



Going Beyond-Code

A Workshop for Arizona Local Governments

Program History & Energy Strategy

October 29, 2008

City of Phoenix

Dimitrios Laloudakis, CEM, CSTM

Energy Manager

“Certified Sustainable Technology Manager”



City of Phoenix





Phoenix – Energy Management

Mission: reduce energy costs and manage citywide energy usage by promoting efficiency, energy conservation and environmental awareness without negatively impacting operations and employee comfort.

- **Goals**

- Eliminate inefficient energy usage
- Develop cost effective & sustainable alternatives
- Increase employee awareness
- Promote renewable energy resources
- Provide example for the community



Phoenix – Energy Management

● Municipal Operations

- Water Services
- Aviation
- Public Works/Fire/Police/Library
- Phoenix Convention Center
- Parks/Community Centers
- Street Lighting/Traffic Signals
- Other



Phoenix – Energy Management

- **Energy Program since 1978**
- **Energy project funding**
 - General fund
 - Enterprise fund(s)
- **Program focus**
 - Energy efficient retrofits (HVAC, lighting, controls)
 - Energy efficient design (new facilities/building standards, FRC)
 - Thermal storage & district cooling system
 - Green Building Standards & LEED
 - 2 LEED “Certified”, 1 LEED “Silver”, 1 LEED “Gold”
 - 2006 bond program, 2% for green building/LEED
 - Sustainability & renewable energy



Phoenix – Energy Management

Initial Activities

- Focus on audits & staffing
- Documented project savings
- Retrofits mostly (lighting, HVAC adjustments)
- Pursuit of grant funding (DOE, UCETF)
- Successful: national attention



Phoenix – Energy Management

Program Funding

- Energy Conservation Savings Reinvestment Plan (1983)
- 50% of documented, cumulative savings up to \$500,000 (fully funded in 1985-'86)
- Also funds for Water Services & Civic Plaza (Phoenix Convention Center)
- Energy CIP increased to \$750,000 annually in FY 1999-2000

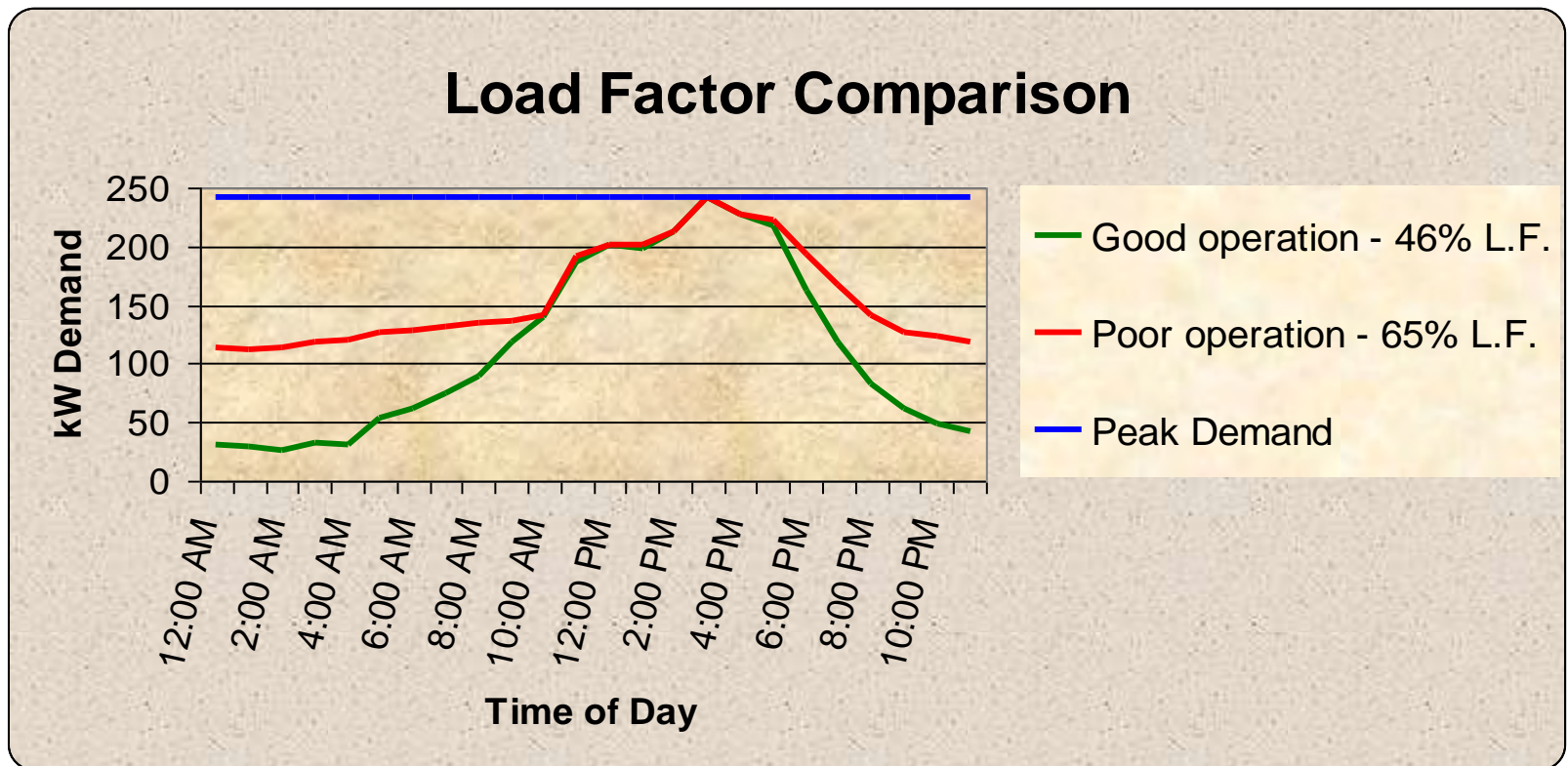


Phoenix - Energy Management

- Typical facilities energy breakdown
(where savings opportunities exist)
 - 45% - HVAC
 - 33% - Lighting
 - 22% - plug loads, etc.
- Understand your load profile
(8 am – 5 pm, or 24/7 operation?)
Monthly Load Factor (LF): $\text{kWh}/[\text{kW}*(730 \text{ hrs})]$



Phoenix - Energy Management



Typical office building, 8 am – 5 pm operation



Phoenix City Hall





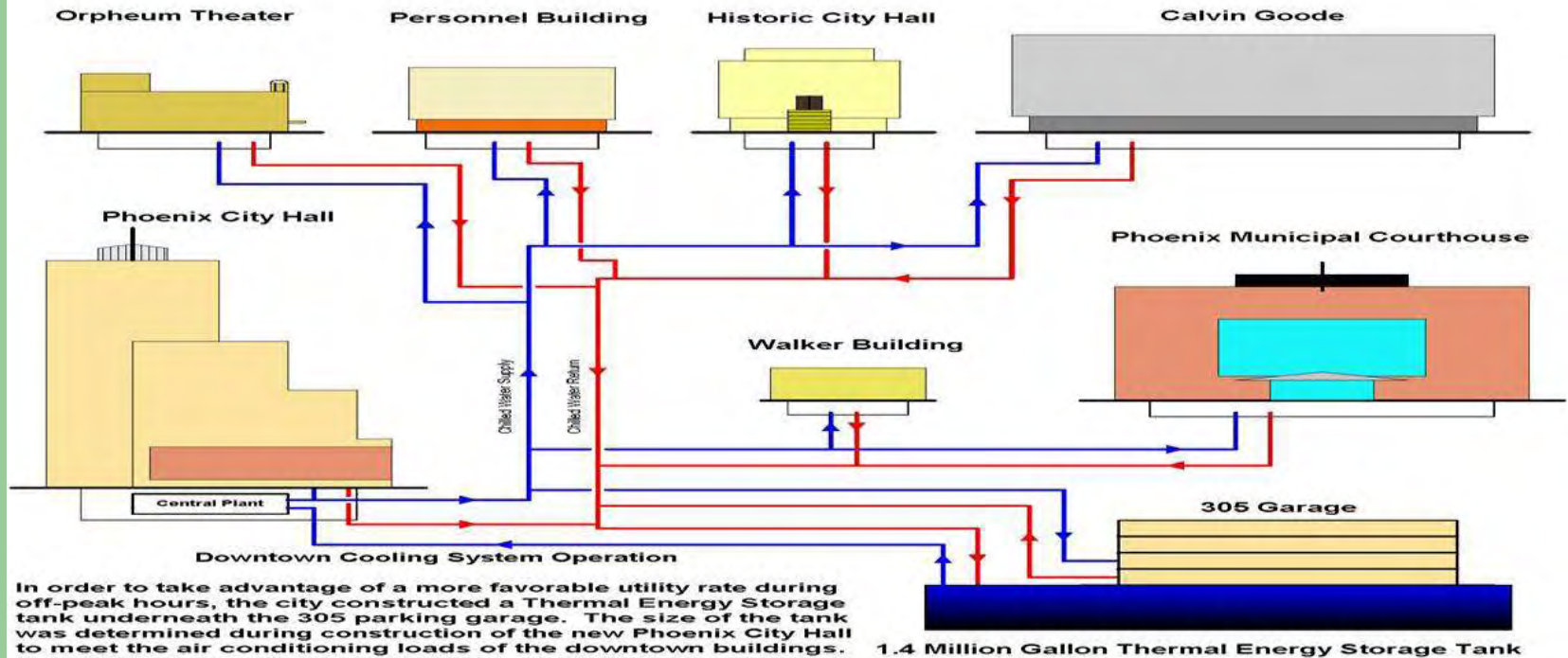
Phoenix City Hall Features

- Thermal storage/district cooling
- EMTCS (zoned w/O.R. controls)
- Energy Efficient Lighting
- Special utility rate (T.O.U) E-35
 - (beneficial but punitive)
- \$1.10/sq.ft.



Downtown District Cooling System

City of Phoenix Downtown District Cooling System



Downtown Cooling System Operation

In order to take advantage of a more favorable utility rate during off-peak hours, the city constructed a Thermal Energy Storage tank underneath the 305 parking garage. The size of the tank was determined during construction of the new Phoenix City Hall to meet the air conditioning loads of the downtown buildings. During the on-peak hours 11:00 AM to 9:00 PM, chilled water at 40°F is supplied through underground pipes to the buildings from the Thermal Energy Storage tank to meet all air conditioning loads. Chilled water is returned to the tank from the buildings at 60°F. During the off-peak periods, the Central Plant Chillers in the City Hall basement operate to meet all air conditioning loads and "recharge" the Thermal Energy Storage tank with 40°F chilled water to use the next on-peak period. Since construction of the Thermal Energy Storage three additional facilities have been added to the system: the Municipal Courthouse, the Walker Bldg and the Historic City Hall.



Burton Barr Central Library





Central Library Features

- EMTCS (zoned control with local overrides)
- Energy Efficient Lighting (1.09 W/ft²)
 - Day lighting, shading, task lighting, etc.
- Gas Absorption Chillers
- \$1.25/sq.ft.
- ***Currently pursuing LEED-EB***

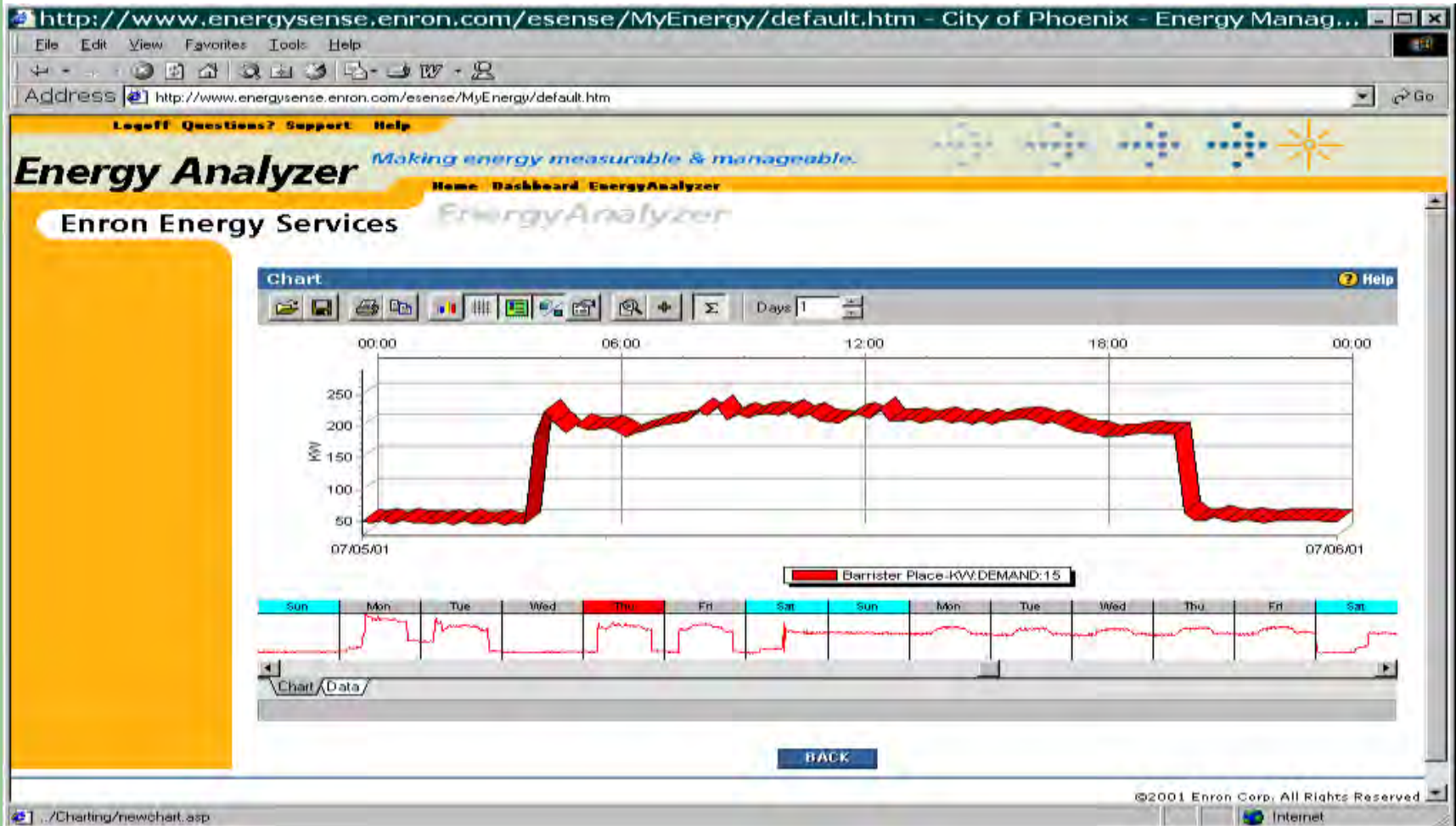


Phoenix - Energy Management

- **Electric metering information system**
 - First for a municipality (1998)
 - 300+ meters (mostly remote communication)
 - Interval time data (15-min), available by 8 AM next morning
 - Tremendous savings potential
 - (energy & demand: over \$1 million savings)
 - ***Transitioned to other vendors (post-Enron) w/real time data monitoring option***

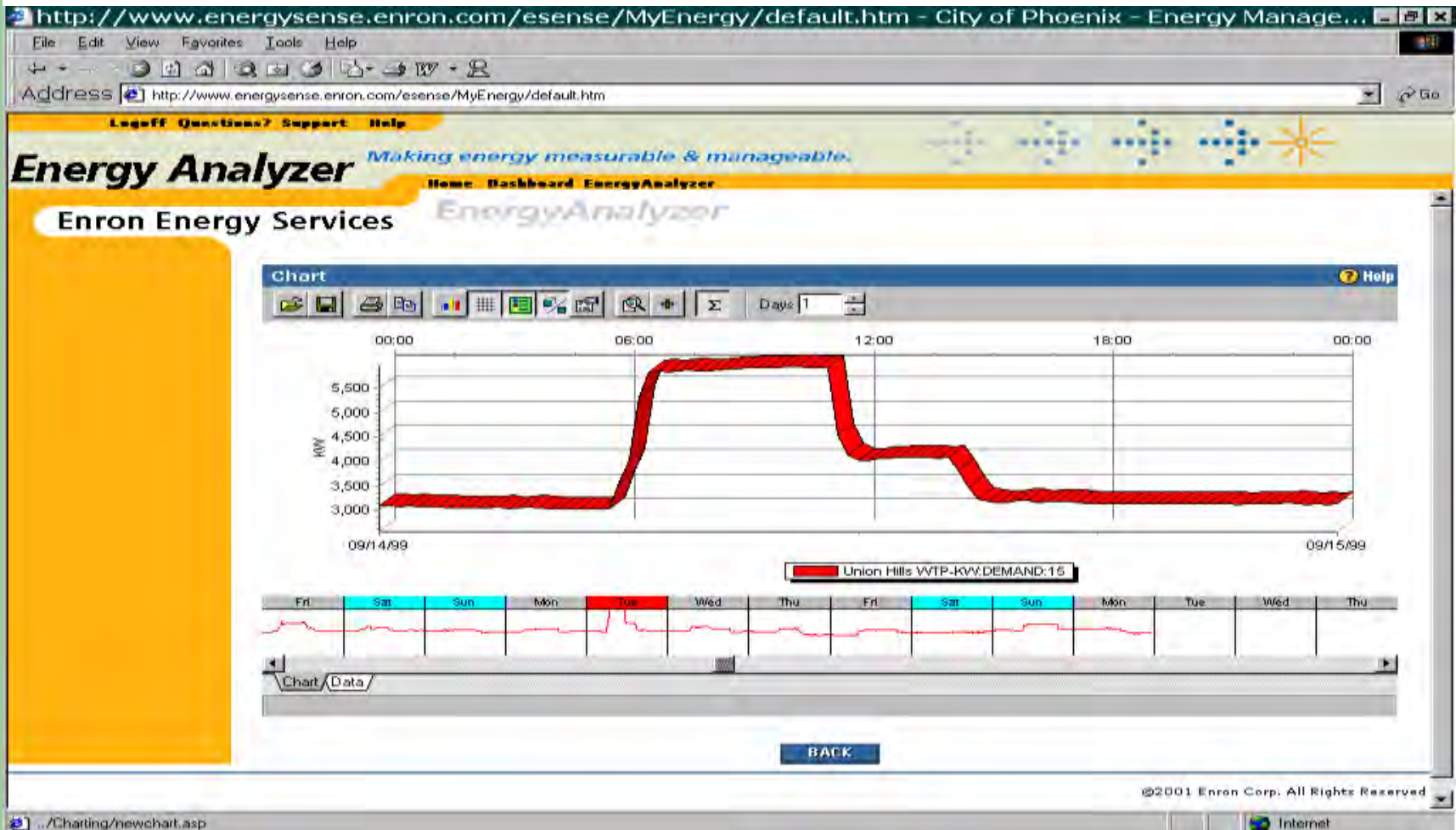


Typical Bldg. Profile (weekday)



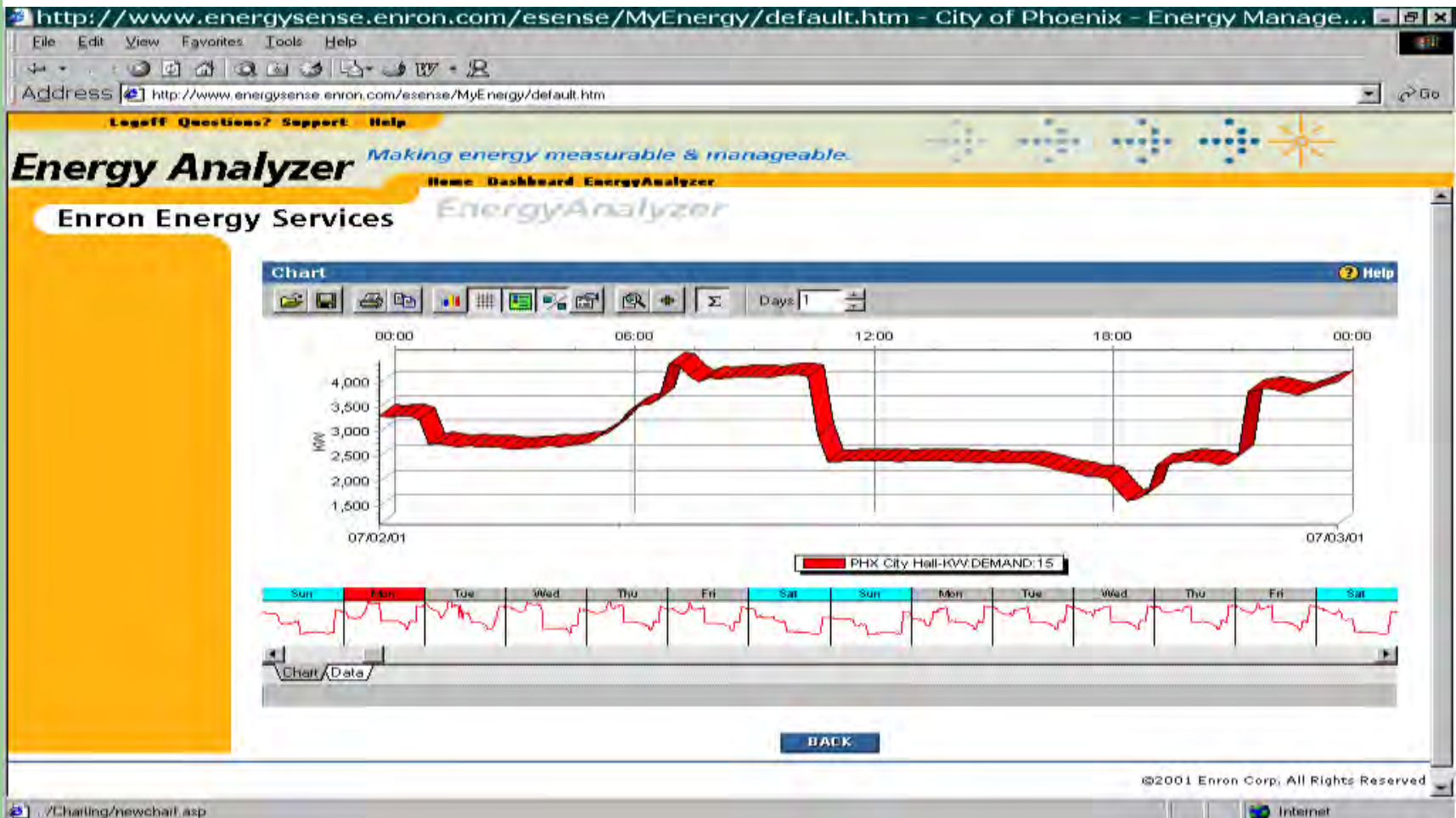


Typical Water Plant Profile





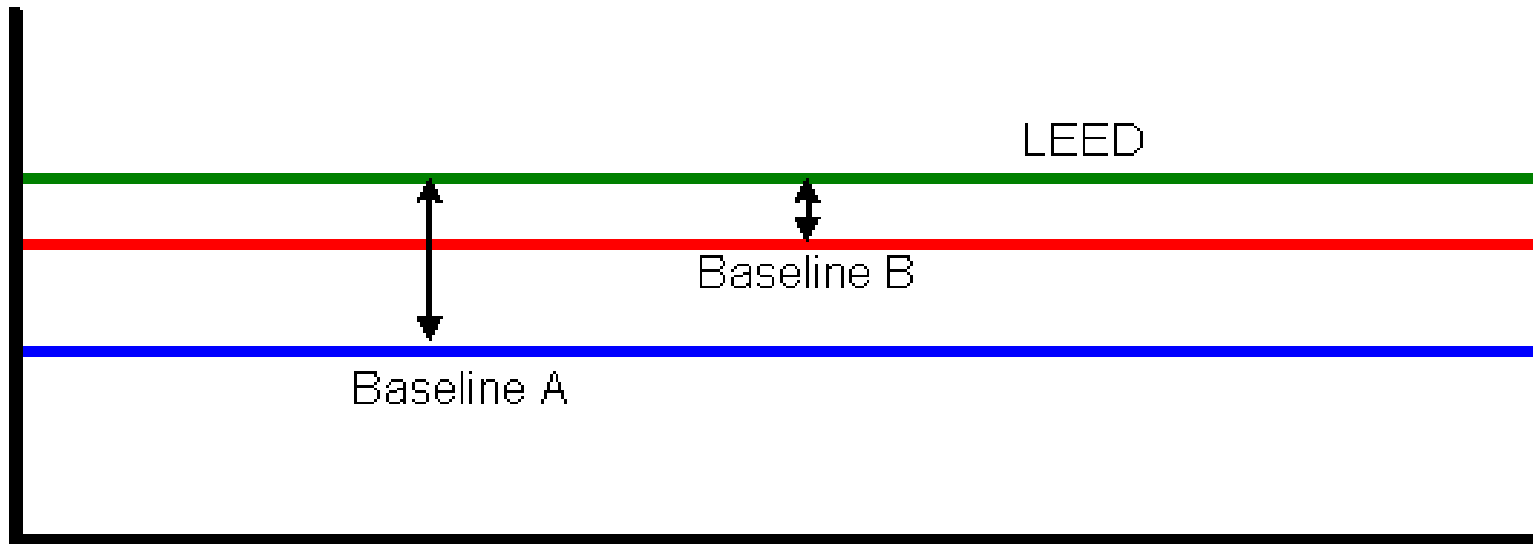
Phoenix City Hall w/Thermal Storage





Pilot LEED projects

- Pilot projects to identify any incremental costs for LEED (started in 2002)
 - Does LEED cost more?
 - It depends ... on your baseline





LEED & Municipal Projects

- Bond money, fixed budgets (NTE)
- Incremental LEED costs (1% - 8%, based on certification level)
- LEED projects save money in the long run
- Municipal projects, 30 – 40 years

Conclusion: LEED does not cost any more based on life-cycle costing & it saves money & natural resources



Green Building Guidelines

- City Council adopts “green building” guidelines (June 2005)
- Design & construct to LEED Certified level (at a minimum)
 - Use LEED scorecard for tracking points
 - Budgets increased by 2% (2006 bond program) to cover additional upfront costs
 - Selected projects to be submitted to USGBC for certification



Green Building Guidelines (cont'd)

- City Bldg. Standards, LEED+
- Existing LEED program prerequisites **plus** Phoenix requirements (8 points)
 - Reduce heat islands (roof & non-roof): 2 pts
 - Water efficient landscaping (50% red.): 1 pt
 - Water use reduction (20%): 1 pt
 - Optimize energy performance: 2 pts
 - Construction waste mgmt. (divert 50%): 1 pt
 - LEED accredited professional: 1 pt



Solar Energy History

- Central Avenue canopies (1990, 1.5 kW)
 - Project continues to expand at Transit canopies (12.5 kW)
- North Mountain Park security lights (1991, 0.15 kW)
- South Mountain Park restroom facility (1995, 0.2 kW)
- Transit Park & Ride in Awhatukee (2004, 100 kW)
- North Gateway Transfer Station (2006, 7 & 3 kW)
- Camp Colley (2006, 8.45 kW)
- North Mountain Park Visitor Center (2007, 3.15 kW)
- Pecos Community Center (2007, 30 kW)
- Washington Adult Center (2008, 10 kW)
- Phoenix Convention Center – West Bldg (2008, 100 kW)



Early solar PV projects



Park Security Lighting



Transit canopies on Central Ave.



Park & Ride solar PV project



100 kW system



Recent solar PV projects



Parking lot lighting



Pecos Comm. Center (30 kW)



Renewable Energy Opportunities (w/city resources)

- Solar Photovoltaics (PV)
 - Small scale: roof top
 - Large scale: open space (landfill space)
- Solar thermal
 - Small scale: pool heating
 - Large scale: central plant generation
- Landfill gas
- Digester gas



Environmental Quality Commission (EQC) & Renewable Energy Goal

- EQC: citizens commission appointed by the mayor
- Renewable energy goal discussions through “Solar & Other Renewables Subcommittee”
- Review city renewable activities “to date” & recommend renewable energy goal
- Create “Solar & Other Renewable Energy Projects” website in phoenix.gov
 - <http://phoenix.gov/sustainability/solarproj.html>
- Take recommendation to the Parks, Education, Bio-science & Sustainability Subcommittee (PEBS)



Energy Goal Guidelines

- 1. 100% of all renewable energy generated from projects sponsored by the City**
- 2. City will partner w/3rd parties and/or utilities to attain goal: City does not operate a utility**
- 3. Use the ACC target as goal setting reference**
- 4. City will use renewable goal as guidance and make effort to meet it w/o binding future City Councils**
- 5. Continue to identify and develop renewable energy projects as opportunities arise**
- 6. City's goals are based on projected renewable energy generation from current City projects**



Proforma to 2025

- **Landfill gas projects:**
 - 27th Ave. landfill (3,000 kW)
 - Skunk Creek landfill (3,000 kW)
- **Solar PV Projects**
 - City & Utility partnerships
 - Roof-top:solar kW (PPA projects)
 - Open space/landfill: solar MW (PPA projects)
- **Green purchases?**
- **Future digester gas opportunities ?**
 - RFQ out in late 2008
 - 2 wastewater treatment plants (23rd Ave & 91st Ave)

GOAL: 15% by 2025



Third – Party Financing

- ITC: 30% (8-yr extension)
- City not a tax-paying entity, looking to leverage ITC
- Issued Request for Qualifications in fall 2007(RFQ)
- Established vendor list (5 vendors)
 - Small roof-top projects (20 kW – 99 kW)
 - Medium roof-top projects (100 kW – 499 kW)
 - Large open space/central plant projects (0.5 MW – 5 MW)
- First 3rd-party financing project out for quote:
 - Metro Facilities Bldg. (30 – 60 kW)
 - Challenge: PPA language
 - ACC reviewing the issue: vendor would be a “utility”
- Prefer to have a performance based contract (\$/kWh)
- System leasing, not the preferred option
- Apply solar PV to an already energy efficient building



Phoenix – Energy Management

- **Ideas for successful Energy Program**
 - Involve everyone from the beginning
 - Owner/designer/construction mgr. (LEED)
 - Energy Savings & Comfort are not mutually exclusive
 - Operators are your biggest asset
 - Design w/diversity (after hours, wk/end use)
 - Provide simple O/R capabilities to control system



Phoenix – Energy Management

- **Energy Strategy into the Future**

- Improve operation of existing facilities using new energy efficient technologies (old stock)
- Design sustainable new facilities (new stock)
- Continuous benchmarking/retro-commissioning
- Efficient uses for municipal resources
 - Landfill gas
 - Digester gas
- Energy Security Issues (substation ownership)
- Renewable Energy Strategy



Utility Industry Acronyms

- **NIMBY**
 - Not in My Back Yard
- **NOPE**
 - Not on Planet Earth
- **BANANA**
 - Build Absolutely Nothing Anywhere Near Anything



Phoenix – Energy Management

- “There’s no Silver Bullet”
- Questions?

dimitrios.laloudakis@phoenix.gov
602-261-8813
602-374-0637 (cell)

