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# Safety Considerations for Renewable Energy Systems

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**NYC**  
Buildings

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



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# Course Description

Incentive programs and the cost of energy make alternatives an attractive option for many building owners. However, these systems come with risks that must be managed.

- This course will explore the risks and hazards of renewable energy systems and how codes and standards regulate such risks.
- The course will also review the requirements for documenting and filing these types of systems with the Department of Buildings along with the potential benefits of including them in your project.



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# Learning Objectives

At the conclusion of this training participants will :

1. Understand the potential benefits of installing on-site renewable energy in a building and how they might contribute to greenhouse gas reductions and energy savings.
2. Be able to describe the risks associated with three types of energy systems- wind generation, solar, and energy storage.
3. Be able to list the code requirements that relate to wind generation, solar installations, and energy storage systems.
4. Gain an understanding of how to successfully file an application that includes renewable systems for approval with the NYC Department of Buildings.



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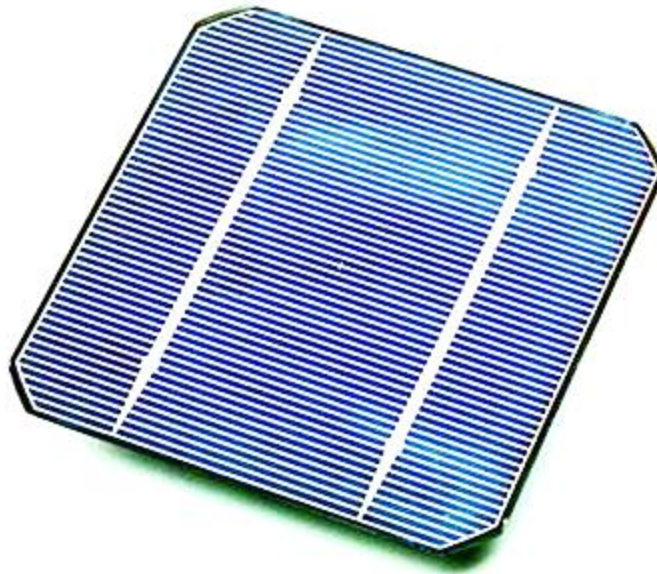
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# Agenda

- Why incorporate renewable energy systems?
- What risks are associated with these systems?
- What are the code requirements?
- How are these addressed in filing?



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# OneNYC Plan



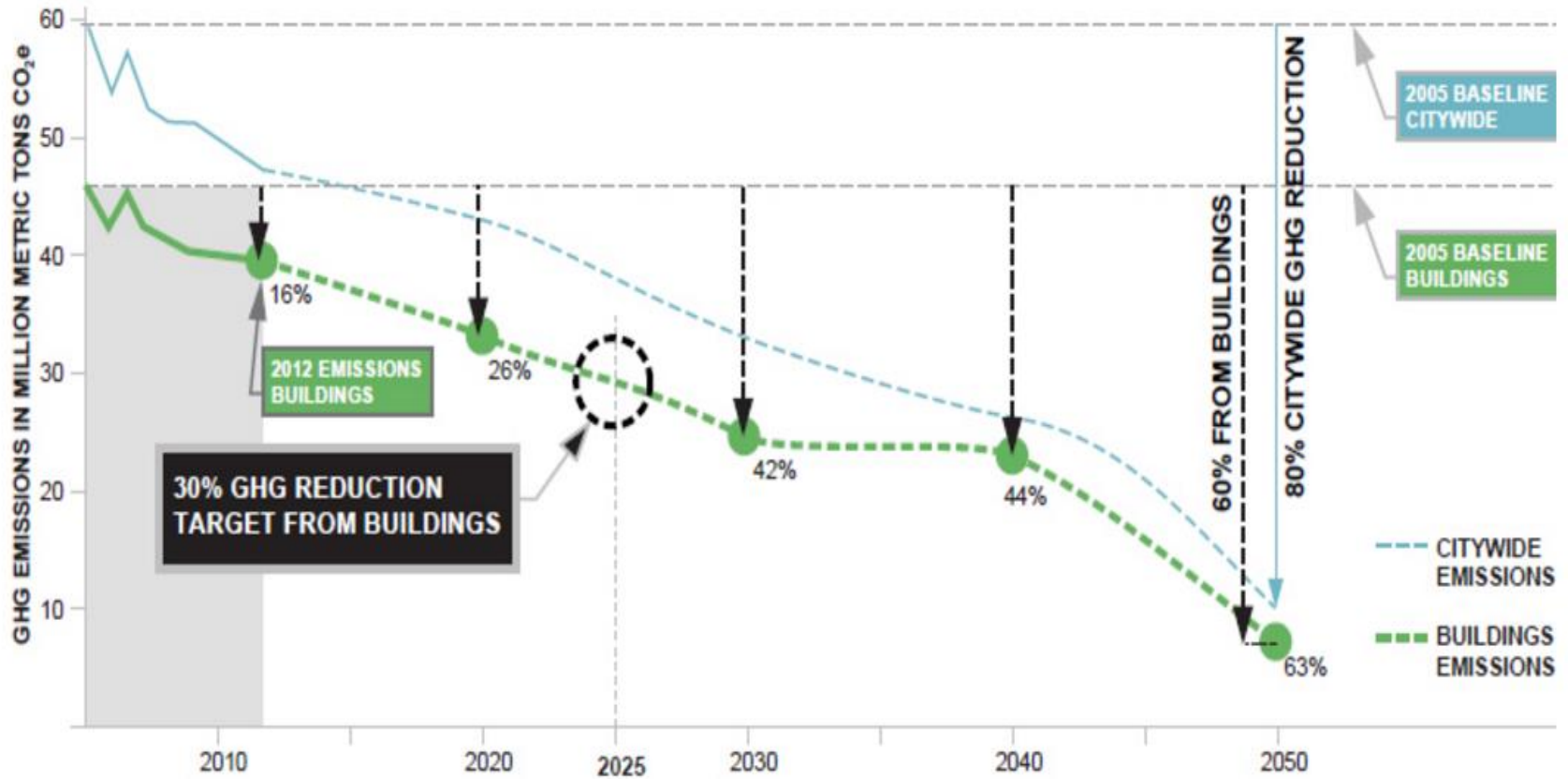
Mayor de Blasio's **One City- Built to Last** plan committed NYC to a greenhouse gas emissions reduction goal of 80% by 2050.

- 30% reduction in emissions from buildings by 2025



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# OneNYC Plan



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# OneNYC Plan



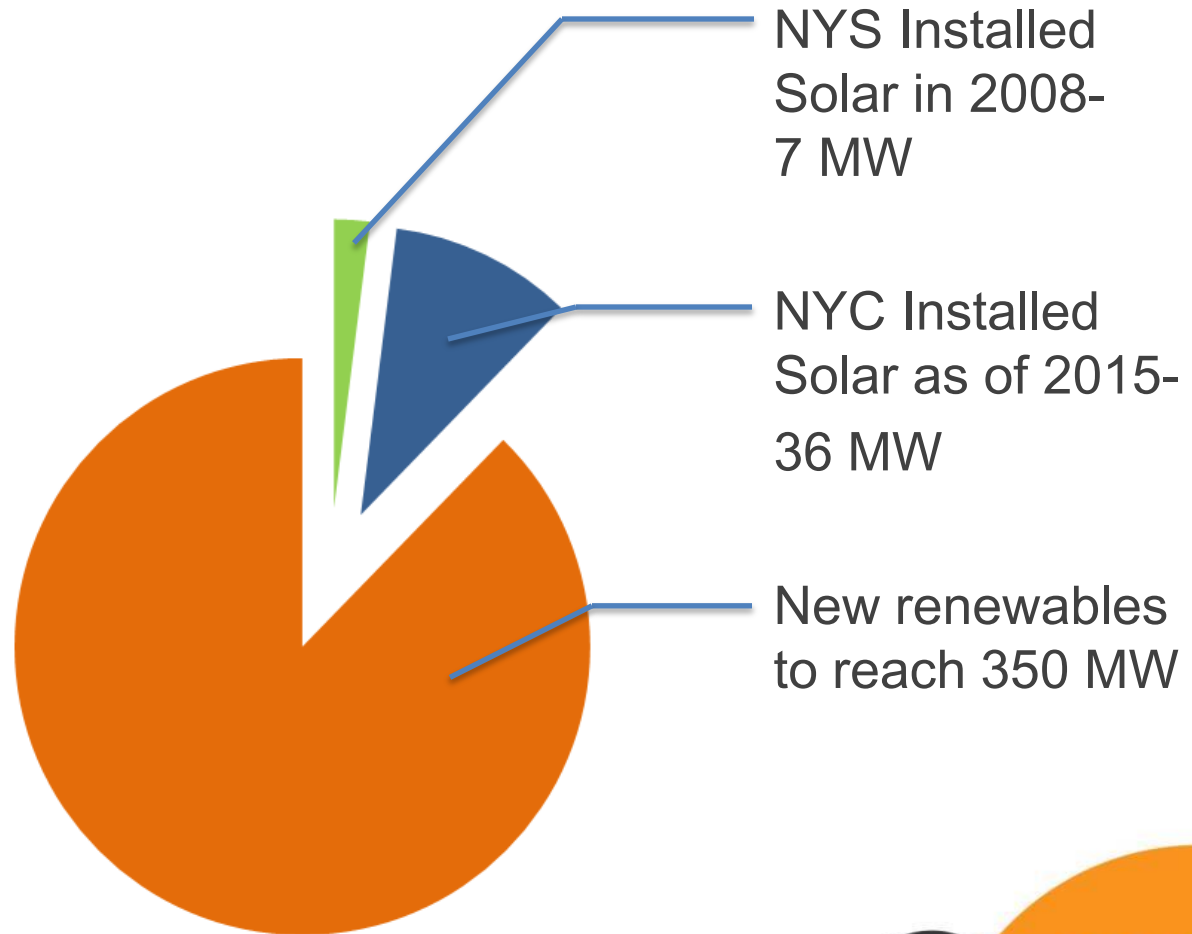
Mayor de Blasio's **One City - Built to Last** plan committed NYC to a greenhouse gas emissions reduction goal of 80% by 2050.

- 30% reduction in emissions from buildings by 2025
- 100 MW of on-site renewable energy in City buildings by 2025
- 250 MW of on-site renewable energy in private owned buildings by 2025



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# OneNYC Plan



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# OneNYC Plan



0.5 MW potential

Source: Rich Mitchell, Wikipedia Commons



4 MW potential

Source: Javits Center, Wikipedia Commons

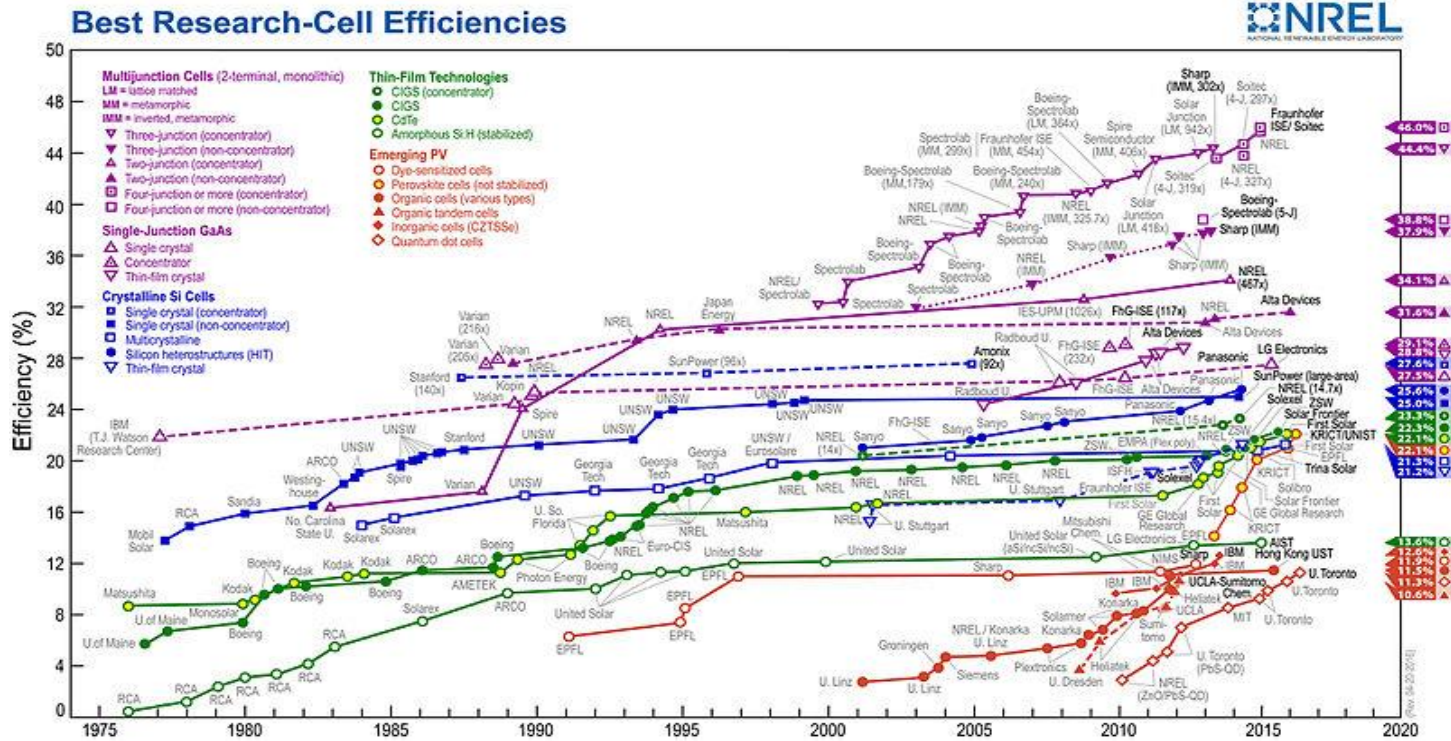


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# Benefits of Solar Energy Systems

1. Operational savings
2. Backup power if paired with storage



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# Incentives

- Incentives for on-site renewables
  - **Ten NY State Incentive Programs**
    - Grant and loan programs
    - Interconnection/utility incentives
    - Tax incentives (property tax, sales tax)
    - Financing (NY Green Bank)
  - **Six Federal Incentive Programs**
    - Grant and loan programs
    - Tax incentives (personal, industrial, corporate)
    - Mortgage programs (new and existing homes)



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# Risks of On-Site Energy Systems

Most buildings incorporate equipment that presents a hazard or has some associated risk.



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# Code Requirements for Solar

## Types of solar systems

- Solar thermal
- Photovoltaic



Source: Solar Coordinates, Wikipedia Commons



Source: Lucan Braun, Wikipedia Commons



Source: Unsplash, Wikipedia Commons

# Code Requirements for Solar

1. Structural loading and wind design
2. Maintaining proper fire rating for assemblies
3. Maintaining thermal properties of the envelope
4. Thermal - material and system performance
5. PV - Electrical Hazards
6. Emergency responder access and safety
7. Best practices for installation and maintenance (OSHA)



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# Code Requirements for Solar

Structural loading and wind design

- **BC Table 601, Chapter 16** - solar panels and racking will add, on average, 3-4 pounds per square foot, but may not be uniformly distributed
  - Confirm the weight of the system to be added, have an engineer evaluate existing structure
  - Configuration of the panels may increase the potential to hold snow
  - System must resist wind uplift



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# Code Requirements for Solar

Structural loading and wind design

- BC Table 601

**601.1 Scope.** The provisions of this chapter shall control the classification of buildings as to type of construction.

**TABLE 601  
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)**

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V <sup>j</sup>	
	A	B	A <sup>d</sup>	B	A <sup>d</sup>	B	HT	A <sup>d</sup>	B
Primary structural frame <sup>e,k</sup> (see Section 202)	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	HT	1	0
Bearing walls Exterior <sup>r,g,h</sup> Interior	3 3 <sup>a</sup>	2 2 <sup>a</sup>	1 1	0 0	2 1	2 0	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior <sup>e</sup>	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction <sup>i</sup> and secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and secondary members (see Section 202)	1½ <sup>b,c</sup>	1 <sup>b,c</sup>	1 <sup>b,c</sup>	0 <sup>b,c</sup>	1 <sup>b,c</sup>	0	HT	1 <sup>b,c</sup>	0

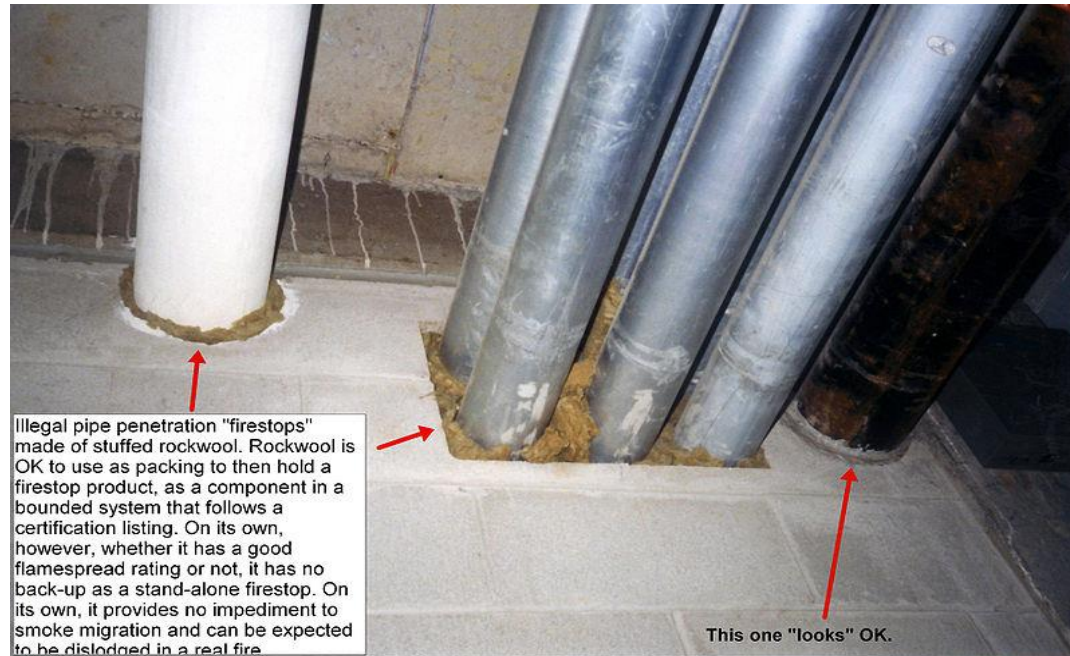




# Code Requirements for Solar

Maintaining proper fire rating for assemblies

- **BC 713** - penetrations through rated assemblies must be properly sealed



Source: Achim Hering, Wikipedia Commons

# Code Requirements for Solar

Maintaining the thermal properties of the envelope

- **ECC 402.2 or ECC C402.4** - penetrations through the air barrier and thermal envelope must be properly sealed



Source: Bocra, DOB



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# Code Requirements for Solar

Solar Thermal systems - material and system performance

- **MC Chapter 14**
  - Non-combustible materials
  - Proper pressures and temperatures
  - Flammable liquid or gas prohibited for heat transfer fluids



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# Code Requirements for Solar

## Electrical Hazards (PV systems)

- **NYC Electrical Code** - the entire *system* **MUST** be listed (UL, or other recognized label)



Source: Multi-Contact AG, Wikipedia Commons



Source: Russell Neches, Wikipedia Commons

# Code Requirements for Solar

## Emergency responder access and safety

- **FC 512** - Rooftop solar panel installations
  - Rooftop access landings
  - Maintain clear path (FC 504)
  - Location and color of conduit
  - Durable, waterproof markings
  - Accessible disconnect
  - Signage



Source: Peter Stehlik, Wikipedia Commons



# OSHA Requirements for Solar

## Best Practices for installation and maintenance

- Follow OSHA standards
  - Shock or electrocution
  - Burns
  - Worker falls
  - Personal protection



Source: US Department of Labor

# How to File Solar Projects

- Solar panels can be included as part of an NB application, an Alt-1, or more commonly, as an Alt-2
  - Full plan review, Self-cert, and Pro-cert
- Projects must have a construction permit and an electrical permit
- Design to accommodate existing conditions!
- <http://www1.nyc.gov/site/buildings/business/solar-panel.page>



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# Wind Turbines





Wind turbines harness wind energy

- Less than 3m (9'-10") sweep diameter (ie, building mounted) – BB 2011-004 establishes acceptance criteria
- 3m or greater sweep diameter – site-specific review required

# Code Requirements for Wind Turbines

1. Alternative material review
2. Buildings Bulletin 2011-004
  - Structural loading and wind design
  - Zoning requirements
  - Peer review
  - Material acceptance criteria




NYC Buildings  
NYC Buildings Department  
200 Broadway, New York, NY 10007  
Robert D. Litrushin, Commissioner

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**BUILDINGS BULLETIN 2011-004**  
Technical

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**Supersedes:** Buildings Bulletin 2009-015

**Issued by:** Fatma M. Amer, P.E., First Deputy Commissioner 

**Issuance Date:** February 17, 2011

**Purpose:** This document establishes a protocol for material acceptance, installation, testing, inspection, approval and maintenance criteria of wind turbine product assemblies.

**Related Code/Zoning Section(s):**

AC 28-103	BC Chapter 16
AC 28-113	1RCNY 101-06
ECC Chapter 6	

**Subject(s):** Renewable energy sources; wind turbine assemblies; Wind turbines, acceptance criteria; Wind turbines, testing; Wind turbines, installation; Wind turbines, inspection; Wind turbines, approval; Wind turbines, maintenance

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In accordance with Article 113 of Title 28 of the New York City Administrative Code (AC §28-113.1 et seq.), certain materials identified in the Construction Codes or by the Commissioner must be tested in accordance with the relevant standard or standards by a Department-approved testing agency. The testing agency must list or label the material to show that the material complies with the applicable standard. In addition, in accordance with Article 103 of Title 28 of the New York City Administrative Code (AC §28-103.3), the Commissioner has the authority to require testing of alternate materials in accordance with recognized test standards approved by the Commissioner. This bulletin provides the criteria for material acceptance, size, location and installation of wind turbine assemblies in New York City.

**I. Material Acceptance Criteria for use in New York City.** Wind turbine assemblies and components shall meet the following acceptance criteria:

**A. Product and testing standards.** The following standards shall govern the manufacture and testing of wind turbine assemblies and their components:

1. IEC Standard 61400-2, "Wind turbines – Part 2: Design requirements for small wind turbines";
2. IEC Standard 61400-11, "Wind turbine generator systems – Part 11: Acoustic noise measurement technique";
3. IEC Standard 61400-12-1, ed. 1, "Wind turbines – Part 12-1: Power performance measurements of electrically producing wind turbines";
4. IEC Standard 61400-1, "Wind turbines – Part 1: Design requirements";
5. DOD Military Standard 6100, Test Method 509.5, "Salt Fog".

Buildings Bulletin 2011-004 1 of 4

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# Code Requirements for Wind Turbines

## Alternative material review

- Wind turbines are not prescribed in the Code
- **28-113** – Alternative materials
  - Approved by the Commissioner
  - Complies with intent of Code
  - Equivalent in quality, strength, effectiveness, fire resistance, durability and safety



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# Code Requirements for Wind Turbines

Structural loading and wind design

- **BB 2011-004, Section (II)(A)** – Design requirements
- **BC Chapter 16** – Loading for rooftop conditions

Zoning Resolution

- **BB 2011-004, Section (II)(A)(8)** – Comply with height and setback limitations



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# Code Requirements for Wind Turbines

## Peer Review

- **BB 2011-004, Section (II)(A)(10)** – Peer review required for structural, electrical, mechanical and noise-mitigation

## Material/Equipment Acceptance Criteria

- **BB 2011-004, Section (I)(A)** – Wind turbines listed in accordance with IEC 61400



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# How to File Wind Turbine Installations

- Wind turbines can be included as part of an Alt-2 (BB 2011-004, Section (II)(B) )
  - Pro-cert not permitted
- Projects must have a construction permit and an electrical permit
- Smaller wind turbines (<3m), as-of-right, comply with BB 2011-004
- Larger wind turbines (3m and greater) must be accepted under a site-specific review, filed under OTCR-2 application



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# Energy Storage



- Energy storage systems include flywheels, thermal storage, electro-chemical batteries, etc.
- Battery Energy Storage Systems (BESS) are typically used with renewables

# Benefits of Energy Storage

1. Peak shaving/load shifting applications
2. Energy management
3. Backup power



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# Code Requirements for Energy Storage

## 1. Alternative material review

- Acceptance based on UPS/emergency power systems
- Listing criteria
- Hazard identification and mitigation



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# Code Requirements for Energy Storage

Acceptance based on stationary storage batteries (standby power, emergency power or UPS)

- **FC 608** – Various requirements, such as thermal runaway, safety caps, spill control, signage, etc.
- **MC 502.4 & 502.5** – Ventilation requirements
- **BC 509.5** – Separation
- **BC Chapter 9** – Sprinkler/extinguishing, fire alarms



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# Code Requirements for Energy Storage

## Listing criteria

- Batteries, UL 1973
- Inverters, UL 1741



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# Code Requirements for Energy Storage

Hazard identification and mitigation

- Thermal runaway
- Electrolyte containment
- Hydrogen/Oxygen excessive buildup
- Elevated operating temperatures
- Applicant must identify other hazards

Applicants must demonstrate adequate mitigation procedures during OTCR review.



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# Risks of Energy Storage

Some risks managed via battery management system. BMS' monitor performance of batteries.

Required risk analysis during site-specific review:

- Performed in accordance with ISO 31010 *Risk Management — risk assessment techniques*
- Applicants must tabulate
  - Hazard identification
  - Severity levels
  - Likelihood levels
  - Hazard modes and risk mitigation analysis
  - Battery safety gap analysis



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# How to File Energy Storage Projects

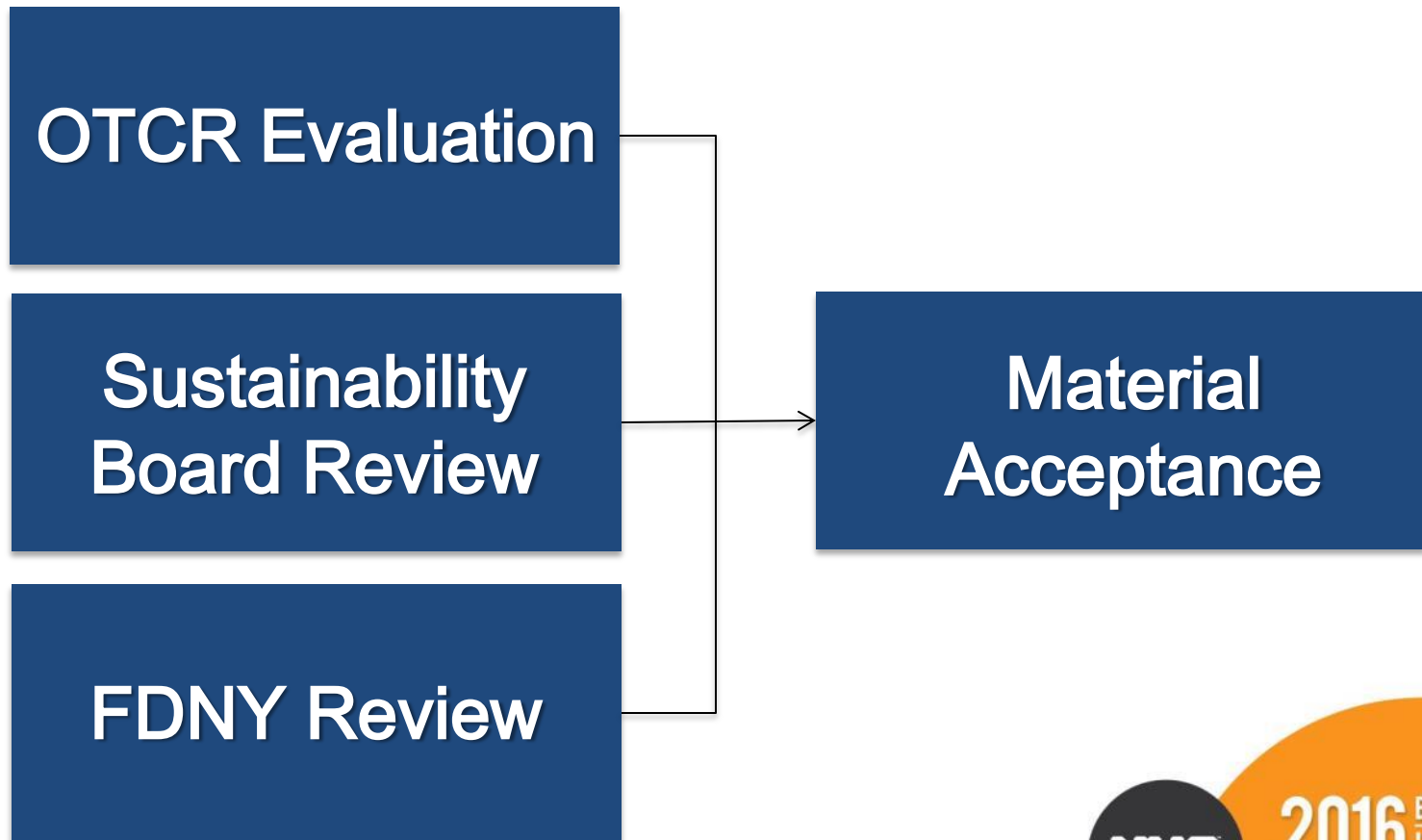
- BESS can be included as part of an NB application, an Alt-1, or more commonly, as an Alt-2
  - Full plan review, self-cert, and pro-cert
- Projects must have a construction permit and an electrical permit
- Projects must be accepted under a site-specific review filed under OTCR-2 application



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# How to file Energy Storage Projects

## *Site-specific Review Requirements*





# How to File Energy Storage Projects

## *Site-specific Review Requirements*

**OTCR Evaluation**



- Applicant files OTCR-2 (site-specific application) along with supporting documentation (checklist)
- OTCR evaluates safety and performance issues
- Coordinates with approvals from FDNY and Sustainability Boards

**Sustainability  
Board Review**

**FDNY Review**



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# How to File Energy Storage Projects

## *Site-specific review requirements*

OTCR Evaluation

Sustainability  
Board Review

FDNY Review

- Review required by BSB/IRB
  - BSB/Buildings Sustainability Board (Technical)
  - IRB/Innovation Review Board (Policy)
  - **Exception:** some battery chemistries no longer require BSB/IRB review
- Applicant presents at joint BSB/IRB meeting
- BSB/IRB issue recommendations

# How to File Energy Storage Projects

*Site-specific review requirements:*

OTCR Evaluation

Sustainability  
Board Review

FDNY Review

- Contact Technology Management
- FDNY review includes hazmat evaluation

# Wrap-up

*Risks can be managed by following the Code!*

<http://www1.nyc.gov/site/buildings/codes/codes.page>

<http://www1.nyc.gov/site/fdny/about/resources/code-and-rules/nyc-fire-code.page>



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*Thank you!*



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This concludes the  
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