INDO-US JOINT CLEAN ENERGY RESEARCH AND DEVELOPMENT CENTER

Centre for Building Energy Research and Development

Indo-US Science & Technology Forum

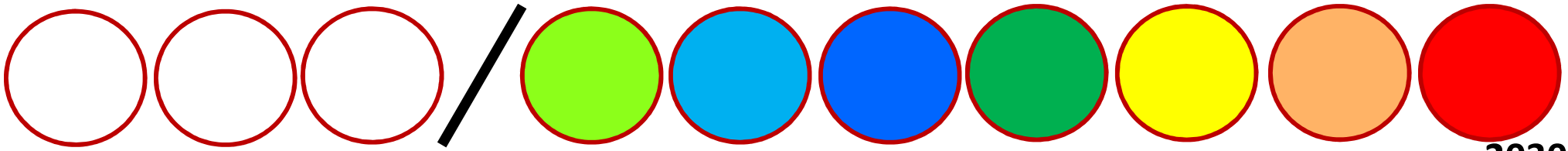
Monday, March 10th , 2014

Agenda

- **Context – India and US**
- **Concept of CBERD**
- **Identified Tasks, Objectives, Means to achieve**
  - **Eventual goals and current status**
  - **Benefits to US Building EE and India Building EE**

Context: India

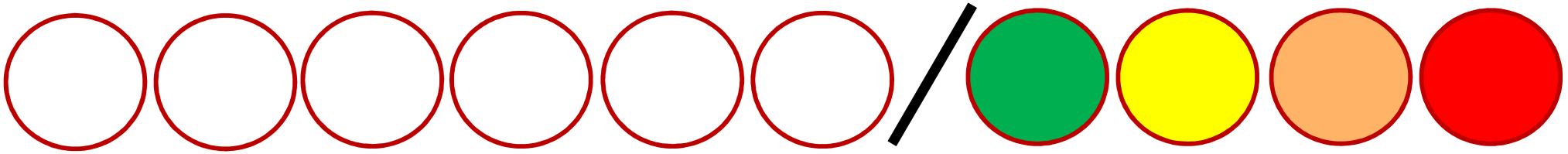
70 % of the India of 2030 is yet to be built



.....2030

India electricity demand , exceeds available supply

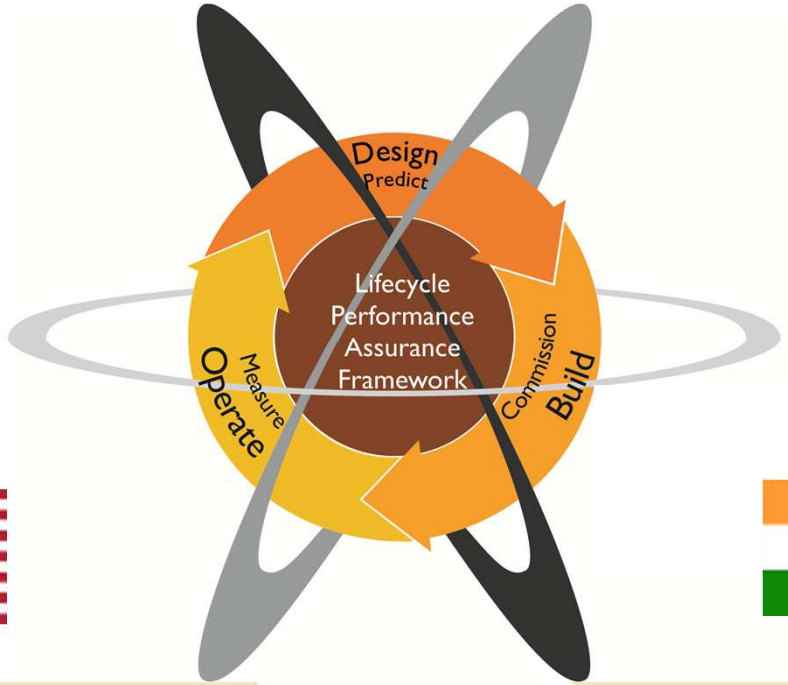
US Buildings consumes 40 % of nation's energy



US will need 200 GW of generation capacity by 2030

Existing buildings needs upgrade to reduce energy demand

CBERD Consortium Strengths



US Team Strength

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

India Team Strength

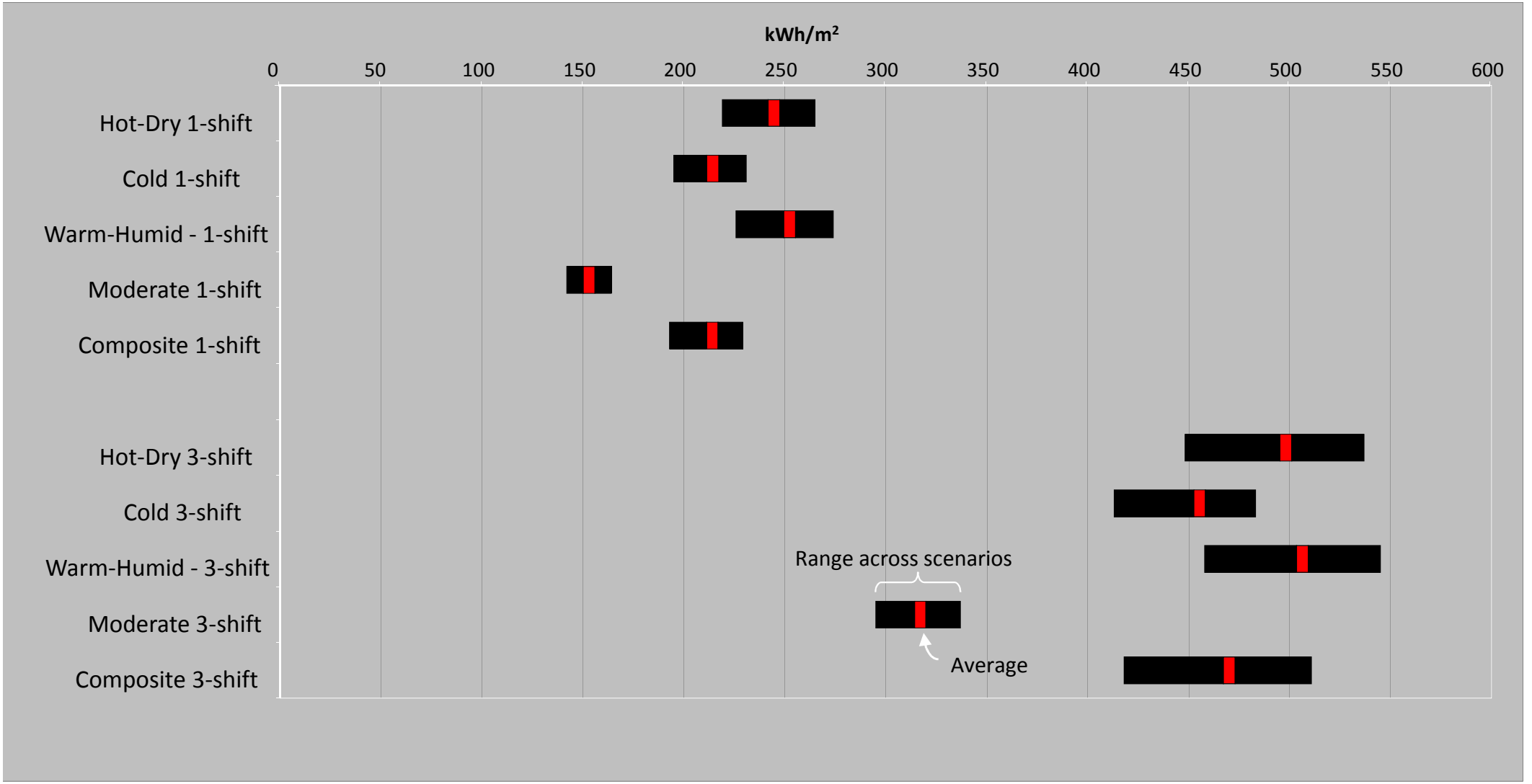
- Software solutions
- Building Systems Interaction, Integration, mechanical control
- Combinatorial HVAC solutions, mixed-mode ventilation
- Passive Design, Daylighting
- In Situ Demonstration of Technology in Indian Buildings

CBERD Consortium Strengths

Information Technology and Controls	Physical and End-Use Systems	Collaboration and Deployment

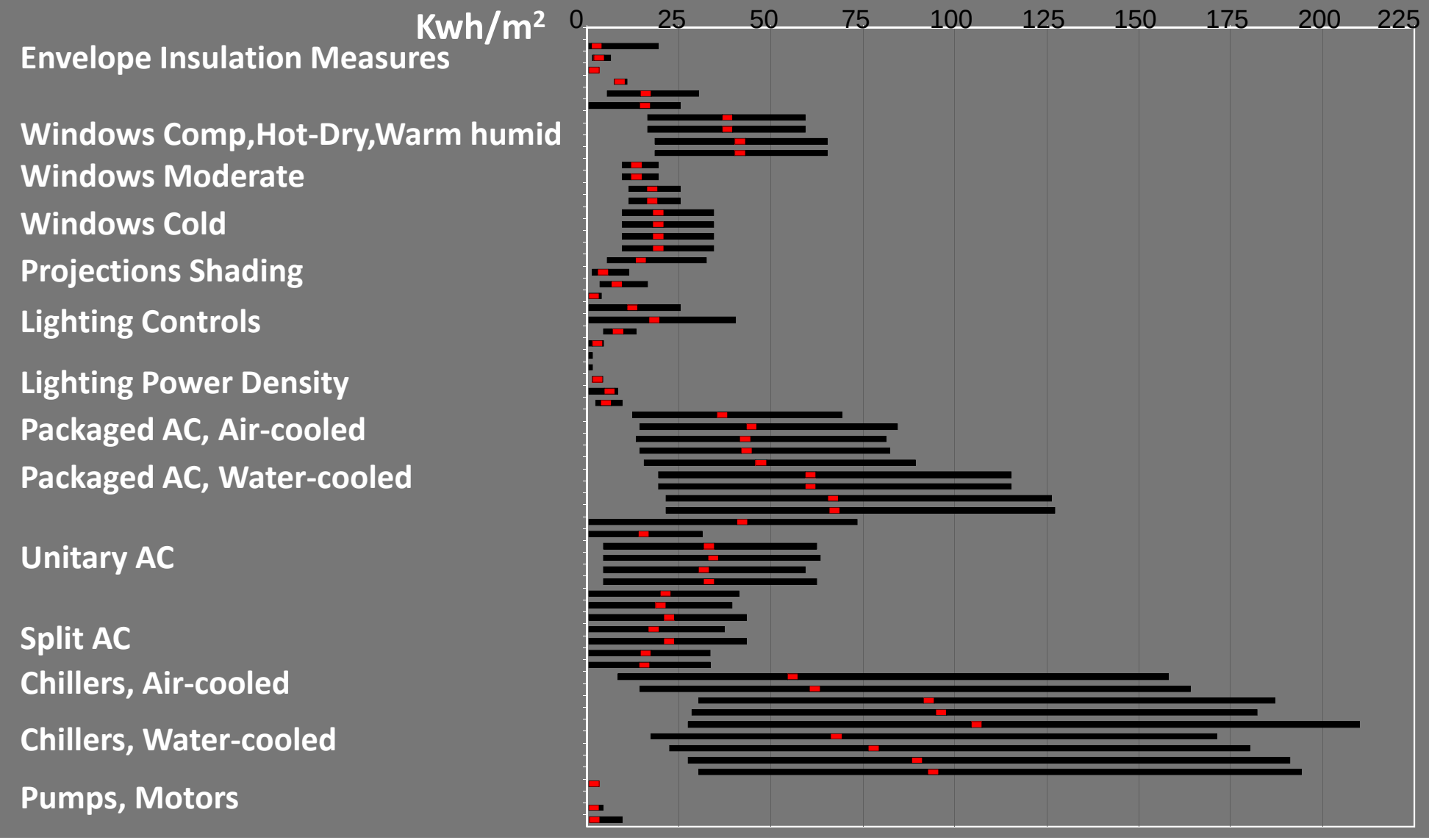
CBERD context leading to objectives

Business as usual building in India
Energy Performance Index in various climate zones

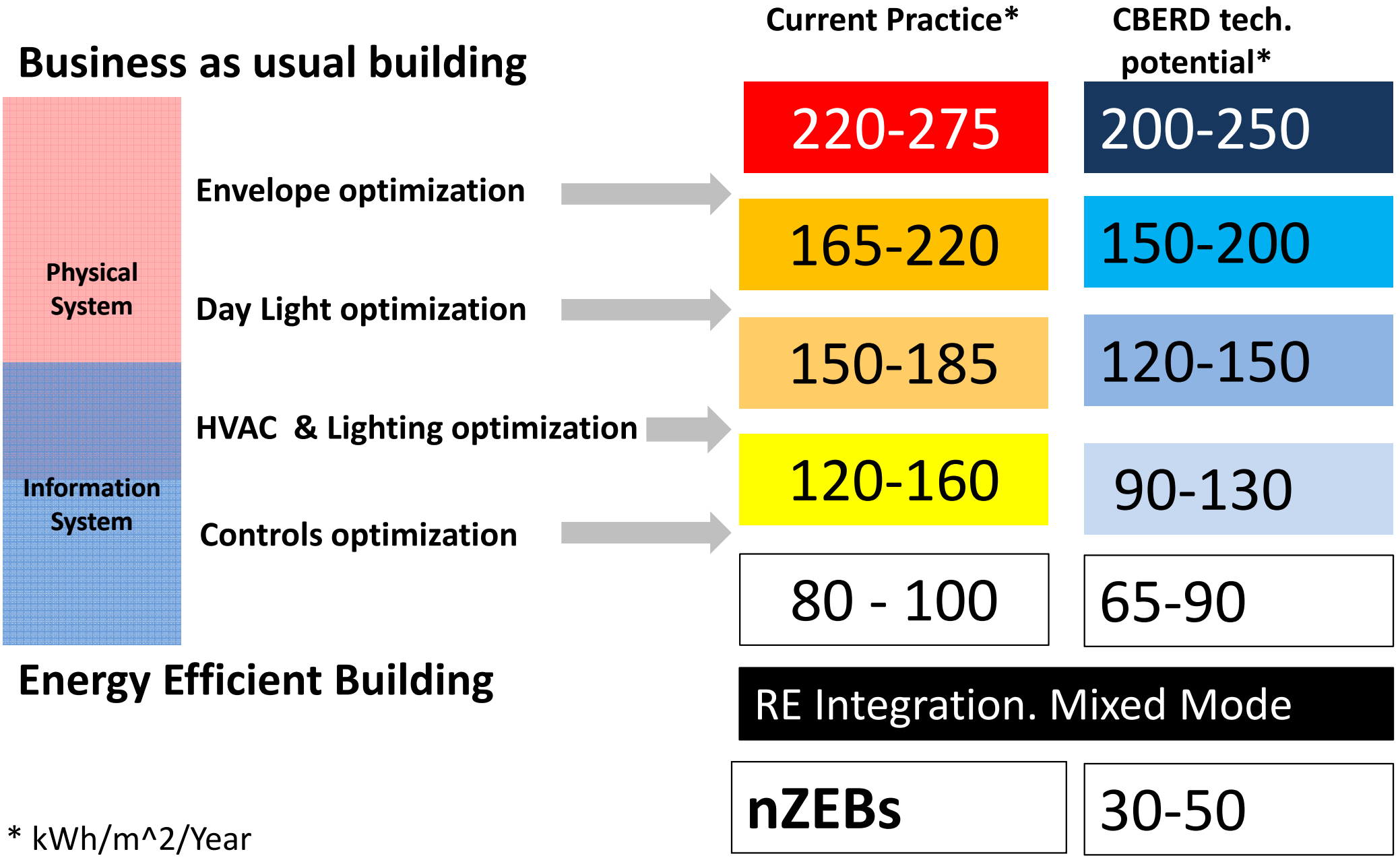


CBERD context leading to objectives

Energy savings potential from physical systems

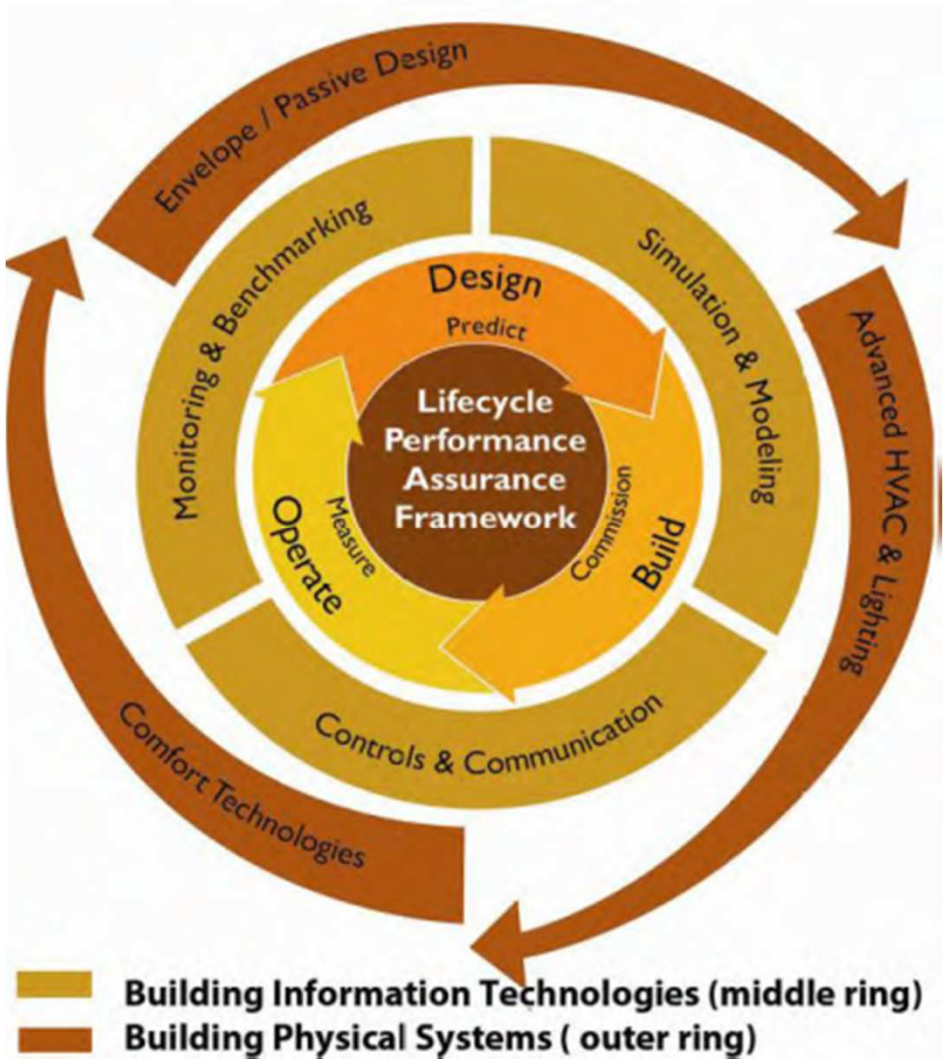


CBERD Objectives and Target



* kWh/m^2/Year

CBERD: Tasks



Consortia Management

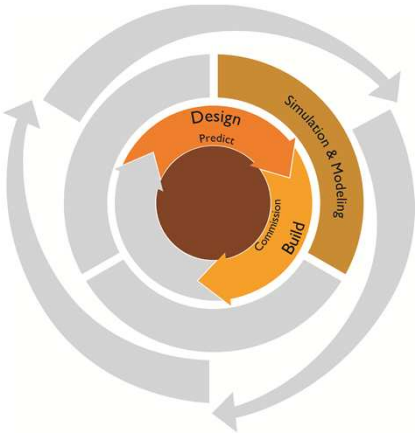
Simulation and Modelling
Monitoring and Benchmarking
Integrated controls and Communication

Advanced material and advanced shell
Day lighting and Windows
Passive Design
Advanced HVAC- Advanced Lighting
Comfort Studies

Grid Responsive Buildings- Renewable Integration - Cost Optimization

Scientific Collaboration

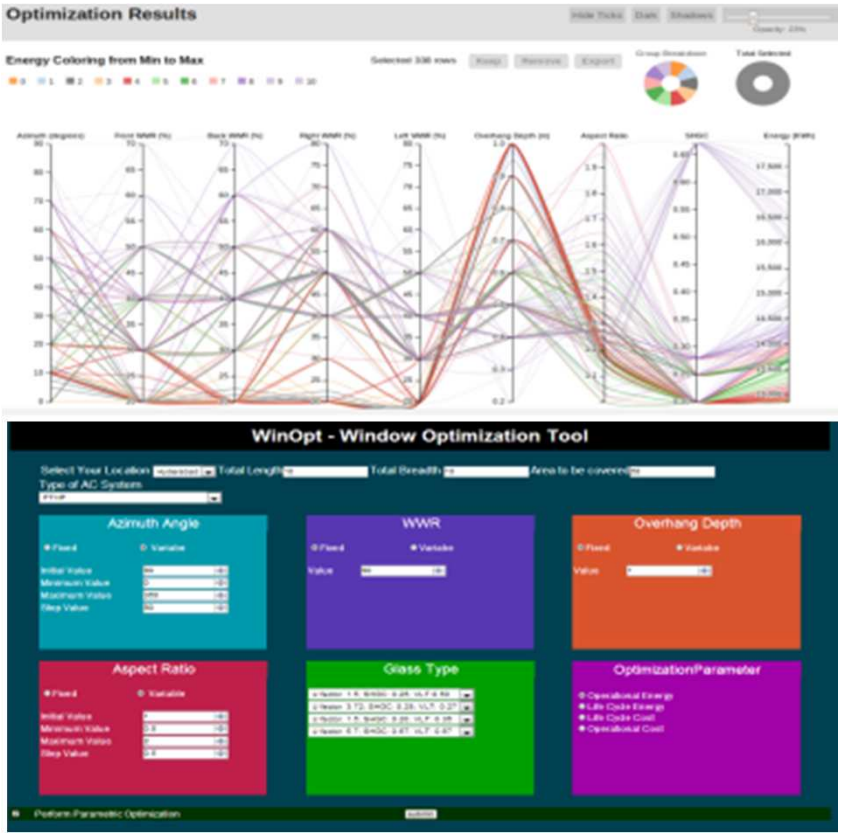
CBERD: Simulation and Modeling



Adapting EnergyPlus GUI for advanced design and operation

Tools for rapid design. Modelling and optimization for codes

Tools framework for real-time building performance monitoring and benchmarking



WinOpt: A tool for early design stage fenestration design tool

Code rule sets for automatic code compliance

Design of test set up for fault detection and diagnostics (FDD)

Simulation tools and enhancement of simulation engine capabilities

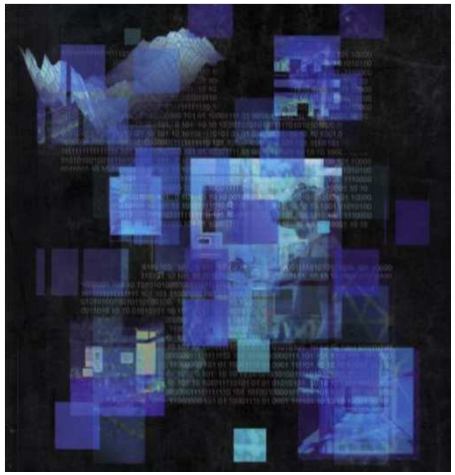
CBERD: Monitoring and Benchmarking

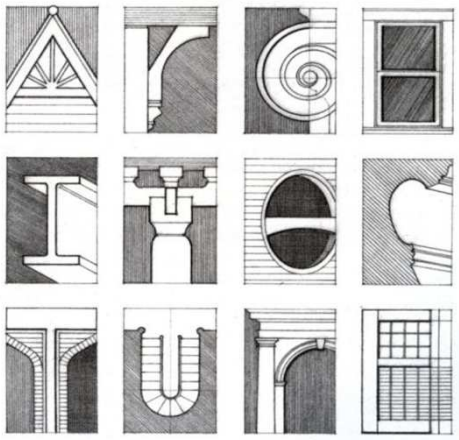
Enhance and expand whole-building benchmarking methods

Develop cost effective, scalable systems to monitor performance

Pilot testing demonstration and technology transfer

Sample specification and selection guide



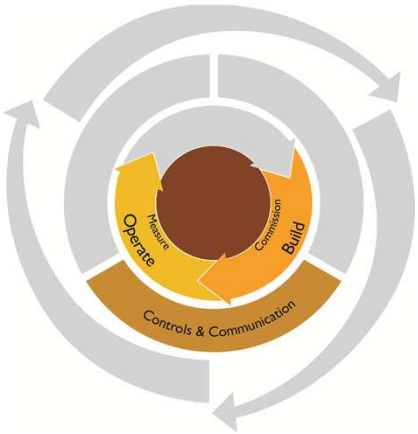


Data analysis for Hotels and Hospital data for benchmarking – Energy Performance Index, collection parameters

Collaboration with BEE-UNDP-GEF project for countrywide data collection efforts

Benchmarking methods for varied building types and varied context

CBERD: Controls and Communication



Advanced lighting and integration

Plug Load controls and integration

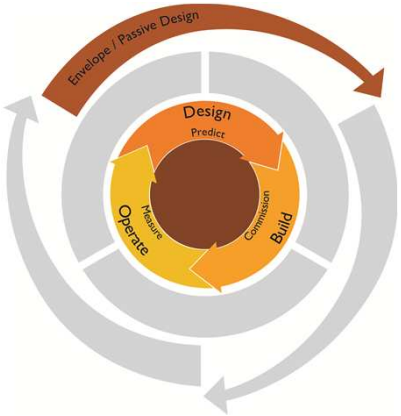
HVAC, Lighting and Building System integration

Smart Luminaire Controller – temperature, humidity, illuminance, power, occupancy, - WiFi capable

Smart Energy Meter
USB Enabled, AC/DC Power supply metering

Cost effective controls and communication Devices to integrate HVAC – Lighting – Plugs

CBERD: Envelope, Performance Evaluation: 1



Advanced Shells and Materials, Cool roofs and Windows

Performance Evaluation of Naturally Ventilated Buildings

Neighbourhood-level Impact of Energy Efficiency Measures

COMFEN India version

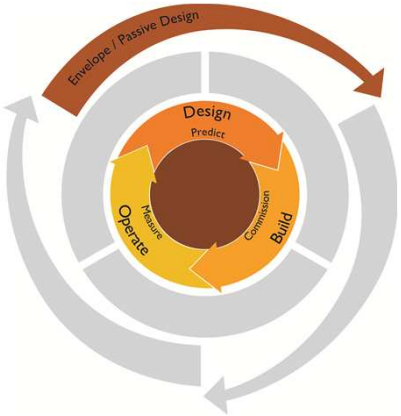
Laser cut panels testing and deployment

Cool roof testing and aging test protocol

Phase change material integration with building construction

Contextual testing protocols
Advanced Building materials and components

CBERD: Envelope, Performance Evaluation: 2



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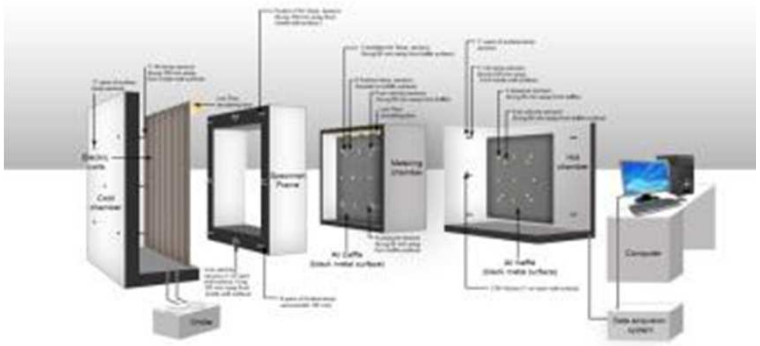


Hygrothermal Characterization

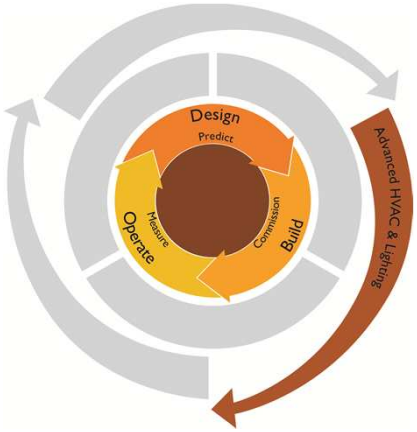
Artificial Sky Model

Daylight Device angular measurement development

Onsite monitoring of buildings in various climate zones

Mixed Mode and Nat-vent building performance Physical infrastructure for next generation testing

CBERD: Advanced HVAC and Lighting Systems



Advanced HVAC System : Dedicated Out Door Air System, Micro Channel heat Exchange

Advanced Lighting System: Innovative Lighting Application

Some Prototypes for Air to Air Heat Exchanger being Setup for Testing

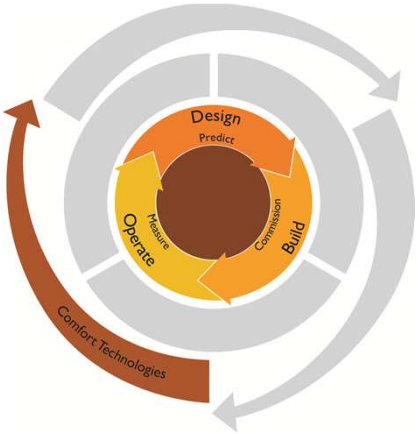
Improvement Micro Channel Heat Exchangers (MCHX)

Chiller testing assessment

Radiant Cooling System evaluation and design improvements

Low Energy Cooling technologies
Standardized terminologies for LED, technologies

CBERD: Comfort Studies



Post Occupancy Evaluation and Building User Survey

Adaptive Thermal comfort Tools linked to Simulation Tools

Evosys

Stantec

Online survey deployment

Indian Clothing value characterization

Mixed Mode Operation Manual

Thermal Comfort Chamber Design and Construction

MM and NV Building Performance

CBERD: Supplemental Tasks – Cross cutting

Grid Responsive Buildings
Renewable Integration in Buildings
Cost optimization
Scientific Collaboration

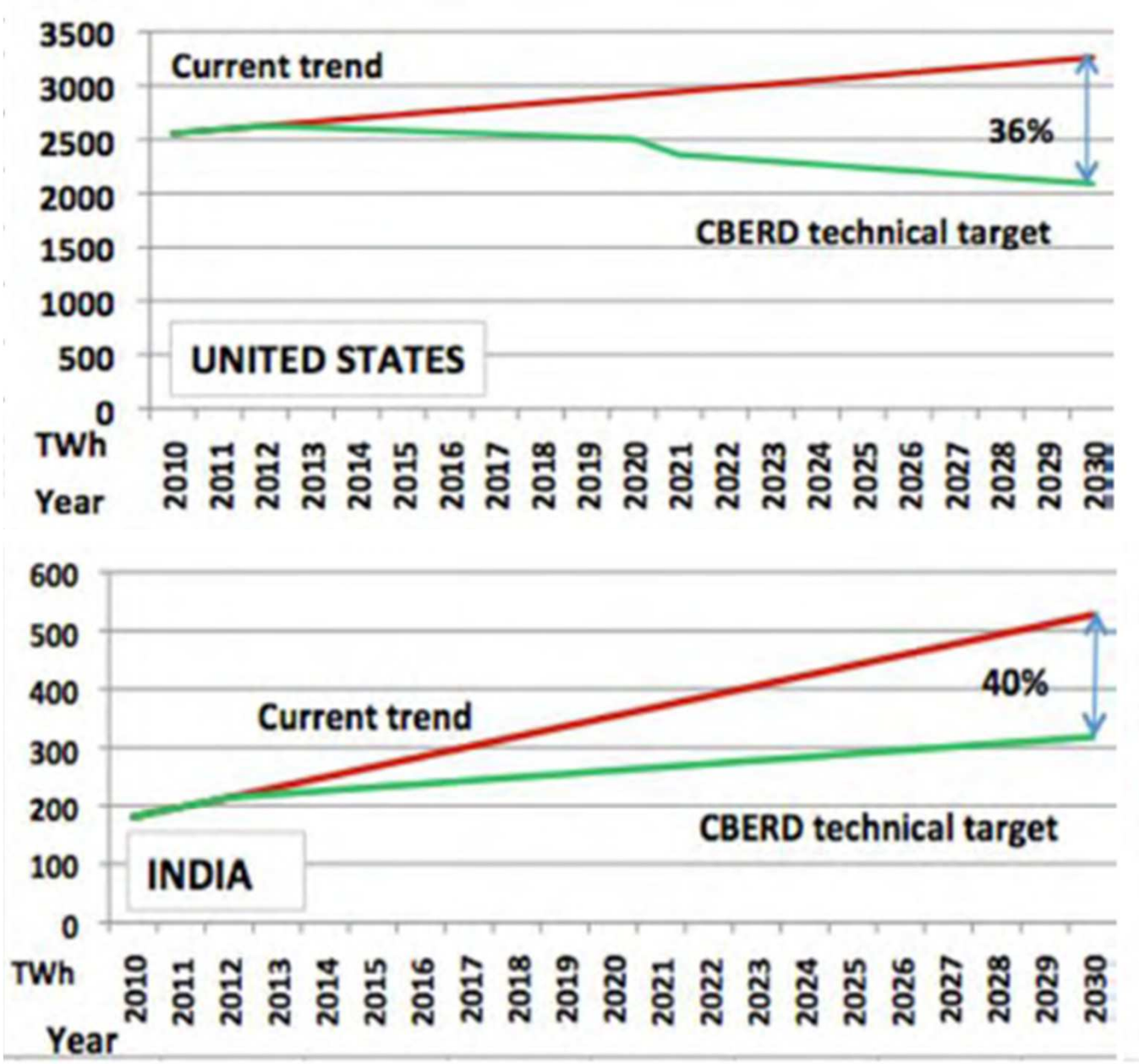
Linking building technologies to enable efficient, responsive, and resilient buildings

BiPV as shading devices over windows

Shading technology cost optimization – triple bottom line approach

Exchange of scientists and researchers - appx. 200 man-days

CBERD :Technical Potential



Thank You

Acronyms in this Presentation

BIPV	Building Integrated Photovoltaics
BM	Benchmarking
CBERD	[The U.S.–India Joint] Center for Building Energy Research and Development
CEPT University	Note: CEPT University is the legal name for the institution that is sponsored by the Centre for Environmental Planning and Technology, a public charitable trust. All academic and research grants are under CEPT University.
CIPO	CBERD Intellectual Property Office
CMO	CBERD Management Office
CMU	Carnegie Mellon University
COMFEN	A design tool for commercial façades and fenestration systems
CSR	Auroville Centre for Scientific Research
DOAS	Dedicated outdoor air systems
DOE	U.S. Department of Energy
EIFs	Exterior insulation finishing systems
EIS	Energy information systems
EMCS	Energy Monitoring and Control System
FOA	Funding Opportunity Announcement
GOI	Government of India
GUI	Graphical user interface
HVAC	Heating, Ventilation and Air Conditioning
IIIT-H	International Institute of Information Technology Hyderabad

IIM-A	Indian Institute of Management Ahmedabad
IIT-B	Indian Institute of Technology Bombay
IP	Intellectual Property
IT	Information Technology
JCERDC	[U.S.-India] Joint Clean Energy Research & Development Center
LBNL	Lawrence Berkeley National Laboratory (Lead Institution)
LED	Light-emitting diode
MCHX	Micro-channel evaporators
MNIT-J	Malaviya National Institute of Technology Jaipur
NDA	Non Disclosure Agreement
OM	Office Manager
ORNL	Oak Ridge National Laboratory
PAB	CBERD Project Advisory Board
PACE	[U.S.-India] Partnership to Advance Clean Energy
PACE-D	[U.S.-India] Partnership to Advance Clean Energy - Deployment
PACE-R	[U.S.-India] Partnership to Advance Clean Energy - Research
QR	Quarterly report
R&D	Research and Development
RPI	Rensselaer Polytechnic Institute
S&T agreement	Science and technology cooperation agreement
ST	Subtask
TMP	Technology Management Plan
UCB	UC Berkeley