U.S.-China Clean Energy Research Center

Building Energy Efficiency Consortium

(CERC-BEE)

13th U.S. Consortium Quarterly Progress Report

Year 4, Quarter 1
(January – March, 2014)

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Prepared on April 22, 2014 at Lawrence Berkeley National Laboratory
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Human Behavior and Standards to Improve Design and Operation

1.	**Full Project Name**	Human Behavior and Standards to Improve Design and Operation of Very Low Energy Buildings
2.	**Reporting Period**	Q1, 2014
3.	**U.S. Research Team**	Tianzhen Hong, LBNL, US project lead Cheng Li, Simona D'Oca, Qi Zhang, LBNL
4.	**U.S. Industry Partners**	Bentley Systems
5.	**China Research Team**	Da Yan, Tsinghua University, China project lead Kaiyu Sun, Xiaohang Feng, Xiaoxin Ren, Tsinghua Benqiang Li, Center of Building Standards Shan Liu, MoHURD
6.	**China Industry Partners**	CABR, Vanke, CECEP, Swire Properties
7.	**One Sentence Project Highlight**	Kicked off 2014 project with China counterparts and industrial partners; made solid progress in all technical tasks.
8.	**2014 Target Outcomes and Progress**	1. Behavior software completed and available for download - a joint deliverable with China side. **Making progress.** 2. Modified EnergyPlus to integrate the behavior software. **Not started yet.** 3. A technical report to support the development of the China design standard for very low energy buildings (the China side is developing the standard with inputs from the U.S. side). **Developing an outline of the standard and reviewing related U.S. standards and guides.** 4. Application guide for the China building energy consumption standard - a joint deliverable with China side. **Compiling actual building operation practice and occupant behavior. Started simulations.** 5. Public workshop, inviting MoHURD, 5 Universities, and IAB partners - a joint event with China side and IAB partners. **Not started yet.** 6. Roadmap with timeline for code adoption/influence - a joint deliverable with China side. **Not started yet.**
9.	**Quarterly Milestones and Deliverables** (*Notable U.S. Technical Progress, Achievements, Findings)*	• Made great progress to complete the 2013 CERC Integrated design project. Writing the technical report of subTask 3 - building information modeling results schema • Discussed with China team about the scope, research plan and deliverables for the design standard of very low energy buildings • Kicked off the review of existing standards and design guides of low energy buildings in the U.S. and Europe • Started comparison of the two China building energy standards
10.	**Notable U.S. Non-Technical Progress,**	• Kickoff the 2014 project with China counterparts and industrial partners • First Annex 66 preparation meeting successfully took place in Hong Kong on 4/13-14 • Prepared presentation for the DOE BTO review in April 2014

	Achievements	• Biweekly conference call with the China team
11.	**Notable U.S. Industry Progress**	• Participated in a conference call to discuss project plan and progress • Discussion about contribution to the project by integrating and testing the behavior module
12.	**U.S. Technical Next Steps**	• Start planning the public workshop • Review low energy standards and design guides in the U.S. • Complete the data mining of occupant behavior and the report • Continue the development of the behavior module
13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	• Participated in the kickoff meeting and discussions of the CERC Standards work • Organized first meeting of Annex 66 in Hong Kong • Started comparison of the two China standards • Developed a draft framework of the China very low energy building standard
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	• March 9-14, 2014, Hong Kong, $3500, CERC project. Annex 66 meeting
15.	**Anticipated Travel in 2014** *(Dates, location, cost, source of funds)*	• April 7 & 8, 2014, San Francisco, $500, CERC project. ASHRAE High Performance Buildings conference. • April 21-24, 2014. Washington DC, $1600, CERC project. BTO Review • August 2-7, 2014, Nottingham, UK, $3500, CERC project. 2nd Annex 66 meetings. • August 26-27, 2014, California, Tentative CERC Annual conference
16.	**U.S. Budget (2014)** *(Intended budget, funds received, costs to-date)*	Intended budget: $220k Fund received in 2014: $110k Cost to date: $50k
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	Contribution To-date: $30k Projected Total: $400k Bentley Systems participated in developing the 2014 proposal, project kickoff meeting, and discussions of progress. Planned to integrate and test the behavior module.
18.	**Issues of Concern and Suggested Solutions**	Lack active participation of C3 Energy. Had a meeting with Brian to discuss how to engage them.
	Prepared by:	Tianzhen Hong

	Prepared on:	April 9, 2014

Advanced Window and Shading Technologies

1.	**Full Project Name**	Advanced Window and Shading Technologies
2.	**Reporting Period**	Q1 2014 (January – March 2014)
3.	**U.S. Research Team**	Eleanor Lee, LBNL
4.	**U.S. Industry Partners**	Robert Licht, Saint-Gobain / Neil Sbar, Sage Electrochromics; John Mansheim, 3M; Robert Nachtrieb, Lutron Electronics, Inc.
5.	**China Research Team**	Li Hong, Wuhan University of Technology; Wu Jianlin, CABR; Li Zhengrong, Tongji University
6.	**China Industry Partners**	Luo Duo, Zhuhai Singye Green Building Technology Co., Ltd
7.	**One Sentence Project Highlight**	Full-scale field testing of electrochromic windows and automated shades initiated in the Advanced Windows Testbed at the Berkeley Lab.
8.	**2014 Target Outcomes and Progress**	**1. Demonstration of innovative shading and daylighting technologies (Task 1.1 Test A)** Developed workplan with Lutron, defined hardware and controls specifications, shipped, then installed materials in the LBNL Advanced Windows Testbed. The scope of work will focus on developing a better understanding of the performance of Lutron's state of the art glare and daylighting control algorithms using several combinations of sensors and shade fabrics. Began preparations for monitoring: calibrated high dynamic range (HDR) imaging systems and building the acquisition modules for monitoring shade operations and daylighting impacts. **2. Testbed evaluation of integrated electrochromic windows and dimmable lighting (Task 1.1 Test A)** Separately, Sage Electrochromics shipped windows in mid-March so we have decided to accommodate them in our field test even though they slipped the go/ no-go milestone in mid-January. Resource adjustments to other tasks to occur in next quarter after completion of detailed planning. Initiated installation of the windows, building and installing of window sensors, building of acquisition and control modules for field testing. **3. Model development to assess dynamic façade technologies with control systems (Task 1.1 Test B; Task 2.1 + Task 3a/ Project D1)** Initiated planning of window-microgrid tests in parallel with controller prototyping task (Task 2.1). Specified hardware for virtual control of Lutron and Sage window systems and discussed methods for

		implementation with vendors. Began development of microgrid system for the Windows Testbed, ordered equipment, and initiated installation. 4. **Implement integrated controls in Xingye building (Task 1.3)** Discussed methods of modeling and implementing solutions developed in Task 2 to this full-scale building with LBNL Xingye team. 5. **Clear value proposition of economics of the electrochromic technology in the U.S. and China markets (Task 1.2)** Electrochromic windows were shipped to Shanghai and received by SGR-Shanghai. The windows will be installed once baseline metering is completed (April 2014). Continued to discuss field monitoring plans for energy and comfort-related assessments and occupant survey protocols that minimize imposition on normal business practices. 7. **Present at major conferences (or trade shows) in China and the U.S.** Prepared for DOE Peer Review, Washington DC, April 22-25, 2014. Began preparations for LightFair 2014 seminar on advanced shading and daylighting (synergistic DOE project), June 3-5, 2014. 8. **One patent filed (by Sage) in 2014 and roadmap for an additional patent in 2014-15** No activity.
9.	**Quarterly Milestones and Deliverables (***Notable U.S. Technical Progress, Achievements, Findings)*	Task 1.1. Initiate testing of Lutron shading system; Go/ No-Go; due 3/15/14: Automated shades received and installed, commissioning of controls now in progress. Task 2.1. Milestone: Complete proof-of-concept model controls for shading system; regular; due 3/14/14: worked out the method of interfacing the window and daylighting control system with the der-cam optimization module; testing the solution was initiated within Task 3a of the D1, D3, and E1 project.
10.	**Notable U.S. Non-Technical Progress, Achievements**	None.
11.	**Notable U.S. Industry Progress**	Sage Electrochromics delivered products to both the LBNL and Shanghai sites for field demonstrations.
12.	**U.S. Technical Next Steps**	Commission Lutron and Sage systems, initiate field testing at LBNL. Initiate field testing at SGRS.

13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	SGRS and Tongji University initiated baselining activities in the new building, which completed construction in mid-February.
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	None
15.	**Anticipated Travel in 2014** *(Dates, location, cost, source of funds)*	DOE Peer Review, Washington DC, April 2014, CERC-BEE funding, $3500. SGRS Headquarters (Task 1.2), June 2014, CERC-BEE funding, $10K (tentative).
16.	**U.S. Budget (2014)** *(Intended budget, funds received, costs to-date)*	FY14: $332K budget; $155K received, $24K costs to date
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	(a) $56K total to date; (b) $155K projected total; (c) materials and support from Sage, SGRS, and Tongji. Sage Electrochromics: $42K for in-kind materials and shipping, $12K engineering/ consulting, total $54K US; SGRS and Tongji: $4K project and measurement support in China.
18.	**Issues of Concern and Suggested Solutions**	None
	Prepared by:	ESLee
	Prepared on:	4/14/14

Materials that Improve the Cost-Effectiveness of Air Barrier Systems

1.	**Full Project Name**	Materials that Improve the Cost-Effectiveness of Air Barrier Systems
2.	**Reporting Period**	2014 – Q1
3.	**U.S. Research Team**	Oak Ridge National Laboratory (ORNL)
4.	**U.S. Industry Partners**	Dow Chemical 3M
5.	**China Research Team**	China Academy of Building Research (CABR) China Building Standard Design and Research Institute (CBS)
6.	**China Industry Partners**	CABR Kelong Insulation
7.	**One Sentence Project Highlight**	This project seeks to improve the cost-effectiveness of air barrier systems by reducing their installation time.
8.	**2014 Target Outcomes and Progress**	**Dow: Sprayable Liquid Flashing** 1. Dow will generate a technical product planning road map for the sprayable liquid flashing in 2014. 2. Dow will launch the sprayable liquid flashing in the US in 2014. 3. Dow/ORNL will initiate in 2014 laboratory and field tests to demonstrate adequate performance of the liquid flashing. Evaluations will be completed in 2015. ***Progress:*** • *Assembled test wall at ORNL. Evaluation will be conducted in Q2.* 4. Dow will generate an economic value proposition in 2014. 5. Dow will present benefits from the sprayable liquid flashing at a major trade conference in the US and/or China in either 2014 or 2015. ***Progress:*** • *Hosted a booth at the National Association of Home Builder's International Builder's Show* • *Attended the 2014 Air Barrier Association of America Conference and Trade Show.* **3M: Primer-less Self-Adhered Membrane** 1. 3M will generate a product planning road map for the primer-less self-adhered membrane in 2015 based on results from laboratory and field tests that are performed in 2014. 2. 3M/ORNL will initiate laboratory and field tests in 2014 that will assess benefits from the primer-less self-adhered membrane. After these tests are completed in 2015, 3M will use results to support the economic value proposition of the primer-less self-adhered membrane. 3. 3M will launch the primer-less self-adhered membrane in China in 2014. 4. 3M will present benefits from the primer-less self-adhered membrane at a

		major trade conference in the US and/or China. ***Progress:*** *attended the 2014 Air Barrier Association of America Conference and Trade Show.*
9.	**Quarterly Milestones and Deliverables** (*Notable U.S. Technical Progress, Achievements, Findings)*	• ORNL: calibrated the airflow measuring system in the new chamber. Also, completed the LabView code to evaluate water penetration under cyclic pressure loads that simulate wind conditions per ASTM E2268. • Dow/ORNL: assembled a test wall at ORNL. • Dow/ORNL/CABR: installed the liquid flashing in two windows at the CABR demonstration building. • 3M/ORNL/CABR: installed the primer-less self-adhered membrane in one window at the CABR demonstration building.
10.	**Notable U.S. Non-Technical Progress, Achievements**	-
11.	**Notable U.S. Industry Progress**	• Dow is in the process of completing the AMAA 714-12 test: Voluntary specification for liquid applied flashing used to create a water-resistive seal around exterior wall openings in buildings. • 3M successfully conducted the ASTM D4541 test method for pull-off strength of coatings using portable adhesion testers. The membrane was attached to concrete blocks and exterior grade gypsum boards, and in both instances results were higher than the recommended pressure of 16 psi.
12.	**U.S. Technical Next Steps**	• ORNL to test the first Dow wall • ORNL to assemble a second Dow wall • ORNL and 3M to finalize the wall assembly to be tested • Dow and 3M to continue evaluating the performance of their products
13.	**Notable China Progress** *(a) research and technical achievements (b) demonstration projects*	Air leakage and water penetration tests of installed windows per ASTM E783 and E1105, respectively, are scheduled to be conducted at the CABR demonstration building on 4/15/14.
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	None
15.	**Anticipated**	4/23 – 4/24: DOE peer review meeting in Washington, DC.

	Travel in 2014 *(Dates, location, cost, source of funds)*	
16.	**U.S. Budget (2014)** *(Intended budget, funds received, costs to-date)*	
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	
18.	**Issues of Concern and Suggested Solutions**	
	Prepared by:	Diana Hun
	Prepared on:	4/10/14

Cool Roofs and Urban Heat Islands (LBNL)

1.	**Full Project Name**	Cool roofs & urban heat islands
2.	**Reporting Period**	2014 Q1
3.	**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 reported separately)
4.	**U.S. Industry Partners**	Dow Chemical
5.	**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, Chinese Academy of Sciences (CAS) Changqing LIN, MOHURD Research Institute of Standards and Norms (RISN)
6.	**China Industry Partners**	China-Icepower Energy Technology Co., Ltd
7.	**One Sentence Project Highlight**	LBNL, GPABR, and CU submitted to *Energy Policy* an 8,000 word manuscript detailing our cool roof simulations, experiment, and policy analysis to date.
8.	**2014 Target Outcomes and Progress**	*Conference paper describing natural exposure campaign.* Campaign outlined, exposure and measurement processes detailed; funding sought for RISN. *Journal article describing urban and global cooling by cool surfaces in Guangzhou.* CAS researcher scheduled to visit LBNL next quarter to collaborate on climate modeling. *Conference paper/presentations describing upgrades to cool surface credits/requirements in China. Participate in special workshop to engage and educate the people/organizations drafting such standards.* Existing mandatory standards reviewed, and reported in manuscript submitted to Energy Policy. Review of green building standards underway. *Conference paper describing designs of black/white/garden roof demonstrations at GPABR/CU.* Experiments designed and monitoring equipment ordered. *Conference paper describing design and instrumentation of cool wall demonstration in Wuhan.* No activity. *Conference paper describing the ongoing testing methods, results and conclusions of accelerated tests of the SH extended cool roof coatings.* Built goniometer to measure hydrophobicity.

9.	**Quarterly Milestones and Deliverables (***Notable U.S. Technical Progress, Achievements, Findings)*	*Task A-1, Q1: Identify up to 10 representative Chinese cities for natural exposure of roofing materials.* RISN began to identify the representative cities. LBNL prepared and shared with RISN/GPABR a draft proposal and a detailed test procedure for evaluate the aging (soiling and weathering) of roofing products in China. With support from LBNL, RISN is now seeking support for its participation from the Energy Foundation Beijing Office. *Task A-3, Q1: Initiate modeling of urban cooling in Guangzhou (model setup in CAS and initiate a case study of the 2004 heat wave event in Guangzhou).* To prepare for next quarter's visit by CAS researcher Meichin CAO, LBNL continued to plan region climate modeling activities to evaluate the application of cool roofs throughout China. *Task A-4, Q1: Tabulate cool surface credits/requirements in Chinese building energy efficiency standards and incentive programs.* LBNL, GPABR, and CU submitted to *Energy Policy* an 8,000 word manuscript detailing our cool roof simulations, experiment, and policy analysis to date. This included an updated review of cool surface credits/requirements in Chinese mandatory standards. LBNL obtained additional local standards through RISN and performed further reviews on cool surface provisions in Chinese mandatory standards. We also received and have begun to review additional green building standards from nine southern provinces with hot summers. *Task B-1, Q1: Design black/white/garden roof demonstration at GPABR.* LBNL worked with both CU and GPABR to refine their plans for black/white/garden roof experiments. CU and GPABR have each ordered the necessary monitoring equipment. *Task C-2, Q1: Train LBNL on SH testing*. Deferred to next quarter because Dow facility is still moving. *Task C-2, Q1: Accelerated aging using LBNL methodology (proposed ASTM method*. Built goniometer to measure water contact angles, which will quantify hydrophobicity before and after accelerated aging.
10.	**Notable U.S. Non-Technical Progress, Achievements**	LBNL's Dev Millstein and Ronnen Levinson corresponded with Meichun CAO and Zhaohui LIN (CAS) to arrange the upcoming visit from Meichun to LBNL.
11.	**Notable U.S. Industry Progress**	(Collaboration with Dow Chemical on anti-soiling coatings is detailed in Scott's report.)
12.	**U.S. Technical Next Steps**	LBNL will help CU instrument and begin its black/white/garden roof experiment. LBNL will help RISN & GPABR seek Energy Foundation Beijing Office funding for study in support of cool roof rating in China, and begin this study. LBNL will host CAS researcher Meichun CAO for 1 month to continue our collaboration on regional climate modeling of cool roofs in China. During her stay, Dev Millstein will work closely with Meichun to develop predictions of potential changes to urban air temperature from the adoption of cool roofs in cities throughout China. They will use the newest version of the regional climate model, WRF, on the NERSC supercomputers (a Department of

		Energy supercomputing cluster). LBNL will visit Dow Chemical for training on SH coating.
13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	See U.S. progress. All work except that on SH coatings is joint (US-China).
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	None.
15.	**Anticipated Travel in 2014** *(Dates, location, cost, source of funds)*	BTO Peer Review Meeting, April 22-24, Arlington, VA; $1K from CERC-BEE
16.	**U.S. Budget (2014)** *(Intended budget, funds received, costs to-date)*	<u>LBNL only</u> CY14 funded expected: $325K CY14 funds received: $162.5K CY14 intended budget: $36K (CY13 carryover) + $325K (CY14) = $361K CY14 costs to date: $52K
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	(Dow Chemical's cost share detailed in Scott's report.)
18.	**Issues of Concern and Suggested Solutions**	No word yet about Wuhan cool wall demo. Not worried—there's much to do w/o it—but I thought I'd let you know.
	Prepared by:	Ronnen Levinson
	Prepared on:	2014-04-10

Cool Roofs and Urban Heat Islands (ORNL)

1.	**Full Project Name**	Cool roofs & urban heat islands (Dow-ORNL-LBNL Advanced White Roof CRADA)
2.	**Reporting Period**	2014 Q1
3.	**U.S. Research Team**	Ronnen Levinson, LBNL, U.S. Team Lead Scott Hunter, ORNL - this report documents the ORNL contribution
4.	**U.S. Industry Partners**	Joe Rokowski, Dow Chemical
5.	**China Research Team**	This activity is US only
6.	**China Industry Partners**	This activity is US only
7.	**One Sentence Project Highlight**	Dow has been able to disperse the ORNL supplied superhydrophobic (SH) powders in aqueous acrylic roof coatings – a significant accomplishment – and observed significant improvement in dirt resistance, a surface property, using a fluorinated silane surface functionalization for the SH particles embedded in the acrylic coatings.
8.	**2014 Target Outcomes and Progress**	Complete formulation and SH testing of basic acrylic formulations and coatings; evaluate the self-cleaning ability of SH coatings. Complete formulation and SH and optical testing of pigmented acrylic based coatings; accelerated durability testing, microbial growth testing, UV weathering and water repellency of new cool roof coatings. Characterize surface roughness and topographical features, perform depth profiling measurement of water retention and coating oxidation.
9.	**Quarterly Milestones and Deliverables (***Notable U.S. Technical Progress, Achievements, Findings)*	Dow was able to disperse ORNL SH silica powders in aqueous acrylic roof coatings using standard dispersants and high shear mixing. Dow has observed significant improvement in dirt resistance, a surface property, using fluorinated silane functionalization for the superhydrophobic particles embedded in the acrylic coatings. ORNL has initiated anti biofouling studies using surface modified SH coatings that are expected to have enhanced anti biofouling properties ORNL researchers submitted 2 invention disclosures: J. Simpson and G. Polyzos, "Superhydrophobic Coatings using Double Silane treated Silica Particles." S. Allman, M. Cheng, A. Desjarlais and D. Graham, "Art and Method on Accelerating Microbial Test of Materials."
10.	**Notable U.S. Non-Technical Progress, Achievements**	None
11.	**Notable U.S. Industry Progress**	Dow moved their R&D facility from Spring Hill, PA to Collegeville, PA during late Q4 of CY13. This was intended to be a two month effort that resulted in the shutdown of most of their R&D activities

		until the new facilities are operational and fully qualified. Facility installation issues and delays in lab qualification procedures have considerably delayed the start of R&D work at the new facility. All qualification work is expected to be completed by early May.
12.	**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 acrylic cool roof paint development effort. ORNL will provide additional milled and SH functionalized diatomaceous earth powders with different functionalization groups to enhance SH particle-polymer binding to reduce coating porosity and improve particle retention during mechanical abrasion of anti-soiling acrylic coatings. 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. Dow, ORNL and LBNL will characterize coupons coated with these acrylic resins for water repellency, optical, anti-biofouling and anti-soiling properties in comparison with standard solvent based coatings.
13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	This activity is US only
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	No travel in Q1 of 2014
15.	**Anticipated Travel in 2014** *(Dates, location, cost, source of funds)*	Buildings Technology Office Peer review Meeting, April 22-24, Arlington, VA; $1,200 from CERC-BEE
16.	**U.S. Budget (2014)** *(Intended budget, funds received, costs to-date)*	ORNL Budget only $125K (Y4) + $78.4K (Y3 carryover) $0K $46.2K
17.	**U.S. Industry**	(a) Dow has performed $30K of in-kind work on this project to date in

	Cost-share (2014) *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	CY14 (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.
18.	**Issues of Concern and Suggested Solutions**	None
	Prepared by:	Scott Hunter
	Prepared on:	2014-04-09

Hybrid Ventilation Technology and Product R&D: Natural Ventilation for Commercial Buildings

1.	**Full Project Name**	Hybrid ventilation technology and product R&D: Natural ventilation for commercial buildings
2.	**Reporting Period**	Q1 2014: January 2014 – March 2014
3.	**U.S. Research Team**	US project leader: Leon R. Glicksman, Massachusetts Institute of Technology Support: Alonso Dominguez, Massachusetts Institute of Technology
4.	**U.S. Industry Partners**	---
5.	**China Research Team**	Chongqing project • Leader: Li Baizhan, Chongqing University • Support: Li Nan, Chongqing University Zhuhai project • Leader: Zhu Neng, Tianjin University
6.	**China Industry Partners**	Chongqing project: Chongqing Jinxi Cultural Center • Project developer: Chongqing Fu Tai Construction Group Heishishan Integrated Tourism development LLC • Contact: Zou Wei, Chongqing Fu Tai Construction Group Heishishan integrated tourism development LLC Zhuhai project: Zhuhai Singyes R & D Building, the 2nd Zhuhai Singyes Renewable Energy Industrial Park • Project developer: Zhuhai Singyes Green Building Technology Co.Ltd • Contact: Deng Xin, Zhuhai Singyes Green Building Technology Co.Ltd
7.	**One Sentence Project Highlight**	Develop natural ventilation design tool and use it in building demonstrations to highlight the efficiency and practicality of natural ventilation
8.	**2014 Target Outcomes and Progress**	2014 targets Extend current air thermal stratification model in naturally ventilated offices Continue work with Chinese developers: fenestration elements, façade elements and ventilation strategies *(See section 8 for detailed progress report)*
9.	**Quarterly Milestones and Deliverables (***Notable U.S. Technical*	Improvement of design tool, CoolVent Achieved: New release of CoolVent available at coolvent.mit.edu. Now being used in a class at MIT. Improvements include extended comfort analysis, updated comfort standard, and several bugs which were fixed.

	Progress, Achievements, Findings)	Collaboration in IAE Annex 62, document demonstration results and define modeling tools Achieved: Participated in IAE Annex 62 document with relevant literature related to modeling tools for natural ventilation Share information with Chinese developers, analysis of impact of façade element on natural ventilation Achieved: Submitted report on façade element to the research team and industrial partners for the Zhuhai Singyes R & D Building. Report included next steps in experimental work to be carried out by Chinese research team.
10.	**Notable U.S. Non-Technical Progress, Achievements**	Preparing for April IAE Annex 62 meeting
11.	**Notable U.S. Industry Progress**	---
12.	**U.S. Technical Next Steps**	• 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 MPC algorithms in CoolVent • Continuing work towards a better thermal stratification model and to include it as part of thermal comfort evaluation in CoolVent • Prepare report for Chinese Zhuhai team regarding night cooling potential in this building
13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	---
15.	**Anticipated Travel in 2014** *(Dates, location, cost, source of funds)*	April 21st to April 24th, Lausanne, Switzerland, for IAE Annex 62 meeting April 23rd to April 24th, Washington DC, for the BTO review meeting
16.	**U.S. Budget**	Intended budget: USD$112,715.00

	(2014) *(Intended budget, funds received, costs to-date)*	Funds received: USD$68,810.83 Cost to date: USD$13,066.14
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	---
18.	**Issues of Concern and Suggested Solutions**	Communication with Chinese research team and with demonstration developer has been difficult. Nevertheless, we have sent a report as we promised, and we are preparing a new one. MIT has suggested having regular (maybe bi-weekly) phone and video conferences with Chinese colleagues to solve this.
	Prepared by:	Alonso Dominguez, Leon Glicksman and Kathleen Ross
	Prepared on:	April 8, 2014

Advanced Lighting Controls in New and Existing Buildings

1.	**Full Project Name**	Advanced Lighting Controls in New and Existing Buildings
2.	**Reporting Period**	Q1 2014
3.	**U.S. Research Team**	Lawrence Berkeley National Laboratory. Francis Rubinstein, Erik Page
4.	**U.S. Industry Partners**	Lutron Electronics. Robert Nachtrieb
5.	**China Research Team**	National Low-Carbon Lighting Research Center. Huang Yuehui
6.	**China Industry Partners**	Lutron Electronics. Matt Blakeley
7.	**One Sentence Project Highlight**	Lutron lighting controls systems were specified and installation was initiated at the CARB field test site in Beijing; initial experimental plans for FLEXLAB and the field test site were developed.
8.	**2014 Target Outcomes and Progress**	1. *Demonstrated launch of control system in U.S. and China markets by end of 2014* Limited Progress in Q1 2014. 2. *Clear road map and progress to establishing codes in 2014* Limited Progress in Q1 2014. 3. *Economic value proposition including field data and modeling against the real cost to demonstrate technology's viability in market/application* The experimental design developed this quarter explicitly addresses this target. 4. *Code language and plan for which partners need to be engaged in both US and China to have the code adopted and implemented* Limited Progress in Q1 2014. 5. *FY2014 goal: Tool for analyzing lighting data collected by manufacturer's control system.* The experimental design developed this quarter explicitly addresses this target. 6. *Stretch goal (FY15): Embed analysis into developed code language to verify compliance* Limited Progress in Q1 2014.
9.	**Quarterly Milestones and Deliverables (***Notable U.S. Technical Progress, Achievements,*	Milestones: • *Installation of lighting controls systems in demonstration site(s) – Jan 2014 – March 2014* The majority of Lutron's lighting controls equipment was installed in CARB in Q1 2014.

	Findings)	Deliverables: • *Experimental plan for evaluating lighting controls system demonstration sites – March 2014* Completed conceptual design of experimental plan at FLEXLAB and field test at CARB (Beijing). We plan to install the same Lutron lighting controls systems in the field test site and in the FLEXLAB. This will allow these systems to be monitored in great detail in a controlled laboratory environment and then later collect "real world" data over a longer period in the field. The data collected in the FLEXLAB is expected to both allow us to refine the final field test plan as well as help to calibration/supplement data received from the field test site.
10.	**Notable U.S. Non-Technical Progress, Achievements**	Updated 2014 Joint Work Statement based on feedback from DOE and reviewers.
11.	**Notable U.S. Industry Progress**	Lutron developed the system specifications for the controls for the CARB field test site. Lutron also participated in discussions with US researchers related to the FLEXLAB test plans.
12.	**U.S. Technical Next Steps**	We will need to develop a detailed experimental plan for the FLEXLAB experiment. This plan is expected to be consistent with the conceptual plan discussed above but will have much greater details (e.g. discuss what specific controls strategies will be employed, what parameters will be measured, what baseline conditions will be used for comparison, etc).
13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	The majority of Lutron's lighting controls equipment was installed in CARB in Q1 2014. These systems will be commissioned in Q2 2014.
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	N/A
15.	**Anticipated Travel in 2014** *(Dates, location, cost, source of funds)*	Erik Page will likely visit the field test site in 2014 though dates have not yet been set. Travel funds for this trip would come for this projects budget.
16.	**U.S. Budget (2014)** *(Intended budget,*	

	funds received, costs to-date)	
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	Estimate for 2014: $140K Estimate for Q1 2014: $35K
18.	**Issues of Concern and Suggested Solutions**	None at this point.
	Prepared by:	Erik Page
	Prepared on:	April 9, 2014

Research and Demonstration of Integrated Building Energy Technologies

1.	**Full Project Name**	**Research and Demonstration of Integrated Building Energy Technologies**
2.	**Reporting Period**	2014 Q1
3.	**U.S. Research Team**	Nan Zhou, Berkeley Lab, Co-PI Michael Stadler, Berkeley Lab, Co-PI Wei Feng, Berkeley Lab, Sr. Scientific Engineering Associate Salman Mashayekh, Berkeley, Postdoc Tyler Yan, Berkeley Lab, Student Research Assistant Yiwen Guo, Affiliate Shi Wang, Affiliate Gonçalo Cardoso, Berkeley Lab, Affiliate
4.	**U.S. Industry Partners**	Demand Energy, C3
5.	**China Research Team**	Neng ZHU, Tianjin University, PI Hongwei TAN, Tongi University, PI Zhe TIAN, Tianjin University, Technical Lead Shilei LV, Tianjin University & Berkeley Lab Affiliate Jing Zhao, Tianjin University & LBNL Affiliate Shuqin CHEN, Tongji University, Research Assistant Jia Wang, Beijing University of Construction and Architecture
6.	**China Industry Partners**	Xingye Solar, Wuhan Rixin
7.	**One Sentence Project Highlight**	Create an open-access web service that permits optimization of building equipment selection and operation for building-scale microgrids.
8.	**2014 Target Outcomes and Progress**	Develop real-time control methods for distributed energy system in buildings
9.	**Quarterly Milestones and Deliverables** (*Notable U.S. Technical Progress, Achievements, Findings)*	■ Worked with Xingye on its demo building microgrid design ■ Refined Building 26 EnergyPlus model and calibrated it with real-time measurement data ■ Identified methods to acquire real-time weather forecast data in China and the U.S. ■ Developed week-ahead load forecasting approach for Blg. 26 ■ Identified case buildings in New Mexico ■ Developed load forecasting for two of 4 target buildings ■ Ran eQuest model of Xingye building and extract building energy load profile

		■ Worked with the windows team to scope the electrochromic window model ■ Set up interface between DER-CAM and controllable shading model
10.	**Notable U.S. Non-Technical Progress, Achievements**	■ Approached Siemens as a potential controls vendor partner ■ Engaged Honeywell to participate Xingye demo building ■ Completed the proposal of 2014 research work
11.	**Notable U.S. Industry Progress**	■ Honeywell gets in touch with Xingye building to understand building characteristics and needs for microgrid control ■ C3 is interested in licensing DER-CAM
12.	**U.S. Technical Next Steps**	■ Work with Xingye to develop an EnergyPlus model for the demo building ■ Assist Xingye with building design, amending DER-CAM as necessary ■ Develop methods to forecast building load ■ Identify a controls vendor ■ Build interface for Operations DER-CAM to selected control system ■ Complete modeling of lab operations model for electrochromic windows
13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	■ Chinese researchers are applying funding for 2014 ■ Preliminary BIM model for Xingye building is developed ■ Tianjin U. produced a load forecasting algorithm for Blg. 26 ■ BCAU is developing a PV electricity generation forecast model ■ Plan a kickoff meeting in BCAU with LBNL, Xingye, BACU, and Hefei institute of technology ■ Drawings of XingYe demo building is ready
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	■ Feb 2014, C Marnay traveled to DC and NY to visit microgrids in MD (White Oak), NY City (NY U.), and NJ, (Princeton U.), U.S. DOE, OE
15.	**Anticipated Travel in 2014** *(Dates, location, cost, source of funds)*	April, 2014, Beijing/Tianjin, CERC Nov 2014, U.S. DOE OE
16.	**U.S. Budget (2014)** *(Intended budget, funds received, costs to-date)*	FY11 74 k$/74 FY12 115 k$/65 k$ FY13 200 k$ b) starting with 200 k$ c) ending with 180 k$ (?)

		FY14 230k$
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	■ 500 k$ promised by C3
18.	**Issues of Concern and Suggested Solutions**	Engaging Honeywell in Xingye project is a long process Should engage a back-up supplier, e.g. Johnson Controls China side is still working on 2014 funding
	Prepared by:	Wei Feng & Nan Zhou
	Prepared on:	04/15/2014

Advance Ground Source Heat Pump Technology

1.	**Full Project Name**	Advance ground source heat pump technology for very low energy buildings
2.	**Reporting Period**	Q1_2014
3.	**U.S. Research Team**	Xiaobing Liu, Oak Ridge National Laboratory (ORNL)
4.	**U.S. Industry Partners**	ClimateMaster
5.	**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
6.	**China Industry Partners**	Unknown
7.	**One Sentence Project Highlight**	Improve GSHP systems' operational efficiency by optimizing controls of major equipment and the entire system
8.	**2014 Target Outcomes and Progress**	1. Improved efficiency of hot water generation by smart tank or distributed GSHP system by smart controls (ongoing, see following technical progress) 2. At least one invention disclosure on the smart tank or system smart controls (in preparation for an invention disclosure on the smart tank control**,** see following technical progress) 3. IEA heat pump conference paper on the field test and evaluation of alternative vertical bore GHXs (**Completed. This paper has been selected for an oral presentation at the 11th IEA heat pump conference in May 22-25 at Montreal, Canada**) 4. Invited ASHRAE Journal paper on ASHRAE HQ HVAC system analysis: distributed GSHP vs. VRF (ongoing, see following technical progress) 5. Conduct lab tests to verify performance of the smart tank (pending on CRADA, see following non-technical progress) 6. Assist in the design of the first-of-a-kind GSHP test bed (ongoing, see following non-technical progress) 7. ClimateMaster heat pump will be installed at other demonstration sites (ongoing, see following industry progress) 8. Technical support for the VLEB demonstration projects in China (ongoing, see following industry progress)
9.	**Quarterly Milestones and Deliverables (***Notable U.S. Technical Progress, Achievements, Findings)*	No milestone was planned for this quarter. Below are some technical progress and findings. • Evaluated field test results of a few tank water temperature control strategies for heat pump water heater (HPWH). It was found that elevating tank temperature a few hours prior to large hot water draws can avoid usage of supplemental resistance heaters and thus increase the operational efficiency of the HPWH. However, elevating tank temperature could reduce the efficiency when hot water usage is low. It indicates that the tank temperature schedule should be optimized based on the upcoming hot water usages. • Investigated domestic hot water (DHW) usage patterns in residential buildings in the US. We found that NREL has developed a series of data to

		represent typical patterns of major residential DHW usages. With these data, we will study optimal schedule of hot water temperature for the typical DHW usage. In addition, we also exploited several different machine-leaning techniques for predicting DHW usage in near future based on its short-term history. • Developed an innovative adoptive control strategy for the hot water tank tied with a GSHP unit (either an integrated unit or a conventional unit through a desuperheater). It automatically adjusts tank temperature set point, circulation water flow rate, and temperature settings for supplemental resistance heaters, based on operation mode of the GSHP unit, and a probability analysis of DHW usage pattern. • Developed a piping design to reduce heat loss from the hot water tank • Compared performance between the VRF system and the distributed GSHP system installed at the ASHRAE HQ.
10.	**Notable U.S. Non-Technical Progress, Achievements**	• The CRADA between ORNL and ClimateMaster for developing the smart control for hot water tank and distributed GSHP systems has been reviewed by DOE and will be sent out for signature by both sides • Revised the design of the ground heat exchanger for the proposed test bed of distributed GSHP systems at ORNL's FRP. Received a quote for installing the revised GSHP system and will discuss with ORNL and ClimateMaster for the implementation plan. • Prepared a presentation on this project for the BTO peer review
11.	**Notable U.S. Industry Progress**	• Provided technical support for the demo building at CABR • ClimateMaster is in negotiation with other demonstration sites for demonstrating its advanced GSHP units
12.	**U.S. Technical Next Steps**	• Conduct computer simulations with the typical DHW usage profiles developed by NREL to identify optimal schedule of hot water temperature for the typical DHW usages and also evaluate its impacts on the overall energy consumption of the GSHP system (including space conditioning and water heating) • Identify state-of-the-art in GSHP system control and exploit promising control strategies to improve operational efficiency of distributed GSHP systems • Work with industrial partners and ORNL facility management to develop a feasible plan for implementing the test bed for distributed GSHP systems
13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	The CABR demo is near completion. A DOE delegation led by Jonathan Elkind, the Acting Assistant Secretary of DOE, has visited the site on 17, February.
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	None
15.	**Anticipated Travel in 2014**	• BTO Peer review (travel cost is shared with another DOE funded project): April 22-24th, Washington, DC

	(Dates, location, cost, source of funds)	• 11th IEA Heat Pump Conference, May 12-16th, Montreal, Canada • CERC-BEE Annual Review, August 25-27th, Berkeley, California
16.	**U.S. Budget (2014)** *(Intended budget, funds received, costs to-date)*	CY13 carry over: $89.8K CY14 intended budget: $215K (received $107,500) Costs to-date: ~$39K
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	(a) $15K (b) $215K (c) Provided technical support on developing new control strategy for smart tank and attended IAB meeting. Will construct a test apparatus and conduct lab tests for the smart tank control in 2014.
18.	**Issues of Concern and Suggested Solutions**	
	Prepared by:	Xiaobing Liu
	Prepared on:	4/10/2014

Commissioning, Operation, Real Time Monitoring and Evaluation of Pilot

1.	**Full Project Name**	Commissioning, Operation, Real Time Monitoring and Evaluation of Pilot
2.	**Reporting Period**	Jan. 2014 to Mar. 2014
3.	**U.S. Research Team**	Xiufeng Pang, LBNL
4.	**U.S. Industry Partners**	Interface Engineering, PG&E
5.	**China Research Team**	Bin Hao, CSTC
6.	**China Industry Partners**	China Academy of Building Research
7.	**One Sentence Project Highlight**	Compare the Cx practice between US and China, and ensure the proper installation and operation of demonstrated technologies.
8.	**2014 Target Outcomes and Progress**	1. Organize two seminars in Beijing to promote the US Cx standard and industry practice. Progress: one US speak is confirmed. 2. Compare Cx practice between US and China. Provide the technical report for US companies that are interested in starting business in China. 3. Develop integrated functional testing protocol to ensure the proper installation and operation of demonstrated technologies.
9.	**Quarterly Milestones and Deliverables (***Notable U.S. Technical Progress, Achievements, Findings)*	Q1 milestone: Conduct project kickoff meeting. Progress: Done
10.	**Notable U.S. Non-Technical Progress, Achievements**	
11.	**Notable U.S. Industry Progress**	
12.	**U.S. Technical**	Q2 milestone:

	Next Steps	1. Organize two-day seminar in Beijing 2. Provide technical support to commissioning the CABR and Xingye demo buildings. 3. Identify the candidate buildings for the comparison.
13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	CABR demo building is soon to be occupied and will start the on-going Cx in the same time. Xingye is working on the design phase Cx.
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	None.
15.	**Anticipated Travel in 2014** *(Dates, location, cost, source of funds)*	1. Apr 22nd to Apr 30th, Beijing and Zhuhai, $3000, 40% CERC fund, 60% paid by others. 2. Jun 15th to Jun 22nd, Beijing and Shenzhen, $3000, 50% CERC fund, 50% paid by other project.
16.	**U.S. Budget (2014)** *(Intended budget, funds received, costs to-date)*	Intended budget: $75K Funds received: $25K Costs to-date: $0.
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	Contribution to-date: $0 Projected total: $50K Brief description: Principle of Interface Engineering will fly to Beijing to provide seminar to Chinese professionals to introduce US Cx standard and practice. He will cover most of the travel cost by himself. He will also contribute labor hours to develop Cx plan using US industry practice.
18.	**Issues of Concern and Suggested Solutions**	None.
	Prepared by:	Xiufeng Pang
	Prepared on:	4/10/2014

Research on Very Low-Energy Building Operations and Management Methods

1.	**Full Project Name**	**Research on Very Low-Energy Building Operations and Management Methods**
2.	**Reporting Period**	Q1 2014 (submitted April 10, 2014)
3.	**U.S. Research Team**	ICF International (ICF), Sustainable Energy Partnerships (SEP), and Lawrence Berkley National Laboratory (LBNL)
4.	**U.S. Industry Partners**	US-China Energy Cooperation Program (ECP) – Xu Haihong, Ma Li
5.	**China Research Team**	Research Counterparts: Center of Science and Technology of Construction (CSTC), Ministry of Housing and Urban-Rural Development (MOHURD), China Academy of Building Research (CABR) Advisors and Collaborators: Tsinghua University and Natural Resources Defense Council (NRDC)
6.	**China Industry Partners**	N/A
7.	**One Sentence Project Highlight**	***Task 1 – Building Energy Performance Database, Rating System, and Policy/Program Framework Development*** • Drawing on US and international experience, develop a policy/program framework, and supporting database and prototype benchmarking tool, to deliver widespread very low-energy buildings in China, thereby advancing the market for US energy-efficient building technologies and providing lessons to advance US building energy policies, databases, and rating systems. ***Task 2 – Evaluation and Energy Reporting Protocol for CERC Demonstration Buildings*** • An Evaluation and Energy Reporting Protocol for the five very low-energy demonstration buildings in China that ensures performance of the demonstration buildings can be consistently, fairly, and accurately evaluated and communicated. ***Task 3 – Collaboration on Building Energy Performance Monitoring and Standards*** • Summary of the innovative building energy data collection and regulatory policy being piloted in China, and identification of relevant lessons to advance building energy data collection methodologies, codes/standards, and policies in the US.
8.	**2014 Target Outcomes and Progress**	***Task 1 – Building Energy Performance Database, Rating System, and Policy/Program Framework Development*** • Final commercial (public) building energy performance database taxonomy for China which has been implemented on a pilot basis in one city or region. • Final prototype Excel-based tool(s) to rate (including normalization)

		commercial building energy performance in China following the ENERGY STAR methodology (with appropriate customizations for China). • Final report describing China's current situation related to building energy data and benchmarking and which proposes a program/policy framework that integrates a national building energy performance database and building energy performance rating system to drive very low-energy buildings in China. ***Task 2 – Evaluation and Energy Reporting Protocol for CERC Demonstration Buildings*** • An Evaluation and Energy Reporting Protocol, approved by MOHURD and DOE, for the five very low-energy demonstration buildings in China. • Template and training materials to support the implementation of the Evaluation and Energy Reporting Protocol. • Workshop to introduce and train demonstration project developers on the Evaluation and Energy Reporting Protocol. ***Task 3 – Collaboration on Building Energy Performance Monitoring and Standards*** • Technical/policy paper about real-time, on-line energy monitoring; innovations in building energy codes, standards, and policy; and the China quota standard for US DOE and publication.

9.	**Quarterly Milestones and Deliverables (***Notable U.S. Technical Progress, Achievements, Findings)*	***Task 1 – Building Energy Performance Database, Rating System, and Policy/Program Framework Development***
		• Began sharing technical information with CSTC on building energy performance databases and methodology for development, including US Department of Energy (DOE) Building Performance Database (BPD), US DOE Standard Energy Efficiency Data Platform (SEED), and US DOE Building Energy Data Exchange Specification (BEDES).
		• Initiated development of a commercial (public) building energy performance database taxonomy for China.
		• Shared technical information with CSTC on approaches for building energy performance rating, including:
		  o ENERGY STAR Portfolio Manager
		  o US DOE Asset Scoring Tool
		• Developed and delivered the following presentations to CSTC, Tsinghua, CABR, and MOHURD in working meetings from December 2013 to April 2014:
		  o *High-Level "Overview of Benchmarking" (Dec 2013)*
		  o *ENERGY STAR Building Energy Performance Benchmarking Tool Development Process (Dec 2013)*
		  o *Background of the ENERGY STAR Benchmark – Context and Objectives (Jan 2014)*
		  o *ENERGY STAR Building Energy Performance Benchmarking Tool Development Process (Revised)(Jan 2014)*
		  o *DOE Asset Scoring Tool Overview (Apr 2014)*
		  o *ENERGY STAR Portfolio Manager 19 building types – Definition and Key Factors(Apr 2014)*
		
		Task 2 – Evaluation and Energy Reporting Protocol for CERC

		Demonstration Buildings • Initiated development of an Evaluation and Energy Reporting Protocol for the five very low-energy demonstration buildings in China. ***Task 3 – Collaboration on Building Energy Performance Monitoring and Standards*** • Initiated development of research topics and questionnaires for CSTC, CABR, ICF Emissions Trading Scheme (ETS) team, and Tsinghua on real-time, on-line energy monitoring; innovations in building energy codes, standards, and policy; and the China quota standard for US DOE report.
10.	**Notable U.S. Non-Technical Progress, Achievements**	• Developed and submitted PPT for the DOE Building Technologies Office (BTO) Peer Review in Washington, DC in April 2014 on CERC Project #F1: Research on Very Low Energy Building O&M Methods. • Developed management calendar and initiated scheduling of May meetings with MOHURD, CSTC, Tsinghua, and CABR on three research tasks.
11.	**Notable U.S. Industry Progress**	N/A

12.	**U.S. Technical Next Steps**	***Task 1 – Building Energy Performance Database, Rating System, and Policy/Program Framework Development***
		• Continue sharing technical information with CSTC, CABR, and Tsinghua on building energy performance databases and methodology for development, including US DOE BPD, SEED platform, and BEDES.
		• Develop first and second draft commercial (public) building energy performance database taxonomy for China.
		• Continue to share technical information with CSTC on approaches for building energy performance rating, including:
		  o ENERGY STAR Portfolio Manager
		  o US DOE Asset Scoring Tool
		• Develop first draft prototype Excel-based tool(s) to rate (including normalization) commercial building energy performance in China following the ENERGY STAR methodology (with appropriate adaptations/customizations for China.)
		
		Task 2 – Evaluation and Energy Reporting Protocol for CERC Demonstration Buildings
		• Develop draft Evaluation and Energy Reporting Protocol.
		• Share final draft Evaluation and Energy Reporting Protocol with MOHURD/DOE.
		• Develop draft template and draft training materials/other collateral to align with latest Protocol.
		
		Task 3 – Collaboration on Building Energy Performance Monitoring and Standards
		• Obtain updates on real-time building energy monitoring; innovations in

		building energy performance codes, standards, and policies in China, and the development of the energy quota standard. • Develop initial draft of full paper. • Submit initial draft technical/policy paper to US DOE.
13.	**Notable China Progress** *(a) research and technical achievements* *(b) demonstration projects*	• Developed China research team to analyze various methodologies for building energy performance database development and benchmarking/rating, and to push forward appropriate methodologies for China in these areas that includes: CSTC (Dr. Hao Bin and Liu Shan), MOHURD (Dr. Liang), Tsinghua (Dr. Yan Da), and CABR (Dr. Song and Wei Zheng). • CSTC, CABR, and Tsinghua held working meetings in December 2013, January 2014, and April 2014 with ICF on the following topics: o *High-Level "Overview of Benchmarking" (Dec 2013)* o *ENERGY STAR Building Energy Performance Benchmarking Tool Development Process (Dec 2013)* o *Background of the ENERGY STAR Benchmark – Context and Objectives (Jan 2014)* o *ENERGY STAR Building Energy Performance Benchmarking Tool Development Process (Revised)(Jan 2014)* o *DOE Asset Scoring Tool Overview (Apr 2014)* o *ENERGY STAR Portfolio Manager 19 building types – Definition and Key Factors(Apr 2014)* • CSTC delivered presentations to ICF, CABR, and Tsinghua on the following: o Building Energy Quota Standard development (Jan 2014) o Research on US and European models for data collection and database development (April 2014) • Tsinghua delivered presentations to ICF, CABR, and CSTC on the following: o Use of DEST simulation tool for building energy performance database development and benchmarking.
14.	**Completed Travel in 2014** *(Dates, location, cost, source of funds)*	None.
15.	**Anticipated Travel in 2014** *(Dates, location, cost, source of funds)*	ICF: • US DOE BTO Peer Review April 18th – 24th, Washington, DC, $3,400, US DOE CERC. • CERC Mid-Term Review August 25th -27th, San Francisco, CA, $3,000 US DOE CERC. SEP: Meetings in China with experts/collaborators, likely June or September: $3,500

16.	**U.S. Budget (2014)** *(Intended budget, funds received, costs to-date)*	ICF Task 1 and 3 Budget: $100,000 Funds Received To-Date: $50,000 Costs To-Date: $7,563 SEP Task 2 Budget: $20,000 Funds Received To-Date: $10,000 Costs To-Date: $0
17.	**U.S. Industry Cost-share (2014)** *(a) Contribution To-date ($)* *(b) Projected Total ($)* *(c) Brief Descriptions*	N/A
18.	**Issues of Concern and Suggested Solutions**	None.
	Prepared by:	Carolyn Szum and Adam Hinge
	Prepared on:	April 10, 2014