

National Association of State Energy Officials

Response to

Department of Energy

Funding Opportunity Number DE-FOA-0000105

*“Net Zero Energy Commercial Building Initiative
Supporting Consortium”*

Project Title:

Supporting Consortium for the DOE Net-Zero Commercial
Buildings Initiative
July 13, 2009

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Project Narrative

Introduction

A growing consensus has emerged that supports aggressive action to improve building energy efficiency dramatically to respond to global climate change by reducing their emissions from energy use. Current efforts to improve energy efficiency have already made important contributions, but their progress to date in the commercial sector is not sufficient to achieve the aggressive savings needed to bring about the reductions in energy and carbon needed to truly meet the climate change challenge. Some programs achieve 5 to 30 percent savings through incremental technology improvements, improved codes and standards, voluntary programs, utility incentives, design assistance, and tax credits. Other efforts reach 30 to 70% savings (e.g. demonstration projects with the most advanced technology)—but these improvements cover very few buildings.

By 2030, *new* commercial construction in the United States will be zero-energy. This can be achieved by implementing aggressive energy efficiency measures to reduce demand by 80%, and meeting the remaining energy requirements through renewable resources. These measures will also be applied to *existing* commercial buildings, to reduce the energy demand in the existing stock by 50%.

The Zero Energy Commercial Building Consortium, proposing to serve as the Supporting Consortium for DOE's Net-Zero Energy Commercial Buildings Initiative, will bring together industries and other relevant private sector parties, research institutions, and government entities to compile performance and cost information on technologies; identify market barriers and solutions; facilitate communication among stakeholders; and distribute this information to inform and guide stakeholder decisions. The aim of this project is to create an umbrella in which every stakeholder is working in a coordinated way toward the same goal. This effort will help accelerate the introduction of current and new technology to the marketplace and transform the entire commercial buildings sector to achieve DOE's net-zero energy goals. Partnership and innovation can make this happen. More information about the Consortium is

available at: www.zeroenergycbi.org.

Project Objectives

This project will be implemented by the Zero Energy Commercial Buildings Consortium. As specified in EISA Subtitle B, Sections 421 and 422, the Consortium's broad membership includes leading national and regional organizations representing the building design and construction community, equipment manufacturers and vendors, operations, finance, and other stakeholders and experts. Through the Consortium's Operating Agent (the National Association of State Energy Offices, NASEO), these members will support DOE, its National Laboratories, and the Commercial Building Energy Alliances and National Accounts partners in achieving the DOE and statutory goals of creating by 2025 technologies and design approaches that enable net-zero-energy commercial buildings that are economic and market-acceptable, and achieving such performance levels for new commercial buildings by 2030 and throughout the commercial buildings stock by 2050. Specifically, the Consortium will build on existing technology roadmaps, market assessments, and related work by DOE, National Labs, and others to:

- 1) Compile and assess, from an industry perspective, information on the **performance and cost of current and next-generation technologies, systems, and practices** that can serve as a knowledge base for industry to achieve net-zero energy performance in new and existing commercial buildings;
- 2) Identify the **market potential, barriers, and strategic solutions** needed to accelerate deployment and widespread use of these technologies, systems, and practices in new and existing commercial buildings;
- 3) **Disseminate this information** to inform and guide decisions by all participants in the commercial building delivery and operations chain as well as national, regional, and local policy makers; and
- 4) **Coordinate** activities and promote the full exchange information with DOE commercial sector partners; other federal agencies; utility, state, and local initiatives; and private sector activities related to advancing the energy performance of commercial buildings; technologies.

We envision the Supporting Consortium as complementing the commercial-sector focus of DOE's Energy Alliances and National Accounts by:

- Extending the focus from relatively near-term measures to include emerging (pre-commercial), next-generation technologies and systems that can achieve much deeper energy savings through systems integration and performance assurance over the building's life-cycle;
- Organizing a sustained dialogue between the suppliers of energy-efficient products and services and their customers: the developers, owners, and operators in each commercial subsector represented in many cases by the Energy Alliances and National Accounts;
- Providing a structure and process to encourage participants across the entire supply side of the market – the delivery-chain for zero-energy buildings – to mobilize, organize, and coordinate their efforts to turn emerging technologies, practices, and services into new business opportunities.

Merit Review Criterion Discussion

1. TECHNICAL APPROACH; *1.1 Comprehensiveness of the approach to adequately identify and advance next generation technologies leading to net-zero energy commercial buildings.*

As described under Task 2, the Consortium will conduct a thorough review and analysis of both published and unpublished sources of information on new, emerging, and potentially needed technologies for zero-energy commercial buildings, including work by DOE national labs, leading building science researchers in the US and internationally, and industry leaders in technology innovation. The strong representation of industry and professional associations within the Consortium membership and Steering Committee provides DOE with unprecedented reach and access to a network of both suppliers and users of advanced technology for new and existing commercial buildings; we will actively engage this network to develop and review the Next Generation Technology Report in Year 1, and to continue updating and extending that report in Years 2 and 3.

1.2 Adequacy of proposed activities to develop an effective net-zero energy knowledge base as well as dissemination of information.

As discussed under Tasks 3 and 4, the Consortium will reach out to the entire commercial buildings delivery and ownership/operating community to share the results of our technology and market analyses, making use of our broad membership and national scope as well as continuing collaboration with the five DOE Energy Alliances, DOE National Accounts partners, DOE National Laboratory team, states and regional organizations, and other stakeholders.

1.3 Clear specification of approach focusing on both existing and new commercial buildings.

Our implementation of Tasks 2, 3, and 4 addresses technology assessment, analysis of cost and non-cost barriers and solutions to achieve widespread market acceptance of these technologies, and coordination with other significant participants in the commercial building delivery and ownership/operating processes. We explicitly address the different opportunities and constraints for technology advancement and improved energy performance in new buildings *versus* the more limited options for improvements in existing stock. On the one hand, the long lifetime of most commercial buildings underscores the need for newly-constructed buildings to maximize their energy-saving potential (especially for siting, orientation, and structural features that are “locked in” for many decades), and to make the building “technology-ready” for future upgrades, including on-site renewable power. At the same time, we recognize that most larger commercial buildings also have a periodic cycle of major renovations, which offer opportunities to significantly improve the energy performance of both envelope and mechanical systems.

1.4 Comprehensiveness in approach to address at least 80% of the national footprint of building floor space in each of the five (5) target markets.

The Consortium will focus our technology and market analysis, outreach, and coordination activities on the five target markets identified by DOE, working primarily through the five DOE Building

Alliances and National Accounts partners, but also using the multi-sectoral perspectives of Consortium members who represent suppliers of advanced technologies and services across all of these commercial subsectors. In addressing the major opportunities for advancing zero-energy enabling technologies in these target sectors, we will be guided by a wide range of existing and ongoing analyses, as indicated in the initial list of references in Appendix I including NREL studies (Griffith et al. 2006), ASHRAE Advance Design Guides, and net-zero energy buildings documented within DOE's High-Performance Buildings data base (<http://zeb.buildinggreen.com/>).

2. TECHNICAL AND MANAGEMENT CAPABILITIES; *2.1 Breadth of representation among design, equipment, operation, finance, and other groups of the commercial building industry.*

Although we will continue throughout the project duration to invite all interested parties to participate in the Zero Energy Commercial Buildings Consortium, the current membership already represents one or more of each of the categories identified in the DOE FOA and in the CBI authorizing legislation (EISA Subtitle B), including professional organizations or companies with expertise in: HVAC, building envelopes and construction materials, windows, lighting, mechanical systems, energy management systems and intelligent controls, building integrated renewable technologies, indoor air quality, advanced sensors, fuel cells, design professionals, developers, construction, finance and real estate, building owners, academic and research organizations, building code organizations, high-performance green building organizations, intelligent building and systems experts, utility energy efficiency programs, manufacturers, public transportation experts, and NGO energy efficiency organizations.

2.2 Depth of applicant technical expertise in technology-specific performances and costs.

As shown in the summary biographies of key personnel, our team, including NASEO staff and subcontractors, offers many years of professional experience working with technology and policy

issues related to commercial building energy performance. The industry and professional associations represented on the Consortium Steering Committee include not only on-staff experts, but association memberships which in turn encompass dozens of leading architecture, engineering, and manufacturing firms, as well as developers/owners of commercial buildings. Several of the associations involved as Steering Committee or Consortium members also manage their own buildings research programs, providing national and international leadership in key fields related to commercial building energy performance (ASHRAE, USGBC, AHRI, ASERTTI, Texas A&M, United technologies, and EPRI).

2.3 Adequacy of the plan for managing the membership of the consortium.

Membership in the Consortium remains open to any interested organization or individual. Upon the advice of the Steering Committee (see criterion 3.1), Consortium members may be invited by the Operating Agent to participate in one or more working groups on specific topics. Every Consortium member will have an opportunity to review and comment on Consortium reports and other products prior to final release.

2.4 Depth of applicant's experience in organizing and managing technical meetings, program reviews, and technical collaborations.

Along with the Operating Agent (see criterion 3.1), each of the Steering Committee member organizations has extensive experience with organizing and managing professional and technical committees, regional and national conferences, and targeted workshops – along with highly skilled meeting planners and other administrative support staff. Most have engaged in numerous collaborative projects on scientific and technical issues, and our technical staff and/or members are often called on for expert testimony and to serve on senior advisory committees at the industry, state, or national levels.

2.5 Likelihood of sustainability of the Supporting Consortium after the federal funding period.

A business plan to guide and sustain the Consortium will be prepared in Year 3 in consultation with DOE and Consortium members, and included in the Final Project Report to DOE. Note that all members of the Steering Committee – and the great majority of other Consortium members – are large organizations with a long track record, substantial resources, and a long-term commitment to commercial building energy performance. Assuming that DOE wants the Consortium to continue effectively fulfilling its function as a partner in advancing commercial buildings toward the goal of net-zero energy, we are confident that we will be able to identify resources and in-kind efforts to sustain this work after the 3-year project period.

3. PROJECT MANAGEMENT; 3.1 *Quality and completeness of the management systems and team structure proposed. Considerations will include procedures/planned approach for coordination with the Commercial Director or delegated appointee, NLCBT, CBEAs, and the Partnership Consortia.*

As discussed below under Roles of Participants and also in the Project Management Plan, the Consortium is designed as a virtual organization. All administrative, fiscal, and contracting responsibilities are centered in the National Association of State Energy Officials (NASEO), serving as the Consortium’s Operating Agent and subcontracting to other organizations to perform selected tasks identified in the Annual Work plan. A Steering Committee, currently composed of eleven leading national organizations (10 committed, 1 invited), will guide the work of the Operating Agent, with a chair and other officers selected by Steering Committee members. In the event that a DOE grant is awarded to the Consortium, DOE will be invited to have an *ex officio* representative on the Steering Committee. Additional members will be considered as circumstances require. A charter and full set of bylaws to govern the Steering Committee are in preparation, and will be finalized once a DOE decision is made on funding to be awarded under this FOA.

3.2 Soundness of the Project Management Plan with respect to proposed tasks, milestones, and organizational structure to achieve project objectives (including overall approach to risk management).

The Project Management Plan and task descriptions under the Statement of Project Objectives clearly identify our approach, milestones, and deliverables for Year 1 in detail, and give a general description of how we plan to continue and build on these efforts in Years 2 and 3. As described under Task 1, the Project Management Plan as initially proposed will be reviewed in depth with DOE upon award of the contract, and then annually thereafter. Detailed work plans for Year 2 and Year 3 will be developed near the end of each preceding year, in consultation with DOE program managers and in light of project results up to that date.

We view the main source of project risk to be difficulty in obtaining information and participation from a wide range of commercial building actors, a risk we are confident in mitigating through the broad range of participants already committed to the Consortium and the high level of interest indicated in their letters of support as well as one-on-one conversations with the Operating Agent and Steering Committee membership.

3.3 Clarity, completeness, and adequacy of the proposed SOPO and schedule.

The sections of the SOPO outline our approach, including objectives, strategy, tasks, milestones, and deliverables in as much detail as the page-limit allows. The Operating Agent and other representatives of the Consortium are available at any time to answer DOE's questions or to provide additional information on request.

3.4 Clear evidence of abilities to successfully perform project management functions on projects similar in complexity and scope as well as reasonableness of key personnel time allotment to fulfill project management requirements.

The Operating Agent has a multi-year track record of organizing, leading, and managing large, complex projects with many participants. Similarly, all members of the Steering Committee and many other consortium members have both led and participated in multi-year projects as members of coalitions and multi-organization teams. In Year 1 the Project Manager (Kate Marks) will devote 20% of her time to this project, while the NASEO Technical Lead (William Nesmith) will commit 17% of his time; while Jeffrey Harris (ASE) will commit 10% of his time in Year 1. For other subcontractor personnel, time commitments will be determined as part of the selection process by the Consortium's Operating Agent and Steering Committee.

Relevance and Outcomes/Impacts

Relevance - Over the past several years policy makers have called for residential and commercial buildings to move toward net-zero energy use. However, beyond setting baseline efficiency levels within building codes and voluntary or demonstration programs, research on how to achieve net-zero energy consumption has been limited, and efficiency gains in existing buildings have typically been in the 10-30% range at best. The project will go beyond the concept of modest building retrofits and increases in baseline efficiency for new buildings to identify technologies, design approaches, project delivery mechanisms, and management systems necessary for net-zero use. Specifically, the project will examine integrated design strategies, equipment performance, building materials, systems and controls, financing, operating practices, performance monitoring and benchmarking, and other techniques to reduce energy consumption over the building's life. The research will also provide guidance on how these technologies and practices can be applied during design, construction, and operation of existing and new commercial buildings.

Outcomes/ Impacts - The resulting reports and/or technical papers will identify specific technologies and methods that will produce significant and measureable reductions in commercial building energy use.

The resulting research will be disseminated through multiple channels to every level of manufacturing, design, construction, and operation in the building delivery chain.

Roles of Participants

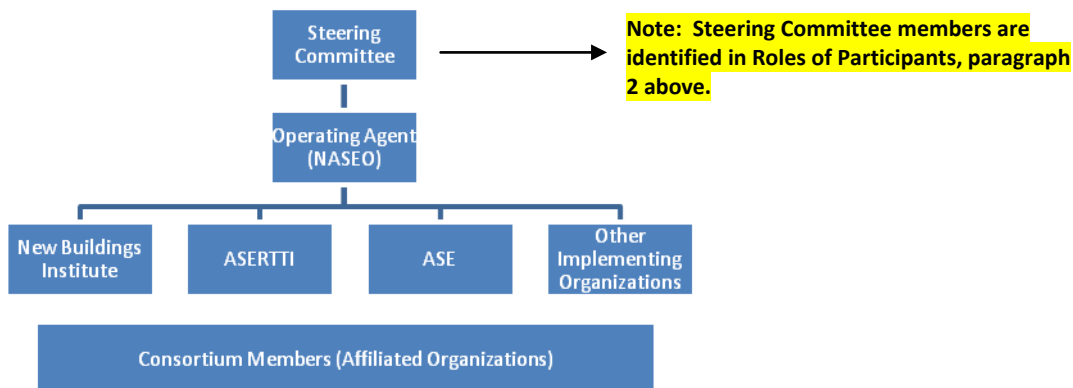
The project will be managed by the Zero Energy Commercial Building Consortium, a broad-based “virtual organization” administered by the National Association of State Energy Officials (NASEO), a 501(c)(3) organization, who will serve as Operating Agent for the Consortium, performing some subtasks directly (especially under Task 1) and contracting for others with implementing organizations as specified in the task descriptions; organize and support Steering Committee meetings and Consortium meetings/webinars; and ensure timely delivery of all required Federal reports and project deliverables. NASEO also will serve as technical lead offering specialized support for research and drafting of the technical reports and annual project reports to DOE.

While NASEO as the Operating Agent will have sole fiduciary responsibility for the project, it will be guided in policy and strategic matters by a Steering Committee that governs the work of the Consortium. In addition to NASEO, other members of the Steering Committee currently include the American Society of Heating, Refrigeration, Air-Conditioning Engineers (ASHRAE); New Buildings Institute (NBI); American Institute of Architects (AIA); Air Conditioning, Heating, and Refrigeration Institute (AHRI); Building Owners and Managers Association (BOMA); International Code Council (ICC); National Electrical Manufacturers Association (NEMA); US Green Building Council (USGBC); and Alliance to Save Energy (ASE) and the Association of State Energy Research & Technology Transfer Institutions (ASERTTI). Additional Steering Committee members will be considered as circumstances require. In the event that a DOE grant is awarded to the Consortium, DOE will be invited to have an *ex officio* representative on the Steering Committee.

Members of the Consortium itself (listed below) are a broad, multi-disciplinary group focused on researching, developing, and applying the technologies, tools, and processes necessary to achieve net-zero

energy performance in commercial buildings. While the Consortium members already satisfy the representative qualifications as outlined in the FOA, additional organizations and industry associations will be invited to join, or actively recruited based on identified needs throughout the term of the project. Among the implementing organizations initially identified for Year 1, the New Buildings Institute will play a key role in tracking and investigating the performance of low energy/zero net energy buildings. This activity will review reasons for performance success or limitations, and suggest paths to improve the measured performance of low-energy buildings. In addition to tracking project related information, NBI will conduct interviews with developers, engineers and architects of low-energy buildings to determine constraints on the design, construction and operation of low-energy buildings that might impact energy performance, and be suitable for future R&D to advance design, construction, and operating practices leading to net-zero energy. ASERTTI will provide input and member expertise in reviewing technical commercial buildings applied research and commercialization issues, and coordinate outreach and communication among the ASERTTI membership. The Alliance to Save Energy will lead the stakeholder collaboration and outreach efforts and offer staff support for website maintenance and webinar organization. Relationships among these project participants are summarized in the Organization Chart.

**Zero Energy Commercial Buildings Consortium
Organization Chart**



Consortium Members (as of 7/13/09)

- 3M
- AEC Science & Technology, LLC
- Air Advice
- Airxchange, Inc.
- American Council for an Energy-Efficient Economy (ACEEE)
- American Solar Energy Society (ASES)
- Biomass Thermal Energy Council
- Building Intelligence Group
- CALMAC Manufacturing Corporation
- Canadian Solar Buildings Research Network
- CB Richard Ellis (CBRE)
- Center for Environmental Innovation in Roofing
- Consortium for Energy Efficiency
- Continental Automated Buildings Association
- Cree, Inc.
- Daikin US
- Danfoss
- DCD Holdings, LTD
- Duke Energy
- Edison Electrical Institute
- EEMAX, Inc
- Efficient Windows Collaborative
- Electric Power Research Institute (EPRI)
- E-Mon, LLC
- Energy Systems Laboratory, Texas A&M
- Epstein
- Extruded Polystyrene Foam Association (XPSA)
- Good Energies, Inc.
- Green Building Initiative
- Green Buildings Finelite, Inc.
- GREENGUARD Environmental Institute
- GreenLink Alliance
- GRUNDFOS Pumps Corporation
- Guild Partners, LLC
- Heating, Air-Conditioning and Refrigeration Distributors International (HARDI)
- ICADE
- Illinois Institute of Technology
- Illuminating Engineering Society of North America
- Institute for Market Transformation
- interNational Association of Lighting Management Companies (NALMCO)
- International Institute for Sustainable Laboratories (I2SL)
- Jones Lang LaSalle
- M.E. Group
- Malachite LLC
- Massachusetts Department of Energy Resources
- McGraw-Hill Construction, Inc.
- McQuay International
- National Commission on Energy Policy (NCEP)
- National Hydrogen Association
- National Institute of Building Sciences
- Net Zero Energy Homes Coalition (multi-family)
- New York University
- North American Insulation Manufacturers Association (NAIMA)
- Northeast Energy Efficiency Partnerships (NEEP)
- Northwest Energy Efficiency Alliance (NEEA)
- Optimum Energy
- Penn State Indoor Environment Center
- PG&E Pacific Energy Center
- Philips Electronics, North America
- Polyisocyanurate Insulation Manufacturers Association (PIMA)
- Roger Williams University
- RPM International
- Ruskin
- Sain Engineering Associates
- Serious Materials
- Solar Buildings Research Network
- Somfy Systems, Inc.
- Southeast Energy Efficiency Alliance (SEEA)
- Southern California Edison
- Southern Company
- Southface
- Spray Polyurethane Foam Alliance
- Summit Blue Consulting
- Sustainable Engineering Group, LLC
- Teng and Associates
- Terrapin Bright Green
- Time Equities, Inc.
- Trane
- United Technologies Research Center
- University of Illinois at Chicago
- Urban Land Institute
- Watt Stopper/Legrand

NOTE: a) Areas of Expertise: HVAC (18); Building Envelope (17); Construction Materials (11); Windows (7); Lighting (9); Mechanical Systems (23); Energy Management Systems (11); Intelligent Controls (12); Building Integrated Renewable Technologies (9); Air Quality (6); Advanced Sensors (5); Fuel Cells (5)

b) Type of Organization: Design Professionals (12); Developers, Construction, Finance, Real Estate (18); Building Owners (5); Academic and Research (25); Building Code Organizations (8); High-Performance Green Building Organizations (15); Indoor Air Quality Experts (4); Intelligent Building and Systems

Experts (9); Utility EE Programs (12); Manufacturers (31); Public Transport. Experts (2); NGO EE Organizations (30)

STATEMENT OF PROJECT OBJECTIVES

Project Title: Supporting Consortium for the DOE Net-Zero Energy Commercial Buildings Initiative

A. OBJECTIVES

Project objectives are to:

- Compile and assess, from an industry perspective, information on the performance and cost of current and next-generation technologies, systems, and practices that can serve as knowledge base for industry to achieve net-zero energy performance in commercial buildings;
- Identify the market potential, barriers, and strategic solutions needed to accelerate deployment and widespread use of these technologies, systems, and practices in new and existing commercial buildings;
- Disseminate this information to inform and guide decisions by all participants in the commercial building delivery and operations chain as well as national, regional, and local policy makers; and
- Coordinate activities and promote the full exchange information with DOE commercial sector partners; other federal agencies; utility, state, and local initiatives; and private sector activities related to advancing the energy performance of commercial buildings technologies.

B. SCOPE OF WORK

The Zero Energy Commercial Building Consortium, as the Supporting Consortium for DOE's Net-Zero Energy Commercial Buildings Initiative, will bring together industries and other relevant private sector parties, research institutions, and government entities to compile performance and cost information on

technologies; identify market barriers and solutions; facilitate communication among stakeholders; and distribute this information to inform and guide stakeholder decisions.

C. TASKS TO BE PERFORMED

TASK 1.0 – REVISE PROJECT MANAGEMENT PLAN

NASEO will coordinate closely with NETL and DOE Program Managers in revision of the submitted Project Management Plan to comply with agreements reached during the award negotiation process and to ensure that our approach meets NETL’s needs, conforms to standard management and reporting practices, complements DOE’s other ongoing and planned program activities for CBI, and guides the project to successful completion.

TASK 2.0 – IDENTIFY POTENTIAL NEXT-GENERATION TECHNOLOGIES

Develop Technology Inventory - The first step in addressing next-generation technologies is to conduct an inventory of what is available in the marketplace right now and what technologies are under development in research institutions and industry product-development groups throughout the US and around the world. We will research technologies (including components, systems, and energy management practices) for each major end-use in commercial buildings, with a focus on the 5 target sectors associated with DOE’s Commercial Building Energy Alliances, as well as commercial “miscellaneous” equipment that is common to many subsectors or is has large load impacts within a limited set of buildings (for example, medical equipment). In conducting the inventory we will contact not only research organizations but also technology developers, manufacturers, and suppliers – along with the companies that would deploy the technologies in new and existing commercial buildings. All these participants in the technology supply chain are represented in the Consortium’s current and projected membership. The product of this activity will be a report identifying and characterizing promising new

technologies for commercial buildings. It will include details of the technology and the most common applications of the technologies.

We will examine all existing information sources including published and gray literature, DOE and National Lab R&D plans and roadmaps, industry internal RD& D and technology development activities; state RD&D programs, industry-sponsored research programs (including individual firms and trade/professional associations such as ASHRAE, AHRI, EPRI, USGBC, etc.) utility research on emerging technologies (such as the California Emerging Technology Coordination Council database (<http://www.etcc-ca.com/>) and similar programs by Bonneville Power Administration and others), proposed new activities such as the DOE “Energy Innovation Hub” for Buildings, and EU and other international sources (for an initial list of source materials see the References attachment). The selected technologies will be grouped into broad areas, such as:

Building design	Renewables – passive design, on-site
Building envelope – including passive solar features, thermal mass, trombe wall, etc.	Photovoltaics and wind
Space conditioning systems and controls	Efficiency of embodied energy in water use and construction materials
Water heating	Site orientation for natural cooling, shading, and solar exposure
Lighting – including daylighting and controls	Proximity to transit
Commissioning and operations	OTHERS
Information technology and controls	
Process Equipment, including standby loads	

Peer input and review will occur during the inventory process, through focus group meetings with key industry experts and researchers and also through a review process after the draft technology report is completed. We will also hold one-on-one meetings with selected industry, government, and research organizations such as national laboratories, university experts, and industry product development teams,

The draft technology inventory will also be thoroughly vetted with developers and other stakeholders, before the Year 1 report is finalized, and then again in the process of annual updates. The Technology Report will be shared on a national scale with developers, contractors, government officials, and others in the high-performance commercial building community, through our own Consortium members as well as participation by the project team in related workshops, conferences, and other meetings around the country.

TASK 3 – IDENTIFY NEEDED COST REDUCTIONS FOR INDUSTRY ACCEPTANCE

This task will identify needed technology cost reductions for industry acceptance as well as non-cost barriers that must be addressed through strategic market-based interventions. To do this, it is important to first identify the key technologies (Task 2) and then evaluate costs and other delivery-system issues and solutions during the design and construction phase – or, in the case of existing commercial buildings, leverage points in building operations, renovation, and changes in ownership and tenancy.

The Consortium will conduct an analysis of existing systems, methods, and procedures that can result in technology cost savings as well as performance improvements and reduction of non-cost barriers to technology acceptance. This will begin with a literature review, but also include evaluations of current experience with technologies development and deployment in commercial buildings. For example, the use of Integrated Project Delivery (IPD) by some design teams incorporates knowledge and expertise from all team members – owners, designers, and builders - at the very beginning of the project, as a means of significantly reducing total project costs and decreasing construction time (which also adds savings). The AIA IPD Committee will assist the Consortium on this and other issues to evaluate how cost savings can be achieved in the project delivery process.

The New Buildings Institute will serve a key role in tracking and investigating the performance of today's leading low-energy/ZNE buildings. This will include reviewing reasons for performance success or

limitations, and suggesting priority RD&D needs that can enhance the measured performance of low-energy buildings. This work will include:

- Review of low-energy buildings case studies, with an emphasis on measured performance.
- Analysis of features related to energy performance in case study buildings where sufficient data are available.
- Conduct more detailed follow-up work with selected buildings to better understand energy performance issues and decision processes. This work element will also draw on utility supplied process and impact evaluations of low-energy buildings activities, and NBI projects funded by other parties, including review of 23 buildings for the USGBC and a more detailed study of 13 buildings for the California Energy Commission.
- Incorporate this information on technologies and decision processes for buildings with exceptional energy performance to the existing DOE database on NZE and High Performance Buildings (<http://zeb.buildinggreen.com/>)
- Recommend steps to collect better data on new construction performance and features, based on another NBI project funded by the California Public Utilities Commission.

The Consortium will also interview building owners, architects, engineers, product/service suppliers, and other experts to identify non-cost barriers (i.e. transaction costs), constraints on the design, construction, and operation of low-energy buildings that might impact energy performance – and possible solutions. NBI will also conduct interviews with developers, engineers and architects of the low-energy buildings being reviewed as case studies to determine constraints on the design, construction, and operating practices that impact energy performance, and that might point toward additional R&D or other efforts. At least 25 interviews will be conducted annually, some of which may take the form of focus groups or workshops at other national or regional meetings where commercial building energy efficiency is one topic.

Further information can be gathered from invitational webinars and from the project team's participation in workshops at related/industry meetings and conferences. Incentives to build high performance buildings can play a significant role in encouraging developers to adopt and deploy next generation technologies. We will gather information about government sponsored tax credits, utility rebates, municipal system development charges, Local Improvement Districts, meter loans, etc., all of which are being employed in various parts of the country to stimulate the construction of high performance buildings. Finally, the AIA reports entitled "Local Leaders in Sustainability" examined various local green building programs across the country, such as expedited permitting, reduced building permit fees, tax incentives, grant/loan programs, etc. The Consortium will review the latest experience with these programs to gauge which are the most successful in incentivizing low-energy commercial buildings as part of green development.

TASK 4 – COLLABORATE WITH CBI STAKEHOLDERS

This task addresses project objectives #3 and #4, to disseminate to Consortium members and others involved in delivering, owning, and operating commercial buildings the knowledge base developed in Tasks 2 and 3 regarding technologies, systems, and practices for zero-energy commercial buildings (ZEB). Task 4 also involves the further development of strategies to improve energy performance, lower costs, and otherwise advance the market readiness and acceptance of technologies needed for both new and existing commercial ZEBs. Outreach and collaboration with participants in DOE's commercial building Energy Alliances will focus on the initial five target markets (Retailers, Commercial Real Estate, Hospitals, Higher Education, and State/Local Government), as well as DOE National Account partners and other commercial sector collaborative activities underway at the regional, utility, state, and metropolitan levels.

In Year 1 this Task will focus on establishing a broad network of relationships with the groups mentioned above and other public and private partners as identified in EISA Subtitle B, in collaboration with one or

more Partnership Consortia that DOE may recognize under EISA Section 421. Through targeted outreach, participation at industry and professional conferences, and tapping into the contacts of Steering Committee members, we will develop and promote our website (www.zeroenergycbi.org) as a widely known and actively used on-line information and networking resource. The aim will be to “connect the dots” within the commercial sector, linking members of the R&D, government/policy, and education/training communities to each other and to the private sector delivery chain for commercial buildings all the way down to the final customers: owners and tenants of commercial buildings.

Feedback from these diverse groups on the draft reports developed in Tasks 2 and 3, and interaction among them at conferences, workshops, and on-line webinars, will help the Consortium to identify remaining gaps in RD&D programs (Baum 2007; NSTC 2008) as well as overlaps and potential synergies among federal, state, utility, and industry-sponsored RDD&D programs. We will also prepare a targeted outreach and pilot implementation strategy to guide the effort in Years 2 and 3.

In Years 2 and 3, the Consortium will continue under this Task our outreach and network-building activities, while adding several new elements. As directed by DOE, we will undertake topical studies and meta-evaluations of existing programs and policies to address specific technology opportunities and constraints identified in Year 1. We will also assist the DOE Director of Commercial High-Performance Green Buildings, DOE staff, and Commercial Building Energy Alliances and other partners in designing pilot programs to test innovative strategies for deploying advanced technologies, practices, and systems that can dramatically improve energy performance in new and existing commercial buildings in different building types and climates.

While specific topics will be defined in consultation with DOE as part of our revised work plan at the end of Year 1, potential examples include:

- Developing and disseminating targeted education materials on the benefits and cost-effectiveness of zero energy commercial buildings, and conducting case studies of the decision and delivery processes as well as measured performance experience with new/emerging technologies in actual buildings (with results incorporated in the NZE portion of DOE's High-Performance Buildings Data Base).
- Further refining and field-testing strategies to help overcome the split incentives between builders and buyers and between landlords and tenants, and thereby bring energy efficiency decisions closer to a lifecycle economic perspective. (For example: "green leasing," building performance rating and disclosure, innovative financing for new construction or renovation including leasing of equipment upgrades, and re-configured tax incentives that focus on integrated design.)
- Working with practicing A&E professionals and educational institutions on workforce development and training to help building professionals and trades achieve cost-effective, high performance energy-efficient buildings. This could include an inventory and needs assessment, leading to collaborative expansion of existing resources such as the Builder Operator Certification program (<http://www.theboc.info/>) and the California-based Advanced Lighting Controls Training Initiative.
- Supporting code-setting organizations and state and local governments in addressing opportunities for building energy codes to advance energy-efficient design, construction, and renovation, and in particular to build in "technology-readiness" so that new commercial buildings have the flexibility to incorporate future technology advances over their 30-50+ year lifetimes.
- Helping to organize and manage technology and product assessment and new-technology procurement activities involving DOE's commercial building Alliances, National Account partners, and others (USDOE/FEMP 1997, tenCate et al 1998, Ledbetter et al 1999).

In general (and subject to the availability of resources), the Consortium's broad membership and open structure can be of special value in helping DOE to address **cross-cutting opportunities** for information-sharing and market transformation, such as:

- *Horizontal* integration to demonstrate integrated design processes and “deep” retrofits that include multiple building end-uses and systems and establish new business relations among diverse trades and supply-chain actors.
- *Vertical* integration across the utility meter to make buildings and component systems (including on-site renewables and CHP) more “SmartGrid compatible.”
- *Temporal* integration throughout the building life-cycle, through Building Information Management and other strategies,
- Strategies to address efficiency and thermal loads in the “other” commercial end-uses which in many buildings represent one-third or more of electrical loads (and growing).
- Diffusion of CBI-developed technologies and practices that are transferrable across commercial subsectors, and in particular among the five DOE Sectoral Alliances.
- Encouraging the exchange of information between DOE and closely related commercial building initiatives by states, utilities, municipalities, and private building developers and owners.
- Intergovernmental collaboration involving federal-state-local government partners to enhance public sector leadership in high-performance building design, construction, facilities management, project finance, and demand aggregation for bulk-procurement of new technologies.
- Identifying and fostering mechanisms to encourage the two-way flow of information between technology development (R&D) and technology deployment, so that field experience can flow “upstream” to help inform the agenda for DOE applied and even basic R&D.

TASK 5 – RESEARCH REPORT

The Zero-Energy Commercial Buildings Consortium will prepare an annual summary report on research conducted during each budget cycle. This report will include key findings from the *Next Generation Technology Report* (Task 2) and the *Analysis of Cost and Non-Cost Barriers and Solutions* (Task 3), as well as lessons learned, design practices and useful tools, construction and installation guidelines, commissioning and controls and operation for all technologies evaluated during the year. This report will

address both commercial building retrofits and new construction with specific emphasis on the five commercial submarkets identified by DOE.

The information provided in the annual reports will be available for public distribution and designed to allow the DOE to assess the applicability of the research results to the full range of activities under CBI, as well as inform its decision regarding the next budget period for this project. The final report will be delivered in Q3 of 2012 (assuming a three-year project starting Q4 of 2009) and will provide a comprehensive technical summary of the entire project. This final report will be peer reviewed and available for public distribution.

D. DELIVERABLES

Quarterly reports will be submitted for all budgeted periods which will include progress toward the proposed quarterly objectives as well as financial statements which will detail the costs incurred, specifying both the Federal and applicant share of such costs. There will be three annual reports which will address the following issues in chronological order: identification of next generation technologies, systems and practices; assessment of market and non-market barriers to introduction and widespread use of next generation technologies, systems and practices; outreach and dissemination of next generation technologies, systems and practices leading to net-zero commercial buildings. This final report will be laboratory published, peer reviewed and available for public distribution.

Supporting Consortium	2009	2010				2011				2012		
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Task 1 – Project Management Plan (PMP)												
Revision of PMP												
End of Year 1 Revision of PMP												
End of Year 2 Revision of PMP												
Develop Road Map												

Supporting Consortium	2009	2010				2011				2012		
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Task 2 – Identify Potential Next Generation Technologies												
Next Generation Technology Report (draft)												
Next Generation Technology Report (final)												
Report Update												
Task 3 – Identify Needed Cost Reductions for Industry Acceptance												
Publish Analysis of Barriers and Solutions												
Update Analysis of Cost and Non-Cost Barriers and Policy Solutions												
Task 4 – Collaborate with CBI Stakeholders												
Develop Targeted Outreach Plan												
Assess and Update Plan												
Task 5- Prepare <i>Final Technology Analysis Report</i>												
Prepare Annual Final Report												
Quarterly Progress Reports to DOE												

E. BRIEFINGS AND TECHNICAL PRESENTATIONS

The project team heading the Zero Energy Commercial Buildings Consortium will provide detailed briefings to the DOE Project Officer at a location of his/her choosing. These will occur on a quarterly basis or at the request of the Project Officer. The briefings will include quarterly progress reports from the preceding quarter as well as the project outline for the ensuing quarter. At least at least one peer reviewed technical paper will be presented at the DOE/NETL Annual NEA Meeting to be held at a location specified by the DOE Project Officer. Last, the project team will provide and present a technical report at the DOE/NETL Peer Review Meeting to be held at a location specified by the Project Officer.

APPENDIX I - REFERENCES

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