Mechanical Requirements

Codes and Standards

The HVAC System will comply with the following codes and design standards:

- International Building Code 2015
- International Mechanical Code 2015
- International Plumbing Code 2015
- International Fire Code 2015
- International Energy Conservation Code 2015
- ASHRAE Standard 90.1 2013
- NFPA 13-2013
- 2010 Guidelines for the Design and Construction of Health Care Facilities FGI
- NFPA 99-2005
- University of Utah Design Standards — January 15, 2016
- DFCM Design Requirements March 13, 2015
- Utah Boiler Code — June 3, 2015

Design Criteria

OUTDOOR DESIGN CONDITIONS:	SUMMER	WINTER
Design Temperatures, Dry Bulb	97°F	0°F
Design Temperatures, Coincident Wet Bulb	62°F	—
Design Temperatures, Wet Bulb	70°F	—

INDOOR DESIGN CONDITIONS:

Office & Support Areas

Summer:	72°F
Winter:	72°F
Humidity:	Max. 50%

OPERATING ROOMS:

Summer:	68°F
Winter:	68°F
Humidity:	20%—60%

PATIENT CARE AREAS/CLINIC

Summer:	68°F - 72°F
Winter:	68°F- 72°F
Humidity:	Max. 50%

LABORATORY:

Summer:	68°F - 72°F
Winter:	72°F
Humidity:	Max. 50%

FOOD SERVICES:

Summer:	68°F - 72°F
Winter:	72°F
Humidity:	Max. 50%

Minimum Redundant Heating & Cooling Code Requirements

The Guidelines for Design and Construction of Health Care Facilities, 2010 edition, that is currently adopted by the State of Utah requires heating and cooling systems greater than 400 tons peak cooling load that serve hospitals to have redundant systems in order to ensure service if one source is disrupted, the hospital can continue to provide patient care to all patients.

Trying to account for possible failures of one source, *The Guidelines* requires a redundant fuel supply be located on site in case the community's natural gas (or other) service is interrupted for heating purposes. "Fuel sufficient to meet demand loads for the same length of time required for emergency generators shall be provided on site." This is currently 48 hours of operation. If 96 hours of operation are required additional fuel oil tanks and piping will be added as part of the design to achieve the 96 hours.

The following paragraphs indicate the components of the heating and cooling systems that need to be redundant as well as the areas of the hospital that need to continue operating in an event.

SECTION 2.1-8.2.6.2:

"Major supporting components of the heating plant, including feed water pumps, fuel pumps, and condensate transfer pumps, shall be provided with redundancy that makes it possible to meet the heating capacity of the plant required in Section 2.1-8.2.6.1 (Boilers—Capacity) when any one of these components is out of service due to failure or routine maintenance."

SECTION 6.1.2.1:

"Provide heat sources and essential accessories in number and arrangement sufficient to accommodate the facility needs, even when any one of the heat sources is not operating due to a breakdown or routine maintenance. The capacity of the remaining source(s) shall be sufficient to provide for sterilization and dietary purposes and to provide heating for operating, delivery, birthing, labor, recovery, emergency, intensive care, nursery, and inpatient rooms."

Regarding the cooling Section 6.1.2.2 indicates "For central cooling systems greater than 400 tons peak cooling load, the number and arrangement of cooling sources and essential accessories shall be sufficient to support the owner's facility operation plan upon a breakdown or routine maintenance of any one of the cooling sources."

Not every component of the hospital's heating and cooling system that is required to be redundant is mentioned in these paragraphs. Each hospital is unique and the methods

used for heating and cooling may differ greatly from one hospital to the next, requiring different components that are not mentioned to have redundancy. Just because one component or source is not mentioned in these paragraphs does not mean it is not required to have redundancy.

Level B Mechanical

A mechanical room will be provided to house major equipment to serve the ACC. The mechanical room will be located in level B and will be configured to be meet the needs of the ACC including remodeling office space that will be converted to patient care in the future.

The new mechanical room will house the following equipment:

Heating System: There are two options being considered for the heating system.

One option (Base Case) is to tie the new ACC into a new steam central utility plant. The steam plant will utilize the two existing 600 HP high pressure steam boilers and add two new 600 HP high pressure steam boilers. These boilers would continue to provide backup heat for buildings 522, 525 and 529 utilizing the existing infrastructure. The two new steam boilers along with two new deaerators would provide the N+1 redundancy required per the FGI Guidelines.

The new plant will house the following equipment:

- Steam boilers (two existing and one new boiler)
- Deaerators (two)
- Steam to heating hot water heat exchangers
- Associated pumps and water treatment
- Boiler blow down and blow down heat recovery
- Steam to instantaneous domestic hot water heat exchangers
- Two new onsite 20,000-gallon fuel oil tanks will be provided to serve the boilers. Four 20,000 gallon tanks would be required for 96 hours of backup capacity.
- The entire heating system shall be on emergency power to meet code requirements.
- Pressure independent/compensating control valves for the heating water and chilled system will be considered to reduce pumping head and will be two—way with tight shut off.

The second option (Option 3) would be to utilize condensing hot water boilers if onsite generation is chosen as the most viable option. With condensing boilers utilized, the most likely option will be to also serve buildings 522, 525 and 529 off of the new condensing boilers located within the ACC. The boilers would be provided with N+1 redundancy and would be designed to run on redundant fuel. The primary source of fuel will be natural gas with No. 2 fuel oil as the backup source.

- Two new onsite 20,000-gallon fuel oil tanks will be provided to serve the condensing boilers as well the new process steam boilers. Four 20,000 gallon tanks would be required for 96 hours of backup capacity.
- The entire heating system shall be on emergency power to meet code requirements.
- New variable volume hot water pumps will be provided.
- High efficiency domestic hot water boilers. These would be instantaneous natural gas fired units to eliminate the need for domestic hot water storage.
- Steam boilers, these boilers will serve the process loads, humidification loads, building 522 kitchen steam requirements, and domestic water needs for not only the ACC but also Buildings 522, 525 & 529 requirements if it is chosen to eliminate the existing onsite steam boiler systems as well as HTHW to the existing buildings.
- Redundant deaerators/feed water tanks will be provided on the steam system to maintain N+1 redundancy of the equipment.
- Pressure independent/compensating control valves for the heating water and chilled system will be considered to reduce pumping head and will be two—way with tight shut off.

Chilled Water System

- Chilled water will be provided by the east campus chilled water plant. How this will be accomplished at this time is still to be determined. Part of the design process may include adding local air cooled chillers for peak shaving as well as to be available to serve critical areas of the ACC and the existing Hospital in an event.
- Chilled water will be provided from the East Campus Chilled Water Plant. Chilled water from this plant will be supplied at 43°F and will be returned to the plant at 59°F. The piping from the plant to the building will be buried uninsulated pipe.
- Plate and frame heat exchangers to decouple the ACC from the campus chilled water plant.
- Pressure independent/compensating control valves for the heating water and chilled system will be considered to reduce pumping head and will be two—way with bubble tight shut off.
- New variable volume chilled water pumps.
- Associated pumps and water treatment.
- At a minimum, a portion of the chilled water system should be on emergency power to provide cooling to the critical components of the building.

Other Systems located within the ACC

- Water softeners
- Pure water systems
- Medical air compressors
- Instrument air compressors
- Medical vacuum pumps
- Bottled medical gases and manifolds
- Storage for oxygen bottles. A 100 bottle minimum oxygen supply has been requested by respiratory therapy.

Snow Melting

Primary heat will come from the steam boiler system or condensing boiler system. A glycol solution will be pumped to the heating piping which will be embedded in the concrete walk & entry ways. Snow melt will be included in the following areas:

- Snow melting will be provided for the walkway/entries to the building.
- Service dock entry.
- Fire department access up the hill from Primary Children's Hospital.

Domestic Water Service

A domestic water system will be provided for all non-laboratory spaces in the building. The system will be designed to provide a minimum of 40 psig at the farthest building fixture on the highest floor of the building.

A backup domestic water line will be provided with the new building to provide redundant feeds to the building.

Domestic Cold Water Service

Domestic cold water will be connected to all plumbing fittings and fixtures, including emergency eye wash and shower stations. Emergency eyewash units will be installed with a check valve and in-line back flow preventer and provided with independent control valves to regulate water pressure. Emergency shower and eyewash water is to be preheated to 70 degrees.

Mechanical Requirements, continued

Domestic Hot Water Service

Domestic hot water will be generated in the level B mechanical space.

Domestic hot water will be produced by instantaneous steam to domestic hot water heat exchangers or by instantaneous gas fired domestic hot water boilers. Steam will be provided by the steam boiler system. These will be provided with redundant services. Water will be generated at 160F and be mixed down to be supplied to the building at 120F with no storage tanks. Water meters will be provided on hot water and hot water return piping and will interface with the building automation system to determine domestic hot water usage.

Other energy saving options for generating domestic hot water will be considered and studied. See the discussion at the end of the mechanical narrative.

Water Softening

A new triplex domestic water softener is to be located within the building. This system will be able to meet the needs of the facility while one resin tank is in a regeneration mode.

Convert the existing 525 brine tank into above ground brine maker with Step-Saver service.

Fire Protection

The fire riser will need to be located and a space will need to be provided for a new 6 to 8-inch fire line into the building. The location of the new riser room will be placed so that there is fire department access to the new fire riser.

The Engineered Water Flow Analysis has been completed and has been provided separate from this report.

A detector check/alarm valve assembly shall be provided at the fire sprinkler system riser for the new building construction, to protect the city water supply from contamination. The riser assembly shall meet the requirements of the Utah State Fire Marshal Department.

The new building construction shall be protected with a Class I Automatic—Wet, Combined standpipe system.

The Sprinkler system supply and floor control assemblies, shall be coordinated with the smoke control zones. Sprinkler systems shall be supplied from the standpipe system.

Pre-action systems will be considered for imaging equipment rooms, IT and main server rooms.

An approximate 30,000 gallons of on—site storage of fire flow water and fire pumps will be required for the high rise construction. This can be accomplished with a concrete storage vault of approximately 13’ deep x 12’ wide x 27’ long. The storage vault will be located below level B. Fire pumps will be duplexed and be of the vertical turbine type.

Natural Gas

The existing natural gas line will be extended to the new mechanical room from building 532. A new natural gas meter will be required and will be sized for the new building load.

Sanitary Sewer and Waste

A complete sanitary waste and vent system will be provided in accordance with International Plumbing Code (IPC) throughout the building. Extend to exterior mains as shown on site utilities plan. Provide grease, sand and or oil traps as needed.

Storm Drainage

A complete roof drainage system that will tie into the existing storm drain systems will be provided. A separate overflow drain system will be provided by means of a piping system or a scupper system.

Grease Interceptor

The existing grease interceptor for the level A kitchen located in building 522 currently resides in the proposed site for the ACC. A new grease interceptor will be provided and located to the south of the ACC foot print. A new grease waste line will be provided along with a new inspection manhole.

Oxygen

The existing campus bulk oxygen storage tank system will serve the new ACC. A new O2 line will be extended to the site. The currently proposed O2 backup bulk tank system and the new proposed manifold system will also be utilized to serve the project.

Medical Vacuum

An NFPA 99 compliant packaged medical vacuum pump system will be provided and located in a medical gas equipment room. The vacuum pump system will be sized to meet the patient demand and will be provided with redundancy

Medical Air

An NFPA 99 compliant packaged medical air compressor system will be provided and located in a medical gas equipment room. The exact size of the medical air system will require further study and will dictate the number of compressors with N+1 redundancy.

Medical Gas Bottled Storage

A new medical gas storage room will need to be provided. It is suggested that the new medical gas storage room be located off of the dock area. The new medical gas storage room will be equipped with Nitrogen, Nitrous Oxide and Carbon Dioxide. A 100 bottle minimum oxygen supply has been requested by respiratory therapy.

Instrument Air

A new instrument air system located in the new mechanical space and will serve the brakes on the booms located in operating rooms, imaging rooms etc.

Piping Systems

Piping materials will be provided as follows:

- Building hot water will be piped to reheat terminals throughout the facility via schedule 40 steel or Type K copper pipe.
- Chilled water will be piped to air handlers throughout the facility via schedule 40 steel or Type K copper pipe.
- Steam will be piped to humidifiers and process systems throughout the facility via schedule 80 steel pipe.
- Glycol hot water will be piped to pre-heat coils located in each air handler via schedule 40 steel or Type K copper pipe.
- Above grade gas piping will be welded or screwed Schedule 40 black steel.
- Domestic water systems will be piped via Type K copper pipe.
- Waste and vent piping will be cast iron.
- Roof drain and roof drain overflow piping will be cast iron.
- Fire protection piping will be NFPA compliant Schedule 40 black steel.
- Medical gas piping will be clean medical gas copper piping.
- Specialty piping materials are described in individual specialty piping sections.

Seismic Restraint

All mechanical and plumbing systems shall be provided with seismic restraints conforming to current code requirements. Systems will be designed with an importance factor of 1.5.

Anesthesia Exhaust

The anesthesia exhaust will be served off of the new vacuum pump system.

Air Handling Systems

Building heating and cooling will be provided via a medium pressure, variable air volume (VAV), reheat system.

Custom air handlers with fan walls (multiple fan arrays) for the supply and return air fans will be used to provide air flow. Fan wall systems provide redundancy, reduce vibration, and facilitate fan replacement. There will be primary and standby VFD's on the supply fans and the return fans for redundancy. This will be at a minimum. The current design will utilize a multi-fan array where each fan will have a VFD. This approach eliminate the concern of a ground fault on a single fan which could potentially shutdown the complete air handling system when there is a primary VFD and a backup VFD.

Each air handler will be equipped with a hot water preheat coil, and a chilled water cooling coil.

Pre filters and final filters shall be provided per latest codes and standards. Pre filters shall have an efficiency of 30% (Merv 8) and final filters an efficiency of 90% (Merv 14) based on ASHRAE Test Standard 52. Final filters shall be installed at the point of discharge.

Each air handler will be equipped to provide outside air economizing.

Humidification at the air handler level will be provided via steam injection where required by the FGI Hospital Guidelines.

All air handling systems shall be designed to accommodate a ducted return air system to meet the FGI Guideline requirements. The current proposed administration floors will be considered as a plenum return. If they are designed to a plenum return these areas will not be able to be served by an air handler serving patient care areas if it is a plenum return.

All air handling systems will be on emergency power.

Air handlers will be located in mechanical spaces within the building or in penthouses located at the roof level.

ZONING OF THE AIR HANDLERS WILL FOLLOW:

Levels B & Level A: EVS, Linen Services, H&I Lab, Transplant services, morgue, prisoner hold, central serv. & dock area. Suggest that the air handler for the space be located at the lower level.

Levels 1 & 2: Clinics, academic offices and Office Space.

Level 3: Surgery, Pre-Op, Post-Op, Sterile Processing etc.

Levels 4 - 6: Academic Offices, Shelled Space & Med Surg. Patient Unit. These floors to be served by two separate air handlers.

Clean Room

There is a Class 10,000 clean room with high supply and low wall returns. The space will be served by a minimum of 10 CFM/FT^2. The clean room will be served by the central air handling system. This system will supply fan powered HEPA filter (99.97%) units. FFU will be provided injection and sampling ports for testing.

Air Intakes and Exhaust

Air intakes shall be positioned to avoid short circuiting of exhaust air back into the building. Every effort shall be made to minimize any entrainment of fumes by strategic location of air intakes.

General Exhaust

Each toilet will be exhausted to atmosphere via roof mounted exhaust fans. Air will be supplied at a constant volume through the air handling system.

INFECTIOUS ISOLATION ROOM EXHAUST

These rooms shall be served by Phoenix valves on both the supply and return. The system will maintain a CFM differential offset to maintain a minimum of 0.01" w.g. pressure differential between the room and the surrounding area. The rooms will be served by two independent exhaust fans discharging directly to the exterior. Stack discharge shall be a minimum of 10'-0" above the roof.

MORGUE EXHAUST

This room shall be served by Phoenix valves on both the supply and exhaust. The system will maintain a CFM differential offset to maintain a minimum of 0.01" w.g. pressure differential between the room and the surrounding area. The rooms will have an independent exhaust fan discharging directly to the exterior.

OPERATING ROOMS

Positive pressure operating rooms will be part of this facility. These rooms shall be served by Phoenix valves on both the supply and return. The system will maintain a constant airflow offset to maintain a 0.05" w.g. pressure differential between the room and the surrounding area. The OR ceiling's air distribution system shall be designed per ASHRAE Standard 170.

High Rise Construction

Stairwell pressurization will be required for each stair well serving the high rise building. This system will maintain a positive pressure as required by code in the stairwell in the event of fire. Each stair well will have an outside air fan at the top of the stair tower. Ductwork will be required to run down the stairwell within the stair envelope to equally pressurize the different levels.

Communication Rooms and Elevator Machine Rooms

Each room will be provided with dedicated cooling. In the case of the Communication rooms these spaces will be served by the air handling system as well as a dedicated cooling system.

Mechanical Requirements, continued

Automatic Temperature Control System

The control system shall be a direct digital control (DDC) system with electric driven actuators. The direct digital control system shall monitor, control and adjust the building controls from an in—building location. The following items of equipment shall be monitored and/or controlled:

- All central HVAC equipment including air handling units, boilers, chillers, cooling towers, heat exchangers, pumps, variable speed drives and exhaust fans.
- All decentralized HVAC equipment such as variable air volume units, reheat coils, thermostats, meters, air and water temperature sensors, system pressure sensors.
- The control system shall be connected to the Intermountain hospital network through the Ethernet network. This building shall be able to be monitored remotely from the internet.

San-I-Pak

The existing San-I-Pak machine will be relocated from building 521 and a new San-I-Pak will be added. Steam, water and sewer services will be provided from the new ACC Building systems.

Water Meters (Water meters should report in cubic feet or gallons)

- A meter placed on the building domestic water system shall measure and record the overall water usage for the building
- Meter the water to the landscape water connections within the building.
- Make-up-water to steam boiler system.

Submetering

Provide tie-in to electrical sub meters for the interior lighting office areas, Exterior (outdoor) lighting, plug load meters, elevators, (meter to be Sage Metering or equal). All electrical sub-meters shall be capable of communicating energy use on an hourly, daily, monthly and annual basis.

Using the communication link to the VFDs and the mechanical equipment, monitor the KW to all supply fans, all blower units, cooling tower fan VFDs, chilled water pump VFDs, chillers, and heating secondary pump VFDs, glycol cooling pumps.

For exhaust fans, fan coil units, pumps that are not controlled by a variable frequency drive the controls contractor shall provide current transducers on this equipment to measure energy usage. See drawings for all equipment not controlled by VFD's.

Building Graphical User Interface:

All metered trend data and power usage should be displayed to the graphical user interface (GUI) of the building management system. The GUI shall be a separate page on the controls graphics that can be access from the home page of the building automation system. This page shall display at a minimum the following information.

- Building energy usage for both electrical consumption and natural gas. Electrical usage shall be displayed in (kWh) and natural gas displayed in (Dth). This display will provide access to past history as well as real time building performance.
- Steam usage.
- Heating hot water usage.
- Cooling usage (MBTU).
- Fan efficiency per air handler. This shall be displayed in (kW/CFM).

Entire building end use breakdown. At a minimun the following should be proivded: Heating, Cooling, Snow Melt, Domestic Hot Water, Industrial Hot Water, Interior Lighting, Exterior Lighting and Plug Loads.

Existing Services to be Relocated/Replaced

- Building 522 kitchen grease interceptor and inspection manhole.
- HTHW lines.
- Refrigerated condensing units on the west end of the existing level A pharmacy.
- Sanitary sewer.
- 20,000 gallon below grade fuel oil tank.
- Roof drainage from Building 525.
- Exhaust air and intake air serving Building 525.
- Natural gas line.
- Foundation drainage.
- San-I-Pak.

Energy Saving Features

The mechanical design will follow the High Performance Building Requirements.

The following items will be incorporated into the HVAC design:

- Air handlers will be sized for 350 feet per minute face velocity (in lieu of the standard 500 feet per minute) for fan energy savings.
- Use outside air economizer on all air handlers. With humidity level requirements being recently lowered, it has become more economical to provide outside air economizing without the large penalty in water usage to generate humidification.
- Medium pressure ductwork will be oversized for fan energy savings.
- Secondary chilled water loop and secondary hot water loop will be variable flow with VFD's on the pumps for pump energy savings.
- Chilled water delta temperature will be 12 deg. F for pump energy savings.
- High efficiency condensing hot water boilers with a low temperature (140 deg. F) hot water heating system will be utilized for the heat source for space heating if this option is chosen. Discharge temperatures will be reset based on polling of the VAV reheat coils.
- Hot water delta temperature will be 30 deg. F for pump energy savings.
- In unoccupied operating rooms, the supply air will be reduced to a minimum flow while maintaining room pressure control. An occupancy sensor will provide the unoccupied control.
- Provide energy metering and/or monitoring.
- Use low water use plumbing fixtures.

Mechanical Brainstorming Energy Saving Ideas

In addition to the energy saving features that will be incorporated design, as noted above, the following ideas are being considered and will need further study:

- Thermal solar domestic water heating system. This system will be to supplement the domestic hot water heating load.
- Provide external shading on east, west and south glass. This option will need to be studied by the design team.
- Provide reflective coating on east, west, and south glass. This option will need to be studied by the design team.
- Provide energy efficient envelope insulation and construction to meet ASHRAE Advanced Energy Design Guide for Hospitals. This option will need to be studied by the design team.

Electrical Requirements

Site Utility Distribution

Provide 12,470, 3-phase, 4-wire connection from a high voltage, pad-mounted switch connected to the university grid at the southwest side of the proposed building to a new 12,470 - 480 Volt, 3-phase, 4-wire transformer. The high voltage switch should be part of the preliminary utility work required to be completed before the ACC building construction can begin in order to relocated existing utility lines that are inside the new construction premises. The new 12,470-480V transformer will be required at the southwest side of the proposed building, coordinated with the final position of the high voltage switch. Size transformer and electrical service based on designed loads of the ACC building. The new electrical service will run into the main electrical room. Standby power will be provided by a 480V, 3-phase, 4-wire, stand-alone generator, dedicated to the ACC building.

Codes and Standards

1. Latest edition of NFPA codes including:
   a. NFPA 70; National Electrical Code with Utah State Amendments
   b. NFPA 99; Health Care Facilities Code
   c. NFPA 101; Life Safety Code
   d. NFPA 110; Standard for Emergency and Standby Power Systems
   e. NFPA 111; Standard on Stored Electrical Energy Emergency and Standby Power System

2. University of Utah DFCM Electrical Supplement

3. University of Utah Standard Vendors

4. 2015 International Energy Conservation Code (being adopted in July 2016)

5. Utah State Fire Marshal's Rules R710

Lighting Design

The lighting design should be robust for patients, visitors, and staff. Support of circadian rhythms is extremely important for both patients and staff. Patients should be exposed to bright and changing light levels during the day and to little or no light at night. This may be in conflict with the needs of the night-shift staff, however, who need to stay awake and also require adequate light levels to observe patients and perform other duties.

Light levels in patient rooms should be off at night to the extent possible. Night lighting in an amber or red color safely helps guide patients, visitors, or staff around the room, and the amber spectrum of lights does not affect sleep cycles. Patients should always have control over the light levels in the room. Patient rest can also be disrupted by light pouring into bedrooms from the hallway, either from the opening and closing of bedroom doors or through glazing on walls or doors. Corridor lights that automatically step down overnight help reduce disruptive light and save energy.
The brightest spaces should be staff work areas that don't have direct visual access to patient rooms. Work areas that need to be brightly lighted but are within view of patient rooms should have focused task lighting that limits light trespass into patient room. Lighting in patient care areas should be cleaned frequently and have minimal crevices or cracks, which can trap infectious material.

To achieve maximum lighting energy savings, lighting power should be optimized, and most spaces should be provided with occupancy sensors and/or daylight-responsive dimming to reduce or shut off the lights when they are not needed. Additionally, lighting left on twenty-four hours a day to provide emergency egress should be designed to limit power use to no more than 10% of total lighting energy consumption.

- Patient Rooms will utilize tunable white fixtures which are adjustable from 2700K to 4000K in color temperature.
- All fixtures in public spaces will be dimmable for increased control abilities.
- Back of house fixtures will be dimmable as code requires. Below is an excerpt of recommended lighting levels per IESNA.

AMBULATORY CARE	
Ambulatory Surgery OR	300-1000 (Note: k)
Consultation	50
Examination/Treatment	50
Life Support Unit	
General	30
Over Bed	50 (Note: a, d, h)
Multipurpose Examination	50
Observation and Treatment	
General	30
Over Bed	50 (Note: a, h)
Over Head of Bed	30
Screening Proctoscopy and Sigmoidoscopy	50
Security Examination	50 (Note: h)

Building lighting control strategies revolve around two principal strategies:
1. Relay Panel / Dimming Panel Automatic Controls
   a. Public Spaces
   b. Non-public spaces as Code Requires

2. Daylighting and Dimming Panel Controls
   a. Spaces with horizontal or vertical fenestrations into the building.

As the building design is developed, a lighting control zone plan will be established to identify lighting loads required by code to be separately controlled. Energy codes require that light fixtures adjacent to windows be switched separately from the remainder of the space, so these fixtures can be switched off when there is enough daylight in the area. Additional energy will be saved by providing fixtures that can automatically be dimmed based on the amount of daylight in the space. Light switch overrides will always be provided. The 2015 International Energy Conservation Code requires significant controls to be in place for code-compliance.

Ensuring that lights are on only when the space is occupied will control lighting energy use. ASHRAE/IESNA Standard 90.1 includes minimal requirements for occupancy controls. By adding manual ON or auto ON to 50% occupancy sensors to exam rooms, administrative offices, staff work and supply rooms, lounges, restrooms, and waiting areas, the lighting system will use 15% to 20% less lighting energy. In well daylighted spaces, automatic sensors that turn the lights off, not on, commonly called "vacancy" sensors, will save lighting power.

Electrical Requirements, continued

TABLE 5-2 SPACE-BY-SPACE LIGHTING POWER DENSITY RECOMMENDATION

Space	How-to Tips	Recommended LPD, W/ft^2	Control Scheme*
Patient room	EL12	0.7[1]	ML/DL
Nurse station	EL13	0.9	ML/DL
Surgery / operating room	EL14	1.7	ML
PACU / noninvasive treatment	EL15	0.8	ML
Treatment / procedure room	EL16	1.5	ML/DL
Exam room	EL17	1.0	ML/OC/DL
LDR / obstetrics	EL18	0.7	ML
Radiology / imaging	EL19	0.8	ML
Work room / supply room	EL13	1.0	ML/DL
Individual office	EL20	0.8	ML/OC/DL
Conference room	EL20	1.0	ML/OC/DL
Corridor (twenty-four-hour care)	EL13	0.7	ML/DL/LS
Corridor (noncare)		0.7	TC/OC/DL/LS
Lab / pharmacy		1.2	SW/OC
Lobby		0.9	TC/OC/DL/LS
Physical therapy		0.9	TC/OC/DL/LS
Laundry		0.6	TC/OC
Lounge / waiting		0.8	TC/OC/DL/LS
Food preparation		1.2	TC/OC

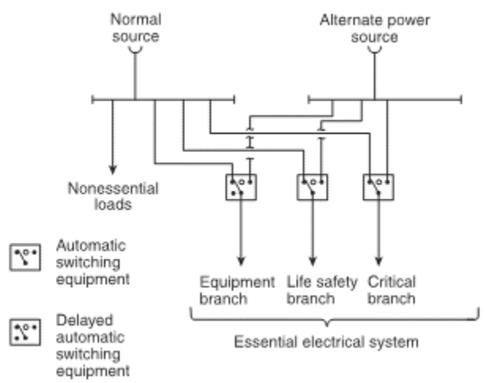
1 Includes allowances for decorative lighting, excluding examination light.
*ML = multi level dimming, SW = manual switch, TC = astronomic time schedule, OC = occupancy/vacancy control, DL = daylight harvesting, LS = light level cutback

Occupant Manual Control—Dimming and Switching
In patient care spaces, controls for switching and dimming the lighting system (and motorized window shades if provided) will be readily accessible by staff, patients, and visitors. In spaces with several lighting zones, where multiple control locations are desired, low-voltage multifunction wall controls with appropriate labeling will be provided. In other than patient-care areas, controls will be located where they are easily accessible and understandable by the staff. In general use spaces, lighting should be controlled by a time of day scheduling system or occupancy sensors. Wall controls should be provided for manual override. These manual controls should be placed in remote locations for use only by staff. Practical patient control of lighting and window shades should be integrated into the patient's pillow speaker or other bed-side remote control.

The effects of lighting on natural circadian rhythms will be considered, and lighting will be designed to avoid disruption of the patient's sleep cycle. These "tunable white" lights will also be considered in the design of the corridor immediately outside the patient room.

Electrical Distribution

Electrical power distribution system will be robust and receive two separate medium voltage feeds for redundancy. Drawout circuit breakers for easiest maintenance are anticipated, with selective coordination and arc flash studies being performed for the distribution system.



Four different electrical power branches are anticipated.
1. Branch 1; Nonessential Loads (Normal Power) Branch

2. Essential Loads
   a. Branch 2; Life Safety Branch
      i. Illumination of Means of Egress
      ii. Exit Signs
      iii. Fire alarm system
      iv. Medical gas alarms
      v. Mechanical, control, and other accessories required for life safety systems operation
      vi. Communication System
      vii. Generator Set and Transfer Switch illumination
      viii. Generator Set Accessories
      ix. Elevator cab lighting, control, and communications
      x. Automatic doors used for building egress
      xi. Panelboards on this branch shall be permitted to serve the floors on which they are located and the floors immediately above/below the level where the panel is located.

   b. Branch 3; Critical Branch
      i. Nurse call systems
      ii. Patient care areas
      iii. Telephone/data rooms
      iv. At least one duplex convenience outlet in each patient room
      v. At least one duplex convenience outlet at each nurse station
      vi. Additional receptacles, task illumination, and selected power circuits needed for effective hospital operations
      vii. Hand washing sinks, scrub sinks, toilets, soap dispensers
      viii. Electronic surveillance systems
      ix. Panelboards on this branch shall serve the floors on which they are located only

   c. Branch 4; Equipment Branch
      i. Smoke control systems
      ii. Stair pressurization systems
      iii. Supply, return, exhaust ventilating systems for isolation rooms
      iv. Supply, return, exhaust ventilating systems for operating rooms.
      v. Supply, return, exhaust ventilating systems for telecommunication rooms.
      vi. Heating equipment with purposes defined in the NEC.
      vii. Elevator(s) selected to provide service to patient, surgical, and ground floors during interruption of normal power.x convenience outlets in the emergency heated area at a ratio of one for each ten patients
      viii. Heating equipment necessary to provide adequate heated space to house all patients under emergency conditions

Main Electrical Room: We will locate the main electrical room close to transformer and near the center of the load as much as possible. The size of the main electrical room will be 20'x40' with the size of the emergency electrical room at 15'x20'. Satellite electrical rooms (12'x14') dedicated for electrical equipment will be on each floor and stack vertically.

Per DFCM requirements, 25% future space for additional overcurrent protection devices in panel boards and switchboards. Provide 25% additional load capacity in addition to the capacity required for continuous loads in panel boards and switchboards.

The on-site emergency generators will not be located in the basement if at all possible. The preference is for them to be located outside and will have on-site fuel storage for at least 96 hours per NFPA 110. Closed transition transfer switches will be used on the distribution branches to prevent systems taking another outage when transferring back to utility.

UPS power shall be provided at a minimum for the servers responsible for the electronic health records system. This will most likely be accomplished through small UPS units placed inside each Telecommunications Room.

Electrical Metering

The building will have electrical metering devices as required by the University of Utah and DFCM. We anticipate meters in the following locations:

1. Meter at Medium Voltage Switchboards at each branch circuit
2. Meter at Low Voltage Main Service Entrance Switchboard
3. Submeter for HVAC Systems
4. Submeter for Lighting Loads
5. Submeter for Plug Loads
6. Submeter for any individual equipment that exceed 100 kW

All submeters will be connect to the monitoring network through one connection point through a dedicated building automation node. We anticipate the submetering being broken down by function instead of by floor. Breaking down the submetering by function is a more cost effective solution that meets the DFCM requirement and measurement and verification LEED requirement.

Acoustics

Mechanical Noise Control: Subject to the restrictions noted elsewhere for duct lining, acoustic duct lining used in supply air systems shall be non-fiberglass material impregnated with an antimicrobial agent and covered by an internal perforated sheet metal liner. Sound attenuators should only be used if other methods of noise reduction such as duct velocity reduction, lining, and fan location are inadequate to achieve noise performance requirements.

Generator Noise: Noise from interior and exterior generators will not exceed 70 dBA at building facades. Noise will not exceed the applicable community noise code for the period of day when maintenance operations occur.

Background Noise: Mechanical and other systems will be designed to meet the following background Noise Criterion (NC) levels.

Space Type	NC Rating
Auditoria, Large Lecture, Teleconferencing Rooms	<30
Patient Rooms, Post-OP	30-35
Offices, Conference Rooms, Teaching Rooms	35-40
Open Offices, Lobbies, Corridors, Public Spaces	40-45
Operating Rooms, Maintenance & Service Areas, Kitchens	50-55

Site Noise: A site noise study will be performed as part of basic services to assess current (and projected) site noise levels. Exterior facades, windows, and doors will be chosen to maintain the background noise levels listed above.

Noise Isolation: Shared partitions will be designed to meet the following Sound Transmission Class (STC) ratings. Penetrations and openings will be accounted for in the design process.

Space Type	STC Rating
Electrical, Mechanical, Service,	57-60
Modules, Patient Rooms, Conference Rooms, Auditoria	54-57
Offices	50-54

Floor-ceiling assemblies and finished floor materials will be chosen to provide a minimum Impact Insulation Class (IIC) of 55 in all areas. STC ratings listed above apply to floor-ceiling assemblies as well.

Room Acoustics: Finish treatments will be chosen to limit excessive reverberation and acoustic anomalies, such as focusing and "flutter echo". Special attention will be paid to areas which require a high level of speech intelligibility. The finish treatments will be chosen to achieve a room-average Sound Absorption Coefficient as shown below.

Space Type	Design Coefficient
Patient Rooms, Corridors, Offices	0.15
Lobbies, Waiting Areas, Operating Rooms, Conference Rooms	0.25

Paging Systems: Paging systems will be designed to achieve a minimum Speech Transmission Index (STI) of 0.5 to provide acceptable intelligibility from the system. Finish materials and acoustic treatments will be selected to ensure this requirement can be met. Emergency notification systems will be designed to achieve a minimum sound level of 70 dBA, or 10 dBA above background noise levels, whichever is higher.

Sound Masking: Masking systems will be designed in spaces where the building construction does not provide sufficient noise isolation. Masking systems will be designed for levels that do not exceed 48 dBA.

Electrical Requirements, continued

Structured Cabling / Communications System

A structured cabling system that can accommodate the current and future needs of the data and voice network is planned. The system components will consist of patch panels, cable organizers, ladder rack tray, basket tray, network cabling, terminations, etc.

1. Electrical Related
   a. Emergency lighting will be provided battery packs in addition to being circuited to emergency power.
   b. Target kW per rack is 3kW unless notified otherwise.
   c. Between 15 and 30 minutes is the necessary UPS backup time per rack.

2. Telecommunications Cabling
   a. Each telecommunication room shall be 12'x14' minimum.
   b. Two data cables are anticipated from each network outlet shown on the plans. A 1" conduit will be provided to the accessible ceiling space, with non-continuous open top cable supports utilized to cable tray to the nearest telecommunications room.
   c. Mid-level Category 6 cabling will be utilized for all horizontal cabling.
   d. One data cable is needed for every wireless access point (WAP) throughout the building. University IT will provide the wireless access point locations.
   e. Two data outlets per office will be installed.
   f. No shielded cabling is required anywhere.
   g. Ladder rack will be utilized within the Telecommunications Room (TR) with basket tray utilized outside the TR.
   h. See conceptual riser diagram for the structured cabling system.
3. The University will source the structured cabling system and have a separate contractor install it hired by the University. This is due to the pricing advantages the University has wil Commscope and the State Contract. System design will be included by the design team but only the pathway system will be provided by the contractor.
4. Telecommunications Rooms will be sized and placed per BICSI standards in a stacked fashion. The main equipment room (ER) will be 30'x30' and the typical TR will be 16'x20'.
5. Spare Communication System Capacities: Provide 100% future space for cabling, data, and communications electronic equipment.

Audiovisual Systems

There will be various audiovisual (AV) systems throughout the building. The main systems will be TV distribution and building paging. There will be a few conference rooms and educational spaces with connectivity. This section is intended to provide a general overview of what we anticipate in the building based on the preliminary floor plans we have seen thus far.

The TV distribution system will deliver cable, satellite and/or other content over coax or category 6 cable throughout the building, including patient rooms. If desired the TV distribution system can be IP based and use the network for delivery.

The building paging system will have multiple zones to isolate pages. Some examples of zones are: operating rooms, PACU, department, common/normal and Code only. Paging system will have a minimum Sound Pressure Level (SPL) of 70 dB or 10 dB above the background noise. It will also have even coverage of ± 4dB at 2 kHz in corridors, open treatment areas and public spaces.

The conference rooms will have standard table top connections, VGA, HDMI and/or Display port. A large flat panel display and/or projector and screen will be used. Screen size will be determined by room size. System may include wireless connectivity, if desired and connection to TV distribution system.

The educational spaces will have voice amplification if needed, and connection from a computer to large flat panel display and/or projector and screen. System may include wireless connectivity, if desired and connection to TV distribution system.

Digital signage will be placed throughout the building. Digital signage will consist of flat panel monitors with networked players.

Digital Signage Areas

1. Digital signage will be located throughout the project for digital wayfinding and marketing needs. Flat screen monitors will be located at coordinated locations within the lobby and other key pedestrian areas.

2. Flat screen monitors will also be located on the patient room floors and connected to the nurse call system. The purpose of the flat screen monitors will be to indicate to nurses and CNA staff the outstanding nurse call alarms and their level of importance. These flat screens are completely connected to the nurse call system and only display nurse call information.

Video Surveillance Systems (Duncan Campbell—Main Contact)

A basic video surveillance system is anticipated with network cabling in conduit. The cameras will watch exterior doors, elevators, and stairwells. The purpose of the cameras will be to watch the general flow of people and not track them. The system will be designed by the design team and provided by the contractor.

The project will utilize Avigilon products per University standards. Therefore, the majority of areas will utilize an Avigilon microdome camera. A handful of PTZ cameras are anticipated in the budget which was provided to Nils Eddy, but their locations are unknown at this point.

1. Pathways: Cable will be in conduit for security purposes.

2. Manufacturer: Avigilon video management system and Avigilon cameras.

Intrusion Detection System (Duncan Campbell—Main Contact)

No true intrusion detection system is currently anticipated. However, duress pushbuttons will be located in nurse stations and reception areas and connected to the access control system.

Access Control System (Duncan Campbell—Main Contact)

A basic access control system will be provided with the following system components:

1. Proximity Card Reader

    a. Exterior Doors
        i. For doors that a card reader is not necessary, electronic locks will be used.
    b. Communication Rooms
    c. Principal Building Entrances
    d. Rooms/Cabinet which store medications
    e. Truck Dock Entrance Mandoors

2. Elevator Controllers will receive a connection to the access control system for controlled access if desired.
3. System is connected to the building LAN and internet for remote configuration and programming. The software will enable the building operator to monitor and track card reader transactions, assign identification of users with access cards and limit access to specific doors/specific times for any access card.
4. The system will be designed by the design team and provided by the contractor.
5. Pathways: Cable will be in conduit for security purposes.
6. Manufacturer: Software House iStar panels.

Fire Alarm and Detection Systems

A robust and code-compliant fire alarm/voice evacuation system is anticipated for the facility that operates in public and private modes, depending on the area. Upon alarm, the hospital facilities group will be alerted to the activated location and an audible sound will inform the public. In the ambulatory care center's private mode area, nurses will be notified via the strobe and an alarm device on the nurse call system so emergency egress can calmly take place in the affected areas. One of the system goals is to utilize varying signals to different facility areas to prevent unnecessary panic amongst bed-ridden patients.

It is anticipated the fire alarm system will be integrated with the HVAC, security, nurse call, mass notification, and elevator systems.

The fire alarm and detection system will be an automatic system capable of detecting fire through the use of smoke detectors and/or air sampling systems.

Summary of System Components:
1. Initiating Devices:
    a. Smoke detectors will be provided in:
        i. Corridors
        ii. Electrical Rooms
        iii. Telecommunications Rooms
        iv. Above Fire Alarm Control Panel per Utah code.
        v. Fire/Smoke Dampers
        vi. Elevator Lobbies
    b. Tamper/Flow switches will be provided as required at fire/sprinkler lines.
    c. Duct Detectors will be provided in all fans over 2,000CFM and designated main trunk lines.

1. Notification Appliances
    a. Speaker/strobes
    b. Speaker only devices
    c. Intelligibility requirements will be met.

2. Miscellaneous Items
    a. System will be interconnected with the smoke control system for the lobby, access control system, and performance audio/video systems.

3. Fire Command Center:
    a. The fire command center will contain the following elements:
        i. Fire Alarm Control Panel (emergency voice/alarm unit), which will have an interface to the Smoke Control Panel designed by the Mechanical Engineer.
        ii. Emergency Generator Annunciator Panel, which shows power status and has manual start/transfer features
        iii. Controls for unlocking stairway doors simultaneously

4. Manufacturer: FCI-Gamewell as provided by Nelson Fire Systems.

Nurse Call Systems

Where nurse call systems are required, system will report to an attended nurse station with electronically supervised visual and audible annunciation. They system shall include a priority hierarchy to account for the needs of specific patients (such as those unable to verbalize or fall risks). The following items are anticipated:
1. Patient Call stations; at each patient sleeping bed
2. Bath stations

Call stations shall activate a visible signal in the corridor at the patient's door and a visible/audible signal at the nurse duty stations in the following locations:
1. Clean workroom
2. Soiled workroom
3. Medication preparation room
4. Documentation area
5. Nourishment area
6. Nurse master station

Nurse call device locations will be located per Table 2.1-2 in the FGI and as required by Hospital Operations. The system will be designed by the design team and provided by the contractor.

Distributed Antenna System (DAS) (Phil Chafee—Main Contact)

In order to ensure communications are not interrupted anywhere in the building with devices utilizing the 800MHz and 450-460MHz UHF bands, a distributed antenna system / emergency communication system will be provided.

A donor antenna will be installed on the roof with a bi-directional amplifier in the basement Equipment Room (ER). Throughout the building omnidirectional antennae, radiating panels, and radiating ½" hardline cable will be utilized to ensure sufficient signal strength is achieved. Peak Mobile Communications is the contractor that will be utilized for the project per University standards.

Electrical Requirements, continued

Mass Notification System (MNS) (Phil Chafee—Main Contact)

In the event of an emergency, a mass notification system is planned to communicate the nature of the emergency and instructions to building occupants. Beacons are anticipated in as many common areas as reasonable on each side of the building including hallways. The system will be designed by the design team and provided by the contractor.

Manufacturer: Alertus

Two Way Emergency Communications Systems

The International Building Code (IBC) Section 1007 requires a two-way communication system on all new construction projects for all areas of refuge regardless of whether the building has a sprinkler system. A call switch will be located at every elevator landing on each accessible floor that is one or more stories above/below the story of exit discharge.

The system will also have a timed automatic telephone dial-out to an off-site location.

Video Intercom Systems

A basic video intercom system will be provided at the truck dock locations for easy visitor identification. Door station will have a camera and microphone to allow two-way communications between a designated location within the building and the truck dock entrance. Door station will be connected to the access control system for remote-entry capabilities. Microphone will have the ability to discreetly listen to audio.

No intercoms are at the existing Hospital's docks because staff is immediately next to the dock area. If staff who handles the ACC dock will be positioned right next to the dock area, no intercom will be required.

Energy Efficiency Requirements

Many of the barriers to reducing plug load energy use are primarily behavioral and not technical. The following items are typically the most significant energy users (besides HVAC and lighting) in buildings along with strategies to reduce the load:

1. Computer Monitors
   a. Purchase high efficiency models and utilize a power strip occupancy sensor.

2. Computer PCs
   a. Purchase high efficiency power supplies and utilize network PC power management software.

3. Water Coolers
   a. Purchase high efficiency models and connect to relay panel, turning water cooler off during unoccupied times in applicable areas.

4. Computer Servers
   a. Use high-efficiency power supplies, high-density servers, and virtualization in the data rooms.

5. Task Lighting
   a. Use high-efficiency LED undercabinet lighting and attach to power strip occupancy sensors.

6. Audiovisual Equipment
   a. Control audiovisual equipment via auto-off/manual-on occupancy sensors or time of day controls.

7. Copy Equipment
   a. Purchase high efficiency model and attach to relay panel, turning copy machine off during unoccupied times.

Power strip occupancy sensors would have the occupancy sensor mounted on the underside of a desk in an office cubicle, shielded from view of the adjacent aisle to avoid false tripping. User's computer is plugged into the unswitched outlets. Peripherals that do not need to stay on when the cubicle is unused such as the computer screen, speakers, printer, task lighting, personal fans, etc. are then plugged into the switched outlet. Rocky Mountain Power offers a $15 incentive per "smart plug strip".

Network PC power management software automatically controls the power settings of networked personal computers at the server level, manages power consumption for each individual computer, and reports the energy savings results. Rocky Mountain Power offers a $7 incentive per controlled PC.

Energy Efficiency Requirements (HPBS / OPR)

Owners Project Requirements & Basis of Design

The purpose of the OPR is to provide a clear and concise document of the Owner's goals, expectations and requirements for the building. It provides the design team with the information to develop the Basis of Design (BOD) during schematic design, serving as a road map for the development of the design and construction documents. Additionally, OPR and BOD provide the owner and commissioning agent with tangible benchmarks to measure success, quality and confirm that the building and systems constructed align with the Owner's expectations and requirements.

A concise OPR must be developed by the design team and owner during the project programming phase, or by the midpoint of schematic design, for projects without a programming phase. For projects with a programming phase, the OPR is required to be complete and included in the project program. For projects without a programming phase the, the OPR is required to be complete and included in the schematic design review set.

As the project develops, it is expected that many of the elements of the OPR and BOD will evolve. Once the initial OPR and BOD are developed by the design team and the Commissioning Agent (CxA) has been integrated into the project, it is to be reviewed by the CxA at the SD, DD and CD submittal. Changes to the OPR and BOD, from one design phase to the next, must be documented by the design team.

Additionally, the OPR and BOD should serve as a foundation for the projects systems manuals delivered to the Owner as part of the "as-built" documents.

The following sections must be included in the OPR.

- Project information
  - Project name - Ambulatory Care Complex
  - Project site address — Address is through the University of Utah Hospital
  - Building typology — inpatient hospital, surgery, clinics, office, support services
  - Utility bill/account information
    - » Rate schedule - unknown
    - » Meter number (if known) - unknown
  - Project team contact information (emails, addresses, phone numbers) per programming and design phase teams
    - » Owner Information
      - – DFCM Project Manager — Dave McKay
      - – DFCM Energy Program Director — John Burningham
      - – Agency Project Manager — Nils Eddy / Curtis Leetham
      - – Agency Energy Manager — Sarah Bolls
      - – Facility Operator - if this is unknown, identify who in the agency will represent the interests of the person(s) who will operate and maintain the building, through the design and construction period. Identify the date in which the Facility Operator will be known. - Unknown
    - » Architect — FFKR /HDR
      - – Principal In Charge — Russ L. Bachmeier
      - – Project Architect — Michael Dolan
    - » Mechanical Engineer — VBFA — Jeff Watkins
    - » Electrical Engineer — BNA — Brian Hicks
    - » Cost Estimator — CM/GC — Jacobsen Construction
    - » Kitchen Designer - None
    - » Lighting Engineer - Unknown
    - » Civil Engineer — VBFA — David Baranowski
    - » Landscape Architect - FFKR
    - » Other project consultants - None
    - » General Contractor — Jacobsen Construction
      - – Project Executive — Blake Court
      - – Project Manager - Unknown
      - – Superintendent - Unknown
      - – Project Engineer - Unknown
      - – Cost Estimator — Shaun Robbins
- Project background
  - General building information including but not limited to the following
    - » Square footage — 296,000
    - » Number of floors - eight
    - » Construction Costs (soft and hard) — 131,500,000.00 (not including FF&E)
    - » Location — University of Utah Health Sciences Campus
    - » Design schedule — 12 months
    - » Construction schedule — 30 months
    - » Project delivery method — CM/GC
    - » Estimated occupancy
    - » Code occupancy schedules
    - » Abatement (if necessary) - Unknown
  - General project background
    - » Brief summary of the project
      - – Intended use — The building is an expansion to the Building 525 hospital. It include one floor of inpatient beds to be built as part of the project and one floor of inpatient beds to be shelled, a 6 OR surgery floor, approximately 120 clinical exam rooms, one floor of office space, and support functions.
      - – Occupancy — Mixed B and I2
      - – Construction type - 1A
      - – Other
    - » Mission — See mission statement in program
    - » Objectives — See objectives in program
    - » Possible needs for flexibility and expansion — the need for flexibility and expansion is paramount.
- Code & standards
  - Building codes — Current 2015 International Building Codes
  - DFCM standards — latest edition
  - Agency standards — University of Utah latest edition
  - Other — State of Utah Department of Health requirements.
- Building performance
  - See Section 5.0 — High Performance Building Standard, for applicable requirements
    - » Context sensitive design
    - » Site design
      - – Open space — There is very little to no open space associated directly with the ACC Building. There is extensive new open space proposed within the Transformation Project, but most of that will happen as part of the future MED project after Building 521 is removed.
      - – Landscape — there is very little landscaping associated with this project. The sloped areas west of the new building will be improved as part of this project. The EPA WaterSense Tool will be used to identify the water allowance for the landscaped areas.
      - – Storm Water — To be determined
      - – Heat Island Reduction — None heat absorbing materials will be used for the pedestrian paving for the project. A reflective color roof will be installed on the roof of the building.
      - – Light Pollution
        - · Exterior lighting (including building and site) will be sensitive to surrounding areas and nearby patient rooms with respect to glare and light spillover.
    - » Energy performance
      - – Performance requirement 20% (TBD) better than ASHRAE 90.1-2013 or IECC 2015
      - – New Construction
      - – Energy Model
        - · Consider impact of utilizing air cooled chillers for peak shaving
        - · Consider operating condensing boilers at 140°F vs. 180°F
        - · Consider impact of elevator equipment
        - · Review the impact of the snow melt system
      - – Life Cycle Cost
        - · Identify anticipated energy costs for all sources to project
          - › Window/wall ratio and impact on mechanical equipment sizing over the life of the facility
          - › Wall construction including insulation, vapor barrier and glazing

Energy Efficiency Requirements (HPBS / OPR)

        - Roof Construction including insulation thickness, white or black roof membrane
- Life cycle expectations
    - General building
    - Building envelop systems
    - HVAC systems — The mechanical air system shall be designed to achieve the energy efficiency goal and shall be designed for maintainability. System will be design to be flexible to meet the continual changes required in a healthcare facility. The system life expectancy will be a minimum of 30 years
    - Electrical systems — The electrical system shall have a life expectancy with a minimum of 20 years. Some components such as a dry-type transformer, will have a longer life expectancy of 25-30 years.
    - Plumbing systems — System to be design to meet DFCM standards and local codes
    - Warranty expectations
- Equipment performance
- Controls strategies — System will be design for open architecture and shall be a Siemens Staefa system designed and installed by Atkinson Electronics. System will be integrated so that it is available throughout the hospital system. Reset schedules will be considered for the heating hot water, chilled water and air systems.
- Economizers — Air side economizers using 100% outside air will be provided for all air systems. Air intakes will be a minimum of 6'-0" above grade or 3'-0" above the roof
- Premium efficiency motors will be used on all air handling equipment and pumps
- Transportation management
- Parking requirements - There is no new parking being constructed as part of this project. The University is re-allocating parking in the Health Sciences to cover any new parking requirements for the inpatient beds.
- Alternative parking requirements — N/A
- Alternative transportation provisions — N/A
- Water Efficiency
- EPA Water Sense Requirements will be met for all plumbing fixtures specified on the project
- Materials and Resources
- Recycling
- Sourcing
- Indoor environmental quality
- Air quality measures
    - Will meet the requirements of the HPBS
    - Building flush prior to occupancy or a combined pre/post occupancy flush
- Views
    - Identify areas in the space program to have visual access to the outdoors.
- Daylighting
- Outside air & Ventilation
    - ASHRAE 62.1 — Current Edition as minimum requirements
    - ASHRAE 170-2008 — Current Edition for patient care areas
    - CO2 sensors located in the return air and spaces where occupancy is 25 people per 1000 sq.ft.
- Lighting levels
- Patient Rooms will utilize tunable white fixtures which are adjustable from 2700K to 4000K in color temperature.
- All fixtures in public spaces will be dimmable for increased control abilities.
- Back of house fixtures will be dimmable as code requires. Below is an excerpt of recommended lighting levels per IESNA.

AMBULATORY CARE	
Ambulatory Surgery OR	300-1000 (Note: k)
Consultation	50
Examination/Treatment	50
Life Support Unit	
General	30
Over Bed	50 (Note: a, d, h)
Multipurpose Examination	50
Observation and Treatment	
General	30
Over Bed	50 (Note: a, h)
Over Head of Bed	30
Screening Proctoscopy and Sigmoidoscopy	50
Security Examination	50 (Note: h)

- Occupancy sensor for lighting and thermal controls
    - Interlock VAV boxes with vacancy sensors located in office space, restrooms storage room etc. VAV boxes to close when spaces are unoccupied
    - Occupied set points
        - Office Space: Summer 72°F, Winter 72°F, Maximum humidity 50%
        - Operating Rooms: Summer 68°F, Winter 68°F, Maximum humidity 20%-50%
        - Patient Care Areas/Clinic: Summer 68°F - 72°F, Winter 68° - 72°F, Maximum humidity 50%
        - Thermostat adjustment +/- 2°F
        - Mechanical & electrical rooms 60°F — 80°F
- Filtration
    - Pre filters and final filters shall be provided per latest codes and standards. Pre filters shall have an efficiency of 30% (Merv 8) and final filters an efficiency of 90% (Merv 14) based on ASHRAE Test Standard 52. Final filters shall be installed at the point of discharge.
    - Building flush - Building flush prior to occupancy or a combined pre/post occupancy flush
    - VOCs
- Education and Outreach Program
- Building envelope
- See Section 5.13 — Envelope Commissioning
- Internal, external and thermal loads in conjunction with mechanical and electrical criteria
- Façade
- Fenestration
- Assemblies
- Roof
- Subgrade
- Warranty expectations
- Incentives and Rebates
- Identify rate schedules
- Identify utility providers
- Identify anticipated energy costs for all sources
- Include final incentive documentation in final OPR and O&M manuals

- Spaces program
    - Occupancy schedules
        - Daily on a weekly and monthly basis per space program
        - Consider weekend uses and summer uses for educational projects
    - After hours schedules
    - Cleaning schedules
    - Set points
- Architectural criteria
    - Identify unique design features that may impact building performance
        - Atriums — N/A
            - Smoke Evacuation expectations
            - VFD's for supply and exhaust fans
            - Code requirements for controls, testing and detection
        - Clerestory — N/A
        - Mixed occupancies - yes
        - Interior garages — covered and partially enclosed service dock area
        - Kitchens — N/A
        - Tunnels — mechanical tunnels
        - Bridges — bridge connection back to Building 525.
        - Future expansions — Build-out of the level 6 shelled space. Construction of a portion of the MED building over the ACC building.
- Electrical & Lighting criteria - per space program
    - Per space program
    - Light power density (LPD)
    - Foot-candle levels
    - Controls

TABLE 5-2 SPACE-BY-SPACE LIGHTING POWER DENSITY RECOMMENDATION

Space	How-to Tips	Recommended LPD, W/ft^2	Control Scheme*
Patient room	EL12	0.7[1]	ML/DL
Nurse station	EL13	0.9	ML/DL
Surgery / operating room	EL14	1.7	ML
PACU / noninvasive treatment	EL15	0.8	ML
Treatment / procedure room	EL16	1.5	ML/DL
Exam room	EL17	1.0	ML/OC/DL
LDR / obstetrics	EL18	0.7	ML
Radiology / imaging	EL19	0.8	ML
Work room / supply room	EL13	1.0	ML/DL
Individual office	EL20	0.8	ML/OC/DL
Conference room	EL20	1.0	ML/OC/DL
Corridor (twenty-four-hour care)	EL13	0.7	ML/DL/LS
Corridor (noncare)		0.7	TC/OC/DL/LS
Lab / pharmacy		1.2	SW/OC
Lobby		0.9	TC/OC/DL/LS
Physical therapy		0.9	TC/OC/DL/LS
Laundry		0.6	TC/OC
Lounge / waiting		0.8	TC/OC/DL/LS
Food preparation		1.2	TC/OC

1 Includes allowances for decorative lighting, excluding examination light.
*ML = multi level dimming, SW = manual switch, TC = astronomic time schedule, OC = occupancy/ vacancy control, DL = daylight harvesting, LS = light level cutback

BUILDING LIGHTING CONTROL STRATEGIES REVOLVE AROUND TWO PRINCIPAL STRATEGIES:

1. Relay Panel / Dimming Panel Automatic Controls
   a. Public Spaces
   b. Non-public spaces as Code Requires
2. Daylighting and Dimming Panel Controls
   a. Spaces with horizontal or vertical fenestrations into the building.

As the building design is developed, a lighting control zone plan will be established to identify lighting loads required by code to be separately controlled. Energy codes require that light fixtures adjacent to windows be switched separately from the remainder of the space, so these fixtures can be switched off when there is enough daylight in the area. Additional energy will be saved by providing fixtures that can automatically be dimmed based on the amount of daylight in the space. Light switch overrides will always be provided. The 2015 International Energy Conservation Code requires significant controls to be in place for code-compliance.

Ensuring that lights are on only when the space is occupied will control lighting energy use. ASHRAE/IESNA Standard 90.1 includes minimal requirements for occupancy controls. By adding manual ON or auto ON to 50% occupancy sensors to exam rooms, administrative offices, staff work and supply rooms, lounges, restrooms, and waiting areas, the lighting system will use 15% to 20% less lighting energy. In well daylighted spaces, automatic sensors that turn the lights off, not on, commonly called “vacancy” sensors, will save lighting power.

- Remote BMS access needs, notifications and clearances
- Occupant controls

OCCUPANT MANUAL CONTROL—DIMMING AND SWITCHING

In patient care spaces, controls for switching and dimming the lighting system (and motorized window shades if provided) will be readily accessible by staff, patients, and visitors. In spaces with several lighting zones, where multiple control locations are desired, low-voltage multifunction wall controls with appropriate labeling will be provided. In other than patient-care areas, controls will be located where they are easily accessible and understandable by the staff. In general use spaces, lighting should be controlled by a time of day scheduling system or occupancy sensors. Wall controls should be provided for manual override. These manual controls should be placed in remote locations for use only by staff. Practical patient control of lighting and window shades should be integrated into the patient’s pillow speaker or other bed-side remote control.

The effects of lighting on natural circadian rhythms will be considered, and lighting will be designed to avoid disruption of the patient’s sleep cycle. These “tunable white” lights will also be considered in the design of the corridor immediately outside the patient room.

- Controls interface requirements
- Lighting strategies
  - Task
  - Ambient
  - Emergency
  - Daylighting & outdoor views

The lighting design should be robust for patients, visitors, and staff. Support of circadian rhythms is extremely important for both patients and staff. Patients should be exposed to bright and changing light levels during the day and to little or no light at night. This may be in conflict with the needs of the night-shift staff, however, who need to stay awake and also require adequate light levels to observe patients and perform other duties.

Light levels in patient rooms should be off at night to the extent possible. Night lighting in an amber or red color safely helps guide patients, visitors, or staff around the room, and the amber spectrum of lights does not affect sleep cycles. Patients should always have control over the light levels in the room. Patient rest can also be disrupted by light pouring into bedrooms from the hallway, either from the opening and closing of bedroom doors or through glazing on walls or doors. Corridor lights that automatically step down overnight help reduce disruptive light and save energy.

The brightest spaces should be staff work areas that don’t have direct visual access to patient rooms. Work areas that need to be brightly lighted but are within view of patient rooms should have focused task lighting that limits light trespass into patient room. Lighting in patient care areas should be cleaned frequently and have minimal crevices or cracks, which can trap infectious material.

To achieve maximum lighting energy savings, lighting power should be optimized, and most spaces should be provided with occupancy sensors and/or daylight-responsive dimming to reduce or shut off the lights when they are not needed. Additionally, lighting left on twenty-four hours a day to provide emergency egress should be designed to limit power use to no more than 10% of total lighting energy consumption.

- Special requirements
- Exterior requirements
- Emergency requirements

The on-site emergency generators will not be located in the basement if at all possible. The preference is for them to be located outside and will have on-site fuel storage for at least 96 hours per NFPA 110. Closed transition transfer switches will be used on the distribution branches to prevent systems taking another outage when transferring back to utility.

- Essential Loads
  - Branch 2; Life Safety Branch
    - » Illumination of Means of Egress
    - » Exit Signs
    - » Fire alarm system
    - » Medical gas alarms
    - » Mechanical, control, and other accessories required for life safety systems operation
    - » Communication System
    - » Generator Set and Transfer Switch illumination
    - » Generator Set Accessories
    - » Elevator cab lighting, control, and communications
    - » Automatic doors used for building egress

Energy Efficiency Requirements (HPBS / OPR)

    - » Panelboards on this branch shall be permitted to serve the floors on which they are located and the floors immediately above/ below the level where the panel is located.

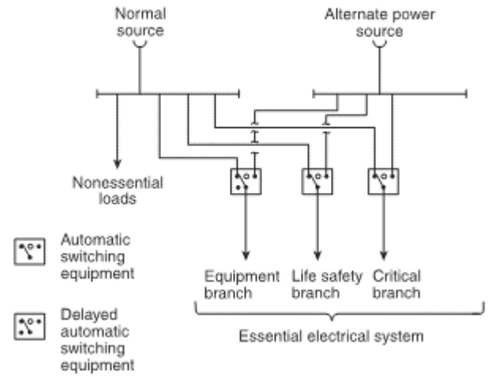
- Branch 3; Critical Branch
  - » Nurse call systems
  - » Patient care areas
  - » Telephone/data rooms
  - » At least one duplex convenience outlet in each patient room
  - » At least one duplex convenience outlet at each nurse station
  - » Additional receptacles, task illumination, and selected power circuits needed for effective hospital operations
  - » Hand washing sinks, scrub sinks, toilets, soap dispensers
  - » Electronic surveillance systems
  - » Panelboards on this branch shall serve the floors on which they are located only

- Branch 4; Equipment Branch
  - » Smoke control systems
  - » Stair pressurization systems
  - » Supply, return, exhaust ventilating systems for isolation rooms
  - » Supply, return, exhaust ventilating systems for operating rooms.
  - » Supply, return, exhaust ventilating systems for telecommunication rooms.
  - » Heating equipment with purposes defined in the NEC.
  - » Elevator(s) selected to provide service to patient, surgical, and ground floors during interruption of normal power.
  - » Duplex convenience outlets in the emergency heated area at a ratio of one for each ten patients
  - » Heating equipment necessary to provide adequate heated space to house all patients under emergency conditions
- UPS

UPS power shall be provided at a minimum for the servers responsible for the electronic health records system. This will most likely be accomplished through small UPS units placed inside each Telecommunications Room.

- Distribution

Electrical power distribution system will be robust and receive two separate medium voltage feeds for redundancy. Drawout circuit breakers for easiest maintenance are anticipated, with selective coordination and arc flash studies being performed for the distribution system.



Four different electrical power branches are anticipated per code requirements.

- Metering

The building will have electrical metering devices as required by the University of Utah and DFCM. We anticipate meters in the following locations:

- Meter at Medium Voltage Switchboards at each branch circuit
- Meter at Low Voltage Main Service Entrance Switchboard
- Submeter for HVAC Systems
- Submeter for Lighting Loads
- Submeter for Plug Loads
- Submeter for any individual equipment that exceed 100 kW

All submeters will be connect to the monitoring network through one connection point through a dedicated building automation node. We anticipate the submetering being broken down by function instead of by floor. Breaking down the submetering by function is a more cost effective solution that meets the DFCM requirement and measurement and verification LEED requirement.

- Equipment types
- Power quality control

Automatic switching capacitor bank will be provided to improve the power factor to the target range of 0.9 to 1.0.

- Peak demand control
  - Redundancy requirements

N+1 redundancy for the emergency generation equipment will be provided.

- Warranty expectations
  - Identify internal, external and thermal loads

- Mechanical criteria - per space program
  - Summer Outdoor Design Conditions: 97°F db, 62°F wb (coincident) and 70°F wb
  - Winter Outdoor Design Conditions: 0°F db
  - Heating and cooling calculations will be based on Summer 68°F - 72°F, Winter 68° - 72°F, Maximum humidity 50%. Mechanical control system will be designed with flexibility to control room temperatures remotely and adjusted to meet the occupancy requirements

- Acoustical isolation criteria — Offices, conference rooms, exam rooms and patient rooms shall be designed with an NC rating less than 30
- Pressurization
  - The building will be design to maintain a positive pressure to the exterior. The positive pressure set point will be +0.02 (adjustable).
  - Isolation rooms, restrooms, food prep areas, soiled utility rooms, morgue, sterile processing, janitor's closets will be maintained at a negative pressure to the surroundings
  - Operating rooms, clean utility and cleanroom will be maintained at a positive pressure.
- Ventilation
  - ASHRAE 62.1 — Current Edition as minimum requirements
  - ASHRAE 170-2008 — Current Edition for patient care areas
  - CO2 sensors located in the return air and spaces where occupancy is 25 people per 1000 sq.ft.
- Humidity
  - Office and clinic spaces — Maximum of 50% RH
  - Operating rooms and patient care areas: 20% - 60% RH
- Zoning — Each individual office, exam room, operating room, conference room shall have an individual thermostat per the University of Utah Guidelines
- Controls - System will be design for open architecture and shall be a Siemens Staefa system designed and installed by Atkinson Electronics. System will be integrated so that it is available throughout the hospital system
- Occupant controls - Thermostat adjustment +/- 2°F
- User interface requirements — System will be integrated with the hospital wide BMS system and shall be accessible through a web browser
- Metering — Shall meet the DFCM Design requirements and well as the University of Utah Design Standards. Metering will include steam, chilled water, culinary water, domestic hot water
- Analytics — Coordinate with the UofU Design Standards to setup the program and for required training
- Equipment types
- Refrigeration needs
  - Air cooled chillers for peak demand shaving as well as provide redundancy cooling needs for critical spaces
  - Dedicated air cooled chillers for TDR and Electrical rooms
- Domestic hot water - Domestic hot water will be produced by instantaneous steam to domestic hot water heat exchangers or by instantaneous gas fired domestic hot water boilers. Steam will be provided by the steam boiler system. These will be provided with redundant services. Water will be generated at 160F and be mixed down to be supplied to the building at 120F with no storage tanks. Water meters will be provided on hot water and hot water return piping and will interface with the building automation system to determine domestic hot water usage
- Peak demand control — Air cooled chillers for peak demand shaving
- Redundancy requirements
  - N+1 redundancy for all heating equipment
  - N+1 redundancy for chilled water will be provided through the campus chilled water plant
  - N+1 redundancy on all domestic water heating equipment and pumps
  - Onsite backup #2 fuel oil for a minimum of 48 hours of operation for heating and electrical needs
- Warranty expectations — One (1) year warranty on all mechanical equipment. Additional/extended warranties will be coordinated with owner
- Identify internal, external and thermal loads - All systems shall be designed for flexibility to allow for growth and function
  - Primary internal heat gain will be from occupants and equipment
  - External heat gain will be dependent on the building envelope design

- BAS/BMS requirements
  - Accessibility - System will be design for open architecture and shall be a Siemens Staefa system designed and installed by Atkinson Electronics.
  - System shall be on emergency power with UPS backup to prevent system from shutting down on an initial loss of power prior to the generator starting.
  - Integration - System will be integrated so that it is available throughout the hospital system
  - Temperature control - Thermostat adjustment +/- 2°F
  - Temperature zones — Each individual office, exam room, operating room, conference room shall have an individual thermostat per the University of Utah Guidelines
  - Metering - Shall meet the DFCM Design requirements and well as the University of Utah Design Standards. See Section 5.10 - Metering
  - Points - see Section 5.11 — Data Points to be developed as the design progresses
- Security requirements

A basic video surveillance system is anticipated with network cabling in conduit. The cameras will watch exterior doors, elevators, and stairwells. The purpose of the cameras will be to watch the general flow of people and not track them. The system will be designed by the design team and provided by the contractor.

The project will utilize Avigilon products per University standards. Therefore, the majority of areas will utilize an Avigilon microdome camera. A handful of PTZ cameras are anticipated in the budget which was provided to Nils Eddy, but their locations are unknown at this point.

1. Pathways: Cable will be in conduit for security purposes.
2. Manufacturer: Avigilon video management system and Avigilon cameras.

No true intrusion detection system is currently anticipated. However, duress pushbuttons will be located in nurse stations and reception areas and connected to the access control system.

A basic access control system will be provided with the following system components:
1. Proximity Card Reader
   a. Exterior Doors
      i. For doors that a card reader is not necessary, electronic locks will be used.
      b. Communication Rooms
      c. Principal Building Entrances
      d. Rooms/Cabinet which store medications
      e. Truck Dock Entrance Mandoors
2. Elevator Controllers will receive a connection to the access control system for controlled access if desired.
3. System is connected to the building LAN and internet for remote configuration and programming. The software will enable the building operator to monitor and track card reader transactions, assign identification of users with access cards and limit access to specific doors/specific times for any access card.
4. The system will be designed by the design team and provided by the contractor.
5. Pathways: Cable will be in conduit for security purposes.

MANUFACTURER: SOFTWARE HOUSE ISTAR PANELS.

Where nurse call systems are required, system will report to an attended nurse station with electronically supervised visual and audible annunciation. The system shall include a priority hierarchy to account for the needs of specific patients (such as those unable to verbalize or fall risks). The following items are anticipated:
1. Patient call stations; at each patient sleeping bed.
2. Bath stations

Call stations shall activate a visible signal in the corridor at the patient's door and a visible/audible signal at the nurse duty stations in the following locations:
1. Clean workroom
2. Soiled workroom
3. Medication preparation room
4. Documentation area
5. Nourishment area
6. Nurse master station

Nurse call device locations will be located per Table 2.1-2 in the FGI and as required by Hospital Operations. The system will be designed by the design team and provided by the contractor.

In order to ensure communications are not interrupted anywhere in the building with devices utilizing the 800MHz and 450-460MHz UHF bands, a distributed antenna system / emergency communication system will be provided.

A donor antenna will be installed on the roof with a bi-directional amplifier in the basement Equipment Room (ER). Throughout the building omnidirectional antennae, radiating panels, and radiating ½" hardline cable will be utilized to ensure sufficient signal strength is achieved. Peak Mobile Communications is the contractor that will be utilized for the project per University standards.

In the event of an emergency, a mass notification system is planned to communicate

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the nature of the emergency and instructions to building occupants. Beacons are anticipated in as many common areas as reasonable on each side of the building including hallways. The system will be designed by the design team and provided by the contractor.

MANUFACTURER: ALERTUS

The International Building Code (IBC) Section 1007 requires a two-way communication system on all new construction projects for all areas of refuge regardless of whether the building has a sprinkler system. A call switch will be located at every elevator landing on each accessible floor that is one or more stories above/below the story of exit discharge.

The system will also have a timed automatic telephone dial-out to an off-site location.

AUDIO VISUAL REQUIREMENTS

There will be various audiovisual (AV) systems throughout the building. The main systems will be TV distribution and building paging. There will be a few conference rooms and educational spaces with connectivity. This section is intended to provide a general overview of what we anticipate in the building based on the preliminary floor plans we have seen thus far.

The TV distribution system will deliver cable, satellite and/or other content over coax or category 6 cable throughout the building, including patient rooms. If desired the TV distribution system can be IP based and use the network for delivery.

The building paging system will have multiple zones to isolate pages. Some examples of zones are: operating rooms, PACU, department, common/normal and Code only. Paging system will have a minimum Sound Pressure Level (SPL) of 70 dB or 10 dB above the background noise. It will also have even coverage of ± 4dB at 2 kHz in corridors, open treatment areas and public spaces.

The conference rooms will have standard table top connections, VGA, HDMI and/or Display port. A large flat panel display and/or projector and screen will be used. Screen size will be determined by room size. System may include wireless connectivity, if desired and connection to TV distribution system.

The educational spaces will have voice amplification if needed, and connection from a computer to large flat panel display and/or projector and screen. System may include wireless connectivity, if desired and connection to TV distribution system.

Digital signage will be placed throughout the building. Digital signage will consist of flat panel monitors with networked players.

Digital signage will be located throughout the project for digital wayfinding and marketing needs. Flat screen monitors will be located at coordinated locations within the lobby and other key pedestrian areas.

Flat screen monitors will also be located on the patient room floors and connected to the nurse call system. The purpose of the flat screen monitors will be to indicate to nurses and CNA staff the outstanding nurse call alarms and their level of importance. These flat screens are completely connected to the nurse call system and only display nurse call information.

- Integration into existing campus infrastructure systems
  - Chilled water
  - Natural gas
  - Sanitary sewer
  - Storm drainage
  - Domestic water
  - Fire protection
  - Foundation drainage
  - Integrate with the campus building management system (BMS)
  - Add meters on the chilled water system served by the campus chilled water plant
  - Provide meters on building 522, 525 & 529 to measure energy usage at each building
  - Provide new meters for ACC
  - Consult campus hydraulic flow analysis — Engineered Water Flow Analysis has been completed and provided as a separate document
  - Diversity — N+1 redundancy for building heating, cooling and domestic hot water. An additional secondary domestic water feed to the building will be provided per the IPC 2015
  - Identify possible campus infrastructure implications
    - » Electrical distribution systems

The schematic design package identifies the utility relocation requirements prior to the construction of the ACC. Several telecommunications and electrical manholes are in the building footprint and require a redundant connection serving their connections prior to taking them offline.

- Building heating and cooling distribution systems
  Heating:
  - **One option (Base Case)** is to tie the new ACC into a new steam central utility plant. The steam plant will utilize the two existing 600 HP high pressure steam boilers and add two new 600 HP high pressure steam boilers. These boilers would continue to provide backup heat for buildings 522, 525 and 529 utilizing the existing infrastructure. The two new steam boilers along with two new deaerators would provide the N+1 redundancy required per the FGI Guidelines

  - **The second option (Option 3)** would be to utilize condensing hot water boilers if onsite generation is chosen as the most viable option. With condensing boilers utilized, the most likely option will be to also serve buildings 522, 525 and 529 off of the new condensing boilers located within the ACC. The boilers would be provided with N+1 redundancy and would be designed to run on redundant fuel. The primary source of fuel will be natural gas with No. 2 fuel oil as the backup source

  Cooling:
  - Chilled water will be provided by the east campus chilled water plant. How this will be accomplished at this time is still to be determined. Part of the design process may include adding local air cooled chillers for peak shaving as well as to be available to serve critical areas of the ACC and the existing Hospital in an event

  - Chilled water will be provided from the East Campus Chilled Water Plant. Chilled water from this plant will be supplied at 43°F and will be returned to the plant at 59°F. The piping from the plant to the building will be buried uninsulated pipe

  - Interface with existing BMS and controls systems
  - Add meters when possible to existing systems to further energy management efforts on older systems
- Identify existing campus systems performance levels
  - Provide existing energy performance data
  - Metering levels of existing systems related to the project
  - Clarify billing arrangements of building tenants
- Identify opportunities for renewables or site based resources
  - Solar — Photovoltaic can be considered
- Greenhouse Gas Emissions performance implications
  - With onsite generation of heat utilizing steam boilers or condensing boilers. The GHG reporting requirements and tracking metrics are required
    - » Carbon dioxide — CO2
    - » Methane — CH4
  - Track throughout the design process
  - Identify direct emissions contributors
  - Identify indirect emissions contributors
- Renewable systems
  - LCC considerations
  - Offsite generation considerations
  - Onsite generation considerations
  - Alternative and additional financing mechanisms
    - » Power Purchase Agreement
    - » Donor funds
    - » Student fees
    - » Agency funding
    - » Grants and incentives
- Renewable Energy Certificates
  - LEED Requirements
  - Acoustical criteria

Mechanical Noise Control: Subject to the restrictions noted elsewhere for duct lining, acoustic duct lining used in supply air systems shall be non-fiberglass material impregnated with an antimicrobial agent and covered by an internal perforated sheet metal liner. Sound attenuators should only be used if other methods of noise reduction such as duct velocity reduction, lining, and fan location are inadequate to achieve noise performance requirements.

Generator Noise: Noise from interior and exterior generators will not exceed 70 dBA at building facades. Noise will not exceed the applicable community noise code for the period of day when maintenance operations occur.

Background Noise: Mechanical and other systems will be designed to meet the following background Noise Criterion (NC) levels.

Space Type	NC Rating
Auditoria, Large Lecture, Teleconferencing Rooms	<30
Patient Rooms, Post-OP	30-35
Offices, Conference Rooms, Teaching Rooms	35-40
Open Offices, Lobbies, Corridors, Public Spaces	40-45
Operating Rooms, Maintenance & Service Areas, Kitchens	50-55

Site Noise: A site noise study will be performed as part of basic services to assess current (and projected) site noise levels. Exterior facades, windows, and doors will be chosen to maintain the background noise levels listed above.

Noise Isolation: Shared partitions will be designed to meet the following Sound Transmission Class (STC) ratings. Penetrations and openings will be accounted for in the design process.

Space Type	STC Rating
Electrical, Mechanical, Service,	57-60
Modules, Patient Rooms, Conference Rooms, Auditoria	54-57
Offices	50-54

Floor-ceiling assemblies and finished floor materials will be chosen to provide a minimum Impact Insulation Class (IIC) of 55 in all areas. STC ratings listed above apply to floor-ceiling assemblies as well.

Room Acoustics: Finish treatments will be chosen to limit excessive reverberation and acoustic anomalies, such as focusing and “flutter echo”. Special attention will be paid to areas which require a high level of speech intelligibility. The finish treatments will be chosen to achieve a room-average Sound Absorption Coefficient as shown below.

Space Type	Design Coefficient
Patient Rooms, Corridors, Offices	0.15
Lobbies, Waiting Areas, Operating Rooms, Conference Rooms	0.25

Paging Systems: Paging systems will be designed to achieve a minimum Speech Transmission Index (STI) of 0.5 to provide acceptable intelligibility from the system. Finish materials and acoustic treatments will be selected to ensure this requirement can be met. Emergency notification systems will be designed to achieve a minimum sound level of 70 dBA, or 10 dBA above background noise levels, whichever is higher.

Sound Masking: Masking systems will be designed in spaces where the building construction does not provide sufficient noise isolation. Masking systems will be designed for levels that do not exceed 48 dBA.
- Per space program
- Internal considerations
- External considerations

- General systems to be commissioned. With the Facilities Operator identify which systems and which equipment is to be commissioned as well as the commission scope
  - See Section 5.12 — Commissioning
  - See Section 5.13 — Building Envelop Commissioning
  - HVAC
  - Electrical
  - Controls
  - Lighting Controls
  - Life Safety
  - Security
  - Plumbing
  - Elevator
  - Equipment
  - Telecom
  - Audiovisual System
  - Mass Notification System
  - Remote BMS access needs and clearances
- Post-occupancy and warranty
  - 5 Month Walk Through Meeting
    - » Onsite meeting five to six months after Substantial Completion to review performance and quality of the facility with the following in attendance (minimum)
      - – Facility Operators
      - – Agency Energy Manager or DFCM Energy Program Director
      - – Commissioning Agent
      - – Mechanical Engineer
      - – General Contractor
      - – Mechanical Subcontractor
      - – Architect
      - – User Representative
  - 10 Month Walk Through Meeting
    - » Onsite meeting 10 months after Substantial Completion to review warranty, performance and quality issues with the following in attendance (minimum)
      - – Facility Operators
      - – Agency Energy Manager or DFCM Energy Program Director
      - – Commissioning Agent
      - – Mechanical Engineer
      - – General Contractor
      - – Mechanical Subcontractor
      - – Architect
  - Operations and maintenance
    - Benchmarking requirements per ENERGY STAR Portfolio Manager
    - Requirements and expectations by Facility Operators
      - » Training
        - – HVAC systems
        - – BMS & Controls
        - – Electrical systems
        - – Lighting systems
        - – Security systems
        - – Audiovisual systems
        - – Identify who is to be trained
        - – Number of training sessions
        - – Follow up training sessions
        - – Other as deemed necessary by Facility Operators and Owner
      - » Systems Manuals
        - – As-Builts
        - – Single line schematics
        - – Controls As-Built
          - · Drawings
          - · Sequences
          - · Set points
          - · Recalibration schedule
        - – OPR
        - – BOD
        - – Commissioning functional test reports
        - – Must be organized, electronic and searchable
        - – Other as deemed necessary by Facility Operators and Owner
    - Preventative maintenance program expectations
      - » Recommended re-commissioning schedule
      - » Attic Stock expectations
    - Education and Outreach Program, see Section 5.9 — Education and Outreach Program
  - Building occupant expectations
    - Additional areas beyond areas previously discussed in the OPR
  - Possible behavioral implications of HPBS goals and strategies
    - Occupants role in energy efficiency and sustainability
    - Facilities operators role in energy efficiency and sustainability
  - Budget considerations
    - Balance efficiency, quality, budget, comfort and maintenance
  - Specific building typology requirements must be developed during programming in conjunction with the design team, Authority Having Jurisdiction, specialized design

consultants, building occupants, and commissioning agent
- Labs
- Vivarium
- Courthouses
- Acute care hospitals
- BioSaftey Level (1,2,3) type facilities
- Prisons and Jails
- Libraries
- Museums
- Data Centers
- Others as necessary

APPENDICES

1. Data Points List — Section 5.11
2. Energy Modeling Spreadsheet — Section 5.5
3. Life Cycle Cost Worksheet — Section 5.5
4. HPBS Sustainability Worksheet — Section 5.6, 5.7, 5.8, 5.
5. HPBS Workshop Suggested Agenda — Section 5.1
6. OPR Required Sections — Section 5.15
7. Envelope Commissioning Matrix — Section 5.13
8. Incentives and Rebates Process Guidelines — Section 5.14
9. Incentives and Rebates Responsibility Matrix — Section 5.14