Re-Light Pennsylvania

Summary:
The Re-Light Pennsylvania initiative is a critical building technology that accelerates replacement of less efficient outdoor and indoor lighting systems, including maximizing use of daylighting in indoor settings. It applies to residential and commercial buildings, and parking facilities. Actively investing in PA manufacturing, sales, green collar jobs, and green building infrastructure by re-lamping, re-fixturing, and upgrading lighting systems, and control systems would also measurably improve the pastoral and remarkable qualities of the state, the quality of light delivered, and the health and safety of residents.

The recommendation recognizes the potential cost to older properties and only includes re-lighting as a part of renovation projects requiring building code compliance. Existing facilities that are not renovated are not included.

Implementation:

Propose establishment of the following goals in the Commonwealth:

Lighting Performance goals
- Lighting power of 0.9 watt/square foot connected load as maximum for all workplaces.
- New construction effective immediately; existing construction increase at 5% annually.

Lamp Performance (for all new lamp purchases, for all points of sale by 2020)
- 90 mean lumens/watt lamps.
- Mercury not to exceed 80 picograms per lumen-hour, 5 milligrams of mercury per lamp.
- CRI (color rendering index) of 85 minimum.
- 92 percent luminance maintenance (lamp depreciation) over rated life.

Controls and System Performance
- Occupancy sensors in single-occupancy rooms or short time-of-use rooms.
- Commissioning of installed lighting system, including controls.
- New construction effective immediately; existing construction increase at 5% annually.

Daylight (all non-residential buildings)
- Seated daylight access for 90 percent of occupants (new construction and historic buildings).
- Daylight-responsive controls for all fixtures within 15 feet of window
- New construction effective immediately; existing construction increase by 5% annually.

Exit Lighting
- Maximum 5 watts per fixture or "face."
- New construction effective immediately; existing construction increase by 5% annually.

Site Lighting (all new construction by 2020; existing buildings by 2025)
- LPD 0.15 watt/sq.ft. max.
- No night sky pollution (0 percent above 90° cutoff).
- Zone-occupancy controls in large parking lots.
- New construction effective immediately; existing construction increase by 5% annually.

No- or Low-Cost Education Campaign

- Commonwealth publish news about new technology (LED and lighting controls) and payback examples via the internet to promote Pennsylvania businesses and jobs.
- Commonwealth speak at conferences about new technology (LED and lighting controls) and payback examples to promote Pennsylvania business and jobs.
- Wash reflectors and lenses to maximize light output.
- Install occupancy and daylight sensors.
- Promote the Turn It Off campaign.
- Delamp where light levels are not needed.
- Raise or tilt the blinds and use daylight.

Continue to encourage incentives:

- Encourage the PUC to promote more programs such as Act 129 program to re-lamp, relight and control lighting using new technology.
- Encourage electric companies to develop pilot programs to expand lighting efficiency in their service areas.
- Encourage the use of on-bill financing and other creative financing options to assist with the payment of new energy efficient lighting and conversion of old lighting to new efficient lighting technology.
- Encourage PennDOT and the Turnpike Commission to continue to advocate public and municipal lighting using energy efficient technology.

Key Assumptions:

- Cost of Electricity (Residential) = $133.9 / MWh
- Cost of Electricity (Commercial) = $97.4 / MWh
- Rate of emission reduction = .771 Mt CO_2e

SUMMARY TABLE

Potential GHG Reduction:

Table 1. Estimated GHG Reductions and Cost-effectiveness

Annual Results (2030)			Cumulative Results (2015-2030)		
GHG Reductions ($MMtCO_2e$)	**Costs (Million $)**	**Cost-Effectiveness ($/MtCO_2e$)**	**GHG Reductions ($MMtCO_2e$)**	**Costs (NPV, Million $)**	**Cost-Effectiveness ($/MtCO_2e$)**
8.6	-843.0	-98.0	71.2	-5,101	-71.6

Assumptions and Calculations	2015	2020	2030	Units
Residential				
Fraction of Res. Elec. Cons. as Lighting	8.8%	8.8%	8.8%	
Residential elec. consumption as lighting	4,544	4,490	4,496	GWh
Power demand of existing lamps	60.0	60.0	60.0	W
Power demand of new lamps	9.0	9.0	9.0	W
Difference between old and new lamp	51.0	51.0	51.0	W
Daily hours of operation	6.0	6.0	6.0	h
Rate of uptake of high-efficiency lamps	5%	30%	80%	
Limetime	10.0	10.0	10.0	yr
Energy Savings	193	1,145	3,057	GWh
Number of high-efficiency lamps in use	1,728,945	10,252,064	27,370,041	lamps
Number of lamps replaced annually	1,901,840	1,766,798	1,842,000	lamps
Cost Premium	$9.00	$9.00	$9.00	one-time
Gross annual cost	17.1	15.9	16.6	$ million
Emissions avoided	.15	.88	2.36	MMtCO2e
Net annual cost	-8.74	-137.42	-392.75	$ million
Commercial	**2015**	**2020**	**2030**	
Lighting Performance Goals				
Existing power density of lighting	2.0	2.0	2.0	W/ft^2
New power density of lighting	0.9	0.9	0.9	W/ft^2
Rate of uptake of high-efficiency lamps	5%	30%	80%	
Commercial Electricity Consumption	42,915	42,939	43,459	GWh
% of Comm. Elec. Consumption as Lighting	23.11%	23.11%	23.11%	
Energy savings - total	232	1,395	3,766	GWh
Cost premium (4-ft. 15 W T8)	$20.00	$20.00	$20.00	one-time
Lifetime	20	20	20	yr
Estimate number of lamps in PA	85,145,276	85,192,678	86,224,415	lamps
Number of lamps replaced annually	4,257,264	5,434,563	8,924,932	lamps
Gross cost of replacing lamps	85.1	108.7	178.5	$ million
Emissions avoided	.18	1.08	2.90	MMtCO2e
Net Cost of replacing lamps	62.50	-27.23	-188.34	$ million
Daylighting	**2015**	**2020**	**2030**	
Reduction in lighting energy consumption	44%	44%	44%	
% of existing buildings that are historic	0.50%	0.50%	0.50%	
Applicable floor space	81.0	81.0	82.2	Million sq. ft.
Cost premium	$0.90	$0.90	$0.90	$/sq. ft.
Gross Cost	3.65	21.86	59.20	$ million
Energy savings	7.53	151.40	931.78	GWh
Emissions avoided	0.01	0.12	.72	MMtCO2e
Net cost	2.91	7.11	-31.56	$ million

Controls and System Performance	2015	2020	2030	
Reduction in lighting energy consumption	25%	25%	25%	
Rate of uptake in existing buildings	5%	30%	80%	
Commercial Electricity Consumption	42,915	42,939	43,459	GWh
% of Comm. Elec. consumption as lighting	23.1%	23.1%	23.1%	%
Energy Savings	124	744	2,009	GWh
Total Floor Space	5,336	5,604	6,139	Million sq. ft.
Cost Premium	$0.30	$0.30	$0.30	$/sq.ft.
Gross Cost	$80.04	$84.05	$92.08	$ million
Emissions avoided	0.10	0.57	1.55	MMtCO2e
Net cost	$67.97	$11.57	-$103.57	$ million

Site Lighting	2015	2020	2030	
Number of vehicles in Pennsylvania	9,637,112	9,697,888	9,824,445	
Ratio of parking spaces to vehicles	9 / 1	9 / 1	9 / 1	
Eligible parking lot area	25%	25%	25%	
Area of parking space	150	150	150	sq. ft.
Existing lighting intensity in parking lots	0.29	0.29	0.29	W/sq. ft.
Proposed lighting intensity in parking lots	0.15	0.15	0.15	W/sq. ft.
Annual hours in operation	2920	2920	2920	hrs/yr
Rate of Participation	5%	30%	80%	
Area of parking lot with efficient lighting	163	164	166	Million sq. ft.
Energy Savings	66	400	1,074	GWh
Cost premium	$0.05	$0.05	$0.05	$ / sq. ft.
Gross cost	$8.13	$8.18	$8.29	$ million
Emissions reduced	0.05	0.31	0.83	MMtCO2e
Net cost	$1.66	-$30.79	-$96.32	$ million

Exit sign - 5 W / face	2015	2020	2030	
Average power of existing sign bulb	16	16	16	W
Average power of new bulb	5	5	5	W
Annual savings per sign	96.36	96.36	96.36	kW/lamp/year
Rate of uptake in existing buildings	5%	30%	80%	
Number of Signs	4,200,000	4,200,000	4,200,000	
Cost of unit retrofit	$5.00	$5.00	$5.00	One time
Total cost of retrofit	$1.05	$1.05	$1.05	$ Million
Energy savings	20.24	121.41	323.77	GWh
Emissions reduced	0.02	0.09	0.25	MMtCO2e
Net cost	-$0.92	-$10.78	-$30.49	$ million