VSHE Virginia Society of Healthcare Engineers

THERMAL RECYCLING 101

THE ENERGY, UTILITY, AND CARBON BENEFITS OF THE GAS-DRIVEN HEAT PUMP

Ilios High Efficiency Water Heater

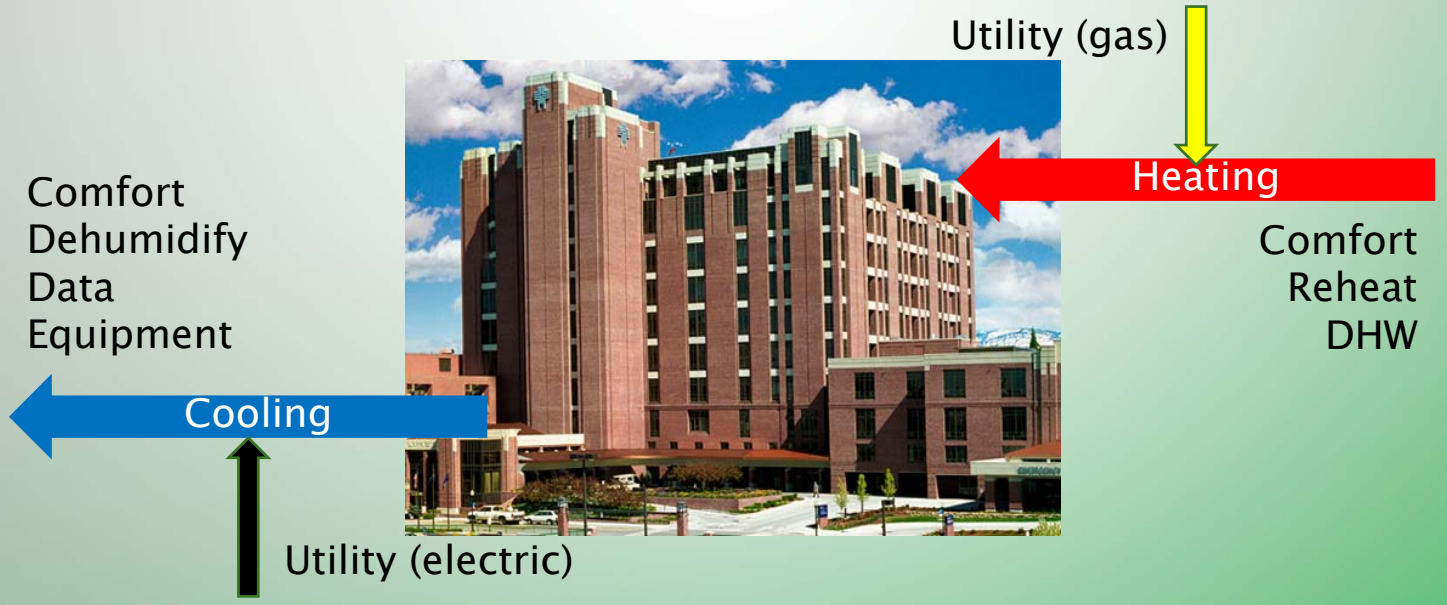
SDCo.

ENERGY?

CARBON?

SUSTAINABILITY?

OVERVIEW OF HEATING AND COOLING



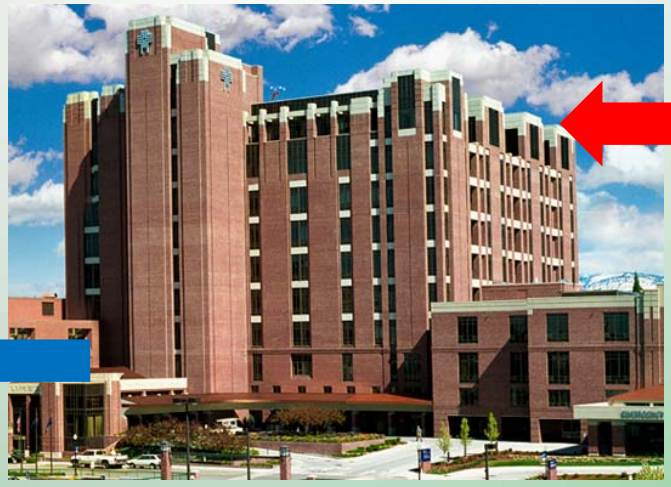
VSHE Virginia Society of Healthcare Engineers

HEATING AND COOLING "AS USUAL"

@ $1.00/therm= $4.58/hr
24.3 kg CDE

Boiler

11 BHP
366,088 BTU
@ 80% effic=
457,610 BTU



12 tons
141,385 BTU
@ 1.00 kW/ton=
11.8 kW

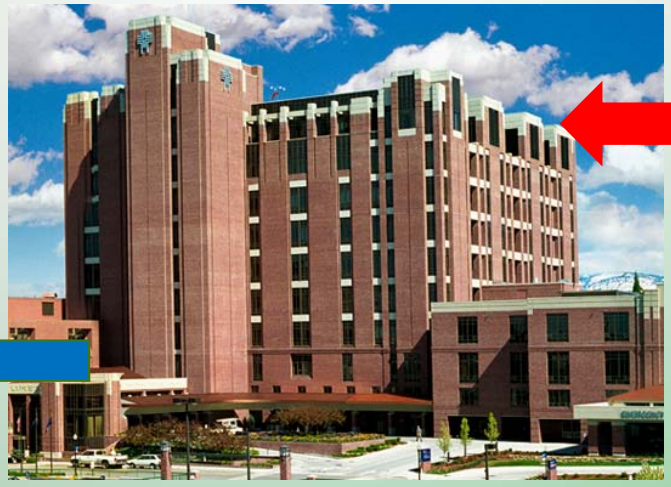
Chiller

@ $0.10/kWh= $1.18/hr
8.1 kg CDE

VSHE Virginia Society of Healthcare Engineers

HEATING AND COOLING "AS USUAL"

Extended over 1000 operating hours



Boiler

4576 therms
$4576
24.3 t CDE

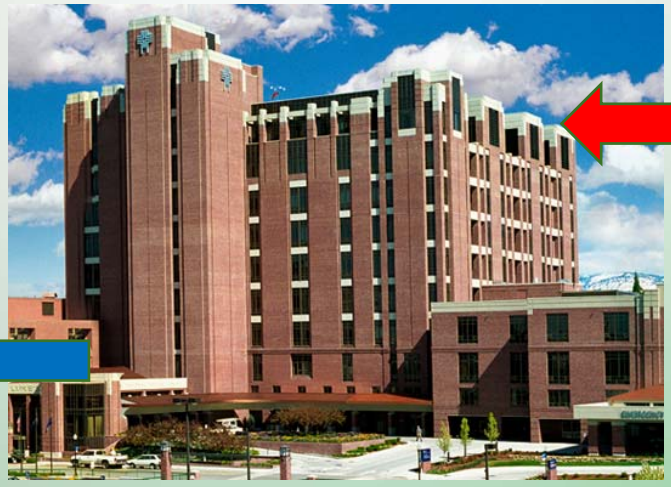
11,782 kW
$1178
8.1 t CDE

Chiller

VSHE Virginia Society of Healthcare Engineers

HEATING AND COOLING "AS USUAL"

Expressed as MBTUs



Boiler

457,610 MBTU
$4576
24.3 t CDE

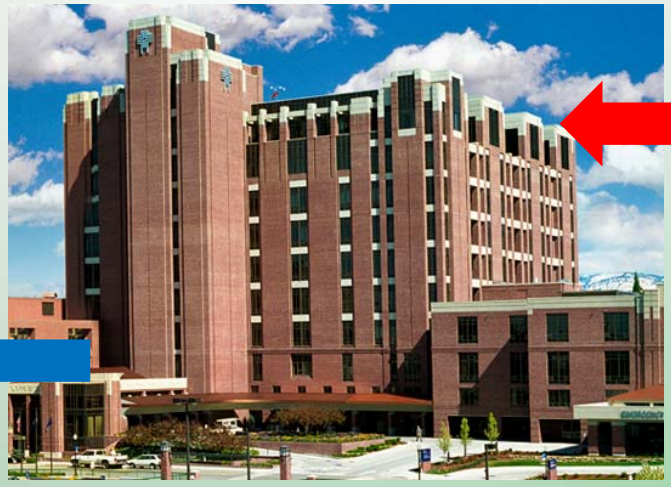
40,212 MBTU
$1178
8.1 t CDE

Chiller

VSHE Virginia Society of Healthcare Engineers

HEATING AND COOLING "AS USUAL"

Taken together, as is often the case…



Boiler

457,610 MBTU
$4576
24.3 t CDE

40,212 MBTU
$1178
8.1 t CDE

Chiller

497,822 MBTU / $5754 / 32.4 t CDE

VSHE Virginia Society of Healthcare Engineers

CARBON FOOTPRINT (*REALLY QUICK*)

Carbon Footprint is the amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels

Fossil fuels are consumed via traditional, convenient utilities directly (natural gas) or indirectly (non-renewable electricity)

Utilities are consumed to conveniently add or remove energy for comfort (HVAC, DHW, pools, etc.). This is the largest fraction of overall emissions in typical buildings.

When efficiencies are improved and/or shifts to more sustainable utilities occur, Carbon Footprint is reduced

CARBON FOOTPRINT (*REALLY QUICK*)

Energy conversion factors

The factors given below are taken from Defra/DECC's GHG conversion factors for company reporting, published in August 2011.

Table 1 *Energy conversion factors*

Fuel	Units	$kgCO_2e$ per unit	Fuel
Grid electricity[1]	kWh	0.5246	Burning oil
Renewable electricity[2]	See footnote 2	See footnote 2	
Natural gas	kWh	0.1836	Diesel
	therms	5.3808	

Different utilities carry greater carbon penalties…

Grid electricity is 3x "worse" than natural gas per kWh consumed

VSHE Virginia Society of Healthcare Engineers

THERMAL RECYCLING

Thermal Recycling returns rather than rejects the energy from cooling, reducing the need to add additional heat

VSHE Virginia Society of Healthcare Engineers

THERMAL RECYCLING

278,000 BTU
@ $1.00/therm= $2.78/hr
14.7 kg CDE

12 tons
141,385 BTU

Cooling

Heating

11 BHP
366,088 BTU

Extended over 1000 operating hours…

278,000 MBTU / $2780 / 14.7 t CDE

VSHE Virginia Society of Healthcare Engineers

THERMAL RECYCLING

Every 1000 operating hours, 12 tons cool and 11 BHP heat:

Heating and cooling "as usual"

497,822 MBTU / $5754 / 32.4 t CDE

Thermal Recycling

278,000 MBTU / $2780 / 14.7 t CDE

Total benefit= (219,822 MBTU / $2974 / 17.7 t CDE)

VSHE Virginia Society of Healthcare Engineers

SUMMARY

Comfort cooling and heating efforts, often occurring simultaneously, consume significant utility and contribute greatly to the current Carbon Footprint.

The Ilios gas-driven heat pump is uniquely suited to recycle energy from cooling to heating, reducing the overall energy consumed (-44%), utility purchased (-52%), and accelerates carbon reduction (-55%) as some cooling is shifted to more sustainable natural gas.

Working between the base cooling and heating loads, the Ilios heat pump intends to deprive existing chillers and boilers of very part load operation… the least efficient and most punishing operating condition.

VSHE Virginia Society of Healthcare Engineers

LANDSTOWN HIGH SCHOOL, VIRGINIA BEACH

$200,000 installed cost

$0.87/therm natural gas
$0.08/kWH electricity
Year round operation

8ish year expected payback

First Ilios water source unit in beneficial operation (02 April 2015)

ENERGY STAR score now 41 (was 34)

VSHE Virginia Society of Healthcare Engineers

PATRICK
PSCHREK@SAMDESANTO.COM
804-479-0402

VSHE Virginia Society of Healthcare Engineers