



Day 1 - 'Naturally cool' session

'Passive progression...'

Mike Rainbow

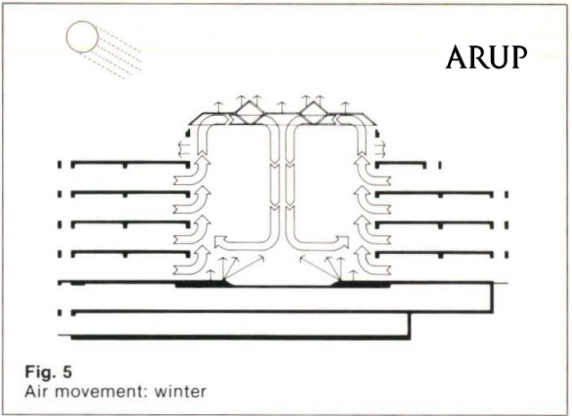
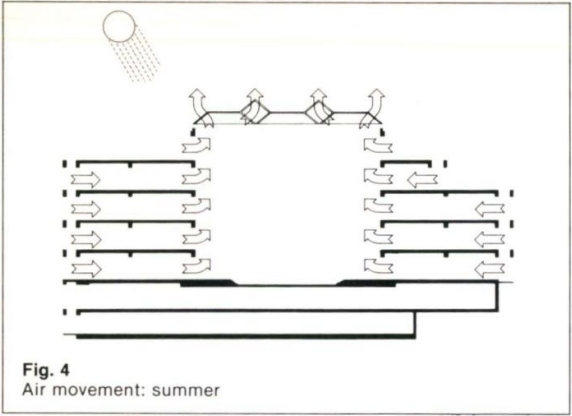
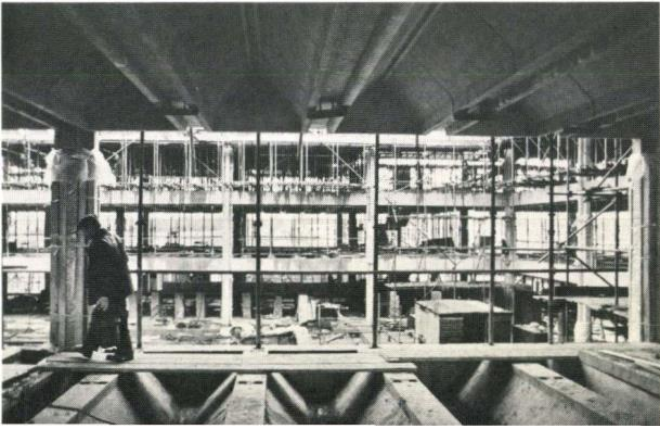
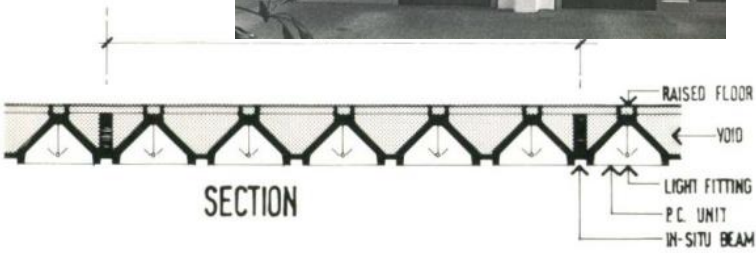
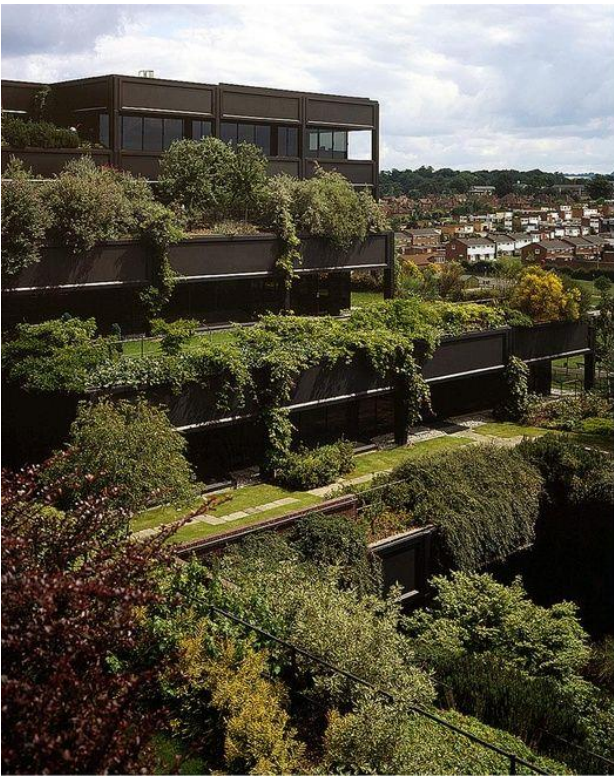






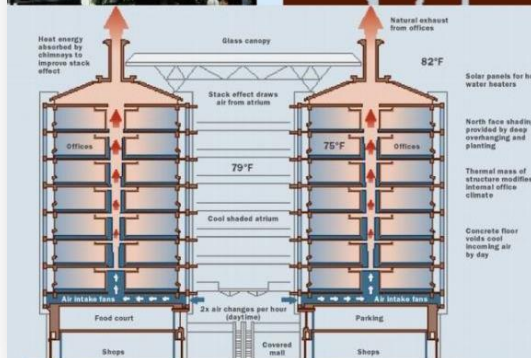


Gateway II, Basingstoke UK









EXPLORE

ILLUMINATING THE MYSTERIES AND WONDERS AROUND US EVERY DAY
NATIONAL GEOGRAPHIC

VOL. 233 NO. 5

IN THIS SECTION
Arctic Ocean Camping
Keeping the Books
Flooding Pluto
Down the Mountain

PLACE Eastgate building
LOCATION Harare, Zimbabwe
DISTINCTION Eastgate's insect-inspired, 90 percent passive climate control has made it a global landmark since it opened in 1996.

DECODER BY MANUEL CAHALES

INSPIRED BY TERMITES

How the Eastgate Building Keeps Cool

THE CHALLENGE: Design a modern office and retail building without expensive air-conditioning for relief from Zimbabwe's tropical heat. The solution: Imitate the engineering prowess of native termites by copying aspects of their systems. This approach, called biomimicry, enabled architect Mick Pearce to insulate the Eastgate building by harnessing nature, not hiding from it.

Keeping it constant
Termites nest deep underground, with apertures for ventilation that can reach 30 feet high. Soil absorbs the sun's heat slowly, providing a constant climate.

95-105°F
Soil surface temperature

77-87°F
Subground temperature

1
Double-thick brick walls and precast concrete have high "thermal masses"; it takes a lot of heat to change their temperatures. The same is true of soil around termite nests.

2
Air shafts direct night-cooled, filtered air in the mornings from the lower atrium up through seven floors of office space. The airflow is assisted only by low-power fans.

3
Double-layer concrete floors are cooled by night air flowing between their layers. They keep the circulating air as cool as possible until it warms and is vented out at the ceilings.

82°F
TYPICAL DAYTIME TEMPERATURE

57°F
TYPICAL TEMPERATURE AT NIGHT INSIDE THE ATRIUM

Eastgate's atrium rises 15 feet above adjacent roofs, trapping cool air at night and naturally venting warm air by day.

Chimneys vent warm air

GLASS CANOPY

WARM AIR

WARM AIR SHAFTS

COOL AIR

COOL AIR SHAFTS

OFFICE AIRFLOW

Extended overhangs shield sun-facing northern windows, allowing light in while at the same time reducing heat absorption.

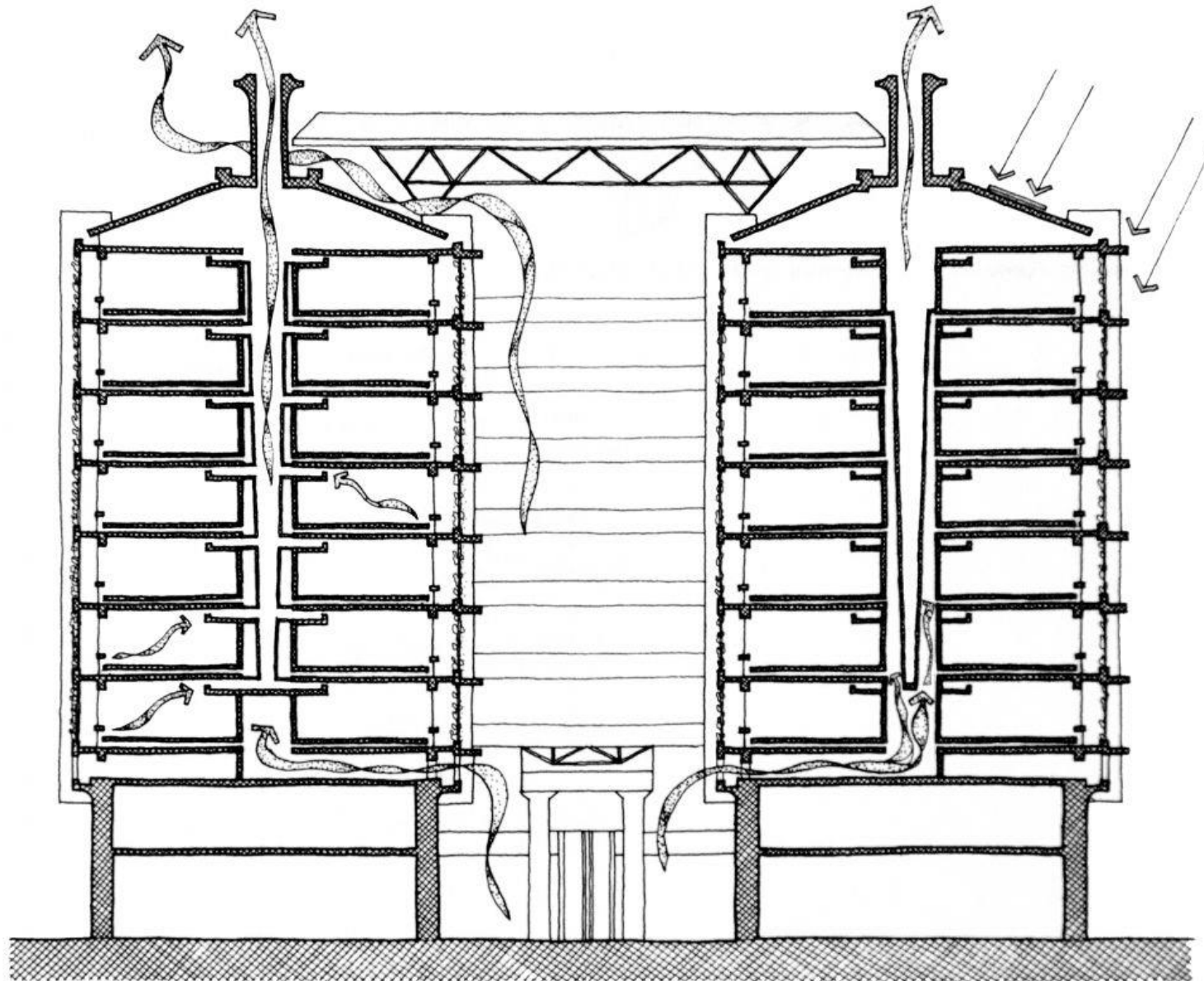
Eastgate uses 35 percent less energy, on average, than six similar Harare buildings that rely on full heating, ventilation, and air-conditioning systems.

AVERAGE ENERGY USE

Eastgate

Other buildings

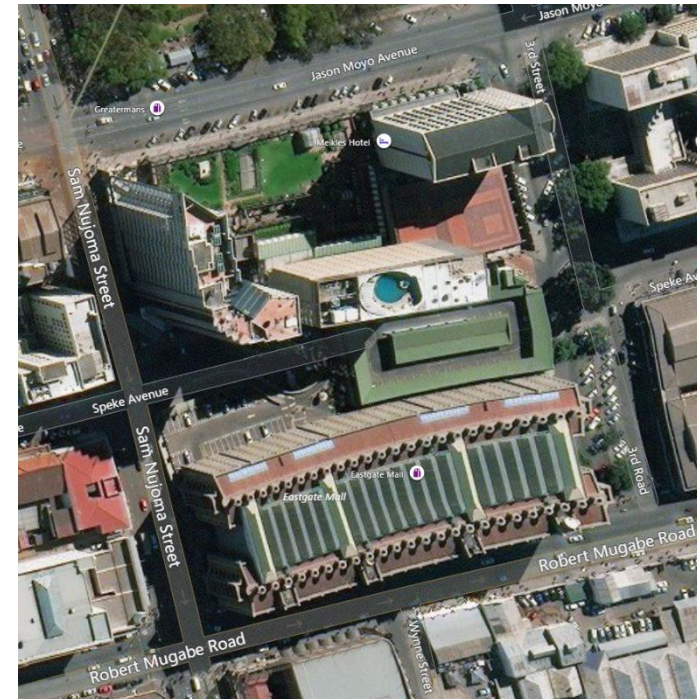
WINDS ARE RELATIVELY SMALL, MINIMIZING HEAT ABSORPTION.



Section, Eastgate Building, Harare, Zimbabwe, Pearce Partnership

Eastgate: Getting the basics right

- Client, architect, engineer and contractor
- Learning from precedents
- Climate – high diurnal temperature swing
- Building orientation – East-West
- Building form - narrow-plan offices + central atrium
- Local materials & skills



Eastgate: Getting the basics right



Features:

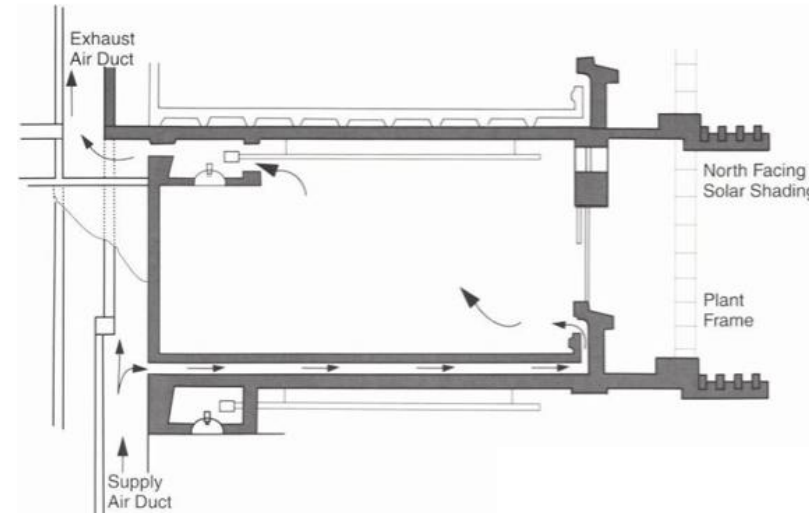
- Exposed thermal mass
- External shading
- Openable windows
- Operable blinds
- Low WWR (25%) + clear glazing
- Low-pressure fans, and filters



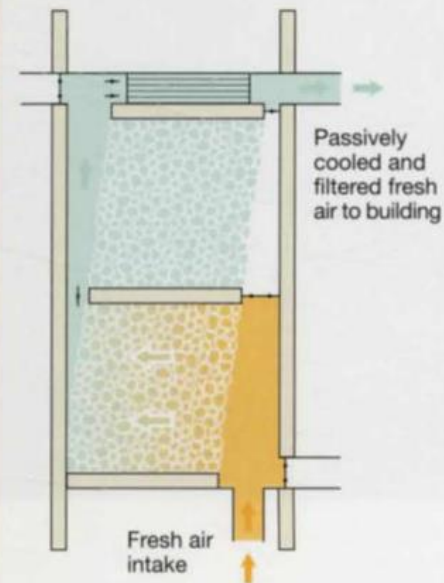
Eastgate in-use:

Living with, & learning from the challenges

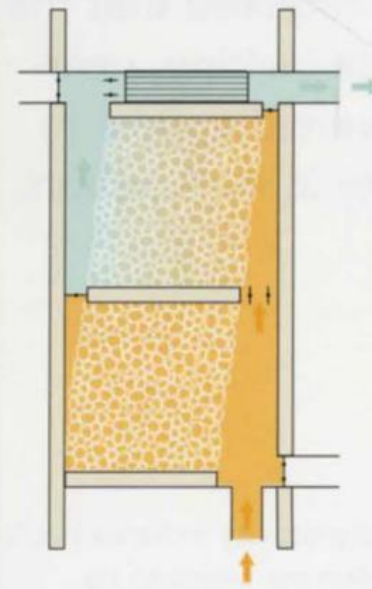
- Passive cooling - staying power of slabs
 - extensive monitoring
- Vermin traps..!
- Expectation management (tenants)
 - user education



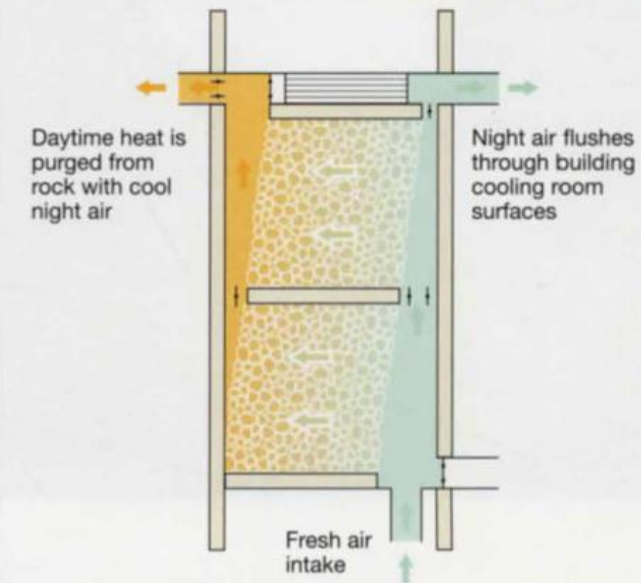
Staged coolth release – ‘rockstores’



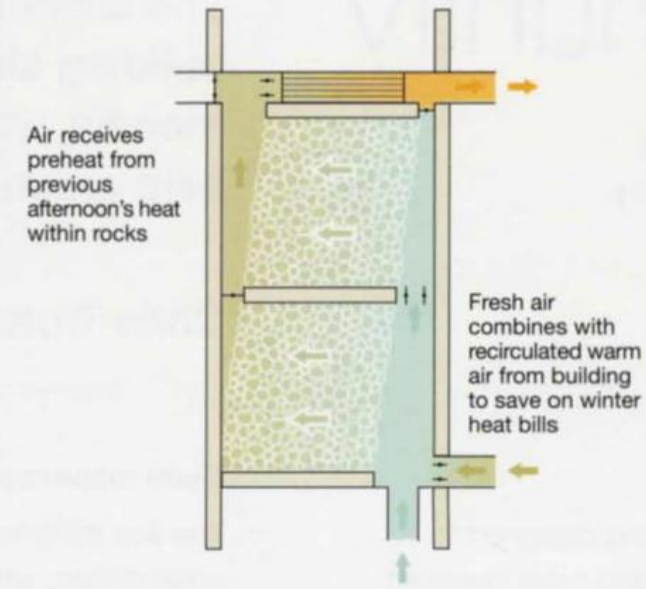
Cooling mode 8am - 2.30pm



Cooling mode 2.30pm - 6pm

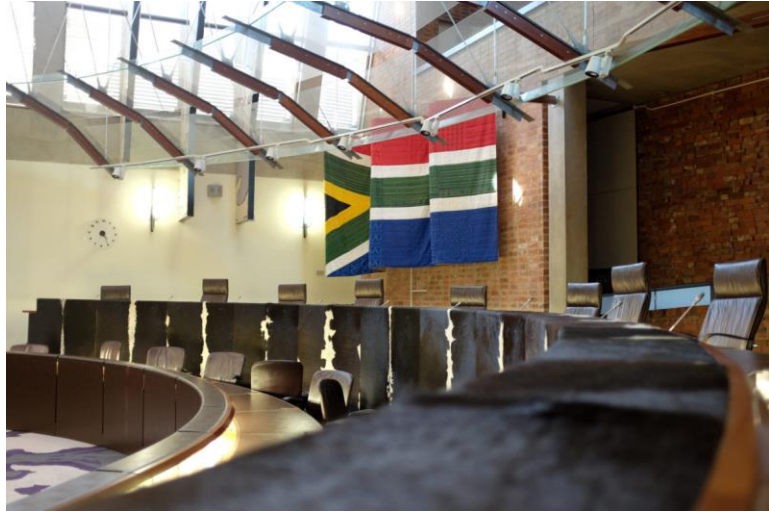


Summer night flush mode 11pm - 6am

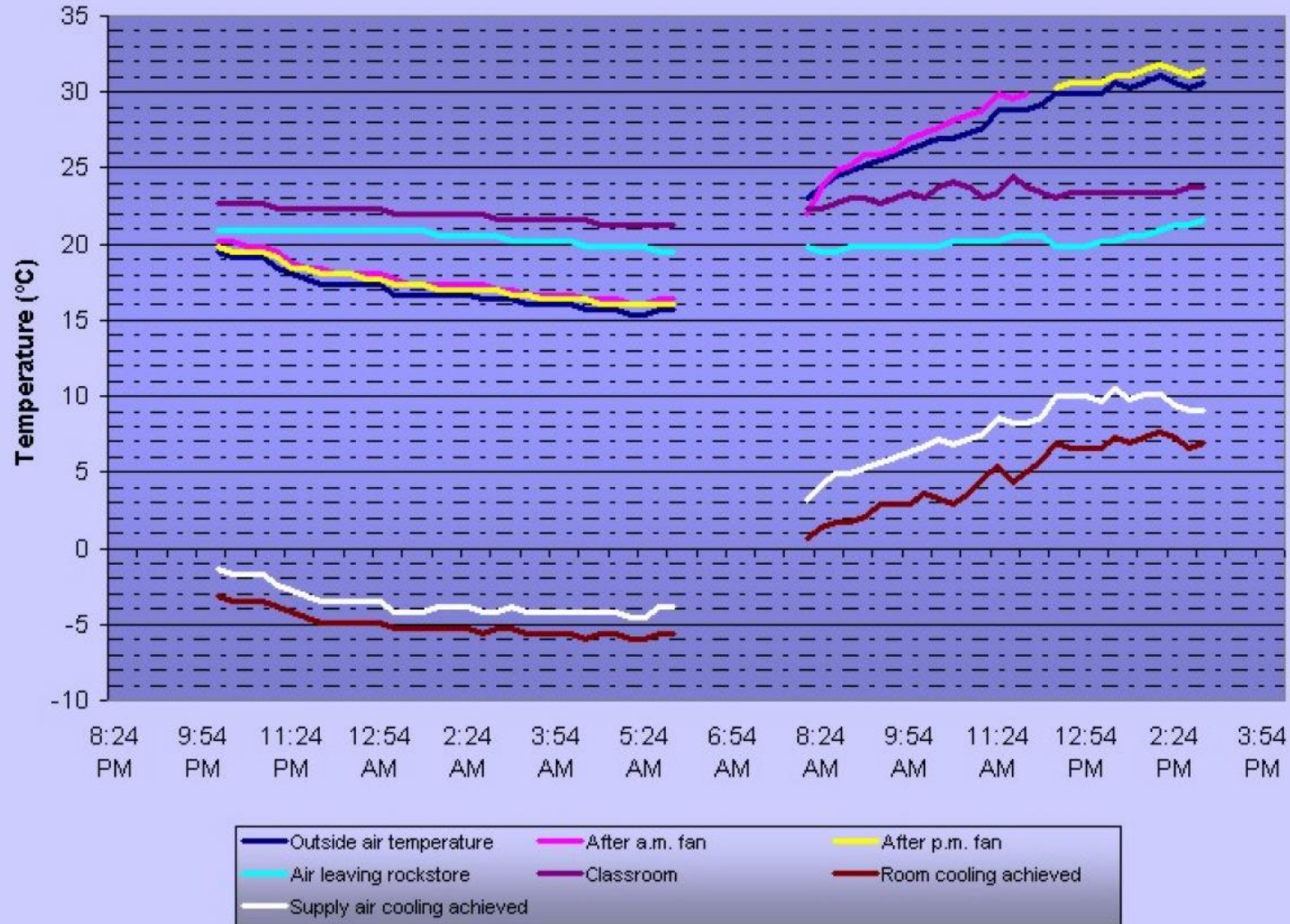


Winter morning preheat mode 8am - 11am

The Constitutional Court of South Africa



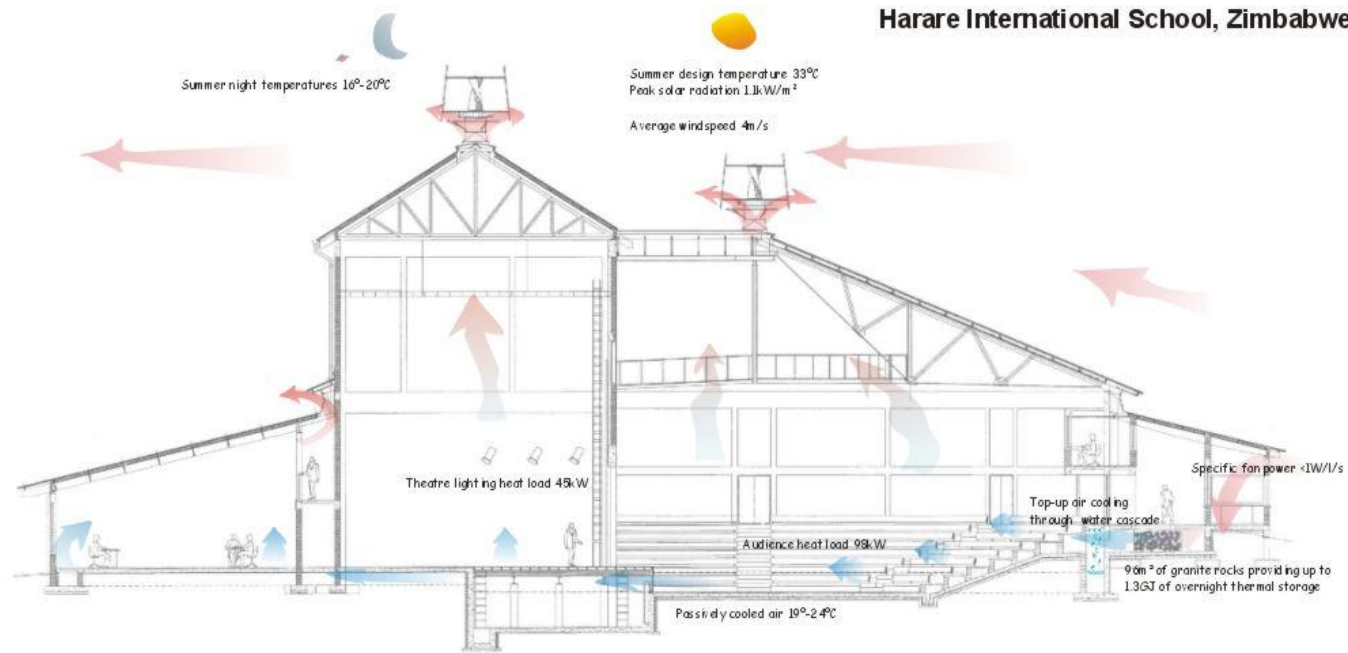
Harare International School
5 November 1999



ARUP



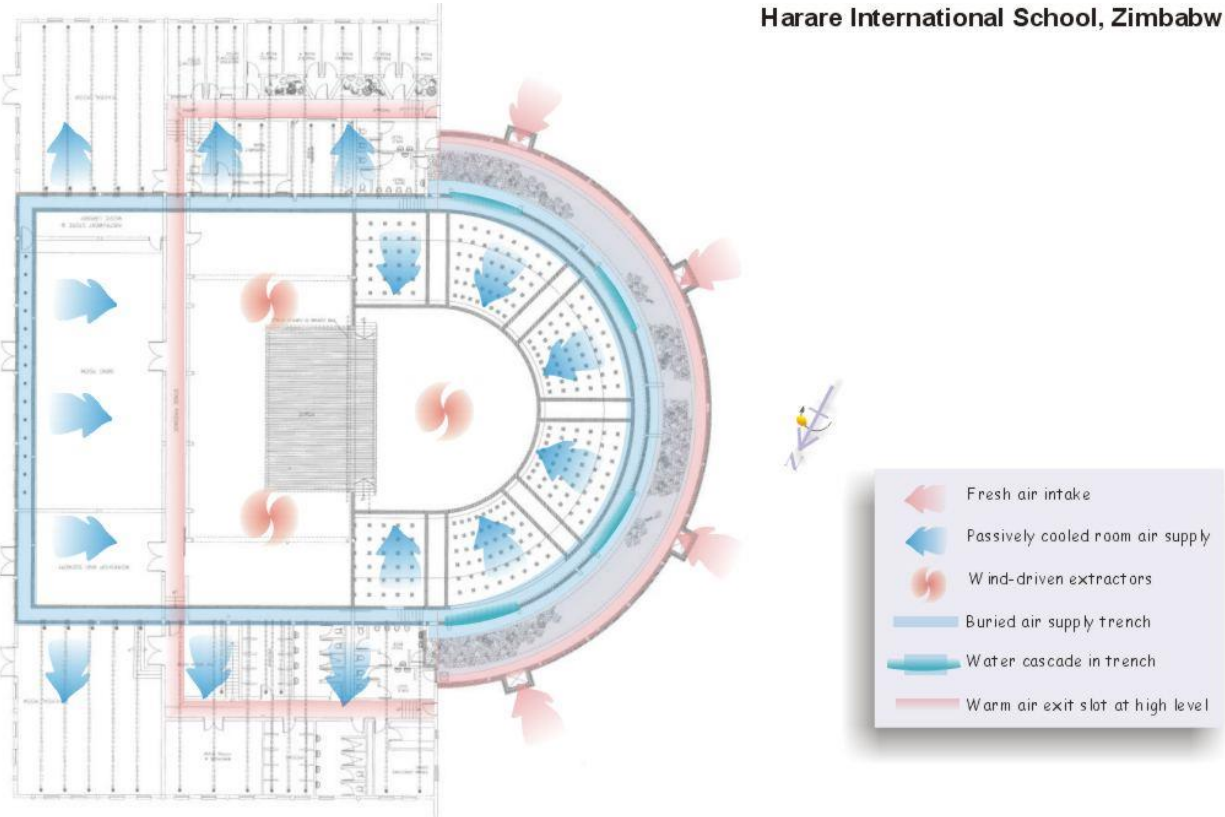
Harare International School, Zimbabwe



PERFORMING ARTS CENTRE SECTIONAL AIRFLOW SCHEMATIC



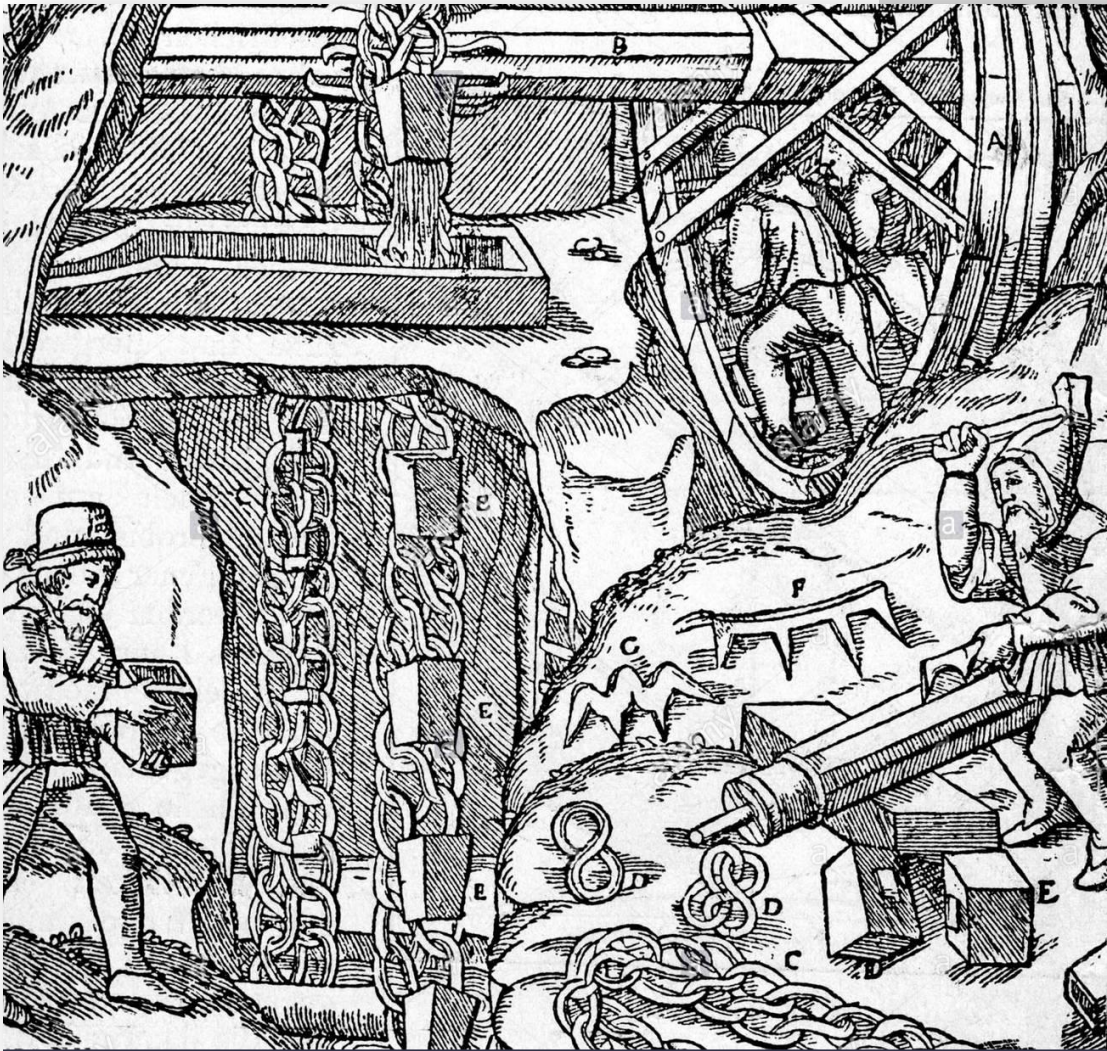
Harare International School, Zimbabwe



Federation Square, Melbourne



Nothing new under the sun..?





DESCRIPTION OF VENTILATORS:

WHEREBY

Great Quantities of FRESH AIR

May with Ease be conveyed into MINES, GOALS,
HOSPITALS, WORK-HOUSES and SHIPS,

In Exchange for their *Noxious Air*.

An Account also of their GREAT USEFULNESS
in many other Respects:

As in Preserving all Sorts of GRAIN Dry, Sweet, and
free from being Destroyed by WEEVLS, both in
GRAINARIES and SHIPS; And in Preserving
many other Sorts of Goods.

As also in drying CORN, MALT, HOPS,
GUN-POWDER, &c. and for many other
useful Purposes.

Which was read before the ROYAL SOCIETY
in May 1741.

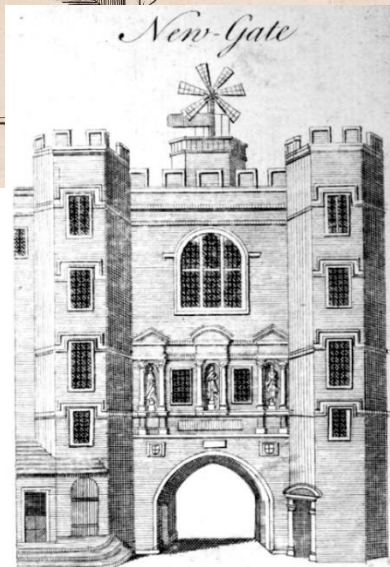
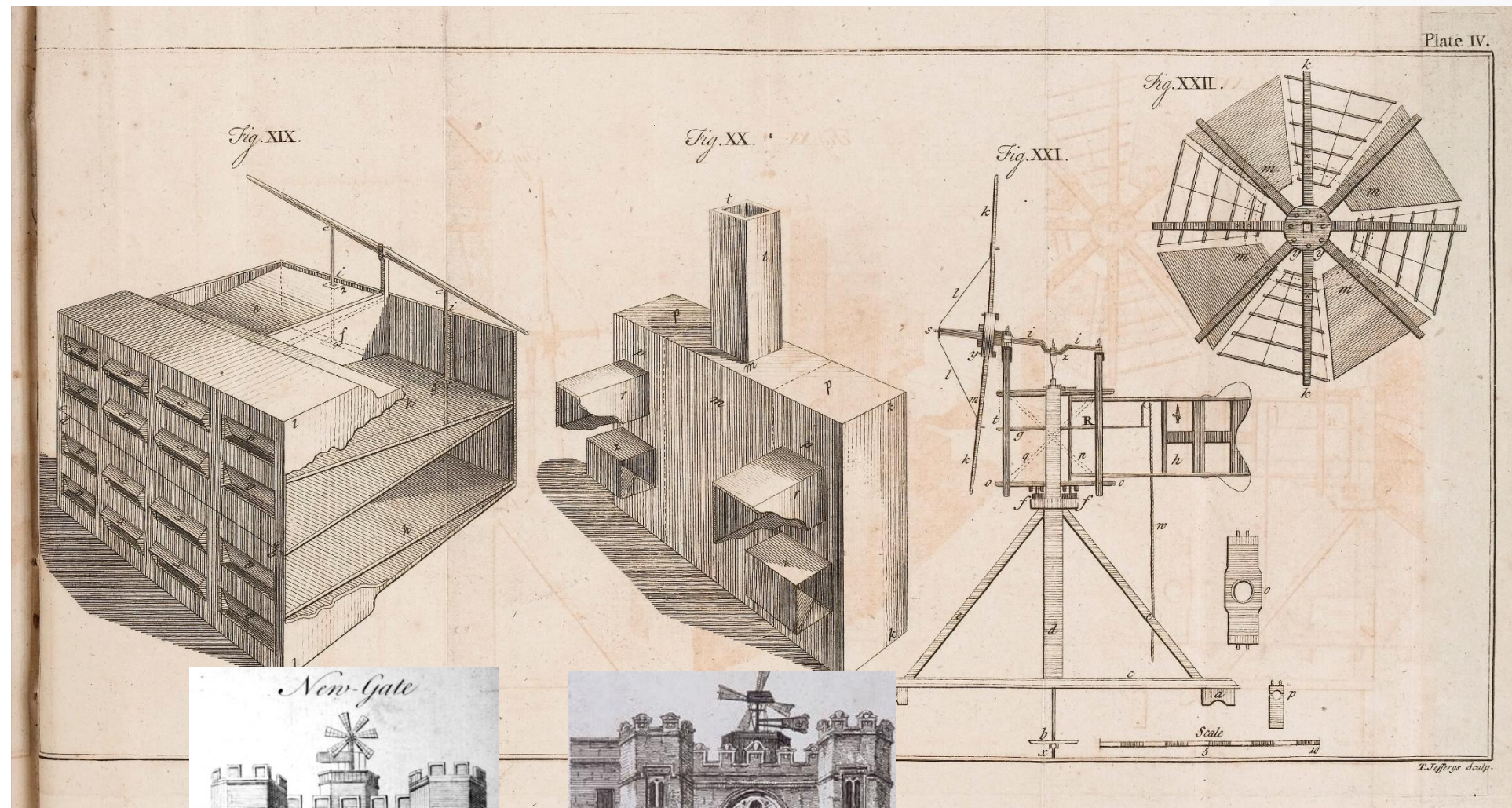
*And God made
The Firmament, Expanse of liquid, Pure,
Transparent, Elemental Air.* MILTON.

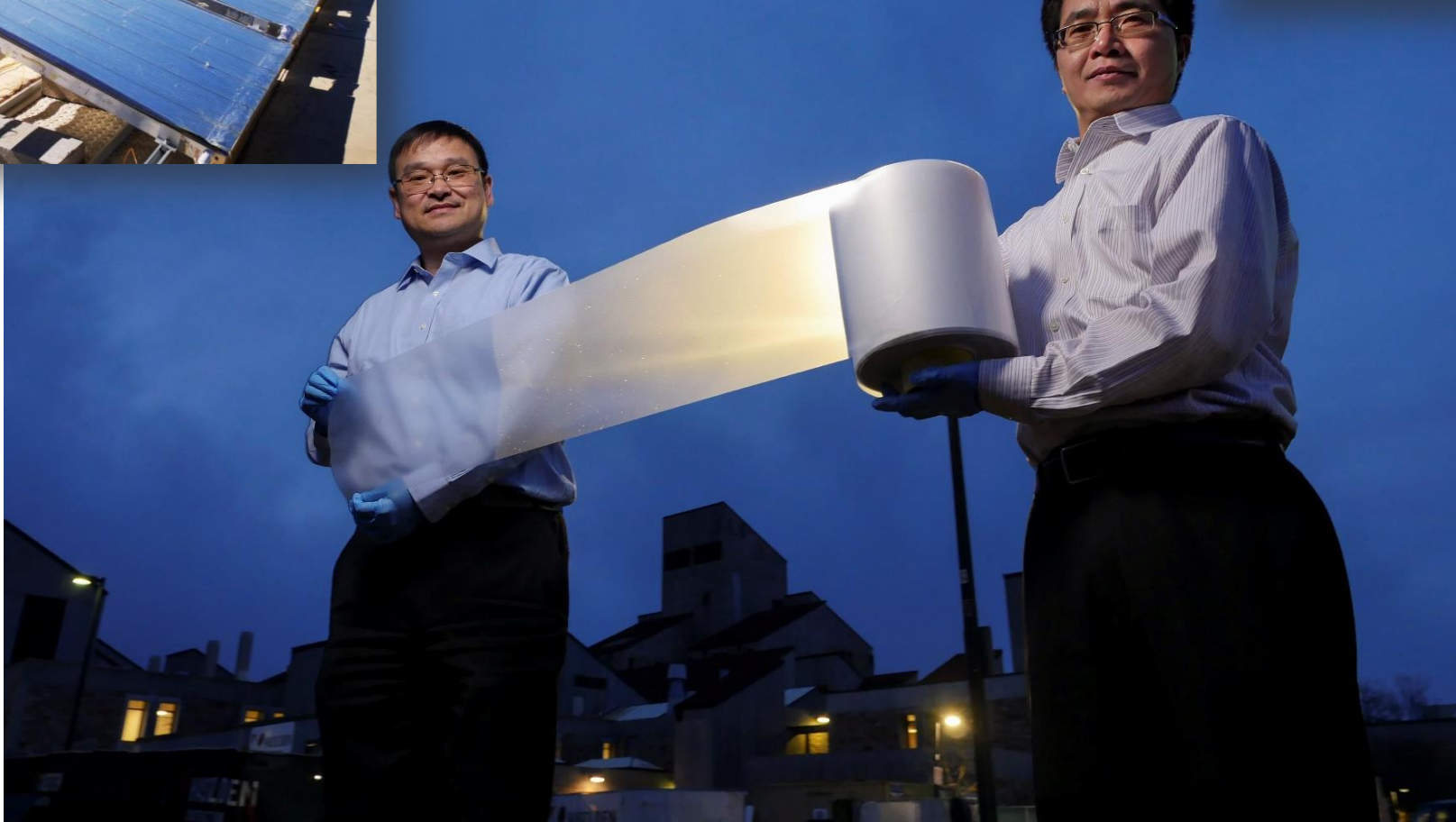
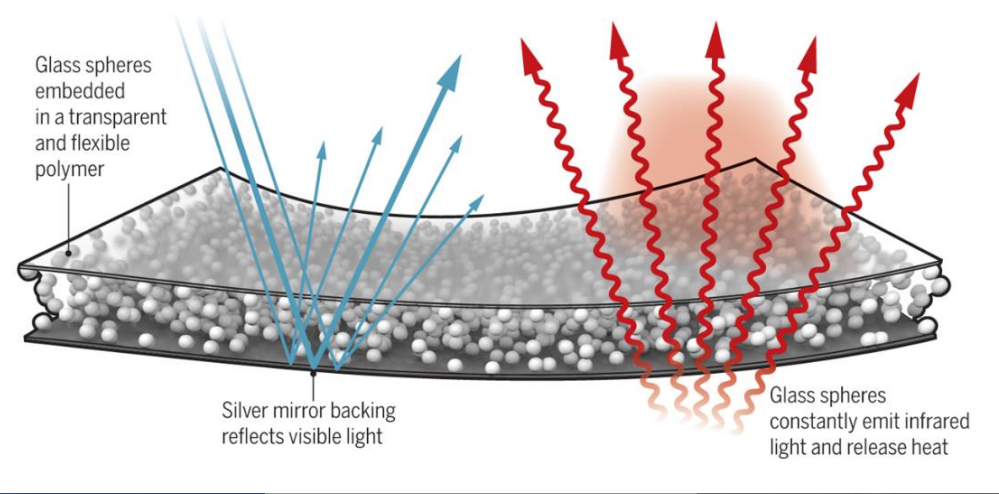
By STEPHEN HALES D.D. F.R.S.
Rector of Faringdon, Hampshire,
And Minister of Teddington, Middlesex.

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'Passive progression...'

Mike Rainbow