

## Massachusetts Green HPCC

*A Briefing for*  
**Innovation District Design and Development Task  
Force**

January 14, 2010

# HPCC Background and Next Steps

## History

- ❑ **Prior to 2008** – MIT conducts detailed study of a HPC facility located in Holyoke
- ❑ **October, 2008** – Meeting with the Governor, Presidents of MIT and UMASS, CEOs of EMC, Cisco, Accenture about need for collaboration to strengthen IT sector in Massachusetts
- ❑ **January, 2009** – Meetings of University Presidents - President Hockfield (MIT) approaches President Wilson (UMASS) about potential collaboration on a HPCC
- ❑ **February to March, 2009** – Conversation extends to Governor and state agencies, Presidents of Harvard and BU, representatives of industry
- ❑ **April 15, 2009** – First convening of academic, industry and state leaders at UMASS Club
- ❑ **May to June, 2009** – Expanded discussions with State about joint planning effort
- ❑ **June 11, 2009** – Signing of LOI by Governor, 3 university presidents, and 3 industry CEOs committing to 120-day planning process
- ❑ **October 21, 2009** – Governor leads press conference in Holyoke outlining progress resulting from initial planning process and setting forth shared goal of initiating construction by Fall 2010

## Plans for Nov. 2009 – Feb. 2010: Tasks to Enable Fall 2010 Groundbreaking

- ❑ Site selection/assembly/control/permitting
- ❑ Organization of participating universities into 501(c)3 corporation
- ❑ Definition of technical requirements
- ❑ Initial design, engineering and facility planning
- ❑ Finalize resources from State, Federal, University and Industry sources meet capital costs for facility
- ❑ Planning for innovation district and cost-competitive clean energy initiative

# GHPCC: An Investment in Infrastructure, Competitiveness and Regional Development

## HPC Co-location Center

- Ensuring our scientists remain at (and define) cutting edge of science, engineering

## R&D, Education, Outreach Hub

- Academia, industry
- Center-scale activities in computing, HPC application (e.g., life sciences), green
- Involving K-12, CC, 4-year, research universities

## Organization, Leadership

- Historic industry, academic, state collaboration
- New 501(c)(3) entity

- Innovation district
- Cost-competitive energy initiative
- Linkage with regional initiatives

## Economic Catalyst

# Vision

## The new HPCC is envisioned to be:

- ❑ A world-class high performance computing center using green energy, green facilities design, and serving as a showcase for concepts of “green computing.”
- ❑ A facility designed to strengthen the state’s leadership role in the development and application of advanced computing to key R&D areas such as the life sciences, clean energy, and climate change.
- ❑ A center that would serve as a catalyst for the development of the IT industry throughout Massachusetts and an IT development district with economic, educational and workforce development benefits to the City of Holyoke and Western Massachusetts that will support the continued growth and strength of other cornerstones of our economy

# Guiding Principles

## The Green HPCC should be designed to:

- ❑ Ensure that the current base needs of participating institutions are met but be flexible to allow for expansion and evolution of the HPCC's mission over time
- ❑ Allow for development and implementation in phases to match the availability of resources and change/expansion of mission
- ❑ Be non-exclusive and provide a platform for additional investment by universities, industry and government beyond the initial commitments
- ❑ Promote inter-institutional collaboration among and between higher education, industry and government
- ❑ Incorporate “green” throughout the facility, focusing on being as green as reasonably achievable – in terms of green power sources, green building design, and green computing architecture and systems
- ❑ Incorporate “best practices” from other leading university-based or related HPCCs
- ❑ Serve to act as a catalyst for the economic, educational and workforce development of Holyoke and the region

# Why Holyoke? – Low Cost, Green Resources



*Low-cost, green energy*

enabling  
infrastructure

## Holyoke Gas & Electric to buy 270 acres on Mt. Tom

by The Republican Newsroom  
Tuesday March 17, 2009, 5:42 PM



## Holyoke infrastructure:

*“ping, power, pipe, permitting”*

- ❑ *power*: hydro, wind (future), other contracted
- ❑ *ping (networking)* near gigabit backbone Xroads
- ❑ *pipe*: cooling options
- ❑ *permitting*: economic zone, incentives

# Accomplishments Since June

## Research and Education

- ❑ Identified technical/program requirements for HPCC
- ❑ Outlined a collaborative R&D agenda focused on the life sciences, clean energy and green computing
- ❑ Reached out to City of Holyoke, PVPC, HCC, STCC, etc. re the HPCC (e.g., local linkages, educational connections)

## Technology

- ❑ Developed a series of facility options using a flexible/modular/phased approach
- ❑ Identified basic site requirements in Holyoke
- ❑ Worked with state and local officials to identify a range of potential sites in Holyoke

## Business

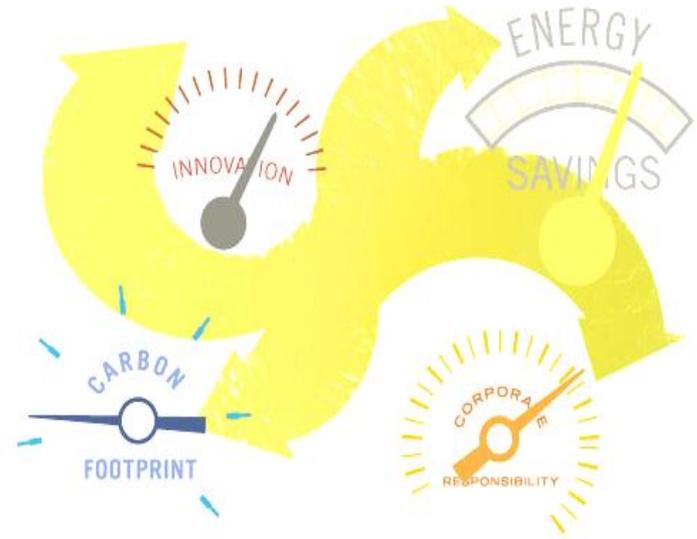
- ❑ Agreed on a 501c3 organizational model with MIT, UMass and Boston University as founding members and identified additional potential members
- ❑ Developed preliminary estimates on capital & operating costs
- ❑ Benchmarked state support for IT initiatives in competing states
- ❑ Secured financial commitments from each of the three universities, the state and TBD industry partners and federal government
- ❑ Initiated links with innovation district/competitive clean energy initiatives

# HPCC Basis of Design

- ❑ Research computing data center
- ❑ Initially 1mw per University of compute load Day 1
- ❑ Growing to 16mw compute load over 10 years in three distinct construction phases
- ❑ 24mw total load at ultimate build (compute + MEP)
- ❑ PUE < 1.5
- ❑ “Green Data Center”
- ❑ Low Carbon Footprint
- ❑ 50% racks and 50% containers
- ❑ 12.5kw/rack on average compute load
- ❑ 500kw/ container compute load
- ❑ UPS and generator back up for 20% of compute load and 20% of MEP infrastructure
- ❑ Phase 1 Build
  - 75,000sf core and shell
  - 4mW compute load built out
  - 158 racks = 2mw
  - 4 containers = 2mw
  - MEP infrastructure built for next 4mw of compute load
- ❑ Phase 2 build out of compute space for the next 4mw of compute load
- ❑ Phase 3 build of next 55,000sf core, shell and data center space, 8mw of compute load and required MEP support

# HPCC – Plans for Green

- ❑ US Green Building Council (USGBC) LEED's Program for guidance and possible certification
- ❑ Design, construct, and operate using industry accepted metrics (like Power Usage Effectiveness [PUE])
- ❑ Develop solid operational process as well as technology
- ❑ Define effective Measurement and Reporting for continuous improvements
- ❑ Focused exploration and design consideration occurring in the following areas:
  - Energy and Cooling for Servers
    - Electrical Opportunities
      - Hydropower from HG&E ; Potential (future) wind energy
  - Cooling Opportunities
    - Geothermal ; Potential Canal cooling ;  
Temperate water cooling (future technology)



| EPA Scenario               | PUE |
|----------------------------|-----|
| Historical                 | 2   |
| <i>Current Trends</i>      | 1.9 |
| <i>Improved Operations</i> | 1.7 |
| <i>best Practice</i>       | 1.3 |
| <i>State-of-the-Art</i>    | 1.2 |

# Research, Education, Outreach

## ***Research Vision***

- ❑ meet advanced research computing needs of partner universities
  - computation becoming “third leg of science” with theory and experimentation
  - HPC: no longer nice-to-have but a competitive advantage / requirement
- ❑ a research collaboration hub:
  - growing strongly-connected community of world-class MA university/industry researchers in HPC, application areas
  - enabling new collaborative research, activities that no one institution/company can take on alone
  - major player in strategic research areas important to Commonwealth, nation, worldwide

## Research – collaborative areas identified

**strategy:** identify exemplar areas of synergistic strengths, with individuals likely to collaborate, innovate around HPCC

### ***life sciences:***

- ❑ e.g., system-level modeling of immune response

### ***green, cloud computing:***

- ❑ virtualization
- ❑ energy-efficient design, monitoring, operation
- ❑ security, privacy
- ❑ heterogeneity, federation

### ***environment, energy:***

- ❑ global, regional climate (water, land, atmosphere, biosphere)
- ❑ energy sources, storage, efficient delivery/utilization

### ***engaging supercomputing:***

- ❑ informatics (e.g., medical)
- ❑ establish supercomputing as “another application on the desktop”
- ❑ simulation, modeling

# Education & Outreach Vision

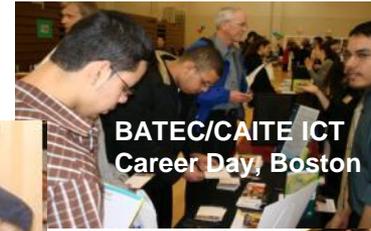
- ❑ leverage academic (universities, state and community colleges) and industry collaboration
  - broad community outreach: understanding impact of computing in daily lives – smart planet
  - energy-aware, green technologies
  - inspire, educate a more computationally literate young generation
  
- ❑ HPCC: locus for activities, physical showcase
  
- ❑ activities developed, funded, sustained and administered *collaboratively, (academia, industry, state)* as HPCC community projects

# Holyoke HPC Education/Outreach

not just this.....



Girls Inc visits  
UMass/CS/OIT



BATEC/CAITE ICT  
Career Day, Boston



IT open house, STCC



Cambridge  
Science  
Fair



Artbotics across  
Massachusetts

this.....



# **Innovation District & Clean Energy Initiative**

## **Innovation District**

- ❑ Purpose is to create a business development district to leverage the presence of the center and attract private sector investment and create jobs;
- ❑ Launch of strategic planning will coincide with commitment to build the HPCC
- ❑ Partners will include local and regional organizations, MA IT Collaborative , as well as the Commonwealth and HPCC partners;

## **Clean Energy Initiative**

- ❑ The state is working with PVPC, HG&E and experts from MIT and UMass to develop and pilot in Holyoke a program to create cost-competitive energy districts in Massachusetts that are based on clean energy, energy efficiencies and offer energy at prices comparable to competitor states.
- ❑ The clean energy initiative is designed to support the region's efforts to support sustainability and to plan for the future energy needs of the Innovation District.

## Tasks Remaining for Fall 2010 Groundbreaking Target

- ❑ Site selection/assembly/control/permitting in Holyoke
- ❑ 501(c)3 corporation
- ❑ Technical requirements
- ❑ Initial design, engineering, planning
- ❑ Finalizing agreements for capital resources:
  - Federal
  - State
  - Universities
  - Industry