Building Energy Efficiency Consortium
U.S. – CHINA CLEAN ENERGY RESEARCH CENTER (CERC)

12th Quarterly Report for 4Q2013
(October – December, 2013)

Prepared on January 15, 2014 by
Lawrence Berkeley National Laboratory

Dr. Nan Zhou
Director for U.S. CERC BEE

For assistance, contact Brian Heimberg at BSHeimberg@lbl.gov

Table of Contents

A1: Integrated Design 3
A2: Human Behavior 5
B1: Advanced Window and Shading Technologies 7
B2: Materials that Improve the Cost-Effectiveness of Air Barrier Systems 9
B3: Cool roofs & urban heat islands (LBNL) 11
B3: Cool roofs & urban heat islands (ORNL) 14
B4: Hybrid ventilation technology and product R&D: Natural ventilation for commercial buildings 16
C2: Advanced Lighting Controls in New and Existing Buildings 19
D/E: Research and Demonstration of Integrated Building Energy Technologies 21
D2: Advance ground source heat pump technology for very low energy buildings 24
F1: Research on Very Low-Energy Building Operations and Management Methods 26

A1: Integrated Design

1.	**Research Area**	A - Integrated Building Design & Operation of Very Low Energy, Low Cost Buildings
2.	**Project ID - Name**	A.1 – Methods and tools to achieve integrated building design
3.	**Reporting Period**	4Q2013
4.	**Objective(s)**	Create solutions, including knowledge, tools, case studies, and guidance to achieving integrated design and operations of very low energy, low cost buildings.
5.	**U.S. Research Team**	Tianzhen Hong, LBNL, US project lead Cheng Li, LBNL
6.	**U.S. Industry Partners**	Bentley System, Drury Crawley C3 Energy, Ed Abbo
7.	**China Research Team**	Da Yan, Tsinghua University, China project lead Qi Zhang, Xin Zhou, Kaiyu Sun
8.	**China Industry Partners**	Swire Property The Vanke Group
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	(a) $230k ($180k + $50k) (b) $123k (c) $52k
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	(a) $175k (Bentley $125k, C3 $50k) (b) $175k (Bentley $125k, C3 $50k) (c) Participated in preparation for annual review meeting in Wuhan, and contributed to the Y4/5 proposal.
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	N.A.
12.	**Issues of Concern, Suggested Solutions**	None
13.	**Notable U.S. Technical Progress, Achievements and Findings**	• Presented integrated design and operations at the Design Charrette in Wuhan, China • Presented research outcomes at the CERC-BEE annual review meeting in Wuhan, China • Prepared journal article and ASHRAE paper "Anatomy of Energy Use and Technologies of High Performance Buildings" • Made progress in Task 2 on the evaluation of energy conservation measures • Produced a memo report for the Design Charrette
14.	**Notable U.S. Operational Progress, Achievements**	• Organized the Design Charrette on Oct 29 in Wuhan • Participated and reported project outcomes in the annual CERC-BEE review meeting on Oct 30 and Nov 1 in Wuhan, China

		• Prepared research proposal for 2014 • Weekly U.S. team meeting • Continuous bi-weekly team conference calls with China research team
15.	**Notable U.S. Industrial Partner Activities**	• Contributed to the development of Y4/5 proposal • Participated in preparation for the annual CERC-BEE review meeting in Wuhan, China • Participated in technical discussions on energy modeling to support the China demo buildings.
16.	**U.S. Technical Next Steps**	• Wrap up Task 3 on exchange of results • Wrap up Task 2 on evaluation of energy efficiency measures • Prepare final report • Submit the journal article and ASHRAE conference paper
17.	**U.S. Operational Next Steps**	• Prepare to wrap up the project and deliver the final report
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	(a) Closed out Phase I projects and completed deliverables (b) Participated in the annual CERC-BEE review meeting and the Design Charrette in Wuhan, China (c) Continued regular meetings to engage partners
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	Annual CERC-BEE review meeting, October 29-November 3, 2013, in Beijing and Wuhan, China. $3500, U.S. project fund.
20.	**Anticipated Travel in 2013** *(Indicate est. dates, location, cost, source of funds)*	Project progress meeting with China counterpart in Hong Kong, March 10-15, 2014. $3500, U.S. project fund.
	Prepared by:	Tianzhen Hong
	Prepared on:	2014-01-08

A2: Human Behavior

1.	**Research Area**	A - Integrated Building Design & Operation of Very Low Energy, Low Cost Buildings
2.	**Project ID - Name**	A.2 – Human Behavior
3.	**Reporting Period**	4Q 2013
4.	**Objective(s)**	1. Research and development of methodology and simulation models to characterize human behavior in building design and operations 2. Enhance simulation tools (EnergyPlus and DeST) and provide realistic simulation inputs related to human behavior to improve accuracy of simulated results 3. Simulate and analyze the impacts of human behavior on building energy consumption and performance, provide guidance on practical engineering designs and retrofits
5.	**U.S. Research Team**	Tianzhen Hong, LBNL, US project lead Sang Hoon Lee, LBNL Yixing Chen, LBNL
6.	**U.S. Industry Partners**	Bentley System, Drury Crawley
7.	**China Research Team**	Da Yan, Tsinghua University, China project lead Chuang Wang, Xin Zhou, Xiaohang Feng, Kaiyu Sun, Qi Zhang, Shan Hu
8.	**China Industry Partners**	Swire Property The Yanke Group
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	(a) $285k ($160k + $125k) (b) $130k (c) $80k
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	(a) $125k (Bentley $125k) (b) $125k (Bentley $125k) (c) Participated in preparation for annual review meeting in Wuhan, and contributed to the Y4/5 proposal.
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	N.A.
12.	**Issues of Concern, Suggested Solutions**	None
13.	**Notable U.S. Technical Progress, Achievements and Findings**	• Presented the paper "A framework to describe and simulate occupant behavior in buildings" at 2013 BECC conference. • Prepared a journal article "Simulation of Occupancy in Buildings" • Continued development of the technical framework and XML schema to describe human behavior in buildings • Presented project outcomes at the annual CERC-BEE review

		meeting in Wuhan, China • Presented the full proposal on occupant behavior to IEA EBC ExCo and Annex 66 started in November 2013. • Presented behavior research at the Xi'an workshop
14.	**Notable U.S. Operational Progress, Achievements**	• Co-organized the Occupant Behavior workshop together with ISHVAC 2013 in Xi'an, China • Participated and reported project outcomes in the annual CERC-BEE review meeting on Oct 30 and Nov 1 in Wuhan, China • Joint project progress meeting in October in Beijing, China • Prepared research proposal for 2014 • The IEA proposal on occupant behavior research was approved. Annex 66 research work started as part of the CERC scope but integrating much stronger international collaboration. • Weekly U.S. team meeting • Continuous bi-weekly team conference calls with China research team
15.	**Notable U.S. Industrial Partner Activities**	• Contributed to the development of Y4/5 proposal • Participated in preparation for the annual CERC-BEE review meeting in Wuhan, China • Participated in technical discussions on integrating the occupancy module into energy simulations.
16.	**U.S. Technical Next Steps**	• Wrap up the framework and XML schema • Plan for Y4 research • Prepare final report • Submit the journal article
17.	**U.S. Operational Next Steps**	• Prepare to wrap up the project and deliver the final report • Attend the joint project progress meeting in March in Hong Kong
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	(d) Continued progress in occupant behavior research (e) Attended and co-chaired the behavior workshop in Xi'an (f) Continued regular meetings to engage partners
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	Attended annual CERC-BEE review meeting and workshops in Beijing and Wuhan, China.
20.	**Anticipated Travel in 2013** *(Indicate est. dates, location, cost, source of funds)*	Progress meeting with China counterparts and workshop on occupant behavior research in Hong Kong during March 10-15, 2014
	Prepared by:	Tianzhen Hong
	Prepared on:	2014-01-08

B1: Advanced Window and Shading Technologies

1.	**Research Area**	Building Envelope
2.	**Project ID - Name**	B1 - Advanced Window and Shading Technologies
3.	**Reporting Period**	Q4 2013 (September – December 2013
4.	**Objective(s)**	Identify, engineer, and evaluate integrated façade technologies needed to attain low-energy, highly energy-efficient commercial buildings for a diverse set of climates.
5.	**U.S. Research Team**	Eleanor Lee, LBNL, Team Lead
6.	**U.S. Industry Partners**	Saint-Gobain/ Sage Electrochromics
7.	**China Research Team**	Li Zhengrong, Tongji University, Team Lead
8.	**China Industry Partners**	Saint-Gobain Research Shanghai
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	(a) $280K ($140K Y3 allocation + $140K Y2 carryover) (b) $211K (c) $183K
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	(a) $10K (b) $75K (c) Sage/ SGRS to ship windows and install in SGRS Shanghai's new headquarters building.
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	(a) $20K estimated (b) $0K (c) Tongji instrumentation and support for monitoring at SGRS Shanghai
12.	**Issues of Concern, Suggested Solutions**	Concern: Sage's problems with manufacturing production have delayed Year 3 activities to Year 4. The Year 4 proposal defined go/ no-go deadlines for product delivery.
13.	**Notable U.S. Technical Progress, Achievements and Findings**	Task 1. No activity. We provided Saint-Gobain Research Shanghai (SGRS) and Tongji University with tutorials and webinars in Q3, concluding our work on this task. Task 2. No activity. Testing of Sage electrochromic windows in the LBNL Advanced Windows Testbed was to commence in early June 2013 but Sage postponed shipment to Year 4/2014 Q1 due to production delays. Task 3.1. Reviewed comfort survey with SGRS and made suggestions on how to issue and administer the survey in order to obtain more useful results. Sage has delayed shipment to Year 4/ 2014 Q1 due to production delays. Task 3.2. Developed Year 4-5 working proposals including defining collaborative activities with China low-energy demonstration partners. Participated in a workshop in Wuhan to discuss demonstration of the 3M daylighting film, Lutron automated shading and dimmable lighting, and Sage electrochromic windows in several of the demonstration sites.

		Discussed technical objectives with the three US manufacturers and collaborative work plans.
14.	**Notable U.S. Non-Technical Progress, Achievements**	None.
15.	**Notable U.S. Industrial Partner Activities**	None.
16.	**U.S. Technical Next Steps**	Initiate electrochromic window demonstration at SGRS and LBNL Windows Testbed in Q1/ Year 4. Initiate project tasks when Year 4 is approved in January/ February 2014.
17.	**U.S. Non-Technical Next Steps**	None.
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	(a) SGRS developed a draft human factors protocol for impending test in their facility. (b) None. (c) None.
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	CERC-BEE Workshop, October 28 – November 1, 2013, Wuhan, $3K, CERC-BEE
20.	**Anticipated Travel in 2013** *(Indicate est. dates, location, cost, source of funds)*	Travel associated with demonstration projects in Year 4, if approved
	Prepared by:	Eleanor Lee
	Prepared on:	January 13, 2014

B2: Materials that Improve the Cost-Effectiveness of Air Barrier Systems

1.	**Research Area**	Building envelope
2.	**Project ID - Name**	Materials that improve the cost-effectiveness of air barrier systems
3.	**Reporting Period**	Q4, 2013
4.	**Objective(s)**	Improve the cost-effectiveness of air barrier systems by reducing their installation time and enhancing their performance.
5.	**U.S. Research Team**	Oak Ridge National Laboratory
6.	**U.S. Industry Partners**	Dow Chemical 3M
7.	**China Research Team**	China Academy of Building Research China Institute of Building Standard Design and Research
8.	**China Industry Partners**	China Academy of Building Research (CABR) Jilin Kelong Building Energy Technology
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	(a) $125K (new project, no carryover) (b) $74.5K (c) $10K
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	Dow (a) $120K/12 = $10K/month × 12 months = $120K (b) $120K (c) Time and materials 3M (a) $63K (b) $63K (joined CERC BEE in last quarter of 2013) (c) Time and travel
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	Not known at this point.
12.	**Issues of Concern, Suggested Solutions**	
13.	**Notable U.S. Technical Progress, Achievements and Findings**	• Dow's liquid flashing and 3M's self-adhered membrane, and their respective installation instructions, were sent to the CABR demonstration building in Beijing. These products were installed in late December primarily around windows. ORNL is coordinating with CABR how to test air and water penetration through the perimeter of windows that were installed with the Dow and 3M products, as well as with typical practices. • Dow selected the wall assemblies to be tested by ORNL • The new chamber at ORNL was programmed to measure the air leakage of wall assemblies before and after cyclic pressure loads that simulate wind conditions per ASTM E2357.
14.	**Notable U.S. Non-**	• 3M joined the CERC BEE B2 project in late October. 3M visited

	Technical Progress, Achievements	ORNL in December to further discuss the project and future steps. • Representatives from ORNL, Dow and 3M attended the Wuhan workshop and interacted with the Chinese developers • CABR and Jilin Kelong Technology committed to the CERC BEE B2 project during the Wuhan workshop. In late December, CABR and Jilin Kelong Technology signed the 2014 CERC BEE proposal.
15.	**Notable U.S. Industrial Partner Activities**	• Dow continued evaluating the performance of the liquid flashing formulation and results have been positive
16.	**U.S. Technical Next Steps**	• Continue investigating construction details in commercial construction in order to appropriately tailor Dow's liquid flashing formulation • 3M to select the wall assemblies to be tested at ORNL • Continue with the development of a durability test protocol for wall assemblies • The first wall assembly will likely be built and instrumented in early February 2014 • ORNL will continue coordinating with CABR how to test air and water penetration through the perimeter of windows that were installed with the Dow and 3M products, as well as with typical practices. • ORNL will periodically contact Jilin Kelong Building Energy Technology to remind them to forward us their building drawings so ORNL, Dow and 3M can provide input on how to improve its airtightness
17.	**U.S. Non-Technical Next Steps**	
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	• Dow's liquid flashing and 3M's self-adhered membrane were installed in the CABR building • CABR and Jilin Kelong Technology committed to the CERC BEE B2 project during the Wuhan workshop. In late December, CABR and Jilin Kelong Technology signed the 2014 CERC BEE proposal.
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	October 26 -31, Wuhan and Beijing. Cost ~$3,000.
20.	**Anticipated Travel in 2013** *(Indicate est. dates, location, cost, source of funds)*	
	Prepared by:	Diana Hun
	Prepared on:	2014-1-10

B3: Cool roofs & urban heat islands (LBNL)

(Dow-ORNL-LBNL Advanced White Roof CRADA)

1.	**Research Area**	Building envelope
2.	**Project ID - Name**	B-3 – Cool roofs & urban heat islands
3.	**Reporting Period**	2013 Q4
4.	**Objective(s)**	Advance the understanding, technology, infrastructure and code requirements for cool roofs and heat island mitigation in China
5.	**U.S. Research Team**	Ronnen Levinson, LBNL, U.S. Team Lead Dev Millstein, LBNL Tim Xu, LBNL Hugo Destaillats, LBNL Mohamad Sleiman, LBNL Scott Hunter, ORNL (Scott's work to be reported separately)
6.	**U.S. Industry Partners**	Dow Chemical
7.	**China Research Team**	Dr. GAO Yafeng, Chongqing University (CU), China Team Lead Prof. YANG Shichao, Guangdong Provincial Academy of Building Research (GPABR) Dr. Meichun CAO, China Academy of Sciences (CAS) Changqing LIN, MOHURD Research Institute of Standards and Norms (RISN)
8.	**China Industry Partners**	China-Icepower Energy Technology Co., Ltd
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	(a) $100K (Y3) + $62.8K (Y2 carryover) (b) $55.8K (c) $36.0K
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	N/A
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	N/A
12.	**Issues of Concern, Suggested Solutions**	Chinese partners do not have current-year funding from Chinese government. This is OK for China Academy of Sciences (self-funded partner), but not ideal for Chongqing University (CU) and the Guangdong Provincial Academy of Building Research (GPABR). GPABR has indicates that it may have another (provincial?) source of funding for our planned cool-roof experiment at their campus.
13.	**Notable U.S. Technical Progress, Achievements and Findings**	In late October, Levinson visited China for 7 days to attend the CERC meeting in Wuhan, and to meet with partners from GPABR, CU, RISN, and CAS. Levinson proposed a cool-wall study for the Wuhan demonstration at the CERC demonstration meeting in Wuhan. He spent an extra day in Wuhan, meeting GPABR and CU researchers to (a) design experiments in Guangzhou and Chongqing, and (b) discuss cool

		roof policy changes underway in Guangdong Province. Levinson then traveled to Beijing to (a) plan with RISN the studies needed to support a Chinese cool roof rating system, and (b) to meet with CAS, where he lectured about cool roofs & urban heat islands, and reviewed LBNL/CAS plans for collaborative research on urban/global cooling. Levinson and Hunter also prepared an integrated proposal for years 4 and 5. LBNL's Dev Millstein and Ronnen Levinvson corresponded Meichun CAO and Zhaohui LIN (CAS) to develop a research plan for the coming year. The plan builds on the modeling investigations initiated during Dev Millstein's visit to CAS in August 2013. The discussions centered on how to use both the global climate model CESM and the regional climate model WRF to best estimate the meteorological effects of installing cool roofs in China. Plans were developed for Meichun Cao to visit LBNL in late spring or early summer 2014 to continue regional climate modeling of the application of cool roofs throughout China. In preparation for that work, Dev Millstein downloaded, debugged and installed the newest version of the regional climate model WRF to the NERSC supercomputers (a Department of Energy supercomputing cluster). Plans were developed for Meichun to prepare for visiting LBNL by working with the regional climate model, WRF, that Dev Millstein installed and setup during his visit in August 2013. Dev Millstein also spent time reviewing relevant scientific literature to help identify the most pressing research questions regarding installation of cool roofs in China. In November 2013, Tim Xu joined the LBNL team to enhance the reviews and communications on cool surface provisions in Chinese standards, incentive programs, and guidelines, and to better understand standards and rating practices of roofing products in China. Tim continued the team's communication with Chinese counterparts, including LIN Changqing of RISN (MOHURD) to discuss the cool roof /wall provisions and roof–coating test standards. He also discussed with the GPABR researchers about cool roof/wall provisions in regional standards. As a result, he has reviewed the literature gathered from Chinese counterparts to date and provided an updated summary of the reviews of national and regional standards. Additional questions and requests for information on the subject (cool roof credits and rating) have been communicated to the collaborators in RISN and GPABR for further feedback. LBNL's visit to the Dow facility in Spring House, PA for training on the characterization of superhydrophobic coatings was postponed to 2014 Q1 because the facility is being moved to Collegeville (PA).
14.	**Notable U.S. Non-Technical Progress, Achievements**	
15.	**Notable U.S. Industrial Partner Activities**	(Scott's work w/Dow to be reported separately)
16.	**U.S. Technical Next Steps**	This quarter, Levinson will continue to work with the CU and GPABR teams to finalize and initiate their long-term cool roof experiments, and may help design a cool wall experiment at the Wuhan demonstration site. He will also help design a study in support of a cool roof rating

		system in China. The cool roof/cool wall policy information recently collected by Xu will be use to update the manuscript prepared for BRI, but (as recently learned) not submitted. The revised manuscript will be submitted to a journal TBD this quarter. Xu will continue to interact with the RISN and GPABR teams, and additional parties in China, to update the summary reviews of Chinese building standards, and to create tables of credits/requirements/incentives of cool surface provisions, including more regional standards for hot-summer warm-winter regions. Millstein will (1) continue climate simulation collaboration with CAS; (2) evaluate, for climate modeling purposes, potential data sets that describe the urban surfaces of Chinese cities for usefulness; and (3) continue preparation for Meichun Cao's visit. Dow will prepare and send LBNL an initial set of superhydrophobic samples for accelerated aging testing and surface characterization. LBNL will acquire and set up a water contact angle goniometer with imaging software to study the self-cleaning properties of superhydrophobic coatings, as well as the effect of accelerated weathering and soiling on hydrophobicity.
17.	**U.S. Non-Technical Next Steps**	Help GPABR & RISN seek Energy Foundation Beijing Office funding for study in support of cool roof rating in China.
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	See U.S. progress.
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	Ronnen Levinson: Oct 27 – Nov 5 / Beijing / $3.2K / DOE
20.	**Anticipated Travel in 2014** *(Indicate est. dates, location, cost, source of funds)*	Mohamad Sleiman / 2014 Q1 / Spring House, PA (Dow facility) / $1K / DOE
	Prepared by:	Ronnen Levinson
	Prepared on:	2014-01-08

B3: Cool roofs & urban heat islands (ORNL)

(Dow-ORNL-LBNL Advanced White Roof CRADA)

1.	**Research Area**	Building envelope
2.	**Project ID - Name**	B-3 – Cool roofs & urban heat islands (Dow-ORNL-LBNL Advanced White Roof CRADA)
3.	**Reporting Period**	2013 Q4
4.	**Objective(s)**	Development of environmentally friendly, superhydrophobic (SH) based, anti-biofouling white cool roof coatings for cool roofs and heat islands mitigation in China and US.
5.	**U.S. Research Team**	Ronnen Levinson, LBNL, U.S. Team Lead Scott Hunter, ORNL - this report documents the ORNL contribution
6.	**U.S. Industry Partners**	Joe Rokowski, Dow Chemical
7.	**China Research Team**	This activity is US only
8.	**China Industry Partners**	This activity is US only
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	ORNL Budget only (a) $200K (Y3) + $0 (Y2 carryover) (b) $117.9K (c) $78.4K
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	(a) Dow has performed $210K of in-kind work on this project to date (b) Dow Chemical – in-kind: $250K (c) Dow is internally funding the development of the solvent free cool roof acrylic coatings to be used in this project.
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	This activity is US only.
12.	**Issues of Concern, Suggested Solutions**	None
13.	**Notable U.S. Technical Progress, Achievements and Findings**	ORNL and Dow personnel continued to hold detailed technical discussions on acrylic based SH powder formulations, methods to incorporate these powders, mixture fabrication and coating testing procedures in Q4. ORNL and LBNL personnel gave a joint cool roofs presentation to the U.S-China CERC-BEE Research/Demonstration Workshop in Wuhan in late October. Hunter and fellow ORNL meeting attendees visited the new Chinese Academy of Building Research (CABR) research facilities, presently under construction in Beijing, where the implementation of various energy efficiency technologies were discussed. ORNL researchers evaluated and discussed with Dow personnel the superhydrophobic extenders (SHE) mixing and dispersability studies performed by Dow during Q3 and Q4 of 2013. Based on these discussions, ORNL has fabricated new silica based SHE powders with different shapes and structural dimensions. These powders are expected to reduce water permeability at higher powder loadings than was the case for the diatomaceous earth (DE) based extenders.

		While waiting for the new acrylic based water repellent coating mixtures that Dow is developing, ORNL initiated several anti biofouling studies using solvent based water repellent SH coatings. These coatings are expected to have enhanced anti-biofouling properties.
14.	**Notable U.S. Operational Progress, Achievements**	None this quarter - the 3 way CRADA between ORNL, LBNL and Dow Chemical was signed at the end of the first quarter.
15.	**Notable U.S. Industrial Partner Activities**	Dow moved their R&D facility from Spring Hill, PA to Collegeville, PA during Q4. This was a two month effort that resulted in the shutdown of most R&D activities until the new facilities are operational and fully qualified. Work at the new facilities is expected to recommence in early Jan.
16.	**U.S. Technical Next Steps**	ORNL will continue to provide technical support to Dow Chemical in the development and production of SH materials for the company's latex based cool roof paint development effort. ORNL will provide additional SH functionalized fumed silica powders to DOW that have different functionalization properties and structures to see if these will reduce the porosity the DOW acrylic based SH formulations. ORNL will continue internal development work on the coating optimization and testing of panels with SH coatings impregnated with anti-biofouling media. Dow will continue to develop low solvent and VOC techniques and processes to disperse and incorporate the SH materials into non-pigmented and pigmented acrylic emulsions and coatings. Dow will continue to study acrylic emulsion stability and optimize water resistance and dirt repellency. LBNL will visit Dow Chemical to review ORNL/Dow coating development process and plan material characterization tests to be performed at LBNL. Dow, ORNL and LBNL will characterize coupons coated with these acrylic resins for water repellency and optical properties in comparison with standard solvent based coatings.
17.	**U.S. Operational Next Steps**	None anticipated
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	This activity is US only
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	U.S.-China CERC-BEE Research/Demonstration Workshop, Wuhan and Beijing, Oct. 27-31; $3,442 from CERC-BEE.
20.	**Anticipated Travel in 2014** *(Indicate est. dates, location, cost, source of funds)*	No anticipated travel in Q1 of 2014
	Prepared by:	Scott Hunter
	Prepared on:	2014-1-08

B4: Hybrid ventilation technology and product R&D: Natural ventilation for commercial buildings

1.	**Research Area**	Hybrid ventilation technology and product R&D
2.	**Project ID - Name**	Project B-3 (China 3-5): Natural Ventilation for Cooling in Commercial and Residential Buildings
3.	**Reporting Period**	Q4 2013; October 2013 – January 2014
4.	**Objective(s)**	To determine the potential of natural ventilation to provide comfortable conditions that will reduce or eliminate the need for air conditioning over the important climatic zones in China and the US. To promote the widespread application of this technology for energy efficiency and improved indoor climatic conditions.
5.	**U.S. Research Team**	US project leader: Leon R. Glicksman, Massachusetts Institute of Technology Support: Alonso Dominguez, Massachusetts Institute of Technology
6.	**U.S. Industry Partners**	Working with Architerra and WindowMaster on design and technology SOM is using CoolVent the software being developed in this project
7.	**China Research Team**	China project leaders: • Li Baizhan, Chongqing University (support: Li Nan, Chongqing University) • Hongwei Tan, Tongji Univeristy • Zhu Neng, Tianjin Univeristy
8.	**China Industry Partners**	• Chongqing project: Chongqing Jinxi Cultural Center; potential partners: CIDSI, Chongqing Hairun Energy-Saving Technology Co., Ltd., Ostberg (Kunshan) Fan Co., Ltd. • Zhuhai demonstration project: Zhuhai Singyes R & D Building, the 2nd Zhuhai Singyes Renewable Energy Industrial Park • Wuhan demonstration project: Hubei Wuhan "Two-Oriented Construction" Photovoltaic Integrated Applied Science Demonstration Park
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	a) $87,130.00 b) $18,725.17 c) $3,810.83
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	*None*
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	*Not known*
12.	**Issues of Concern, Suggested Solutions**	• There are currently a lack of valid design and control knowledge for natural ventilation that limits its useful application. The current work

		is directed toward meeting that challenge . • Lack of enough founding to participate in all the demonstration projects in China that showed interest in natural ventilation and working with MIT.
13.	**Notable U.S. Technical Progress, Achievements and Findings**	• Application of CoolVent to several low energy buildings in the US and China • Established a web site for users • Continued work in design tool, CoolVent, to help in the design of naturally and hybrid ventilated buildings. Latest additions include: o Possibility of defining ventilation elements in openings and air paths, such as grates, air path expansion and contraction, dampers. o Evaluation of design based both on energy consumption, as well as thermal comfort criteria. Thermal comfort criteria include percentage of time under comfort conditions per zone, per floor and per time of the day. • Continued work regarding thermal stratification model. Now looking at the effect of multiple connected floors and of thermal connection through the slab into the temperature stratification of the space.
14.	**Notable U.S. Non-Technical Progress, Achievements**	• Participation of MIT in the CERC-BEE meeting in Wuhan: o Strong commitment to natural ventilation expressed by Chinese researchers and developers of demonstration buildings o Established communication with research teams in the Zhuhai, Wuhan and Chongqing demonstration projects o Exchange of first ideas as part of a research partnership in all these three demonstration projects including development of innovative technology • MIT recently wrote a research proposal for 2014. This proposal was shared with all the members of the demonstration projects in Zhuhai, Wuhan and Chongqing. We have received a very positive answer from the teams. We are now in the process of defining concrete tasks for the involved parts • A new demonstration project in the US has been identified. Arquiterra, the architecture design firm in charge of the construction of a new net-zero energy office building in Massachusetts, has agreed to MIT collaboration in the design and monitoring of the ventilation system in this building • Participating in IEA Annex 62 on Ventilative Cooling
15.	**Notable U.S. Industrial Partner Activities**	• Met with WindowMaster representative at IEA Annex 62 meeting in Athens. WindowMaster has been invited to be part of our participation in the demonstration projects in China and wants to share technical information. • SOM has begun using CoolVent in their design work
16.	**U.S. Technical Next Steps**	• Validation of optimization of hybrid system control in CoolVent • Monitoring of buildings in China • Evaluation of new models to predict the operative temperature in hybrid rooms • Continue research regarding “Model-Predictive Control” (MPC) in hybrid ventilation systems • Implementation of novel MPC algorithms in CoolVent • Continuing work towards a better thermal stratification model and to

		include it as part of thermal comfort evaluation in CoolVent
17.	**U.S. Non-Technical Next Steps**	• Finish definition of tasks with the Zhuhai, Wuhan and Chongqing research teams. • Define research objectives and methodology with Arquiterra regarding MIT's participation in the new net-zero energy office building in Massachusetts
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	*(Second phase of project has not started)* Following phase in China will focus on the construction of several demonstration buildings. Chinese colleagues have an approved proposal for a building in Chongqing. MIT was asked to participate in the ventilation system design of this building. MIT could also help in the design of the monitoring of this building. Very positive response from the Zhuhai demonstration project team to our research proposal. Research effort will focus in the ventilation shaft, façade and ventilation curtain design. Have agreed to work on the Wuhan project in the conceptual design of ventilation cooling
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	October 26th to November 1st, Wuhan, China for the CERC-BEE demonstration buildings meeting.
20.	**Anticipated Travel in 2013** *(Indicate est. dates, location, cost, source of funds)*	None
	Prepared by:	Leon R. Glicksman, Kathleen Ross, Alonso Dominguez
	Prepared on:	12/24/2013

C2: Advanced Lighting Controls in New and Existing Buildings

1.	**Research Area**	Lighting
2.	**Project ID - Name**	Advanced Lighting Controls in New and Existing Buildings
3.	**Reporting Period**	Q4 2013
4.	**Objective(s)**	Achieve deep lighting energy savings (50%) with lighting controls that payback the initial investment in less than 5 years in key Chinese and US building markets.
5.	**U.S. Research Team**	Lawrence Berkeley National Laboratory. Francis Rubinstein, Erik Page
6.	**U.S. Industry Partners**	Lutron Electronics. Robert Nachtrieb
7.	**China Research Team**	National Low-Carbon Lighting Research Center. Huang Yuehui
8.	**China Industry Partners**	Lutron Electronics. Matt Blakeley
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	Year 1: Budgeted: $125K Spent to date (12/31/2013): $81K Year 2: New budget request: $115K [Total Y2 budget: $159K ($115K new + $44K Y1 carryover)]
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	Year 1: $150K Year 2 & 3: $420K
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	N/A
12.	**Issues of Concern, Suggested Solutions**	Need to coordinate experimental designs of CABR demo and testing in FlexLab. Need to flesh out more compelling deliverable for code language development task (Task 7)
13.	**Notable U.S. Technical Progress, Achievements and Findings**	Identified demonstration sites in China (CABR) and the US (FlexLab) in which to test the proof-of-concept system being fielded by Lutron in 2014 and 2015.
14.	**Notable U.S. Non-Technical Progress, Achievements**	Completed detailed scope of work for Years 2 and 3 that integrates the research efforts in China and US.
15.	**Notable U.S. Industrial Partner Activities**	Lutron signed agreement with CABR in 11/2013 to test POC system at CABR Green Office building in Beijing.
16.	**U.S. Technical Next Steps**	Develop experimental design for testing the POC in test chambers at FlexLab during summer, 2014.
17.	**U.S. Non-Technical Next Steps**	
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	Lutron identified demonstration site - CABR Green Office building in Beijing. Signed agreement (11/2013). In October 2013, Lutron received Chinese RF certification of a line of wall-mounted sensors that had been redesigned for lower cost.

19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	N/A
20.	**Anticipated Travel in 2013** *(Indicate est. dates, location, cost, source of funds)*	N/A
	Prepared by:	Francis Rubinstein
	Prepared on:	January 13, 2014

D/E: Research and Demonstration of Integrated Building Energy Technologies

1.	**Research Area**	**Research and Demonstration of Integrated Building Energy Technologies**
2.	**Project ID - Name**	D/E2
3.	**Reporting Period**	2014 Q1
4.	**Objective(s)**	Create an open-access web service that permits optimization of building equipment selection and operation for building-scale microgrids.
5.	**U.S. Research Team**	Nan Zhou, Berkeley Lab, Co-PI Michael Stadler, Berkeley Lab, Co-PI Wei Feng, Berkeley Lab, Sr Scientific Engineering Associate Chien-Yu Jacqueline Ko, Berkeley Lab, Student Research Assistant Chris Marnay, Berkeley Lab, Affiliate Yiwen Guo, Affiliate Shi Wang, Affiliate Gonçalo Cardoso, Berkeley Lab, Affiliate Gonçalo Mendes, Berkeley Lab, Affiliate
6.	**U.S. Industry Partners**	Demand Energy, C3
7.	**China Research Team**	Neng ZHU, Tianjin University, PI Zhe TIAN, Tianjin University, Technical Lead Shilei LV, Tianjin University & Berkeley Lab Affiliate Yan DING, Tianjin University Jing ZHAO, Tianjin University & Berkeley Lab Affiliate
8.	**China Industry Partners**	XingYe Solar, Wuhan Rixin
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	FY11 74 k$/74 FY12 115 k$/65 k$ FY13 200 k$ b) starting with 130 k$ c) ending with 106 k$
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	C3 is developing the APIs necessary to deploy the Reference Building modeling developed by Berkeley Lab under WebOpt

11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	China provided no 2013 funding.
12.	**Issues of Concern, Suggested Solutions**	Commercialization with C3 has been bogged down by LBNL licensing. Prospects of quick resolution seem dim. Review of licensing procedures needed. China side had no 2013 resources, and fast pace of MOHURD's pivot to demonstrations limits our ability to effective engage potential partners, especially over the holiday period. Need to establish regular exchanges with MOHURD developers. Long delayed receipt of a negative review by BRI was a massive disappointment and waste of time. Don't deal with this journal again.
13.	**Notable U.S. Technical Progress, Achievements and Findings**	• Resubmitted rejected paper to Energy & Buildings • Attended Oct-Nov planning meeting in Wuhan • Developed proposals for CERC phase 2, with different buildings • Worked with XingYe on their building microgrid system design and renewable energy generation estimation. • Engaged with Wuhan Rixin on their building's microgrid system design. • Continued to work on Tianjin U. Building 26 control. E+ and elementary WebOpt models used and calibrated to historic data. • Developed and deployed a WebOpt based multi-objective optimization with a cost-CO2 frontier. • Continued work on a district version DER-CAM, to optimize energy system selection in Chinese cities. A mockup interface is developed to host district energy system topology and load inputs.
14.	**Notable U.S. Non-Technical Progress, Achievements**	• Met with XingYe research partner, Beijing Construction and Architecture U, and presented a lecture to students & faculty • Met twice with Cornell group working on wireless demonstration in building. • Visited 4 new demonstration buildings in Albuquerque and Santa Fe • Pursued licensing with C# • Approached Siemens to partner on XingYe building partner
15.	**Notable U.S. Industrial Partner Activities**	

		• Licensing with C3 in progress
16.	**U.S. Technical Next Steps**	• Continue work on Tianjin University building #26 data analysis and DER-CAM analysis. Estimate to what extent renewable generation plus energy efficiency can drive Chinese buildings to net zero energy buildings • Work with XingYe to understand their demo building's control system and feasibility of deploying real-time control. • Identify a control vendor partner, possibly Siemens • Explore the wireless sensor network development in B26. •
17.	**U.S. Non-Technical Next Steps**	• Engage C3 participations in CERC on the China side • Develop scope with Tianjin University's partner at Cornell to develop real-time load monitoring and control. • Attend the MOHURD demonstration building meeting in Wuhan.
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	• XingYe's demo building design is finished • Wuhan has finished preliminary design
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	• Marnay: Sep 2013 Salem OR – CERC - $600 • Zhou & Marnay, Fang (Beijing only): Oct-Nov 2013, Wuhan, Beijing, & Tianjin – Energy Foundation – 6 k$ • Marnay: Dec 2013 Albuquerque & Santa Fe – U.S. DOE – 1 k$
20.	**Anticipated Travel in 2014 Q1** *(Indicate est. dates, location, cost, source of funds)*	• Mar 2014, Beijing, Tianjin, & Zhuhai
	Prepared by:	Chris Marnay, Wei Feng, Nan Zhou, & Michael Stadler,
	Prepared on:	2014-01-10

D2: Advance ground source heat pump technology for very low energy buildings

1.	**Research Area**	HVAC equipment/renewable energy
2.	**Project ID - Name**	D2 - Advance ground source heat pump technology for very low energy buildings
3.	**Reporting Period**	Q4_2013
4.	**Objective(s)**	Further advance distributed ground source heat pump (GSHP) technologies and update design tools enabling applications in U.S. and China.
5.	**U.S. Research Team**	Xiaobing Liu, Oak Ridge National Laboratory (ORNL)
6.	**U.S. Industry Partners**	ClimateMaster
7.	**China Research Team**	WU Jianlin, LI Wang, and other researchers at China Academy of Building Research (CABR) will lead GSHP related studies at the joint US-China CABR demonstration project.
8.	**China Industry Partners**	One or more of the current China-side IAB member GSHP companies; we also request that China-side IAB consider Broad Residential Industrial Co. (HQ in Changsha).
9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	(a) $300K ($120K + $180k), (b) $149K, (c) $90K
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	(a) $200K, (b) $200K, (c) ClimateMaster is actively pursuing opportunity for demonstrating advanced distributed GSHP systems in China and it has worked with ORNL to develop a new CRADA for smart tank and smart control for distributed GSHP systems. It plans to test both the baseline and proposed smart tank controls at its labs and install GSHP units at ORNL's 2-stoty flexible research platform (FRP) test building.
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	Not known yet.
12.	**Issues of Concern, Suggested Solutions**	China side performers and work plan are not known yet.
13.	**Notable U.S. Technical Progress, Achievements and Findings**	• Completed 100% design in collaboration with Cannon Design for the ground loop and city water emulator used for the test bed of distributed GSHP systems in ORNL's 2-stoty FRP. • Finished an in-depth case study for a distributed GSHP system in the US and identified areas to improve operational efficiency and performance evaluation for distributed GSHP systems, which will be further studied with the test bed. • Discussed and drafted potential collaboration plans with all of the five very-low-energy-building demonstration projects in China.
14.	**Notable U.S. Non-**	• Attended and presented at the CERC-BEE technical review

	Technical Progress, Achievements	meeting at Wuhan, China in October, 2013 • Developed a proposal for continuing this project in 2014 and 2015.
15.	**Notable U.S. Industrial Partner Activities**	• Reviewed and provided valuable suggestions during the entire design process for the ground loop and city water emulator, as well as the experimental distributed GSHP system to be installed at ORNL's two-story FRP. • Provided technical support and additional thermostats and control boards to the three ClimateMaster GSHP units installed at the demonstration building at CABR. • Attended the CERC-BEE technical review meeting at Wuhan and discussed with all of the five Chinese demonstration buildings on potential collaborations.
16.	**U.S. Technical Next Steps**	• Calibrate and improve existing hot water tank model with initial test data of the smart tank from ClimateMaster as soon as it is available. • Conduct a parametric study with the calibrated computer model to identify optimal design and control of the smart tank. • Implement the identified optimal design and control in the smart tank and conduct lab tests at ClimateMaster to evaluate the resulting performance improvements.
17.	**U.S. Non-Technical Next Steps**	• Collaborate with industrial partners to demonstrate the advanced distributed GSHP system in China, and potentially also in the US.
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	Chinese partners have completed or been finalizing the design for the five selected very-low-energy-buildings. The demonstration building at CABR is near completion.
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of funds)*	• Attended CERC-BEE technical review meeting from Oct. 28 through Nov. 1 at Wuhan with CERC-BEE funding. The cost is $3,746. • Attended annual conference of International Ground Source Heat Pump Association (IGSHPA) to chair IGSHPA research committee meeting and meet with industrial collaborators. The travel was from Oct. 8 through 10 at Las Vegas and the cost is $1, 396.
20.	**Anticipated Travel in 2013** *(Indicate est. dates, location, cost, source of funds)*	• All trips in 2013 are completed.
	Prepared by:	Xiaobing Liu
	Prepared on:	2014-01-10

F1: Research on Very Low-Energy Building Operations and Management Methods

1.	**Research Area**	#F1
2.	**Project ID - Name**	#F1: Research on Very Low-Energy Building Operations and Management Methods
3.	**Reporting Period**	Q4 2013
4.	**Objective(s)**	***Task 1 – Comparison of Energy Use and Related Characteristics of US and Chinese Buildings*** This research task has two objectives: • To perform an exhaustive analysis of data to estimate energy use in buildings, to characterize the new and existing buildings in China, and to make comparisons with buildings in the United States. • To assess approaches to gather statistically meaningful data on building energy use and building characteristics at the national level in China and to encourage relevant Chinese decision makers to implement a national survey/data gathering effort. ***Task 2 – Assessment of Major Technical Measures for Energy Efficiency and Suggestions for Design and O&M for Low-Energy Buildings*** ▪ The objective of this research task is to assess the application effects of major technical measures for energy efficiency in Chinese buildings and to provide feedback and suggestions for building design, construction, equipment, and O&M to policymakers. ▪ Drawing heavily on the existing work of LBNL under CERC Projects D and E on "Renewables Integration," analyze the effectiveness of renewable energy technologies in achieving low energy buildings.
5.	**U.S. Research Team**	ICF International (ICF): David Hathaway, Carolyn Szum, Yanbing Zhao, Zhou Zhou Lawrence Berkley National Laboratory (LBNL): Mark Levine, Feng Wei, Tianzhen Hong Sustainable Energy Partnerships: Adam Hinge
6.	**U.S. Industry Partners**	Horwath HTL - Damien Little Energy Foundation China Sustainable Energy Program (CSEP) – Kevin Mo Wyndham Hotels Asia-Pacific – Gert Noordzy Starwood Hotels – Thien Hui Tay Hilton Hotels – Kenneth Fong US-China Energy Cooperation Program (ECP) – Ray Cheung, Ma Li China Property Management Institute – Chai Yong Shenzhen Hotel Association / Grand Skylight Hotel – Wang Wenhui
7.	**China Research Team**	Ministry of Housing and Urban-Rural Development (MOHURD) China Center of Science and Technology of Construction (CSTC): Hao Bin, Liu Shan Tsinghua University: Jiang Yi
8.	**China Industry Partners**	n/a

9.	**U.S. Budget** *(a) Total Y3 $ (Indicate Y3 Allocation + Y2 Carryover)* *(b) Funds Remaining at Start of Quarter* *(c) Funds Remaining at End of Quarter*	(a) 2013 Budget Task 1: $20,000 (Yr 3 Allocation) Task 2: $94,443 ($12,433 Yr 2 Carryover + $82,000 Yr 3 Allocation) Total $114,443 (b) Q4 Start (Oct 1, 2013) Task 1: $20,000 Task 2: $22,607 Total $44,607 (c) Q4 End (Dec 31, 2013) Task 1: 0 Task 2: $5,090 Total $5,090
10.	**U.S. Industrial Partner Cost-share (valued in $)** *(a) Y3 Contribution To-date* *(b) Y3 Total Projected* *(c) Brief Description*	n/a
11.	**China Budget *(if known)*** *(a) Govt. Funds Committed* *(b) Industrial Cost-share / Brief Description*	Unknown
12.	**Issues of Concern, Suggested Solutions**	n/a
13.	**Notable U.S. Technical Progress, Achievements and Findings**	**Task 1** • Meetings with Chinese partners on Building Energy Consumption reporting and quotas, and preparation for building energy rating workshop to take place in China in fourth quarter. • Made preparations for and attended the Project Technical Review meeting in Wuhan, China in October 2013. • Organized speakers and prepared agenda and hosted workshop in collaboration with International Partnership for Energy Efficiency Cooperation (IPEEC) on "Building Energy Rating Schemes: Issues and Prospects." Speakers included representatives from MOHURD, CSTC, CABR, SEP, ICF, Shanghai Building Research Institute, and Jiangsu Province. • Developed draft "Evaluation and Energy Reporting Protocol" for the five very low-energy demonstration buildings in China to ensure that the performance of the demonstration buildings can be fairly and accurately evaluated. Held discussions with CSTC and ICF to review and revise draft. • Held discussions with CSTC and ICF to confirm activities for cooperation under CERC BEE Project #F1 in 2014, which will include: o Task 1 – National Building Energy Performance Database Development; Building Energy Performance

		Rating System Development; and Policy Frameworks to Advance Very Low-Energy Buildings o Task 2 – Evaluation and Energy Reporting for US-China CERC Demonstration Buildings o Task 3 – Collaboration on Building Energy Performance Standards • Collaborated with ICF to develop CERC BEE #F1 2014 proposal. **Task 2** **<u>Analysis of Characteristics of Very Low-Energy Buildings in China</u>** • Completed comprehensive analysis of data for 56 hotels in the temperate monsoon climate and subtropical monsoon climate in China to identify the key design, construction, technology, and operations and management (O&M) characteristics of very low-energy hotels in China. This included completing the following: o A comprehensive ranking of 56 hotels as upper quartile (top 25%), second quartile (better than 50%), third quartile (better than 25%), and fourth quartile (bottom 25%) of the marketplace in terms of energy use/square meter (EUI) and energy performance "score" (1-100) using the CERC on-line hotel energy performance benchmarking tool. ▪ Through this analysis, ICF confirmed that low EUI hotels receive higher benchmarking scores, indicating that the tool was functioning correctly. o Identified characteristics of best and worst energy-performing hotels in the survey for major categories: ▪ Wall construction ▪ Exterior windows and glass ▪ Main source of building cooling ▪ Main source of building heating ▪ Main air distribution and ventilation ▪ Water heating systems ▪ Indoor lighting ▪ Energy efficiency technologies ▪ O&M measures o Completed energy performance comparisons of US and Chinese hotels based on source energy use intensity for major fuel types. ICF converted site to source energy for Chinese and US hotels for major fuel types and made comparisons of energy use intensity. o Developed a PPT to share findings at the Project Technical Review meeting in Wuhan, China in October 2013.

		• Developed case studies describing the design, construction, technology, and O&M characteristics of 3 very low energy hotels surveyed.
		
		• Continued to revise/refine hotel benchmarking tool (in Chinese and English) and developed overview document/PPT on process for developing hotel benchmarking tool.
		
		Chinese Demonstration Buildings
		
		• Completed a one-page proposal on potential areas of cooperation with the 5 demonstration buildings, and submitted to LBNL.
		
		• Held meetings with China Center for Science of Technology (CSTC) and China Sustainable Energy Partnerships (SEP) to develop draft "Evaluation and Energy Reporting Protocol" for the five very low-energy demonstration buildings in China to ensure that the performance of the demonstration buildings can be fairly and accurately evaluated.
		
		• At the Wuhan Technical Review Meeting, held discussions with Wu Jianlin – lead developer for the CABR demonstration building - and confirmed CABR's cooperation in testing the "Evaluation and Energy Reporting Protocol" for the five very low-energy demonstration buildings in China.
		
		Collaboration with International Partnership for Energy Efficiency Cooperation (IPEEC)
		• Prepared PPT on ENERGY STAR Portfolio Manager Tool and presented at the IPEEC workshop in October 2013. Participated in roundtable discussions, where Chinese requested further collaboration on benchmarking and potential need for ENERGY STAR-type program in China.
		
		• Provided comments on IPEEC, "Building Energy Rating Schemes: Issues and Prospects"
		
		Preparation for 2014 Work
		• Held discussions with CSTC and SEP on activities to undertake under Project #F1 in 2014. CSTC requested collaboration in the following key areas, which ICF and SEP agreed to:
		  o Task 1 – National Building Energy Performance Database Development; Building Energy Performance Rating System Development; and Policy Frameworks to Advance Very Low-Energy Buildings
		  o Task 2 – Evaluation and Energy Reporting for US-China CERC Demonstration Buildings
		  o Task 3 – Collaboration on Building Energy Performance Standards
		
		• Developed proposal for work under Project #F1 of CERC, covering the three tasks outlined above, and submitted to LBNL on December 5, 2013.

		• Held initial meeting with CSTC on December 20th 2013 to:
		  o Provide high-level introduction on building energy performance benchmarking (what it is, why important, approaches globally, etc.)
		  o Demo of the China hotel benchmarking tool
		  o Step-wise process for developing the benchmarking tool, including data collection, regression analysis, etc.
		
		<u>Technical Progress Reporting</u>
		
		• Prepared project status PPT and presented at the Project Technical Review meeting in Wuhan, China in October 2013.

	Notable U.S. Non-Technical Progress, Achievements	**Task 1** • Workshop held with both US and Chinese partners on October 28 in Beijing; workshop agenda and all presentations available at www.buildingrating.org/ipeec • Greater Chinese interest in IPEEC Building Energy Efficiency Taskgroup, and potential involvement in that growing project. **Task 2** ▪ Completed analysis of 2012 Horwath HTL "Hotel Energy Benchmarking Survey" data set to identify characteristics of very low- energy hotels.
15.	**Notable U.S. Industrial Partner Activities**	n/a
16.	**U.S. Technical Next Steps**	**Task 1** • Collaboration with Chinese partners on a technical/policy paper on the China Building Energy Quota Standard **Task 2** ▪ Conduct surveys in Beijing for 50 hotels to obtain design, equipment, and O&M characteristics of very low energy hotels. ▪ Complete on-site investigation for several low-energy hotels in Beijing to verify findings and collect additional information for low-energy building case studies. ▪ Develop final report summarizing key findings from analysis of the application effects of major technical measures for energy efficiency in 100 Chinese hotels. Include feedback and suggestions for design, construction, equipment, O&M, and energy efficiency measures for low-energy buildings. ▪ Kick off work in 2014 proposal.

17.	**U.S. Non-Technical Next Steps**	**Task 1:** • Collaboration with Chinese partners on a technical/policy paper on the China Building Energy Quota Standard **Task 2:** ▪ Conduct workshop for policymakers and key stakeholders to share findings from analysis of application effects of major technical measures for energy efficiency, including suggestions for design, construction, equipment, O&M, and energy efficiency measures for low-energy hotels.
18.	**Notable China Progress** *(a) technical* *(b) operational* *(c) industrial partners*	**Task 1:** ▪ **Technical** Substantially increased knowledge among Chinese partners on building energy rating activities taking place around the world, and increased interest in collecting building energy performance data and using that toward Chinese building energy benchmarking and rating. ▪ **Operational** n/a **Task 2:** ▪ **Technical** ▪ CSTC made specific request to ICF for collaboration on the following research areas in 2014 and reviewed/signed the 2014 proposal: o Task 1 – National Building Energy Performance Database Development; Building Energy Performance Rating System Development; and Policy Frameworks to Advance Very Low-Energy Buildings o Task 2 – Evaluation and Energy Reporting for US-China CERC Demonstration Buildings o Task 3 – Collaboration on Building Energy Performance Standards ▪ CSTC invited ICF to give a preliminary training/workshop to: o Provide high-level introduction on building energy performance benchmarking (what it is, why important, approaches globally, etc.) o Demo of the China hotel benchmarking tool o Step-wise process for developing the benchmarking tool, including data collection, regression analysis, etc. ▪ **Operational** ▪ n/a
19.	**Completed Travel** *(Indicate est. dates, location, cost, source of*	Task 1: Meetings in Beijing and Wuhan in October 2013, ~$3,000; all with CERC funds Task 2:Meeting in Wuhan, China in October 2013, ~$1,000, CERC

	funds)	funds
20.	**Anticipated Travel in 2014** *(Indicate est. dates, location, cost, source of funds)*	Task 1: TBD Task 2: TBD
	Prepared by:	Carolyn Szum, Adam Hinge
	Prepared on:	2013-1-10