Summary

Issue: Commissioning is a quality assurance process that is not typically done on building systems. Although often omitted, commissioning helps identify and correct deficiencies in design or installation, resulting in higher energy efficiency and building performance.

Recommendation: Require commissioning in all new construction, substantial renovations, and additions of greater than 50,000 square feet. Also, require building acceptance testing (“commissioning light”) for projects between 5,000 square feet and 50,000 square feet.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code

1. Add a new Section 1302 as follows:

SECTION BC 1302
COMMISSIONING OF NEW BUILDINGS

1302.1 Definitions.

The following words and terms shall, for purposes of this chapter, applicable appendices and as used elsewhere in this code, have the following meanings:

BUILDING ACCEPTANCE REPORT. A document setting forth the results of any building acceptance testing process in the most current format made available by the department.

BUILDING ACCEPTANCE TESTING. For new mid-sized buildings, mid-sized additions, and alterations, performance of the procedures required by Section 28-1302.6.

COMMISSIONING. For new large buildings and large additions, performance of the procedures required by Section 28-1302.3 below.

COMMISSIONING AGENT. A person or agency approved by the department to perform commissioning.

COMMISSIONING PLAN. A document outlining the organization, schedule, allocation of resources, and documentation requirements of the building commissioning process, in the format established by the department.

COMMISSIONING REPORT. A document setting forth the results of any commissioning process in the format established by the department.

FINAL COMMISSIONING REPORT. A commissioning report in the format established by the department and containing documentation and verification of the commissioning of all applicable building systems required to be commissioned under Section 28-1302.4 in the format established by the department.

LARGE ADDITION. Any addition of greater than 50,000 square feet of gross floor area.
LARGE BUILDING. Any structure located on a lot on which the total existing and proposed gross floor area is equal to or greater than 50,000 square feet.

MID-SIZED ADDITION. Any addition equal to or greater than 5,000 square feet, and less than 50,000 square feet, of gross floor area.

MID-SIZED BUILDING. Any structure located on a lot on which the total existing and proposed gross floor area is equal to or greater than 5,000 square feet and less than 50,000 square feet.

POST-OCCUPANCY REPORTS. A commissioning report in the format established by the department and containing (i) documentation and verification of the post-occupancy commissioning activities for all applicable building systems required to be commissioned under Section 28-1302.4, and (ii) submission of all post-occupancy reports and building systems operations manuals.

PRELIMINARY COMMISSIONING REPORT. A commissioning report in the format established by the department and containing documentation and verification of the commissioning of all applicable building systems (i) required to be commissioned under Section 28-1302.4, and (ii) capable of being fully commissioned, other than required post-occupancy reports, at the time of year when a temporary or permanent certificate of occupancy is sought.

1302.2 General. Commissioning is required as part of construction of large buildings and large additions. Building acceptance testing is required as part of (i) construction of mid-sized buildings and mid-sized additions, and (ii) alterations of greater than 5,000 gross square feet.

1302.3 Commissioning. Commissioning shall be performed in accordance with this section using generally accepted engineering standards as determined by the department.

Commissioning shall be incorporated into the pre-design, design, construction, and first year occupancy of the building.

(a) Activities prior to issuance of building permit. Prior to issuance of a building permit, the designated commissioning agent shall submit to the department a commissioning plan providing for commissioning of all applicable building systems required under Section 1302.4.

(b) Activities prior to building occupancy. Prior to issuance of a temporary or permanent certificate of occupancy, the commissioning agent shall submit a preliminary commissioning report, which shall include certifications by such commissioning agent that:

1. All systems required to be commissioned under Section 1302.4, other than those specified systems that cannot be fully commissioned at the time of occupancy due to seasonal operation, have been commissioned other than any required post-occupancy reports.

2. All operating personnel training requirements identified in the commissioning plan and pertaining to those systems fully commissioned under Section 1302.4(b)(1) have been completed.

3. A system manual has been prepared that includes operations and maintenance documentation and complete warranty information and provides operating personnel all information needed to optimally operate the commissioned systems.

(c) Post-occupancy activities. Within one year of issuance of a permanent certificate of occupancy for the building project, the commissioning agent shall submit a final commissioning report to the department, which shall include:

1. A certification by the commissioning agent that all systems required to be commissioned under Section 1302.4 below have been commissioned.

2. All required post-occupancy reports.

3. A certification by the commissioning agent that a system manual has been prepared that includes operations and maintenance documentation and complete warranty information and provides operating personnel all information needed to optimally operate the commissioned systems.

1302.4 Systems. The following systems, if included in any large building or large addition, shall be commissioned:

(a) Heating, ventilating, air conditioning, indoor air quality and refrigeration systems (mechanical and/or passive) and associated controls;
(b) Building envelope systems, components and assemblies;
(c) Building envelope pressurization, if air-tightness is specified in the commissioning plan;
(d) All lighting and shading controls;
(e) Irrigation;
(f) Plumbing;
(g) Domestic and process water pumping and mixing systems;
(h) Service water heating systems; and
(i) Renewable energy systems.

1302.5 Documentation. Owner shall retain the system manual and final commissioning report, which manual and report shall be provided to local, state and federal agencies or their representatives upon request.

1302.6 Building Acceptance Testing. Building acceptance testing shall be performed in accordance with this section using generally accepted engineering standards as established by the department.

(a) Activities prior to issuance of building permit. Prior to issuance of a building permit, the designated commissioning agent shall certify to the department that he or she has reviewed construction documents to verify relevant sensor locations, devices and control sequences are properly documented for all applicable building systems required under Section 1302.7.

(b) Activities prior to building occupancy. Prior to issuance of a temporary or permanent certificate of occupancy, the commissioning agent shall submit a building acceptance report to the department, which shall include a certification by such commissioning agent that a system manual has been prepared that includes operations and maintenance documentation and complete warranty information and provides operating personnel all information needed to optimally operate the commissioned systems.

28-1302.7 Systems. The following systems, if included in any mid-sized building, mid-sized addition, or alteration of greater than 5,000 square feet, shall have building acceptance testing:

(a) Mechanical Systems: Heating, ventilating, air conditioning, indoor air quality, and refrigeration systems (mechanical and/or passive) and associated controls;
(b) Lighting Systems;
(c) Automatic daylighting controls;
(d) Manual daylighting controls;
(e) Occupancy sensing devices;
(f) Automatic shut-off controls; and
(g) Renewable energy systems.

13.2.2.5 Documentation. Owner shall retain the system manual and building acceptance report, which manual and report shall be provided to local, state and federal agencies or their representatives upon request.

Amendment to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code

1. Delete Section 6.7.2.4

[6.7.2.4 System Commissioning. HVAC control systems shall be tested to ensure that control elements are calibrated, adjusted, and in proper working condition. For projects larger than 50,000 square feet conditioned area, except warehouses and semiheated spaces, detailed instructions for commissioning HVAC systems (see Informative Appendix E) shall be provided by the designer in plans and specifications.]
Supporting Information

Issue – Expanded
No building functions exactly as its designers intended. In part this is due to usage patterns the designers could not or did not anticipate. Often, buildings use more energy and water than necessary because of large or small errors during installation of the countless components that make up a modern building. Building commissioning is a process for testing building systems to ensure they function according to engineering design objectives or specifications. The commissioning process has been applied to ocean-going ships for centuries, as designers, ship-builders and crews saw the risk-management value in verifying that all systems were working according to design intent before leaving shore. Applied to buildings, the process ensures that owners get what they pay for when constructing or retrofitting buildings, provides risk-management and “insurance” for policymakers and program managers enabling their initiatives to actually meet targets, and detects and corrects problems that would eventually surface as far more costly maintenance or safety issues.

No two commissioning reports are alike because each building has its own particular systems and construction mistakes; but every commissioning report will find a litany of correctable problems that have a major impact on energy and water consumption. A commissioning report might find: control sensors are disconnected, nonfunctional or installed in the wrong place; temperature and other set points are incorrect; valves are open when they should be closed; or a ventilating fan that is installed facing the wrong direction – this list of potential issues is virtually endless.

A recent report on new building commissioning indicates that it is likely the single-most cost-effective strategy for reducing energy, costs, and greenhouse gas emissions in buildings today. Beyond significant energy and other savings, building commissioning also provides occupants with improved indoor environmental conditions.

Environmental & Health Benefits
Building commissioning saves a substantial amount of energy and water, reducing air pollution and greenhouse gas emissions. Until recently, commissioning services were driven more by other reliability and safety issues, rather than energy or water savings. In the past, the primary goal of commissioning was often occupant safety in laboratory and industrial buildings, and improved occupant comfort in educational and office buildings. Valuation of these benefits can be more challenging than estimating energy cost savings, but interviews among nearly 100 commissioning team members across 21 projects in the Pacific Northwest estimated non-energy commissioning benefits of $0.17 per square foot, a level nearly as high as energy cost savings.2

This proposal is found to have a have low, positive environmental impact and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committee prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates. This proposal was estimated to increase capital cost by between $0.10 and $0.20/square foot. It was thus categorized as incurring a low to medium capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years for some building types.

Precedents
California has adopted Green Building Standards Code to supplement the California Building Standards Code. Sections on Commissioning require the inclusion of commissioning be in the design and construction processes of the building project and the completion of a commissioning plan.3

LEED
The measures outlined in this proposal will assist in meeting the following LEED prerequisite and credit requirements:

- LEED NC-EA prerequisite 1, Fundamental Commissioning
- LEED NC-EA cr. 3, Enhanced Commissioning
- LEED CI-EA prerequisite 1, Fundamental Commissioning
• LEED CI-EA cr. 2, Enhanced Commissioning
• LEED for Schools EA prerequisite 1, Fundamental Commissioning
• LEED for Schools EA cr.3, Enhanced Commissioning
• LEED EB- EA prerequisite 1 Existing Building Commissioning
• LEED EB-EA credit 3.1, 3.2, & 3.3 Building Operations and Maintenance

The components of LEED commissioning outlined in this proposal for larger projects exceed LEED criteria. Therefore, adherence to these measures will have a strongly positive impact on LEED certification. For adherence with LEED E&A prerequisites and credits, a Commissioning Authority (CxA) must be assigned to oversee the commissioning process. The CxA will be ultimately responsible to verify the performance of systems for the purposes of LEED certification.

The process of documenting building performance for the code revisions under this proposal will assist in the accumulation of data for the LEED Construction Submittal Template, which is required to verify prerequisite and credit compliance.

LEED has no equivalent for acceptance testing.

Implementation and Market Availability
There are no known implementation issues for this proposal. Commissioning agents are readily available.

Notes
The language in this proposal largely follows a similar provision in ASHRAE 189.1. Further detail that the Department of Buildings may wish to consider during rulemaking include:

• Specification of submissions to the Department.

• The design review stages should be adjusted to conform to architectural terminology, such as 100% DD documents and 80% CDs.

• These steps “verify the installation and performance...” but do not explicitly discuss start-up. The CxA commissioning agent should be present at equipment start-up and at least witness and collect documentation.

• Envelope commissioning should be mentioned. The specifications should require wall mock-ups that are either inspected by the project architect or the commissioning authority. Wall inspection/photographs at all phases of construction should also be required.

• Consider making a building pressurization, infrared scan mandatory prior to occupancy (although this is season-dependent).

• Consider making a digital recording of training part of the commissioning agent’s scope. This should include the actual camera/sound recording and the editing of the sessions on a DVD for the convenient future use of the operations and maintenance staff.

• The commissioning agent should meet with each contractor before providing training and discuss noise control and staying on-topic for the training session.

• A systems manual should be assembled by the commissioning agent and should include complete one-line diagrams of air-side and water-side systems and integrated operating sequences of chillers, cooling towers, circulation pumps, AHUs, VAV boxes, etc., prepared by the design engineer.
ENDNOTES:


2 SBW CONSULTING AND SKUMATZ ECONOMIC RESEARCH ASSOCIATES, NORTHWEST ENERGY EFFICIENCY ALLIANCE, COST-BENEFIT ANALYSIS FOR THE COMMISSIONING IN PUBLIC BUILDINGS PROJECT (2003).