

DO
SOMETHING,
YOU BUNCH
OF MANIACS!

WELL! IT'S
EASY TO JUST
CRITICIZE,
YOUNG
LADY...

...AND
I SUPPOSE
YOU'VE GOT AN
ALTERNATIVE ALL
WORKED OUT,
HAVE YOU?

HYSTERICAL
ECO-FANATICS!
ALWAYS TELLING
PEOPLE HOW
TO LIVE...

GET
YOURSELF
A PROPER
JOB!

Polyp.org.uk



a viable
future?

"I don't want your hope. I
want you to panic.
I want you to feel the fear
I do.
Every day.
And I want you to act.
I want you to behave like
our house is on fire.
Because it is."

Greta Thunberg

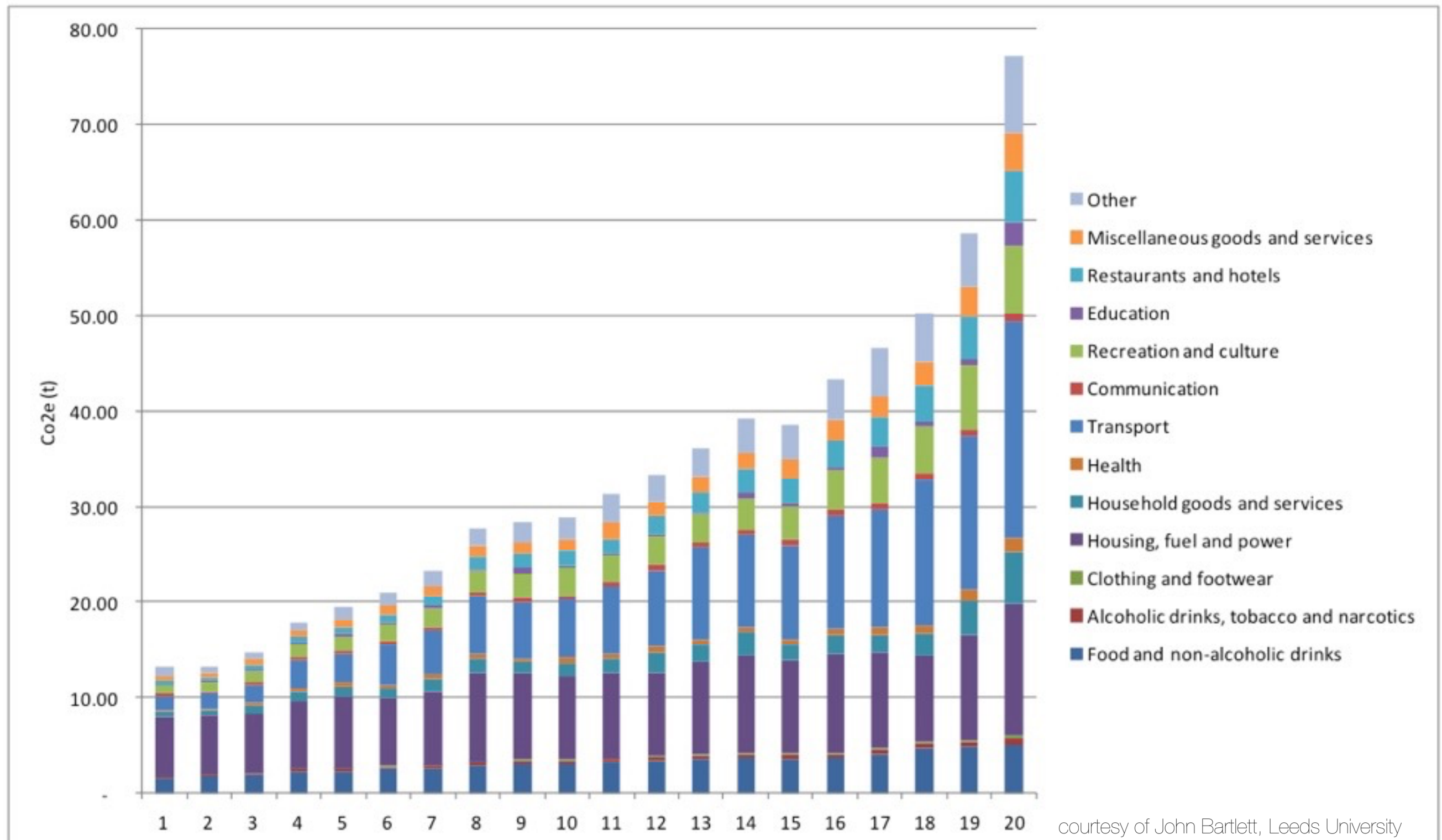


our share of emissions is not equally spread

Carbon Emissions by income



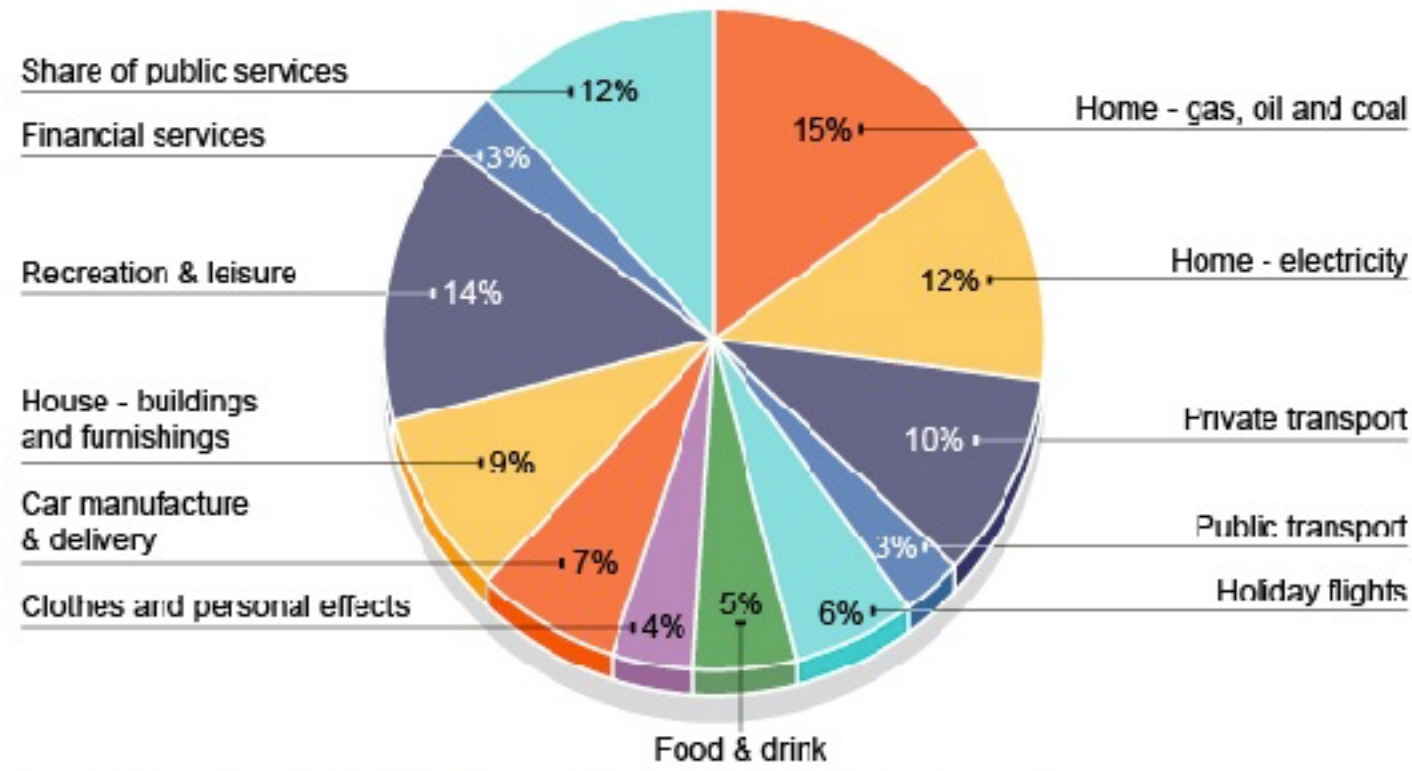
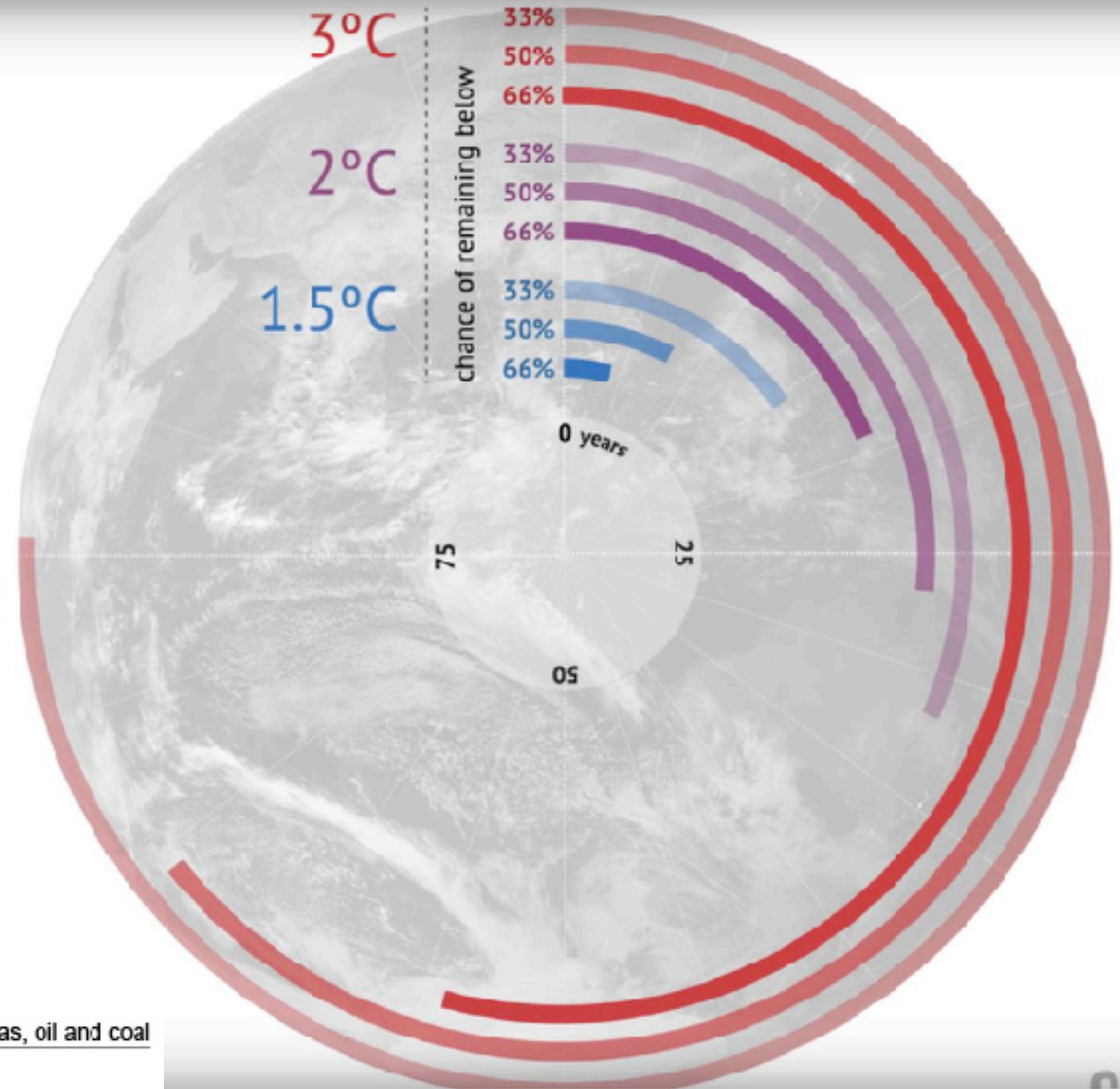
UNIVERSITY OF LEEDS





Carbon Countdown

How much time is left before we **use up** our carbon budgets for different levels of global warming?



carbon budgets

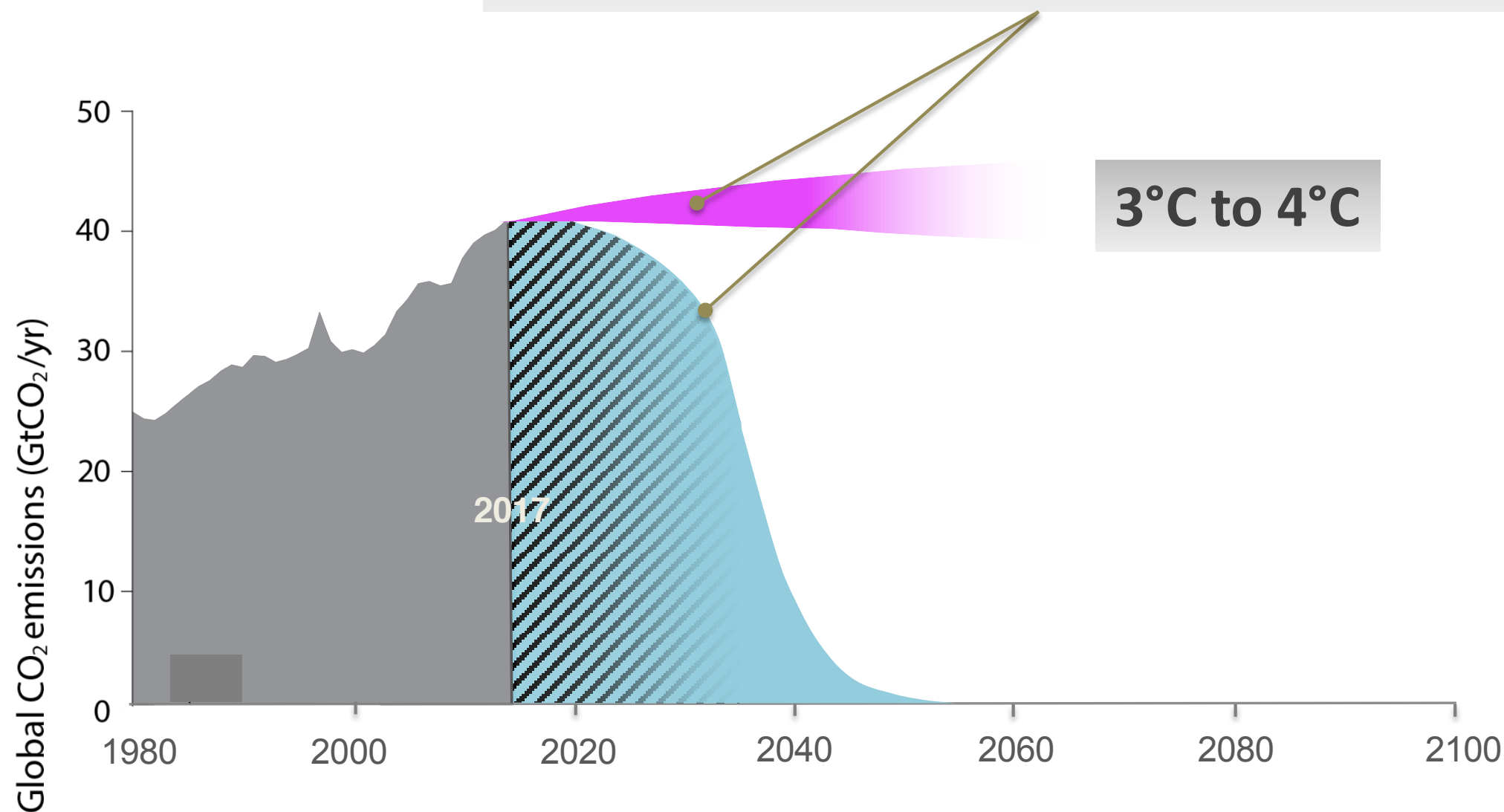


13% reductions per year, starting NOW!

75% reduction in CO₂ by 2025

fully decarbonised by 2035-2040

To move rapidly from current to 2°C pathways, requires
Immediate & deep cuts in ENERGY DEMAND

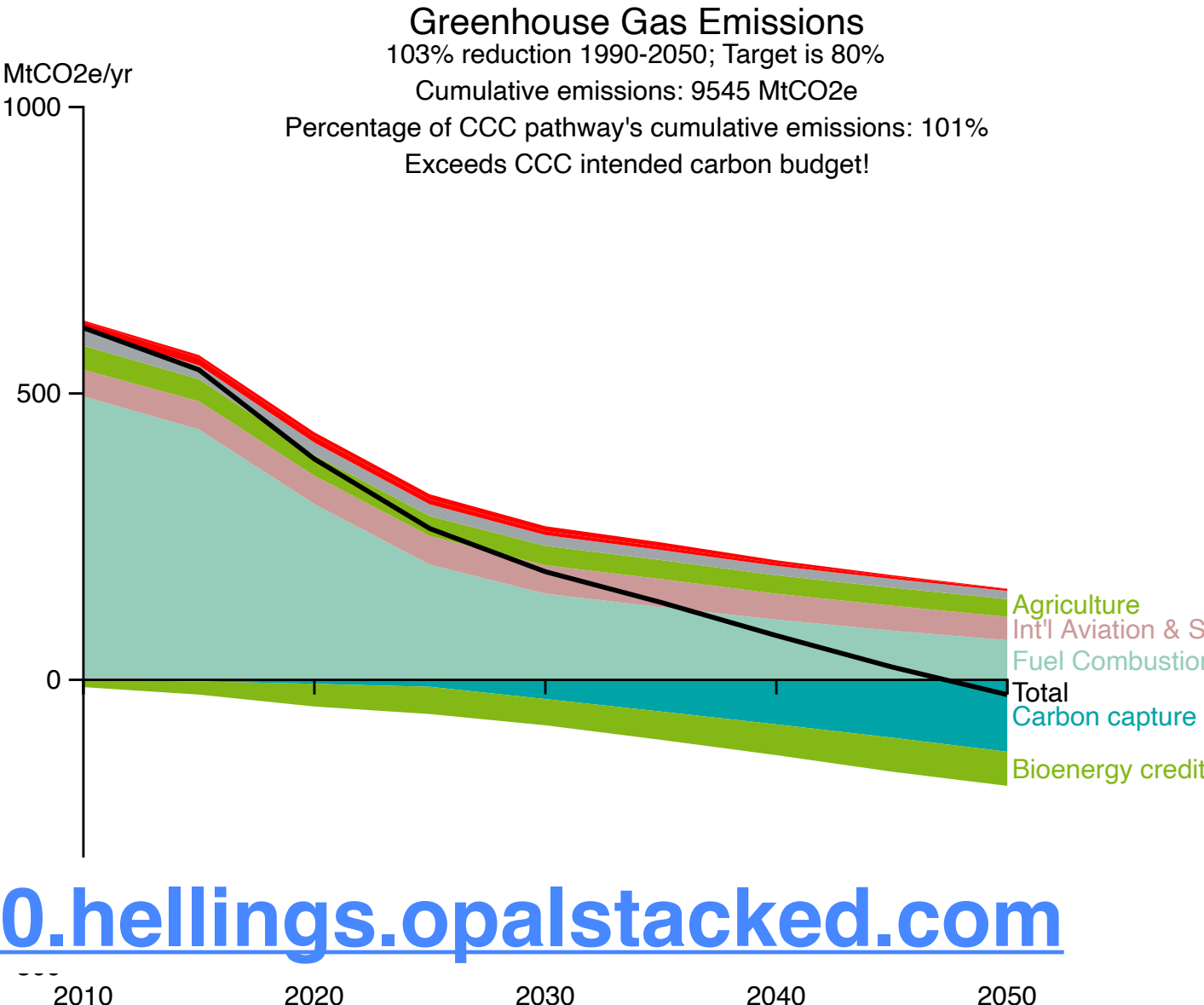
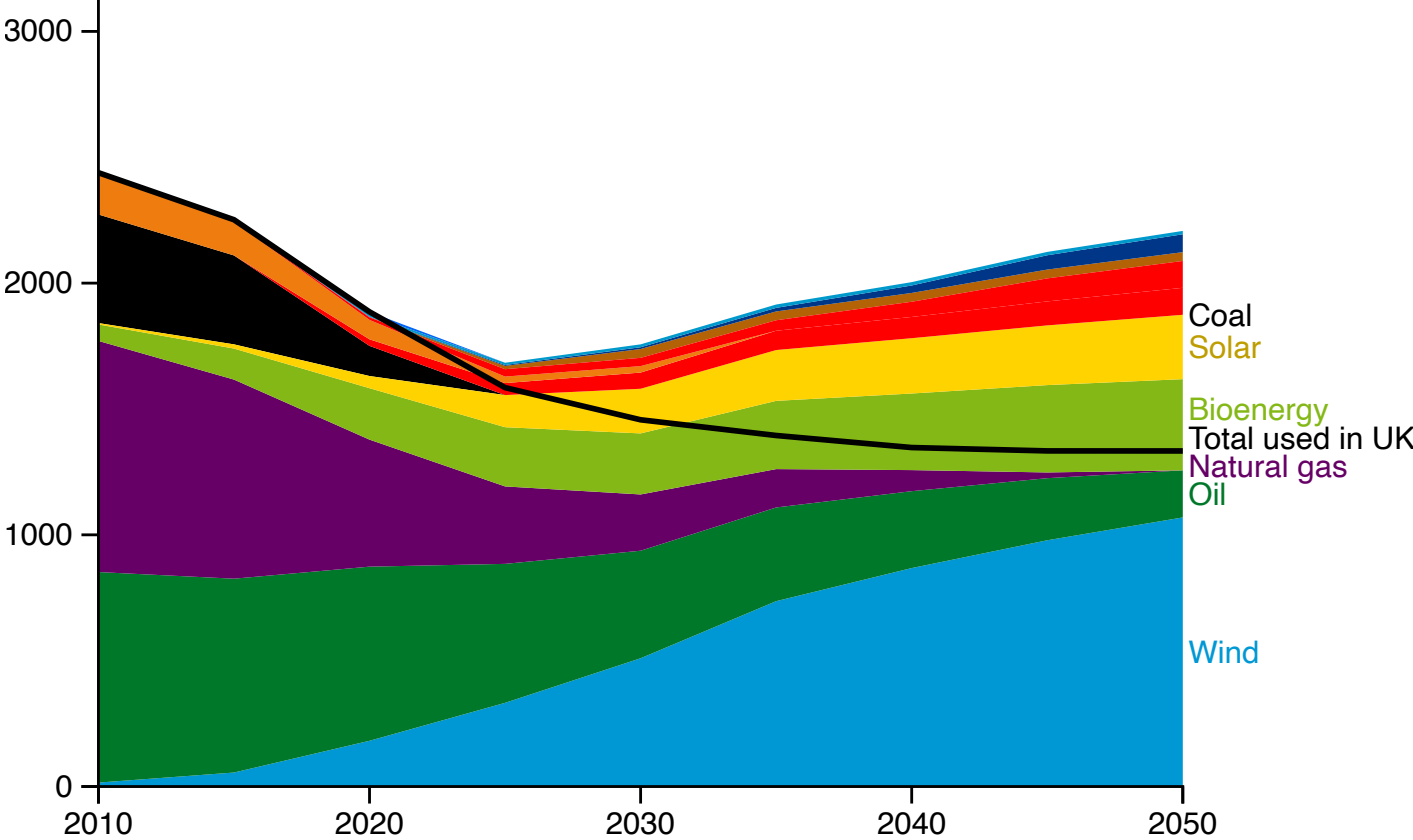


courtesy of Kevin Anderson, Tyndall Centre @kevinclimate



DECC 2050 calculator #2

Domestic transport behaviour	?	1	2	3	4
Shift to zero emission transport	?	1	2	3	4
Choice of fuel cells or batteries	?	A	B	C	D
Domestic freight	?	1	2	3	4
International aviation	?	1	2	3	4
International shipping	?	1	2	3	4
Average temperature of homes	?	1	2	3	4
Home insulation	?	1	2	3	4
Home heating electrification	?	A	B	C	D
Home heating that isn't electric	?	A	B	C	D
Home lighting & appliances	?	1	2	3	4
Electrification of home cooking	?	A	B		
Growth in industry	?	A	B	C	
Energy intensity of industry	?	1	2	3	
Commercial demand for heating and cooling	?	1	2	3	4
Commercial heating electrification	?	A	B	C	D
Commercial heating that isn't electric	?	A	B	C	D
Commercial lighting & appliances	?	1	2	3	4
Electrification of commercial cooking	?	A	B		



<http://2050.hellings.opalstacked.com>

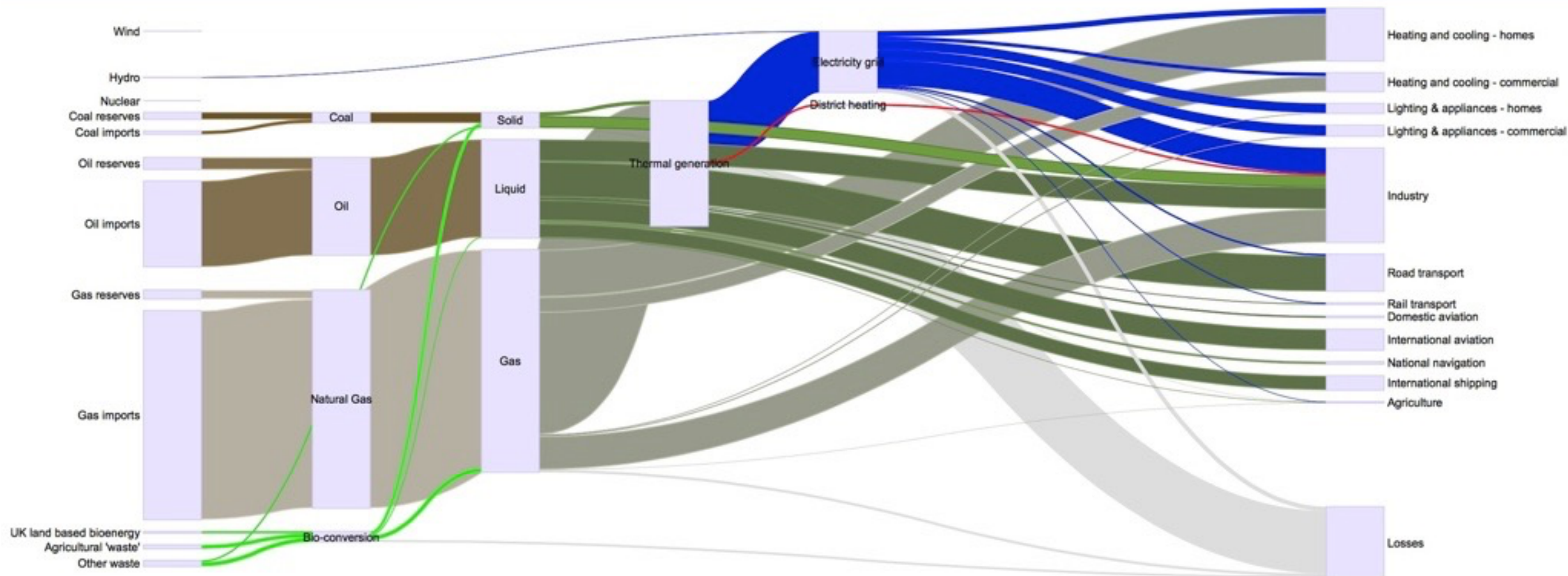
DECC 2050 calculator #2

Nuclear power stations	?	1	2	3	4
CCS power stations	?	1	2	3	4
CCS power station fuel mix	?	A	B	C	D
Offshore wind	?	1	2	3	4
Onshore wind	?	1	2	3	4
Wave	?	1	2	3	4
Tidal Stream	?	1	2	3	4
Tidal Range	?	1	2	3	4
Biomass power stations	?	1	2	3	4
Solar panels for electricity	?	1	2	3	4
Solar panels for hot water	?	1	2	3	4
Geothermal electricity	?	1	2	3	4
Hydroelectric power stations	?	1	2	3	4
Small-scale wind	?	1	2	3	4
Electricity imports	?	1	2	3	4
Land dedicated to bioenergy	?	1	2	3	4
Livestock and their management	?	1	2	3	4
Volume of waste and recycling	?	A	B	C	D
Marine algae	?	1	2	3	4
Type of fuels from biomass	?	A	B	C	D
Bioenergy imports	?	1	2	3	4
Geosequestration	?	1	2	3	4
Storage, demand shifting & interconnection	?	1	2	3	4

headlines:

- **Nukes are too slow,**
- **we can do this without CCS,** (which is good as its not a doesn't exist)
- **we need all kinds of renewables**
- **but we need to make better use of our land and eat less meat**

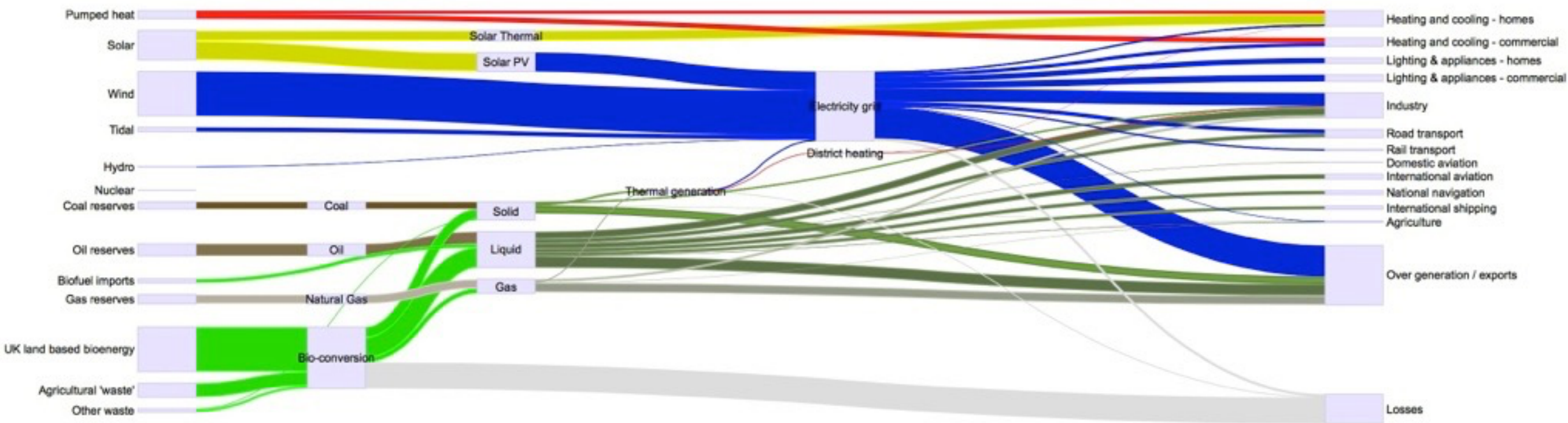
DECC's 2050 Pathway Calculator #2



this takes the
massive flows of
fossil fuels...



DECC's 2050 Pathway Calculator #2

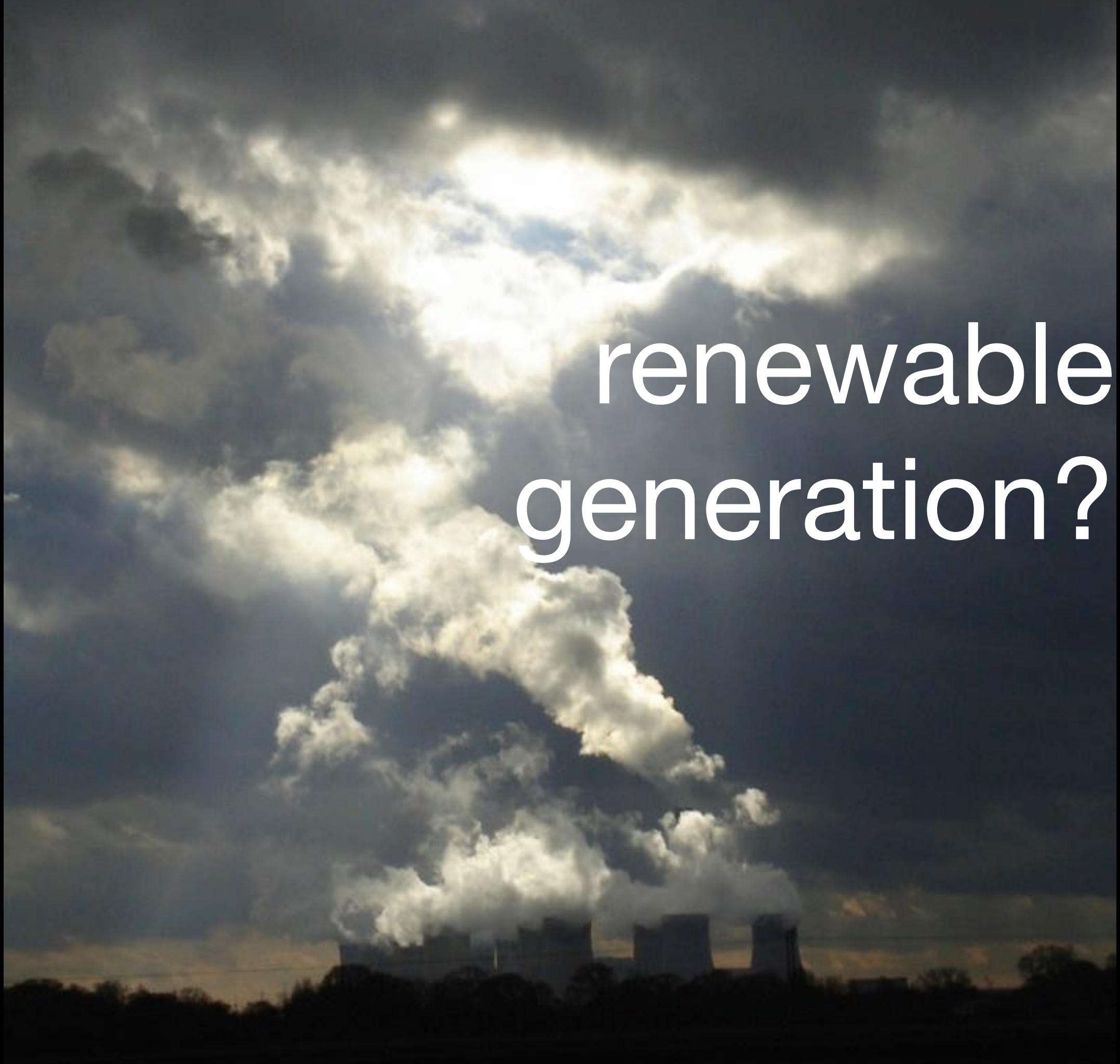


...& reduces them
to what can be
delivered through
zero carbon fuels



renewable
generation

renewable
generation?



adding value
to waste

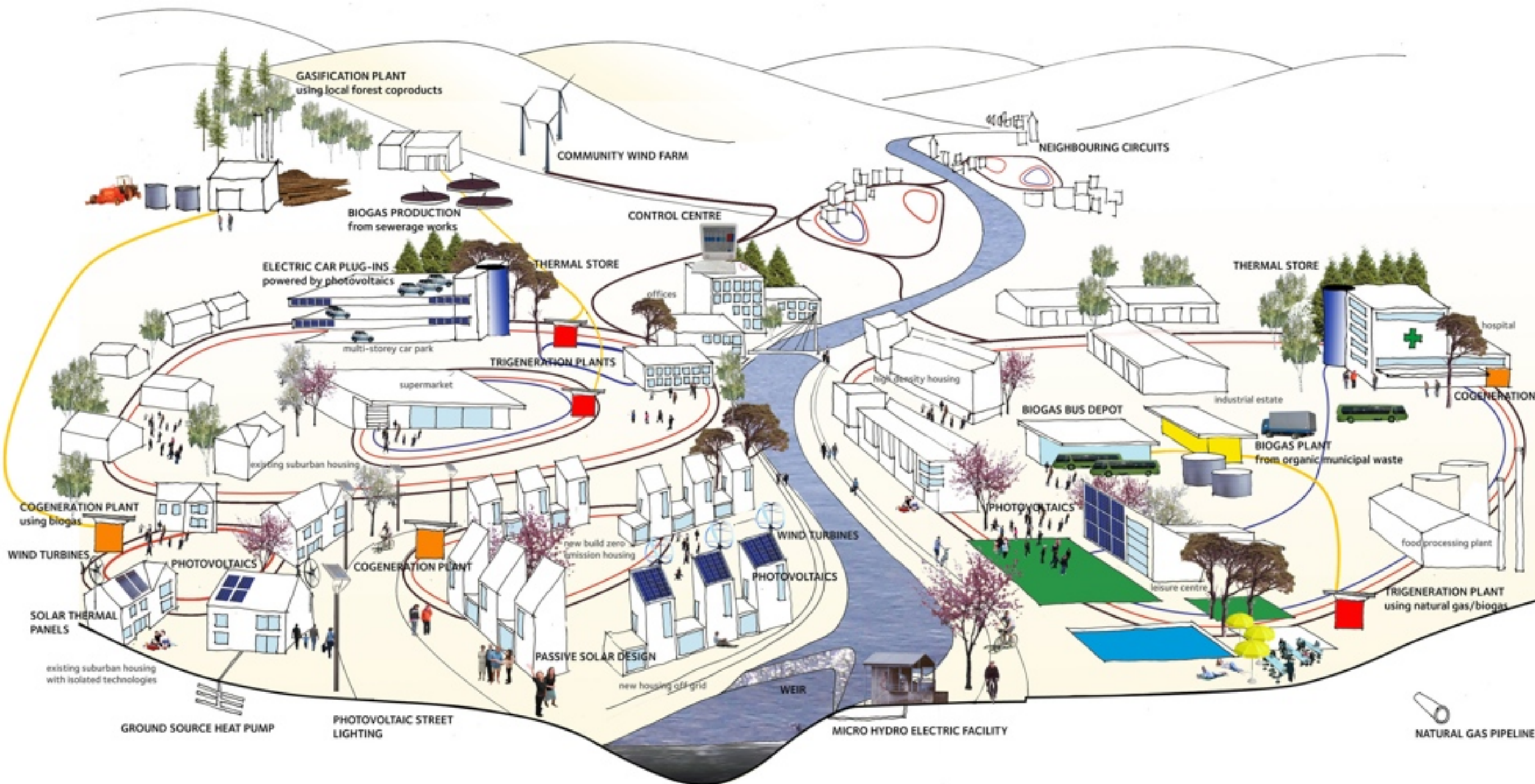
community renewables:
fuel from used cooking oil



sundance renewables co-operative

future cities?

Decentralised energy vision



who owns our energy supply? why isn't it the people?



the co-operative option:
bay wind
bristol energy co-op
brighton energy co-op
brighton & hove energy
saving co-op
ad that's just B
there's 200 of them in the UK





renewable generation





who owns our energy supply?
why isn't it the people?

co-ops like energy4all and
shareenergy.coop have
raised funds and helped
out a lot of them



Scaling Up Retrofit

a revolution from
the comfort of
our own homes?

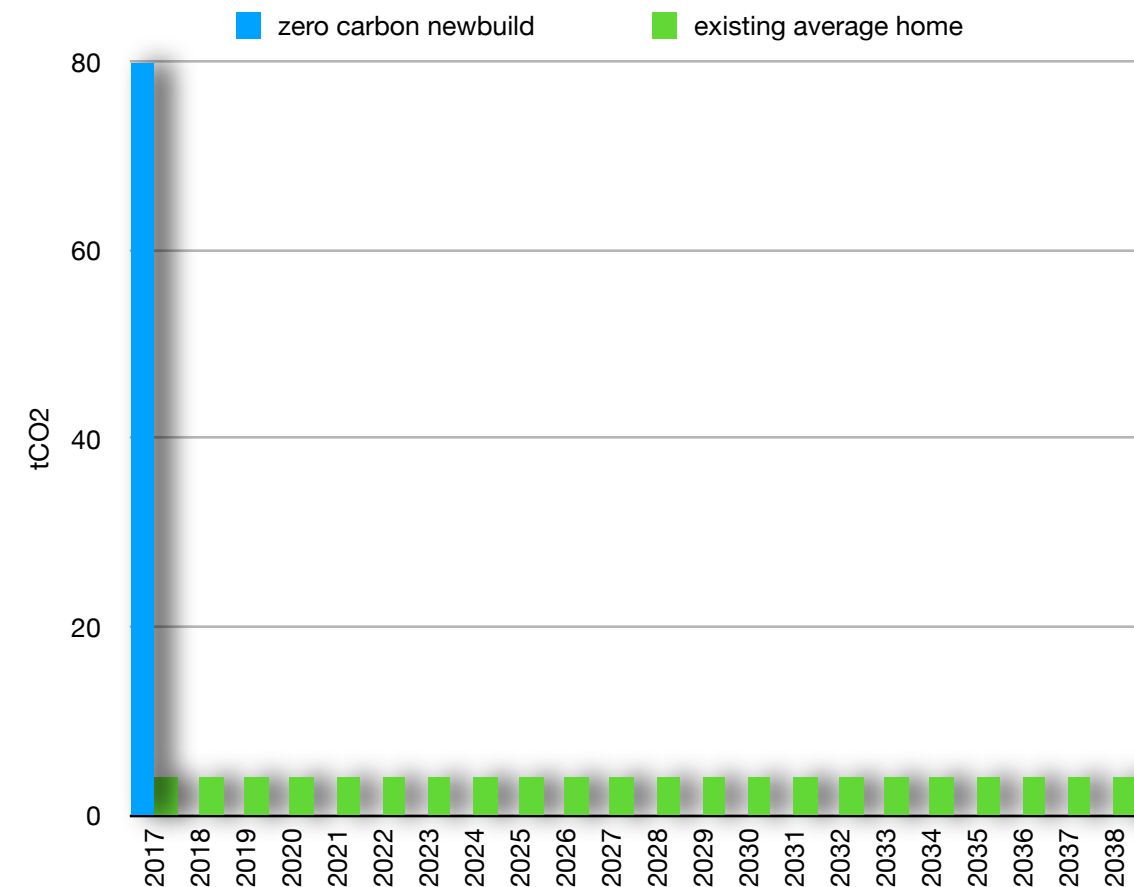
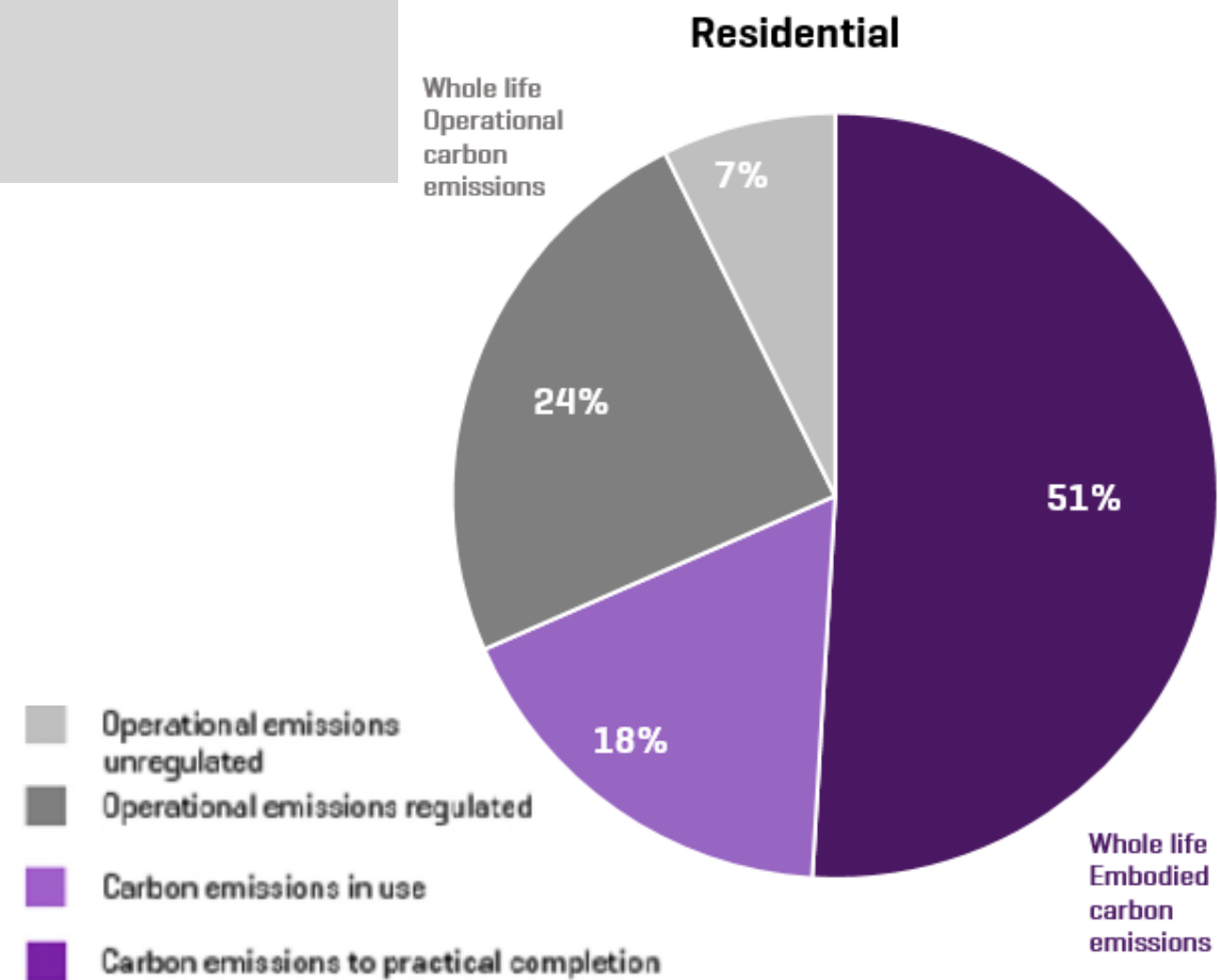
building the
change we want or
shouting for others
to do it to us?



reuse/
retrofit/
renewable
design/
development/
delivery

the carbon elephant

- 1.17 million homes
37% of GM emissions
4.1tCO₂/home pA
- by 2040
98% of today's homes will still be standing at current replacement rates
- each new home currently consumes 50-80tCO₂ to build.
a 'zero carbon' house cannot only be zero carbon to operate
- we have to make much better use of our existing buildings

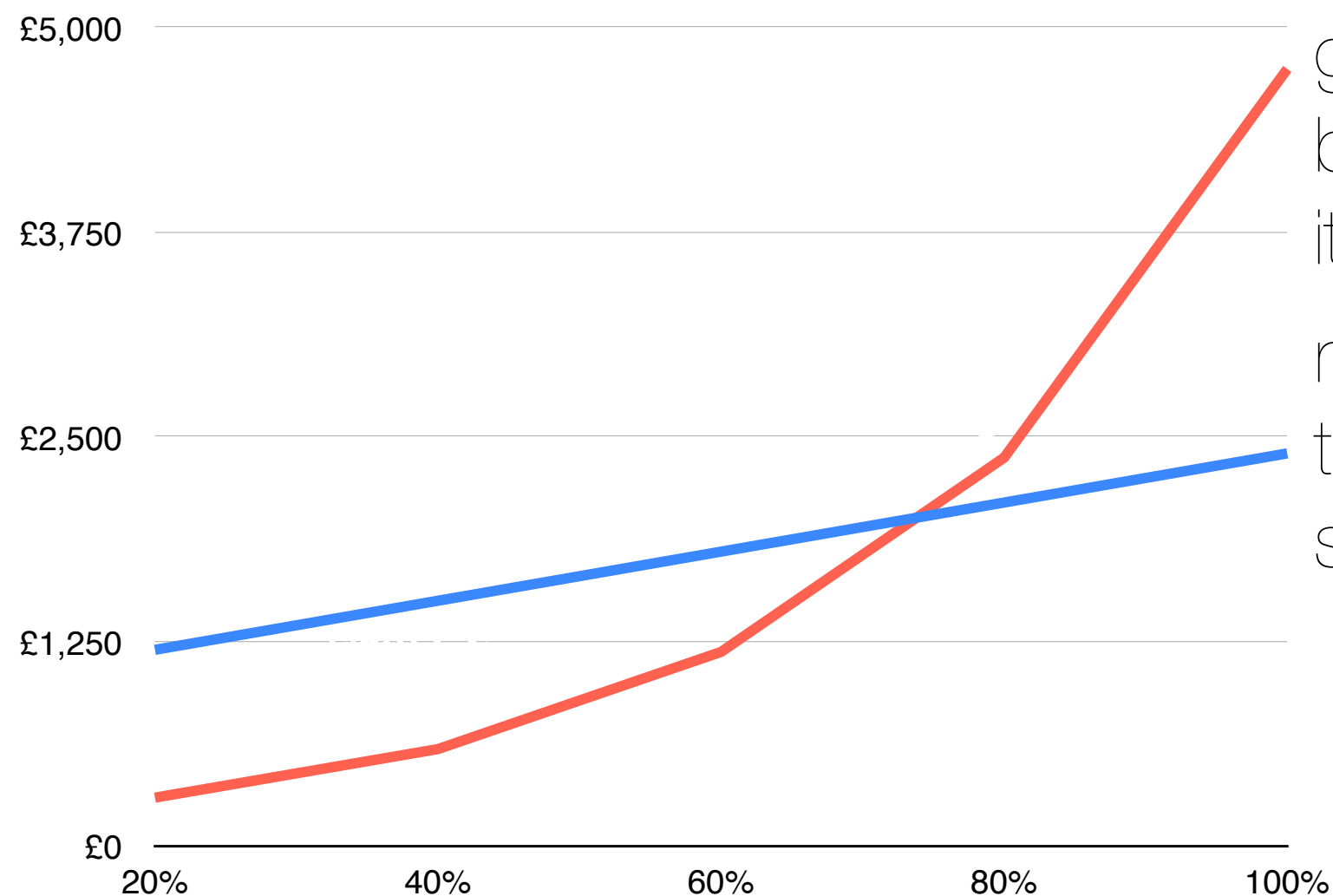


red



fabric 1st but
not fabric only

we propose:



get the space heating demand
below $40\text{kWh/m}^2/\text{A}$,
it's often 5 times that
reduce energy demand
to what can be produced by
solar PV on roof or nearby



external wall insulation
 $0.2 \text{ W/m}^2\text{K}$





this saves the 50-80tCO₂ emissions of a newbuild



IM

internal wall insulation
 $0.3 \text{ W/m}^2\text{.K}$



roof

$0.1 \text{ W/m}^2\text{.K}$ for loft
 $0.15\text{-}0.2 \text{ W/m}^2\text{.K}$ for room in roof



floors

0,15 W/m².K fully insulated

0,4 W/m².K perimeter insulation



lots of
variety
lots of
problems
to solve not
avoid



windows & doors

0.85 W/m².K windows
1.0 W/m².K doors



windows & doors

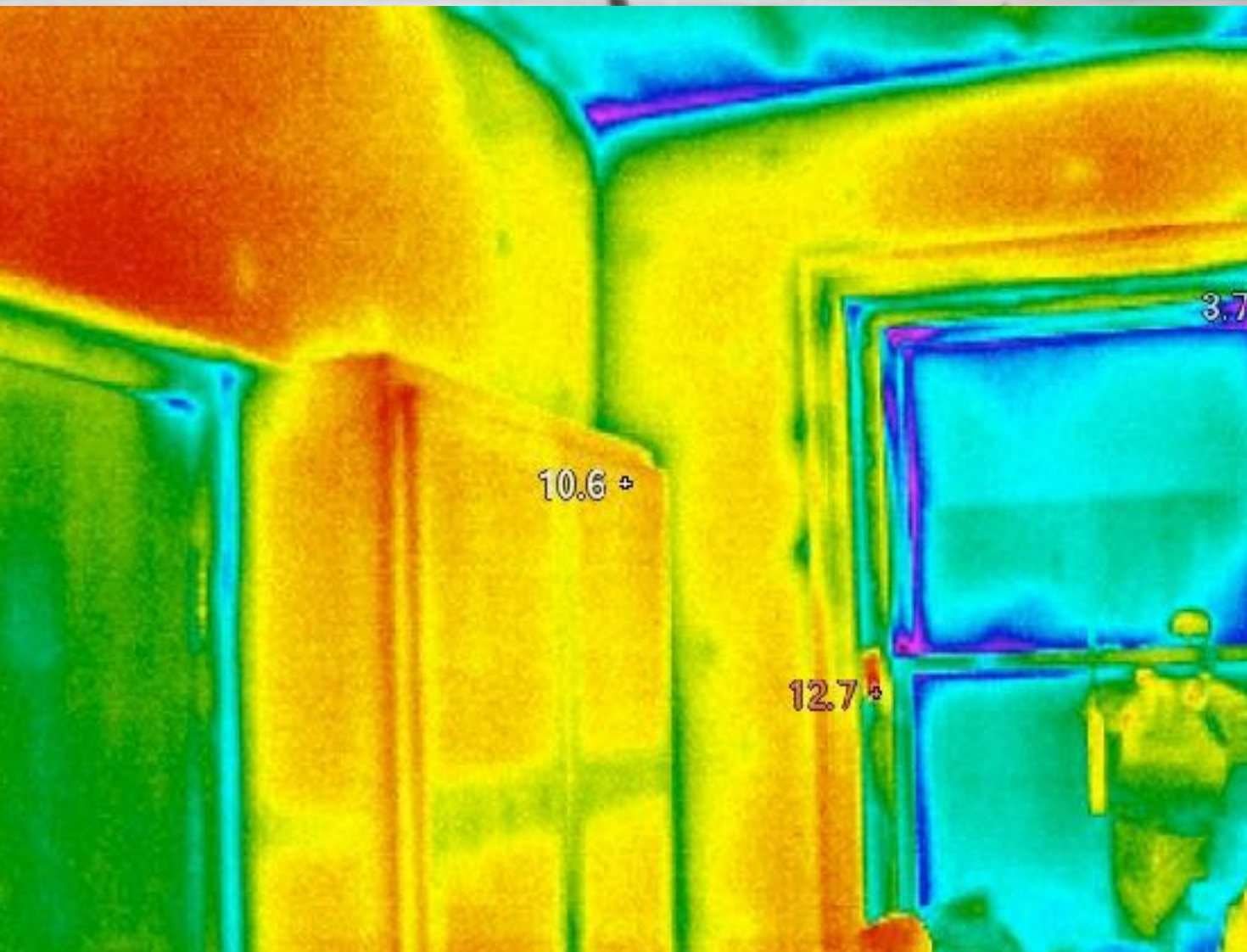
retained windows 2 - 3 W/m².K



cold bridging & airtightness

y-value: max 0.08,
pref 0.04,
stretch 0.02 W/m²

max 5,
pref 3,
stretch 1.5 m³/m²/hr @50pa





soil pipes: you can embed them in the EWI because moving them to the outside may be a shame

ventilation

MVHR ducting
coming down the
chimney



inlet air grill from
underfloor void with
600mm of insulation
on around

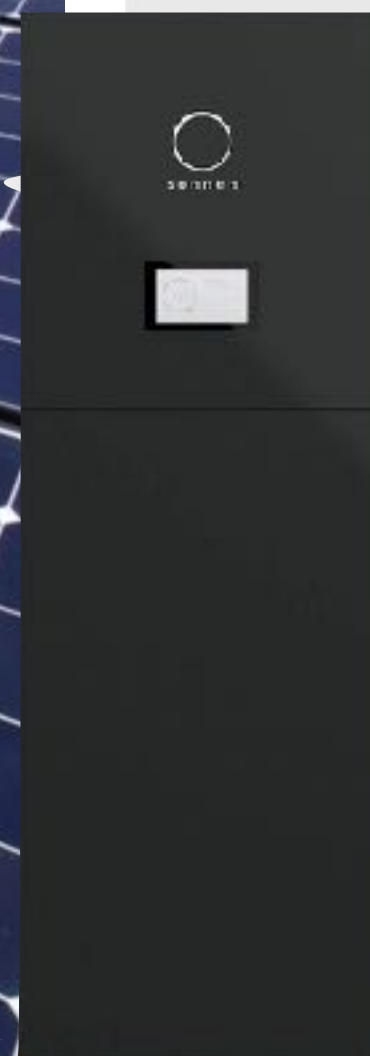


demand controlled extract
on passive stack system



renewable
generation

5kW of PV + 8-10kWh of energy storage



red

renewable
generation

heat pumps



zero carbon retrofit?

electricity with efficient appliances

hot water “

space heating at 25kWh/m²/A -> space heating

3,000kWh +

2,000kWh +

2,200kWh =

7,200kWh/A

heat pump (CoP at 3.75) reduces heat & hot water to 1,100kWh_

total energy needed

4,100kWh/A

5kW of PV > approx

4,200kWh/A

whole house retrofit +
renewable energy +
storage =

Scaling Up
Better Homes
Yorkshire?

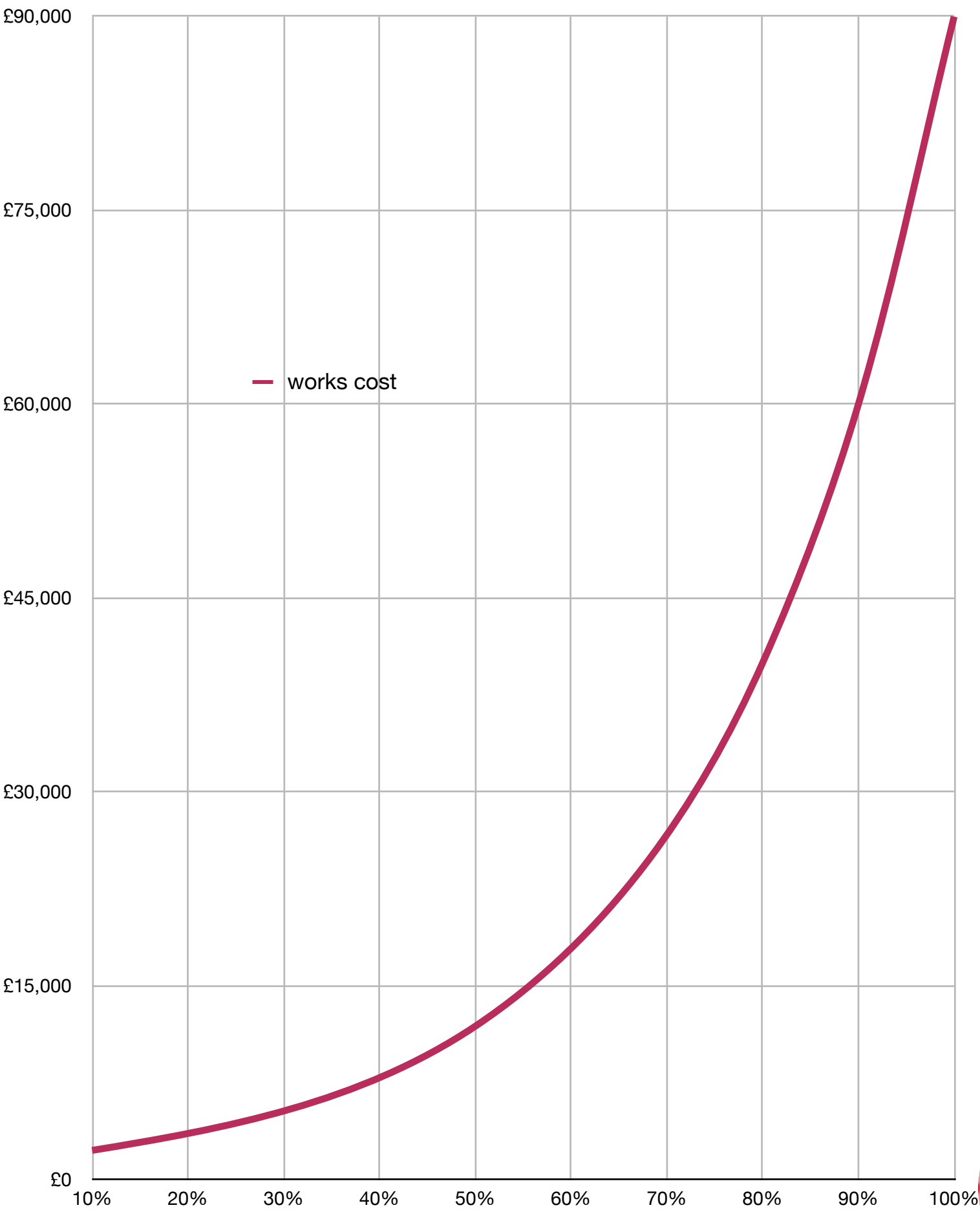
zero carbon by 2038

zero fuel poverty by 2030

zero net cost to the public purse

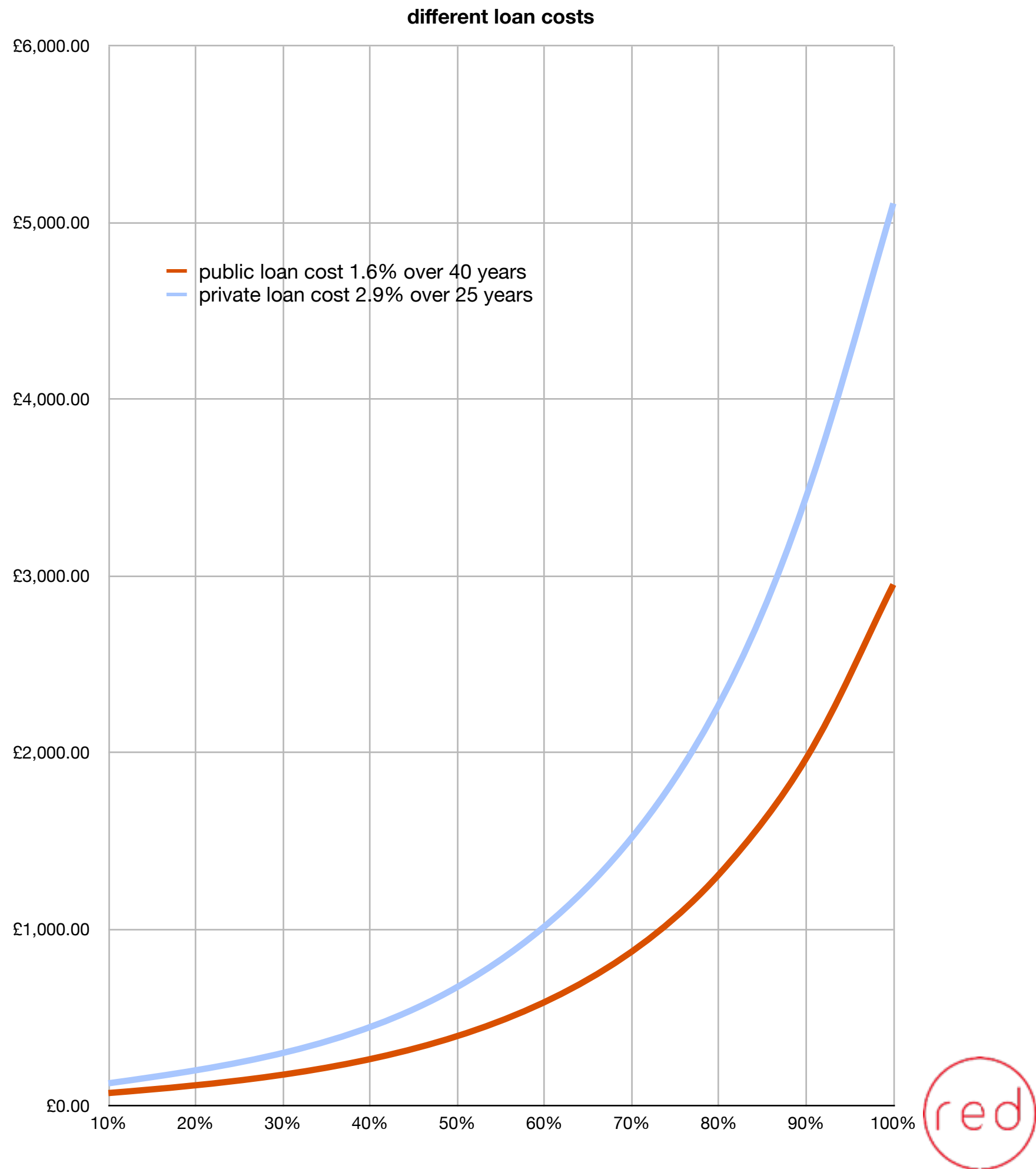


the
numbers?



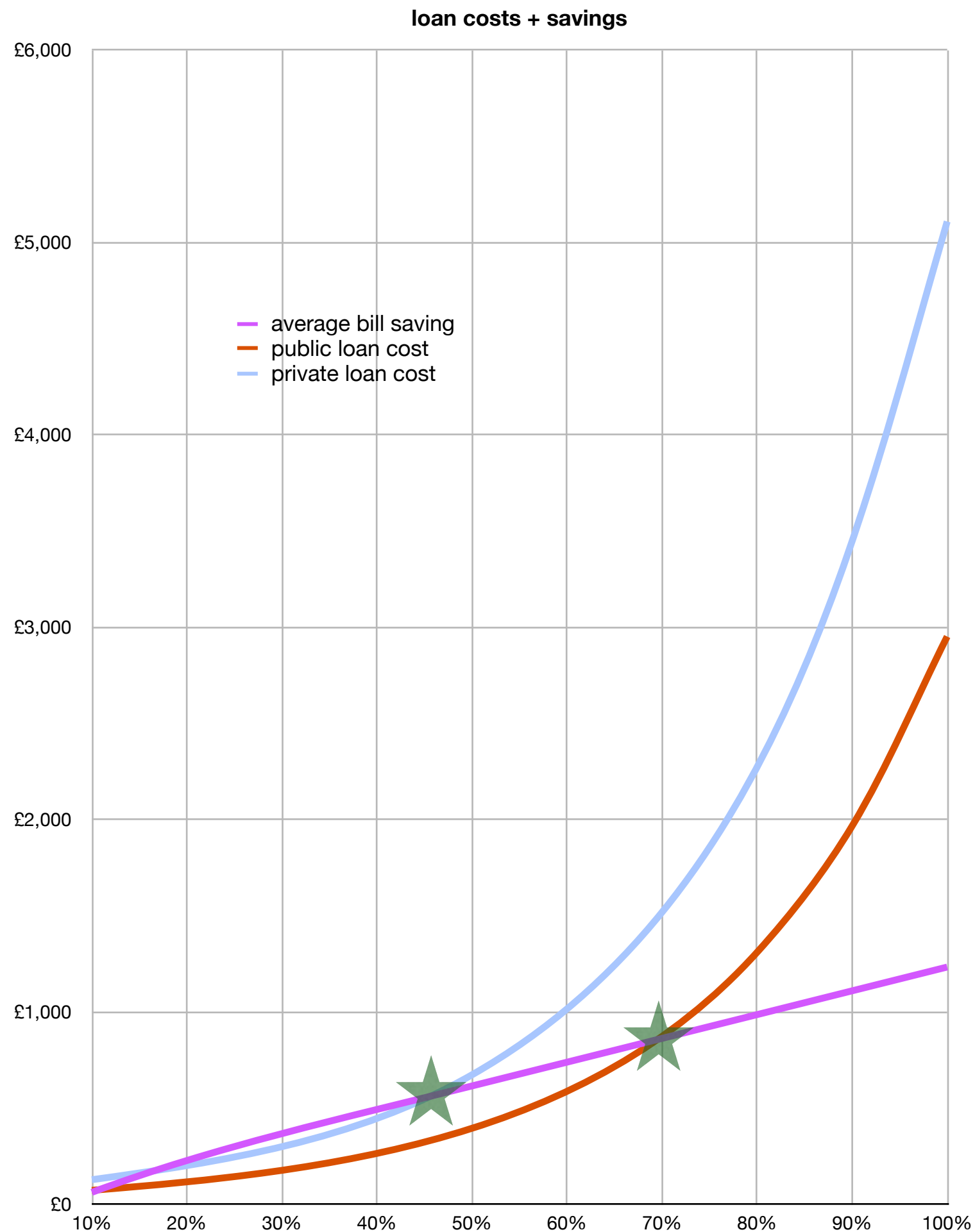
building retrofit

the cost of that borrowing can vary enormously here is a comparison between a standard mortgage and municipal prudential borrowing



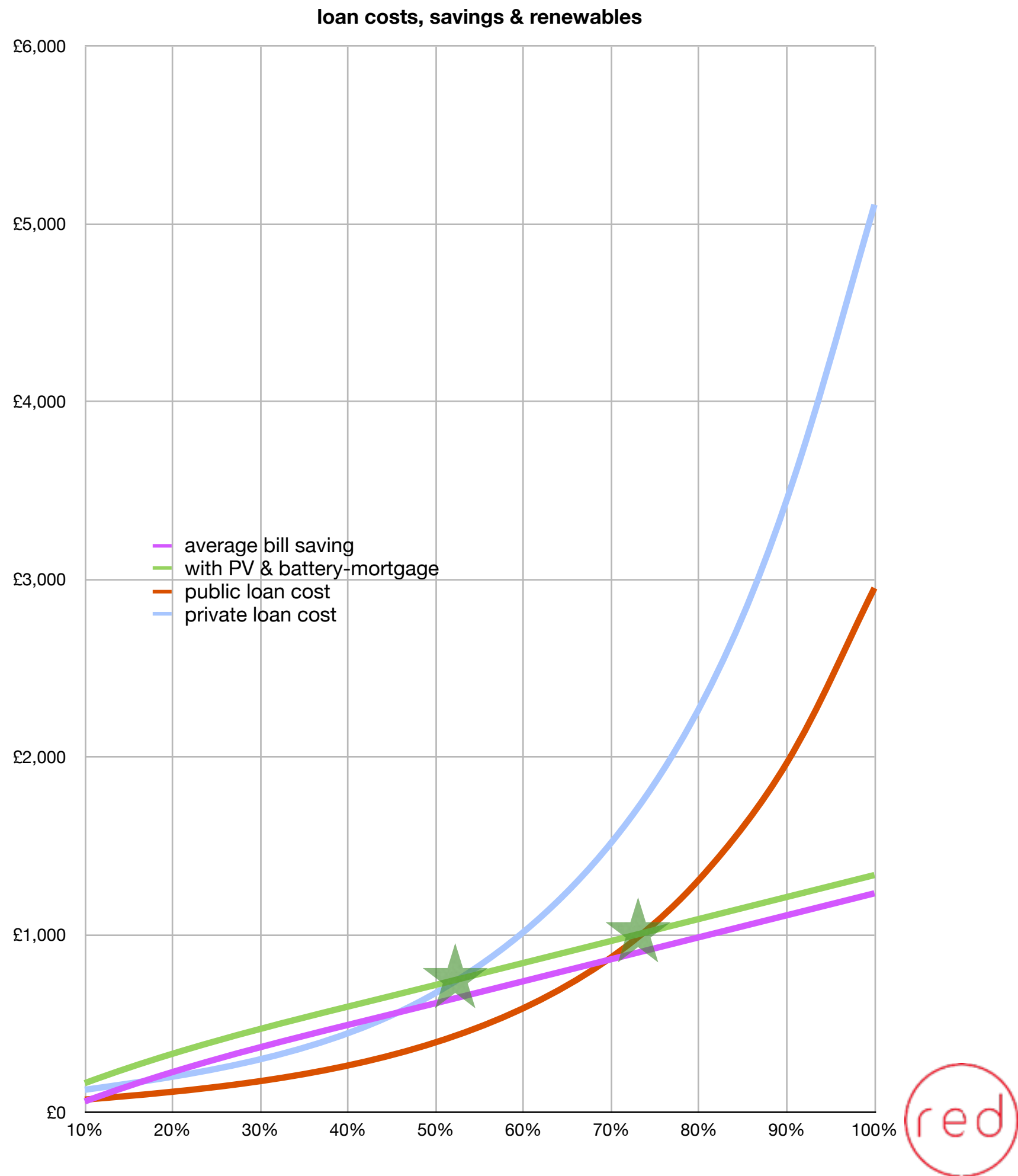
building retrofit

costs are exponential,
savings are linear



building
retrofit

PV + battery enable
more savings but also
have to be paid for so
the sweet spot hasn't
moved far yet

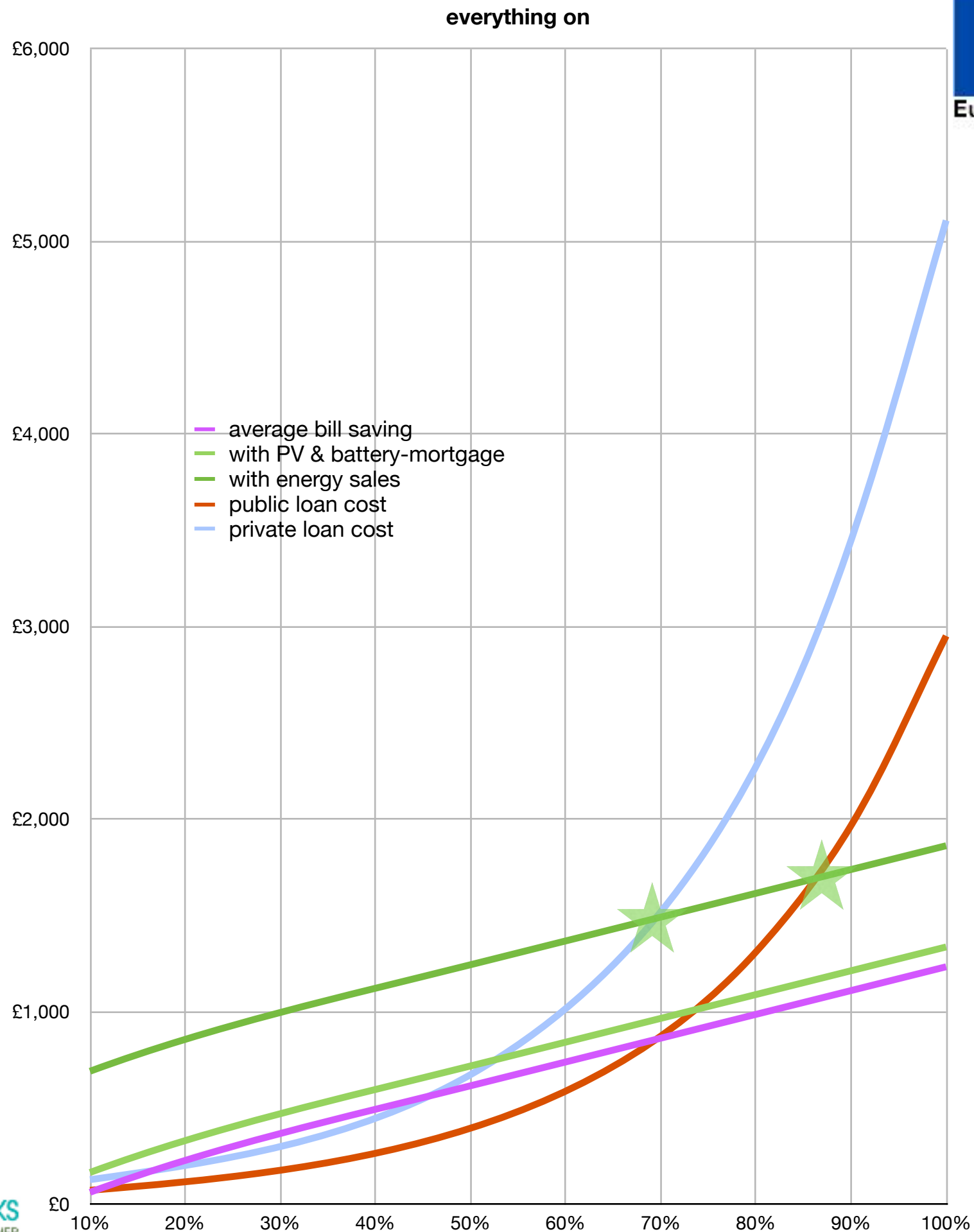


building retrofit

the leap is with aggregated sales of energy from thousands of homes (more later)

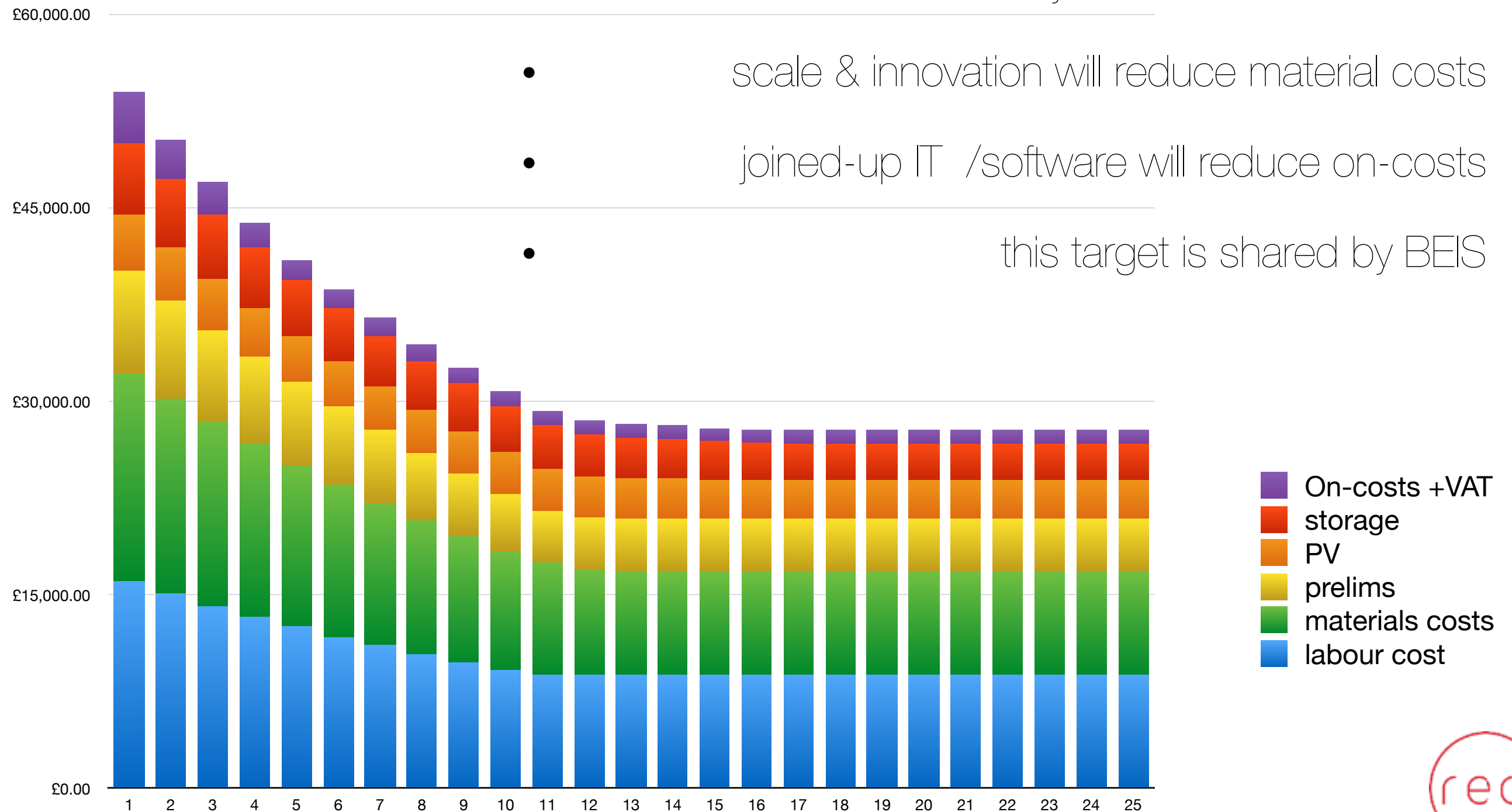


RETROFITWORKS
BUILDING EFFICIENCY TOGETHER



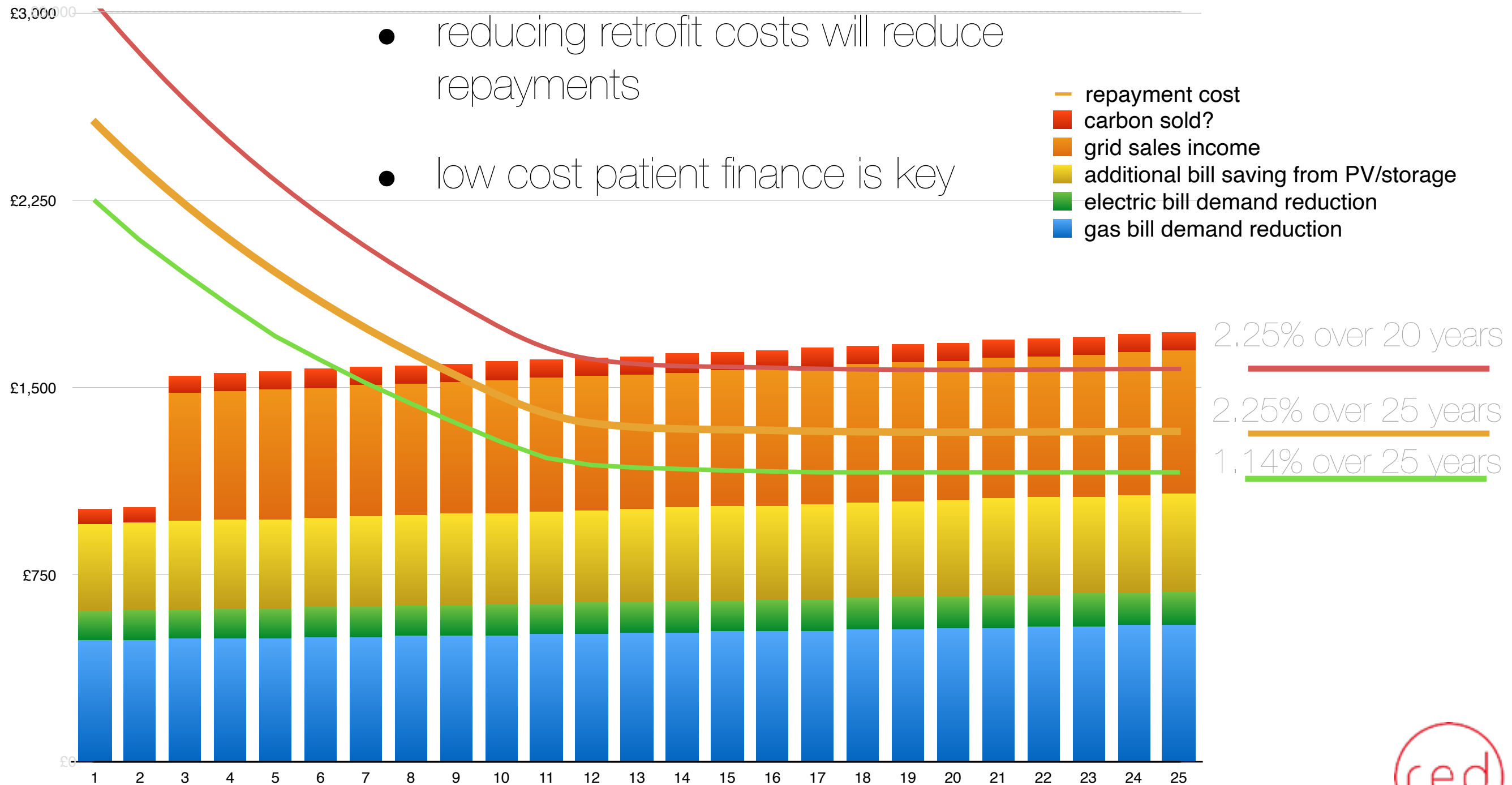
costs of retrofit are currently too high

- supply & demand can push prices up if bottlenecks are not addressed early but...
- efficiency will reduce labour costs
- scale & innovation will reduce material costs
- joined-up IT /software will reduce on-costs
- this target is shared by BEIS



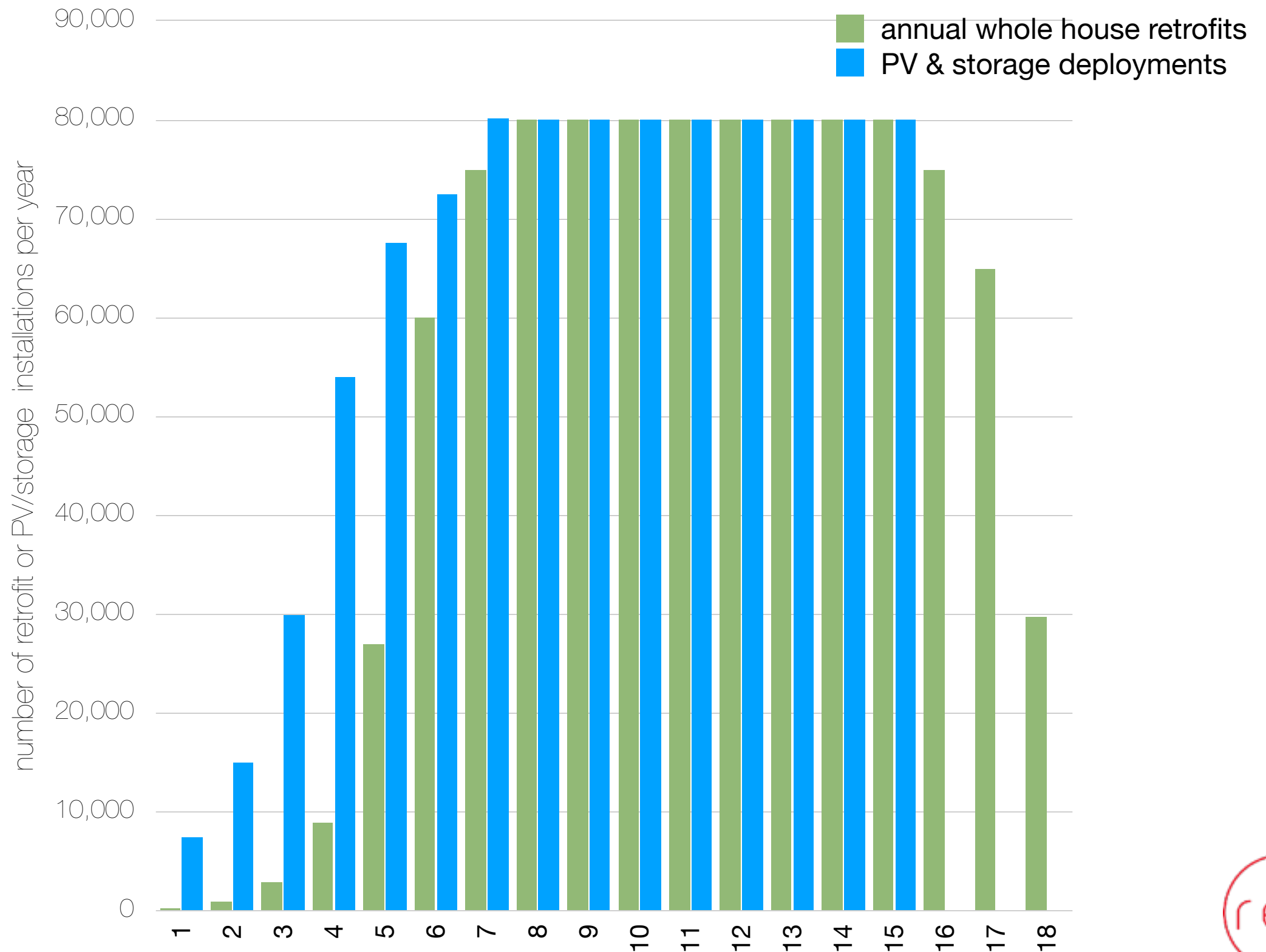
repayments & how they can be covered

- various sources of revenue/savings - the revenue stack
- reducing retrofit costs will reduce repayments
- low cost patient finance is key

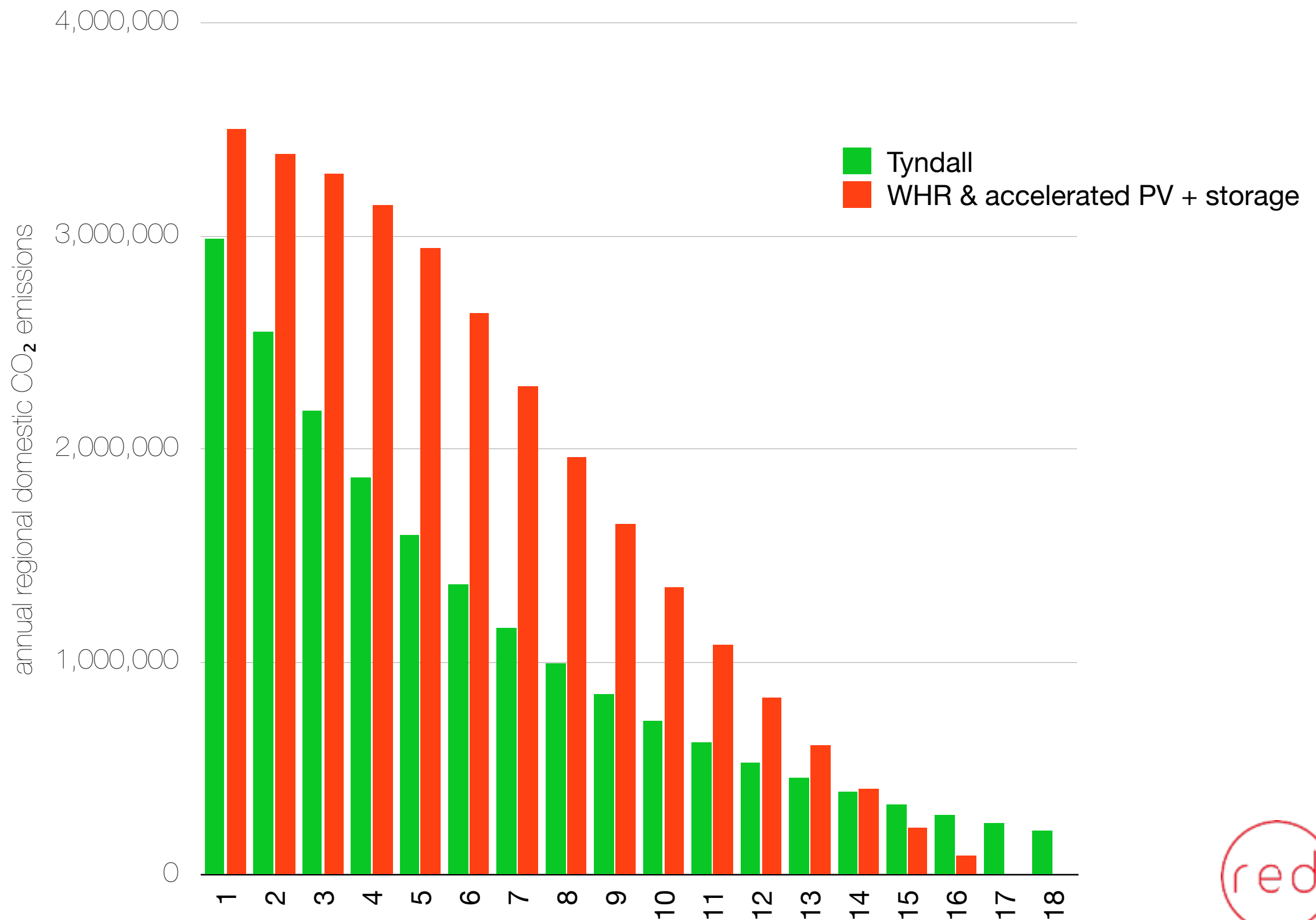


- scale up the PV & storage programme faster than the remand reduction will create early years revenues

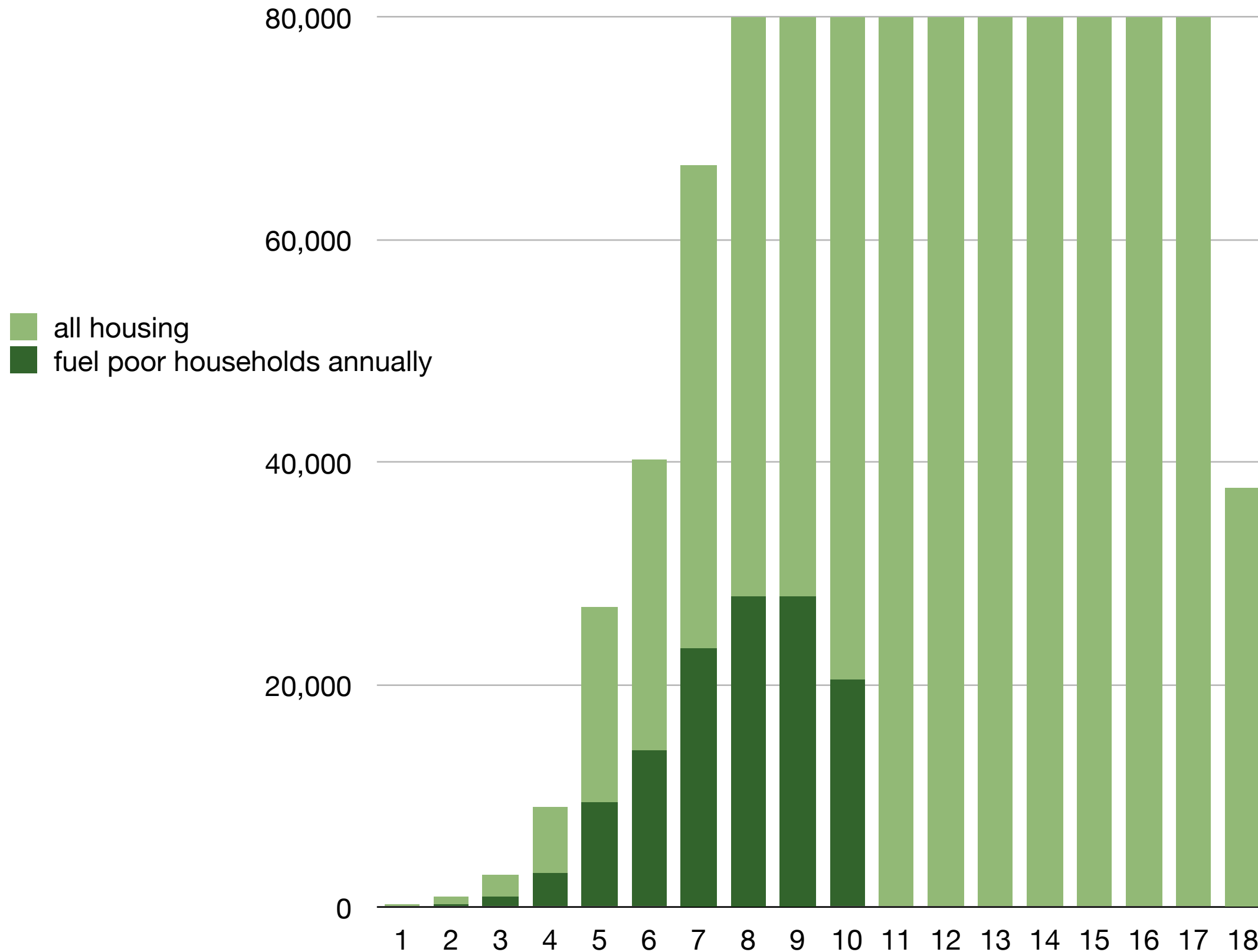
fig 2.1 retrofits & PV + storage installs/year



- help stay nearer the carbon budget...



- additional income will enable forms of lending to be able to eradicate fuel poverty within a decade



the 10 components

- 
1. customer journey
 2. assessment + calculation
 3. monitoring + data
 4. IT + software
 5. specification + detailing
 6. contracting + guarantees
 7. additional revenues
 8. financial vehicles
 9. scalability
 10. workforce development

1	customer journey	a	consistent independent advice									
		b	knowledge of status of every home									
		c	market intelligence									
		d	show homes	local	federal	national		trusted offer	building the market	fit for purpose	paying fir it	delivery
2	assessment & calculation	a	accurate whole house assessment									
		b	cost benefit									
		c	accurate costing works									
3	monitoring & data	a	pre- & post-works monitoring									
		b	identify & quantify best practice									
		c	user & contractor feedback									
		d	data repository									
4	IT & software	a	interoperable software development									
		b	mass customisation									
		c	site management									
		d	on site works remote monitoring									
5	specification & detailing	a	specification improvement									
		b	retrofit pattern book									
6	contracting & guarantees	a	contract models									
		b	warranties									
		c	performance guarantee									
		d	quality control									
7	additional revenues	a	roof top PV									
		b	domestic or street scale energy storage									
		c	energy production & storage aggregation									
		d	carbon sales?									
		e	rented housing cost recovery methods									
8	finance vehicle	a	multiple sources of finance									
		b	policy driven lending									
		c	multiple bottom lines on surpluses									
9	scalability	a	develop delivery infrastruture									
		b	demonstrators to increase scale									
		c	competitions									
		d	pipeline development									
		e	supply chain development									
		f	connect new & existing delivery infrastructure									
10	workforce development & skills	a	audit of skills, providers & methods									
		b	training provision study									
		c	awareness raising									
		d	schools introductions									
		e	apprenticeship dev't									
		f	college & university engagement									
		g	DLO & TU engagement									
		h	industry participation									
		i	work with LA's on COVID recovery plans									

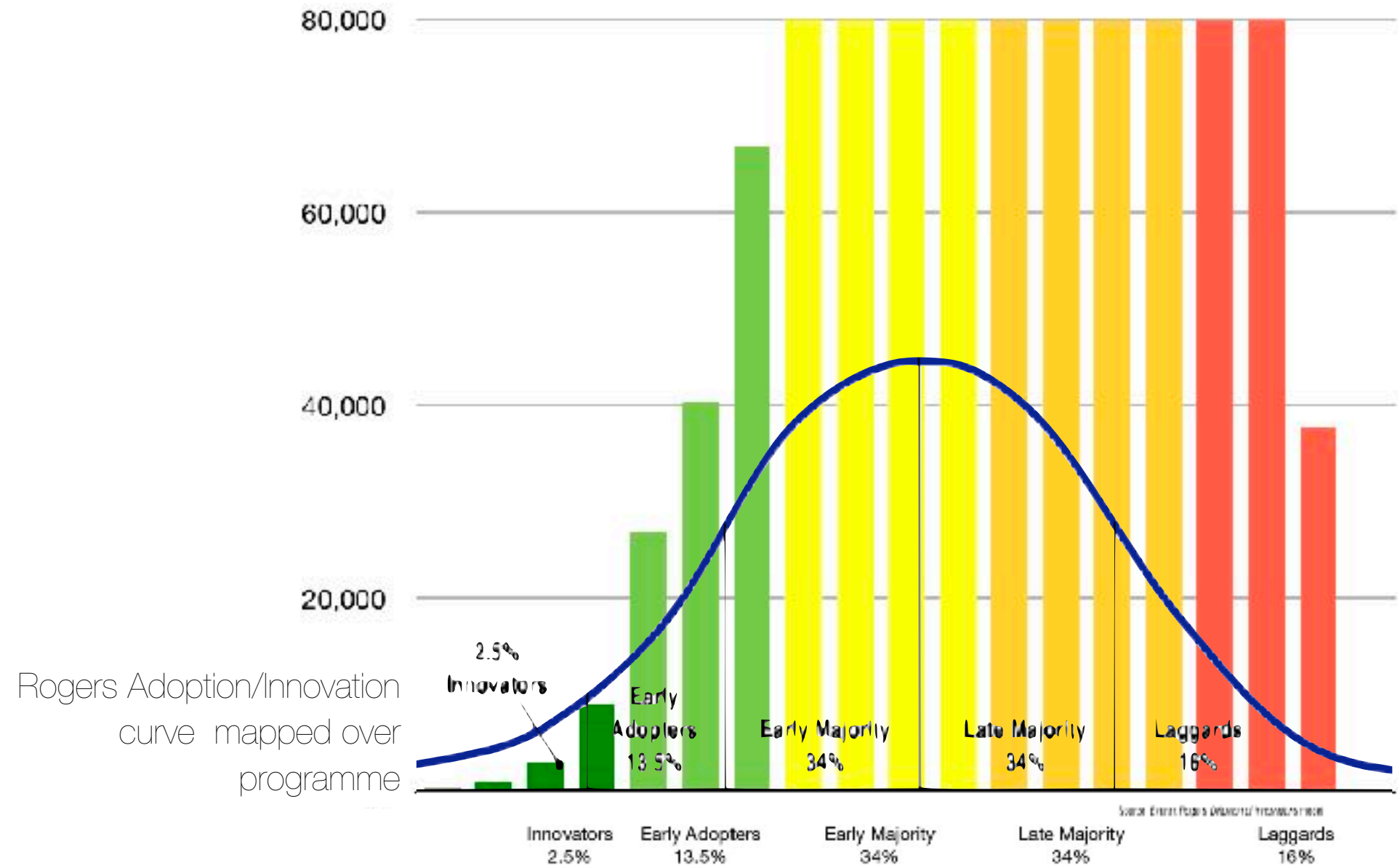
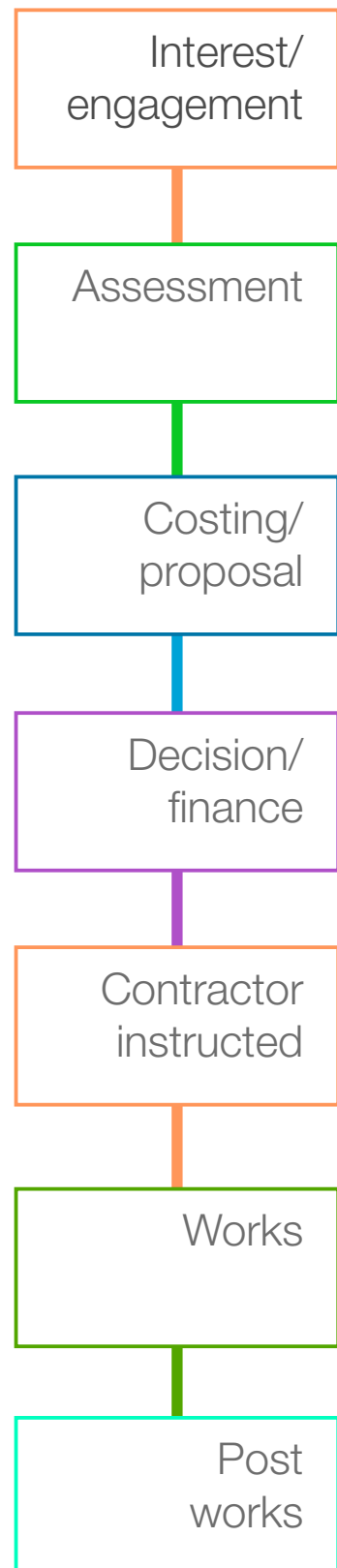
components

- action is needed across many fronts
- we mustn't just sit & wait for others
- this can & must be a collective effort



1 customer journey

work with those that want to go now to create: choice, certainty & trust



2 assessment & calculation

reliable, accurate methods of assessment & calculation of measures, including cost & their impact on running costs

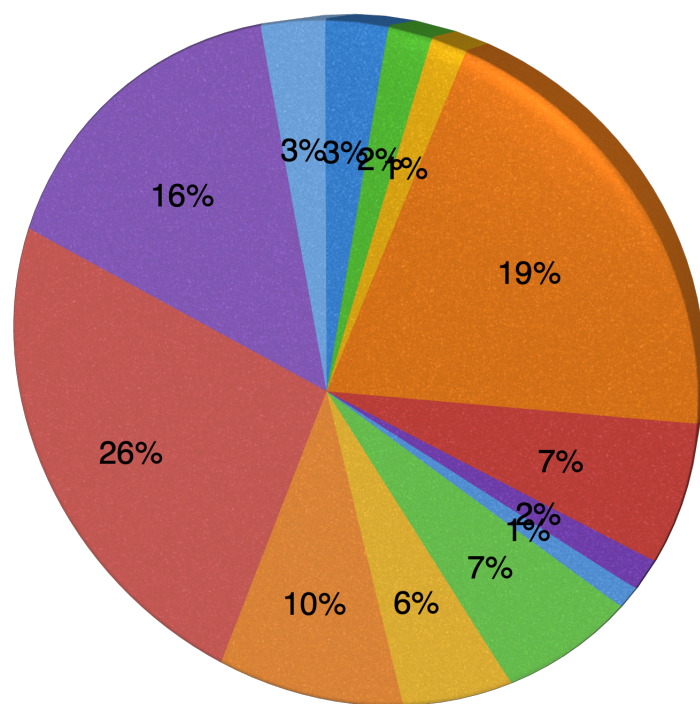
whole house assessment retrofit plans

space heating demand

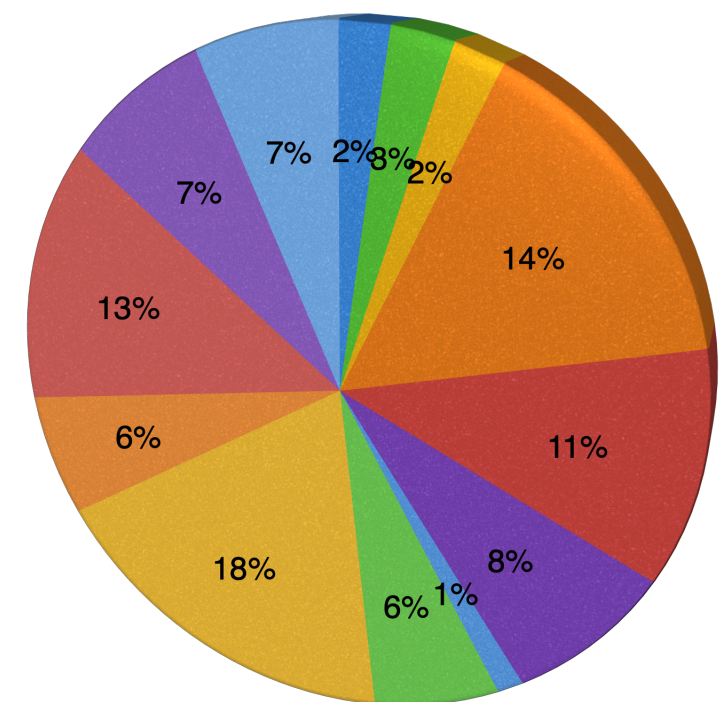
before: 120-160 kWh/m².A

space heating demand after:

25-40 kWh/m².A



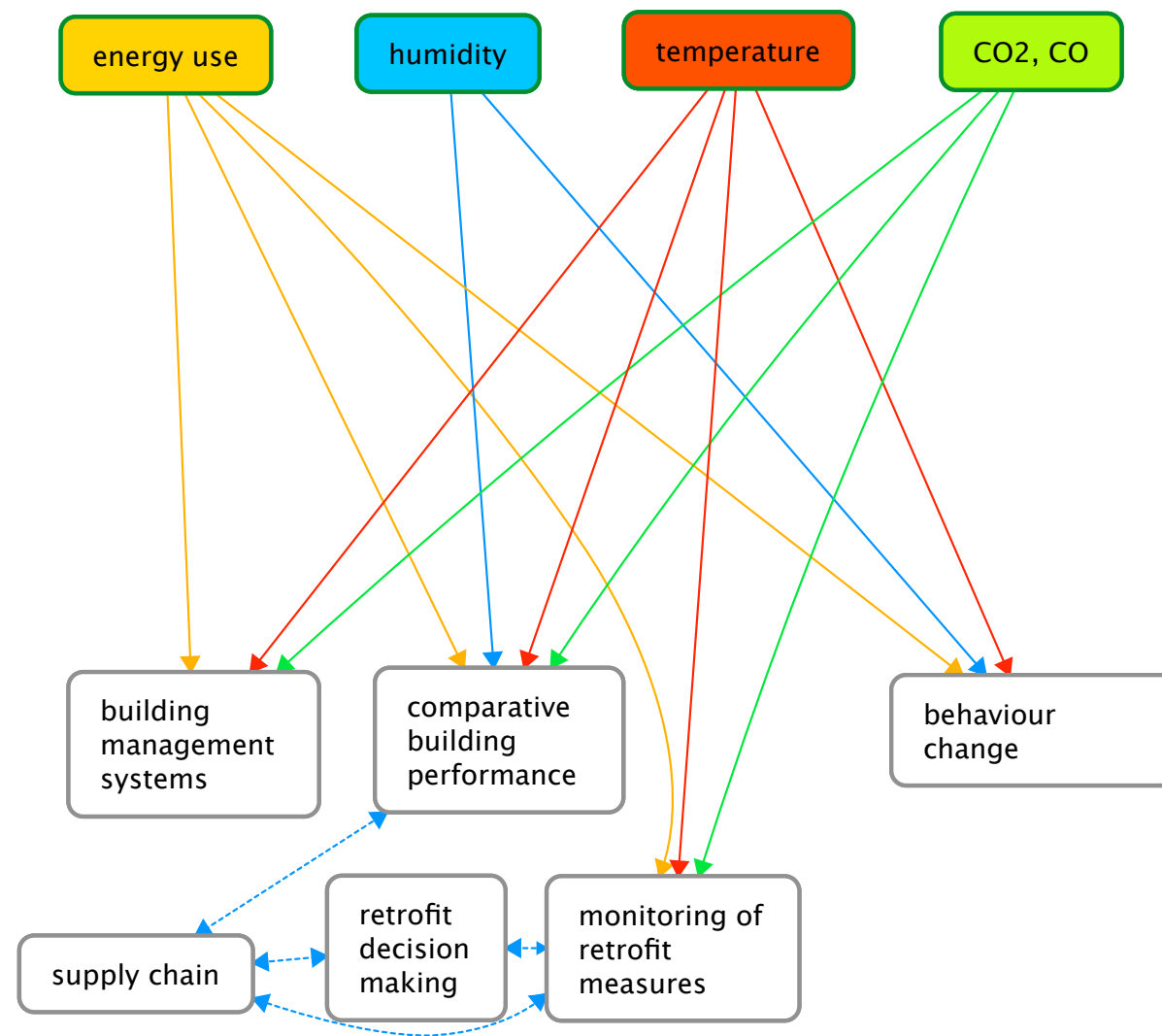
- Front door
- Back door
- Kitchen door
- Double Glazing
- Single glazed window
- Patterned single glazing
- Obscured Double glazing
- Suspended ground floor
- Solid kitchen floor
- Front wall
- Side wall
- Rear wall
- Main roof



3 monitoring & data



Pre- & post-works monitoring, at much lower cost, on all properties

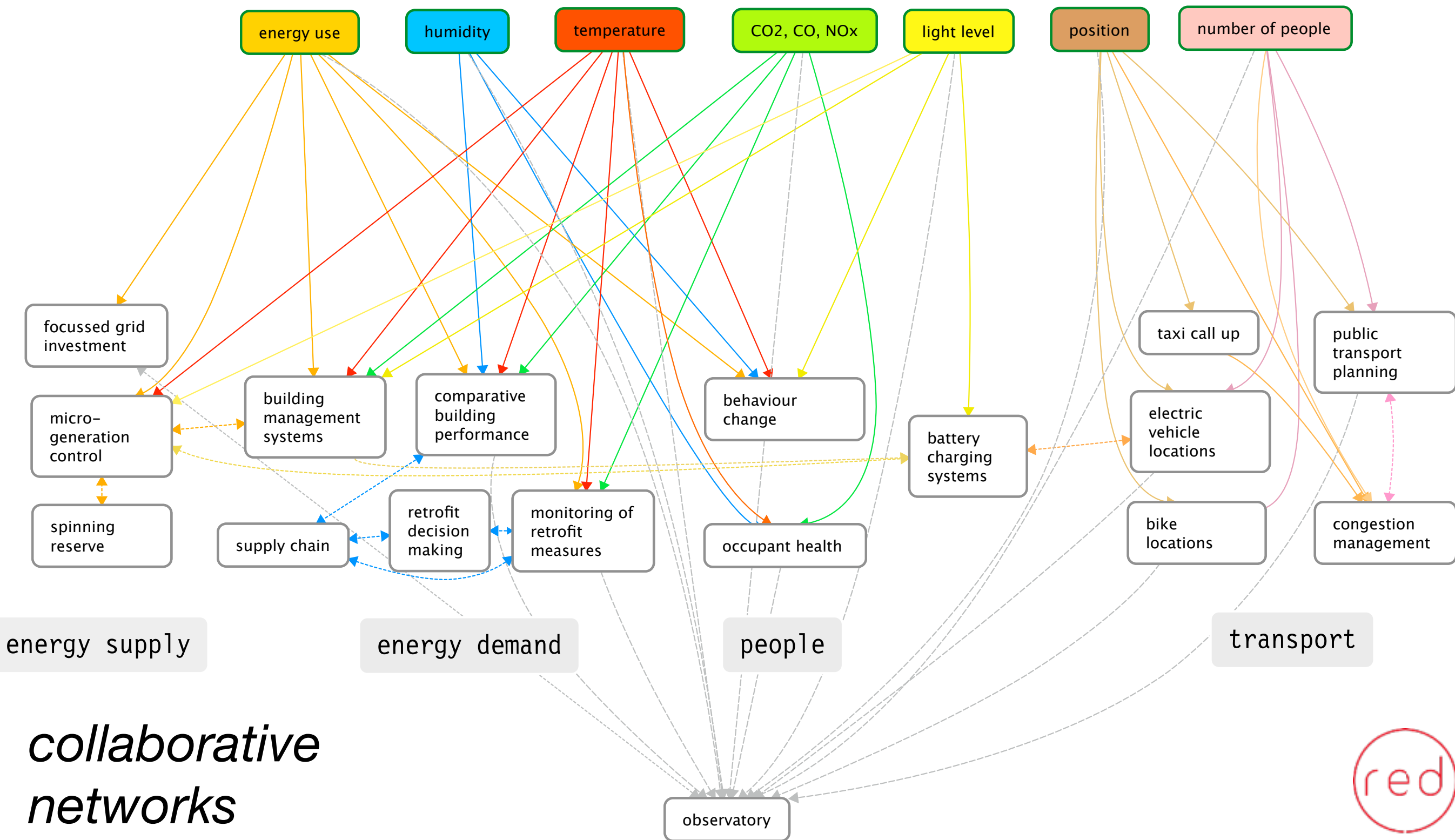


to gather data to
develop, prove then
disseminate best
practice as well as
identify problems.

it already happens with
heat pumps

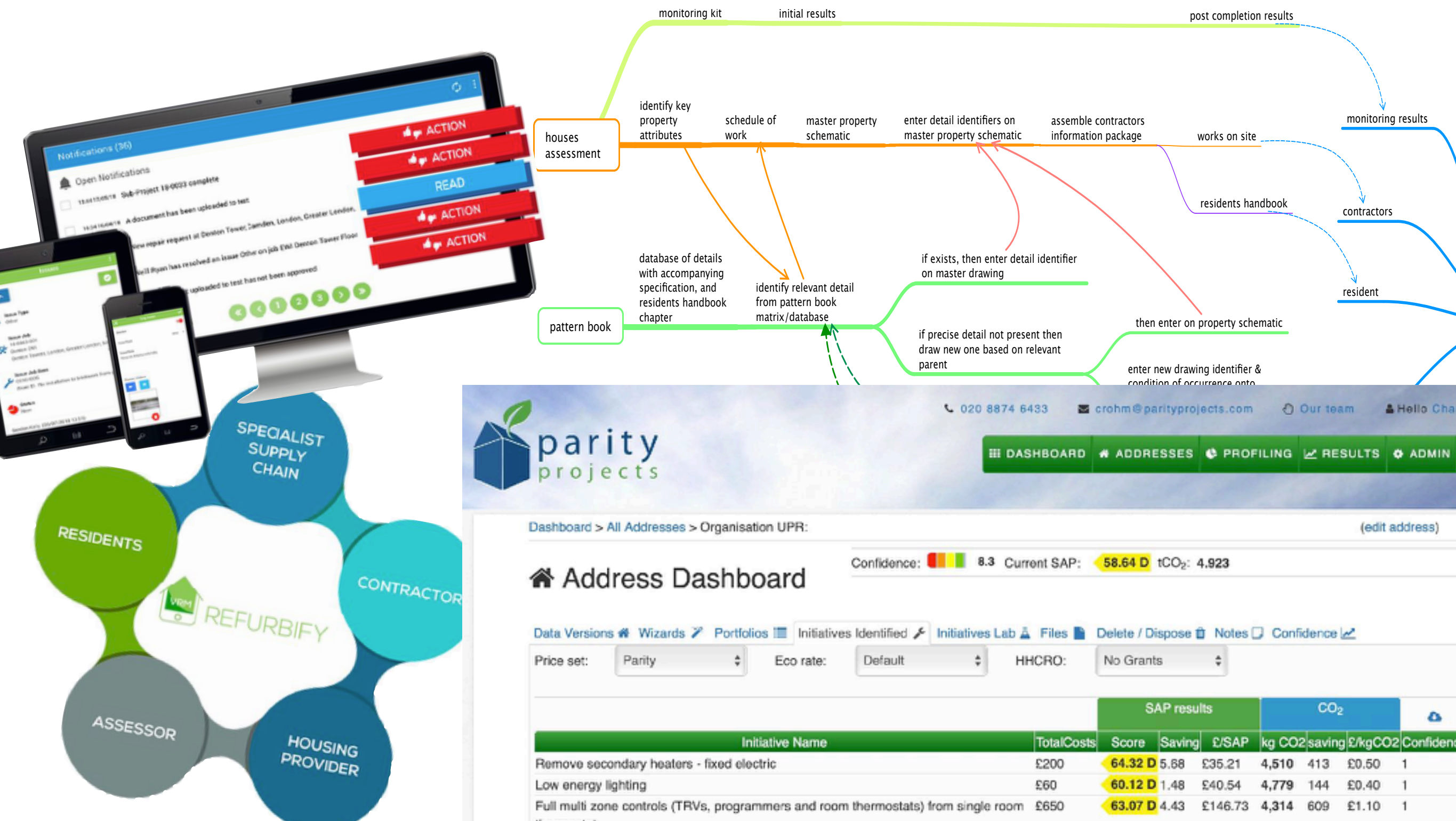
3 monitoring & data

change how innovation is stimulated, disseminated and rewarded...



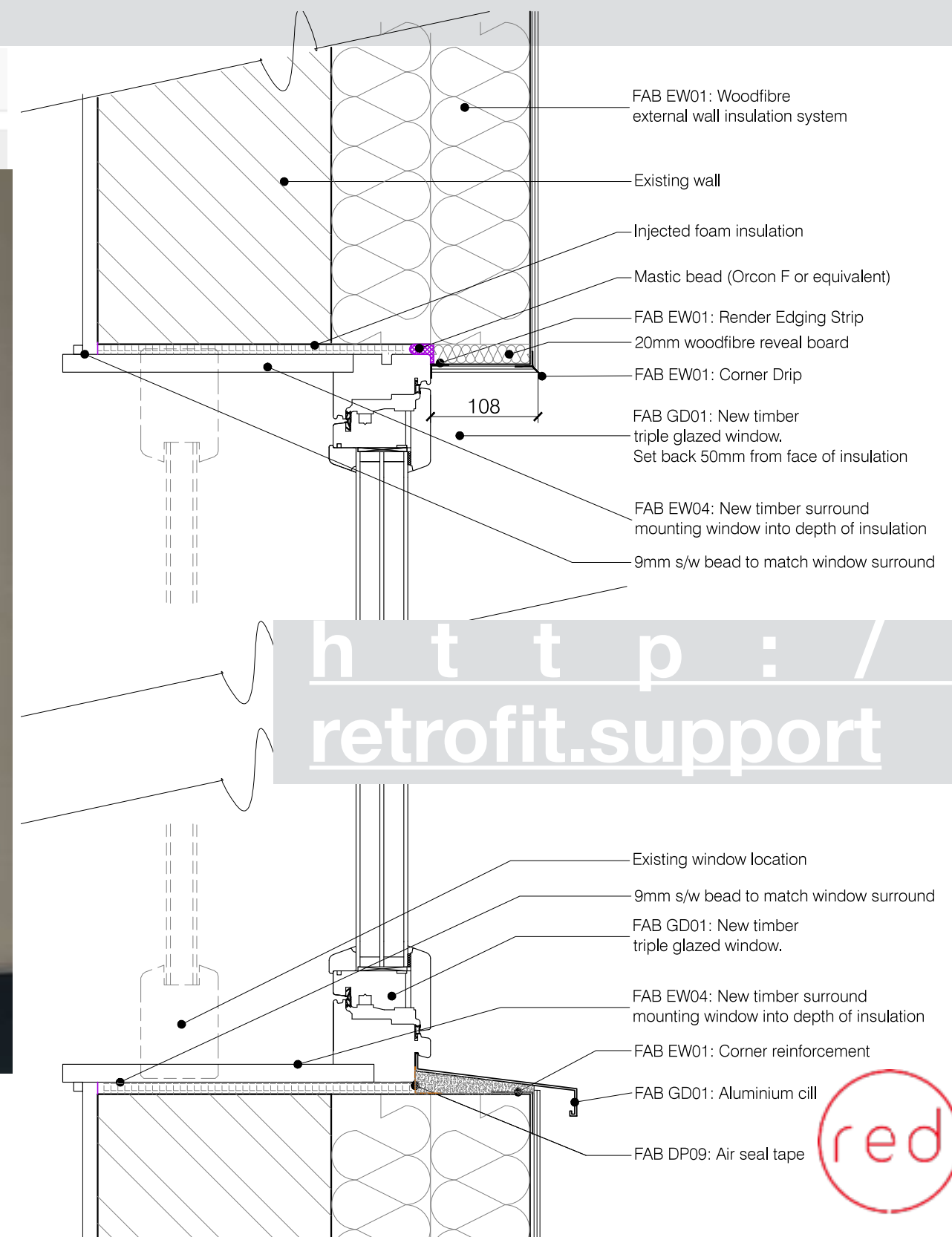
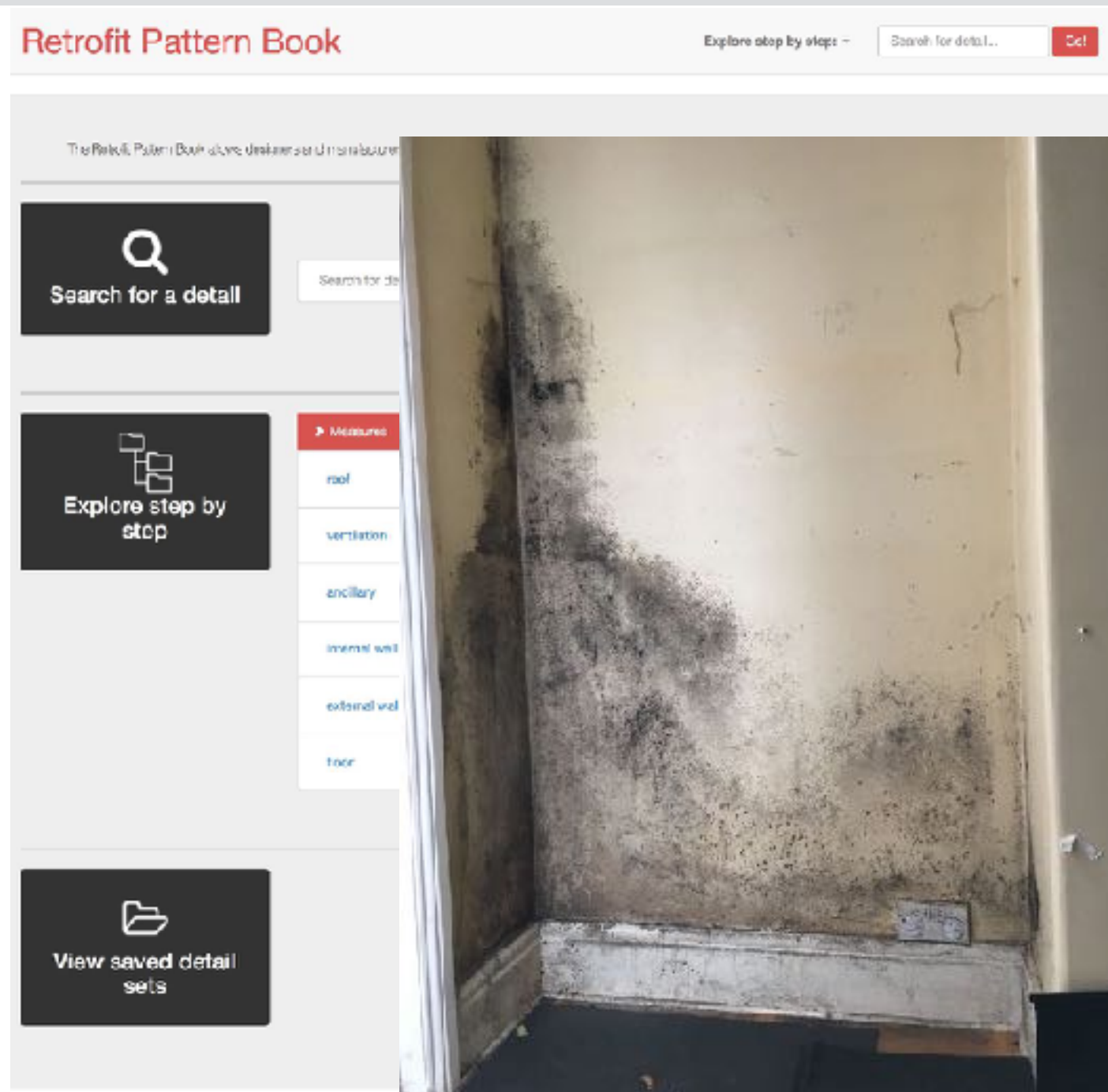
4 IT & software

Development of IT systems & **interoperable** software to allow mass customisation, more streamlined design, site management & cost control.



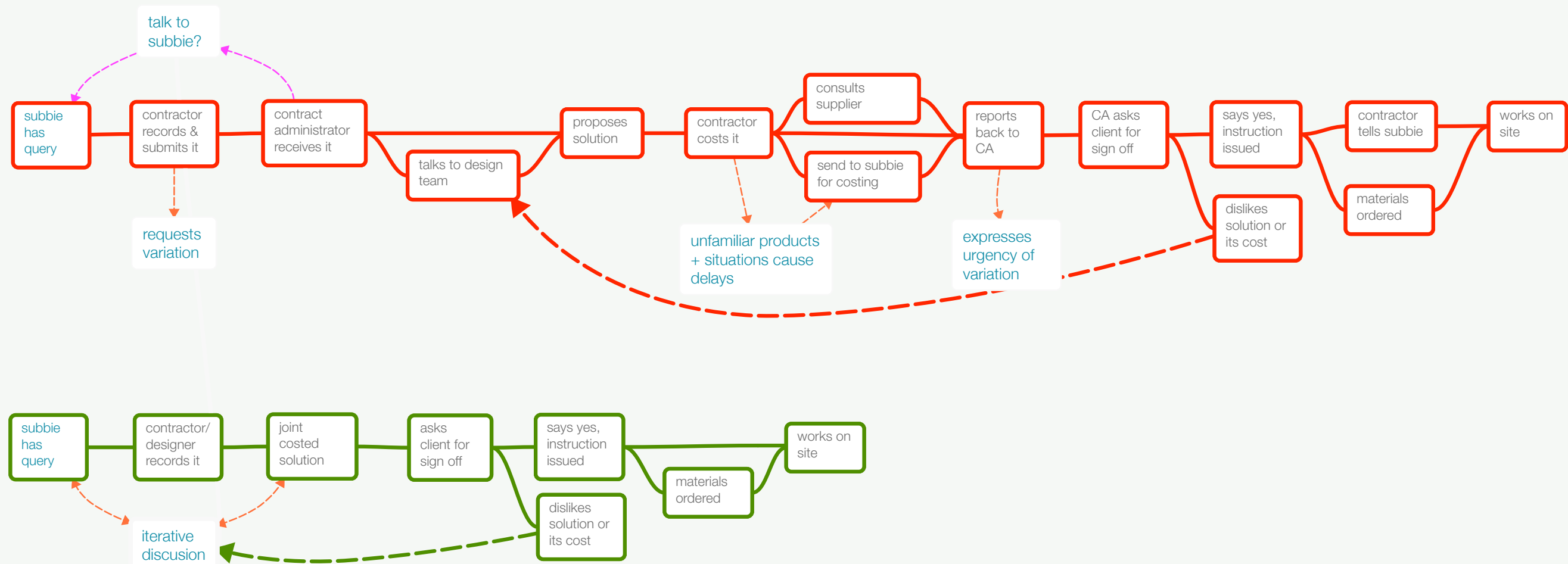
5 specification & detailing

science & risk based **specification**, not just lowest cost material selection,
proper **detailing** to reduce underperformance, defects & health effects.



6 contracting & guarantees

Better contract models, delivery structures + energy performance guarantees.



- the current models are not fit for purpose,
- involve trades in the process
- on-site access to project docs -Refurbify
- enabling problems to be spotted and sorted more effectively
- basically **co-operate** more



energiesprong - netherlands

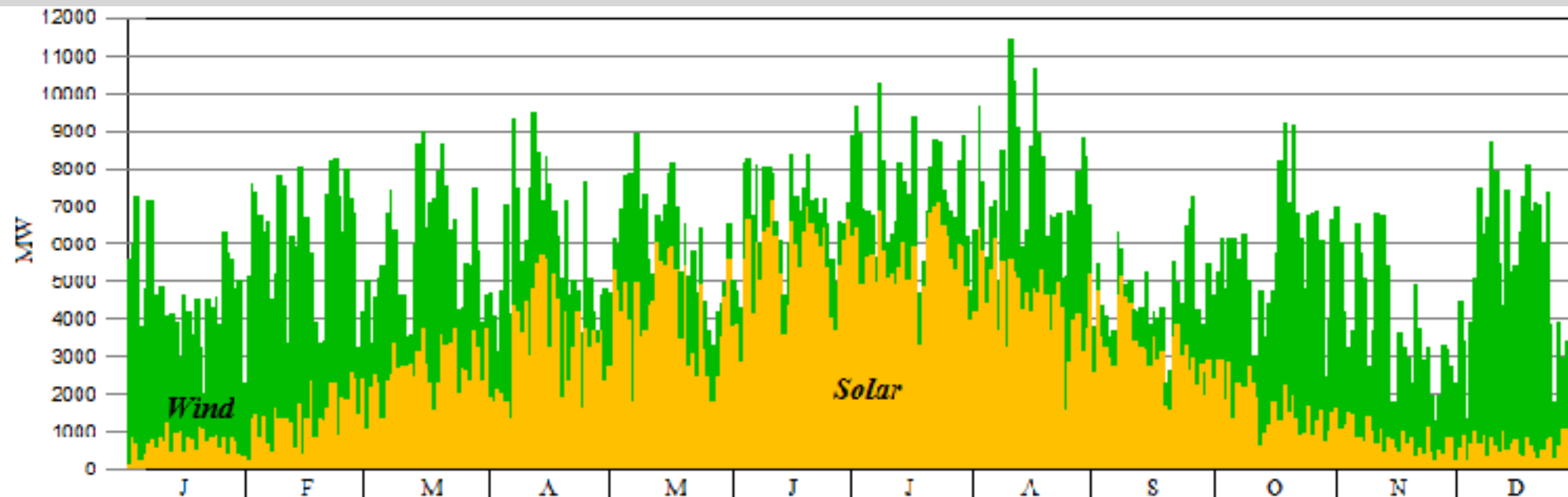
off-site construction - zero net energy



performance guarantee for 30 years

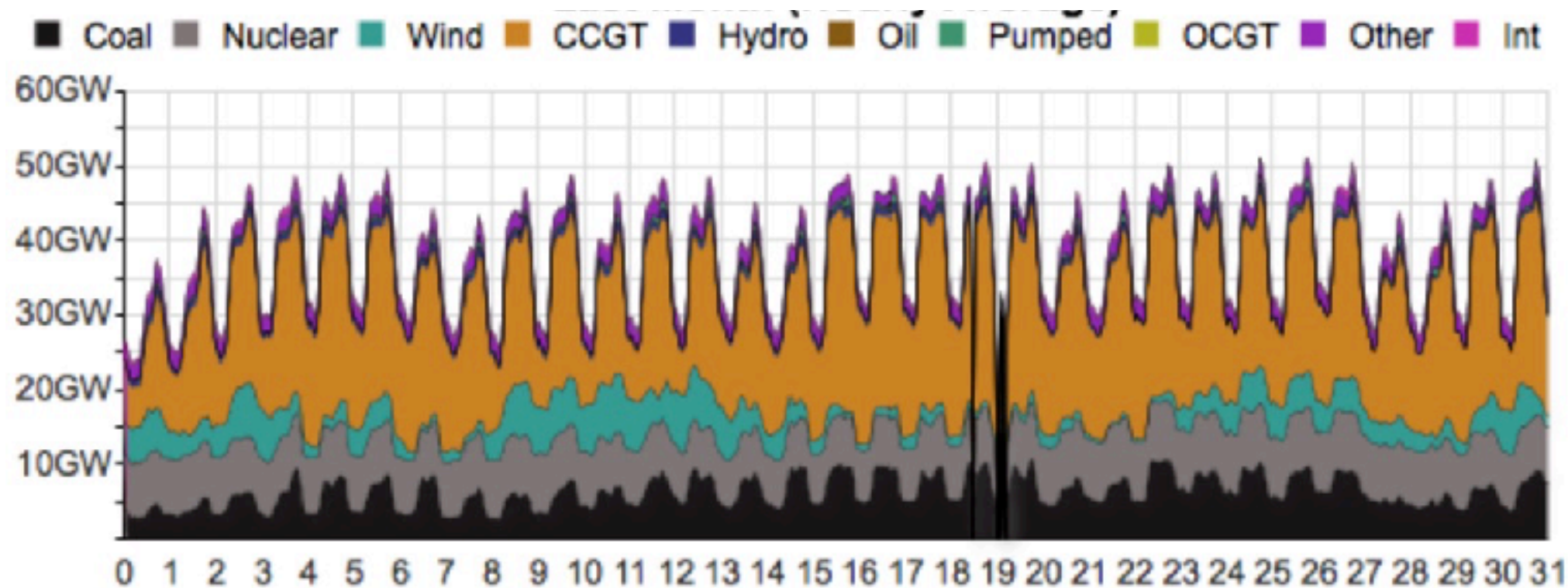
7 additional revenues

the new component is energy storage



- move energy from when it's generated to when it's needed
- enabling more self-consumption
- and future income from energy sales

annual renewable energy variations



daily energy supply variations

the new component is energy storage

1. demand shifting

Time of day tariff costs 4-8p/kWh instead of 14p/kWh

average UK bill at 3,800kWh then if sufficient battery to provide whole day then annual saving $> 3800 \times \text{difference} = \text{approx } \pounds 300$

2. supply shifting

assume a 4kW PV installation generating 3,200kWh/A, additional saving = $3200 \times 5 = + \pounds 160$

3. aggregated sales to grid

Short Term Operating Reserve - up to $\pounds 350$
or Frequency Response up to $\pounds 300$

4. Demand Side Response

(possibly) DUoS Red band avoidance $\pounds 60$

energy storage income is not subsidy,
it is the energy market

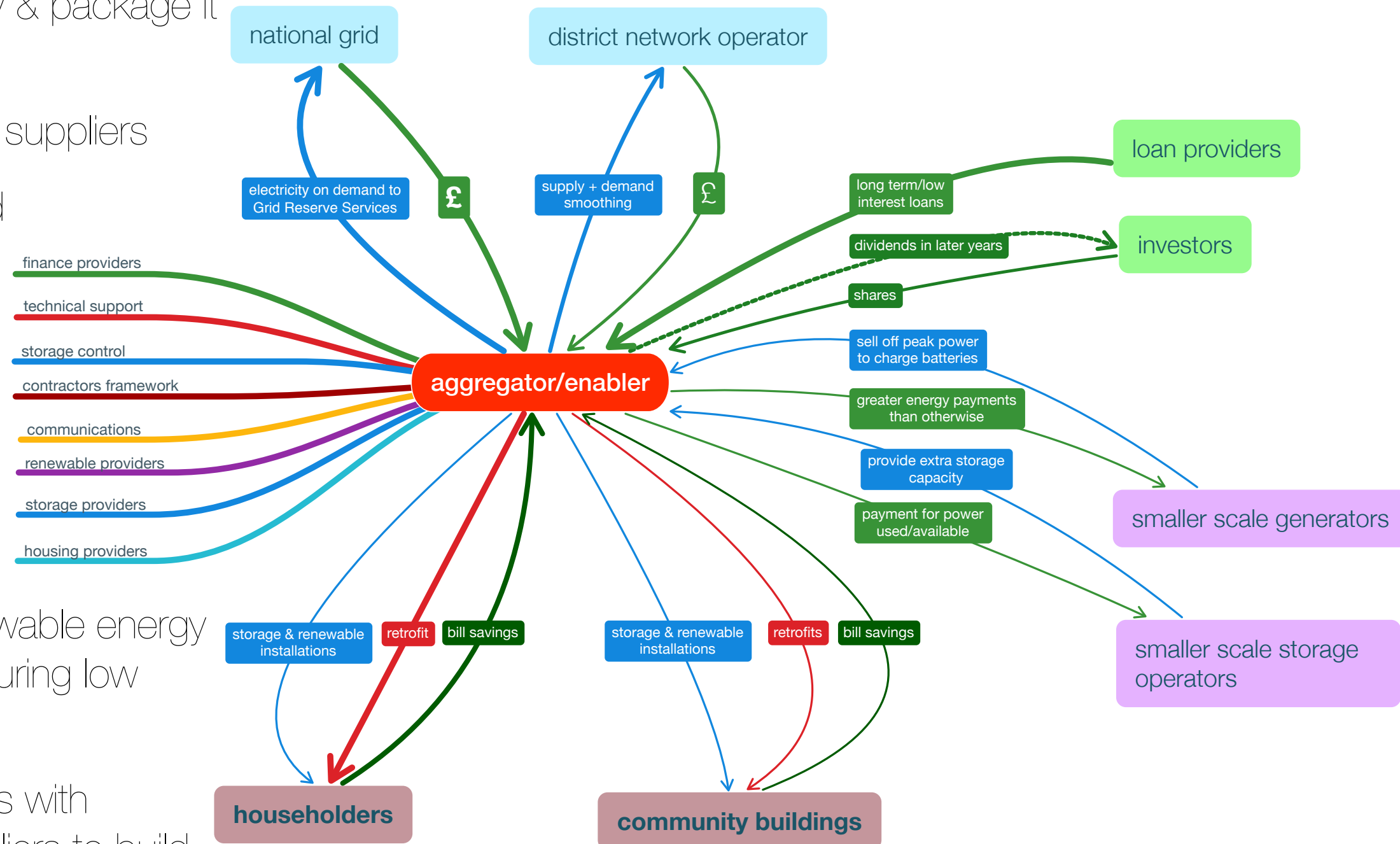


7. aggregation

intermediaries are needed to access these new revenues

- to take the individual batteries' energy & package it for sale

- ▶ to energy suppliers
- ▶ to the grid



- purchase renewable energy for recharging during low demand

- negotiated PPA's with renewable suppliers to build the market

- this really must be a community controlled vehicle,

8. financial vehicle

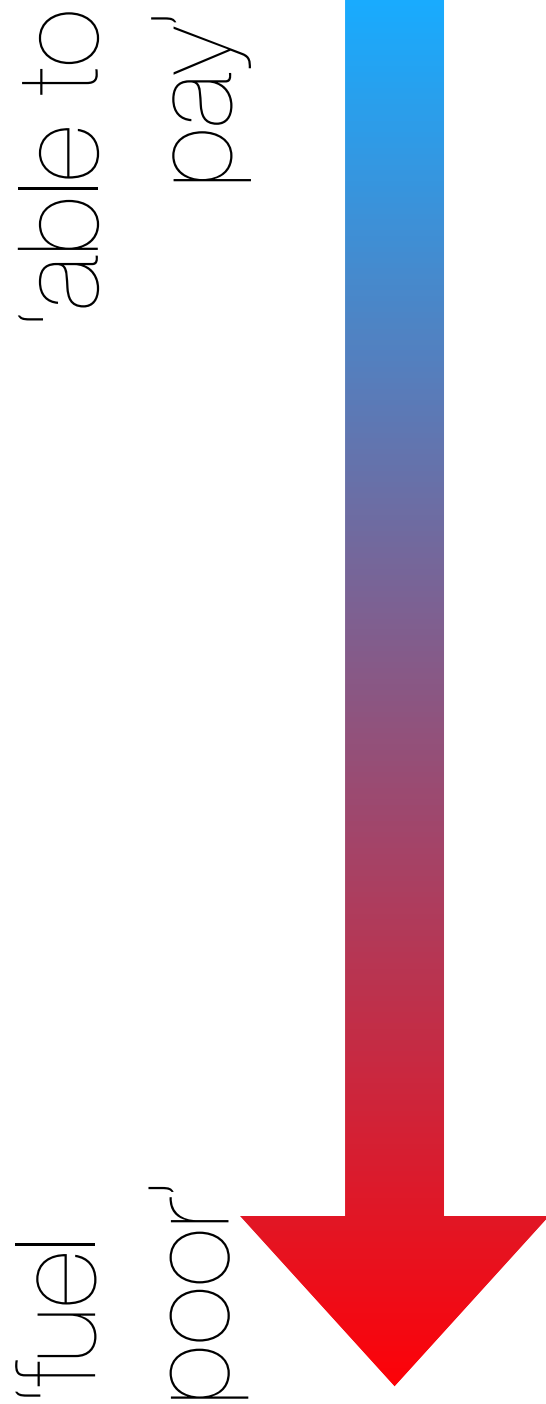
- to take in large scale, low cost finance from multiple sources, distribute to fund householders works,
- enable policy led lending, such as progressive equity loans, to less well-off households,
- being the preferred source of finance creates gateway to quality control
- Personal Retrofit Loan Fund





Loans to those able to pay can help those less able to pay

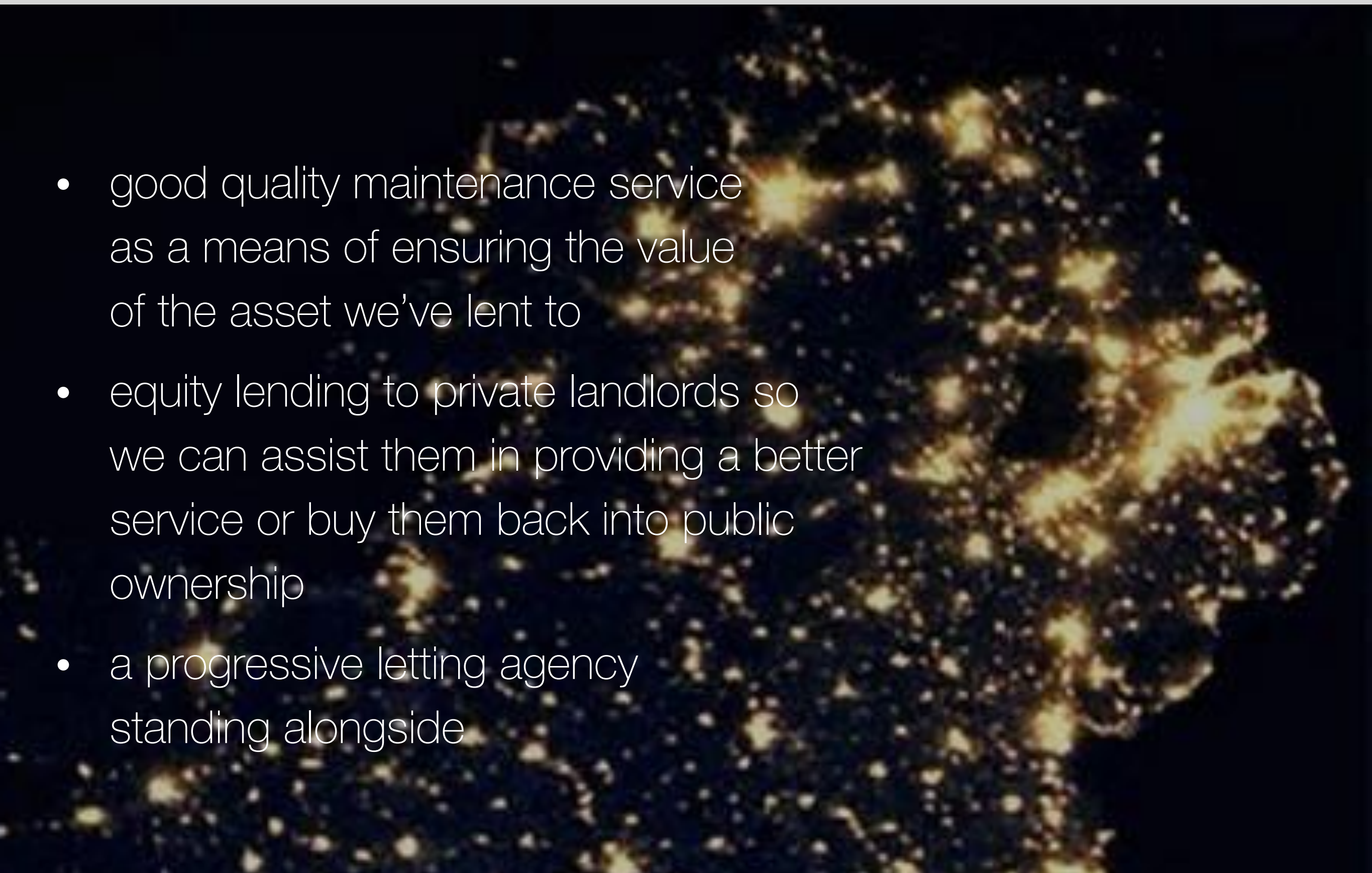
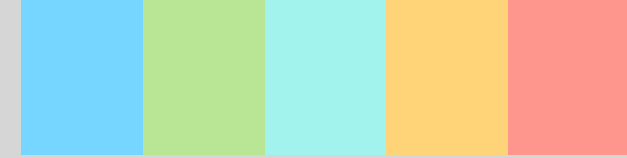
- retrofit bonds
- loans but at sub-high street interest rates
- unsecured loans at sub-high street interest rates
- unsecured loans at cost of finance
- interest only equity loans
- equity loans with no charge until sale of property



8. financial vehicle

it can grow from there:

- good quality maintenance service as a means of ensuring the value of the asset we've lent to
- equity lending to private landlords so we can assist them in providing a better service or buy them back into public ownership
- a progressive letting agency standing alongside



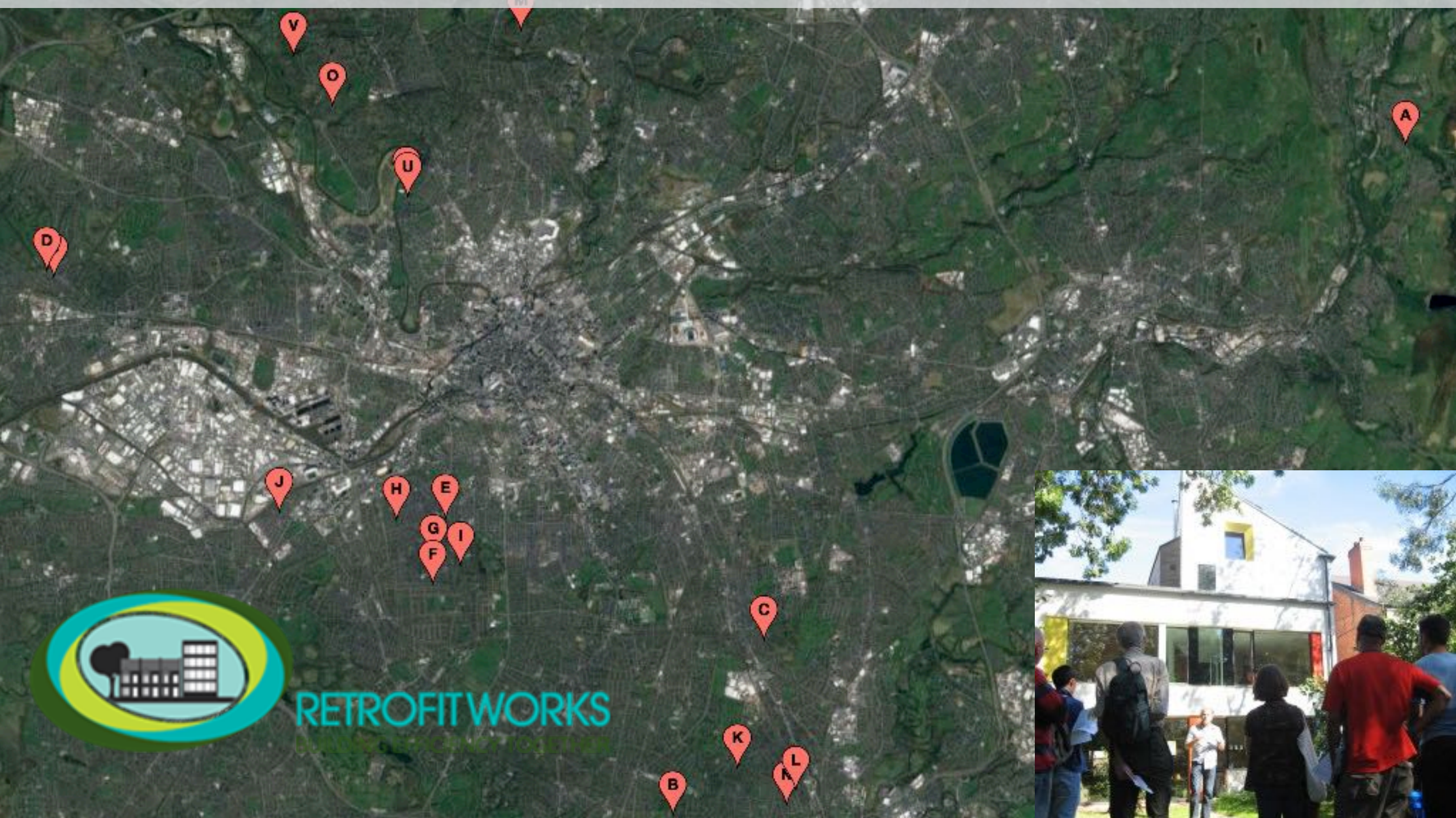
8. source of finance



- Green Deal Finance Company was too expensive at nearly 8%
- UK pension pot 1.6% last year
- savers get 1%, 1.5% if lucky
- US bonds during the 1st world war only paid 3.5%.
- a municipal bond? so your savings could help your community
- will PWLB become popular again post-Brexit?
- when will institutional investors become interested
- the quality of the public sector covenant enables the cheapest borrowing
- then there's always the people

9 scalability

Developing capacity: delivery infrastructure, demonstrators, competitions or rolling competitive funds to develop designer/contractor teams capable of delivering deep retrofits to roll out at scale

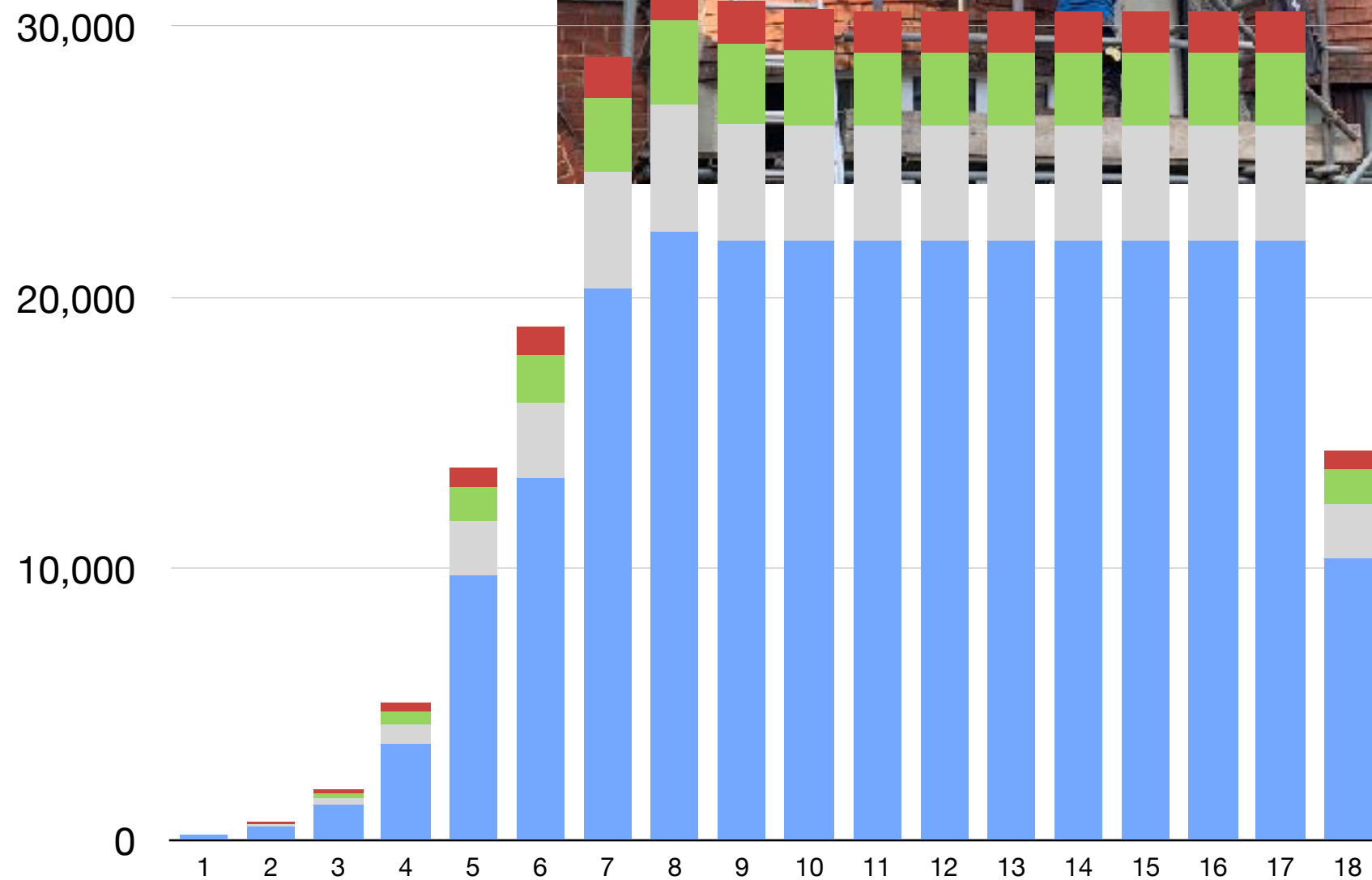


10. workforce development

Training needs to be developed, and be scalable to respond.

approximate workforce size
over the life of the
programme

- designers
- renewables & storage installers
- management
- trades

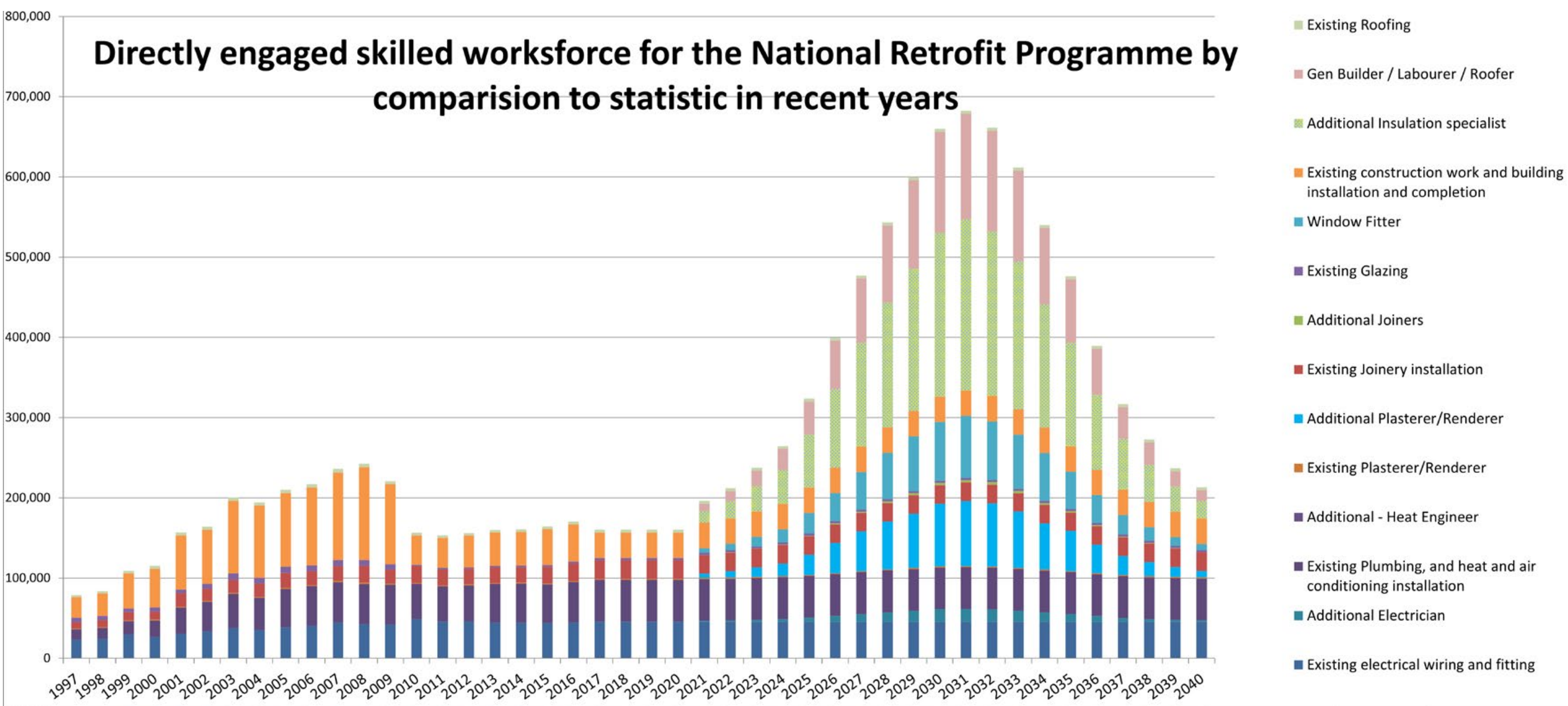


potentially 30,000 new
jobs in West Yorks where
are they going to come
from?

10. workforce development


Jobs

there's a very larger number of jobs



this is based on a lower assumption of retrofit energy savings
there's also an argument that having 700,000 jobs for only 1 year makes careers choices difficult

even the Construction Leadership Council's National Retrofit Strategy agrees

A photograph of a building under renovation. Scaffolding is visible on the left side of the frame. A large, leafy tree dominates the right side and the foreground. The text is overlaid on the right side of the image.

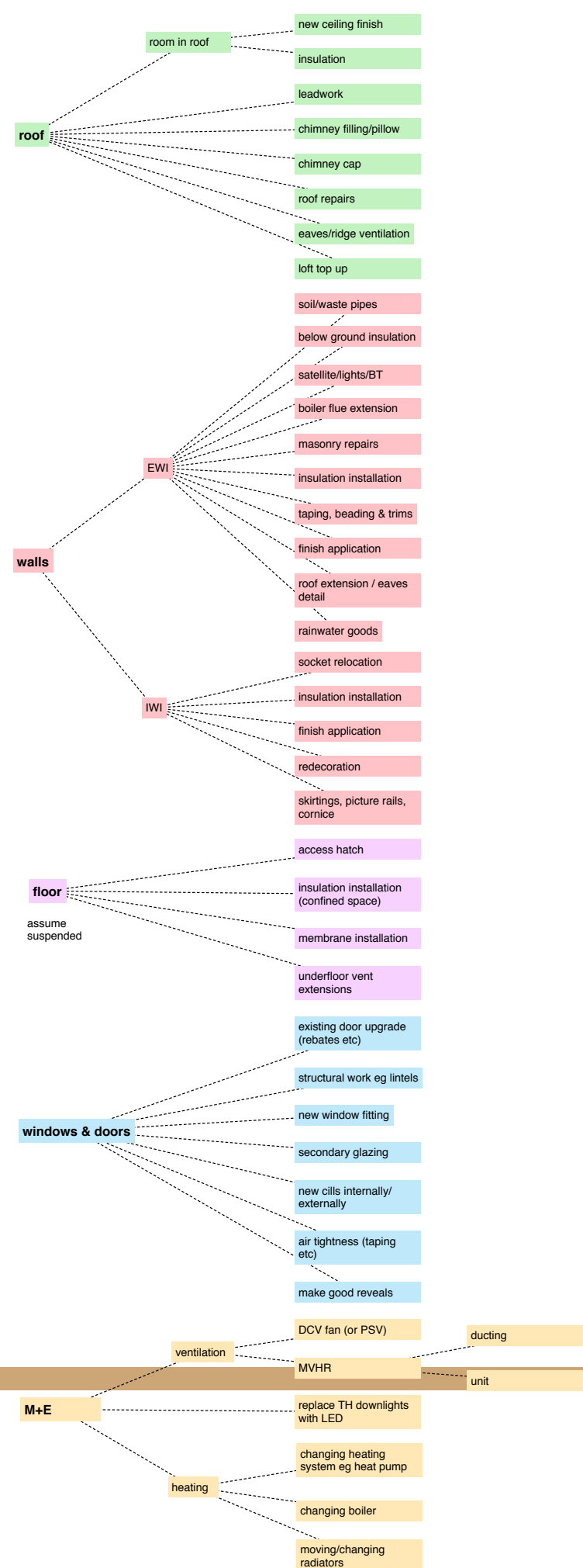
Retrofit Get in Project Theatre workers into retrofit

Premise

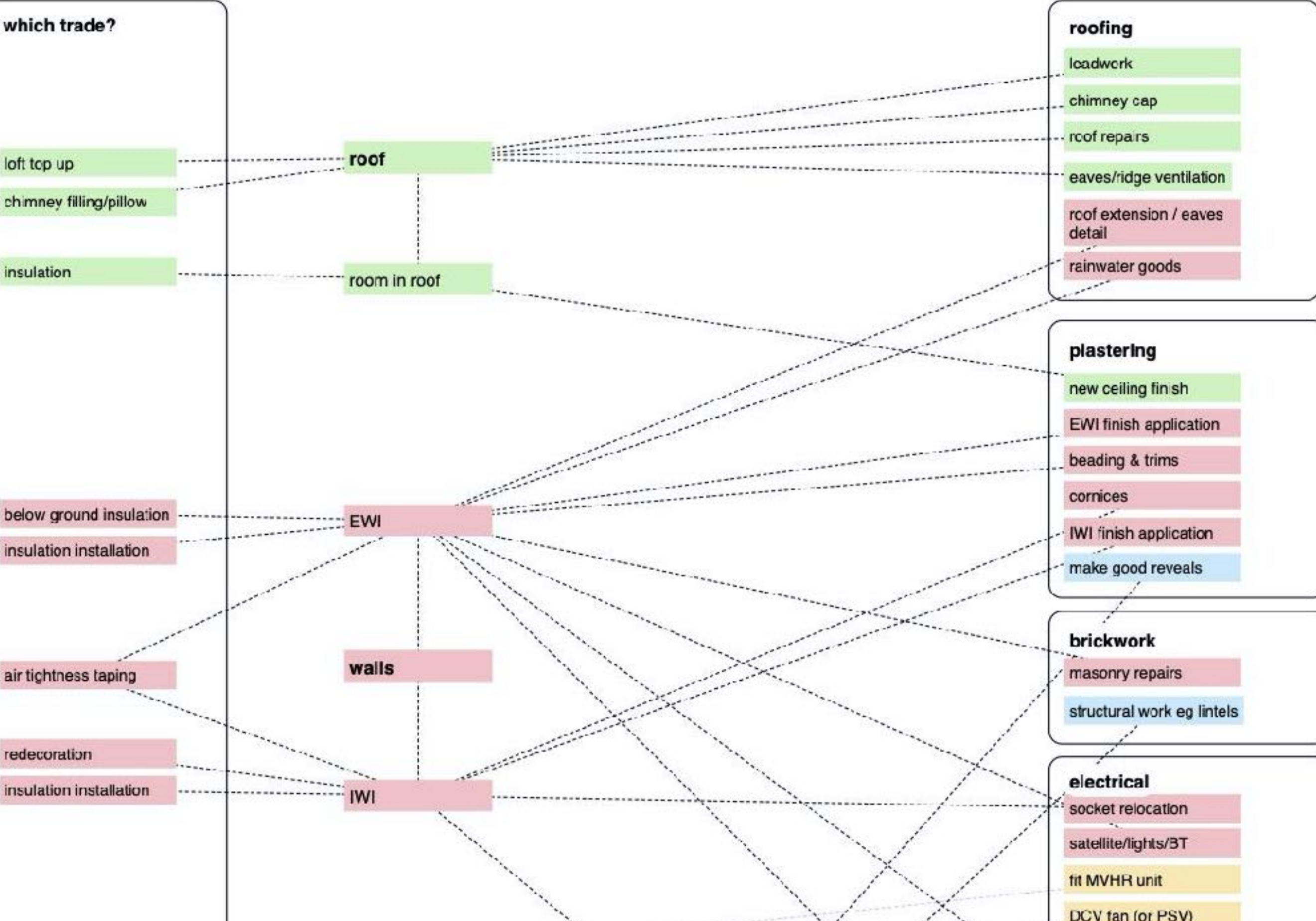
Matching skills from other fields into construction and retrofitting.

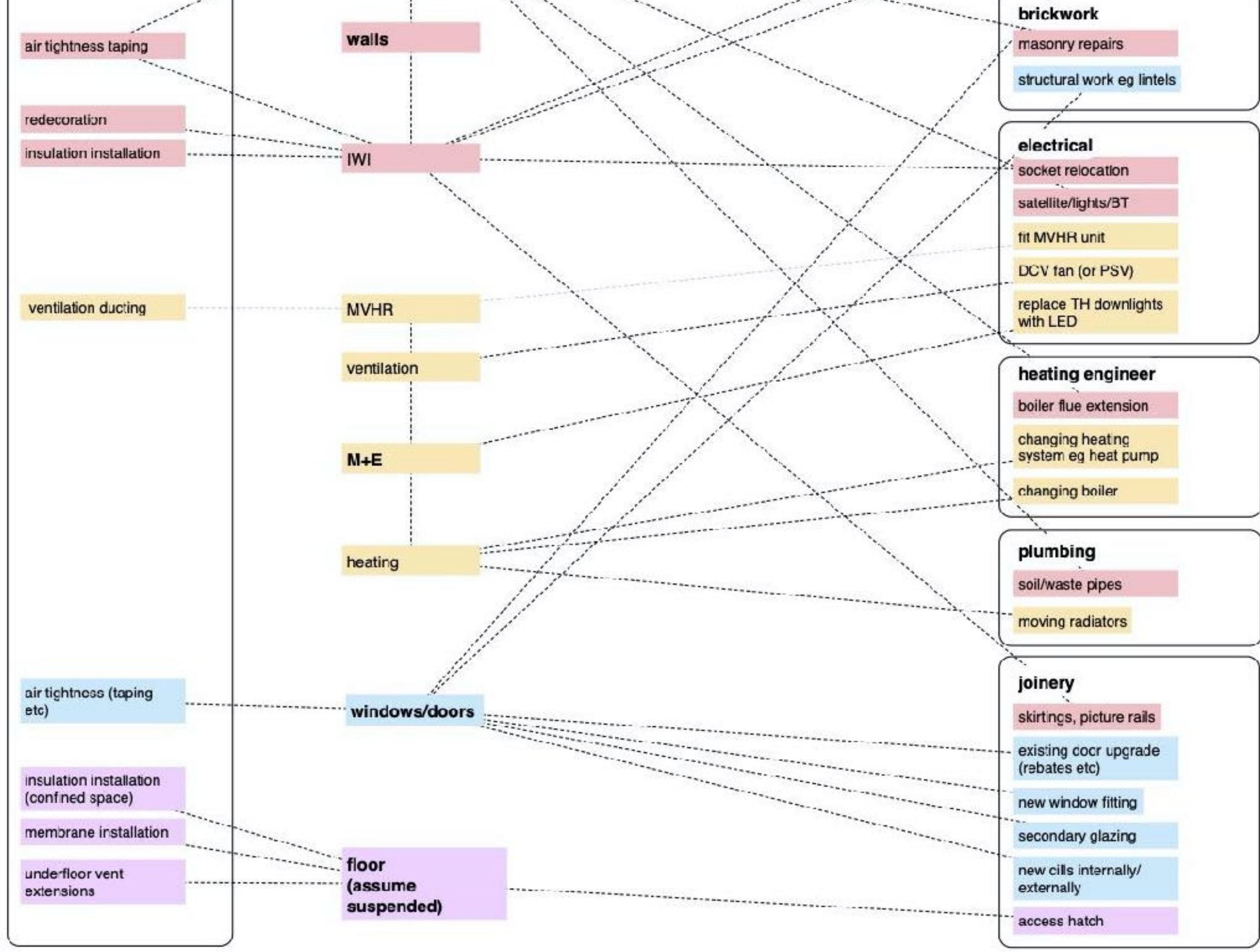
Test what it takes to make a good retrofitter.

Provide work for people who aren't being supported.



retrofit tasks arranged by trade





practice

reskilling



Late September
to now
12 people working
on retrofits:

IMI, floor replacement, plastering
decoration. Replacement of bay windows.

Varying skill sets.

Working during Covid.



Next steps

Creation of a bespoke retrofitting training course.

Using a granular approach to spread out work and train more people.

Setting a “skill level” system to break up work.

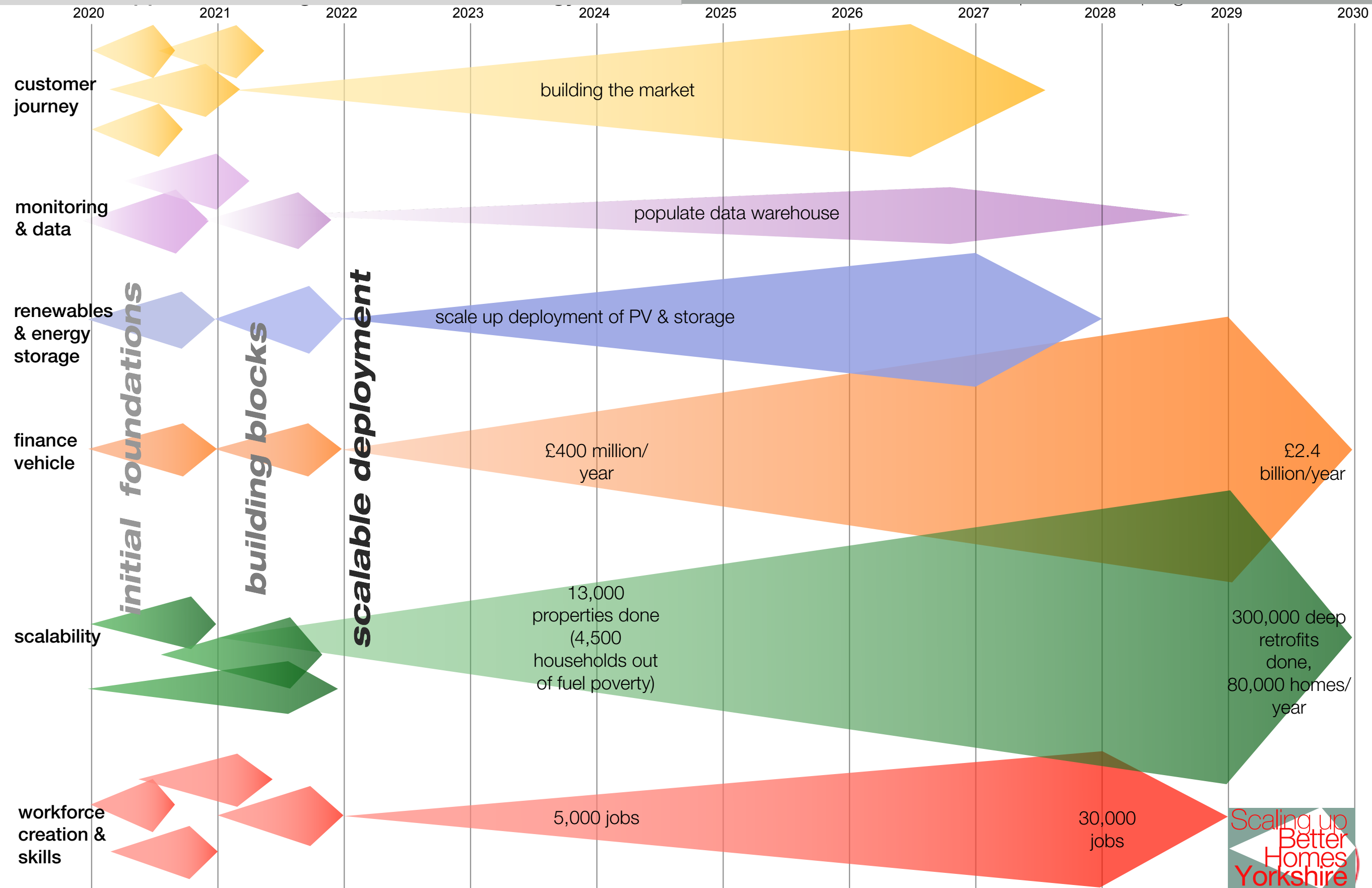
PAS:2035 and beyond,
remote quality
management

summary

	skill level			room in roof	IWI		average
		hours (excl breaks)	7.5				
unskilled	i	£10.00	£75	7%	6%		7%
1/4 skills	ii	£13.33	£100	29%	29%		29%
1/2 skills	iii	£16.00	£120	46%	53%		50%
fully skilled	iv	£20.00	£150	18%	12%		15%

room in roof insulation

	task	skill level	% of task		
1	Strip previous ceiling, remove previous lighting	i	7%	2	7%
2	Install new rafters on plywood extension pieces beneath existing rafters to create 200mm insulation zone	iii	29%	8	29%
3	Cut and install 2 new layers of woodfibre insulation	ii	14%	4	14%
4	Install vapour control / airtightness layer	ii	7%	2	7%
5	Install plasterboard	iii	18%	5	18%
6	Apply skim coat of plaster	iv	11%	3	11%
7	lighting	iv	7%	2	7%
8	redecorate	ii	7%	2	7%
			100%	28	100%



building
retrofit

more
than just energy
efficiency



let's make the best
use of the buildings
we've got not building
new poorly built ones
in the wrong places



more than housing



building
retrofit

more than housing





not just housing

- an energy efficiency retrofit can be a trigger for making it look better too








NORTH WEST
REGIONAL CONSTRUCTION
AWARDS ★
2017
FINALIST



regenerated
& improved



not just housing

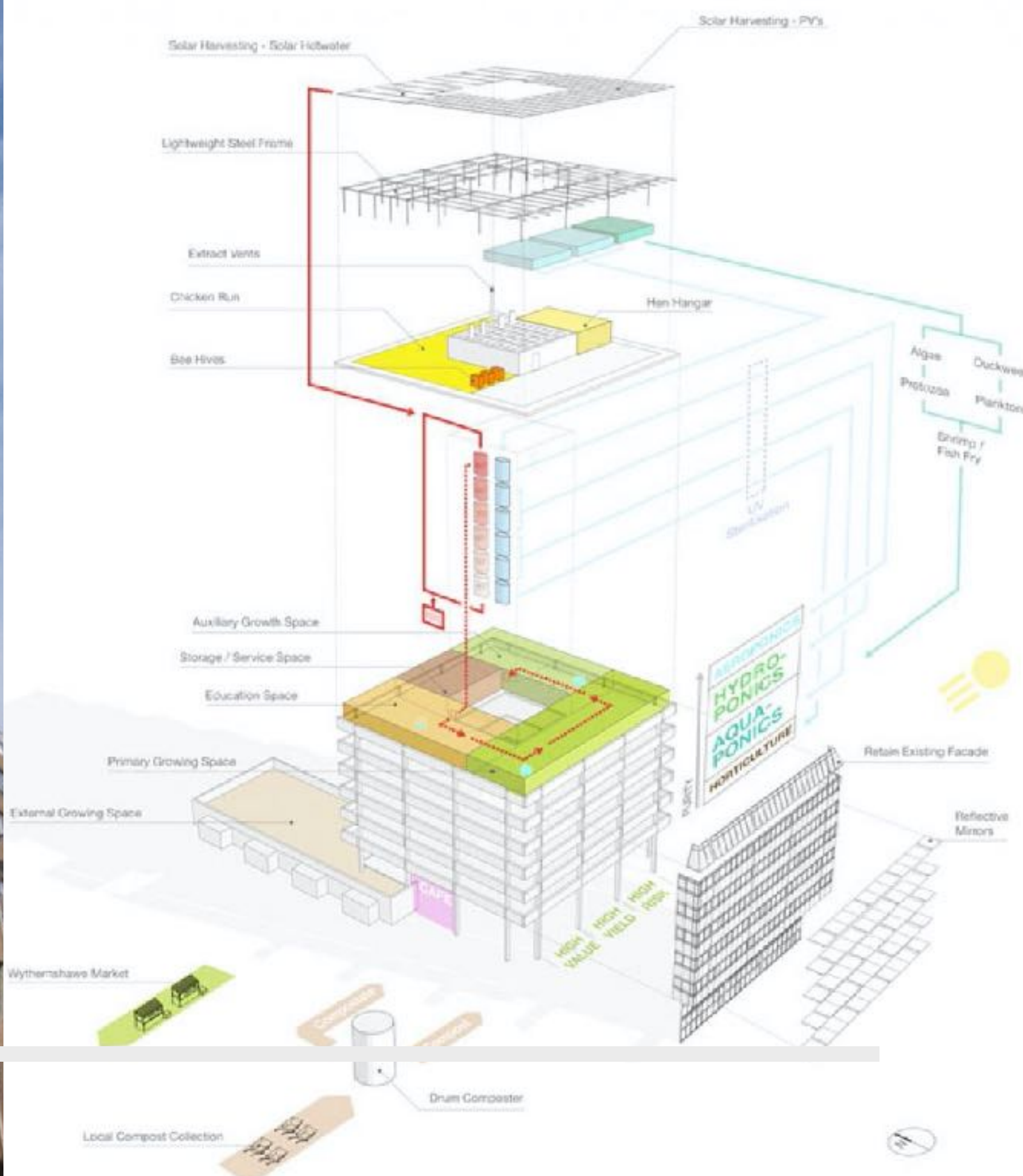


so any
buildings that
could be
better used





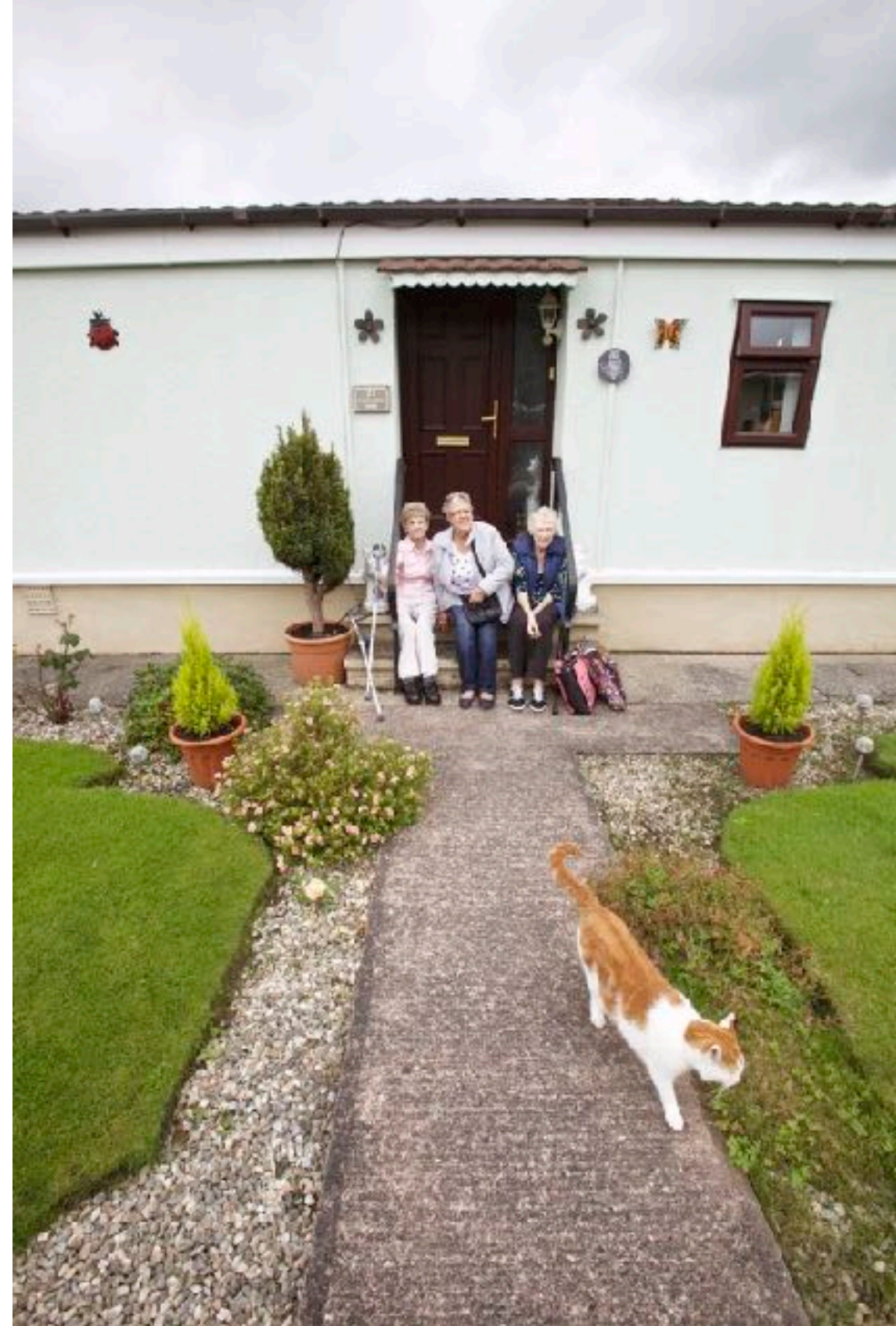
we can do much more with left over buildings



**a viable
future?**

imagine a future with:

- regenerated communities
- homes that don't make you ill
- no fuel poverty
- meaningful jobs with a future
- pensions + savings used for the benefit of our community
|+ planet
- ...more chance of a future for our children not just an apology



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