Greening Infrastructure Programmes in South Africa

Case Study 2: Health Care Infrastructure

DBSA 2011 Knowledge Week
13 October 2011

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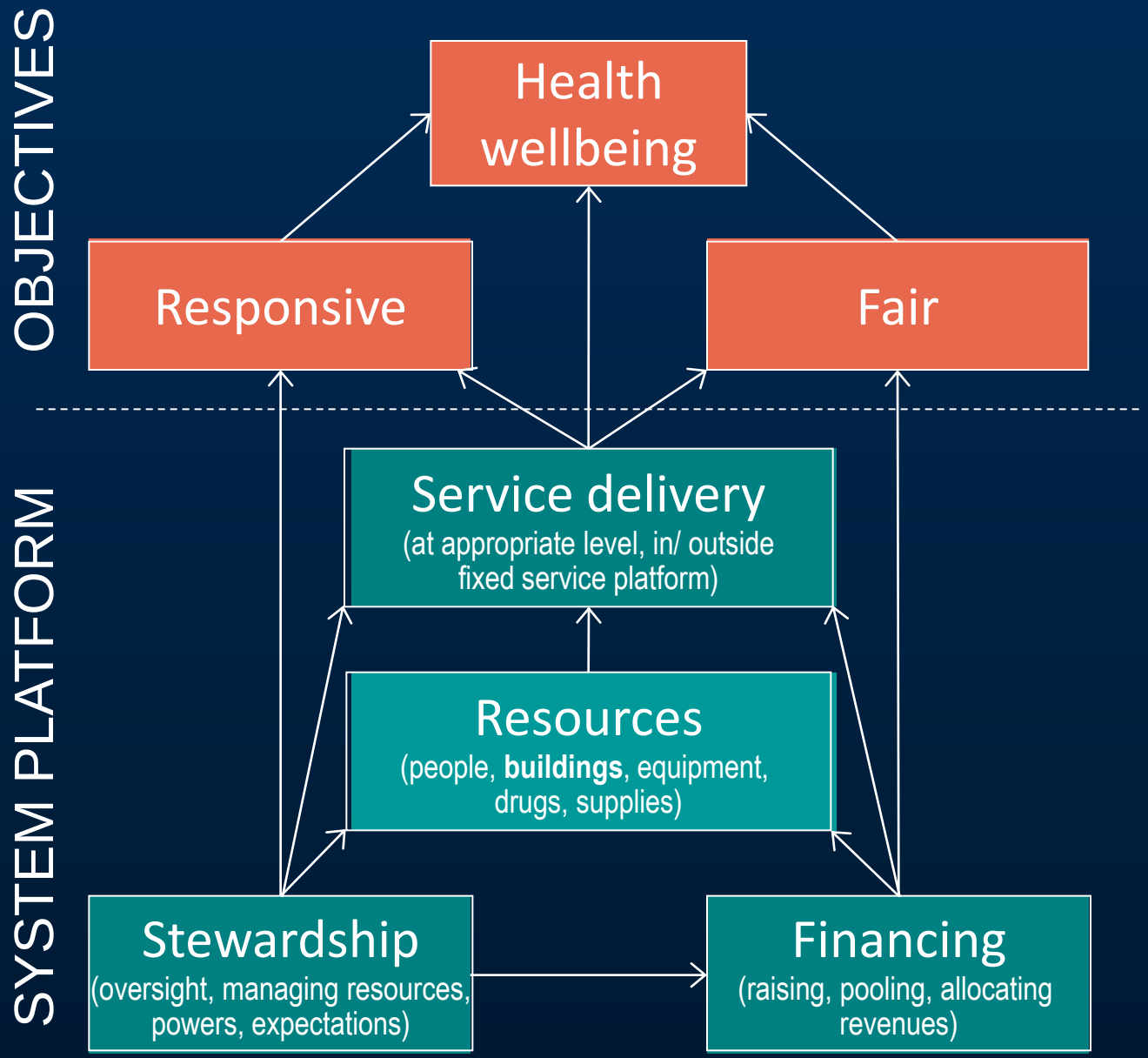
CSIR Built Environment : Building Science and Technology

our future through science

Health system



Public sector health estate

- ±3 900 PHC facilities
- ±500 hospitals
- ±100 000 beds
- ±R200bn current replacement value

InKosi Albert Luthuli Hospital, Durban, KwaZulu-Natal
Architects: FGG

King Edward Hospital, Durban

Sipetu Hospital, Eastern Cape

Tomorrow's healthcare environment

- Healthcare infrastructure in South Africa
  - Legacy estate – poor condition, location (?), functionality
  - Incremental replacement/ growth
  - Refurbishment requirement
- Drivers for change
  - Health service transformation – policy, NHI, PHC reengineering…
  - Population – growth, distribution, migration…
  - Disease profile – SA's triple burden of disease, HIV/ TB…
  - Technology – medical, IT, communications, engineering systems…
  - Environmental – climate change, sustainability
  - Efficiency – people, funding…
- Health system / facilities
  - Complex, many interacting and interrelated variables
  - Function paramount

Enabling health care for the people

"It may seem a strange principal to enunciate as the very first requirement of a hospital, is that it should do the sick no harm."

"In attempting to arrive at the truth, I have applied everywhere for information but scarcely in an instance have I been able to obtain hospital records fit for any purpose of comparison"

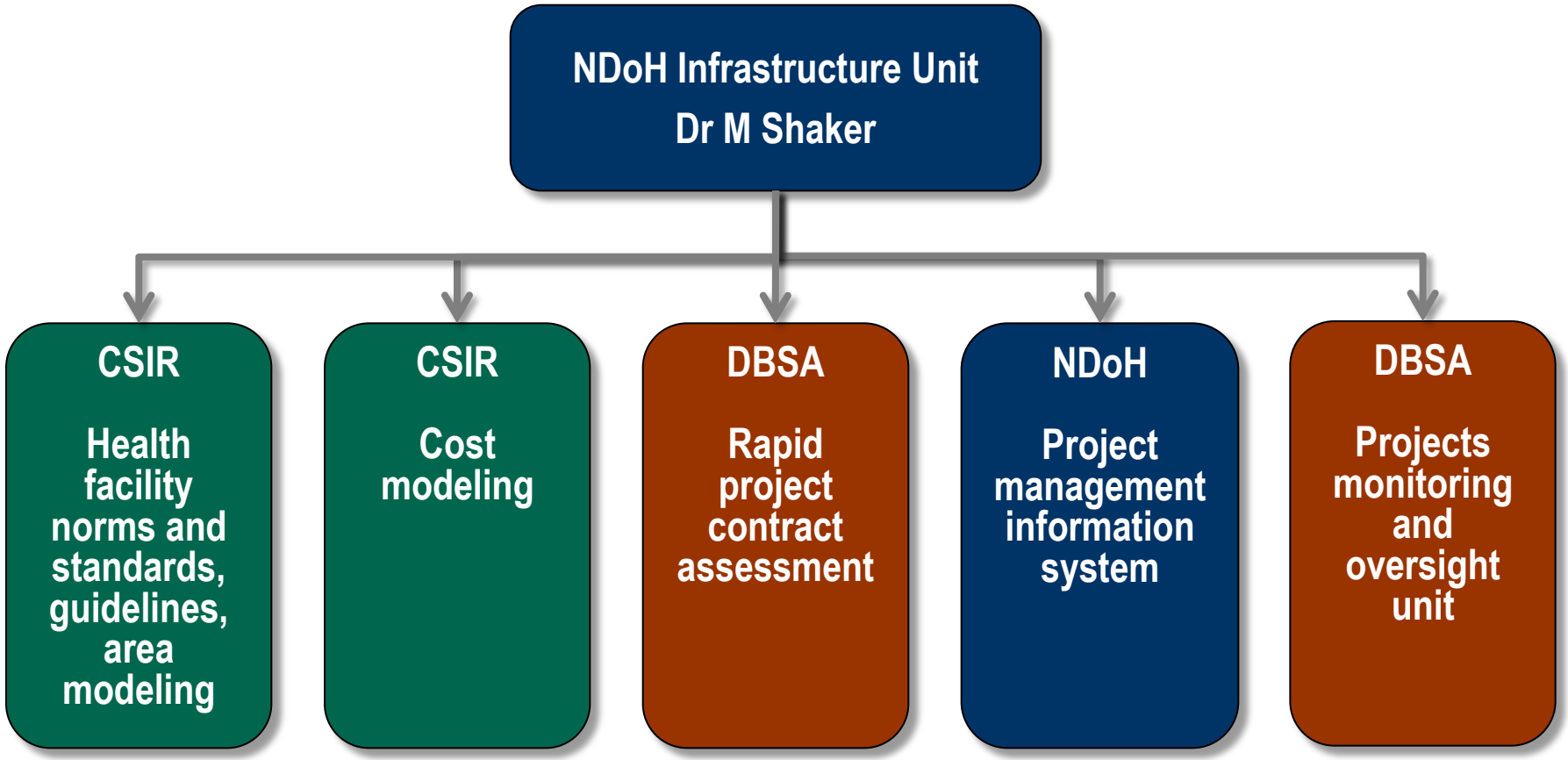
Florence Nightingale. Notes on Hospitals, 1863

"First we shape our buildings, then they shape us"

Winston Churchill, 1943

IUSS project

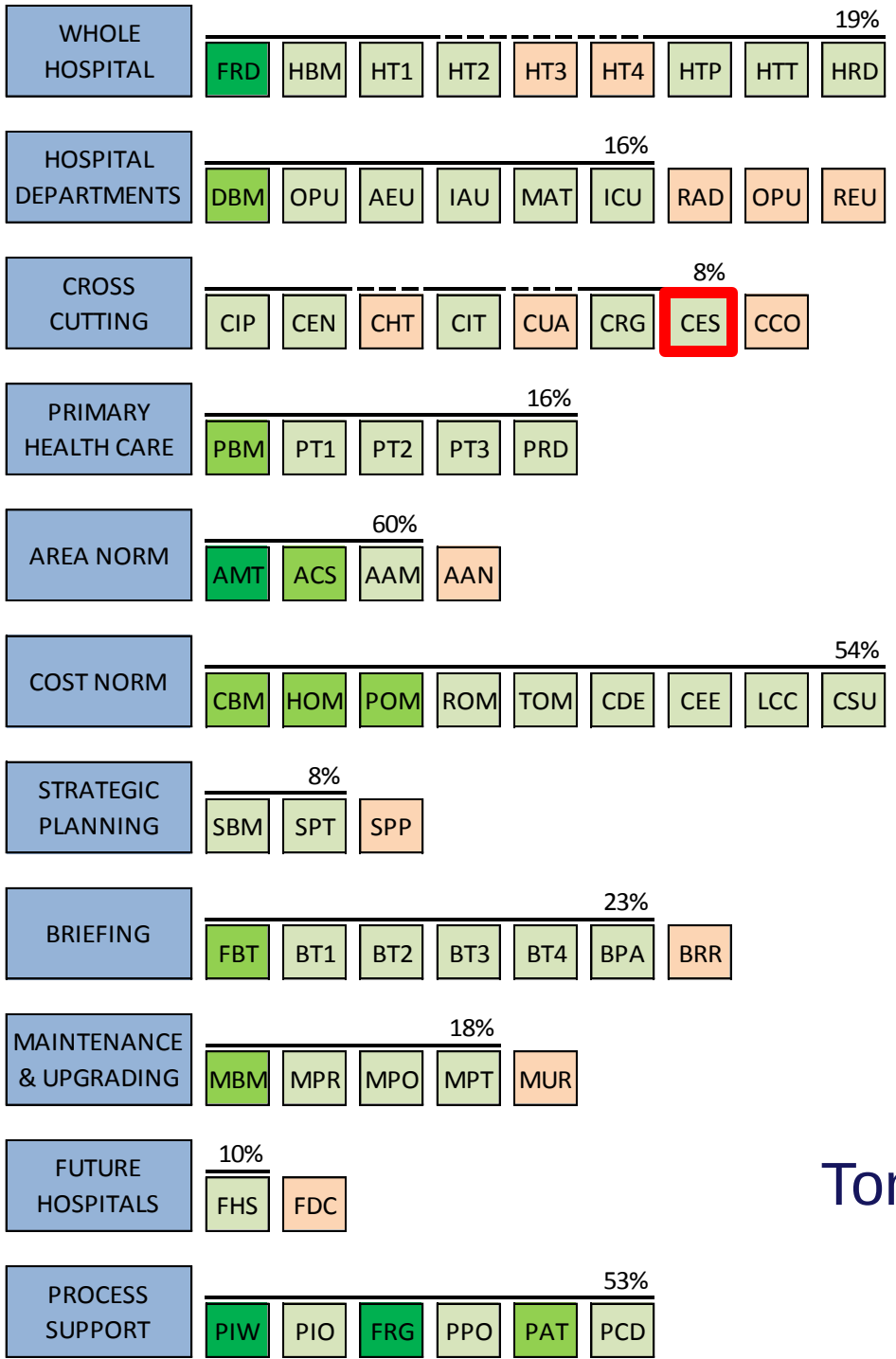
National Department of Health – 2010 to …



health
Department:
Health
REPUBLIC OF SOUTH AFRICA
Infrastructure Unit

DBSA
Development Bank of Southern Africa

CSIR
our future through science



Whole hospital

Hospital departments

Cross cutting

Environment and sustainability

Primary health care

Area norms

Cost norms

Strategic planning

Briefing

Maintenance and upgrading

Tomorrows healthcare environments

Process support

Hospital N&S Guide Framework

NDoH

IUSS team

Health service context / policy framework / NHI	Department 1 Policy & service context manual	Department 2 Policy and service context manual	Department 3 Policy and service context manual	Depart Policy a context
General (whole hospital) design principles	Department 1 Planning & design manual • function • relationships • people • environment	Department 2 Planning & design manual • function • relationships • people • environment	Department 3 Planning & design manual • function • relationships • people • environment	Depart Plannin manual • functi • relatio • people • enviro
Room data, layouts • generic – whole hospital	• dept. specific	• dept. specific	• dept. specific	• dept. s
Cross cutting – Infection prevention and control				
Cross cutting – Engineering services				
Cross cutting – Environment and sustainability				
Cross cutting – Fire / other regulations…				
Health care facilities futures study				

IUSS norms and standards
Environment and sustainability

- IUSS task group – public and private sector, health & technical
- South African / international best practice for sustainable healthcare facilities planning, design and operation
- Performance measurement and benchmarking
- Lifecycle guidelines
  - Strategic planning
  - Project planning and briefing
    - *Performance targets*
  - Design
  - Construction
  - Operational management
  - Retrofitting and refurbishment
  - Disposal
- Case studies

UK NHS: Towards a sustainable future
Focus - low carbon, low energy

- Environmental impact of NHS health estate
  - 893 000 tonnes of carbon emissions per year – just under one third of total emissions of public buildings
  - 125 MWh of energy, half of which is electricity
  - £563 million per year

  Better building design could save 25% of energy costs

  South African health estate equivalent?
- Directives
  - The Climate Change Act 2008 focuses on reducing carbon emissions by 80% between 1990 and 2050
  - UK budget statement from 2008 requires all public buildings to aim to be zero carbon by 2018. All new buildings to achieve this from 2019 onwards

Tomorrow's healthcare environments: Towards a sustainable future, June 2011
Department of Health Gateway Review and Estates and Facilities Division, UK

South Africa
Estimate of current energy cost and potential savings

- Total SA beds (public and private, 2010) 126 000
- Assume occupancy 80%
- Total occupied beds 101 000
- Assume energy consumption / bed day 95 kWh
- Estimated energy consumption / year 3 495 400 mWh
- Estimated energy cost / year * R2.4 bn
- Potential operational cost saving with 25% energy saving (increasing with tariff increases) R600 m/year

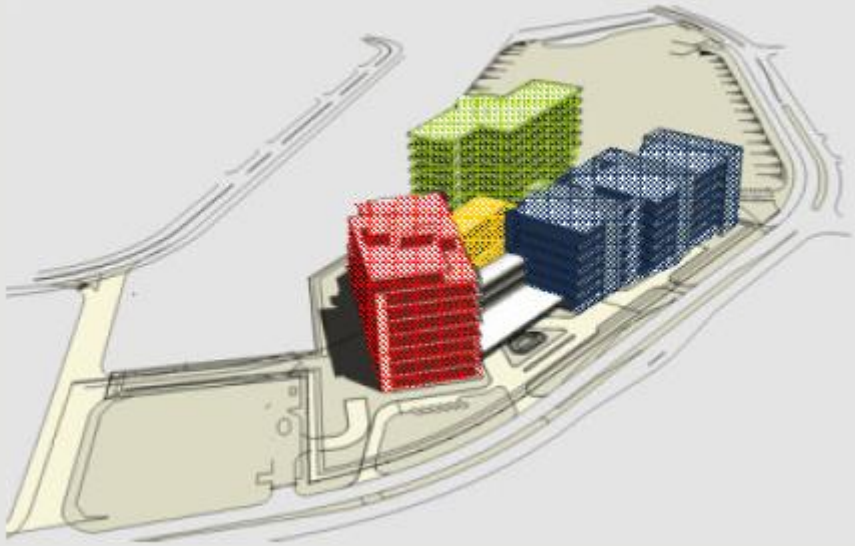
Rough estimate only

* Based on R0.68/kWh; excludes peak load and administration charges

Case study – environmentally conscious design

Khoo Teck Puat hospital, Singapore


Offering a comprehensive range of medical and healthcare services, Khoo Teck Puat Hospital is a 550-bed hospital with integrated approaches to environmental sustainability, climate control, patient care, disease and disaster management.
VIEW FROM YISHUN CENTRAL
KHOO TECK PUAT HOSPITAL @ YISHUN



Distinct Blocks for Different Functions

a. Specialist Outpatient Clinics
b. Podium (Dignostic & Treatment)
c. Private Ward Tower
d. Subsidised Ward Tower

BUILDING MASSING

KHOO TECK PUAT HOSPITAL @ YISHUN

TOTAL BUILDING PERFORMANCE

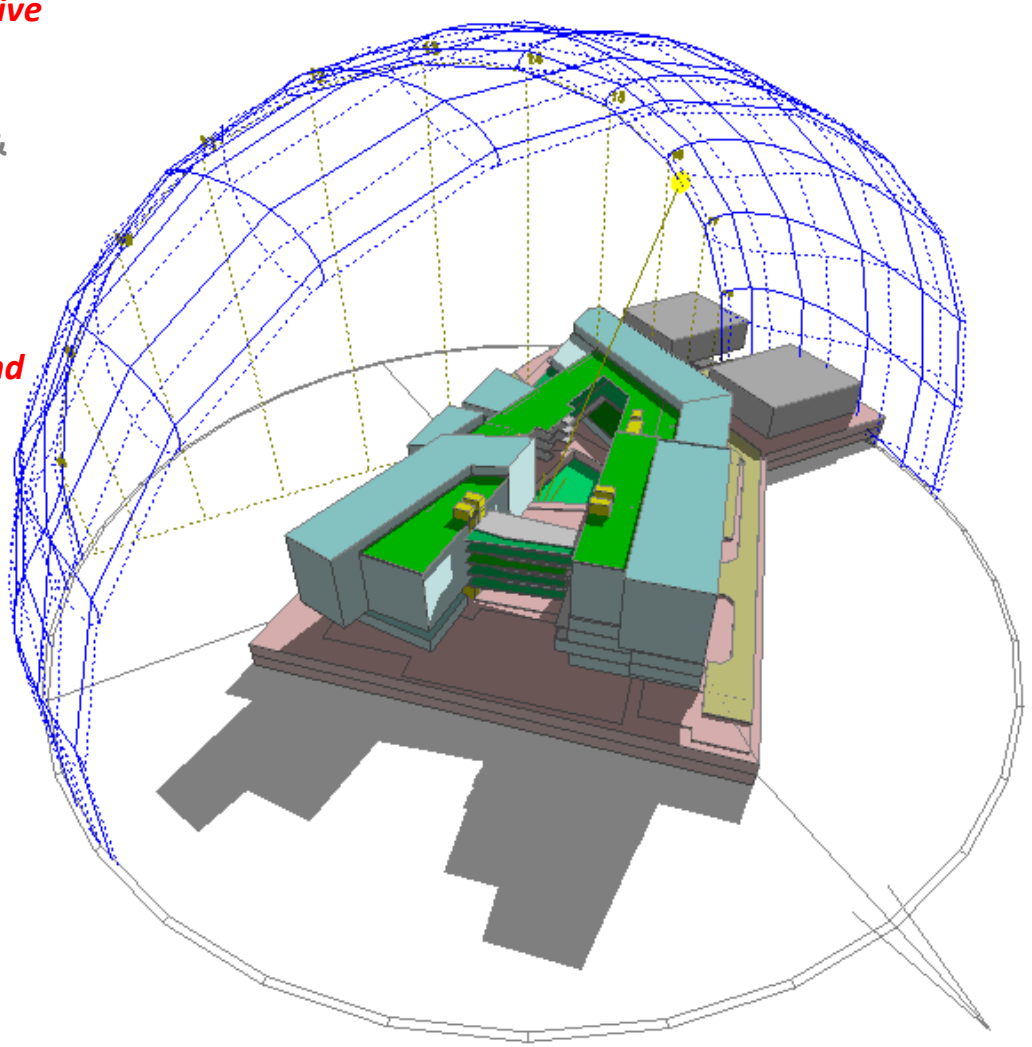
Passive and Active Systems

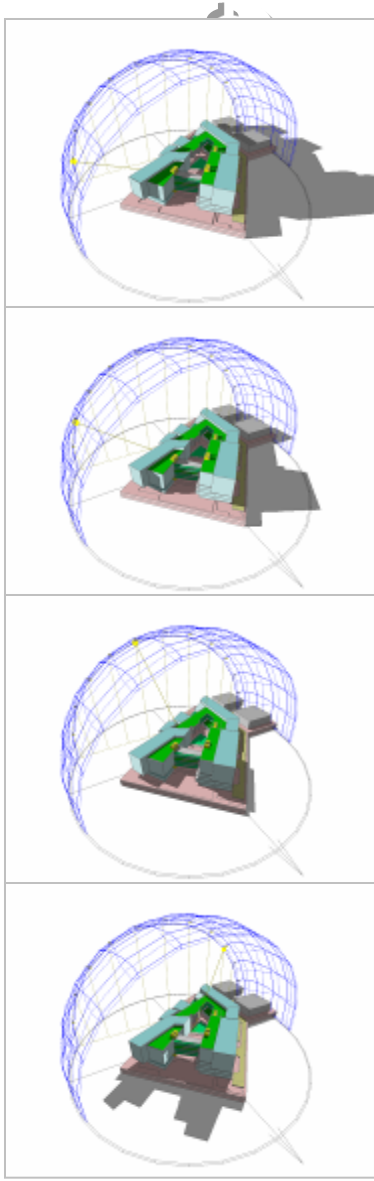
Form & Orientation ***responsive to sun-path***

Shaded Internal Courtyard & Multiple Landscaped Decks ***reduced heat island effect***

Permeable Form ***enhanced natural airflow and daylight access***

Self-Shading Geometry ***reduced façade solar gains***

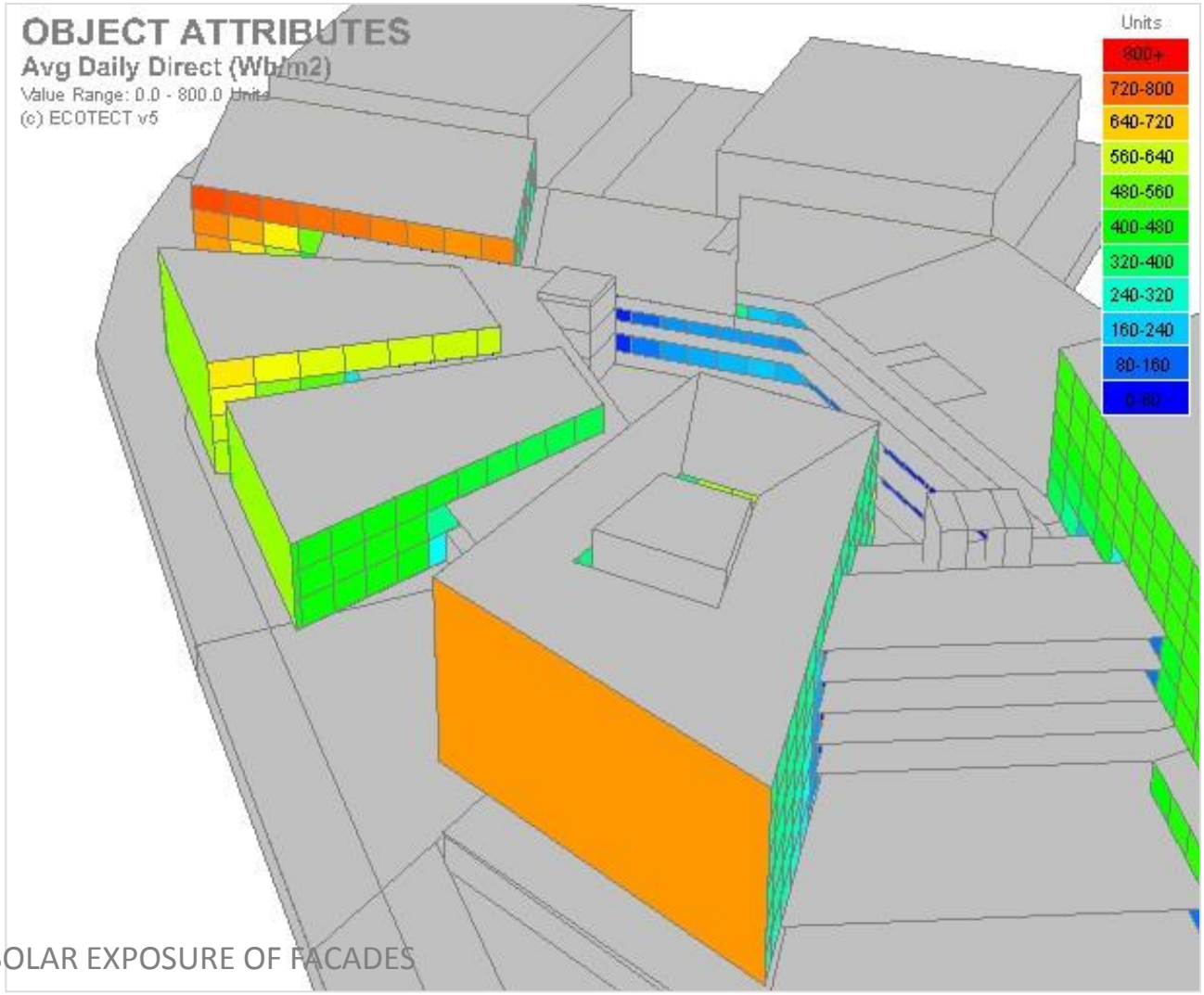


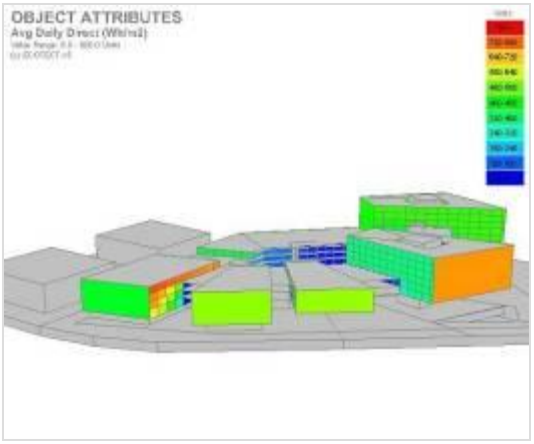


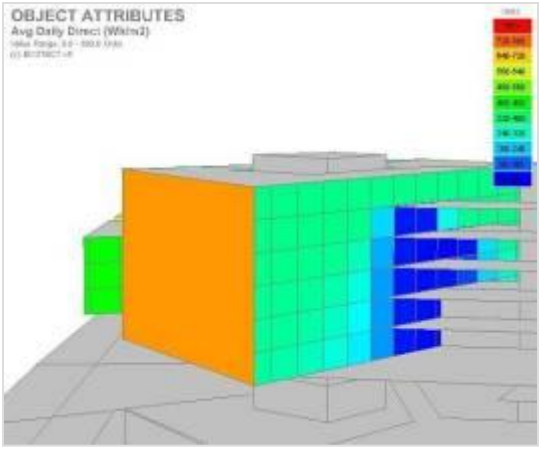
SUN PATH & BUILDING FORM

TOTAL BUILDING PERFORMANCE

Passive Design – Form and Geometry







SOLAR EXPOSURE OF FACADES

ETTV : Envelope Thermal Transfer Value

It is the measure of thermal transfer from the facade into the building interior.
Baseline ETTV is 50 W/m2.K

KTPH ETTV: **38.2 W/m2.K**

23.6% less heat gain through facades over current standard.

1. Critically designed external sunshades on the critical east and west facade.

2. High performance glazing

3. Optimal thermal insulation for opaque facade. Low U-Value.

PASSIVE STRATEGIES

KHOO TECK PUAT HOSPITAL @ YISHUN

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PASSIVE STRATEGIES

KHOO TECK PUAT HOSPITAL @ YISHUN

HIGH RISE GREENING FOR A

HEALING ENVIRONMENT

Planter boxes for green respite in every subsidized ward

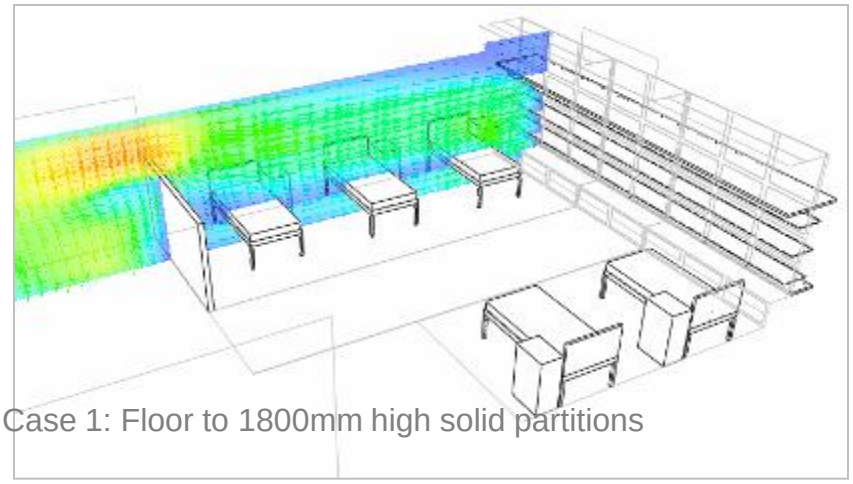
Bringing a garden right outside the window


VIEW OF SUBSIDIZED WARD
KHOO TECK PUAT HOSPITAL @ YISHUN

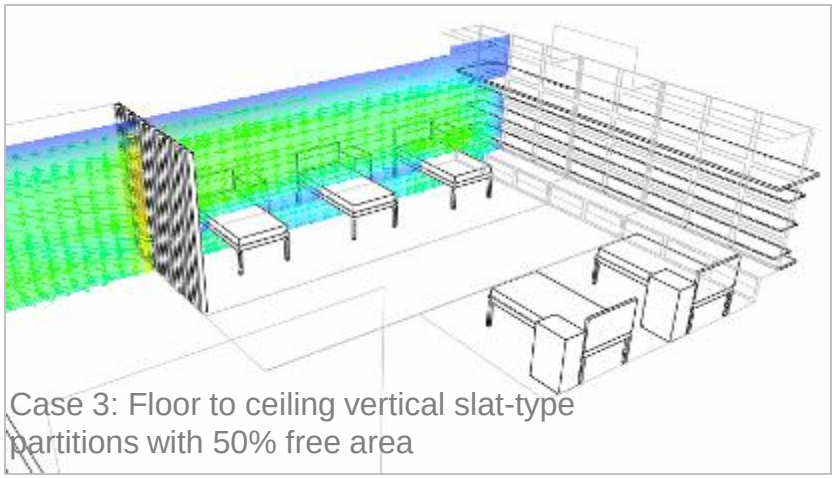
TOTAL BUILDING PERFORMANCE

Passive Design – Airflow and Natural Ventilation

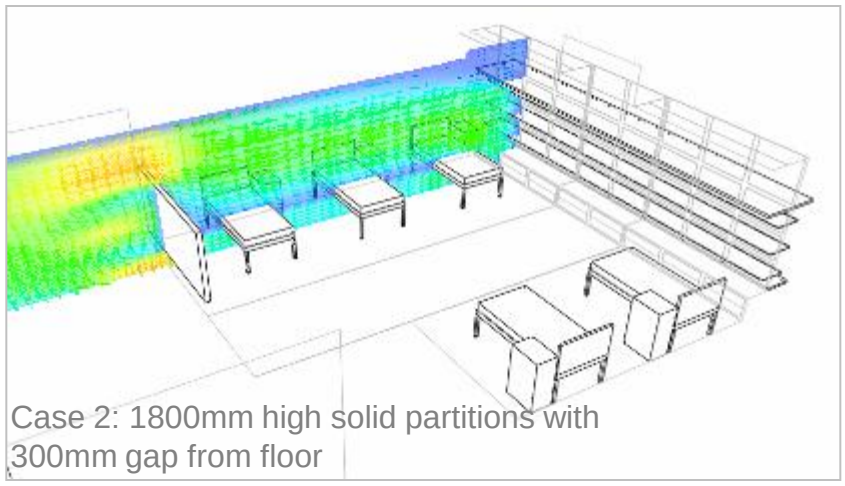
Impact on Ward Design and Patient Comfort



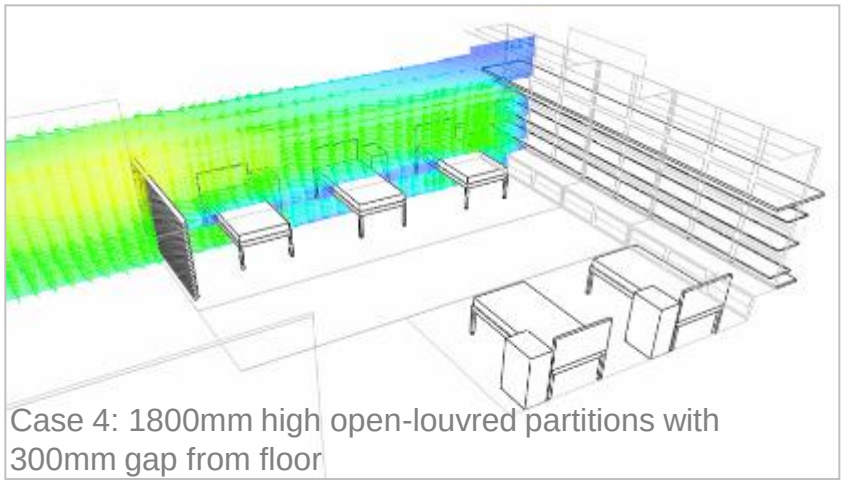
Case 1: Floor to 1800mm high solid partitions



Case 3: Floor to ceiling vertical slat-type partitions with 50% free area



Case 2: 1800mm high solid partitions with 300mm gap from floor



Case 4: 1800mm high open-louvred partitions with 300mm gap from floor


COMMUNITY GREENING
KHOO TECK PUAT HOSPITAL @ YISHUN


LANDSCAPE TERRACES
KHOO TECK PUAT HOSPITAL @ YISHUN


GARDEN COURTYARD
KHOO TECK PUAT HOSPITAL @ YISHUN

Khoo Teck Puat Hospital
Total building performance

Energy efficiency

Reduction from 3.26 MWh/month-bed → **New AH@Yishun 1.63 MWh/month-bed**

Achieve target yet presenting a high comfort, high performance, aesthetic hospital building

- ✓ **Enhanced daylight design, reduced gloominess.**
- ✓ **Enhanced thermal comfort with personal control.**
- ✓ **Enhanced air quality through ventilation and materials usage.**
- ✓ **Enhanced aural comfort by suitable noise control design.**
- ✓ **Enhanced spatial quality through visual design.**

Khoo Teck Puat Hospital
Total building performance

Energy efficiency

1. **Lighting:** Integrated daylight design
   Energy efficient lamps
   Lighting design

   Save 40% ..... **Total Save 11%**

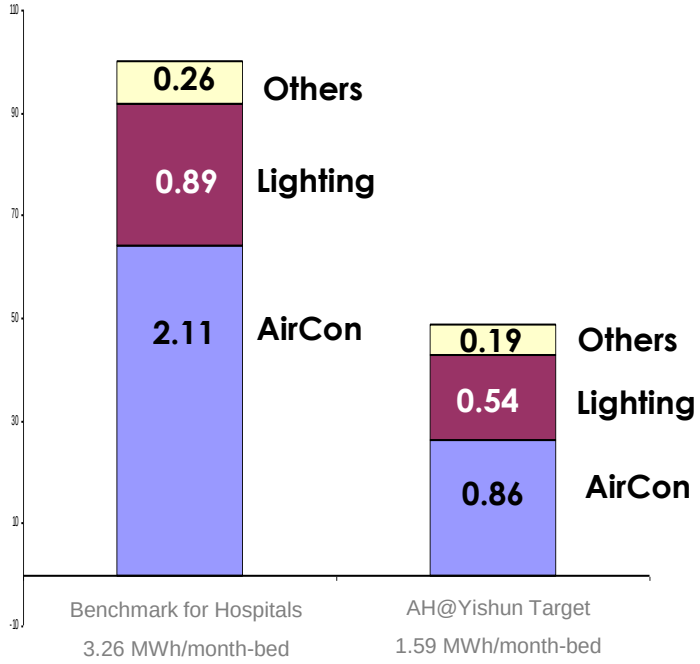
2. **Air-con:** Absorption chillers with CHP
   VSD and efficient components
   Cleaning and maintenance features
   High performance facades
   Desiccant cooling

   Save 59% ..... **Total Save 38%**

3. **Others:** Heat recovery for hot water
   Energy efficient transportation
   Solar PV (optional)

   Save 28% ..... **Total Save 3%**

Global Saving 52%



Design performance 1.59 MWh/month-bed

Deventer – Deventer ziekenhuis

Architects, Engineers, Contractors: de Jong, Gortemaker, Algra

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Deventer ziekenhuis

- 380 bed teaching hospital - 55 000m2, 145m2/bed
- Completed 2007
- EU Hospitals project demonstration facility
- Energy efficiency focus
  - *Emissions (CO2, SOx, NOx) 69% below average Dutch hospital*
  - *Annual energy cost savings – payback 13,4 years (8,7 with EU incentives)*
  - *Heating 73% below average; cooling 50% below average*
  - *Electricity 16% below average*
  - *'Green' planted roof over 13 300m2 out-patient – view from overlooking blocks*
- Patient care focus
  - *Single, double, triple patient rooms – away from high traffic areas, daylight, views, operable windows*

Carbon Neutral Hospitals

Knokke Hospital Campus Competitiion – Belguim

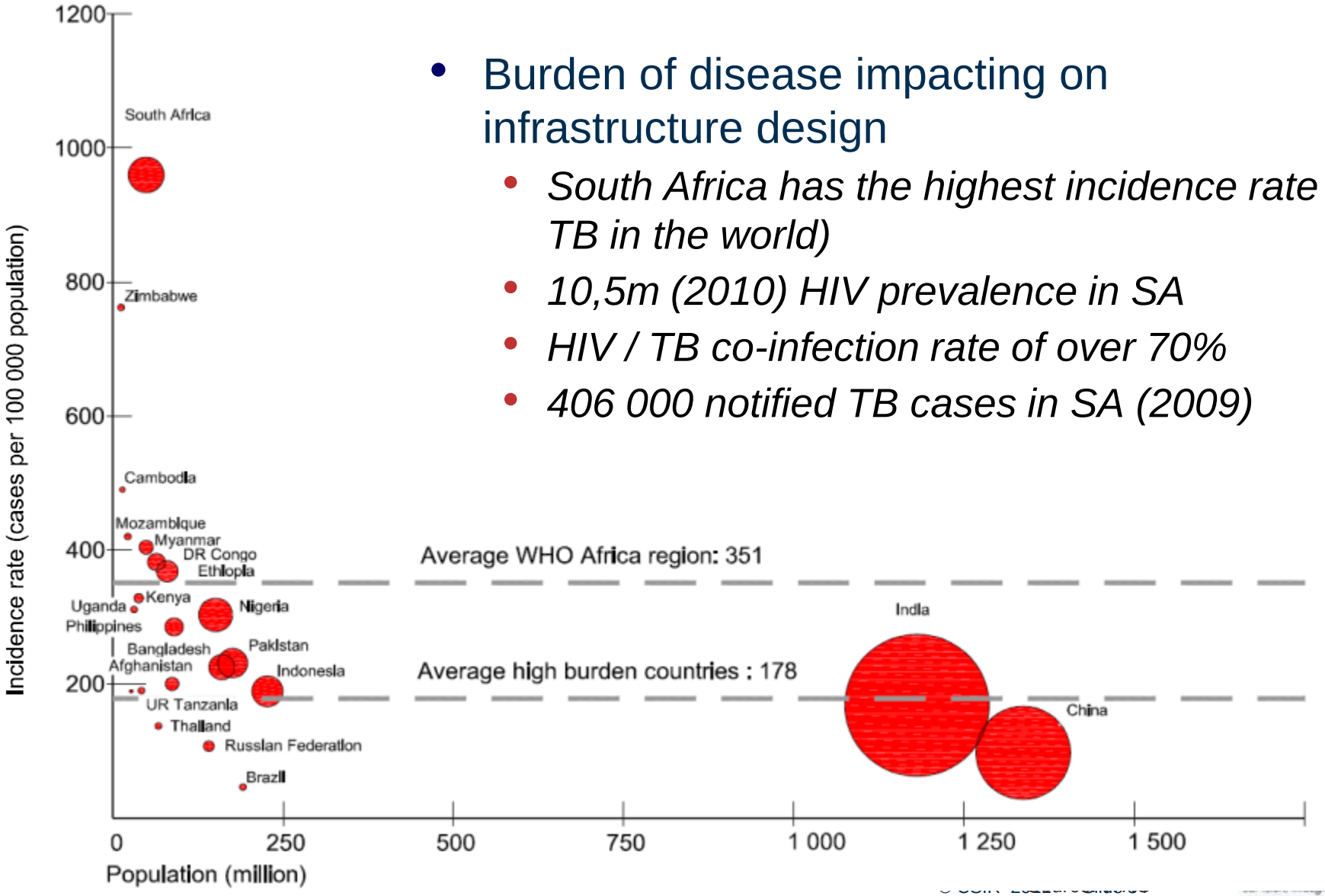
de Jong Gortemaker Algra / STABO / ARUP
Roelof Gortemaker

The hospital has a compact structure which allows for good orientation and short walking routes. The teardrop form also has certain technical advantages such as reduced wind influence, improved direct sunlight and improved energy yield

Design

Safer hospitals – airborne infection control

Incidence of TB in high-burden TB countries : 2008



- Burden of disease impacting on infrastructure design
  - *South Africa has the highest incidence rate of TB in the world)*
  - *10,5m (2010) HIV prevalence in SA*
  - *HIV / TB co-infection rate of over 70%*
  - *406 000 notified TB cases in SA (2009)*

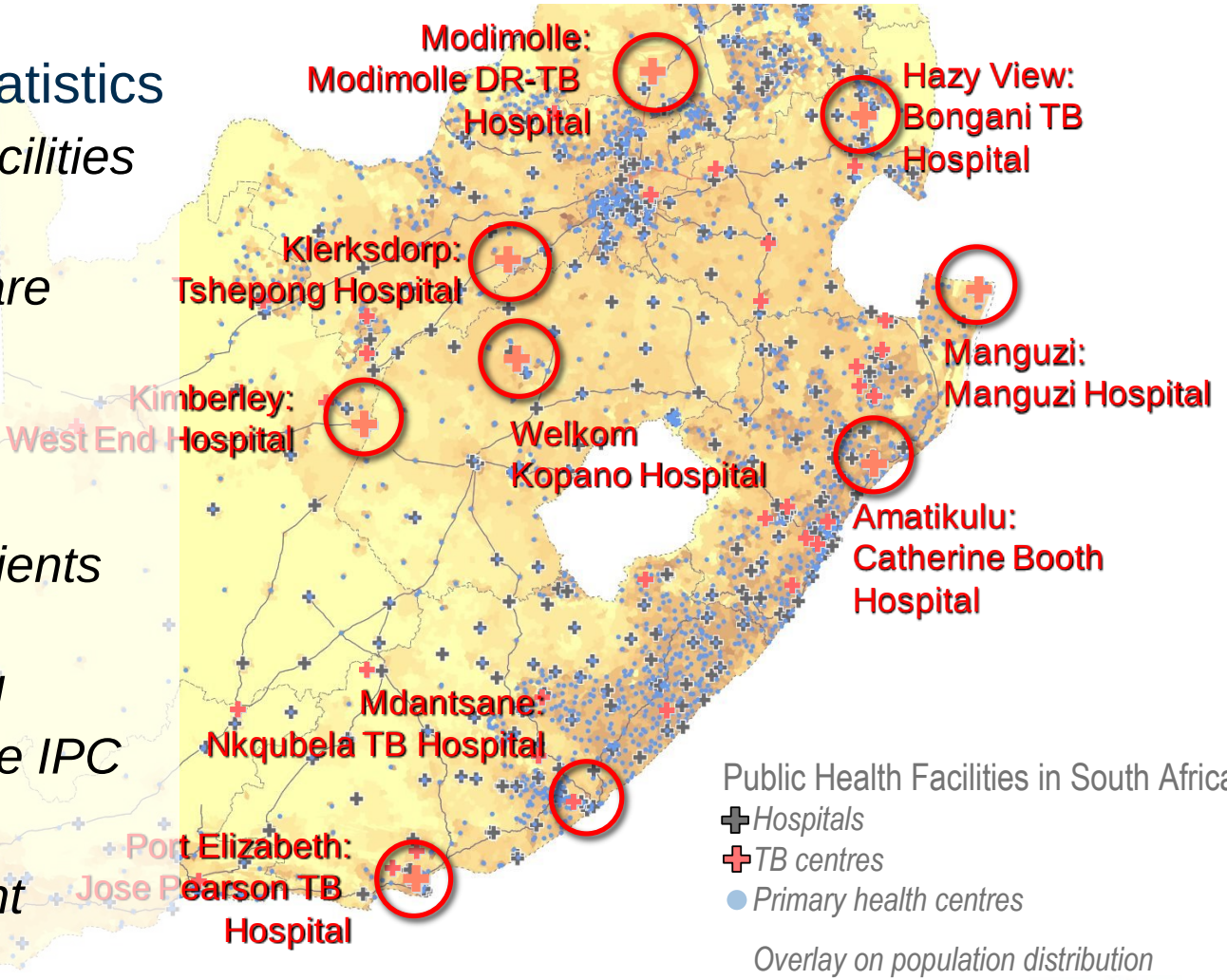
Global Fund DR-TB Infrastructure Project
Reducing airborne cross infection

Global Fund Project statistics

- *9 sites (of 22 MDR facilities in SA)*
- *400 new long term care beds*

Project deliverables

- *Safer facilities for patients and staff*
- *Guidelines for natural ventilation for airborne IPC*
- *Sustainable solution*
- *Capacity development*



Modimolle XDR-TB unit

Regulations and targets

- SANS 10400-XA
  - Part X – Environmental sustainability
  - Part XA – Energy in buildings

  - Building should be designed to reduce energy usage
    - *All buildings shall obtain at least 50% of water heating from sources other than electrical resistance heating*
    - *Design orientation, floors, walls, fenestration, roof assembly*
    - *Design to meet set energy consumption values for occupancy types - health buildings excluded; however need to comply with deemed to satisfy design principles or rational design*

IUSS way forward
Greening health infrastructure in SA

- Significant MTEF public sector investment in new and upgrade health capital projects
  - HRG/HIG: 12/13 R6.1bn (2012/13) R6.0 (2013/14), R6.3bn (2014/15)
  - Equitable share – about R4bn/annum
  - Total: Over R10bn/year over MTEF
- Private health sector making it core business
  - New and retrofit projects
- IUSS N&S guidelines, including environment and sustainability
  - Input into process welcomed
  - Benchmarking website being developed
  - Case studies
  - Design targets should be included in all new health project briefing
  - Retrofit project guidelines

Thank you

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