CBERD promotes innovation in energy efficiency through collaborative research, contributing to significant reduction in building energy use in both nations.

- Building IT systems
- Building Physical Systems
- Supplemental Applications

Task 1 CBERD Management

Task 2 Building Information Technology Systems

Task 3 Building Physical Systems

Coordinated Integration

Simulation

Passive / Envelope Design

Monitoring + BM

Adv Technologies: HVAC / Lighting

Control & Comm

Thermal / Occupant Comfort

Task 4 Supplemental Applications
Smart Grid Response & Connectivity • Renewable Integration • Cost Optimization

Task 5 Scientific Collaboration

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Lawrence Berkeley National Laboratory (LBNL)**

Project Summary

Timeline:

Start date: Oct 2012; Planned end date: Sep 2017

Key Milestones

1. Sample specification and selection guides for benchmarking and monitoring tools. (Sep 2013)

2. New techniques, documentation, and code/algorithms to address unique Indian benchmarking needs. (Sep 2014)

Budget:

Total DOE $ to date: $300 K (FY'13 and FY'14)

Total future DOE $: $450 K (FY'15-FY'17)

Target Market/Audience: Commercial Buildings

- Benchmarking programs

- EIS vendors

- Building owners and operators

Institutional partners	Industry partners
Center for Environmental Planning and Technology (CEPT), India	1. Synpasense, USA 2. Schenider Electric India 3. Wipro Eco-energy India

Project Goals

- Enhance and expand whole-building and system level benchmarking methods adapted for India and applicable to US benchmarking

- Develop cost effective, scalable systems to monitor real time performance in commercial buildings which can be integrated into EIS and metering products with broad applicability in the U.S. and Indian markets

Project start
Oct 2012

NOW

Project end
Sep 2017

Oct 2012   Oct 2013   Oct 2014   Oct 2015   Oct 2016   Oct 2017

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Purpose and Objectives

Problem Statement:
Advanced techniques of Benchmarking and Energy Information Systems (EIS) can enable up to 20% energy savings. However 3 key barriers exist:

1. Lack of actionable energy information to spur decisions in building design and operation
2. Dearth of scaleable, cost- effective approaches for building energy measurement and monitoring that can enable widespread market adoption
3. U.S. industry partners may not be adequately exposed to unique emerging markets such as India

Picture courtesy: Atelier Ten   Copyright Atelier Ten 2013

Target Market:
 Broad applicability to commercial building retrofit and new construction in the US and India

Target Audience:
- Benchmarking programs
- Owners, operators of commercial buildings
- EIS vendors

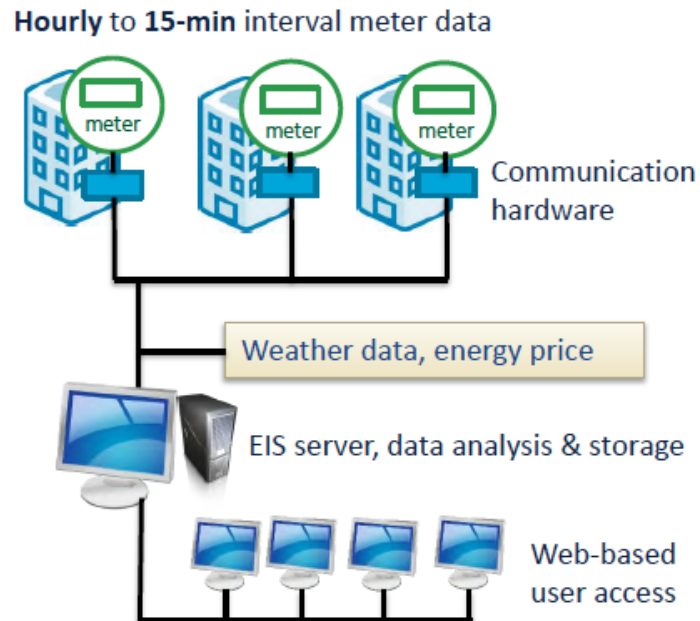U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

Purpose and Objectives

Impact of Project: Project outputs

1. NEW TECHNOLOGY:
    Guidelines and specifications for EIS solutions that address current challenges by being
    - Packaged
    - Scalable
    - Cost effective

Hourly to 15-min interval meter data

meter meter meter

Communication hardware

Weather data, energy price

EIS server, data analysis & storage

Web-based user access

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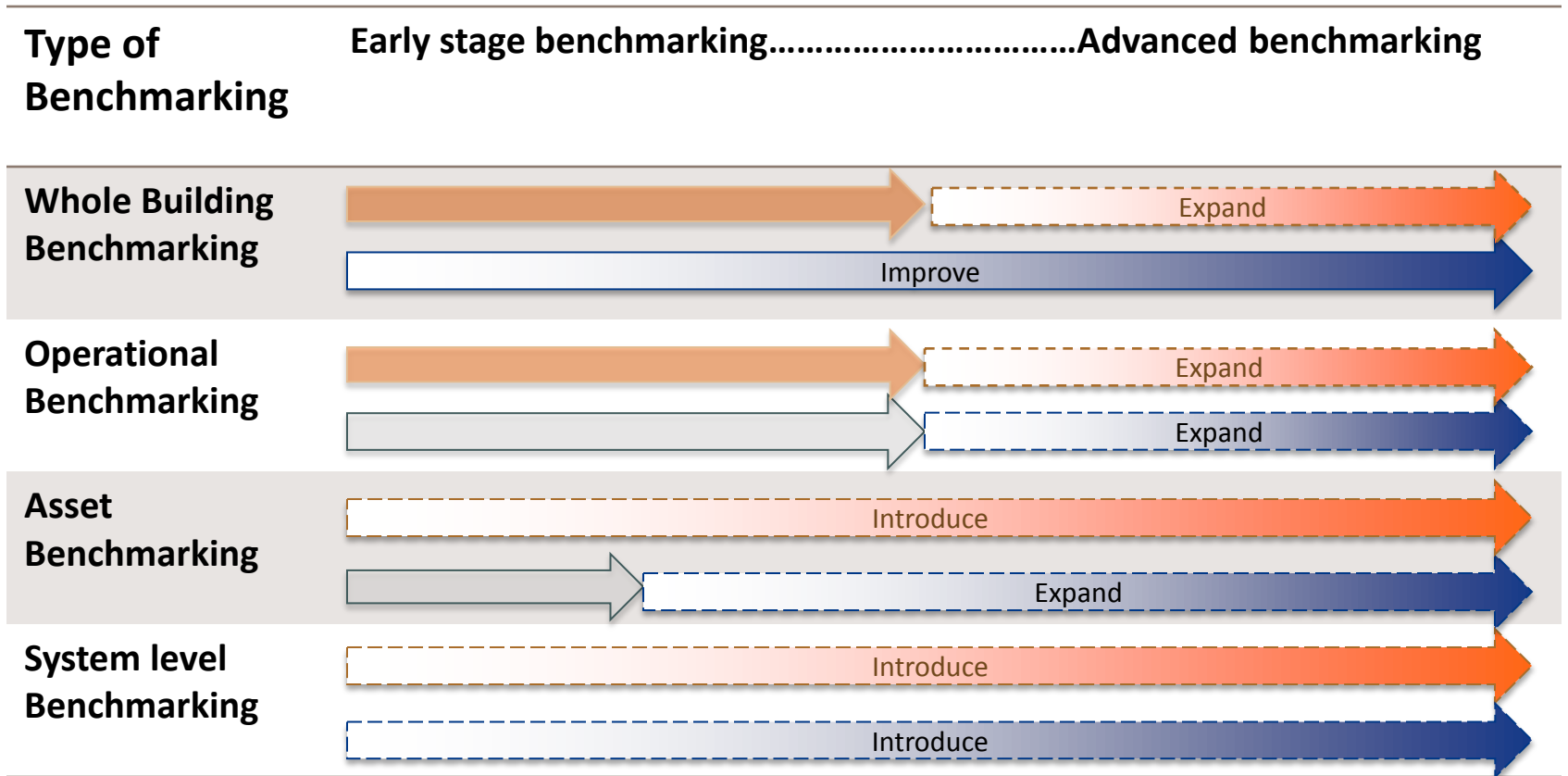
Purpose and Objectives

Impact of Project: Project outputs

2. NEW TOOLS/ METHODS/ALGORITHMS: An integrated suite of benchmarking methods, tools and practices; embedded into market-facing deployment programs and policies.

Type of Benchmarking	Early stage benchmarking…………………………Advanced benchmarking
Whole Building Benchmarking	Expand / Improve
Operational Benchmarking	Expand / Expand
Asset Benchmarking	Introduce / Expand
System level Benchmarking	Introduce / Introduce

KEY

India-current → US-current → CBERD contribution ⇢

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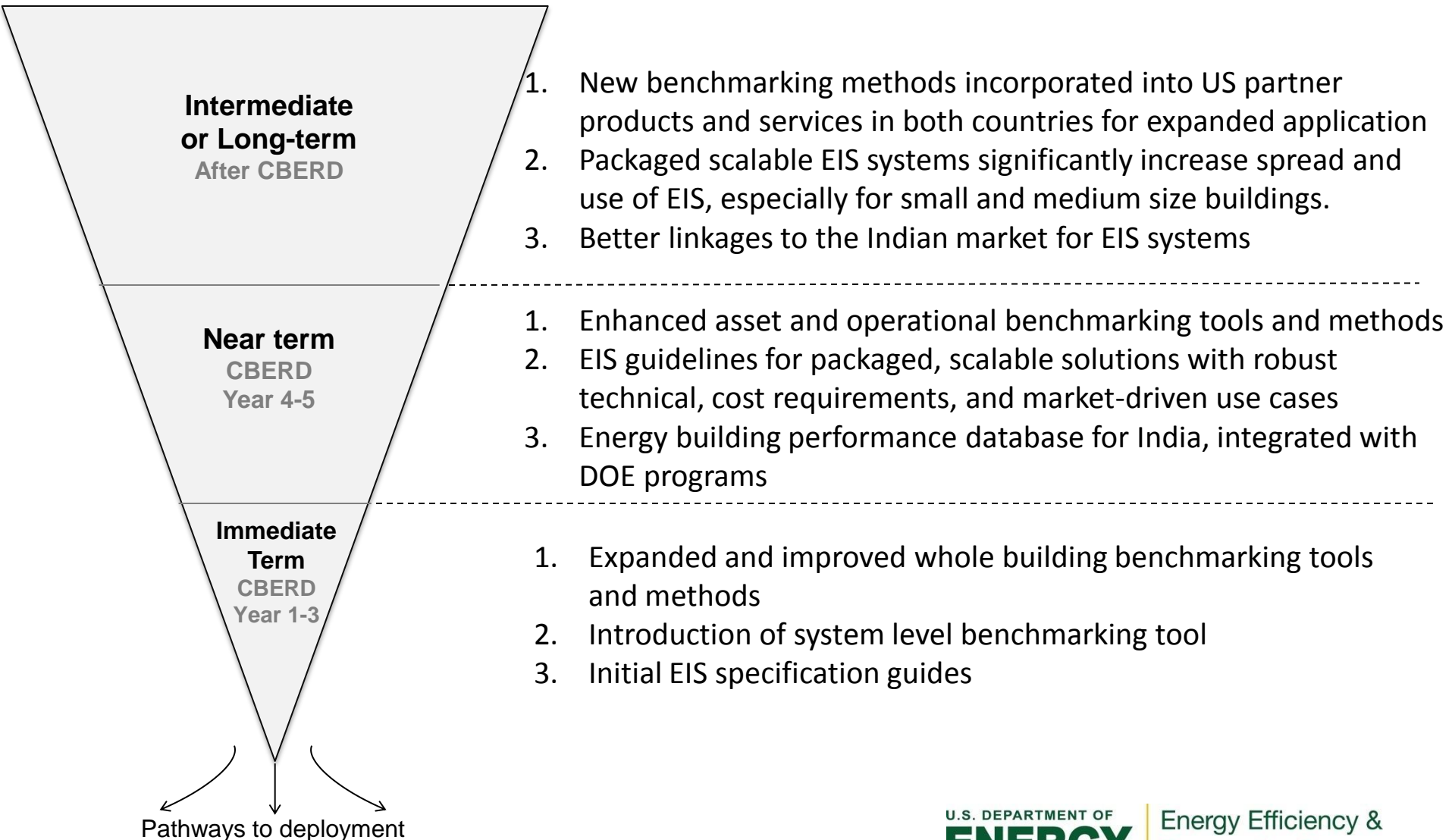
Purpose and Objectives

Impact of Project: Project outputs

3. NEW MARKETS: Create opportunity for U.S. technical and product expertise related to EIS to be effective at a global level such as an emerging Indian market
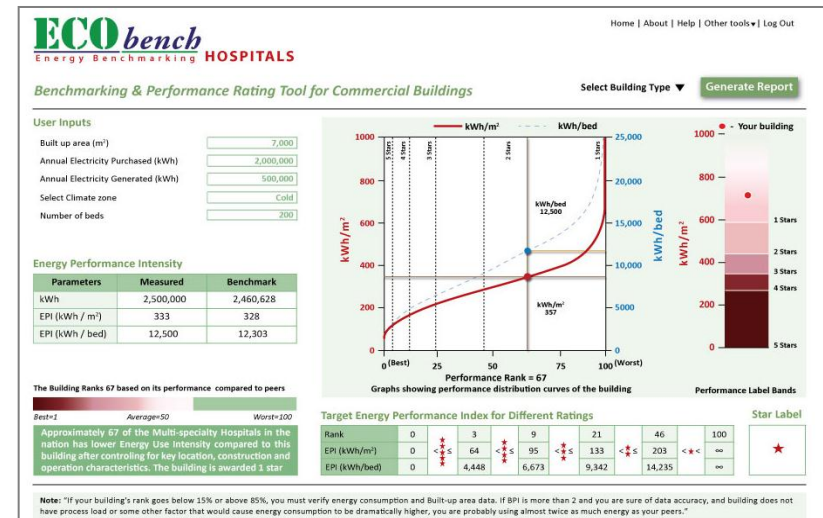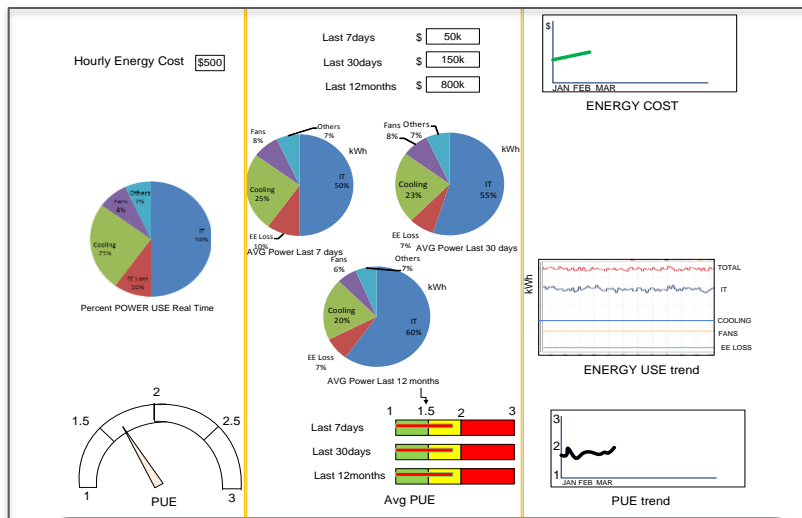
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Purpose and Objectives

Impact of Project: Measuring achievement towards goals

Intermediate or Long-term
After CBERD

1. New benchmarking methods incorporated into US partner products and services in both countries for expanded application
2. Packaged scalable EIS systems significantly increase spread and use of EIS, especially for small and medium size buildings.
3. Better linkages to the Indian market for EIS systems

Near term
CBERD
Year 4-5

1. Enhanced asset and operational benchmarking tools and methods
2. EIS guidelines for packaged, scalable solutions with robust technical, cost requirements, and market-driven use cases
3. Energy building performance database for India, integrated with DOE programs

Immediate Term
CBERD
Year 1-3

1. Expanded and improved whole building benchmarking tools and methods
2. Introduction of system level benchmarking tool
3. Initial EIS specification guides

Pathways to deployment

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Approach

Monitoring

- EIS Market Intelligence: Market segmentation; technical, usability and cost requirements for EIS solutions

- R&D: Sample specification and selection guides; cost-benefit framework for packaged EIS

- Deployment: Implement in 5-10 demonstration sites

Benchmarking

- Market Intelligence: Analysis of current state of the art, goals, use cases and gaps

- R&D: Develop new techniques/ algorithms for asset, operation and system level benchmarking.; Prototype next-gen database design, algorithms and tools

- Deployment: Training workshops; technical assistance to potentially Energy Star, India's BEE Benchmarking program etc
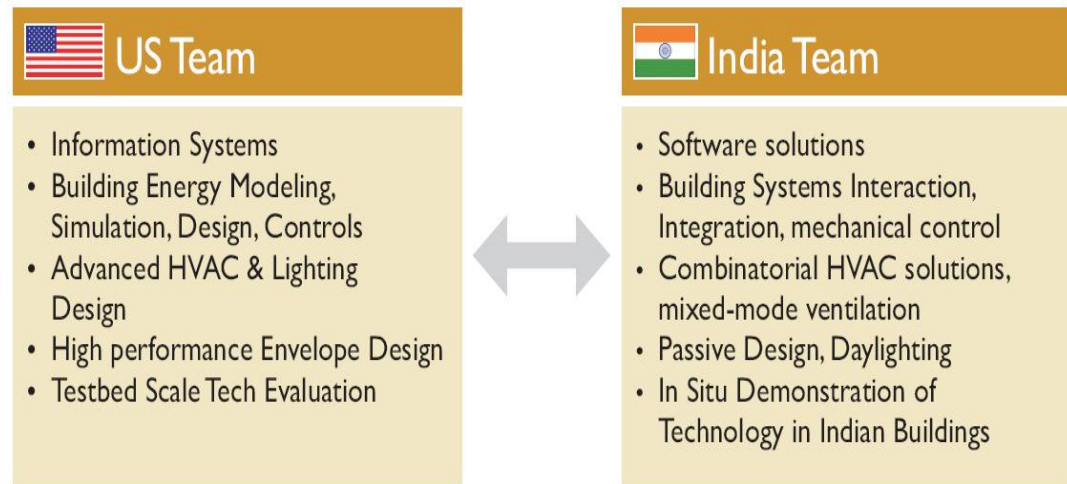
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Approach
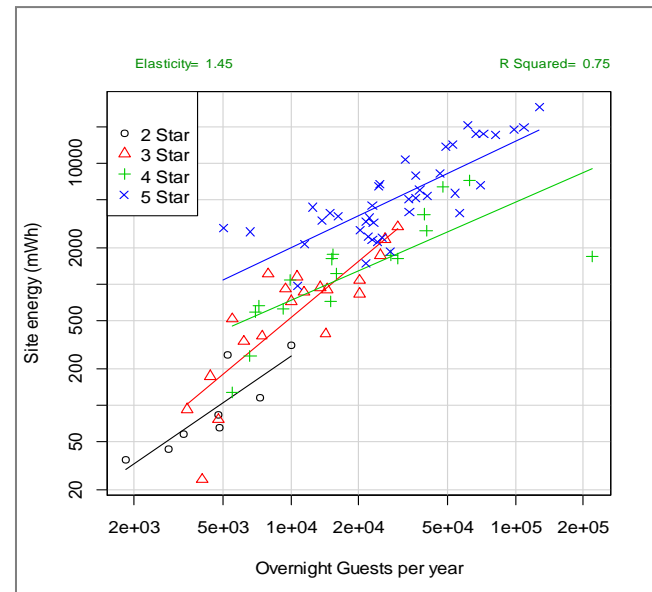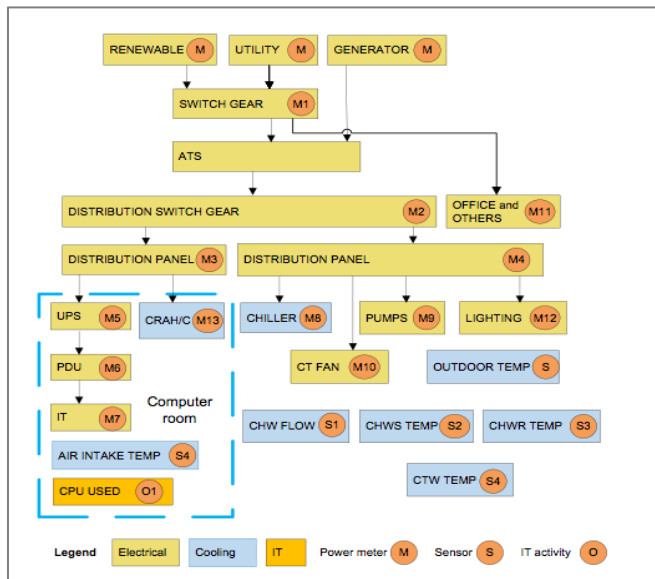
Key Issues and Lessons Learnt:
1. Important to have early and frequent engagement with industry partners: continue to leverage current partners; obtain additional US partners
2. Consistently tighten connections with deployment channels since PACE-R not directly touching the market: leverage vendor, owner, practitioner communities for concept awareness, technical and market input on EIS
3. Maintain frequent communications and face-to-face interactions to overcome the general challenges of international collaboration

Distinctive Characteristics
- Opportunities for bilateral learning - quick lessons from early proof of concept projects in India can provide valuable lessons for the US
- Early market intelligence gathering and rapid deployment of EIS prototypes in India can lead to growth opportunities for US EIS vendors
- Leveraging connections to India as an IT powerhouse for co-development can be a win-win situation

US Team
- Information Systems
- Building Energy Modeling, Simulation, Design, Controls
- Advanced HVAC & Lighting Design
- High performance Envelope Design
- Testbed Scale Tech Evaluation

India Team
- Software solutions
- Building Systems Interaction, Integration, mechanical control
- Combinatorial HVAC solutions, mixed-mode ventilation
- Passive Design, Daylighting
- In Situ Demonstration of Technology in Indian Buildings

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Progress and Accomplishments

Monitoring

Dissemination of EIS work-stream outputs
- Datacenter EIS guidelines being advanced by US industry partner Sypansense for use by their potential clients
- Webinars being developed on Datacenter EIS guidelines for forums such as Better Buildings Alliance, Datacenter Dynamics, Indian Green Building Congress

Benchmarking

R&D work products are informing more rigorous benchmarking as a practice
- New Action Plan on Benchmarking for India under review by Indian Ministry of Power (Bureau of Energy Efficiency)
- CBERD data collection approach being used for next phase of data collection in India
- New analysis of hospital and hotel data sets with expanded variables being done

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Project Integration and Collaboration

Industry partners

Technology & Product Industry

Real Estate Developers

Organizational Partners

R&D institutions

Academic Institutions

Synapsense, Schneider, Wipro: current industry partners providing in-kind cost-share and market inputs into guidelines and EIS products

Infosys: Early adopter and market leader, will run pilots for benchmarking tools and demonstrations of EIS in their buildings across various cities

LBNL: R&D lead partner, leveraging domestic experience in monitoring and benchmarking

CEPT: Access to Indian data and methods; leverage for training and workshops
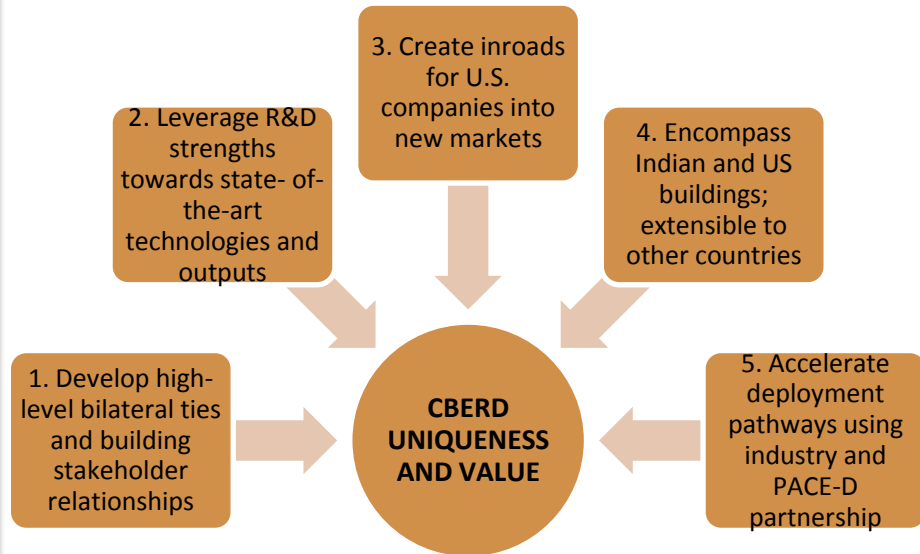
Communications protocol

- Weekly Indian and US R&D team calls

- Monthly calls with industry partners

- Annual face-to-face whole-team charrettes

- Semi-annual CBERD Forum leveraged for sub-task meeting

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Next Steps and Future Plans

Next Steps

1. Complete the data analysis on hotels and hospitals based on previous Indian ECO III data

2. Continue to work with deployment channel such as BEE and USGBC/IGBC for uptake of new benchmarking methods and algorithms

3. Develop new guidelines and specifications for EIS for various types of commercial buildings

Overall CBERD Future Plans

2. Leverage R&D strengths towards state- of-the-art technologies and outputs

3. Create inroads for U.S. companies into new markets

4. Encompass Indian and US buildings; extensible to other countries

1. Develop high-level bilateral ties and building stakeholder relationships

CBERD UNIQUENESS AND VALUE

5. Accelerate deployment pathways using industry and PACE-D partnership

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Progress and Accomplishments

Market Impact:

CBERD Outputs

- Methods, algorithms and actionable analysis on real buildings characteristics and energy performance for both India and US

- Guidelines and specifications for packaged, scalable, cost effective EIS solutions

Outcomes

- New data collection and benchmarking approach for next phase of benchmarking activities in both countries
- Targeted technology development for EIS solutions: industry partners to incorporate packaged EIS in their product offering; owners to use guides for informed product decision making

Actual/measured impacts

- Increase in projects benchmarked in US and India using CBERD advanced method (#)
- Better data on project performance (actionable information)
- More EIS deployed across the building sector(#)
- Stronger foothold of US EIS products in emerging market ($)

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REFERENCE SLIDES

Project Budget

Project Budget: Through DOE funding for CBERD: $150K per year for 5 years
Variances: None
Cost to Date: $227K
Additional Funding: In kind- cost share from U.S. industry partner Sypansense ($450K per year)

Budget History					
FY2013 (past)		FY2014 (current)		FY2015 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
$150K	$450K	$150K	$450K	$150K	$450K

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Project Plan and Schedule

Project Schedule													
Project Start: Oct 2012		Completed Work											
Projected End: Sep 2017		Active Task (in progress work)											
		◆ Milestone/Deliverable (Originally Planned)											
		◆ Milestone/Deliverable (Actual)											
		FY2013				FY2014				FY2015			
Task: CBERD Monitoring and Benchmarking		Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)
Past Work													
FY2013 Q1 Milestone: Development of a detailed scope of work		◆											
FY2013 Q2 Milestone: Summary of current state of the art in India			◆										
FY2013 Q3 Milestone: Goals and use cases for Indian benchmarking program				◆									
FY2013 Q4 Milestone: Gap analysis relative to current state of art benchmarking in India					◆								
FY2014 Q1 Milestone: Action Plan for benchmarking						◆							
FY2014 Q1 Sample specification guide for monitoring tools						◆							
FY2014 Q2 Milestone: Market segmentation for EIS							◆						
Current/Future Work													
FY2014 Q3 Milestone: Technical and cost Requirements for packaged scalable EIS								▓					
FY2014 Q4 Milestone: Recommended usability guidelines for Indian performance measurement tools								▓	▓				
FY2014 Q4 Milestone: New techniques and code/algorithms to address Indian benchmarking needs								▓	▓				