ENERGY EFFICIENCY IN HEALTHCARE SECTOR

A Webinar by CAHO and AEEE

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June 22, 2016

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Motivation

Green is Becoming an Imperative for Hospitals

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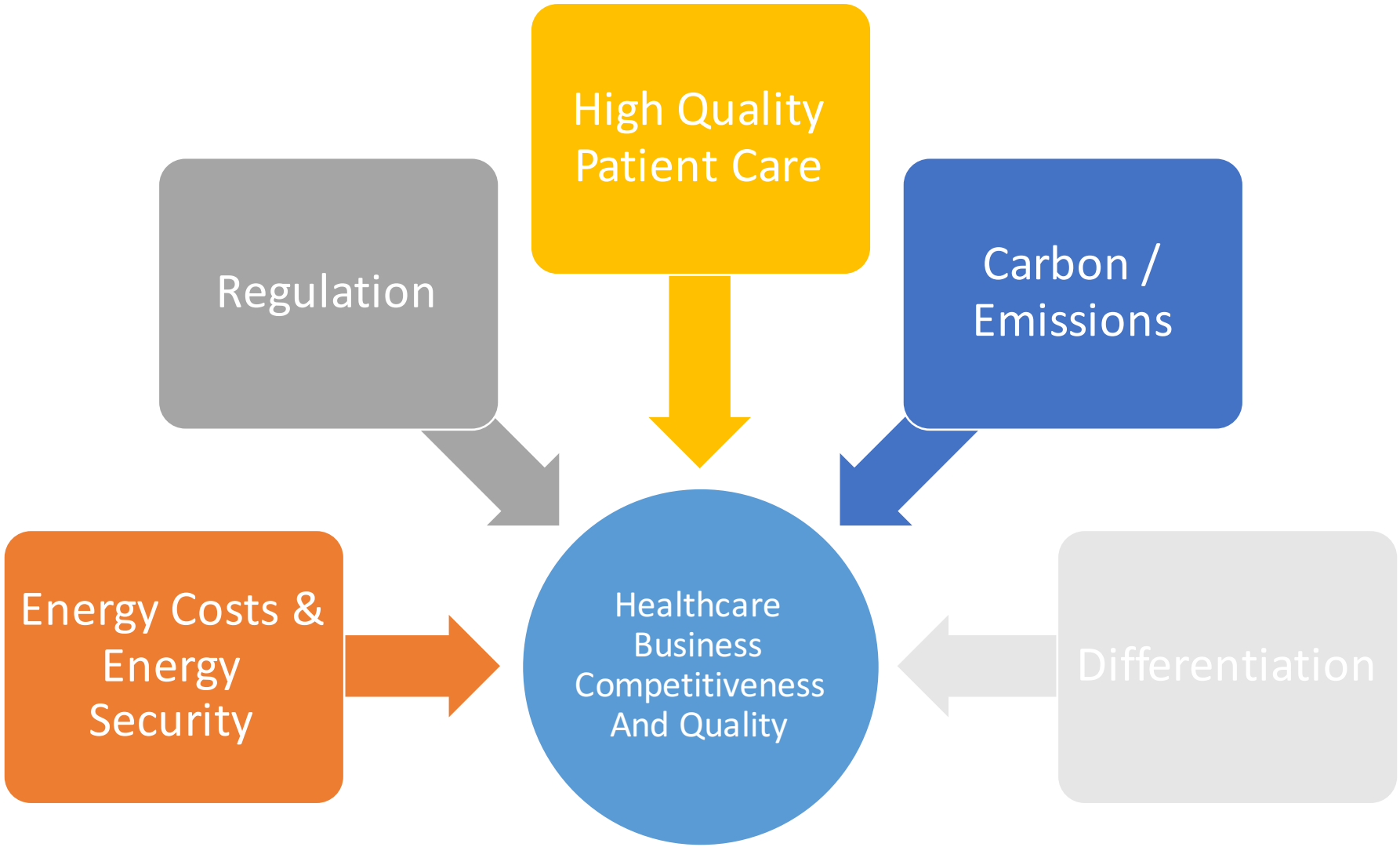

WHAT'S IT WORTH? WHY BOTHER?

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0.9 bed per 1000 population in 2014 ~ 11 Lakh beds

Private sector's share in **total number of hospitals** and **hospital beds** is estimated at **74 per cent** and **40 per cent**

Annual energy consumption per bed varies from 4,000 kWh – 16,000 kWh and Annual energy consumption per m^2 varies 75 kWh – 320 kWh

Total national level electricity consumption ~ 9,40,000 GWh

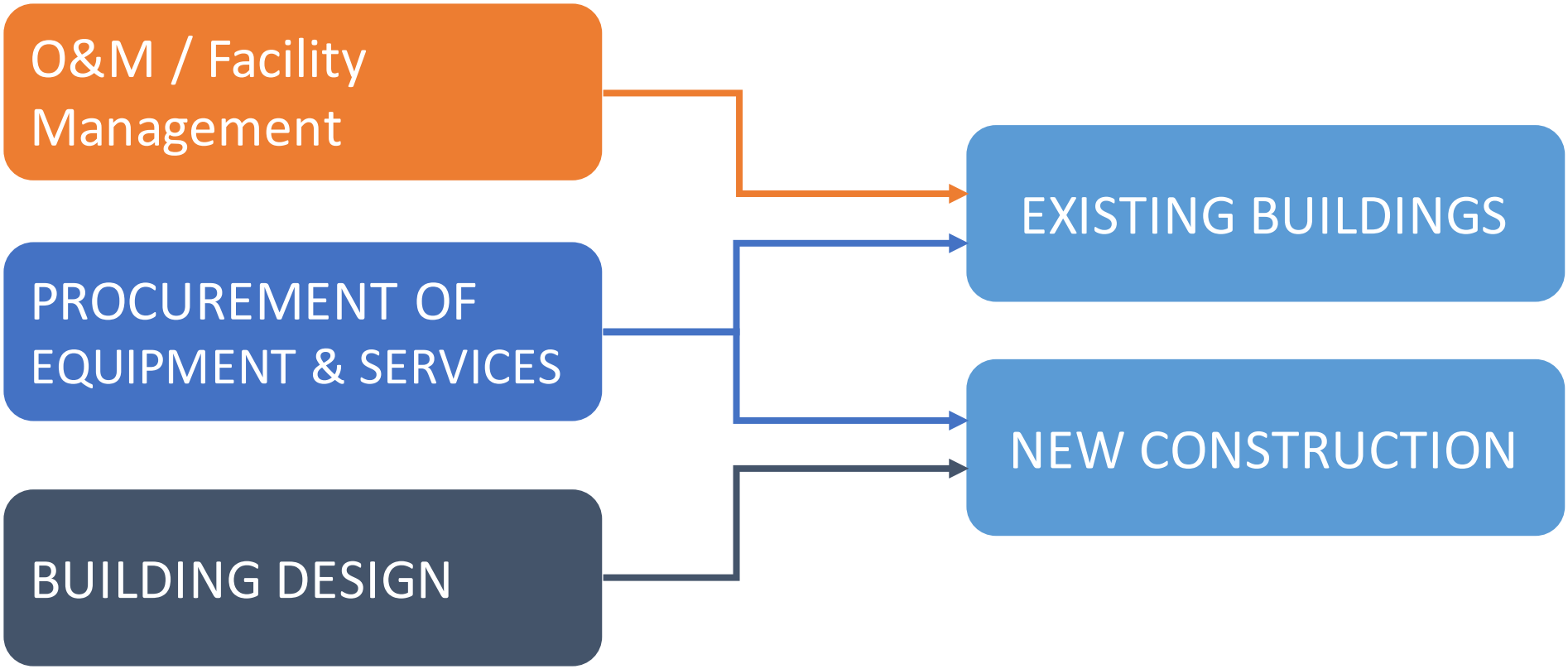
Total commercial sector consumption ~ 1,03,000 GWh (11%)

Total healthcare sector energy consumption – 5,000 GWh – 10,000 GWh (5% - 10%)

Total built-up area in health care sector considering 11 lakh beds – **30 - 50 million m^2**

Expected rise in number of beds in next 5 years – 50,000 equivalent to 2 million m^2

Energy Management in Hospitals



Align Energy Efficiency with the Critical Function of Health Care Facilities

Energy Efficient Facility Management in Hospitals

Overarching Goals of Hospital Facility Administrators

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- Ensure quality patient care and minimize health risks
- Secure reliable energy and utility supplies
- Manage building services and indoor environmental services
- Guarantee performance and cost
- Measurable and Enforceable Service Level Agreements (SLAs)

Get Basics Right Before Attempting Ambitious Projects

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- Know Your Facility - Meter Your Building and System
- Benchmark Your Hospital Building and Systems
- Set KPIs for Facility Staff (EPI, Plug Power, HVAC, etc.)
- Conduct Action-Oriented Energy Audit – Use Facility/System Data to Get Best Bang for your Buck
- Identify ECMs with ROI; Develop Implementation Plan
- Measure and Verify
- Apply for BEE Star or Green Building Rating

SPECIAL NEEDS IN CRITICAL ENVIRONMENTS HAVING ENERGY IMPLICATIONS

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Air Conditioning	Lighting & Electrical	Uninterrupted Power Supply
Cogeneration	Refrigeration	Medial Vacuum Systems
Cleanrooms	Sterilization	Steam

KPI Driven Energy Management:
From ISO 50001 to Capex Investments

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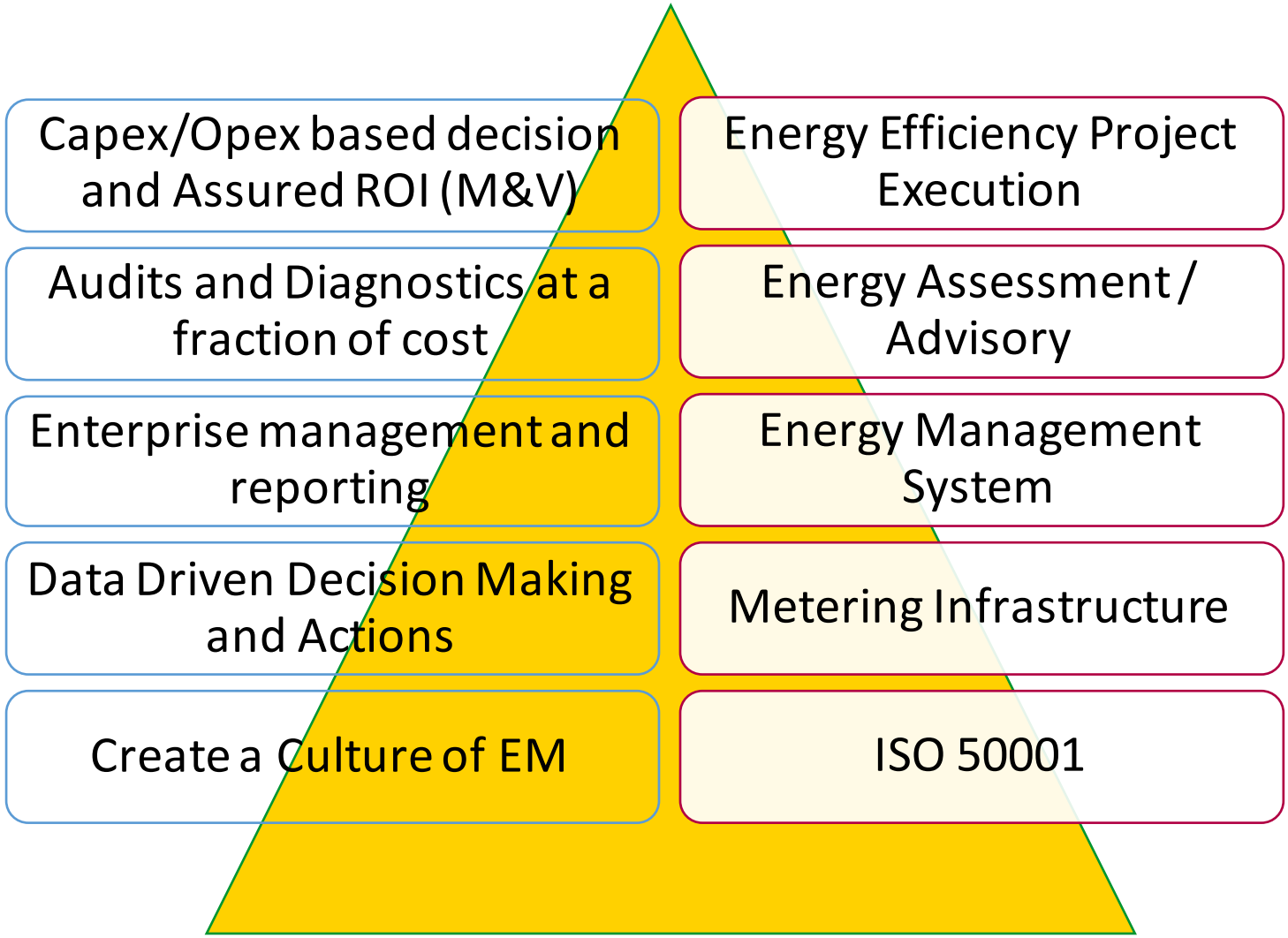

ISO 50001 ENERGY MANAGEMENT

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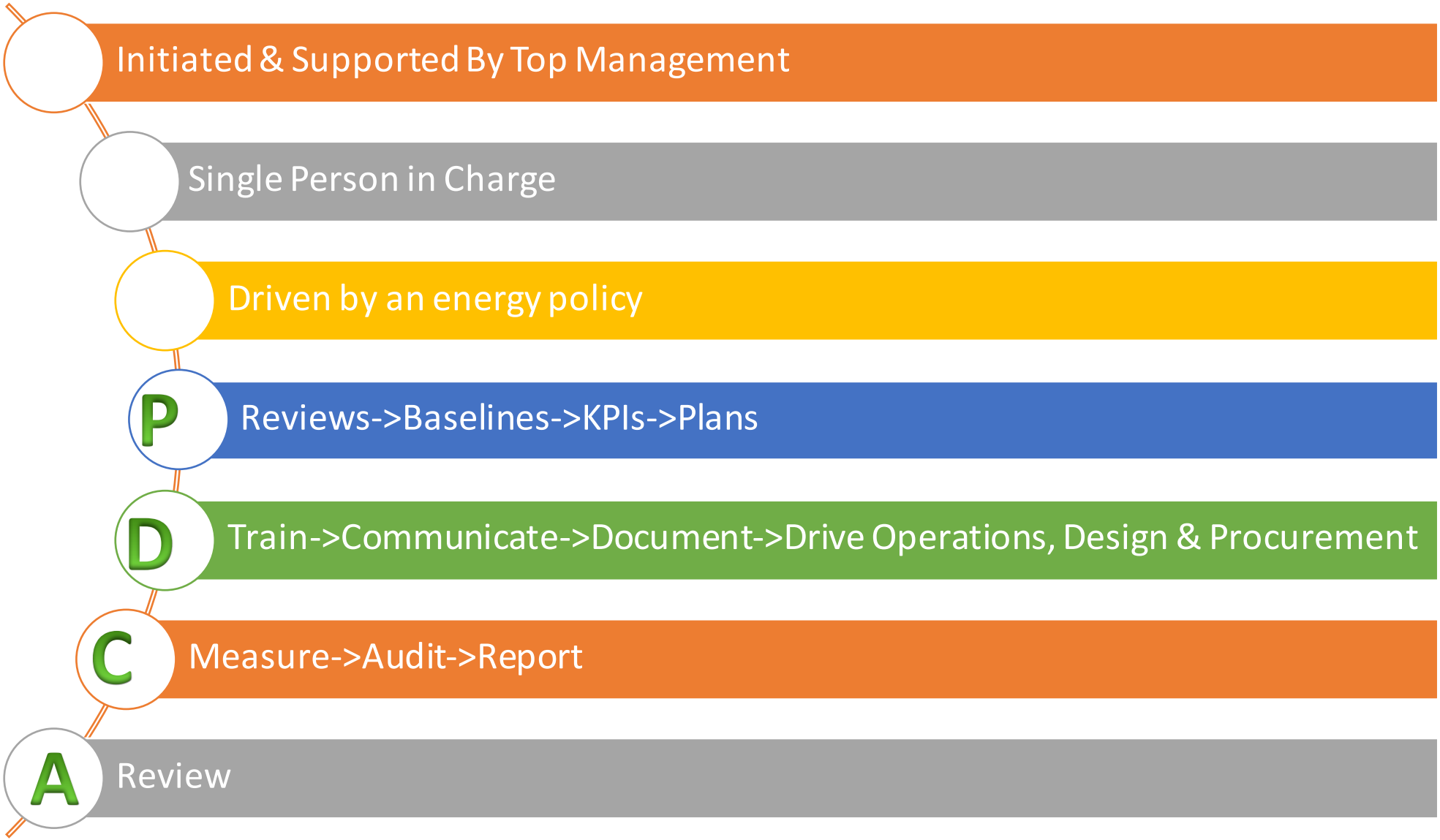

BEE-ECO-III BENCHMARKING STUDY
AVERAGES FOR DIFFERENT COMMERCIAL BUILDINGS

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Count	Building Type	Floor Area, (m^2)	Annual Energy Consumption (kWh)	Energy Performance Index (kWh/m^2/year)
OFFICE BUILDINGS				
145	**One shift Building**	16,716	20,92,364	**149**
55	**Three shifts Building**	31,226	88,82,824	**349**
88	**Public Sector Building**	15,799	18,38,331	**115**
224	**Private Sector Building**	28,335	44,98,942	**258**
10	**Green Buildings**	8,382	15,89,508	**141**
HOSPITALS				
128	**Multi-specialty Hospitals**	8721	24,53,060	**378**
22	**Government Hospitals**	19,859	13,65,066	**88**
HOTELS				
89	**Luxury Hotels – 4&5 Star**	19,136	48,65,711	**279**

Source: BEE ECO III benchmarking study

BEE Star Label for Hospitals

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Average hospital: Yearly : ~230 kWh/sq.m or ~11500 kWh/bed

Monthly: Rs. ~12/sq. ft. or Rs. ~6680/bed

Energy costs for BEE 5-Star rated hospital:

Monthly: Rs. ~8/sq. ft. or Rs. ~4500/bed

Collected sample characteristics

		★		★		★		★		★	
		< ★ ≤		< ★ ≤		< ★ ≤		< ★ ≤		< ★ ≤	
Rank	0		4		12		24		40		60
EPI (kWh/m2)	0		153		192		229		269		318
EPI (kWh/bed)	0		7661		9616		11445		13425		15900
INR/sq ft/month	0		8		10		12		15		17
INR/bed/month	0		4469		5609		6676		7831		9275

Source: Stakeholder workshop on Star Rating of Hospitals, BEE

MAJOR CONTRIBUTORS OF ELECTRICITY CONSUMPTION - CBERD STUDY

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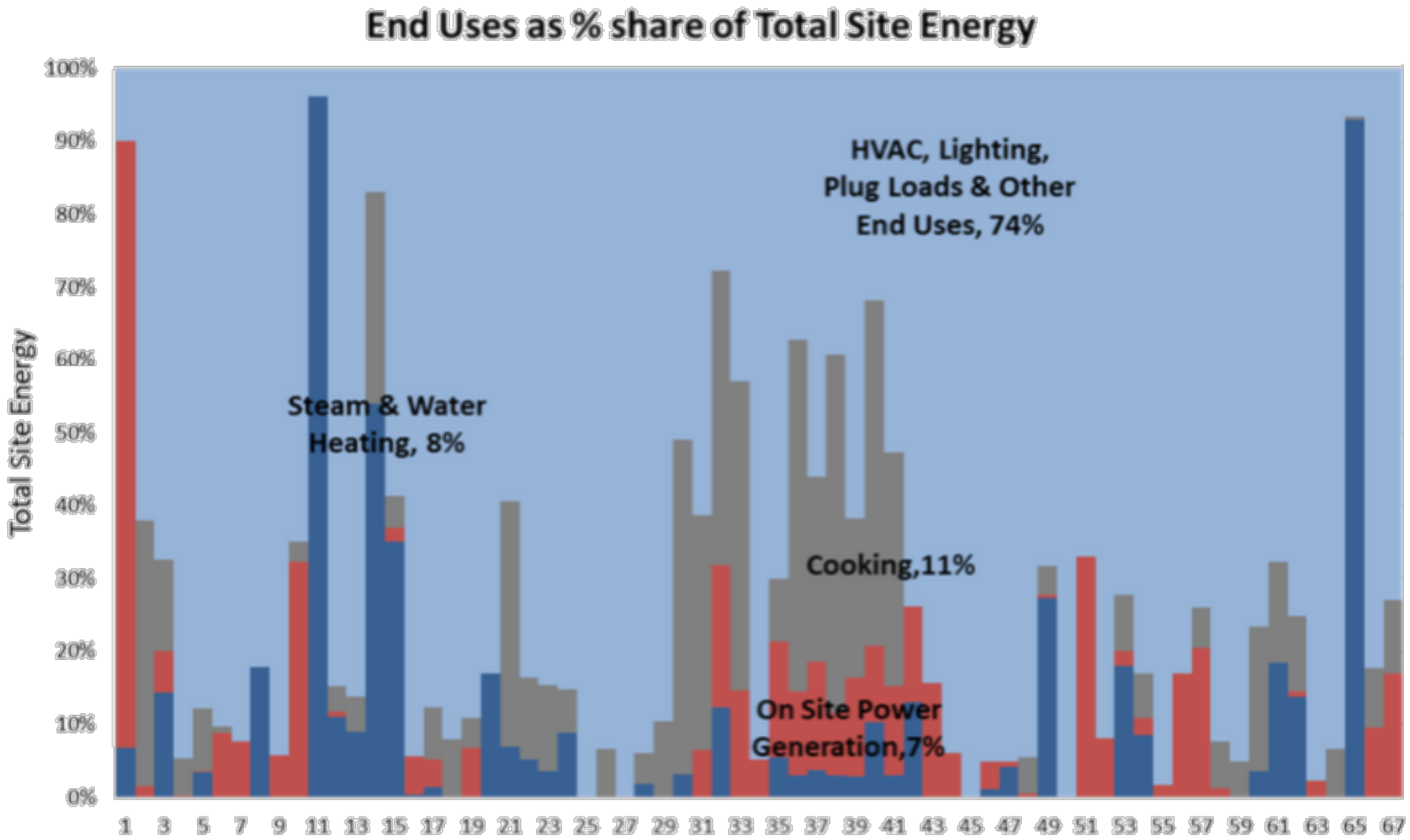
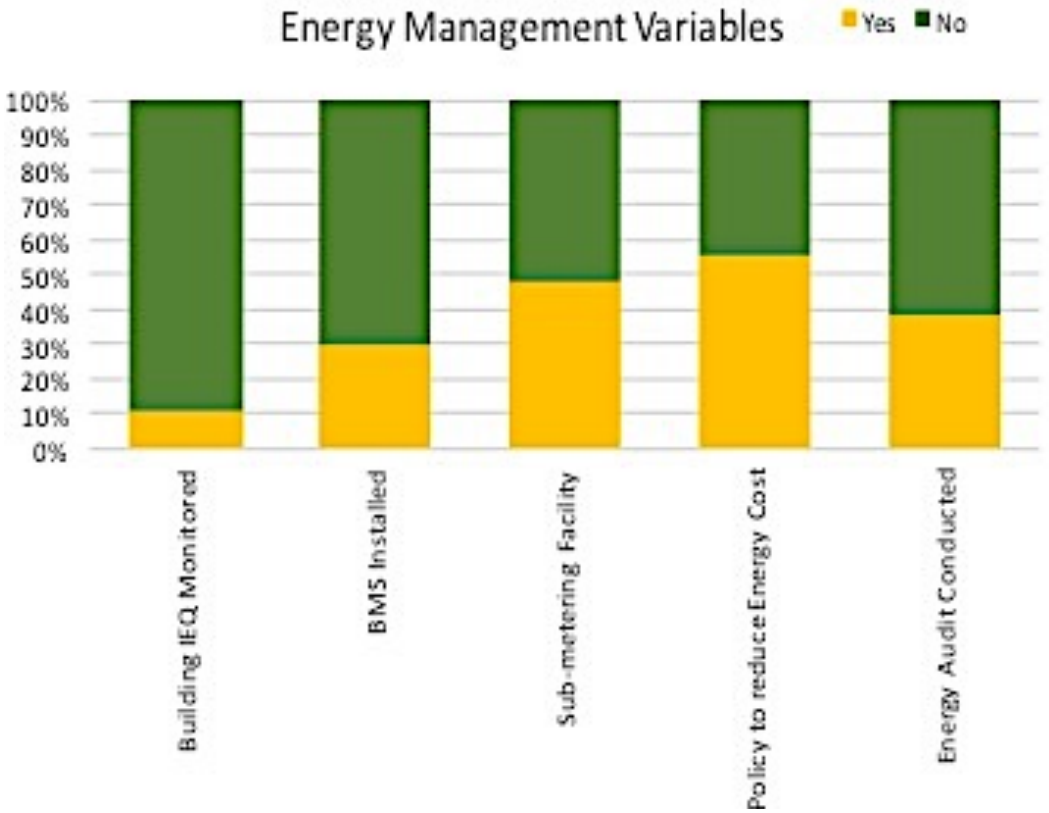
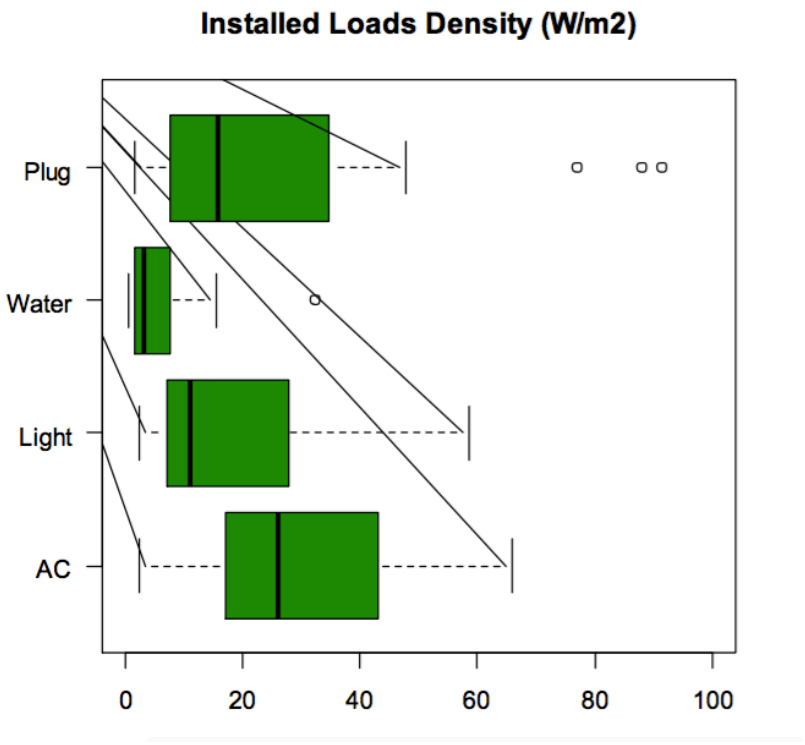
67 Indian hospitals analysis carried by CBERD



Source; Exploratory Data Analysis of Indian Hospital Benchmarking Dataset: Key Findings and Recommendations, 2014, CBERD

CBERD STUDY - 67 INDIAN HOSPITALS ANALYSIS





Source; Exploratory Data Analysis of Indian Hospital Benchmarking Dataset: Key Findings and Recommendations, 2014, CBERD

STRATEGIES FOR Energy Efficient Procurement in HEALTHCARE SECTOR

Medical Equipment Categories

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Diagnostic and Imaging Equipment

- Computer Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Molecular Imaging (MI)
- PET & PET/CT Imaging
- Mammography
- Ultrasound

Life Saving Equipment

- Operation Theater Equipment
- Intensive Care Unit Equipment
- Catheterization Laboratory Equipment
- Central Sterilization Equipment
- Patient Monitoring Solutions

Hospital IT Equipment

- Hospital Information System
- Workstations
- Computers
- Laser Camera
- Film Processors
- Printers
- Television/Screens

PROCUREMENT OF EQUIPMENT

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Energy Consumption of some of the medical equipment

EQUIPMENT	HIGH	MEDIUM	LOW
MRI	High		
CT	High		
CATHLAB	High		
PET & PET CT	High		
OT Equipment	High		
CSSD (Central sterilization supply dept.)	High		
X-RAY (Radiography & Fluoroscopy)		Medium	
ICCU Equipment		Medium	
Mammography		Medium	
Ultrasound			Low
Healthcare IT workstations			Low

PLUG LOAD ENERGY CONSUMPTION

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In US installed base of MRI machines is estimated to have increased by over 40% in just three years from 7000 in 2005 to 9400 in 2008 (Zogg et al. 2009)

TIAX (2010) estimates the standby power draw of MRI machine as 14kW and even an off mode power draw as high as 7 kW

TIAX estimates about 40% savings in annual energy consumption from MRI machines

Source: Miscellaneous Energy Loads in Buildings by Sameer Kwatra, Jennifer Amann, and Harvey Sachs June 2013

MRI Power Consumption pattern – European study

MODE	Average Power Consumption (kW)	Average distribution of daily energy consumption %
Off	9,3	34
Ready to scan	14,6	34
Scan	22,3	32

Source: COCIR Self-regulatory Initiative for Medical Imaging Equipment Status Report 2013

PROCUREMENT OF EE EQUIPMENT

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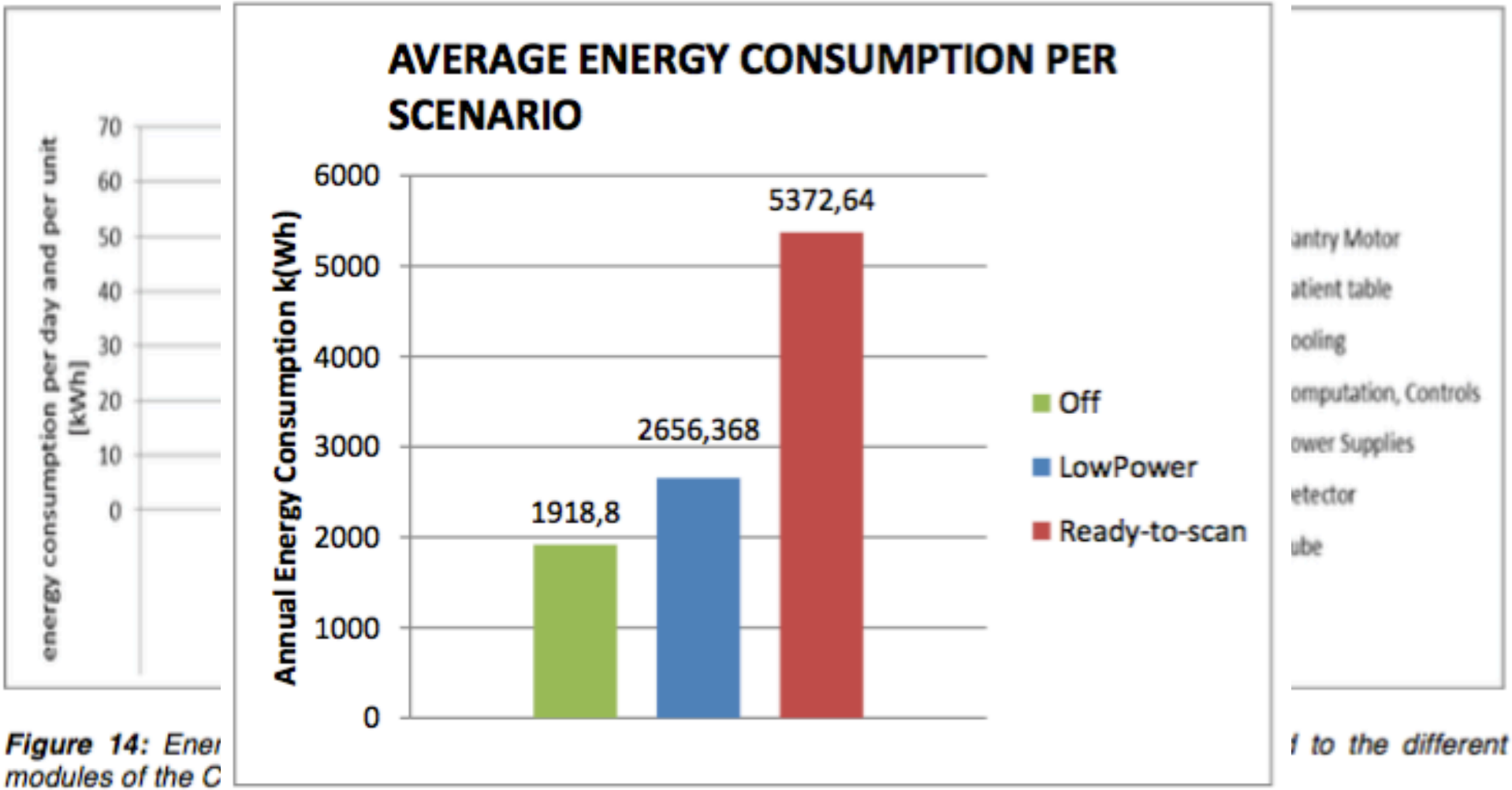

Figure 14: Ener … *f to the different modules of the C*

Figure 22: *Annual energy consumption of x-ray device per scenario*

PROCUREMENT OF EE EQUIPMENT

The EU project launched in 2011 to define green criteria for public procurement of medical devices has concluded and published in July 2014

Some opportunities include:

Evolving technology - Shifting to digital X-ray technology, Digital X-ray technology eliminates the need for film processing and uses less energy than conventional analog systems

Given the intermittent use of medical imaging services, **efficient power management** should offer substantial energy savings, equipment to be designed to consume less energy on standby mode

Energy efficiency rating systems for medical equipment - helping to create a market for more efficient products by providing the buyers with more information and giving manufacturers an incentive to differentiate

Future research and product development with a focus on energy efficiency are likely to reveal additional opportunities to reduce energy use.

In US, clinics could save over $2000 per year per unit and hospitals could save over $6000 per unit with the purchase of more efficient equipment (EPA 2013).

Hospital Building Design

Energy Efficient Design Fundamentals

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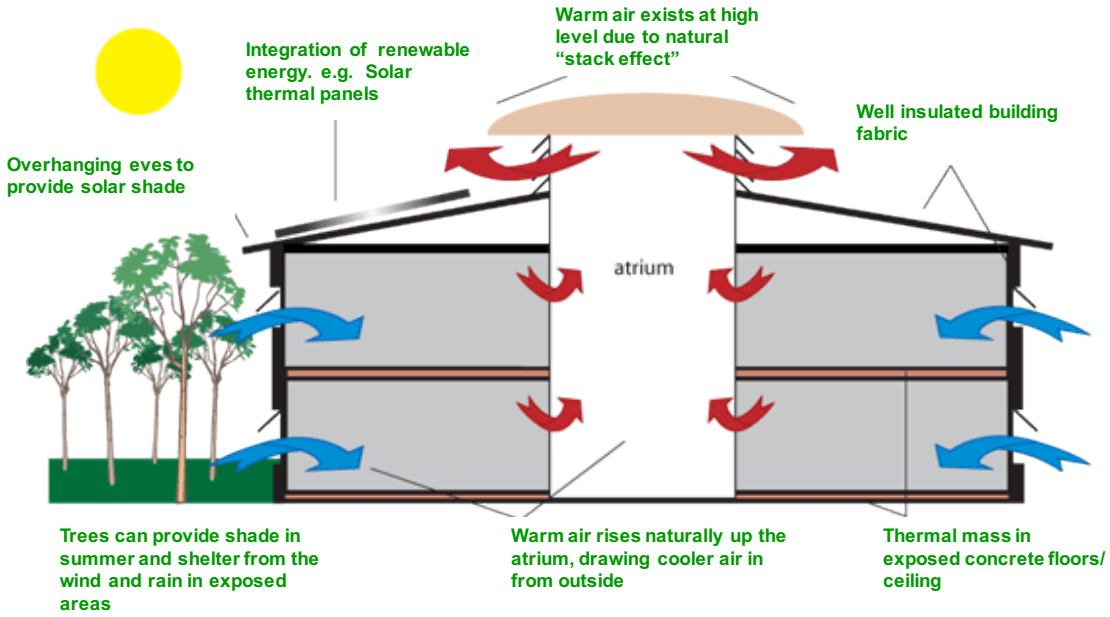

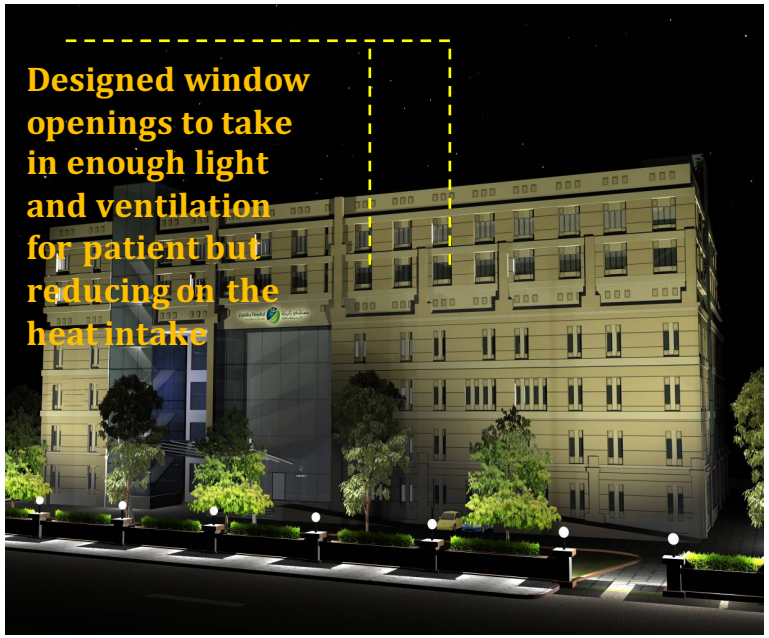

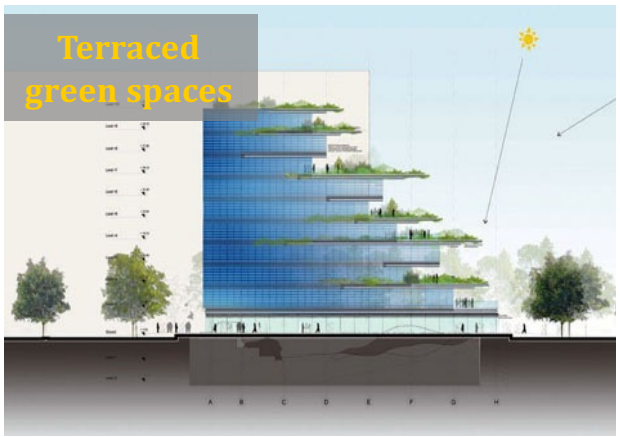

Hospital Layout and Form Evolution

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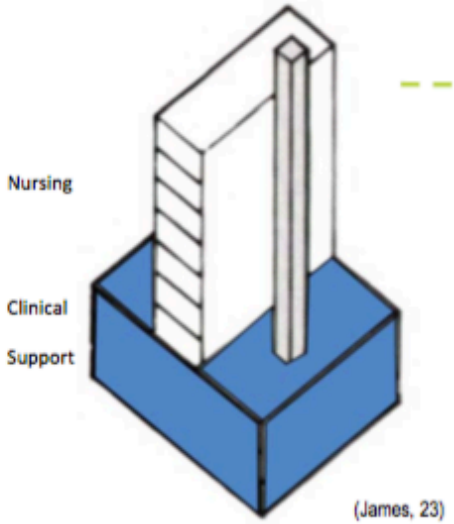
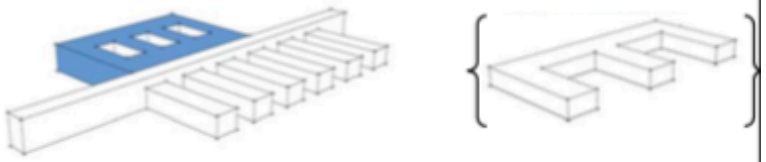
Better Circulation, Accessibility and Expandability: European Hospital Leading the Way

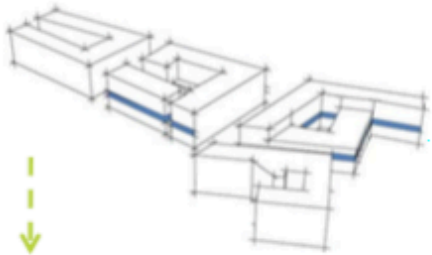
Vertical model: "Podium on a Platform"



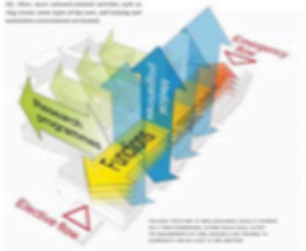
Horizontal model: the "Pavilion Concept"



Unbundled model: "Community Place Making"



Layered model: Ultimate Flexibility of Function



Role of Environment in Theraupatic Care of Patients

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Building Design Fundamentals
Executive Level

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1. Be Lean: Halve the Demand	• Review Standards • Reduce Losses • Eliminate Wastage
2. Be Mean: Double the Efficiency	• Buy efficient equipment/technology • Optimise system efficiency • Operate and maintain the system with KPIs
3. Be Green: Halve the Carbon	• With on-site renewables, if possible • With green procurement, where possible • With validated offsets, where possible

Potential to reduce energy consumption to 1/8th of business as usual BUT you need to all the above steps and in the right order

Credits

- Bureau of Energy Efficiency
- Center for Building Energy Research and Development Program
- Dalkia Energy Services Ltd.
- USAID ECO-III Program
- General Electric India
- Schneider Electric India Pvt. Ltd.
- Usable Building Trust

REFERENCES

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Discussions and Questions