Smart & Sustainable Cities Conference Delhi, June 2014

A building economist's perspective

Presenter: Peter Cox

Agenda

- Introduction
- Case study #1 – An established city (Melbourne, Australia)
- Case study #2 – A new city (Gujarat India)
- Case study #3 – Facilitating High Performance buildings (Australia, India, Singapore)
- Conclusions

Introduction

- Global competition amongst cities (and nations) for investment, talent and profile
- Significant capital investment in new Cities, Buildings & Infrastructure planned & committed
- Community (and Corporate) expectation that investment = demonstrate value for money and provide world class service delivery settings and improved quality of life
- Current policies and procurement practices focus on capital investment (especially initial cost) and development before social and environmental considerations
- Opportunity now to shift focus to long term liveability and a whole of life economic paradigm and broader definitions of sustainability and value

Introduction

- Acknowledgements;
  - Stefan Preuss, Director Resource Efficiency, Sustainability Victoria
  - Dr Vyt Garny, MD CETEC environmental science
  - Mr Bruce Crook, Director international projects, STH healthcare architecture

Agenda

- Introduction
- **Case study #1 – A government, business and community approach to driving sustainability in an established city (Melbourne, Australia)**
- Case study #2 – A new city (Gujarat India)
- Case study #3 – A method of facilitating High Performance hospital buildings (Australia, India, Singapore)
- Conclusions

Victoria

25% GDP

Liveability Prosperity Growth

Victoria is situated in the south east corner of the Australian mainland and is home to 5 million people

75% of people in Victoria live in the city of Melbourne

Melbourne is home to some of the world's most innovative and renowned architects, urban designers, planners and clean tech practitioners who have contributed to Melbourne being a liveable city.

Victoria's has a long and well established history in environmental regulation.

MELBOURNE
VICTORIA AUSTRALIA

State Government Victoria
AUSTRALIA

EPA Victoria

Environment Protection Authority Victoria (EPA Victoria) is Victoria's independent environmental regulator

Second oldest environmental regulator in the world.

Responsible for protecting the environment and the community through effective regulation of industry and pollution.

Sits within the Government's environment portfolio.

Sustainability Victoria

sustainability.vic.gov.au

Sustainability Victoria (SV) is the Victorian Government agency responsible for:

- State integrated waste management planning
- Delivery of government waste programs
- Resource recovery programs
- Resource efficiency programs

SV works closely with EPA Victoria and also sits within the environment portfolio in Victoria.

Through its role in planning, education and facilitating investment in waste infrastructure and delivery of the Victorian Government's Smarter Resources Smarter Business program, SV supports the development of the Victoria's thriving sustainability industry.

Victoria

Victoria is home to some of Australia's leading sustainable urban design and clean tech expertise who can learn from, assist and trade with India as you also seek to pursue a pathway for sustainable growth.

Victoria's building, construction and related design industries employ more than 350,000 people with an annual turnover in excess of A$23Bil.

It is one of the most mature and innovative sectors in the State.

Victoria

Victoria faces similar challenges to India, including a highly industrial / urban interface

Victoria has a highly skilled clean tech sector with 19,000 people employed by more than 300 businesses, producing revenues of A$3.5 billion

The Victorian Government also actively supports the sharing of public policy frameworks as enablers of sustainable growth and improved liveability.

Liveability Prosperity Growth

The livability of the Victorian community now benefits from the decades of active policy, research, education and experience that is now trading as our Sustainability Industry.

Public, private and the research sectors all contribute to the strength of Victoria's Sustainability industry.

The Indian community is one of the fastest growing in Victoria and we are committed to strengthening ties.

Working together to grow business and develop a pathway to sustainable growth benefits both the Indian and Victorian communities.

MELBOURNE
VICTORIA AUSTRALIA

State Government Victoria
AUSTRALIA

BUILDING BLOCKS

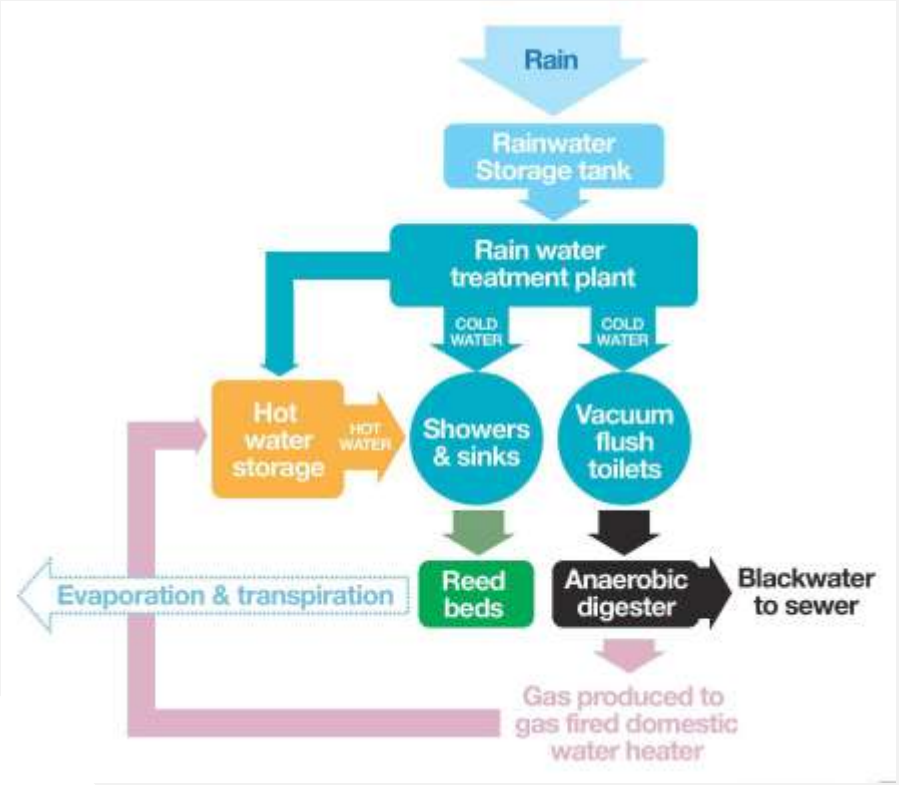
1. Smart Design
2. Closing the Loop - Achieving More with Less
3. Beyond Efficiency

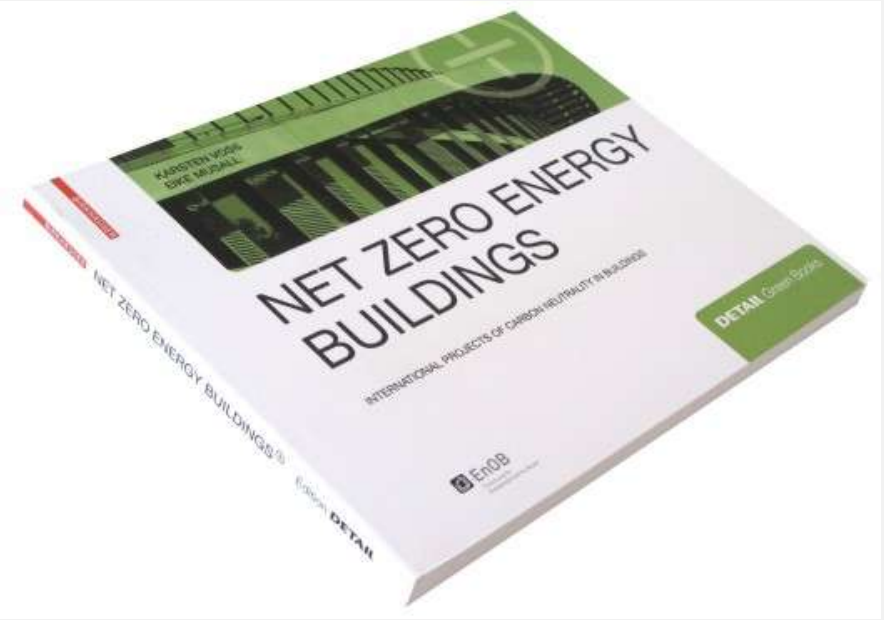
SMART DESIGN

1. Products

SMART DESIGN

1. Products
2. Buildings





Sustainability Victoria

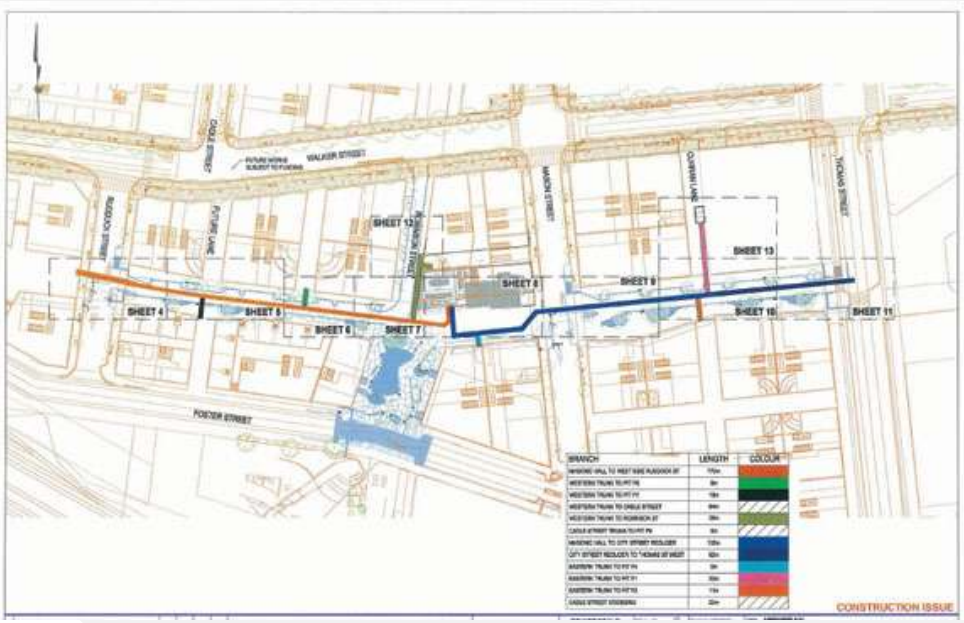
State Government Victoria

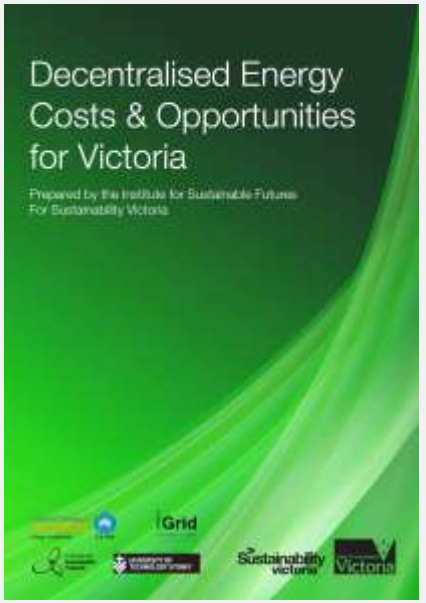
SMART DESIGN

1. Products
2. Buildings
3. Streets + Public Spaces

SMART DESIGN

1. Products
2. Buildings
3. Streets + Public Spaces
4. Neighbourhoods + Cities





Central Dandenong district heating and cooling

Sustainability Victoria

State Government Victoria

CLOSING THE LOOP – DOING MORE WITH LESS

NABERS

Sustainability Victoria

State Government Victoria

Smarter Resources Business education program

> $14 m business program
> Helping business reduce costs and environmental impacts

Sustainability Victoria
State Government Victoria

“Smarter Choice” consumer education program

Smarter Choice™
Save energy, water and money

BUNNINGS warehouse

THE GOOD GU...

PAY LESS PAY CASH

MIGHTY HELPFUL MITRE 10

JB HI-FI

Beacon LIGHTING

...rvey Norma...

Betta HOME LIVING

...s trading
feel at home

IYE...
is my st...

DAVID JONES

Changing culture - results

Example: Residential Energy Use (absolute)

State	PJ/a 2006-07	PJ/a 2010-1	Difference	% Change
Victoria	42.9	42	-0.9	**-2.1**
Queensland	41.8	46.2	4.4	10.5
NSW/ACT	78.3	85.9	7.6	9.7
South Australia	16.7	18.2	1.5	9.0
Tasmania	8	8.5	0.5	6.3

(Bureau of Resource and Energy Economics (BREE 2012)


Melbourne city ranked “worlds most livable city – 3 years running – The Economist”

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- **Case study #2 – Planning a new sustainable city (Gujarat India)**
- Case study #3 – A method of facilitating High Performance hospital buildings (Australia, India, Singapore)
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Case study – a new sustainable city in Gujarat

- Objective to create a new Indian city which is truly sustainable having;
  - Sound environmental and sustainable development policies
  - Cohesive social framework
  - Strong economic and employment growth potential
- Adopting best practice sustainable city principles from outset of planning
- Colaboration between professionals from India and Australia
  - Govt to Govt MOU
  - Policy & guidelines
  - Legislation
  - Town Planning & Urban Design
  - Building & Environmental design concepts
  - Innovative International & Local Finance & investment models

Case study – a new sustainable city in Gujarat

- Status;
  - Working party formed
  - Govt to Govt MOU being drafted
  - Seeking EOI from interested parties
  - Discussions with local RE & Township developers
  - Seeking EOI from interested parties

To be continued…

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Introduction

- "*While much is being done to conserve energy, salary costs are up to 100 times more than energy costs*" CSIRO Aust

- "*For office work the physical environment (IEQ) accounts for a 5-15% variation in productivity*" BOSTI USA

CETEC Study: Value of IEQ vs Energy

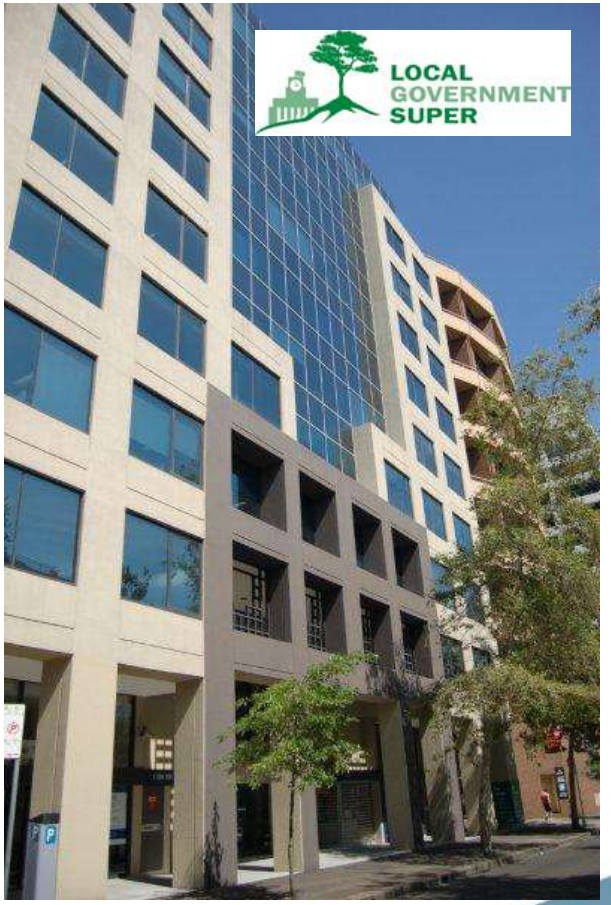
PRE & POST OCCUPANCY
Indoor Environment Study
Local Government
Superannuation, Sydney CBD

Refurbishment of four buildings
Value Gained

2009 – 2011

Energy gains: INR 800 per/m^2

IE gains: INR 2,000 per/m^2

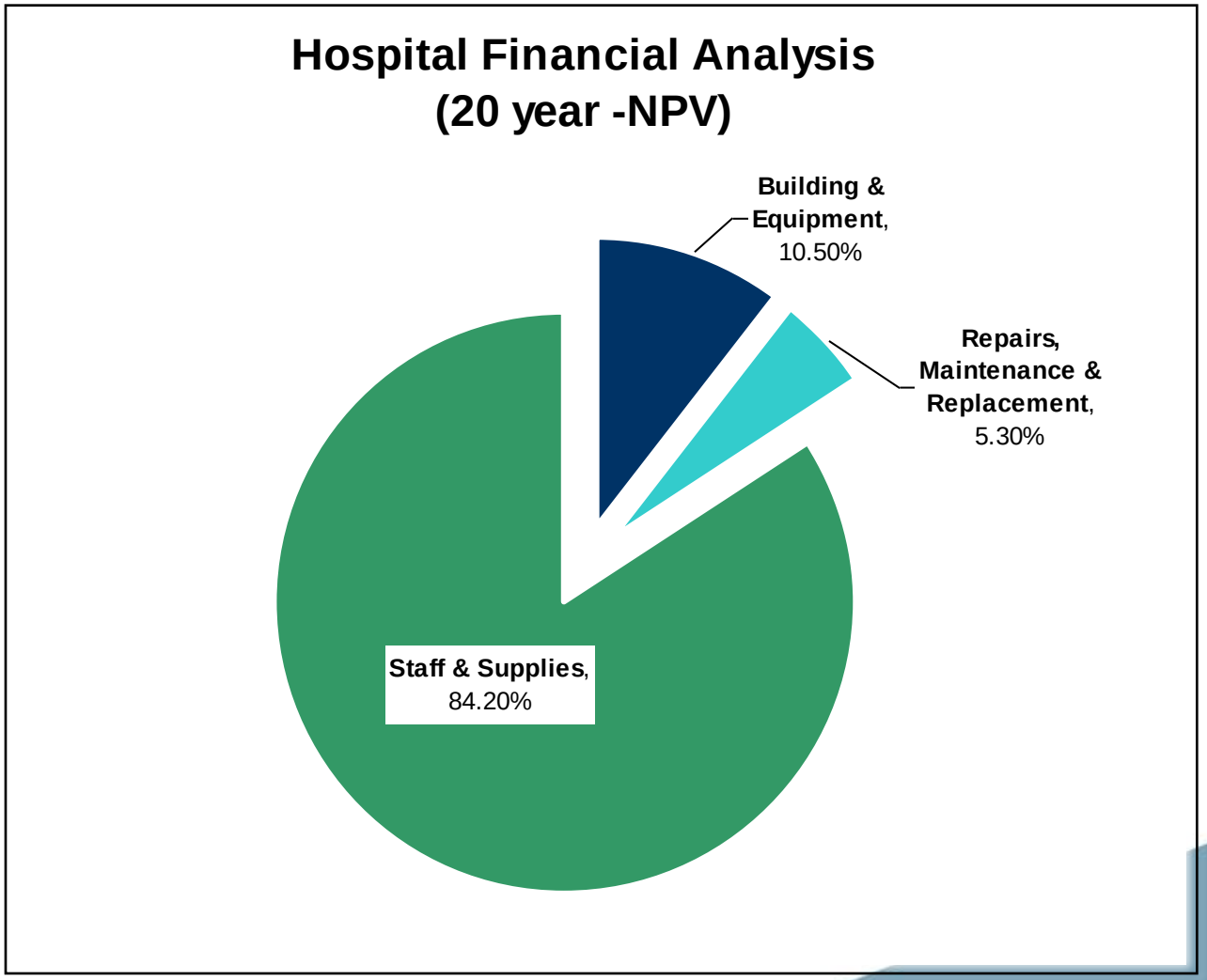


Introduction

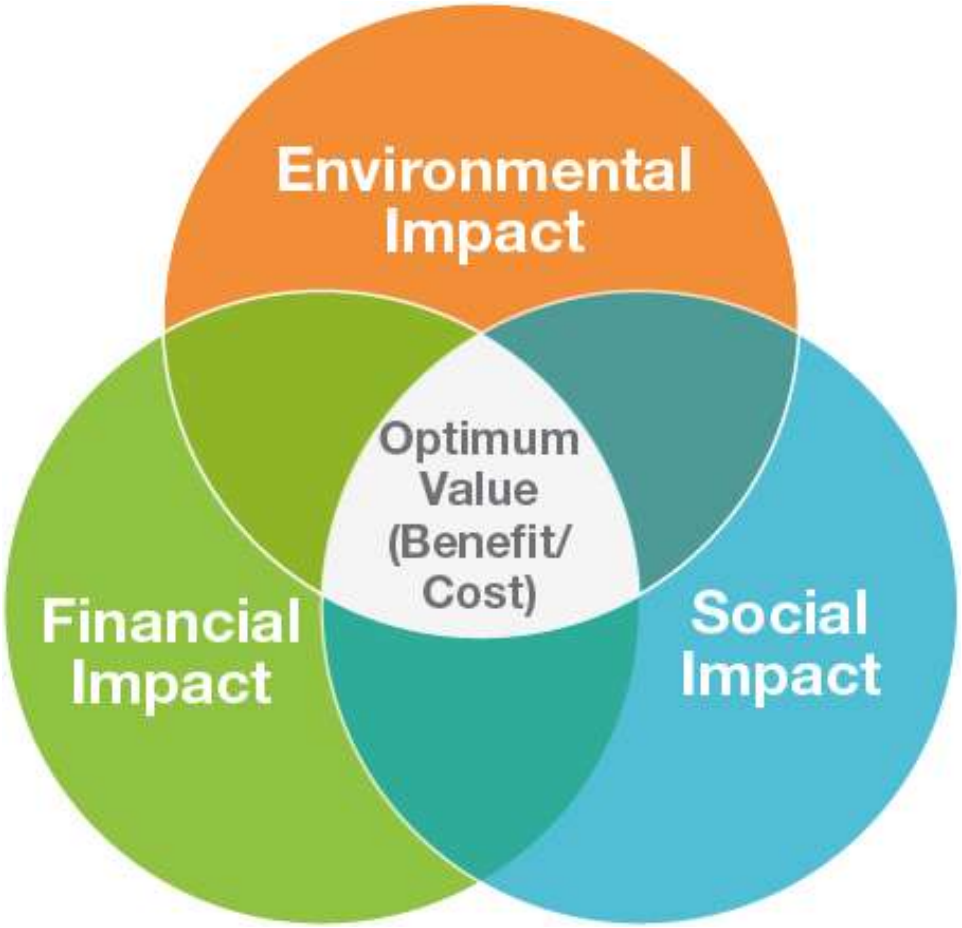
- *"The physical environment can help increase effectiveness in providing care, reducing errors, increasing job satisfaction and reducing staff turnover"*
- *"An additional investment of $12m to the total construction cost of a $240m replacement hospital paid for itself in less than two years"*
- *(The Centre for Health Design USA)*

Introduction

PCA Studies



Triple bottom line focus (creating High Perfoirmance buildings)



From Green to Green, Healthy and Productive Buildings

What is a Green building?

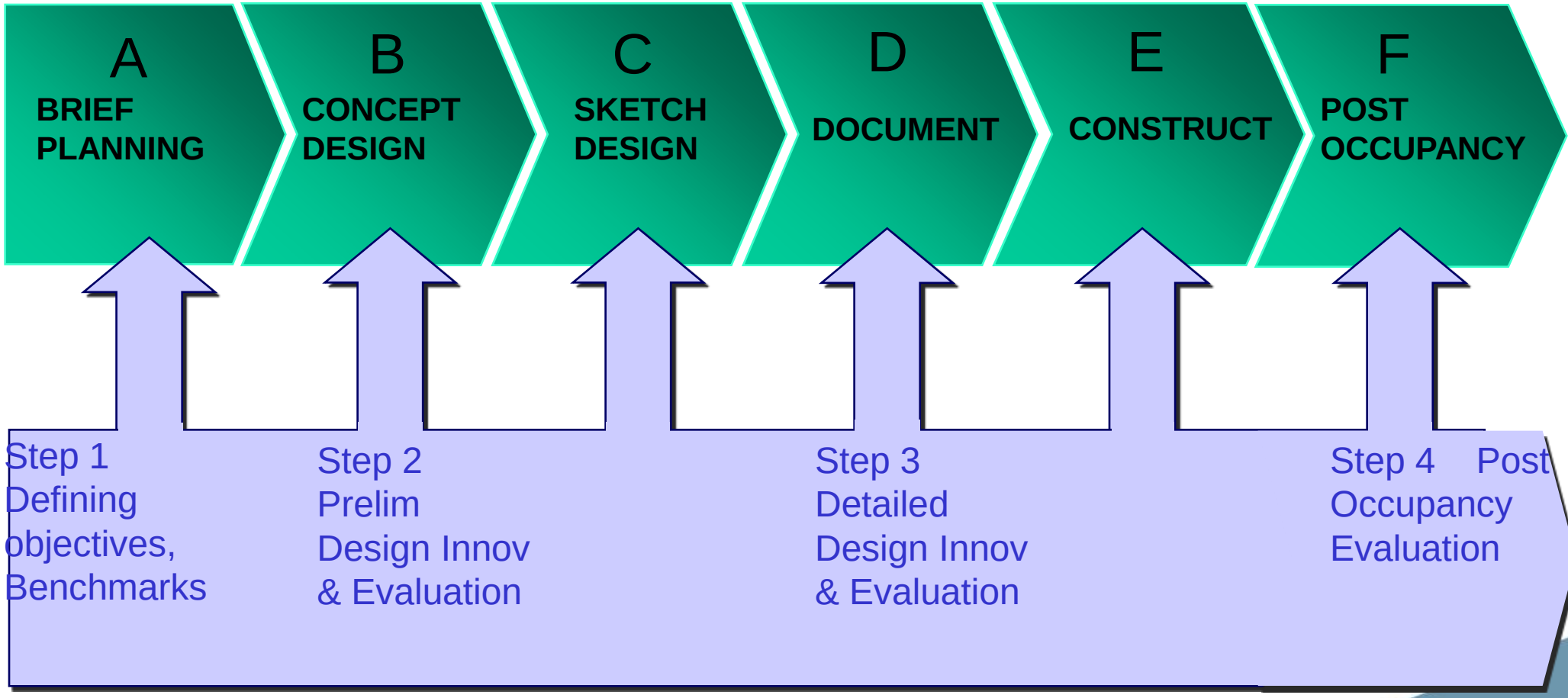
"A green building is one which uses less water, optimises energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building." – Indian Green Building Council, 2011

What is a Green, Healthy & Productive building?

CETEC
Professional Scientific Solutions

PCA Directions

Project Development cycle



HPB Facilitation cycle

Step 1: Defining Operational (Hospital management objectives)

NUMBER OF PATIENT FALLS PER 1,000 PATIENTS

NUMBER OF ROOM TRANSFERS PER PATIENT STAY

PERCENTAGE OF PATIENTS INFECTED BY DISEASES PICKED UP IN HOSPITAL

PERCENTAGE OF THE COST ATTRIBUTABLE TO DRUG DISPENSING

PERCENTAGE OF NURSES THAT LEAVE EVERY YEAR

AVERAGE NUMBER OF DAYS THAT EACH PATIENT STAYS IN HOSPITAL

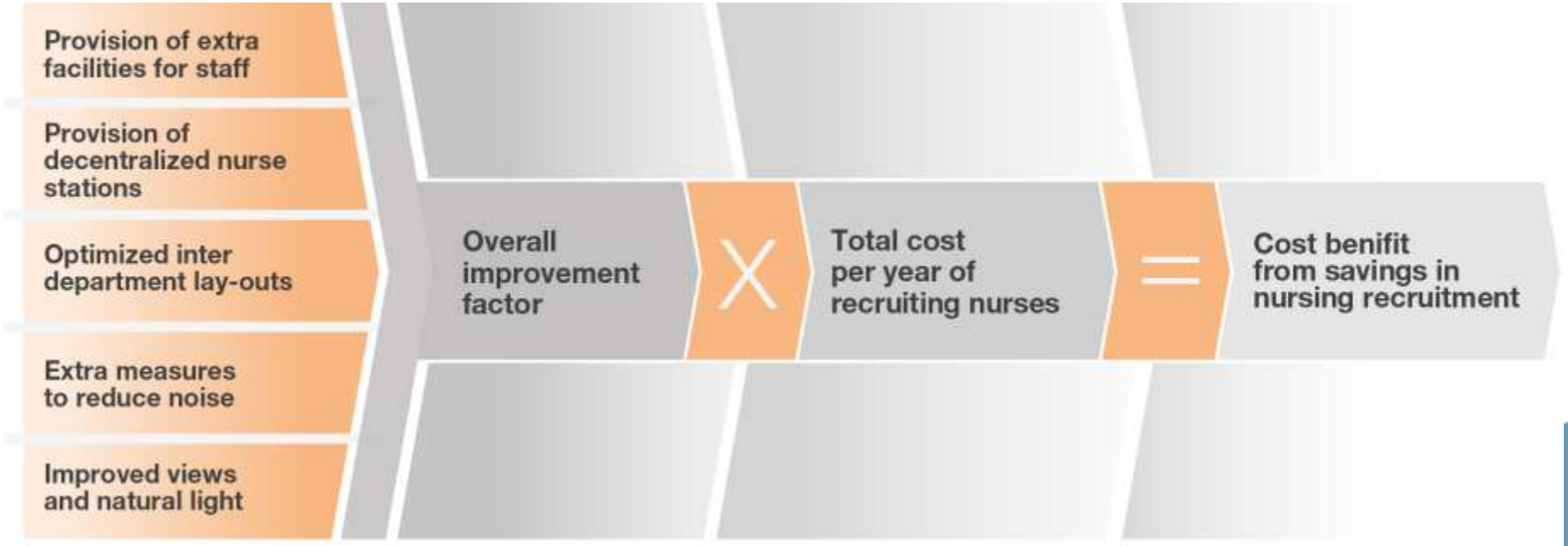
Step 2B: Identifying proven drivers of healthcare operational performance

- Inter-department relationships to improve way finding and reduce medical and nursing staff traffic distances
- Intra-department relationships to reduce medical and nursing staff productivity and effectiveness
- Variable patient demand patterns and use of designated swing (shared) beds between adjacent wards
- Nurse to patient dependency ratios
- Decentralized nurse management
- Lighting levels and sources (Natural v Artificial)
- Acoustic & visual privacy
- Thermal comfort & ventilation
- Air and water quality and contaminated waste management

(Based on International research - social science, management and design)

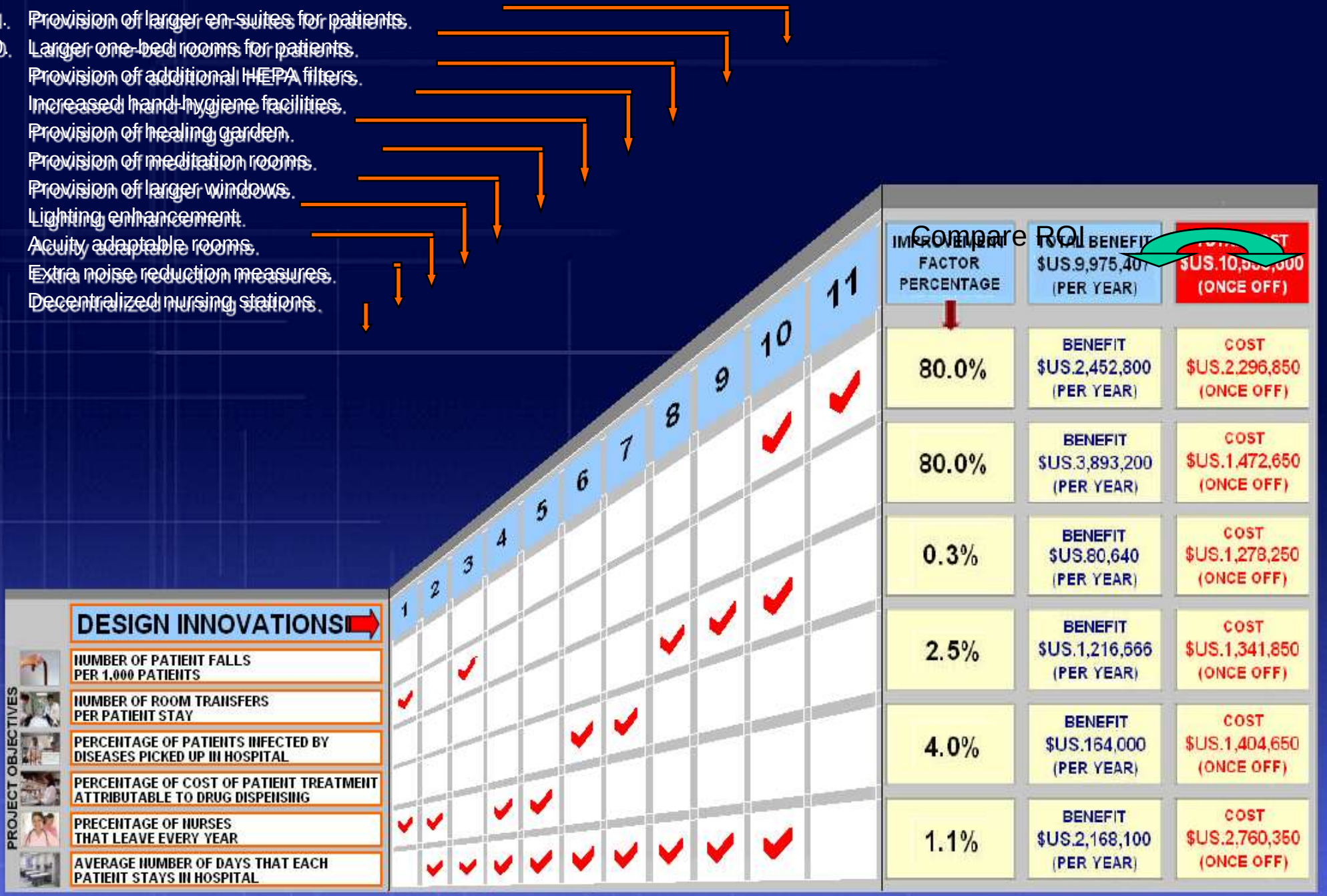
Step 3: Quantify the Cost and Benefits impacts

(Example of CBA for Reduction in staffing turnover)



INNOVATIVE DESIGN FEATURES ADOPTED:

11. Provision of larger en-suites for patients.
10. Larger one-bed rooms for patients.
9. Provision of additional HEPA filters.
8. Increased hand-hygiene facilities.
7. Provision of healing garden.
6. Provision of meditation rooms.
5. Provision of larger windows.
4. Lighting enhancement.
3. Acuity adaptable rooms.
2. Extra noise reduction measures.
1. Decentralized nursing stations.



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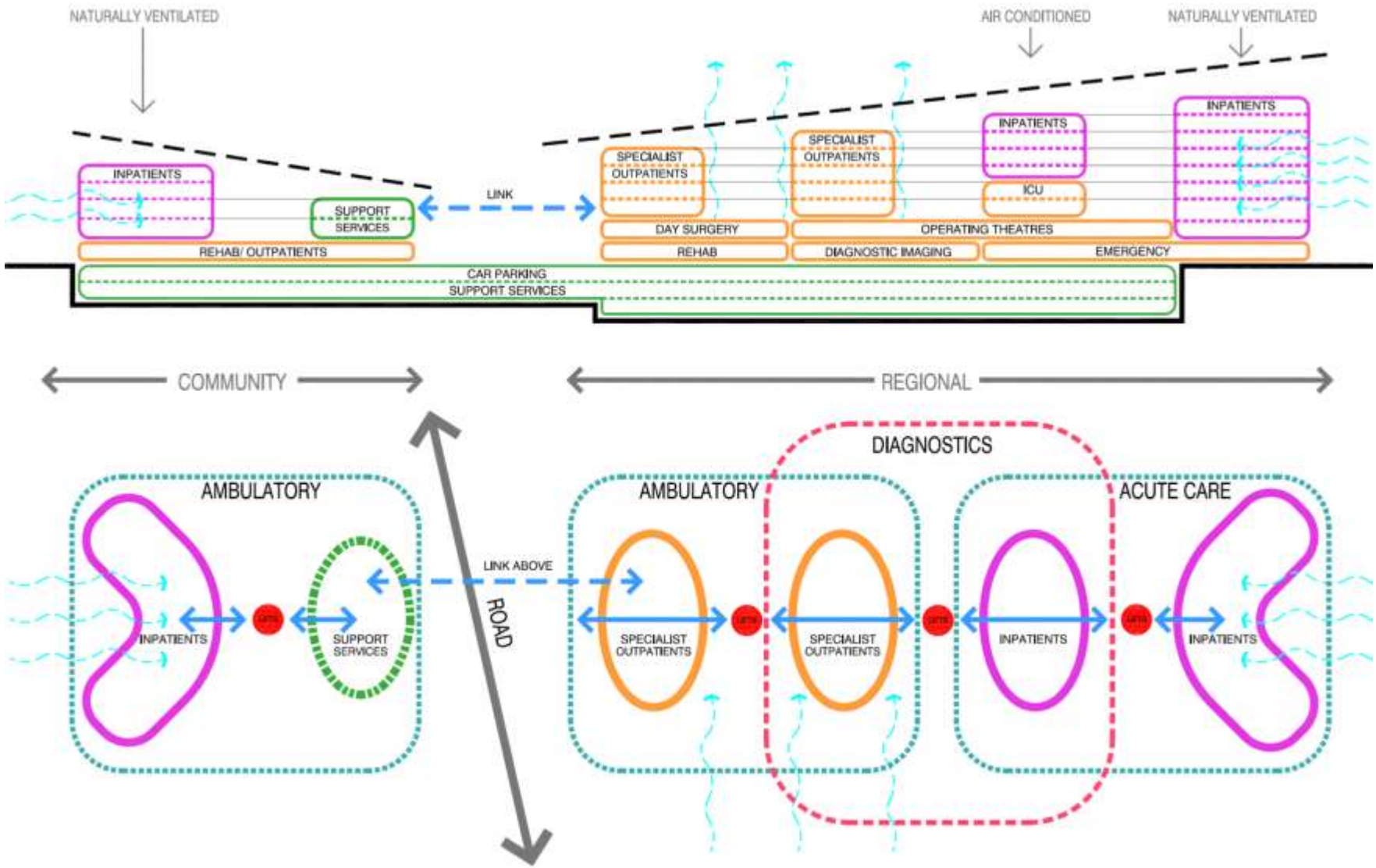
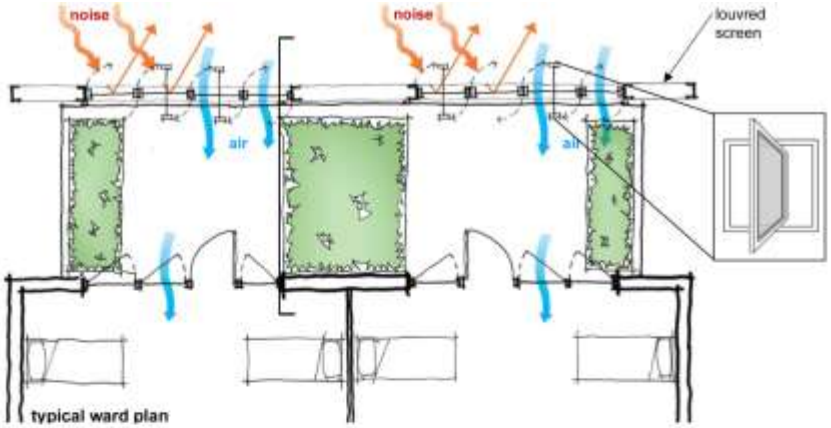
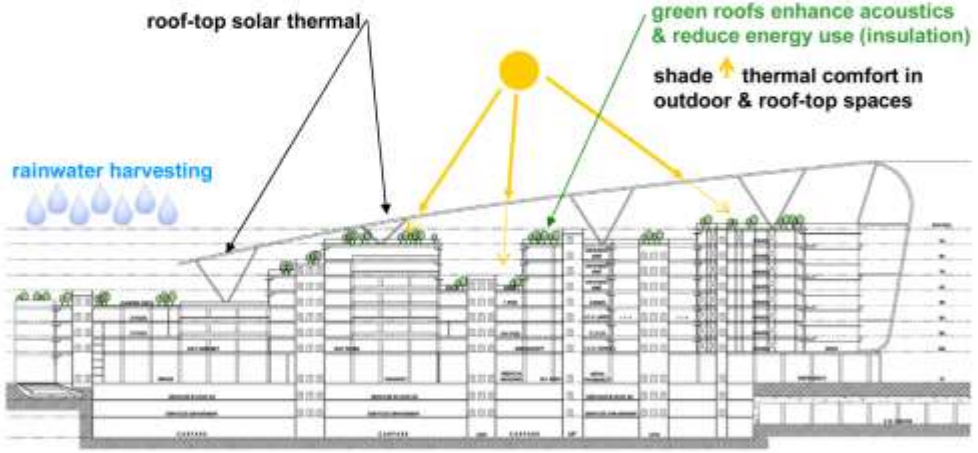
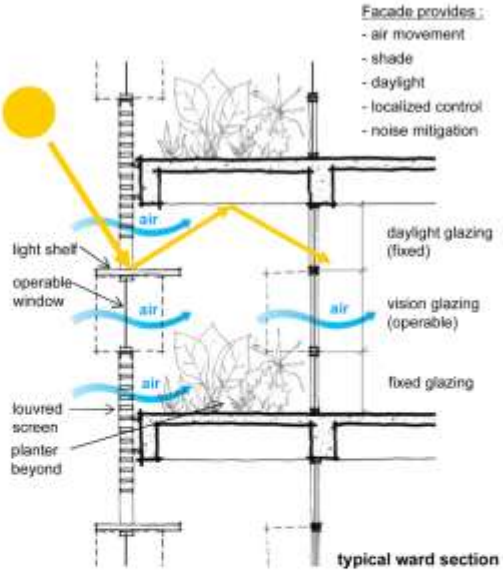
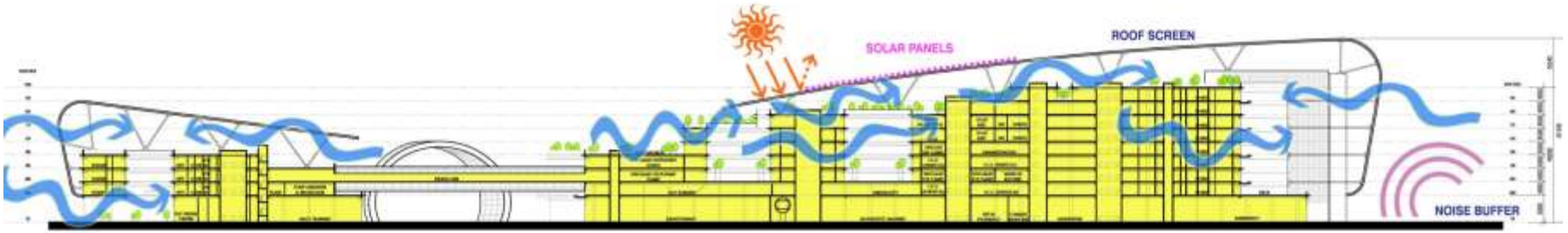

NATURALLY VENTILATED
AIR CONDITIONED
NATURALLY VENTILATED
INPATIENTS
SUPPORT SERVICES
REHAB/ OUTPATIENTS
LINK
SPECIALIST OUTPATIENTS
DAY SURGERY
REHAB
SPECIALIST OUTPATIENTS
OPERATING THEATRES
DIAGNOSTIC IMAGING
INPATIENTS
ICU
EMERGENCY
INPATIENTS
CAR PARKING
SUPPORT SERVICES
COMMUNITY
REGIONAL
AMBULATORY
INPATIENTS
SUPPORT SERVICES
LINK ABOVE
ROAD
DIAGNOSTICS
AMBULATORY
SPECIALIST OUTPATIENTS
SPECIALIST OUTPATIENTS
ACUTE CARE
INPATIENTS
INPATIENTS


noise
noise
louvred screen
air
air
typical ward plan

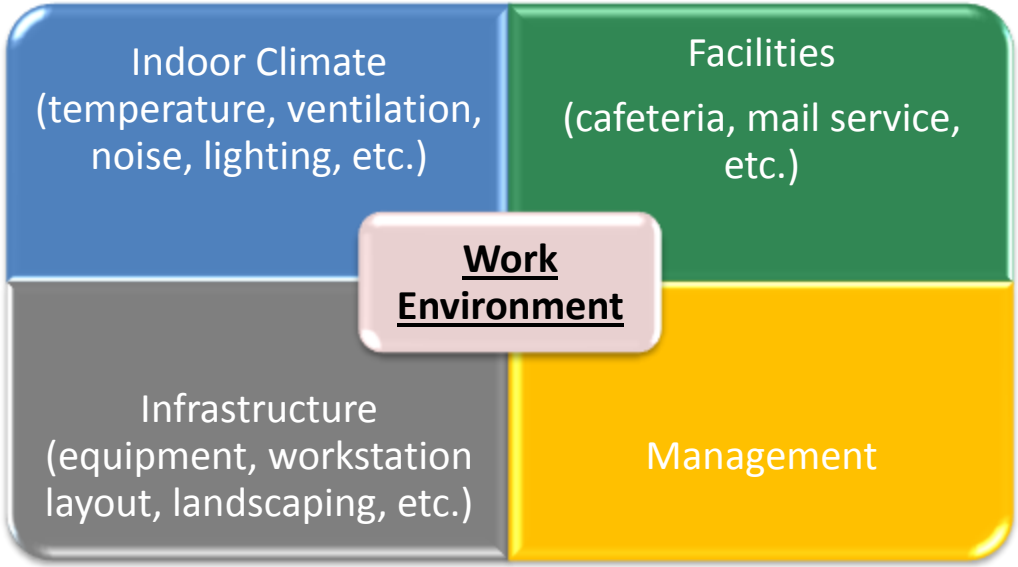

roof-top solar thermal
green roofs enhance acoustics & reduce energy use (insulation)
shade ↑ thermal comfort in outdoor & roof-top spaces
rainwater harvesting


Facade provides :
- air movement
- shade
- daylight
- localized control
- noise mitigation
air
light shelf
operable window
air
air
air
louvred screen
planter beyond
daylight glazing (fixed)
vision glazing (operable)
fixed glazing
typical ward section


SOLAR PANELS
ROOF SCREEN
NOISE BUFFER

Indoor environment quality is good for people and profit

The quality of the work environment affects out workers now spend more than 80% of their working lives indoors. Building design, its use, and management, influence their comfort, wellbeing and business productivity.



The quality of the work environment affects company outcomes

Indoor Environment
Enhancing the potential of the organization

	Management / Communication	Implementation / Facilitation	Contaminants / Cleanliness	Ergonomics	Steady state / procedures	Future proof	Sickness	**Indoor Air (IAQ)**	**Total Indoor Environment**
Health			√					✓	
Behaviour	√								✓
Work Stress		√							✓
Human Relations	√								✓
Comfort				√				✓	✓
Hygiene			√					✓	
Predictability					√				✓
Training	√	√				√			✓

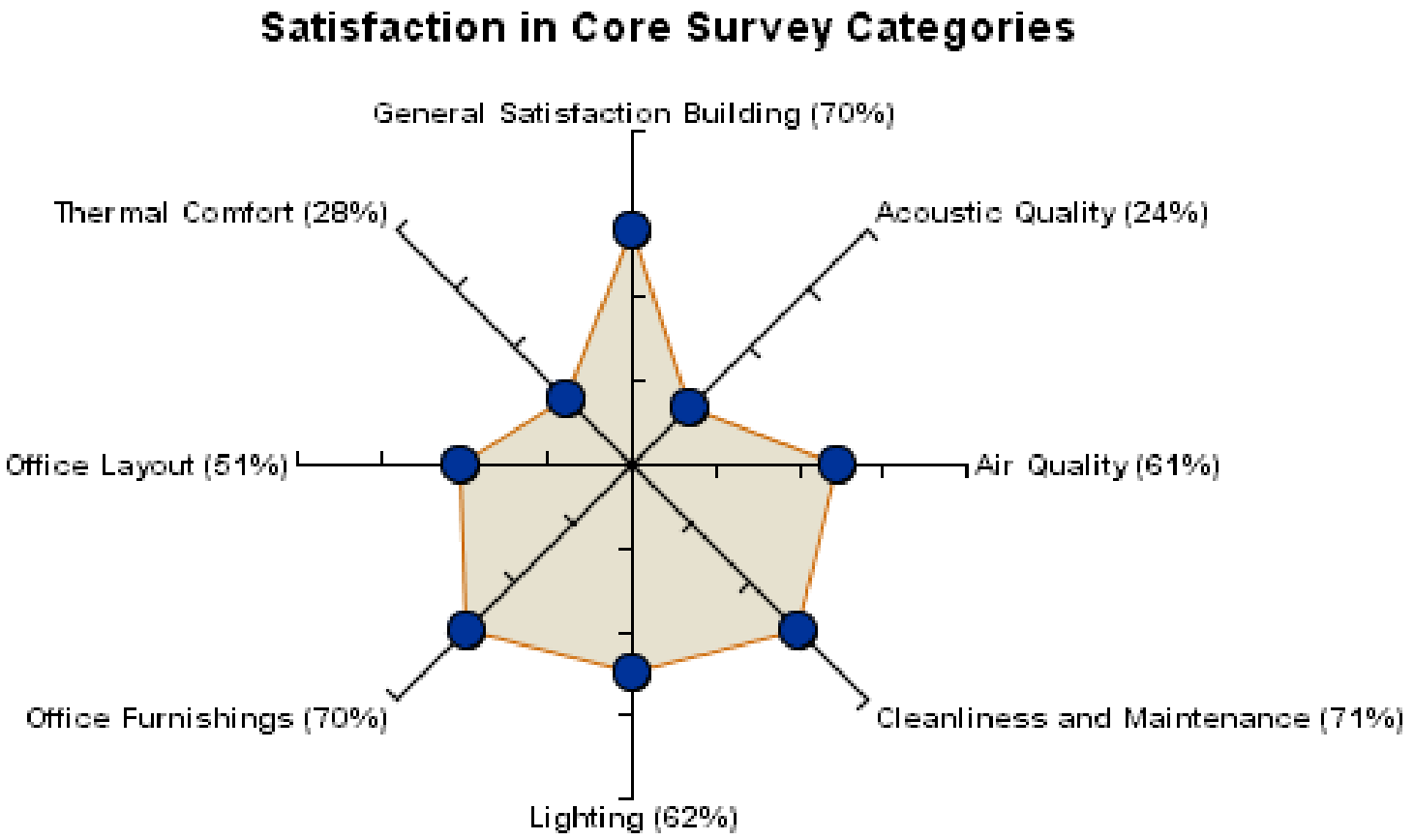
IEQ and Better Performance

2% office productivity gain can be worth INR 20,000 per employee

	Higher productivity	Less absenteeism
Good overall indoor environment	10-15%	2.5%
No air pollution source	3-7%	1.5%
Adequate ventilation	1-2%	0.5%
Adjustable temperature	2-3%	0.5%
Temperature not too high, not too low	7%	
Cellular office (max. 4 people)	2-4%	Decrease
Good lighting	2-3%	
Daylight		0.5%
Good monitor	Gain	
Less noise nuisance	3.9%	

Leijten, J (2002), Binnenmilieu, productiviteit en ziekteverzuim (The inside environment, productivity and sick leave) FM (15) 103, pp 17-21

IEQ/Occupant well-being project



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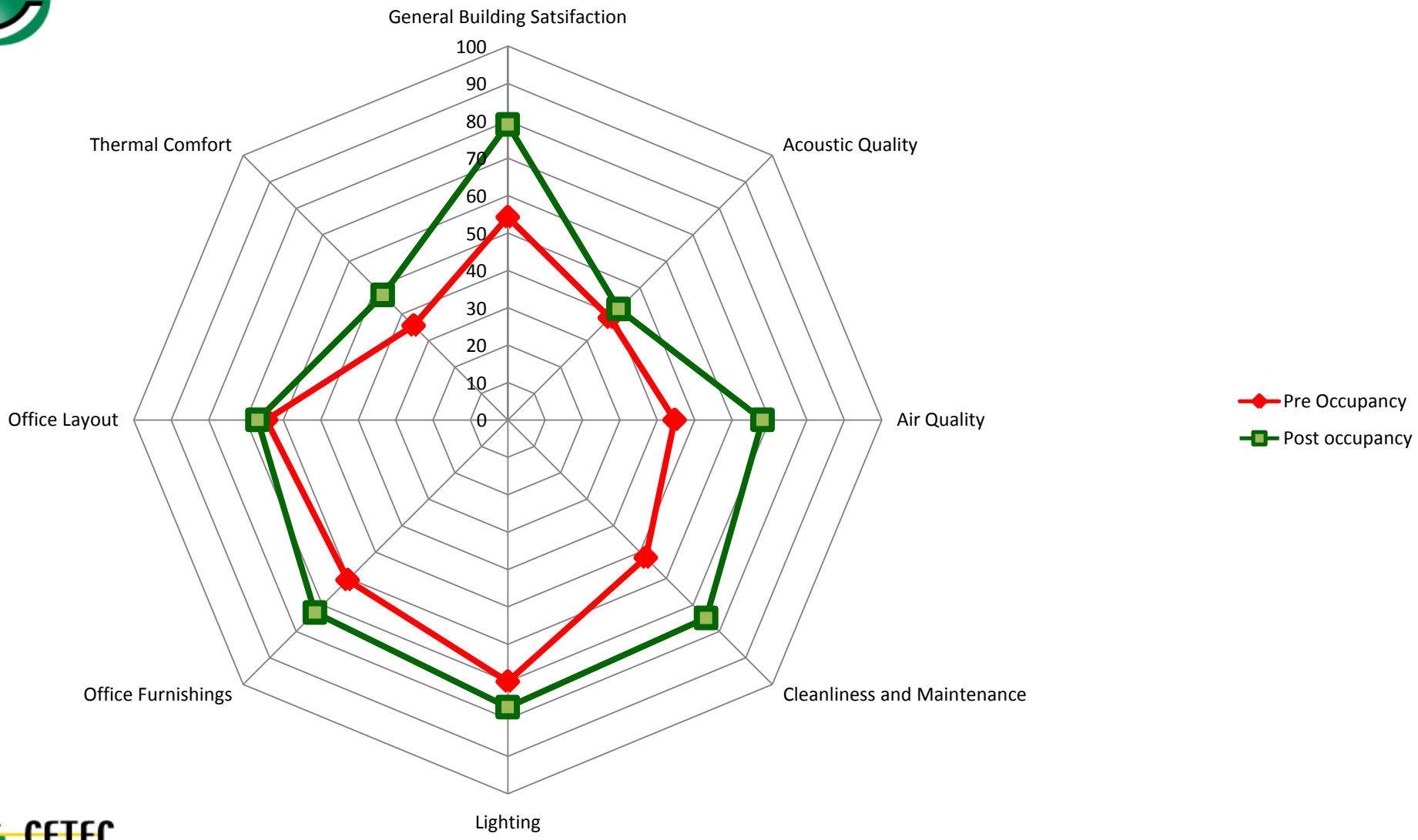
The improvement of occupant well-being in HP buildings – using real case studies



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Case study : IEQ and Productivity

PRE & POST OCCUPANCY
Indoor Environment Study
Umow Lai Consulting Engineers

PRODUCTIVITY GAINS

2007 -2009

Projected by CETEC: 13%

Achieved by Client: 12.5%

Value Gained: $1m/year or
$5,000/employee/year

CETEC
Professional Scientific Solutions

Conclusions

- Increasing awareness of the need for balanced approach to development of cities and buildings
- Demonstrable evidence of community benefits for embracing Smart and Sustainable cities
- Demonstrable market evidence of enterprises paying a premium for high performance buildings (environmental social and economic benefits)
- Government of India incentives (via CSR levies on corporate sector)
- Need more local (Indian) R&D to provide scientific evidence of link between design innovations & benefits….

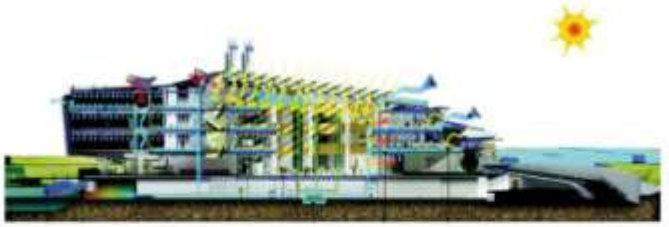
Experience base - Australia

RMIT Biosciences Research Facility, Melbourne

Royal North Shore Hospital, Sydney

Commonwealth Law Courts, Melbourne

National Bioscience Centre, Melbourne



PCA Directions

Experience base - India

Hexaware R & D Centre, Chennai

ITC Grand Chola Hotel, Chennai

L & T South City Township, Chennai

Taj Mahal Hotel, Mumbai

PCA Directions

Our Project Advisory Services

PCA Directions' specialist project advisory service provides the crucial tools to enable its clients to maximise the success of these projects. It incorporates:

- Review project and associated business objectives
- Review risk and success/failure potential
- Facilitate appointment of suitable designers, operators and other partners
- Facilitate HP cities and buildings
- Provide on-going project direction and strategic advice
- Build corporate in-house project team capability

PCA Directions

Conclusions

- PCA Directions and its partners STH healthcare architecture, CETEC environmental science, Sustainability Victoria and SGA Design Lab are taking a leadership role in promoting innovation and facilitating Smart and Sustainable cities and High Performance buildings. Looking for partners to;
  - Research & Develop - Help develop local knowledge & capability
  - Implement and invest – Adopt best practice

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