



# Utility Master Planning & Implementation for a Federal District Energy System

U.S. Capitol Power Plant

December 6, 2017

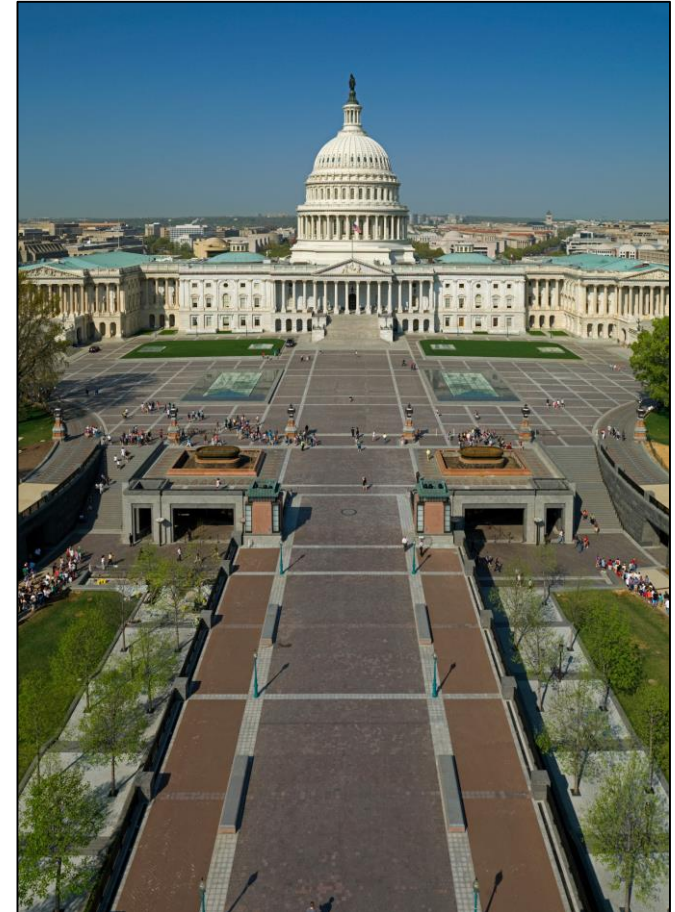


# Utility Master Planning & Implementation for a Federal District Energy System



## *Presentation topics:*

- *Overview of utility master planning efforts*
- *Recommendations and results*
- *Observations from the field during implementation*





# The Architect of the Capitol



*Care for: 17.4 million+ square feet of facilities; 580+ acres of grounds and thousands of works of art*

***Serve***



*Oversee annual budget of approximately \$600 million per year and manage \$1 billion+ in active construction projects*

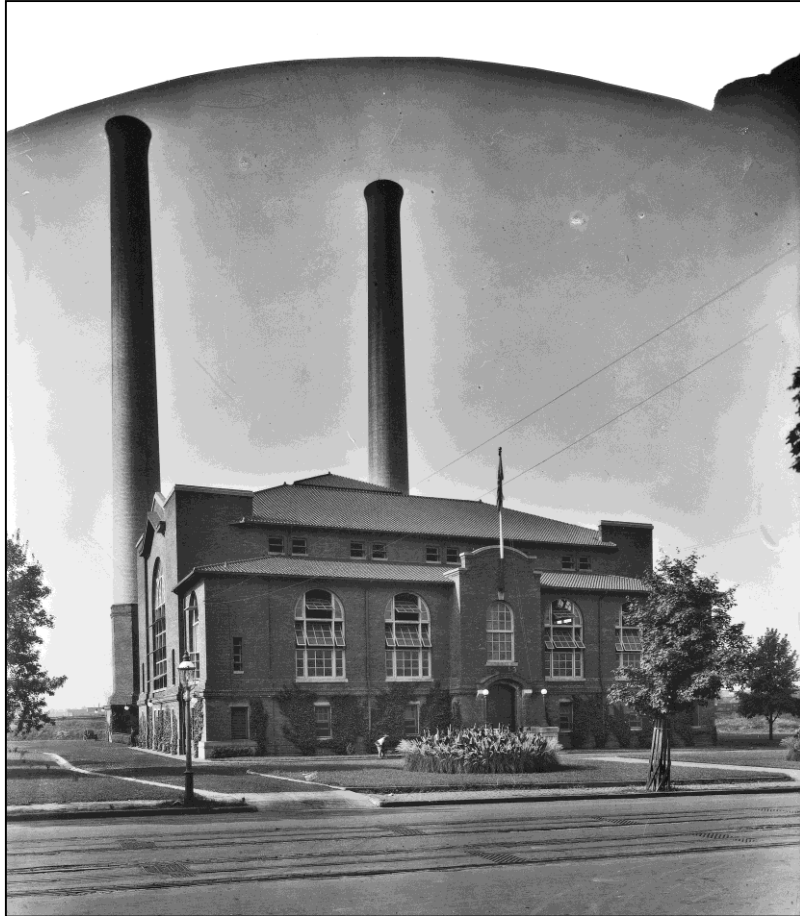
***Preserve***



*Host 3 million+ visitors annually while serving 30,000 daily occupants around the clock to maintain the Capitol campus*

***Inspire***

# The Capitol Power Plant





# The Capitol Power Plant



## ***Current System:***

*Connected load for ~17.5 million sq. ft.*

*Distribution system length of ~4 miles*

*9 electric driven chillers*

*Chiller capacity: 43,600 tons*

*Chilled water load: 25,000 tons peak*

*Variable primary pumping*

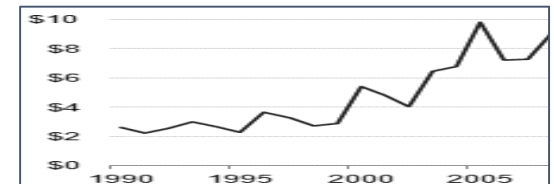
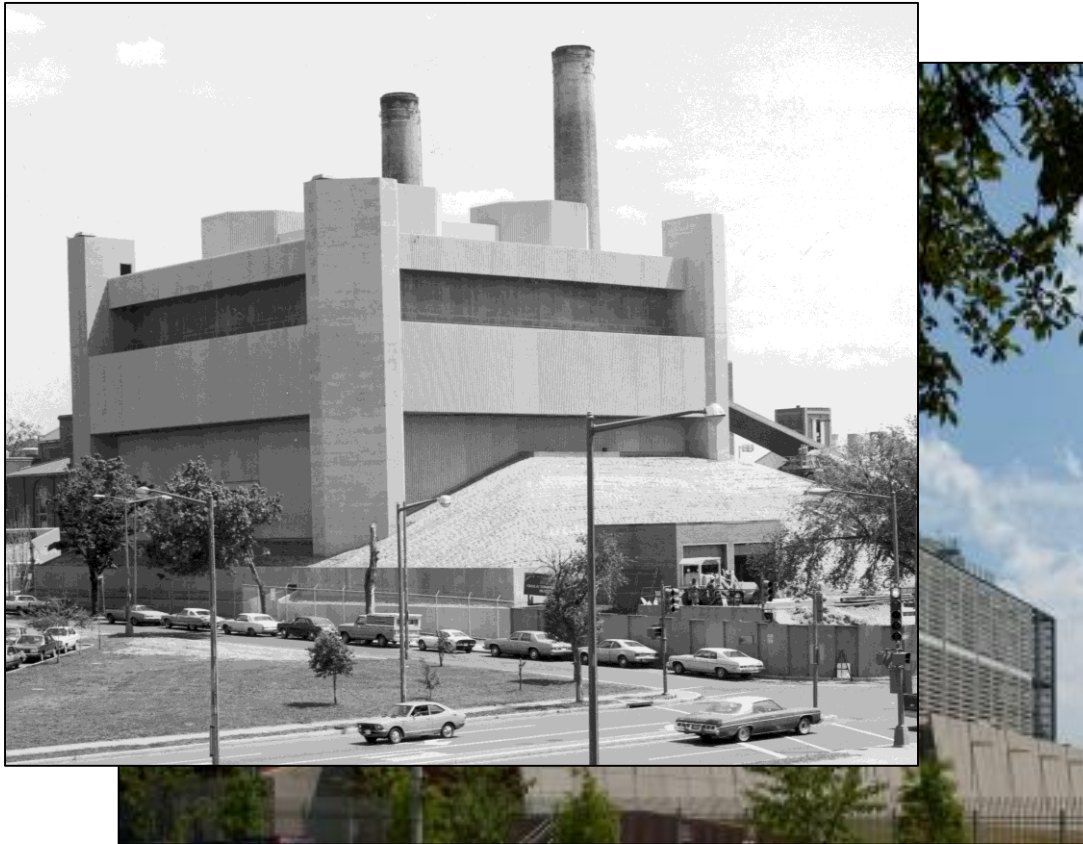
*Supply temperature 40°F - 42°F*

*7 steam boilers*

*Boiler capacity: 620,000 pph*

*Steam load: 300,000 pph peak*

# The Capitol Power Plant (in 2007)



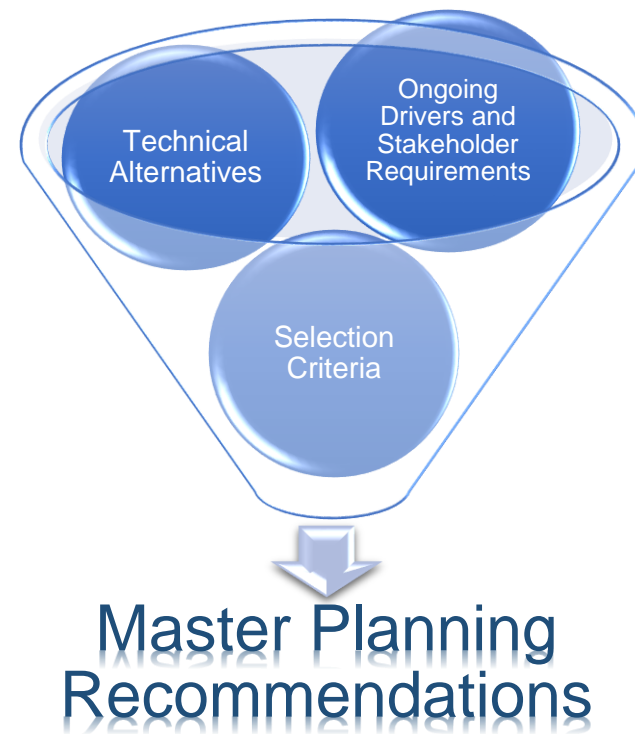
# Utility Master Planning & Implementation

## Purpose & Process



### **Purpose**

- ❑ *Collect and consolidate all information*
- ❑ *Evaluate several technical options and ensure the best option is selected*
- ❑ *Provide a long-term planning and decision-making tool*
- ❑ *Document the process, recommendations and decisions*





# Utility Master Planning & Implementation

## Drivers & Stakeholder Requirements



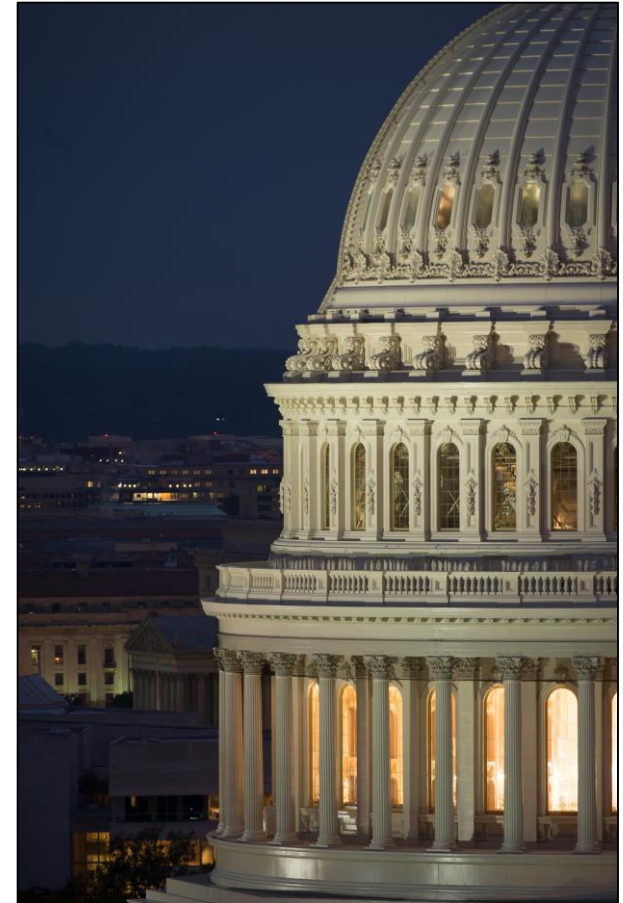
### **On-going Drivers**

- ❖ *Aging infrastructure*
- ❖ *Utility market volatility*
- ❖ *Statutory energy reduction goals*
- ❖ *Regulatory requirements*

**&**

### **Emerging Stakeholders Requirements**

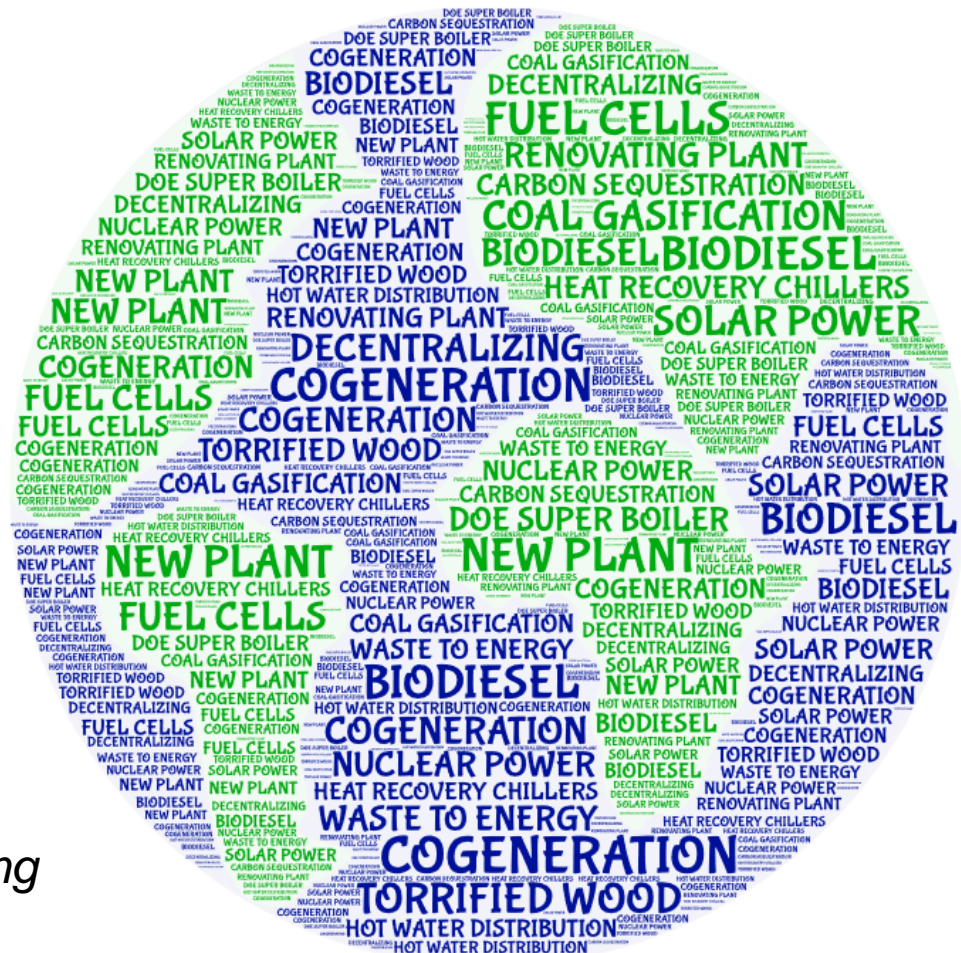
- ❖ *Congressional Members & Staff*
- ❖ *Customer buildings*
- ❖ *Campus growth*
- ❖ *AOC organizational requirements*
- ❖ *Regulators*
- ❖ *U.S. Capitol Police*
- ❖ *General public*



# Utility Master Planning & Implementation Technical Alternatives



- › Refurbishment of existing plant
- › Construction of a new plant
- › Decentralizing the system
- › Coal gasification
- › Cogeneration
- › Geothermal
- › Fuel cells
- › Solar
- › Biodiesel
- › Torrified wood
- › DOE super boiler
- › Carbon sequestration
- › Heat recovery chillers
- › Waste to energy systems
- › Various distribution system routing



# Utility Master Planning & Implementation

## Selection Criteria



### **Selection Criteria**

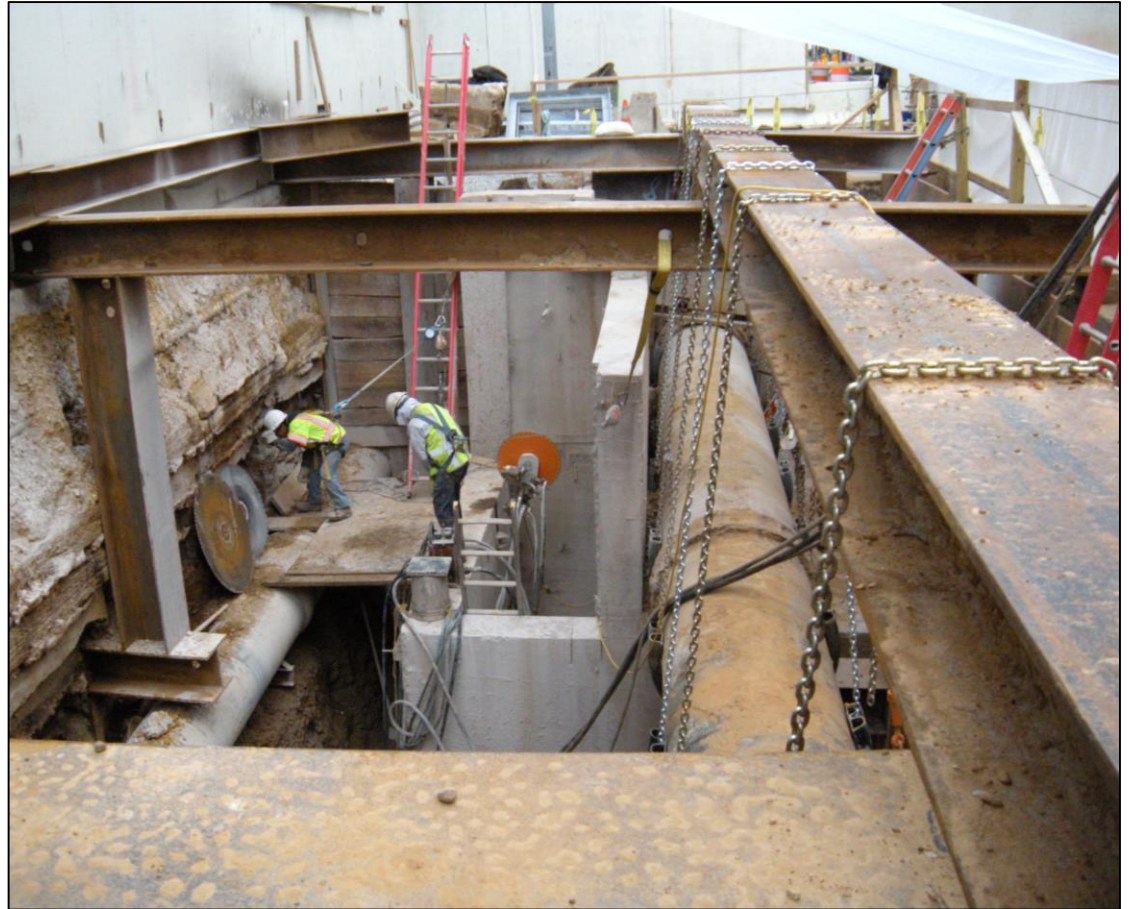
- ❖ *Construction Costs*
- ❖ *Life Cycle Costs*
- ❖ *Environmental Impacts*
- ❖ *Energy Efficiency Rating*
- ❖ *Energy Security*



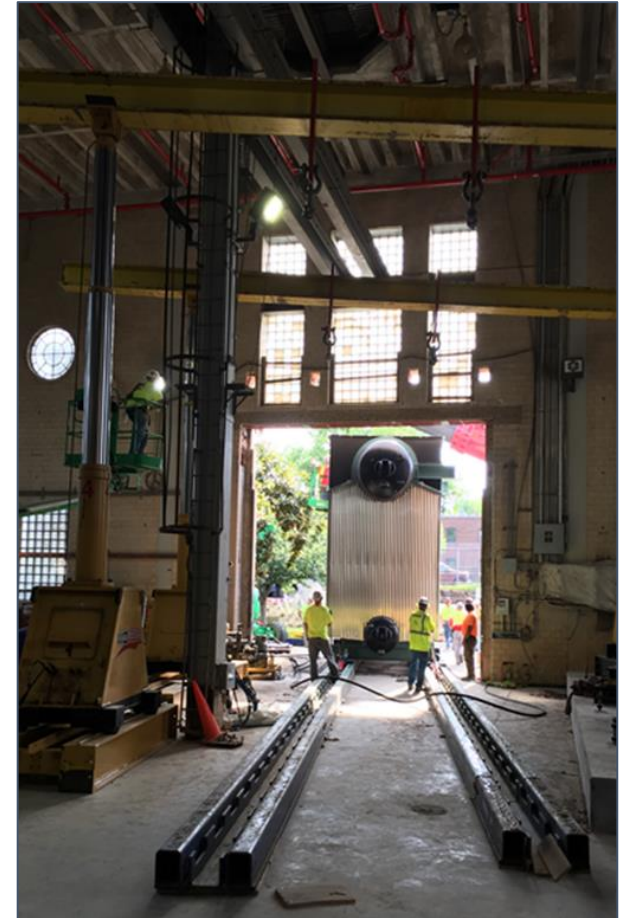
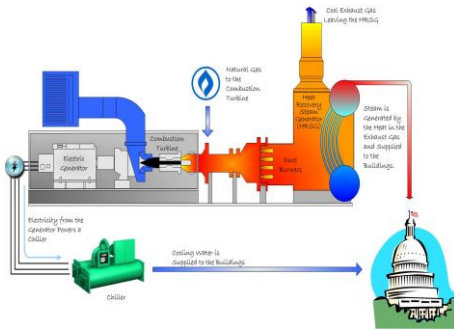


# Utility Master Planning & Implementation

## Utility Distribution



# Utility Master Planning & Implementation Cogeneration Project





# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization Program





# Utility Master Planning & Implementation Observations from the Field During Construction



# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization



### *Master Planning:*

- *Data quantity and quality are extremely important*
- *Load projections should reflect internal and external factors*
- *Fully develop PORs and IGEs for final selection of options*
- *Conduct aggressive risk analyses for final options*
- *Incorporate phased approach to accurately reflect current fiscal environment*



# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization



### *Design:*

- *Structure the contract to incorporate phases and options*
- *Incorporate seasonal construction activities within the specification*
- *Focus on code compliance of the project and the existing facility*
- *Develop rigorous controls specifications and incorporate a control systems integrator*
- *Allow bidders to submit multiple bids based on multiple equipment manufacturers*



# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization



### *Project Management:*

- *Establish clear roles and responsibilities for central staffing PM / CM team*
- *Include inspectors dedicated for each trade*
- *Remain flexible for incremental funding*
- *Consider value engineering recommendations and impact to facility operations*
- *Investigate opportunities to invoke the Defense Priorities and Allocation System (DPAS) program*

# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization



### *Continuing Facility Operations:*

- *Establish daily coordination procedures for project management, contractor and plant operations staffing*
- *Closely coordinate LOTO requests between the contractors and facility operations*
- *Plan for installation and removal of equipment while maintaining full system functionality*
- *Protect existing equipment and roof structures during construction (eg. silica dust)*
- *Maintain emergency egress during construction*
- *Ventilate operating spaces during welding operations*

# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization



### *Logistics and Deliveries:*

- *Coordinate multiple projects and the use of limited space*
- *Plan for a lack of space for staging cranes and laydown of equipment before installation*
- *Ensure coordination between vendors and United States Capitol Police*

1,300 days & 680 crane lifts  
without a lost-time injury



# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization



### *Existing Conditions:*

- *Expedite contract modification processes to address differing site conditions*
- *Be prepared for hazardous materials*
- *Plan for extensive deterioration of aging systems*



# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization



### *Training:*

- *Include a combination of vendor factory and on-site training*
- *Develop SOPs and maintenance procedures early in the project*
- *Incorporate facility staff walkthroughs during construction*
- *Develop specification for training requirements to accommodate rotating operational shift schedules*
- *Require contractor submittal of O&M and training materials prior to scheduling training*
- *Utilize the engineer of record to update the Computerized Maintenance Management System*



# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization



### *Startup and Commissioning:*

- *Subcontract the engineer of record to provide Cx support and act as an owner's rep for start-up activities*
- *Ensure a good balance of plant support and involvement of all trades and facility staffing*
- *Incorporate off-site factory acceptance testing of controls before implementation*
- *Involve operations staff in factory acceptance testing*



# Utility Master Planning & Implementation

## Refrigeration Plant Revitalization

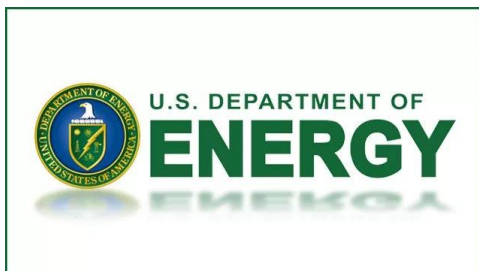


NATIONAL ACADEMY  
OF SCIENCES



### Outreach:

- Utilize industry and government agency expertise to enhance all three phase of master planning, design and construction



# Utility Master Planning & Implementation for a Federal District Energy System



*Thank you*

- *Christopher Potter*  
*Director, Utilities and Power Plant Operations*  
[cpotter@aoc.gov](mailto:cpotter@aoc.gov)

