Passivhaus for all

Do you ever look at a wild bird and think it looks too functional?

Laholm October 2019

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Elemental Solutions
Making the complicated simple

Problem:

"I'd love to build a Passivhaus
but I am waiting for the right client"

Passivhaus Designer graduate from 2 years before.

Common reasons given

- Too expensive
- Too difficult
- Too constrained
- No budget at planning stage so can’t even try

If CEPH graduates are finding reasons not to build Passive, what hope is there?

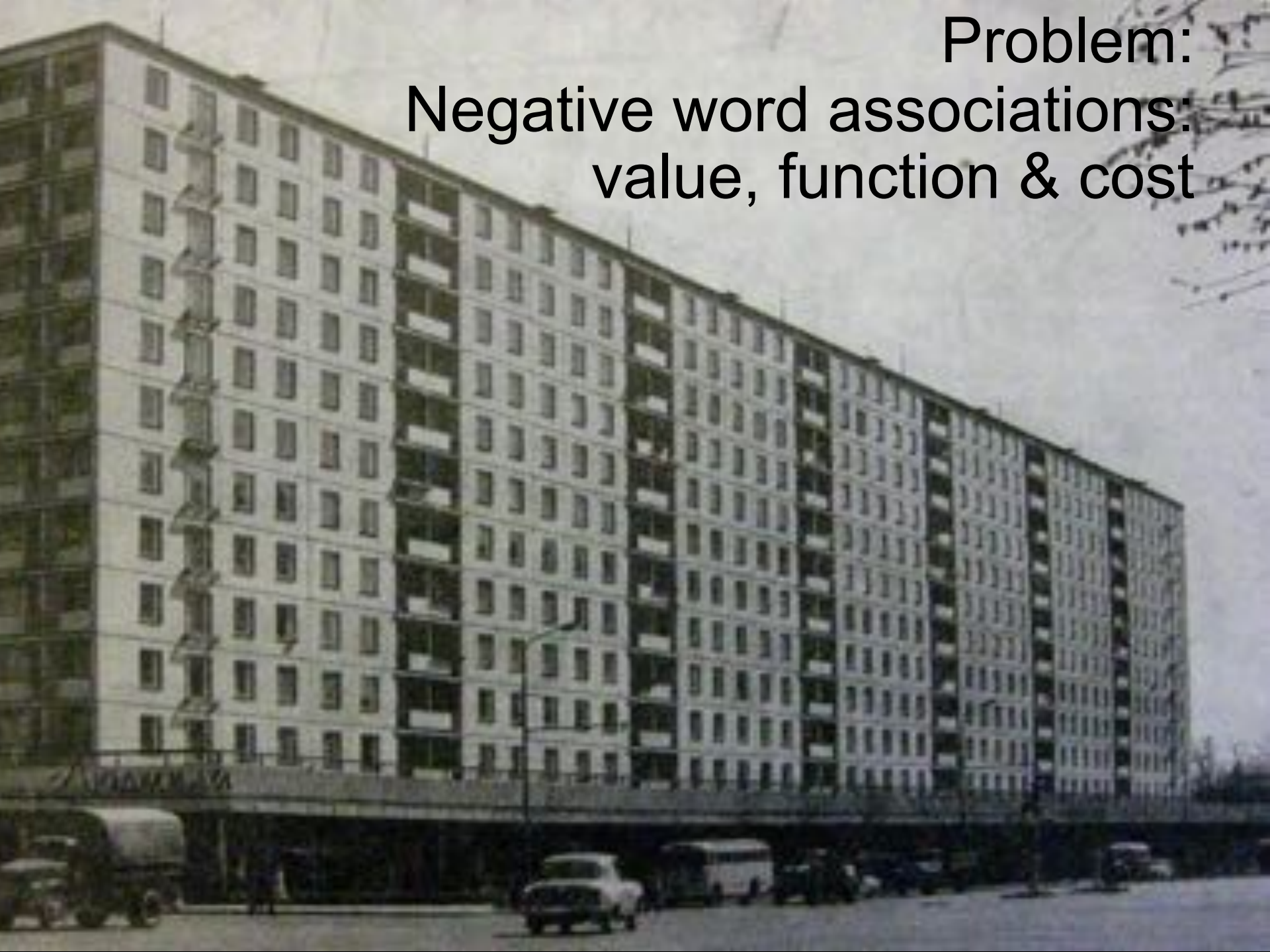
But our house is on fire

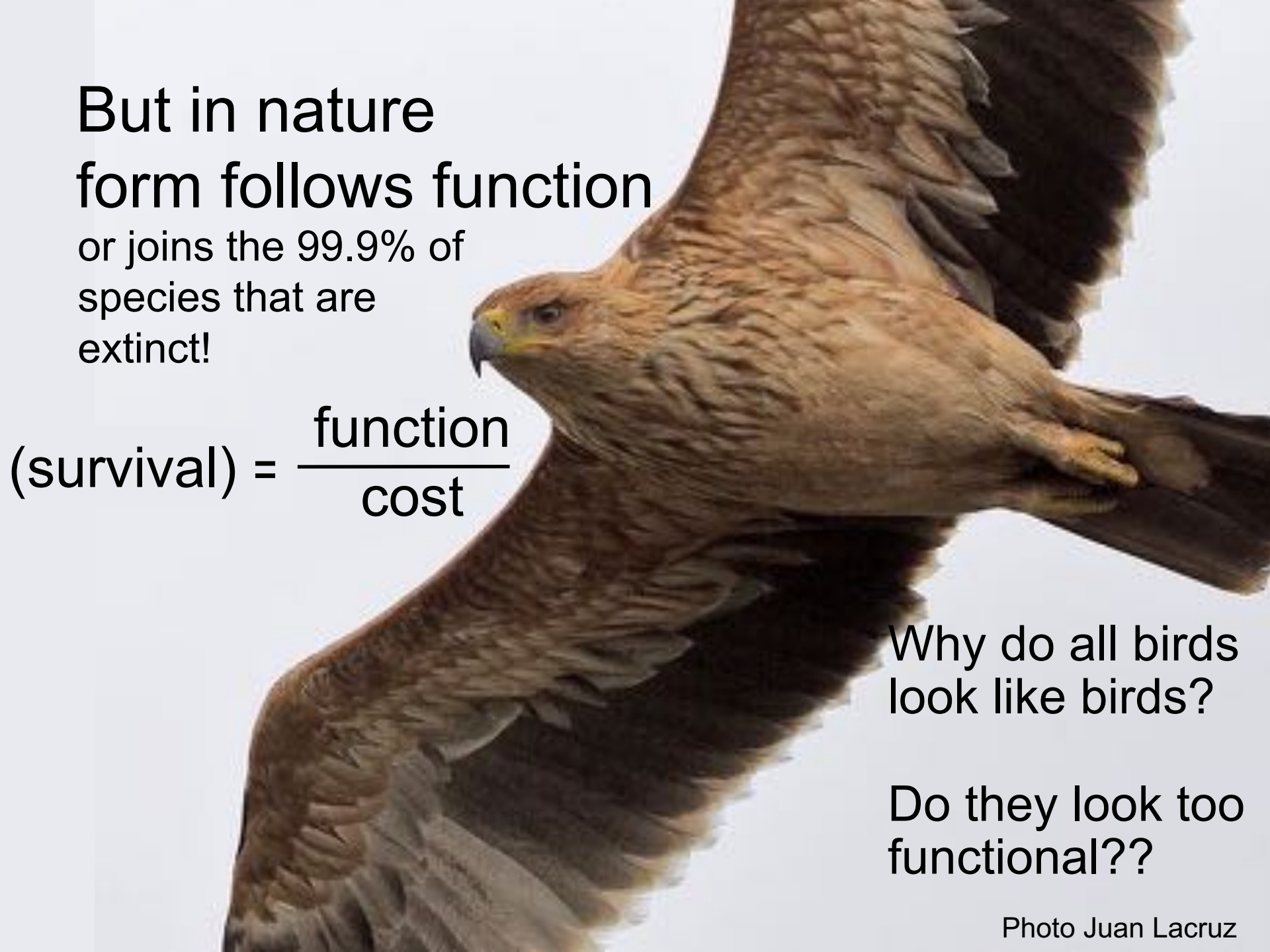
The answer:
Embrace Value Engineering

VE = Doing more for less

$$\text{Value} = \frac{\text{function}}{\text{cost}}$$

First Rule of VE
Function must not be reduced.
No loss of quality or performance


Problem:
Negative word associations:
value, function & cost



But in nature
form follows function
or joins the 99.9% of species that are extinct!

$$(\text{survival}) = \frac{\text{function}}{\text{cost}}$$

Why do all birds look like birds?

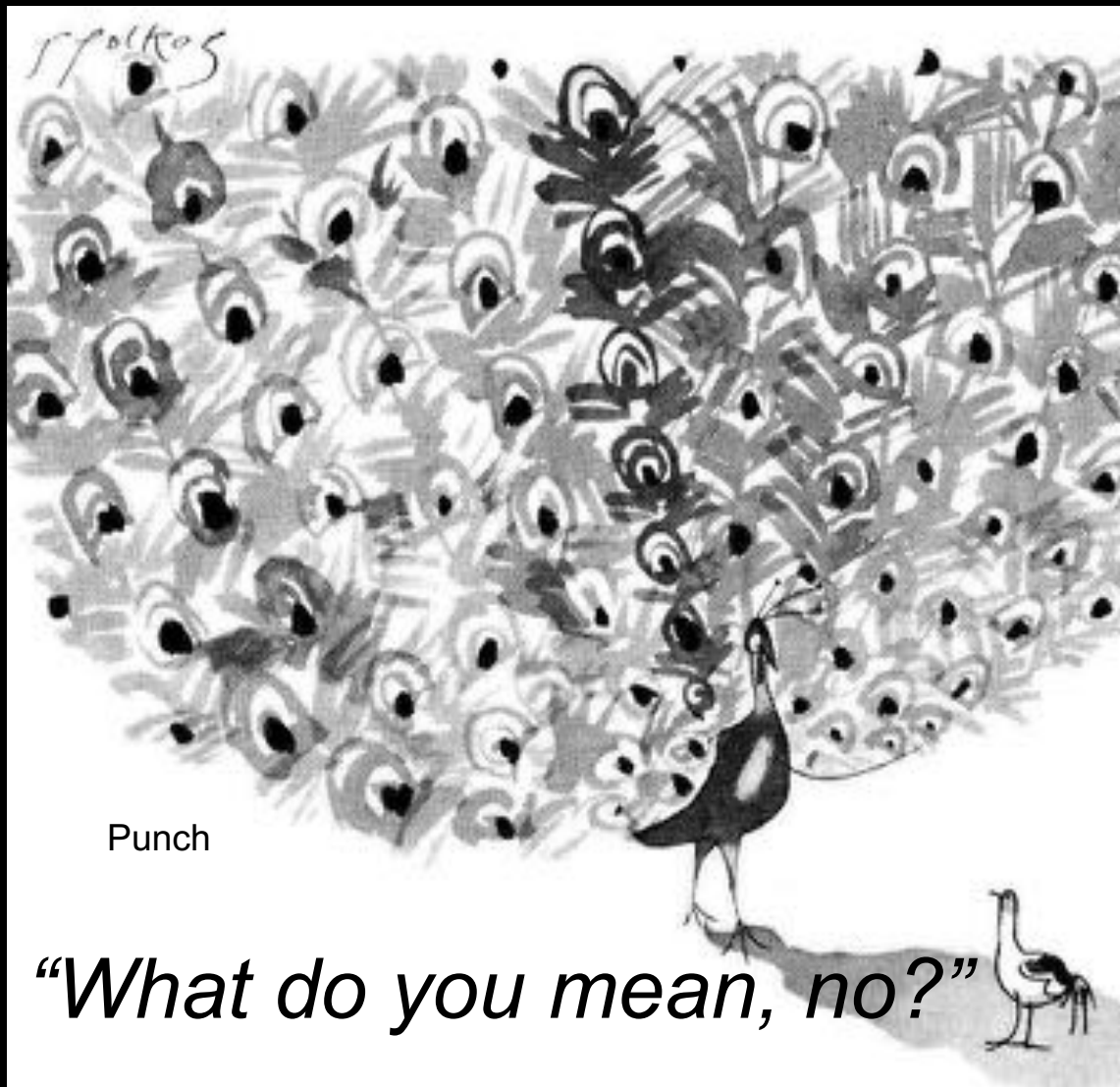
Do they look too functional??

Photo Juan Lacruz

What about peacocks??

"Just the sight of a feather makes me sick!"
Charles Darwin, April 1860

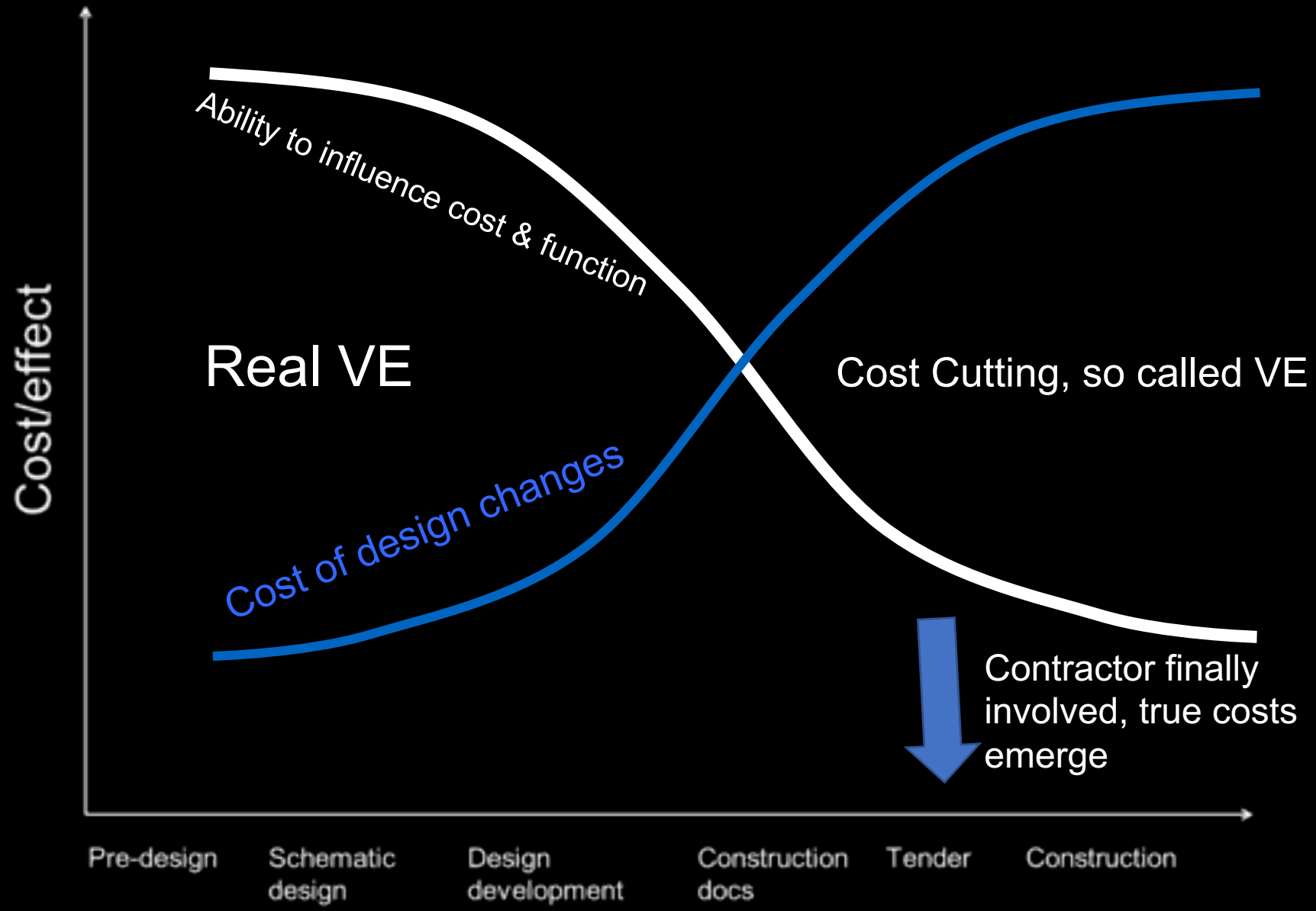
$$\text{Value} = \frac{\text{function}}{\text{cost}}$$



Peacock architecture

$$\text{Value} = \frac{\text{tourists}}{€1{,}000{,}000}$$

Value is designed in not added at end



Don’t confuse them:

Value Engineering

Cost Cutting

Daisy Stone; Flickr

The Eames secret of good design:

"Here is one of the few effective keys to the design problem — the ability of the designer to recognize as many of the constraints as possible — their willingness and enthusiasm for working within these constraints"

Ray and Charles Eames

Is VE just for factory homes?

Architect Charles Grylls
Builder Mike Whitfield
Passivhaus and details Elemental Solutions

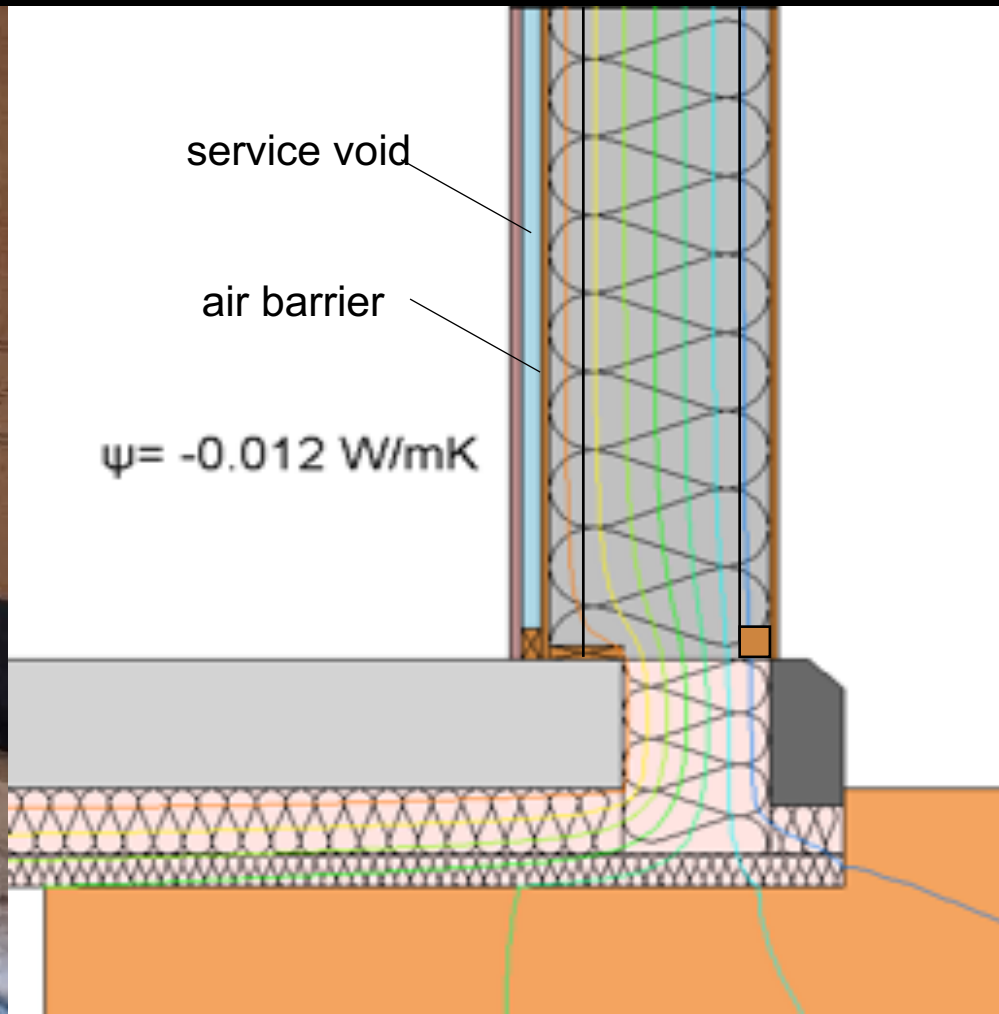
Photo Juraj Mikurcik

Ultra lean balloon framed
Minimal thermal bridges

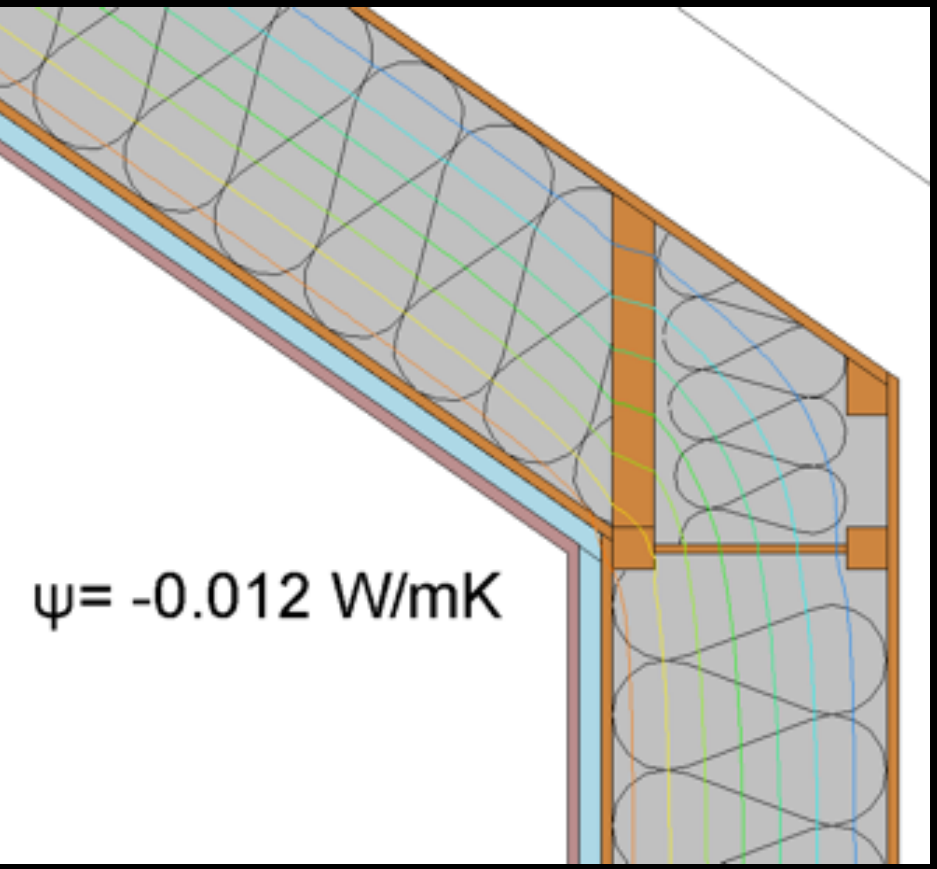
Radically simple stick built on site

300mm I studs on slab edge!

(Specific site built design, different approach needed for factory)

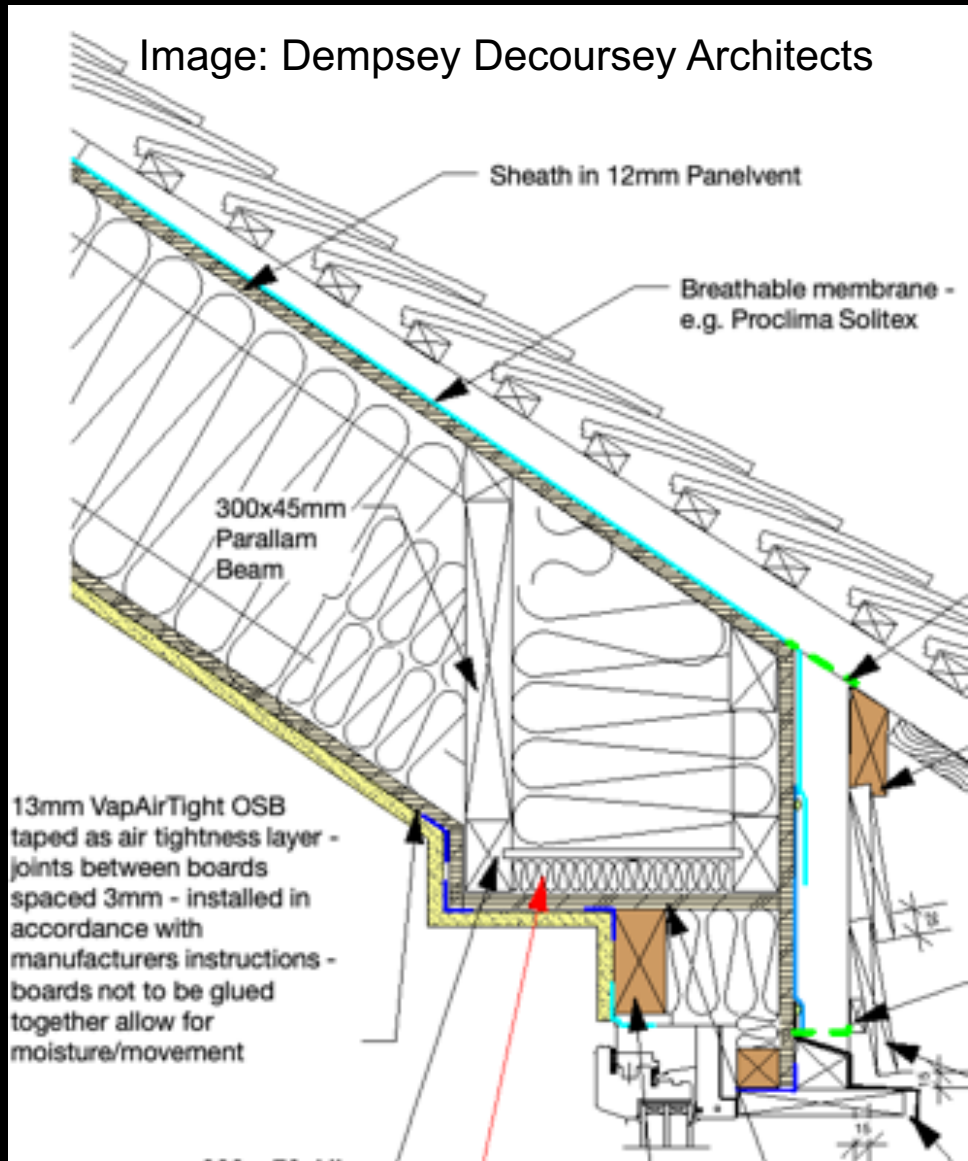


Details reused saving time & errors



Architect: Charles Grylls Dempsey Decourcy Architects
Building physics: Nick Grant
Builder: Mike Whitfield Construction
Structural Engineers: Allan Pierce, Beth Williams
Services: Alan Clarke

Image: Dempsey Decoursey Architects



Simple is not obvious

Cheaper
More weatherproof
Better thermally
More elegant
More satisfying work
Better look (can leave visible)

Is VE just for poor people?

warren benbow architects


warren benbow architects

Sloping site, architect and builder's first Passivhaus, high end finishes, Viessman ground source heat pump, underfloor heating, winner of architectural awards . . .

€4,000/m^2?

Extra for Passivhaus +10%? +20%?

Result:
£704k construction cost
351m^2 Gross Internal Floor Area, £2000/m^2
26000 SEK/m^2

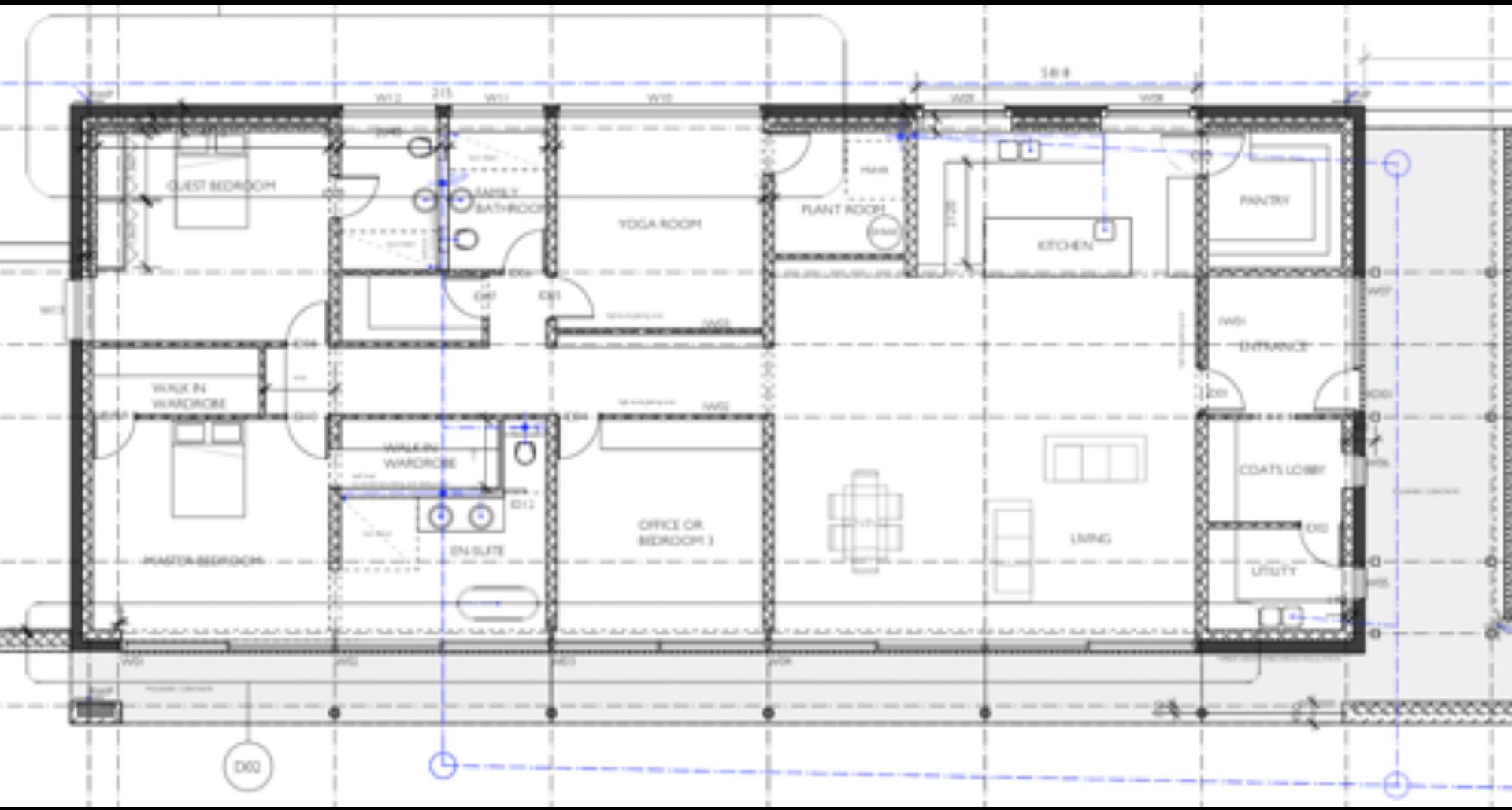
"Forget Passivhaus, it's a £1.5M house for £700K!"

Jon Broome, architect visiting the house.

Constraints not compromise

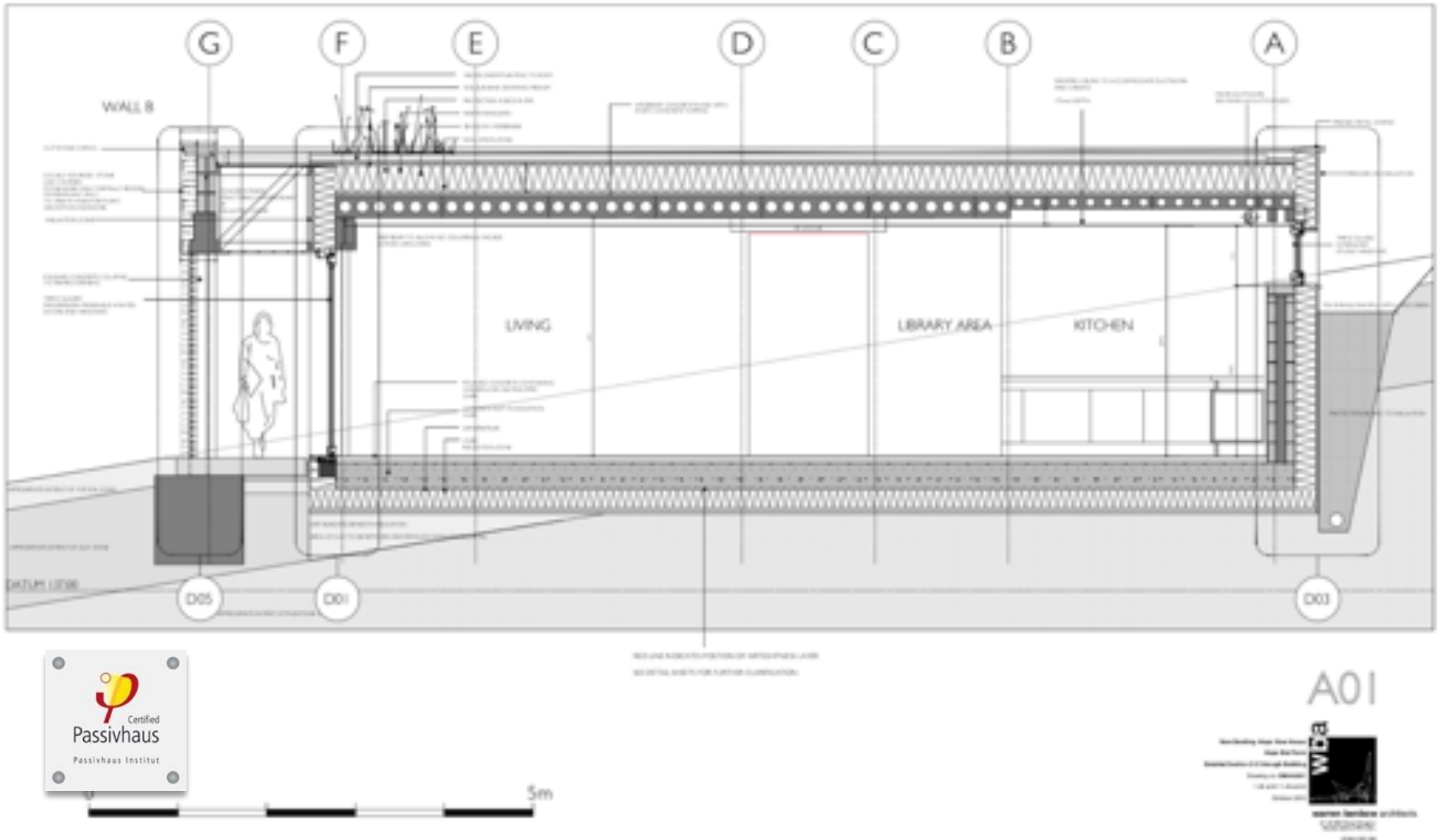
Simple plan, PHPP from the start.

The plan looks boring but the building is not viewed like this!



Simple structure, simple airtightness

Structural engineer in first design meeting



Example - Old Holloway Cottage
Beautifully simple

Juraj Mikurcik

Eco Cocon
Cradle to Cradle

Photos: Juraj Mikurcik

Photo: Juraj Mikurcik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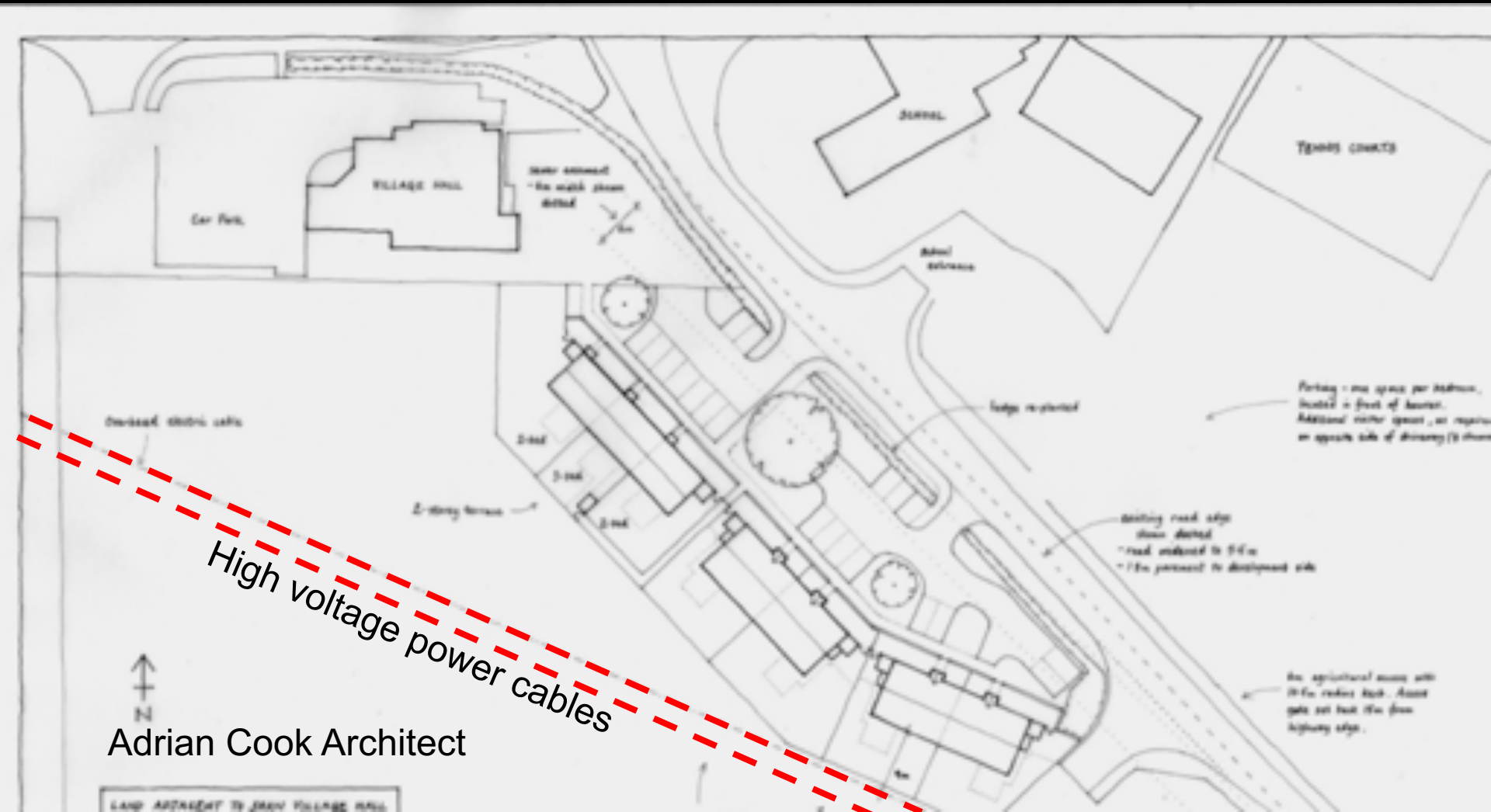
IKEA
IKEA
Better value than a €4000 Corbusier Chaise!
Photo: Juraj Mikurcik

PHPP and VE

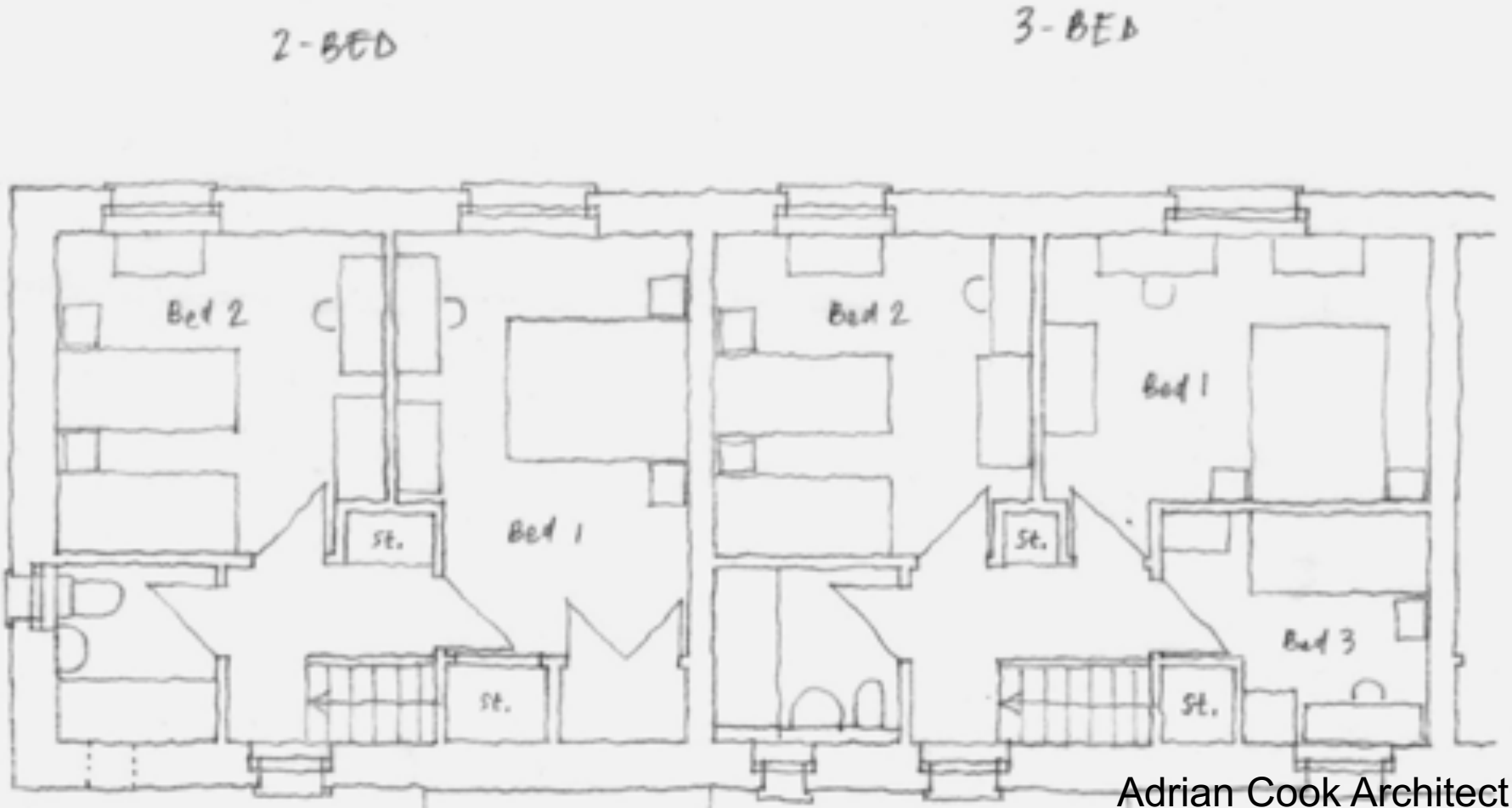
Constrained rural site faces south west, road, contours, power lines, footpath etc. . .



Constraints create the floor plans

Accessibility, space standards, storage, daylight, views, vent, escape etc

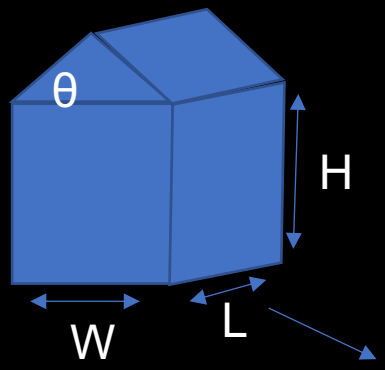
Always room for creative solutions but the plan pretty much designs itself



Adrian Cook Architect

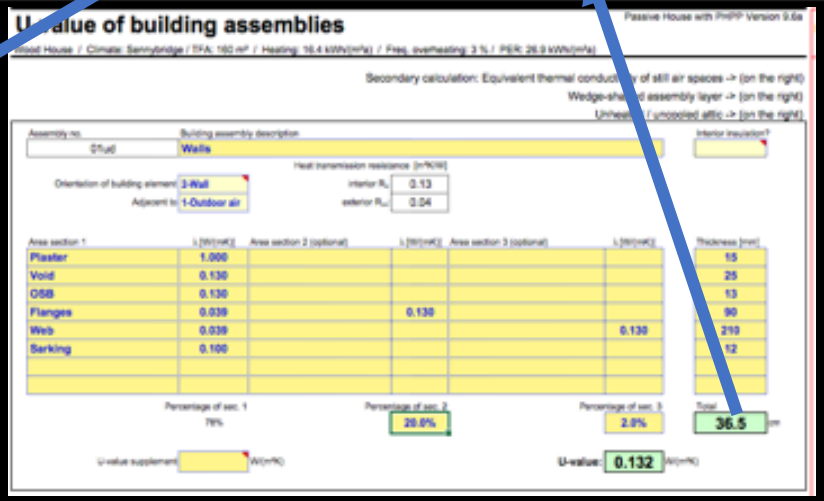
Constraints - no PH designer fee!

House shaped house assumed from start as most cost effective, allows simple PHPP.



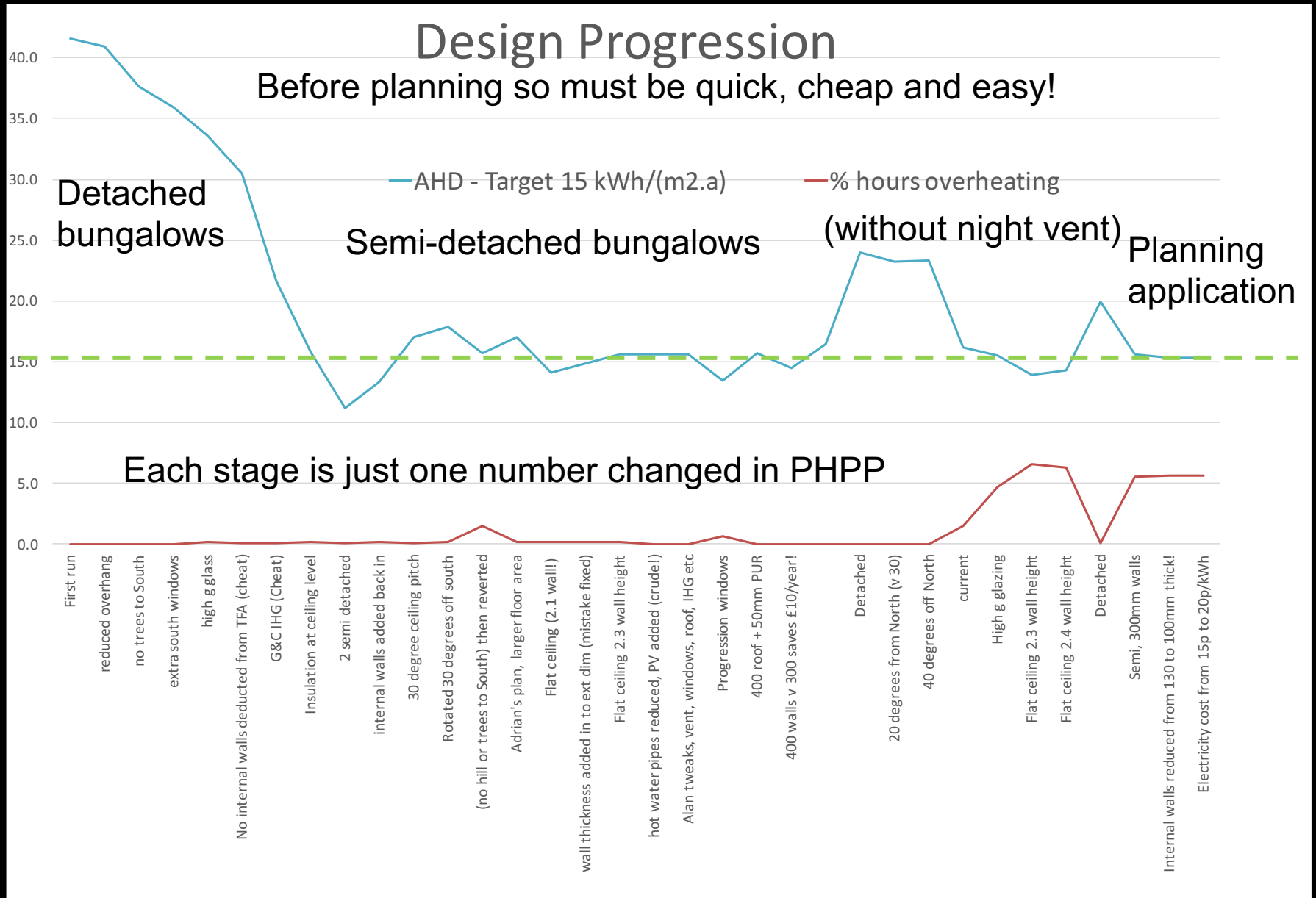
1	Floor	11	Floor slab / basement ceiling	1	x (	11.08	x	8.98	+		
2					x (		x		+		
3	West wall	8	External wall - Ambient	1	x (	11.08	x	5.61	+		
4	East wall	8	External wall - Ambient	1	x (	11.08	x	5.61	+		
5	South wall	8	External wall - Ambient	1	x (	8.98	x	5.61	+	14.12	
6	North wall	8	External wall - Ambient	1	x (	8.98	x	5.61	+	14.12	
7	West roof	10	Roof/Ceiling - Ambient	1	x (	11.08	x	5.48	+		
8	East roof	10	Roof/Ceiling - Ambient	1	x (	11.08	x	5.48	+		
9					x (		x		+		
10	GF gross internal	1	Treated floor area	1	x (	10.35	x	8.25	+		
11	FF GIFA	1	Treated floor area	1	x (	10.35	x	8.25	+		

19	Dimension input here:		
20	Internal length		
21	10.35		
22	Internal width		
23	8.25		
24	internal wall h	=2.6+0.3+2	
25	4.9		
26	Pitch degrees		
27	35.0		

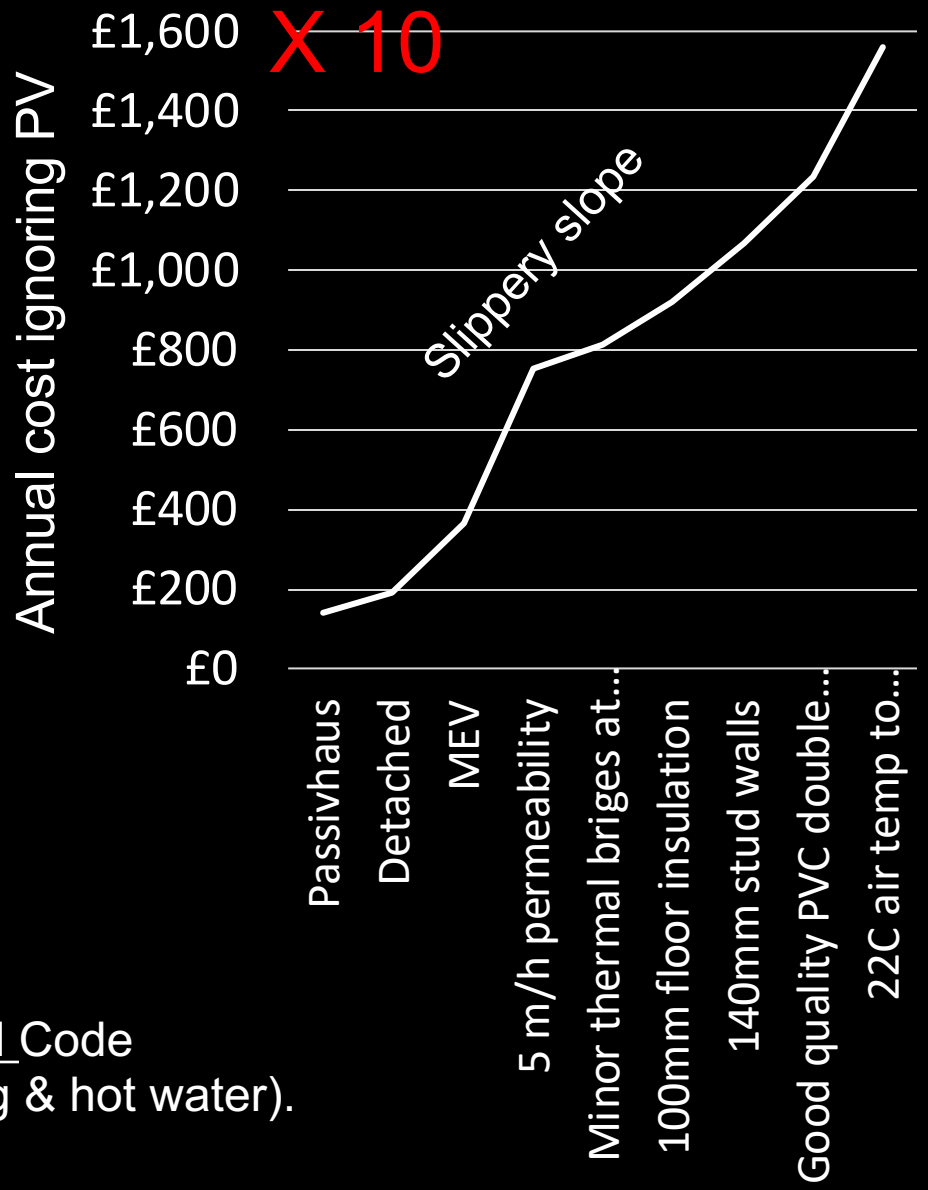


5 numbers define the envelope & orientation
of a simple house-shaped house
20 minute PHPP (plus 1h for TFA and Vn50!)

PHPP as time-saving tool not extra cost



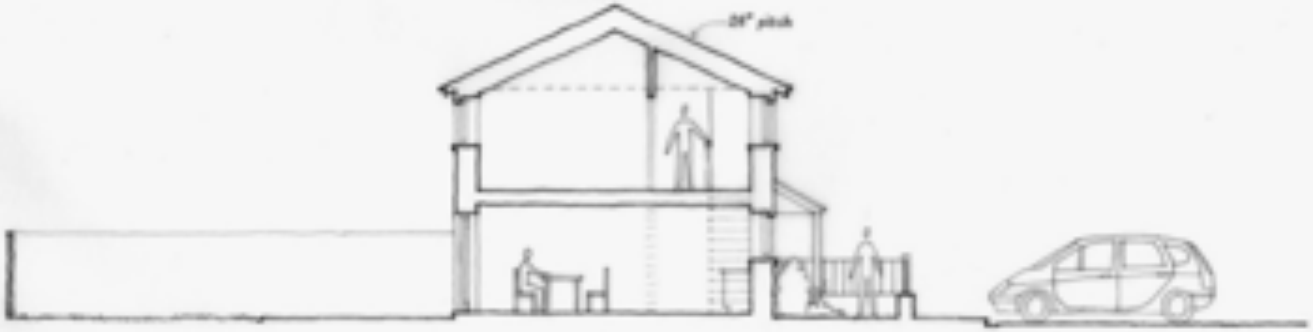
“How about nearly Passivhaus?”



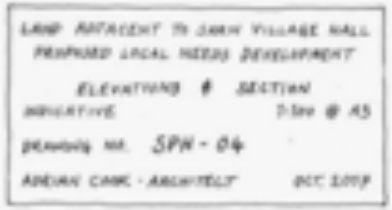
From Passivhaus to <u>well constructed</u> Code bungalow (with direct electric heating & hot water).

Process led to ‘vernacular’ look

BUNGALOWS - FRONT ELEVATION



Adrian Cook Architect



The local vernacular;
also emerged from (different) constraints

True vernacular design is an approach not a style

Passivhaus and climate emergency

What else is limiting uptake?

- Too geeky – getting more complex
- Risk of ‘failure’ leads to overdesign
- Proprietary

How can we simplify Passivhaus?

Cheap and simple can be effective . . .

Would Greta have been more effective with professional designed sign?


ZERO JOBS
DEAD
PLANET
IT'S
TO

Simplifying Passivhaus

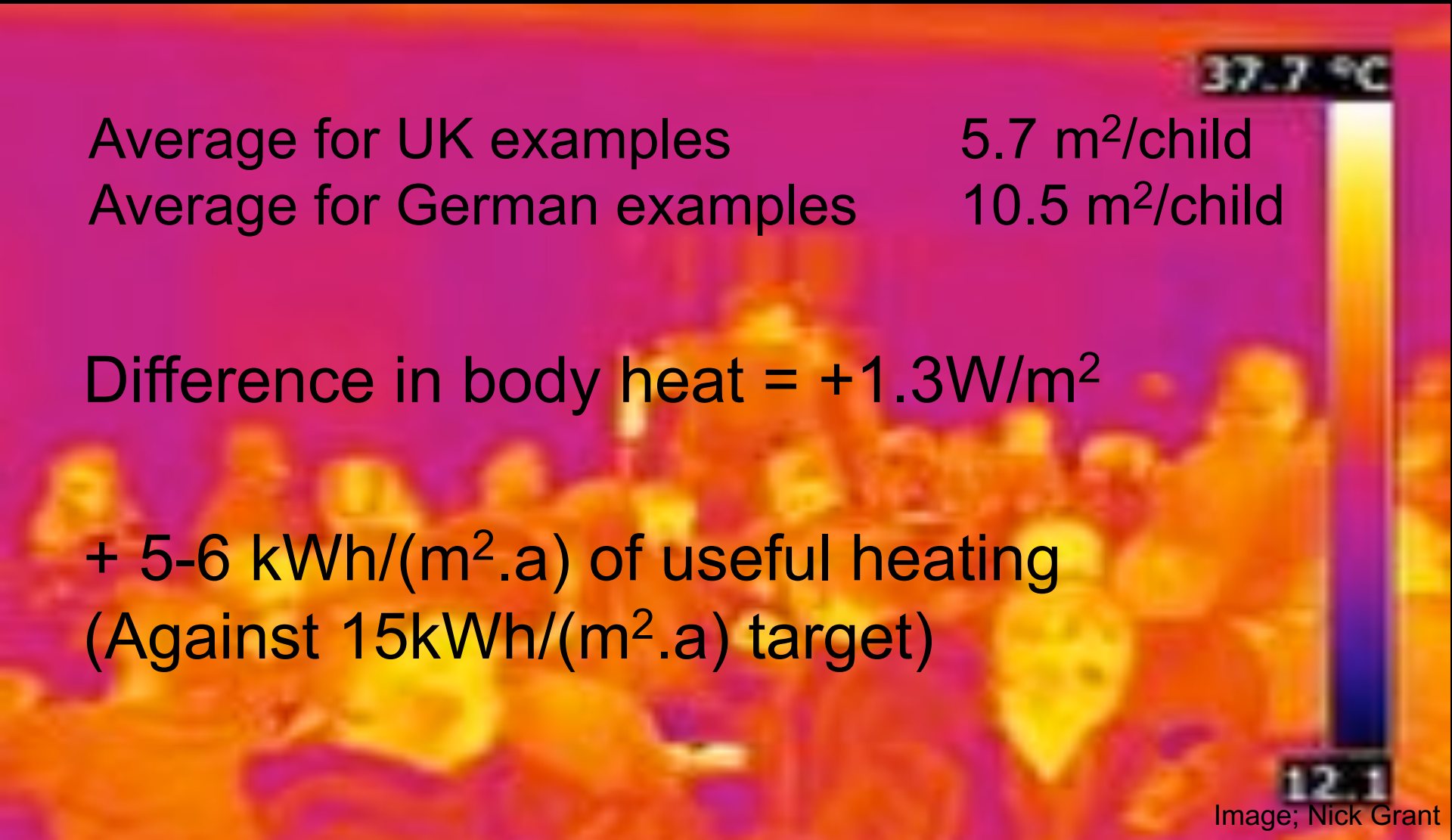
- Building on experience
- Avoiding over-design

But there is fear that standards will slip! Remember the first rule of Value Engineering, function, performance and quality must not reduce.

How can we make changes?

Example – experience

British kids are hotter than German kids!



Average for UK examples 5.7 m^2/child
Average for German examples 10.5 m^2/child

Difference in body heat = +1.3W/m^2

+ 5-6 kWh/(m^2.a) of useful heating
(Against 15kWh/(m^2.a) target)

Image; Nick Grant

Wilkinson Passivhaus School

Higher IHG assumption in PHPP had a big impact on the design, cost and performance. Extra constraints also helped, budget time etc.

Image Courtesy Architype. © Dennis Gilbert/VIEW

So how much worse with the cheat?

Cheapest build, much better better summer comfort (lower g and less glass)
But how much more energy use? 5%? 10%

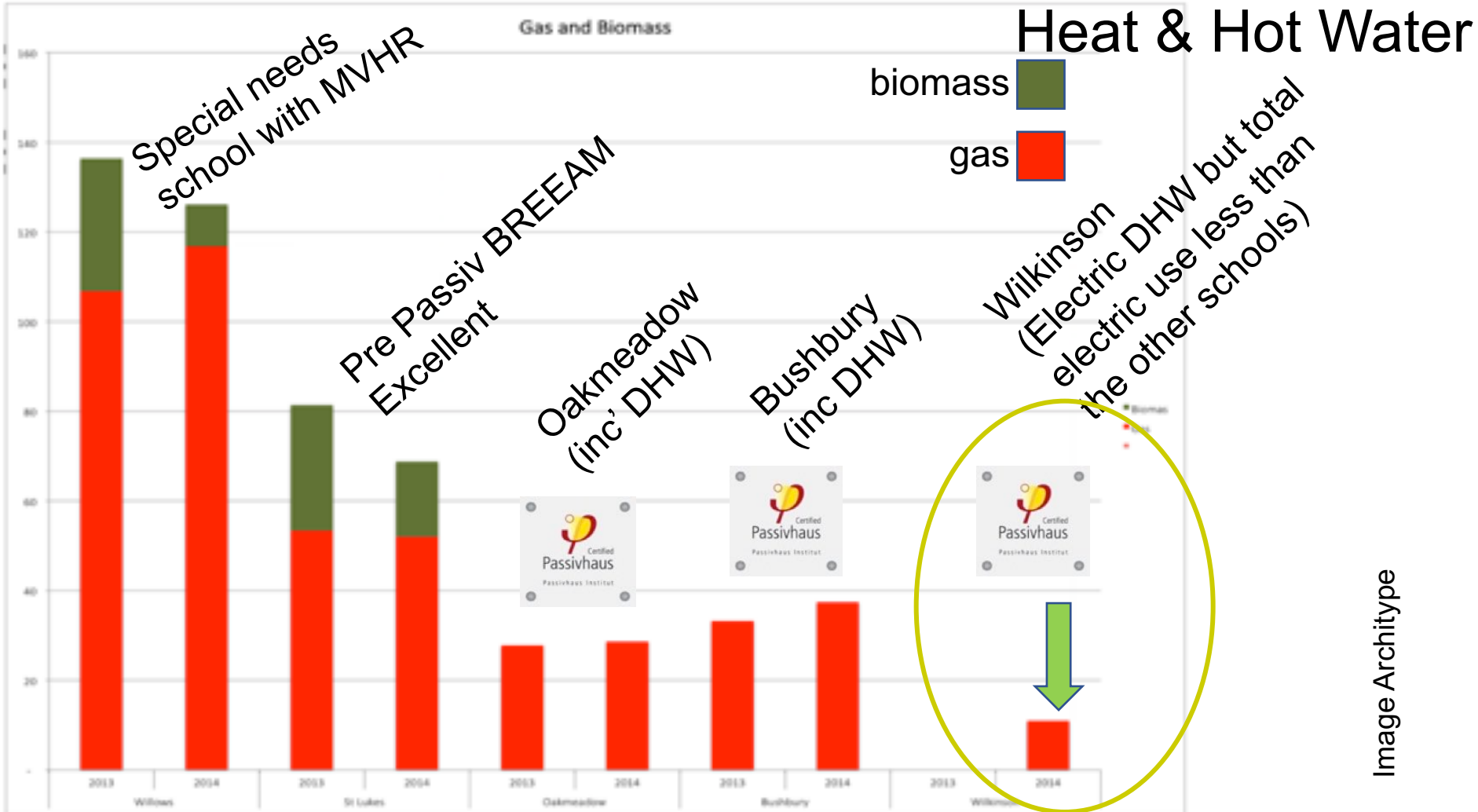
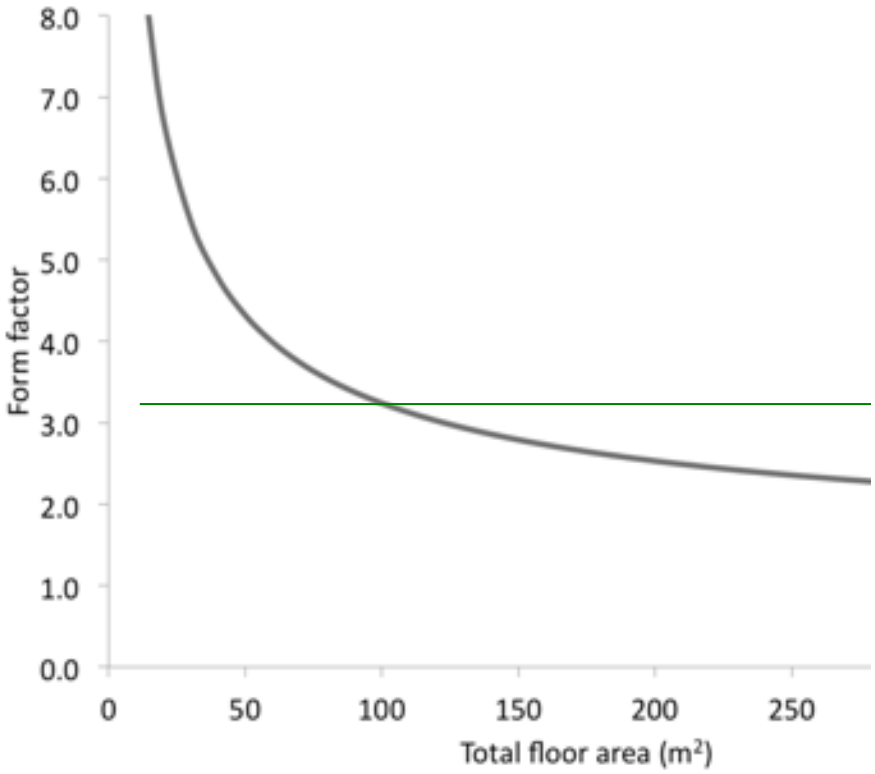


Image Architype

Experience-small homes and flats

In UK, insulation thickness = Form factor x 100mm
Small Passivhaus was not practical

Form factor = heat loss area / floor area



Sorted in PHPP 9 (almost)

IHG curve cancels form factor curve

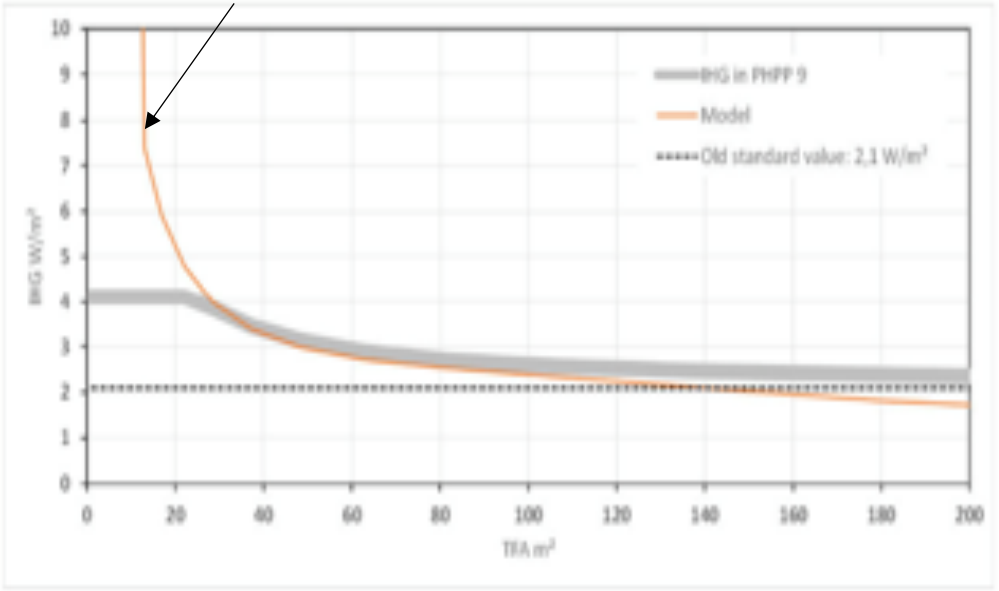


Figure 6: IHG depending on the living area, as used in the PHPP 9

Risk of missing 15kWh/(m^2.a) results in over-design

??

Worse for:

Shaded sites and microclimates

East/west detached dwellings

- Adds considerable cost for minimal benefit – e.g. extra glass and insulation. Increases risk of summer overheating.
- If first project then extra slack

Agar Grove VE

UK's largest PH scheme

- Insulation from 300mm to 150mm
  - This reduced thermal bridges
- PHPP 9 IHG - 2.2 kWh/(m^2.a)
- Relaxed design closer to 15kWh/(m^2.a)

- PE for certification a challenge because of high density – a serious issue for flats. PE/m^2 is the wrong metric.

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Hawkins\Brown

ARCHITYPE

Elemental Solutions
Making the complicated simple

Agar Grove

Too late for deep VE, only changes that do not alter the look were allowed.

Hawkins\ Brown ARCHITYPE

Bespoke specifications across site? Or standardise and over design?

1
2
3
4
5
6

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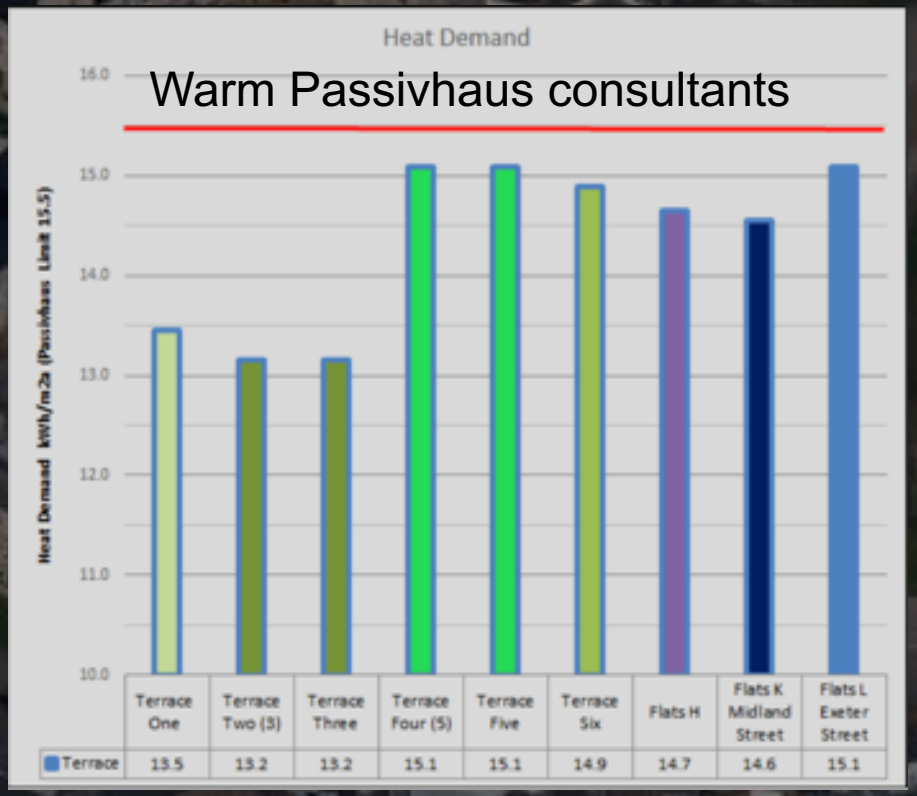

With compact homes, winter heat is not an issue but summer comfort is

A very small sign of hope

RIBA Stirling Prize 2019

Award winning VE

Mikhail Riches

Passivhaus consultancy by Warm

But is it prize winning architecture or ‘virtue signalling’??

The 2018 winner, (before the Greta effect)

Finally;
Birds look like birds
Cost effective Passivhaus looks like
Cost effective Passivhaus

The following images are a non exhaustive selection of UK Passivhaus buildings that I think are good examples of cost effective design.

* means that Elemental Solutions were not involved with the project

Architect; Juraj Mikurcik

Architect; Dean Benbow

Architect; Hawkins Brown/Architype


Architect; Charles Grylls

Architect; Adrian Cook (north elevation)

Architect; Adrian Cook (south elevation)

Architect; Architype


Architect; Architype

*Architect; Mikhail Riches

Architect; Sjolander da Cruz

Architect; Charles Grylls


*Mitchell Architects
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*Mole Architects

Architect; Eco Arc


*Architect: Hamson Barron Smith
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Summary

- Cheaper and simpler can actually be better
- Love Value Engineering, embrace constraints
- Passivhaus MUST get MUCH easier to have impact
- Solutions need to be open


Would Greta be impressed by our approach?

Thanks For Listening
Questions please

I have some for you:

- What about retrofit?
- What about construction and retrofit emissions?

The scale of the problem is HUGE

Nick Grant

Elemental Solutions

Making the complicated simple

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