

SAFETY CONSIDERATIONS for RENEWABLE ENERGY SYSTEMS

presented by

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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 renewable energy systems with the Department of Buildings, along with the potential benefits of including them in your project.

LEARNING OBJECTIVES

At the end of the this course, participants will be able to:

1. Participants will recognize 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. Participants will be able to describe the risks associated with two types of energy systems - solar and energy storage.
3. Participants will be able to list the code requirements that relate to solar installations and energy storage systems.
4. Participants will learn what is an adequate renewable energy system and how that affects the procedure for filing with the NYC Department of Buildings.

AGENDA

- OneNYC Plan
- Solar Energy Systems
 - Benefits
 - Incentives
 - Risks
- Solar Energy Systems Requirements
 - Code Requirements
 - OSHA Requirements
 - Department of Buildings Requirements
- Battery Energy Systems (BESS)
 - Benefits
 - Safety Issues
 - Filing Requirements
 - Materials Acceptance
- Q & A

OneNYC PLAN

INDICATOR	LATEST DATA	PREVIOUS DATA
 Greenhouse gas emissions reductions relative to 2005	14% (through the end of 2015)	12% (through the end of 2014)



A 50 kW solar installation on a NYC public school in Battery Park

- **Goal: 80 x 50**

Achieving an 80 percent reduction in greenhouse gas emissions by 2050 (80 x 50) presents a unique opportunity for New York City to continue our global leadership on climate action and we are already taking the necessary steps to achieve this goal

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OneNYC PLAN

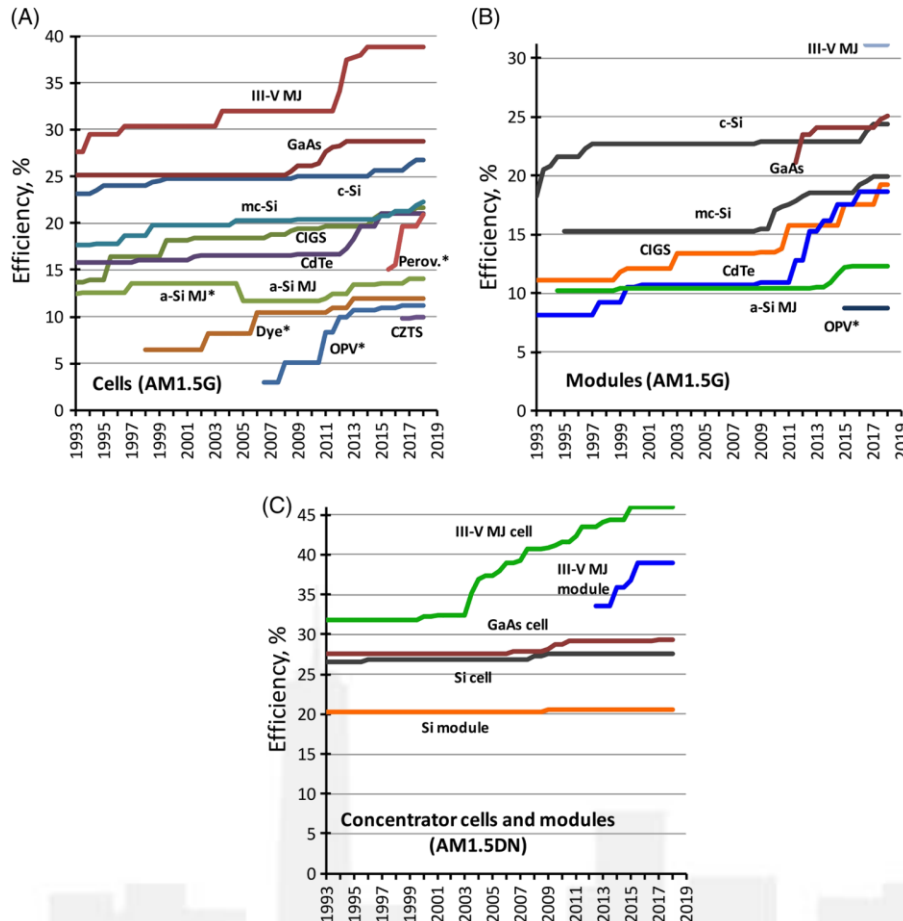


A 362 kW solar installation on Hillcrest High School in Jamaica Queens

- The City set new solar targets for 2030 and citywide solar capacity surpassed 100MW

Citywide solar capacity has surpassed 100 megawatts (MW), keeping the city on track to meet the goal of installing 100 MW of solar power on public buildings and spurring the installation of 250 MW on private buildings by 2025

BENEFITS OF SOLAR ENERGY SYSTEMS



1. Operational savings
2. Backup power if paired with storage
3. Efficiency Improvements

INCENTIVES

- Incentives for on-site renewables
 - 10 NY State Incentive Programs
 - Grant and loan programs
 - Interconnection/utility incentives
 - Tax incentives (property tax, sales tax)
 - Financing (NY Green Bank)
 - Six (6) Federal Incentive Programs
 - Grant and loan programs
 - Tax incentives (personal, industrial, corporate)
 - Mortgage programs (new and existing homes)

RISKS OF ON-SITE ENERGY SYSTEMS

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

CODE REQUIREMENTS FOR SOLAR SYSTEMS



Types of solar systems

- Solar thermal
- Photovoltaic



CODE REQUIREMENTS FOR SOLAR SYSTEMS

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)

CODE REQUIREMENTS FOR SOLAR SYSTEMS

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

CODE REQUIREMENTS FOR SOLAR SYSTEMS

Structural Loading and Wind Design

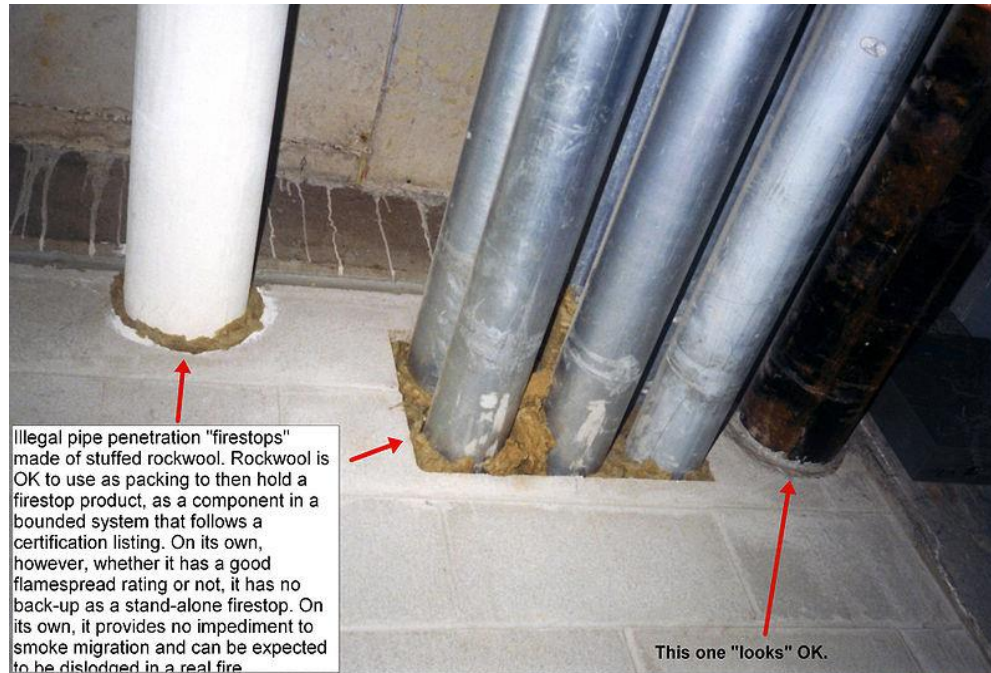
601.1 Scope. The provisions of this chapter shall control the classification of buildings as to type of construction.

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

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



CODE REQUIREMENTS FOR SOLAR SYSTEMS



Source: Achim Hering, Wikipedia Commons

Maintaining proper Fire Rating for **Assemblies**

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

CODE REQUIREMENTS FOR SOLAR SYSTEMS



Maintaining Proper Fire Rating of the **Envelope**

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

CODE REQUIREMENTS FOR SOLAR SYSTEMS

Solar Thermal Systems - Material & System Performance

- **MC Chapter 14**

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

CODE REQUIREMENTS FOR SOLAR SYSTEMS

Electrical Hazards (PV systems)



Source: Multi-Contact AG, Wikipedia Commons



Source: Russell Neches, Wikipedia Commons

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

CODE REQUIREMENTS FOR SOLAR SYSTEMS



Source: Peter Stehlik, Wikipedia Commons

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

OSHA REQUIREMENTS FOR SOLAR SYSTEMS



Source: US Department of Labor

Best Practices for Installation and Maintenance

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

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DEPARTMENT OF BUILDINGS

GENERAL REQUIREMENTS

- **Construction Permit** – required before beginning of installation
- **Electrical Permit** – required before beginning of installation
- **Construction Sign-off** – required following the completion of installation
- **Electrical Sign-off** – required following the completion of installation
- **Licensing** – required to operate in New York City

DEPARTMENT OF BUILDINGS

FILING REQUIREMENTS

- **Projects filing for the Property Tax Abatement (PTA)** **must** be filed through the Hub Full Service Professional Certification of Objections process or, for 1- and 2 family homes with sloped roofs as defined by FDNY and a maximum of 10Kw, through a Professionally Certified Application at Hub Self Service as of January 1, 2016.
- **Projects NOT filing for the Property Tax Abatement (PTA)** can be filed in-person at a DOB Borough Office, or online through the either Hub Full Service or Hub Self Service, Professional Certification

DEPARTMENT OF BUILDINGS

LICENSING REQUIREMENTS

- **New York State Professional Engineer (PE) or Registered Architect (RA)** – Required to submit drawings to obtain building permits and FDNY variances. Considered applicant of record . Anyone can prepare applications, but license numbers and seals are required on forms and officially submitted to DOB & FDNY.
- **NYC Certified Asbestos Investigator** – The NYC DEP requires a Certified Asbestos Investigator to verify if there is asbestos containing material (ACM) in the area construction is taking place unless the building was built per plans approved after April 1, 1987. The asbestos forms must be submitted through ARTS (Asbestos Reporting and Tracking System), and signed/sealed by the Certified Asbestos Investigator.
- **NYC Registered Special Inspector and Special Inspector Agency** – TR1 Special Inspection must be completed and signed by a registered Special Inspector

NOTE: Applicant of record may perform TR1 / TR8 progress inspections.

DEPARTMENT OF BUILDINGS

SPECIAL CONSIDERATIONS

Equipment Locations in Flood Zone Projects

- Con Edison utility meter can be located anywhere The utility company requests.
- Any new meter (from utility company and any other equipment **must** be located above the DFE (design flood elevation).
- AC disconnect switch may be located below the DFE and **must** be readily accessible per NEC article 100. Center line of the operation handle, when it is in the highest position can not be more than 2.0 m (6'7") above ground floor or working platform.

DEPARTMENT OF BUILDINGS

SPECIAL CONSIDERATIONS: Ballast Projects



- Ballast is prohibited for installations one hundred (100) feet or higher above grade.
- For rooftop installations less than one hundred (100) feet above grade and grade-level installations, ballast **must** be fully contained and **must** comply with requirements for aggregate in Chapter 15 of the New York Building Code.

ADDITIONAL REQUIREMENTS

SPECIAL CONSIDERATIONS

Recent updates to the FDNY Code Guide regarding roof obstructions and clear path requirements

- **FC Chapter 5- Fire Operation Feature #37**
 - Clarifies section FC 504.4.4(2) for required clearance around a skylight.
- **FC Chapter 5- Fire Operation Feature #39**
 - Reduces 6'-0" clear path required by FC 504.4 at specific qualifying obstructions for buildings with a width or depth of not more than 25 feet.

BESS

BATTERY ENERGY STORAGE SYSTEMS



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What is a BESS?

- BESS = **B**attery **E**nergy **S**torage **S**ystems
- BESS provide a means to store energy through electrochemical means for later use to supply the utility or local grids

BESS

IN NEW YORK STATE

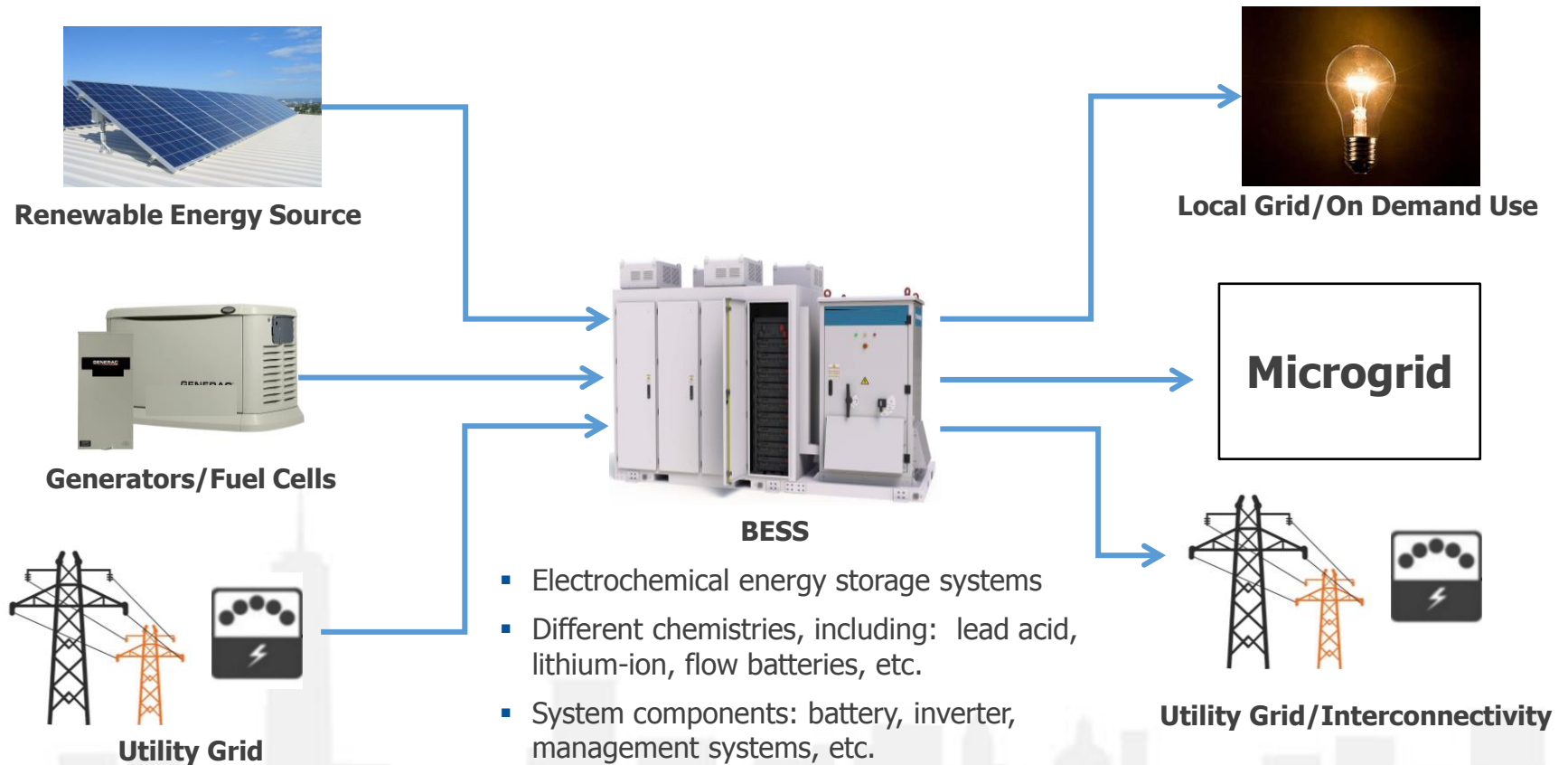
"Energy storage target of 1,500 Megawatts by 2025 in order to increase transmission of clean and renewable energy."

- Governor Andrew Cuomo

20th Proposal of 2018 State of the State

BESS

IN NEW YORK CITY



BESS

IN NEW YORK CITY

- BESS is not prescribed in the NYC Construction Codes, NYC Electrical Code, NYC Fire Code.
 - UPS, Emergency management systems are prescribed in FC 608, BC 307 & 509, MC 502
- BESS is an alternative material in accordance with 28-113.2.2:

§28-113.2.2 Alternative materials. Except as otherwise specifically limited by this code, the provisions of this code are not intended to prevent the installation of any material or to prohibit any alternative engineered design or method of construction not specifically prescribed by this code, provided that the use of such alternative material has been previously approved by the commissioner and may be used only to the extent set forth in such approval. The use of an alternative material, design, method of construction or equipment shall be approved where the commissioner finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

BESS

BENEFITS

Utilities

- Peak shaving/Demand Management
- Reduce expensive infrastructure upgrade
- Reduction of green house gases
- Improving the reliability of the electrical network
- Resiliency

Building Owners

- Energy savings
- Reduction of green house gases
- Resiliency

BESS

SAFETY ISSUES

Hazardous Concerns

- Fire – Thermal runaway
- Explosion – hydrogen ventilation, build-up of explosive gasses in fire event.
- Chemical spills – Flow batteries
- Protecting life and property
- Tragic events tarnish industry

Mitigation

- Listing to national standards
- Testing
- Battery management systems
- Siting and suppression requirements
- Risk Analysis

BESS

FILING REQUIREMENTS

BESS installation requires permit

- Electrical Permit
- Construction Permit

Prior to Approval	<i>Full plan examination required.</i> Submit: PW1 – Work type OT , Battery Energy Storage System OTCR2 – Material Acceptance, Checklist items. TM1 – FDNY Technology management evaluation.
Prior to Permit	Obtain: OTCR Conditional Acceptance Letter FDNY Letter of No Objection (LNO).
Prior to Sign-Off	Install: Per OTCR Conditional Acceptance Letter and FDNY LNO Submit: Letter certifying compliance with Conditional Acceptance Letter Obtain: OTCR Final Acceptance Letter

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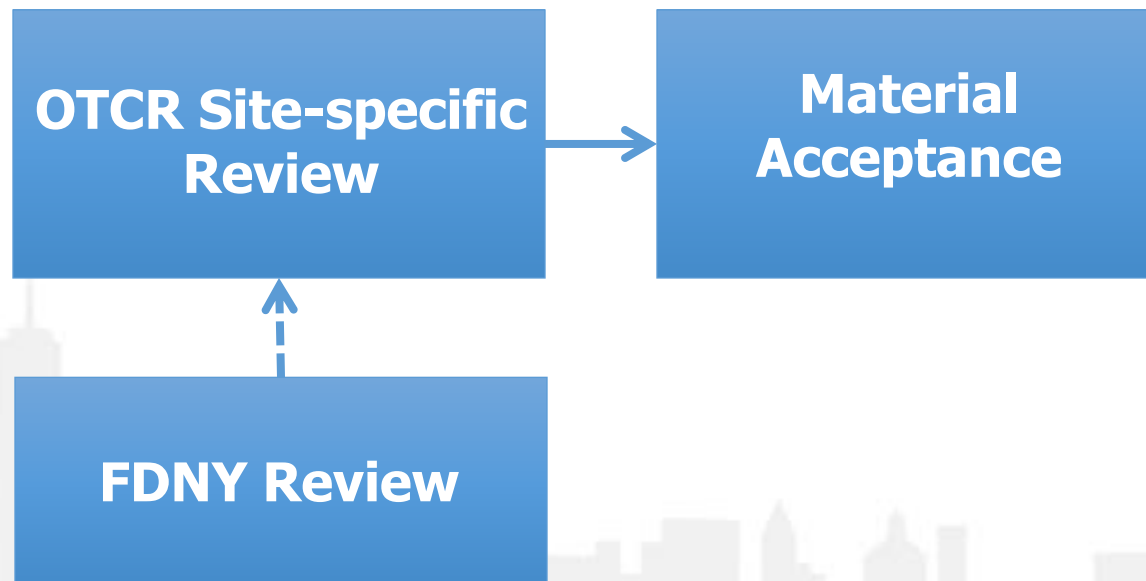
CHECKLIST REQUIREMENTS

1. Project Information
2. Battery Properties and Characteristics
3. Specific Risks
4. Plans and Statements
5. Proposed Design Features
6. Certification and Testing
7. System Monitoring
8. Operating Precautions
9. Additional Requirements
 - Zoning Analysis, Code Analysis, Risk Analysis

BESS

MATERIAL ACCEPTANCE

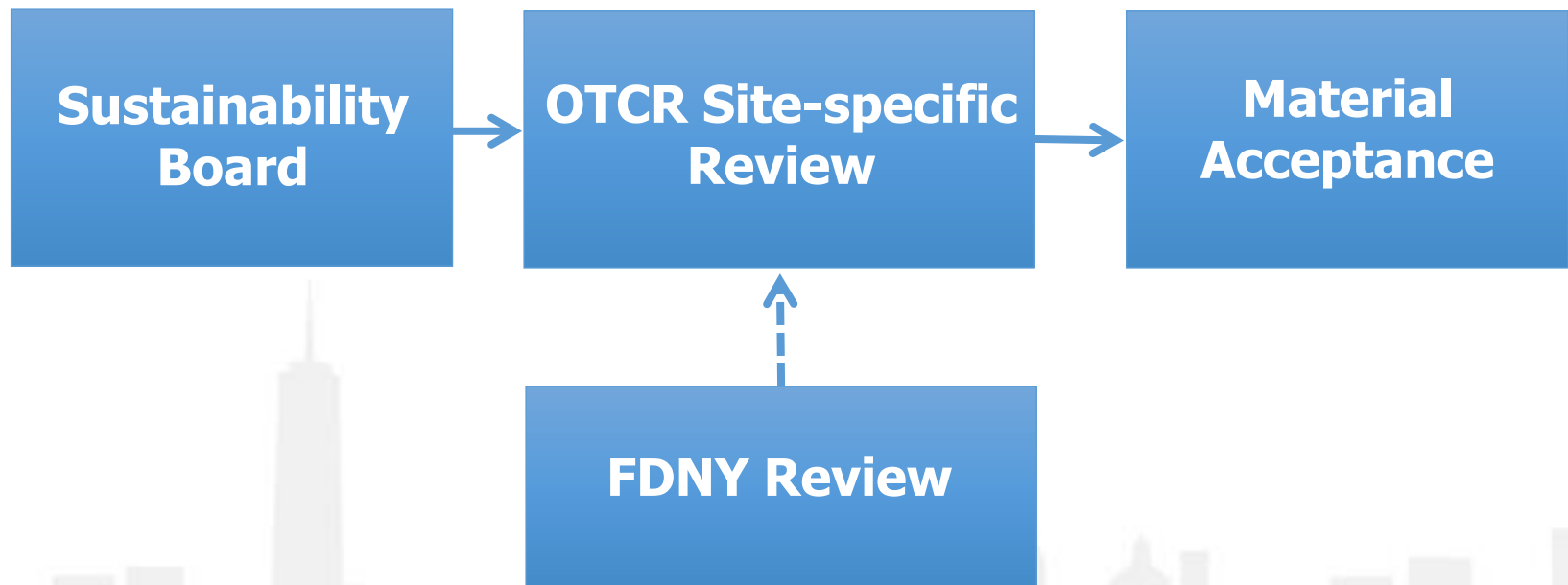
Site-specific review for lead acid, lithium-ion and flow batteries:



BESS

MATERIAL ACCEPTANCE

Site-specific review for new chemistries:



CONTACT INFORMATION

OTCR

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CONTACT INFORMATION

SOLAR PV FILING INFORMATION

Hub Full Service/Hub Self Service

Attn: Elizabeth Skowronek, Borough Commissioner

Attn: Claudia Misi, Project Advocate

HubFullService@buildings.nyc.gov

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**This concludes the
American Institute of Architects
Continuing Education Systems Course.**

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