POWER OUTAGES & EMERGENCIES

Risks to Buildings, Occupant Safety & Environment

- Reduced functionality of building heating & cooling systems compromises indoor thermal comfort
- Access to potable water and sanitary services cannot be guaranteed
- Decreased lighting and communications connectivity
- Decreased indoor air quality and associated risk to human health due to lack of ventilation, increased humidity, condensation, and mould
- Medical equipment may be inoperable, and medication requiring refrigeration may be threatened
- Vulnerable populations without extensive support networks may become temporarily homeless
- Carbon monoxide poisoning

Design Strategies

Strategy	Cost	Impact	Alignment
Provide natural lighting and operable windows in common areas, corridors, and stairwells	$	**	
Finish floors with exposed concrete or natural tile for added cooling during extreme heat events (thermal mass)	$	*	
Include passive and mixed-mode ventilation strategies to cool internal spaces without dependence on active cooling systems	$$	**	
Design mechanical and ventilation systems for both central control and/or on a per unit basis	$	**	
Consider the use of high energy efficiency or 'regenerative' elevators in building design	$$$	*	
Ensure building entry and exits can be operated manually	$	***	
Identify the appropriate size, form, and location of back-up power. Consider on-site renewable energy systems as a way to decentralize the building's energy supply	$	***	
Identify a building's critical load and necessary duration of back-up power. Ensure a minimum of 72 hours energy storage/backup energy is provided for critical systems, as well as water booster pumps, sump pumps, alarms and secury equipment, outlets for phone charging and medical equipment, wireless/telecomm services, lighting, refrigeration, and bathrooms.	$$$	***	
Integrate solar PV into shading devices and connect to ventilation and other critical systems	$$$	**	
Designate one or more easily accessible amenity rooms as refuge areas in a north-facing area of the building. Design the refuge area for additional cooling capacity/fans and operable windows.	$$	***	
Consider unit designs that allow for refuge within a home (e.g. one room that is resilient to extreme events)	$$	***	
Provide high efficiency (e.g. LED) emergency lighting in highly trafficked areas, and solar power lighting where possible	$	**	
Introduce rainwater or grey water harvesting as a source of non-potable water	$$$	***	
Install outdoor water fixtures connected to a gravity-fed source in a location easily accessible to building occupants	$	**	

Additional Resources

- Minimum Backup Power Guidelines for MURBs
- Enterprise Green Communities' Strategies for Multifamily Building Resilience
- Designing for ZNE and Passive Survivability
- Urban Green Council, Baby it's Cold Inside
- Enhancing the Livability and Resilience of Multi-Unit Residential Buildings (MURBs), MURB Design Guide

A building's power supply may be interrupted for a number of reasons. Windstorms may knock out above-ground power lines, and heavy ice or snow may damage or break power lines. High demand for cooling during heat waves may overwhelm the grid, and flooding may down power lines or flood critical infrastructure such as transformer stations. As most buildings rely on active mechanical equipment to maintain appropriate ventilation rates and interior temperatures, power outages can have dramatic consequences. When paired with thermally inefficient enclosures, interior spaces can overheat due to solar gains and ventilation can become ineffective. Buildings with low thermal resilience become unsafe for occupants during power outages. Changes in climate expected for BC include extreme events and conditions, which may threaten energy supply to buildings and neighbourhoods.

Operations Strategies

Strategy	Cost	Impact	Alignment
Plan, rehearse, and identify necessary procedures (e.g. testing equipment, checking shelf life of stored provisions)	$	***	
Provide an emergency kit, including a backup lithium ion battery, food supplies, flashlights, medical supplies, an emergency radio, sources of entertainment, blankets, and other supplies	$$	***	
Establish a maintenance schedule for emergency power systems	$	**	
Design or connect to a building emergency communication system (e.g. SMS) with a back-up in the building (e.g. bulletin board in Refuge Area)	$	**	
Establish operations and maintenance procedures and building management systems (BMS) to include information about resources available to occupants during extended power outages	$	**	
Create an emergency management manual identifying key information and contacts. Develop procedures for temporary storage of sewage and waste	$	***	

Flood Events	Heat Waves	Fire at the Urban Interface	
Severe Storms	Seismic Events	Air Quality	

Relative Cost/ Cost Premium		
Low	Medium	High
$	$$	$$$

Relative Impact		
Low	Medium	High
*	**	***

Community Benefits

Consider the following strategies to help improve the resilience of the community overall:

♦ Provide a resilient potable water supply in site design to allow for universally accessible drinking water
♦ Design amenity rooms to act as refuge areas for at-risk community members (e.g. seniors) and a central location for emergency support and services
♦ Ensure refuge areas are designed to foster social connection, mental health, and overall cultural safety
♦ Build community connectivity through preparedness and other events (e.g. movie nights, block parties)
♦ Provide occupant education on refuge areas, evacuation measures, exit locations, etc. in multiple languages according to building occupancy
♦ Designate building or community members with first aid or other experience as emergency coordinators
♦ Ensure building and community members have access to key information and contact details
♦ Engage residents in a process of neighbour check-ins to address risks of isolation
♦ Conduct a sensitivity analysis for occupant demographics to identify key needs and critical services

Potential Design Conflicts

Take care and ensure resilient strategies do no exacerbate vulnerability and other risks

♦ Passive ventilation strategies that rely on natural air flow to cool and ventilate a building may exacerbate indoor air quality issues during times of poor air quality (e.g. forest fire smoke).

INTEGRAL GROUP

BC HOUSING
RESEARCH CENTRE