Energy Services Technician
practical training for a new job title

Michael Bobker, M.Sc.,CEM

CUNY Building Performance Lab and

the EST program at Bronx Community College
City University of New York (CUNY)

New Ideas in Educating a Workforce for Renewable Energy and Efficiency
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Overview of Presentation

- What is the job title “EST for buildings” and why is it so important now?
- Knowledge and Skill Areas
- Practical Exercises in the Curriculum

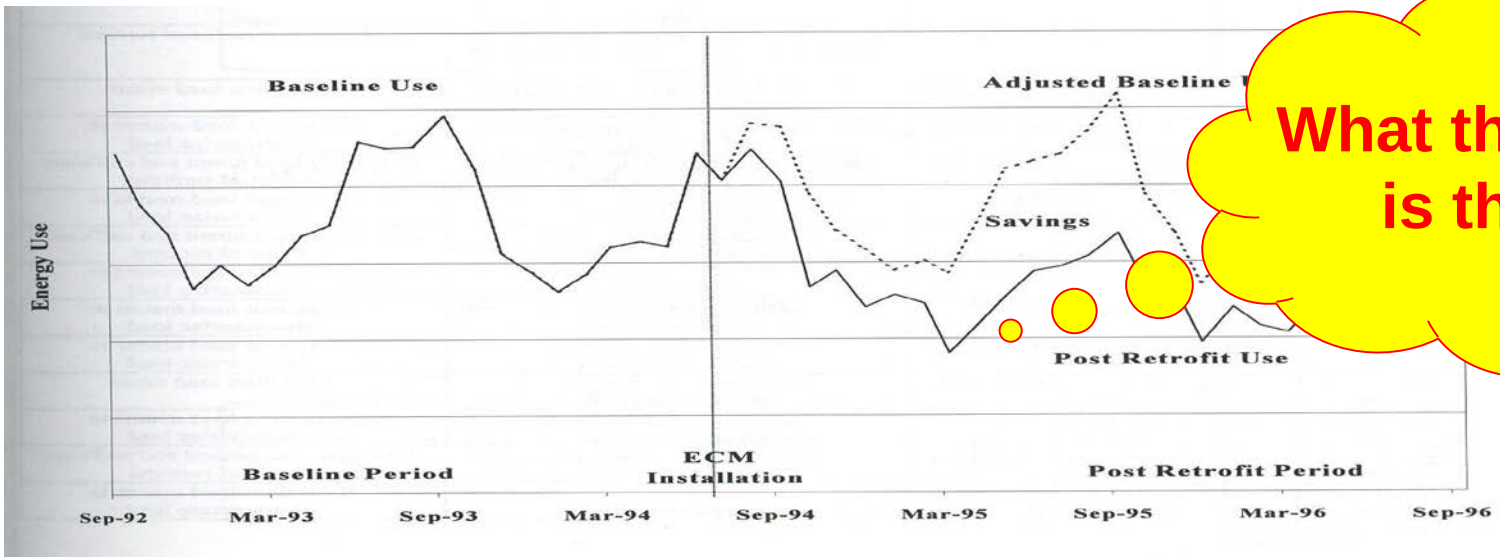
EST: A New Job Title

- **Not** an HVAC or Environmental Control Tech
- *More **energy analysis** than equipment troubleshooting*

Courtesy: Hampden Engineering Inc.

EST: A New Job Title

- Energy management
- Energy use analysis, facility energy performance monitoring & reporting
- System optimization, commissioning
- Energy project id, analysis and development



What the heck is this?

EST: A New Job Title

- Market demand for energy efficiency services
  - portfolio benchmarking, energy audits, design/build, commissioning services, M&V, maintenance services, “carbon reporting”
  - LEED for Existing Buildings
  - End-users, consultants, contractors, utilities
- Provide a marketable package of skills

EST: Fulfills an Urgent Workforce Need

- Energy efficiency in buildings represents a huge resource for carbon reduction
- Who will implement critical building energy efficiency projects?

  ….and make sure they run as intended over the long-term?
- Workforce as a ***supply constraint***

EST - Potential Employers

- Engineering firms, Consultants, ESCO's
- Product companies
  - BAS vendors
  - Solar installers
- Property Managers
- Outsource building services firms
- Utilities

Who are we educating & training as EST? Two slightly different audiences

- **Present workforce** (building operators, maintenance staff, service technicians)
  - Upgrading skills, promotions, career ladders
  - Returning for degree
- **New entrants** (engineering, arch tech & enviro sci students, technical high school grads)
  - Little or no building experience
  - In degree program, career options
  - Importance of internships

EST KNOWLEDGE & SKILLS

- **Data Acquisition**
  - Historical energy use
  - Use of plans
  - Measurement & instrumentation & - tools, readings, tests, sampling
  - observation of systems, dynamics, opportunities
- **Analysis**
  - Synthetic skills - integration, interpretation
  - Calculation - energy loads, modeling, economic analysis
- **Communication**
  - Written reporting, verbal presentation
  - Teamwork, Interviewing

EST KNOWLEDGE & SKILLS
Academic Subjects

Physics	***properties of materials, simple thermo***
Chemistry	***reactions, equations, combustion***
Math	***algebra, statistics, graphical analysis***
Communications	***verbal, written***
Technology	***spreadsheets, word-processing***
Business	***organizational concepts***
Economics	***market concepts, demand & supply curves***

EST KNOWLEDGE & SKILLS
Specific Job Performance Areas

- energy units, conversions
- energy data, data management, interpretation
- building characteristics
- mechanical and electrical system components & functions
- system & equipment testing, data acquisition
- energy efficiency measures & analysis
- modeling and equipment selection

PRACTICAL EXERCISES

energy units, conversions	• **Fuel price comparison - spreadsheet** • **Carbon footprint calculation**
energy data, data management	• **Compile a data set** • **Use a spreadsheet or db tool - benchmark**
building characteristics	• **Work with plan sets** • **Field measurements and drawing** • **Dimensional take-offs**
building system components & functions	• **Draw system schematics** • **Read and develop sequences of operation** • **Simulations**
data acquisition, testing	• **use data loggers, conduct field tests, access BAS data**
energy efficiency measures & analysis	• **Define and calculate an EE project** • **Model and design a system replacement**

PRACTICAL EXERCISES

- The exercises avoid physical “lab” set-ups
- Use campus facilities and/or student’s workplaces
- Emphasize data skills and energy performance rather than equipment troubleshooting
- Understand energy process and outcomes

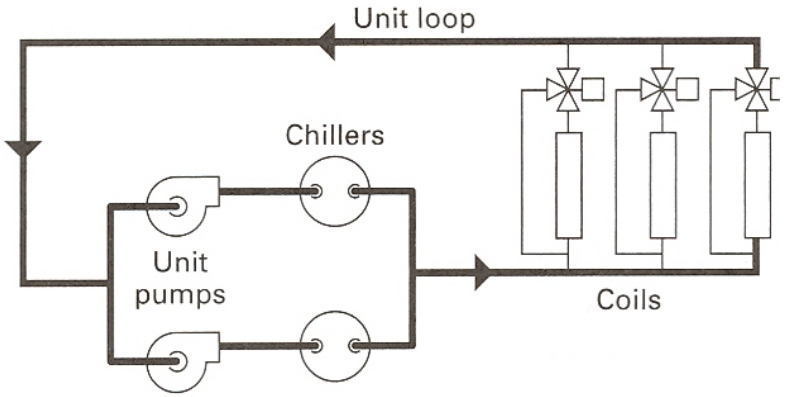
PRACTICAL EXERCISES

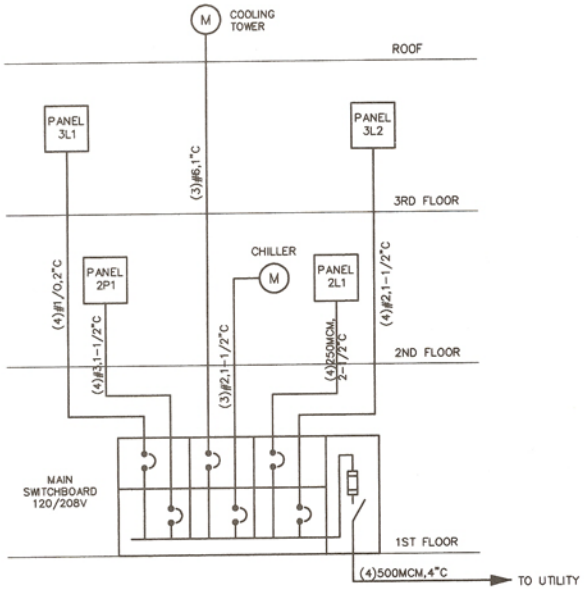
example of a simple calculation tool

CALCULATING PRICE PER MILLION BTU				
	electricity	**nat gas**	**#2 oil**	**#6 oil**
unit	kwh	ccf	gallon	gallon
cost/unit	$ 0.15	$ 2.50	$ 3.20	$ 2.75
btu/unit	3,414	102,000	138,700	150,000
$/mmBTU	$ 43.94	$ 24.51	$ 23.07	$ 18.33
notes:				
electric btu value is site energy only				
fuel values only, does not take into account differences in efficiencies				

- Teach fuel / energy values, prices
- Basic spreadsheet skills

PRACTICAL EXERCISES
Schematics & Sequences of Operation



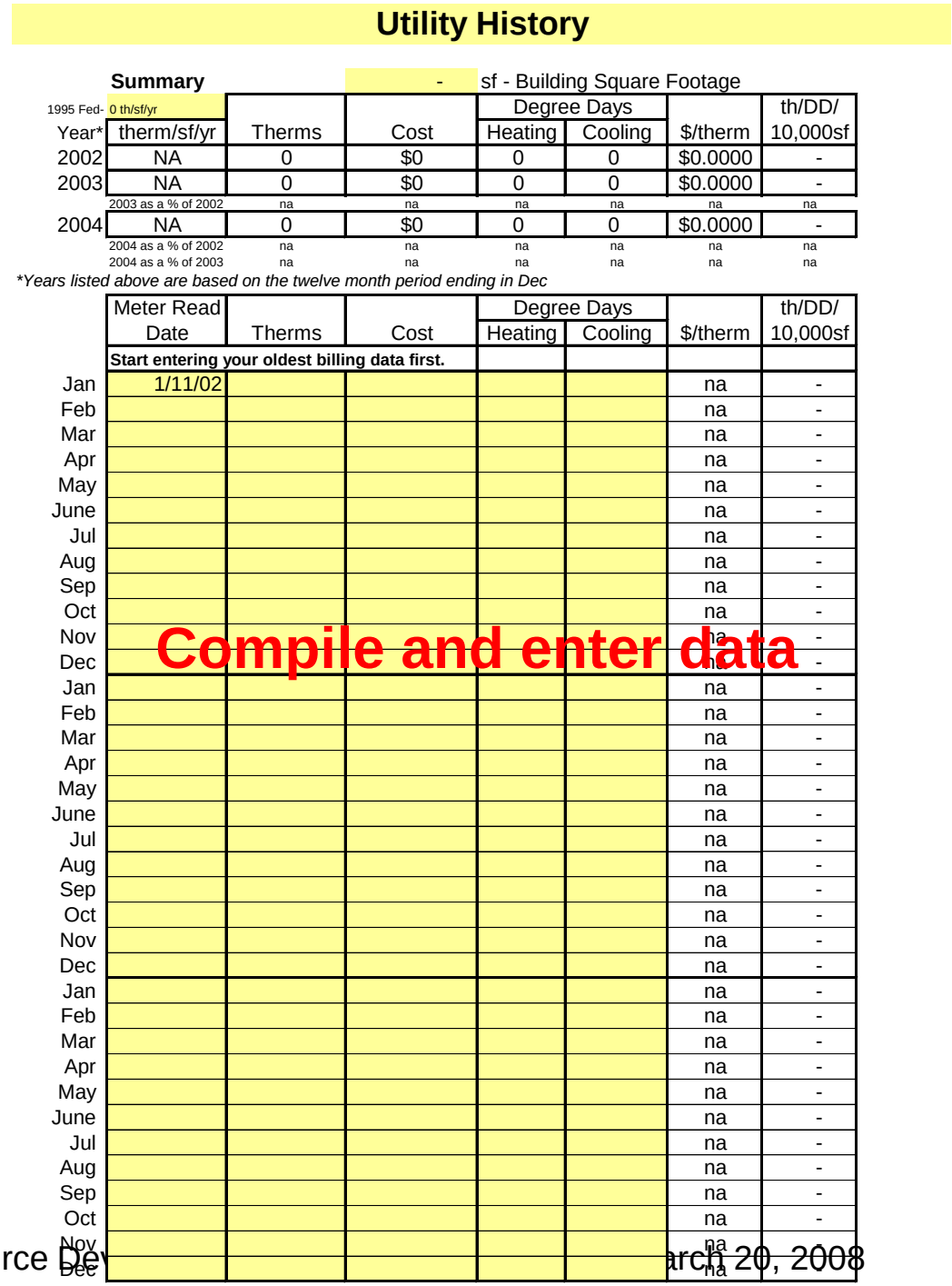


- logical relationships between equipment elements
- fundamental fieldwork skill
- common for mechanical and electrical
- clarity of thought and presentation

PRACTICAL EXERCISES

energy data spreadsheet tools

- organizing data from individual bills or from utility websites
- public domain software – Wisconsin Focus on Energy -- or other - EPA EnergyStar Portfolio Manager



Utility History

Summary		-	sf - Building Square Footage			
1995 Fed- 0 th/sf/yr			Degree Days			th/DD/
Year* therm/sf/yr	Therms	Cost	Heating	Cooling	$/therm	10,000sf
2002 NA	0	$0	0	0	$0.0000	-
2003 NA	0	$0	0	0	$0.0000	-
2003 as a % of 2002	na	na	na	na	na	na
2004 NA	0	$0	0	0	$0.0000	-
2004 as a % of 2002	na	na	na	na	na	na
2004 as a % of 2003	na	na	na	na	na	na

**Years listed above are based on the twelve month period ending in Dec*

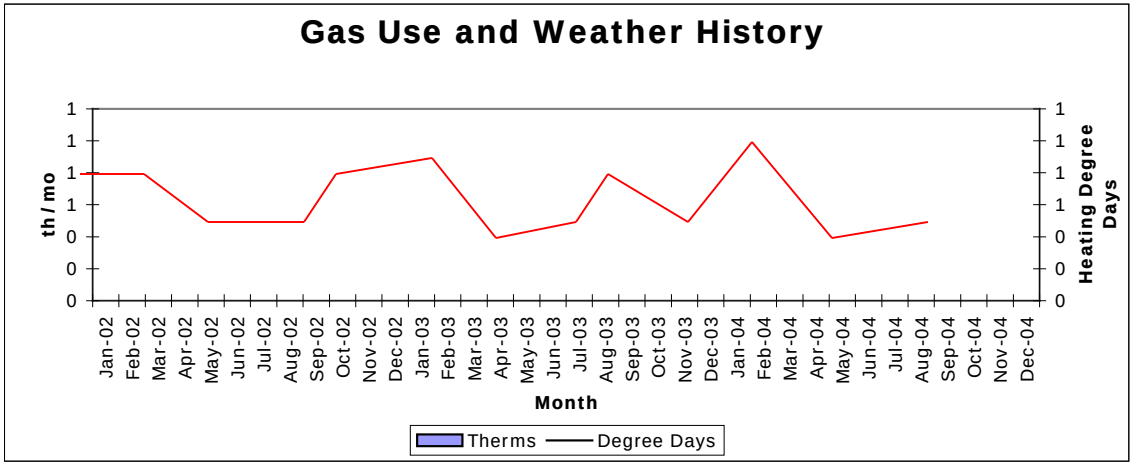
	Meter Read Date	Therms	Cost	Degree Days Heating	Degree Days Cooling	$/therm	th/DD/ 10,000sf
	Start entering your oldest billing data first.						
Jan	1/11/02					na	-
Feb						na	-
Mar						na	-
Apr						na	-
May						na	-
June						na	-
Jul						na	-
Aug						na	-
Sep						na	-
Oct						na	-
Nov						na	-
Dec						na	-
Jan						na	-
Feb						na	-
Mar						na	-
Apr						na	-
May						na	-
June						na	-
Jul						na	-
Aug						na	-
Sep						na	-
Oct						na	-
Nov						na	-
Dec						na	-
Jan						na	-
Feb						na	-
Mar						na	-
Apr						na	-
May						na	-
June						na	-
Jul						na	-
Aug						na	-
Sep						na	-
Oct						na	-
Nov						na	-
Dec						na	-

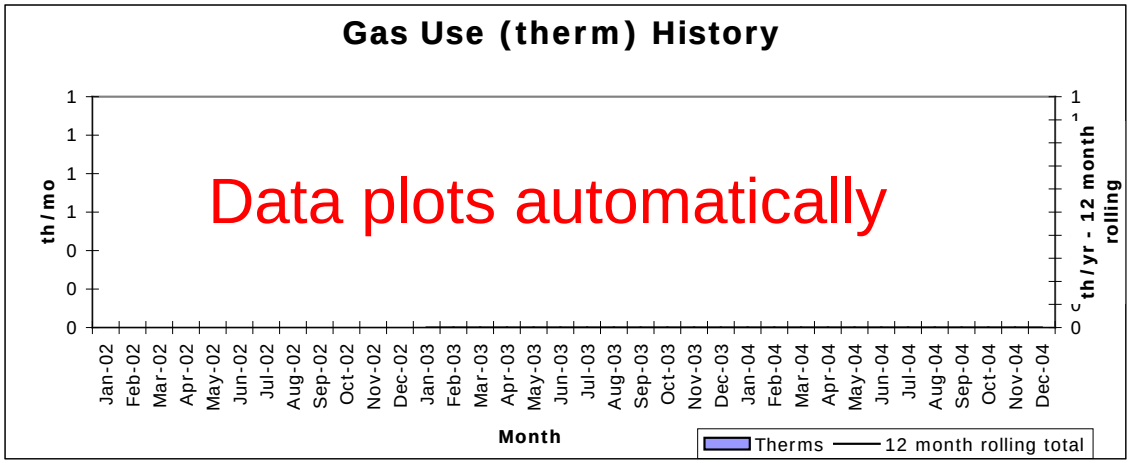
Compile and enter data

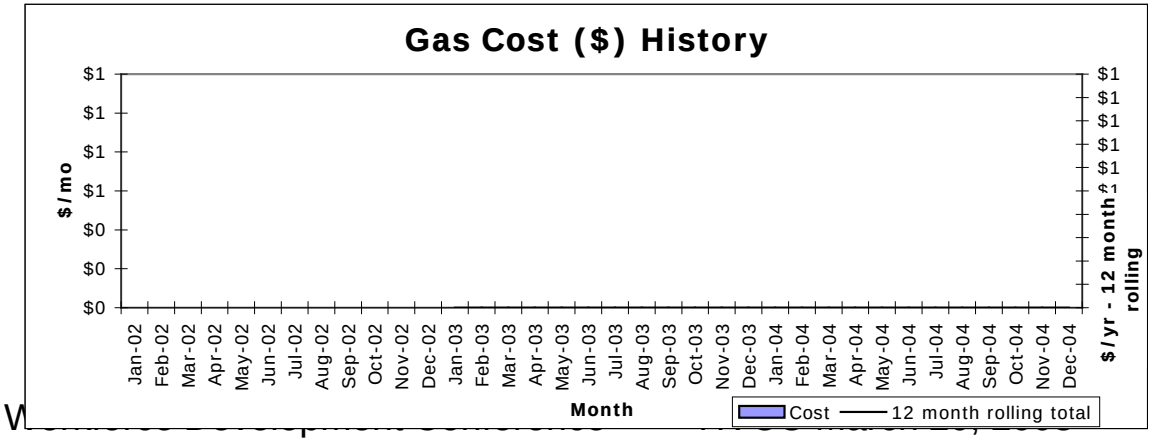
PRACTICAL EXERCISES

energy data spreadsheet tool

- graphical plots, trends
- normalization by degree-days
- baseline creation







PRACTICAL EXERCISES
Define & Develop an ECM Project

- Existing condition description
- Description of proposed measure(s)
- Energy Analysis
  - Assumptions
  - Method of Calculation
  - Measurement plan
  - Measure interactions
- Feasibility and Cost Estimate
- Economic Analysis

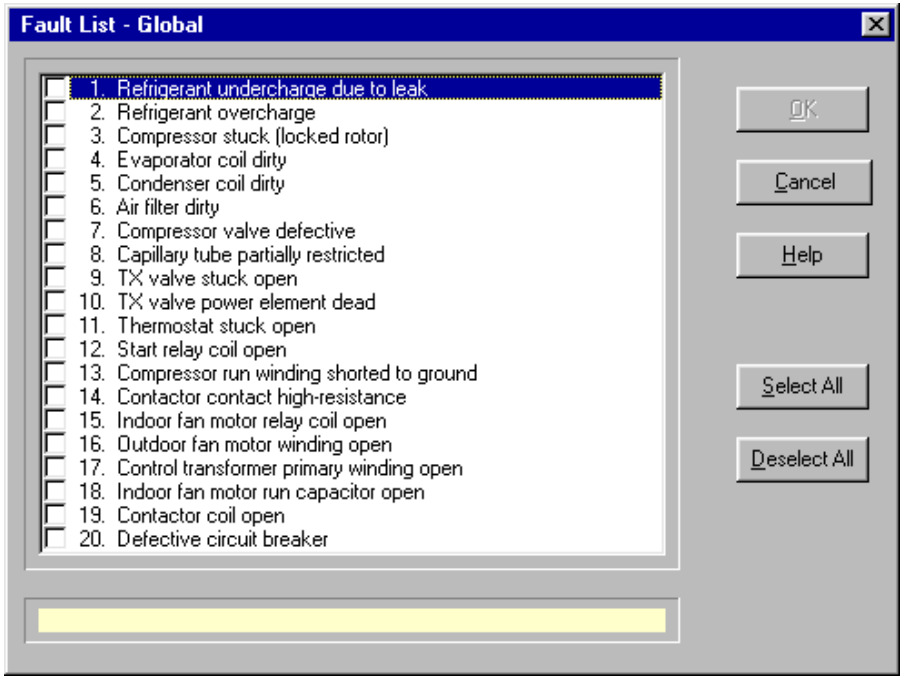
PRACTICAL EXERCISES
Model Alternatives in an HVAC Design

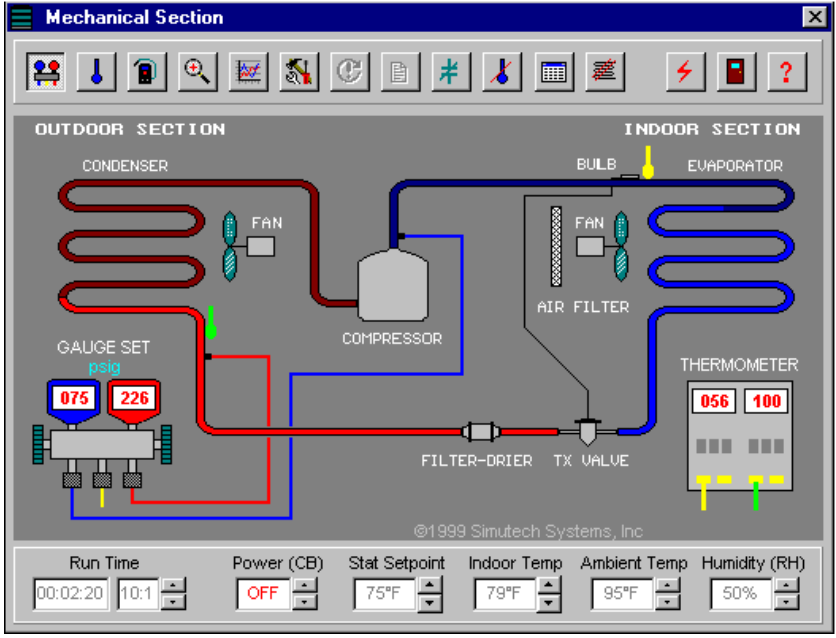
- Develop a schematic design for an HVAC replacement, following a summary program
- Use an energy modeling tool to compare alternative configurations, equipment selections
  - E-Quest is a popular free program that provides easy data inputs and graphical outputs for DOE-2 modeling engine
- Select and size equipment and show on a schematic plan set

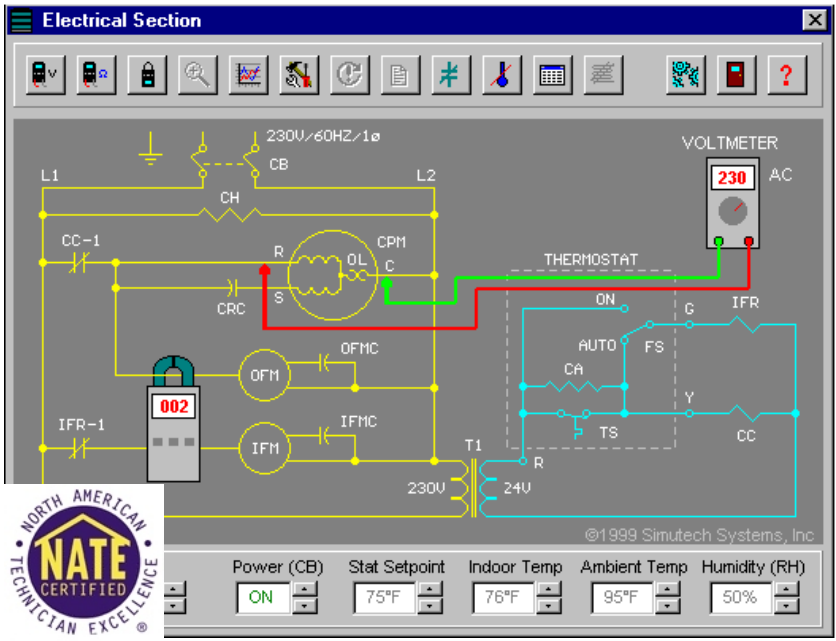
PRACTICAL EXERCISES

Simulations

- Lab-on-a-desktop
- Equipment operation ***but not energy use***







NORTH AMERICAN TECHNICIAN EXCELLENCE NATE CERTIFIED

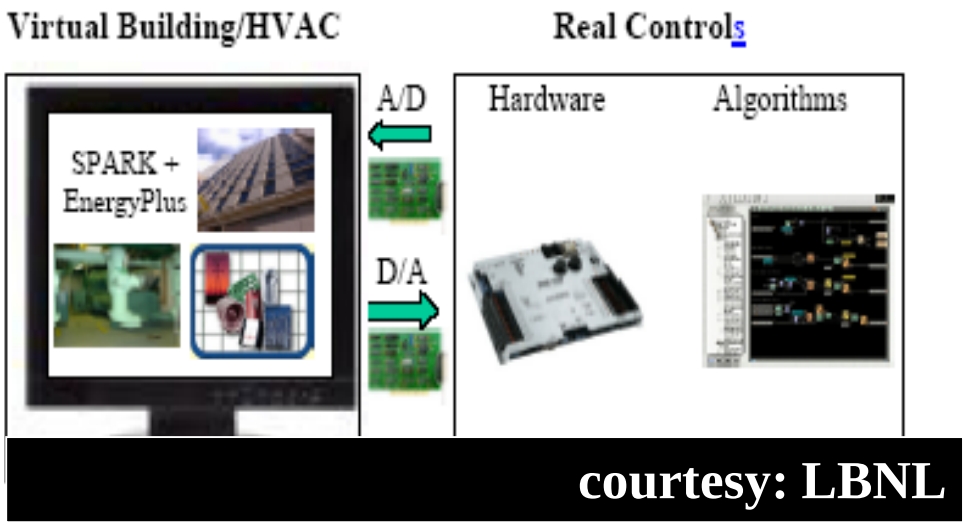
courtesy: SimuTech Systems Inc.

PRACTICAL EXERCISES

Advanced Simulators

- Energy model provides outputs to real digital controls or on-screen graphics. Response feeds back into model.
- **Potential to show energy use outcomes of control and operating decisions**

courtesy: NIST



courtesy: LBNL

Fitting Practice to Courses

• Plans and building characteristics • Schematics, mechanical & electrical • Simulations	Building Systems-1
• System design and modeling • Write control sequences of operation	Building Systems-2
• Energy units & conversions, fuel prices • Energy data management, benchmarking • ECM project analysis	Energy Management-1
• Project economic/financial analysis (LCC)	Energy Economics
• ECM project analysis • Report Preparation and Presentation	Energy Management-2 (capstone)
• Carbon footprint calculation	Intro to EST and again in EM-2 (capstone)

Conclusion

- Building EST knowledge / skill requirements can be matched to a set of practical training exercises
- Practical exercises can be delivered without large investment (of time and $$) in physical lab facilities
- Students will obtain a directly marketable package of skills

Thank you.

Questions?

Michael Bobker

Building Performance Lab

City University of New York

michael_bobker@baruch.cuny.edu

646-660-6977