

The Edge Debate on Comfort - A personal view from CLG

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From 2010 to 2050

‘FROM THE INDUSTRIAL AGE TO THE ECOLOGICAL AGE’

P Head, Arup

[1]: Introduction: The Triple Challenge

[2]: The UK Housing Stock and Some China Data

[3]: Possible National Actions

[4]: Comfort

[1] The Triple Challenge

UK now a net importer of *Energy*, and so energy security/independence is a vital national interest.

The basic *Climate* change science is in, and the future scenarios are unpleasant – we must adapt to and mitigate against future climates.

The UK indulges in 3-planet living (US=1 1!), which is absolutely not *Sustainable*.

The *ECS* triple challenge will be met or missed in existing buildings, **where the solutions are common.**

50% engineering and 50% psychology and sociology ₃

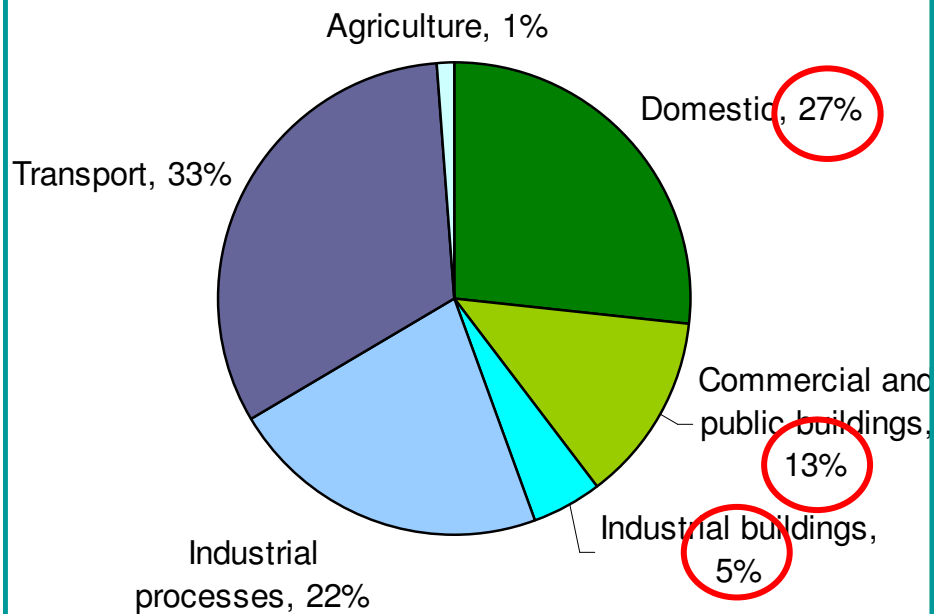
Carbon reduction and the built environment:

Five initial facts

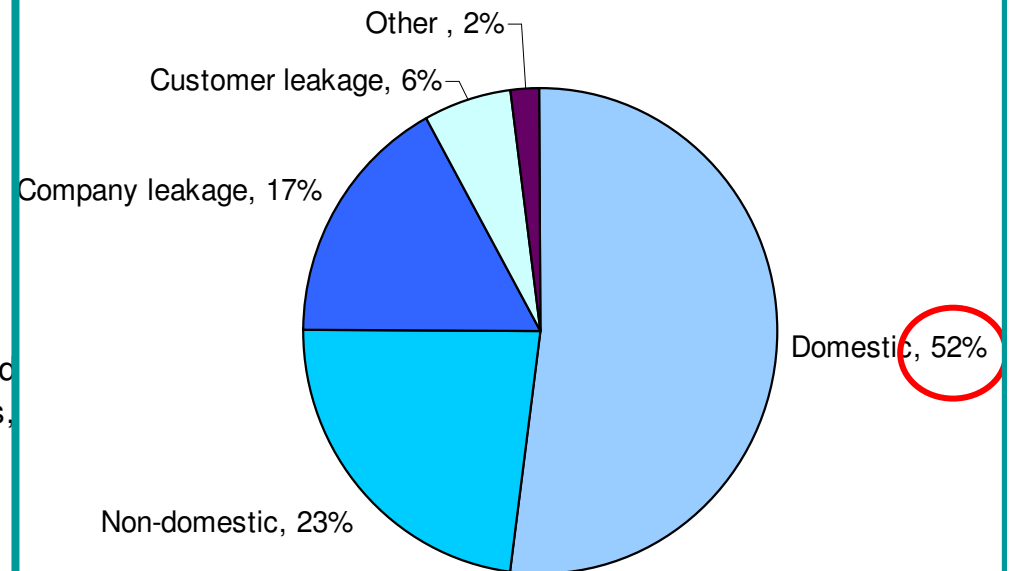
- HMG is about to commit to an 80% reduction in carbon emissions by 2050
- 45% of all present carbon emissions come from existing buildings, with 27% from homes
- 87% of existing buildings will still be here in 2050
- CLG is the lead department of HMG concerning the built environment: planning, building codes, building regulations,...
- We must work with OGDs on existing buildings

The built environment has a significant impact on emissions and water consumption

Carbon emissions from energy use in buildings account for 45% of UK emissions; our homes 27%



Water use in homes accounts for over half of public water consumption in England and Wales

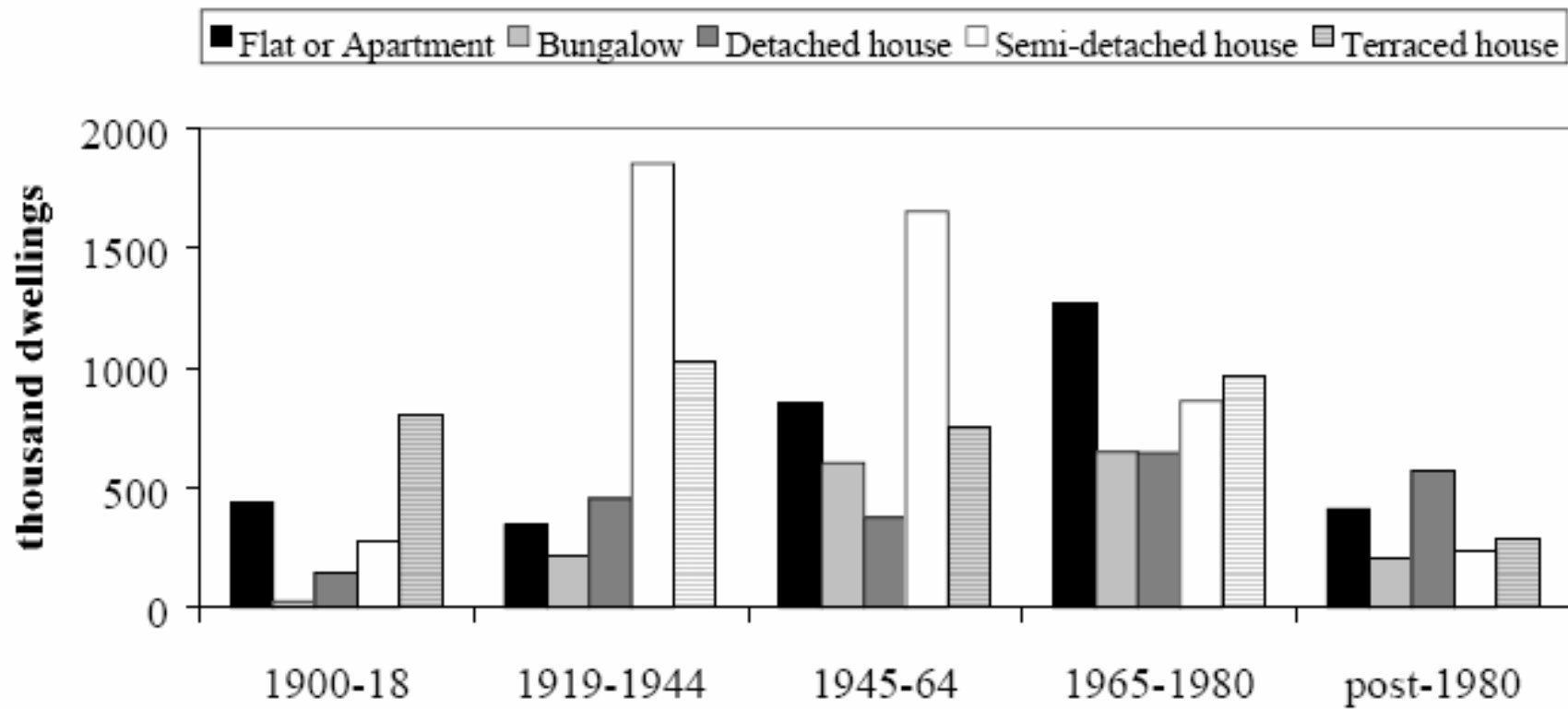


Buildings almost equal to transport and industry together

[2] UK Housing Stock Much of it is old, and not well insulated.



Profile of English Housing Stock



Further data on English housing stock.

During 1900-1998, housing stock grew from 7M to 22M
Building peaked in 1968 with 410K, but down to 141K in 1999
(140K in 1900!).

Age: 62% of homes before 1965, and 35% before 1939.

Semi-detached housing at 4.9M is 31% of total stock, followed by low-rise flats and detached houses.

During 20th century

- urbanisation went from 77% to 89% of the population
 - small change, cf France: 59% urban in 1954 to 74% in 1990
- owner occupiers from 10% to 68% of homes
- private renting down from 89% to 10%.

In 1999 18% of homes rented from local authority, and 5% from housing association.

Recent progress Hard data from recent times projected forward

1990#:	154MtCO ₂ equivalent from housing 35% of energy saving interventions installed*
2005#:	147MtCO ₂ equivalent from housing 65% of energy saving interventions installed*
2020	114MtCO ₂ , HMG's <i>target</i> for housing

Must achieve savings at **six** times rate of recent history

At most a 20% further reductions via 100% reach of * above.

Measured data, incontrovertible

* 3" loft insulation, >60% window double glazed, >60% rooms draught proofed, cavity wall insulation to modern standards

Residential AC energy in Beijing (from Prof Y Jiang, Tsinghua U)



A. 5 floors, 1981, 74m²/unit
Split unit



C. 26 floors, 2003, 141m²/unit
Split unit



D. 26 floors, 2004, 132m²
one outdoor & multi
indoor units

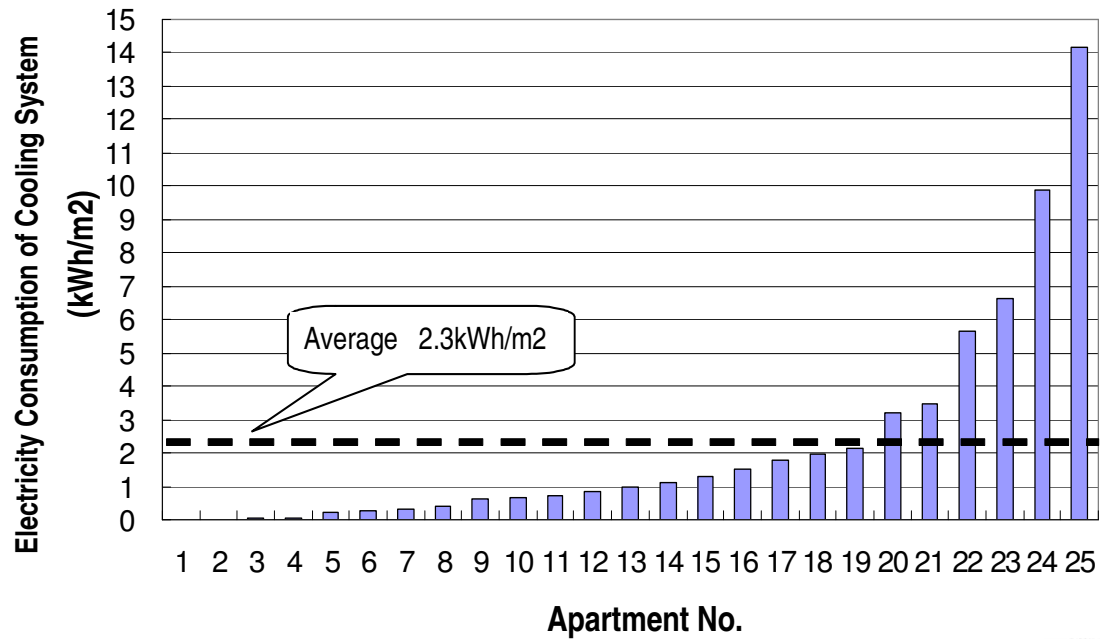


B. 18 floors, 1996, 103m²/unit,
Split unit

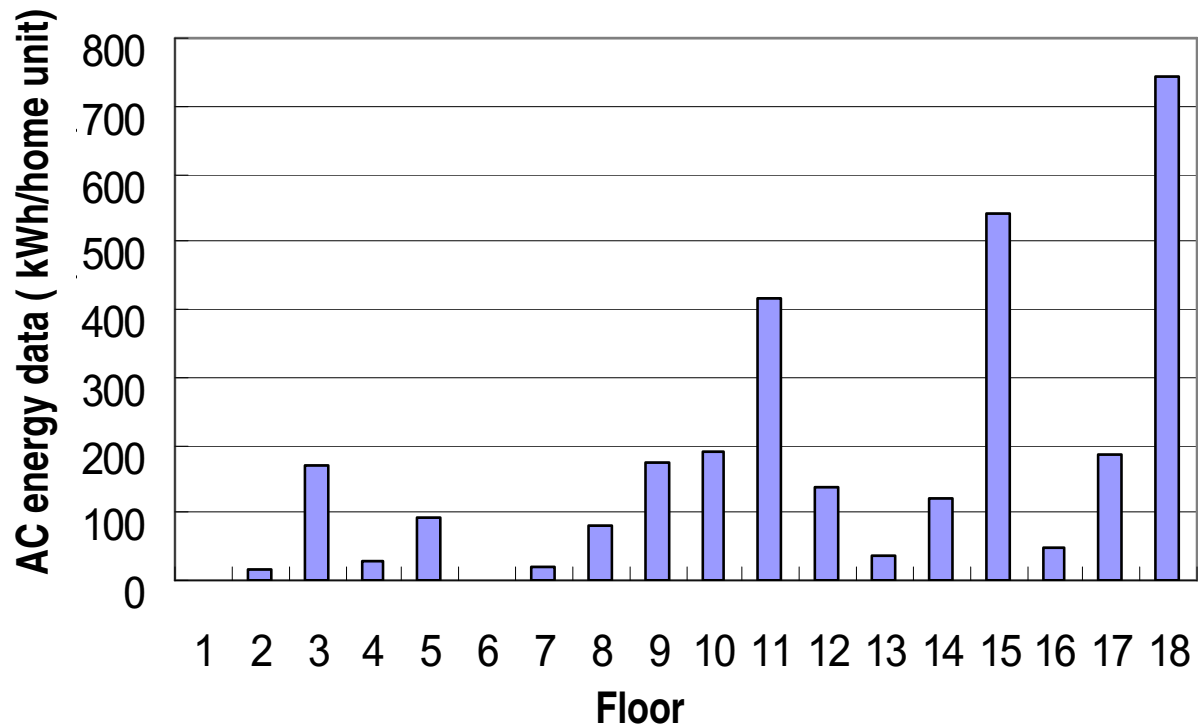


E. 26 floors, 2005, 280
m²/unit Central AC
system

The measured energy consumption of AC in every units of building A in Beijing, 2006, split unit

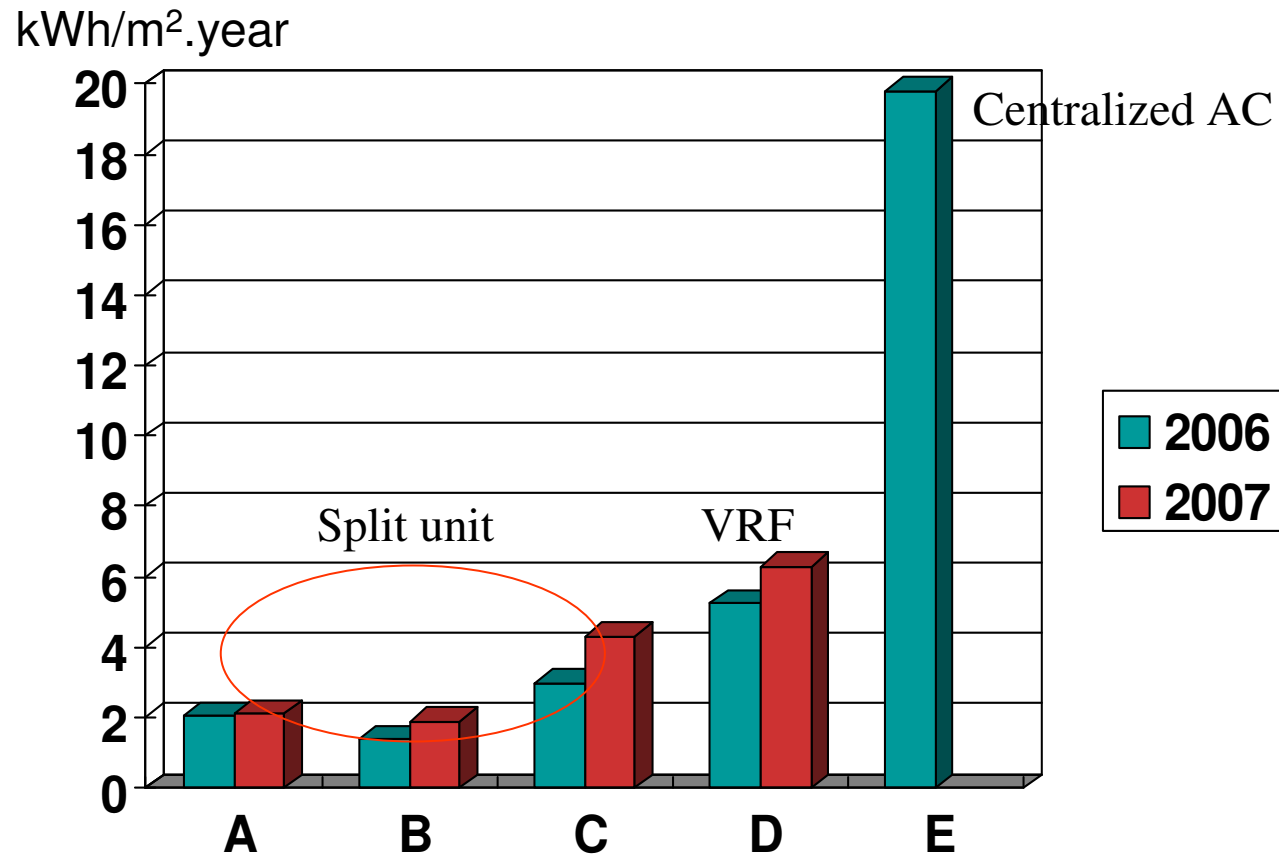


AC energy in building B in Beijing



Electricity consumption by AC for home units at same location but different floors in building B

Residential AC energy in Beijing

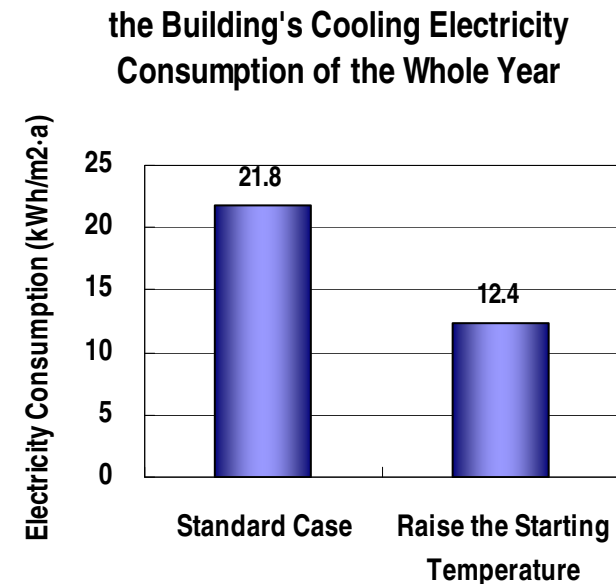


The average electricity consumption for different buildings: kWh/m².year

Where the difference come from?

Starting temperature:

- As soon as indoor temperature is lower than the starting point, occupant may not turn on the AC even it is higher than comfort set point
- However, after the AC is turned on, it is very likely that the occupant keeps the indoor at the comfort set point



Starting temperature: 29 °C

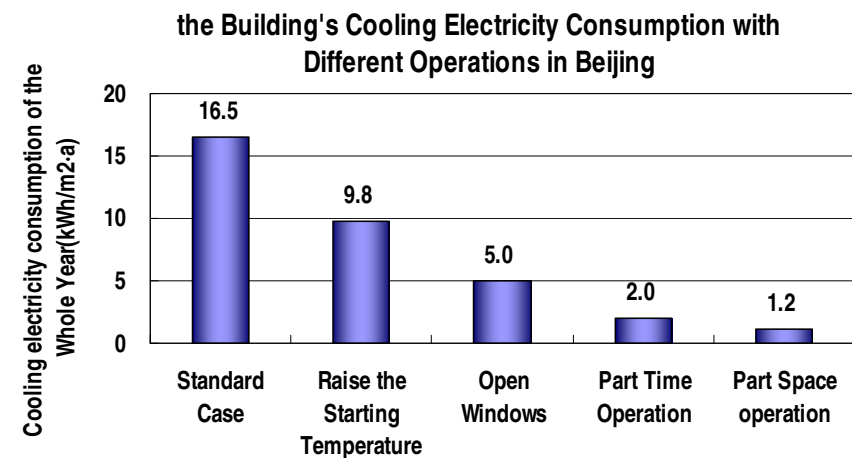
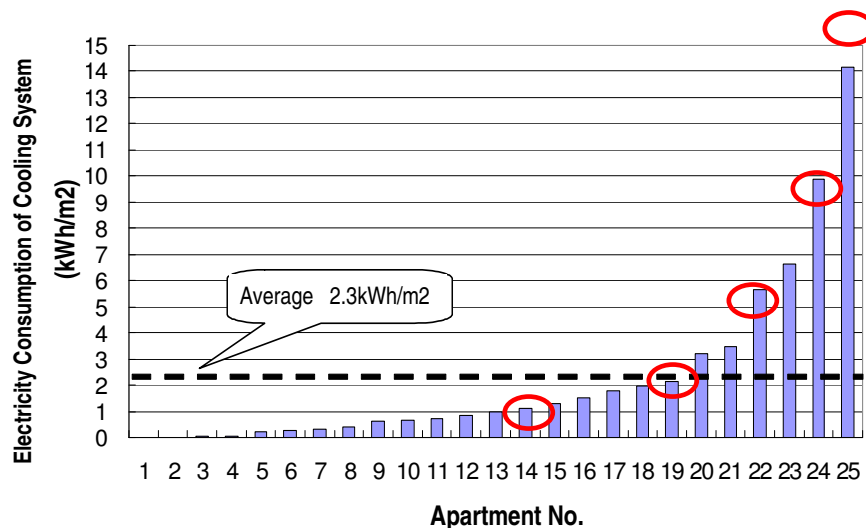
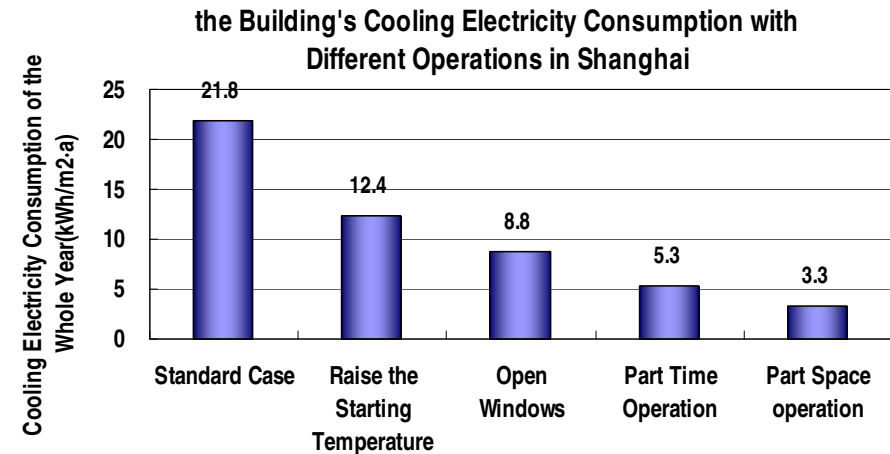
Operation set point : 26 °C

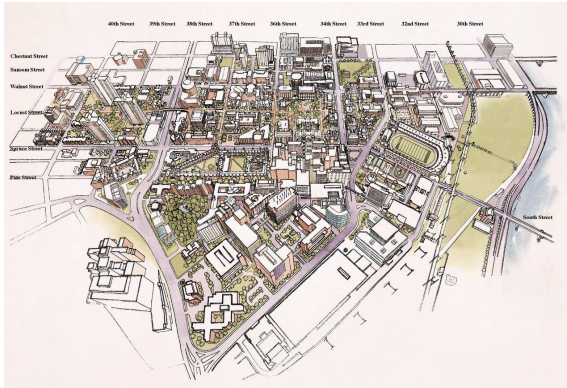
How energy relate with operation?

Comparing with the energy consumption of the five cases

- Total cooling electricity consumption : 21.8kWh/m² to 3.3kWh/m²!

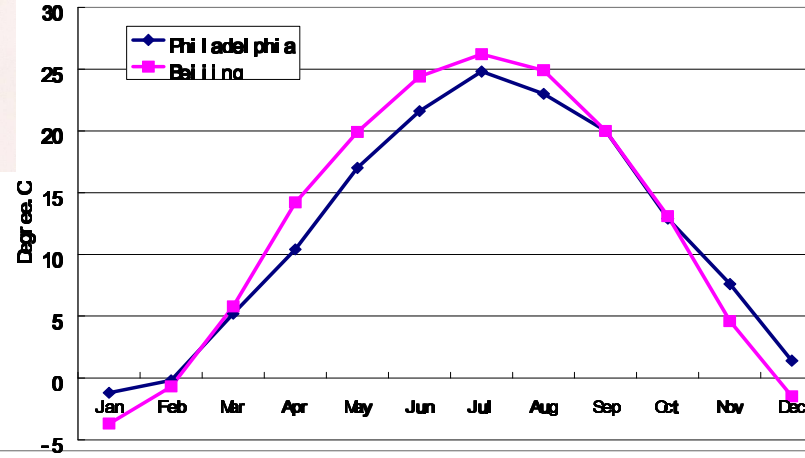
Measured data & simulation data in Beijing





Beijing & Philadelphia

Monthly Mean Temp. in Philadelphia and Beijing

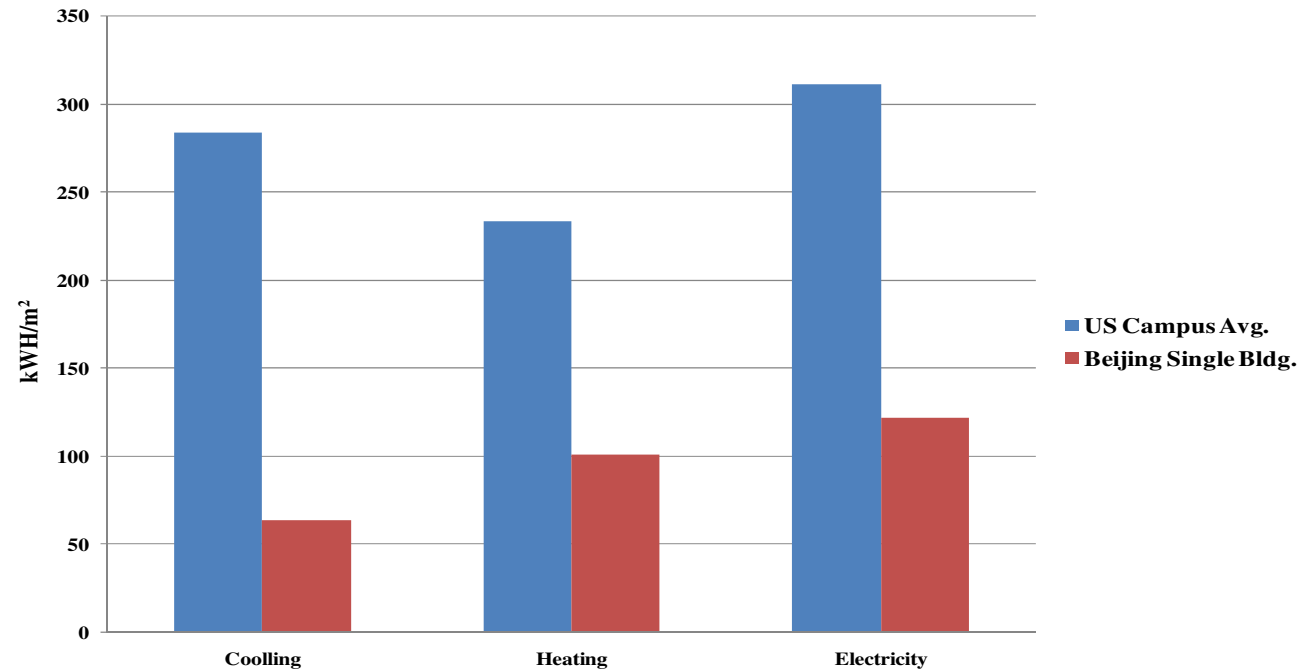


Building in Beijing



Campus building in US

Annual Energy Intensity



[3] Possible National Actions

SCALE is the essential ingredient

- (1) Get the HE/FE sector to show us the way
- (2) Produce a concrete trajectory from 2010 to 2050 for an urban local authority
- (3) Establish a retrofit consortium
- (4) Start a campaign to change public attitudes and behaviours - comfort

(4) Public Attitudes and Behaviour Change

Must reach the stage where profligate use of energy is considered as deeply antisocial.

Like drink-driving, smoking in confined public spaces, not wearing seat-belts, etc.

Target the young using their own communications.

Ready exemplars of alternative good behaviour to be available.

A new look at comfort

Mr Koizumi's initiative: public buildings in Tokyo, not cooled below 28C nor heated above 20C

Change in business dress code

No robust data on decreased worker or
IT efficiency

CLG announcement last week:

from 22 ± 1 all year to 23 ± 2 in summer
and 21 ± 2 in winter