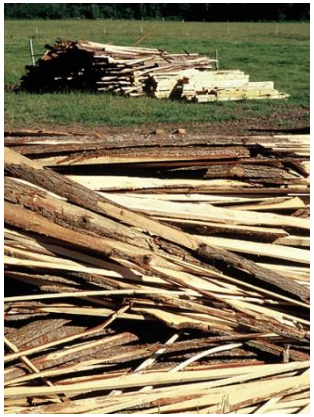
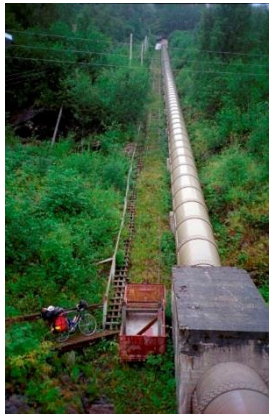


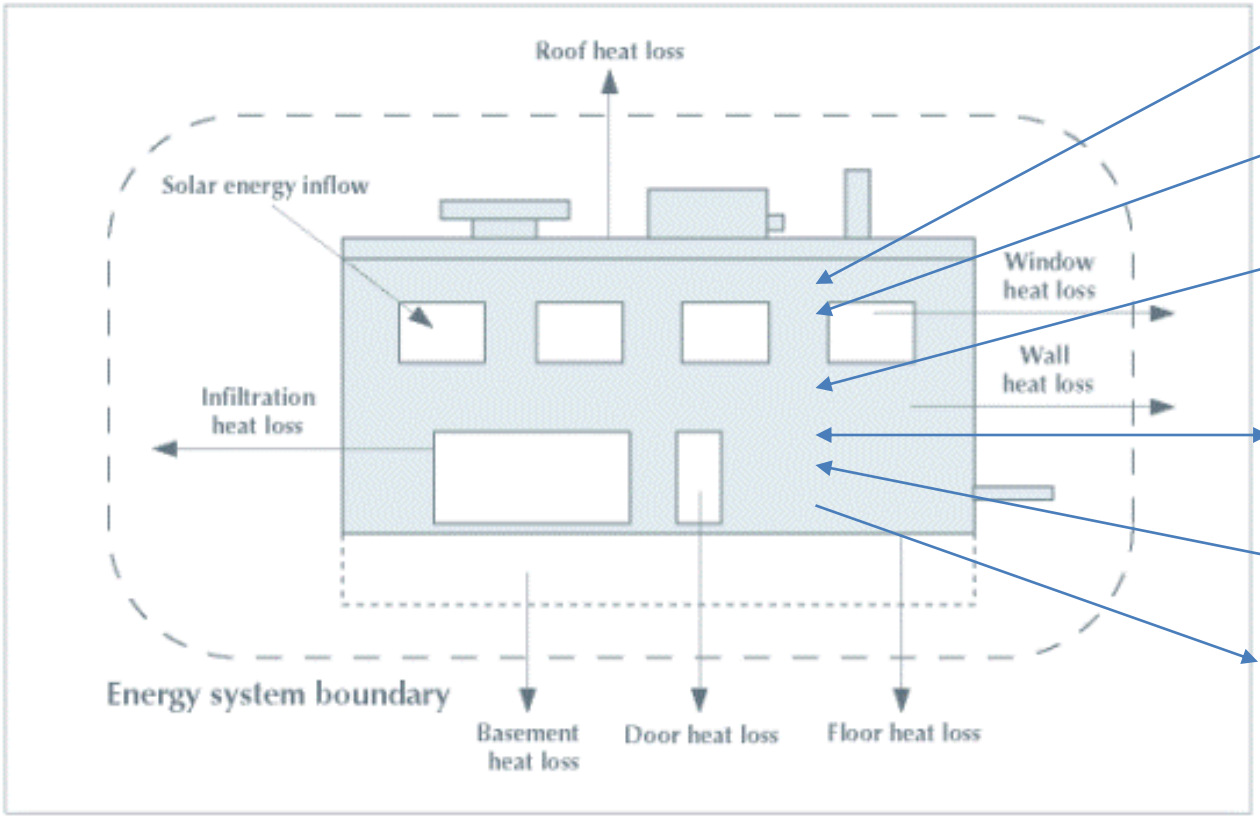

EE & Basic Building Modelling with RETScreen® 4

Longwood University

August 7, 2014

Michael Ross
RER Energy

Building as a System



Lighting

Plug loads

Occupants

Ventilation air

Heating (as necessary)

Cooling (as necessary)

Building envelope

Schedules:

Interior temperature & when fans are on

Interior temperature can differ in heating and cooling seasons

User specifies changeover temperature: below this heating is required; above this, cooling is required.

Interior temperature during occupied hours

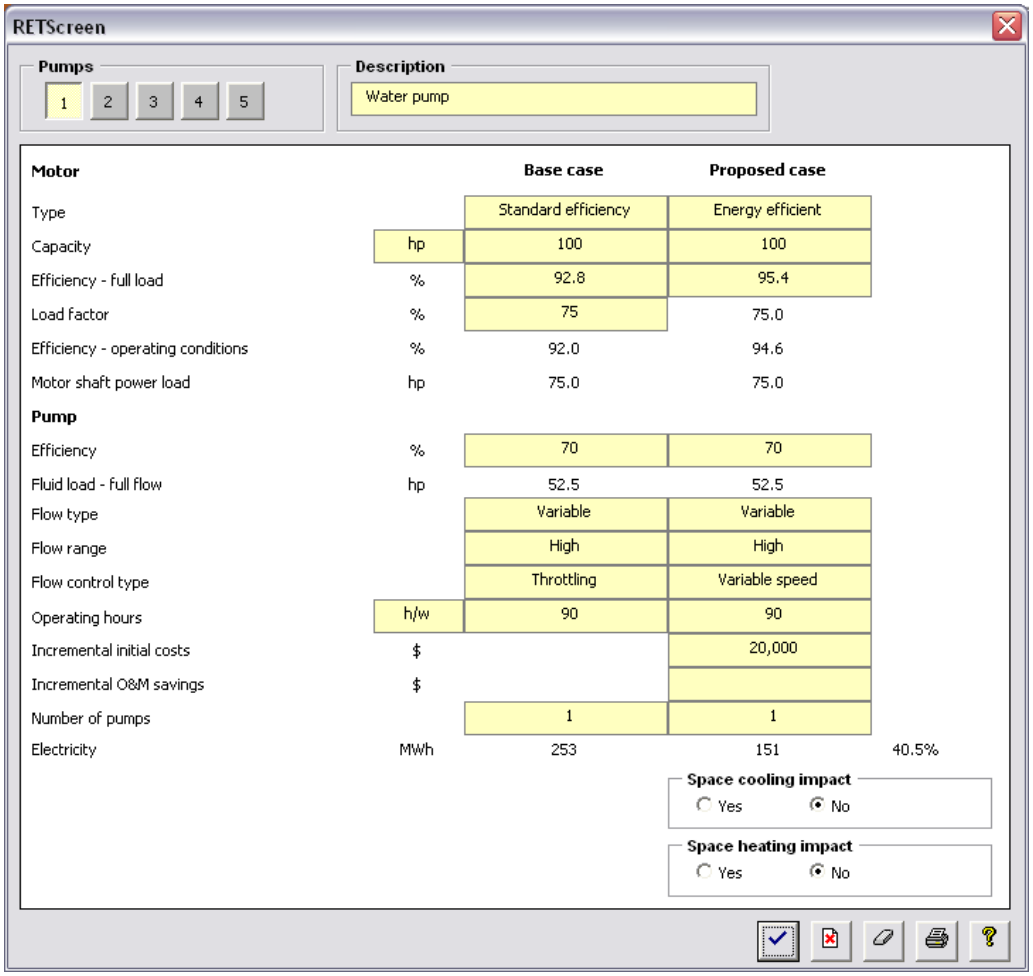
Temperature setback during unoccupied hours

Schedule	Unit		Schedule 1	Schedule 2
Description			24/7	Night Setback
				Occupied
Temperature - space heating	°C		20.0	21.0
Temperature - space cooling	°C		20.0	22.0
				Unoccupied
Temperature - unoccupied	+/-°C			2.0
				Occupied
Occupancy rate - daily			h/d	h/d
Monday			24	16.0
Tuesday			24	16.0
Wednesday			24	16.0
Thursday			24	16.0
Friday			24	16.0
Saturday			24	12.0
Sunday			24	12.0
Occupancy rate - annual	h/yr		8,760	5,423
	%		100%	62%
Heating/cooling changeover temperature	°C	15.0		
Length of heating season	d	250		
Length of cooling season	d	115		

Occupancy each day of week- for temperatures & ventilation fans

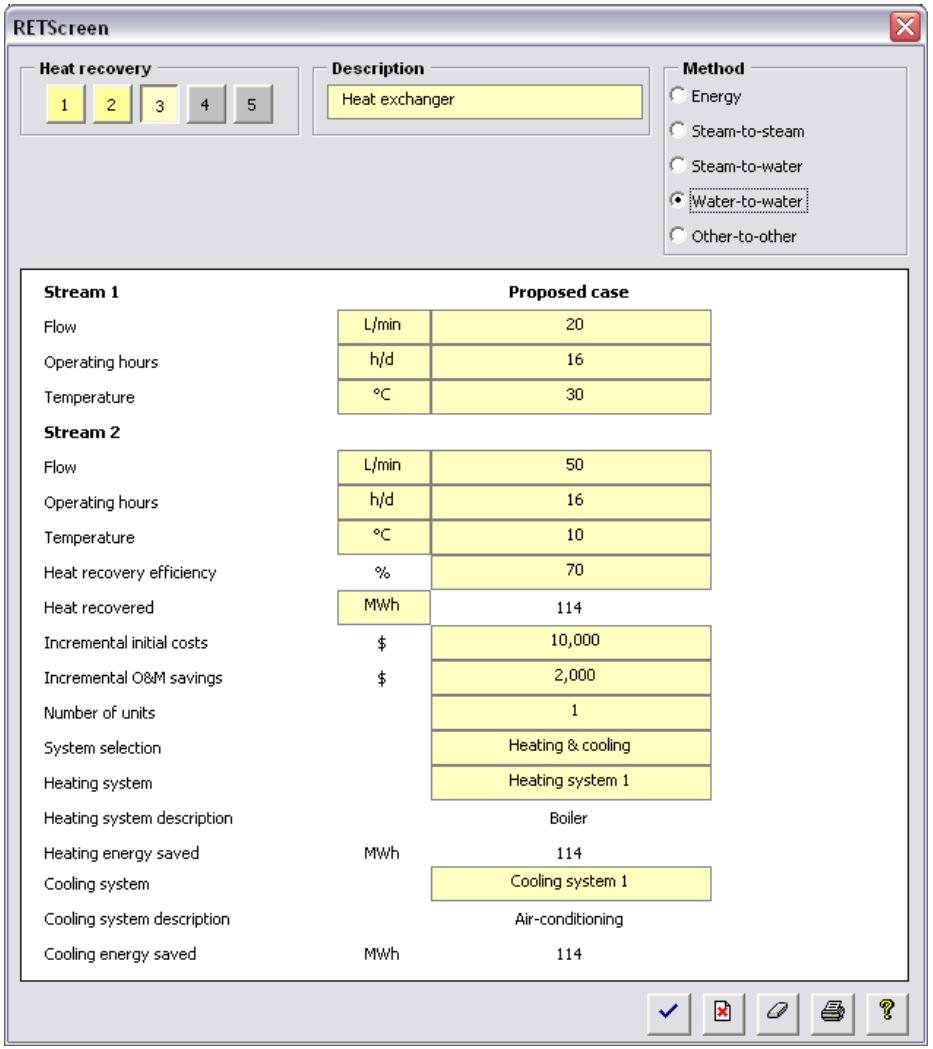
Facility Characteristics

- Heating system
- Cooling system
- Building envelope
- Ventilation
- Lights
- Electrical equipment
- Hot water
- Pumps
- Fans
- Motors



Facility Characteristics

- Process electricity
- Process heat
- Process steam
- Steam losses
- Heat recovery
- Compressed air
- Refrigeration
- Other



Facility Characteristics

Heating & Cooling System are Special

Facility characteristics ☑ Show data

Show:	Heating	Cooling	Electricity	Incremental initial costs
Energy - proposed case	GJ	GJ	GJ	$
Heating system				
Switch electricity to gas	0	-	-	10,000
Switch Oil to Natural Gas	0	-	-	2,000
Cooling system				
Chiller upgrade	-	0	-	23,000
Building envelope	4,912	264	-	0
Ventilation				
Changing Fan Control	205	16	-	3,000
Add heat recovery	444	21	-	8,000
Lights				
Lobby	-	-	7	300
Office Spaces 1 & 2	-	-	32	20,000
Electrical equipment				
Hot water	171	-	-	0
Heat recovery				
Other				
Total	5,732	301	39	66,300

These provide heating and cooling

These require heating, cooling & electricity

Facility Characteristics

Energy versus Fuel

Facility characteristics ☑ Show data

Show:	Heating	Cooling	Electricity
Energy - proposed case	GJ	**GJ**	**GJ**
Fuel consumption - base case			
Fuel consumption - proposed case			
Fuel saved			
Energy - base case			
Energy - proposed case			
Energy saved			
Chiller upgrade	-	0	-
Building envelope			
Ventilation			
Changing Fan Control			
Add heat recovery			
Lights			
Lobby			
Office Spaces 1 & 2	-	-	32

0 ← Fuel saved

0 ← Energy - base case

No energy requirement, so always 0

Energy: heating, cooling & electricity requirement

Fuel: fuel (including electricity) expended to supply heating, cooling, ventilation, lighting, etc.; reflects efficiency of conversion from fuel to energy

Facility Characteristics

"-" versus "0"

"-" indicates "not applicable": building system can't influence this column
"0" indicates with current parameters, building system doesn't influence column

Facility characteristics ☑ Show data

Show:	Heating	Cooling	Electricity	Incremental initial costs
Energy - proposed case	GJ	GJ	GJ	$
Heating system				
Switch electricity to gas	0	-	-	10,000
Switch Oil to Natural Gas	0	-	-	2,000
Cooling system				
Chiller upgrade	-	0	-	23,000
Building envelope				
	4,912	264	-	0
Ventilation				
Changing Fan Control	205	16	-	3,000
Add heat recovery	444	21	-	8,000
Lights				
Lobby	-	-	7	300
Office Spaces 1 & 2	-	-	32	20,000

Heating system affects only heating column

Cooling system affects only cooling column

Envelope & ventilation affect only heating & cooling

Lighting requires only electricity

Facility Characteristics

Fuel Savings

Only configuration where non-zero figures appear for heating & cooling system

Facility characteristics ☑ Show data

Show:	Heating	Cooling	Electricity	Incremental initial costs
Fuel saved	GJ	**GJ**	**GJ**	**$**
Heating system				
Switch electricity to gas	-1,512	-		
Switch Oil to Natural Gas	71	-		
Cooling system				
Chiller upgrade	-	32	-	23,000
Building envelope				
Warehouse envelope	-24	1	-	0
Ventilation				
Changing Fan Control	362	2	-	3,000
Add heat recovery	243	1	-	8,000
Lights				
Lobby	-	-	32	300
Office Spaces 1 & 2	-	-	32	20,000

Fuel savings due to heating & cooling system efficiency improvements

Fuel savings due to reduced energy requirements
-envelope improvements
-more efficient ventilation
-reduced operating hours

Nota Bene

- Cooling load does not account for dehumidification!
- Must specify Heating/Cooling changeover temperature for building (for heating and cooling calculations)
- Doesn’t allow for season between heating and cooling when neither is needed
- Single zone, steady-state heat loss/gain calculation
- Rudimentary models for most loads
- When you uncheck “include measure”, base case is assumed
- Can’t use formulas within data entry forms
- Watch the unit switches!

How to Approach Energy Efficiency

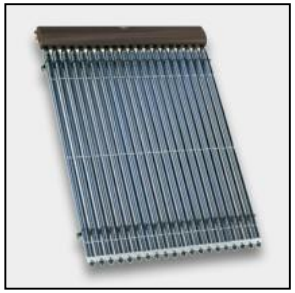
Fuel

End-use

Start here!

Minimize usage

Maximize efficiency



Optimize supply

Questions?