The long game - Future hospitals - investing in sustainable healthcare facilities

Philip A. Nedin, Director, Global Healthcare Business Leader
Arup
United Kingdom

The 5th Concept Symposium on Project Governance
Valuing the Future - Public Investments and Social Return
20. – 21. September 2012

Symposium web-site: http://www.conceptsymposium.no/
Concept Research Programme: http://www.concept.ntnu.no/english/

"A design team which produces a total, balanced, efficient design can help to produce a better environment."

Sir Ove Arup, November 1968

"Valuing the Future"

Losby Gods – Oslo

Future hospitals – Investing in sustainable healthcare facilities

Phil Nedin

Wednesday 20th September 2012

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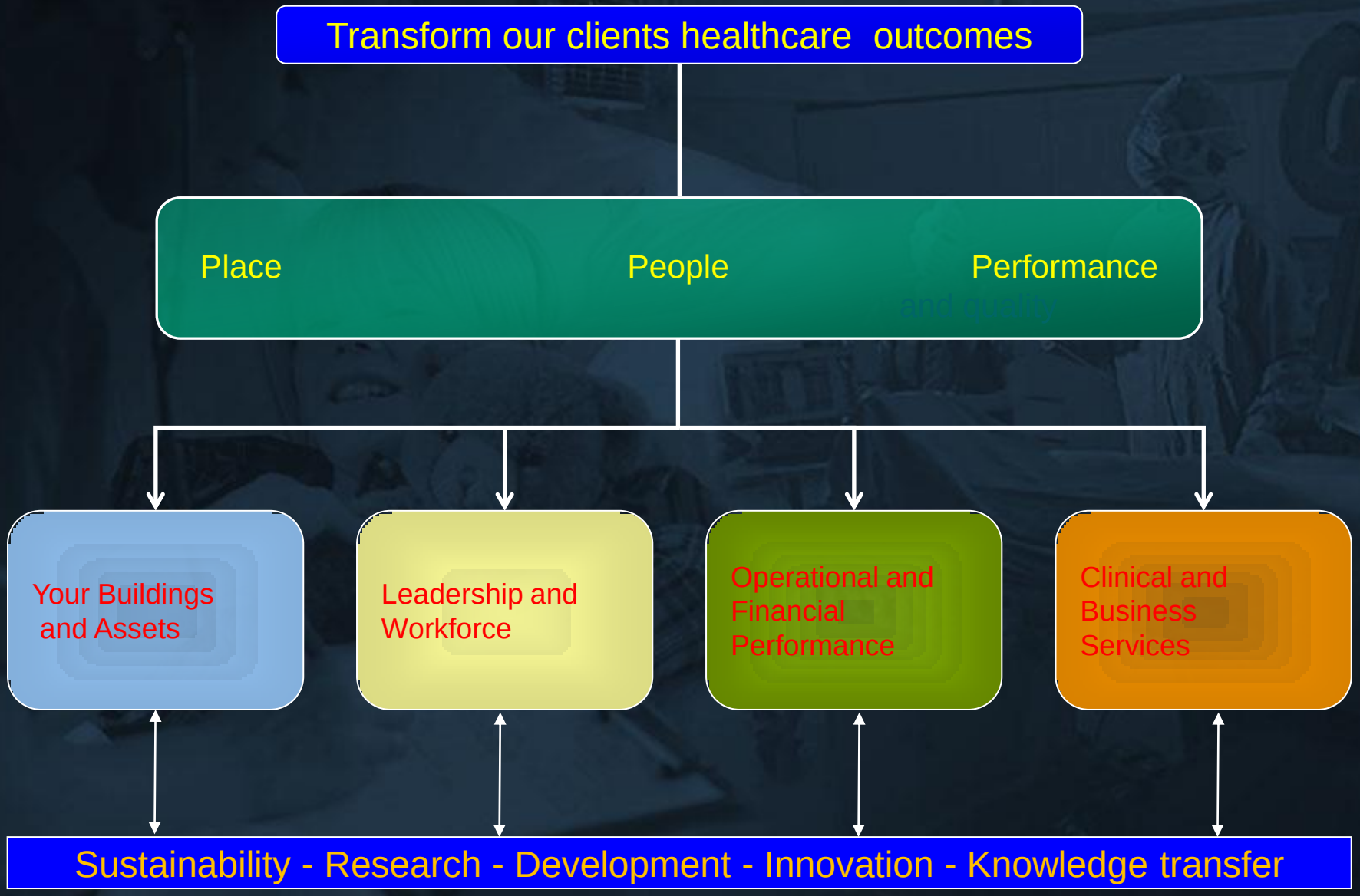
10,000 people in more than 90 offices around the world

Our Business Goal



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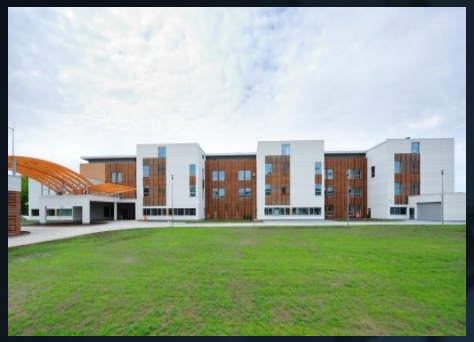
Shaping our business through design

Altnagelvin hospital clinical block Northern Ireland

Ysbyty Aneurin Bevan. South Wales. UK.

Moorfields children's eye hospital .London

Basildon Cardiothoracic hospital. Essex UK



Medicover hospital Poland

Alfred ICU Melbourne Aus.

Kenema clinic Sierra Leone

Hospital Del Norte Madrid

Pembury hospital Kent. UK

St Helens PFI hospital England

OASTSIH Aus.

Kaiser – Antioch USA

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Adding value to the process through consulting advice

Clinical Leaders Network

DH – 18 weeks Action Learning Sets

Patient Safety - Single Bed Wards

Developing Sustainability Guidance

Lean Process Improvement

Asset Management – Life cycle funds

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Arup research project involvement

Project 1
The Centre for Health Design
An Open-Source Searchable Database to Assess the Impact of Environmental Strategies on Health Outcomes

Project 2
Practical Resilience to Climate Change

Project 3
The Effect of Phase Change Materials on Building Thermal Performance

Project 4
Reinforce links with the Pathogen Control Engineering Institute (PaCE) based at Leed University

Project 5
Reducing the risk of infection through the introduction of single patient bedrooms

Project 6
Application of air disinfectant devices to enhance the respiratory transmission protection in hospital wards

Project 7
Areas of infection risk in healthcare facilities.

Project 8
Beyond Master Planning Beyond Estate strategy

Project 9
The impact of environmental space on delirium in ICU departments

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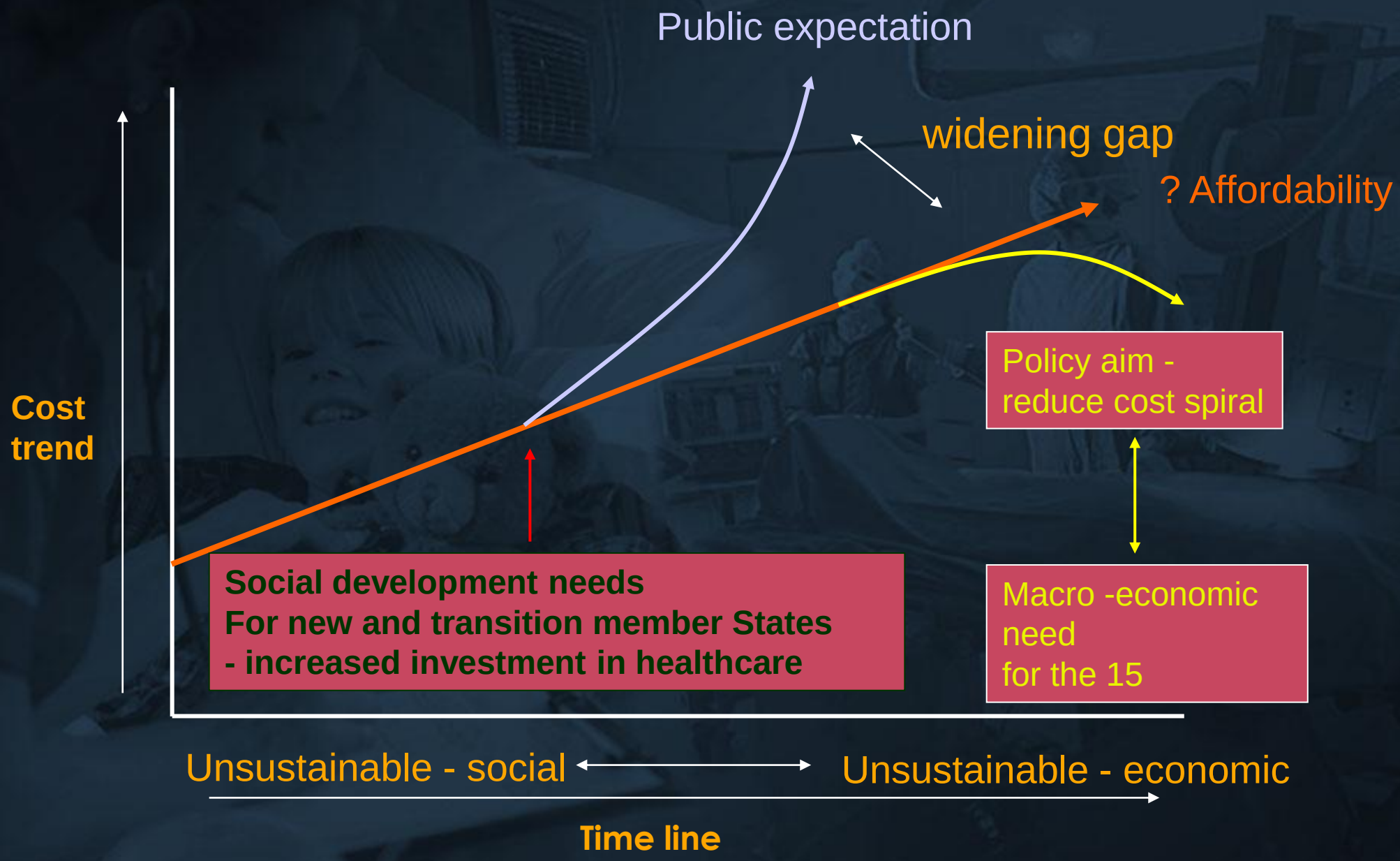
European gradation in health – and health facilities

EuHPN European Health Property Network



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The cost of healthcare 2012

USA	47,150	17.9	$8,439.85	6,680.69 €	£5,297.02
Norway	85,390	9.5	$8,112.05	6,420.17 €	£5,090.46
Denmark	56,240	11.4	$6,411.36	5,076.68 €	£4,023.25
Netherlands	46,900	11.9	$5,581.10	4,418.77 €	£3,502.56
France	39,450	11.9	$4,694.55	3,719.21 €	£2,946.84
Sweden	48,900	9.6	$4,694.40	3,716.74 €	£2,946.09
Germany	40,120	11.6	$4,653.92	3,687.12 €	£2,907.87
Belgium	43,080	10.7	$4,609.56	3,649.88 €	£2,893.05
Australia	50,750	8.7	$4,415.25	3,495.23 €	£2,771.29
Ireland	46,170	9.2	$4,237.64	3,355.10 €	£2,659.44
Finland	44,380	9.0	$3,994.20	3,162.46 €	£2,506.84
UK	36,340	9.6	$3,488.64	2,763.84 €	£2,189.87
New Zealand	32,370	10.1	$3,269.37	2,587.71 €	£2,052.07
Spain	30,550	9.5	$2,902.25	2,299.34 €	£1,821.49
Greece	26,610	10.2	$2,714.22	2,149.98 €	£1,703.77

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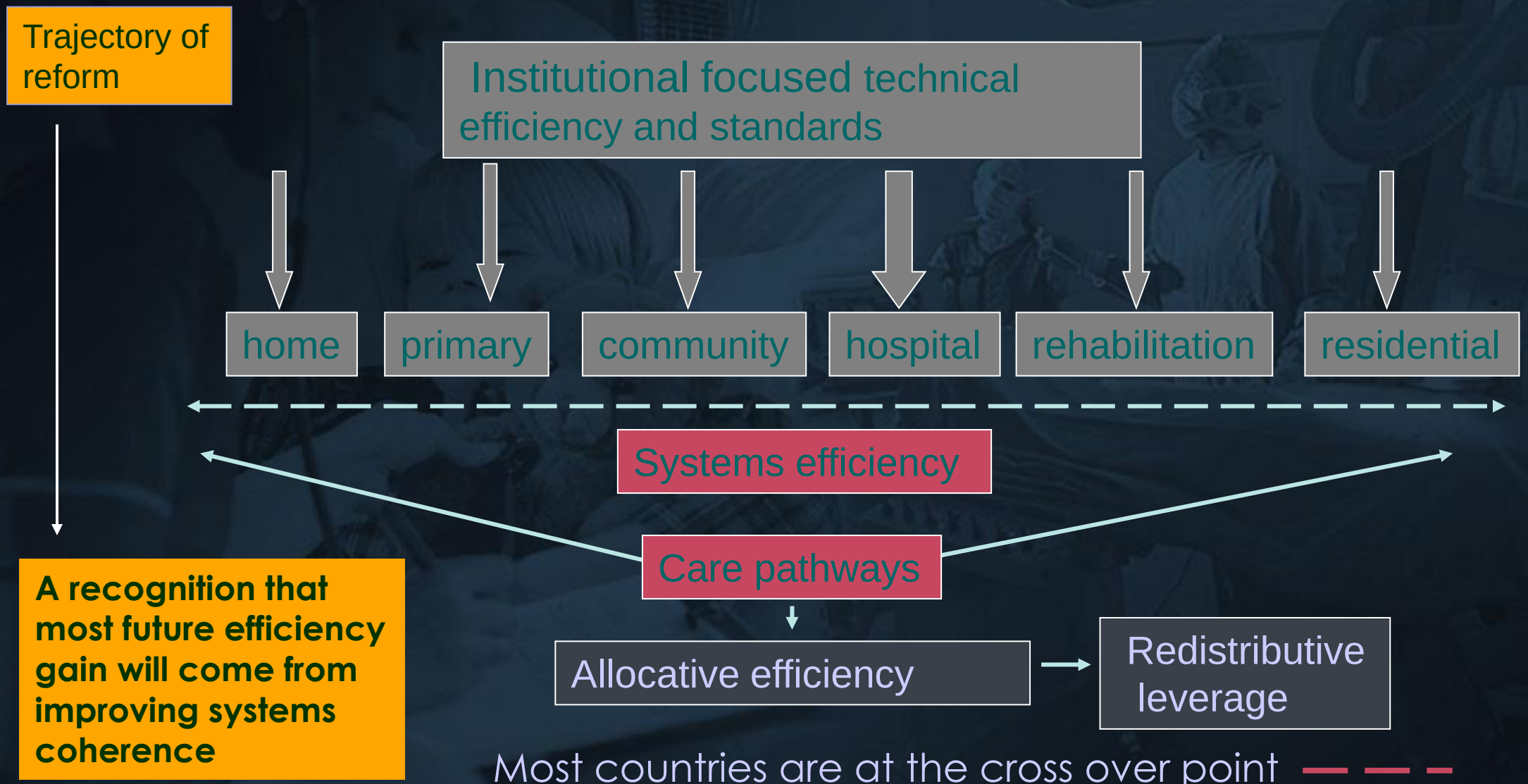
Source – The world in Figures 2013. Conversion $ to € to £ Sept 2012

Facilitating reform in the mature healthcare markets whole systems efficiency – extending the provision of care

EuHPN European Health Property Network



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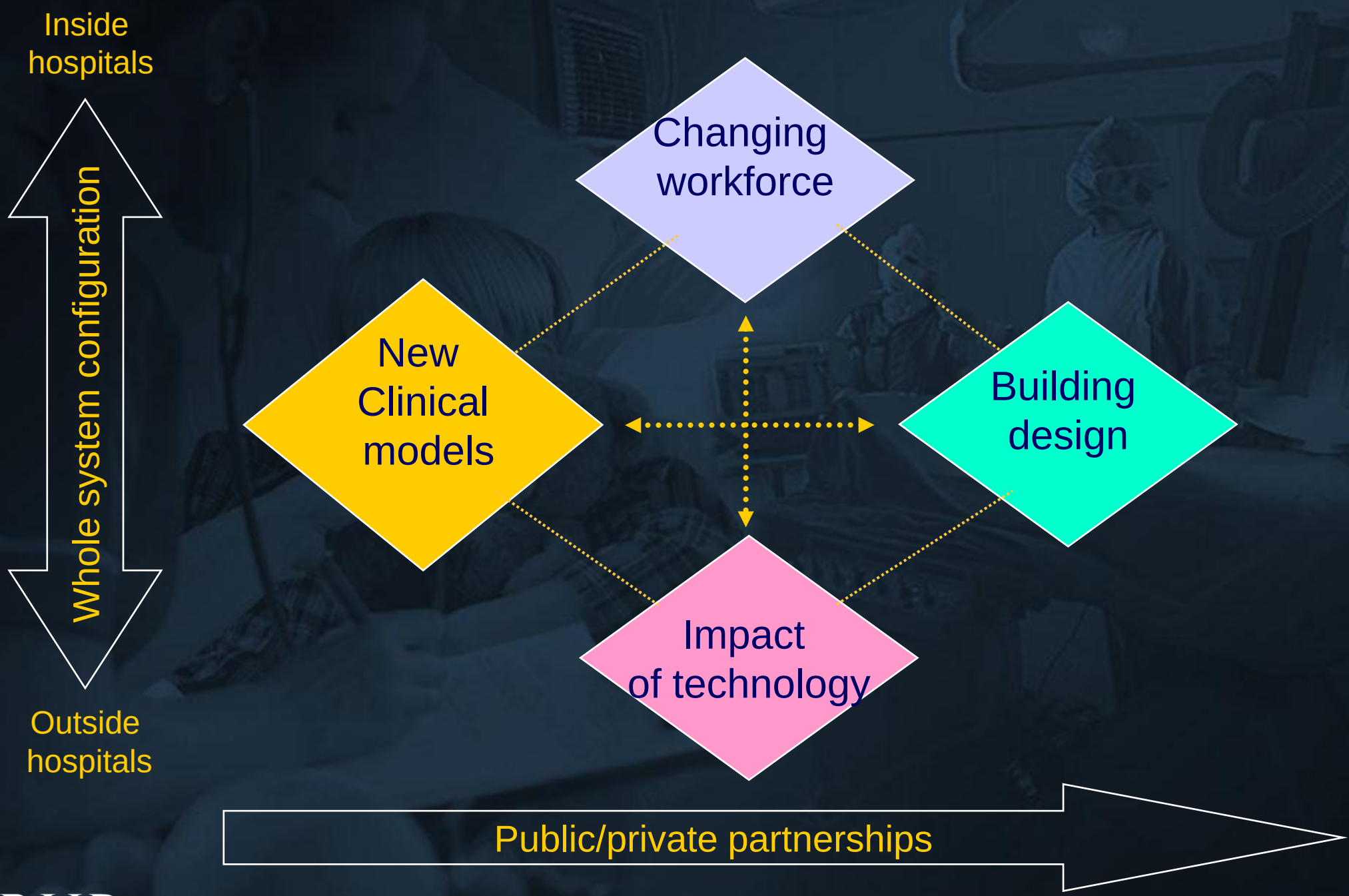
Drivers for change – The changing face of healthcare



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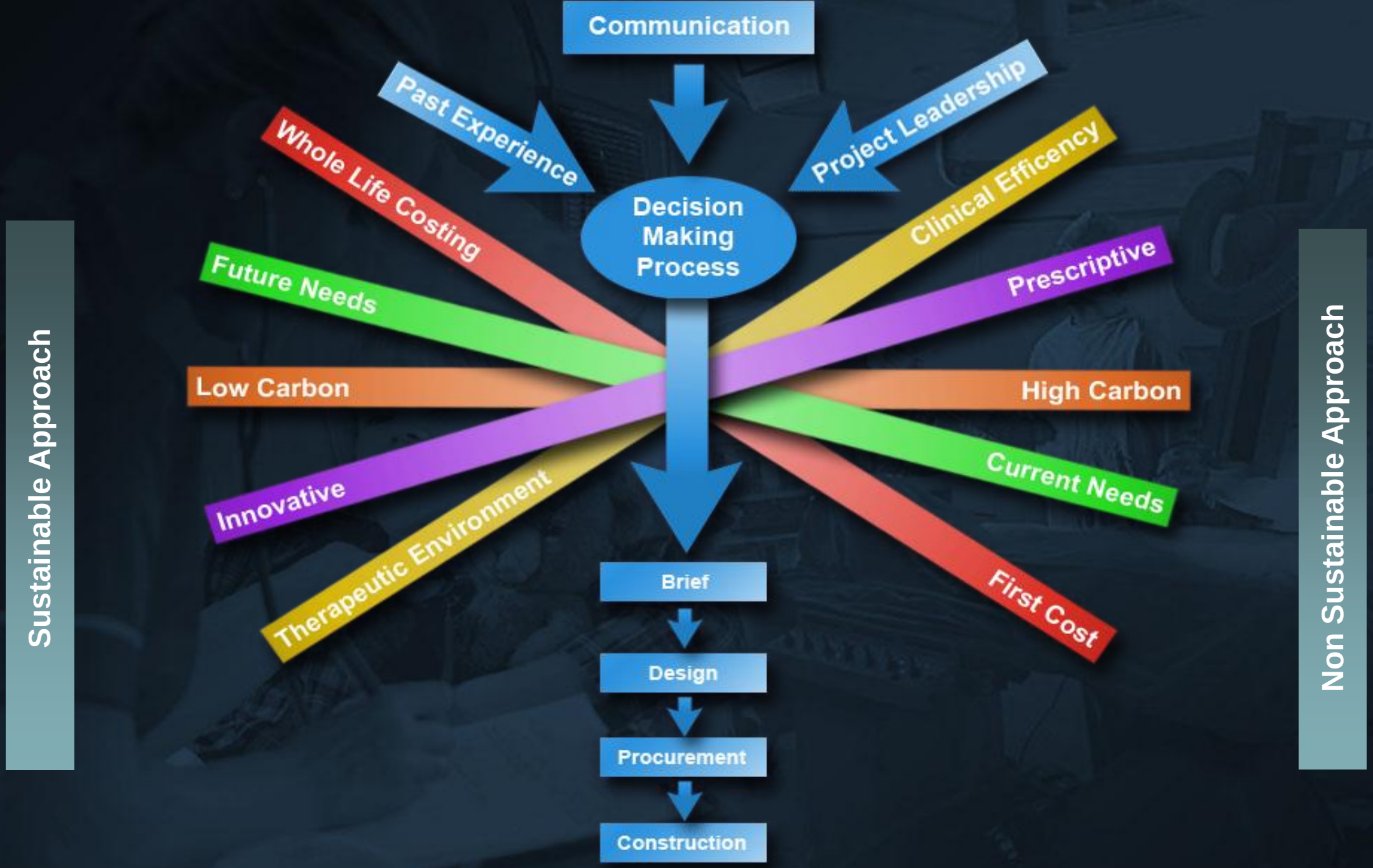
Communication
Past Experience
Project Leadership
Whole Life Costing
Clinical Efficency
Decision Making Process
Future Needs
Prescriptive
Low Carbon
High Carbon
Innovative
Current Needs
Therapeutic Environment
First Cost
Brief
Design
Procurement
Construction
Sustainable Approach
Non Sustainable Approach

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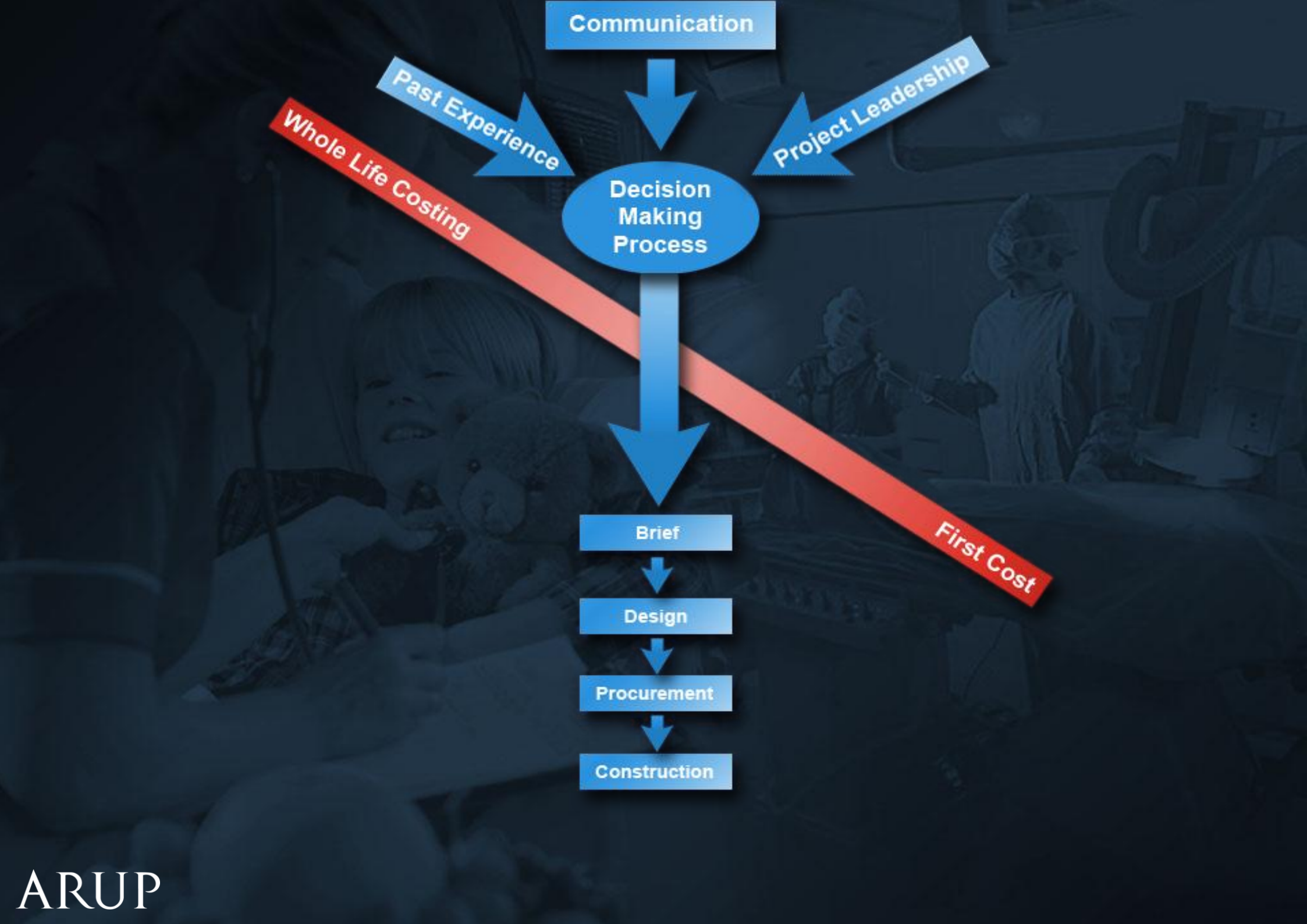
Communication
Past Experience
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First Cost
Brief
Design
Procurement
Construction

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Design adds value

100

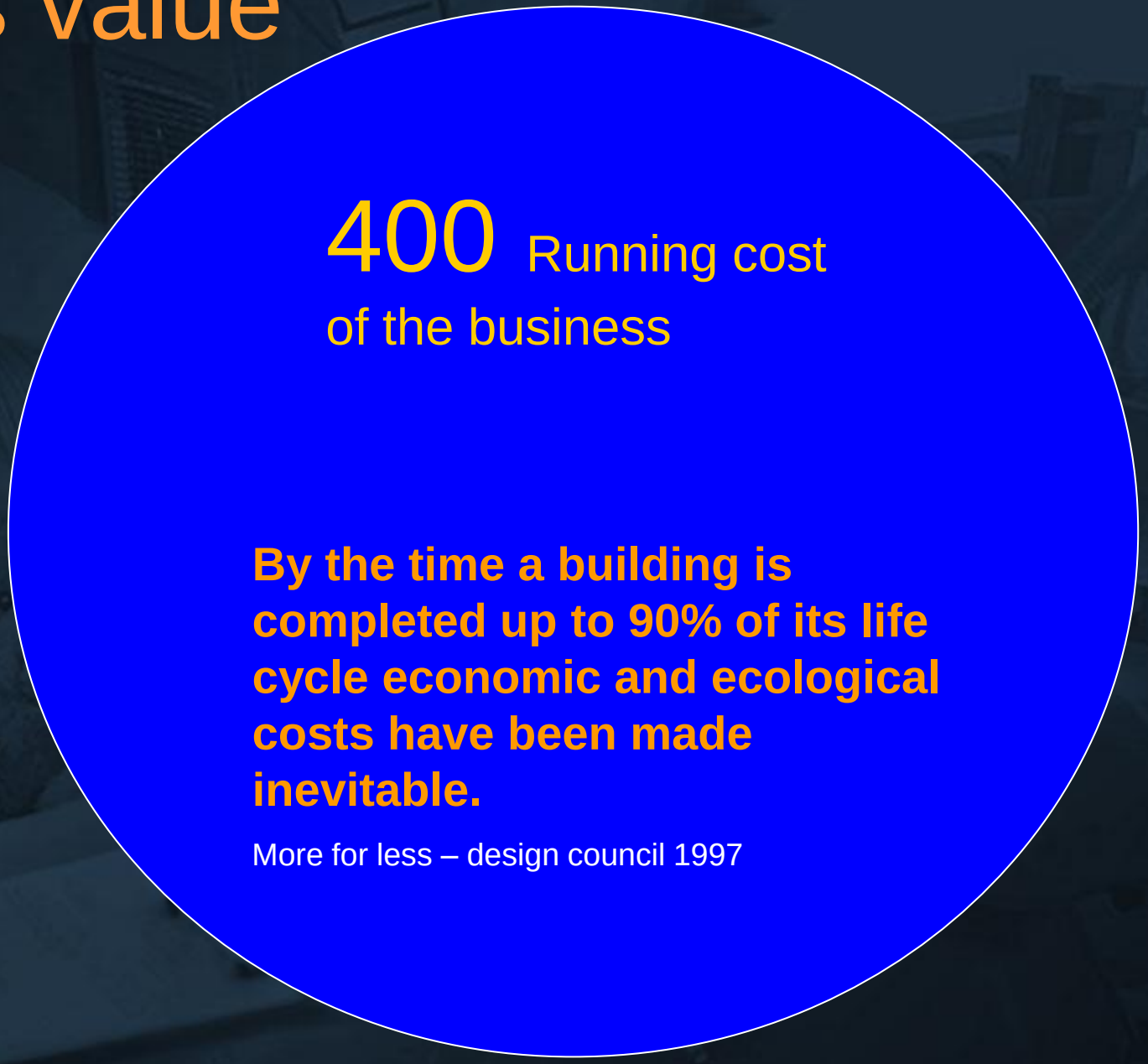
Maintenance cost

1

Capital cost

0.1

Design costs



400 Running cost of the business

By the time a building is completed up to 90% of its life cycle economic and ecological costs have been made inevitable.

More for less – design council 1997

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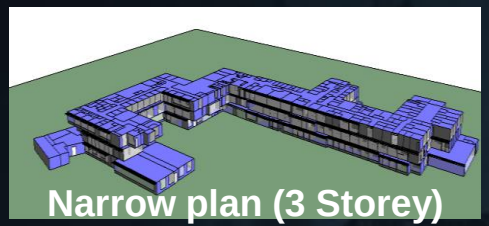
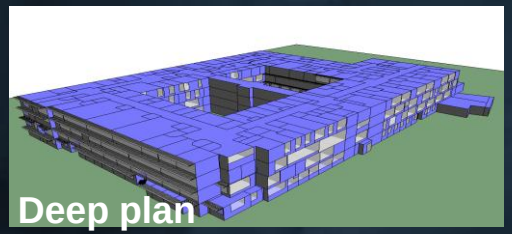
Hospital Geometry – generic options





	Narrow Plan (2 Storey)	Narrow Plan (3 Storey)	Intermediate Plan	Deep Plan
Total Floor Area	14,795m^2	14,663m^2	14,775m^2	13,956m^2
Number of Floors	2	3	3	4
Façade Length	1886m	1863m	2051m	1840m
% Façade	34.41%	34.31%	37.48%	35.60%
External Length of foundation	1008m	686m	681m	482m
Area of Foundation	8127m^2	5830m^2	5210m^2	3680m^2
% glazing	60.20%	60.35%	56.27%	35.42%
Ventilation strategy	Predominantly Natural Ventilation	Predominantly Natural Ventilation	Mixed mode	Predominantly Air conditioned

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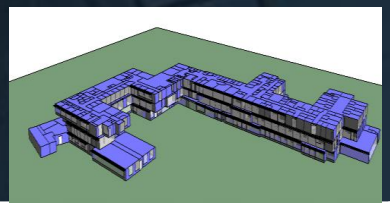
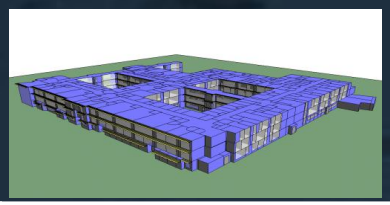
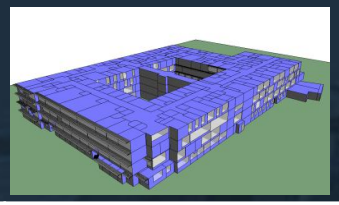
Capital Cost Breakdown

	Narrow Plan (2 Storey)	Narrow Plan (3 Storey)	Intermediate Plan	Deep Plan
Substructure	£2,082,540	£1,417,444	£1,408,147	£996,497
Superstructure	£2,379,005	£2,540,942	£2,612,866	£2,580,671
Roof	£1,865,548	£1,338,273	£1,195,924	£844,742
Façade	£4,678,560	£4,630,479	£4,882,135	£3,397,578
Internal finishes	£4,944,949	£4,931,111	£4,985,500	£5,004,332
Mechanical Services	£3,790,082	£3,762,333	£4,042,619	£4,740,210
Electrical Services (incl. lifts)	£4,150,357	£4,048,077	£4,106,319	£3,939,734
BWIC	£720,261	£617,680	£642,500	£617,680
Preliminaries and contingencies	£6,835,712	£5942,914	£6,367,686	£5,999,323
Total	£31,447,315	£29,229,253	£30,243,696	28,128,205

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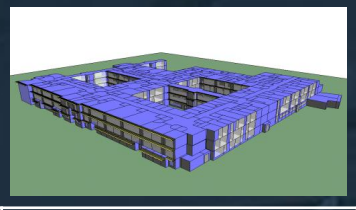
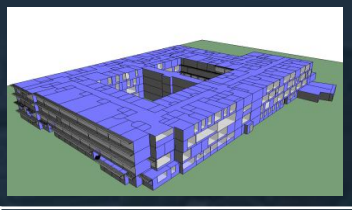
Whole life costing



	Narrow Plan (2 Storey)	Narrow Plan (3 Storey)	Intermediate Hospital	Deep Plan
Capital cost	£31,447,315	£29,229,253	£30,243,696	£28,128,205
Financial cost at Year 1	£2,258,348	£2,236,854	£2,396,193	£2,447,218
Financial cost at Year 10	£23,915,483	£23,574,025	£25,293,023	£25,715,045
Financial cost at Year 30	£92,87,066	£91,040,351	£97,796,126	£94,761,126
Financial cost at Year 60	£196,828,900	£192,524,507	£198,863,388	£196,488,271
Annual social cost of carbon (£70/ton)	£20,567	£20,266	£22,001	£36,440

Financial cost includes: Operation and maintenance, social cost of carbon and energy.

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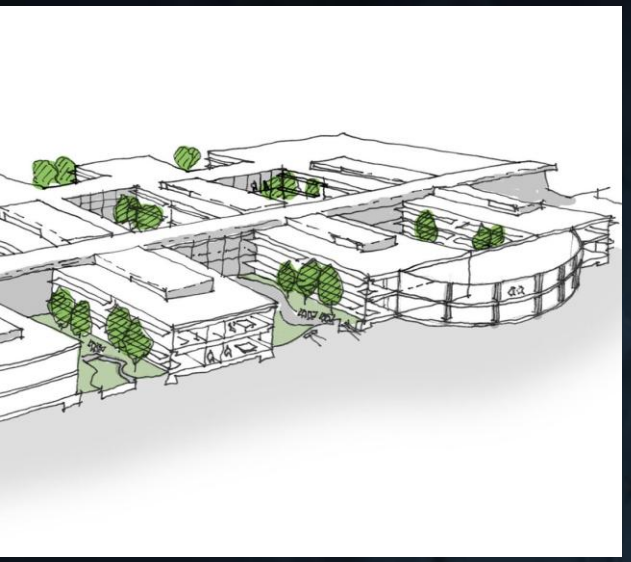
Narrow plan v's deep plan – Whole life costing



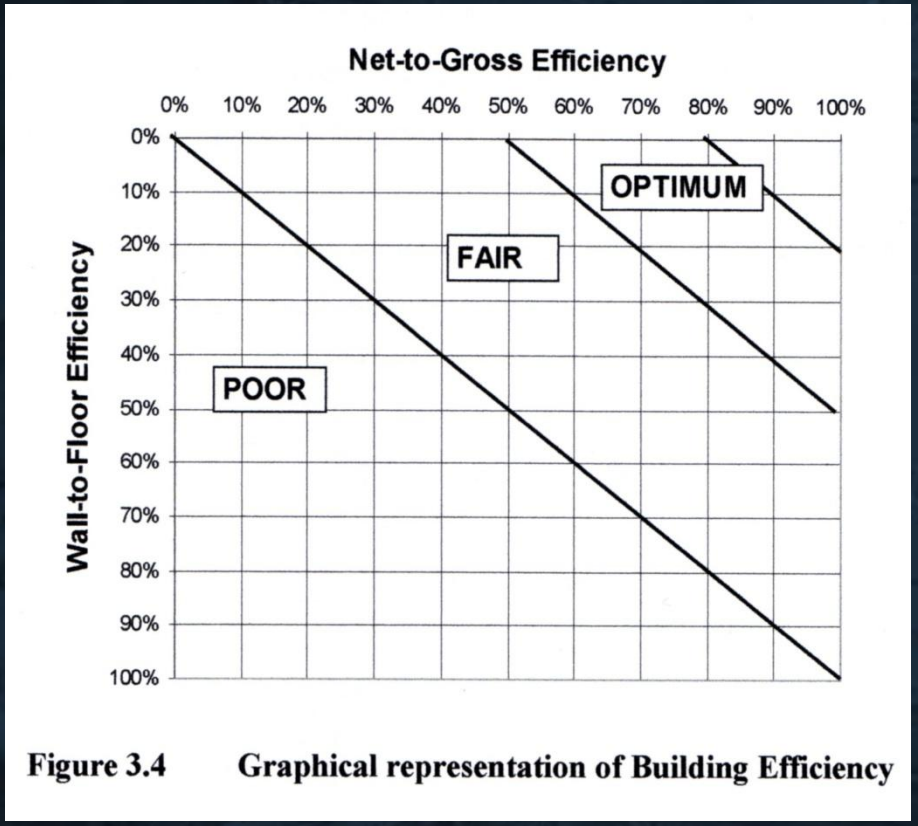
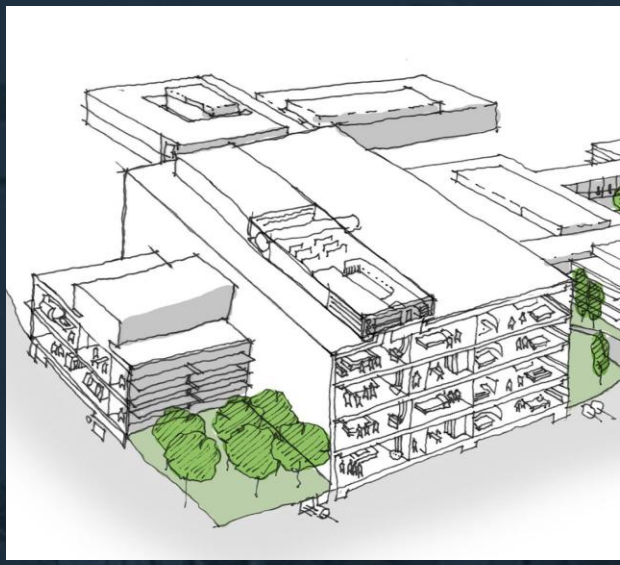


Figure 3.4 **Graphical representation of Building Efficiency**



- Departmental adjacencies = Clinical efficiencies

- Construction efficiency = Capital cost economies

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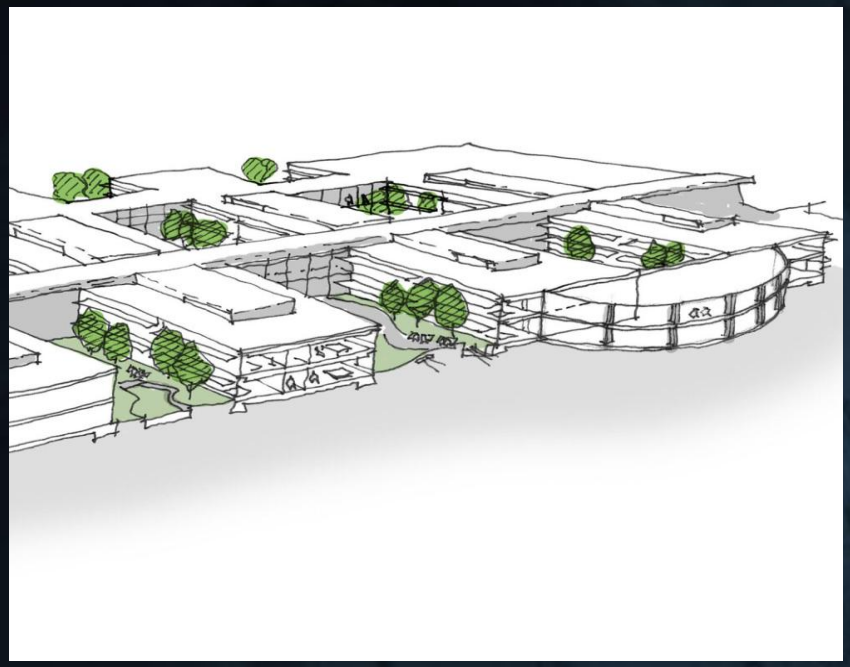
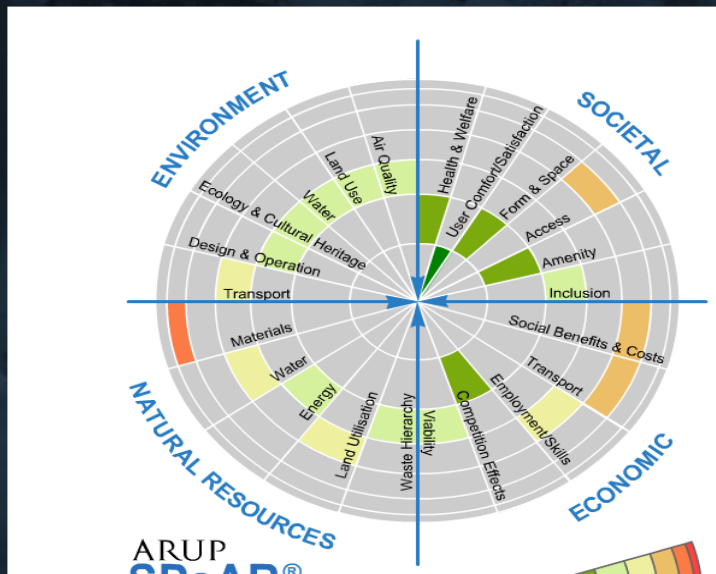
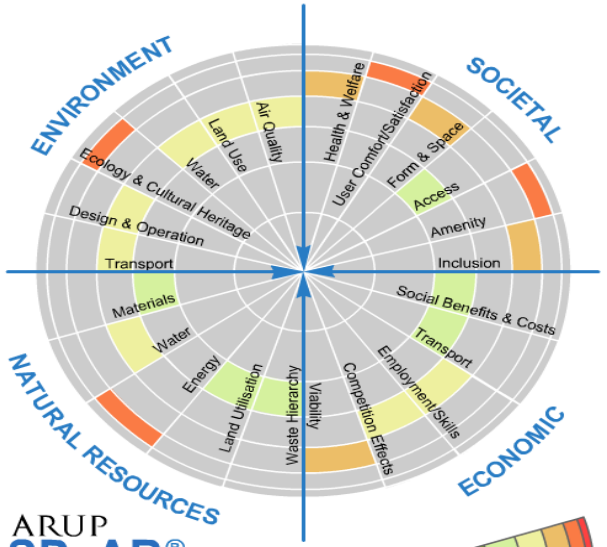
Sustainable planning – Narrow plan v's deep plan







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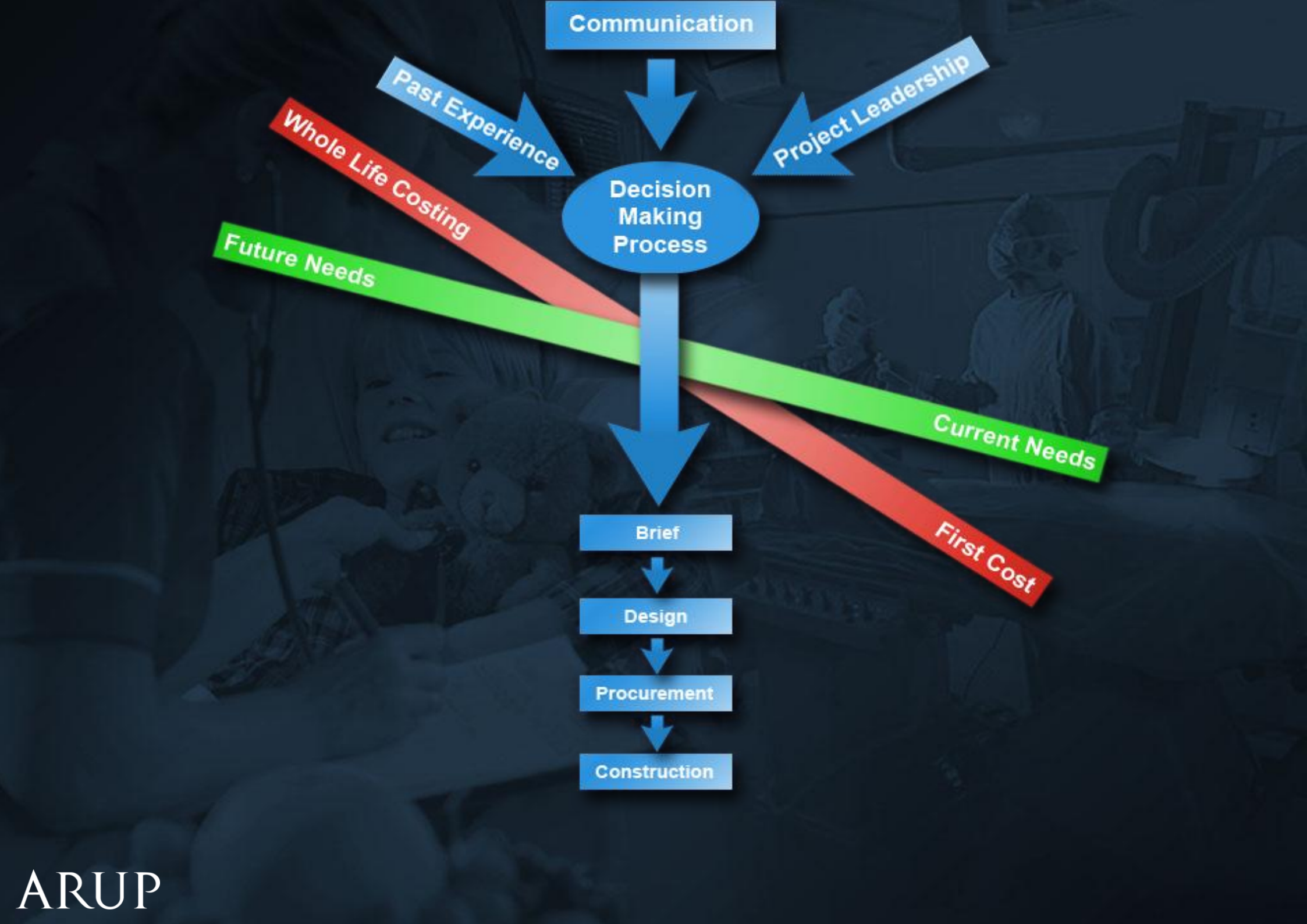
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Healthcare drivers that shape our business

Robotics

The intelligent patient

Infection control

Drug development

Private finance

Surgical techniques

Alternatives

Therapeutic environments

Intelligent pills

DNA, RNA, Stem cell

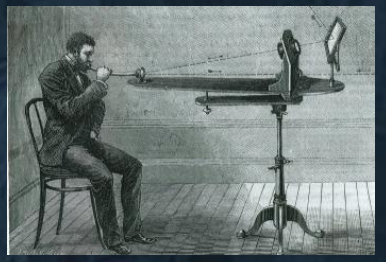
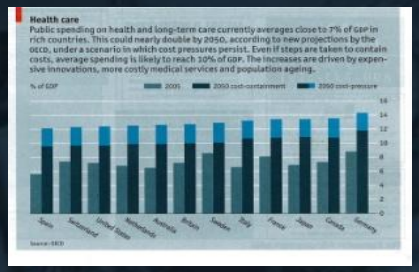


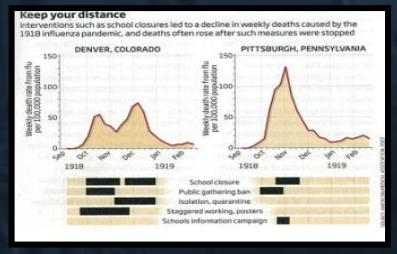
Photo acoustics

The elderly & chronic illness



Affordability

Home diagnostics



Pandemic risk

Artificial organs

Public health

Government & Legislation

Global warming

ITC

Imaging

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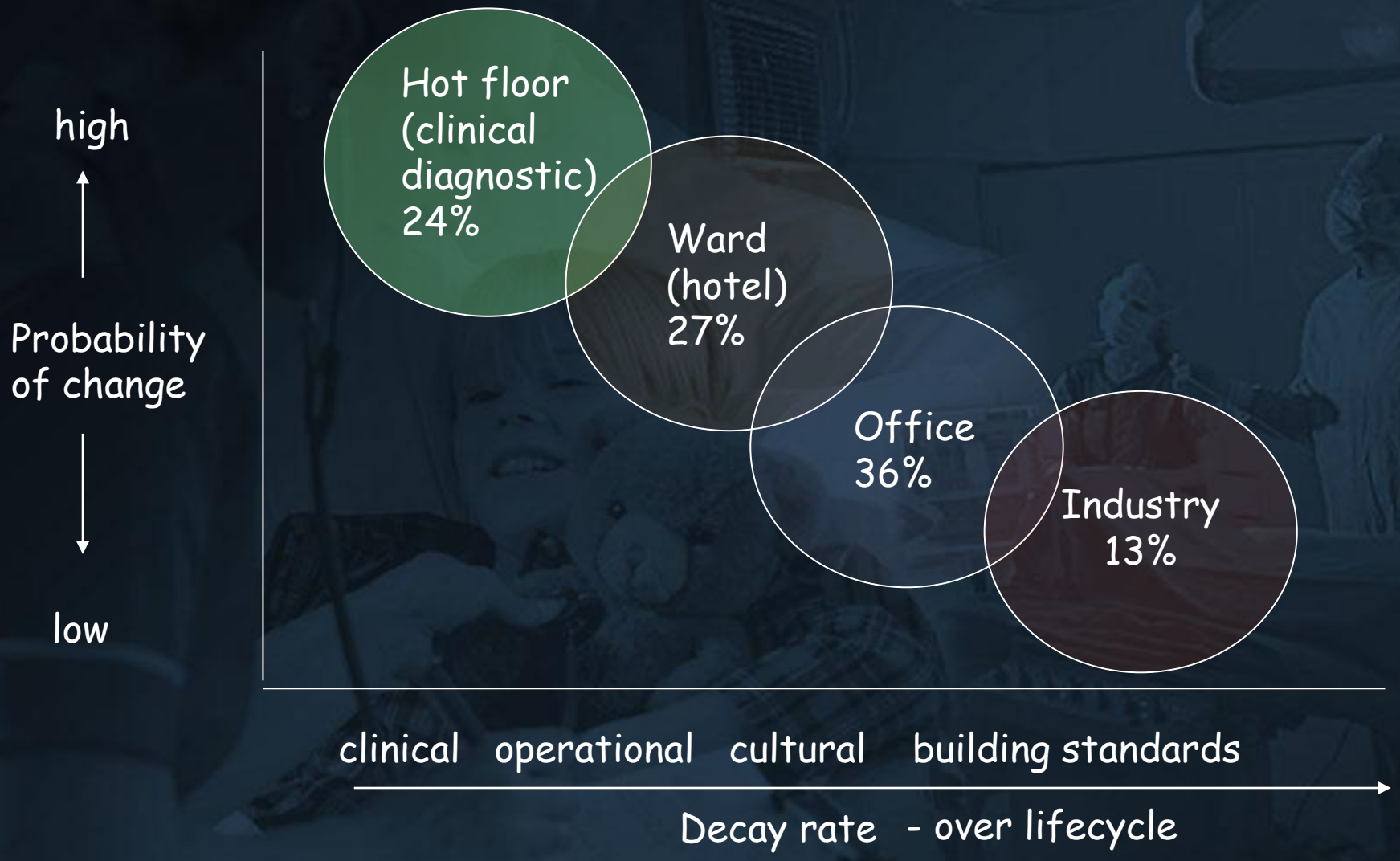
Flexibility in design



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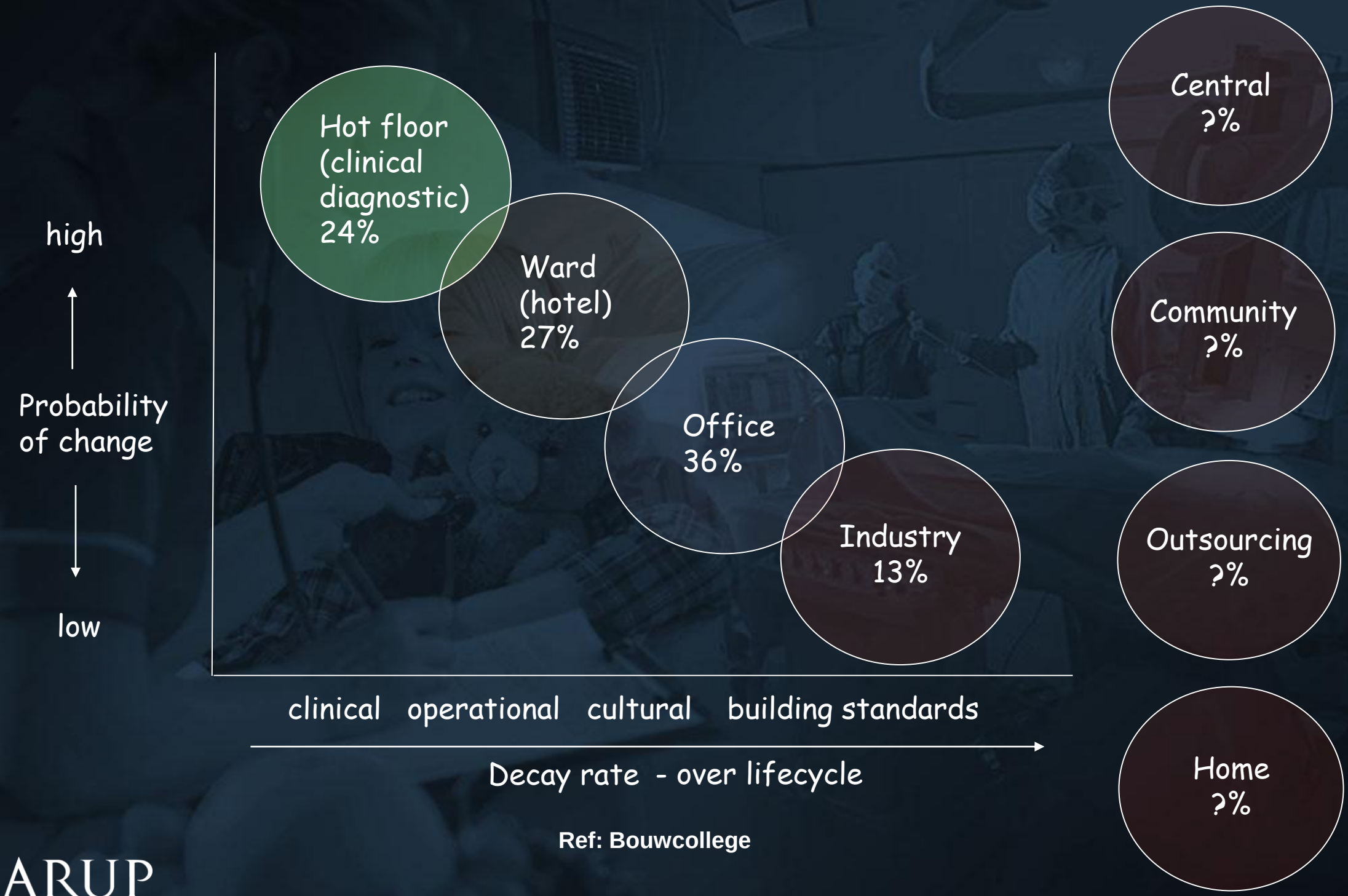
The changing face of healthcare provision



Ref: Bouwcollege

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lifestyle developments!

- If eating habits met nutritional standards, 70,000 lives a year would be saved in the UK.
- Domino pizza & Kentucky fried chicken profits rose by 25% and 14% respectively in 2008 while McDonalds had their best trading ever year in the UK.
- Anorexia in girls under 16 in the UK has risen by 80% in the past decade.
- 23% of liver transplants in UK 2008 went to people with alcohol related disease – an increase from 14% in 2007.





- Smoking ban in public places – benefits apparent !
- Danish place a tax on saturated fats Oct 2011 – governments are watching!
- Mayor Bloomberg (NY) action on Fizzy drinks, smoking, fast food chain calorie counts and banned trans fats in restaurants.

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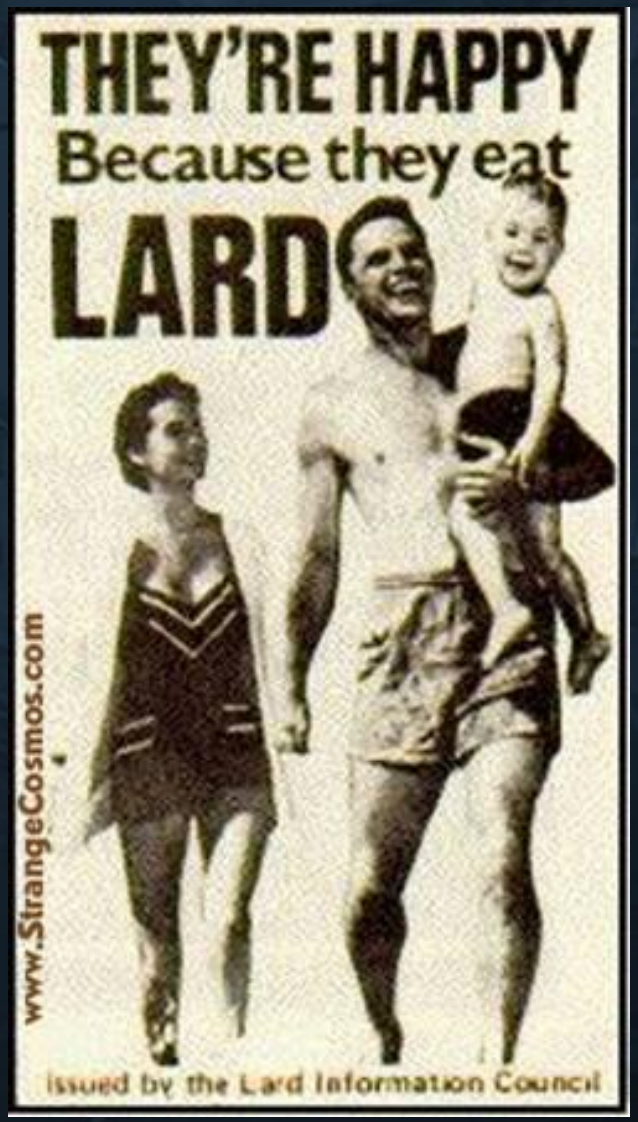
1930's adverts promoting lifestyle



Legislation v's the nanny state

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Genetic developments!

The completed human genome is only 5 years old but genetic pathways have already been successful:

- **Age related macular degeneration**
- **Inflammatory bowel disease**
- **Cardiovascular disease**
- **Type 2 diabetes**
- **Obesity**
- **Cancer therapies**
- **Stroke therapies**
- **Major genome centres are now able to sequence 1 human genome every day – the first one took many years**

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Drug developments

- The development of the Poly-pill to postpone cardio-vascular disease!

Surgical developments

- Tumours to be illuminated with targeted dye to ensure first time removal!

Technical developments

- Proton beam for targeted radiation treatment – large scale
- iphone apps – small scale

Diagnostic developments

- Early CDT testing

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The internet, social networking sites & wireless devices

The catalyst for new healthcare business models

Smart phones (Apple Apps store)

Access to medical records

Health monitoring – exercise, diet and vital signs

Health advice by phone (developing countries)

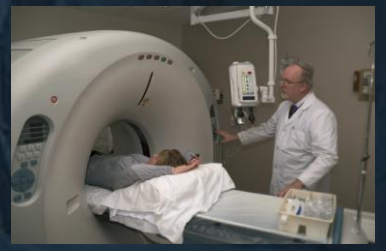
Medical education by phone and networking sites

Magic carpets for the elderly

Medication reminders

Personal health coaching by phone

Social networks organised for common ailment support



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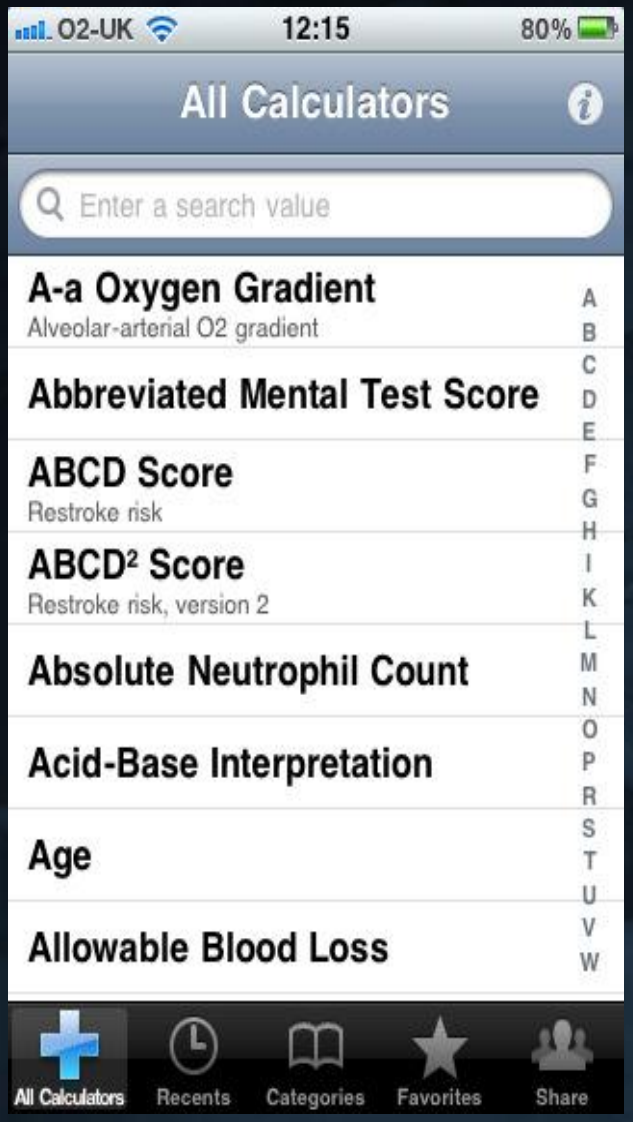
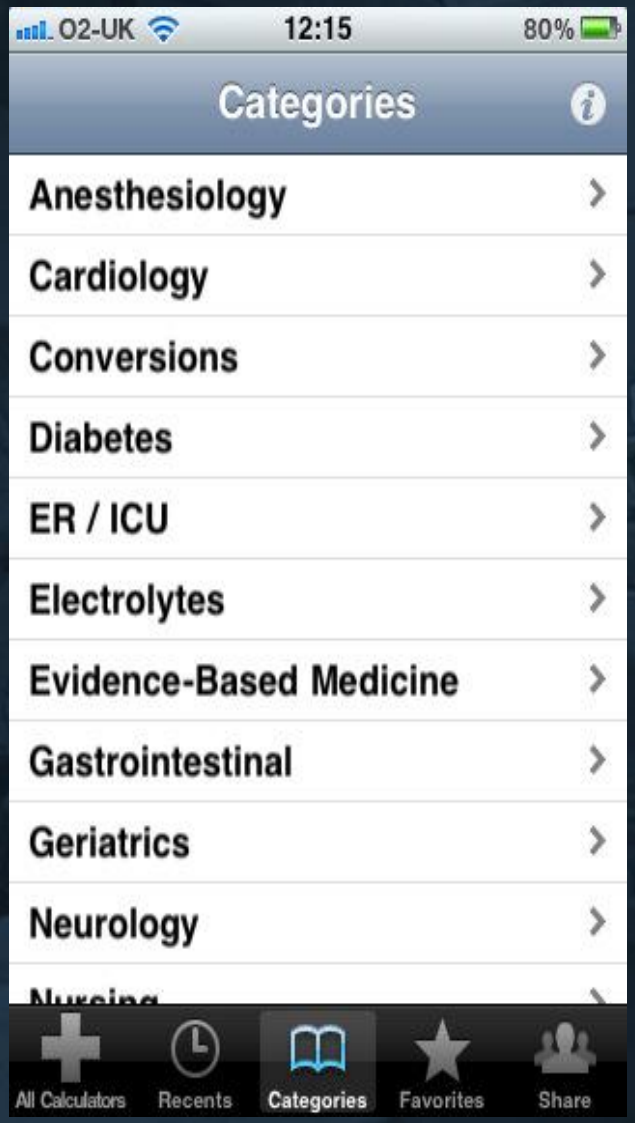
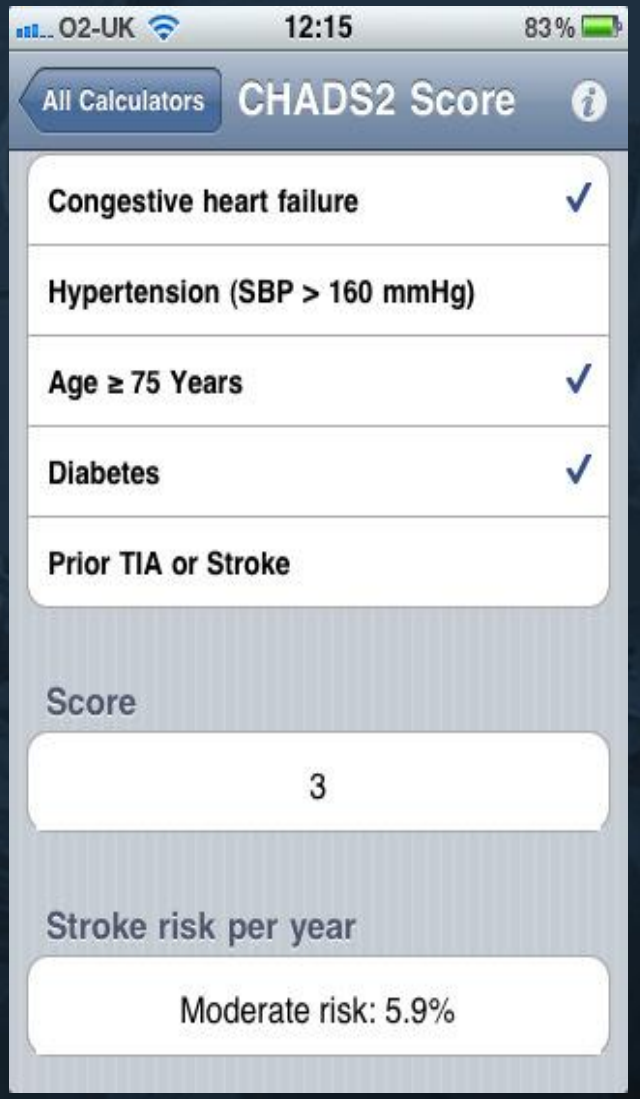
The available APPS technology







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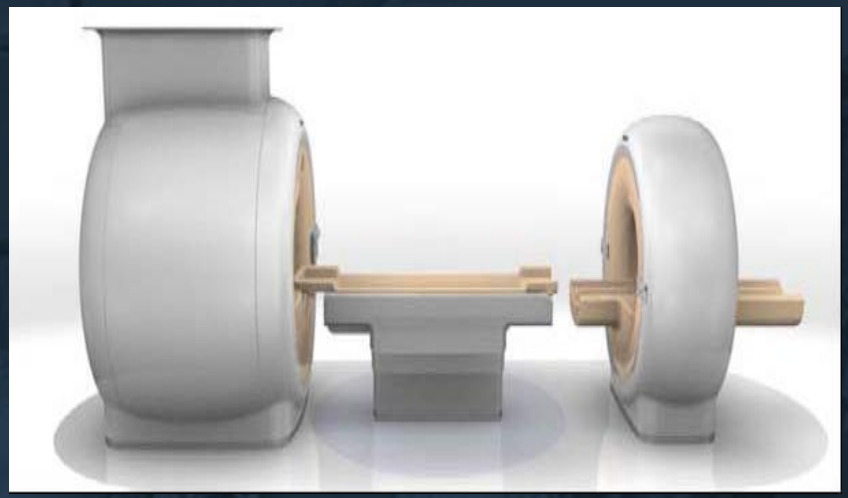
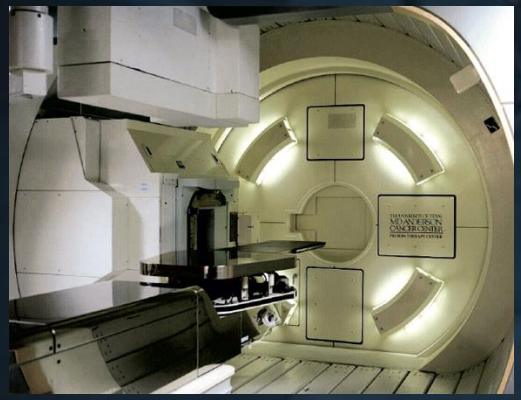
Technology developments

Gamma knife



CT/MRI



Proton Beam

?

Where next

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Smaller……smarter……..swifter

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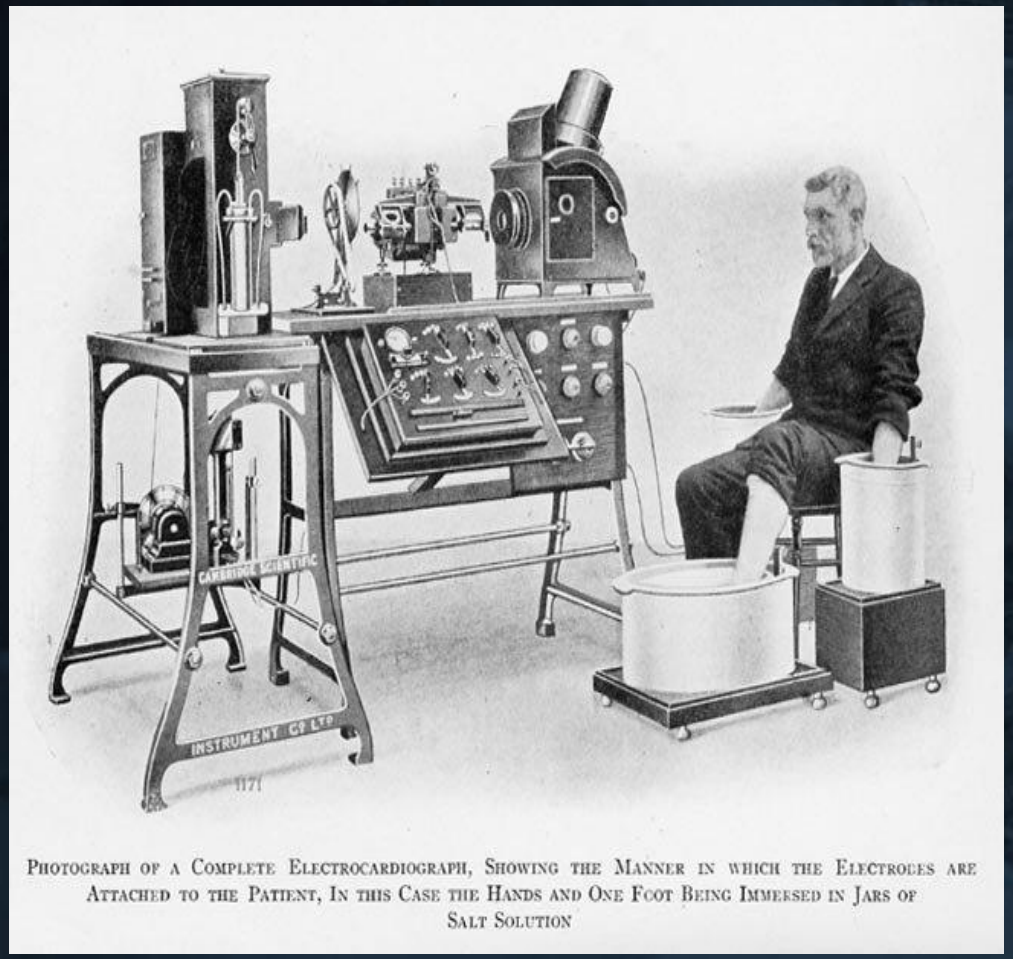
ECG development



PHOTOGRAPH OF A COMPLETE ELECTROCARDIOGRAPH, SHOWING THE MANNER IN WHICH THE ELECTRODES ARE ATTACHED TO THE PATIENT, IN THIS CASE THE HANDS AND ONE FOOT BEING IMMERSED IN JARS OF SALT SOLUTION

Experimental c1888

GE MAC 400 ECG - 2008

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Barn theatre incorporating laminar flow units

Nightingale Architects

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Alzheimer's Disease – UK trend

- 700,000 .....now
- 940,000 2021
- 1,700,000 2051
- 154% INCREASE OVER THE NEXT 45 YEARS!

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NCD - Prevalence of Diabetes

	2000	2030 predicted
Worldwide	171,000,000	366,000,000
China	20,757,000	42,321,000
United States of America	17,702,000	30,312,000
United Kingdom of Great Britain & Northern Ireland	1,765,000	2,668,000

Source: World Health Organization

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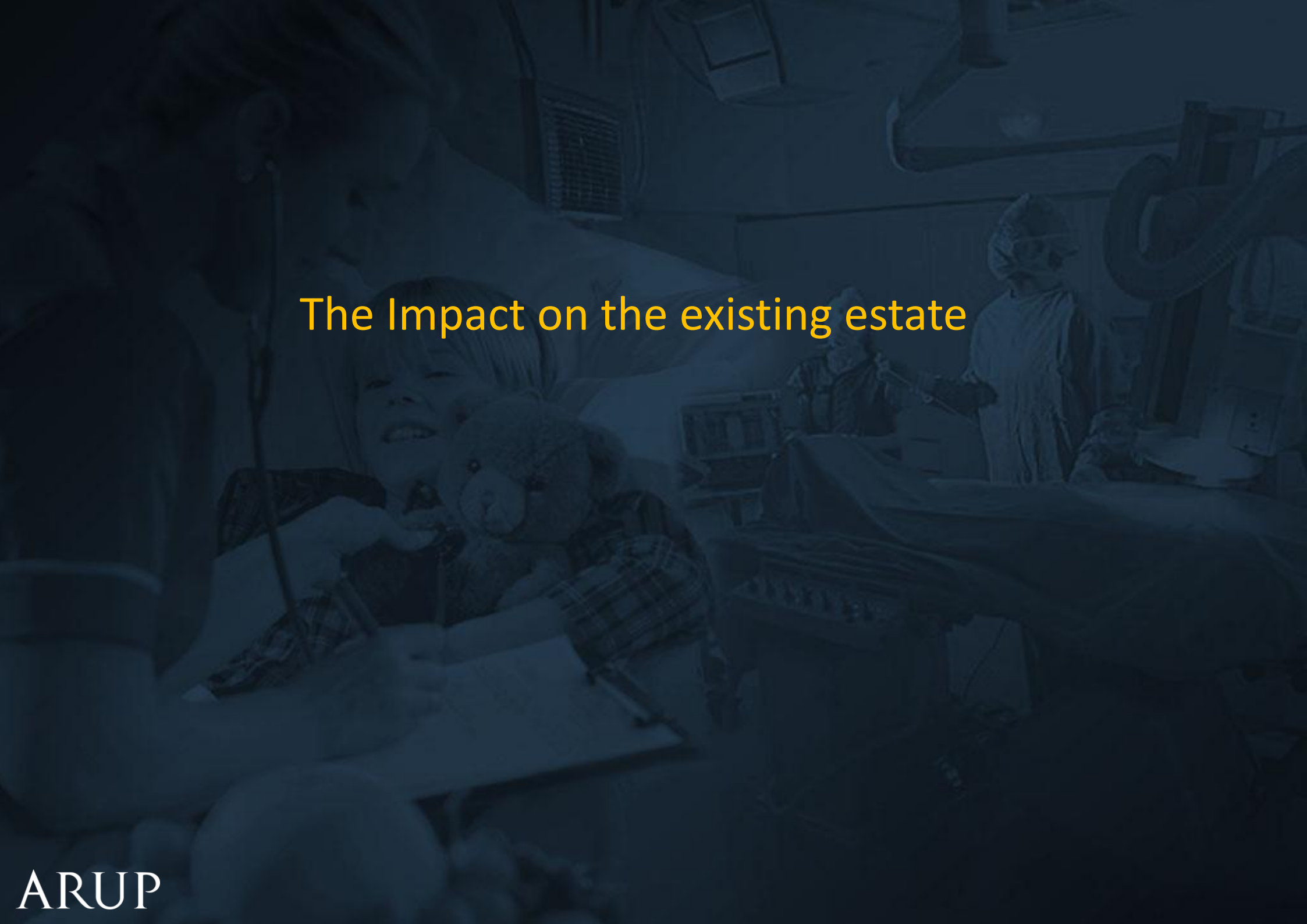

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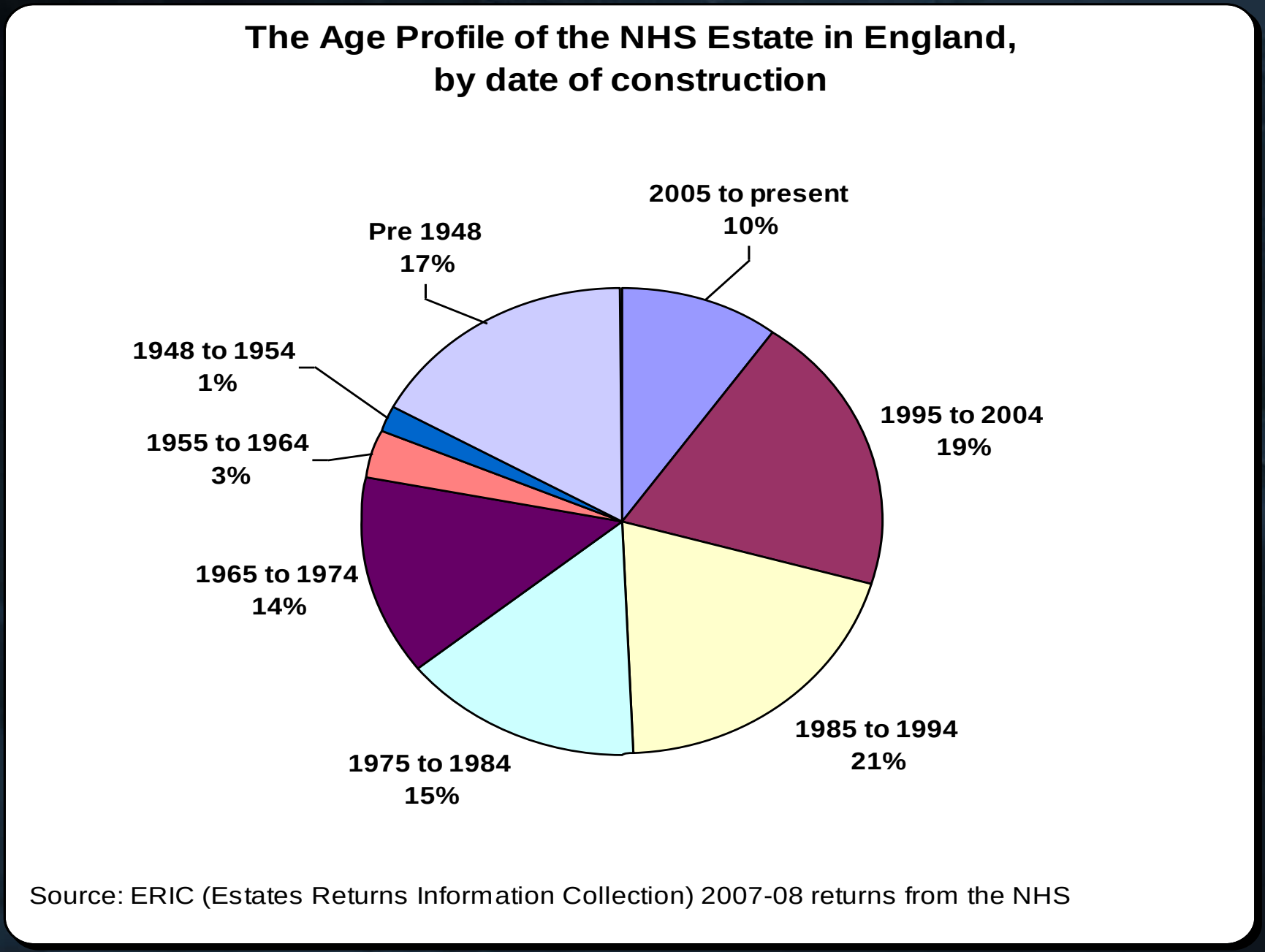
The existing estate – A major challenge



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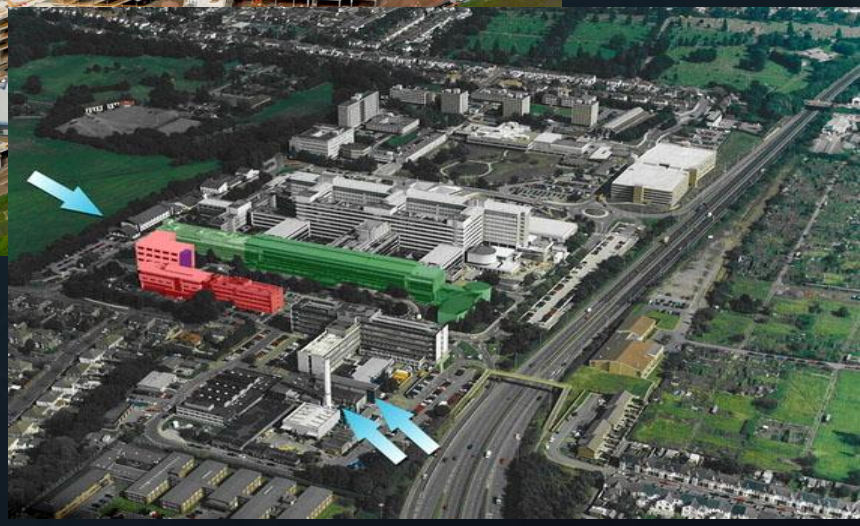
50% of the Estate pre-dates 1985

The existing estate – our starting position!



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The existing estate – building generations!

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Refurbishment – Multiple contracts

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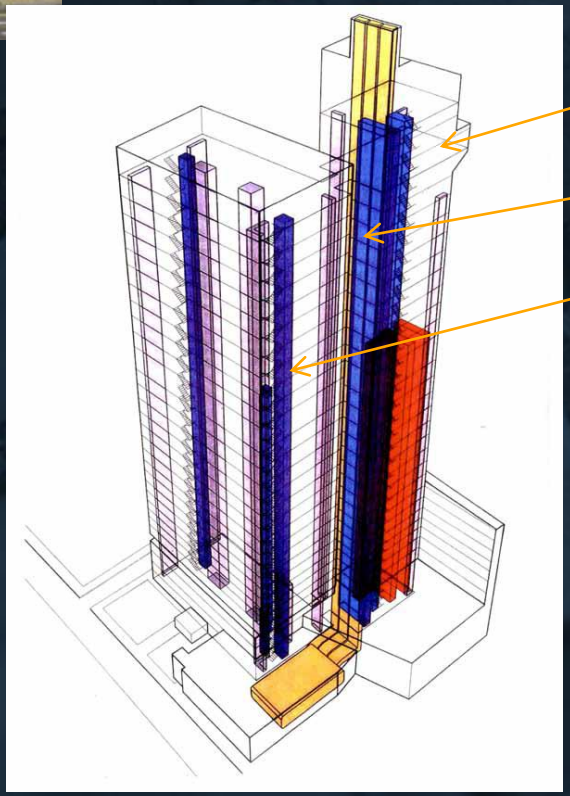
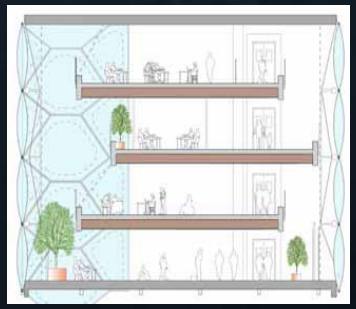
Guy’s Hospital tower London

Constructed 1974

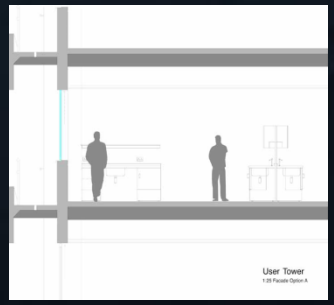


Proposed solution

Space



Links



Facade

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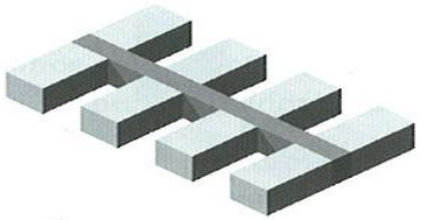
Typical models of the built estate

1. Linked pavilion or finger plan

The oldest typology and still in common use. The pavilions would often have clinical spaces on lower levels with wards above.

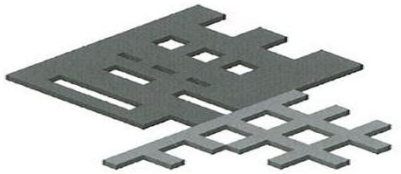
Examples
Woolwich Hospital and St Thomas's Hospital, London;
Hotel Dieu, Paris; many others worldwide



2. Low-rise multi-courtyard or checkerboard

This typology can offer a human scale in contrast to the institutional character that tends to overwhelm most hospital design. However it will tend to apply to the larger, non-urban sites or smaller hospitals.

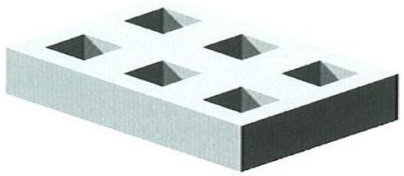
Examples
Wexham Park Hospital; Venice Hospital (unrealized design by Le Corbusier); Homerton Hospital, London



3. Monoblock

The classic compact and circulation efficient type. The small atria/lightwells can take many forms and the lower floors may have fewer, with deep planning for non-patient areas or operating theatres. There is a need for artificial ventilation and the opportunity to incorporate Interstitial Service Floors.

Examples
Greenwich Hospital, London (demolished); Boston City Hospital; McMaster University Hospital, Ontario

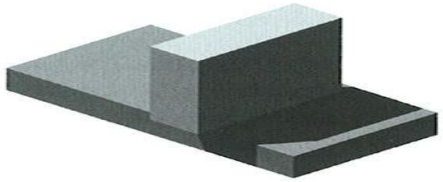


Typical models of the built estate

4a. Podium and slab/tower
(also 'Bundled' or 'Stacked' in US)

The wards are generally in the tower with the clinical and technical areas in the slab. This typology can be effective on urban sites with small footprints but the upper floors can be problematic in terms of travelling distance.

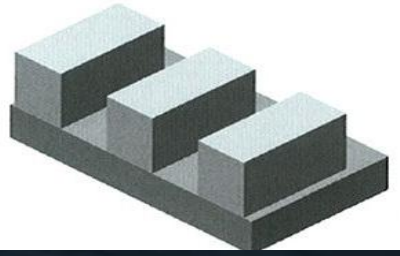
Examples
Bridgeport Hospital, Connecticut; Prince of Wales Hospital, Sydney; Royal Free Hospital, London; UCL Hospital (PFI), London



4b. Podium with two or more towers/ blocks over

This typology avoids some of the potential travel distance and scale problems of no. 4a above but will require a larger site.

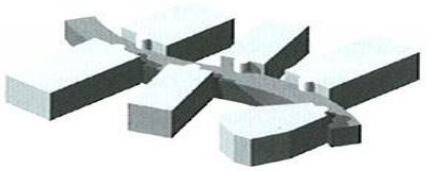
Examples
Birmingham Hospitals (PFI)



5. Street

The attraction of this type has lain in its flexibility and extendibility as well as the legibility that the street itself offers to patients.

Examples
Wythenshawe Hospital, Manchester; Northwick Park Hospital, London; Westmead Hospital, Sydney, Rikshospitalet, Oslo



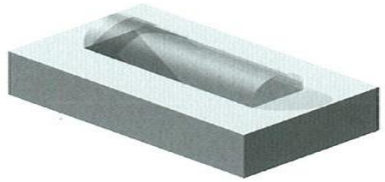
Typical models of the built estate

6. Atrium/galleria

Atria have become extremely common in open plan office buildings where daylight can penetrate working floors from both sides. The cellular character of hospital buildings make atrtri a less obvious solution but there are a number of successful uses of this typology

Examples

New Children's Hospital, Sydney; Chelsea and Westminster Hospital, London; Hospital for Sick Children, Toronto; University of Maryland Homer Gudelsky Building

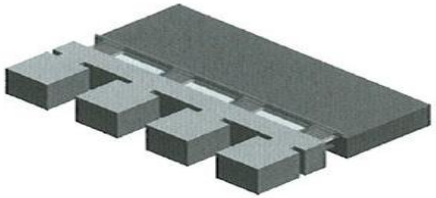


7. Unbundled

Unbundled is a pattern of segregation of the diagnostic and treatment functions on the one hand, and on the other the nursing functions along a shared circulation/support spine. 'Unbundled' is a North American term and the typology is dominant in current design there; but it is also used worldwide.

Examples

Norfolk and Norwich Hospital; many US examples

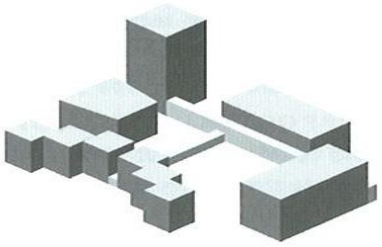


8. Campus

Individual buildings disposed around the site with or without enclosed circulation network.

Examples

Hospital sites that have been built up over the years with successive additions.



Refurbishments – flexible engineering services?

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single room vs multi bed.

- Effective isolation
- Specific cleaning regime
- Privacy & dignity
- Improved patient environment
- Reduced patient travel
- Individual room stores/supplies

- Patient interaction
- Capital cost
- Staffing cost

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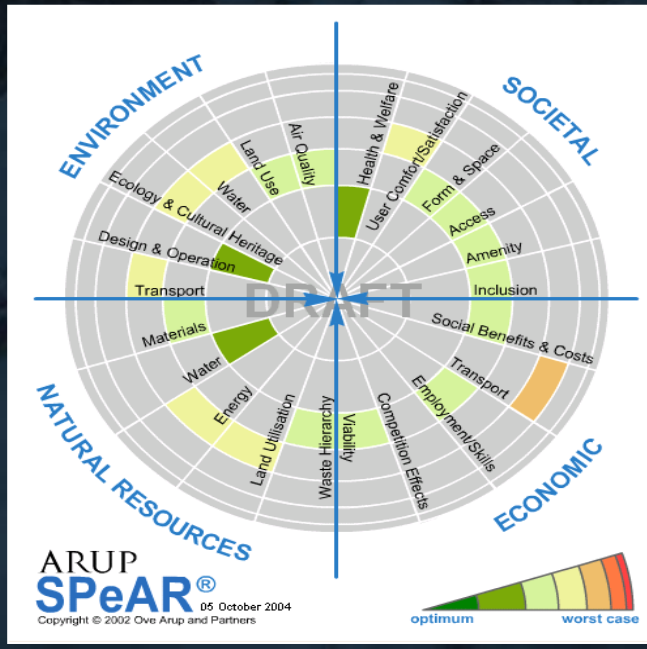
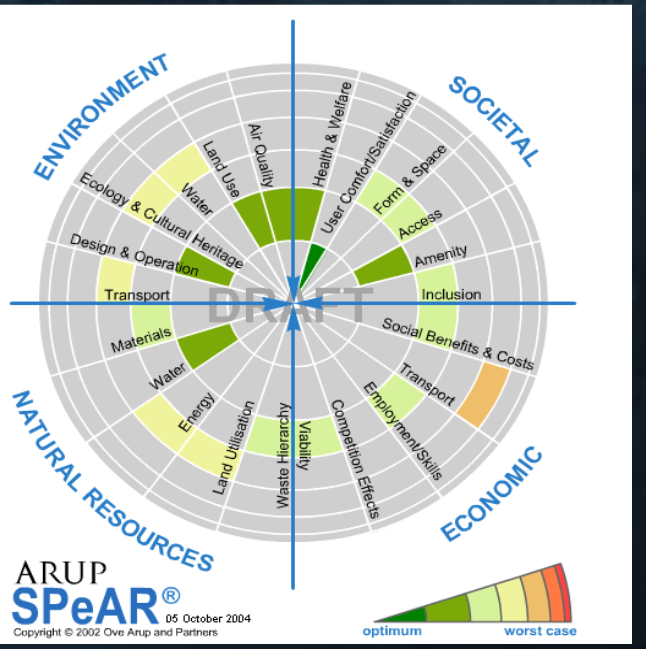
Modelling Sustainability

Multi bed room

Single bed room





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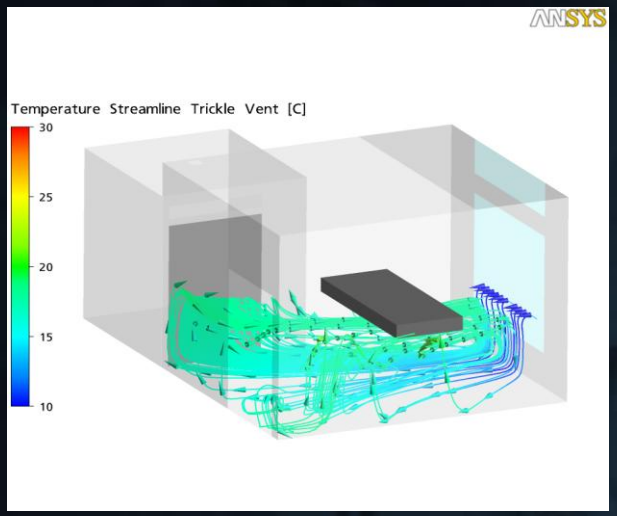
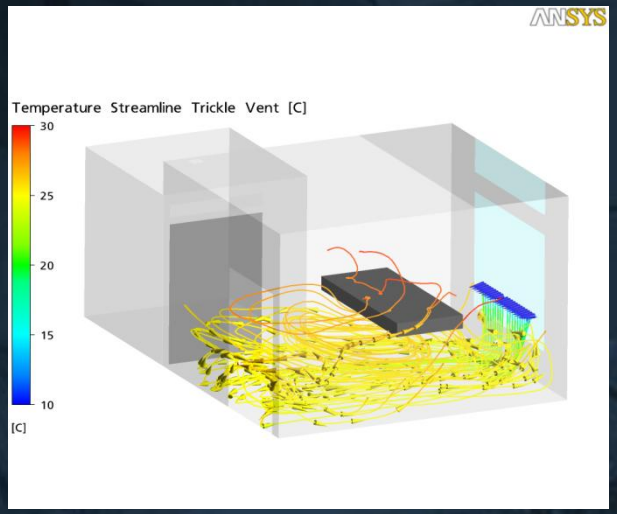
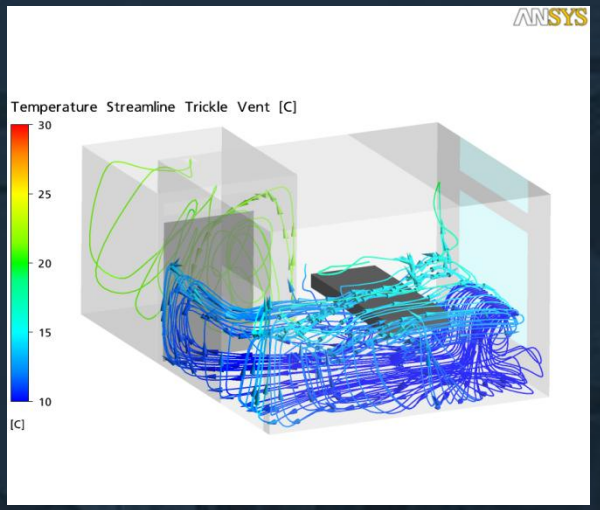
CFD Analysis – window and door leakage



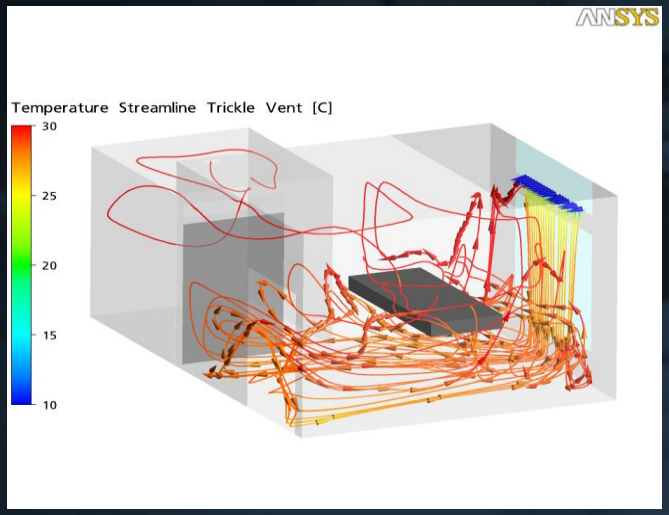
No wind LL Vent



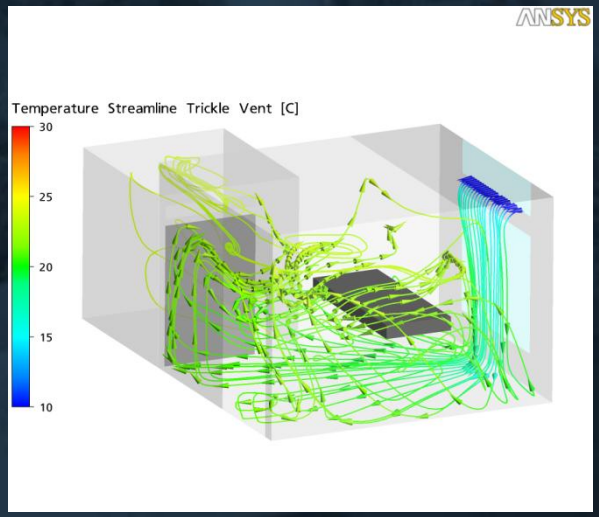
Leeward LL Vent



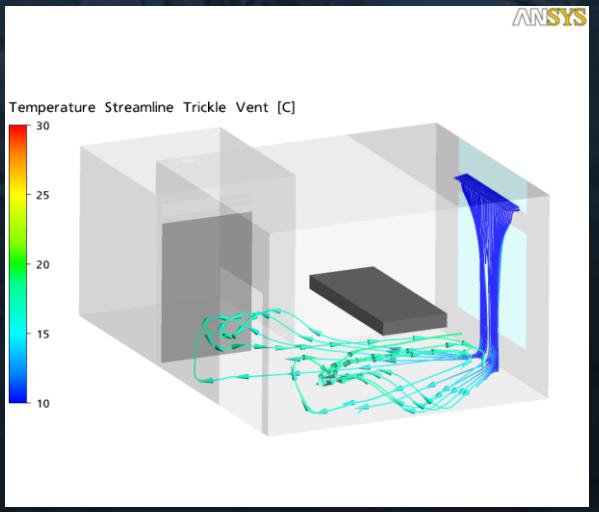
Windward LL Vent



No wind HL Vent



No wind HL Vent



Windward HL Vent window curtain

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Single room of the future

The real cost of refurbishment?

	Narrow Plan (2 Storey)	Narrow Plan (3 Storey)	Intermediate Plan	Deep Plan
Substructure	£2,082,540	£1,417,444	£1,408,147	£996,497
Superstructure	£2,379,005	£2,540,942	£2,612,866	£2,580,671
Roof	£1,865,548	£1,338,273	£1,195,924	£844,742
Façade	£4,678,560	£4,630,479	£4,882,135	£3,397,578
Internal finishes	£4,944,949	£4,931,111	£4,985,500	£5,004,332
Mechanical Services	£3,790,082	£3,762,333	£4,042,619	£4,740,210
Electrical Services (incl. lifts)	£4,150,357	£4,048,077	£4,106,319	£3,939,734
BWIC	£720,261	£617,680	£642,500	£617,680
Preliminaries and contingencies	£6,835,712	£5942,914	£6,367,686	£5,999,323
Total	£31,447,315	£29,229,253	£30,243,696	28,128,205

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What is the real value?

	Narrow Plan (2 Storey)	Narrow Plan (3 Storey)	Intermediate Plan	Deep Plan
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Approx 13% saving due to a refurbishment!!

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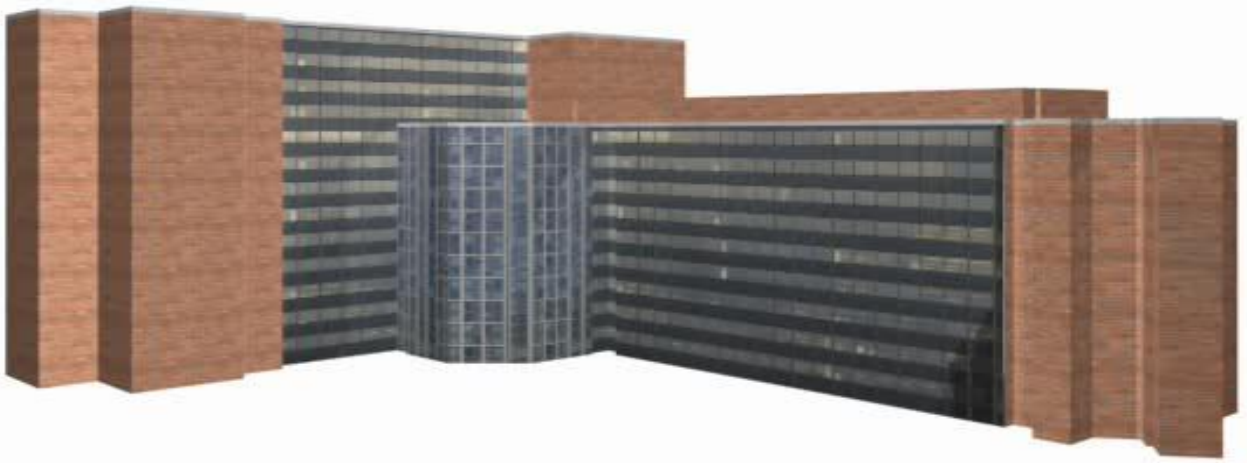
Optimising flexibility - #1



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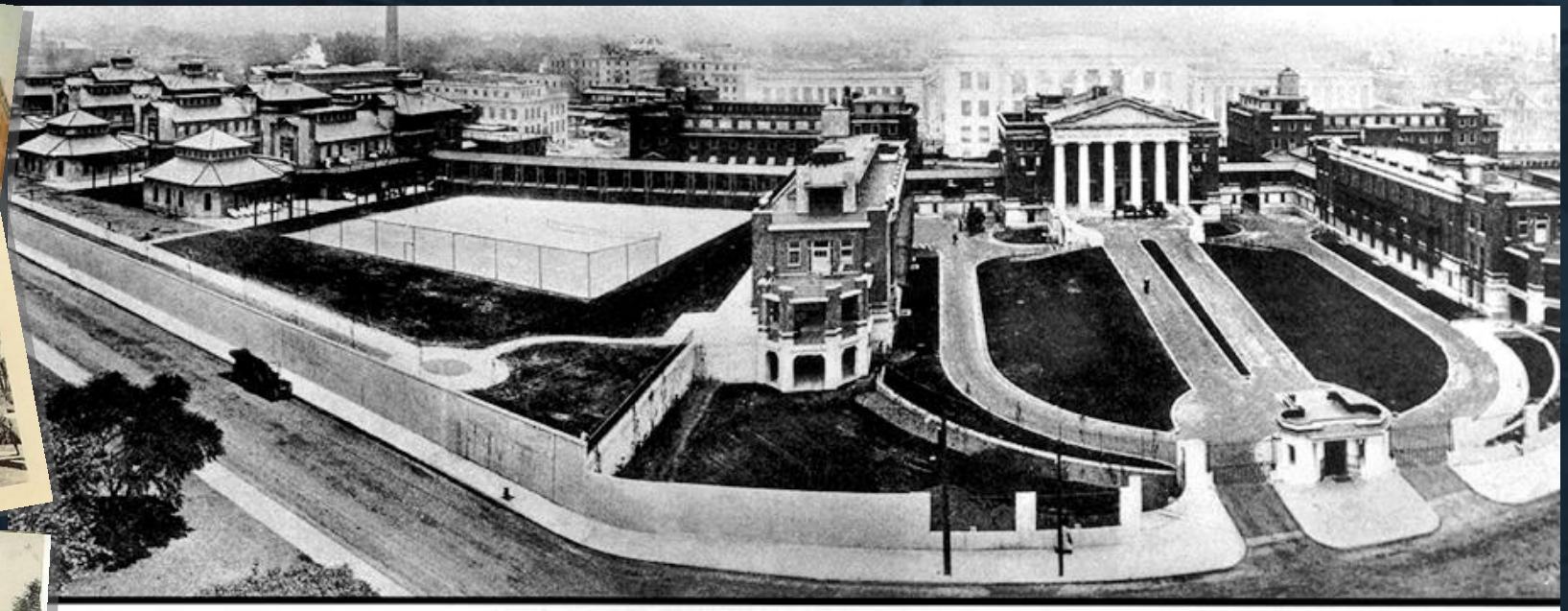
Optimising flexibility - #3 Planning in advance

If this were not a hospital then what could it be?

ORIGIN | HISTORICAL PERSPECTIVE – BRIGHAM AND WOMEN'S



F, E, D, C

Domestic Building | Pavilion A | Administration Building | Entrance Lodge | Outdoor Nurses' Bui

GENERAL FACTS

The Hospital covers about 10 acres of land.

pacity 225 beds.

truction Fire-proof throughout.

Some of the chief objects have been to furnish the patients with the optimum amount of light and sunshine, and to make it possible for every patient to be easily moved out of doors.

lation By several systems, according to the requirements :

1. By the ordinary use of wall windows.
2. By windows in monitor roofs.
3. By accelerating heating coils in stacks.
4. By inlet fans.
5. By outlet fans.

Air Space in Typical Pavilions 2,400 cubic feet per patient. This air can be changed five times each hour.

Flooring Largely battleship linoleum cemented to granolithic, except the outside marginal eight feet of open wards on main floor, which space is wholly granolithic to allow of heating by hot water pipes in an enclosed space below this part of the floor.

Heating Wards

1. Hot water direct.
2. By warmed granolithic floors in bed space.
3. By fanning filtered air over hot water pipes into wards.

Plumbing Single pipe system used throughout.

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HOSPITAL GROWTH | A HOSPITAL MUST CHANGE IN ORDER TO REMAIN RELEVANT

New and expanded fields of knowledge created space needs that were difficult for the hospital to meet. “The character of the work done within the walls of an institution is vastly more important than the walls themselves. Even so, it must not be overlooked that if the work is good, it grows, and the time comes when walls must expand in correspondence.” – BWH 1937 Second Master Plan Report

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HOSPITAL GROWTH | A HOSPITAL MUST CHANGE IN ORDER TO REMAIN RELEVANT

Hospital Growth Milestones:

1911 Hospital Opens
1937 Second Master Plan
1950's Research spurs New Construction
1969 to 1986 BWH triples in size.
1978 New 500 Bed Patient Tower opens
1994 Ctr for Women and Newborns opens
2008, Shapiro Cardiovascular Building opens.

Today, over 2.4 million square feet on main hospital campus.

2008, The Hospital Today

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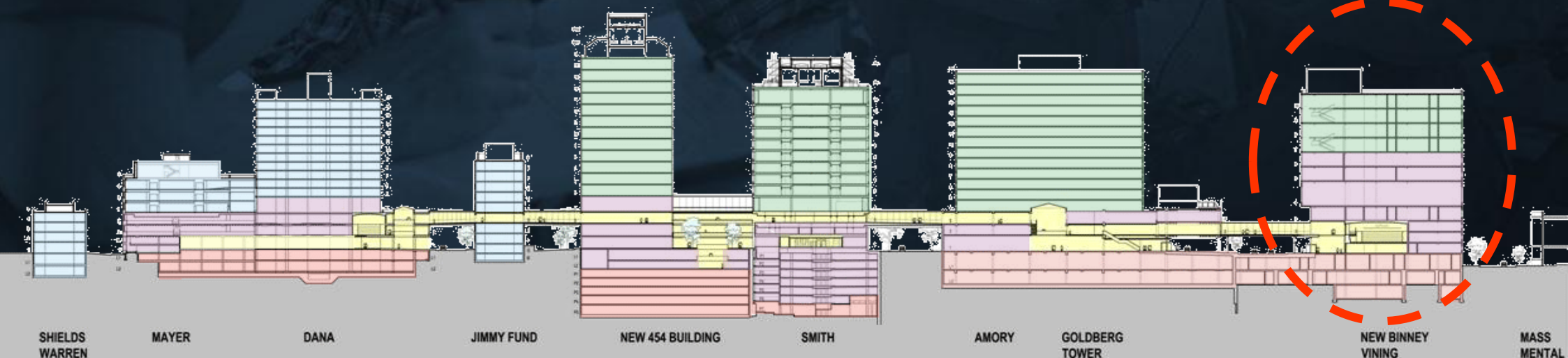
THICK & THIN | HORIZONTAL INTEGRATION - VERTICAL FINGERS

- **Centers of Excellence**
  - Service Line / Disease Centric
  - Discrete Institutions
- **Accommodations**
  - Thematic Centers
  - Institutional Identity
  - Mixed Acuity
  - Bidirectional Bench to Bedside



Refurbishment – A wise sustainable investment

- Refurbished in a phased manner whilst in occupation
- Single phase with decant – original use
- Single phase with decant - change of use
- Structural integrity – extended floor-plate
- Building engineering systems – impact on space and use
- Consider low energy/carbon solutions
- Consider the requirements for privacy and dignity
- Consider the needs of resilience due to climate change
- Non-viable spatial solution for future models of care - Demolish

All healthcare estate sites to have a development control plan clearly defining the future for the building stock given the likely changes in the provision of healthcare – this is wise sustainable investment!

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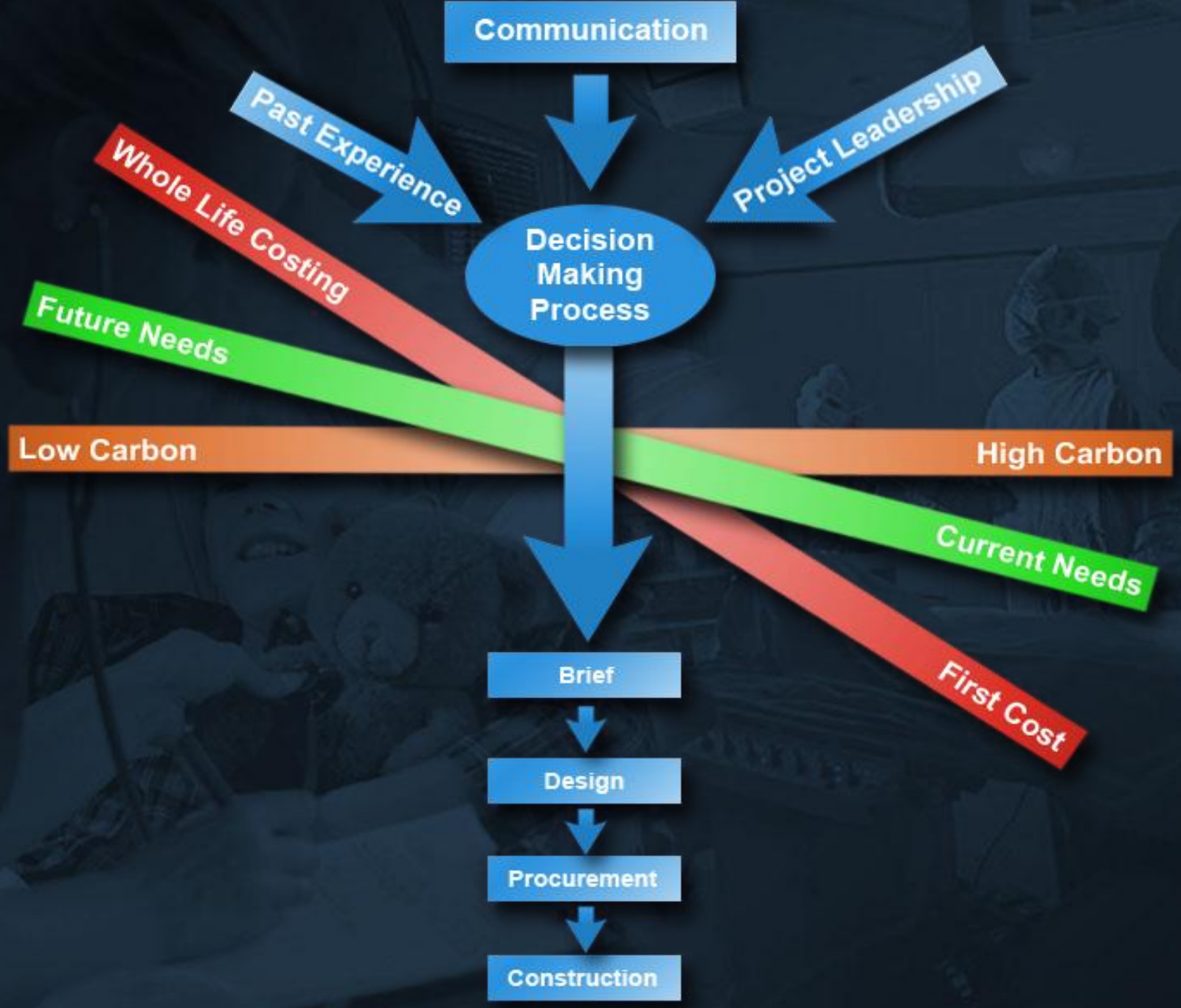
Communication
Past Experience
Project Leadership
Whole Life Costing
Decision Making Process
Future Needs
Low Carbon
High Carbon
Current Needs
First Cost
Brief
Design
Procurement
Construction

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Design Audit to achieve a Low Carbon Buildings

- Building form and orientation
- Passive ventilation strategy
- Lighting Controls
- Reduced Air Leakage
- Exposed Mass
- Glazing Spec
- Increased Shading
- Increased Insulation
- Biomass boilers
- Solar Hot Water Generators
- CHP
- Ground Source Heat Pump
- Wind Turbines
- Small Scale Hydro
- PV
- Fuel Cells

Kg Carbon saved per £ spent

Carbon Neutral Building

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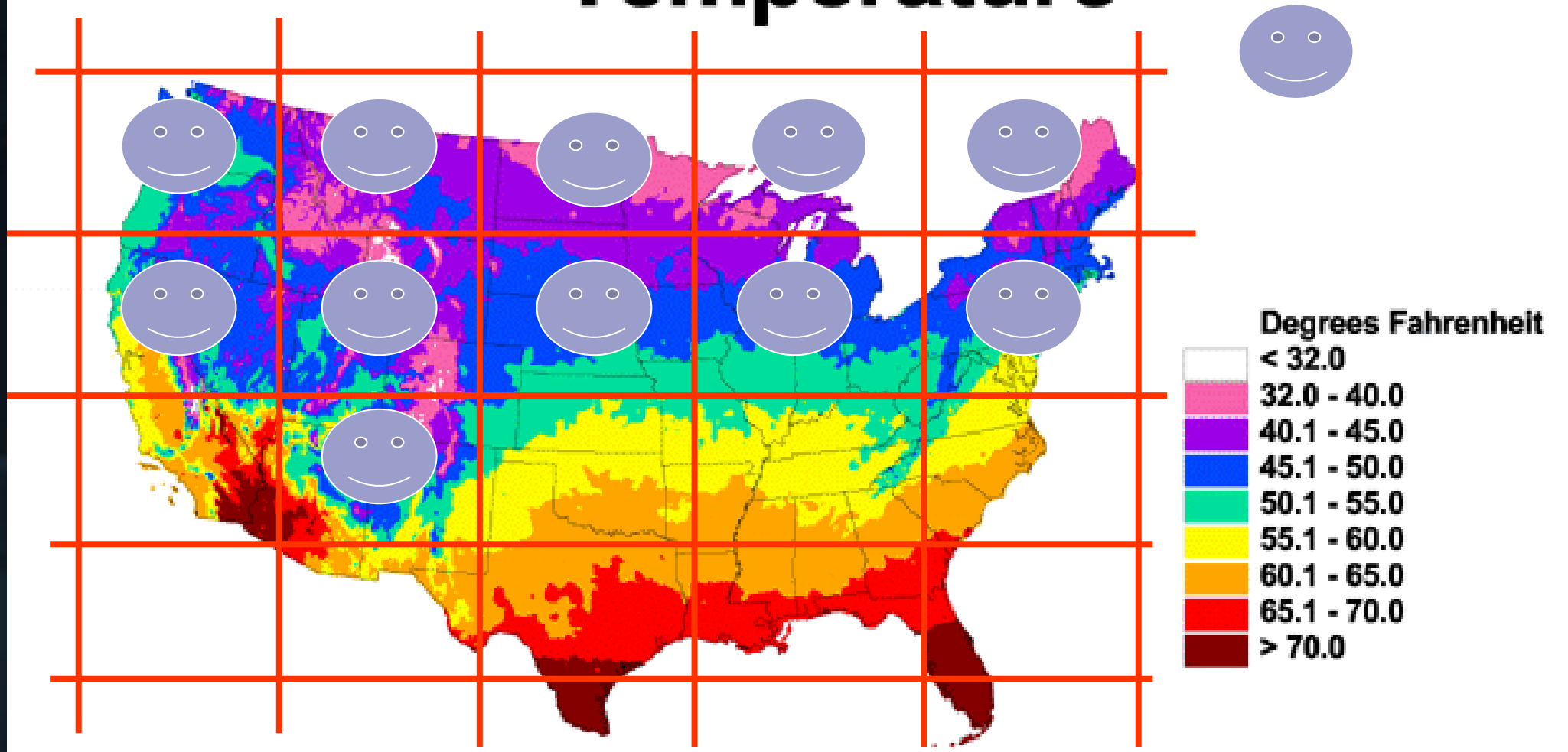
Annual Mean Daily Average Temperature



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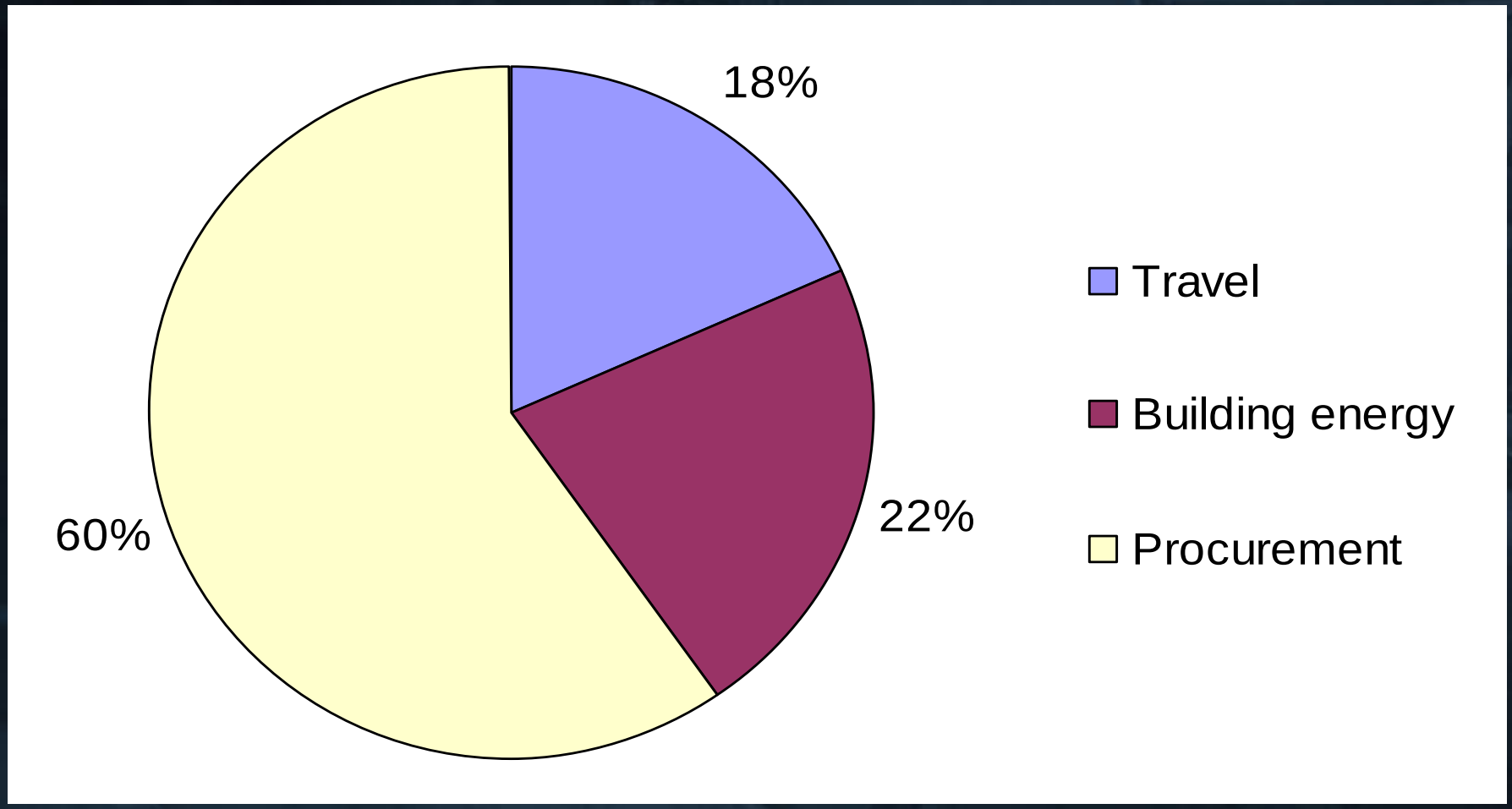
3 - NHS England CF: Total consumption emissions



NHS England (2004): 18.6MtCO2

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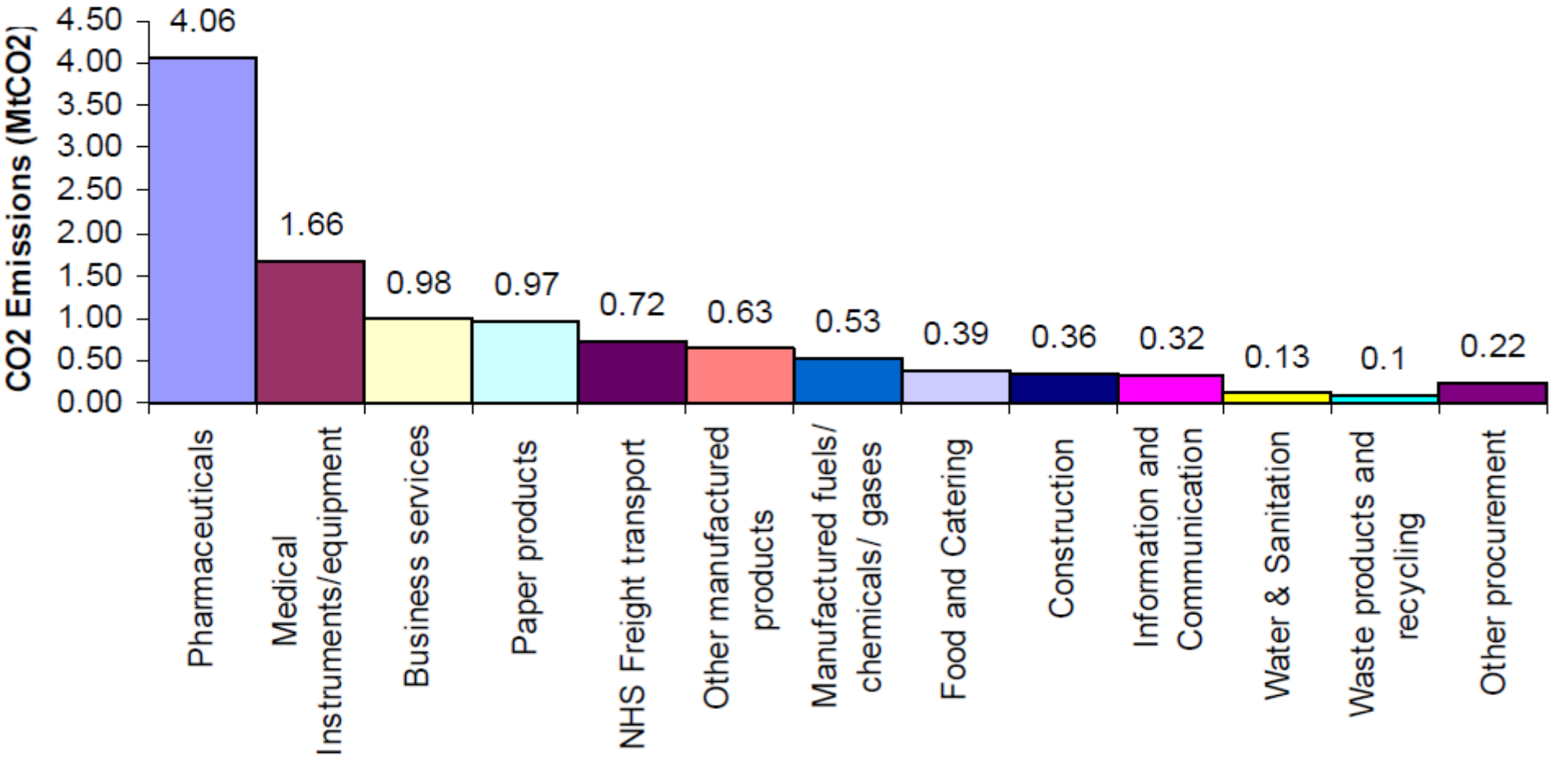
3 - NHS England CF: Procurement emissions breakdown



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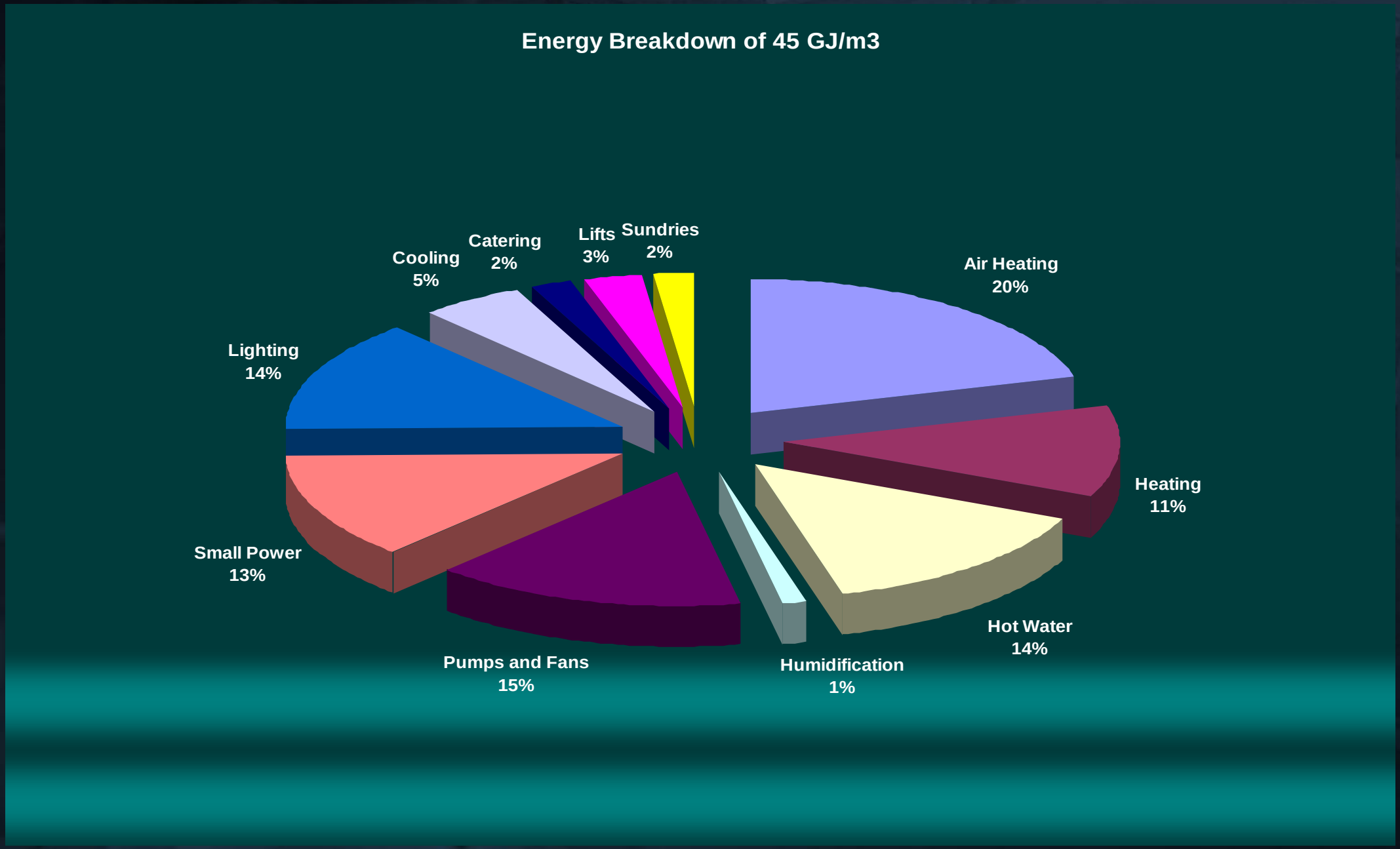
Acute hospital energy breakdown – May 20th 2008



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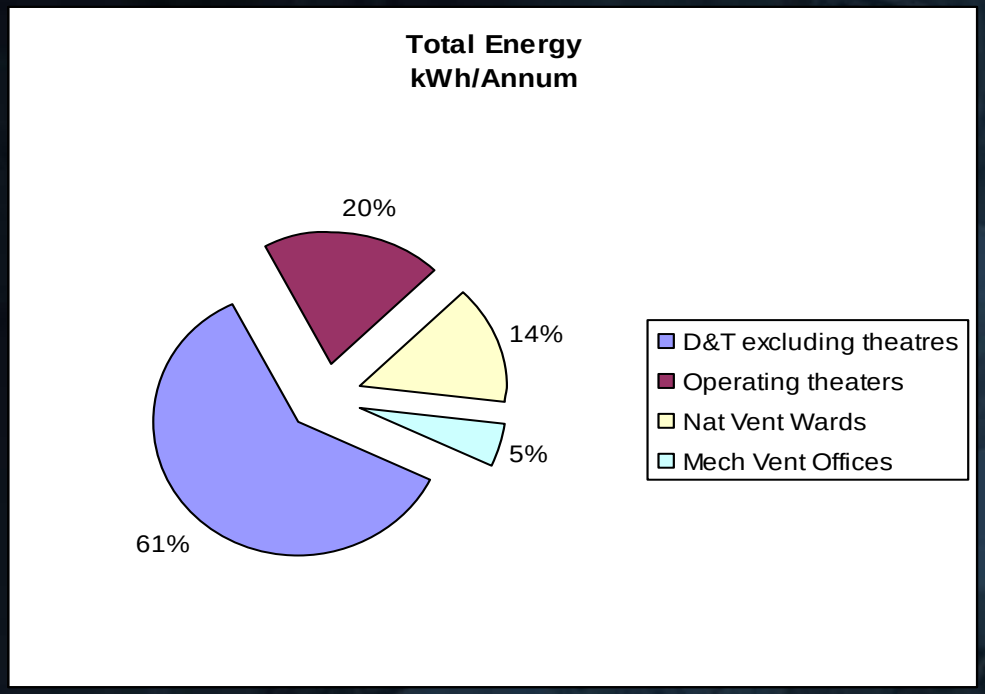
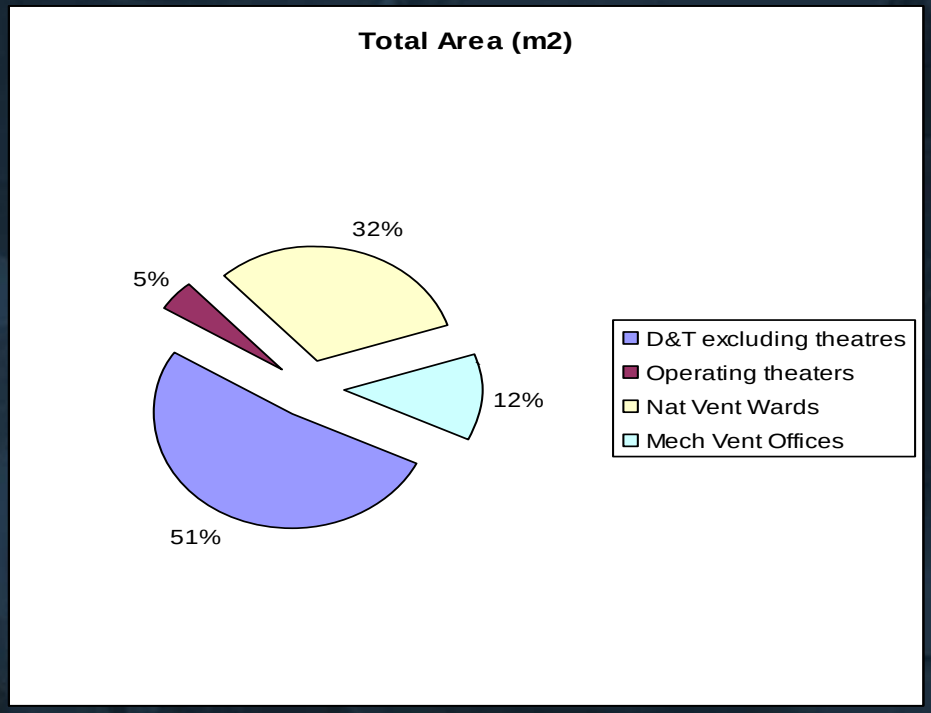
Energy Calculations for targeting and monitoring energy use





	Total Wards + D&T + Theatres	D&T only	theatres	Nat Vent Wards	Mech Vent Offices
kWh/m2/annum	736	593	2237	229	221
GJ/100m3/annum	48	38	192	26	25

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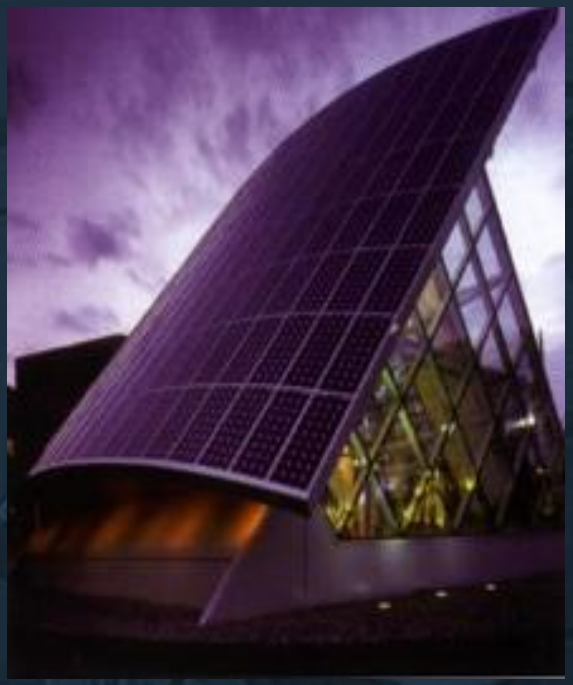
Reducing the use of natural resources through new technology

- Photovoltaic Panels
- Wind Turbines
- Combined Heat and Power Generation
- Biomass boiler systems
- Ground water heat pumps
- Water saving technology
- Rainwater Collection



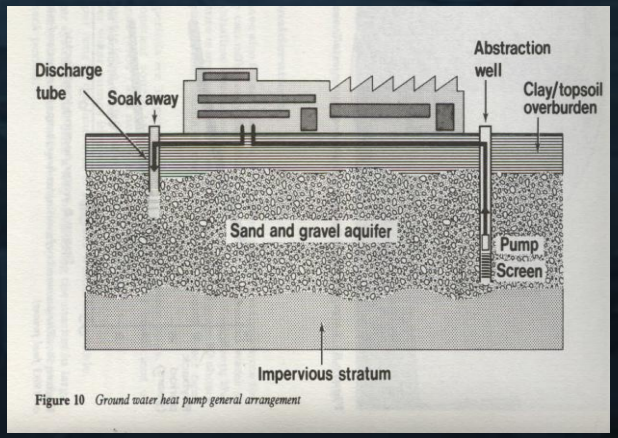


Figure 10 *Ground water heat pump general arrangement*

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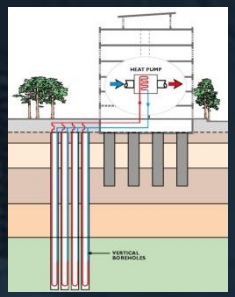
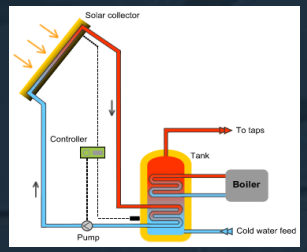
Proposed sustainable energy strategy

Small scale wind turbines for window control gear or extract fans in wards

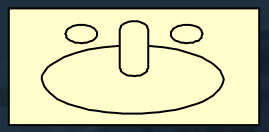
PV cells for Car park lighting



Ground water to A&E entrance underfloor htg.

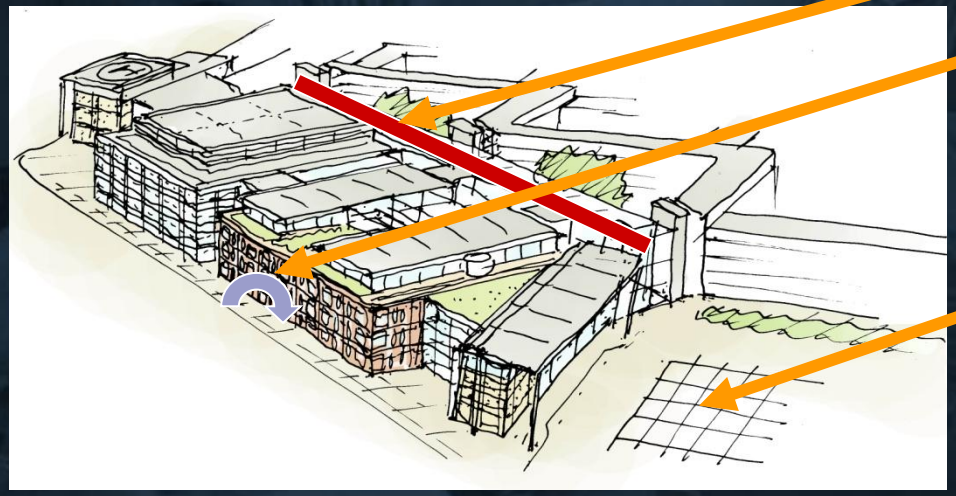


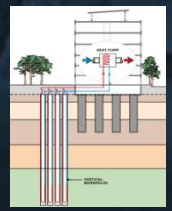
Solar panels. Summer DHWS



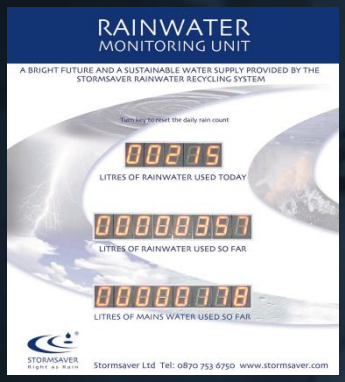
PIR water sensors on all basins

Solar chimney moves air from north side openings via simple labyrinth through atrium for summer cooling





Car park ground source heat pump



Rainwater harvesting
Feeding WC's or irrigation

CHP Tri generation -.Cooling for theatres 300KW refrigeration effect (cooling capacity).

Bio-mass boiler installation
2MW base load

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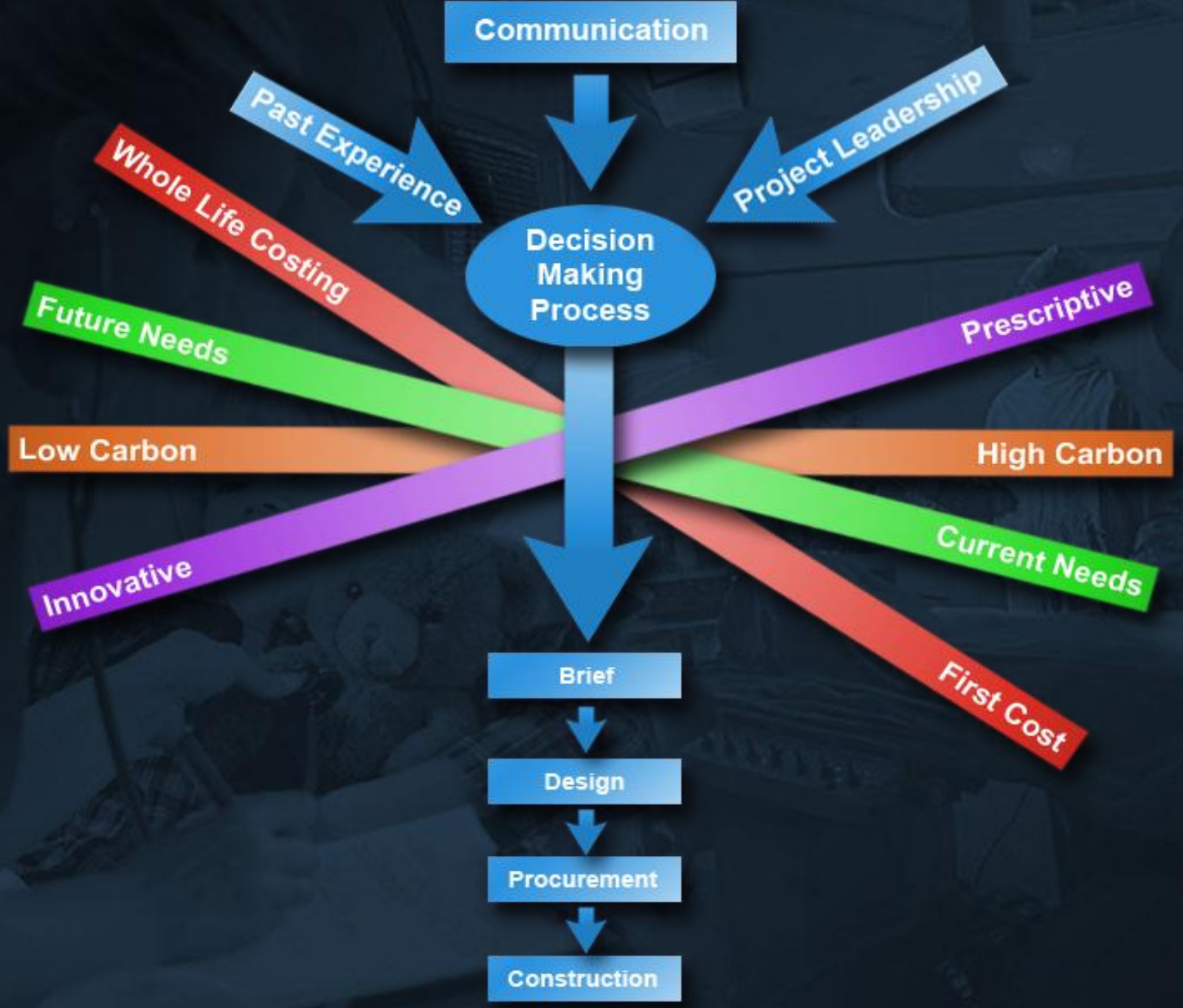
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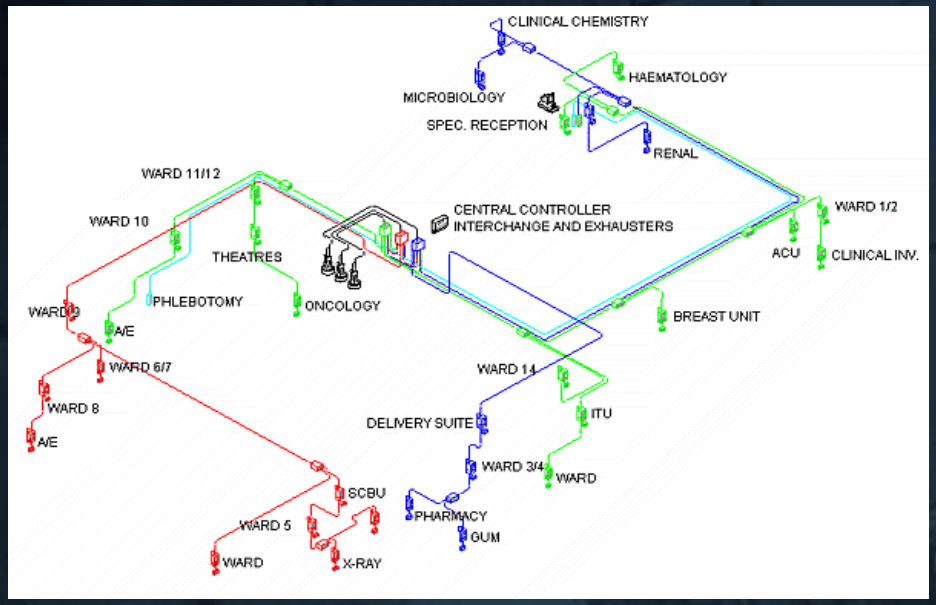
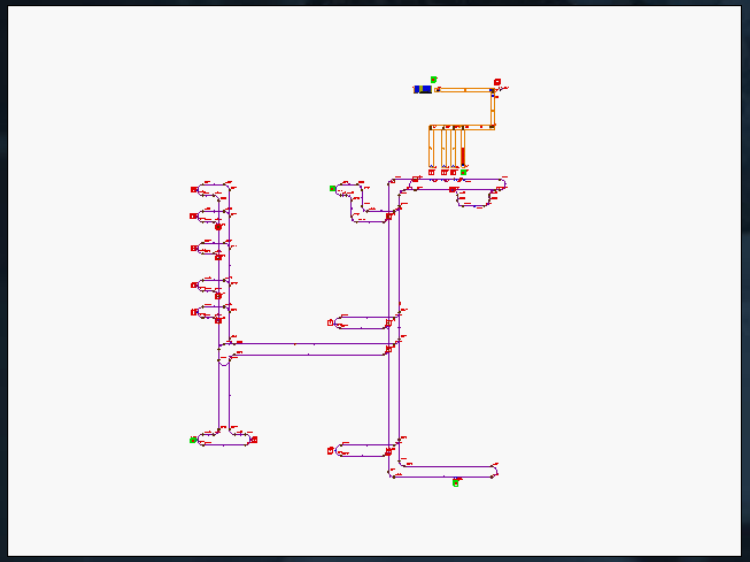
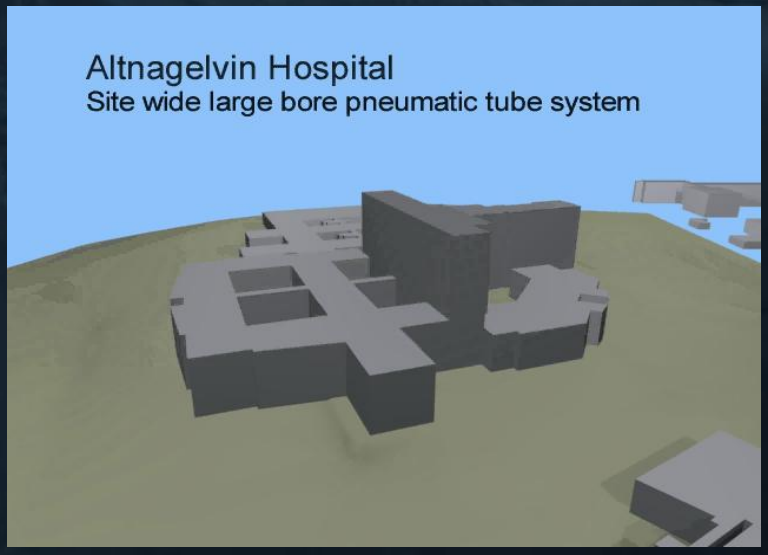
Industrial logistics in healthcare



Small bore Pneumatic tube



Movement of people and supplies



Large bore Pneumatic tube

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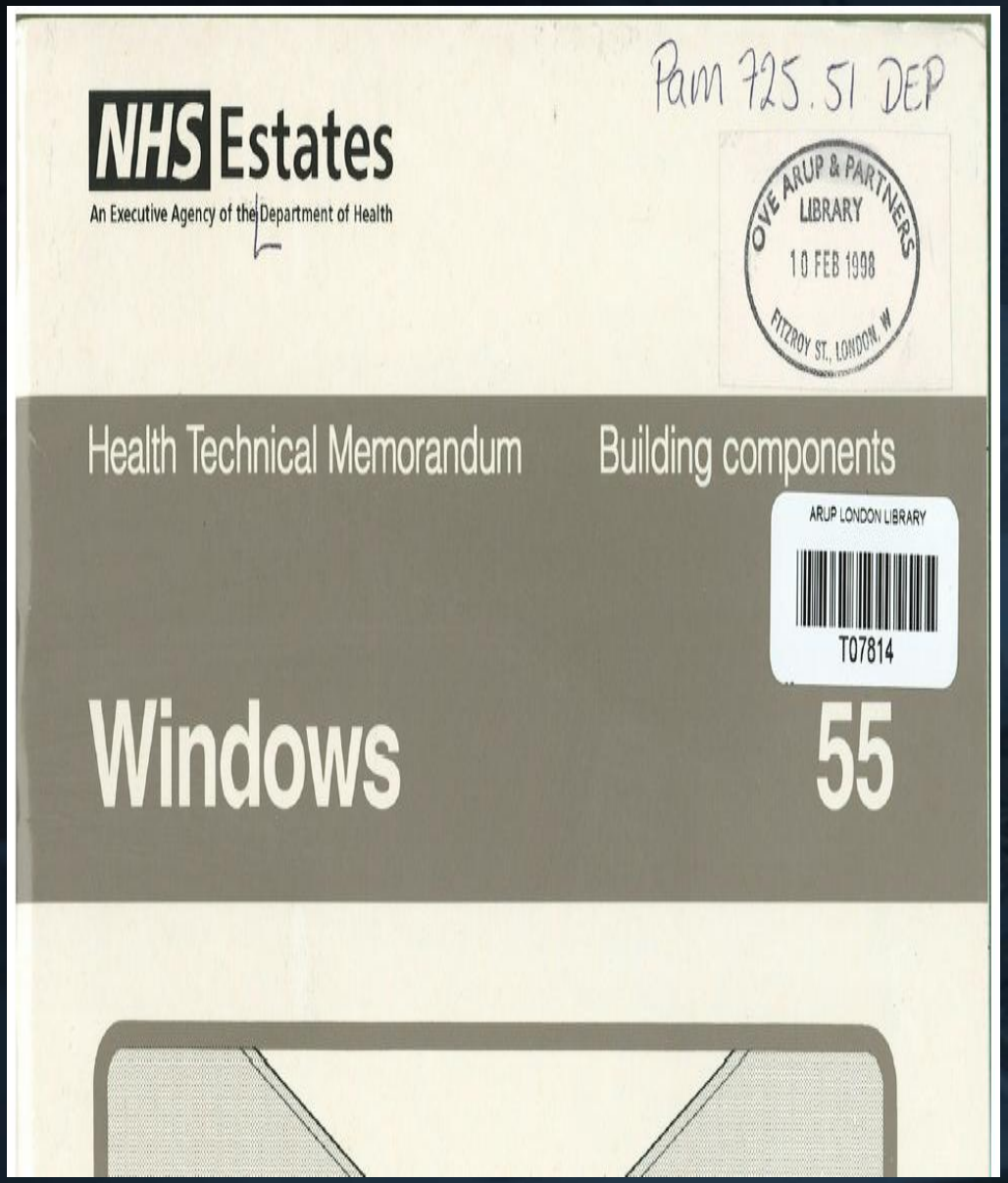
Influencing Standards & guides



Natural lighting
Natural ventilation
View
Weather tightness
Energy conservation
Sound insulation
Security
Safety
Fire spread
Cleaning

Soaring hospital fuel costs could hit patient care

Jonathon Carr-Brown and Sarah-Kate Templeton

THE energy bills of some NHS hospitals have almost doubled as multinational oil and gas companies increase their prices to the health service by £120m a year.

The Department of Health said this weekend that the

which represents health trusts, said: "These price increases could amount to several hundred thousand pounds for each hospital trust, which could be difficult to find in the middle of the year, given all the other financial commitments such as pay rises.

"Hospital trusts do not have a lot of money in reserve. They tend to spend money as they get

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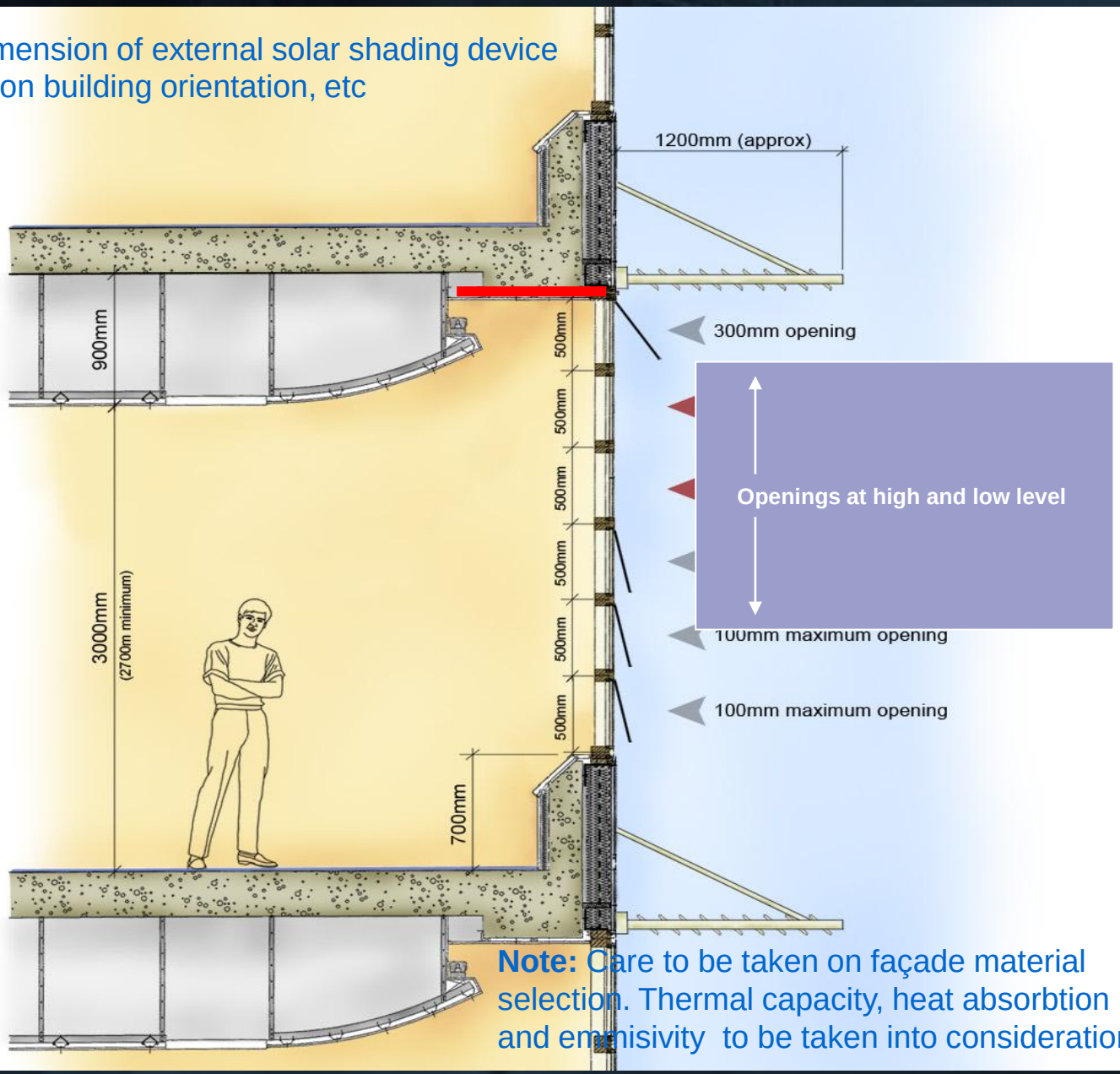
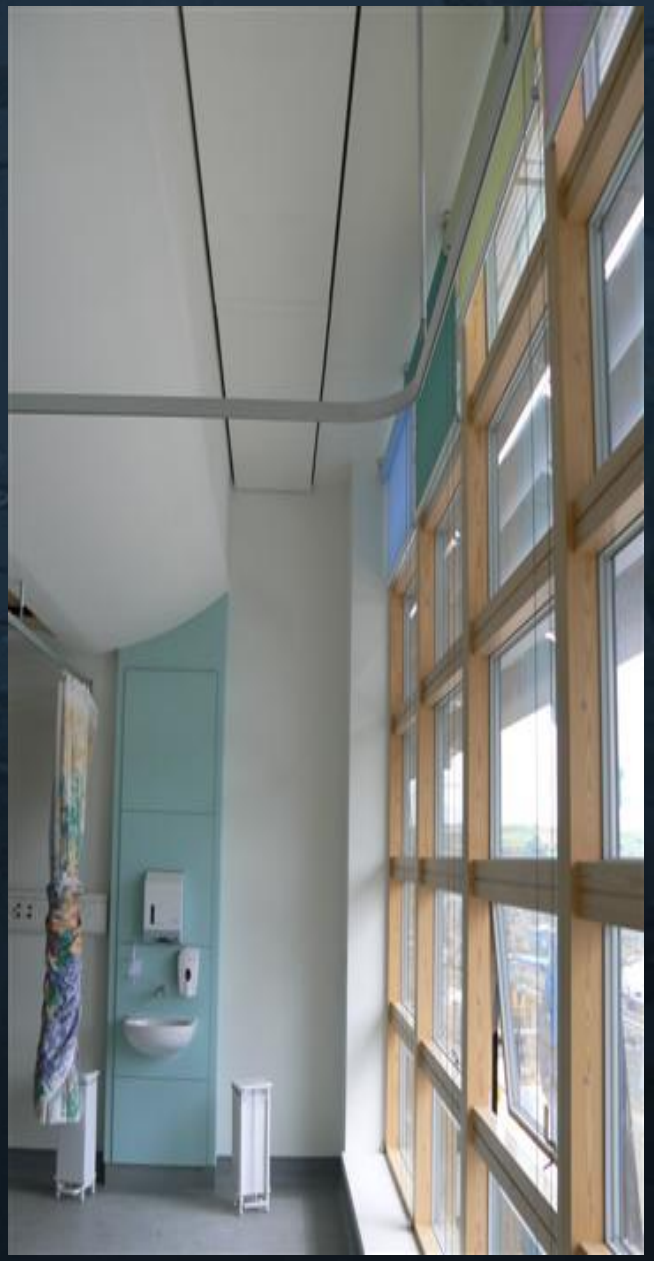
Exemplar window design

Note: Dimension of external solar shading device depends on building orientation, etc



Note: Care to be taken on façade material selection. Thermal capacity, heat absorbtion and emmisivity to be taken into consideration



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The window – the most important system in the building

The sash v's the casement!

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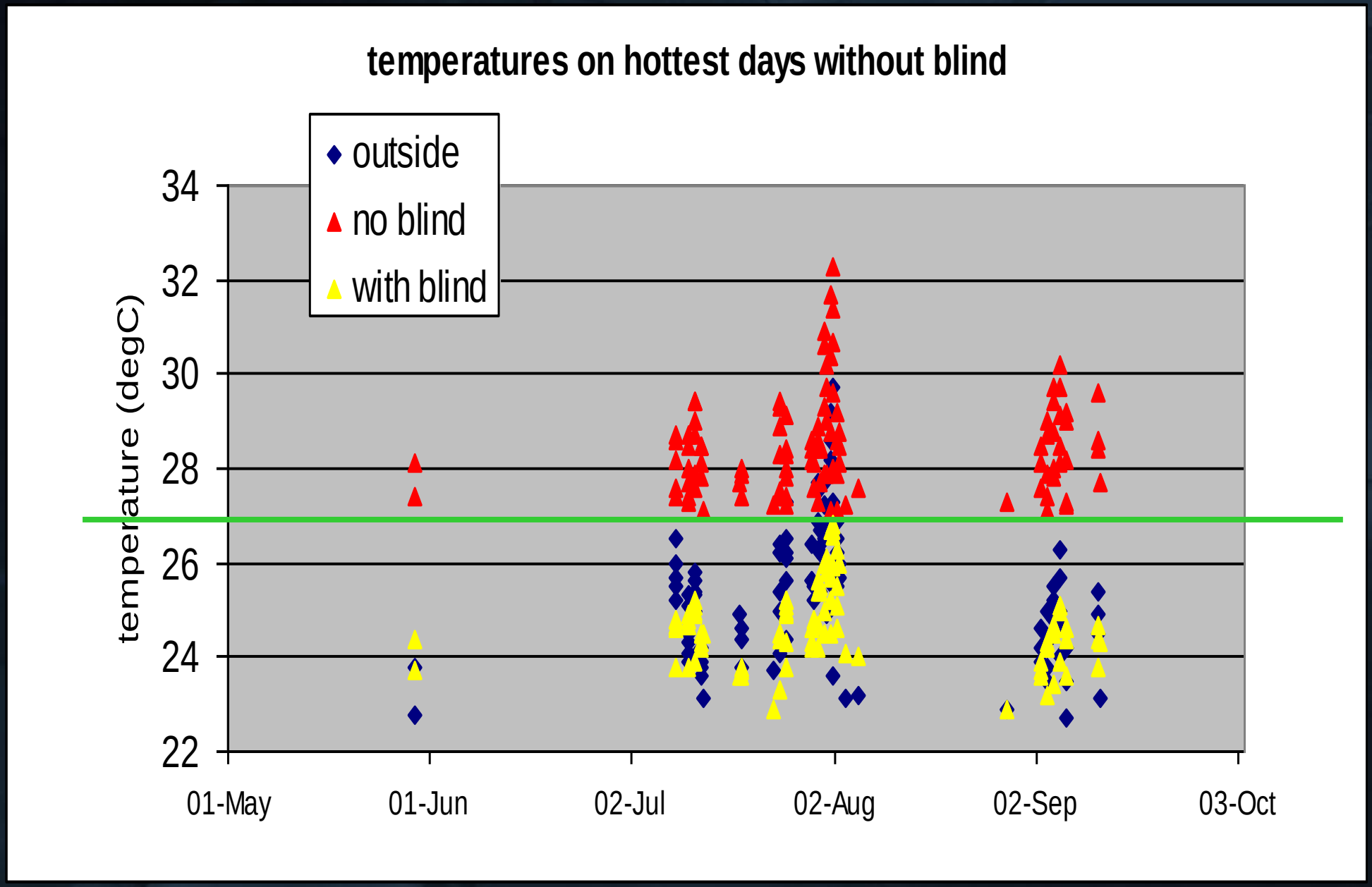
1999 summer analysis showing warmest days (exceeds 27degC in room) without blinds



South west England UK ref

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Ward design – solar shading concept & Leeward-windward effect

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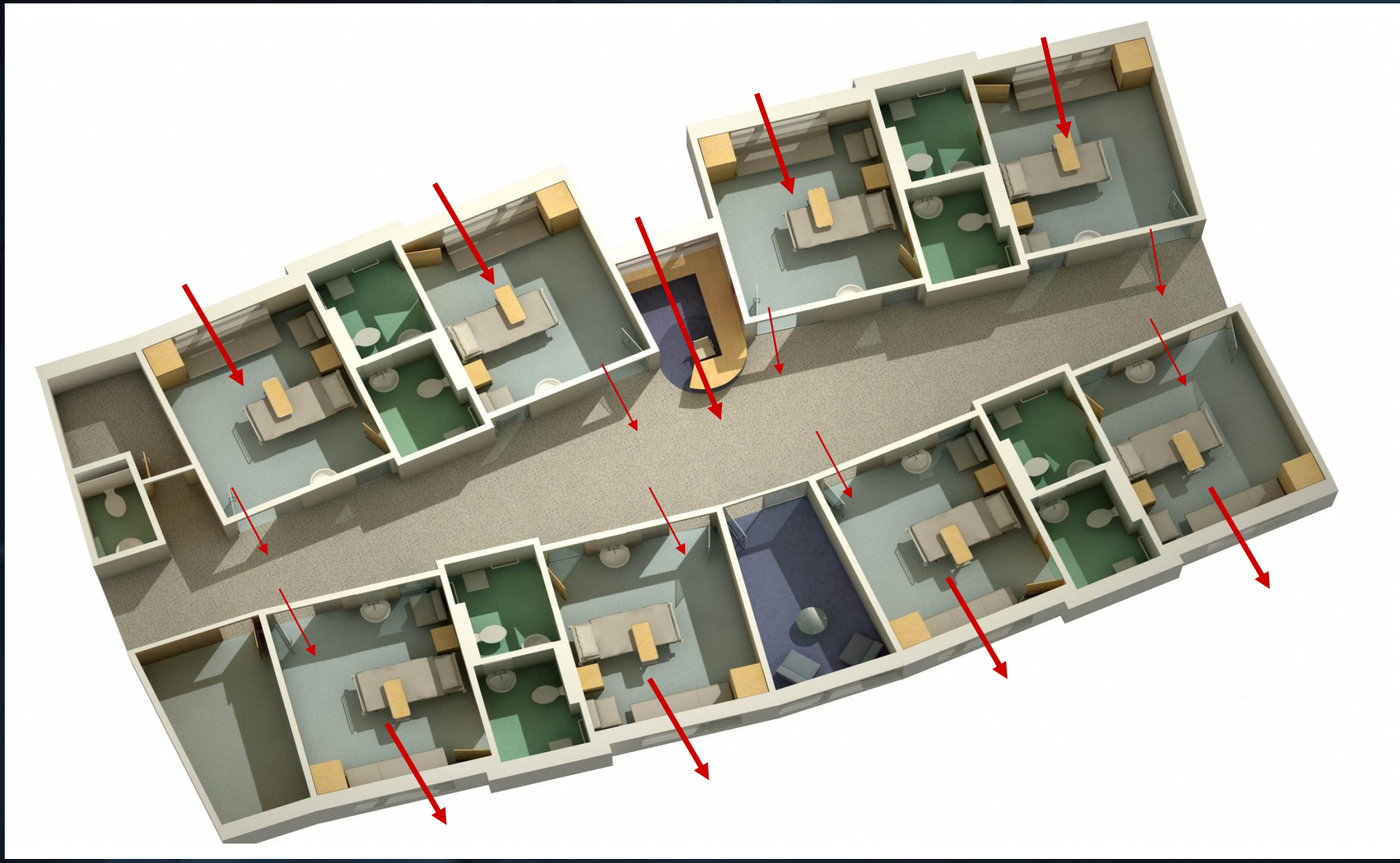
Ward cluster – day light and air flow across the floor plate – climate resilience.



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Future Overheating Risk (Room)

	Temperature (°C)	25	26	27	28	29	30
	Hours exceeded						
London	**July**	**291**	**189**	**129**	**77**	**50**	**19**
2050s DSY	**June to Aug**	**543**	**310**	**170**	**78**	**50**	**19**
	Annual	**574**	**322**	**172**	**78**	**50**	**19**
Swindon	**July**	**53**	**14**	**0**	**0**	**0**	**0**
2050s DSY	**June to Aug**	**96**	**34**	**10**	**0**	**0**	**0**
	Annual	**97**	**34**	**10**	**0**	**0**	**0**
Cardiff	**July**	**43**	**10**	**0**	**0**	**0**	**0**
2050s DSY	**June to Aug**	**57**	**10**	**0**	**0**	**0**	**0**
	Annual	**57**	**10**	**0**	**0**	**0**	**0**

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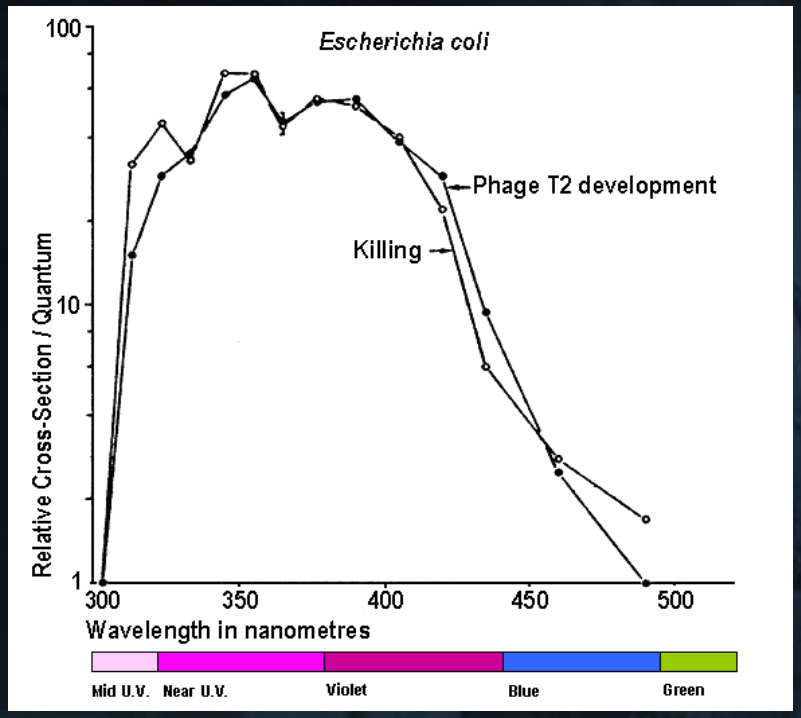
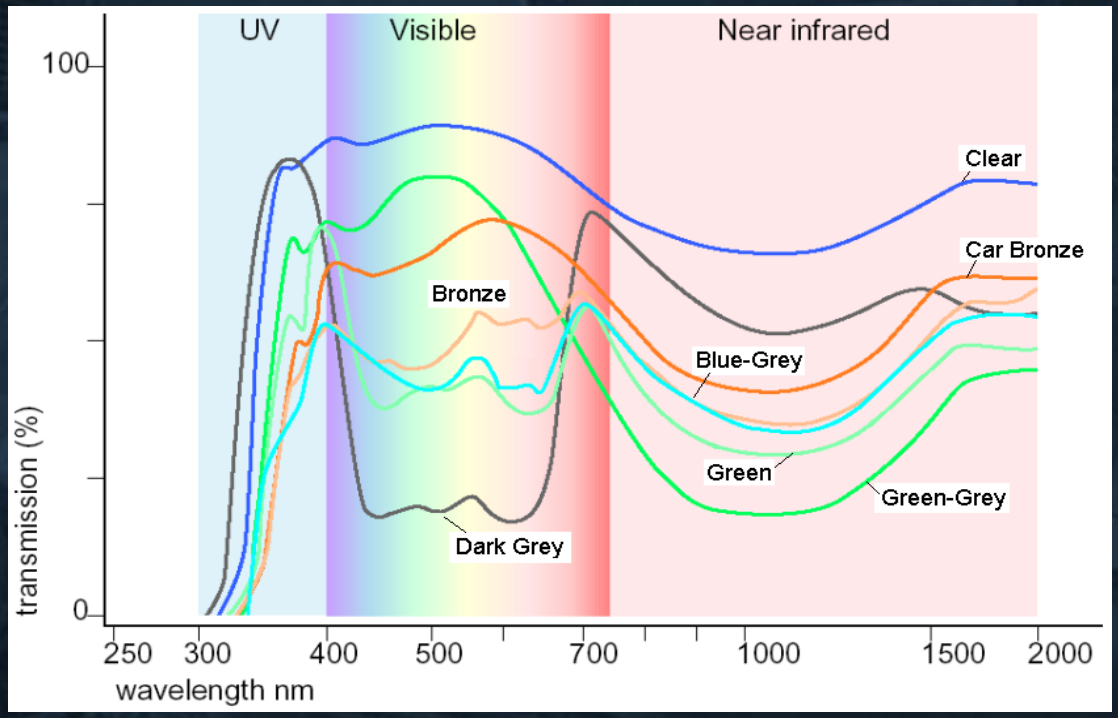
MICROBES AND LIGHT SPECTRA

The spectra of light microbes are exposed to may influence their growth rates & viability





In many instances light wavelengths that may kill microbes can be screened or heavily filtered through coloured glazing systems. Serotonin released by the patient may be reduced through screening in the same way.

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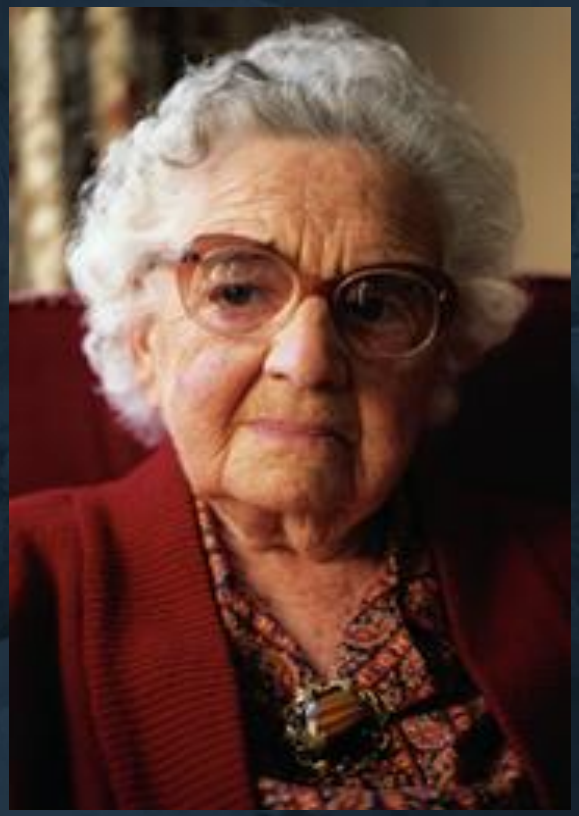
Isaac Jamieson – Imperial College London

Caring for our elderly

Family lives 200 miles away

Poor vision and hearing



Low income

Lives alone

Own home

Has diabetes and arthritis

Does not qualify for L.A. home care assistance

Fiercely independent

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TMS data analysis

david.muxworthy@alere.com

TMS DATA	COPD	CHF	Diabetes	Totals
Total Patients	790	113	159	1,062
Total number of Clinical Alerts	15,451	1,663	3,006	20,120
Total number of Clinical Escalations	2,420	238	189	2,847
Total Unplanned Admissions Prevented	472	37	23	532
Total Emergency Admissions to Hospital as a result of an Escalation	94	8	5	107

Ref: Data based on >1,062 NHS LTC patients monitored over 3 years

Estimated savings

david.muxworthy@alere.com

Ref: Data based on >1,000 NHS LTC patients monitored over 3 years

Area of Savings	Total	NHS Tariff	Gross Saved
COPD Admissions Prevented	472	£2,793.00	£1,318,296.00
Nurse Visits Saved	1,758	£30.00	£52,740.00
Mileage Saved	1,758	£8.00	£14,064.00
CHF Admissions Prevented	37	£2,987.00	£110,519.00
Nurse Visits Saved	205	£30.00	£6,150.00
Mileage Saved	205	£8.00	£1,640.00
Diabetes Admissions Saved	23	£2,112.00	£48,576.00
Nurse Visits Saved	160	£8.00	£1,280.00
Mileage Saved	160	£30.00	£4,800.00

Totals Gross Savings **£1,558,065.00**

Formula: 20 Miles per journey @ £0.40 per mile
Nursing Time: 1.5 hours @ £20 per hour

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'Delivering outcomes – not boxes'


Communication
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Therapeutic environment

‘The first requirement of a hospital should be that is should do the sick no harm.

Little as we know about the way in which we are affected by form, colour, by light, we do know this, that they have a physical effect.

Variety of form and brilliancy of colour in the objects presented to patients is the actual means of recovery.’

Florence Nightingale Notes on Hospitals 1885

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Therapeutic environment and Clinical efficiency

Cardiff Royal Infirmary c1880

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Components of the therapeutic environment

- Sufficient car parking
- Clear way-finding
- Privacy & dignity
- Appropriate acoustics
- Natural daylight
- Interesting/relaxing views
- Low risk of hospital acquired infection
- Thermal comfort
- Environmental control
- Artificial lighting
- Art
- Entertainment systems

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Transmission of Infection

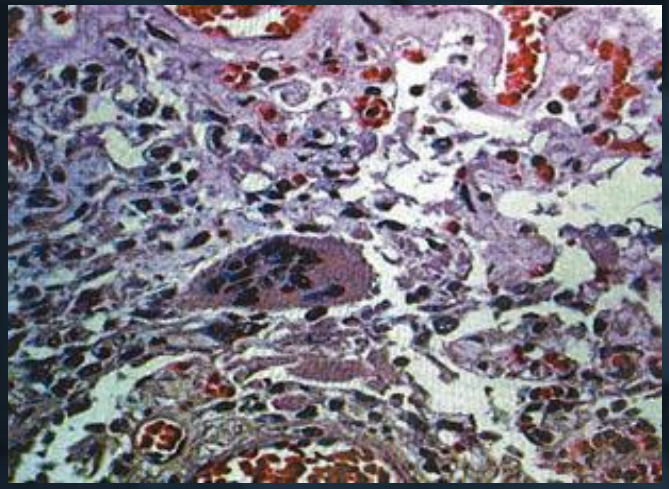
Contact transmission

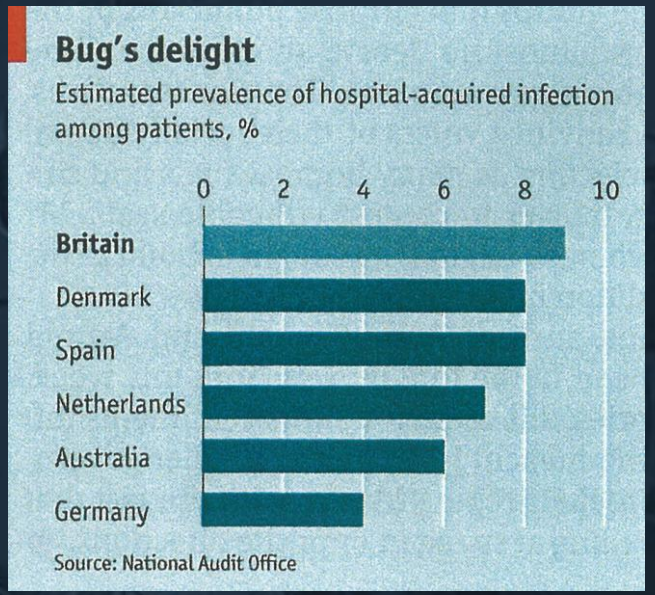
Droplet transmission

Airborne transmission

Common vehicle transmission

Vector borne transmission





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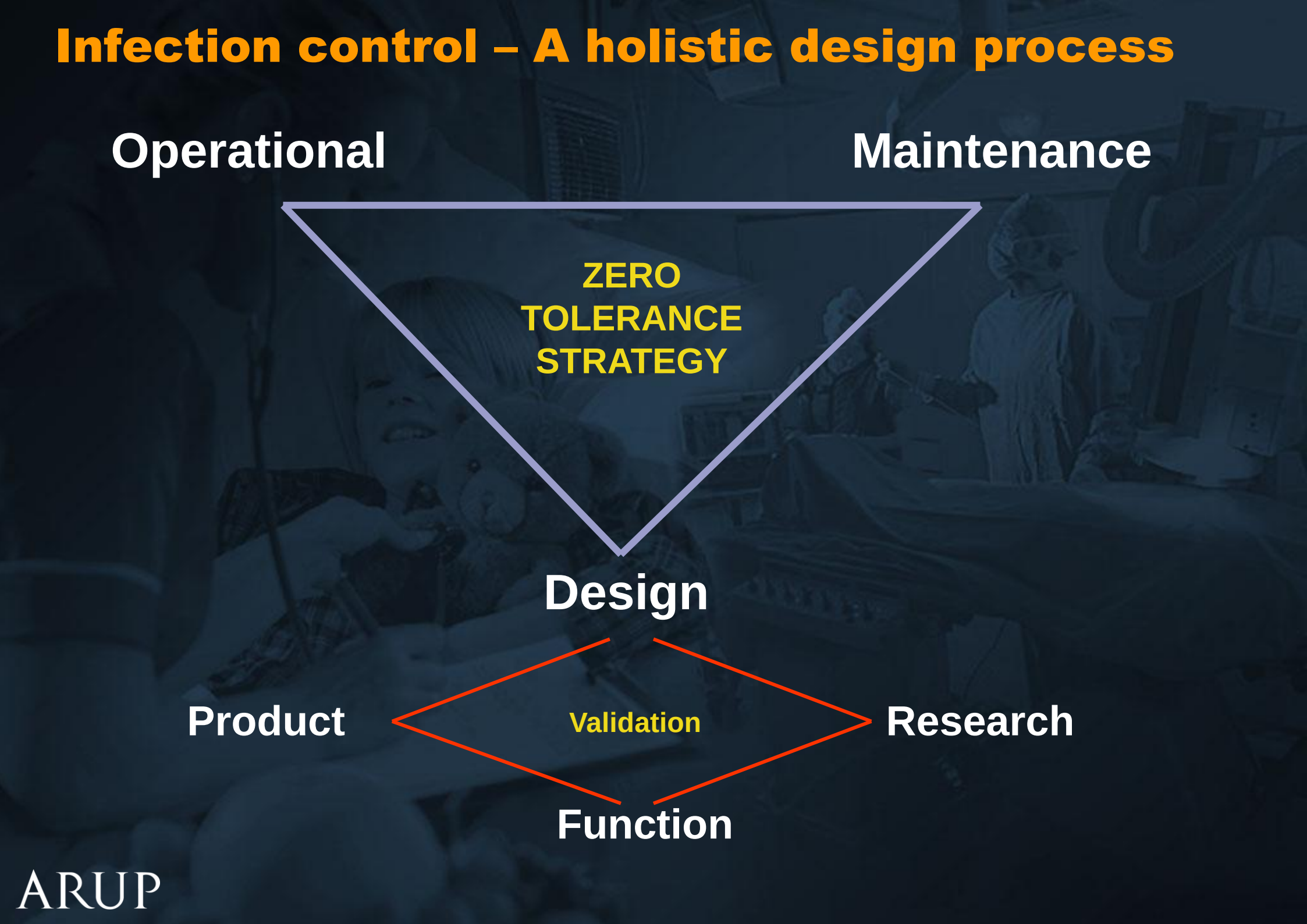
Infection control – A holistic design process



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MRSA 2001 – 10, UK NHS

• 2001/2	7291	
• 2002/3	7426	
• *2003/4*	*7700*	
• 2004/5	7212	
• 2005/6	7097	
• 2006/7	6383	
• 2007/8	4451	
• *2008/9*	*2932*	*62% reduction*
• *2009/10*	*1898*	*75% reduction*

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Conclusions

- Healthcare is the most complex sector
- Different countries have different priorities & funds
- Future developments must be clinically driven
- Understanding the role of the existing estate must be a key element for future planning
- Long term planning is essential
- A WLC model is essential to deliver clear value
- “Future needs” sensitivity analysis is required on all solutions – what if…….!
- The wider carbon agenda must be recognised
- Innovation and best practice must be introduced
- The therapeutic environment needs a greater evidence base
- We must be holistic in our development of solutions

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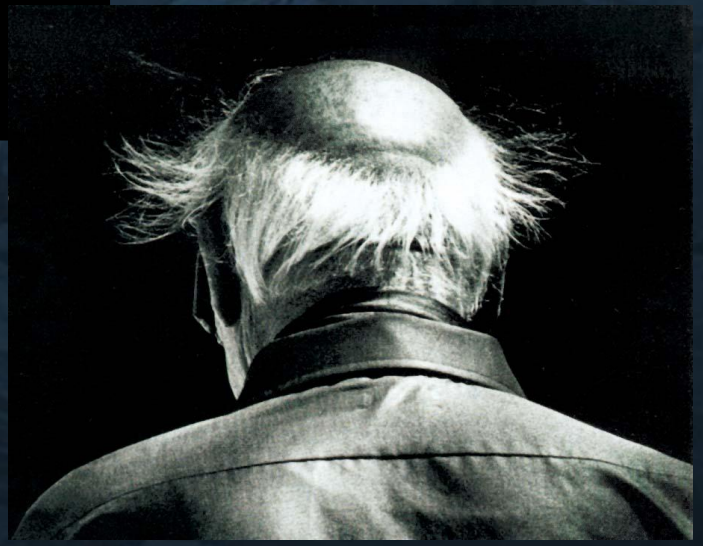
"A design team which produces a total, balanced, efficient design can help to produce a better environment."

Sir Ove Arup, November 1968



Thank you

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