Accelerating Energy Efficiency in Indian Data Centers: Phase II – Revised Specifications for Data Centers for Incorporation in ECBC 2016 version

April 2016

Confederation of Indian Industry

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CONTENT

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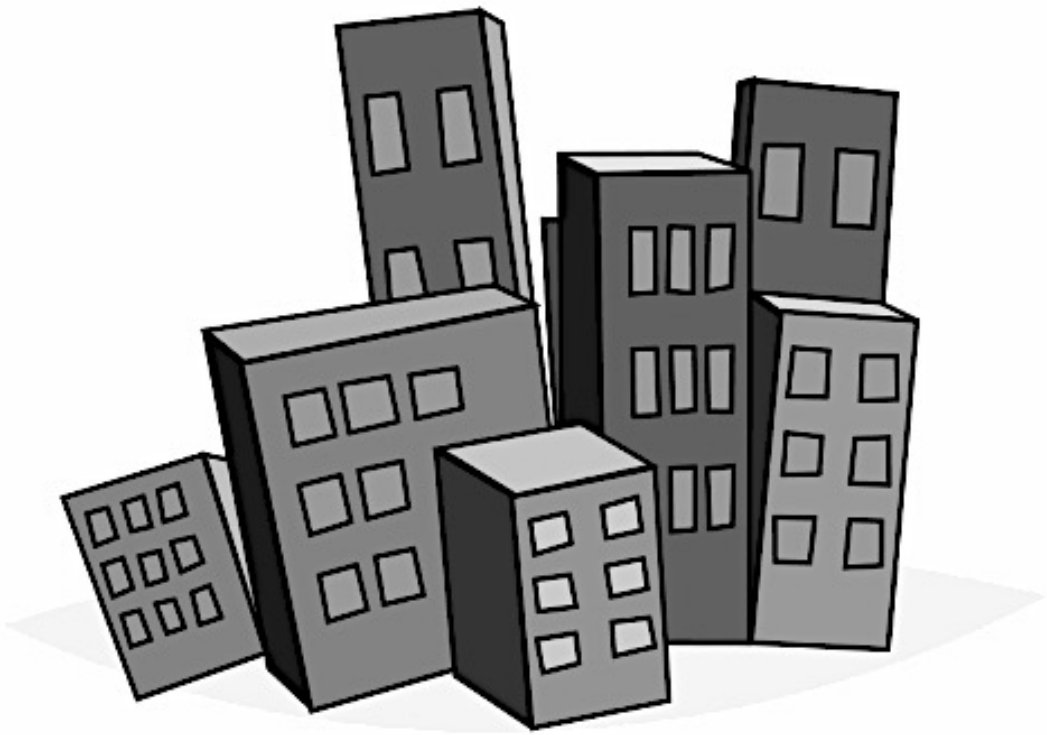
BACKGROUND

DATA CENTERS



Data centers are energy-intensive facilities that house computer systems, a dedicated cluster of computers and associated components, and support a diverse set of services such as web browsing, e-mail, social media, data storage, and processing.

Data centers are part of commercial buildings and are typically designed as a part of (embedded) IT/ITES office buildings.

The recommendations provided are applicable to buildings having data center connected load more than 100 kW

ECBC is the appropriate place to specify minimum energy performance standards for facility level components and systems

OVERVIEW OF THE INITIATIVE

The "Accelerating Energy Efficiency in Indian Data Centers" initiative aims **to develop an energy efficiency policy framework for Indian data centers** involving key stakeholders

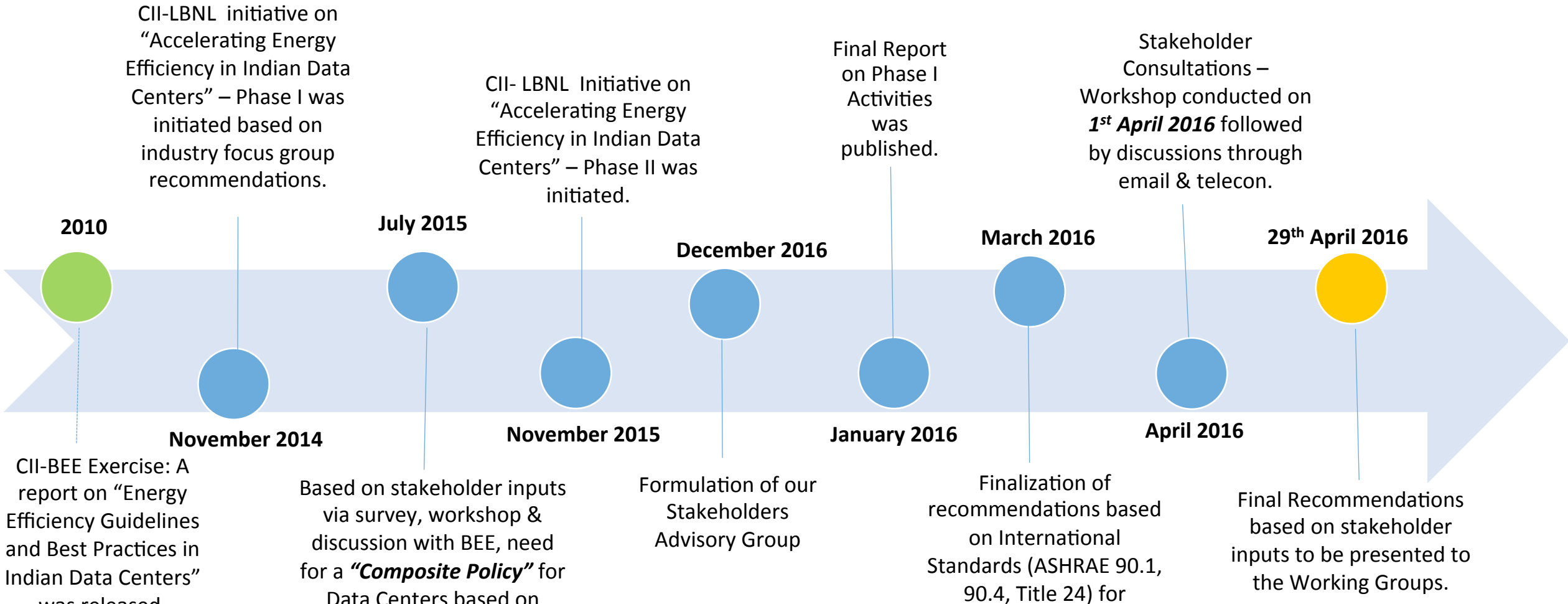
The study is being led by the **Confederation of Indian Industry** (CII), in collaboration with **Lawrence Berkeley National Laboratory** (LBNL)-U.S. Department of Energy, and under the guidance of **Bureau of Energy Efficiency** (BEE)

This initiative has been taken under the **US-India Energy Dialogue**

The initiative is carried out in two (02) phases: **PHASE I** (November 2014 – September 2015)

PHASE II (November 2015 – September 2016)

IMPORTANT PROJECT MILESTONES



PHASE 1 –KEY ACTIVITIES

Comprehensive review of **existing data center standards** from **around the world**

Comprehensive review of **existing energy efficiency polices in India**

Analysis of international standards to the Indian context

Stakeholder engagement through a **primary survey**

Stakeholder engagement through an **in-person workshop** **(July 13, 2015)**

Meeting with Bureau of Energy Efficiency (BEE) to share results **(July 21, 2015)**

MAJOR GLOBAL ENERGY EFFICIENCY STANDARDS/GUIDELINES

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USA

- **ENERGY STAR** Rating by Environment Protection Agency (EPA) - USA
- Leadership in Energy and Environmental Design **(LEED) -** USA
- American Society of Heating, Refrigerating and Air-Conditioning Engineers **(ASHRAE) 90.1& 90.4** - USA/ International
- **California Title 24** Standards - USA/CA

EUROPE

- Certified Energy Efficient Datacenter Audit (**CEEDA**)
- Building Research Establishment Environmental Assessment for Data Centers (**BREAM**)
- **European Code of Conduct** by the European Commission - European Union
- **Blue Angel Eco-Label**

INDIA

- Energy Conservation Building Code (**ECBC**)
- Perform Achieve & Trade (**PAT**)
- **Star Labelling** of Buildings
- Indian Green Building Council (**IGBC**) Green SEZ Rating System
- **GRIHA** – Green Rating for Integrated Habitat Assessment

ASIA

- **Green Mark** - Singapore
- Green Building Index (**GBI**) - Malaysia

AUSTRALIA

- National Australian Built Environment Rating System (**NABERS**) – Australia

International Organization for Standardization (ISO) 50001 - Global

PHASE 1 –KEY RECOMMENDATIONS

1

- Development of a ***"Composite Policy Framework"*** for Indian data centers that encompasses all the components of a data center (e.g., IT and Infrastructure) and is based on existing Indian energy efficiency standards such as Perform, Achieve & Trade (PAT) and Energy Conservation Building Code (ECBC).

2

- Formulation of a ***Core-IT Stakeholder Consultative Group*** to focus on the IT performance metric and a ***Large Stakeholder Consultative Group*** to focus on synchronizing the standard with existing ECBC and PAT frameworks to make the standard easily adoptable by BEE.

3

- Factors to be considered in the new standard: variation in size of data centers; variation in type of data centers (e.g., captive, colocation), their implication on energy use; reliability; and air and environmental quality.

PHASE 2 –TASKS

1) Develop short- and long-term strategies/mechanisms to implement energy efficiency standards for Indian data centers using ECBC and PAT-type scheme.

2) Develop technical and administrative procedures for ECBC (short term) and PAT (long term) energy efficient data center standards.

3) Organize consultative stakeholder meetings for outreach and plans to implement the procedures developed.

PHASE 2: OBJECTIVE & METHODOLOGY

PHASE 2 – KEY OBJECTIVE

To develop ***Data Center specific Recommendations/Technical Specifications*** based on review of international standards (ASHRAE 90.1 & 90.4 and California Title 24 because of their similarity to ECBC structure) for incorporation in ECBC 2016 version involving important stakeholders.

METHODOLOGY

Key Activity	Description	Date/Month
Development of a Comparative Matrix on ECBC and targeted and relevant international standards.	The matrix documents the characteristics of international standards relevant to data center energy efficiency – The comparative matrix lists the energy performance specifications and its context including for instance, the test methods behind the specifications.	November 2015
Formulation of Stakeholder Advisory Group (Through email communications & phone discussions)	The group has been formulated with the aim to develop short-term and long-term strategies/mechanisms to implement energy efficiency standards for Indian data centers in the context of existing policy mechanisms.	December 2015
Development of Draft Technical Specifications and Recommendations Specific to Data Centers for Incorporation in ECBC Revision.	After extensive review and analysis of the three standards – ASHRAE 90.1 & 90.4, California Title 24 & ECBC Building Code, data-center specific technical specifications & recommendations had been formulated for incorporation in ECBC revised version.	December 2015 – January 2016

METHODOLOGY

Key Activity	Description	Date/Month
Finalization of Technical Specifications & Recommendations Specific to Data Centers for Incorporation in ECBC Revision.	Through extensive internal discussions & review process, data center specific recommendations were revised and are focused on the HVAC & Electrical Systems. The sections & sub-sections in our recommendations are consistent with the current ECBC format for ease of adoption.	January 2016 – March 2016
Bangalore Workshop – Consultation with our Stakeholder Advisory Group	The focused group discussion ***(22 Participants)*** was conducted to share the findings of the work done so far and gather valuable inputs from industry stakeholders to finalize our Data Center specific Technical Specifications/Recommendations for incorporation in ECBC revised version.	1st April 2016
Meeting with Bureau of Energy Efficiency (BEE)	Our project progress including the findings from the Bangalore workshop were discussed with BEE.	5th April 2016.
Further Engagement with our Advisory Group	Two sets of communication emails were sent to our Advisory group members to seek further technical inputs on specific recommendations. Based on inputs received from key industry experts that include CRIS, Nxtra, Dell, IBM, Schnabel, NetApp & Intel, the recommendations have been further revised and include seven (07) key parameters for suggested changes.	8th April & 18th April 2016.

OVERVIEW OF ENERGY CONSERVATION BUILDING CODE (ECBC)

OVERVIEW OF ECBC V1

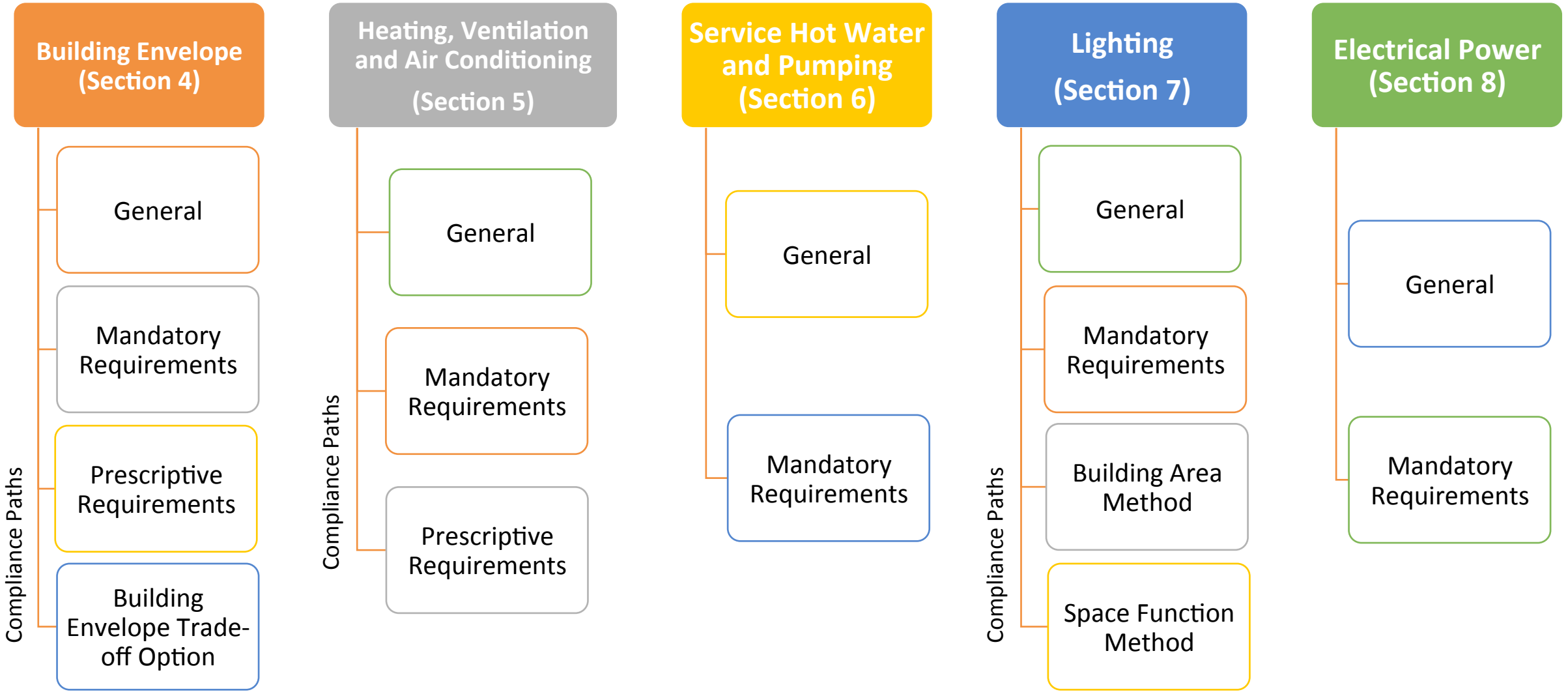
- The **purpose** of this standard is to establish ***minimum requirements for the energy-efficient design and construction of commercial buildings,*** but does not contain data center specific requirements.

- Support for the development of ECBC came from:
  - United States Agency for International Development (USAID) as a part of the Energy Conservation and Commercialization (IIEC - ECO II and IRG – ECO III) project.

- ECBC by Bureau of Energy Efficiency (BEE) follows the ***same structure as ASHRAE 90.1*** standard and covers ***similar buildings components*** as ASHRAE 90.1 and California Title 24.

- Similar to ASHRAE 90.1 & California Title-24, it includes 3 compliance options - Prescriptive, Trade-Off & Whole-Building Performance Method.

ECBC V1 (Sections and Compliance Paths)



Alternate Compliance Path for ECBC all Sections : Whole Building Performance Method

OVERVIEW OF INTERNATIONAL STANDARDS

OVERVIEW OF ASHRAE 90.1

- The **purpose** of this standard is to establish ***minimum requirements*** for the energy-efficient design of buildings except low-rise residential buildings.

- The standard is developed by the ***American Society of Heating, Refrigerating and Air - Conditioning Engineers (ASHRAE)*** with support from:
  - IES (Illuminating Engineering Society)
  - ANSI (American National Standards Institute)

- It is accredited by the ANSI and follows their requirements for due process and standards development.

- It is the reference standard for US Energy Policy Act and many building energy codes in USA (e.g. California Title 24).

Data Centers or Computer Rooms *specifications are included in this standard*

OVERVIEW OF CALIFORNIA TITLE 24

- The California Energy Code, part 6 of the California Building Standards Code which is ***title 24 of the California Code of Regulations***, were created by the California Building Standards Commission in 1978 in response to a legislative mandate to reduce California's energy consumption.

- It is also titled ***The Energy Efficiency Standards for Residential and Nonresidential Buildings*** and is applicable to all buildings.

- It covers efficiency requirements for Building Envelope, HVAC, Service Water Heating, Lighting and Electrical System under different subchapters & sections as shown in detail in the next slide.

The 2013 Building Energy Efficiency Standards includes ***Data Centers or Computer Rooms*** *specifications under Section 140.9 – Prescriptive Requirements for Covered Processes.*

FINALIZED DATA CENTER SPECIFIC TECHNICAL SPECIFICATIONS/ RECOMMENDATIONS FOR INCORPORATION IN ECBC REVISED VERSION – BASED ON INDUSTRY INPUTS

Broad Sections	Sub-Sections	Key Parameters	Data Center Specific Revised Specifications for Incorporation in ECBC 2016 version - Minimum Efficiency Requirements
Heating, Ventilation and Air-conditioning (HVAC)	**Minimum Equipment Efficiencies**	Heating & Cooling Equipment Efficiencies	As per ECBC 2016 (draft version) Requirements, with the addition of: Air conditioners and condensing units in data centers (CRAC units) shall have a minimum Sensible Coefficient of Performance (SCOP) value of 2.5.
	System Balancing	Air System Balancing	As per ECBC 2016 (draft version) Requirements.
		Hydronic System balancing	As per ECBC 2016 (draft version) Requirements.
	Economizers	Air Economizers & Water Economizers	Since economizers are not common in Indian data centers, this requirement is waived off.
	Data Center Air Management System		Data Centers designed for air-cooled equipment and with a design load exceeding 100 kW/room shall include air barriers such that there is no significant air path for computer discharge air to recirculate back to the computer inlets without passing through a cooling system. Target IT inlet temperature shall be no more than 3 ˚C higher than the cooling system supply temperature.

Broad Sections	Sub-Sections	Key Parameters	Data Center Specific Revised Specifications for Incorporation in ECBC 2016 version - Minimum Efficiency Requirements
Heating, Ventilation and Air-conditioning (HVAC)	**Controls**	Temperature and Humidity Control	Air temperature controls must be able to control the inlet air temperature to the IT equipment in the range of 23˚C to 27 ˚C (with preference to the upper end). Controls must prevent humidification or dehumidification when within the range of -9 ˚C to 15 ˚C dew point and 60% RH. Also, if multiple units serving the same space have humidity control, prevent simultaneously humidifying and dehumidifying in the same room. No reheat should be allowed with dehumidification.
		Fan Control	Each computer room air conditioner (CRAC) with mechanical cooling capacity exceeding 63,300kJ/hour (5 tons, 60,000 Btu/hour) and each air handler shall be designed to vary the airflow rate as a function of actual load and shall have controls and/or devices (such as variable speed control) that will result in fan motor demand of no more than 50 percent of design wattage at 66 percent of the design fan speed.
	Variable Flow Hydronic Systems		As per ECBC 2016 (draft version) Requirements.
	Performance - Based Calculation	Whole Building Performance Method	As per ECBC 2016 (draft version) Requirements.

Broad Sections	Sub-Sections	Key Parameters	Data Center Specific Revised Specifications for Incorporation in ECBC 2016 version - Minimum Efficiency Requirements
Electrical System	Transformers		As per ECBC 2016 (draft version) Requirements.
	Diesel Generators		Star labeling requirements shall be followed. Minimum Star rating: 3
	Power Factor Correction		As per ECBC 2016 (draft version) Requirements.
	Metering & Monitoring		For data center services exceeding 100 kW, sub metering at the data center shall be provided to allow the monitoring and calculation of Power Usage Effectiveness (PUE). Minimum metering includes IT equipment energy and total data center energy including cooling energy (e.g. compressors, fans and pumps), electrical distribution system losses (e.g. UPS), and lighting. PUE to be measured as per The Green Grid Level 1 guidelines. Minimum thermal (air) monitoring shall be at the IT equipment inlet at the top of every 5th rack (in the cold aisle).

Broad Sections	Sub-Sections	Key Parameters	Data Center Specific Revised Specifications for Incorporation in ECBC 2016 version - Minimum Efficiency Requirements
Electrical System	**Power Distribution Systems**	Power Distribution Losses	As per ECBC 2016 (draft version) Requirements.
	Performance - Based Calculation	Whole Building Performance Method	As per ECBC 2016 (draft version) Requirements.
	Uninterrupted Power Supply (UPS)		For data centers with an IT Design Load greater than 100kW, each UPS module shall have a minimum efficiency of 94.0% at 100% load and 92.0% at 25% load.
Renewable Energy	**Solar Energy Integration**		As per ECBC 2016 (draft version) Requirements.

OUR ADVISORY GROUP
MEMBER ORGANIZATIONS

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S.No	Organization/Institution's Name	Category
1	Nxtra Data Ltd	Data Center Owner/Hosting Provider
2	Vmware	Technology Provider
3	IBM India Private Limited	Data Center Owner & Technology Provider
4	Cisco Systems	Data Center Owner & Technology Provider
5	INTEL	Data Center Owner & Technology Provider
6	Schneider Electric	Data Center Owner & Technology Provider
7	Schnabel DC Consultants	Consultants
8	NxtGen Data Center & Cloud Technologies Pvt. Ltd	Data Center Owner/Hosting Provider
9	Tata Communications	Data Center Owner/Hosting Provider
10	Emerson Network Power	Technology Provider
11	ABB India Limited	Technology Provider
12	Infosys Technologies	Data Center Owner & Technology Provider

S.No	Organization/Institution's Name	Category
13	NetDataVault	Data Center Owner/Hosting Provider
14	Dell	Data Center Owner & Technology Provider
15	Oracle	Data Center Owner & Technology Provider
16	EMC 2	Data Center Owner & Technology Provider
17	NetMagic Solutions	Data Center Owner/Hosting Provider
18	Aeon Consultants	Consultants
19	Indian Institute of Technology, Madras	Academic Expert
20	Center for Railways Information Systems	Data Center Owner /Large users
21	Ctrl S	Data Center Owner/Hosting Provider
22	Reliance Communications	Data Center Owner/Hosting Provider
23	Airport Authority of India	Data Center Owner /Large users
24	National Informatics Center	Data Center Owner /Large users
25	NetApp	Data Center Owner & Technology Provider

THANK YOU