The South End suffered greatly from flooding caused by Superstorm Sandy and sustains other chronic and acute flood conditions. To increase confidence that future extreme weather events will not bring a repeat of the impacts of Superstorm Sandy, WSP evaluated the technical and financial performance of various options for achieving higher levels of resilience.

The figure below shows existing and planned energy assets that were considered for integration into a community-wide energy resilience strategy. In the South End, WSP conducted extensive inventorying of the conceptual recovery of waste heat from the auxiliary cooling system of the new PSEG combined cycle power plant (Harbor Unit 5) and using it in a heat-to-energy resource for the later phases of development of the South End Thermal Loop.

### MOSCONTE CENTER EXPANSION

1. SF PUC provides the building with electricity zero emissions.
2. Largest roof PV array in San Francisco (600+ kW) over an occupied space.
3. Daylight harvesting in above ground spaces improves visitor’s connection to the environment and reduces lighting energy.
4. Ultra-tuned Mechanical HVAC system calibrated to Moscone’s on/off cycle of scheduled calendar events provides 100% fresh air for most of the year and enables a whole building energy savings of 30% to 40% below a convention center built to national code standards.
5. Net Zero/Zero 1.5/2.5/2.2+ gallons of ground and rainwater captured annually (equivalent to 5 Olympic-sized swimming pools) and reused for the Moscone Expansion’s toilet flushing and irrigation, as well as exported for San Francisco street cleaning and irrigation.
6. The Martin Luther King Jr Memorial Fountain.
7. South End Energy Strategy
8. Resilient Bridgeport

The concept considered here uses heat pump technology to achieve a water temperature that can be effectively used by the South End Thermal Loop. This concept enables the power plant to export some of its heat to the district heating system, where it can be used to heat either the ultimo-thermal energy resource (the electricity power generation plant) or back to the building during the summer.

### RESILIENT BRIDGEPORT

**SOUTH END ENERGY STRATEGY**

Submitted to Connecticut Department of Housing
Prepared by WSP USA

The South End Energy Strategy was developed to create a heat pump system that would be able to achieve a water temperature that can be effectively used by the proposed South End Thermal Loop. The strategy also includes the conceptual recovery of waste heat from the auxiliary cooling system of the new PSEG combined cycle power plant (Harbor Unit 5) and using it in a heat-to-energy resource for the later phases of development of the South End Thermal Loop.

### Net Zero Water

- 5,500,000+ gallons of ground and rainwater captured annually (equivalent to 8.5 Olympic-sized swimming pools)
- Reused for the Moscone Expansion’s toilet flushing and irrigation, as well as exported for San Francisco street cleaning and irrigation

### Ultra-tuned Mechanical HVAC

- Provides 100% fresh air for most of the year
- Enables whole building energy savings of 30% to 40% below a convention center built to national code standards

### Daylight Harvesting

- Improves visitor’s connection to the environment
- Reduces lighting energy

### Proposed NuPower Loop

- Includes heat recovery from the PSEG combined cycle power plant
- Increases level of heating energy supplied to the South End

### Estimated Parameters of Heat Recovery Equipment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Rejection (mm Btu/hr)</td>
<td>2016</td>
<td>2017</td>
<td>2018</td>
<td></td>
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<tr>
<td>Condenser Water Flow Rate (gpm)</td>
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<tr>
<td>Condenser Water Outlet Temp (ºF)</td>
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<tr>
<td>Condenser Water Inlet Temp (ºF)</td>
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<tr>
<td>Net GHG emissions reduction (mtCO2e)</td>
<td>2016</td>
<td>2017</td>
<td>2018</td>
<td></td>
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<tr>
<td>Total installed cost ($)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Maintenance cost ($)</td>
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</tr>
<tr>
<td>Electricity cost ($)</td>
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<tr>
<td>Heat pump electricity usage (MWh)</td>
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</tr>
<tr>
<td>Amount of heat recovery (mmBtu)</td>
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</tr>
<tr>
<td>Hours of heat recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average heat recovery rate (mmBtu/hr)</td>
<td>2016</td>
<td>2017</td>
<td>2018</td>
<td></td>
</tr>
</tbody>
</table>

Based on the three years of hourly power generation data, WSP estimated the average rate of heat recovery in each season and the number of hours per season that the heat recovery equipment would be available. The estimated rate of heat recovery is the amount of heat rejected by the PSEG plant for each hour of typical winter, spring, summer, and fall days during 2016, 2017, and 2018. These load shapes reflect the hours of the year that can be expected to have waste heat available from the auxiliary cooling system.

### Estimated Performance of Heat Recovery Equipment

- **Net ZEROS**: Provides the building with electricity zero emissions
- **Largest roof PV array in San Francisco (600+ kW) over an occupied space**
- **Daylight harvesting in above ground spaces** improves visitor’s connection to the environment and reduces lighting energy
- **Ultra-tuned Mechanical HVAC** system calibrated to Moscone’s on/off cycle of scheduled calendar events provides 100% fresh air for most of the year and enables a whole building energy savings of 30% to 40% below a convention center built to national code standards

### Proposed Scenario 3

- **District Heating Network**