VIRGINIA TECH™

Vice President for Campus Planning, Infrastructure, and Facilities
230 Sterrett Dr., Suite 112 (0127)
Blacksburg, Virginia 24061
Phone: 540/231-6291 Fax: 540/231-4745

STUDENT ORGANIZATION SUSTAINABILITY INITIATIVE PROPOSAL FORM

Part I- General Information:

Name of Student Organization	Students for Sustainable Practice
Contact/Responsible Person	Erika Tuttobene
Contact Office Held/Title	Club Vice President
Contact Email Address	erikat27@vt.edu
Contact Telephone Number	(805) 720-0412

Part II- Project Cost Information

Estimated Cost of this Proposal	$10,250.60	See III.C. below
Estimated Savings -	$4,263.92 annually	See III.D. below
Net Cost of this Proposal =	$10,250.60 with approximately 29 month period until return on investment	

A. Please describe your sustainability initiative and attach supporting documentation.

Improve the energy efficiency of Lane Hall through the implementation of T8 LED lamps in existing corridor lighting fixtures. Lane Hall is Virginia Tech's oldest building with significant historical value. Unfortunately, this means the building contains outdated and aging technologies that are not energy efficient. In order to help preserve this landmark and maintain progress towards Virginia Tech's climate goals, lighting improvements should be made. By retrofitting existing lighting fixtures (see attachment 2), this low-cost, high-efficiency approach to introducing the building's first LEDs will both reduce waste and spending associated with a full-replacement, and will avoid damage to the building.

B. How does this initiative help to achieve the goals of the Virginia Tech Climate Action Commitment Resolution and Sustainability Plan?

Sustainability Plan

- **Supports goals outlined in the Climate Action Commitment and Policy Memorandum #262 amendments 1, 3, 4, 7, and 10**
- **Supports continuation of Point 4 - GHG Emissions Reduction through "Energy Usage", and "Electrical Demand Response"**
- **Supports continuation of Point 7 - Energy Efficiency through "Lighting Retrofits and Occupancy Sensors"**
- **Supports continuation of Point 10 - Campus Engagement through "Student Involvement and Organizations"**

Virginia Tech Policy #5505

- **Supports goal of ensuring efficient energy use**

Sustainability Annual Report 18-19

- **Supports Point 4 - Improved Energy Efficiency through "Addressing Operational Inefficiencies" and "Retro-commissioning"**

C. What is the cost of your proposal? Please describe in adequate detail the basis for your cost estimate.

Specifications & Key Notes

- State Electric Supply Company located in Christiansburg, VA is the current supplier for most Virginia Tech lighting and company representative Chris Caldwell provided cost estimates and calculators for project savings
- 61 2-tube lighting fixtures

Material Costs

- Cost of light + ballast for one tube Philips 9.5T8/MAS/48-840/IF16-P 10/1 (see attachment 3) $9.18
- Cost of socket replacement (4 required per fixture) $.89

(122 tubes)x($9.18 lamp/ballast) + (61 fixtures)(4 sockets)x($.89 socket replacement) = **$1,337.12**

Labor Costs

With the assistance of Virginia Tech Facilities Services Energy Engineer Lowell Jessee, labor cost was calculated through an estimate of 1 hour per lighting fixture retrofit, totaling 61 hours. With an anticipated labor force of 2 contractors, paid at a rate of $50 per hour, the following labor cost estimate was reached.

(61 fixtures)x(1 hour) + (2 contractors)x($50/hour) = **$6,100**

Project Management & Contingency Budget Costs

With the assistance of Virginia Tech Facilities Services Energy Engineer Lowell Jessee, project management cost was calculated through an estimate of 15% of labor cost. An additional 15% of labor cost was factored to account for any unexpected costs that may arise. For example, needing to replace a lens that may be damaged during lamp replacement. A final 5% is factored for commissioning costs to ensure functionality. This could likely be handled by Virginia Tech's Engineering Services however, therefore external management may not be necessary.

($6,100 labor)x(.15 project management budget) + ($6,100 labor)x(.15 contingency budget) + ($6,100 labor) x (.05 commissioning costs) = **$2,135**

Total Cost

($2,015.60 material) + ($6,100 labor) + ($2,135 project management & contingency) = **$10,250.60**

Reference Information

Chris Caldwell, State Electric Supply Co. : chris.caldwell@stateelectric.com, (540) 382-6415 x25061
Lowell Jessee, Virginia Tech Facilities Services, Engineering Operations : ljessee@vt.edu, (540) 231-7305
Wesley Linkous, Virginia Tech Facilities Services, Building Trades : wesleyll@vt.edu, (540) 231-4300

D. Will your proposal produce cost savings for the University? If so, how much? Please describe in adequate detail the basis for your savings estimate.

The proposed Philip LED lamps have a 250% lifetime improvement (70,000 hours compared to 20,000) expected in comparison to the current lamps (specified in documentation provided by State Electric Supply Co). By accounting for material replacement[1] and average of expected labor costs savings[2] [3] due to extended lamp lifetimes, an estimated annual $316.80 in labor and $472.78 in material savings can be expected (see attachment 5). The proposed lamps require 76.25% less wattage input than the existing (see attachment 4) (40w lamps to 9.5w lamps). Since the lights are run 24 hours a day, this change would amount to an annual energy savings of 34,733 kWh in electricity costs ($3,474.34).
Adding all this up results in a total annual savings of $4,263.92 for this project.

Prepared By: **Erika Tuttobene** **Vice President - Students for Sustainable Practice** **Virginia Tech Class of 2021** **erikat27@vt.edu (805) 720-0412**	**Date:** **November 23, 2020**
Lowell Jessee	11/30/20
Reviewed By (Name of Appropriate University Official)	Date
Denny Cochrane	11/30/20
Reviewed By (Name of Office of Sustainability Representative)	Date

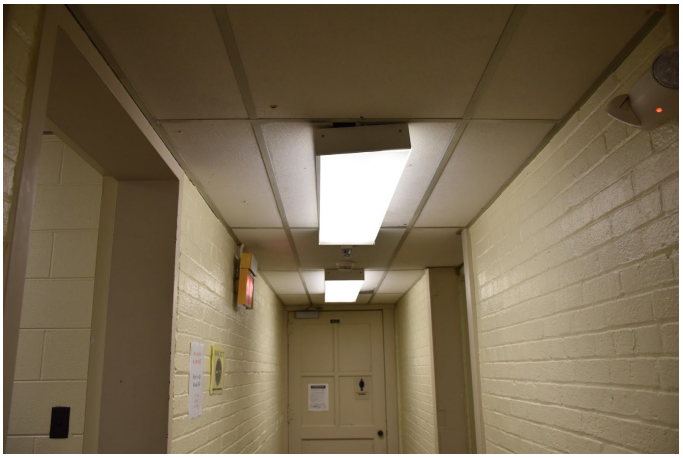
[1] "How to Calculate Material Savings from an LED Lighting Retrofit Project." *PKK Lighting Inc.*, 19 June 2019, www.pkklighting.com/how-to-calculate-material-savings-from-an-led-lighting-retrofit-project/.

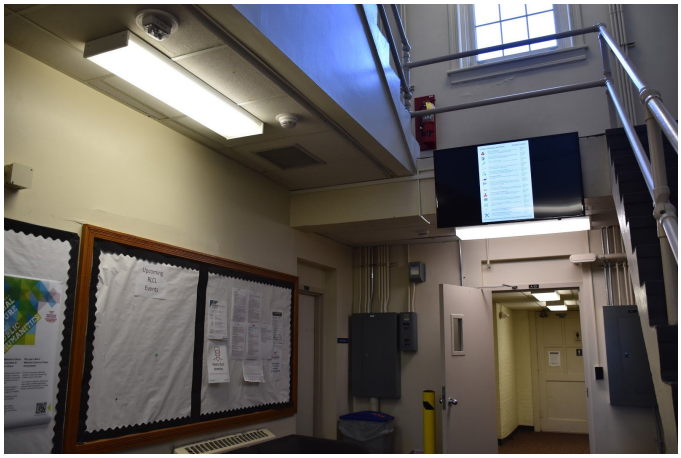
[2] "Labor Savings from an LED Lighting Retrofit Project." *PKK Lighting Inc.*, 24 Mar. 2019, www.pkklighting.com/labor-savings-from-an-led-lighting-retrofit-project/.

[3] Thomas, Andrew. "How to Calculate Labor Savings from a Lighting Retrofit: A Step-by-Step Guide." *Lighting Insights Blog*, Mar. 2017, insights.regencylighting.com/how-to-calculate-labor-savings-from-long-life-lighting-step-by-step-guide.

Attachment # 2

Examples of Lane Hall corridor lights, seen on all 3 floors.





Attachment # 3

PHILIPS
Lighting

T8

9.5T8/MAS/48-840/IF16/P 10/1

Product data

General Information	
Base	G13 [Medium Bi-Pin Fluorescent]
Nominal Lifetime (Nom)	70000 h
Switching Cycle	50000X
B50L70	70000 h

Light Technical	
Color Code	841 [CCT of 4100K (841)]
Beam Angle (Nom)	180 °
Initial lumen (Nom)	1600 lm
Luminous Flux (Rated) (Nom)	1600 lm
Rated Beam Angle	180 °
Correlated Color Temperature (Nom)	4000 K
Color Consistency	<6
Color Rendering Index (Nom)	80
LLMF At End Of Nominal Lifetime (Nom)	70 %

Approbation Marks	RoHS compliance UL certificate DLC compliance

Product Data	
Order product name	9.5T8/MAS/48-840/IF16/P 10/1
EAN/UPC - Product	046677473990
Order code	473990

Starting Time (Nom)	0.5 s
Warm Up Time to 60% Light (Nom)	0.5 s
Power Factor (Nom)	0.9
Voltage (Nom)	120-277, 347 V

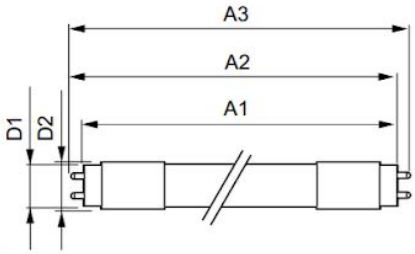
Temperature	
T-Ambient (Max)	55 °C
T-Ambient (Min)	-20 °C
T-Storage (Max)	65 °C
T-Storage (Min)	-40 °C
T-Case Maximum (Nom)	55 °C

Controls and Dimming	
Dimmable	No

Mechanical and Housing	
Product Length	1200 mm

Numerator - Quantity Per Pack	1
Numerator - Packs per outer box	10
Material Nr. (12NC)	929002016004
Net Weight (Piece)	0.220 kg
Model Number	9290020160

Dimensional drawing



TLED 1200mmT8 120-277 9.5W 1600lm 4000K

Product	D1	D2	A1	A2	A3
9.5T8/MAS/48-840/IF16/P 10/1	25.7 mm	28 mm	1198.1 mm	1205.2 mm	1212.3 mm

Philips. (2019) 9.5T8/MAS/48-840/IF16/P 10/1
https://rexel-cdn.com/Products/EA2E326C-127B-432E-8FFF-9E86F9C2207A/EA2E326C-127B-432E-8FFF-9E86F9C2207A.pdf

Attachment # 4

PHILIPS
Lighting

High CRI T12

F40T12 DX ALTO

Product data

- General Characteristics

Base	Medium Bi-Pin [Medium Bi-Pin Fluorescent]
Base Information	Green Base
Bulb	T12
Rated Avg. Life [3 hr Start]	20000 hr
Energy Saving	Not Applicable
Life with 3h/day use [years]	7 an

- Light Technical Characteristics

Color Code	57
Color Rendering Index	90 Ra8
Color Designation	Daylight Deluxe
Color Temperature	6500 K
Initial lumen	2325 Lm
Design Mean Lumens	2025 Lm

- Electrical Characteristics

Watts	40 W

- Environmental Characteristics

Mercury (Hg) Content	4.4 mg

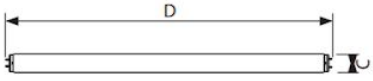
- Product Dimensions

Nominal Length [inch]	48

- Product Data

Product number	273599
Full product name	F40T12 DX ALTO
Short product name	F40T12 DX ALTO/30
Pieces per Sku	1
eop_pck_cfg	30
Skus/Case	30
Bar code on pack	46677273590
Bar code on case	50046677273595
Logistics code(s)	927888005709
eop_net_weight_pp	0.001 kg

G13



F40T12 DX ALTO

Philips. (2014) F40T12 DX ALTO
https://a89b8e4143ca50438f09-7c1706ba3fabeeda794725d88e4f5e57.ssl.cf2.rackcdn.com/spec_sheets/files/000/000/547/original/philips-273599-specs_1.pdf?1440219246

Attachment # 5

STATE ELECTRIC SUPPLY CO.
CUSTOMER FOCUSED, QUALITY DRIVEN

Lighting Upgrade Worksheet

Prepared for:	Lane Hall Green RFP					Prepared by:	Erika Tuttobene			
City:	Blacksburg		State:	VA		Phone #:	(805) 720-0412			
kWh rate:	$ 0.10									
Area/Space:	Lane Hall Corridors									
Description of existing fixture:	T12 2-tube Fluorescent									
Existing fixture wattage:	86									
Existing quantity:	61									
Description of new fixture:	T8 2-tube LED									
New fixture wattage:	21									
New quantity:	61									
Annual operating hours:	8,760									
No. fixtures with sensor/control:	-									
KW controlled by sensor/control:	-	-	-	-	-	-	-	-	-	-
Sensor/Control reduction in on-hours:	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sensor/Control cost energy savings:	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual operating hours:	8,760									
No. fixtures with sensor/control:	-									
KW controlled by sensor/control:	-	-	-	-	-	-	-	-	-	-
Sensor/Control reduction in on-hours:	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sensor/Control cost energy savings:	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KW saved:	3.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
kWh saved:	34733.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual savings:	$ 3,473.34	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Total Annual KW saved	Total Annual kWh saved	Total Annual Energy Cost Savings	Annual Labor Cost Savings	Annual Material Cost Savings
3.97	34,733	$ 3,473.34	$ 316.80	$ 472.78

Total Material Cost	Total Labor Cost	Utility Incentives	Other Incentives
$ 1,337.12	$ 6,100.00	$ -	$ -

Payback (years):	1.74	Payback (months):	20.94

Equivalent tons CO_2 removed: 28

Equivalent to CO_2 emissions from the electricity used by 3 homes for one year.

Equivalent greenhouse gas emissions from 5 passenger cars per year.

www.stateelectric.com

Above is a Lighting Upgrade Worksheet provided by vendor State Electric Supply Company. This assisted in calculations of energy savings and payback period for the proposed lighting retrofit. While Virginia Tech pays closer to $.095 per kWh of energy, for purposes of this document this cost was rounded up to $.10 per kWh. Note that estimated payback period on document does not account for project management and contingency budget costs. The actual lighting project total is $10,250.60, therefore estimated payback period is 2.4 years or just under 29 months.

Labor savings were calculated using recommendation from Regency Lighting's estimating guidelines. If an assumed 10 minutes is required to change a lamp, and labor is compensated at a rate of $50 per hour ($8.30 per lamp), which is consistent with project labor requirement estimates, then labor savings can be calculated by how often the replacement of a lamp is required.

Existing lamps (see attachment 4):
(8,760 hours per year) / (20,000 hour lifetime of current lamps) = .44 lamp replacements required per year
(.44 annual replacements) x (122 lamps) = 53.44 replacements annually for all Lane Hall corridor lights
(53.44 replacement lamps) x ($8.30 per lamp in labor) = **$443.52 in total current annual labor costs**

Proposed lamps:
(8,760 hours per year) / (70,000 hour lifetime of proposed lamps) = .13 lamp replacements required per year
(.13 annual replacements) x (122 lamps) = 15.27 replacements annually for all Lane Hall corridor lights

(15.27 replacement lamps) x ($8.30 per lamp in labor) = **$126.72 in proposed annual labor costs**

($443.52 current estimated labor costs) - ($126.72 proposed estimated labor costs) **= $316.80 in labor savings**

Material savings were calculated using costs from State Electric Supply Company. Savings were calculated by frequency of replacement, and replacement of ballast was factored into the cost as well.

Existing Lamps:
(8,760 hours per year) / (20,000 hour lifetime of current lamps) = .44 lamp replacements required per year
(.44 annual replacements) x (122 lamps) = 53.44 replacements annually for all Lane Hall corridor lights
(53.44 replacement lamps) x ($11.47 per lamp/ballast) = **$612.96 in total current annual material costs**

Proposed Lamps:
(8,760 hours per year) / (70,000 hour lifetime of proposed lamps) = .13 lamp replacements required per year
(.13 annual replacements) x (122 lamps) = 15.27 replacements annually for all Lane Hall corridor lights
(15.27 replacement lamps) x ($9.18 per lamp/ballast) = **$140.18 in proposed annual material costs**

($612.96 in total current estimated annual material costs) - ($140.18 in proposed estimated annual material costs) = **$472.78 in proposed annual material savings**

Total Annual Savings
($316.80 labor) + ($472.78 material) + ($3,474.34 energy) = $4,263.92