

Conservation & Efficiency Efforts



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UNIVERSITY OF SOUTH CAROLINA

USC's Efforts Come in Different Forms

- Purchasing Standards
- Green Buildings/LEED
- Education
- **Performance Contract**
- **Cost Savings**
- Demonstration Projects
- Climate Change
- Transportation
- Renewable Energy
- Recycling/Composting



Simple Energy Solutions with <4 year payback

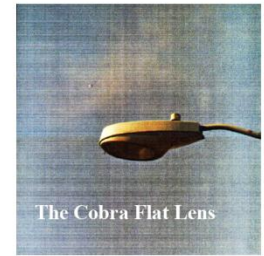
- Lighting – Move away from T12
 - Two bulb 4' Lighting Fixture
 - Normally use 145 Watts
 - Replacement uses 90 watts
 - **Savings from replacing just 2 light bulbs**
 - 330 kWh/yr
 - \$17.39/yr/energy
 - \$3.11/yr/HVAC
 - \$2.52/yr/maintenance
 - **Total = \$23.03/yr**
 - **Next conversion from 32w bulbs to 25w bulbs > then LEDs**
 - Occupancy/Lighting Sensors
 - LED exit lamps
- Other
 - CO2 Monitors - Steam Traps
 - Heat Recovery - Pool Covers
 - Vending Misers- Energy Star Roofing
 - VAV's - VFDs & VSDs
 - Thermostats
 - Hot water heater/valve jackets
 - Replace pneumatic controls with DDC



Street Lighting



The Nema Head



The Cobra Flat Lens

DATA	DESIGN A	DESIGN B	DESIGN C	DESIGN D
Fixture Classification	NEMA	NEMA	COBRA	COBRA
Lamp Type	MV	HPS	HPS	HPS
Wattage	175	100	100	250
Lumens	7500	9500	9500	27500
Design Spacing (FT)	108	119	372	342
Average Foot Candles (FC)	0.84	0.84	0.60	1.06
Uniformity Ratio (Average FC / Minimum FC)	1.35	1.68	5.98	5.96
Number Fixtures Required	20	18	7	7
Total Watts Required	3500	1800	700	1750
Energy Savings	0	49%	80%	50%
Base Rate (PL Inside NC)	\$5.47	\$6.66	\$7.72	\$9.48
Total Design Revenue Per Month	\$109.40	\$119.88	\$54.04	\$66.36



LED Lighting Conversions

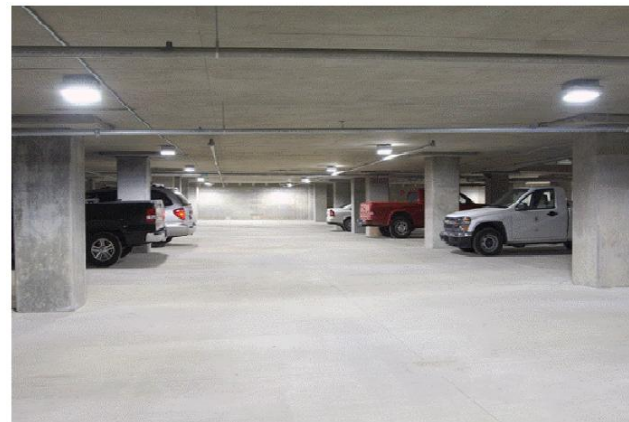
Total life-cycle cost assessment

Using the results outlined above, the total 15-year life-cycle cost analysis shows

Capital cost differential	\$(262,000)
Energy savings	\$574,335
Maintenance savings	\$615,163
Replacement costs	\$(291,950)
Total savings	\$635,548



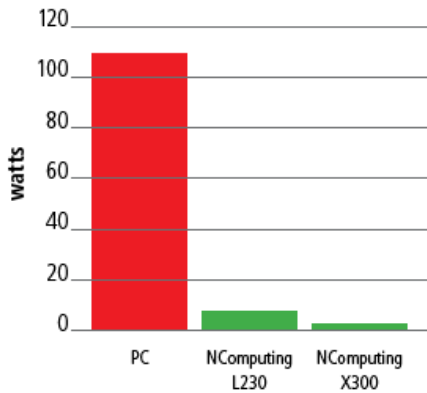
The payback comes in just over 3 years (see the cumulative savings by year below).



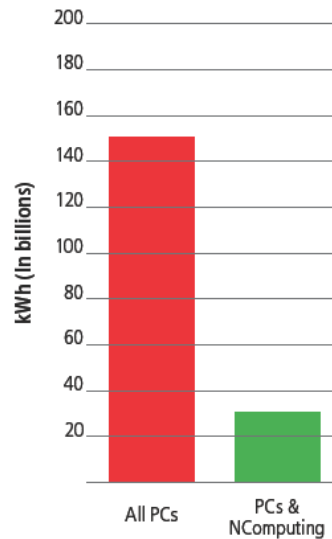
Virtual Computers



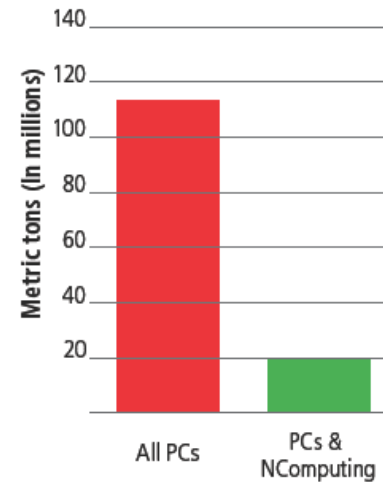
NComputing access devices consume 90% less energy than a PC



Annual energy consumed (850 million seats)



Annual CO₂ emissions (850 million seats)



Upcoming Projects

Project Title / Description	Total Estimated Project Cost	Estimated Years for Payback	Estimated Yearly Savings in Energy Efficiencies	Carbon Reduction
1. Install automated building lighting controls and occupancy sensors campus wide (\$110,00/BLDG)	\$ 497,500	4.6	\$ 107,883	TBD
2. Bubble street lights – Replace lights with campus standard and LCDs or at least tops with new fixture types and LEDs	\$ 15,000	7	\$ 2,143	TBD
3. N Computing virtual computer terminals	\$ 6,720	1.1	\$ 6,116	TBD
5. Upgrade Existing EMS controls and add new Utility Metering (Steam, CHW & Electricity)	\$ 391,091	3.7	\$ 106,294	TBD
6. East,West & South Energy Plants– add VSD drives to condenser water pumps	\$ 248,400	4.7	\$ 52,986	TBD
7. East,West & South Energy Plants – Install central CHW air separators	\$ 464,400	3.3	\$ 139,507	TBD
8. Energy Performance Web Based Education Program & Educational Website	\$ 23,000	7	\$ 3,571	TBD
9. Fume Hood Retrofits (8 units)	\$ 171,519	4.6	\$ 36,935	TBD
11. Plate Frame Heat Exchange at North Energy Plant	\$ 246,240	3.2	\$ 76,874	TBD
LED Parking Garage	\$ 496,300	6.8	\$ 72,583	970 tons
Lighting Replacement from 32 W to 25 W	\$ 455,836	1.9	\$ 239,283	1,554 tons
Weather Base Landscape Irrigation	\$ 155,000	11	\$ 14,030	TBD
Absorption chiller at West Energy Plant	\$ 1,100,000	N/A	N/A	16,695 tons

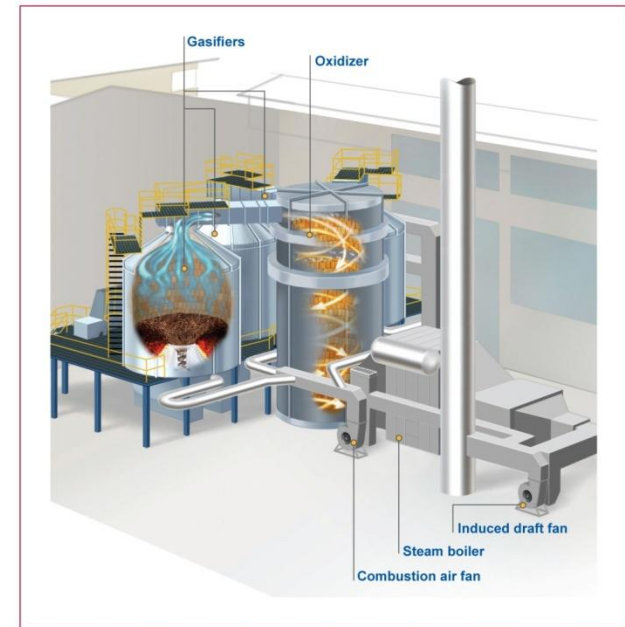
Biomass

Benefits of the USC Biomass Facility:

- Provides 80% of the annual steam needed to heat the campus
- Generates 1,380 kW of electricity
- Lower cost, renewable fuel source
- Saves USC over \$2 million annually in energy costs
- Predictable, stable fuel source enables more savings over time
- “Green” energy reduces greenhouse gases
- Provides steam to buildings currently heated by steam from 3 USC energy plants
- Reduces dependency on natural gas and fossil fuels
- Utilized by the School of Engineering as an academic tool

The USC Biomass Facility uses wood fuel that is:

- Virgin wood chips only
- Purchased from in-state sources
- Unloaded and stored inside the facility



Waster Consumption

Table 2. Water Intensity of Thermoelectric Power Generation in South Carolina

Year	Utility Thermoelectric* Generation (MWh)	Thermoelectric Water Use (million gallons)	Water Intensity (gallons/MWh)
2004	93,173,693	3,232,104.071	34,689
2005	97,444,270	4,256,504.44	43,681
2006	95,226,224	3,570,217.16	37,492
Average 2004–2006			38,621

* Thermoelectric = coal, petroleum, natural gas, nuclear, wood, and other biomass.

Source: EIA (2009c); SCDHEC (2004–2006)

- Average person consumes 100 gallons/day
- Over 30,000 people on campus
- Currently consume over 500 million gallons/year
- Cost of over \$2 million/year
- Demand has increased 39% over four years
- Limited and shrinking budget
- Anticipate shortages and price increases by 2013
- Unknown impact of carbon legislation on water production



Water Efficiency Improvements

- Improvements in 99 buildings
- 44% reduction in water usage
- \$3.9 million
- Saves 92 million gallons/year
- \$805,000 a year in savings
- 4.8 year payback
- >\$7.8 million savings/10 years
 - 3268 toilets
 - 741 urinals
 - 3897 rest room sinks
 - 1626 showers
 - Additional GP sinks, food & mechanical systems, & irrigation



EXAMPLE (266 fixtures in 1 Building)

- 3,172 Kgals/yr
 - 117 MMBTUs **BEFORE**
 - 1,156 Kgals/yr
 - 60 MMBTUs **AFTER**
- SAVINGS**
- 2,015 kgals/yr
 - 57 MMBTUs
 - \$8,606/yr/water
 - \$420/yr/energy



West Quad Residence Hall

FACILITY	Avg. Monthly Use	Avg. Monthly Use per Student	Reduction per Student	Savings	Cost to Install
East Quad	500,412 gals	1,189 gals			
West Quad	417,384 gals	838 gals	30% / student	\$4,942 /year	-\$4,204.30



West Quad
Creating a Sustainable Future... Today



Examples from Campus

● Washing Machines

- Converted 132 top load to HE/Energy Star front-load washers
- Savings:
 - \$20,000 year (includes energy savings)
 - 2 million gallons/yr (30% reduction)
 - Additional Cost = Zero
 - Payback = Immediate

● Aerator Installation

- Converted 210 aerators from 2.75 gpm to 0.5 gpm
- Savings:
 - \$8488/yr
 - 1.1 million + Gallons/yr
 - Cost to implement = \$735 (\$3.50each)
 - Payback = <2 months

Comparison:

- Sprinklers
 - 180 gallons/hour for each sprinkler
 - Runs 1-3 hours/day
- Drip Irrigation
 - 1 gallon/hour per 100' hose
 - Runs 1 – 2 hours/day
 - Installs faster/cheaper
 - Less maintenance
 - Can remove once established

● Example:

- Weather Based Irrigation
 - Cost \$155,000
 - Annual Savings \$24,090 +
 - Pay Back 6.4 years



Setting New Standards (that make sense)

	WaterSense	EPAct	Existing	Other	Savings	
Toilets	1.28 gpf*	1.6	2.2-6.0	Dual Flush	20% +	700 gals/yr
Urinals		1	2.0-5.5	0.5	50%+	
Faucets	0.5 gpm	2.2	2.2-7.0		30%+	300 gals/yr
Showers	1.72	2.5	1.6-6.0	2.2		
Washers				Energy Star / High Efficiency Front Load	30-60%	7,000 gals/yr
Dishwashers				Energy Star / High Efficiency Front Load		
Ice makers				Energy Star		
Commercial Kitchen Sinks				1.5 w/Pedal Valves	65%	65,000 gals/yr +
Irrigation				Drip/Micro	50%	
Pre Rinse Spray		1.6 gpm		Hand valve/pedals	60% +	50,000 gals/yr

Toilets – 1.28 w/ MaP certification



Dual Flush Fixtures

- 30% - 40% reduction in water use
- \$145 = comparable
- Upgrade existing \$45
- No new technology to learn or maintain
- Can use existing equipment



Questions ???