New Jersey's Clean Energy Program

LGEA Exit Meeting for:

Princeton University

TRC Energy Services

April 2, 2019

Introductions

Princeton University

- Tom Nyquist – Executive Director of Facilities Engineering & Campus Energy
- Bill Broadhurst – Manager of Campus Energy
- Art Murphy – Project Energy Engineer

NJ Clean Energy Program

- Brian DeLuca, CEM – TRC Program Manager
- Vish Nimbalkar, PE – TRC Lead Auditor
- Sarah Walters – TRC Account Manager
- Tony O'Donnell – TRC Outreach Manager
- Mike Thulen – ESIP Coordinator
- Arif Welcher – BPU Ombudsman
- Uprendar Chivukula – BPU Commissioner

Agenda

- The audit process overview
- Energy use & existing conditions
- Review of **E**nergy **C**onservation **M**easures (ECMs) identified
- Questions or concerns regarding the draft audit report
- Overview of NJCEP equipment incentives
- Next steps for Princeton University

LGEA Process

- Application Approval
- Scheduling Call
- Audit
- Benchmarking & Analysis
- Draft Report
- Exit Meeting Presentation
- Final Report

Site Visit and Utility Analysis

Overview of Systems, Baseline & Existing Conditions:

- Building Envelope
- Lighting System
- HVAC and Mechanical Systems
- Plug Load Equipment

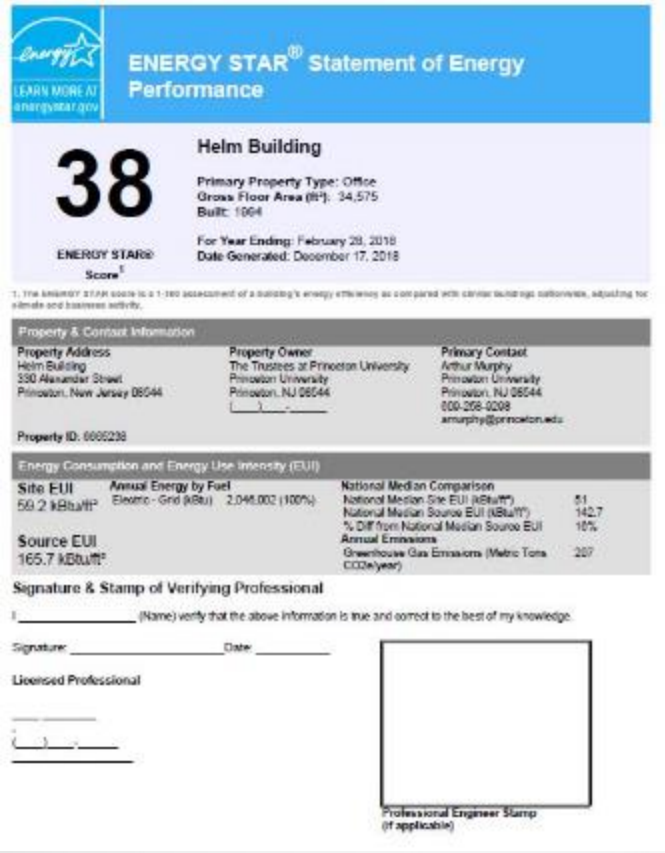
Utility Consumption:

- Electric Consumption and Costs
- Natural Gas Consumption and Costs

Sites Visited/Analyzed

- New South Office
- Helm Building
- Computer Science/Friend Center
- Sherrerd Hall
- Frist Campus Center
- Fine Hall
- Woolworth Music Center

Benchmarking



ENERGY STAR® Statement of Energy Performance

38

ENERGY STAR® Score

Helm Building

Primary Property Type: Office
Gross Floor Area (ft²): 34,575
Built: 1964

For Year Ending: February 28, 2018
Date Generated: December 17, 2018

Property & Contact Information

Property Address
Helm Building
330 Alexander Street
Princeton, New Jersey 08544

Property Owner
The Trustees of Princeton University
Princeton University
Princeton, NJ 08544

Primary Contact
Arthur Murphy
Princeton University
Princeton, NJ 08544
609-258-0208
amurphy@princeton.edu

Property ID: 6000238

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
59.2 kBtu/ft²

Annual Energy by Fuel
Electric - Grid (kBtu) 2,046,002 (100%)

Source EUI
165.7 kBtu/ft²

National Median Comparison
National Median Site EUI (kBtu/ft²) 51
National Median Source EUI (kBtu/ft²) 142.7
% Diff from National Median Source EUI 16%
Annual Emissions
Greenhouse Gas Emissions (Metric Tons CO2e/year) 207

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____ Date: _____

Licensed Professional

Professional Engineer Stamp (if applicable)

Building Name	ENERGY STAR Score
New South	3
Helm Building	38
Computer Science/Friend Center	N/A
Sherrerd Hall	N/A
Frist Campus Center	N/A
Fine Hall	N/A
Woolworth Music Center	N/A

ENERGY STAR Scores are percentile ranking from 1 (least efficient) to 100 (most efficient). It compares your building's energy performance to similar buildings nationwide.

All Opportunities

Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades	397,826	76.4	-165.3	$26,610	$74,208	$12,116	$62,092	2.3	376,404
Retrofit Fixtures with LED Lamps	397,653	76.4	-165.3	$26,600	$73,701	$12,116	$61,585	2.3	376,240
Install LED Exit Signs	173	0.0	-0.1	$10	$507	$0	$507	51.3	164
Lighting Control Measures	247,351	26.1	-101.9	$16,664	$119,696	$16,870	$102,826	6.2	234,161
Install Occupancy Sensor Lighting Controls	179,552	19.0	-73.9	$12,102	$74,096	$9,120	$64,976	5.4	169,994
Install Daylight Dimming Controls	21,520	1.9	-9.0	$1,383	$11,000	$7,750	$3,250	2.3	20,353
Install High/Low Lighting Controls	46,279	5.1	-19.0	$3,179	$34,600	$0	$34,600	10.9	43,814
Motor Upgrades	33,320	4.4	0.0	$2,233	$82,166	$0	$82,166	36.8	33,553
Premium Efficiency Motors	33,320	4.4	0.0	$2,233	$82,166	$0	$82,166	36.8	33,553
Variable Frequency Drive (VFD) Measures	856,722	113.0	54.2	$57,635	$236,675	$32,530	$204,145	3.5	870,644
Install VFDs on Constant Volume (CV) Fans	600,403	97.3	0.0	$39,875	$162,409	$26,880	$135,529	3.4	604,601
Install VFDs on Chilled Water Pumps	73,485	8.3	0.0	$5,031	$17,603	$0	$17,603	3.5	73,999
Install VFDs on Heating Water Pumps	95,564	7.4	0.0	$6,650	$39,863	$0	$39,863	6.0	96,232
Install VFDs on Kitchen Hood Fan Motors	87,270	0.0	54.2	$6,079	$16,800	$5,650	$11,150	1.8	95,813
Electric Unitary HVAC Measures	1,476	0.6	0.0	$228	$8,218	$0	$8,218	36.0	1,486
Install High Efficiency Air Conditioning Units	1,476	0.6	0.0	$228	$8,218	$0	$8,218	36.0	1,486
HVAC System Improvements	6,120	0.0	223.2	$1,568	$24,470	$0	$24,470	15.6	38,831
Implement Demand Control Ventilation (DCV)	6,120	0.0	223.2	$1,568	$24,470	$0	$24,470	15.6	38,831
Domestic Water Heating Upgrade	42,000	0.0	210.2	$4,299	$789	$0	$789	0.2	73,058
Install Low-Flow DHW Devices	42,000	0.0	210.2	$4,299	$789	$0	$789	0.2	73,058
Food Service Equipment & Refrigeration Measures	7,252	0.5	0.0	$482	$3,718	$380	$3,338	6.9	7,303
Refrigerator/Freezer Case Electrically Commutated Motors	5,771	0.5	0.0	$383	$607	$80	$527	1.4	5,812
Refrigeration Controls	1,481	0.0	0.0	$98	$3,112	$300	$2,812	28.6	1,491
Plug Load Equipment Control - Vending Machine	7,012	0.8	0.0	$503	$1,840	$0	$1,840	3.7	7,061
Vending Machine Control	7,012	0.8	0.0	$503	$1,840	$0	$1,840	3.7	7,061
Custom Measures	258,215	216.3	-991.6	$32,981	$30,102	$0	$30,102	0.9	143,912
Replace Electric Boiler with Gas Fired Boiler	246,966	216.0	-991.6	$32,234	$26,802	$0	$26,802	0.8	132,584
Reach-In Glass Door Refrigerator - Anti Sweat Heating Controls	11,249	0.3	0.0	$747	$3,300	$0	$3,300	4.4	11,328
TOTALS	1,857,294	438.1	-771.4	$143,202	$581,882	$61,896	$519,986	3.6	1,786,413

Cost Effective Opportunities*

** Opportunities considered cost effective have a payback period less than 2/3rds of the useful life of the measure*

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		397,653	76.4	-165.3	$26,600	$73,701	$12,116	$61,585	2.3	376,240
ECM 1	Retrofit Fixtures with LED Lamps	397,653	76.4	-165.3	$26,600	$73,701	$12,116	$61,585	2.3	376,240
Lighting Control Measures		247,338	26.1	-101.9	$16,663	$119,426	$16,835	$102,591	6.2	234,149
ECM 2	Install Occupancy Sensor Lighting Controls	179,539	19.0	-73.9	$12,101	$73,826	$9,085	$64,741	5.4	169,981
ECM 3	Install Daylight Dimming Controls	21,520	1.9	-9.0	$1,383	$11,000	$7,750	$3,250	2.3	20,353
ECM 4	Install High/Low Lighting Controls	46,279	5.1	-19.0	$3,179	$34,600	$0	$34,600	10.9	43,814
Motor Upgrades		30,697	3.9	0.0	$2,042	$68,777	$0	$68,777	33.7	30,912
ECM 5	Premium Efficiency Motors	30,697	3.9	0.0	$2,042	$68,777	$0	$68,777	33.7	30,912
Variable Frequency Drive (VFD) Measures		841,888	111.4	54.2	$56,649	$224,108	$32,530	$191,578	3.4	855,707
ECM 6	Install VFDs on Constant Volume (CV) Fans	600,403	97.3	0.0	$39,875	$162,409	$26,880	$135,529	3.4	604,601
ECM 7	Install VFDs on Chilled Water Pumps	73,485	8.3	0.0	$5,031	$17,603	$0	$17,603	3.5	73,999
ECM 8	Install VFDs on Heating Water Pumps	80,730	5.9	0.0	$5,664	$27,296	$0	$27,296	4.8	81,295
ECM 9	Install VFDs on Kitchen Hood Fan Motors	87,270	0.0	54.2	$6,079	$16,800	$5,650	$11,150	1.8	95,813
HVAC System Improvements		3,178	0.0	123.6	$853	$10,875	$0	$10,875	12.7	21,299
ECM 10	Implement Demand Control Ventilation (DCV)	3,178	0.0	123.6	$853	$10,875	$0	$10,875	12.7	21,299
Domestic Water Heating Upgrade		42,000	0.0	210.2	$4,299	$789	$0	$789	0.2	73,058
ECM 11	Install Low-Flow DHW Devices	42,000	0.0	210.2	$4,299	$789	$0	$789	0.2	73,058
Food Service Equipment & Refrigeration Measures		5,771	0.5	0.0	$383	$607	$80	$527	1.4	5,812
ECM 12	Refrigerator/Freezer Case Electrically Commutated Motors	5,771	0.5	0.0	$383	$607	$80	$527	1.4	5,812
Plug Load Equipment Control - Vending Machine		7,012	0.8	0.0	$503	$1,840	$0	$1,840	3.7	7,061
ECM 13	Vending Machine Control	7,012	0.8	0.0	$503	$1,840	$0	$1,840	3.7	7,061
Custom Measures		258,215	216.3	-991.6	$32,981	$30,102	$0	$30,102	0.9	143,912
ECM 14	Replace Electric Boiler with Gas Fired Boiler	258,215	216.3	-991.6	$32,981	$30,102	$0	$30,102	0.9	143,912
TOTALS		1,833,752	435.3	-870.8	$140,973	$530,224	$61,561	$468,663	3.3	1,748,149

New South Office

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**1,423**	**0.2**	**-1**	**$91**	**$1,368**	**$298**	**$25**	**$273**	**3.0**	**1,346**
ECM 1	Retrofit Fixtures with LED Lamps	1,423	0.2	-1	$91	$1,368	$298	$25	$273	3.0	1,346
Lighting Control Measures		**13,145**	**1.5**	**-5**	**$842**	**$6,739**	**$5,190**	**$595**	**$4,595**	**5.5**	**12,433**
ECM 2	Install Occupancy Sensor Lighting Controls	11,877	1.3	-5	$761	$6,089	$4,590	$595	$3,995	5.2	11,233
ECM 3	Install High/Low Lighting Controls	1,269	0.1	-1	$81	$650	$600	$0	$600	7.4	1,200
Domestic Water Heating Upgrade		**0**	**0.0**	**24**	**$125**	**$1,252**	**$57**	**$0**	**$57**	**0.5**	**3,530**
ECM 4	Install Low-Flow DHW Devices	0	0.0	24	$125	$1,252	$57	$0	$57	0.5	3,530
Food Service & Refrigeration Measures		**1,551**	**0.2**	**0**	**$103**	**$514**	**$460**	**$0**	**$460**	**4.5**	**1,562**
ECM 5	Vending Machine Control	1,551	0.2	0	$103	$514	$460	$0	$460	4.5	1,562
TOTALS		**16,120**	**1.8**	**18**	**$1,162**	**$9,873**	**$6,005**	**$620**	**$5,385**	**4.6**	**18,890**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Helm Building

#	Energy Conservation Measure	*Recommend?*	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**319**	**0.1**	**0**	**$49**	**$740**	**$465**	**$0**	**$465**	**9.4**	**321**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	319	0.1	0	$49	$740	$465	$0	$465	9.4	321
Lighting Control Measures			**3,632**	**0.9**	**0**	**$562**	**$4,492**	**$3,230**	**$315**	**$2,915**	**5.2**	**3,657**
ECM 2	Install Occupancy Sensor Lighting Controls	Yes	2,903	0.7	0	$449	$3,590	$2,430	$315	$2,115	4.7	2,923
ECM 3	Install High/Low Lighting Controls	Yes	729	0.2	0	$113	$902	$800	$0	$800	7.1	734
Motor Upgrades			**188**	**0.1**	**0**	**$29**	**$437**	**$800**	**$0**	**$800**	**27.5**	**190**
	Premium Efficiency Motors	No	188	0.1	0	$29	$437	$800	$0	$800	27.5	190
Variable Frequency Drive (VFD) Measures			**4,681**	**1.4**	**0**	**$724**	**$10,855**	**$3,276**	**$400**	**$2,876**	**4.0**	**4,713**
ECM 4	Install VFDs on Constant Volume (CV) Fans	Yes	4,681	1.4	0	$724	$10,855	$3,276	$400	$2,876	4.0	4,713
Electric Unitary HVAC Measures			**1,476**	**0.6**	**0**	**$228**	**$3,423**	**$8,218**	**$0**	**$8,218**	**36.0**	**1,486**
	Install High Efficiency Air Conditioning Units	No	1,476	0.6	0	$228	$3,423	$8,218	$0	$8,218	36.0	1,486
Domestic Water Heating Upgrade			**1,668**	**0.0**	**0**	**$258**	**$2,579**	**$43**	**$0**	**$43**	**0.2**	**1,680**
ECM 5	Install Low-Flow DHW Devices	Yes	1,668	0.0	0	$258	$2,579	$43	$0	$43	0.2	1,680
Custom Measures			**246,966**	**216.0**	**-992**	**$32,234**	**$644,676**	**$26,802**	**$0**	**$26,802**	**0.8**	**132,584**
ECM 6	Replace Electric Boiler with Gas Fired Boiler	Yes	246,966	216.0	-992	$32,234	$644,676	$26,802	$0	$26,802	0.8	132,584
TOTALS			**258,930**	**219.1**	**-992**	**$34,084**	**$667,202**	**$42,835**	**$715**	**$42,120**	**1.2**	**144,632**

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** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Computer Science/Friend Center

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**173,224**	**21.6**	**-72**	**$12,296**	**$184,434**	**$36,705**	**$5,326**	**$31,379**	**2.6**	**163,927**
ECM 1	Retrofit Fixtures with LED Lamps	173,224	21.6	-72	$12,296	$184,434	$36,705	$5,326	$31,379	2.6	163,927
Lighting Control Measures		**74,542**	**8.9**	**-31**	**$5,290**	**$42,317**	**$37,450**	**$3,255**	**$34,195**	**6.5**	**70,500**
ECM 2	Install Occupancy Sensor Lighting Controls	53,799	6.4	-22	$3,818	$30,541	$25,650	$3,255	$22,395	5.9	50,882
ECM 3	Install High/Low Lighting Controls	20,743	2.5	-9	$1,472	$11,776	$11,800	$0	$11,800	8.0	19,618
Motor Upgrades		**11,867**	**1.7**	**0**	**$868**	**$13,018**	**$26,578**	**$0**	**$26,578**	**30.6**	**11,950**
ECM 4	Premium Efficiency Motors	11,867	1.7	0	$868	$13,018	$26,578	$0	$26,578	30.6	11,950
Variable Frequency Drive (VFD) Measures		**279,127**	**40.0**	**0**	**$20,413**	**$306,200**	**$82,744**	**$8,720**	**$74,024**	**3.6**	**281,078**
ECM 5	Install VFDs on Constant Volume (CV) Fans	185,313	31.5	0	$13,552	$203,287	$55,448	$8,720	$46,728	3.4	186,608
ECM 6	Install VFDs on Chilled Water Pumps	48,990	5.6	0	$3,583	$53,742	$10,389	$0	$10,389	2.9	49,333
ECM 7	Install VFDs on Heating Water Pumps	44,824	3.0	0	$3,278	$49,172	$16,907	$0	$16,907	5.2	45,137
HVAC System Improvements		**1,688**	**0.0**	**58**	**$424**	**$6,360**	**$8,157**	**$0**	**$8,157**	**19.2**	**10,173**
	Implement Demand Control Ventilation (DCV)	1,688	0.0	58	$424	$6,360	$8,157	$0	$8,157	19.2	10,173
Domestic Water Heating Upgrade		**40,331**	**0.0**	**0**	**$2,950**	**$29,496**	**$215**	**$0**	**$215**	**0.1**	**40,613**
ECM 8	Install Low-Flow DHW Devices	40,331	0.0	0	$2,950	$29,496	$215	$0	$215	0.1	40,613
Food Service & Refrigeration Measures		**3,506**	**0.4**	**0**	**$256**	**$1,282**	**$920**	**$0**	**$920**	**3.6**	**3,530**
ECM 9	Vending Machine Control	3,506	0.4	0	$256	$1,282	$920	$0	$920	3.6	3,530
TOTALS		**584,285**	**72.7**	**-45**	**$42,496**	**$583,107**	**$192,769**	**$17,301**	**$175,468**	**4.1**	**581,773**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Sherrerd Hall

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**30,041**	**10.2**	**-12**	**$2,144**	**$32,155**	**$20,473**	**$3,849**	**$16,624**	**7.8**	**28,431**
ECM 1	Retrofit Fixtures with LED Lamps	30,041	10.2	-12	$2,144	$32,155	$20,473	$3,849	$16,624	7.8	28,431
Lighting Control Measures		**13**	**0.0**	**0**	**$1**	**$7**	**$270**	**$35**	**$235**	**252.4**	**12**
	Install Occupancy Sensor Lighting Controls	13	0.0	0	$1	$7	$270	$35	$235	252.4	12
Domestic Water Heating Upgrade		**0**	**0.0**	**52**	**$271**	**$2,713**	**$93**	**$0**	**$93**	**0.3**	**7,648**
ECM 2	Install Low-Flow DHW Devices	0	0.0	52	$271	$2,713	$93	$0	$93	0.3	7,648
Food Service & Refrigeration Measures		**1,954**	**0.2**	**0**	**$144**	**$718**	**$460**	**$0**	**$460**	**3.2**	**1,968**
ECM 3	Vending Machine Control	1,954	0.2	0	$144	$718	$460	$0	$460	3.2	1,968
TOTALS		**32,009**	**10.4**	**40**	**$2,560**	**$35,594**	**$21,296**	**$3,884**	**$17,412**	**6.8**	**38,060**

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** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Frist Hall

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**126,685**	**36.3**	**-53**	**$8,142**	**$122,131**	**$5,212**	**$310**	**$4,902**	**0.6**	**119,831**
ECM 1	Retrofit Fixtures with LED Lamps	126,685	36.3	-53	$8,142	$122,131	$5,212	$310	$4,902	0.6	119,831
Lighting Control Measures		**141,450**	**12.8**	**-59**	**$9,090**	**$72,723**	**$63,676**	**$11,935**	**$51,741**	**5.7**	**133,780**
ECM 2	Install Occupancy Sensor Lighting Controls	99,785	9.1	-42	$6,413	$51,302	$34,676	$4,185	$30,491	4.8	94,374
ECM 3	Install Daylight Dimming Controls	21,520	1.9	-9	$1,383	$11,064	$11,000	$7,750	$3,250	2.3	20,353
ECM 4	Install High/Low Lighting Controls	20,145	1.8	-8	$1,295	$10,357	$18,000	$0	$18,000	13.9	19,052
Motor Upgrades		**8,312**	**0.9**	**0**	**$552**	**$8,284**	**$23,241**	**$0**	**$23,241**	**42.1**	**8,370**
ECM 5	Premium Efficiency Motors	8,312	0.9	0	$552	$8,284	$23,241	$0	$23,241	42.1	8,370
Variable Frequency Drive (VFD) Measures		**251,547**	**22.4**	**54**	**$16,993**	**$254,902**	**$60,535**	**$11,010**	**$49,525**	**2.9**	**261,239**
ECM 6	Install VFDs on Constant Volume (CV) Fans	128,371	19.5	0	$8,529	$127,929	$33,347	$5,360	$27,987	3.3	129,269
ECM 7	Install VFDs on Heating Water Pumps	35,906	2.9	0	$2,386	$35,783	$10,389	$0	$10,389	4.4	36,157
ECM 8	Install VFDs on Kitchen Hood Fan Motors	87,270	0.0	54	$6,079	$91,190	$16,800	$5,650	$11,150	1.8	95,813
HVAC System Improvements		**3,178**	**0.0**	**124**	**$853**	**$12,797**	**$10,875**	**$0**	**$10,875**	**12.7**	**21,299**
ECM 9	Implement Demand Control Ventilation (DCV)	3,178	0.0	124	$853	$12,797	$10,875	$0	$10,875	12.7	21,299
Domestic Water Heating Upgrade		**0**	**0.0**	**23**	**$118**	**$1,183**	**$57**	**$0**	**$57**	**0.5**	**3,334**
ECM 10	Install Low-Flow DHW Devices	0	0.0	23	$118	$1,183	$57	$0	$57	0.5	3,334
Food Service & Refrigeration Measures		**7,252**	**0.5**	**0**	**$482**	**$7,325**	**$3,718**	**$380**	**$3,338**	**6.9**	**7,303**
ECM 11	Refrigerator/Freezer Case Electrically Commutated Motors	5,771	0.5	0	$383	$5,752	$607	$80	$527	1.4	5,812
	Refrigeration Controls	1,481	0.0	0	$98	$1,574	$3,112	$300	$2,812	28.6	1,491
Custom Measures		**11,249**	**0.3**	**0**	**$747**	**$3,737**	**$3,300**	**$0**	**$3,300**	**4.4**	**11,328**
ECM 12	Reach-In Glass Door Refrigerator - Anti Sweat Heating Controls	11,249	0.3	0	$747	$3,736.72	$3,300	$0	$3,300	4.4	11,328
TOTALS		**549,674**	**73.2**	**89**	**$36,979**	**$483,081**	**$170,615**	**$23,635**	**$146,980**	**4.0**	**566,483**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Fine Hall

#	Energy Conservation Measure	*Recommend?*	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**49,546**	**5.3**	**-21**	**$2,821**	**$42,316**	**$8,057**	**$1,904**	**$6,153**	**2.2**	**46,860**
ECM 1	Retrofit Fixtures with LED Lamps	Yes	49,373	5.3	-21	$2,811	$42,168	$7,550	$1,904	$5,646	2.0	46,696
	Install LED Exit Signs	No	173	0.0	0	$10	$148	$507	$0	$507	51.3	164
Lighting Control Measures			**7,856**	**0.7**	**-3**	**$447**	**$3,579**	**$3,240**	**$350**	**$2,890**	**6.5**	**7,430**
ECM 2	Install Occupancy Sensor Lighting Controls	Yes	7,856	0.7	-3	$447	$3,579	$3,240	$350	$2,890	6.5	7,430
Motor Upgrades			**10,518**	**1.2**	**0**	**$622**	**$9,325**	**$18,958**	**$0**	**$18,958**	**30.5**	**10,591**
ECM 3	Premium Efficiency Motors	Yes	10,518	1.2	0	$622	$9,325	$18,958	$0	$18,958	30.5	10,591
Variable Frequency Drive (VFD) Measures			**252,501**	**36.6**	**0**	**$14,925**	**$223,879**	**$60,997**	**$9,360**	**$51,637**	**3.5**	**254,267**
ECM 4	Install VFDs on Constant Volume (CV) Fans	Yes	228,006	33.8	0	$13,477	$202,161	$53,783	$9,360	$44,423	3.3	229,600
ECM 5	Install VFDs on Chilled Water Pumps	Yes	24,495	2.8	0	$1,448	$21,718	$7,214	$0	$7,214	5.0	24,666
HVAC System Improvements			**1,254**	**0.0**	**42**	**$290**	**$4,356**	**$5,438**	**$0**	**$5,438**	**18.7**	**7,359**
	Implement Demand Control Ventilation (DCV)	No	1,254	0.0	42	$290	$4,356	$5,438	$0	$5,438	18.7	7,359
Domestic Water Heating Upgrade			**0**	**0.0**	**68**	**$355**	**$3,548**	**$172**	**$0**	**$172**	**0.5**	**10,002**
ECM 6	Install Low-Flow DHW Devices	Yes	0	0.0	68	$355	$3,548	$172	$0	$172	0.5	10,002
TOTALS			**321,676**	**43.9**	**86**	**$19,461**	**$287,003**	**$96,862**	**$11,614**	**$85,248**	**4.4**	**336,509**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Woolworth Music Center

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**16,587**	**2.8**	**-7**	**$1,067**	**$16,005**	**$2,998**	**$702**	**$2,296**	**2.2**	**15,688**
ECM 1	Retrofit Fixtures with LED Lamps	16,587	2.8	-7	$1,067	$16,005	$2,998	$702	$2,296	2.2	15,688
Lighting Control Measures		**6,713**	**1.2**	**-3**	**$432**	**$3,455**	**$6,640**	**$385**	**$6,255**	**14.5**	**6,349**
ECM 2	Install Occupancy Sensor Lighting Controls	3,320	0.7	-1	$214	$1,708	$3,240	$385	$2,855	13.4	3,140
ECM 3	Install High/Low Lighting Controls	3,393	0.5	-1	$218	$1,746	$3,400	$0	$3,400	15.6	3,209
Motor Upgrades		**2,435**	**0.5**	**0**	**$162**	**$2,428**	**$12,589**	**$0**	**$12,589**	**77.8**	**2,452**
	Premium Efficiency Motors	2,435	0.5	0	$162	$2,428	$12,589	$0	$12,589	77.8	2,452
Variable Frequency Drive (VFD) Measures		**68,866**	**12.5**	**0**	**$4,579**	**$68,692**	**$29,123**	**$3,040**	**$26,083**	**5.7**	**69,347**
ECM 4	Install VFDs on Constant Volume (CV) Fans	54,032	11.0	0	$3,593	$53,896	$16,556	$3,040	$13,516	3.8	54,410
	Install VFDs on Heating Water Pumps	14,834	1.5	0	$986	$14,796	$12,567	$0	$12,567	12.7	14,937
Domestic Water Heating Upgrade		**0**	**0.0**	**43**	**$222**	**$2,217**	**$151**	**$0**	**$151**	**0.7**	**6,251**
ECM 5	Install Low-Flow DHW Devices	0	0.0	43	$222	$2,217	$151	$0	$151	0.7	6,251
TOTALS		**94,600**	**17.0**	**33**	**$6,462**	**$92,798**	**$51,500**	**$4,127**	**$47,373**	**7.3**	**100,087**

* - All incentives presented in this table are based on NJ SmartStart equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Solar Energy Generation Potential

	Computer Science/Friend Center	First Campus Center	Fine Hall	Woolworth Music Center
Potential:	**MEDIUM**	**MEDIUM**	**MEDIUM**	**MEDIUM**
System Potential: (kW)	337	157	159	83
Electric Generation: (kWh per year)	253,574	118,134	119,639	62,453
Displaced Cost: (per year)	$18,540	$7,850	$7,070	$4,150

For more information on the SREC Registration Program (SRP) please visit:

http://www.njcleanenergy.com/renewable-energy/programs/solar-renewable-energy-certificates-srec/new-jersey-solar-renewable-energy

Energy Efficient Best Practices

- Reduce Air Leakage
- Close Doors and Windows
- Develop a Lighting Maintenance Schedule
- Ensure Lighting Controls Are Operating Properly
- Use Fans to Reduce Cooling Load
- Use Window Treatments/Coverings
- Clean and/or Replace HVAC filters
- Check and Seal Duct Leakage
- Perform Proper Boiler Maintenance
- Perform Proper Water Heater Maintenance
- Plug Load Controls
- Water Conservation

See individual reports for specific EE practices by building

Clean Energy Program Portfolio

ELIGIBLE SECTORS

Commercial, Industrial, Government, Non-Profit, Institutional and Multifamily

INCENTIVE PROGRAMS

Equipment Rebates:

- SmartStart
- CTEEP (Customer Tailored Energy Efficiency Pilot)
- Direct Install
- Large Energy Users

Whole Buildings:

- Pay for Performance

Energy Generation:

- Combined Heat and Power (CHP)

OTHER PROGRAMS

Renewable Energy Generation:

- SREC Registration Program (SRP)

* eligible programs are highlighted in yellow

Recommended NJCEP Incentives per Building

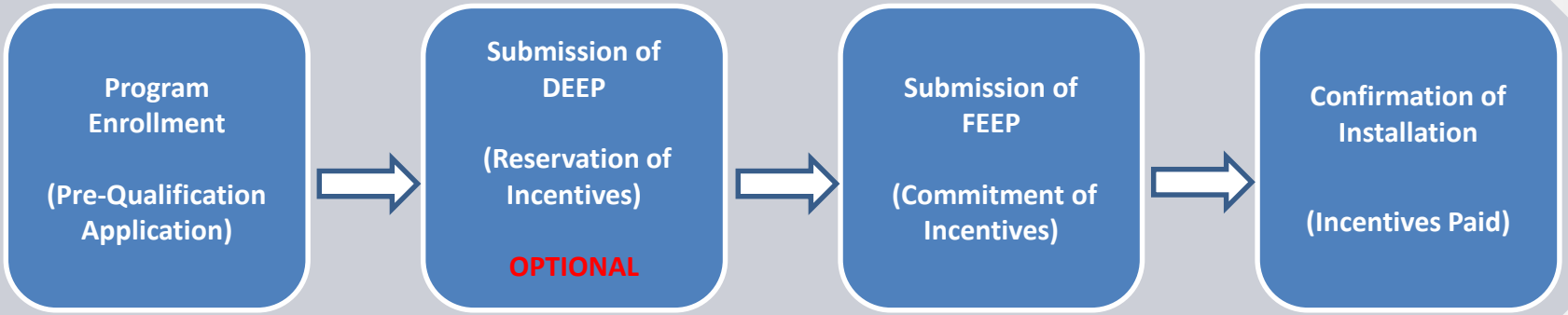
Princeton University	Pay For Performance	SmartStart	CTEEP	LEUP
New South		X	X	
Helm Building		X	X	
Computer Science/Friend Center	X	X	X	
Sherrerd Hall		X	X	X
Frist Campus Center		X	X	
Fine Hall		X	X	
Woolworth Music Center		X	X	

Large Energy Users - Overview

- LEUP aims to encourage large C&I utility customers to self-invest in energy efficiency and combined heat & power projects.
- Qualifications:
  - Applicants must have paid a minimum of $200,000 NJCEP funds (via the SBC) in the previous 12 months of utility bills
  - Ability to “bank” funds for up to two fiscal years
  - The average peak demand of all facilities submitted must meet or exceed 400kW and/or 4,000 DTh.
- Applicants must submit a Draft Energy Efficiency Plan (DEEP) and/or Final Energy Efficiency Plan (FEEP) for approval.
- The maximum incentive per entity is $4 million or 75% of total project cost, 90% of NJCEP contribution or annual energy saving caps ($0.33/kWh and $3.75/Therm), whichever is less.

www.NJCleanEnergy/LEUP

Large Energy Users – Process



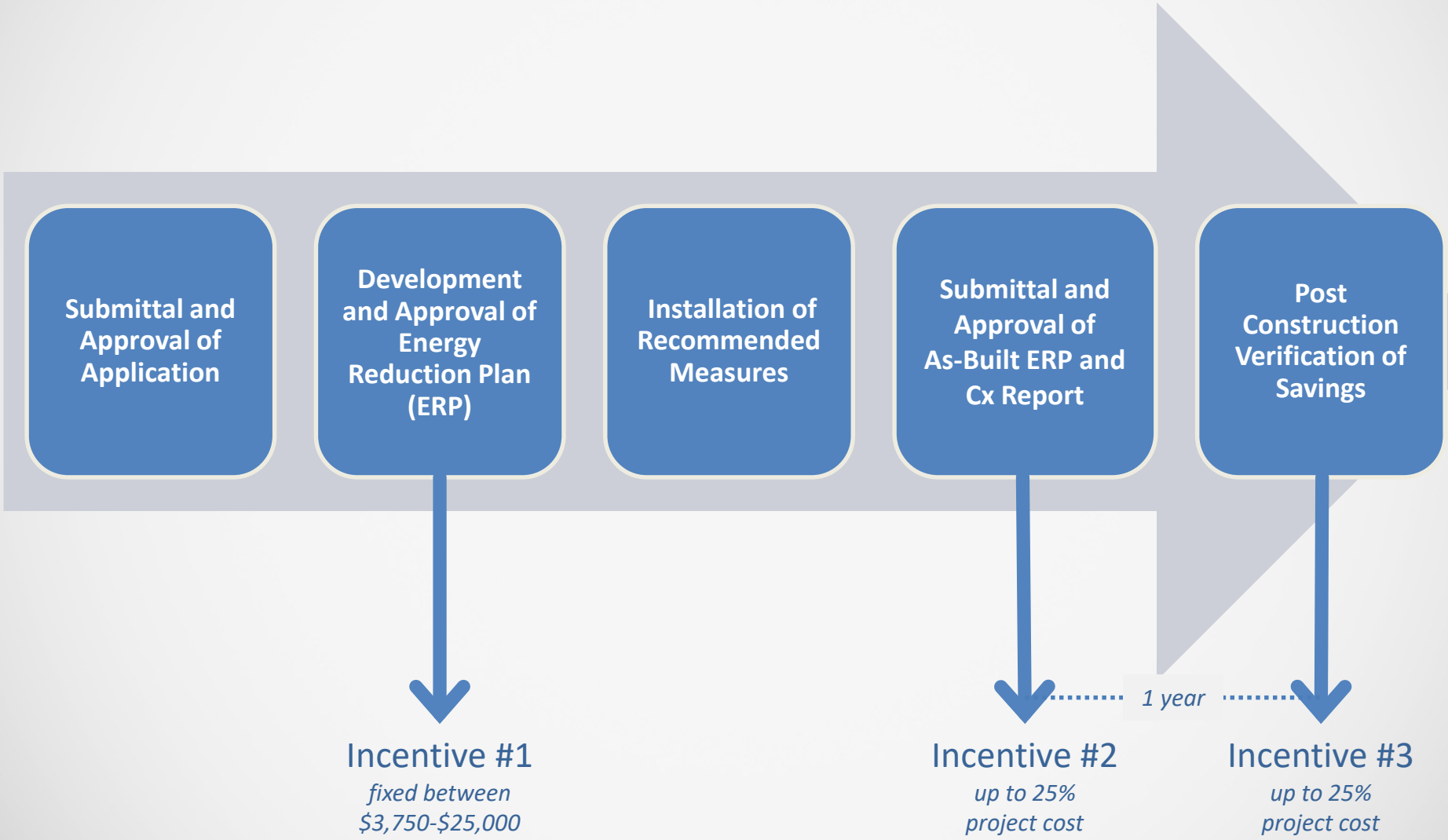
Customers may submit up to 3 DEEPs/FEEPs within the fiscal year enrolled

Pay for Performance: Overview

- Comprehensive, whole-building approach to saving energy in existing or new facilities
- Qualification based on energy consumption, energy savings and measure types
- Customer chooses from network of pre-approved ***Participating Partners***
- Incentives paid in three installments at milestones
  - Incentives up to $2MM per project ($4MM entity cap/year)
    - $1 million for electric measures
    - $1 million for gas measures
  - Incentives up to 50% of total project cost

www.NJCleanEnergy/P4P

Pay for Performance: Process



Pay for Performance: Details

Incentive #1: Energy Reduction Plan			
	Incentive Amount:	$0.15	per sq ft
	Minimum Incentive:	$3,750	
	Maximum Incentive:	$25,000	or 50% of facility annual energy cost
Incentive #2: Installation of Recommended Measures			
	Minimum Performance Target:	**15%**	
Electric Incentives	Base Incentive based on 15% savings:	$0.09	per projected kWh saved
	For each % over 15% add:	$0.005	
	Maximum Incentive:	$0.11	
Gas Incentives	Base Incentive based on 15 % savings:	$0.90	per projected Therm saved
	For each % over 15% add:	$0.05	
	Maximum Incentive:	$1.25	
	Incentive Cap:	**25%**	**of total project cost**
Incentive #3: Post-Construction Benchmarking Report			
	Minimum Performance Target:	**15%**	
Electric Incentives	Base Incentive based on 15% savings:	$0.09	per projected kWh saved
	For each % over 15% add:	$0.005	
	Maximum Incentive:	$0.11	
Gas Incentives	Base Incentive based on 15% savings:	$0.90	per projected Therm saved
	For each % over 15% add:	$0.05	
	Maximum Incentive:	$1.25	
	Incentive Cap:	**25%**	**of total project cost**

SmartStart: Overview

- Two types of incentives for high efficiency equipment installation:
  - Prescriptive
  - Custom
- Project Categories:
  - New Construction
  - Renovation
  - Remodeling
  - Equipment Replacement
- Project pre-approval required for lighting and custom measures
- Incentives up to $500,000 per electric account & $500,000 per natural gas account
- Specific incentives and individual applications for Lighting, HVAC, VFDs, Refrigeration, Controls and more!

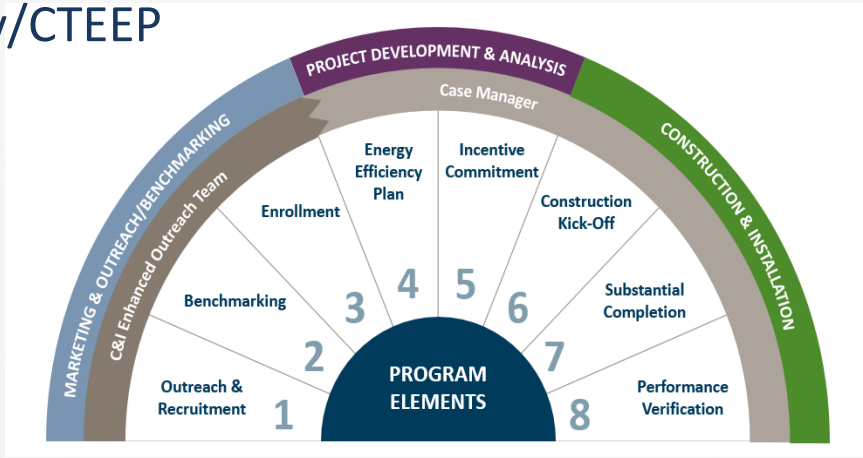
www.NJCleanEnergy/SSB

CTEEP: Overview

Customer Tailored Energy Efficiency Pilot (CTEEP)

- Provide customers with **on-site assistance** to discuss project opportunities and program incentives.
- A **single application** submission streamlines multiple prescriptive and custom measures.
- Provide **technical assistance incentives** to help offset soft costs associated with developing and planning an energy efficiency project.
- Incentives up to $250,000 entity cap.

www.NJCleanEnergy/CTEEP



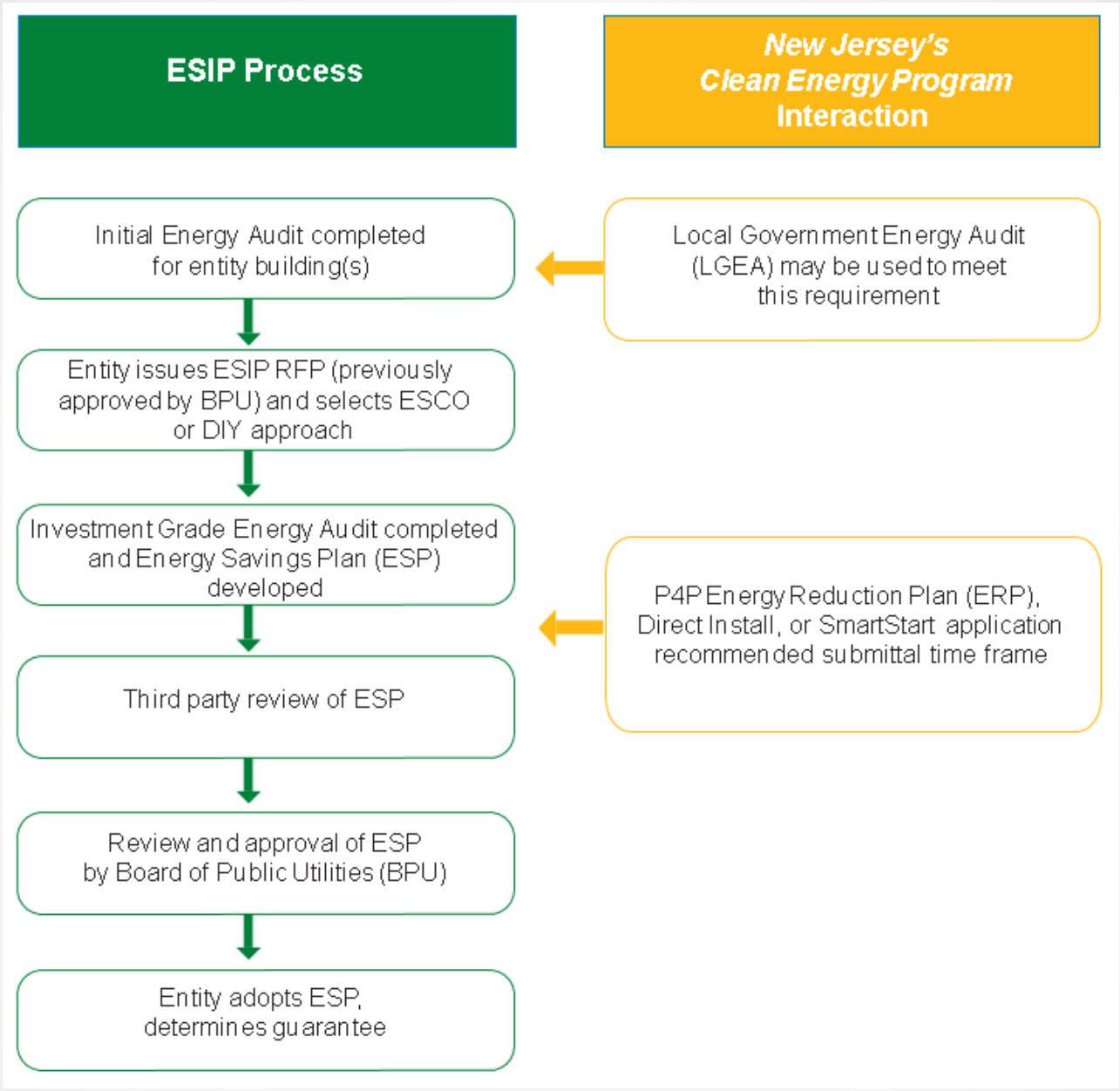
Recommended NJCEP Incentives per Building

Princeton University	Pay For Performance	SmartStart	CTEEP	LEUP
New South		X	X	
Helm Building		X	X	
Computer Science/Friend Center	X	X	X	
Sherrerd Hall		X	X	X
Frist Campus Center		X	X	
Fine Hall		X	X	
Woolworth Music Center		X	X	

ESIP

Energy Savings Improvement Program (ESIP)

- Provides alternative financing for energy savings projects at public institutions. Value of energy savings leveraged to pay for cost of EE projects over a 15 year contract. Does not count as debt/require voter approval.
- Requires an audit as 1st step (LGEA satisfies requirement)
- ESIP participation question on LGEA application
- Program administered directly by BPU


ESIP Process
New Jersey's Clean Energy Program Interaction
Initial Energy Audit completed for entity building(s)
Local Government Energy Audit (LGEA) may be used to meet this requirement
Entity issues ESIP RFP (previously approved by BPU) and selects ESCO or DIY approach
Investment Grade Energy Audit completed and Energy Savings Plan (ESP) developed
P4P Energy Reduction Plan (ERP), Direct Install, or SmartStart application recommended submittal time frame
Third party review of ESP
Review and approval of ESP by Board of Public Utilities (BPU)
Entity adopts ESP, determines guarantee

FOR MORE INFORMATION

ESIP

Mike Thulen

ESIP Coordinator

Office: 609-777-3338

Cell: 732-330-2419

ESIP@bpu.nj.gov

Questions

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FOR MORE INFORMATION

Visit NJCleanEnergy.com

Call (866) NJSMART

Tony O'Donnell

Regional Outreach Manager

732.259.4938

aodonnell@trcsolutions.com