WELCOME!

SAME OC Post
Presents:

ENERGY & INFRASTRUCTURE RESILIENCY

27 May 2021

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Sustaining member companies and public agencies, and individual members benefit from the programs, and initiatives led by the SAME Orange County. Highlights of membership at the OC Post include:

- Seminars, Workshops and Meetings for the Architecture, Engineering, and Construction / Consulting Industry Professional: meet and hear from top caliber Speakers, Presenters and Workshop Facilitators

- Engage in technical competency and professional development opportunities

- Network with representatives from other companies and government agencies

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APS Development

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PROJECT X CORROSION ENGINEERING

Corrosion Control – Soil & Forensics Lab

Agenda

- Presentations
  - SAME OC Resiliency Committee Chair Introduction
  - Resiliency Consideration at Military Facilities
- Sponsor Recognition
- Close

Reminder for Q&A

- Please click on “?” or “Show Q&A” in upper right corner
- Click “Ask a Question”
- Type question
- You can “upvote” the question that most interests you

SAME OC Resiliency & Readiness Committee Summary

- Presenter: Steven Tayanipour, SAME OC Resiliency & Readiness Committee Chair, PE, SE, Fellow ASC, Fellow SAME

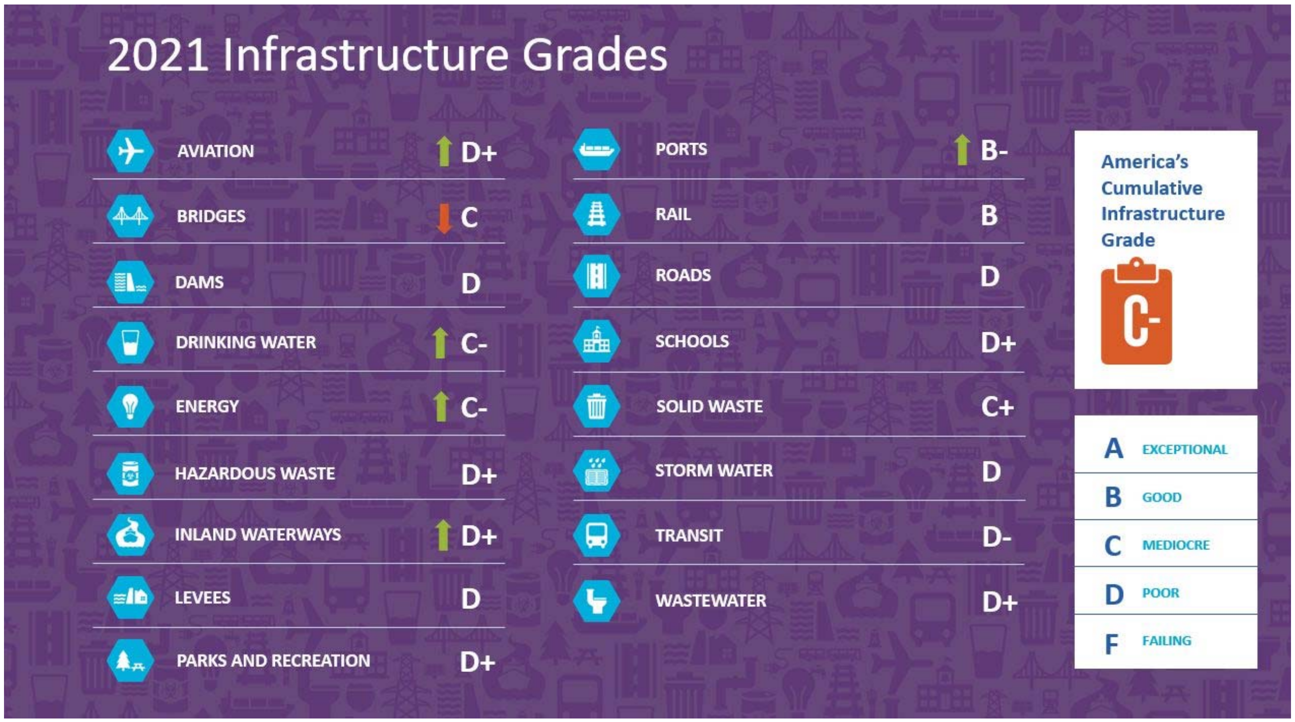
Resiliency & Readiness

Presenter: Steven Tayanipour, PE, SE, F. ASCE, F. SAME

- **Program Overview:**
  - $ 5.9 Trillion needed to be invested in our infrastructure
  - With COVID-19, this estimate will only increase

- Without the investment it will cost lives:
  - Oroville Dam Spillway Breach
  - 1971 Sylmar Earthquake
  - 1989 Loma Prieta Earthquake
  - 1994 Northridge Earthquake
  - 2005 Katrina Levee Failure, with Total Fatalities: 1833

USA 2021 Infrastructure GPA



OROVILLE DAM SPILLWAY FAILURE—188,000 Homes Evacuated

1971 SYLMAR EQ., Parking Structure Failure; deficient code!

1971 SYLMAR EQ-Fwy. Connectors collapses-1

1971 SYLMAR EQ-Fwy. Connectors collapses-2

1953 construction, with deficient code, based on 1971 Sylmar EQ. finding!

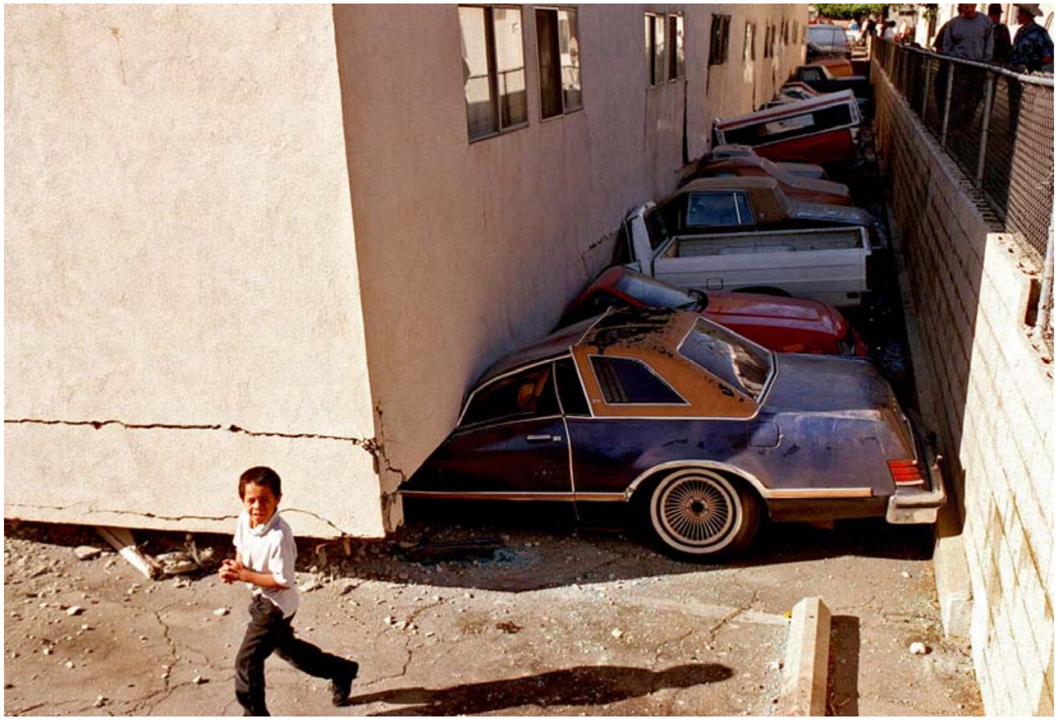
1953 Construction; WHY NOT RETROFITED even when Warned about its Deficiency

6.4 $Billion, post EQ. Retrofit Cost! LA Times initial estimate was $250 Mil.!

Northridge Jan. 17, 1994 Earthquake

Northridge Jan. 17, 1994 Earthquake

Northridge Jan. 17, 1994 Earthquake



Katrina's true cost was $250 billion, according to the Univ. of North Texas Professor Bernard Weinstein. He includes both the damage and its economic impact. The worst flooding occurred in 'low-income, mostly uninsured area that. Insurance Company LO$$E$ (?) NOT included to the TOTAL CO$T of the DAMAGE! And, how about LO$$ of LIVES & Opportunity CO$TS?!! Total Fatalities 1833.

Katrina 2005: 300,000 homes became Uninhabitable! Total Fatalities 1833.

Squeaky wheel gets the Grease/Oil ($$'s)

- Namely, PUBLIC AGNCIES may consider trying NOW, if not done already, to do their homework, to qualify for the FUND$$$ & prepare their--list working with their in-house and/or consultants' support team to IDENTIFY the deficient infrastructures which is their responsibility to FIX, ASAP!

For the first time in 20 yrs. our Infrastructure GPA is a C- up from a D+ in 2017; this is a good news, namely, we are heading in good direction!

- WHAT HAPPENED POST 1971 EQ.; WE DID VERY LITTLE TO RETROFIT DUE TO DEFFICIENT CODE
- CALIF. REPORT CARD OF 2019; C's &D's
- PAY NOW OR PAY MORE LATER;

**EACH $1 WE SPEDND ON INFRASTRUCTURE AVE $6 ON FUTURE LO$$

**REVAMP 20,000 MILES OF ROADWAY/HWY

& REPAIR 10,000 BRIDGES

Resiliency Considerations at Military Facilities

- Presenters:
  - Paul C. Sweetwood, T&M Vice President, Regional Client Service Manager, PE, Distributed Generation Certified Professional
    - Mr. Sweetwood's 40 years of engineering experience encompasses a broad range of concentrations, with a focus on energy and utility projects, as well as campus-wide utilities and site development. His projects have included utility, renewable energy, municipal, educational, pharmaceutical, healthcare, industrial, commercial, food service, and residential facilities.
  - Elaine Dasti, T&M Company Practice Leader, PE, ASHRAE Member
    - Ms. Dasti has 14 years of mechanical building systems design experience. Her responsibilities include calculating heating and cooling loads, mechanical equipment selection and specification, mechanical system design, LEED submissions, and inspection of existing mechanical, electrical, and plumbing (MEP) systems.

May 27, 2021

PRESENTATION FOR

Society of SAME American Military Engineers

RESILIENCY CONSIDERATIONS AT MILITARY FACILITIES

About T&M

- Founded in 1966
- 17 Offices in 8 States
- Headquartered in Middletown, NJ
- More than 300 employees holding over 200 professional licenses
- Multi-disciplined consultants, engineers, construction managers and environmental specialists serving public and private clients throughout the United States

OUR MISSION

Improve quality of life and create sustainable value for employees, clients and communities.

OUR VISION

Excel as a diverse company of technical professionals inspired to lead and united in teamwork.

Our Core Practices

MUNICIPAL

WATER RESOURCES

MEP

TRANSPORTATION

NATURAL HAZARDS

PM/CM

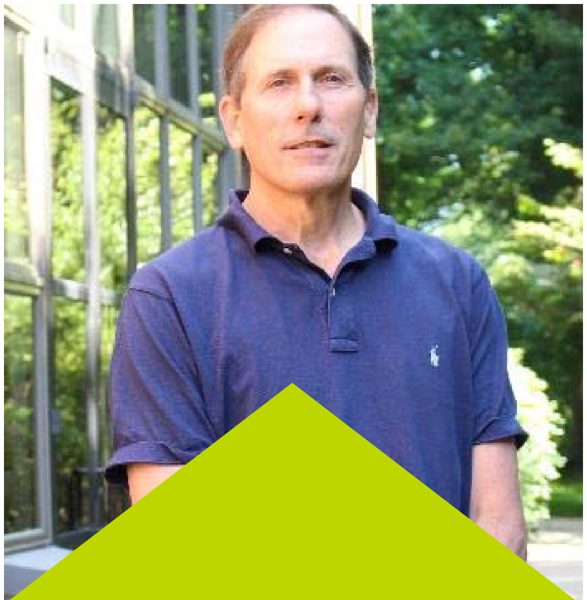
SITE/CIVIL

ELECTRICAL + AUTOMATION

ENVIRONMENTAL

HEALTH & SAFETY

Meet the Team



Paul C. Sweetwood, PE

Distributed Generation
Certified Professional
Vice President, Regional
Client Service Manager

Elaine Dasti, PE

ASHRAE Member
Company Practice Leader

Miriam Webster includes a definition of Resiliency as an ability to recover from or adjust easily to adversity or change

In order to enhance this ability, facilities can implement a number of measures in advance of disruptive events to avoid or minimize the adverse impacts of the events. Such measures may include:

- Installation of physical improvements to protect the facility by deflecting or avoiding damaging forces
- Providing secondary sources of thermal energy, electric energy, communications, security and/or control to support the facility and its personnel during grid outages
- Reducing dependency on outside support
- Providing alternative means of accomplishing on-site tasks (working remotely, redundant/remote facilities)
- Preparing contingency plans in advance of disruptive events to expedite recovery including communication protocols, initial direction to staff, arrangements with responders, etc.

The implementation of Resilient Measures is affected by a number of drivers:

- Federal, regional, state and local governments/agencies can regulate the need for Resilient Measures to be implemented with the development of facilities.
- Good management practices utilizing assessments throughout the operational life of facilities that weigh the costs (first costs and periodic costs, service interruptions/limitations, complexity, etc) and benefits of implementing such measures.

This presentation will discuss some of the above factors as they relate to several types of resiliency opportunities:

Solar Projects and Battery Back-up

Peak Shaving & Resiliency Generation

Building & Utility Control Systems

Infrastructure Hardening Related to Potential Natural Disasters

SOLAR PROJECTS AND BATTERY BACK-UP

- Government agencies have adopted policies to promote the generation of energy from renewable energy sources such as solar, wind, geothermal, and hydro in order to reduce hydrocarbon emissions and provide a more diverse source of electric power.
- The reduction in hydrocarbon emissions is intended to reduce the negative impact of the emissions on the environment and associated consequences (severe weather events, flooding, etc). In this respect, the reduction of hydrocarbon emissions is intended to be a resiliency measure by reducing the frequency and magnitude of the disruptive events.
- In addition, certain agencies have adopted policies to utilize energy storage in order to improve the quality of the power on the electric grid as well as provide some capacity as alternate sources of power during service interruptions. This initiative is also a resiliency measure to avoid overloading the grid, and an economic measure to avoid the need to develop/operate large central plants to address grid power fluctuations.

SOLAR PROJECTS AND BATTERY BACK-UP

- Many of these governmental polices have incorporated economic incentive programs intended to defray the initial cost for implementation of the noted facilities. In addition, Utility Companies in certain areas of the Country have developed programs which can also provide incentive programs to developers of these projects to utilize these power supplies during high demand periods.
- As a result, depending upon local programs, solar and battery storage projects can take advantage of economic incentives that afford developers the opportunity to develop these projects at a profit and contribute toward the governmental goal to utilize renewable energy and minimize carbon emissions.

SOLAR PROJECTS AND BATTERY BACK-UP

What are the drivers for solar and battery storage?

- **Government programs regarding resiliency**
  - Typically subject to state regulation
- **Economics of potential projects**
  - First costs
    - Land valuation – solar can have a large footprint for large systems
    - Proximity to offtaker connection point
    - Plant installation
    - Balance of plant installation, including site improvements, power connections
    - Legal, engineering, permit fees
  - Periodic costs
    - Maintenance
    - Regulatory fees
    - Land lease costs
  - Compensation
    - Payment from offtaker
    - Government subsidies, such as renewable energy certificates, feed in tariffs, accelerated depreciation, tax incentives
    - avoidance of service interruptions (if capable of island mode operation)
- **Environmental/land use regulatory considerations**
  - Environmental constraints – state, local, federal
  - Conforming with local/county/state/regional ordinances

SOLAR PROJECTS AND BATTERY BACK-UP

What are the hurdles (why isn't everyone doing it?)

- **Cost**
  - Requires favorable government programs
  - Local utility company commodity costs may be relatively low
  - Access to capital
- **Complexity**
  - Instituting a new operation requires
    - New training
    - New operations
    - New maintenance programs
    - Interruption of ongoing/primary operations
  - Integrating new and existing systems can have challenges
- **Local resiliency considerations:**
  - What is the effect of normal utility service interruptions?
    - Loss of security
    - Repair costs caused by loss of power
    - Personnel productivity

T&M's personnel have participated in numerous designs for Battery Storage installations which currently, are generally performed in conjunction with solar projects. The following is a summary of several recent PV/battery storage design projects as well as some PV projects completed at military installations:

SOLAR/BATTERY STORAGE PROJECTS

LOCATION	PV SIZE	BATTERY STORAGE
Chaumont, NY	38 MWdc	76.0 MW-hr, +32 MW-hr future
Deerfield, MA	2.6 MWdc	2.2 MW-hr
Upper Merion Twp, PA	NA	0.8 MW
Montgomery, NY	3.0 MWdc	4.4 MW-hr
Goshen, NY	3.0 MWdc	4.0 MW-hr
Hadley, MA	4.0 MWdc	4.4 MW-hr
Webster, MA	1.6 MWdc	1.0 MW-hr
Oakham, MA	2.7 MWdc	3.0 MW-hr
Winchendon, MA	2x1.3 MWdc	2x1.0 MW-hr

SOLAR PROJECTS AT MILTARY FACILITIES

LOCATION	PV SIZE
Camp Atterbury Army Base, Edinburgh, IN	2.75 MWdc
Marine Corps Logistics Base Barstow, CA	1.45 MWdc
Naval Weapons Station Earle, Colts Neck, NJ	27.0 MWdc
Eglin Air Force Base, FL	4.5 MWdc
Joint Base McGuire-Dix-Lakehurst, NJ	16.5 MWdc

SOLAR PROJECTS AND BATTERY BACK-UP

The following project illustrates the convergence of various resilience factors which will result in the development of a self-supporting PV/Battery storage microgrid at 4 schools in California:

- Onyx Renewable Partners L.P. ("Onyx"), a leader in the development and finance of Commercial and Industrial and small-scale utility solar projects in North America, had previously developed 7 MW of solar installations for 29 district campuses in the Rialto, California Unified School District. Commercial Operation for the solar systems started in 2017.
- Given the recent Utility Company concerns in the area, the State and District have requested that Onyx retrofit the installation at a High School, a Middle School and two elementary schools with Battery Storage in order to maintain operations at all times, whether the electric grid is providing power or there is a curtailment of service. This will allow the solar and Battery Storage Systems to operate as a microgrid and allow the facilities to serve as evacuation shelters during emergency conditions in the area.
- Development of the project is scheduled to begin in the near future.

PEAK SHAVING/RESILIENCY GENERATION

Examples of redundant systems to provide resiliency

- Backup generators have long been required for Wastewater Treatment Plant facilities in order to maintain operations and prevent the discharge of untreated effluent during power outages.
- Data centers utilize n+1, 2N or 2N+1 redundancy due to the financial risks associated with the loss of the base equipment operation.
- The Space Shuttle included five general-purpose computers to have reliability through redundancy. Four of the computers, each loaded with identical software, operated in what is termed the "redundant set" during critical mission phases such as ascent and descent. The fifth, since it only contains software to accomplish a "no frills" ascent and descent, is a backup. The four actuators that drove the hydraulics at each of the aerodynamic surfaces were also redundant, as were the pairs of computers that controlled each of the three main engines.
- Different industries have different guidelines, and it is expected that backup requirements will continue to evolve in other arenas in the future to provide resiliency to the facilities.

The next few slides show some examples of installations where resiliency and economic drivers resulted in the installation of on-site generation which both provided an economic incentive and provided resiliency for the facility.

PHILADELPHIA NAVY YARD MICROGRID

As part of its overall Electric Microgrid initiative, Philadelphia Industrial Development Corporation (PIDC) entered into an Agreement with Ameresco to develop and operate an 8 MW natural gas fired peak shaving natural gas generator power plant.

Drivers for the project included:

1. **Economics** - The operation of the plant at strategic periods of time will result in cost savings for the microgrid operator and customers.
2. **The generator plant will provide resiliency** by delivering electrical power to support the islanding of the microgrid during electric service interruptions.

OCEAN COUNTY NEW JERSEY
COMBINED HEAT AND POWER UNIT/MICROGRID

Ocean County has a cluster of major buildings that house critical operations including the Justice Complex, Jail, and Courthouse, some of which operate 24 hours a day. Superstorm Sandy caused the electric utility service to these buildings to be interrupted for over a week. Ocean County decided to investigate installing a Combined Heat and Power (CHP) unit/Microgrid at the site in order to:

- Improve the resiliency of the facility with respect to possible electric utility service interruption during a major storm event
- Reduce its energy consumption and related costs
- Reduce its carbon footprint

A detailed feasibility study was performed that included:

- An electric and thermal operating analysis of the facilities
- An installation budget and estimation of potential incentives.
- A financial model demonstrating CHP related costs and savings
- A cost sensitivity analysis for higher and lower electric and natural gas costs

Based on the study, the size of the unit was optimized to meet the base load of the combined facilities in order to provide the maximum operation of the system at its peak output.

The result of the study was that the electric services of the three buildings were combined in order to maximize the system electrical capacity, and thermal energy was provided to two of the buildings.

Utilizing the CHP in Island Mode in conjunction with the existing emergency generators provides the Owner with **resiliency** during utility outages. The system was installed while maintaining all operations, public access, security and other Owner requirements.

The installation qualified for a $1.2 MM incentive from the New Jersey BPU.

SEASIDE HEIGHTS, NJ PEAK SHAVING GENERATORS

Seaside Heights is one of the nine municipalities in New Jersey that distributes electrical energy through a municipally-owned utility grid to its residents.

An assessment was performed on the potential cost reductions by installing Peak Shaving Generators to provide power to the distribution system during regionally high peak demand periods, thus reducing the demand charges. The results of the evaluation were favorable, and the Borough proceeded with the installation of the system.

The system includes three, 2-Megawatt generators. Seaside Height's generating plant is capable of independent operation and can be used for resiliency to support the Borough's customers in the event of a sustained area-wide blackout.

The generator enclosures are acoustically treated to accommodate the nearby residential locations. The exhaust systems included selective catalytic reduction (SCR) equipment for the reduction of NOx emissions. The systems meet US EPA Tier 4 standards. The generators were installed one foot above the 100-year flood elevation level.

During Superstorm Sandy, the main power supply from JCP&L to the Borough was lost for several weeks. **The generators survived the storm with no adverse effects and were the only source of power on the entire barrier island for many weeks after the storm, initially providing power to the firehouse, emergency management, the police headquarters and the municipal building. For the next three weeks, Seaside Heights used the generators to power the community.**

SOUTH MONMOUTH REGIONAL SEWERAGE AUTHORITY INTERNAL COMBUSTION ENGINE GREEN ENERGY PROJECT

South Monmouth Regional Sewerage Authority owns/operates a regional wastewater treatment facility that serves numerous local municipalities. The facility included a combined heat and power system utilizing two reciprocating engines that utilized biogas as fuel at the Authority's 9.1 MGD wastewater treatment plant facility.

T&M was retained to design the installation of a third unit that had the flexibility to utilize either biogas or natural gas, and also design the retrofit of the existing units to utilize natural gas when biogas supplies are low, which provided flexibility for power generation and further enhanced the **resiliency** of the facility.

OCEAN COUNTY UTILITIES AUTHORITY
FEASIBILITY STUDY FOR COGENERATION IMPROVEMENTS

The Ocean County Utilities Authority (OCUA) views biogas as a valuable resource and continually strives to maintain the most beneficial use of available "green" energy in efforts to protect the environment and curtail future power costs. OCUA hired T&M to provide an economic and engineering evaluation to determine the feasibility of installing a Combined Heat and Power (CHP) system fueled by biogas generated from the mesophilic anaerobic digester system at the regional Southern Water Pollution Control Facility.

Key components of the evaluation included:

- Biogas qualities and quantities (seasonal and diurnal patterns)
- Requirement and method for the storage of biogas to provide reliable generation of electric and thermal energy
- Natural gas blending to supplement the production of biogas and its impact on energy production and project financial performance
- Site electrical/thermal energy demands
- Maximizing biogas energy potential and utilization
- Biogas scrubbing and moisture removal system
- Biogas distribution system and integration with existing infrastructure
- System operation to ensure black start, islanding and parallel operation with existing emergency generation system to comply with the requirements of the **Energy Resiliency Bank**
- Biogas fueled internal combustion engine performance
- Waste heat utilization system to support the anaerobic digestion process and facility HVAC requirements
- Utilization of waste heat to support an adsorption chiller process for air conditioning
- Exhaust gas emissions controls
- Electrical and thermal energy tie-in point(s)
- Economic and project implementation feasibility analysis

OCUA subsequently initiated the procurement and installation of the improvements recommended in T&M's feasibility report.

BUILDING AUTOMATION SYSTEMS (BAS)
"Smart Building"

The computer networking of electronic devices designed to monitor and control the systems in a building.

Core Functionality

- Keep a building climate within a specified range.
- Light rooms based on occupancy schedule.
- Monitor performance and device failures.
- Provide malfunction alarms.

Objectives

- Improve occupant comfort.
- Efficient operation of building systems.
- Reduce energy consumption.
- Reduce operating and maintenance costs.
- Increase security.
- Historical performance documentation.
- Improve life cycle of equipment and related utilities.

BUILDING AUTOMATION SYSTEMS (BAS)
“Smart Building”

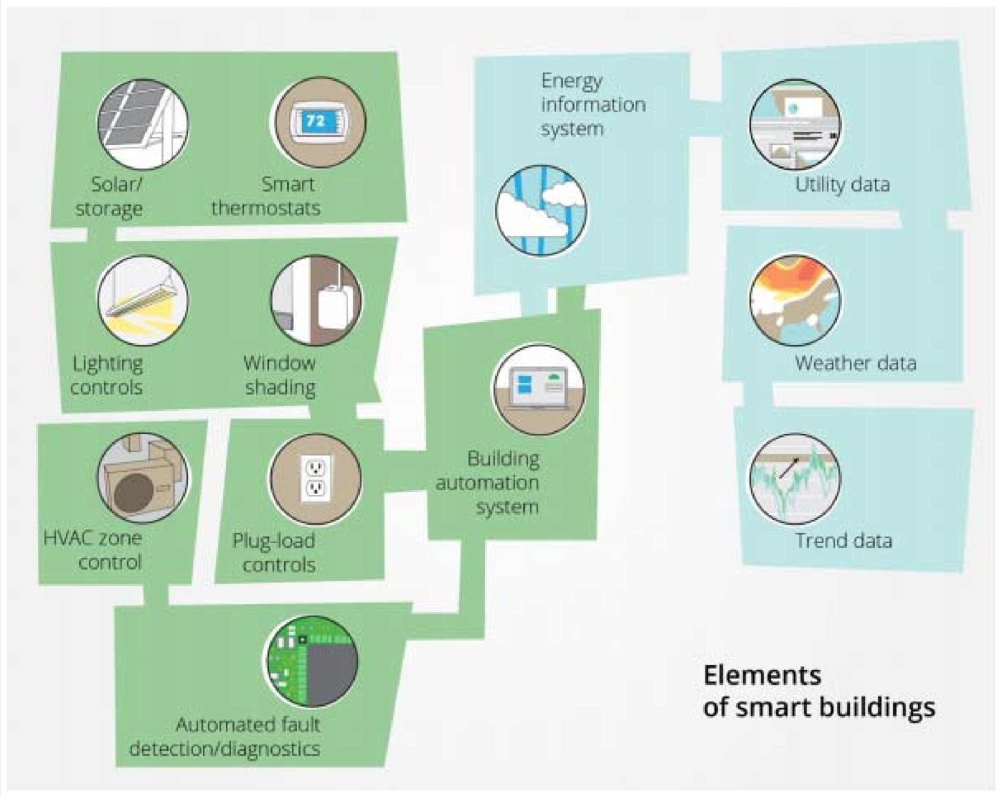
Barriers

- Initial purchase costs.
- Financial and insurance industries do not take these into account for accurate appraisal and underwriting.
- Operators are concerned that there is a “learning curve”.
- Lack of standardization of communication protocol for interconnecting smart devices.

BUILDING AUTOMATION SYSTEMS (BAS)
"Smart Building"

Smart Technologies

- HVAC Systems
- Plug Loads
  - Computers
  - Printers
  - Task Lighting
  - Vending Machines
  - Pantry Appliances
- Lighting
- Window Shading
- Automated System Optimization
  - Remote Access
  - Scheduling Zones
  - Load Shedding
  - Alarm Workflow
  - Daily Override Report
- Human Operation
- Connected Distributed Generation of Power



BUILDING AUTOMATION SYSTEMS (BAS)
"Smart Building"

Energy Savings & Cost Effectiveness

- Smart buildings save energy by automating controls and optimizing systems.
- Upgrades to a single component or isolated system can result in **5-15% energy savings.**

System	Technology	Energy savings
HVAC	Variable frequency drive	15–50% of pump or motor energy
HVAC	Smart thermostat	5–10% HVAC
Plug load	Smart plug	50–60%
Plug load	Advanced power strip	25–50%
Lighting	Advanced lighting controls	45%
Lighting	Web-based lighting mgmt system	20–30% above controls savings
Window shading	Automated shade system	21–38%
Window shading	Switchable film	32–43%
Window shading	Smart glass	20–30%
Building automation	BAS	10–25% whole building
Analytics	Cloud-based energy information system (EIS)	5–10% whole building

Smart Buildings: Using Smart Technology to Save Energy in Existing Buildings, Report A1701 by the American Council for an Energy-Efficient Economy.

BUILDING AUTOMATION SYSTEMS (BAS)
"Smart Building"

Energy Savings & Cost Effectiveness

- Smart Building with integrated systems can realize **30-50% savings** in existing buildings that are otherwise inefficient

Building type	Floor area (sq. ft.)	Smart building technology	Average energy consumption (kWh/year)*	Percent savings	Average savings (kWh/year)
Education	100,000	Occupancy sensors Web-based lighting control management system	190,000	11%	20,900
Office	50,000	Lighting controls Remote HVAC control system	850,000	23%	200,000
Hotel	200,000	Guest room occupancy controls	4,200,000	6%	260,000
Laboratory	70,000	Air quality sensors Occupancy sensors Real-time ventilation controllers	980,000	40%	390,000
Hospital	120,000	Lighting controls + LED upgrade Data analytics software package	7,900,000	18%	1,400,000

Smart Buildings: Using Smart Technology to Save Energy in Existing Buildings,
Report A1701 by the American Council for an Energy-Efficient Economy.

BUILDING AUTOMATION SYSTEMS (BAS)
"Smart Building"

First Cost & Simple Payback

- Simple payback of individual items ranges from 4 months to 5 years.
- Life expectancy of these improvements is 7-30 years.

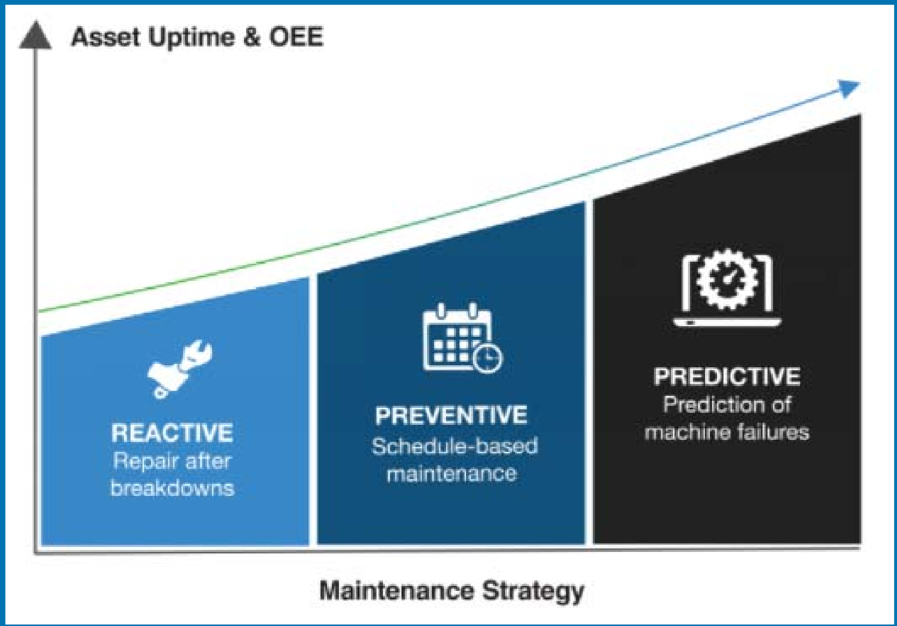
Category	Technology	Components	Cost	Energy savings	Simple payback	Measure life
HVAC	Wired sensor	Energy, temperature, flow, pressure, humidity sensors	$50–100/ sensor + $1.60/linear foot wiring	Not applicable	Not applicable	15–30 years
HVAC	Wireless sensor	Energy, temperature, flow, pressure, humidity sensors	$150–300/ sensor	Not applicable	Not applicable	15–30 years
HVAC	Variable frequency drive	Variable frequency drive (pumps and motors)	$125–250/ hp	15–50% pump or motor energy	1–2 years	7–10 years
HVAC	Smart thermostat	Smart thermostat	$150–330/ thermostat	5–10% HVAC	3–5 years	10 years
HVAC & lighting	Hotel guest room occupancy controls	Door switches, occupancy sensors	$100–500/ guest room	12–24% HVAC, 16-22% lighting	2.5–3.0 years	10 years
Plug load	Smart plug	120v 220v	$100 each $200 each	50–60%	4–12 months	9 years
Plug load	Advanced power strip	Tier One types	$45–50 each	25–50%	8–18 months	10–20 years
Lighting	Advanced lighting controls	Occupancy/vacancy, daylighting, task tuning, lumen maintenance, dimming, daylighting	$2–4/sf	45%	3–6 years	10–20 years
Lighting	Web-based lighting mgmt system	Software and hardware	$1.15/sf	20–30% above controls savings	1–4 years	10–15 years
DER	Smart inverter	Smart inverter	$0.16/watt	12%	4–5 years	10 years

Smart Buildings: Using Smart Technology to Save Energy in Existing Buildings,
Report A1701 by the American Council for an Energy-Efficient Economy.

BUILDING AUTOMATION SYSTEMS (BAS)
"Smart Building"

Non-Energy Benefits of Smart Buildings

- Enables Predictive Maintenance.
- Sensors collect data about equipment operation continuously, which serve as a baseline for performance.
- Over time, irregular data may indicate that problems exist or may be developing.
- Ability to better plan maintenance activities.
- Allows for ordering of equipment or replacement parts so repairs can be made more swiftly
- Prioritize maintenance based on necessity.



PROJECT EXAMPLE

Englewood Public Safety Building

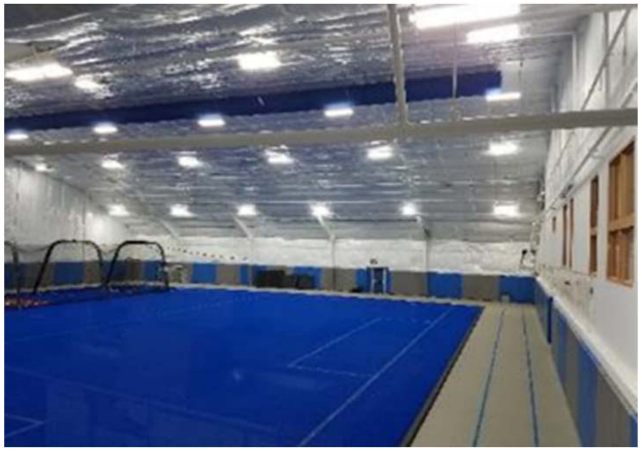
(Englewood, NJ)

- Consistent controls issues since units were replaced in-kind 12 years ago.
- Existing units are multizone rooftop units (RTUs) with hot deck/cold deck that allows simultaneous heating and cooling.
- Traditional multizone units are no longer code compliant.
- Replacing existing RTUs with variable air volume RTUs and individual VAV boxes serving each (smaller) zone.
- Supply fans on units have variable frequency drives.
- Thermostats that control individual zone temperatures based on occupancy and space loads.
- Smaller zones allow for more accurate temperature control.
- HVAC equipment networked to a central BAS to be accessed from a web-browser.

PROJECT EXAMPLE

The Club at Woodbridge
(Woodbridge, NJ)

- Township purchased an athletic facility, previously served as a racquetball club.
- Equipment in the entire facility was outdated and had standalone controls.
- For example: basketball courts had four (4) standalone ceiling-hung heating/cooling split systems.
- Replaced equipment serving the various spaces with centralized air handling units that utilized energy recovery and supply fans with VFDs.
- Appropriately sized centralized equipment leads to more accurate temperature control.
- Controls networked into the Township's existing centralized BAS.
- Existing BAS allows the Township to manage all of their buildings.
    - Improve occupant comfort.
    - Reduce energy consumption through occupancy schedules.
    - Monitor performance and device failures.
    - Utilize predictive maintenance.



Infrastructure Hardening Related to Potential Natural Disasters

ATLANTIC HIGHLANDS MUNICIPAL HARBOR RECONSTRUCTION

The Atlantic Highlands Municipal Harbor is among the largest public marinas on the East Coast, docking and servicing over 400 private vessels and has a mooring field for over 100 sailboats. The harbor consists of three fixed piers, 10 modern floating docks with utilities, a state-of-the-art fuel dispensing system, public fishing areas, and parking. The harbor also serves as a prominent transit hub for ferry passengers commuting to various destinations in Manhattan.

After the devastation from Superstorm Sandy, the Harbor required complete restoration.

The following steps were taken to restore the operations of the Harbor, taking into consideration resiliency measures to mitigate the impact of future similar events:

- Perform an initial Harbor-wide Condition Assessment to confirm both the original construction and the current condition of the facilities including structure, utilities and other elements.
- Based on the findings of the Condition Assessment, develop restoration alternatives for the facility that included the relative ability to withstand future events, costs, schedule and other factors. The alternatives were reviewed with the Owner to determine the preferred option to implement, funding sources, and implementation schedule to meet the seasonal opening of the facility.
- Resiliency elements that were incorporated into the improvements included:
    - Replacement of fixed piers with new storm-resilient floating dock system anchored to steel extended pipe piles to allow for tidal fluctuations. Provisions include flexible utility connections.
    - Installation of steel sheet piling bulkhead and wave screens at the outboard fixed pier location.
    - Reconfiguration of the Ferry Terminal and installation of ADA-compliant floating dock ramps and fishing pier.

Awards

- Project of the Year, ASCE, NJ Section
- Project of the Year, NJ Society of Municipal Engineers
- Excellence in Design of Recreation or Park Facilities, NJ Recreation and Park Association
- Distinguished Engineering Award, 2013 NJ Alliance for Action

STORM HARDENING TO FORTIFY CONSOLIDATED EDISON MAJOR SUBSTATIONS

Shortly after Hurricane Sandy ravaged the region in 2012, including causing more customer outages than any storm in the utility's long history, Consolidated Edison Company of New York initiated a $1 billion Storm-Hardening Protection Plan to build a smarter and stronger energy delivery system. The Plan would deliver state-of-the-art solutions to **make the region's energy grid more resilient to future major storm events.**

Con Edison retained T&M to prepare storm hardening concept studies for nine major New York City substations, several of which were operationally impacted by Sandy since they front on major water bodies. Multiple options for protecting the equipment at these facilities were investigated, and summary reports were presented to Con Edison for review and selection of preferred options to implement. Each option was evaluated against various criteria including constructability, cost, environmental, health and safety (EH&S) parameters, regulatory compliance, and others. Options that were considered included:

- Elevating flood sensitive equipment throughout the substations
- Construction of perimeter walls around the perimeter of the sites, along with flood gates.
- Providing protection for FEMA 100-year flood conditions pus an additional three feet of surcharge (for future conditions)

T&M subsequently prepared detailed, site-specific designs for storm hardening measures at four of the larger (6–12 acre) substations utilizing a combination of epoxy coated sheet pile/concrete perimeter walls up to 13' tall, flood gates, elevated new equipment, provisions to seal the sites and pump out precipitation during storm events, elevated egress stairs, and other measures. During the work, over a mile of new sheet pile walls were constructed. Stations remained in operation during the installation.

Example Sheet Pile Flood Wall photo courtesy of Skyline Steel

IOWA COURT & SOUTH GREEN LIVING SHORELINE PROJECT

The purpose of the project was to restore and replenish local marsh, wetlands, and beaches through the dredging of lagoon communities to remove silt build up that was blocking storm water drains and impeding the passage of wildlife and boats. The dredging and marsh restoration will directly benefit the local community by strengthening natural buffers against storm surges and sea level rise, which will help protect critical infrastructure in the area. The resiliency measures included:

- Living Shoreline Treatments,
- Thin-Layer Deposition
- Tidal Marsh Replacement and Restoration
- Beach Replenishment and Nourishment

Key project deliverables included:

- **Resiliency Measures Feasibility Study** and Preliminary Survey, which involved meetings with local partners, NJ Natural Lands Trust, and Great Bay Wildlife Management Area, to help identify the project areas, environmental constraints, permit requirements, native plantings, estimates, etc.
- Hydrographic survey and sediment sampling was completed within the project area.
- Initial project design and permitting with the NJDEP and Army Corps
- Final design, bidding, and construction.

Industry Awards + Project Recognition

- American Council of Engineering Companies, National, 2020 Engineering Excellence Award (National Recognition Award, non-transportation category)
- American Council of Engineering Companies, NJ Chapter, 2020 Engineering Excellence Award (Honor Award, non-transportation category)
- New Jersey Society of Municipal Engineering, 2019 Municipal Project of the Year, 2nd Place

ENERGY REDUCTIONS

One topic that should not be overlooked with respect to resiliency is the implementation of energy reduction measures.

Large scale reductions of energy consumption throughout a Utility franchise area can result in decrease power plant demand and lower transmission across power lines, providing additional 'breathing room' during peak demand periods.

As discussed above, lowering energy consumption can provide additional capacity to allow backup generation to support more of the on-site loads at individual facilities.

Why T&M?

1. ***Absolute Focus on Your Goals…***
   "Your Goals. Our Mission."
2. ***People & Culture… we're not just your engineer, we're your trusted advisor and partner***
3. ***Technical Expertise and State-of-the-Art Technology***
4. ***Creative Problem Solvers***

> **"Everyone in our business knows how difficult it is to navigate the entitlement process. T&M's tenacity and attention to detail unquestionably played a major role„in our ability to move this project forward. We look forward to working with you on future projects."**
>
> **- MICHAEL SCHURR, PRESIDENT, OKKS DEVELOPMENT**

Thank You.

Questions?

Society of SAME American Military Engineers

Thank You Small Business Sponsor!!!

APS Development

MS Hatch CONSULTING

PROJECT X CORROSION ENGINEERING

Corrosion Control – Soil & Forensics Lab

Society of SAME American Military Engineers

Thank You!