State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 10-7

February 25, 2010

Agenda Item No.: 10-2-1

WHEREAS, the Air Resources Board (ARB or Board) has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2685-266, entitled "Behavioral Strategies to Bridge the Gap Between Potential and Actual Savings in Commercial Buildings," has been submitted by the University of California, Davis (UC Davis);

WHEREAS, the Research Division staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee (RSC) has reviewed and recommends for funding:

> Proposal Number 2685-266 entitled "Behavioral Strategies to Bridge the Gap Between Potential and Actual Savings in Commercial Buildings," submitted by UC Davis, for a total amount not to exceed $134,981.

NOW, THEREFORE, BE IT RESOLVED that ARB, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendation of RSC and approves the following:

> Proposal Number 2685-266 entitled "Behavioral Strategies to Bridge the Gap Between Potential and Actual Savings in Commercial Buildings," submitted by UC Davis, for a total amount not to exceed $134,981.

BE IT FURTHER RESOLVED that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed $134,981.

I hereby certify that the above is a true and correct copy of Resolution 10-7, as adopted by the Air Resources Board.

Sandra Bannerman, Clerk of the Board

ATTACHMENT A

Behavioral Strategies to Bridge the Gap Between Potential and Actual Savings in Commercial Buildings

Background

As required by the California Global Warming Solutions Act of 2006, Air Resources Board (ARB or board) must identify and implement cost-effective strategies for reducing California's greenhouse gas (GHG) emissions. Addressing emissions associated with California's commercial sector which accounts for more electricity use than any other sector, and a substantial portion of the state's natural gas consumption, will be critical to meeting both near- and long-term emissions targets. However, efforts to reduce commercial building energy consumption are impeded by a lack of understanding of the human elements that play into energy consumption in buildings through occupant behavior, management practices, and building operations. The gaps between building operations in theory and building operations in practice place serious limits on the success of strategies that are exclusively technology-oriented. The mismatch also points to the under-tapped social and behavioral potential of building operators and occupants to work with the built environment to provide indoor spaces that require less energy and cause less GHG emissions while preserving or enhancing occupant comfort.

Objective

The proposed project is designed to identify behavioral, social, and organizational strategies that reduce energy use and GHG emissions from California commercial buildings; and to develop improved conceptual models of how energy and comfort are managed in commercial buildings. Research results will produce strategies that the State can implement to guide energy policy, behavior change initiatives, technology and building design, and energy research to accommodate the realities of how buildings are actually operated and how building occupants adapt, or can adapt, to their environment. The focus of this research is on existing buildings as they currently operate in the commercial sector, which has received relatively little attention compared to residential buildings and new building design. Research results will also be useful to inform new building design and retrofits. The essential value of this research is that it moves beyond theoretical understandings to deliver actionable strategies in a context that is networked with the professional, policy-making, and research communities who can promote, implement and refine them.

Methods

The basic approach will be sociological and anthropological, carefully informed by technological and engineering considerations. The technical plan is devised to include multiple buildings and multiple approaches to the issues of interest, and to generalize from the particular attributes of these buildings. Primary tasks include a synthesis of quantitative performance of commercial buildings, based on publications and databases; interviews with building energy researchers to elaborate and critique

normative models of building operation; analysis of occupant survey data and development of a follow-on module to illuminate attitudes and adaptive behaviors related to energy conservation, efficiency, and management; interviews with building operators and energy management to shed light on motivating factors in and limitations to their choices; and development of building case studies to support development of strategies for reduced energy consumption.

Expected Results
Positioned alongside several recent and ongoing efforts that have begun to push the building energy field to more sophisticated and effective strategies for influencing energy consumption, this effort will deliver practical results to support ARB's efforts to reduce GHG emissions from the commercial building sector. The highly interdisciplinary project team, which is strongly credentialed in both research and professional roles, will deliver a unique and closely targeted analysis of how real-world emissions can be reduced as well as ensure, in collaboration with the project advisory board, that results are disseminated to building energy professionals and architects. The dataset to be acquired by this research will also be valuable for future research and outreach efforts that build on results from this work.

Significance to the Board
Space conditioning and ventilation represent 28 percent of the electricity use and 38 percent of the natural gas consumption in California's commercial sector. Technology-based efforts to reduce commercial building energy consumption have typically fallen short of their technical potential to influence energy consumption, since they fail to account for practices that influence energy consumption in buildings. Understanding these practices will help guide research and policy toward improved technology development, building design, and toward behaviorally-oriented conservation campaigns that fit, or can successively influence, actual social practices. Research results will also support development of new and potentially more powerful, more cost-effective, GHG emissions reduction strategies for commercial buildings with the co-benefits of protecting and even improving occupant health, productivity, and well-being. Improved emissions reduction strategies in the commercial building sector are essential to the Board if it is to meet its near-and long-term GHG emissions reduction goals.

Contractor:
University of California, Davis

Contract Period:
36 months

Principal Investigator (PI):
Alan Meier

Contract Amount:
$134,981

Basis for Indirect Cost Rate:
The State and the UC system have agreed to a ten percent indirect cost rate.

Past Experience with this Principal Investigator:
The project principal investigator, Dr. Alan Meier, is Associate Director and a Faculty Researcher with the Energy Efficiency Center at UC Davis; as well as a senior scientist at Lawrence Berkeley National Laboratory. His research has had direct and significant impact on energy policy. For example, his international plan to reduce standby in all devices to less than one watt has been endorsed by the G8 countries.

The highly interdisciplinary research team brought together for this research has recently conducted highly successful energy analyses at the intersection of technological, social, and behavioral factors. Proposal reviewers from multiple agencies concur that the researchers' previous reports offer new and useful information that supports demand-side energy management, policy, and planning.

Prior Research Division Funding to UCD:

Year	2008	2007	2006
Funding	$1,209,135	$935,020	$1,684,890

BUDGET SUMMARY

Contractor: University of California, Davis

Behavioral Strategies to Bridge the Gap Between Potential and Actual Savings in Commercial Buildings

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 20,080	
2.	Subcontractors	$ 105,278[1]	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 0	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 0	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 1,580	
	Total Direct Costs		$126,938
INDIRECT COSTS			
1.	Overhead	$ 8,043	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$8,043
TOTAL PROJECT COSTS			**$134,981**

[1] The team for the proposed research has been selected to bring in an outstanding and broad range of capabilities, perspectives, and resources; and combines academic researchers as well as practitioners in the field of building energy use. Moreover, the research team includes staff who work in three University of California centers, each of which has established strong links between academia and the building industry.

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Mithra Moezzi

Description of subcontractor's responsibility: Dr. Moezzi, a private consultant specializing in bridging engineering and social scientific approaches to research, with 17 years of experience in the building energy field, will serve as the Project Director. She will be responsible for direction of day-to-day research and will participate in the research tasks.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	41,210	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	650	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	500	
9.	Analyses	$	0	
10.	Miscellaneous	$	2,780	
	Total Direct Costs			$45,140
INDIRECT COSTS				
1.	Overhead	$	0	
2.	General and Administrative Expenses	$		
3.	Other Indirect Costs	$		
4.	Fee or Profit	$	0	
	Total Indirect Costs			$0
TOTAL PROJECT COSTS				**$45,140**

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Christine Hammer

Description of subcontractor's responsibility: Christine Hammer, a LEED® accredited professional with extensive experience working with and interviewing the commercial building community, will conduct interviews with building energy researchers, building operators, and energy managers; play a major role in the conduct of building case studies; and contribute to the final report.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	23,270	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	1,240	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	0	
9.	Analyses	$	0	
10.	Miscellaneous	$	780	
	Total Direct Costs			$25,290
INDIRECT COSTS				
1.	Overhead	$0		
2.	General and Administrative Expenses	$0		
3.	Other Indirect Costs	$0		
4.	Fee or Profit	$ 0		
	Total Indirect Costs			$0
TOTAL PROJECT COSTS				**$25,290**

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Loren Lutzenhiser

Description of subcontractor's responsibility: Dr. Lutzenhiser, a sociologist specializing in the social dynamics of building energy use, will contribute to the overall framework, literature and database synthesis, and interpretation of results. He will also help develop the energy researcher workshop as well as provide advice and review throughout the course of the project.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	8,000	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	770	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	0	
9.	Analyses	$	0	
10.	Miscellaneous	$	0	
	Total Direct Costs			$8,770
INDIRECT COSTS				
1.	Overhead	$	0	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$0
TOTAL PROJECT COSTS				**$8,770**

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: University of California, Berkeley

Description of subcontractor's responsibility: John Goins, a survey specialist at the University of California, Berkeley, is the lead researcher of the Center for the Built Environment's Occupant Indoor Environmental Quality Survey project. In collaboration with Dr. Moezzi, he will be in charge of the survey data analysis and the development of the revised survey module, particulate in selected reviews, and contribute to the final report.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	20,313	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	400	
5.	Electronic Data Processing	$	2,000	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	600	
9.	Analyses	$	0	
10.	Miscellaneous	$	395	
	Total Direct Costs			$23,708
INDIRECT COSTS				
1.	Overhead	$	2,370	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$2,370
TOTAL PROJECT COSTS				**$26,078**