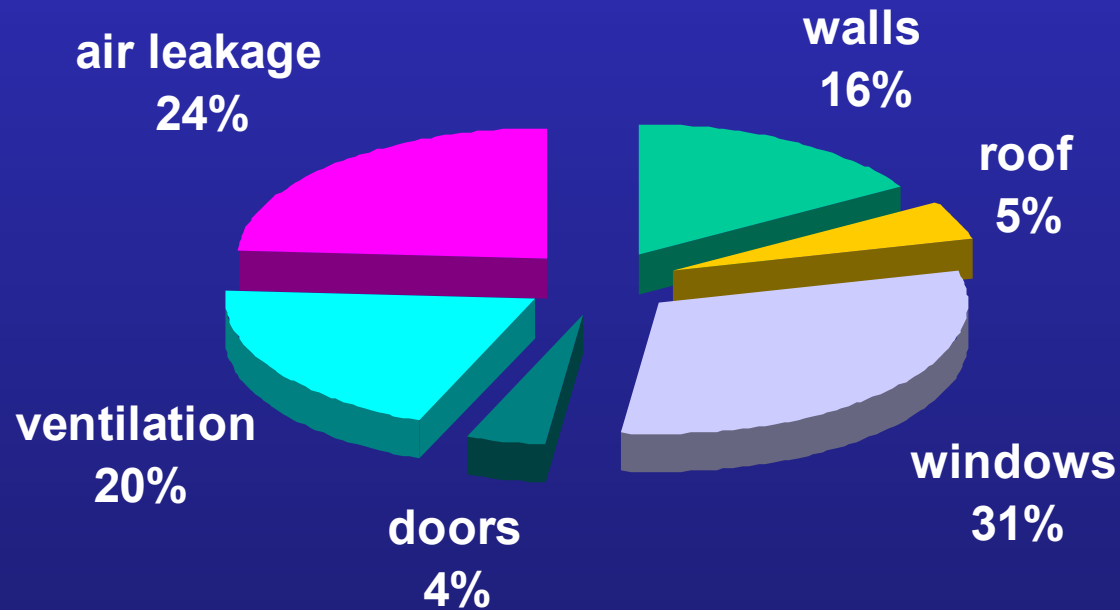
- For electric heated buildings (with gas dhw)



Where Energy is Used:



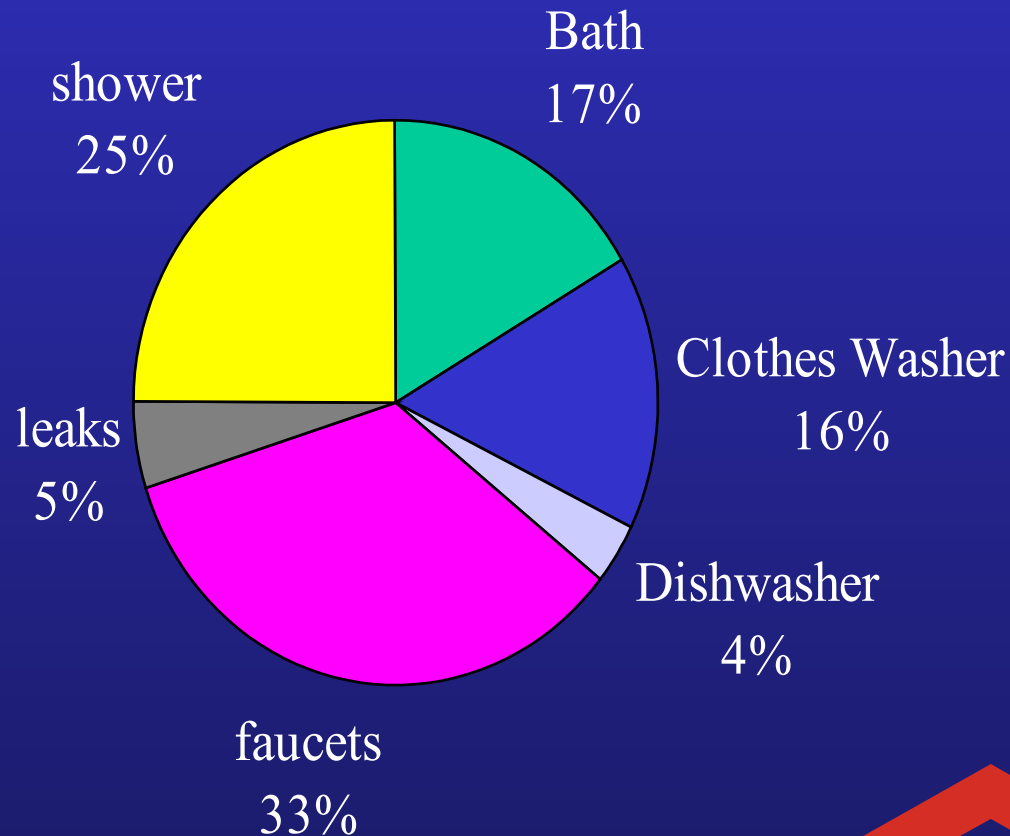
Where the Heat Goes:



Where the Hot Water Goes:

(single family houses!)

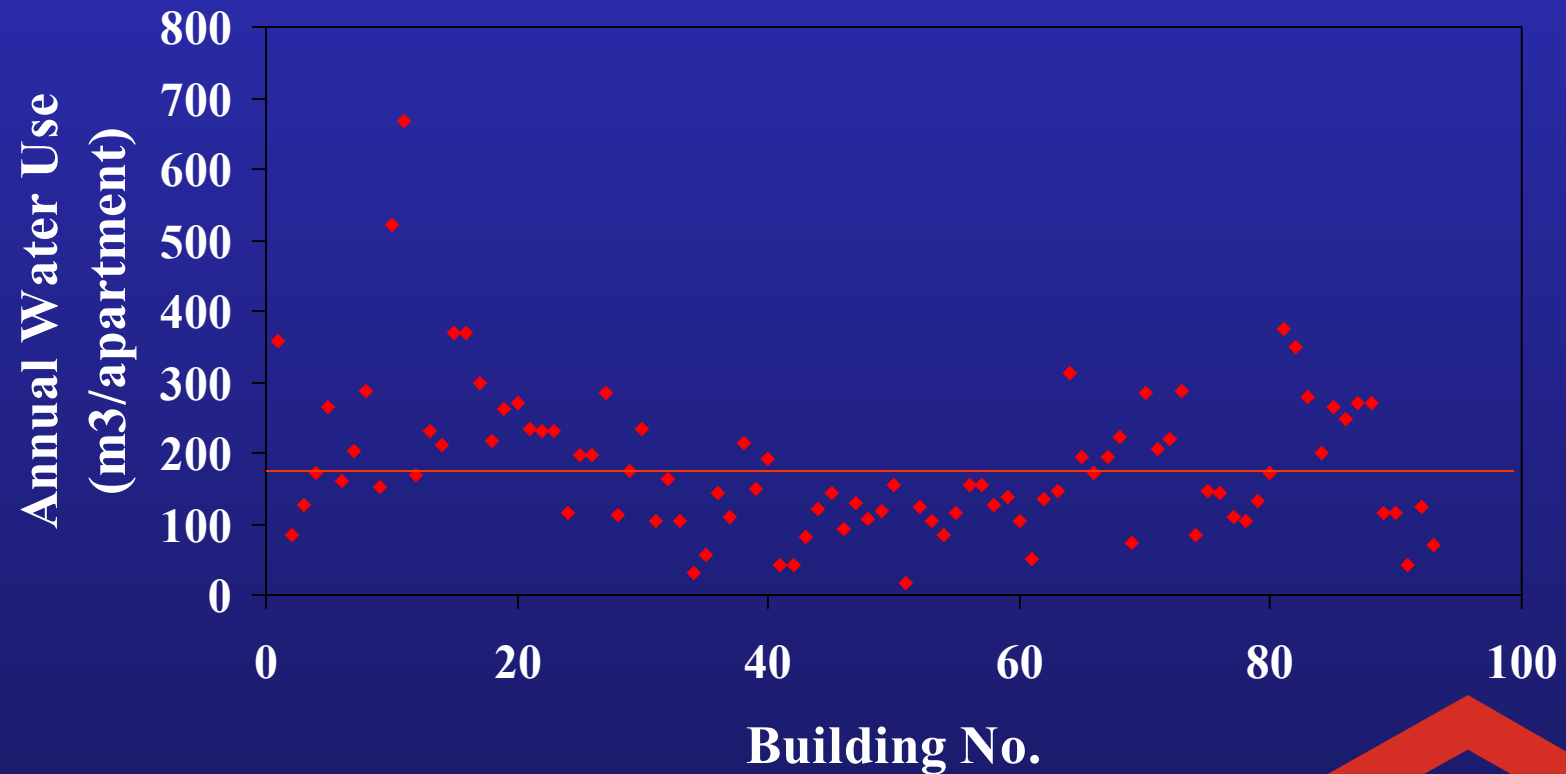
40% of
Overall
Water use



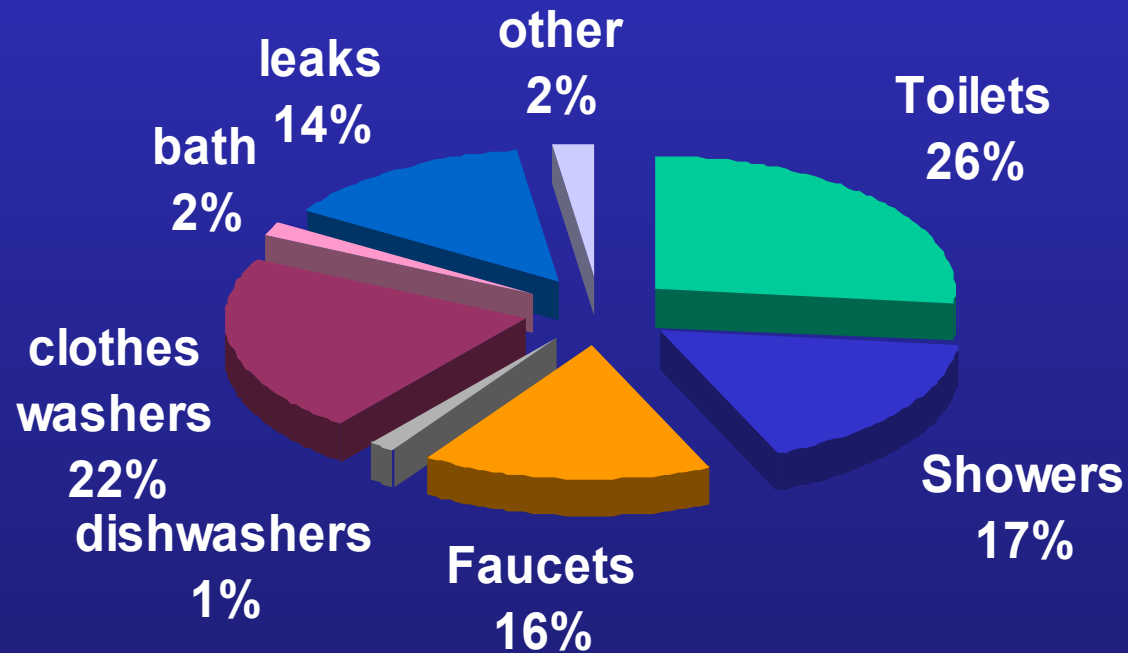
Source: DeOreo W., Mayer, P. "The End Uses of Hot Water in Single Family Homes from flow Trace Analysis"

Water (hot and cold) Consumption

Average consumption = 182 m³/apartment/year



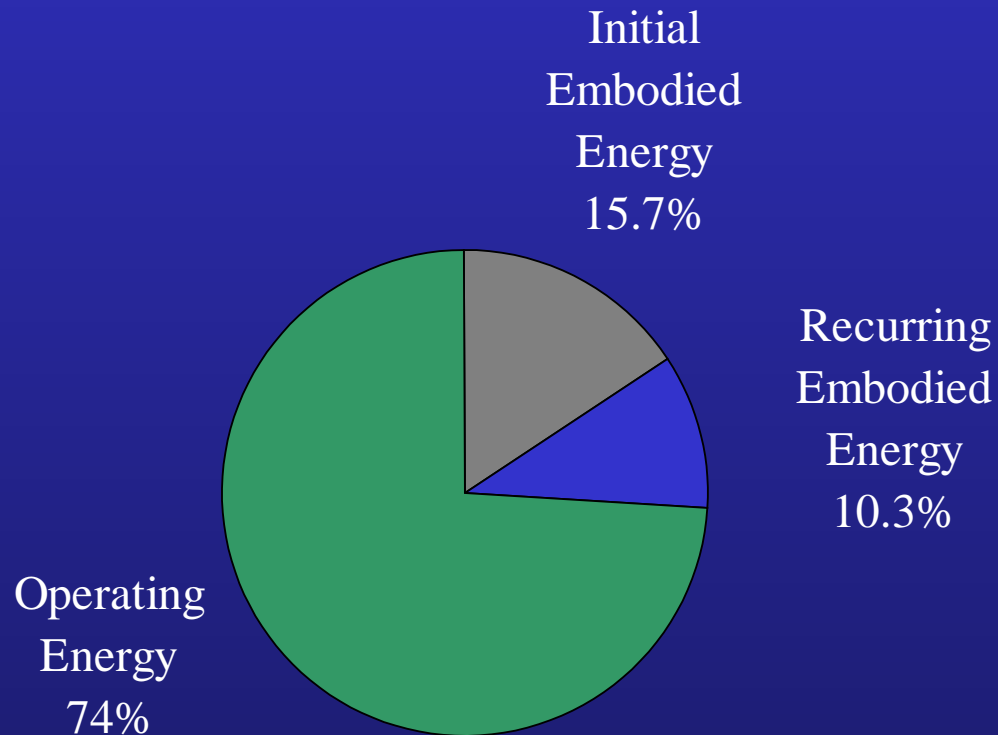
Where the Water Goes:



(Single family houses)

Source: AWWA

Why We Care:



Tip #1: Know Your Usage

Understand **how** much energy is used

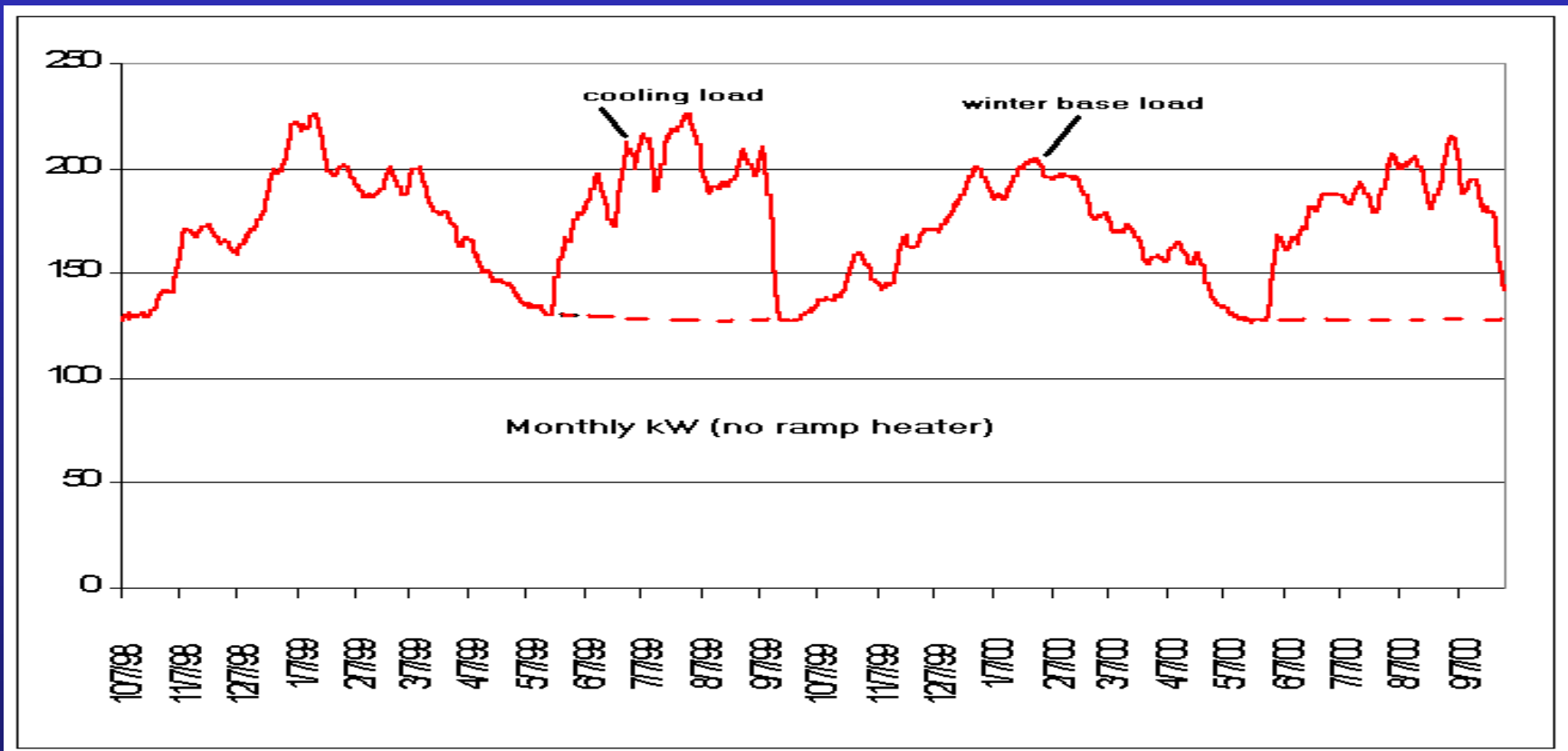
- Understand **where** your energy is used
- Track your usage
- Same goes for water

Tip #1: Know Your Usage

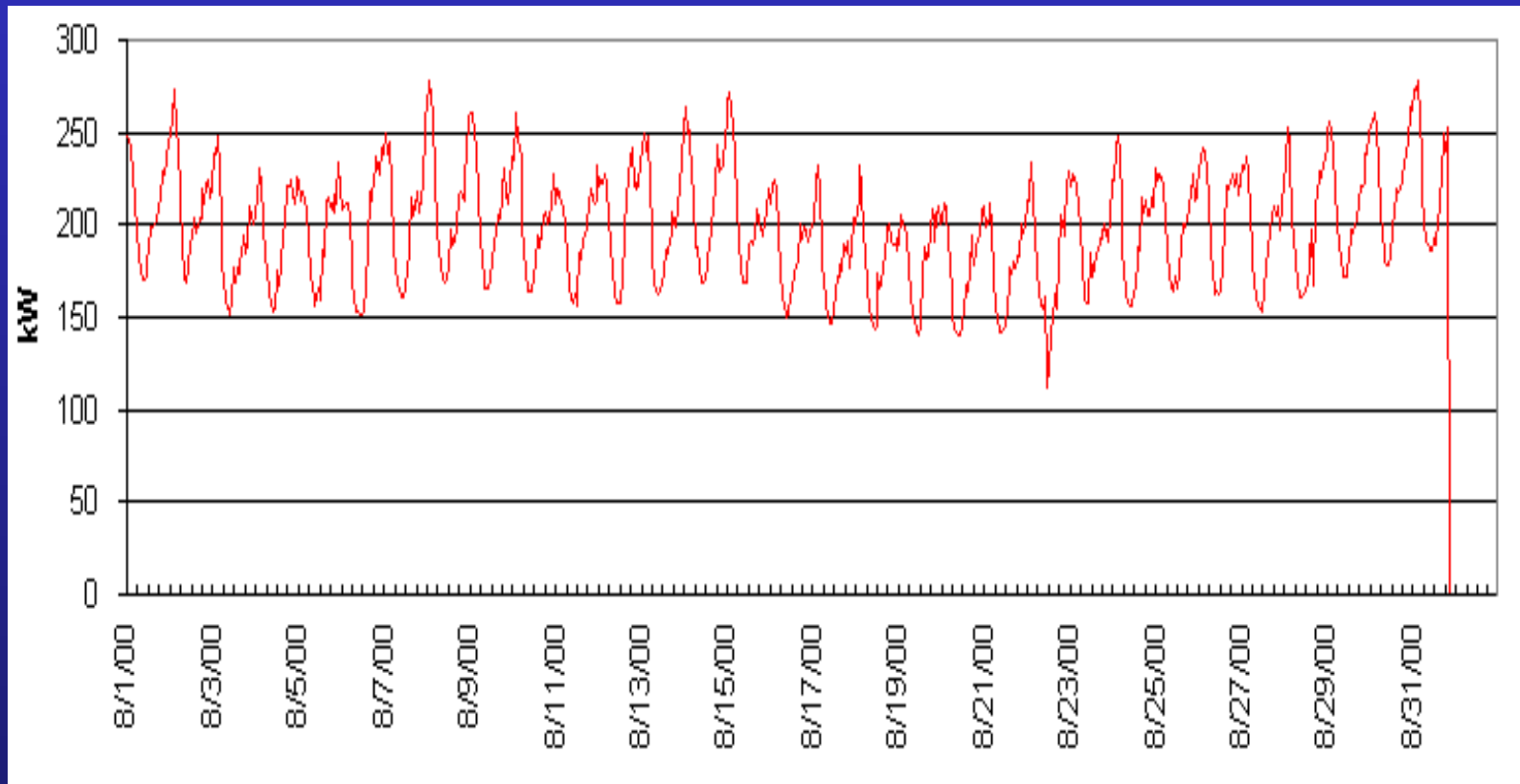
Why Track Your Energy Use ?

- Identify anomalies
- Responsible management of costs
- Confirm Meter Validity
- Estimate end-use
- Explore Time of Use consumption costs

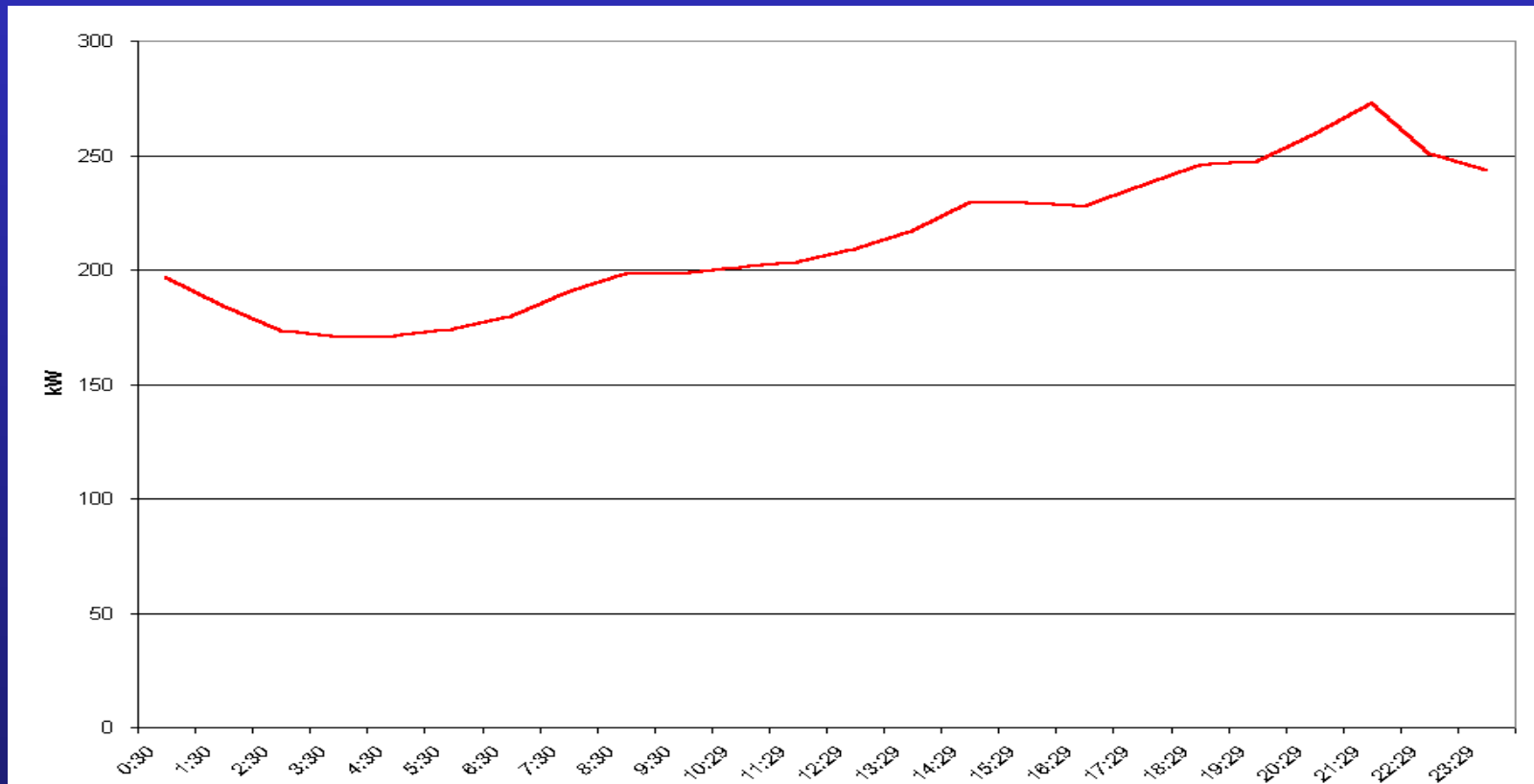
Typical Seasonal Electrical Load



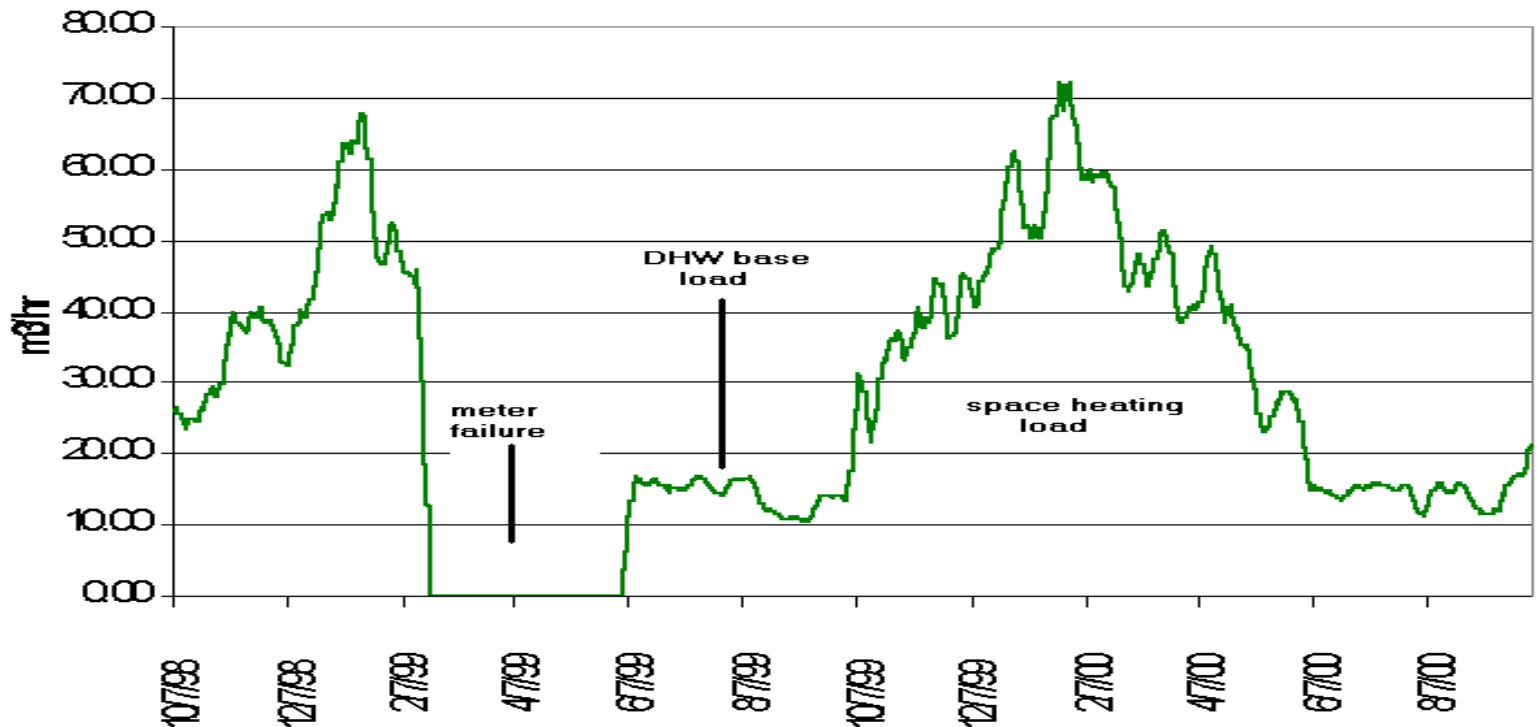
Typical August Electrical Load



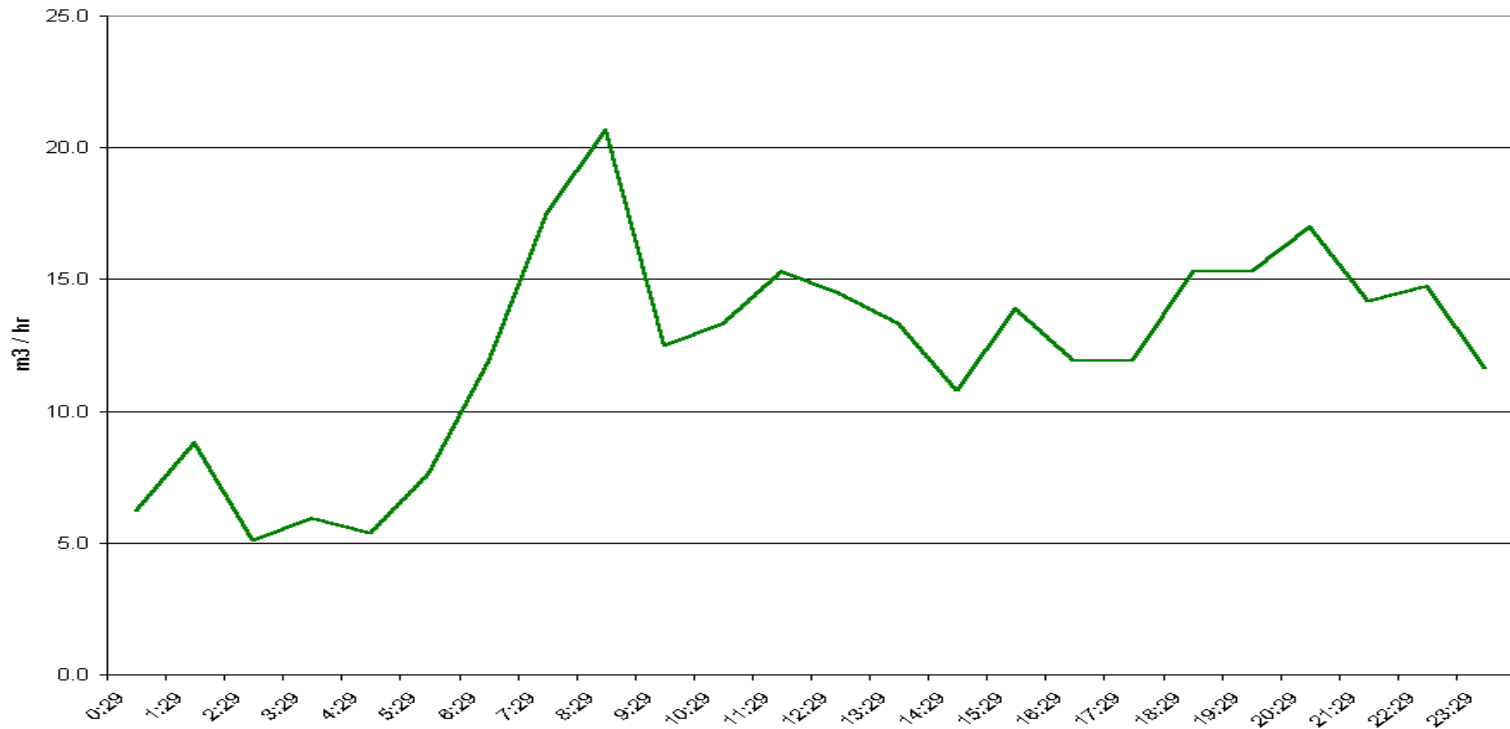
Typical Daily Electrical Load



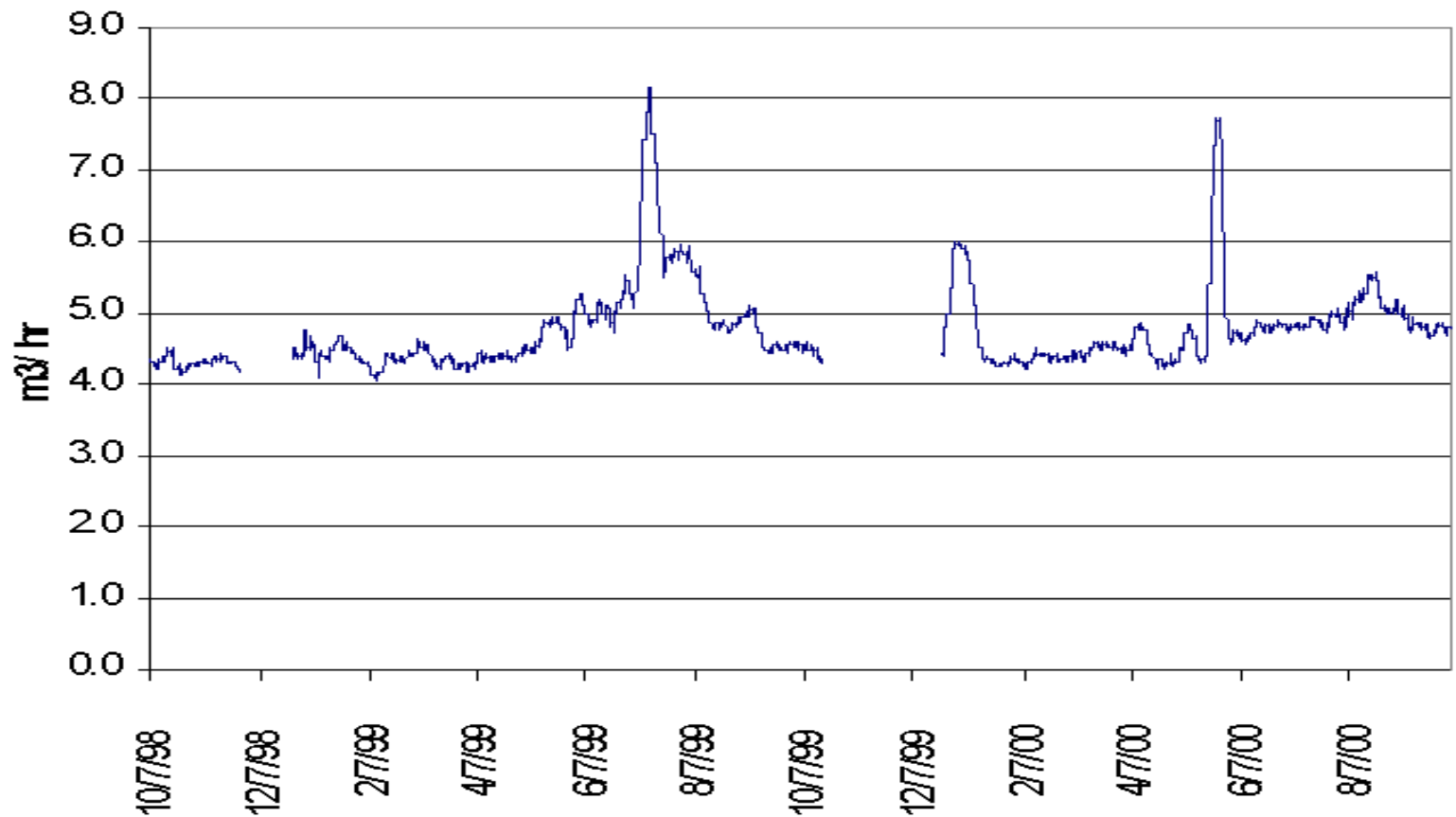
Typical Seasonal Gas Load



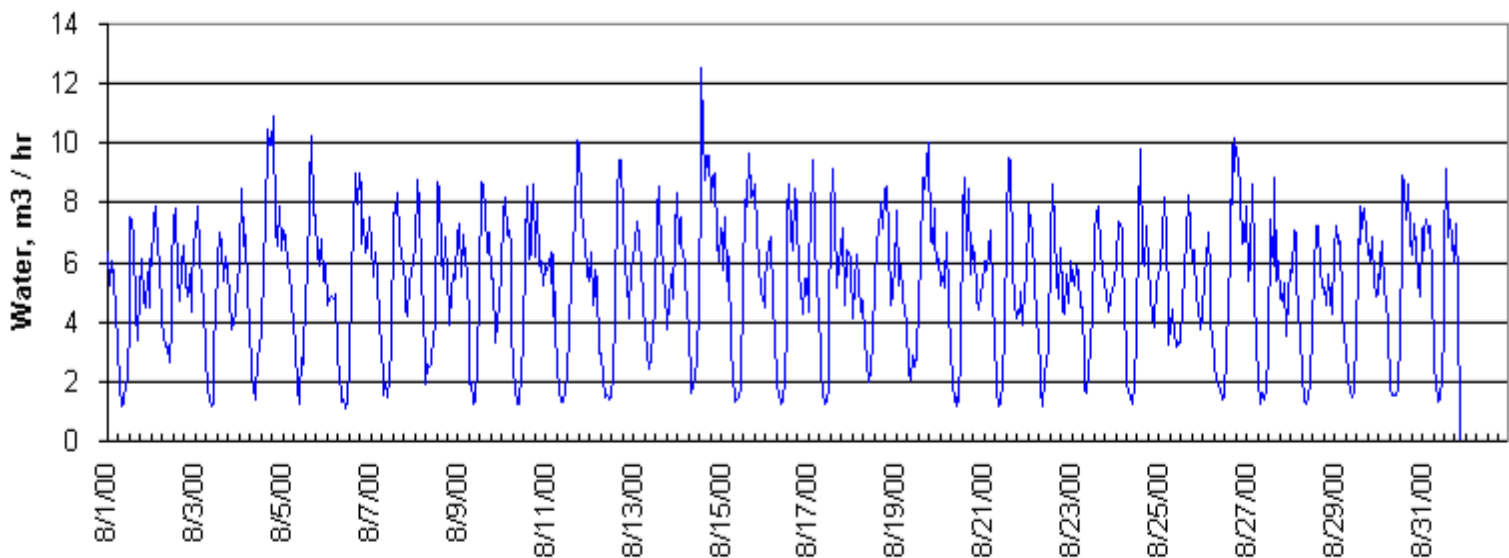
Typical Summer Gas (DHW) Load



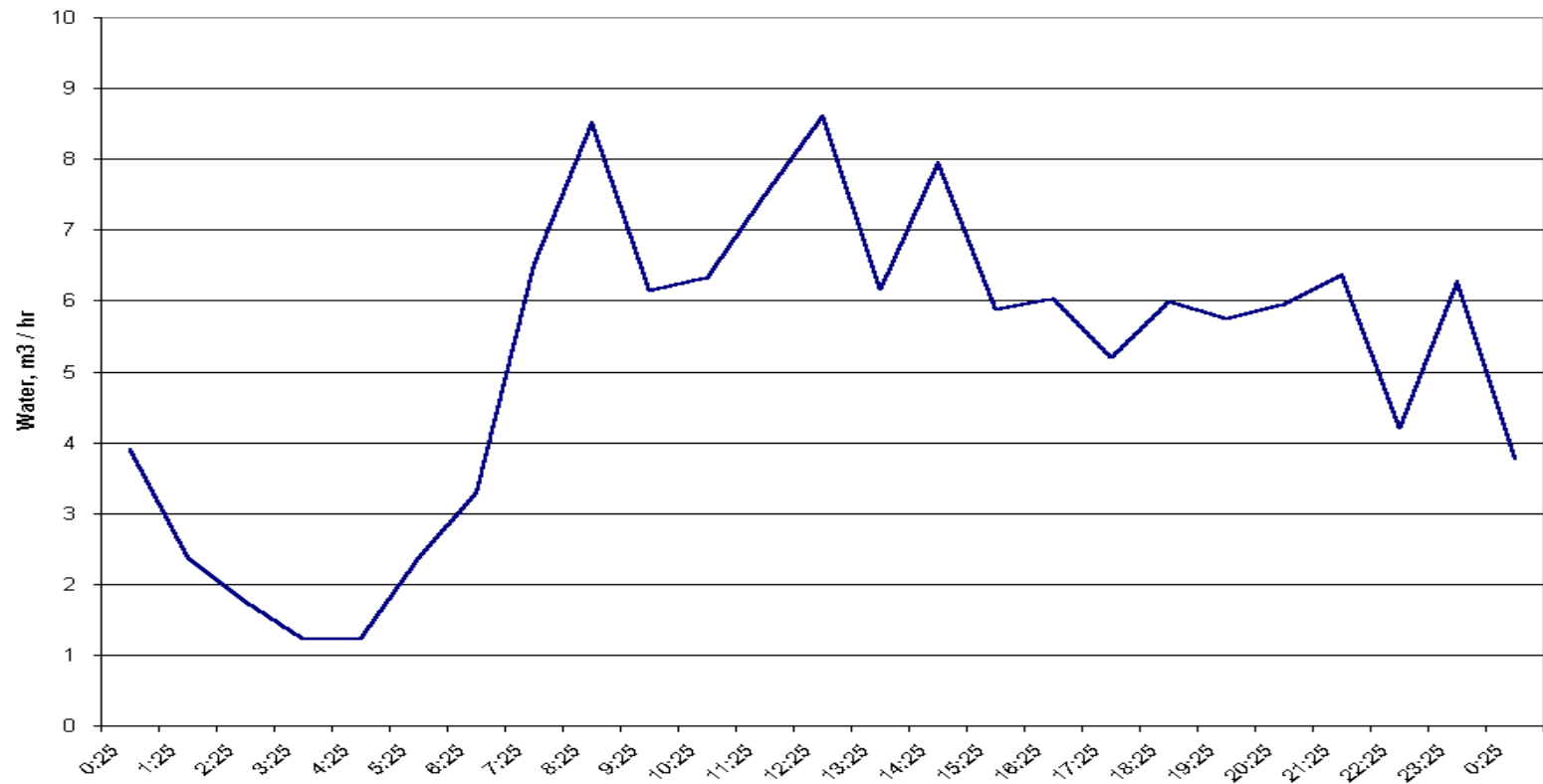
Typical Annual Water Consumption



Typical Monthly Water Consumption



Typical Daily Water Consumption



Utility Bill Analysis

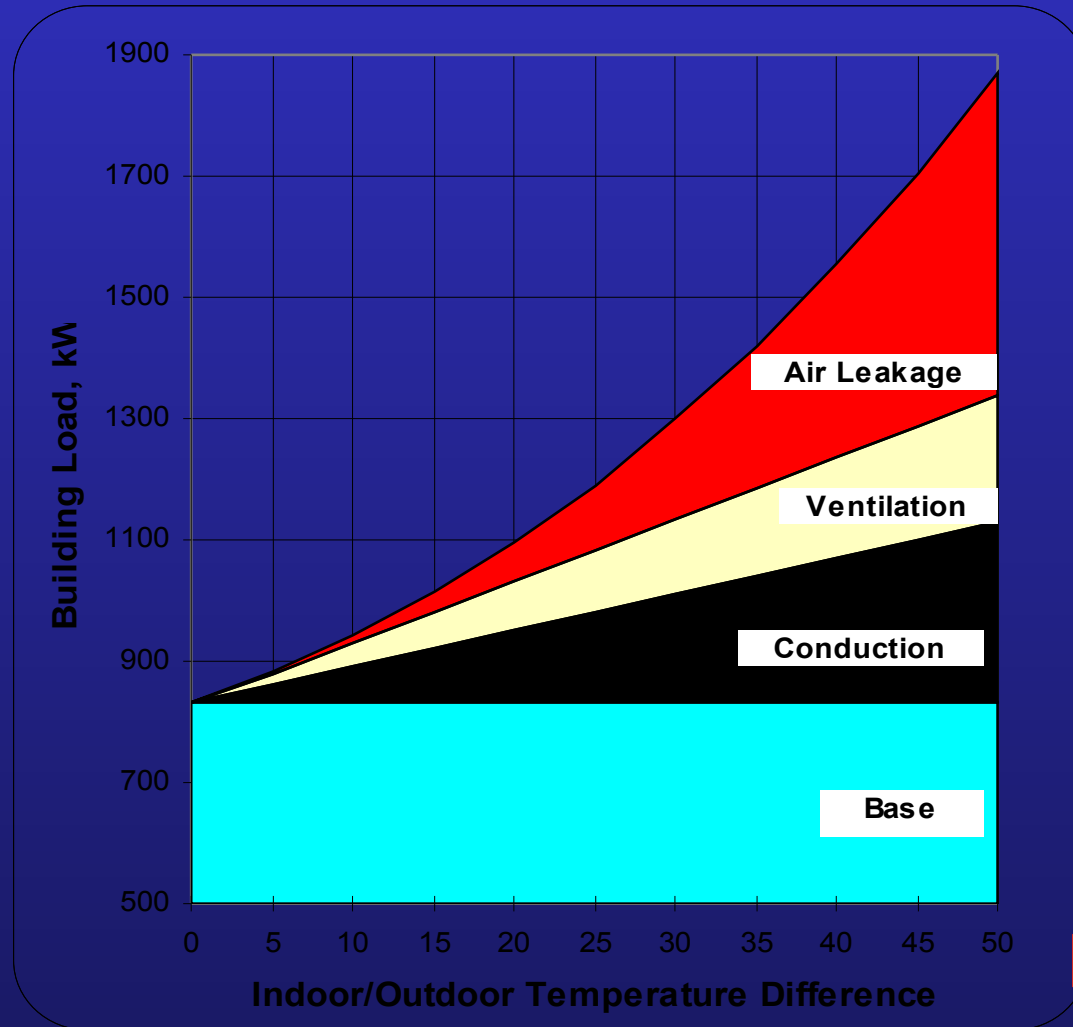
- Permits estimates of space heating, domestic hot water and electrical consumption
- Puts a perspective on potential energy and water saving measures
 - Is energy use reasonable?
 - Are savings possible?
- Need to know how other bldgs perform

Tip #2 Tighten Your Building

Simple air leak problems cause huge waste

- Easy to implement (in common areas)
- Priorities:
 - Top and Bottom of Building
 - Interior Shafts
 - Exterior Wall

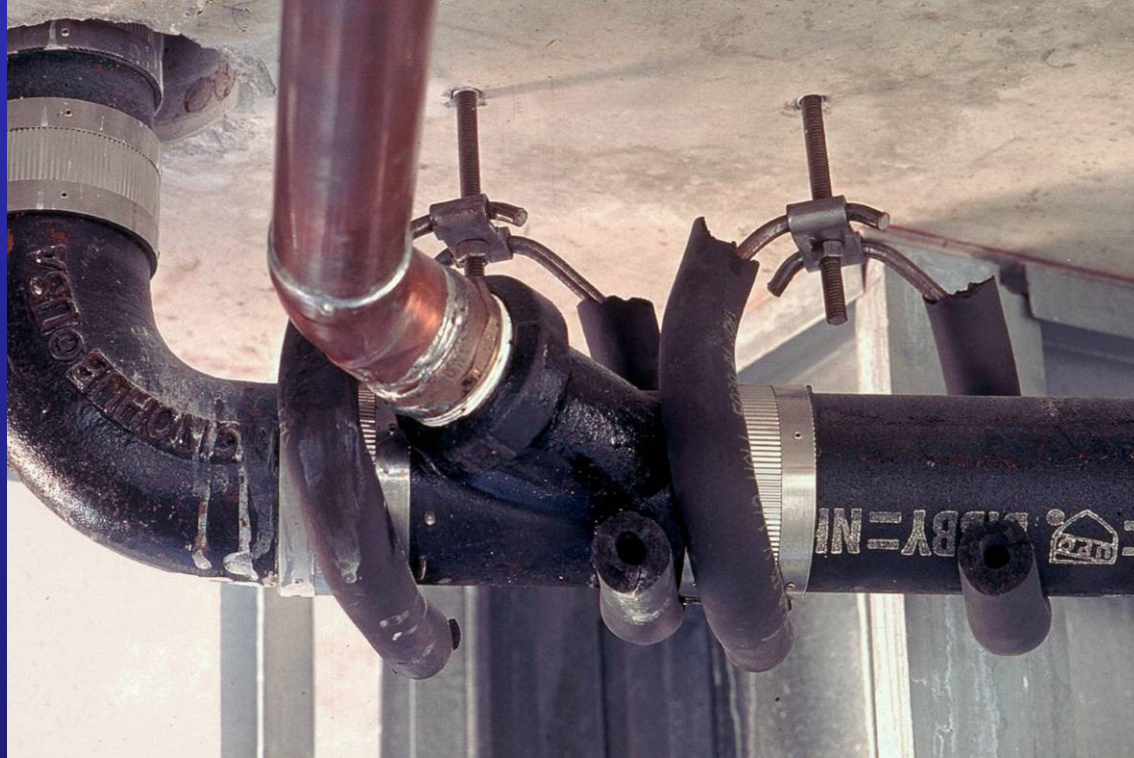
Building Envelope



Bottom: Parking Garage: Pipe and duct Hangers



Bottom: Floor Penetrations of Services



Ductwork through Slabs and Walls



Bottom: Garage Vestibule Doors



Bottom: Garage/Basement Areas



Rooftop Level: Stairwell Doors



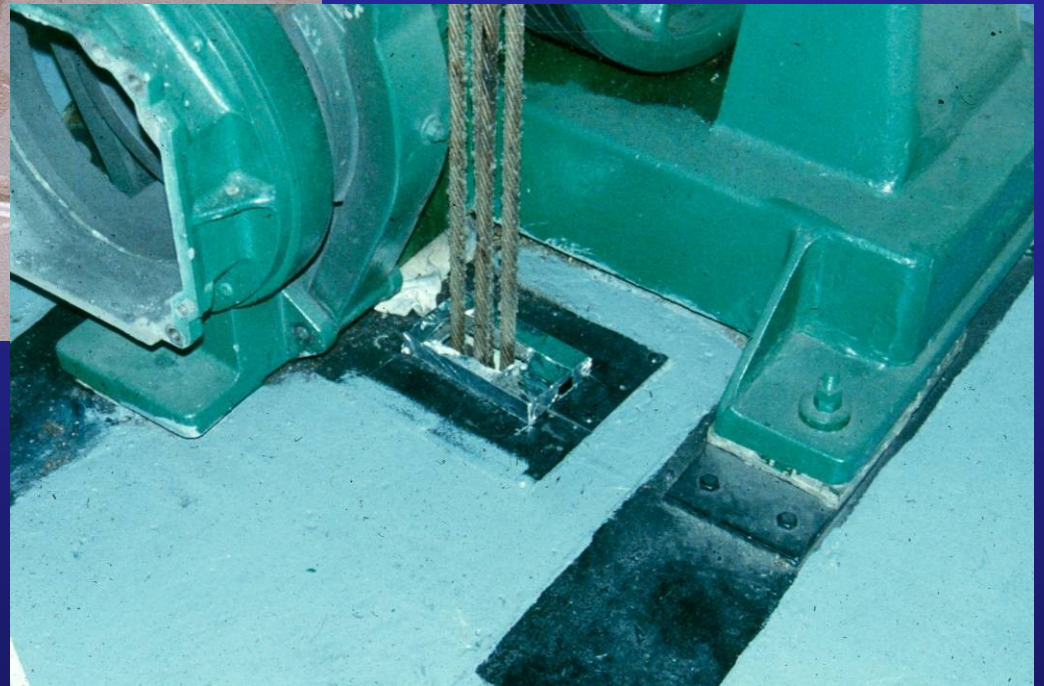
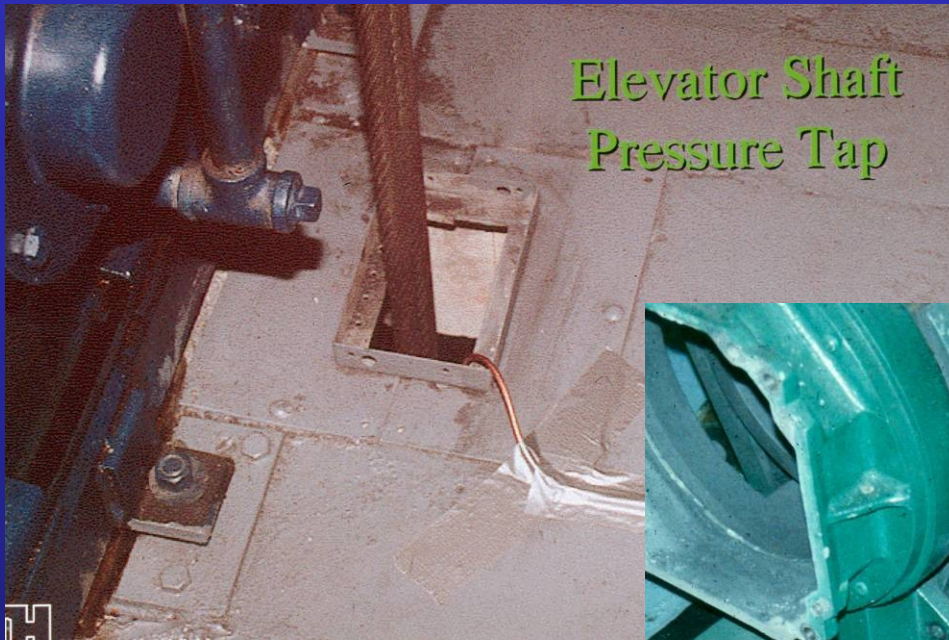
Rooftop Level: Stairwell Doors



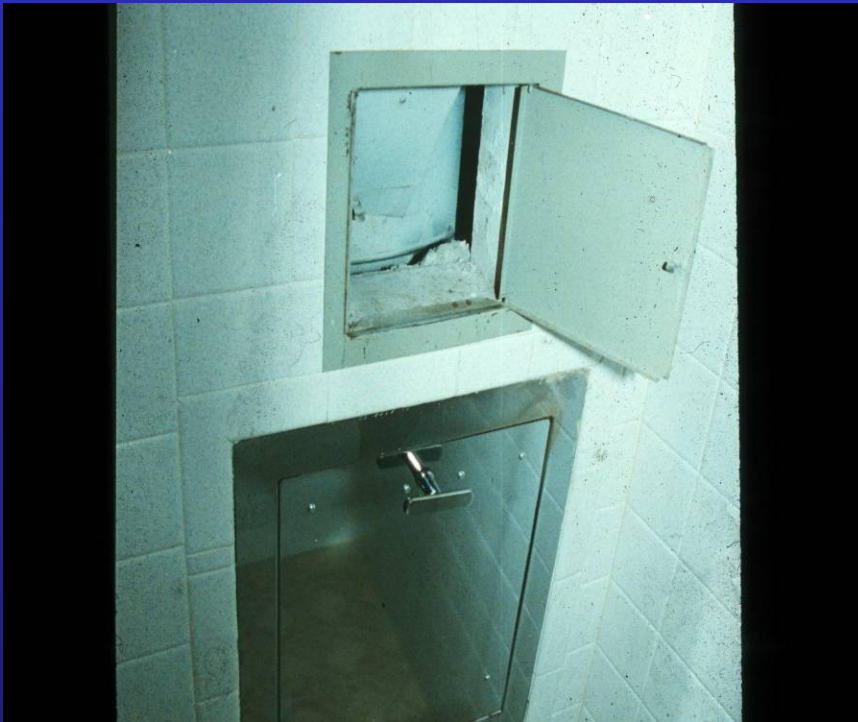
Rooftop Level: Stairwell Doors



Rooftop: Elevator Hoist Cables Wiring Conduits

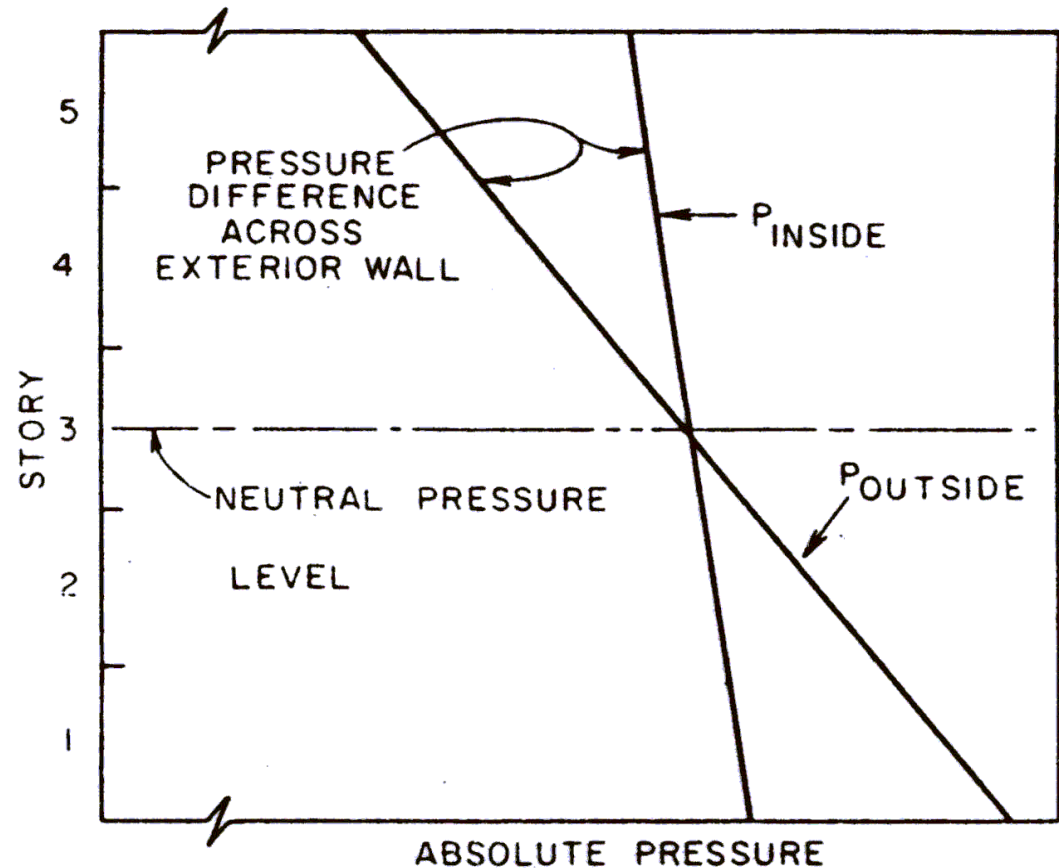
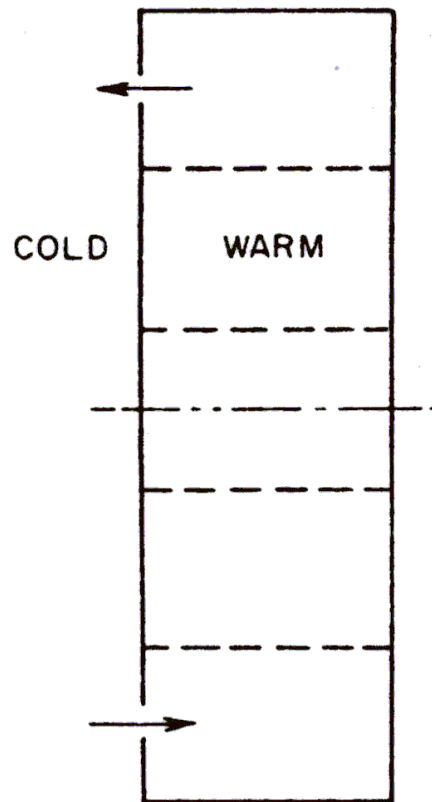


Interior Shafts:



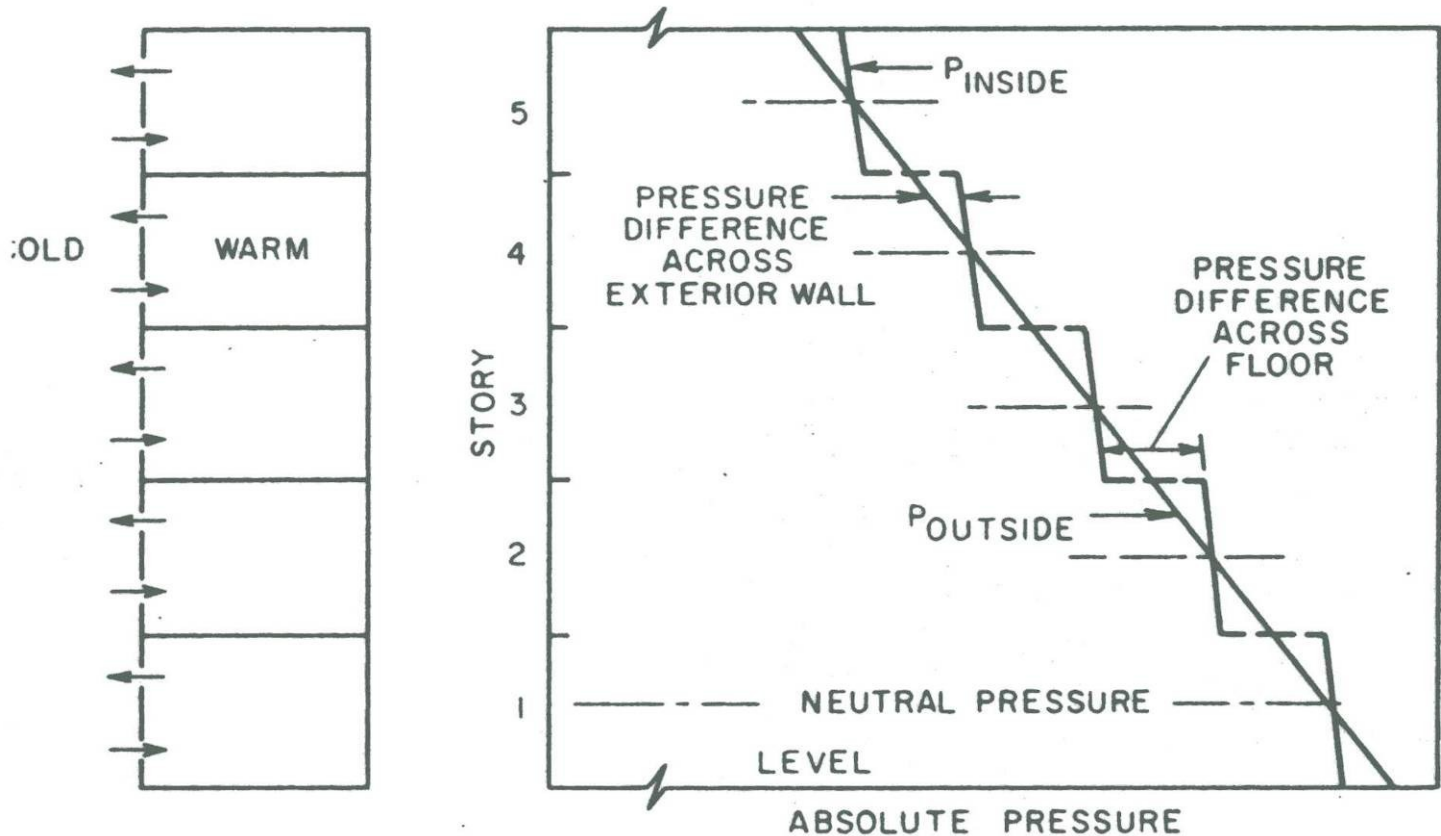
Interior Shafts: Why we care

Air Pressure Profile - unsealed



Interior Shafts: Why we care

Air Pressure Profile: sealed



Exterior Walls:



Exterior Walls:



Exterior Walls: Windows



Air Leakage Control Savings

- CMHC-Ontario Hydro Study 1991:

Building 1: 30 years, 21 storeys, 240 apts

Building 2: 29 years, 10 storeys, 95 apts

Building	Annual energy Savings	Peak Load Reduction (kW)	Annual Cost Savings	Retrofit Cost	Payback (years)
1	164,870	85	\$9,656	\$54,816	5.7
2	63,340	42	\$6,107	\$38,000	6.2

Tip #3 Electrical Reductions

1. Lighting Retrofit

- Age old story – new twist
- Relight with higher output product but overall
- Relight with emphasis on quality & energy
- 1-32 W, \$45, CFL can replace one 100W incandescent and save \$17 - \$45 per year
- Occupancy sensors for parking garage and stairwells



Tip #4 Ventilation Control

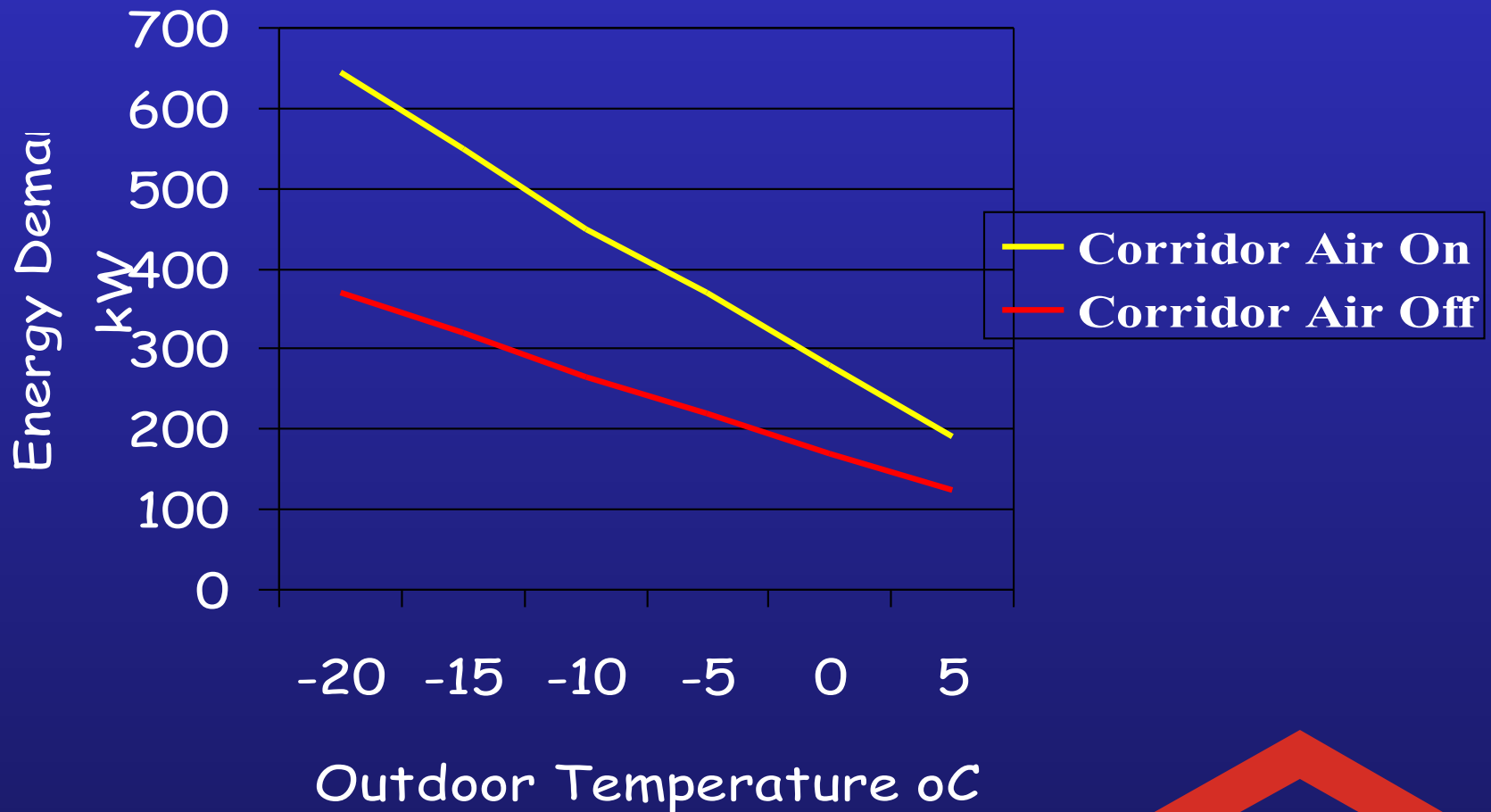
Automate Corridor Ventilation

- Time clock control – check with buildings dept.
- Use Variable Speed Drive technology & BAS
- Match Speed to Occupancy
- Combined example (100 suite Apartment)

Cost: \$20,000 Savings: \$3,500 - \$7,500/year

Tip #4 Ventilation Control

Energy Implications of Corridor Air Systems



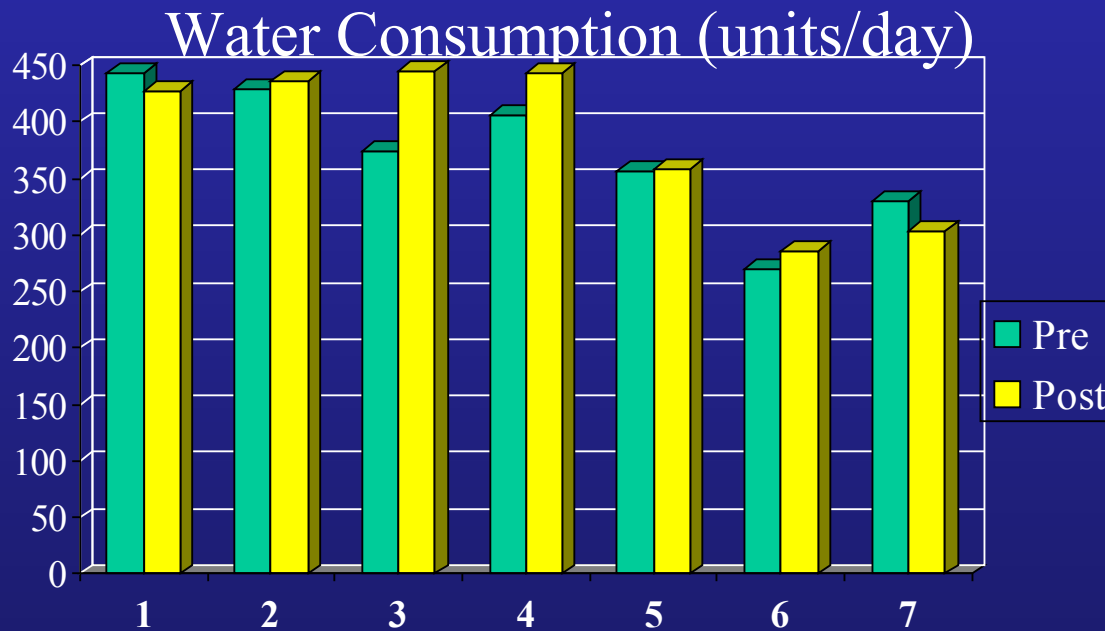
Tip #5 Booster Pumps



- Booster Pumps operate to maintain water pressure on all floors – often run continuously at a single speed and high pressure: wasteful of energy (and water?)
- CMHC/City of Toronto/Minto tested VSD and VPRV technologies in 7 buildings, 12-26 storeys

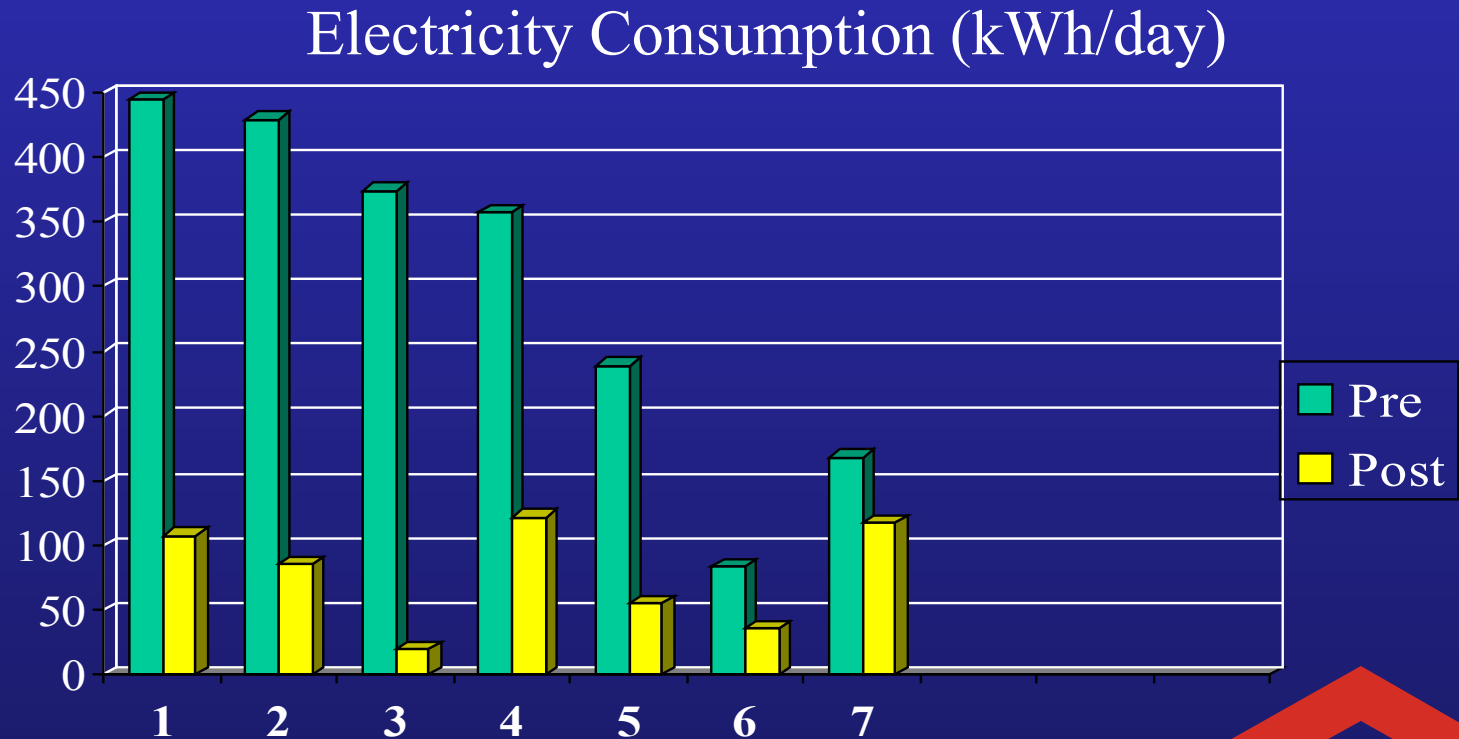
Tip #5: Booster Pump

- Water/electricity consumption monitored 4 weeks before and after implementation



Tip #5: Booster Pump

- Water/electricity consumption monitored 4 weeks before and after implementation



Tip #5: Booster Pump

- 51% reduction in pumping energy
- No water savings
- Overall 7 bldg savings of \$14,882/year in electricity
- Capital Costs for 7 bldgs \$52,000
- Pump Controls \$5,000 per building (2 pumps were replaced during study adding to cost)
- 3.4 year payback

Tip #6: Boilers

Heating Plant Upgrade

- Convert with higher quality Equipment - sized appropriately
- Condensing boilers good – 10% fuel savings opp.
- Tie into BAS
- Costs and saving will vary
- Automate Boiler Plant:
Fine tune the old reset controllers
Replace reset controllers with Building Automation System (BAS)

Tip #7 DHW Plant

Domestic Hot Water Plant Conversion

- Use condensing boiler technology (90%+)
- OR review tying into existing heating plant if high efficiency boiler in place for space heat

Tip #8: Toilet Conversions

Replace toilets with 6L ULFs

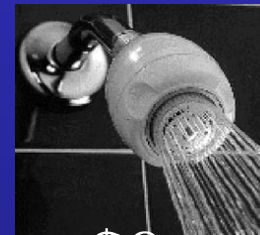
- Be careful of technology used for high rise applications
- cost: \$180/ unit, annual savings: \$40 - \$60/ unit
- Go to www.cmhc-ca and search on “Toilets”



Tip #9: Hot Water Conversions

Shower Retrofit

- Verify actual flow
- cost: \$20 per unit, savings: \$8 per year per unit
- Potential 10-15% energy savings on dhw



Tip #9: Hot Water Conversions

Laundry Retrofit

- DOE Study in 50 apartments in Murbs
- Horizontal washers installed - retrofit
- Washers used 50% less energy, 41% less water, 19% less detergent
- Dryer energy fell 22%
- 800,000 litres water/year savings

Tip #9: Hot Water Conversions

Laundry Retrofit

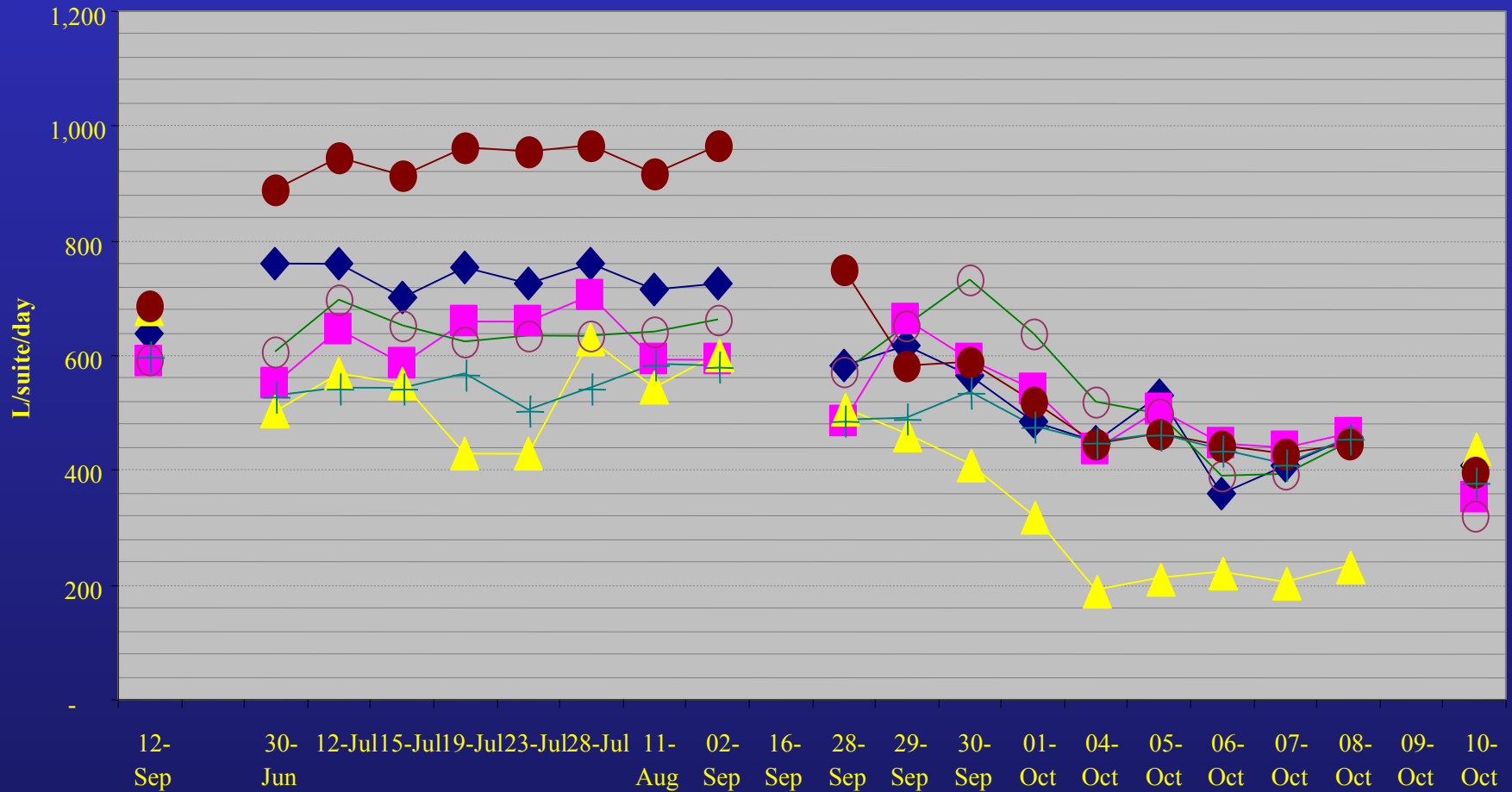
- City of Toronto Study
- 6 buildings, 945 suites, 39 washers each
- Washers used 61% less hot water use, 5% less electricity Dryer energy savings ??
- 44% water savings – daily basis
- Bottom line - \$170/yr/machine
- Incremental cost \$500

AND FINALLY

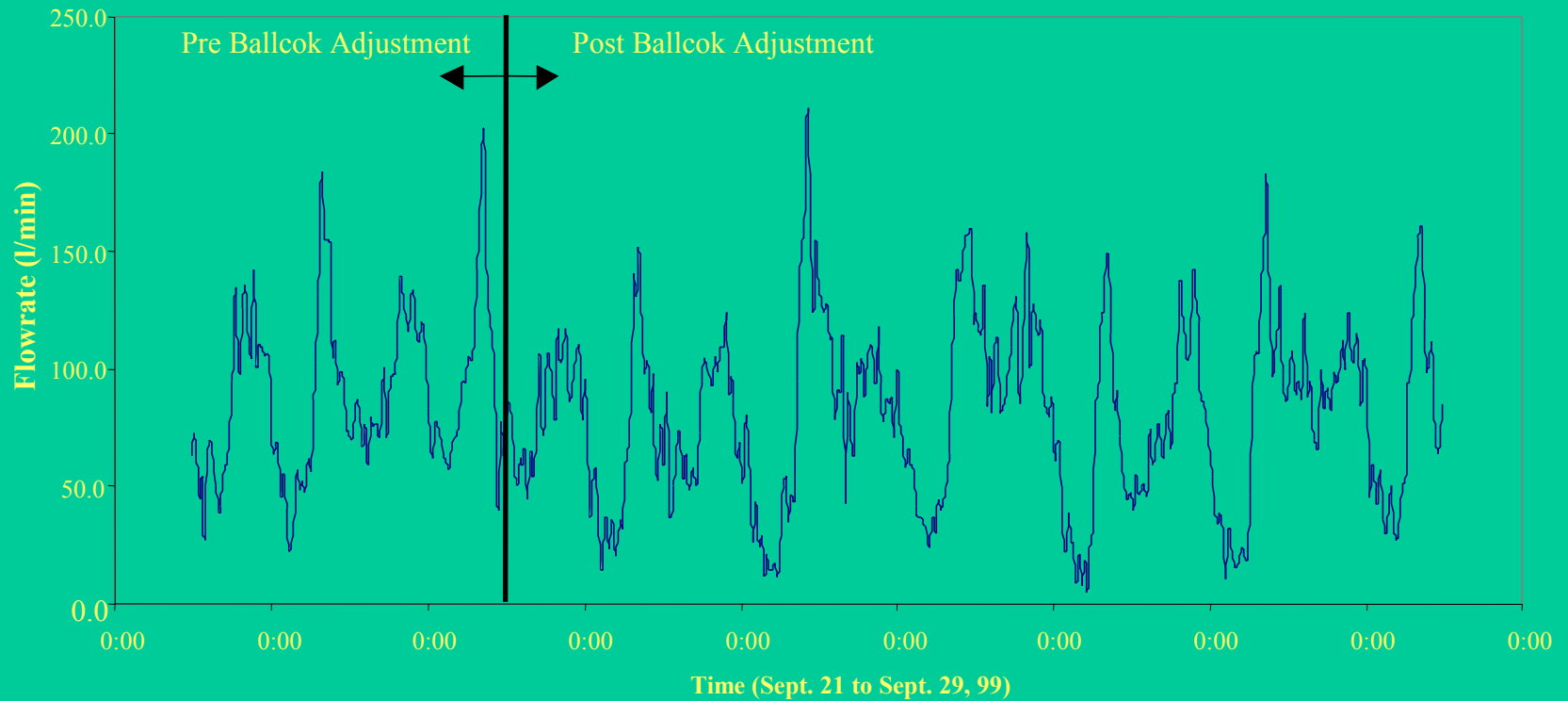
Tip #10. Verify your Results

- Follow up with utility tracking to ensure your measures work properly
- Applies to all work – water, electric and gas
- Respect your contractor's opinion but use 3rd party verification if project is sizable

Water Use Post- Retrofit



Water Use Post- Retrofit



Solar Walls



Saves energy:

Payback 3-6 yrs on incremental costs

Provides 21% of ventilation heating

Recovers 50% of wall heat loss

Relatively inexpensive:

\$8-9/ft² (incremental costs)

\$23/ft² (total costs)

Simple to operate and maintain



Winnipeg Apartment Building

- 7175 ft² on upper 14 storeys
- No other envelope work done
- Savings: \$17,500/year
- 10 year payback on total costs



Windsor Housing Authority

- 30 years old
- 24 storeys
- 400 apartments
- Brick veneer deterioration
- Solar Wall added as part of envelope restoration
- 200' x 18'
- Heats 13,500 cfm
- Saves \$4,800/yr

Should Walls be reinsulated?



Should Walls be reinsulated?



EIFS Retrofit
Example:

Costs: \$235/m²
Estimated energy
savings:
\$3,393/year

Payback = 95
years!!

What about Individual Metering?

10-15% savings
seem to be the
norm

Beware of change
in unit energy or
water costs

Beware of
metering related
charges



Clothes Washing: Energy and Water

Common Laundry vs In-suite Laundry

2001 US Study Compared Water and Electricity consumption of in-suite and common laundries in 8 buildings

Conclusions:

in-suite laundry consumed 3.3 X more water and 5X more energy

Source National Research Centre “A National Study of Water And Energy Consumption in Multi-Family Housing”, 2001



What about New Buildings?

Design Charrette - Integrated design team

Set Targets - energy use and ALC

Reduce loads as far as possible:

- Increased wall/roof/window insulation

- Optimize Solar orientation - heating and cooling

- Smart lighting -

 - low watts/fixture and controls

 - good design layout

Build Tight - Ventilate Right

High efficiency space and DHW heating

Plan in flexibility for future energy source

Individual metering

Measure	kWh/ year savings	\$/year savings	Incremental Cost	Simple Payback
Low E Windows	151,502	\$4,531	\$39,988	8.8
Air Leakage Control	41,081	\$1,229	\$5,880	4.8
Wall Insulation	180,475	\$5,398	\$75,530	14
Heat Recovery Ventilation	225,921	\$6,757	\$67,912	10
Combo System	242,931	\$7,266	\$54,600	11.7
Total	841,910	\$25,180	\$245,247	9.7

Questions & Answers

Top 10 Energy & Water Saving Tips

in

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Visit our website at www.cmhc.ca

