

## **Building Commissioning**

### **Summary:**

Promote the common practice of performing commissioning and retro-commissioning processes on newly constructed and renovated buildings for the purpose of ensuring optimal performance of building systems.

Commissioning is tuning a building to operate as it was intended. It requires testing, monitoring and adjusting the building systems to operate at optimum efficiency. It is similar to having your car tuned-up.

### **Goals:**

Commission or retro-commission non-commonwealth new and renovated commercial buildings greater than 25,000sq.ft. within 8 years and, commission or retro-commission commonwealth new and renovated buildings greater than 25,000 sq.ft. within 5 years.

### **Possible Vehicles:**

Promote the common practice of performing commissioning processes on newly constructed and/or renovated buildings for the purpose of ensuring optimal performance of building systems.

Building project teams are currently familiar with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards, which cite building commissioning as good practice (Guideline 0-2005).

Expand existing training for building operators to include energy management training. Building operators, such as maintenance technicians, lead custodians, and plant engineers, currently have little formal training in building efficiency.

### **Implementation Steps:**

This program may be implemented through stricter municipal/state building codes.

- Consider adopting the **International Green Construction Code (IgCC) in 2015**, which incorporates commercial performance standards consistent with goals and commercial building performance standards listed above, including the prerequisite requirement for commissioning. Support educational and training sessions about the IgCC provided by professional associations and providers.
- Alternatively, amend the Pennsylvania Uniform Construction Code (UCC) to include commissioning requirements.

Certain tax incentives and/or credits may also be assigned to assist in full implementation. Several mainstream certification standards also promote the practice of performing building commissioning, making the activity seem more attractive.

An example of such a program is the California Governor's Green Building Executive Order and AB 32, which calls for all California state buildings greater than 50,000 square Feet (sq.ft.) to be retro-commissioned (RCx) by June 30, 2013, and re-commissioned every 5 years. Nearly 25 RCx buildings are at or near completion. The energy efficiency measures implemented through this program to date have a verified electricity savings of approximately 10 percent.

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**Key Assumptions:**

<b>Key Data and Assumptions</b>	<b>2013</b>	<b>2020</b>	<b>Units</b>
First Year Results Accrue		2013	
Building size threshold		25,000	sq.ft.
Eligibility <sup>1</sup>		68.9%	% of all commercial bldgs.
Avoided Costs			
Avoided Electricity Cost		130.2	\$/MWh
Avoided Natural Gas Cost		4.6	\$/MMBtu
Avoided Electricity Emissions Rate	0.69	0.69	tCO <sub>2</sub> e / MWh
Avoided Natural Gas Emissions Rate	0.05	0.05	tCO <sub>2</sub> e / MMBtu

<b>Other Data and Assumptions</b>	<b>2013</b>	<b>2020</b>	<b>Units</b>
Eligible non-Commonwealth, commercial floorspace	3,603	3,862	million sq.ft.
Eligible Commonwealth floorspace	132	141	million sq.ft.
Electricity savings <sup>1</sup>		961	GWh
		0.24	kWh / sq.ft.
Implied number of square feet recommissioned		4,003,679,007	sq.ft.
<b>Commercial non-Commonwealth</b>			
Number of years to full uptake		8	
Annual rate of uptake	15%	50%	
Building area recommissioned	1,802	3,862	million sq.ft.
Electricity savings	432,362,305	926,945,655	kWh
Natural gas savings <sup>2</sup>	5,602,695	12,011,671	MMBtu
Natural gas savings rate		3.11	MBtu / sq.ft
<b>Commonwealth</b>			
Number of years to full uptake		8	
Annual rate of uptake	15%	50%	
Building area recommissioned	66	141	sq.ft.
Electricity savings	15,829,636	33,937,307	kWh
Natural gas savings <sup>2</sup>	205,126	439,771	MMBtu
Natural gas savings rate		3.11	MBtu / sq.ft
GHG reductions	0.62	1.33	MMtCO <sub>2</sub> e / yr
Levelized cost of recommissioning (electricity) <sup>3</sup>		0.07	\$/ kWh (\$2010)
Levelized cost of recommissioning (natural gas) <sup>4</sup>		4.62	\$/ MMBtu (\$2010)

Gross annual cost	58	125	\$ million (\$2010)
Annual savings	85	182	\$ million (\$2010)
Net annual cost	-27	-58	\$ million (\$2010)

<sup>1</sup>ACEEE (2009) Potential for Energy Efficiency, Demand Response and Onsite Solar in Pennsylvania - Table B-10

<sup>2</sup>ACEEE (2009) Potential for Energy Efficiency, Demand Response and Onsite Solar in Pennsylvania - Table B-13

<sup>3</sup>Calculated from ACEEE (2009) Table B-10

<sup>4</sup>Calculated from ACEEE (2009) Table B-13

**Potential GHG Reduction:**

**Table 1. Estimated GHG Reductions and Cost-effectiveness**

Annual Results (2020)			Cumulative Results (2013-2020)		
GHG Reductions (MMtCO <sub>2</sub> e)	Costs (Million \$)	Cost-Effectiveness (\$/tCO <sub>2</sub> e)	GHG Reductions (MMtCO <sub>2</sub> e)	Costs (NPV, Million \$)	Cost-Effectiveness (\$/tCO <sub>2</sub> e)
1.3	-\$57.68	-\$43.30	8.7	-\$298	-\$34.10

**Economic Cost:**

See Table 1, above.

**Potential Overlap:**

Some overlap with Higher Performance Buildings work plan

**Subcommittee Comments:**

Commissioning Renovated and New Buildings should be state law, for both the health and comfort of building occupants and for the guaranteed energy savings.

In addition, HVAC retro-commissioning efforts in existing buildings consistently reveal over 10 percent energy savings with 1-2 year paybacks, given the age and poor maintenance of systems due to consistent maintenance under-funding, and should be encouraged as well.

The technologies to achieve these goals are available now, however the commissioning workforce is not. This will be a significant job growth opportunity with excellent payback for both the public and private sector.

The real challenge for commissioning is the trained workforce, especially given the diversity of installed HVAC, lighting and electrical systems. The accuracy of cost and savings are accurate given the track record.

Building commissioning is labor intensive, with in-state job benefits. The reduction of energy loads and mechanical conditioning operation have definite environmental benefits as well as health benefits through the upgrading of systems that are long overdue for improvements.

This Action Plan may be considered redundant with High Performance Building Standards Action Plans, in which commissioning would very likely be undertaken to meet the annual goal increases. However, National energy reduction mandates have not often been met since the building community was unclear

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on critical steps to undertake in the near term. Building commissioning is a critical step in achieving timely building energy reductions.