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September 4, 2008

MEMORANDUM

TO: Power Committee

FROM: Charlie Grist and Tom Eckman

SUBJECT: Emerging Technologies for Energy Efficiency

The development of a new conservation assessment for the Sixth Power Plan requires a look at emerging technologies for energy efficiency. Tom and I will highlight initial findings of a research project aimed at identifying candidate new and expanded conservation measures and practices. The research is being conducted by the Energy Extension at Washington State University (WSU).

We are not alone in the quest for information about emerging technology. WSU consulted twenty organizations for information on emerging technologies and has so far looked at 250 to 300 measures or practices considered emerging by one source or another. Many of these are already considered in the Council's conservation assessment, however there are several notable findings that may impact the 6th Power Plan.

First, the research has not uncovered any emerging measures with large savings potential and low cost. There's no emerging technology identified in this research on the scale of compact fluorescent light bulbs for example. But there are many existing measures where technological or market developments have improved cost, efficacy, applicability or longevity. There is also a proliferation of niche measures, new technologies with limited scope of application. Another key finding of the research is that there are several energy management business practices that are emerging as effective means to achieve much higher penetration of existing technologies. Our presentation at the September meeting will touch on a sampling of these.

Finally, there are a few new technologies that hold promise for future energy savings, but which are not ready for market yet and thus will not be in the conservation supply curves. However, we recommend including a specific action item in the 6th Plan to ensure that these pre-emergent technologies and practices move to market so they are ready for deployment in the 7th Plan Power Plan.

Attachment

Emerging Technologies in Energy Efficiency

September 2008



Purpose:

- Identify new technologies & practices
- Select those with near-term potential
 - Evaluate costs, savings & applicability
 - Add to supply curves
- Identify those with long-term promise
 - Consider 6th Plan Action Items to advance applicability

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Approach

- Contract with WSU Energy Extension
- Review literature, programs, organizations
- Develop list of measures & practices with key characteristics
- 250 to 300 measures & practices considered .. so far

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Organization Consulted

- ACEEE
- BC Hydro
- BPA
- California Lighting Technology Center
- E Source
- ECOS Consulting
- Edison Electric Institute
- Emerging Technology Coordinating Council
- Federal Energy Management Program
- National Labs
- Natural Resources Canada
- Puget Sound Energy
- Seattle City Light
- Sacramento Municipal Utility District
- UC Davis
- U.S. Dept of Energy
- WSU Energy Program
- Washington Technology Center

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Selection Criteria

- Significant savings likely within 15 years
- Advanced stages of development
 - Commercially available or
 - Ready for commercialization
- Not yet in wide use in PNW
- Little negative impact on the service provided
- Not fully considered in 5th Power Plan

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Major Findings So Far

- No Silver Bullets
- Many Incremental Improvements
- Proliferation of Niche Applications
- Development of Business Practices for Energy Management
- Some Potential “Breakthrough” Technologies Warrant RD&D Now



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Findings in Three Categories

Improvements to Existing Technology. Gains in cost, efficacy, applicability or measure life.

Improved Tech

Changes to Design & Business Practices: Systematic business strategies that improve measure applicability, penetration and persistence ... Design & Operations

New & Improved Practices

New Products & Technology. Breakthrough technologies not previously considered viable. Includes both direct and enabling technologies & products.

New Tech

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Improved Technology A Sampling of Measures

- SSL Solid State Lighting (LED)
- System Controls for Lighting & HVAC
- Interior Fluorescent Fixtures
- Improved Lamp & Ballast Efficacy
- Process Equipment Performance
- Heat Pump Water Heaters
- Low Flow Shower Heads
- Variable Speed Control for Small Motors
- Evaporation-Aided Cooling
- Ventilation Strategies for Commercial Buildings

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Let's Look at Some Improved Tech Emerging SSL Products & Applications

- Traffic Lights
- Outdoor Lighting
 - Street & Roadway
 - Walkway
 - Parking
 - Façade & Signage
- Refrigeration Display Case
- Recessed Can Downlight
- MR16 Replacements
- Desk Lamp / Task Lighting
- Undercabinet

•These were in 5th Plan
•Mostly completed now

•Good Applications
•Promising Economics
•New Potential MWh

•Compete with CFL (few new MWh)
•Some new MWh in Niches

•Room for Improvement

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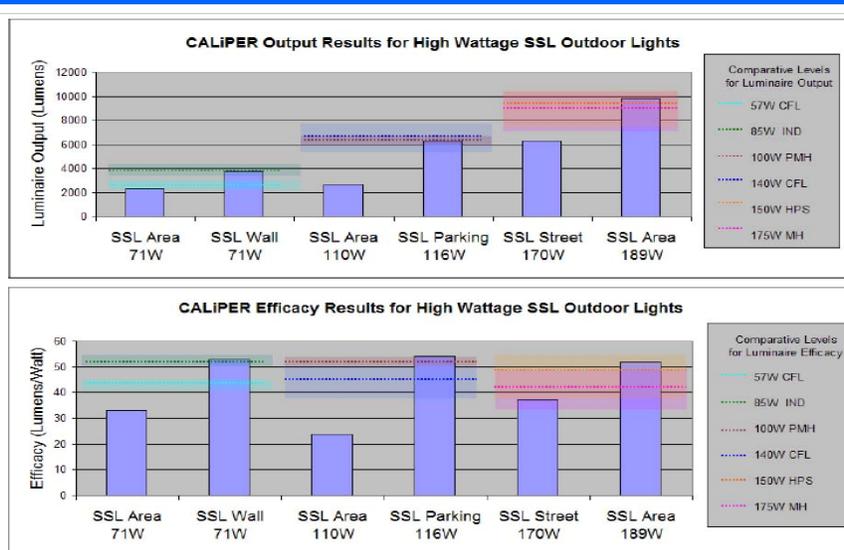
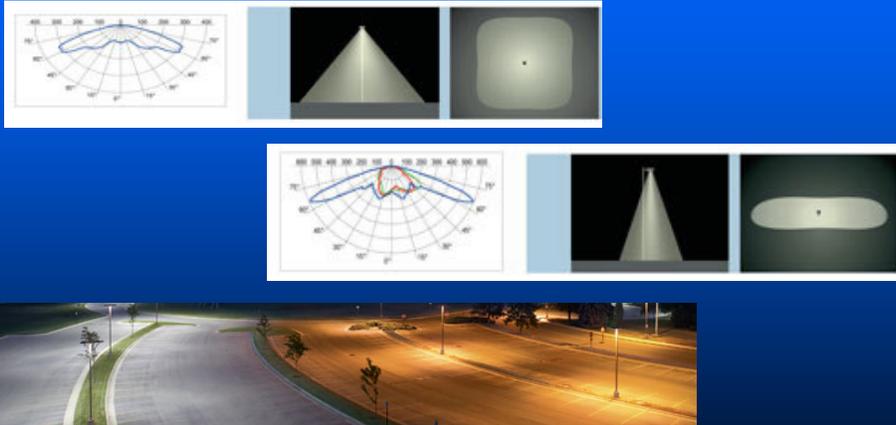


Figure 4. CALiPER Output and Efficacy Values Showing Comparable Levels for Other Light Sources

Comparative levels represent initial luminaire efficacy established using IES files and ballast factors for outdoor area lights, cobraheads, post-top, and pedestrian lights for CFL, induction, metal halide, pulse start metal halide, and high pressure sodium fixtures.

Directional Point Sources Tunable Optics



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SSL: Long Life vs High First Cost

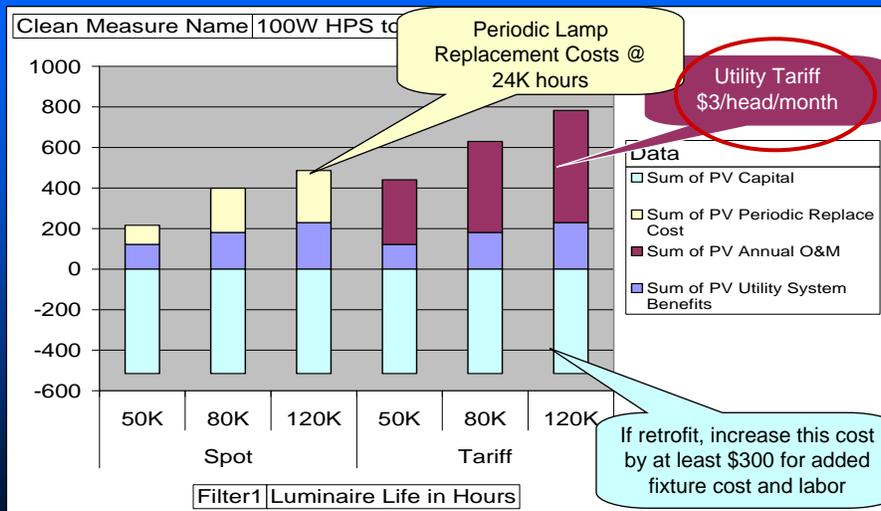
- First Cost vs Periodic Replacement Cost
 - Periodic Replacement Costs Avoided
 - Frequency of Lamp & Ballasts Replacements
 - Reduced Labor Costs



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Streetlight – 100W HPS vs LED - New Present Value Benefits (\$ per head)



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Improved Technologies System Controls for Lighting & HVAC

- Occupancy-Sensor Control
 - Lighting: Warehouse & Parking
 - HVAC: Personal Control
- Demand Control Ventilation (DCV)
 - Vent Hoods: Restaurant, Lab & Industrial
- Fault Detection Diagnostics
- Key Card Control for Lodging

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Improved Technologies *Interior Lighting*

- Improved Fluorescent Fixtures
 - More useful light: 10% - 40%
- Electrodeless Lamps
 - Higher efficiency & longer life
- Improved Fluorescent Lamp Life
 - Reduces levelized cost
- Low Wattage Ceramic Metal Halide
 - Increases applicability for retail display lighting

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Business Practices

- Not Technologies
- Strategies that:
 - Create new savings due to synergies
 - Allow higher penetration of measures
 - Improve persistence of measures
- Significant new conservation potential

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Improved Strategies & Practices A Sampling

- Integrated Building Design
- Energy Management Business Practices
 - Analyzing how corporate decisions get made
 - Continuous Energy Improvement, Envinta 1 to 5, Enterprise Energy Management
- Data Center Optimization 
 - Server Virtualization
- Building Commissioning Practices
 - Monitoring-Based Commissioning

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New Technologies & Products A Sampling

- Magnetic Levitation Centrifugal Compressors 
- Wireless Sensors & Communication
- Smarter Low-Power Computer Chips
- Aerosol-Based Duct Sealing for Commercial
- OLED – Organic Light Emitting Device 
- In-Home Energy Display Systems 

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Summary

- Evaluating these technologies for 6th Plan
- Expand Supply Curves for Commercially Available
- Identify Actions to Speed Up Commercial Readiness for others



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Northwest
Power and
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Council

End

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