IDEA Campus Energy 2017

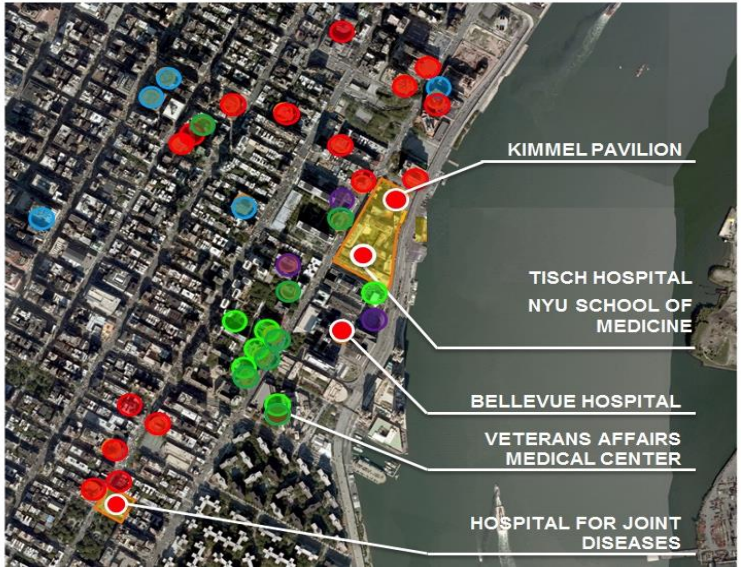
Resiliency and Efficiency: Optimizing the Integration of CHP into an Urban Academic Medical Campus

Introduction to NYULMC

NYU LANGONE MEDICAL CENTER

World-Class Patient-Centered Integrated Academic Medical Center

- Founded in 1836
- 11-acre campus created by the City of New York and deeded to New York University Medical Center in 1949
- Mission: Clinical Care, Research, Education
    - 1,069 licensed beds
    - $280+ million in research grants
    - 650 medical students
- 5.1 million SF (2.3 million on main campus)
- Over 2 million SF added since 2010
- Another 3.5 million SF will be added through 2020 (including Brooklyn Campus)
- Ranked #10 Hospital and #11 Medical School by US News and World Report
- Ranked #1 for overall patient safety and quality by UHC



Off-Campus Facilities:

- Clinical
- Wet Research
- Dry Research
- Administration
- Education

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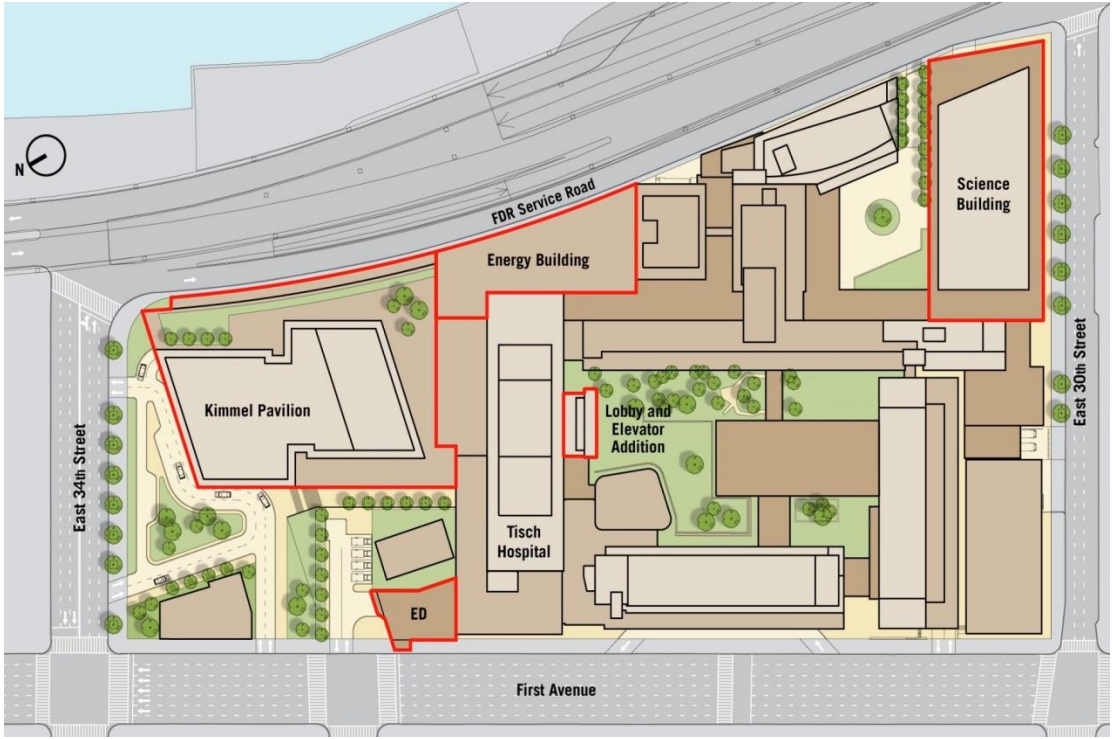
NYULMC Main Campus

- 2.3 MM SQFT with 1.2 MM SQFT under construction
- 11 Connected Buildings, Built From 1950's to present
- 3 Electric + 1 Steam Turbine Chiller Plant



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Campus Transformation

ENERGY BUILDING (2016)

- New Con Edison Electric Service
- 7.5 MW Emergency Power Plant
- 10.5 MW Cogeneration Plant
- Standby boilers to provide 100% onsite steam
- Radiation Oncology
- Loading docks

KIMMEL PAVILION (2018)

- 830,000 SF new, high acuity clinical facility (374 beds, 32 OR/Procedure rooms)
- 7.5 MW Emergency Power Plant
- 3 MW Cogeneration Plant
- LEED Platinum goal

SCIENCE BUILDING (2017)

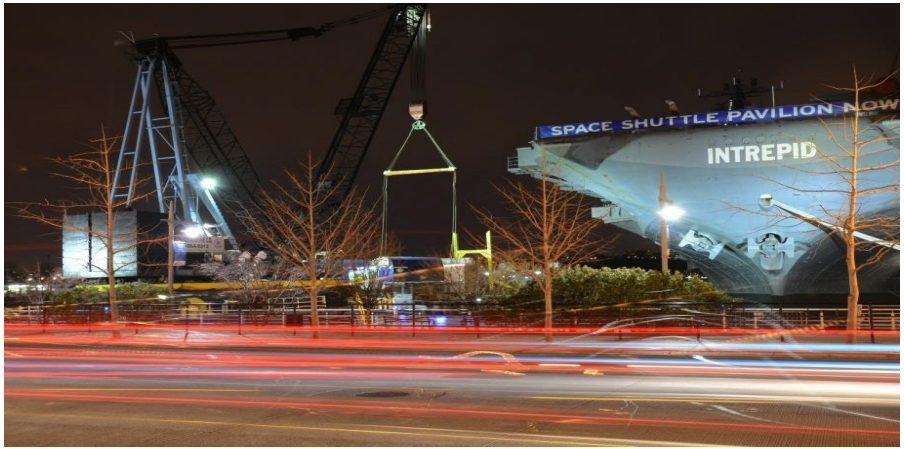
- 365,000 SF
- New laboratory, vivarium and conference facilities
- 6 MW Emergency Power Plant
- LEED Platinum goal

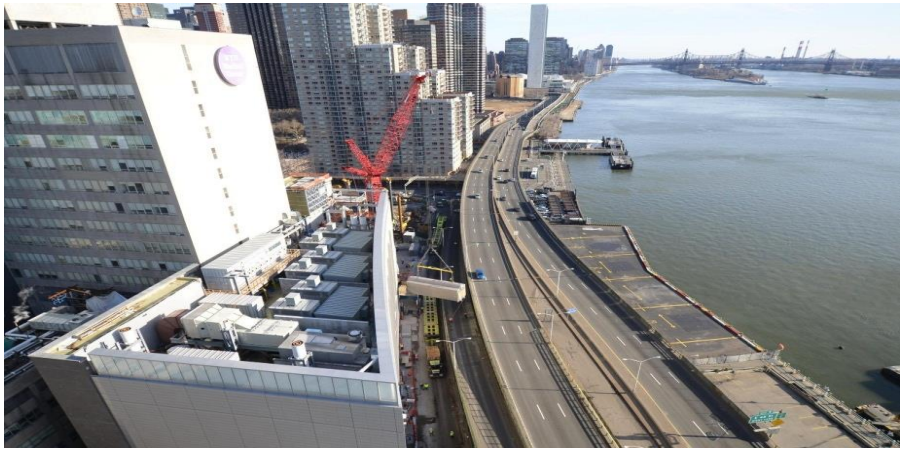
Energy Building

Energy Building Plant Equipment

- Solar Taurus 70, 7 MW Nominal Gas Turbine
- 130,000 lb/hr HRSG
- 2.5 MW Steam Turbine (added after Superstorm Sandy)
- 2 X 115,000 lb/hr Low Pressure Backup Boilers
- 3 x 2.5 MW Diesel Backup Generators
- 30 kVA ConEd High-Tension Service
- 300 HP Gas Compressor

Energy Building – Equipment Delivery





Energy Building – Gas Turbine, HRSG & Boilers

Energy Building – Emergency Generators & Switchgear

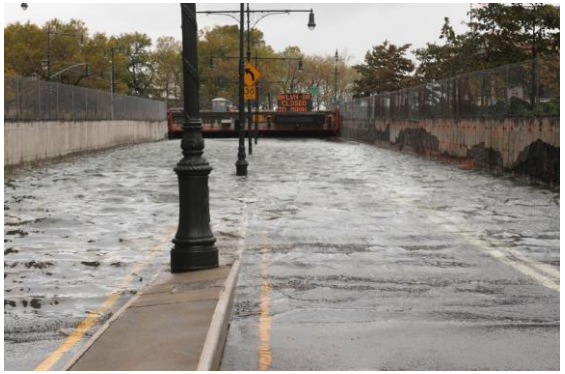
Why Cogeneration?

- Energy Operating Cost Savings
- Integration into Transforming Campus
- Sustainability / Reduced Carbon
- Resiliency

Resiliency

Resiliency - Hurricane Sandy

October 29, 2012, Hurricane Sandy storm surge devastates low lying portions of NYC with a storm surge of 13.88 feet at Battery Park; previous record was 11.2 feet set in 1821.



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Sandy Impacts - NYULMC

- Utility services disrupted
- Patients evacuated
- Research lost
- Hospital reopened on 12/26/2012


EXIT


MECHANICAL EQUIPMENT ROOM
AUTHORIZED PERSONNEL ONLY
MECHANICAL EQUIPMENT ROOM
AUTHORIZED PERSONNEL ONLY
DANGER
CAUTION
NOT IN SERVICE


Medicine


NYU School of Medicine
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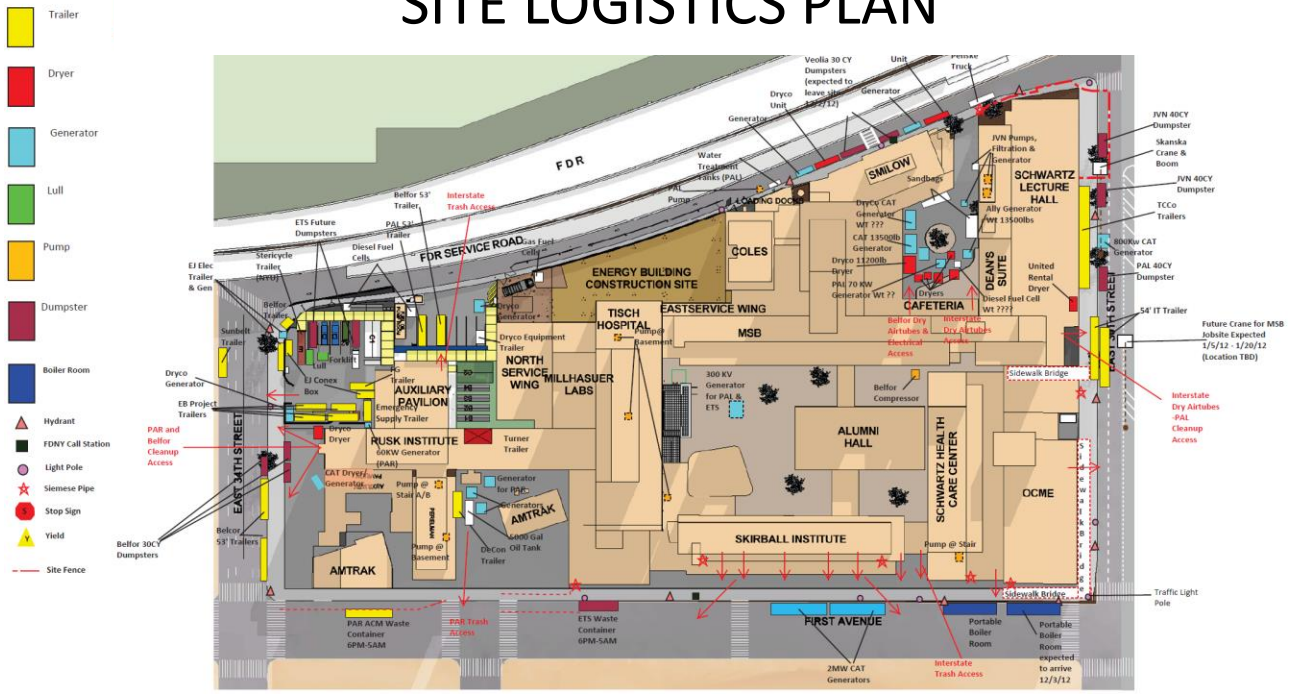
EXIT


DANGER
Electromagnetic Field
Authorized
Personnel Only
PELIGRO
Campo Electromagnetico
Personal Autorizado
Solamente
DANGER!
THIS MAGNET IS
ALWAYS ON
The power of the
MR magnet is
ALWAYS ON
SIEMENS
MAGNETOM

Sandy Recovery Effort

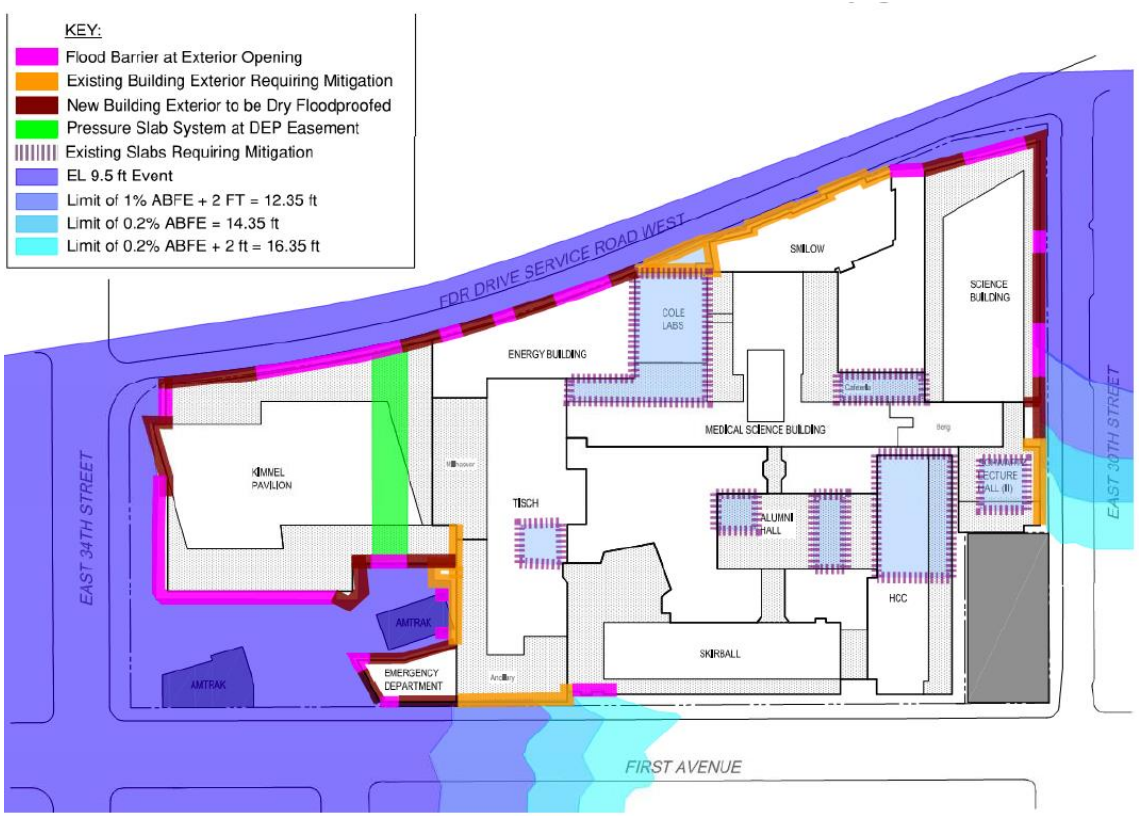
SITE LOGISTICS PLAN



Enhancing Resiliency Going Forward

- Flood Protection
- Elevating Critical Utility Systems
- Elevating Critical Programs and Support Functions
- Utility System Redundancy

Perimeter Protection



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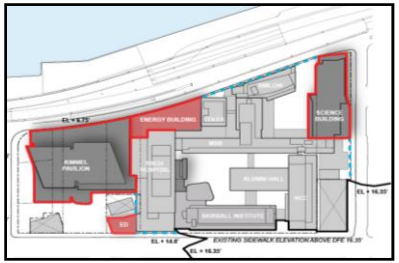
Perimeter Protection

Temporary Protection

Flood Gate at Loading Dock



Permanent Flood Walls

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Infrastructure Protection

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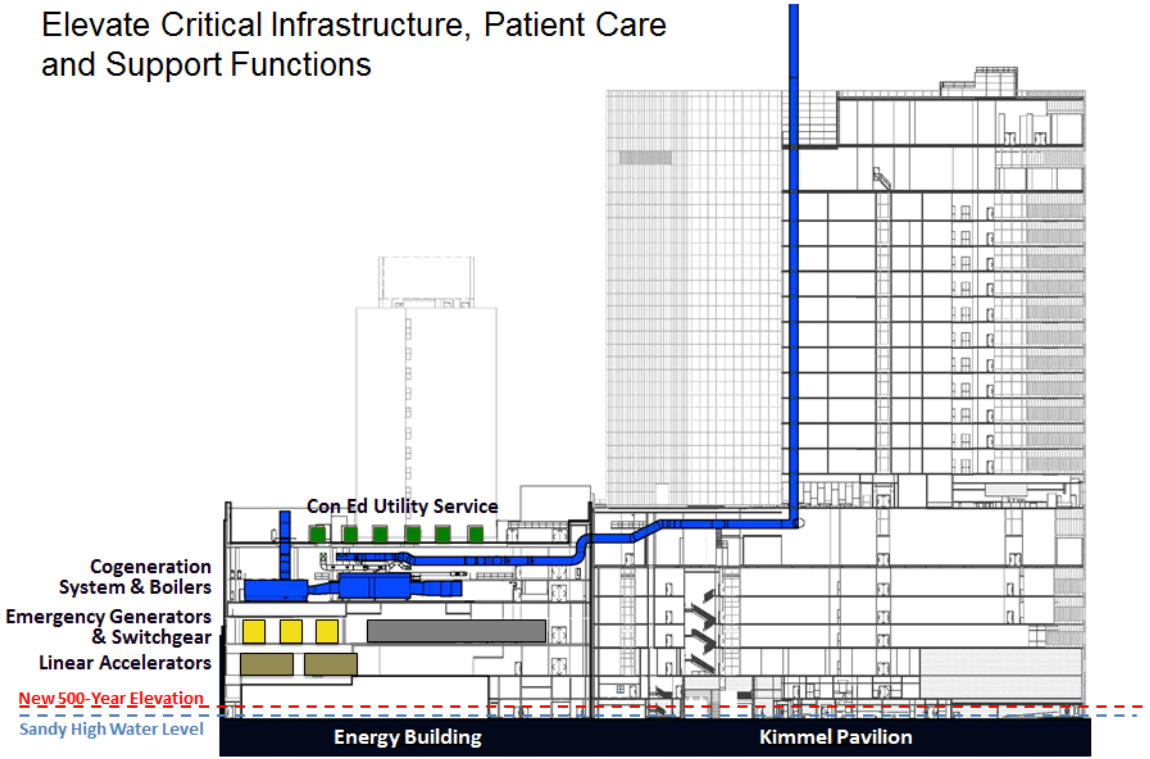
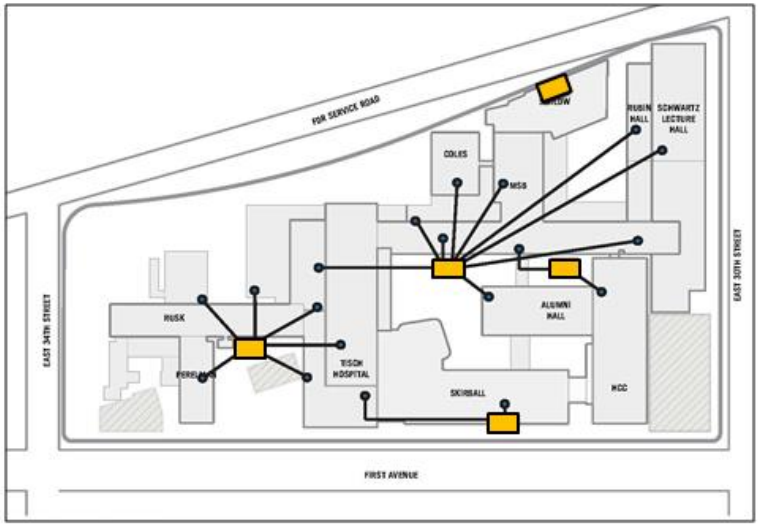
Flood Doors and Waterproofing of Concrete

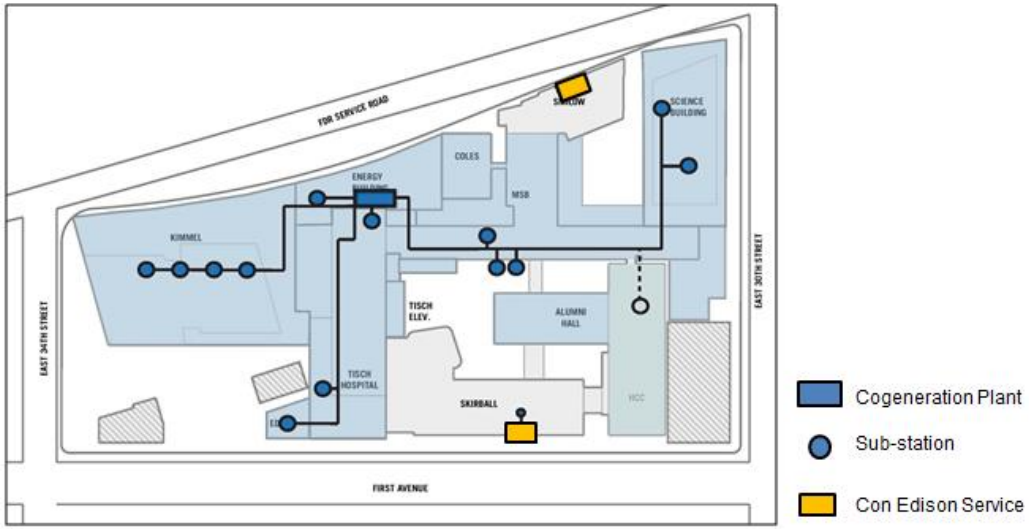
Elevating Critical Systems



Utility Resiliency



Pre-Sandy Power Systems



Planned Power Systems

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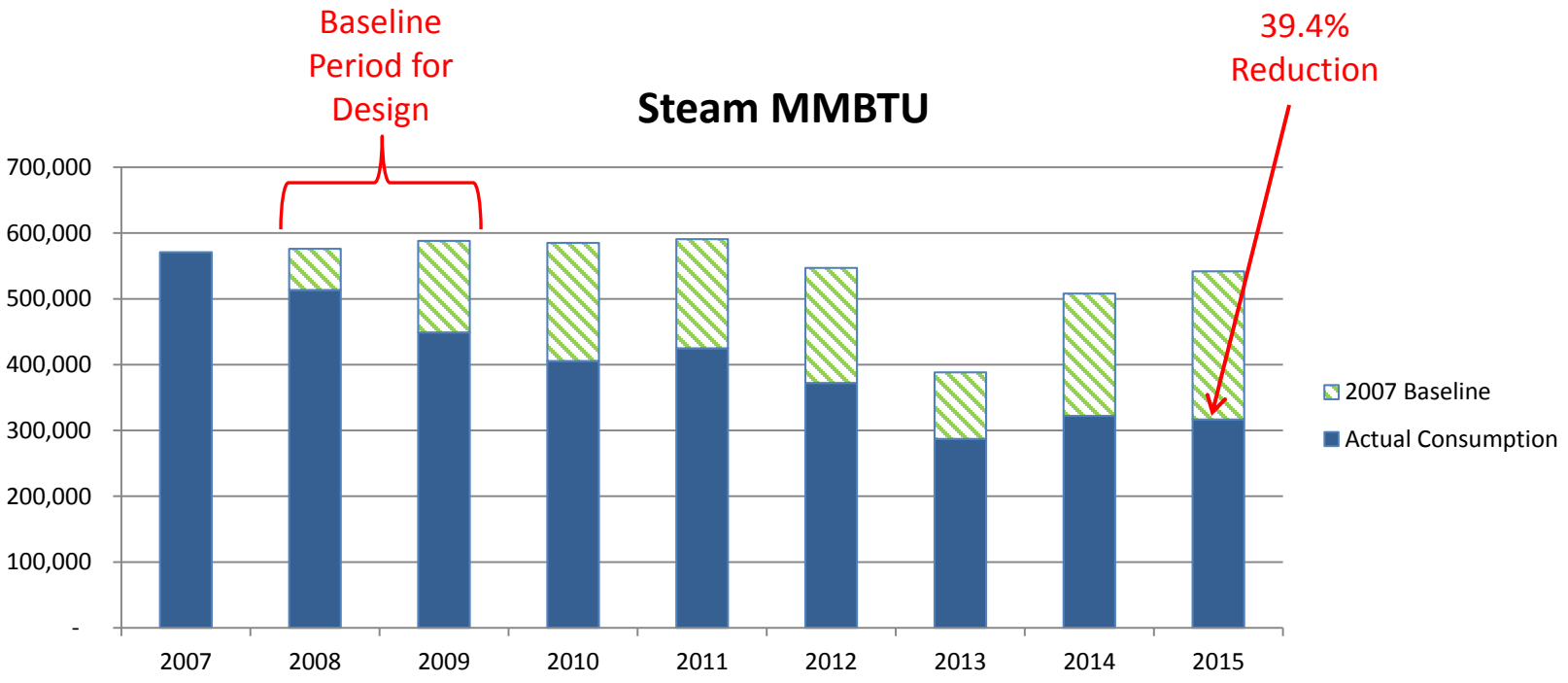
Operational Challenges/Lessons Learned

- Thermal Sizing Challenges
- New Utility Tariffs
- Cost Modelling
- Optimization of Inlet Air Temperatures
- Fuel Switching Optimization

Thermal Sizing



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Utility Tariff Changes

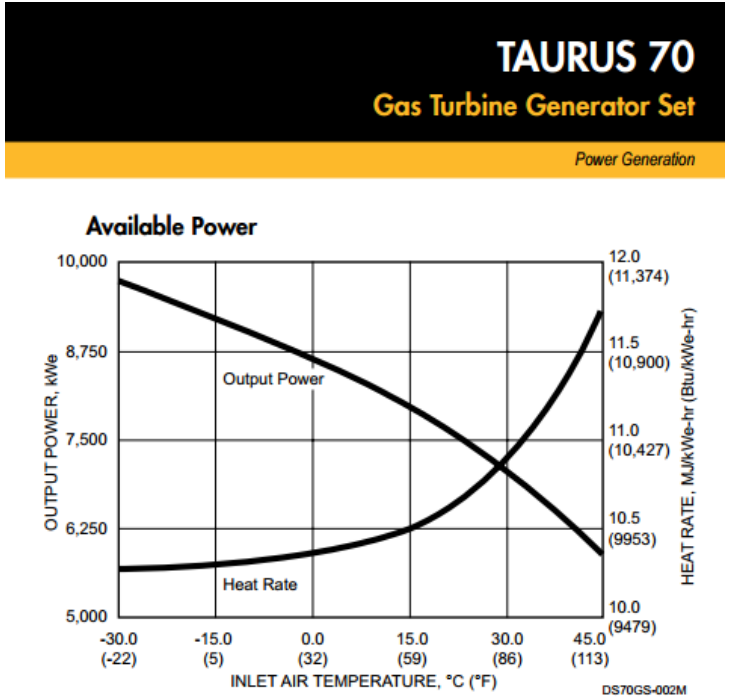
Utility	Old Model	New Model
Electric	Flat rate commodity, monthly demand, variable T&D.	Day-ahead commodity, contract and as-used daily demand (no ratchet), no T&D. Virtual offset of other accounts.
Natural Gas	Minimal Use (Kitchen Only)	Fixed price interruptible for CHP, market price firm for boilers
District Steam	High rates, monthly demand in winter only	High contract demand, reduced rates, tertiary backup only
Chillers (Steam & Electric Drive)	Lead with electric, peak shave with steam	Lead steam during demand period, lead electric off-peak.

Cost Modelling

- Design engineers often calculate savings using blended rates instead of true marginal costs
- Many recommendations conclude that running flat out 24/7 is optimal
- Significant opportunity to reduce utility spend by tailoring plant operations to conditions and energy prices
- Using true marginal rates for CHP analysis is key

Inlet Temp Optimization

- Power and Heat Rate are Determined by Inlet Temp (T1)
- Colder T1 = More Gas Consumption, More Power, Less Heat Per Therm of Gas
- 600 Ton Cooling Coil on Inlet
- Optimize Based On Electric Prices, Demand, and Chiller Plant Status



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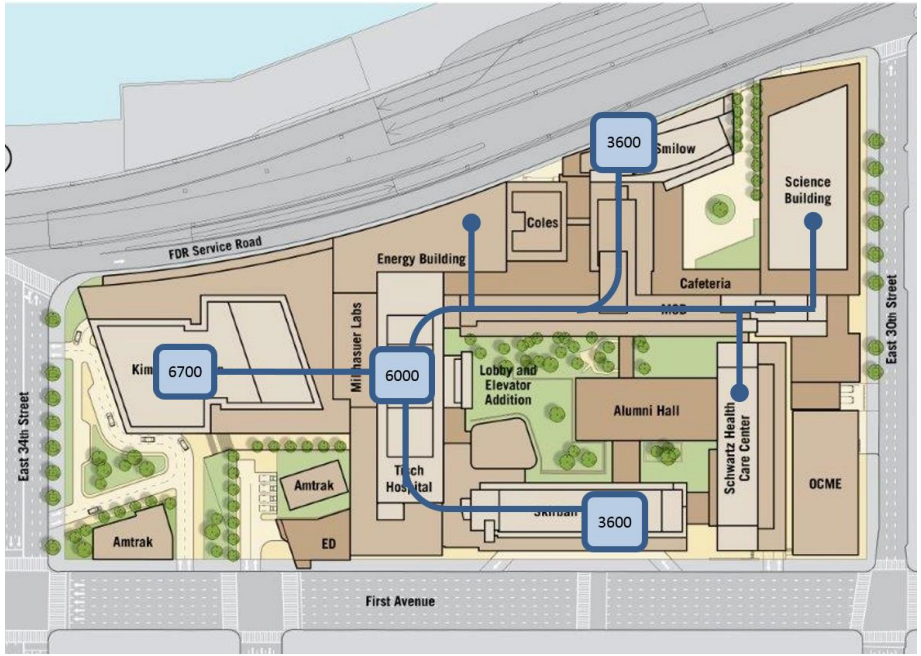
Chiller Plant Optimization



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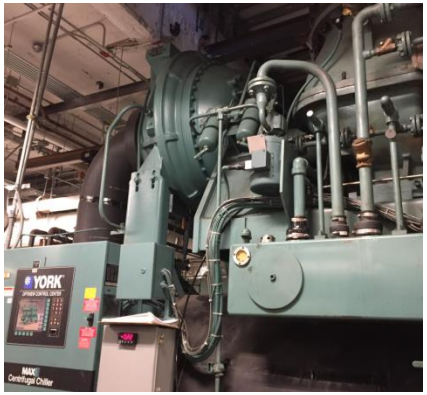
Chiller Fuel Switch Optimization



Tisch Chiller Plant

- 3 x 2000 Ton York Steam Turbine Driven Centrifugal Chillers
- 8-10 lbs Steam/Ton Hour = ~1.2 COP

Skirball Chiller Plant

- 3 x 1200 Ton York Electric, 1 w/VFD
- COP > 6
- As Used Daily Demand
- Receives Virtual Offset from CHP

Smilow Chiller Plant

- 3 x 1200 Ton York Electric Chillers
- COP > 6
- Separate Electric Account
- Monthly Demand
- No Offset

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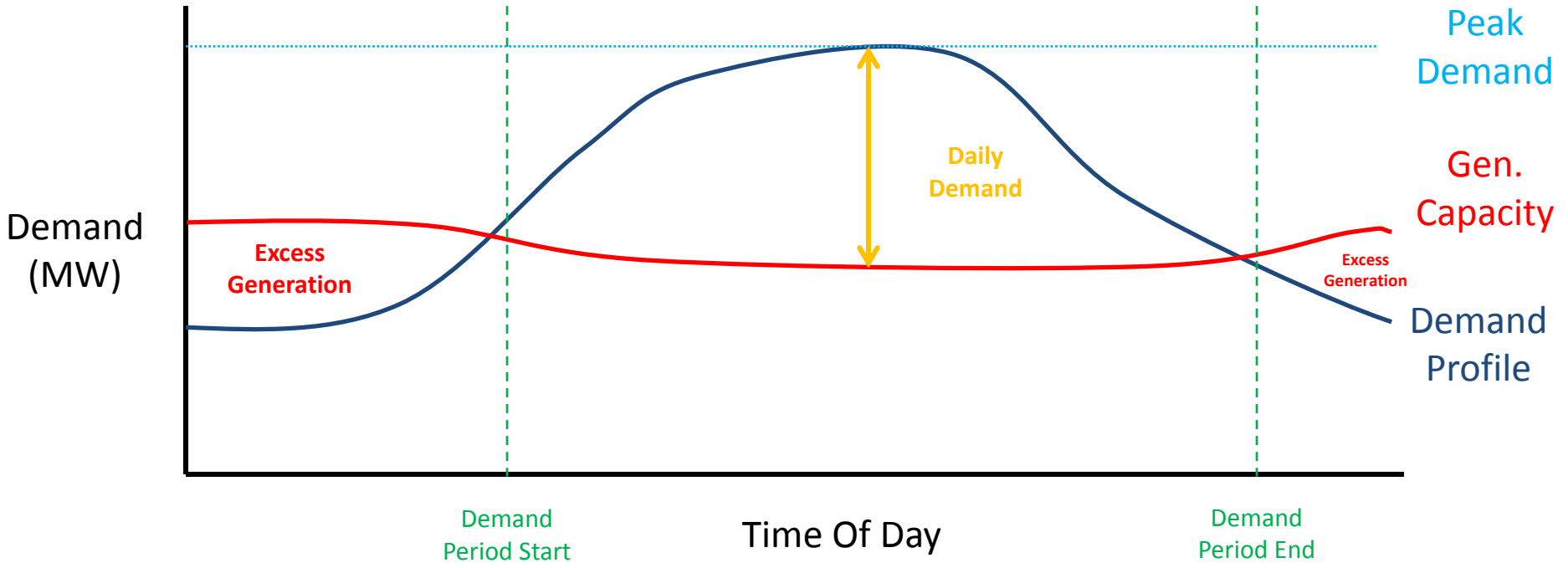
Fuel Switch Optimization



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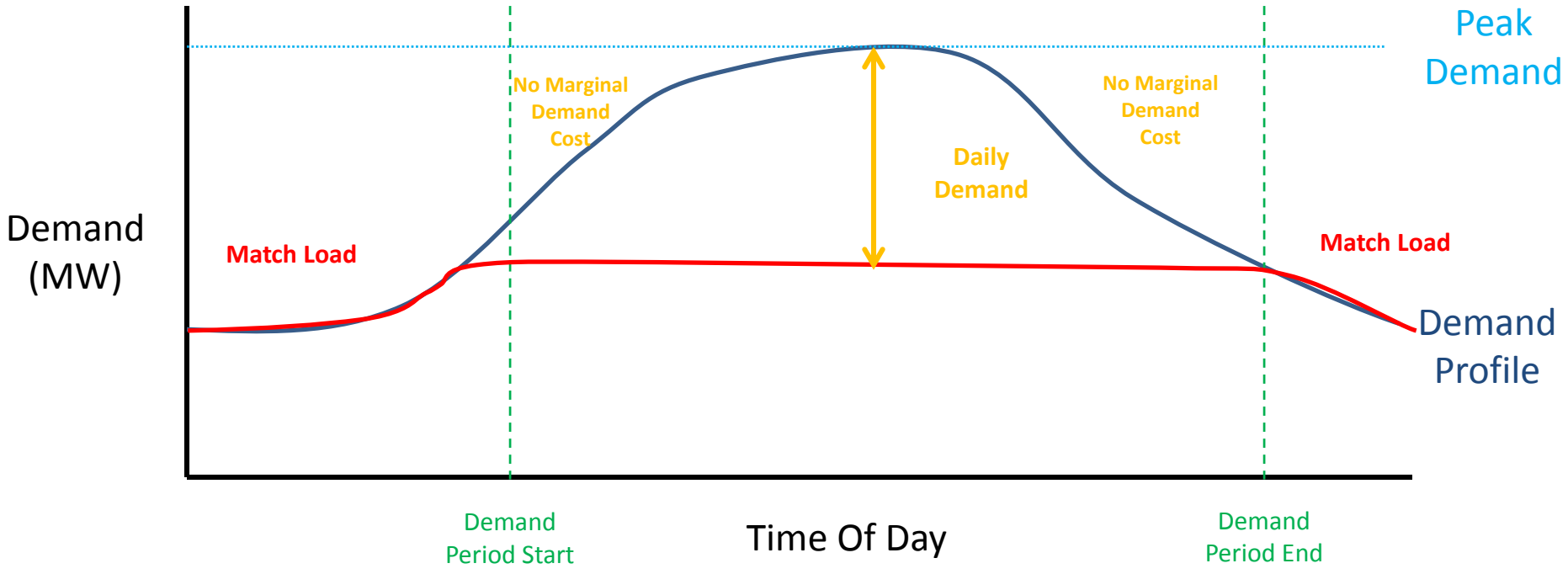
Fuel Switch Optimization



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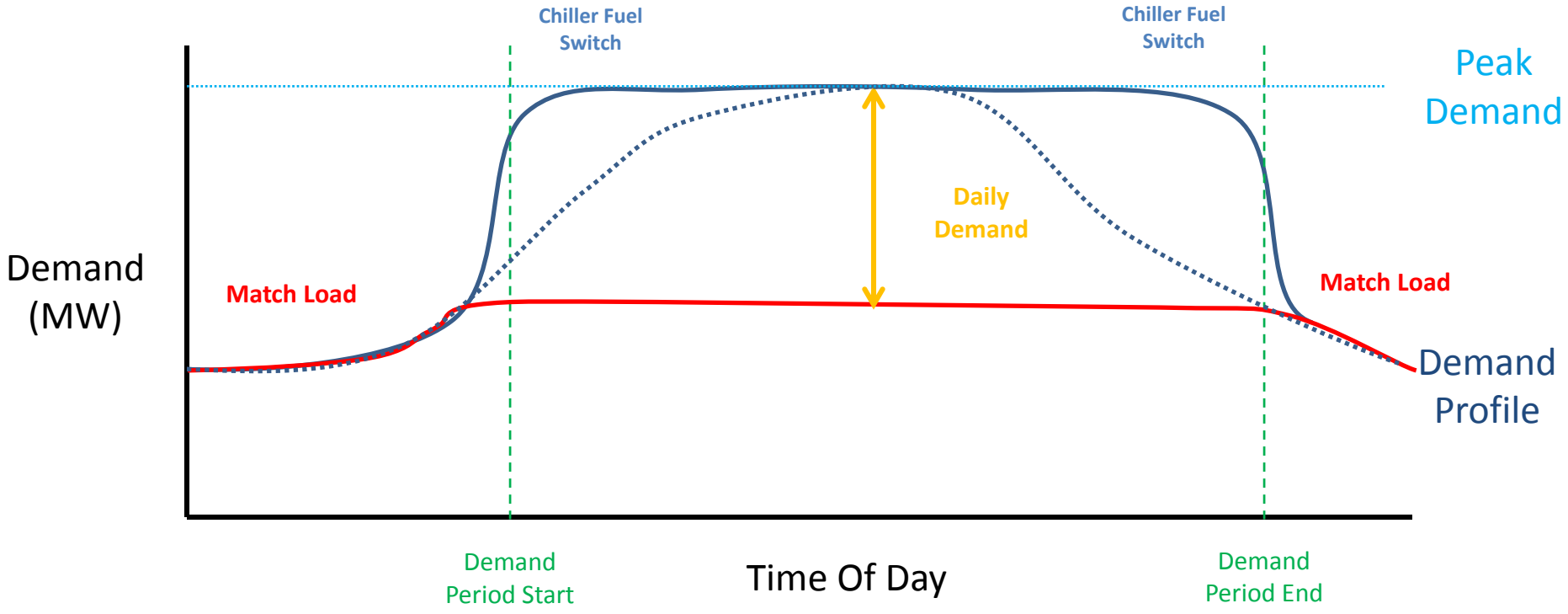
Fuel Switch Optimization



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Questions?