IMPLEMENTING ECBC 2017 IN DATA CENTRES Advisory Group meeting

JULY 17, 2019

V4.1 July 13

Phase I Accomplishments

- Phase I Activities Included:
  - Review of energy efficiency (EE) policies in India
  - Review of global data center standards
  - Analysis of international standards relative to the Indian context
  - Stakeholder engagement through an online survey and in-person workshop
  - Phase I Report

Phase II Activities

- Phase II built on Phase I findings related to international best practices and how EE standards in India could better address data centers.
- The Indian standards central to Phase II were:
  - the Energy Conservation Building Code (ECBC).
  - the Perform, Achieve & Trade (PAT) market-based scheme.
- Phase II Activities Included:
  - Development of recommendations for incorporating data center specific requirements into the 2016/2017 revision of the ECBC.
  - Evaluation of various Energy Performance Metrics for reporting data center energy efficiency under a PAT-type programme.
- Phase II report and Phase II white paper

Phase III (Current Activities)

- Data Centre specific User Guide on meeting ECBC standards as well as recommendations and resources to achieve best practices.
- Guide will include level 2 (stretch) and level 3 (superefficient) recommendations to augment ECBC Code Compliance requirements:
  - Recommended for adoption as ECBC+ and Super-ECBC requirements in the future.
  - Can be used as a guide to achieve international best practices.
  - Can be used in rating systems such as the IGBC Green Data Centre Rating System.
  - Can be adopted as a corporate Standard.
- Identify and document case studies to highlight energy efficiency best practices in the Indian context (supporting Guide recommendations)
- Conduct workshops and other outreach activity

Data Centres and ECBC

- Latest ECBC was issued in 2017
- Data centers are no longer excluded from the ECBC
- But few standards are specifically relevant to data centers, and some are a less-than-perfect fit
- The ECBC allows for three levels of performance
  - ECBC Code Compliance
  - ECBC+
  - SuperECBC
- Generally, data centre-specific standards were not developed for the higher levels by the 2017 ECBC

The Advisory Group for the ECBC Implementation Guide for Data Centres

- **Mr Raghuveer Singh, chair of the Room Cooling Committee,** Director -Thermal Management, Vertiv Energy Private Ltd.
- **Mr P.C. Lohia, chair of the Chiller Plant Committee**, Vice President - HVAC, Reliance Industries Ltd.
- **Mr Pritam Goyal, chair of the Electrical Committee,** General Manager - Data Centres, Vodafone Idea Ltd.
- **Mr Vivek Rajendran, chair of the IT Hardware and Management Committee,** Director, Software Engineering, Dell EMC, Infrastructure Solutions
- Mr Ashish Rakheja, Managing Partner, Aeon Consultants
- Mr B. Rajput, Senior Technical Director, National Information Centre
- Mr Brahma Reddy Kasu, Vice President, Data Centres Infrastructure, Controls
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- Mr Ravi A Giri, Enterprise Solutions Architect, Intel Technology India Pvt. Ltd.
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- Mr Robin Roy, Director, Mission Critical Infra Solutions (MCIS), Delta Power Solutions Pvt. Ltd.
- Mr Mahesh Trivedi, Head - Solutions Engineering, Bridge Data Centres
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Guide Overview

- Purpose:
  - Cross-cutting identification of ECBC17 requirements relevant to data centers
  - Recommendations for more relevant requirements and higher levels of performance
  - Tips and Best Practices for implementation and operational excellence
  - Highlight resources to help users achieve the target efficiency levels
- Target Audience: Indian Data Centre Owners, Developers, Designers, and Operators
- Final proposed values in all tables for each measure type

Download at: datacenters.lbl.gov/resources/ecbc-user-guide

Or do a search for ECBC at: datacenters.lbl.gov

Data Centre Efficiency Code Requirements and Recommendations

1. **Room Cooling**	2. **Chiller Plant**	3. **Electrical**	4. **IT Equipment & Management**
a) Computer Room Air Conditioning (CRAC) Equipment Efficiency b) Air Management c) Temperature and Humidity Control d) Fan Systems e) Air-Side Economizing	a) Chillers b) Cooling Towers c) Pump Efficiency d) Water-Side Economizing e) Chiller Plant (Performance Approach)	a) Diesel Generators b) Metering and Monitoring c) Uninterruptible Power Supply (UPS)	a) Efficiency ratings and CPU vintages b) Power Supplies c) Virtualization and Utilization

Convention for Guide Tables

Level I	Level II	Level III
ECBC Compliant Reference to ECBC 2017 Section Number if applicable. Listed requirements to achieve ECBC Compliant level. **Recommended Additional Requirements** Additional requirements (if any) to achieve this level, that are not directly addressed by ECBC 2017.	**ECBC+** Reference to ECBC 2017 Section Number if applicable. Listed requirements to achieve ECBC+ level, over ECBC requirements. **Recommended Additional Requirements** Additional requirements (if any) to achieve this level, that are not directly addressed by ECBC 2017.	**SuperECBC** Reference to ECBC 2017 Section Number if applicable. Listed requirements to achieve SuperECBC level, over ECBC+ requirements. **Recommended Additional Requirements** Additional requirements (if any) to achieve this level, that are not directly addressed by ECBC 2017.

- Requirements are cumulative: Level II and III requirements include all lower level requirements plus whatever higher efficiencies or additional requirements are specified.

Advisory Group Discussion

- Final Feedback on Guide Including Tables of ECBC Data Centre Requirements
- Future enhancements
- Participation in case studies
- Next Steps

Some Key Discussion Issues

- ECBC has requirements but we recommend tougher ones (if data centers are not unique, do we want to mess with the existing requirements?)
- Should we minimize added requirements to ECBC Compliant level (Level I)?
- Needs careful review as input received was “rough” and contained conflicts and gaps.

Room Cooling

CRAC EQUIPMENT EFFICIENCY

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 5.2.2.4: ✓ Minimum Net Sensible Coefficient of Performance (NSCOP) rating of 2.5, regardless of capacity, for both downflow & upflow. **Recommended Additional Requirements** ✓ CRACs/air handlers shall be equipped with variable-speed fans. ✓ Minimum Net Sensible Coefficient of Performance (NSCOP) rating of 2.5, regardless of capacity or air flow direction.	**ECBC+** Same as ECBC compliant **Recommended Additional Requirements** Same as Level I, plus: ✓ Minimum Net Sensible Coefficient of Performance (NSCOP) rating of 3.0, regardless of capacity or air flow direction.	**SuperECBC** Same as ECBC compliant **Recommended Additional Requirements** Same as Level II, plus: ✓ Minimum Net Sensible Coefficient of Performance (NSCOP) rating of 3.1, regardless of capacity or air flow direction.

Advisory Group Discussion

- Should we have additional requirements under Level I?
- Where should variable speed fans be recommended as a requirement, Level I, Level II, or Level III? We are inconsistent.
- Level III recommended NSCOP of 3.1 seems not worth it. Level III are supposed to be stretch goals.
  - Should we specify a higher value for non-standard test conditions (but recommended in best practices)?

AIR MANAGEMENT

Level I	Level II	Level III
ECBC Compliant ECBC 2017 does not address this level. **Recommended Additional Requirements** - None -	**ECBC+** ECBC 2017 does not address this level. **Recommended Additional Requirements** ✓ No more than 30% extra supply air relative to IT airflow. ✓ IT inlet temperature at any point no more than 4˚C higher than the cooling system supply air temperature.	**SuperECBC** ECBC 2017 does not address this level. **Recommended Additional Requirements** ✓ No more than 15% extra supply air relative to IT airflow. ✓ IT inlet temperature at any point no more than 2˚C higher than the cooling system supply air temperature. ✓ Automatic variable air flow control.

Advisory Group Discussion

- LBNL removed recommended additional requirements from Level 1
  - Should we keep (key issue throughout)
- LBNL felt maximum excess airflows of 20, 15, and 10% were too restrictive and increased to none (for level I), 30%, and 15%.
  - Decide
- Variable speed air flow is inconsistently specified, e.g. Level I for CRAC/AH units, but at Level III here.
  - Where should it be
  - Was the key here the automation?

TEMPERATURE & HUMIDITY CONTROL

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 5.2.3.2: ✓ Each floor or building block shall be installed with at least one control to manage the temperature. ✓ Separate thermostat control shall be in each computer room of educational.	**ECBC+** ECBC 2017, Sections 5.2.4.1 - 5.2.4.3: In addition to ECBC Compliant: ✓ Centralized demand shedding controls shall have capabilities to be disabled by facility operators and be manually controlled by a central point by facility operators to manage cooling set points. ✓ Supply air temperature reset capabilities. Controls shall reset the supply air temperature to at least 25% of the difference between the design supply air temperature and the design room air temperature. ✓ Chilled water systems with a design capacity>350 kWr supplying chilled water to comfort conditioning systems shall have controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outdoor air temperature. ✓ Exceptions: Controls to automatically reset chilled water temperature shall not be required where the supply temperature reset controls causes improper operation of equipment.	**SuperECBC**

TEMPERATURE & HUMIDITY CONTROL

Level I	Level II	Level III
	Recommended Additional Requirements ✓ CRACs/air handlers shall operate on fixed supply air temperature control, not return air temperature control. ✓ CRACs/air handlers shall have the ability to provide supply air at the upper limit of the ASHRAE recommended temperature/humidity range. This means systems support high supply air temperature (26/27˚C) and return air temperature (38/40˚C). *See additional Tip below.* ✓ CRACs/air handlers shall be equipped with variable-speed fans. See CRAC Efficiency section above. ✓ Cooling system controls shall prevent simultaneous humidification & dehumidification by multiple units serving the same space.	**Recommended Additional Requirements** Same as Level II, plus: ✓ CRACs/air handlers shall have the ability to control supply air dewpoint temperature as well as supply air relative humidity, to conform with the ASHRAE Recommended range. ✓ All CRAC/air handler operating modes (supply air temperature & humidity setpoints, actual supply air temperature and humidity, de-humidification status, reheat status) shall be monitored from a central monitoring system. See Metering and Monitoring section below.

Advisory Group Discussion

- LBNL moved recommended additional requirements from Level I to Level II. Confirm what we want to do.
- Same question regarding where VSD control should be recommended?
- The recommended additional requirements were moved from Level II to Level III. Should they be moved back? Can they be simplified?

FAN CONTROL

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 5.3: ✓ Supply, exhaust, and return or relief fans with motor power exceeding 0.37 kW shall meet or exceed: • Fan mechanical efficiency of 60%. • Motor efficiency IE2, as per IS 12615. Exception: ✓ Fans in un-ducted air conditioning unit where fan efficiency has already been taken in account to calculate the efficiency standard of the unit.	**ECBC+** Same as ECBC Compliant, except: • Fan mechanical efficiency of 65%. • Motor efficiency IE3, as per IS 12615.	**SuperECBC** Same as ECBC+, except: • Fan mechanical efficiency of 70%. • Motor efficiency IE4, as per IS 12615. ECBC 2017, Section 5.2.5.1: ✓ Fans in Variable Air Volume (VAV) systems shall have controls or devices that will result in fan motor demand of no more than 30% of their design wattage at 50% of design airflow based on manufacturer's certified fan data.

Advisory Group Discussion

- Should we recommend additional fan control requirements?
  - For example, adoption at Level I or II, and with better performance
  - If so, what is the justification relative to data centres?
- Need consistency regarding what level variable speed and controls are required.

Air-Side Economizing

Level I	Level II	Level III
ECBC Compliant [waived for compliant and added back at Level II]	**ECBC+** ECBC 2017 Section 5.3.3.1: Each cooling system shall include at least one of the following: ✓ An air economizer capable of modulating outside-air and return-air dampers to supply 50% of the design supply air quantity as outside-air. ✓ A water or pumped refrigerant economizer. (*See Water-Side Economizer section below.*) Exemptions: ✓ Projects in warm-humid climate zones; projects with only daytime occupancy in the hot-dry climate zones; individual ceiling mounted fan systems of less than 3,200 liters per second.	**SuperECBC**

Air-Side Economizing

Level I	Level II	Level III
ECBC Compliant *See Recommended Additional Requirements.* *(next slide)*	**ECBC+** ECBC 2017 Sections 5.3.3.2-5.3.3.4: ✓ Economizers shall be capable of providing partial cooling even when additional mechanical cooling is required to meet the cooling load. ✓ Air economizer shall be equipped with controls that 1) allow dampers to be sequenced with the mechanical cooling equipment and not be controlled by only mixed air temperature; 2) are capable of automatically reducing outdoor air intake to the design minimum outdoor air quantity when outdoor air intake will no longer reduce cooling energy usage; and 3) are capable of adjustable high-limit shutoff at a temperature below the return-air temperature or return-air enthalpy.	**SuperECBC**

Air-Side Economizing

Level I	Level II	Level III
ECBC Compliant **Recommended Additional Requirements** ✓ Use of air-side economizer for ECBC compliance is waived.	**ECBC+** **Recommended Additional Requirements** ✓ The exception for daytime occupancy is removed, as the data centre is assumed to be continuously operated.	**SuperECBC** **Recommended Additional Requirements** If an air economizer is selected instead of a water-side economizer, then it shall be: ✓ Capable of modulating outside-air and return-air dampers to supply 100% of the design supply air quantity as outside-air. Exceptions: None.

Advisory Group Discussion

- Where should pumped refrigerant based economizers go?
  - Under CRAC specifications, here, or central plant?

Chiller Plant

Chillers

Level I

ECBC Compliant

ECBC 2017 Section 5.2.2.1:

- ✓ Chillers shall meet or exceed the minimum efficiency requirements presented under ANSI/ AHRI 550/ 590 conditions.
- ✓ **Both** COP and IPLV shall be met.

Water Cooled Chillers		
Chiller Capacity (kWr)	**COP**	**IPLV**
<260	4.7	5.8
≥ 260 & < 530	4.9	5.9
≥ 530 & < 1,050	5.4	6.5
≥ 1,050 & <1,580	5.8	6.8
≥ 1,580	6.3	7.0

Air Cooled Chillers		
Chiller Capacity (kWr)	**COP**	**IPLV**
<260	2.8	3.5
≥ 260	3.0	3.7

Level II

ECBC+

ECBC 2017 Section 5.2.2.1:

- ✓ Chillers shall meet or exceed the minimum efficiency requirements presented under ANSI/ AHRI 550/ 590 conditions.
- ✓ **Either** COP or IPLV shall be met.

Water Cooled Chillers		
Chiller Capacity (kWr)	**COP**	**IPLV**
<260	5.2	6.9
≥ 260 & < 530	5.8	7.1
≥ 530 & < 1,050	5.8	7.5
≥ 1,050 & <1,580	6.2	8.1
≥ 1,580	6.5	8.9

Air Cooled Chillers		
Chiller Capacity (kWr)	**COP**	**IPLV**
<260	3.0	4.0
≥ 260	3.2	5.0

Level III

SuperECBC

ECBC 2017 Section 5.2.2.1:

- ✓ Chillers shall meet or exceed the minimum efficiency requirements under ANSI/AHRI 550/ 590 conditions.
- ✓ **Either** COP or IPLV shall be met.

Water Cooled Chillers		
Chiller Capacity (kWr)	**COP**	**IPLV**
<260	5.8	7.1
≥ 260 & < 530	6.0	7.9
≥ 530 & < 1,050	6.3	8.4
≥ 1,050 & <1,580	6.5	8.8
≥ 1,580	6.7	9.1

Air Cooled Chillers		
Chiller Capacity (kWr)	**COP**	**IPLV**
<260	N/A	N/A
≥ 260	N/A	N/A

Chillers

Level I	Level II	Level III
ECBC Compliant ✓ The application of an air-cooled chiller is allowed in all buildings with cooling load < 530 kW. ✓ For buildings with cooling load ≥ 530 kW, the capacity of air-cooled chiller(s) is restricted to 33% of the total installed chilled water capacity unless the authority having jurisdiction mandates the application of air-cooled chillers. ✓ Minimum efficiency requirements under BEE Standards and Labeling Program for chillers shall take precedence over requirements outlined above. **Recommended Additional Requirements** ✓ Air-cooled chillers above 530 kWr shall have COP of 3.2 **and** IPLV of 4.0.	**ECBC+** ✓ The application of an air-cooled chiller is allowed in all buildings with cooling load < 530 kW. ✓ For buildings with cooling load ≥ 530 kW, the capacity of air-cooled chiller(s) is restricted to 33% of the total installed chilled water capacity unless the authority having jurisdiction mandates the application of air-cooled chillers. ✓ Minimum efficiency requirements under BEE Standards and Labeling Program for chillers shall take precedence over requirements outlined above.	**SuperECBC** ECBC 2017 Section 5.2.2.1: ✓ The application of an air-cooled chiller is allowed in all buildings with cooling load < 530 kW. ✓ For buildings with cooling load ≥ 530 kW, the capacity of air-cooled chiller(s) is restricted to 33% of the total installed chilled water capacity unless the authority having jurisdiction mandates the application of air-cooled chillers. ✓ Minimum efficiency requirements under BEE Standards and Labeling Program for chillers shall take precedence over requirements outlined above.

Advisory Group Discussion

- What additional requirements would be unique to data centres and should be recommended?
- Should we require a chiller plant to run warmer (non-condensing) for larger data centres?
  - In a multi-use facility this will require two chilled water loops

Cooling Towers

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 5.3.2: ✓ Equipment Type: Open circuit cooling tower fans. ✓ Rating Condition: 35°C entering water 29°C leaving water 24°C WB outdoor air ✓ Efficiency: 0.017 kW/kWr or 0.31 kW/l/s	**ECBC+** Same as ECBC Compliant, plus: ✓ Cooling tower fans shall be variable speed. **Recommended Additional Requirements** ✓ Cooling tower efficiency shall be 0.012 kW/kWr or 0.17 kW/l/s.	**SuperECBC** Same as ECBC+. **Recommended Additional Requirements** Same as Level II.

Advisory Group Discussion

- What is the justification to have tougher requirements for cooling towers? Longer run time?
  - Why only Level II enhancements?
- What additional requirements would be unique to data centres and should be recommended?

Pump Efficiency

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 5.3.1: ✓ Chilled Water Pump (Primary and Secondary) (maximum): 18.2 W/kWr with VFD on secondary pump. ✓ Condenser Water Pump (maximum): 17.7 W/kWr. ✓ Pump Efficiency (minimum): 70%. ECBC 2017 Section 5.3.4.1: ✓ HVAC pumping systems having a total pump system power exceeding 7.5 kW shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to an extent which is lesser or equal to the limit, where the limit is set by the larger of: (a) 50% of the design flow rate, or (b) the minimum flow required by the equipment manufacturer for proper operation of the chillers or boilers.	**ECBC+** ✓ Chilled Water Pump (Primary and Secondary) (maximum): 16.9 W/kWr with VFD on secondary pump. ✓ Condenser Water Pump (maximum): 16.5 W/kWr. ✓ Pump Efficiency (minimum): 75%.	**SuperECBC** ✓ Chilled Water Pump (Primary and Secondary) (maximum): 14.9 W/kWr with VFD on secondary pump. ✓ Condenser Water Pump (maximum): 14.6 W/kWr. ✓ Pump Efficiency (minimum): 85%.

Advisory Group Discussion

- What additional requirements would be unique to data centres (e.g. longer run time) and should be recommended?

Water-Side Economizing

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 5.3.3.1: Each cooling system shall include at least one of the following: ✓ An air economizer. ✓ A water economizer capable of providing 50% of the expected system cooling load at outside air temperatures of 10°C dry-bulb/7.2°C wet-bulb and below. Exemptions include 1) Projects in warm-humid climate zones; 2) Projects with only daytime occupancy in the hot-dry climate zones; 3) individual ceiling mounted fan systems of less than 3,200 liters per second. ECBC 2017 Sections 5.3.3.2-5.3.3.4: ✓ Economizers shall be capable of providing partial cooling even when additional mechanical cooling is required to meet the cooling load.	**ECBC+**	**SuperECBC**

Water-Side Economizing

Level I	Level II	Level III
Recommended Additional Requirements ✓ The exception for daytime occupancy is removed, as the data centre is assumed to be continuously operated.	**Recommended Additional Requirements** If a water-side economizer is selected instead of an air-side economizer, then it shall be: ✓ Capable of providing 100% of the expected system cooling load at outside air temperatures of 10°C dry-bulb/7.2°C wet-bulb and below. Exceptions: None. (remove all)	

Advisory Group Discussion

- Should larger data centres be required to have “condenser water” available in the data centre at Level III?
  - For use in warm water cooling systems
- Should pumped refrigerant systems be addressed?

Chiller Plant- Performance Approach

Buildings may show compliance by optimizing the total system efficiency for the chiller plant instead of the individual components covered by the prescriptive requirements. This alternate compliance approach can apply to central chilled-water plants in all building types. The total installed capacity per kW of refrigeration load shall be less than or equal to the maximum thresholds specified below.

Equipment that can be included in central chilled-water plant for this alternate approach are chillers, chilled water pumps, condenser water pumps, and the cooling tower fan.

Compliance checks will be based on annual hourly simulation.

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 5.4: ✓ Water Cooled Chill Plant Maximum Threshold (kW/kWr) of 0.26.	**ECBC+** ECBC 2017 Section 5.4: ✓ Maximum Threshold (kW/kWr) of 0.23.	**SuperECBC** ECBC 2017 Section 5.4: ✓ Maximum Threshold (kW/kWr) of 0.20.

Advisory Group Discussion

- Should Level II and III be more efficient than required by ECBC to account for higher operating temperatures and more hours of operation (at cooler ambient air temperatures)?
  - Significantly more compressorless cooling especially at Level III?

Electrical

DIESEL GENERATORS

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 7.2.3: ✓ Minimum 3 stars rating.	**ECBC+** ECBC 2017 Section 7.2.3: ✓ Minimum 4 stars rating.	**SuperECBC** ECBC 2017 Section 7.2.3: ✓ Minimum 5 stars rating.

Advisory Group Discussion

METERING & MONITORING

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 7.2.4: **Service 65 kVA and less:** ✓ Energy (kWh) **Service >65 to 1000 kVA:** ✓ Demand (kW) ✓ Total Power Factor or, alternatively, kVARh **Service >1000 kVA:** ✓ Current in each phase and the neutral ✓ Voltage between phases and between each phase and neutral ✓ Total Harmonic Distortion (THD) as percent of total current **Service 120 kVA and greater:** ✓ HVAC system and components ✓ Interior and Exterior Lighting ✓ Plug loads ✓ Renewable power source ✓ Domestic hot water	**ECBC+**	**SuperECBC**

METERING & MONITORING

Level I	Level II	Level III
	Recommended Additional Requirements **IT load capacity 100 to 250 kVA:** ✓ Data Centre Total kWh & kW ✓ IT Equipment Total kWh & kW ✓ UPS Input kW ✓ UPS Output kW ✓ IT hardware inlet air temperature at the top of every 3rd rack in every cold aisle **IT load capacity >250 kVA:** ✓ Cooling System Total Cooling Load kWr ✓ Power Usage Effectiveness (PUE) measured as per Green Grid Level 1 guidelines.	**Recommended Additional Requirements** **IT load capacity 100 to 250 kVA:** ✓ Electric power draw of each IT rack (kW) ✓ UPS Room Cooling System Power Draw (kW) ✓ Supply Air Temperature Setpoint for every CRAC/air handler ✓ Actual Supply Air Temperature for every CRAC/air handler ✓ Cooling System Total Cooling Load kWr ✓ Power Usage Effectiveness (PUE) measured as per Green Grid Level 1 ✓ PUE for mechanical systems, Green Grid Level 2 or 3 ✓ PUE for electrical systems, Green Grid Level 2 or 3. **IT load capacity >250 kVA:** ✓ Water consumption in cooling system (if applicable) ✓ CRAC/air handler air filter status ✓ Battery Room and UPS Room temperature & humidity ✓ All data available in real time in an automated data centre infrastructure management (DCIM) system.

Advisory Group Discussion

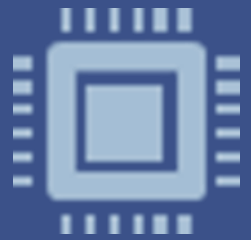
- Can we simplify this list?
- Are all recommendations applicable to all data centres (of the sizes specified)?
- Should some of the recommendations be moved to best practices?
- Should there be data centre specific requirements at Level I?

Uninterruptible Power Supply (UPS)

Level I	Level II	Level III
ECBC Compliant ECBC 2017 Section 7.2.7: ✓ UPS modules with kVA <20 shall have minimum efficiency of 90.2% at 100% load. ✓ UPS modules with 20 <= kVA <=100 shall have minimum efficiency of 91.9% at 100% load. ✓ UPS modules with kVA > 100 shall have minimum efficiency of 93.8% at 100% load.	**ECBC+** **Recommended Additional Requirements** ✓ UPS modules with kVA <=100 shall have minimum efficiency of 94.5% in the 40-70% load range. ✓ UPS modules with kVA > 100 shall have minimum efficiency of 96% in the 40-70% load range.	**SuperECBC** **Recommended Additional Requirements** Same as Level II.

Advisory Group Discussion

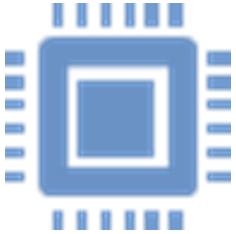
- What is the justification for better performance required in data centers? Longer operating hours?
- Can we get the higher performance at 40% of the load (as stated)?
- Shouldn’t we have a Level III performance level?
- Are efficiency ratings for modules or at the system level (e.g. 40% load of module or system)



IT Hardware and Management

IT Hardware

Level I	Level II	Level III
Efficiency Ratings for Servers and Data Storage Equipment		
[placeholder]	[placeholder, ENERGY STAR?]	[placeholder, ENERGY STAR?]
Processors		
No recommended requirement.	Percentage of processors no older than N-2 Generation: >60%	Percentage of processors no older than N-1 Generation: >60%
Power Supplies		
80 Plus Silver or below for more than 75% of all server hardware.	**80 Plus Gold** or better for more than 75% of all server hardware.	**80 Plus Platinum** or better for more than 75% of all server hardware.
Power Type		
Power Input Type: Any	Power Input Type: Any	Power Input Type: High Voltage (over 48V) Direct Current



IT Management

Level I	Level II	Level III
Server Utilization		
CPU load 10 – 20%	CPU load >20% - 40%	CPU load > 40%
Server Virtualization		
10% - 20% Virtualization	>20% – 40% Virtualization	>40% Virtualization

Advisory Group Discussion

- Note all IT Hardware and Management are best practices, not ECBC requirements.
- Is an India-specific rating system already in place for servers, storage, etc.? If not, should another rating system be adopted or adapted (e.g. Energy Star)?
- How should efficiency levels for equipment (e.g., server CPUs with continually advancing technology) be specified? Is the recommended use of recent generation equipment a good metric?
- How to measure virtualization? What levels are appropriate?
- How to measure a weighted average CPU load across a data centre? What levels are appropriate?

Future Enhancements

Total Data Centre - Performance Approach

- Should India have a performance-based approach across the data centre's infrastructure?
- Should it be handled similarly as the performance approach for the chiller plant (e.g., through annual simulation)?
- If so, what whole-centre performance metrics and values are appropriate?

Case Studies

Nomination for Data Centre Case Studies

1. Case studies will complement the recommendations in the guide and provide the Indian context
2. New High Performance Data Centre(s)
3. Existing Data Centre(s) that have demonstrated significant improvements
4. Nominations still being accepted

Next Steps

Next Steps

1. Participation in awareness and capacity building programmes
2. Adopt higher levels of performance to own work
    a. Should we seek public commitments
3. Review draft guide and provide input via track changes (when?)
    a. Recommendations
    b. Tips and best practices
    c. Resources that apply to the Indian context
    d. Graphics – editable and permission to use (will acknowledge sources)
4. Solicit input from a wider audience?