The Resilient Water Based system – Capabilities the building to the community

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What does resilience mean for commercial real estate?

What it takes to prepare for disasters and then quickly return to full operations after a disaster

by Ryan M. Colker — *Originally published in the September/October 2017 issue of* BOMA Magazine — Around the world, the frequency, intensity and impacts of natural disasters are increasing. These events can significantly affect the social, economic and environmental functionality of communities. The ability of commercial buildings and the businesses they house to adequately prepare for such events and quickly return to full operations—a quality known as resilience—contributes significantly to a community's ability to bounce back. In addition to the community-wide impacts, the state of individual buildings also can affect the long-term viability of the businesses that occupy those buildings.

Identifying measures to reduce risk and increase resilience, undertaking actions deemed cost-effective and communicating such actions to tenants and prospective tenants can help commercial building owners and managers serve their communities, while also providing value to their occupants.

Design Keys:

- **Resources and Choices**
- **Ability to Bounce Back**
- **Reduce Risk**
- **Cost Effective**
- **Communicate Actions**
- **Provide Value**

HVAC – what if there is NO POWER?

Whatever the cause, what to do?

Options: Planning is difficult in preparing for the unknown in a range from an accident, to weather (polar coaster to record highs), or tragically, a terrorist attack…

- Backup generation – "the building as an Island from the grid"
  - Planning – load reduction and life safety decisions to be made
    - Fuel sources available
    - Equipment location
      - Inside, outside, rooftop, buried?
- **WHERE** to extract or reject heat is a key – **WHEN** takes advantage of opportunity
- Storage of fuel or water – the ground as both a source and storage
  - Tanks or Emergency ground loops sized for reduced load or added capability
- Solar – power or thermal
- Batteries
- Other Renewables - **WATER will interface with them all**

HYDRONIC systems are all about CHOICE

HYDRONIC central system:

- **Designed to an ambient range** that will both heat and cool on demand from the space control
  - Designed to a specific water temperature range for advantage of efficiency and life
    - OUTSIDE AIR is not controllable - performance and efficiency are reduced
    - Comfort is lost
    - Ability to recover is more complex
- **Energy sharing simultaneously or cyclically is standard**
  - **Entire building shares energy** – because whole building central system "NETs ENERGY"
  - **No special controls** – simple, any unit heats or cools to space demand
  - **HVAC and Water heating** – it is your energy reuse it
  - **A central plant that does not add to increased temperatures in our cities**.
- Choice and options enable **Resilience**

Hydronics – Bring choice to the table

Planning for Resilience - Identify critical needs (loads) at reduced capability

- **Hybrid systems options** – Heat recovery Chillers, high efficiency boilers, WSHP's and renewables (geoexchange) are all in play.
  - Use the outside temperature through adiabatic cooling tower
  - Gas boiler or other fuel or from storage
  - Ground loops and storage tanks or solar panels
  - Emergency pumping from
    - natural water source or wells, irrigation, ponds, heat exchanger in the sewer…
- **BMS emergency** mode easy interface with systems all disciplines understand
- **Operable windows** – Hydronic capabilities handle locally generated latent and filtration
- **Heat exchangers** – take advantage of what is available – maybe even flood water!

BUDGET is a limiting factor – hydronics provides the ability to design and execute a plan in phases

Hydronics will reduce the energy required

Identify ways at central plant and terminal space

<u>Water based system INSULATES the HVAC system from outdoor temperature – too Hot or Cold</u>

- Efficiency – Highest EER's and COP's against the "load"
  - **Water-cooled means 30-50% more efficient than air source**
  - **Hybrid allows Air, Water, or Ground (etc.) as source = CHOICE**
    - Adiabatic Tower air only – go 100% geo or condenser loop at peak or emergency
    - Central high efficiency natural gas – HVAC and Water heating – backup generator
    - Hydronic systems handle the weather – the load – for the life of the building
  - **Thermal or operational zoning makes it easy to implement emergency plan**
    - Change set point
    - Change all units to low capacity – low air, low water, low compressor – all variable
    - Turn units off - Rotate or load shed
- **Comfort distribution in water piping is the lowest HP most cost effective – period!**

Before resilience there must be Capability There are multiple hydronic solutions

Owner requirements for the space vary based on use, occupancy, function, or safety

- Air – flow and temperature, velocity and stratification
- Humidity – locally generated latent – interface with ventilation and heat recovery or DOAS
- Filtration – What is recommended – MERV 8 and higher
- Water
  - Hot or Cold
  - Condenser or GeoExchange
  - Radiant or chilled beam to ice melt protecting walking surfaces in winter
  - 1-2-4-pipe system water, service water – hotter or colder
- VAV – direct or water to other AHU with heat recovery chillers, water source heat pumps
- Zoning – direct per thermal zone, individual space control, or sub zoning with air or water
  - Variable or constant speed, two speed or on/off - choices
- Controls – interface with all BMS to “tell” system what you want and need
  - Self diagnostics, comfort or performance alarm before failure

Resilience requires OPTIONS - CHOICES

Resilience requires elimination of proprietary

- **Must have** cross, forward and backward compatibility
- Availability of components and parts an essential element for resilience
- Refrigerant contained in factory-sealed circuits; refrigerants will change – just change the unit as with R-22

- Competition ensures cost control
  - New construction
    - Any mechanical contractor can install and commission hydronic systems
    - Multiple unit types and multiple manufactures units work on the same central system
    - Multiple manufacturers boilers, or pumps, or cooling towers, or pipe and fittings work together
  - Maintenance – Central system to a RANGE, the units provide specific functions
  - Service or replacement – because there are options there are multiple choices
  - Tenant finish options or churn – the central system does not change
- The Budget
  - Simplicity and Capability will effect costs for the life of the building
    - WSHP because they are indoors and water-cooled have a very long life

Easy to upgrade SYSTEM as Central system or Terminal equipment improve efficiency or function

The Budget – Hydronic options
District Application for resilient communities

WHY Hydronic – the lowest cost System

- High efficiency because water-cooled
- Energy sharing to reduce “new energy” cost
- The ability to maximize tenant finish choices
- Long life of all system components
  - Short life will kill all ROI calculations
  - Competitive bidding
    - Install, maintain, service, replace
    - **Non-PROPRIETARY**

The Community/District system design:
Community increases opportunities to share energy
Incorporate higher efficiency central system design
“Thermal Utility” renewables and infrastructure
Eliminate loses with district heating or chilled water
Energy sharing via ambient temperature water loop
– underground, resilient, sustainable –
immediate energy saved – all HVAC systems improve

Upgrades increase resilience - the system is already CAPABLE & Sustainable

- **Sustainable due to compatibility of components**
- **System efficiency and integration of renewables**
- **Refrigerant contained in factory-sealed and “tested as shipped” units**
- **Hydronics is all about the “Owner Requirements” not the system requirements**