

NREL – ESIF HPC Data Center SC10 EEHPC Overview

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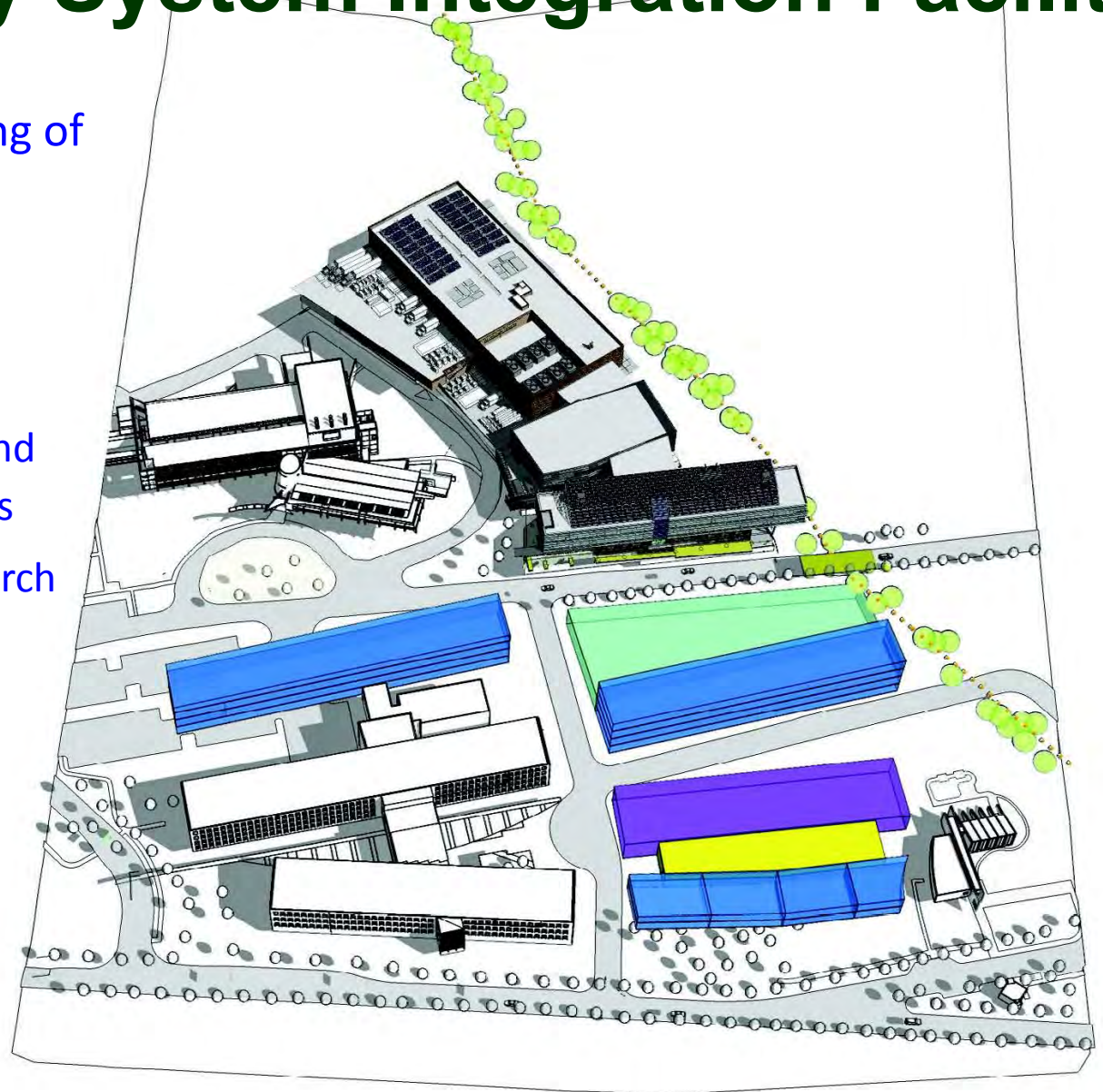
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ESIF: Energy System Integration Facility

- Research facility for testing of electrical systems:

- Renewable energy generating systems integration
- Plug-in hybrid vehicles and electrical storage systems
- 400+ Tflop HPC for research modeling and simulation (expansion to 1+ Pflops)
- Showcase “Green Computing” Data Center
- LEED™ Gold minimum



ESIF: Context, Schedule & Status

- Using Design-Build approach
 - NREL defines performance specifications, not the design
- Summer 2008, Started with Request for Qualifications
- Held numerous ESIF “programming” meetings
 - Matching needs, mission, space, equipment, requirements
- Selected 3 teams to receive RFP
- RFP distributed summer 2009
- Winner got the job, the other two teams received stipend.
 - All content from the proposals then property of NREL
- Final/detail design in progress.
- Validated HPC power & cooling assumptions.
- Planned occupancy late 2012.

ESIF HPC Data Center

- **Showcase Facility**
 - World's most energy efficient data center, PUE 1.06 and ERE <1.0!
 - Leverage favorable climate
 - Use evaporative rather mechanical cooling.
 - Waste heat captured and used in cold months to heat lab and office space.
- **High Performance Computing**
 - Initially, 400 Tflop HPC Capability
 - 20 year planning horizon
 - 5 to 6 HPC generations.
 - Energy Data Hub
 - Data mgmt, mining, analytics
 - Insight Center
 - Scientific visualization
 - Collaboration and interaction.





ESIF HPC Data Center Performance

- 10,000 sq ft usable raised floor (no pillars)
- Up to 10MW of available IT power supply.
- Required: Annual PUE < 1.06
 - NO mechanical cooling or perimeter CRAC units.
 - Leverage favorable climate, evaporative cooling only.
 - Numerous sensors to monitor and report PUE.
- Utilize HPC equipment waste heat, ERE <1.0
 - Want both bytes and BTUs
 - Heat office and lab space
 - Possible snow melt
 - Optimize overall building energy efficiency and carbon footprint.
- Dashboards to report instantaneous, seasonal, annual and cumulative PUE values.

ESIF Data Center Electrical Systems

- Utilize higher voltage AC (480 or 415 Vac) distribution to enhance energy efficiency, eliminate the losses and heat associated with PDU's and step down transformers.
 - Data Center electrically isolated from rest of facility.
- Switchboards and distribution panels shall include extensive power monitoring.
- Plan on 10MW max electrical demand
 - 2MW at initial build, rough in or provide space for rest
 - 5MW and 10MW scenarios.
- UPS at 10% of load
 - Protect critical components
 - Sufficient duration to allow generator to spin up.

ESIF HPC Data Center Environmentals

- 90% of heat load captured to liquid.
 - 75F “chilled” (tower) water supply
 - Summer when we have to and winter because we want to.
 - Want 20F (or more) delta T
- Operate in ASHRAE recommended range 99% of the time (~87 hours per year in allowable).
- Treat this as the data center equivalent of the “visible man”
 - Tour views into pump room and mechanical spaces
 - LCD monitors
 - Color code pipes
 - Extensive instrumentation and monitoring



Energy Systems Integration Facility

