MINNESOTA B3 GUIDELINES®

Introducing B3 Resilience Guidelines and the Resilience Worksheet Tool

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Liz Kutschke, Research Fellow, CSBR

February 25, 2021

OVERVIEW

- Logistics and Housekeeping
- Introduction to Resilience
- Resilience in B3
  - New and additional guidelines
  - B3 Resilience Worksheet Walk-Through
- Questions and Discussion

WEBINAR LOGISTICS

- Webinar is being recorded and will be shared on our YouTube page and at https://www.b3mn.org/guidelines/training-and-education/
- All attendees are on mute, please use the Question-and-Answer function during the presentation.
- For AIA credit, please provide your number in chat (if not previously entered)
- All attendees will be emailed a certificate of completion after the conclusion of this webinar
- A survey about this training experience and PDF slide deck will also be emailed after the webinar

WEBINAR LOGISTICS

- Closed captioning available for this webinar – in your Zoom window locate this button to turn subtitles and the live transcript on or off
  - For most users, this button is on the bottom with Chat and Q&A

B3 UPDATES

- Small Buildings Method
  - Finalizing right now
  - Will be available on website within next couple months
  - Upcoming training session, March 18th at 10:00am
    - https://z.umn.edu/SmallBuildingsMethod
- Best of B3 Virtual Recognition Event
  - Upcoming in April, invitations will be sent soon

REGENERATIVE DESIGN:
A BRIDGE BETWEEN SUSTAINABILITY AND RESILIENCE

Weeks after Tesla founder Elon Musk and Gov. Ricardo Rossello spoke about the tech company aiding Puerto Rico, Tesla says it has restored electricity to a children's hospital, using solar energy and batteries.

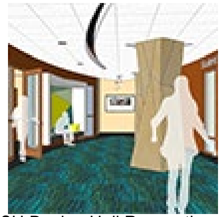
Tesla

MINNESOTA SUSTAINABLE BUILDING 2030

CASE STUDY METRICS – www.casestudies.b3mn.org


Bear Head Lake State Park


Hennepin County 911 Facility


BSU Decker Hall Renovation


MnSCU Mankato Clinical Sciences Building


Hamline Station


Tettegouche Visitor Center and Rest Area


Western U Plaza

Kendall's Payne Avenue Hardware


Big Bog State Recreation Area


Minnesota National Guard Winona Armory Renovation


MSU Science Education Building

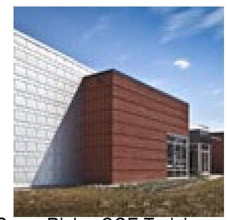

NHCC Biosciences and Health Careers Center

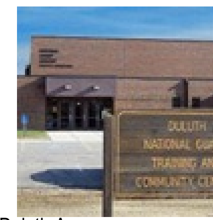

NCC Academic Partnership Center


SCC Classroom Renovation and Addition

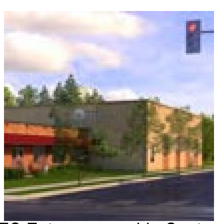

UMM Green Living and Learning Community

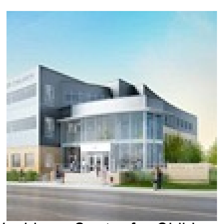

BSU Memorial Hall Renovation


Camp Ripley COE Training Facility

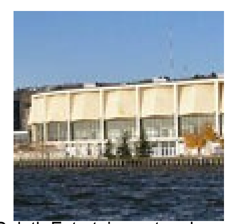

Duluth Armory


Maplewood Mall Parking Structure


PTC Entrepreneurship Center and Business Incubator

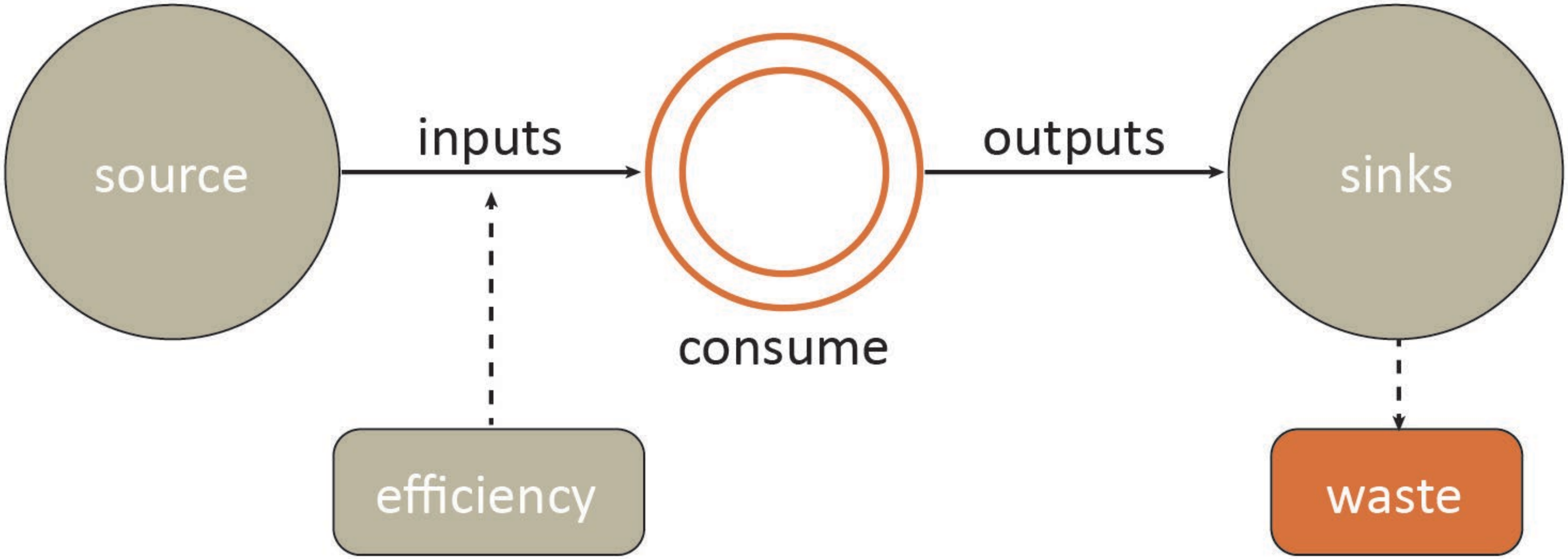

Washburn Center for Children


STCC Medium Heavy Truck and Auto Body


Duluth Entertainment and Convention Center


Silver Creek Corner

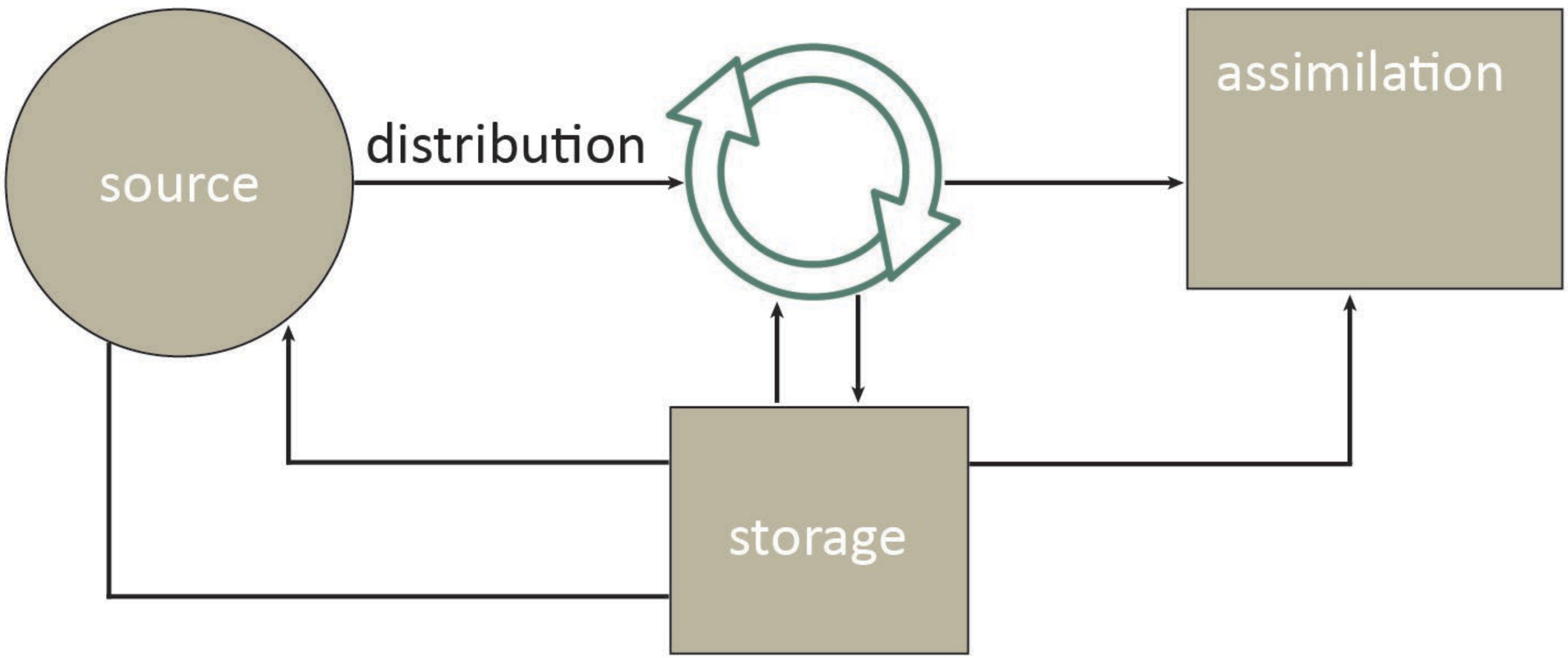
Existing Throughput Systems



- Efficiency as end goal
- Degenerative linear flows

John Tillman Lyle, Regenerative Design for Sustainable Development, 1994

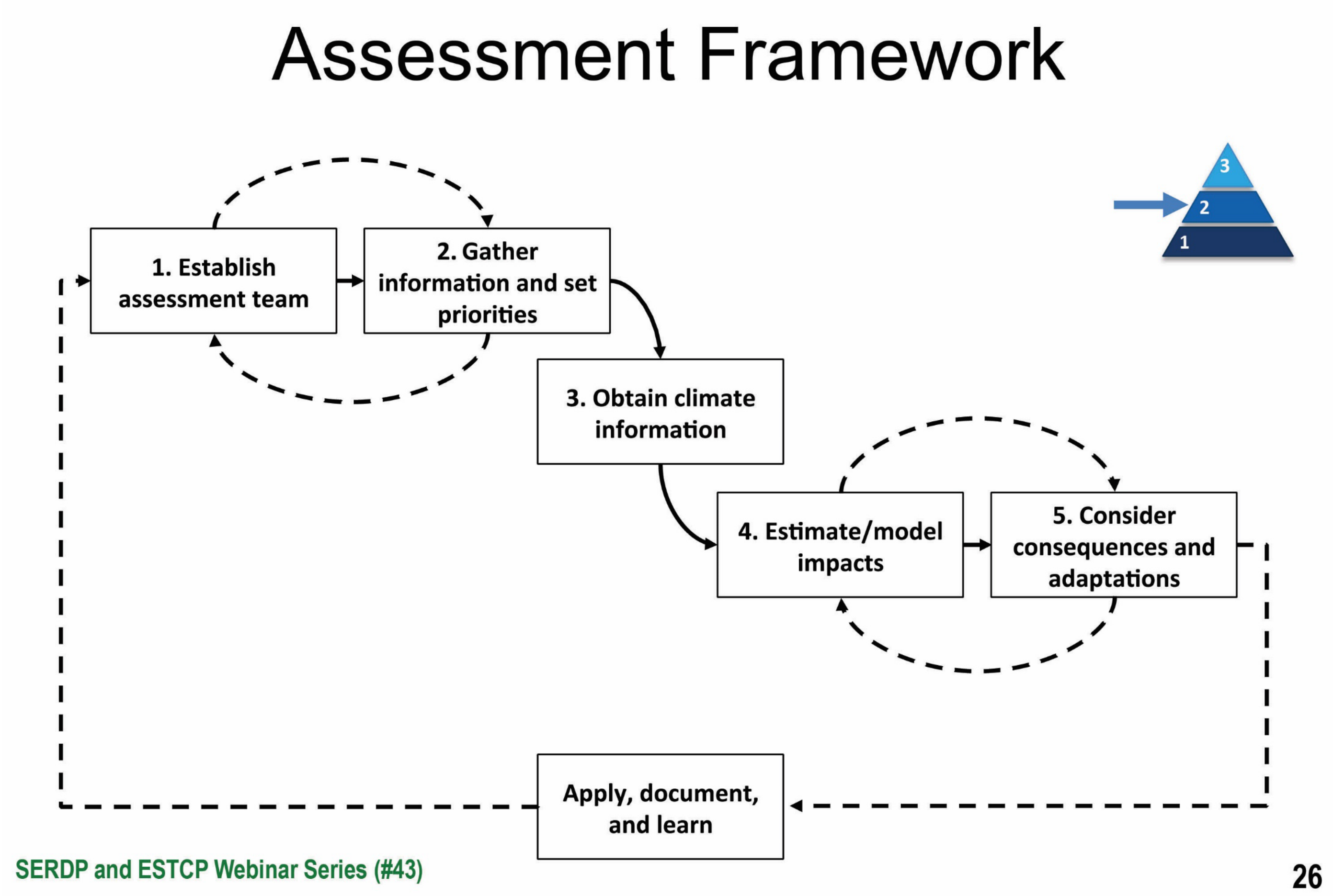
Regenerative Systems



- Effectiveness as end goal
- Within renewal capacity
- Integrate with natural processes
- Symbiosis
- Closed-loop system
- Multiple pathways

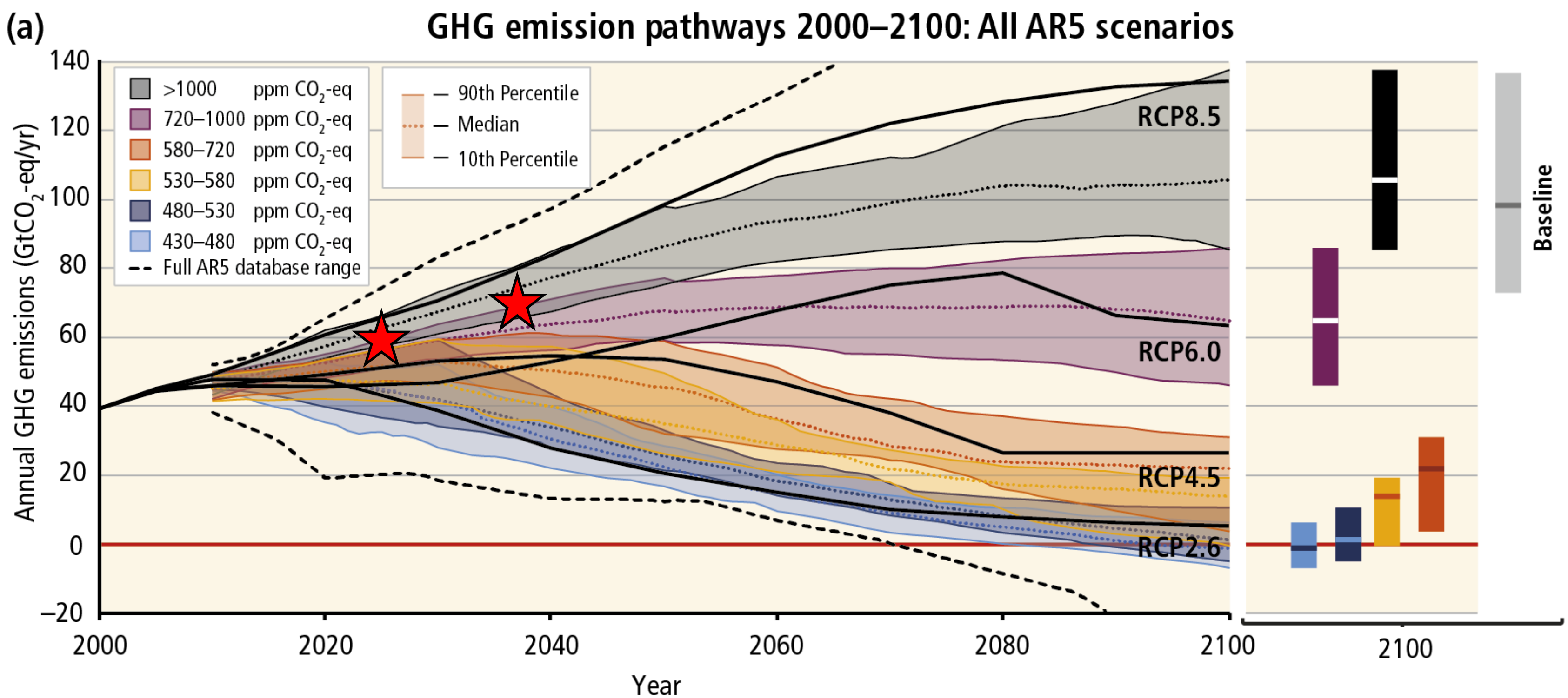
John Tillman Lyle, Regenerative Design for Sustainable Development, 1994

Vulnerability Assessment Framework



SERDP and ESTCP Webinar Series, Vulnerability Assessments and Resilience Planning at Federal Sites, 2016
Strategic Environmental Research and Development Program (SERDP), Environmental Security Technology Certification Program (ESTCP)

Future Weather Files



Intergovernmental Panel on Climate Change, Fifth Assessment Report. 2014

- Morphed weather files for the Minneapolis / Saint Paul Area
- Future performance analyzed using RCP 8.5, 50th percentile

Future Weather Files

Strategy	Hours: Actual and Percentage					
	Now		2030		2040	
Comfort	942	11%	885	10%	936	11%
Sun Shading of Windows	586	7%	778	9%	817	9%
High Thermal Mass	154	2%	217	2%	240	3%
High Thermal Mass Night Flushed	154	2%	228	3%	256	3%
Direct Evaporative Cooling	109	1%	179	2%	198	2%
Two-Stage Evaporative Cooling	111	1%	192	2%	216	2%
Natural Ventilation Cooling	104	1%	162	2%	170	2%
Fan-Forced Ventilation Cooling	72	1%	104	1%	106	1%
Internal Heat Gain	1589	18%	1353	15%	1361	16%
Passive Solar Direct Gain Low Mass	899	10%	826	9%	796	9%
Passive Solar Direct Gain High Mass	624	7%	559	6%	539	6%
Wind Protection of Outdoor Spaces	259	3%	254	3%	249	3%
Humidification Only	0	0%	0	0%	0	0%
Dehumidification Only	491	6%	659	8%	692	8%
Cooling, add dehumidification if needed	305	3%	549	6%	604	7%
Heating, add humidification if needed	4791	55%	4545	52%	4436	51%

Predicted Effectiveness of Comfort Strategies for Minneapolis / Saint Paul – Climate Consultant, UCLA Energy Design Tools Group

Future Weather Files

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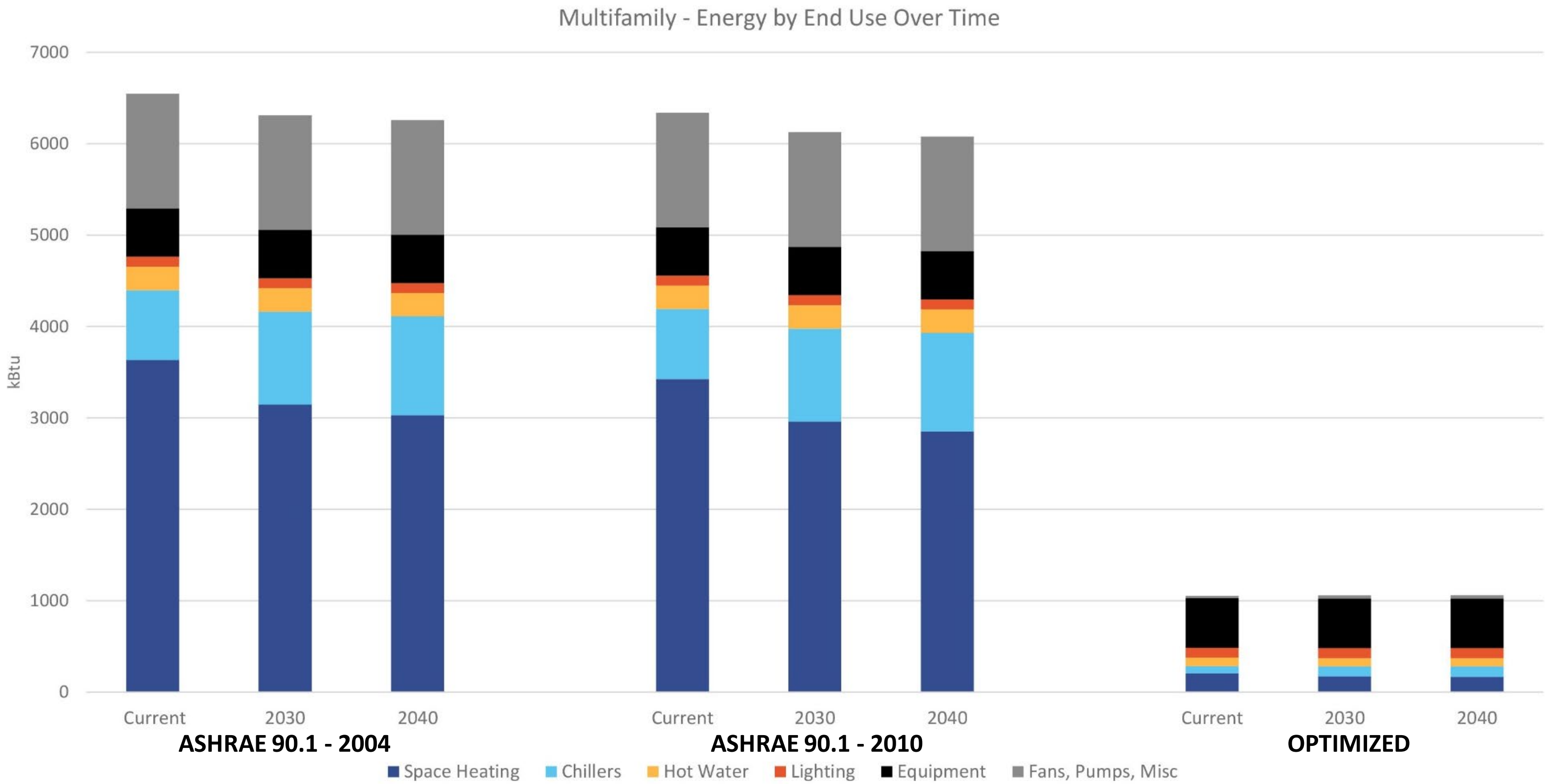
Future Weather Files

- Energy use in code buildings decreases over time
- Increase in cooling load is outweighed by decrease in heating loads
- Energy use in high performing buildings stable over time



Future Weather Files

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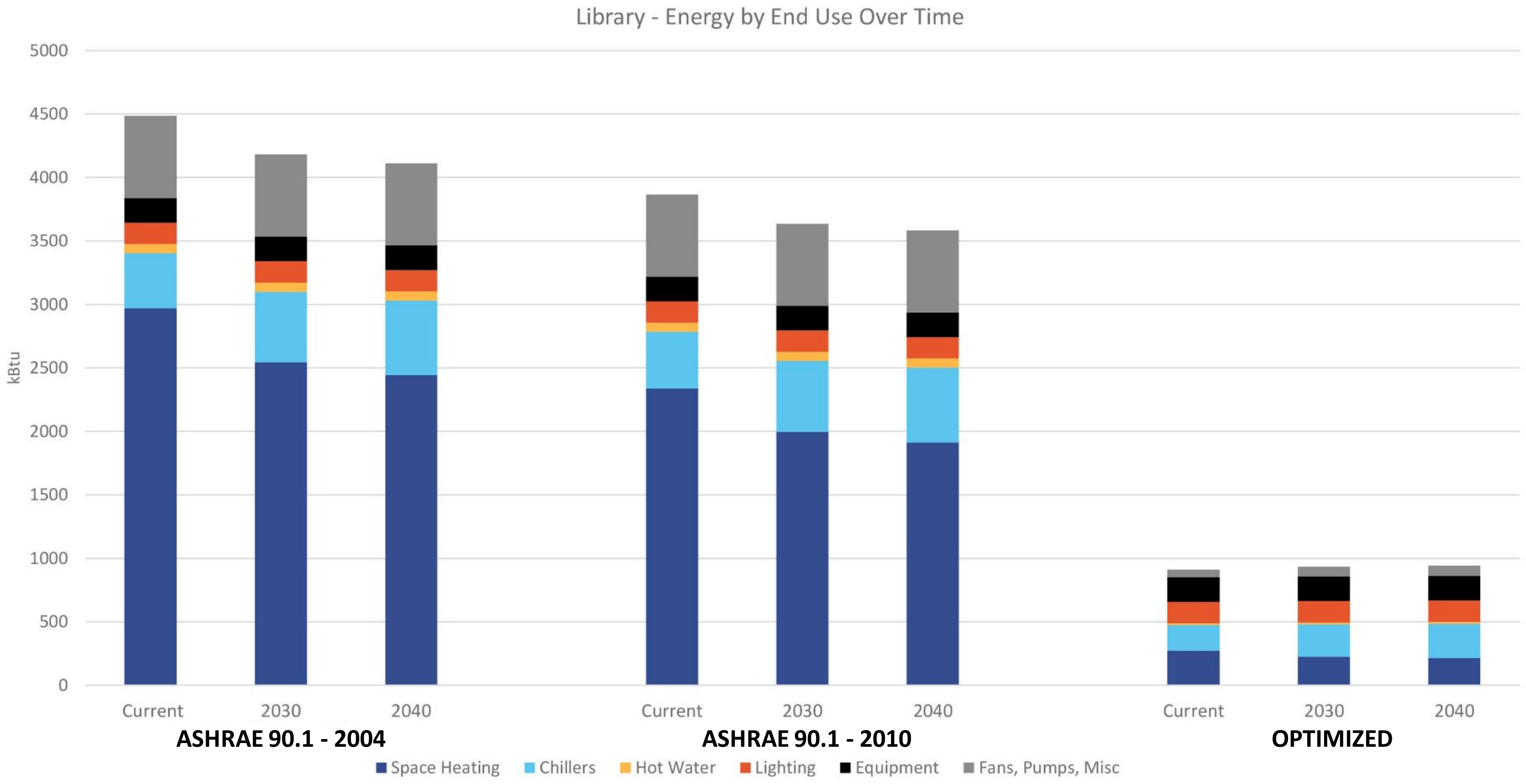
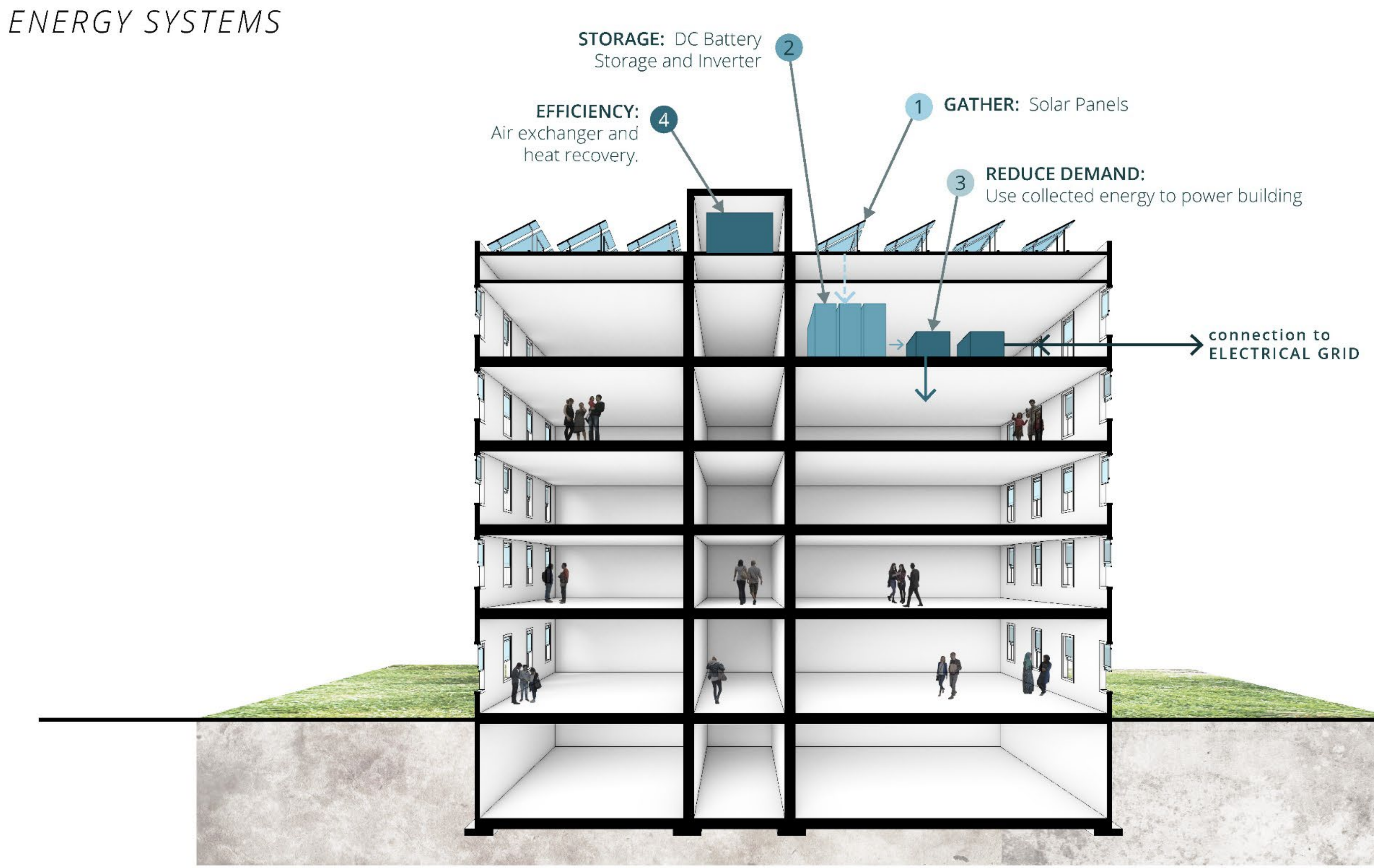


Prototype: Multi-Family Residential



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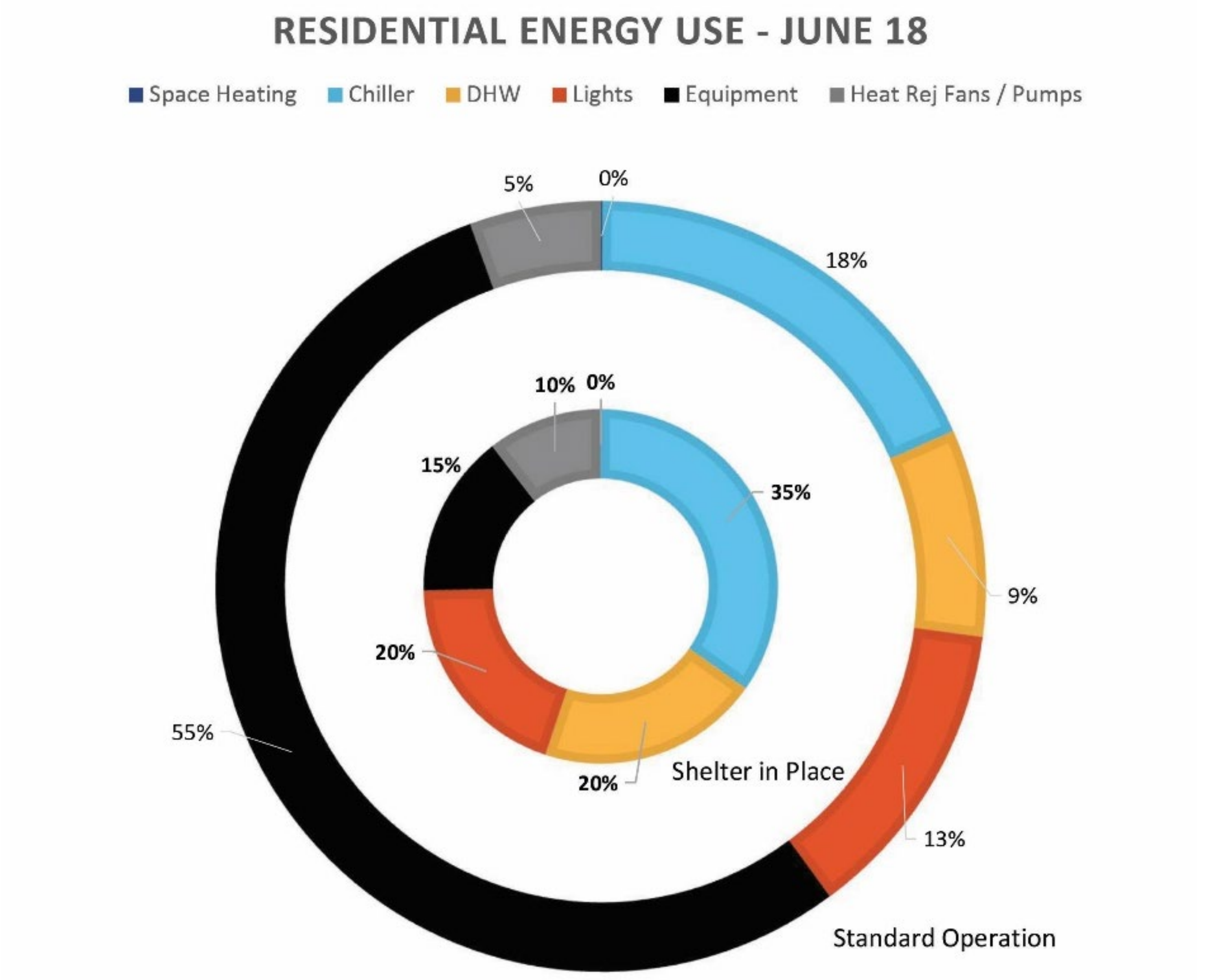
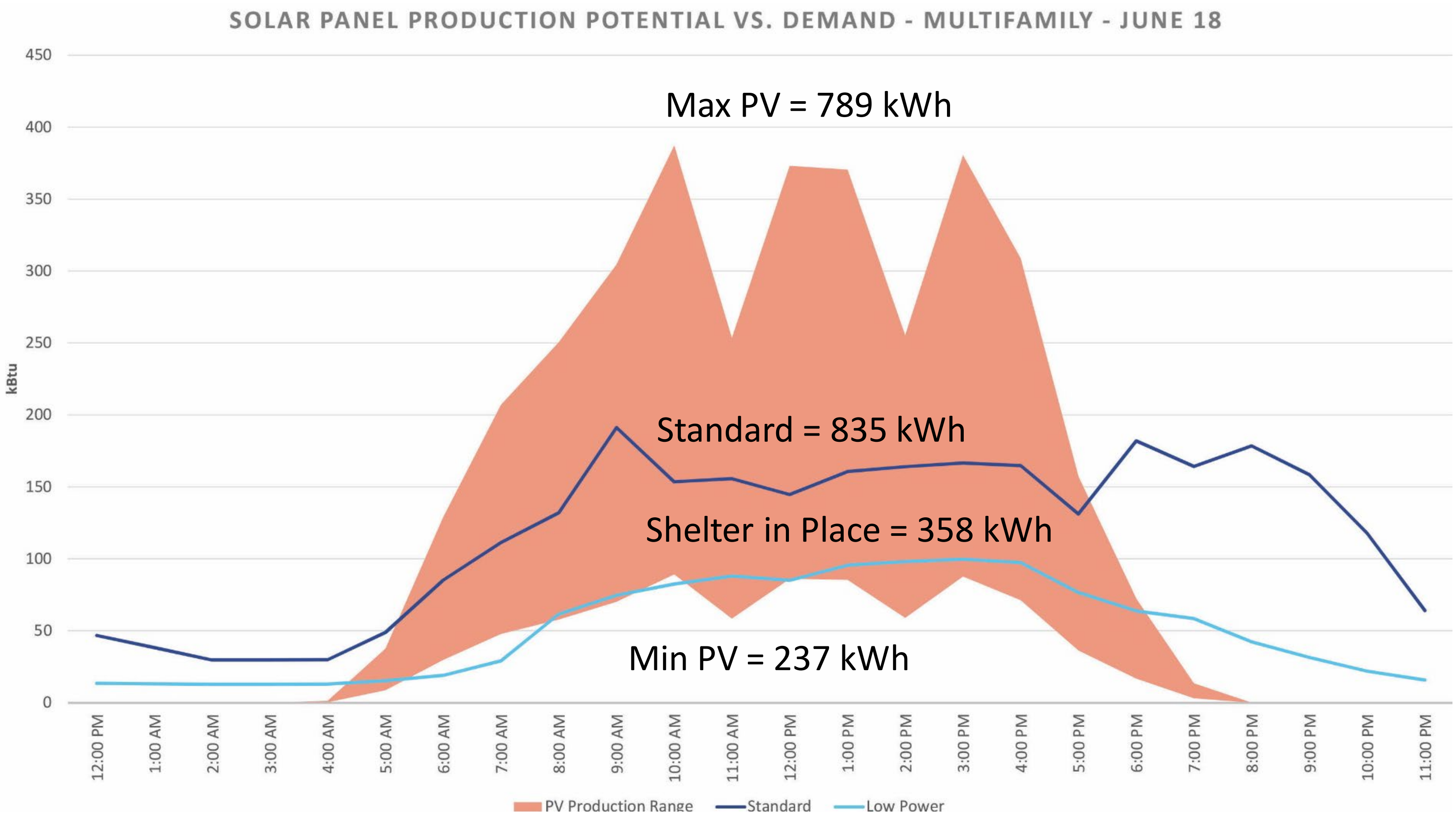


Simulated Energy Use during Standard Operation and Shelter in Place Operation. Energy Modeled in IES-VE 2015

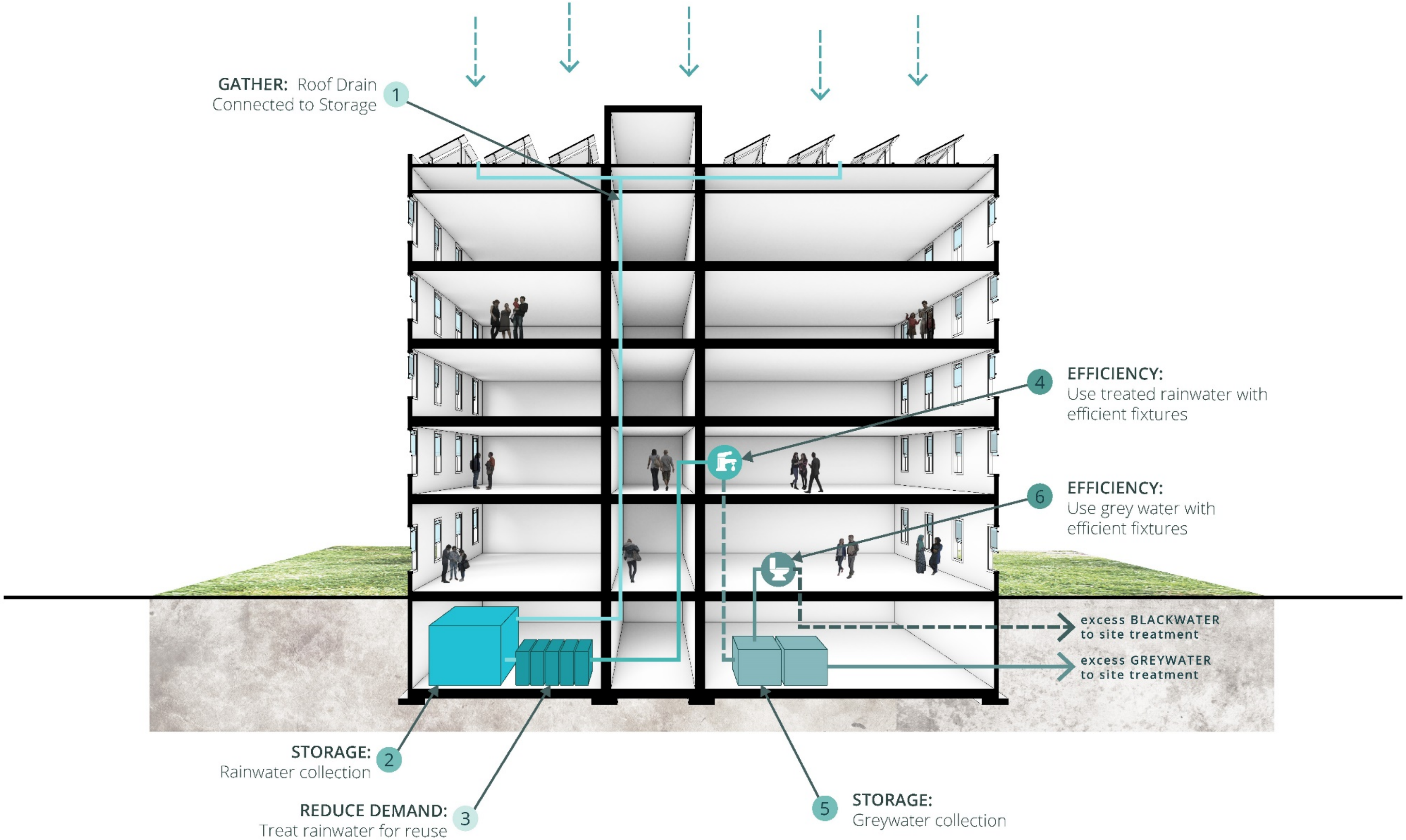
Prototype: Multi-Family Residential



Predicted PV Production and Predicted Energy Use. Energy Modeled in IES-VE 2015, PV data from NREL PVWatts

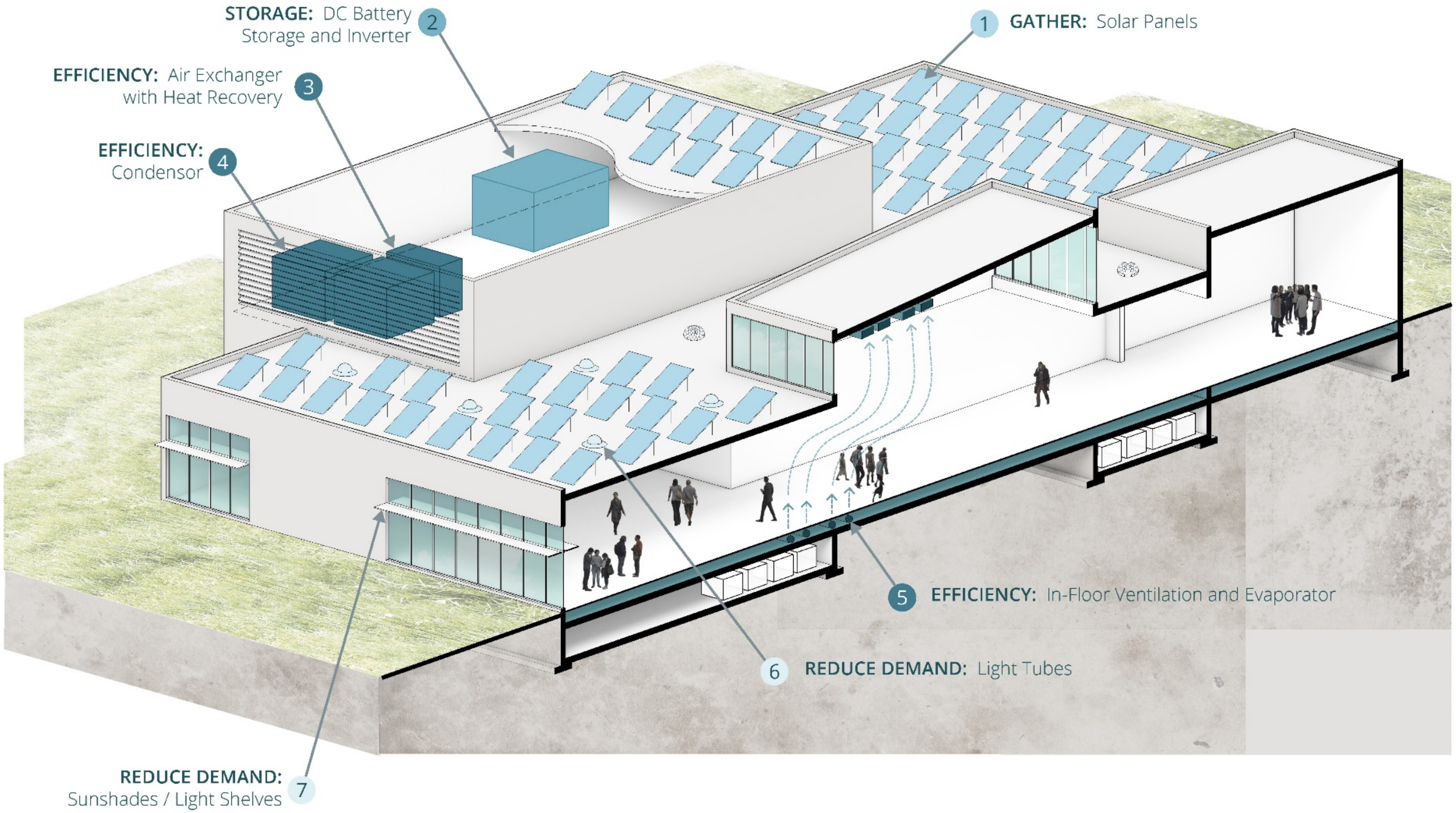
Prototype: Multi-Family Residential

WATER SYSTEMS



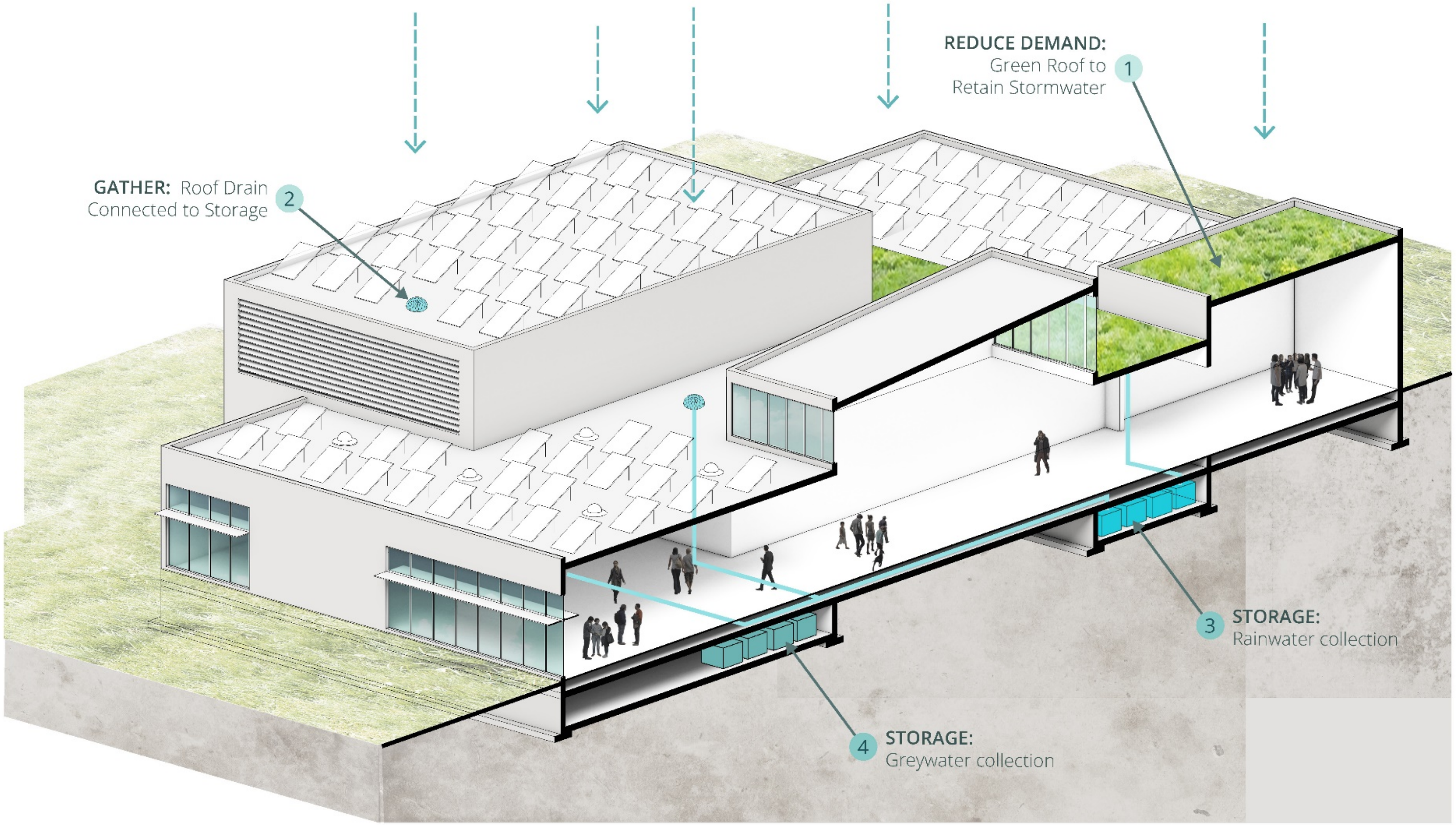
Prototype: Library

ENERGY SYSTEMS

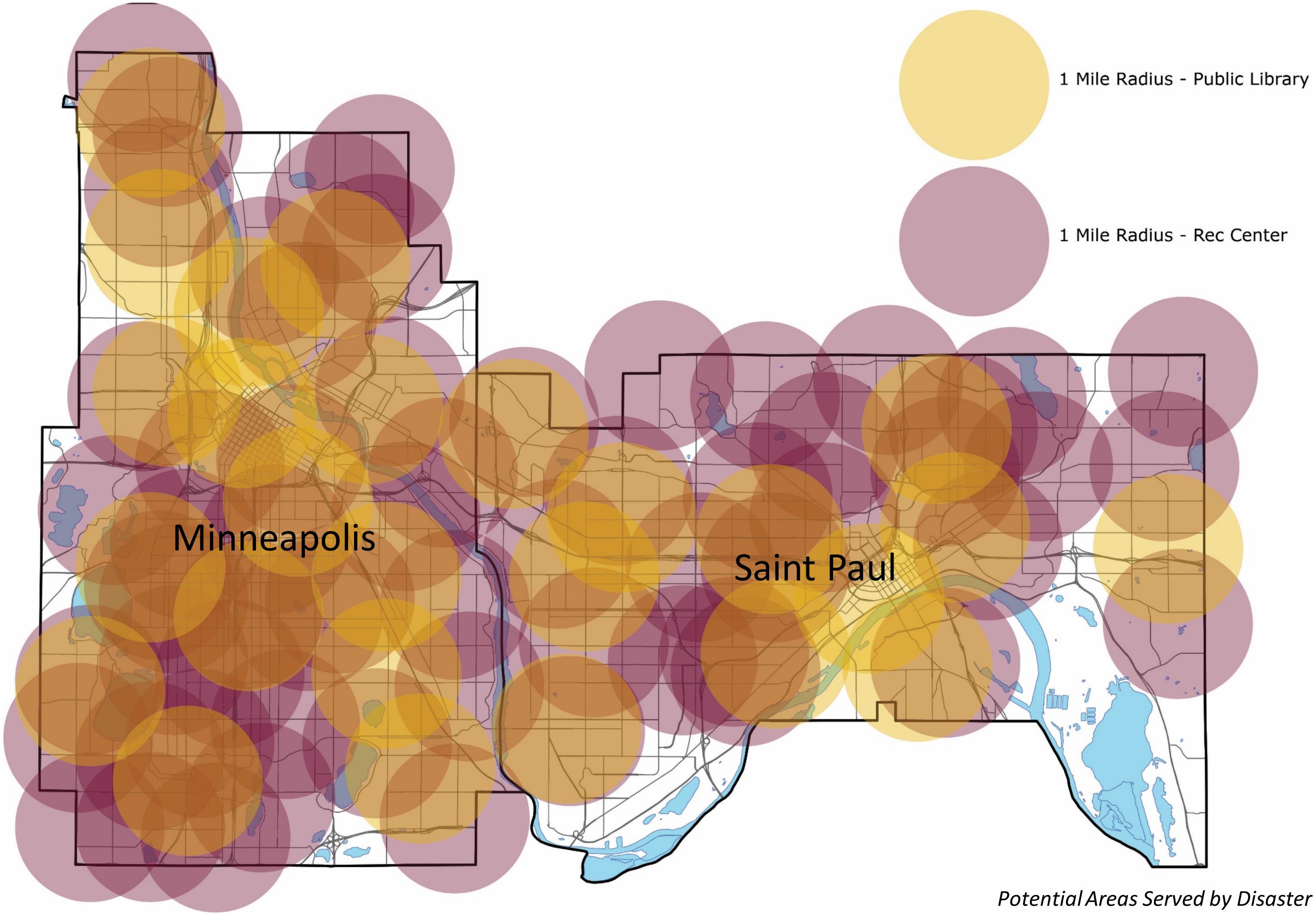


Prototype: Library

WATER SYSTEMS



Prototype: Library



Potential Areas Served by Disaster Hubs

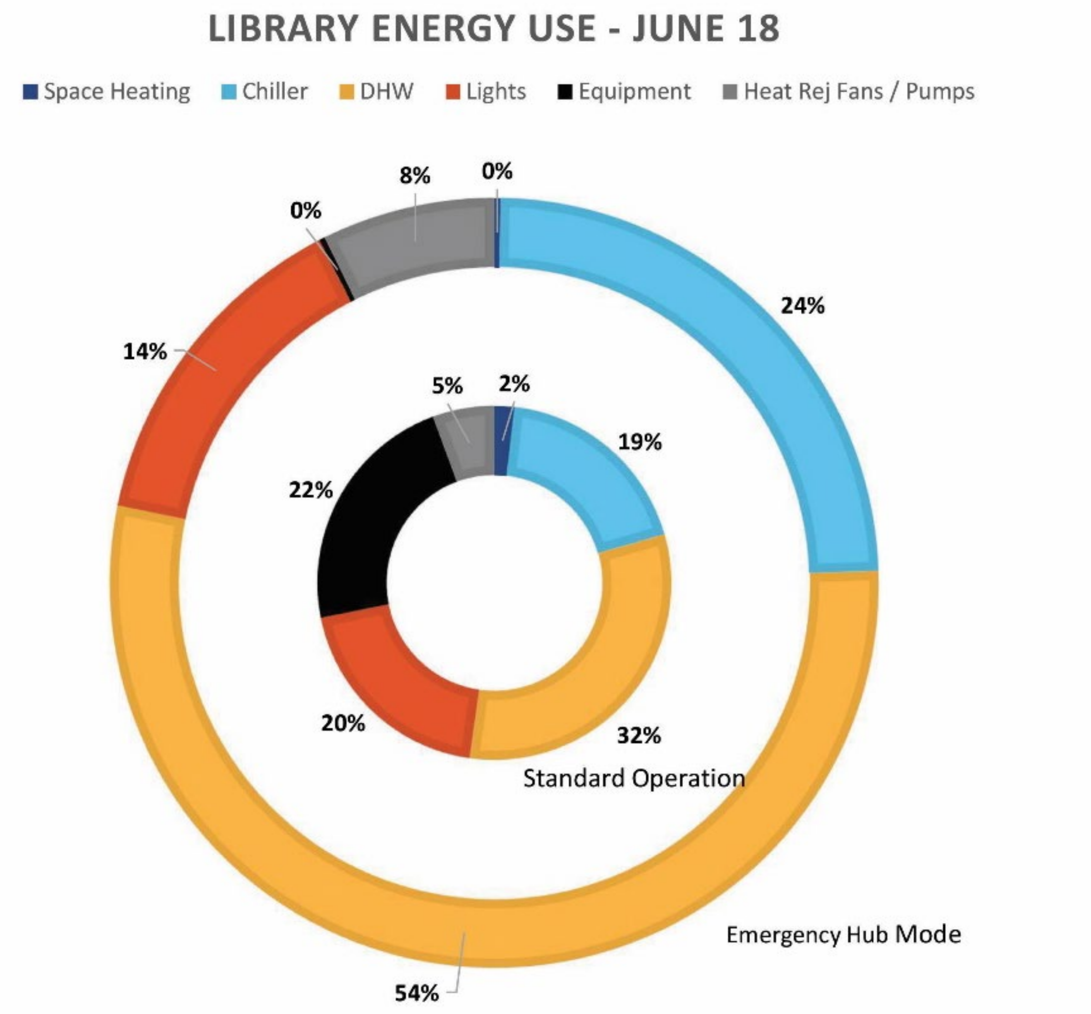
Prototype: Library

Library can support approximately 550 people in 'hub mode'

- Roughly 10% of population living within ½ mile
- Statistically will include:
  - 64 people with a disability
  - 125 people living within 150% of poverty line
  - 42 children under age 5
  - 52 people over age 65

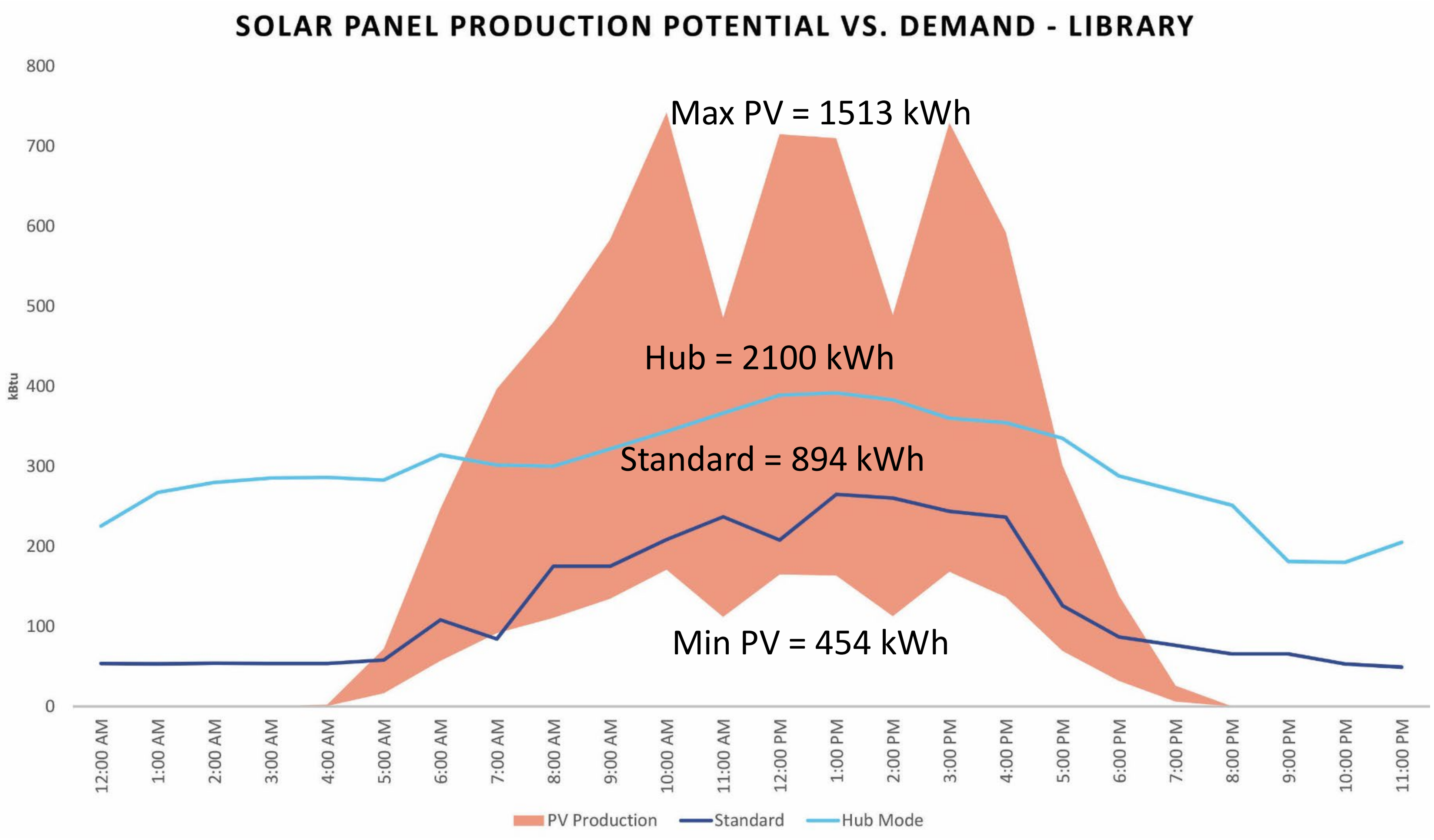
Potential Population Served by Disaster Hubs
American Community Survey, 2015

Prototype: Library



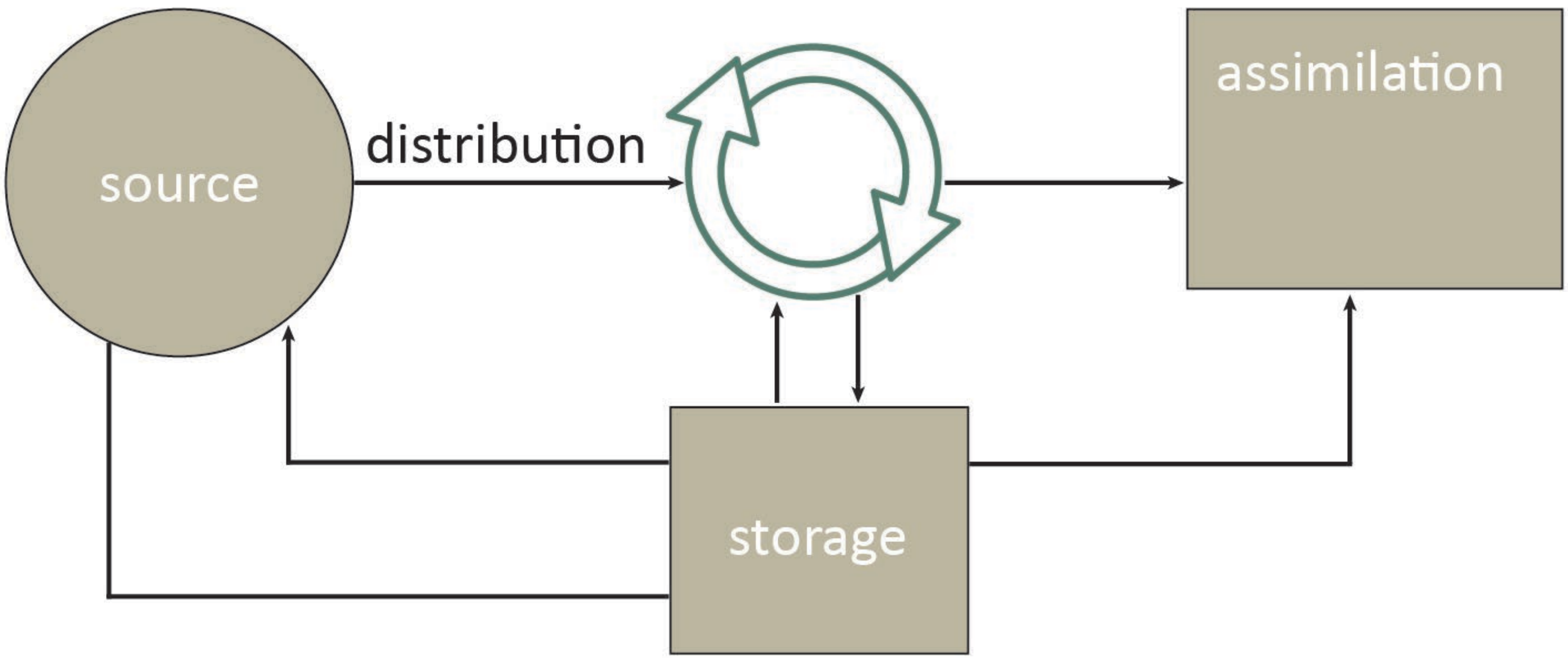
Simulated Energy Use during Standard Operation and Disaster Hub Operation. Energy Modeled in IES-VE 2015

Prototype: Library



Predicted PV Production and Predicted Energy Use. Energy Modeled in IES-VE 2015, PV data from NREL PVWatts

Regenerative Systems



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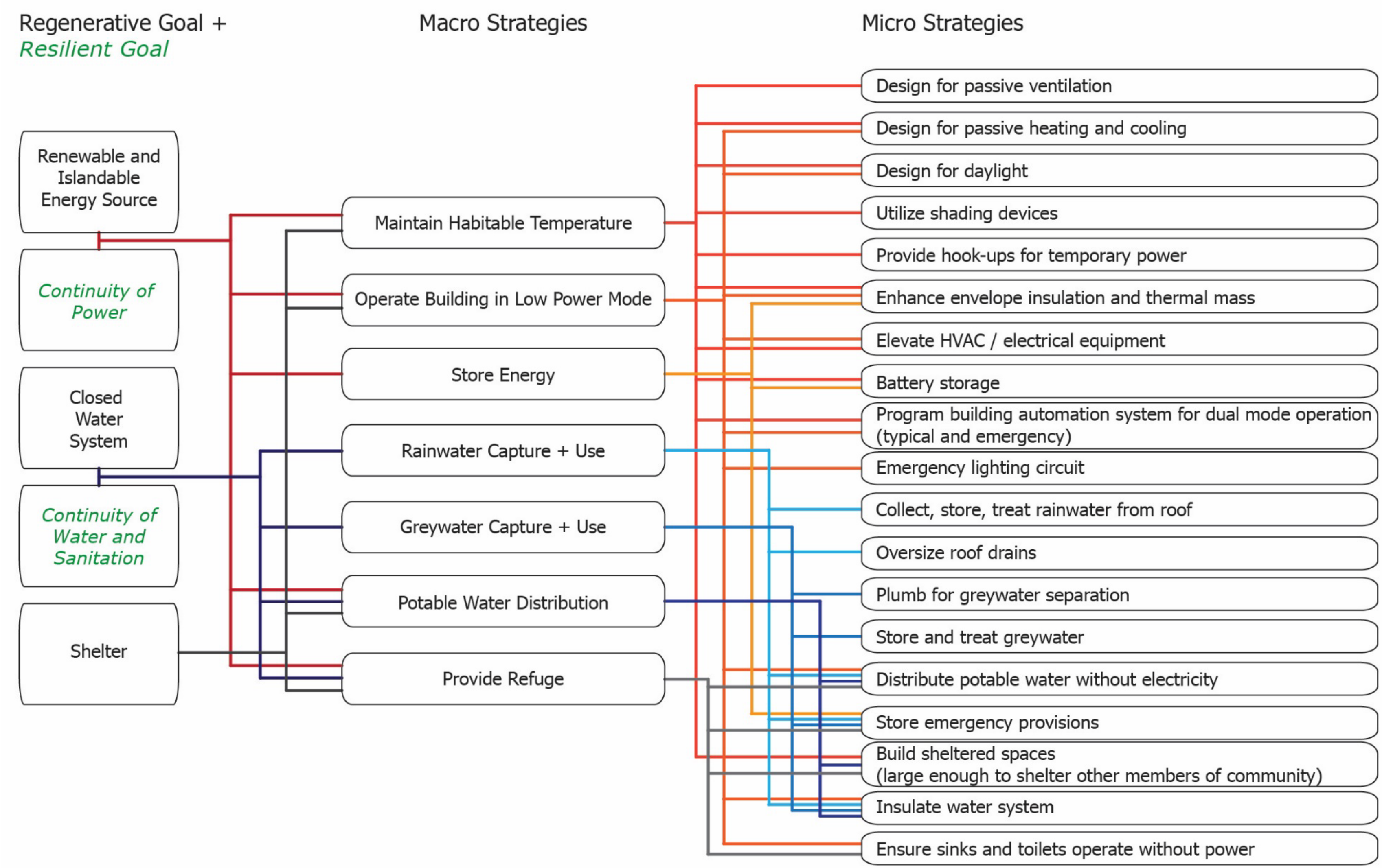
John Tillman Lyle, Regenerative Design for Sustainable Development, 1994

Regenerative and Resilient Design Strategies



RESILIENCE IN B3

OVERVIEW

- Timeline for development and implementation
- New guideline
- Additions to existing guidelines
- Resilience co-benefits from other guidelines
- Green building programs comparison
- B3 Resilience Worksheet Walk-Through

RESILIENCE IN B3 - DEVELOPMENT

2017 - CSBR starts exploring intersection between resilience and sustainability as components of regenerative design, including a research project funded by the MPCA

http://csbr.umn.edu/work/mpca.html

2019 – Initial review of resilience within existing B3 guidelines, identification of gaps and opportunities. Guideline and tool development commences.

March 2020 – Expert working group convened to review progress and advise development

Thanks to Laura Millberg, MPCA, Kenny Blumenfeld, DNR, and Terry Zien, US Army Corps for your time and knowledge!

Later March 2020 – world blows up / shuts down

November 2020 – Preliminary guidelines and resilience worksheet presented at AIA Minnesota Conference on Architecture

March 2021 – Resilience guidelines go live as 'Recommended' measures in Guidelines v3.2r01

January 2022 – Resilience guideline(s) become 'Required' measures for projects starting pre-design for Guidelines v3.3

NEW GUIDELINE – P.3

P.3 Vulnerability and Capacity Assessment and Resilience Planning

Intent

The processes included in these guidelines aim to bring awareness and intention to the functionality and role of the project in the event of a disruption of energy, water, communication, or other services. Building measures identified in this requirement contribute to the ongoing operational sustainability and adaptation to a changing climate and enhance a resilient response to a disruptive event.

Recommended Performance Criteria:

A. Using the B3 Resilience Worksheet, beginning at the pre-design or equivalent phase:
  a. Perform assessment of potential natural and human-made hazards and identify highest priority hazards and impacts at the site scale.
  b. Assess project attributes including building systems, occupants, and potential for back-up power. Identify vulnerabilities of building attributes during a disruption event.
  c. Establish goal(s) for response to highest priority hazard(s) during a hazard or disruption event.
  d. Identify resilient design strategy or strategies to implement in project to accomplish the resilience goal.

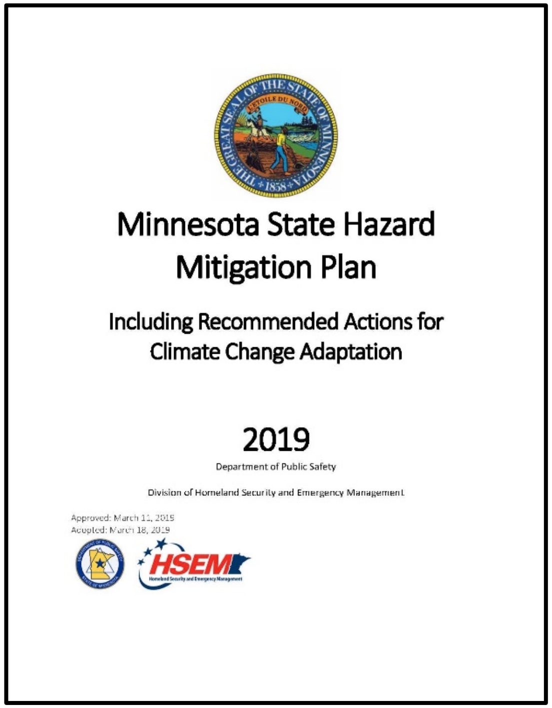
B. Integrate and implement at least one design strategy to mitigate a disruption event, based on the highest priority hazards and goals identified.

C. Provide documentation and information to building end users or occupants explaining resilient design features and the operation and maintenance of those features, if necessary.

D. Integrate and implement additional design strategies to enhance resilient response to highest priority hazard(s)

B3 RESILIENCE TOOL

- Excel worksheet tool
- County level data
  - Minnesota State Hazard Mitigation Plan, 2019
  - FEMA National Risk Index, 2020
- Natural hazards and human-made hazards
- System assessment and goal setting
- Resilient design strategy bank


Minnesota State Hazard Mitigation Plan

Including Recommended Actions for Climate Change Adaptation

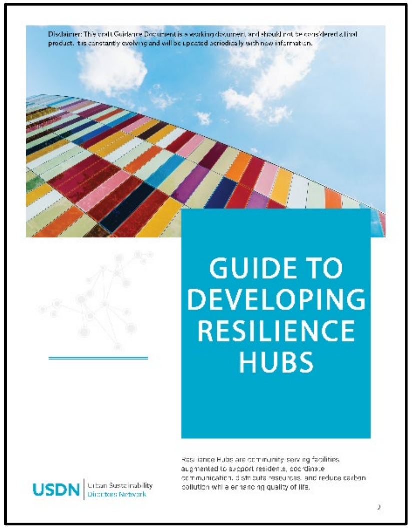
2019

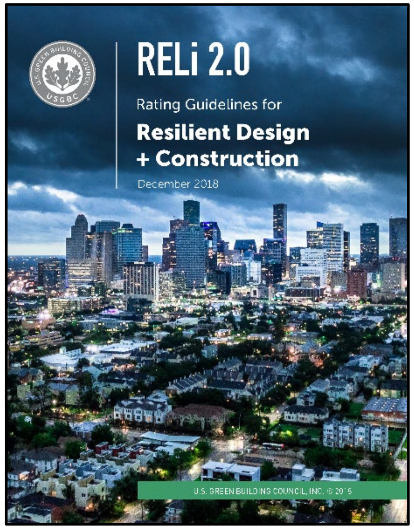
Department of Public Safety

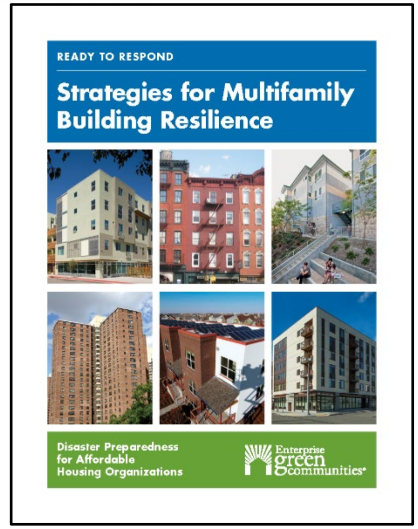
Division of Homeland Security and Emergency Management

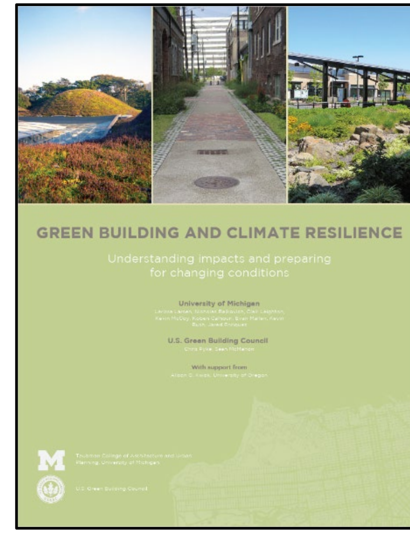
Approved: March 11, 2019
Accepted: March 18, 2019

DESIGN STRATEGY SOURCES

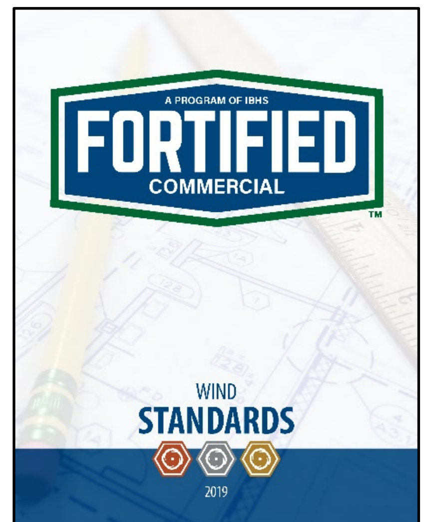








PILOT
CREDITS



ADDITIONS TO EXISTING GUIDELINES – E.1

E.1 Energy Efficiency

Recommended Performance Criteria

F. Using the SB2030 As-Designed tool, perform an annual energy model of the project with provided future-looking weather file to assess how changes in climate will impact the expected energy use of the building over its expected service life. Future weather may impact HVAC sizing, overall energy demand, or other performance aspects. Incorporate findings from this analysis into current building design, if relevant.

ADDITIONS TO EXISTING GUIDELINES – I.4

I.4 – Thermal Comfort

Recommended Performance Criteria:

C. Passive survivability – Demonstrate with energy modeling that a building will passively maintain thermally safe conditions during a power outage that lasts four days during representative extreme summer and winter time conditions.

ADDITIONS TO EXISTING GUIDELINES – M.2

M.2 – Environmentally Preferred Materials

Recommended Performance Criteria:

C. Specify and install window and door assemblies that meet the appropriate performance level identified in *ASTM E1996-Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes** when building in areas with a high-risk of hail, windstorm, or tornados, based on the B3 Resilience Worksheet.

D. Specify and install window and door assemblies that meet the appropriate performance level identified in *ASTM E2395-Standard Specification for Voluntary Security Performance of Window and Door Assemblies with Glazing Impact* when building in areas with a high-risk of civil disobedience or other risks, based on the B3 Resilience Worksheet.

E. Consider expanding termite range when specifying materials and detailing foundation system.

*Tool developed for hurricanes but appropriate for other windstorms capable of generating windborne debris.

EXISTING RESILIENCE IN B3

- Site and Water
  - S.1- Human System Connections
    - Human System Connections –Connections to bike paths, walking paths, water trails, and direct connection to existing or planned transit stops within half a mile. (Required)
  - S.2- Site Water Quality and Efficiency
    - Manage site water cycle – including runoff and stormwater quality to manage large rain events on site and avoid overloading municipal systems, while also protecting the building from water intrusion. (Required)
    - Follow FEMA flood protection requirements if building in flood plain, and building in floodplain is prohibited unless essential to the project (Required)
    - Reduce potable water use in project from baseline established by 1992 Energy Policy Act. This decreases the need for potable water required for non-consumptive uses, therefore extending potable water reserves while utilizing recycled water for non-consumptive purposes. (50% Required, 70% Recommended)
  - S.3- Soil
    - Soil management and erosion control to maintain the stability of the site in increasingly intense rain events and other weather events (Required)
  - S.4- Sustainable Vegetation Design
    - Biodiverse and non-invasive planting practices contribute to soil stability, stormwater management, and provide habitat and sustenance to other species (Required)
    - Site albedo at least 0.25 (Required) / 0.3 (Recommended). A low site albedo decreases the contribution to urban heat island effects, and increases the resilience of the larger area by mitigating some extreme day time and overnight temperatures.

EXISTING RESILIENCE IN B3

- Energy and Atmosphere
  - E.1- Energy Efficiency
    - Meet MN SB 2030 Energy Standards to ensure the building uses energy in the most efficient way, and that electrical loads critical to the resilient goals can be supported by renewable energy and battery storage (Required)
  - E.2- Renewable Energy
    - Provide 2% of energy needs with onsite renewables which could support critical electrical loads in the event of a grid power disruption. (Required)
    - Design and construct project to be renewable-energy ready so new or additional on-site renewable energy generation can be easily installed at a later date. (Required)
    - Resilient power infrastructure installation for one of three options: electrical grid disconnection and renewables with battery storage, grid disconnection and permanently installed generator and fuel storage, or grid disconnection and use of a portable generator. (Recommended)
  - E.3-Efficient Equipment and Appliances
    - Select new equipment and appliances that meet energy star criteria to decrease the overall electrical demand, and increase the amount of equipment and appliance able to function in a critical load scenario. (Required)

EXISTING RESILIENCE IN B3

- Indoor Environmental Quality
  - I.2- Moisture and Water Control
    - Control bulk water on site to direct water away from building to protect the enclosure construction and prevent water intrusion. (Required)
    - Design building envelope to manage moisture flow and maintain safe moisture levels to ensure structural stability, and to deter mold and mildew growth. (Required)
    - Construct building to control air leakage to maximize energy efficiency of heating, cooling, and ventilation systems, and to contribute to the overall moisture-safe envelope (Required)
  - I.4- Thermal Comfort
    - Passive thermal comfort – avoid high solar heat gain, avoid radiant temperature asymmetry, and utilize natural ventilation to provide comfortable conditions with the lowest amount of energy possible (Required)
  - I.5- Lighting and Daylighting
    - Demonstrate useful daylighting for program to maximize energy-free lighting, and to allow solar gain when it is useful to contribute to passive solar heating. (Required)
    - High reflectance interior surfaces to increase daylight utilization and promote daylight penetration further from exterior walls. (Recommended)

EXISTING RESILIENCE IN B3

- Indoor Environmental Quality, continued
  - I.8- Ergonomics and Physical Activity
    - Provide showers, changing facilities, and lockers for both day-to-day use, and for use in the event of the building sheltering occupants for an extended period of time during a disaster event. (Recommended)
    - Select site located maximum 1/3 mile from at least five basic services to allow human powered transportation and connection in the event of a transportation network disruption. (Recommended)
  - I.9- Wayfinding and Universal Access
    - Interior wayfinding should be easily understood by regular and occasional users of the building to ensure safe and efficient evacuations or to direct occupants to shelter spaces (Required)
    - Universal design principles should be implemented in any building with a goal of sheltering people during a disaster event to safely accommodate occupants of all abilities (Required)

EXISTING RESILIENCE IN B3

- Materials and Waste
  - M.3- Waste Reduction and Management
    - Select materials with appropriate durability for service life to ensure building materials do not fail due to weather events, and are repairable if damaged (Required)
    - Address partial and total deconstruction in the event the building is damaged beyond repair, consider which materials and components may be salvaged and reused or recycled to contribute to a more resilient materials economy (Required)
  - M.4- Health
    - Demonstrate reduction of likely hazardous materials to protect occupant health in the event of extended habitation of a space, possibly in conditions that exceed the design parameters (over-crowded, longer operational hours, etc.) and that will not harm human or environmental health if exposed to the elements during a disaster event. (Required)

PEER PROGRAMS – OPTIONAL MEASURES

LEED v4.1

IPpc98 – Assessment and Planning for Resilience

Intent: "To encourage designers, planners and building owners/operators to proactively plan before design commences for the potential impacts of natural disasters or disturbances as well as address issues that impact long term building performance such as changing climate conditions"

Requirements:

1. Prerequisite Hazard Assessment
   a. Identify the potential high risks associated with natural hazards affecting the site and building
   b. Solicit input from client on site-specific hazards and identify top three hazards for future planning
2. Climate Related Risk Management Planning OR
   a. Complete a vulnerability assessment of impacts associated with climate change over project service life
   b. Perform a climate risk management analysis to identify climate risk factors that the project should take into account
   c. Based on risk factors, develop site selection (if possible), programming, planning and design parameters to reduce vulnerability or increase resilience
3. Emergency Preparedness Planning
   a. During pre-design, prepare the Red Cross 123 Assessment and Facility Description Forms to identify specific emergency preparedness features of the building and planning process

PEER PROGRAMS – OPTIONAL MEASURES

LEED v4.1

IPpc99 – Design for Enhanced Resilience

Intent: "Design and construct buildings that can resist, with minimal damage, reasonably expected natural disasters and weather events (i.e. flooding, hurricanes/high winds, tornadoes, earthquakes, tsunamis, drought, wildfires, landslides, extreme heat, and winter storms).

Requirements:

1. For any two of the top three hazard-related risks identified in 'IPpc98 – Assessment and Planning for Resilience,' implement the mitigation strategy processes described below.
    a. Flooding – ReLi or FEMA guidelines
    b. Sea Level Rise – NOAA guidelines
    c. Wildfire – ICC 2012 International Wildland Urban Interface Code or 2013 NFPA 1144
    d. Hail – Fortified Commercial High Wind and Hail
    e. Hurricanes and High-Wind Areas – Fortified Commercial Hurricane or High Wind and Hail, FEMA wind zone guidelines, FEMA storm shelter guidelines
    f. Earthquake – ARUP's REDi system
    g. Tsunami – Designing for Tsunamis: Seven Principles for Planning and Designing for Tsunami Hazards
    h. Drought – LEED water efficiency credits
    i. Landslides / unstable soils – consult with geotechnical engineer
    j. Extreme heat – meet minimum of six extreme heat mitigation strategies across site, enclosure, and systems
    k. Winter storms – meet minimum of six winter storm mitigation strategies across site, enclosure, and systems

PEER PROGRAMS – OPTIONAL MEASURES

LEED v4.1

IPpc100 – Passive Survivability and Back-Up Power During Disruptions

Intent: ‘To ensure that buildings will maintain safe thermal conditions in the event of an extended power outage or loss of heating fuel or provide backup power to satisfy critical loads. The electricity needed by a building to maintain a reasonable level of functionality during an extended power outage will vary greatly depending on building function.’

Requirements:

1. Provide for passive survivability
   a. Demonstrate with energy modeling or PHIUS certification that a building will passively maintain thermally safe conditions during a power outage that last four days during peak summer and winter time conditions.
2. Provide backup power for critical loads
   a. Demonstrate that adequate emergency power will be available to provide for critical loads that have been identified by the design team as being necessary for the building. The time duration for backup power varies based on the building type.

PEER PROGRAMS – OPTIONAL MEASURES

- Enterprise Green Communities
  - Resilient Communities: Multi-Hazard / Vulnerability Assessment (10 pts)
  - Resilient Communities: Strengthening Cultural Resilience (8 pts)
  - Access to Potable Water During Emergencies (8 pts)
  - Resilient Energy Systems: Flood Proofing (8 pts)
  - Resilient Energy Systems: Critical Loads (8 pts)

B3 RESILIENCE TOOL WALK THROUGH

- Please follow along with the spreadsheet tool
- Share experience, issues, results in the chat
- Reminder – this is being recorded and will be available online

QUESTIONS AND DISCUSSION

- Follow up questions or comments – email Liz at kutsc009@umn.edu

THANK YOU FOR ATTENDING!

REMINDER

- Watch your email for PDF slides, training session survey, and completion certificate