

## PIER Buildings RFP Research Topics Input Template

Topics Provided by Lawrence Berkeley National Laboratory

July 26, 2007

Contact: Nance Matson, [nematson@lbl.gov](mailto:nematson@lbl.gov), 510-486-7328

### A. Additional Ideas - not discussed in CEC Public Input Session on July 12, 2007

**\*Note: Range and Timeline inputs provided in this table are for the specific research topic, rather than the research area.**

Comm.	Res	App / Plug Loads	Type of Project	Research topic (general)	\$ Range*	Timeframe*	Nature of Research
x	x		Building Component Performance	Low-emittance interior and attic paints to save energy and increase thermal comfort	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x		Building Component Performance	Panelized Construction Applications in Affordable Housing	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x	x		Building Performance and Loads	Optimization Tools for Selection of Building Integrated Generation, CHP, Passive Solar, Active Solar, Absorption Cooling, Efficiency, etc.	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x			Building Power Generation	Building Power Generation and Energy Storage Scheduling and Control	<input checked="" type="checkbox"/> < \$200K <input type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input checked="" type="checkbox"/> < 2 Years <input type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input type="checkbox"/> Applied research <input checked="" type="checkbox"/> Fundamental
x	x		CHP, MicroCHP	Microgrids, small commercial and residential applications	<input checked="" type="checkbox"/> < \$200K <input type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input checked="" type="checkbox"/> < 2 Years <input type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x	x		Design and Simulation Tools	Collaboration Platform Between Different Simulation Tools for Integrated Buildings R&D	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input checked="" type="checkbox"/> Fundamental
x	x		Diagnostic and Communication Tools	Building Diagnostics – Develop and implement whole building data analysis tools and algorithms with interval meter data	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental

x			HVAC - DR	Modeling of DR – Thermal Mass and HVAC Strategies	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x			HVAC - FDD	FDD – New Approaches to Simulation and Testing	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x	x		Indoor Environmental Quality related to Energy Efficiency	Technologies and Practices for Assurance of Indoor Environmental Quality during Implementation of Energy-Efficient Technologies and Strategies	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x		Integrated Community Design - Tools	Integrated Energy-Efficient Community Design - Tools to evaluate and guide optimized residential development designs that take into account energy efficiency and environmental factors - such as building construction, orientation, spacing, street layout, density, shading, shared local power sources, etc.	<input type="checkbox"/> < \$200K <input type="checkbox"/> \$200K - \$750K <input checked="" type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x		Integrated Community Design - Tools	Design tools for Zero-Energy Neighborhoods for developers, architects, city planners and energy regulators - to take into account impact of neighborhood design, layout, building and landscape siting on overall neighborhood energy use.	<input type="checkbox"/> < \$200K <input type="checkbox"/> \$200K - \$750K <input checked="" type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x			Other Sectors	Hospitals - End-Use Efficiency and implementation study	<input type="checkbox"/> < \$200K <input type="checkbox"/> \$200K - \$750K <input checked="" type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x	x	x	Rating and Labeling	Rating and Consumer Labeling for Building Materials and Modules (Assemblies and Systems) - Life Cycle Costs and Emissions	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental

x			Standards Tools	<p>Enable Building Information Models (BIM) for Title-24. Building information models are becoming the industry designated data bases that include all information about a given building throughout its life cycle. BIM will serve as the accepted authoritative building data sources for all performance simulation, analysis and code checking. Standards related BIM initiatives and projects currently include the developments of the National BIM Standard (NBIMS) by the National Institute of Building Sciences (NIBS), and Automated Code Checking by the International Code Council (ICC).</p>	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
---	--	--	-----------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------

x			Standards, Diagnostic and Communications Tools, HVAC	<u>Compliance Tools for Air Distribution System Performance (Commercial)</u> . For Title 24 to be able to address air distribution system deficiencies in large commercial buildings by 2011, the following research and development efforts are required now: 1) Evaluate the applicability and reliability of recently developed duct airflow diagnostics, and carry out engineering development so that products and standardized test procedures become commercially available for the test and balance industry; 2) Carry out modeling and analyses of air distribution system impacts on energy use and indoor environmental quality to establish Title 24 baselines that are technologically feasible and economically justified over the life of the system;3) Develop joint CEC/DOE/ASHRAE guidelines about design and installation practices that avoid problems that occur now in the current building stock. Also develop stand-alone guidelines for use by building designers and HVAC contractors describing how to commission air distribution systems. This effort should include working with industry partners to update related sections of ASHRAE Handbooks and Standards and to develop education programs for technology implementers so that the design, installation, and commissioning of efficient air distribution systems becomes standard practice.	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x	x	Standards, Enabling Technologies for Smart Buildings	Grid-Friendly Appliance Standards relating to Grid Security and Reliability	<input checked="" type="checkbox"/> < \$200K <input type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input checked="" type="checkbox"/> < 2 Years <input type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental

x		Understanding Current Building Performance	Expansion of Action-Oriented Commercial Building Benchmarking - Action-oriented benchmarking is designed to provide more specific guidance on efficiency opportunities, primarily by benchmarking end-use energy intensity and system efficiencies. Research needed includes development of a simulation-model based tool which can interface with building EMCS systems to integrate with continuous commissioning activities.	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x	Water Use Efficiency	Field Monitoring of Hot Water Use (coordinate with CEE and utilities)	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x	Water Use Efficiency	Revise Test Procedures for Water Heaters (ASHRAE 118.2), to assure results are meaningful for different technologies (tankless water heaters)	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x	Water Use Efficiency	Development of Condensing Sidearm Water Heater	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x	Water Use Efficiency	Investigate Fluid Dynamics (pressure drop, heat transfer, surface shear) of Mixed Hot and Cold Water Flow in Pipes and Fittings	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x	Water Use Efficiency	Impacts of Different Shower Heads on Behavior and Implications for Energy Consumption	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x	Water Use Efficiency	Performance of Temperature Compensating and Pressure Compensating Mixing Valves	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental

**B. Elaboration on ideas discussed in CEC Public Input Session on July 12, 2007**

**\*Note: Range and Timeline inputs provided in this table are for the specific research topic, rather than the research area.**

Comm.	Res	App / Plug Loads	Type of Project	Research topic (general)	\$ Range*	Timeframe*	Nature of Research
x	x	x	Appliances	Accelerating Replacement and Destruction of Energy-Inefficient Building Components and Equipment - stock efficiency survey, analysis, implementation planning	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x		Building Assembly Rating	Rating Energy Performance of Complete Roofing Systems for Title 24 Compliance	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
		x	Demand Response Technologies	Bottom-up DR	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x		Diagnostics & Communications Tools	Wireless End-Use Monitoring using Microchips in CFLs, appliances	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x		Diagnostics & Communications Tools	Real Time Metering (Residential) - Disaggregation of Current Signal to monitor performance and energy use of building end uses	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x	x		Enabling Technologies for Smart Buildings	Networks and Communication to Take Advantage of Smart Appliances and Equipment	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x			Enabling Technologies for Smart Buildings	Plug-load controls (occupancy sensors, DR) - Integrated Furniture-Based Task Lighting Control	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x	x	Enabling Technologies for Smart Buildings	Optimal Heating of Houses with Gas and Electricity - control software and hardware for energy- and cost-effective switching between gas furnace and electric space heaters	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental

		x	Enabling Technologies for Smart Buildings	Two-way Communication Between Smart Appliances and Utilities (grid-friendly appliances) - Current smart appliances are typically equipped with one-way (open-loop control) communication devices to receive and react to utility signals. For effective control of the supply- and demand-side of electricity, it is essential to equip appliances with two-way (closed-loop control) communication devices, including meters to provide feedback to the utility control systems.	<input type="checkbox"/> < \$200K <input type="checkbox"/> \$200K - \$750K <input checked="" type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x	x	x	Enabling Technologies for Smart Buildings	Standardizing User Interfaces for Lighting Controls	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x		Energy Use Feedback Strategies	Statewide Residential Retrofit Program - integrated whole-house implementation to optimize performance	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x			HVAC	Integrated Gas Powered Cooling (Commercial) to Reduce Greenhouse Gas Emissions - integrated absorption cooling and heating systems for the California market - technology advancement and application.	<input type="checkbox"/> < \$200K <input type="checkbox"/> \$200K - \$750K <input checked="" type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x			HVAC	Simultaneous Heating and Cooling - Stock Analysis	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x			HVAC, Understanding Current Building Performance	Cool Coating on Exposed Roof Ducts - Simulation Tools	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x	x		Innovative Building Envelope Solutions	Integration of Phase Change Materials in Buildings	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
	x		Innovative Building Envelope Solutions, Windows	Dynamic Zero-Energy Windows - Integrated with Lighting and Other Building Loads - Predictability of Loads (Residential)	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental

x	x		Integrated Community Design	Community and Transportation Planning related to Building Loads (for example, Plug-in Hybrids)	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x	x		Low Energy Cooling Systems	Impact of Climate Change on Low-Energy Cooling	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental
x	x		Test Procedures	Test Procedures for Particular Appliances - AC, Furnaces, HW Heaters, Tankless HW Heaters	<input type="checkbox"/> < \$200K <input checked="" type="checkbox"/> \$200K - \$750K <input type="checkbox"/> > \$750K	<input type="checkbox"/> < 2 Years <input checked="" type="checkbox"/> 2 – 5 Years <input type="checkbox"/> > 5 Years	<input checked="" type="checkbox"/> Applied research <input type="checkbox"/> Fundamental