20 Add Hookups for Temporary Generators & Boilers

I. Summary

Issue:
Buildings with extended service disruptions can use electricity and heat from temporary emergency generators and boilers. It is much easier to connect this equipment if convenient hookup points are installed in advance.

Recommendations:
Require some existing health care facilities to install external electrical hookups. Recommend these installations as best practice for other buildings, and recommend external hookups for heating and cooling as well.

II. Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Add a new section BC2702.4 as follows:

   2702.4 Temporary Generators. The provisions of this section for an external connection of secondary source of power shall be required for buildings that are:

   a. New construction or undergoing substantial alteration of the building electrical service;
   b. Served electrically by either a separate spot network for the building that allows the utility company to disconnect electric service to the building, or that have a single main disconnect switch; and
   c. In occupancy groups I-1 or I-2.

   Exceptions:
   1. Buildings with permanently installed generators in accordance with this chapter that additionally supply a secondary source of power sufficient to allow for the operation of space heating, vertical transportation, domestic water, and 50% of occupied spaces' lighting and power.
   2. Buildings with interior transformer vaults which are elevated within the building and have a distance in excess of 200 feet from the main distribution to the temporary generator.

2702.4.1 Switchboard Modifications. The main electrical distribution for a building shall allow for use of an externally located source of power, such as an portable generator, by means of a manual or automatic switch meeting the requirements of sections 2704.4.1.1 through 2704.4.1.8.

2704.4.1.1 The switchboards shall be constructed to create a point of connection for temporary cables that connect to a temporary source of power, such as a generator.

2704.4.1.2 First or second level distribution gear shall be considered permissible connection points for temporary cabling. Cabling extensions from the switchboard(s) are not required as part of the permanent installation.

2704.4.1.3 Connection points can be established “ahead of the main” or as a secondary or tertiary level connection point, provided that the sum total of the connection points does not exceed the equivalent quantity of main (1st Level) devices.

2704.4.1.4 Connection points that are “ahead of the main” require the utility company to disconnect the service prior to the manual connection of the temporary cabling and energization of roll-up generators. These “ahead of the main” connection points shall employ hinged, locking panel sections with warning labels that include the following information:

1. Contact information for the electrical utility serving the building;
2. Necessary safety procedures to implement a temporary connection; and
3. Maximum cabling and generator size.

2704.4.1.5 Connection points shall either be established as additional over-current protective devices or as main or branch busway extensions, provided that the connection points permit the full service capacity to be made with temporary cabling.

2704.4.1.6 A clear notice shall be posted near the connection points describing the specifications of the required generator to serve the building, including phases, voltage, capacity, and any other information required to correctly procure a temporary generator.

2704.4.1.7 In new I-2 (non-hospital and non-acute care) facilities, the electrical system shall be designed with an electrical “quick-connect” to allow for an external generator to be easily connected and power all electrical services.

2704.4.1.8 In existing and new hospital and/or acute care I-2 facilities, the electrical system shall be designed with an electrical “quick-connect” to allow for an external generator to be easily connected and power, as a minimum, emergency power services.

2704.4.1.9 In existing and new I-1 and adult care facilities located within a Special or Moderate Flood Hazard Area, the electrical system shall be designed with an electrical “quick-connect” to allow for an external generator to be easily connected

and power all electrical services.

2704.4.2 Architectural Openings. Architectural provisions, including but not limited to doors, hatches, framed openings, access panels, sleeves, and conduit, shall be established and sized to readily permit the installation of temporary cabling in accordance with the New York City Electrical Code.

2704.4.3 Special Hazard Flood Areas. External connection routes shall be either located above the design flood elevation, or wet floodproofed in accordance with ASCE 24.

2. Add a new subsection 7 to Section BC G304.1.1 of Appendix G as follows:

7. Backup systems. New I-1 and adult care facilities shall have a backup generator above the Design Flood Elevation or shall be designed with an electrical quick-connect to allow for an external generator to be easily connected and power all electrical services.

3. Add a new subsection 3 to section G304.1.2:

3. Backup systems. All new I-2 facilities shall be designed with an electrical quick-connect to allow for an external generator to be easily connected and power all electrical services, except that I-2 that are hospitals providing acute medical care shall be designed with an electrical quick-connect that can handle, as a minimum, emergency power services. All new I-2 that are hospitals providing acute medical care with heating or cooling equipment below the Design Flood Elevation shall be designed with a quick-connect that can allow temporary heating or cooling to be connected.

Amendments to the New York City Construction Code:

1. Add Article 315 as follows:

315. RETROFIT OF BACKUP ELECTRIC SYSTEMS IN ACUTE CARE HOSPITALS AND ADULT CARE FACILITIES

315.1 The provisions of this article shall apply retroactively to I-2 buildings and structures that are hospitals or nursing homes and to I-1 buildings and structures that are adult care facilities. Compliance shall be required of the applicable facilities within 20 years of the effective release date of most recent FEMA FIRM maps.

315.1.1 Retroactive requirements for I-2 and are hospitals providing acute medical care.

All existing buildings and structures in designated areas of moderate and special flood hazard shall retrofit the following utilities and attendant equipment to comply with G304.1.2 Nonresidential 3. Backup systems.

315.1.2 Retroactive requirements for I-1 and adult care facilities.

All existing buildings and structures in designated areas of special flood hazard shall retrofit the following utilities and attendant equipment to comply with G304.1.1 Residential (7) Backup systems.

III. Supporting Information

Expanded Issue and Benefits:

The intent is to require hookups in buildings that meet all of the following criteria:

1. New construction or substantial “total building gut” renovation
2. Occupancy I-1 and I-2
3. Electrical service with either a separate spot network for the building or a single main disconnect switch.

The Task Force recommends these installations as best practice for commercial office buildings in occupancy group B (especially if the building is in excess of 100,000 square feet of gross floor area) and hotels and residential buildings in group R-1 and R-2 (especially if the building has 40 or more units). The provisions of this recommendation may also be a good practice for smaller buildings or buildings that do not meet all the requirements shown above, and should be considered by building owners to allow for easy connection of portable generators during extended blackouts.

Individual homes are not required to provide generator connectivity but it is recommended as best practice to install quick connects of the twist-lock variety to avoid dangerous connections to small generators during blackouts.

It is recommended to limit the distance between the intended portable generator location and the electric service connection to no more than 200 feet. If the distance is greater, it is recommended to place a full rated connectivity interface, served by permanent fixed feeders, within 200 feet of the generator parking location.

This proposal places most of its text in the NYC Building Code but the Electrical Code may be another appropriate place for this new code language.

Healthcare Facilities
Hospitals need to quickly enable connectivity of a redundant source of power, should their backup generation be lost and utility power unavailable.

“Quick-connect” equipment allows hospitals, acute care facilities, and nursing homes to quickly establish an additional source of power by avoiding the time-consuming rewiring that is required of traditional connections. The speed of power deployment can play a major factor in avoiding forced evacuation of critical care facilities.

Adult care facilities aren't required to have any backup power today, but serve a medically frail community for whom even basic care depends on powered systems and whose safety is difficult to ensure in the absence of power.

Electrical Choices
There are two primary options available when providing external connections to a temporary generator:

1. **Bussing Only**
   The least expensive path is simply to add bus extensions for service switchboards, without the inclusion of an additional service switch. This allows for the installation of temporary cabling by authorized personnel, *but only after* disconnection of normal electrical service by the utility. This could present delays for buildings dependent on action by the utility company before the external generation can be energized.

   In these cases, both new and existing buildings should create temporary cabling access paths to readily allow for connection between an outdoor "roll-up" generator and the main switchboards.

2. **Connectivity "After the Main"**
   To temporarily eliminate dependence on the utility, switchboards with a single main disconnect can be provided with additional bussing, or with an additional secondary overcurrent protective device, to allow for connection of cabling to a temporary generator interface on the secondary side of the single main service switch. In this configuration, switchboards with a temporary generator connection on the secondary side of its single main overcurrent protective device "main" would not require the inclusion of the utility in the disconnect process. Buildings could utilize a manual or automatic transfer switch (or interlocking service switch) to allow for the connection of external generators; however, this would not be absolutely necessary, especially since the time to deliver and implement a temporary generator solution is not congruent with the speed of a transfer switch operation.

Exceptions
Under either path, buildings with sufficient backup generation would not need to add external connections. There is also an exception for buildings in which it is very difficult to connect external cabling (due to distance and location.) Exceptions in these instances require the approval of the Department of Buildings.

Other MEP Systems
Internal or utility systems failures during extreme weather events can easily impact a building's ability to run MEP systems. Often, the loss of one system can impact the ability to operate other systems.

To more easily allow for the temporary supply of heating and cooling in the event of an extended power (or other utility) outage, building owners should consider adding the following to their heating and/or cooling systems:

1. Appropriately sized steel piping from the physical plant to an external, accessible location for the supply and return of hot and/or chilled water, or low pressure steam and condensate return with valved and capped outlets; and,

2. Valving internal to the building to enable primary heating and cooling sources to be disconnected from the distribution system, and to allow the distribution system to be served by the temporary heating and cooling source; and,

3. External connections for a temporary heating and/or cooling source. In Special or Moderate Flood Hazard Areas, these connections are to be either located above the design flood elevation or floodproofed (not just waterproofed). These external connections can provide for safer and more efficient hook-ups to portable boilers or other units, without “snaking” piping or hoses through building apertures.

Implementation:

There are no known implementation issues for this proposal.

Cost:

Turner Construction Company prepared cost estimates based upon several standardized building typologies. Due to the innate variances in construction costs between projects, the complexity of the Task Force proposals, and the wide range of buildings to which the proposals may apply, these cost estimations should only be used as rough order-of-magnitude guides. The cost analysis is presented at the end of this proposal; more information about the cost methodology is given at the end of the full report.

NEW CONSTRUCTION

		Commercial High Rise				Commercial Low Rise				Residential High Rise				Residential Low Rise			
		Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total
20.1	**Add Hookups for Temporary Generators & Boilers**																
	Boiler (Hot Water)																
	Acquisition of temporary equipment				By Owner								By Owner				
	Fuel oil for temporary equipment				By Owner								By Owner				
	Pipe main to system (permanent boiler in basement)	350	LF	$365.00	$127,800					250	LF	$200.00	$50,000				
	Required valving for switchover to temp system	1	ALW	$50,000.00	$50,000					1	ALW	$50,000.00	$50,000				
	Pipe main dedicated emergency riser			Not Required								Not Required					
	External hot water temporary connections	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	Connection to existing hot water loop	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	Core drilling (supply and return piping)			Not Required								Not Required					
	Added testing of temporary piping	1	ALW	$7,200.00	$7,200					1	ALW	$4,800.00	$4,800				
	Cold water makeup pipe from first floor or below	200	LF	$200.00	$40,000					200	LF	$150.00	$30,000				
	External temporary cold water connection	1	ALW	$10,000.00	$10,000					1	ALW	$10,000.00	$10,000				
	Architectural feature on connections	1	ALW	$5,000.00	$5,000					1	ALW	$5,000.00	$5,000				
	SUBTOTAL DIRECT WORK				**$290,000**								**$199,800**				
	Contingency		10%		$29,000						10%		$19,980				
	SUBTOTAL				**$319,000**								**$219,780**				
	GC Mark-ups		20%		$63,800						20%		$43,956				
	TOTAL	620,000	GSF	$0.62	**$382,800**				**N/A**	231,000	GSF	$1.14	**$263,736**				**N/A**

EXISTING BUILDINGS

		Commercial High Rise				Commercial Low Rise				Residential High Rise				Residential Low Rise			
		Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total
20.1	**Add Hookups for Temporary Generators & Boilers**																
	Boiler (Hot Water)																
	Acquisition of temporary equipment				By Owner								By Owner				
	Fuel oil for temporary equipment				By Owner								By Owner				
	Pipe main to system (permanent boiler in basement)	350	LF	$365.00	$127,800					250	LF	$200.00	$50,000				
	Required valving for switchover to temp system	1	ALW	$50,000.00	$50,000					1	ALW	$50,000.00	$50,000				
	Pipe main dedicated emergency riser			Not Required								Not Required					
	External hot water temporary connections	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	Connection to existing hot water loop	1	ALW	$50,000.00	$50,000					1	ALW	$25,000.00	$25,000				
	Core drilling	4	EA	$10,000.00	$40,000					4	EA	$1,000.00	$4,000				
	Added testing of temporary piping	1	ALW	$7,200.00	$7,200					1	ALW	$4,800.00	$4,800				
	Cold water makeup pipe from first floor or below	200	LF	$200.00	$40,000					200	LF	$150.00	$30,000				
	External temporary cold water connection	1	ALW	$10,000.00	$10,000					1	ALW	$10,000.00	$10,000				
	Architectural feature on connections	1	ALW	$10,000.00	$10,000					1	ALW	$10,000.00	$10,000				
	Retrofit of existing conditions	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	SUBTOTAL DIRECT WORK				**$385,000**								**$233,800**				
	Contingency		10%		$38,500						10%		$23,380				
	SUBTOTAL				**$423,500**								**$257,180**				
	GC Mark-ups		20%		$84,700						20%		$51,436				
	TOTAL	**620,000**	**GSF**	**$0.82**	**$508,200**				**N/A**	**231,000**	**GSF**	**$1.34**	**$308,616**				**N/A**

NEW CONSTRUCTION

		Commercial High Rise				Commercial Low Rise				Residential High Rise				Residential Low Rise			
		Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total
20.2	**Add Hookups for Temporary Generators & Boilers**																
	Boiler (Steam)																
	Acquisition of temporary equipment				By Owner								By Owner				
	Fuel oil for temporary equipment				By Owner								By Owner				
	Pipe main to system (permanent boiler in basement)	350	LF	$475.00	$166,300					250	LF	$275.00	$68,800				
	Required valving for switchover to temp system	1	ALW	$50,000.00	$50,000					1	ALW	$50,000.00	$50,000				
	Pipe main dedicated emergency riser				Not Required								Not Required				
	External steam temporary connections	1	ALW	$35,000.00	$35,000					1	ALW	$35,000.00	$35,000				
	Connection to existing steam and condenser water loop	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	Core drilling (supply and return piping)				Not Required								Not Required				
	Added testing of temporary piping	1	ALW	$7,200.00	$7,200					1	ALW	$4,800.00	$4,800				
	Cold water makeup pipe from first floor or below	200	LF	$200.00	$40,000					200	LF	$150.00	$30,000				
	External temporary cold water connection	1	ALW	$10,000.00	$10,000					1	ALW	$10,000.00	$10,000				
	Architectural feature on connections	1	ALW	$8,000.00	$8,000					1	ALW	$8,000.00	$8,000				
	SUBTOTAL DIRECT WORK				**$341,500**								**$231,600**				
	Contingency		10%		$34,150						10%		$23,160				
	SUBTOTAL				**$375,650**								**$254,760**				
	GC Mark-ups		20%		$75,130						20%		$50,952				
	TOTAL	620,000	GSF	$0.73	**$450,780**				**N/A**	231,000	GSF	$1.32	**$305,712**				**N/A**

EXISTING BUILDINGS

		Commercial High Rise				Commercial Low Rise				Residential High Rise				Residential Low Rise			
		Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total
20.2	**Add Hookups for Temporary Generators & Boilers**																
	Boiler (Steam)																
	Acquisition of temporary equipment				By Owner								By Owner				
	Fuel oil for temporary equipment				By Owner								By Owner				
	Pipe main to system (permanent boiler in basement)	350	LF	$475.00	$166,300					250	LF	$275.00	$68,800				
	Required valving for switchover to temporary system	1	ALW	$50,000.00	$50,000					1	ALW	$50,000.00	$50,000				
	Pipe main dedicated emergency riser				Not Required								Not Required				
	External steam temporary connections	1	ALW	$35,000.00	$35,000					1	ALW	$35,000.00	$35,000				
	Connection to existing steam and condenser water loop	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	Core drilling	6	EA	$1,000.00	$6,000					6	EA	$1,000.00	$6,000				
	Added testing of temporary piping	1	ALW	$7,200.00	$7,200					1	ALW	$4,800.00	$4,800				
	Cold water makeup pipe from first floor or below	200	LF	$200.00	$40,000					200	LF	$150.00	$30,000				
	External temporary cold water connection	1	ALW	$10,000.00	$10,000					1	ALW	$10,000.00	$10,000				
	Architectural feature on connections	1	ALW	$8,000.00	$8,000					1	ALW	$8,000.00	$8,000				
	Retrofit allowance	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	SUBTOTAL DIRECT WORK				**$372,500**								**$262,600**				
	Contingency		10%		$37,250						10%		$26,260				
	SUBTOTAL				**$409,750**								**$288,860**				
	GC Mark-ups		20%		$81,950						20%		$57,772				
	TOTAL	**620,000**	**GSF**	**$0.79**	**$491,700**				**N/A**	**231,000**	**GSF**	**$1.50**	**$346,632**				**N/A**

NEW CONSTRUCTION

		Commercial High Rise				Commercial Low Rise				Residential High Rise				Residential Low Rise			
		Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total
20.3	**Add Hookups for Temporary Generators & Boilers**																
	Chiller																
	Acquisition of temporary equipment				By Owner								By Owner				
	Fuel oil for temporary equipment				By Owner								By Owner				
	Pipe main to system (permanent chiller in basement)	350	LF	$475.00	$166,300					250	LF	$275.00	$68,800				
	Required valving for switchover to temp system	1	ALW	$50,000.00	$50,000					1	ALW	$50,000.00	$50,000				
	Pipe main dedicated emergency riser				Not Required								Not Required				
	External temporary chiller connections	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	Connection to existing chilled water loop	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	Core drilling (supply and return piping)				Not Required								Not Required				
	Added testing of temporary piping	1	ALW	$7,200.00	$7,200					1	ALW	$4,800.00	$4,800				
	Cold water makeup pipe from first floor or below	200	LF	$200.00	$40,000					200	LF	$150.00	$30,000				
	External temporary cold water connection	1	ALW	$10,000.00	$10,000					1	ALW	$10,000.00	$10,000				
	Condenser water riser (not required for air cooled chiller)				Not Required								Not Required				
	Architectural feature on connections				Not Included								Not Included				
	SUBTOTAL DIRECT WORK				**$323,500**								**$213,600**				
	Contingency		10%		$32,350						10%		$21,360				
	SUBTOTAL				**$355,850**								**$234,960**				
	GC Mark-ups		20%		$71,170						20%		$46,992				
	TOTAL	**620,000**	**GSF**	**$0.69**	**$427,020**				**N/A**	**231,000**	**GSF**	**$1.22**	**$281,952**				**N/A**

EXISTING BUILDINGS

		Commercial High Rise				Commercial Low Rise				Residential High Rise				Residential Low Rise			
		Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total
20.3	**Add Hookups for Temporary Generators & Boilers**																
	Chiller																
	Acquisition of temporary equipment				By Owner								By Owner				
	Fuel oil for temporary equipment				By Owner								By Owner				
	Pipe main to system (permanent chiller in basement)	350	LF	$475.00	$166,300					250	LF	$275.00	$68,800				
	Required valving for switchover to temp system	1	ALW	$50,000.00	$50,000					1	ALW	$50,000.00	$50,000				
	Pipe main dedicated emergency riser				Not Required								Not Required				
	External temporary chiller connections	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	Connection to existing chilled water loop	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	Core drilling	4	EA	$1,000.00	$4,000					4	EA	$1,000.00	$4,000				
	Added testing of temp piping	1	ALW	$7,200.00	$7,200					1	ALW	$4,800.00	$4,800				
	Cold water makeup pipe from first floor or below	200	LF	$200.00	$40,000					200	LF	$150.00	$30,000				
	External temporary cold water connection	1	ALW	$10,000.00	$10,000					1	ALW	$10,000.00	$10,000				
	Condenser water riser (not required for air cooled chiller)				Not Required								Not Required				
	Architectural feature on connections	1	ALW	$5,000.00	$5,000					1	ALW	$5,000.00	$5,000				
	Retrofit allowance	1	ALW	$25,000.00	$25,000					1	ALW	$25,000.00	$25,000				
	SUBTOTAL DIRECT WORK				**$357,500**								**$247,600**				
	Contingency		10%		$35,750						10%		$24,760				
	SUBTOTAL				**$393,250**								**$272,360**				
	GC Mark-ups		20%		$78,650						20%		$54,472				
	TOTAL	**620,000**	**GSF**	**$0.76**	**$471,900**				**N/A**	**231,000**	**GSF**	**$1.41**	**$326,832**				**N/A**

NEW CONSTRUCTION

		Commercial High Rise				Commercial Low Rise				Residential High Rise				Residential Low Rise			
		Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total
20.4	**Add Hookups for Temporary Generators & Boilers**																
	Generator (Switchgear Room Adjacent to Access Panel; Extend Bus Only)																
	Option 1A: Extend bus only (within switchgear room)	6	EA	$4,000.00	$24,000					1	EA	$4,000.00	$4,000				
	Option 1A: Access panel and signage at exterior (assume 24"x24" stainless steel)	1	EA	$2,000.00	$2,000					1	EA	$2,000.00	$2,000				
	SUBTOTAL DIRECT WORK				**$26,000**								**$6,000**				
	Contingency		0.1		$2,600						0.1		$600				
	SUBTOTAL				**$28,600**								**$6,600**				
	GC Mark-ups		0.2		$5,720						0.2		$1,320				
	TOTAL	**620,000**	**GSF**	**$0.06**	**$34,320**				**N/A**	**231,000**	**GSF**	**$0.03**	**$7,920**				**N/A**
20.5	**Add Hookups for Temporary Generators & Boilers**																
	Generator (Switchgear Room Adjacent to Access Panel; Tapbox with Kirkkey Interlock)																
	Option 1B: Tapbox with kirkkey interlock	6	EA	$27,500.00	$165,000					1	EA	$27,500.00	$27,500				
	Option 1B: Conduit + wire (power + controls) from tap box to gear	50	LF	$13,500.00	$675,000					50	LF	$2,250.00	$112,500				
	Option 1B: Access panel to exterior wall (not required, included in tap box)				Not Required								Not Required				
	SUBTOTAL DIRECT WORK				**$840,000**								**$140,000**				
	Contingency		10%		$84,000						10%		$14,000				
	SUBTOTAL				**$924,000**								**$154,000**				
	GC Mark-ups		20%		$184,800						20%		$30,800				
	TOTAL	**620,000**	**GSF**	**$1.79**	**$1,108,800**				**N/A**	**231,000**	**GSF**	**$0.80**	**$184,800**				**N/A**

EXISTING BUILDINGS

		Commercial High Rise				Commercial Low Rise				Residential High Rise				Residential Low Rise			
		Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total
20.4	**Add Hookups for Temporary Generators & Boilers**																
	Generator (Switchgear Room Adjacent to Access Panel; Extend Bus Only)																
	Option 1A: Extend bus only (within switchgear room)	6	EA	$4,000.00	$24,000					1	EA	$4,000.00	$4,000				
	Option 1A: Access panel and signage at exterior (assume 24"x24" stainless steel)	1	EA	$2,000.00	$2,000					1	EA	$2,000.00	$2,000				
	SUBTOTAL DIRECT WORK				$26,000								$6,000				
	Contingency		10%		$2,600						10%		$600				
	SUBTOTAL				**$28,600**								**$6,600**				
	GC Mark-ups		20%		$5,720						20%		$1,320				
	TOTAL	**620,000**	**GSF**	**$0.06**	**$34,320**				**N/A**	**231,000**	**GSF**	**$0.03**	**$7,920**				**N/A**

EXISTING BUILDINGS		Commercial High Rise				Commercial Low Rise				Residential High Rise				Residential Low Rise			
		Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total	Quantity	Unit	Unit Cost	Total
20.5	**Add Hookups for Temporary Generators & Boilers**																
	Generator (Switchgear Room Adjacent to Access Panel; Tapbox with Kirkkey Interlock)																
	Option 1B: Tapbox with kirkkey interlock	6	EA	$27,500.00	$165,000					1	EA	$27,500.00	$27,500				
	Option 1B: Conduit + wire (power + controls) from tap box to gear	50	LF	$13,500.00	$675,000					50	LF	$2,250.00	$112,500				
	Option 1B: Access panel to exterior wall (not required, included in tap box)			Not Required								Not Required					
	SUBTOTAL DIRECT WORK				**$840,000**								**$140,000**				
	Contingency		10%		$84,000						10%		$14,000				
	SUBTOTAL				**$924,000**								**$154,000**				
	GC Mark-ups		20%		$184,800						20%		$30,800				
	TOTAL	**620,000**	**GSF**	**$1.79**	**$1,107,800**				**N/A**	**231,000**	**GSF**	**$0.80**	**$184,800**				**N/A**
20.6	**Add Hookups for Temporary Generators & Boilers**																
	Generator (Switchgear Room ~200 LF from Access Panel; Extend Bus Only)																
	Option 2A: Extend bus only (within switchgear room)	6	EA	$4,000.00	$24,000					1	EA	$4,000.00	$4,000				
	Option 2A: Conduit + wiring (from switchgear to access panel)	200	LF	$13,500.00	$2,700,000					200	LF	$2,250.00	$450,000				
	Option 2A: Access panel to exterior wall (assume 24"x24" stainless steel)	1	EA	$2,000.00	$2,000					1	EA	$2,000.00	$2,000				
	SUBTOTAL DIRECT WORK				**$2,726,000**								**$456,000**				
	Contingency		10%		$272,600						10%		$45,600				
	SUBTOTAL				**$2,998,600**								**$501,600**				
	GC Mark-ups		20%		$599,720						20%		$100,320				
	TOTAL	**620,000**	**GSF**	**$5.80**	**$3,598,320**				**N/A**	**231,000**	**GSF**	**$2.61**	**$601,920**				**N/A**
20.7	**Add Hookups for Temporary Generators & Boilers**																
	Generator (Switchgear Room ~200 LF from Access Panel; Tapbox with Kirkkey Interlock)																
	Option 2B: Tapbox with kirkkey interlock	6	EA	$27,500.00	$165,000					1	EA	$27,500.00	$27,500				
	Option 2B: Conduit + wire (power + controls) from tap box to gear	200	LF	$13,500.00	$2,700,000					200	LF	$2,250.00	$450,000				
	Option 2B: Access panel to exterior wall (not required, included in tap box)			Not Required								Not Required					
	SUBTOTAL DIRECT WORK				**$2,865,000**								**$477,500**				
	Contingency		10%		$286,500						10%		$47,750				
	SUBTOTAL				**$3,151,500**								**$525,250**				
	GC Mark-ups		20%		$630,300						20%		$105,050				
	TOTAL	620,000	GSF	$6.10	**$3,781,800**				**N/A**	231,000	GSF	$2.73	**$630,300**				**N/A**