VIRGINIA TECH™

**Vice President for Campus Planning, Infrastructure, and Facilities**
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Blacksburg, Virginia 24061
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# 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 | $18,770.88 | See III.C. below |
| Estimated Savings - | $2,697.30 annually | See III.D. below |
| Net Cost of this Proposal = | $18,770.88 with approximately 84 month period until return on investment | |

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

**Improving the energy efficiency of McBryde Hall through updated stairwell lighting systems, accomplished through replacing aged T8 fluorescent bulbs with occupancy-sensing LED bulbs and sensors, installing daylight harvesting sensors, and cleaning the fixtures. This would be the building's first significant lighting upgrade since 1994. Retrofitting the existing fixtures is considered a low cost, high efficiency approach to reducing Virginia Tech's emissions produced by electricity usage. The current lights run 24 hours a day for safety and security assurance and through the installation of occupancy sensing dimmers as well as daylight harvesting sensors, a minimum projected average of 45% in energy savings can be expected. Upgrading and cleaning these lights will help transition this historic building as Virginia Tech continues to adopt more environmentally-focused changes.This solution also helps reduce waste and cost compared to a full replacement, but will provide a much-needed upgrade to the efficiency and aesthetic value of the building (see attachment 3).**

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
- 64 2-tube lighting fixtures
- 20 tandem fixtures (requiring only 1 relay per two fixtures), 24 single 2-tube fixtures
- 4 stairwells

**Material Costs**

- Cost of light + ballast for one tube Philips 13T8/MAS/48-840/IF21/P/DIM 10/1 InstantFit (see attachment 4) $9.46
- Ballast/driver upgrade per fixture $55
- Relay per separate light fixture $86
- Sensor for each stairwell doorway $54
- Daylight harvesting sensor $80

(128 tubes)x($9.46 lamp/ballast) + (64 fixtures)x($55 driver upgrade) + (44 separate lighting fixtures)x($86 relay) + (6 hallway to stairwell entrances)x(4 stairwells)x($54 sensor) + (4 stairwells)x($80 daylight sensor) = **$10,130.88**

**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 64 hours. With an anticipated labor force of 2 contractors, paid at a rate of $50 per hour, the following labor cost estimate was reached. This includes cleaning up the fixtures to optimize light effectiveness.

(64 fixtures)x(1 hour)+ (2 contractors)x($50/hour) = **$6,400**

**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. 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.

($6,400 labor)x(.15 project management budget) + ($6,400 labor)x(.15 contingency budget) + ($6,400 labor) x (.05 commissioning costs) = **$2,240**

**Total Cost**

($10,130.88 material) + ( $6,400 labor) + ($2,240 project management & contingency) = **$18,770.88**

**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
Dwight Carroll, Virginia Tech Facilities Services, Building Trades : dwcarrol@vt.edu, (540) 321-9434

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 115% lifetime improvement (70,000 hours compared to 30,000) expected in comparison to the current lamps (specified in documentation provided by State Electric Supply Co). By accounting for material replacement[1] and labor costs savings[2] due to extended lamp lifetimes, an estimated annual $234.88 in labor and $257.42 in material savings can be expected (see attachment 6). The current lamps (see attachment 5) are discontinued, further highlighting the obsolescence and inefficiency of the existing lighting system, and pose a potential problem with future procurement. The proposed bulbs require 59.4% less wattage input than the existing (32w lamps to 13w lamps), and expected savings from dimming and daylight harvesting features can conservatively be estimated at a combined energy savings of 45%[3] with upper estimates up to 80%[4], potentially during times such as weekends or university holidays. This results in anticipated energy savings of 23,210 kWh per year in electricity costs. Using an estimate of $.10 cost per kWh, this would result in an annual electricity savings of $2,205.**

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E. Is this funding request for a One-Time need or an Ongoing need (**please check one**)?

■ **One-time** ☐ **Ongoing**

F. Is funding available for this request from another source? If yes, describe the funding (source, amount, etc.)

**Virginia Tech Facilities Services typically handles projects of this sort. Due to hopes in meeting quotas for Virginia Tech's energy goals, and since no major-projects are currently planned for McBryde, funding through the Green RFP program would ensure this project is a priority!**

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[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] DiLouie, Craig, et al. "Estimating Energy Savings with Lighting Controls." *Lighting Controls Association*, National Electrical Manufacturers Association, 15 Feb. 2017, lightingcontrolsassociation.org/2013/09/16/estimating-energy-savings-with-lighting-controls/.

[4] "Wireless Occupancy Sensors for Lighting Controls." *Energy Efficiency & Renewable Energy*, U.S. Department of Energy, Dec. 2019, www.energy.gov/sites/prod/files/2019/12/f70/wireless_occupancy_sensor_guide.pdf.

*Attachment # 2*

## STUDENT ORGANIZATION SUSTAINABILITY INITIATIVE PROPOSAL FORM (Continued)

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

*Attachment #3*

**Figure 1 (left)**


**Figure 2 (right)**

**Figure 3 (left)**

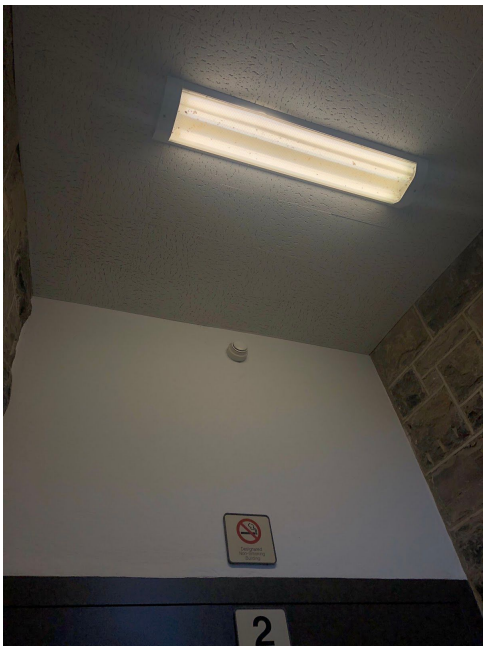



**Figure 4 (right)**

**Notes**

- **Figures 1, 3: Tandem fixtures**
- **Figures 2, 4: Single fixtures**
- **Figures 1, 4: Note debris and insect build-up**
- **Figure 2: Note bulb failure**
- **Figure 3: Note example of location well-suited for daylight-harvesting sensor**

*Attachment #4*

PHILIPS
Lighting

# T8

## 13T8/MAS/48-840/IF21/P/DIM 10/1

Our TLEDs are available in InstantFit (Type A / Type C) or MainsFit (Ballast bypass / Type B) versions. The InstantFit lamps work on a broad variety of ballasts and LED drivers. Only InstantFit has over 15,000 lamp & ballast combinations delivering even light output, energy savings and a long lifetime. Our MainsFit products feature a double-ended design, simplifying installation while a proprietary safety circuit minimizes a shock risk. Lamp sizes range from 2-foot to 8-foot and U-bend with a variety of lumen outputs.

## Product data

| General Information | |
|---|---|
| Base | G13 [ Medium Bi-Pin Fluorescent] |
| EU RoHS compliant | Yes |
| Nominal Lifetime (Nom) | 70000 h |
| Switching Cycle | 50000X |

| Light Technical | |
|---|---|
| Color Code | 841 [ CCT of 4100K (841)] |
| Beam Angle (Nom) | 180 ° |
| Initial lumen (Nom) | 2100 lm |
| Color Designation | Cool White (CW) |
| Correlated Color Temperature (Nom) | 4000 K |
| Luminous Efficacy (rated) (Nom) | 161.00 lm/W |
| Color Consistency | <6 |
| Color Rendering Index (Nom) | 82 |
| LLMF At End Of Nominal Lifetime (Nom) | 70 % |

| Mechanical and Housing | |
|---|---|
| Product Length | 48 in |

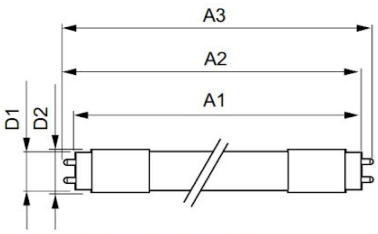
| Approval and Application | |
|---|---|
| Energy Efficiency Label (EEL) | Not applicable |
| Energy Saving Product | Yes |
| Approbation Marks | RoHS compliance UL certificate DLC compliance |
| Energy Consumption kWh/1000 h | - kWh |
| Energy Certifications | DLC Standard |

| | |
|---|---|
| Lamp Current (Max) | 400 mA |
| Lamp Current (Min) | 130 mA |
| Starting Time (Nom) | 0.5 s |
| Warm Up Time to 60% Light (Nom) | 0.5 s |
| UL Type | Type A - works on ballast Type C - works with dedicated LED driver Type A+C - works with both ballasts and the LED driver |
| Power Factor (Nom) | 0.9 |
| Voltage (Nom) | 277 V |

| Temperature | |
|---|---|
| T-Ambient (Max) | 45 °C |
| T-Ambient (Min) | -20 °C |
| T-Storage (Max) | 65 °C |
| T-Storage (Min) | -40 °C |
| T-Case Maximum (Nom) | 50 °C |

| Product Data | |
|---|---|
| Order product name | 13T8/MAS/48-840/IF21/P/DIM 10/1 |
| EAN/UPC - Product | 046677473945 |
| Order code | 473942 |
| Numerator - Quantity Per Pack | 1 |
| Numerator - Packs per outer box | 10 |
| Material Nr. (12NC) | 929001397834 |
| Net Weight (Piece) | 0.220 kg |
| Model Number | 9290013978B |

## Dimensional drawing




TLED IF MasterClass 4ft 2100lm 4000K

| Product | D1 | D2 | A1 | A2 | A3 |
|---|---|---|---|---|---|
| 13T8/MAS/48-840/ IF21/P/DIM 10/1 | 25.7 mm | 26.3 mm | 1198.1 mm | 1205.2 mm | 1212.3 mm |

**Philips. (2020) 13T8/MAS/48-840/IF21/P/DIM 10/1**
**https://www.usa.lighting.philips.com/api/assets/v1/file/content/fp929001397834-pss-en_us/929001397834_NA.en_US.PROF.FP.pdf**

*Attachment #5*

PHILIPS
Lighting

# T8 Standard

F32T8/TL741 ALTO

## Product data

- General Characteristics

| | |
|---|---|
| Base | Medium Bi-Pin [Medium Bi-Pin Fluorescent] |
| Base Information | Green Base |
| Bulb | T8 |
| Energy Saving | Energy Saving |
| Rated Avg Life [12-Hr Prog St] | 36000 hr |
| Rated Avg Life [12-Hr Inst St] | 30000 hr |
| Rated Avg Life [3-Hr Prog St] | 30000 hr |
| Rated Avg Life [3-Hr Inst St] | 24000 hr |

- Light Technical Characteristics

| | |
|---|---|
| Color Code | TL741 [CCT of 4100K] |
| Color Rendering Index | 78 Ra8 |
| Color Designation | TL741 |
| Color Temperature | 4100 K |
| Initial lumen | 2600 Lm |
| Design Mean Lumens | 2470 Lm |

- Electrical Characteristics

| | |
|---|---|
| Watts | 32 W |

- Environmental Characteristics

| | |
|---|---|
| Mercury (Hg) Content | 1.7 mg |
| Picogram per Lumen Hour | 27 p/LuHr |

- Product Dimensions

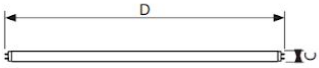
| | |
|---|---|
| Nominal Length [inch] | 48 |

- Footnotes

| | |
|---|---|
| Footnotes Fluorescent/CFL | 920 [Circle E- The encircled E means this bulb meets Federal minimum efficiency standards.] |

- Product Data

| | |
|---|---|
| Product number | 281576 |
| Full product name | F32T8/TL741 ALTO |
| Short product name | F32T8/TL741 ALTO |
| Pieces per Sku | 1 |
| eop_pck_cfg | 30 |
| Skus/Case | 30 |
| Bar code on pack | 46677281571 |
| Bar code on case | 50046677281576 |
| Logistics code(s) | 927869774118 |
| eop_net_weight_pp | 0.001 kg |




F32T8/TL741 ALTO


G13

**Philips. (2012) F32T8/TL741 ALTO**
**https://rexel-cdn.com/Products/PhilipsLighting/F32T8-TL741-ALTO.pdf?i=841F3AD3-AC31-4F41-949F-89B9B5E85D0A**

*Attachment #6*

**STATE ELECTRIC SUPPLY CO.**
CUSTOMER FOCUSED, QUALITY DRIVEN

## Lighting Upgrade Worksheet

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Prepared for: | Green RFP | | | | | Prepared by: | Erika Tuttobene | | | |
| City: | Blacksburg | | State: | CA | | Phone #: | (805)720-0412 | | | |
| kWh rate: | $ 0.10 | | | | | | | | | |
| Area/Space: | McBryde Stairwells | | | | | | | | | |
| Description of existing fixture: | T8 Fluorescent 2-lane | | | | | | | | | |
| Existing fixture wattage: | 59 | | | | | | | | | |
| Existing quantity: | 64 | | | | | | | | | |
| Description of new fixture: | T8 LED 2-lane Dimmable | | | | | | | | | |
| New fixture wattage: | 32 | | | | | | | | | |
| New quantity: | 64 | | | | | | | | | |
| Annual operating hours: | 8,760 | | | | | | | | | |
| No. fixtures with sensor/control: | 64 | | | | | | | | | |
| KW controlled by sensor/control: | 2.05 | - | - | - | - | - | - | - | - | - |
| Sensor/Control reduction in on-hours: | 45% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Sensor/Control cost energy savings: | $ 766.96 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| KW saved: | 3.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| kWh saved: | 23210.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual savings: | $ 2,205.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |

| Total Annual KW saved | Total Annual kWh saved | Total Annual Energy Cost Savings | Annual Labor Cost Savings | Annual Material Cost Savings |
|---|---|---|---|---|
| 3.78 | 23,210 | $ 2,205.00 | $ 234.88 | $ 257.42 |

| Total Material Cost | Total Labor Cost | Utility Incentives | Other Incentives |
|---|---|---|---|
| $ 10,130.88 | $ 8,000.00 | $ - | $ - |

| Payback (years): | 6.72 | Payback (months): | 80.66 |
|---|---|---|---|

| | | |
|---|---|---|
| Equivalent tons $CO_2$ removed: | 18 | |
| Equivalent to $CO_2$ emissions from the electricity used by | 2 | homes for one year. |
| Equivalent greenhouse gas emissions from | 3 | 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. 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. Actual estimated payback period is just under 7 years.**

**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 bulb is required.**

**Existing lamps:**
(8,760 hours per year) / (30,000 hour lifetime of current lamps) = .29 lamp replacements required per year
(.29 annual replacements) x (128 lamps) = 37.12 replacements annually for all McBryde Stairwell lights
(37.12 replacement lamps) x ($8.30 per lamp in labor) = **$308.10 in total current annual labor costs**

**Proposed lamps:**
(8,760 hours per year) x (.55 hour usage reduction due to occupancy controls and daylight harvesting) = 4,818 operating hours per year
(4,818 hours per year) / (70,000 hour lifetime of proposed lamps) = .07 lamp replacements required per year
(.07 annual replacements) x (128 lamps) = 8.81 replacements annually for all McBryde Stairwell lights

(8.81 replacement lamps) x ($8.30 per lamp in labor) = **$73.12 in proposed annual labor costs**

($308.10 current estimated labor costs) - ($73.22 proposed estimated labor costs) **= $234.88 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) / (30,000 hour lifetime of current lamps) = .29 lamp replacements required per year
(.29 annual replacements) x (128 lamps) = 37.12 replacements annually for all McBryde Stairwell lights
(37.12 replacement lamps) x ($9.18 per lamp/ballast) = **$340.76 in total current annual material costs**

**Proposed Lamps:**
(8,760 hours per year) x (.55 hour usage reduction due to occupancy controls and daylight harvesting) = 4,818 operating hours per year
(4,818 hours per year) / (70,000 hour lifetime of proposed lamps) = .07 lamp replacements required per year
(.07 annual replacements) x (128 lamps) = 8.81 replacements annually for all McBryde Stairwell lights
(8.81 replacement lamps) x ($9.46 per lamp/ballast) = **$83.34 in proposed annual material costs**

($340.76 in total current estimated annual material costs) - ($83.34 in proposed estimated annual material costs) = **$257.42 in proposed annual material savings**

**Total Annual Savings**
**($234.88 labor) + ($257.42 material) + ($2,205.00 energy) = $2,697.30**