FEFPA 2019 Summer Conference

Role of Managers in Central Energy Plant

CEP

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SGM ENGINEERING

Project Manager

1. What is Project Manager?

The position which has the ownership to the project and sees the project from inception to completion.

2. How will the PM succeed?

Project completed on time and within budget.

3. Essential elements for solid project management?

- Develop solid scope validation
- Ensuring budget is maintained
- Ensuring design time accommodates construction Schedule
- Allocating resources
- Communication
- Response time

Central Energy Plant (CEP)

1. **What does a typical Central Energy Plant consist of?**

- **Air Cooled**
  - Typically 2 chillers, 2 to 3 pumps (variable primary), associated piping and BAS
- **Water Cooled**
  - Typically 2 or more chillers, 2 to 3 CHWP, 2 to 3 towers, variable flow for towers or dedicated pumps to towers

2. How to scope and define a CEP project?

- Define master plan
- What are the short term and long term needs
- Budget
- Warranty and service contracts (in-house or outsource)

3. Improve energy efficiency through controls optimization

- Analyze plant peak loads and annual cooling load profiles and how they affect plant design and equipment capacity
- Define how the components relate to one another, how they are controlled, and what their physical and operational limitations are
- Carefully design piping layout and CHW distribution systems and condenser water systems
- Optimize the design to minimize first costs and operating costs (in particular, energy costs) over the plant's life cycle
- Selecting chillers using life-cycle cost techniques
- CHW plant building automation system (BAS) and suggested control sequences
- Commissioning process key to ensuring that chiller plants meet their design intent

A proper chiller plant operation requires:

- A written SOP(standard operating procedure). Do not rely on operators to program or analyze the system. It doesn't work like that.
- Always specify "maintenance friendly" system.
- Primary-secondary pumping systems are easier to understand and use, yet variable primary systems can save a lot of pumping energy.
- Best way to control pumping still is with differential pressure sensor, but location of the sensor is of utmost importance.
- Chillers are always controlled with temperature. Here is when chiller optimization come into the picture because these temperature and pressures have to be tested for efficiency. An over pressurized or under pressurized system can cost the owner and reduce life of the system.
- Building's chilled water tertiary pumps would operate efficiently if they are VFD with differential pressure at worst case per building.
- If thermal storage is owner's preference, full ice storage is easier understood by the maintenance staff than partial ice.

Useful formulas

- Pump Hp = (GPM x Total Head in ft. water) / (Pump Eff. x 3960)
- Chiller Design: Recommend minimum of 12 F Delta-T.
- kW/ton = 12/EER
- 1 Ton = 12,000 BTU/HR
- Tons = (GPM x Delta T x specific heat* x specific gravity*) / 24.
  where* for fluids other than water.

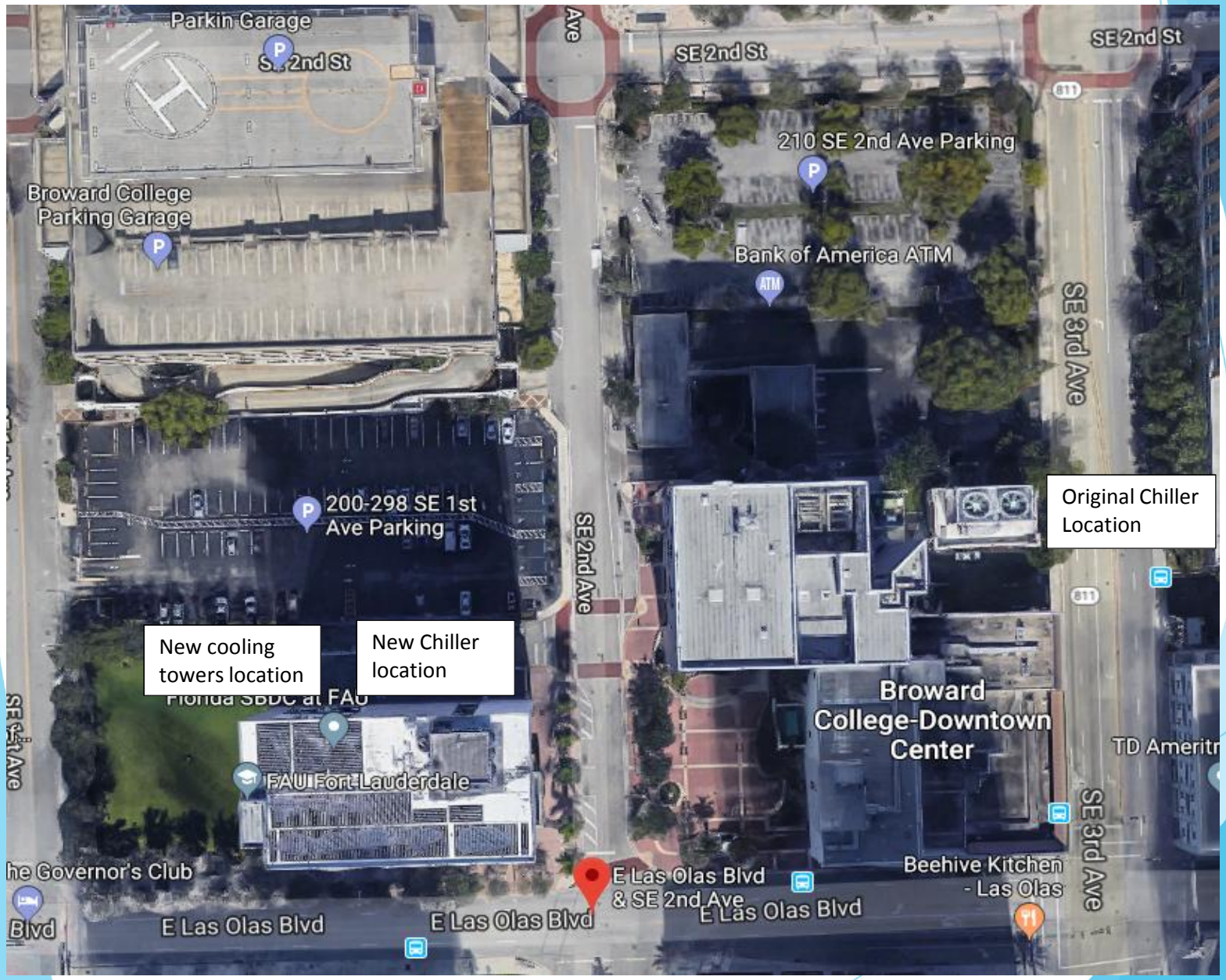
Tower System Design Formulas

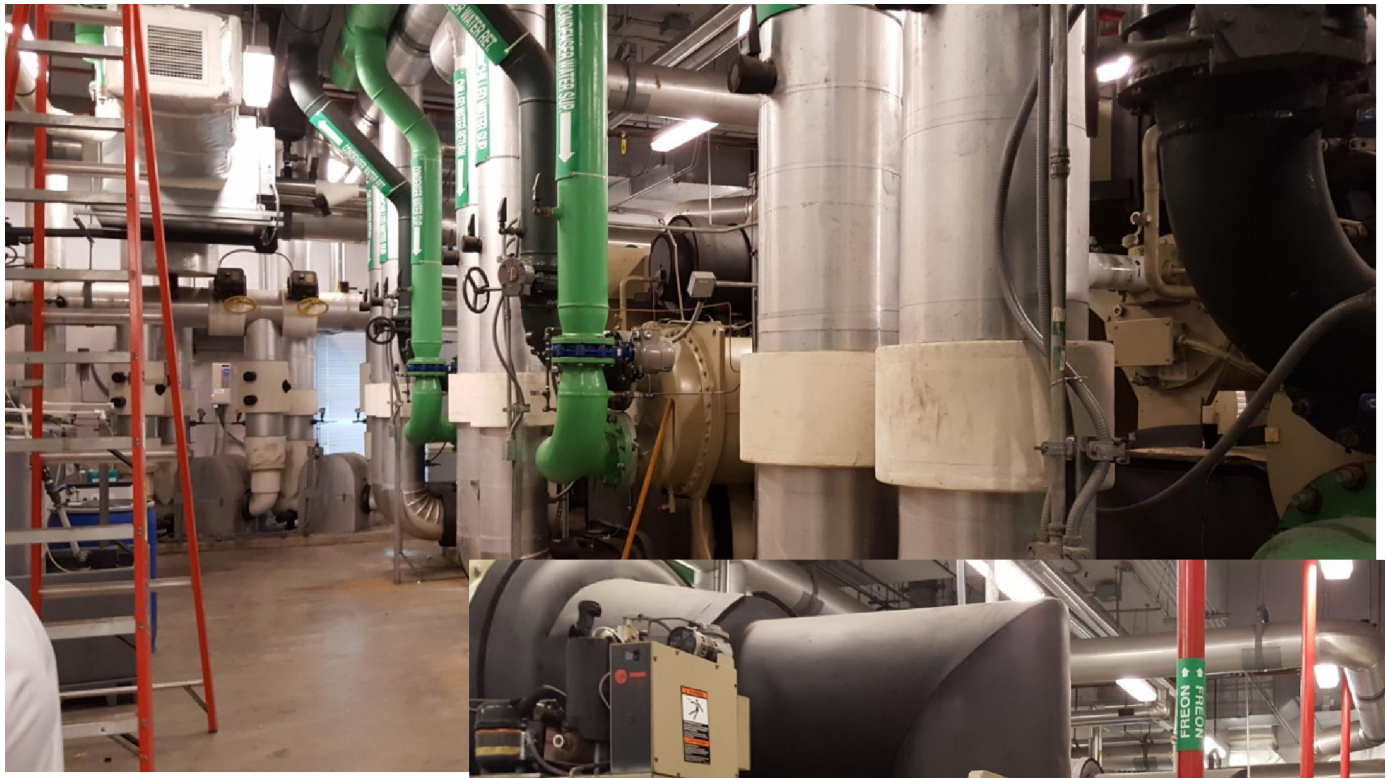
- Cooling Tower = 3 GPM per ton for 10F Delta –T.
- 1 Tower Ton = 15,000 BTU/ hr.
- Tower Ton = GPM x ΔT/30
- Chiller Tower = 2.4 GPM / ton
- 1 Chiller Ton = 12,000 BTU / hr.
- Chiller Ton = GPM x ΔT / 24

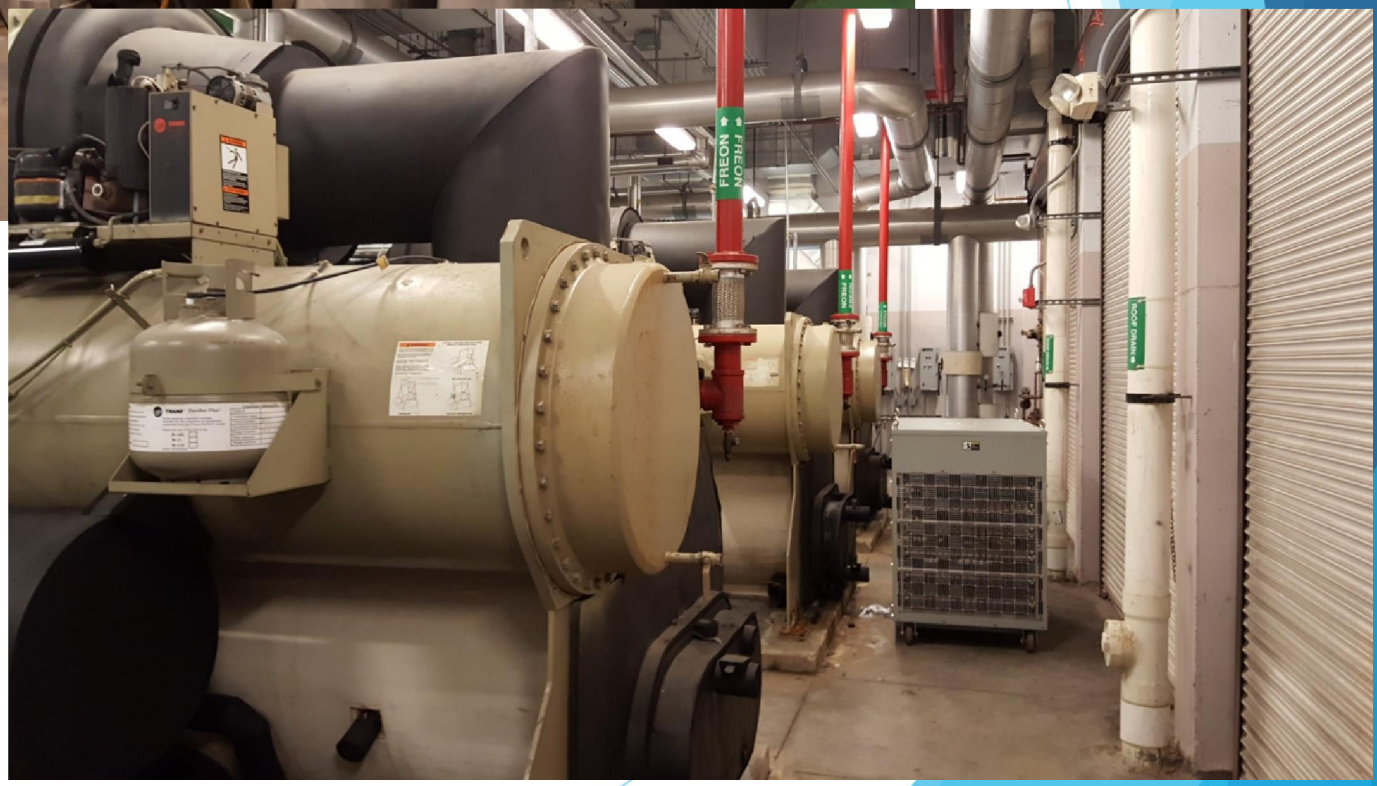
Rule of Thumb:

- There are 1.8 gallons per hour of evaporation per ton of cooling.
- Evaporation of 1 pound of water takes about 1,000 BTU of heat.
- Evaporating 1.8 Gallons of water requires 15,000 BTU of heat.

“Chillin’ in Downtown Ft. Lauderdale”
Broward College’s Chilled Water Relocation Project




CONDENSER WATER SUB
CONDENSER WATER OUT


FREON
FREON
ROOF DRAIN

Scope of the project

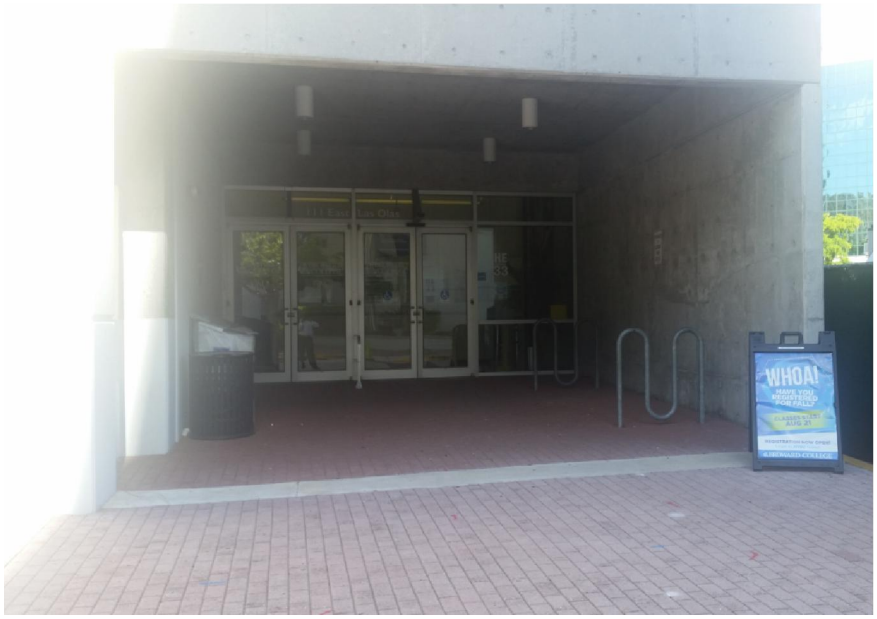
1. Chiller plant feeding (3) Buildings
2. Demo (2) buildings
3. (1) existing building to remain
4. Provide new CEP for existing building to remain
5. Occupied building shall not have interruptions related to cooling
6. Cost control
7. Utilize existing chillers (2001) N+1
8. Provide new CT, pumps, controls, ect
9. Provide NEC clearances for all equipment
10. Manufacturer service contract
11. Smoke control system
12. Design Schedule
13. September 2016 to be completed by December 2016
14. Construction to be completed by August 2017

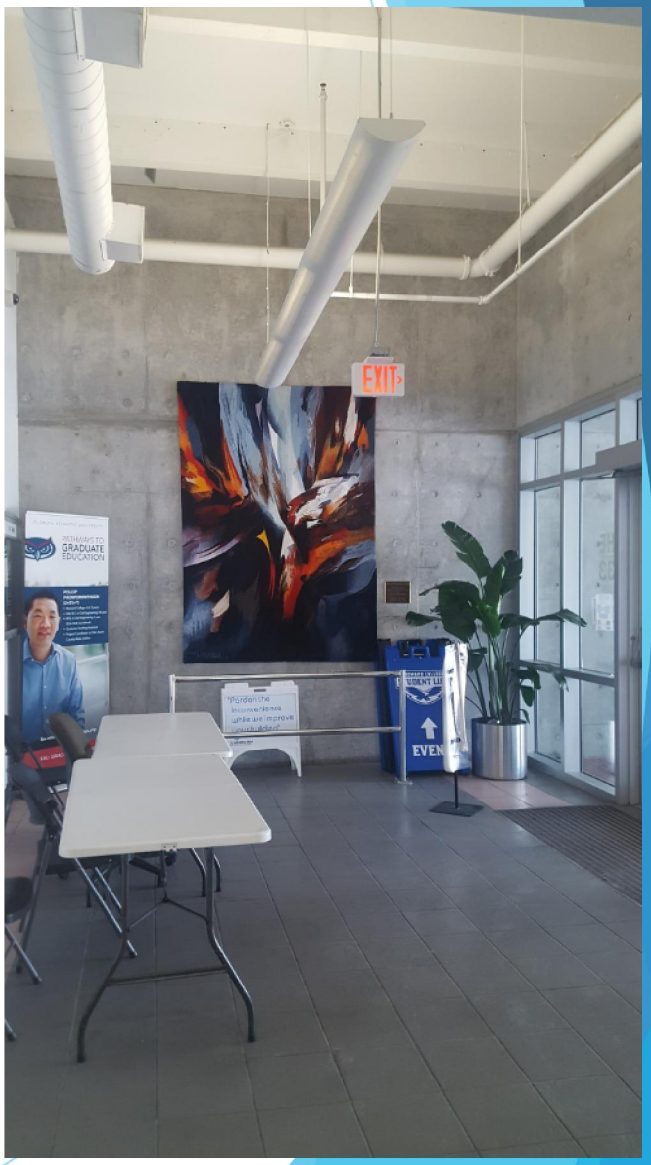
Project Considerations

1. Broward College will be able to control the system through the EMS as required to keep up with the educational facilities' schedule
2. FAU has Architectural students who often occupy the classrooms overnight
3. Broward College would be able to apply their Design and Construction Standards
4. The chiller room would occupy a space not otherwise used at the building
5. Stiles Inc. would pay the college $2M for the construction of the chiller
6. There would be an additional savings by reusing one of the three chillers to another campus ($500K value)
7. Broward College would be able to use temporary chillers during construction in order to demo the existing and allow Stiles to begin their site clearing.

Construction Phasing

1. Coordination between FAU and Broward College
2. Temporary cooling package + early site package
3. Redundancy on temporary cooling
4. EMS

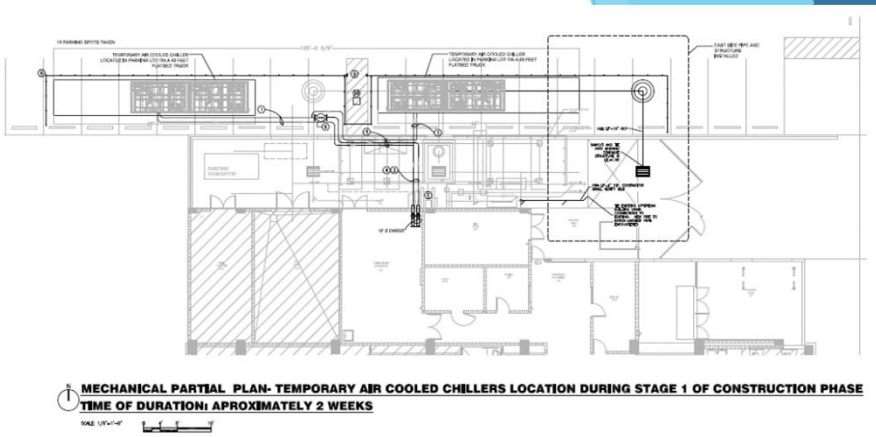




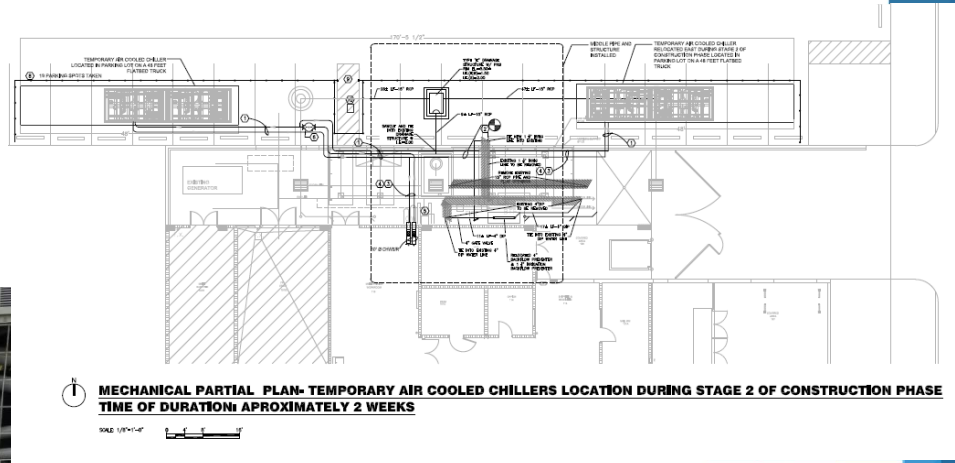
Temp Cooling

1. Chiller location with Parking lot considerations
   - Multiple Phasing plan

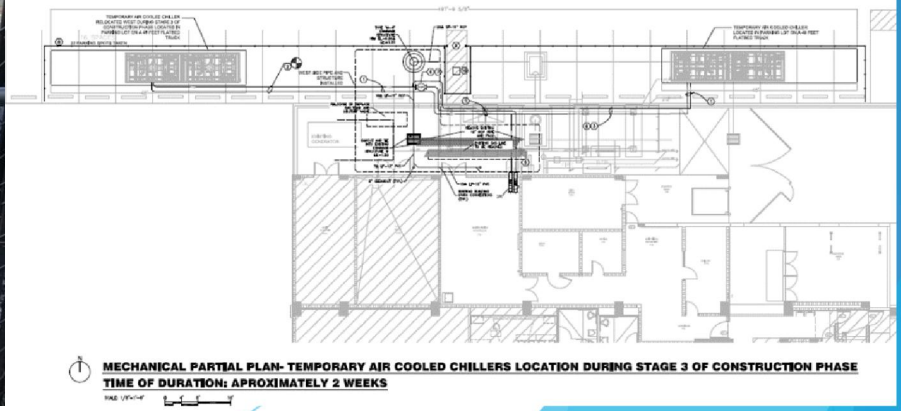
2. Coordination with chiller plant renovation and demo



MECHANICAL PARTIAL PLAN- TEMPORARY AIR COOLED CHILLERS LOCATION DURING STAGE 1 OF CONSTRUCTION PHASE
TIME OF DURATION: APROXIMATELY 2 WEEKS



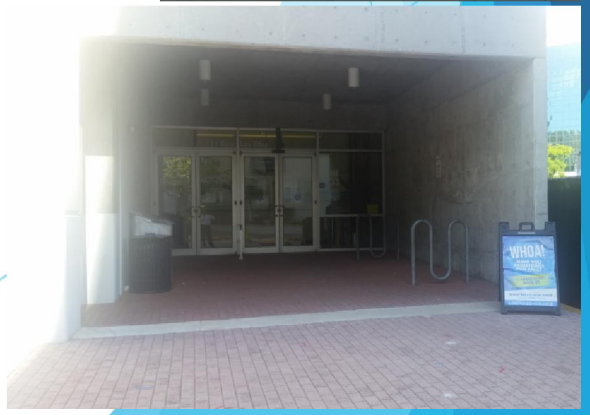
MECHANICAL PARTIAL PLAN- TEMPORARY AIR COOLED CHILLERS LOCATION DURING STAGE 2 OF CONSTRUCTION PHASE
TIME OF DURATION: APROXIMATELY 2 WEEKS



MECHANICAL PARTIAL PLAN- TEMPORARY AIR COOLED CHILLERS LOCATION DURING STAGE 3 OF CONSTRUCTION PHASE
TIME OF DURATION: APROXIMATELY 2 WEEKS

Chiller Location

1. Chiller room
   - Lobby
2. Use existing space without increasing footprint of building
3. Cost
4. NEC and Maintenance clearance
5. Primary, secondary, and condenser water pumps (all N+1)
6. Chemical Treatment, pot feeder, ET, AS, Controls, VFDs, Refrigerant exhaust, ALL to meet NEC clearance, BC standards, and maintenance




CORNELL
CORNELL

Chiller Challenges

1. Sound level in lobby
2. Compressor clearance requirements not met
   - Solution: *“Raise the roof”*
3. Close coordination with pump, electrical equipment, piping--everything

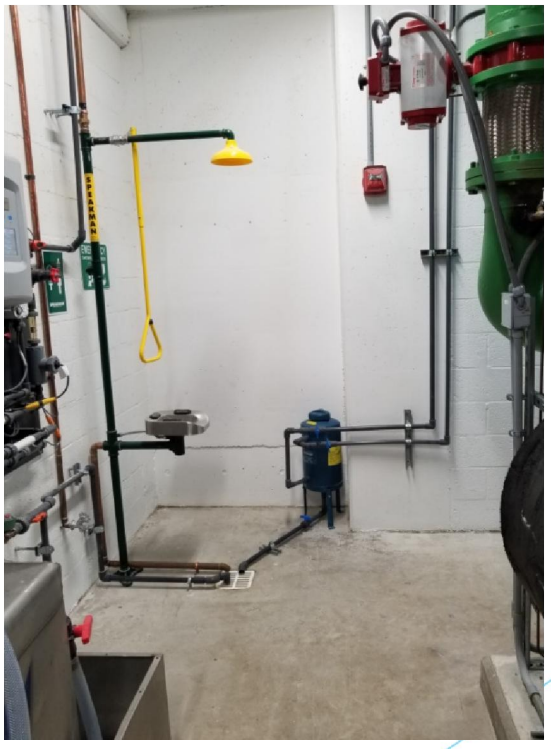
CT Location

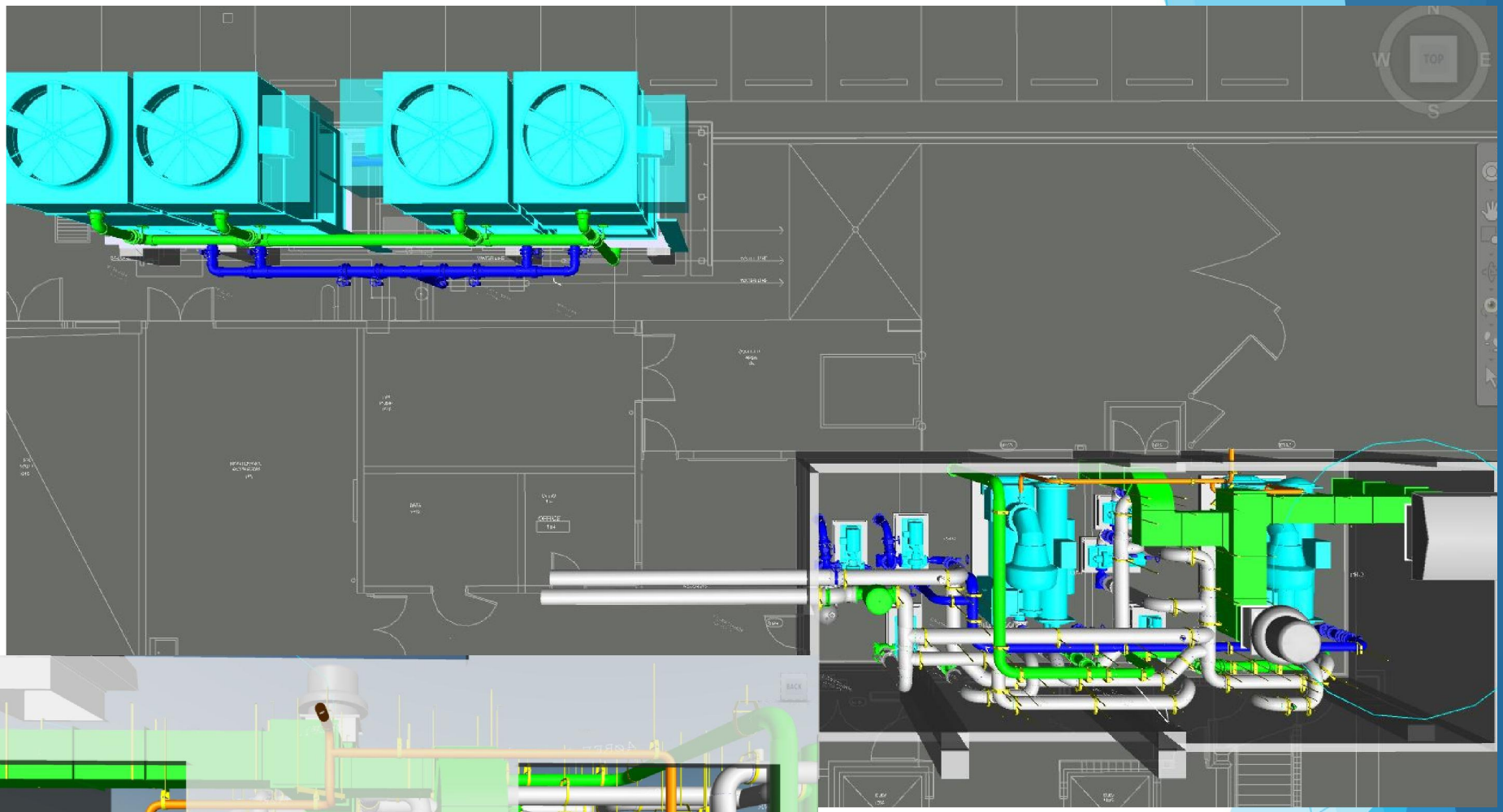
1. Maintain footprint within area of scope
2. Vehicles
3. Maintenance constraints
4. Vehicle deliveries
5. The dumpster.
6. Existing stairwell and egress
    - 2nd floor scope of work to accommodate

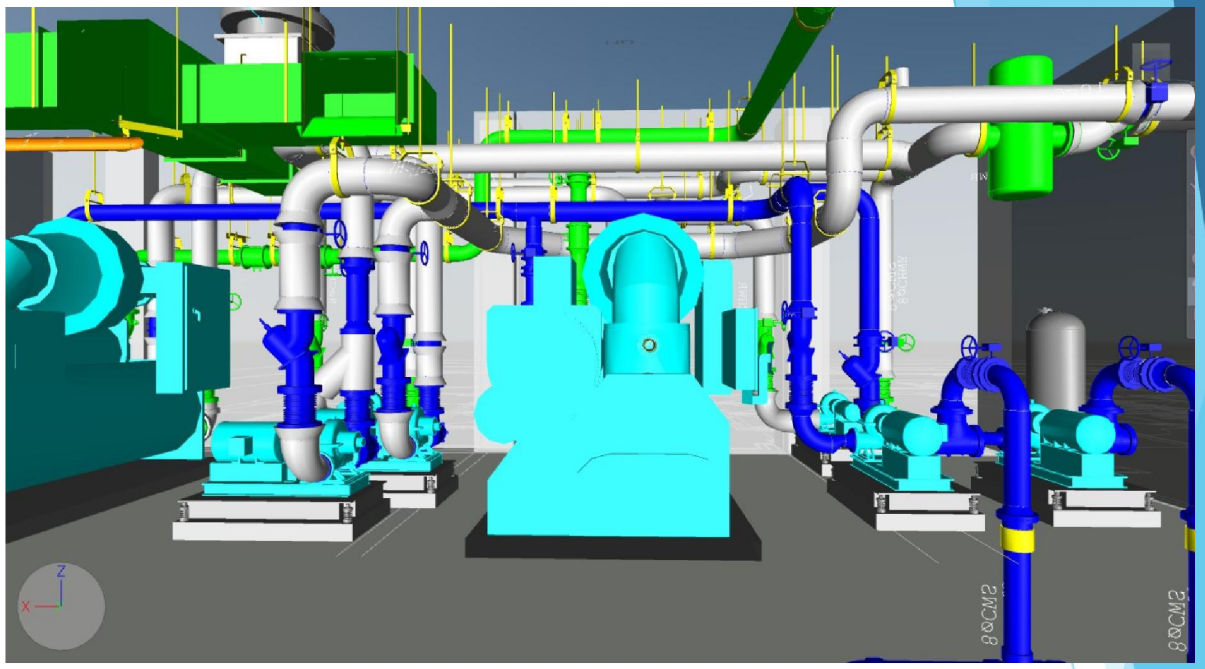

evapco

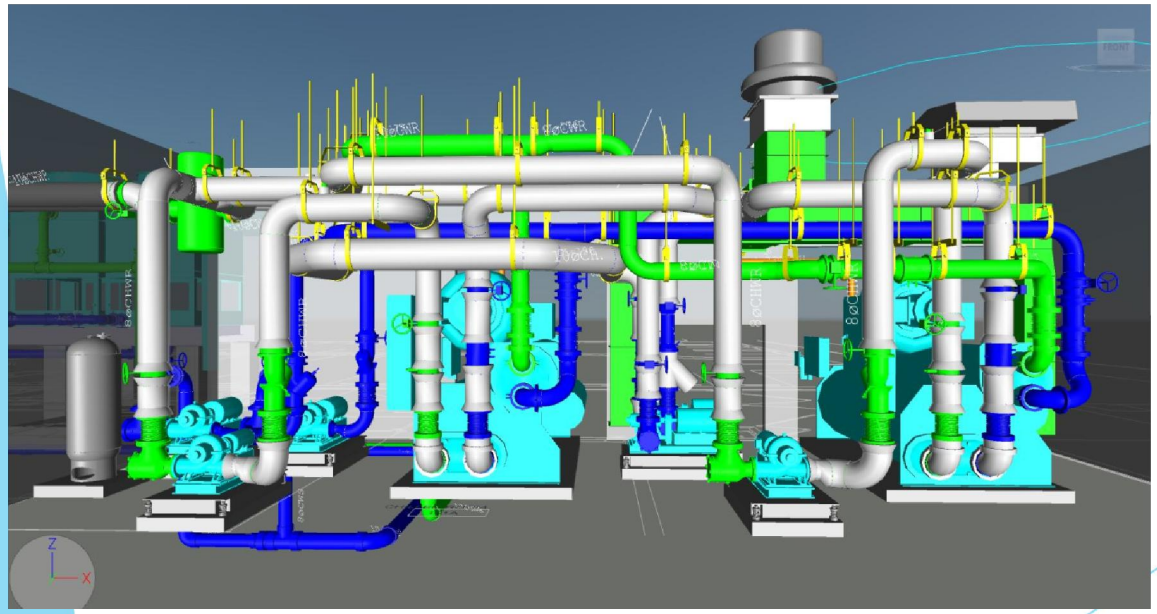
CEP

1. Chemical treatment stands
2. Consideration with chemical treatment
3. Maintaining NEC










LOCATION OF NEW CHILLER ROOM'S EXTERIOR WALL
STREET VIEW OF AREA OF WORK, CURRENT CANOPY TO BECOME ENCLOSED CHILLER ROOM.
COVERED
AREA
127
482
SF
100
100
16x12
24x14
14x14


WELCOME!
LINGUA
BROWARD COLLEGE
2ND FLOOR
STUDENT SERVICES
LEARN ABOUT STUDENT
AND UPCOMING
GET A HEAD STAR
YOUR EDUCATIONAL
EXPLORE YOUR CAREER
REGISTER FOR YOUR


BROWARD COLLEGE
REGISTER NOW FOR FALL
EXIT

Conclusion

Critical Factor for Successful Project

1. Exceptional Project team
2. Define goals and objectives
3. Communication
4. Weekly updates and managing milestones
   - Expedited schedule
   - Design for maintenance