Dispelling 10 environmental design myths

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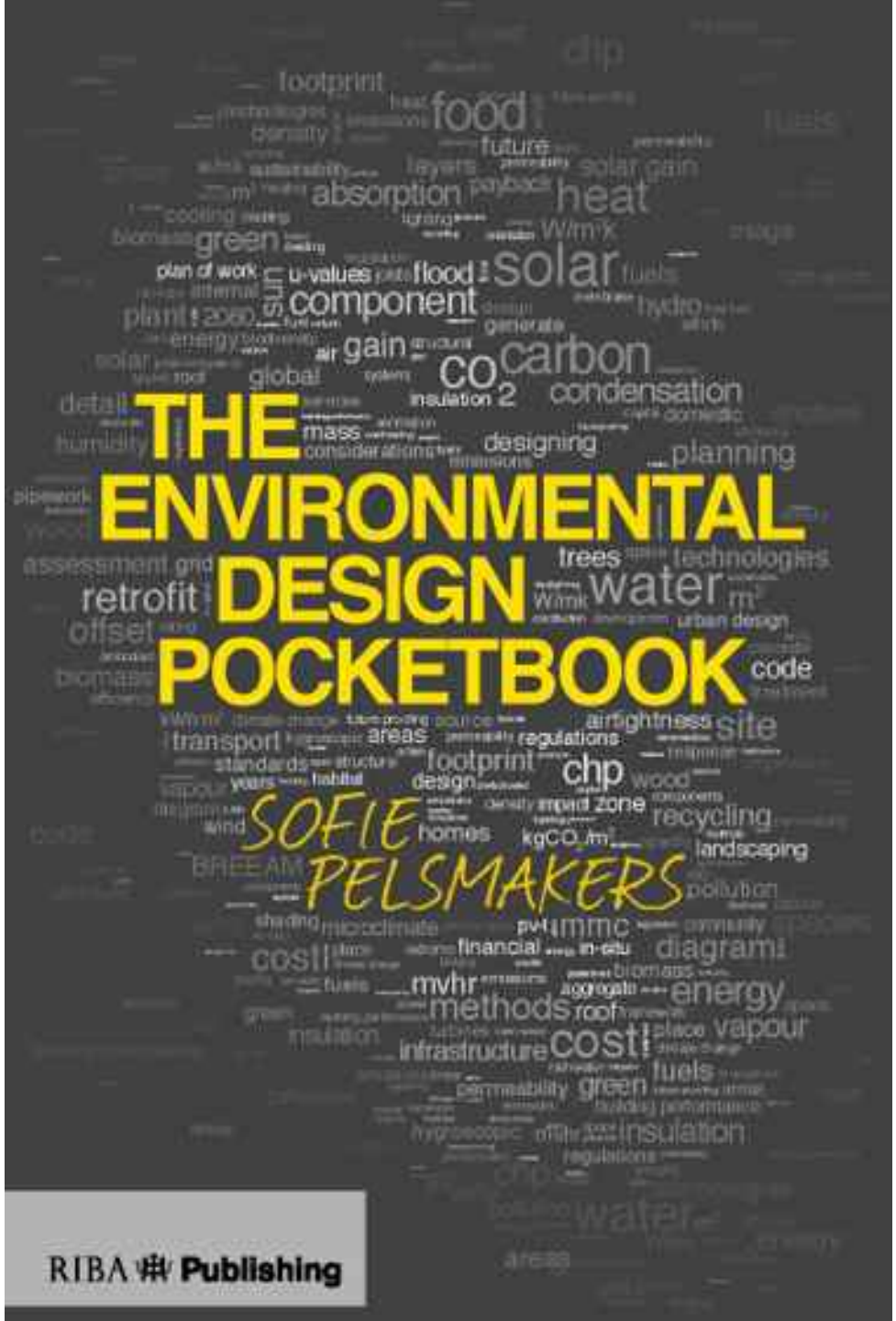

THE ENVIRONMENTAL DESIGN POCKETBOOK
SOFIE PELSMAKERS
RIBA Publishing

Why sustainable design matters

1. 40-50% of CO_2 emissions associated with building industry in UK/USA; 30% globally.

→ To light, heat (cool) & ventilate buildings + to construct them (i.e. embodied energy materials)

2. But CO_2 is not the only environmental impact of the construction industry: health, biodiversity, water use, waste, use of finite resources,…

→Focus on CO_2 as main greenhouse gas from burning fossil fuels leading to **global warming**

Our fossil-fuel addiction

→There is **no** dispute that CO_2 levels are rising as a result of human activity, which is changing the planet's climate and will continue to do so until we **stop** burning fossil fuels altogether.

→ commitment for **80% reduction in CO_2** by 2050 by EU/UK government,

Kicking-our fossil-fuel habit = challenging

→cutting CO_2 is **very** challenging,….

→ we need to ensure we don't design 'bad' buildings in a quest to 'save CO_2'

→ we need to rebalance CO_2 reduction with reducing other environmental impacts

... it is easy to get things wrong

This is why debunking myths matters

why debunking myths matters

- If we get it wrong, we can do more damage to the environment than good
- ‘we look bad’/give industry a bad name
- Liability/PII (insurance) issues down the line as some of it is ‘forsee-able’ – i.e. Duty of Care?

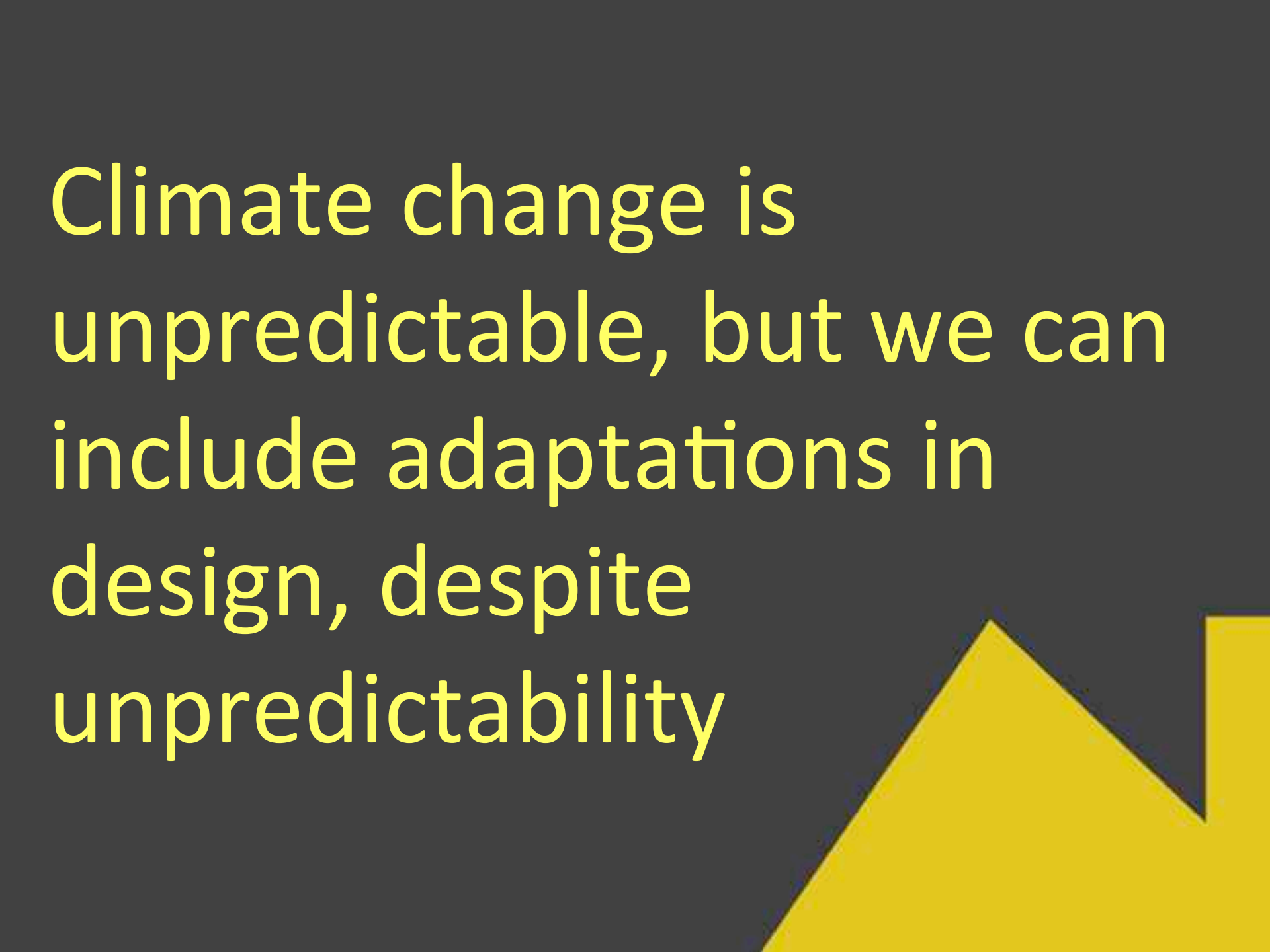
Myth 1

Climate change is in future

UK: Climate change is Already happening

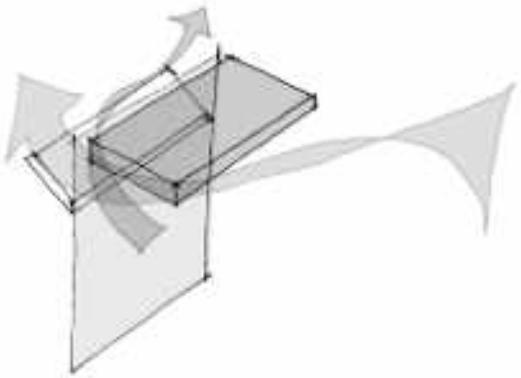
- **4 hottest years** on record in last 15 years (2014: hottest so far)
- Summer heat-wave in 2003: **2000** people died in UK of heat-related deaths
- **Summers to be 4-5ºC warmer by 2080**

Climate change is unpredictable, but we can include adaptations in design, despite unpredictability

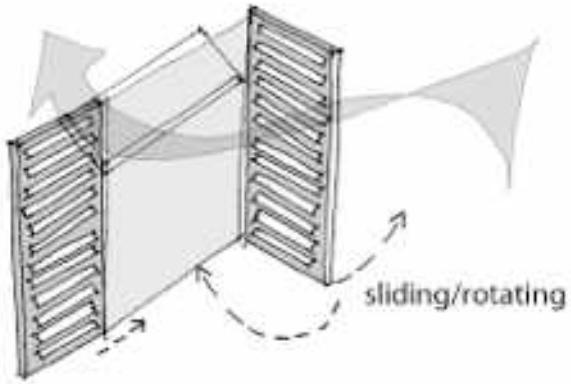


Increased temperatures – be smart about solar shading to avoid increased reliance of active cooling

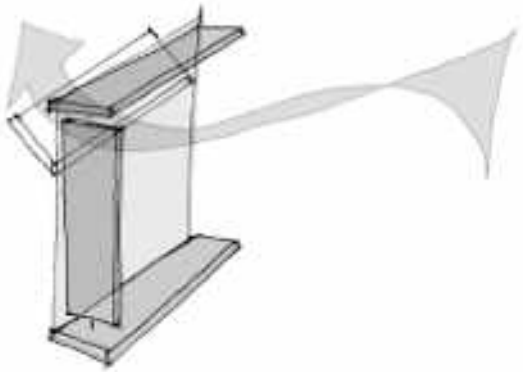
Airflow & shading



Horizontal solar shading
south



Vertical shading
west/east



Horizontal + vertical 'fins'
SW/SE

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Light-coloured surfaces to reflect solar radiation and trees to provide shade in Avignon, France. © Pelsmakers

Prevent overheating: hybrid of measures (not a single solution)

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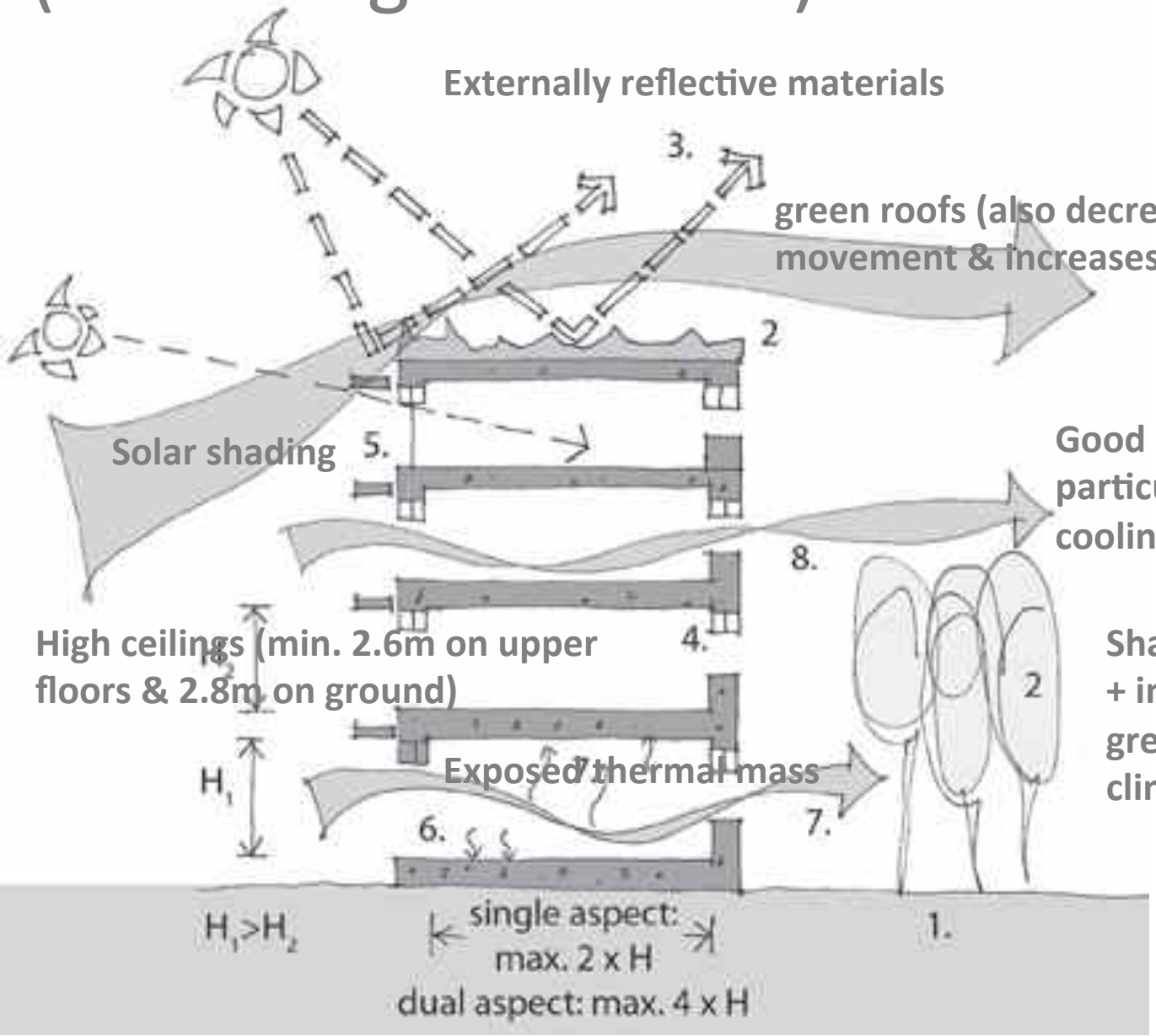


Flooding- design buildings to withstand flooding!

Different building typologies to withstand flooding

A. Sacrificial basement/ ground floor

A raised ground floor with water retention in the basement (storage/car park) area, with residential at first floor. Suitable in zones 1 & 2.
This typology can lead to poor-quality street levels and security issues. Better to put workshop uses with less vulnerability on ground floor and vulnerable uses above to create active frontages. Move all equipment etc. above flood risk level.

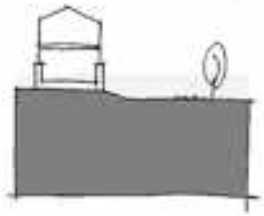
B. Building on stilts

Useful in a flood inundation area; but still needs protection from breakwaters to avoid debris damaging stilts structurally. Suitable in zone 3a. Difficult in an urban environment: issue with the undercroft and aerial walkways, usually lacking surveillance and ownership, leading to poor-quality street level and security issues. Lift or ramps required. Nothing can really grow under the stilts, to utilise as open space. Workshop/community infill space could be useful.

C. Floating buildings

Ground floor rises with water levels up to around 5.5 m. Usually built with EPS polystyrene slabs, with concrete screed over, to achieve floating ground floor base. Suitable in zone 3a/3b. Good for areas where inundation can be controlled. Building on water avoids the need to reclaim land. Services to be encased in flexible pipework to allow vertical movement of buildings. Connection to a floating pier and mooring posts required. Most suited to smaller buildings. Usually low thermal mass buildings, which may lead to issues of summer overheating. Not many UK precedents, but more common in Netherlands.

D. Flood-resilient or 'wet-proofed' buildings



'Wet-proofed' buildings are designed with possible future flooding in mind and with minimal damage to the property when this happens. This may be achieved through the use of water-resistant materials for floors, walls and fixtures and the siting of electrical controls, cables and appliances at a higher than normal level. If the lowest floor level is raised above the predicted flood level, allow ramp access for disabled users. Suitable in all zones.

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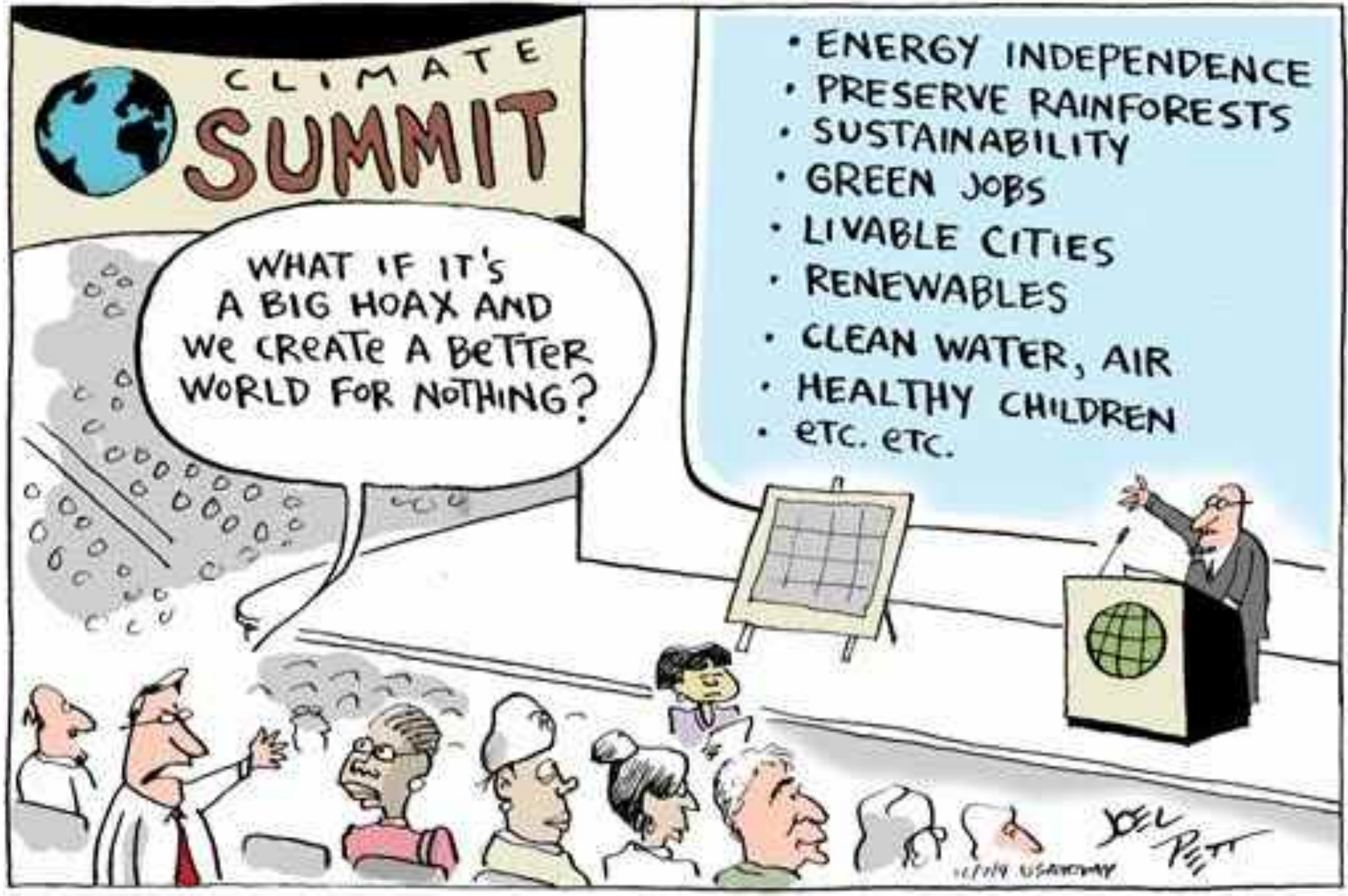
Myth 2

What if global warming is not as bad as predicted?



Comic by Joel Pett.

What is the worst that can happen by building more sustainable?

Then we have:

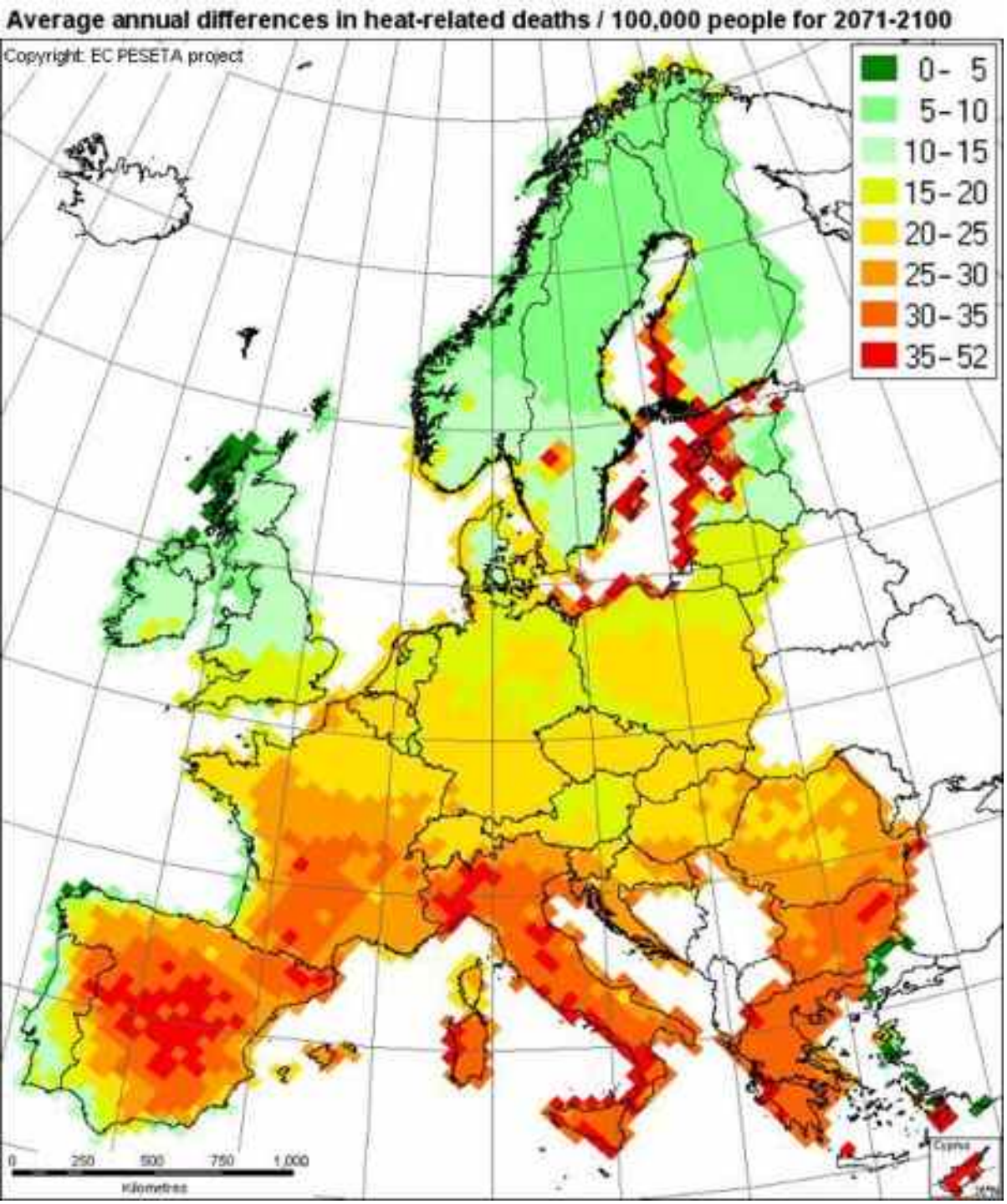
- Provided thermal comfort & healthy buildings 'for nothing'
- Minimised the need for demolition of buildings ' for nothing'
- Reduced CO_2 emissions for 'nothing'

→ **So we will have built better buildings which use fewer resources to build and run 'for nothing'!**

→ **'risks' associated with designing adaptable buildings to climate change are 'benefits' and opportunities.**

But what if we do nothing?

Risk of more of this in UK/world



Predicted increase in heat-related deaths,…

http://peseta.jrc.ec.europa.eu/docs/Humanhealth.html

Doing nothing means we are taking real risks with building stock, resources & (quality of) life

Myth 3

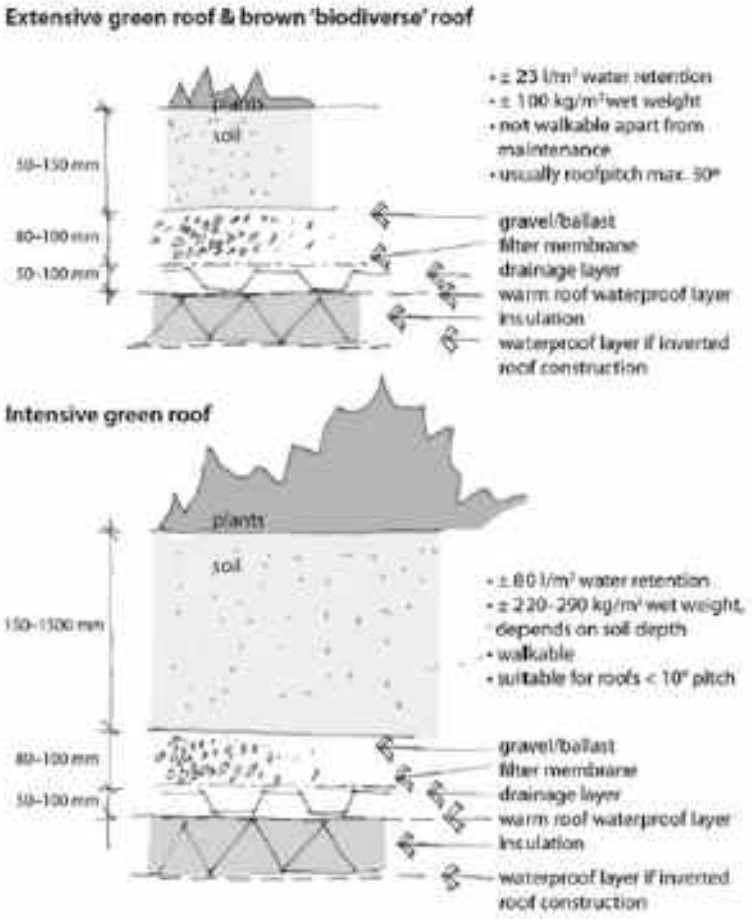
Green roofs are ‘green’, right?

green roofs

Green roofs are great and have many benefits, as long as you specify the right kind of green roof for its region, location, use and exposure

green roofs

there are different kinds of green roofs,……



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1. Extensive ‘sedum’ green roofs

Sedum extensive green roof

2. Intensive (deep) green roofs

2. Intensive (deep) green roofs (Jardin Atlantique, Paris)

green roofs
- a combination

bere:architects

green roofs – extensive green roofs may not be very ‘green’

- The embodied energy of **sedum planted, extensive green** roofs is high
- So try to order locally,

green roofs – what to look out for

- **large** areas (>10m^2) of **unshaded,** thin, (sedum) extensive green roofs are not such a good idea if they need to be irrigated in dry periods
- Only use extensive green roofs in **small areas**, or where shaded, or opt for biodiverse/brown or intensive green roofs (i.e. with deeper soil/ substrate)

green roofs

Green roofs should ideally **not** be combined with solar thermal panels & PV-Ts

green roofs

Are good combined with PV

green roofs & PV

as long as:

- plants do not shade
- Good/safe maintenance access

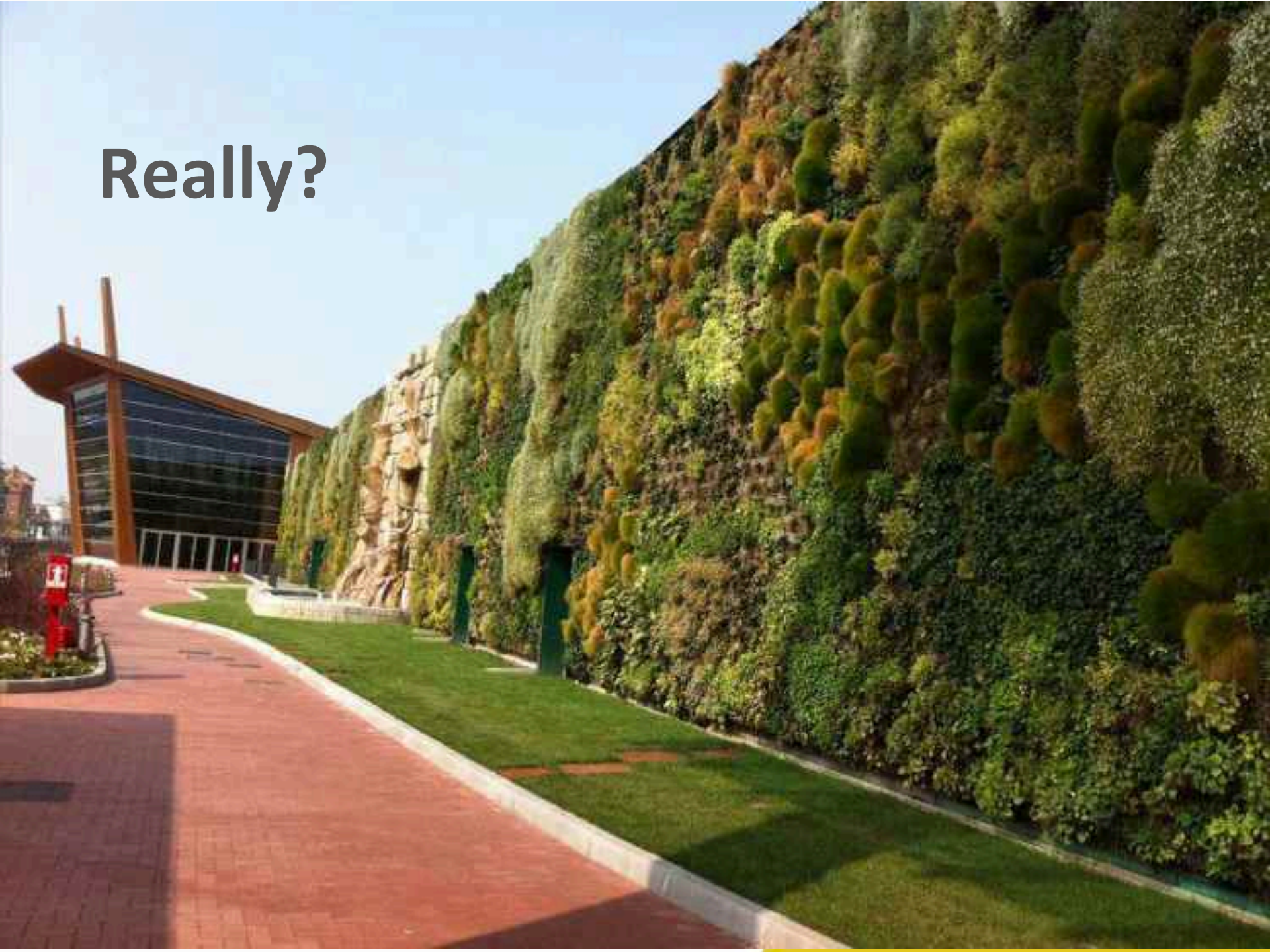
Myth 4

So what about green walls?

‘green walls are “green”?

Jean Nouvel + Patrick LeBlanc

Really?



Really?

- Plants forced to grow horizontal roots in little/ no soil
- Continuous irrigation required (water + nutrients)
- with large energy/carbon costs
- High maintenance
- Many plants fail

Paradise park, London – as intended

Paradise park, London – now

PARADISE
PASSAGE

Grow from ground up instead (Mario Cucinella)

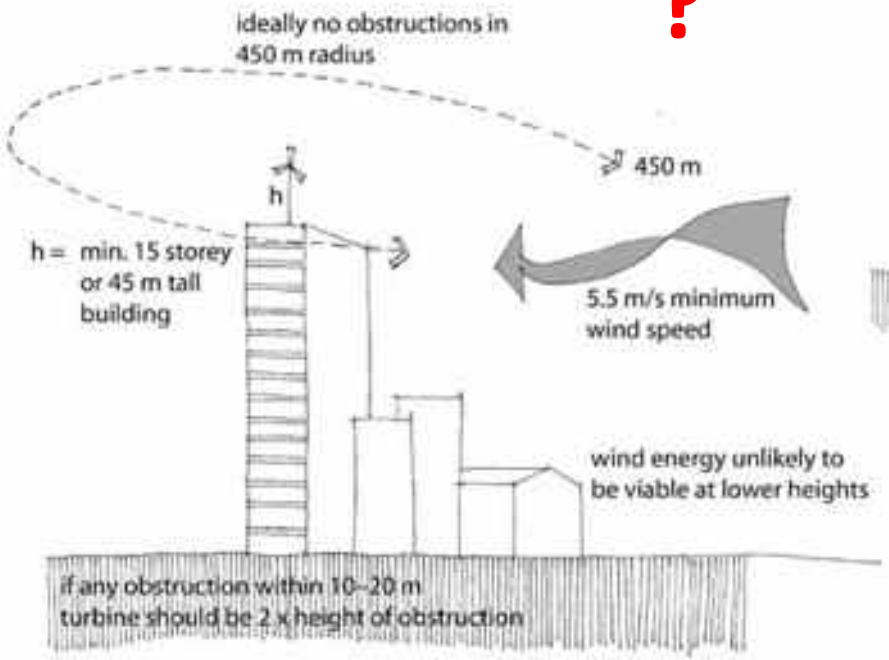
Myth 5

Micro-renewables such as micro-wind turbines are a great idea in urban areas

Micro-wind

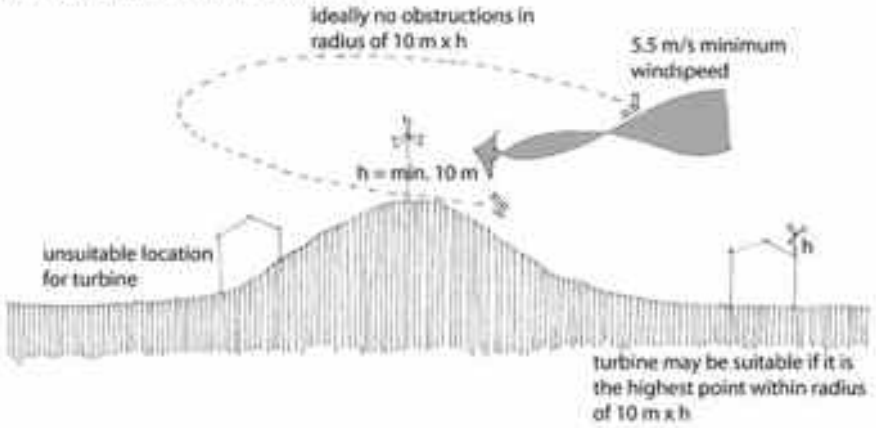
Urban high rise area – may be suitable if ≥ 15 storeys

?



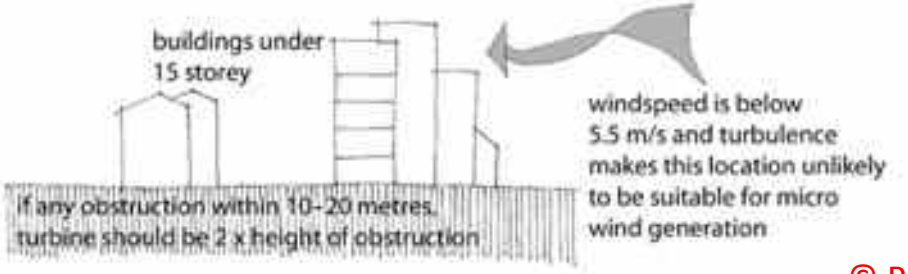
Most appropriate location – rural areas

✓



Urban low rise location – unlikely to be suitable

✗



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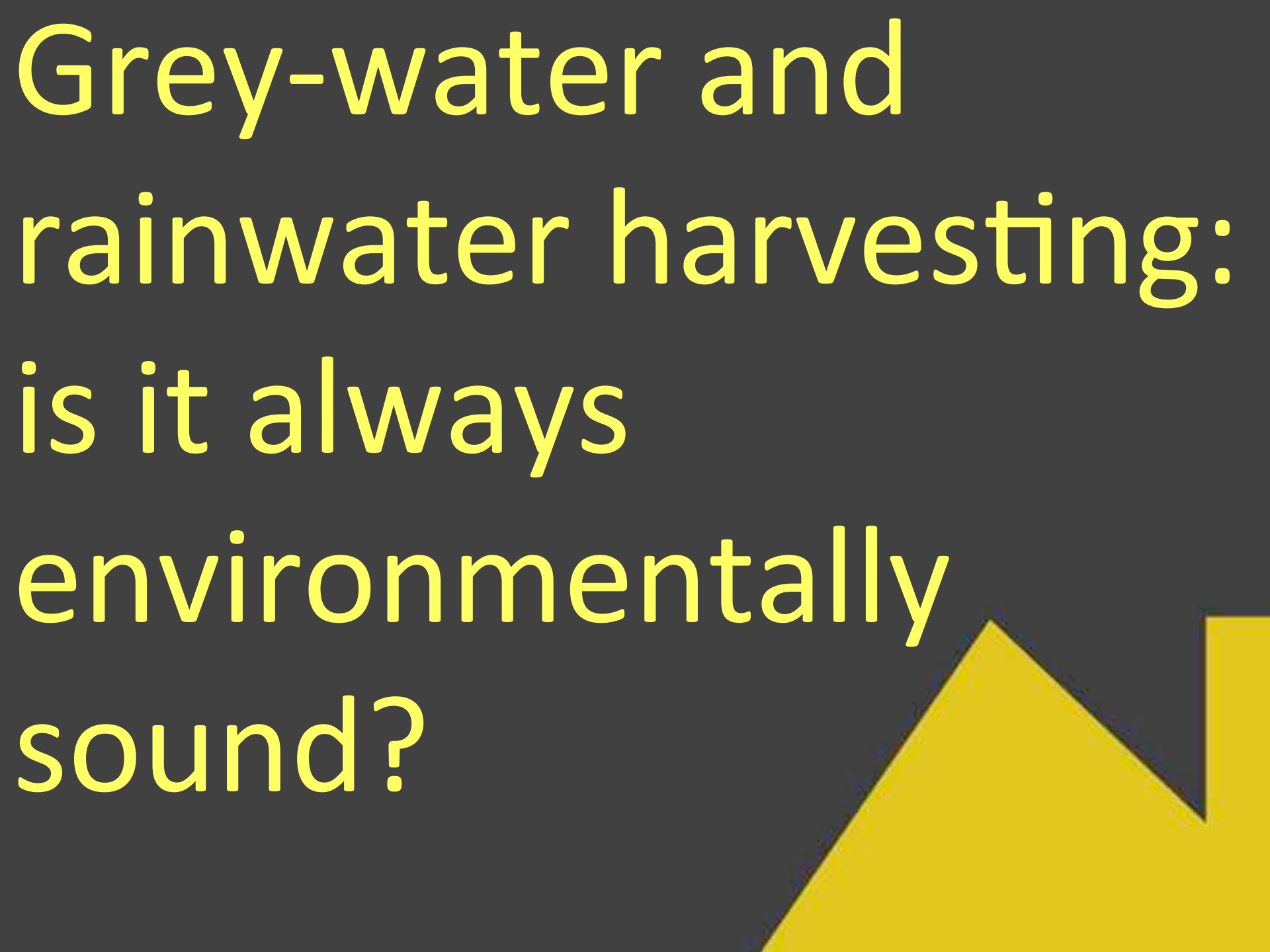
Myth 6

Grey-water and rainwater harvesting: is it always environmentally sound?

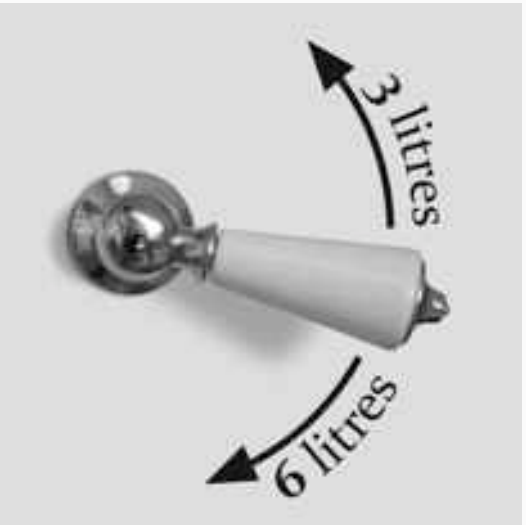


Grey water and rainwater harvesting

- not all systems are **energy efficient**, even if they save water
- it is **not** always a good idea, particularly where electrical pumping and chemical treatment are required
- **Usually higher embodied energy (compared to mains water use)** (dual pipework, system)

→ So a balancing act between CO_2 savings and that which cannot be measured in CO_2 (water)

- **water-efficient appliances** are **always** a priority over water harvesting.



- **Simple harvesting techniques without pumping or long-term storage (so no need to treat water chemically) are best**

Myth 7

‘Eco-measures’ lead to energy savings and reduced bills, right?

Eco-measures= energy savings?

- If we specify energy intensive ‘eco-measures’ such as rain-water harvesting & grey-water recycling, **bills are likely to increase due to increased energy use!**

Eco-measures= energy savings?

For example, Angela Carter close results:

- Energy used
  - Total ranged from 62 - 171 kWh/m2/yr ~ 2.8 fold variation
  - Gas ranged from 41 – 146 kWh/m2/yr ~ 3.6 fold variation
  - Electricity from 20-36 kWh/m2/yr ~ 1.8 fold variation
  - CO2 emissions from 18 – 38 kg/m2/yr ~ 2.1 fold variation

- **Why such big differences??**
  - Temperature choice,
  - Number of occupants,
  - Different orientation
  - User behaviour...
  - Take back?

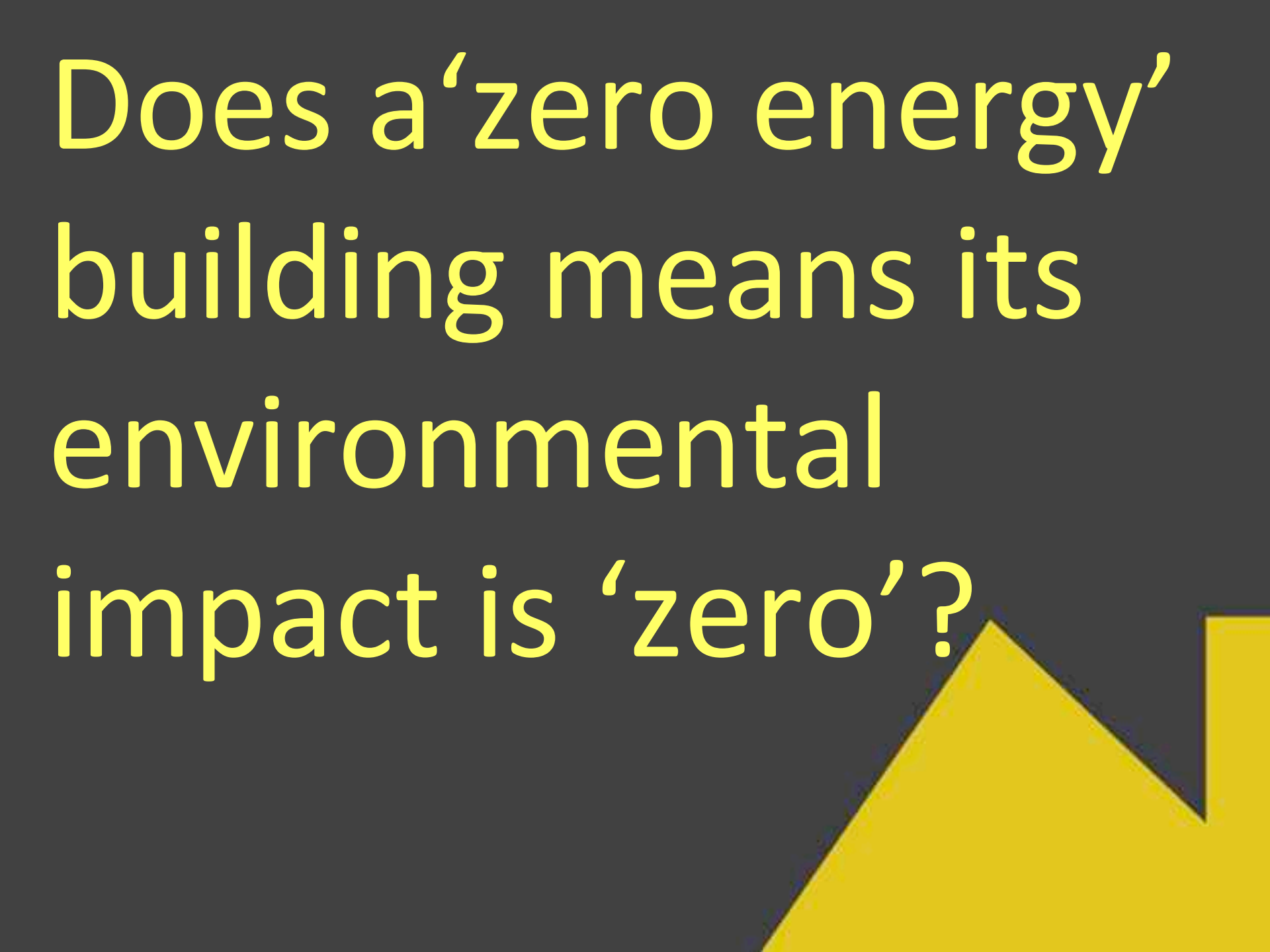
Eco-measures= energy savings?

- **Also: Models** are inaccurate to predict energy use, which may explain wide gaps between predicted vs actual energy use and may not lead to savings

- **And do not underestimate User behaviour**, particularly ‘take-back’, is influential in ‘energy-saving’.

Myth 8

Does a‘zero energy’ building means its environmental impact is ‘zero’?



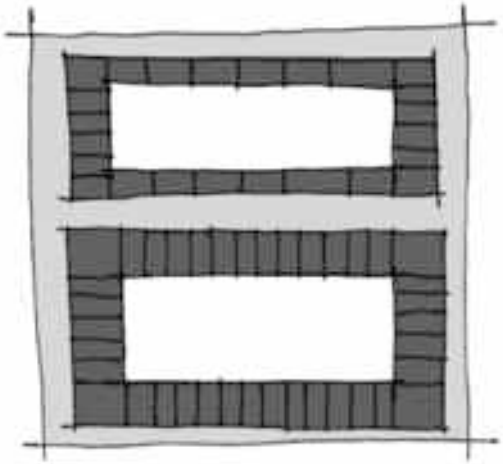
No!

We already identified other environmental impacts which cannot be measured in CO_2

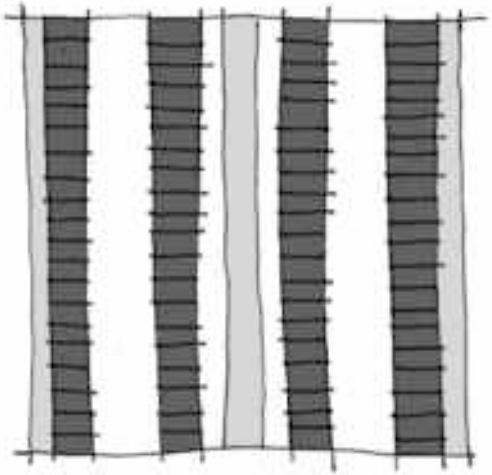
also, $0CO_2$

- Is difficult to achieve, particularly in urban areas.
- Because most urban areas are of **too high density** to achieve 'zero energy'

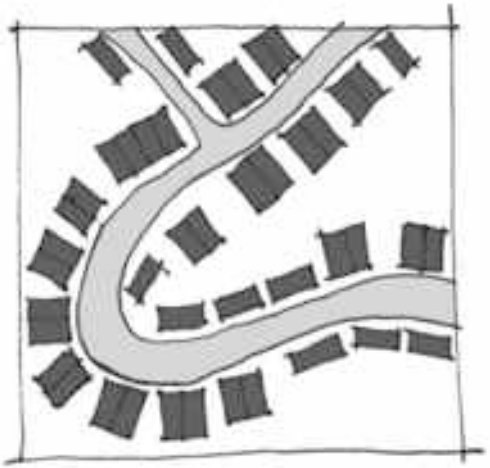
1 ha development & typical densities



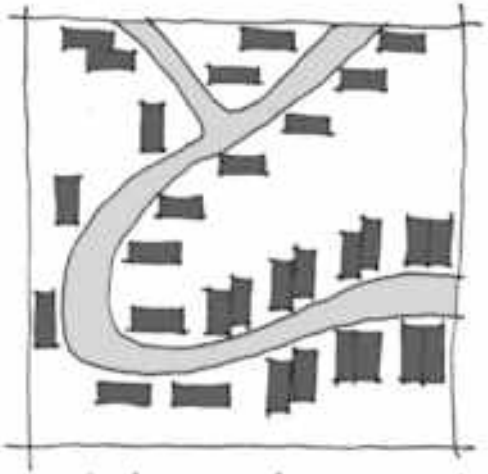
London +/-120 dw/ha



typical terraced house:
65–100 dw/ha



average England:
45 dw/ha



typical zero carbon:
30 dw/ha

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Approx. 100 dw/ha – low energy

Approx. 30 dw/ha – ‘zero carbon’

→ So even if ‘zero carbon’, may not be sustainable in other ways! (transportation energy increases at lower densities)

Myth 9

If I have ‘clean’, renewable energy, it does not matter how much I use of it?

No!

1. Solar panels, wind turbines etc have a high embodied energy and are made from finite resources. **The more energy we use, the more renewables we need!**
2. Most renewables have a 15-25 year life-span. But most buildings last > 60 years.
3. If our building is energy-inefficient & renewables stop working, environmental impact (and bills) will be high and thermal comfort may be compromised

Energy efficiency

= first

renewable

Myth 10

Retrofit of existing buildings= unneeded & boring ?

No!

~27 million buildings in UK – in urgent need of upgrade

How ‘bad’ is the UK stock?

Existing housing stock legacy and CO_2 savings of other standards. Based on a typical two-storey, 100 m² mid-terrace Victorian house

Building Standard (mid terrace house)	**Approximate estimated space heat demand** (kWh/m² per year)	**Estimated CO_2 impact from space heating**	**Estimated CO_2 impact of space heat demand for 7.6 million houses[7]**	**% CO_2 reduction if Victorian house upgraded to higher standards**
solid wall Victorian – UK average[9]	115–215[10]	2500 to 4700 $kgCO_2$ per year	19 to 27 million tonnes of CO_2 per year	—
Part L New dwellings (Region 4)	60	1200 $kgCO_2$ per year	9 million tonnes CO_2 per year	48–72% reduction
zero carbon fabric energy efficiency	39[11]	840 $kgCO_2$ per year	6.4 million tonnes CO_2 per year	66–82% reduction
EnerPHit standard (Section 7.5.3)	25[12]	1300 kg CO_2 per year[13] or 540 $kgCO_2$ if gas	9.8 or 4.1 million tonnes CO_2 per year if electricity or gas respectively	78–88% (gas space heating assumed)
Passivhaus standard (Section 7.5.3)	15	780 $kgCO_2$ per year[14] or 325 kg CO_2 if gas	5.9 or 2.5 million tonnes CO_2 per year if electricity or gas respectively	87–93% (gas space heating assumed)

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Thank you

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