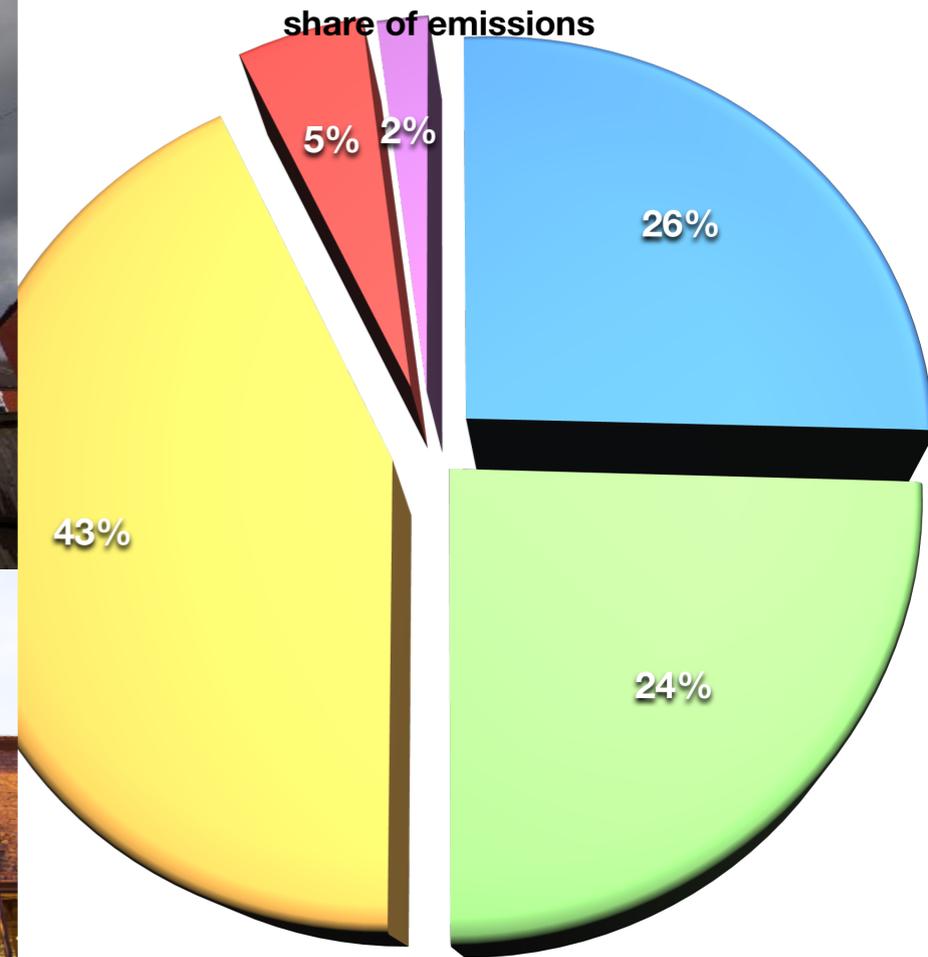




- where we live
- moving us + stuff around
- business
- public buildings + services
- agriculture + forestry



zero by 2040
with whole
building
retrofit?



GM housing stock

- 1.17 million homes
37% of GM emissions
4.1tCO₂/home pA
- by 2040
90% of today's homes will still be standing at current build 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

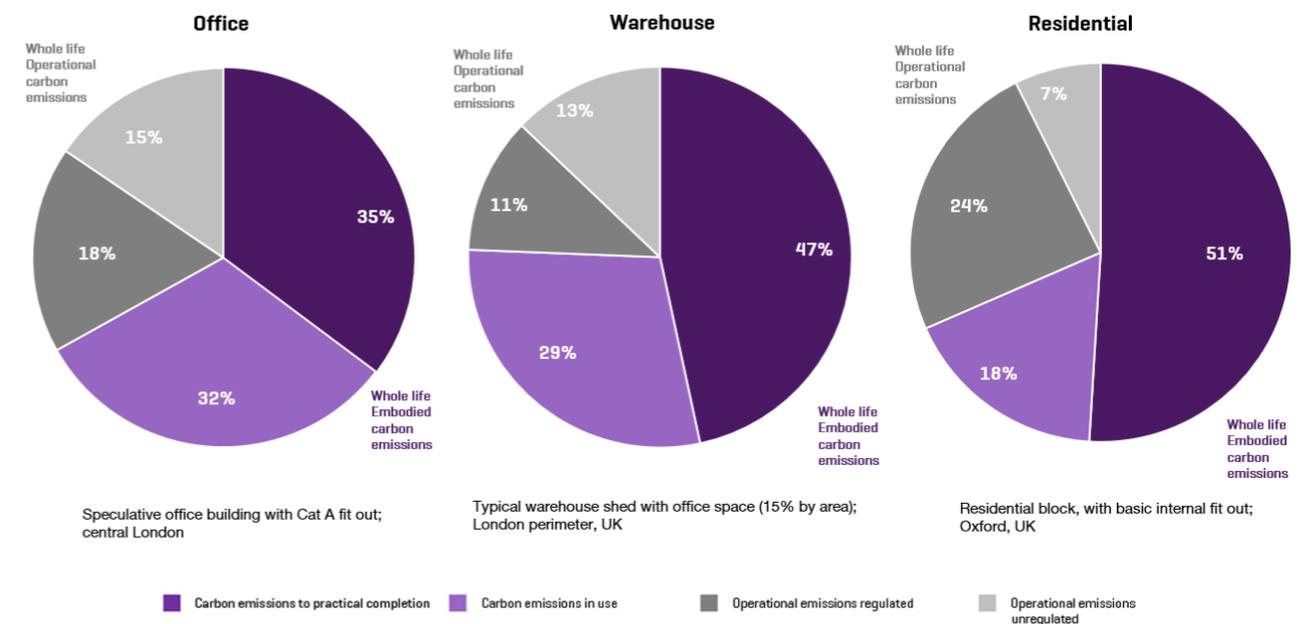
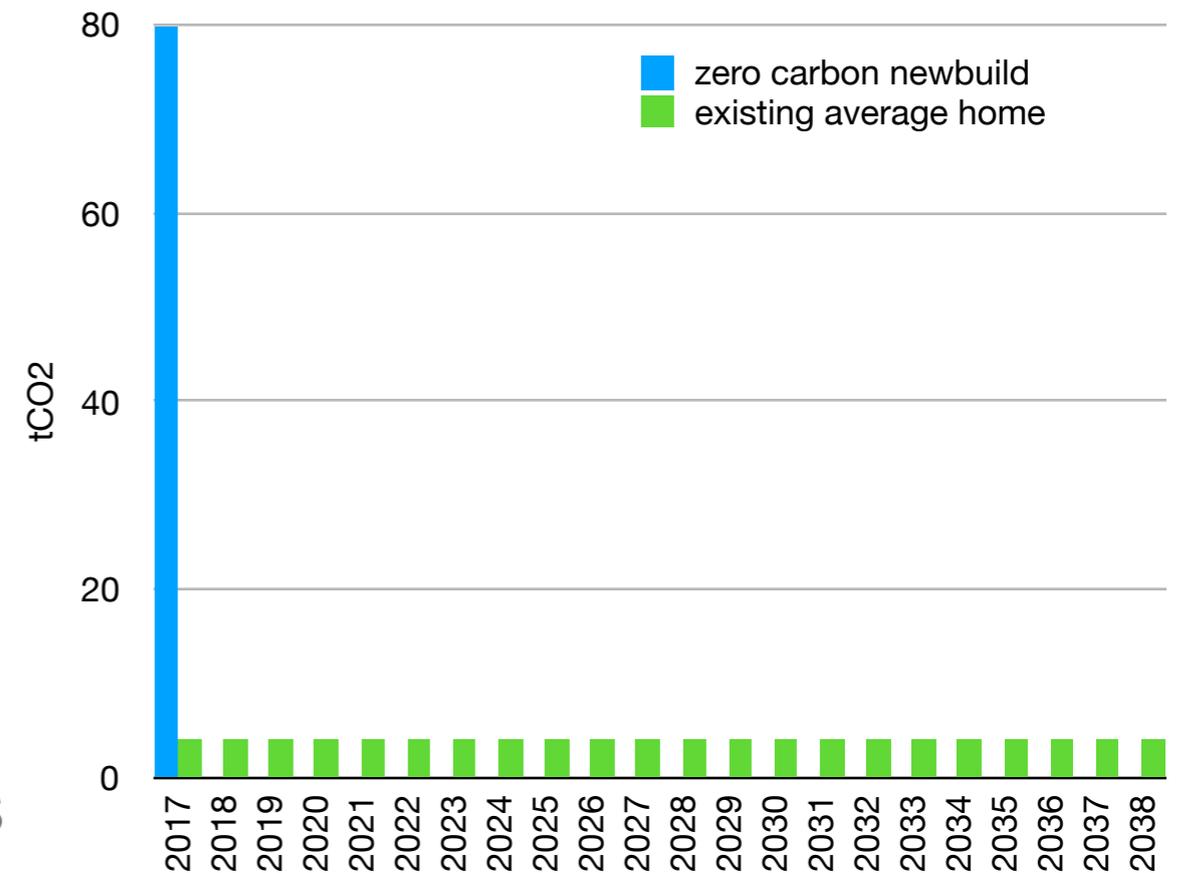


Figure 1: Total whole life carbon emissions breakdown for different building types © Sturgis Carbon Profiling



what standard?

- Passivhaus - **15** kWh/m²/A
- Enerphit - **25** kWh/m²/A
- AECB - **40** kWh/m²/A

Retrofit for the Future (approx) **55** kWh/m²/A
current industry custom & practice - ?

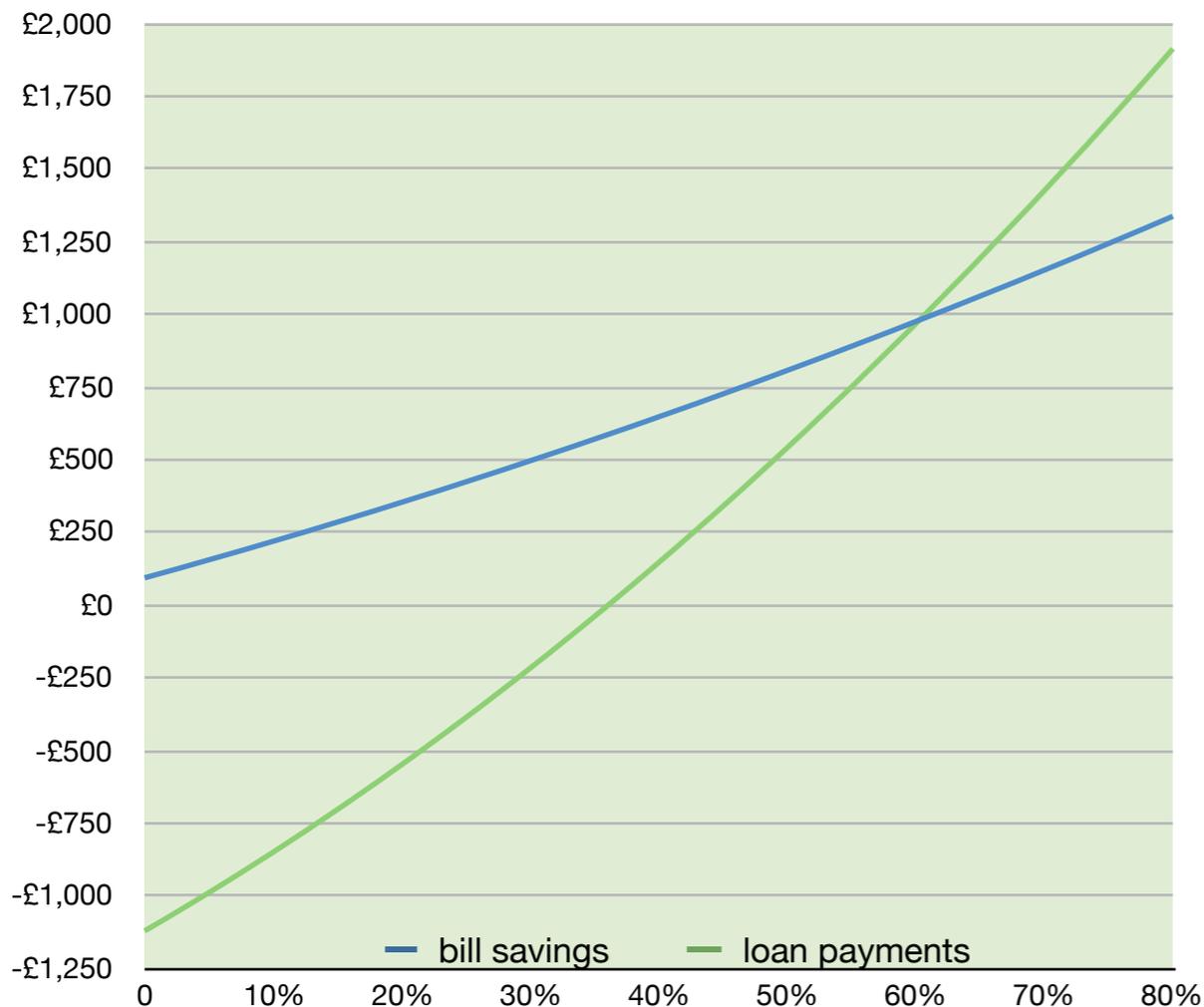
airtightness ?

**proved not just calculated
80% emissions reduction**

<->

zero net CO₂

red



building
retrofit

EWI

external wall insulation
0.2 W/m².K





we can do a lot more
with external wall
insulation



case study: eaves + EWI



IWI

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



roof

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



floors

0.15 W/m².K fully insulated
0.4 W/m².K perimeter insulation



some are
so damp
they need
draining



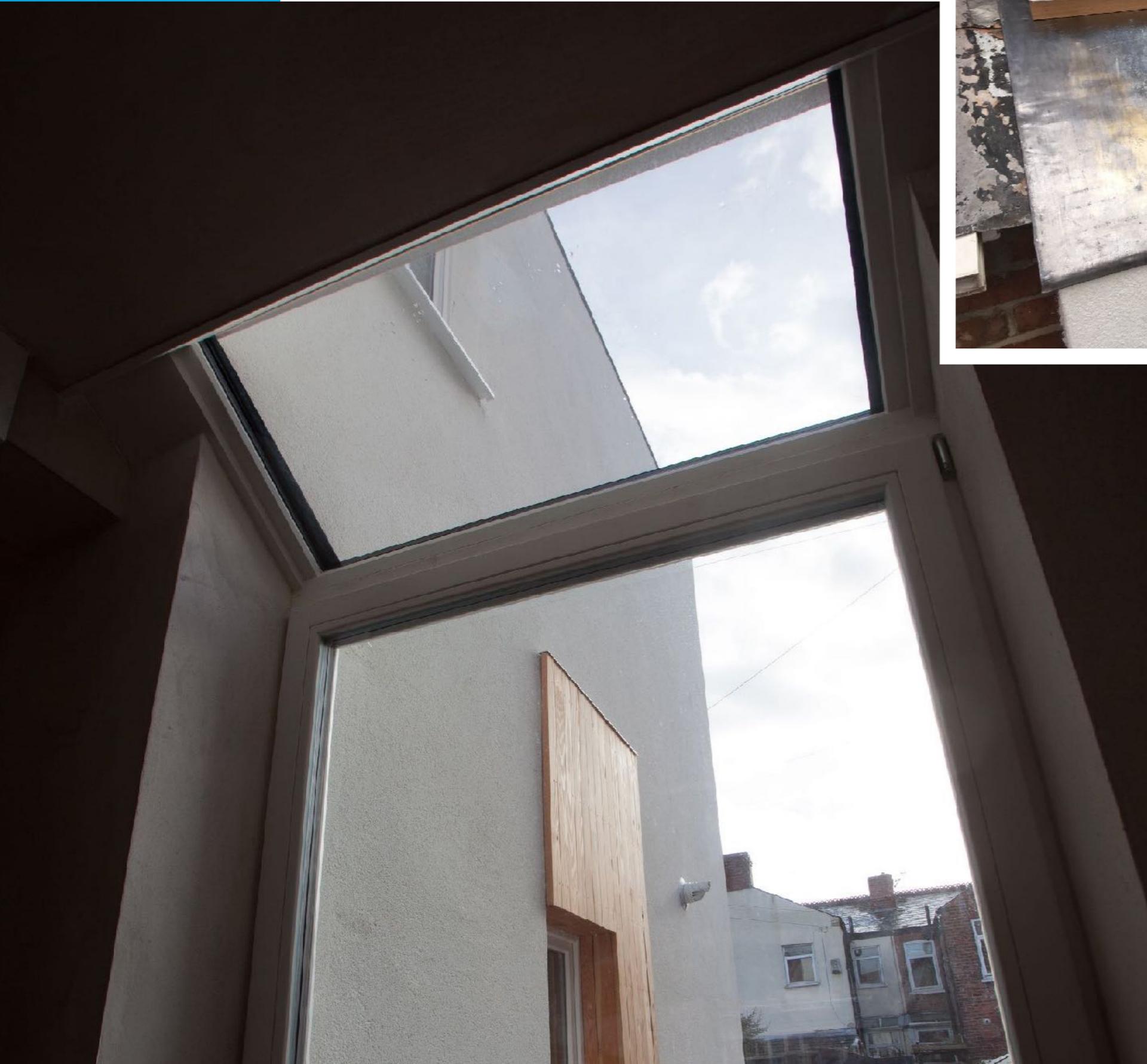
replacing suspended floor
starting with recycled glass
pumice insulation and
underfloor heating

windows & doors

0.85 W/m².K windows

1.0 W/m².K doors





special windows

retained windows



cold bridging & airtightness

max 0.08, pref 0.04, stretch 0.02 y-value
max 5, pref 3, stretch 1.5 m³/m²/hr @50pa



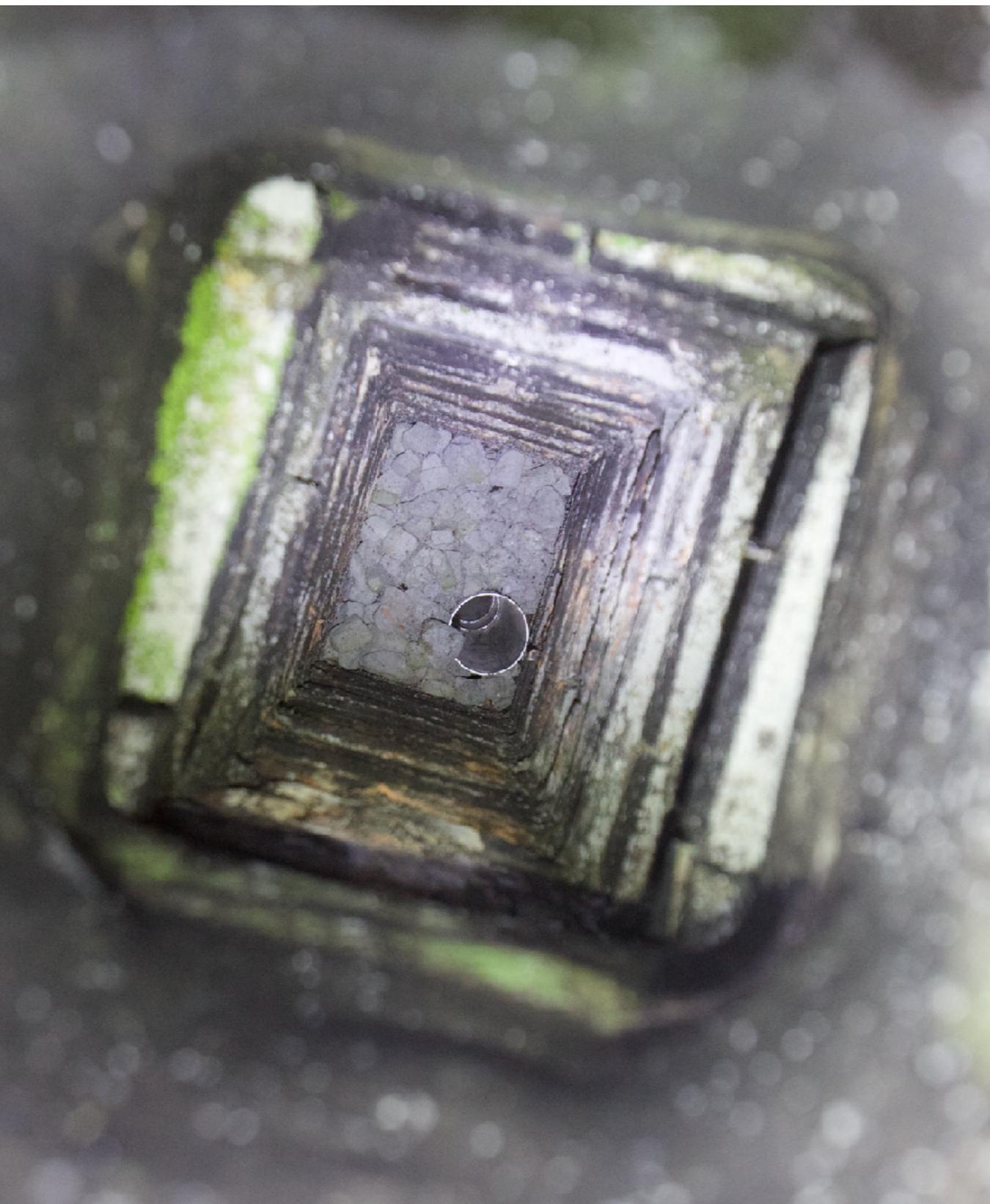


- perimeter insulation down to foundations
- drainage has to be moved, above and below ground



soil stack
embedded in
the EWI then
insulated then
clad with locally
grown larch

ventilation



use the
chimneys



passive stack
ventilation





retrofitted MVHR



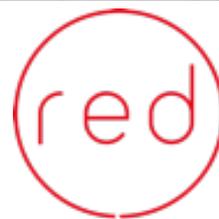
more than housing



let's do workspace fit outs properly
13kWh/m²/A space heating,



regeneration -
madlab



not just housing



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







60% emissions & bill reductions






NORTH WEST
REGIONAL CONSTRUCTION
AWARDS ★
2017
FINALIST



regenerated &
improved

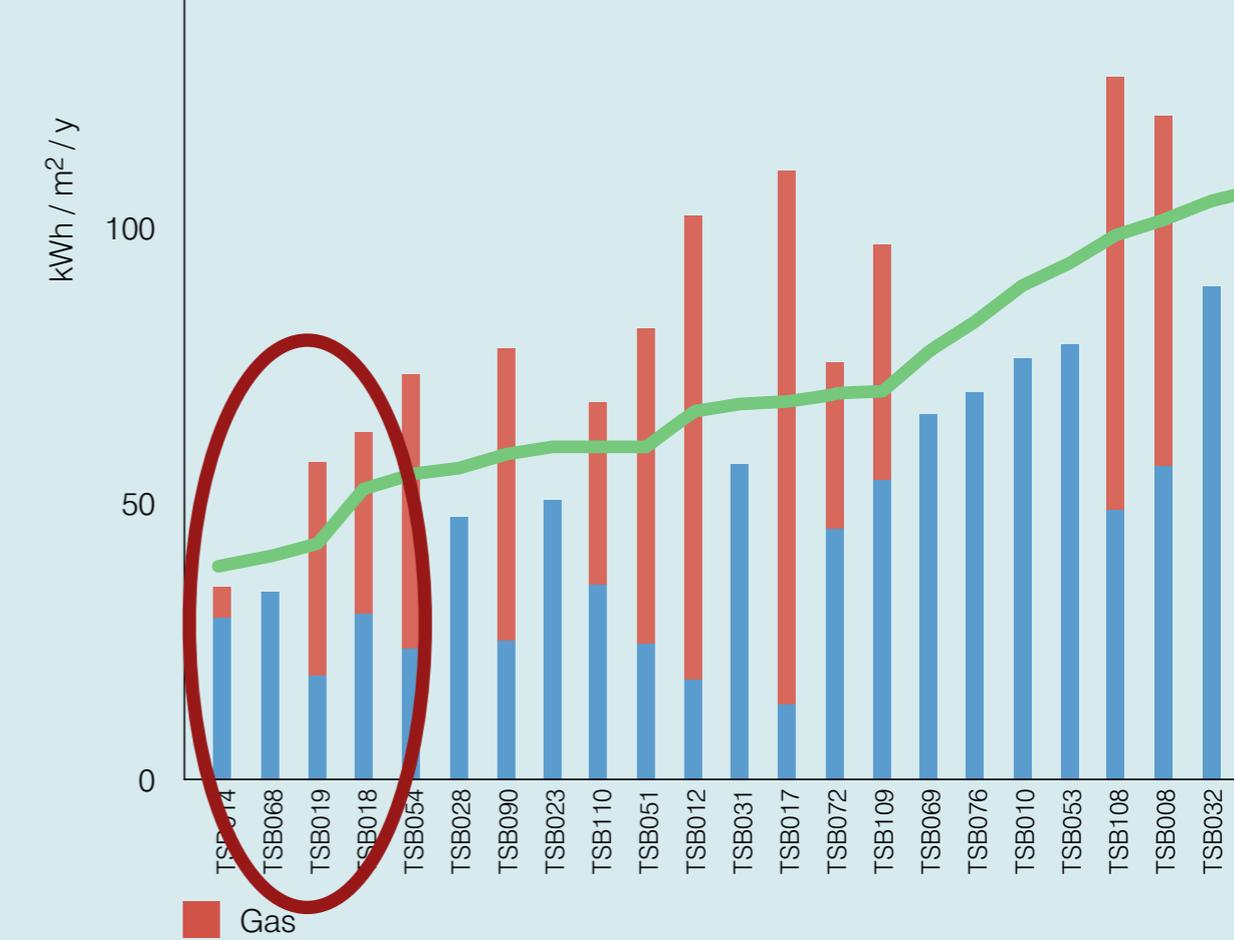


80-90% reductions in energy demand from homes is feasible for pioneers now



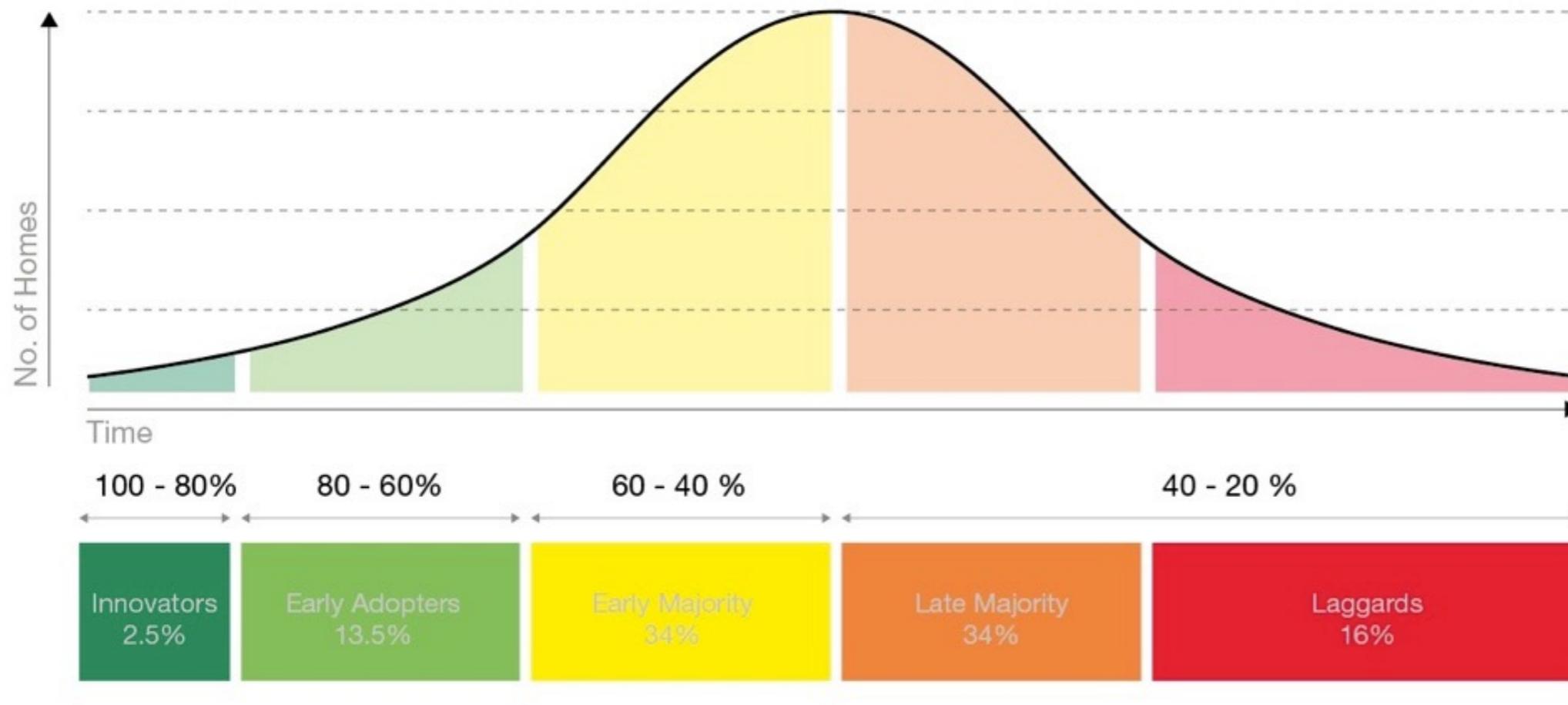
retrofit average stats from pilots so far:

- emissions: < 17 kg CO₂/m².A
- tonnes saved approx 5t CO₂/A
- cost: £45,000



segment the market

- trust
- certainty
- choice



Proper reliable methods of **assessment** and **calculation** of measures to be developed/adopted, including the cost to install measures and their impact on running costs of being warm and healthy in the home.

controls

servicing

		Freezer (undercounter	£335.00				
				11.0	1.50		£17
low energy lighting - replace all GLS or bayonet bulbs with CFL's and all low energy spotlights and downlighters with LED equivalents	This reduces both power use and maintenance	CFLs		8.0	9.50		£76
		LEDs		3.0	55.00		£165
masterswitches - remote controlled sockets either bypass or replacement sockets	This allows for all the appliances in a room to be turned off at the mains when turning off the lights	Sockets for things like TiVo boxes can be left off the circuit. This does not need to be hardwired there are products such as intermediate plug/sockets that power to be switched off to several remotely		6.0	175.00		£1,050
better heating controls such as programmable thermostats, gate valves to create differently programmed heating zones	This allows heating to be confined to areas of the house in use, minimising heating of unoccupied area	The effect of zones will have less effect as the heating needs of the house are reduced however it can be an early measure. Products need to be chosen that allow for easy manual override		1.0	55.00		£55
energy monitor		http://www.efergy.com/index.php/default/products-uk-1/e2v2-wirelessmonitor-uk.html					
basic measures							
draught proofing - adding draught seals and extra rebate front door	Much heat is lost through draughts	Chimneys can be sealed to if not needed for the design ventilation arrangements, if external these should be filled with granular inert closed pore insulation		94.2	3.50		£330
sealing timber ground floor	Much heat is lost through draughts	This can be done with mastic on top prior to re-sanding or can be done with air seal membrane and tape while fitting insulation beneath.		32.0	6.00		£192
increase loft insulation to an overall depth of 400mm of high recycled content glass wool to achieve U-value of 0.1W/m ² K ⁻¹	Cost effective reduction in heat loss while allowing vapour permeability	If used for storage and the rafters are inadequate then build up the rafters to enable decking on top of insulation. If adequate then some of the glass wool can be replaced with layer of extruded polystyrene to create deck.		4.0	7.50		£30
high efficiency woodburner	flexible focal point heating that reduces CO ₂			1.0	935.00		£935
replace boiler with modern A rated	Even a 10% rise in efficiency has a considerable effect on overall energy performance	The boiler will also need to be sized to suit the much reduced heat losses depending on what the final level of thermal performance is post-retrofit.		1.0	875.00		£875
design in a passive stack ventilation system making use of existing openings	Improve and stabilise internal air quality while minimising energy use.	Making use of warm air rising to vents in the roof or up existing chimneys, with replacement fresh air being allowed in in a controlled way through humidity controlled vents in windows or up from below the ground floor.		1.0	1,000.00		£1,000
				2.0	90.00		£180

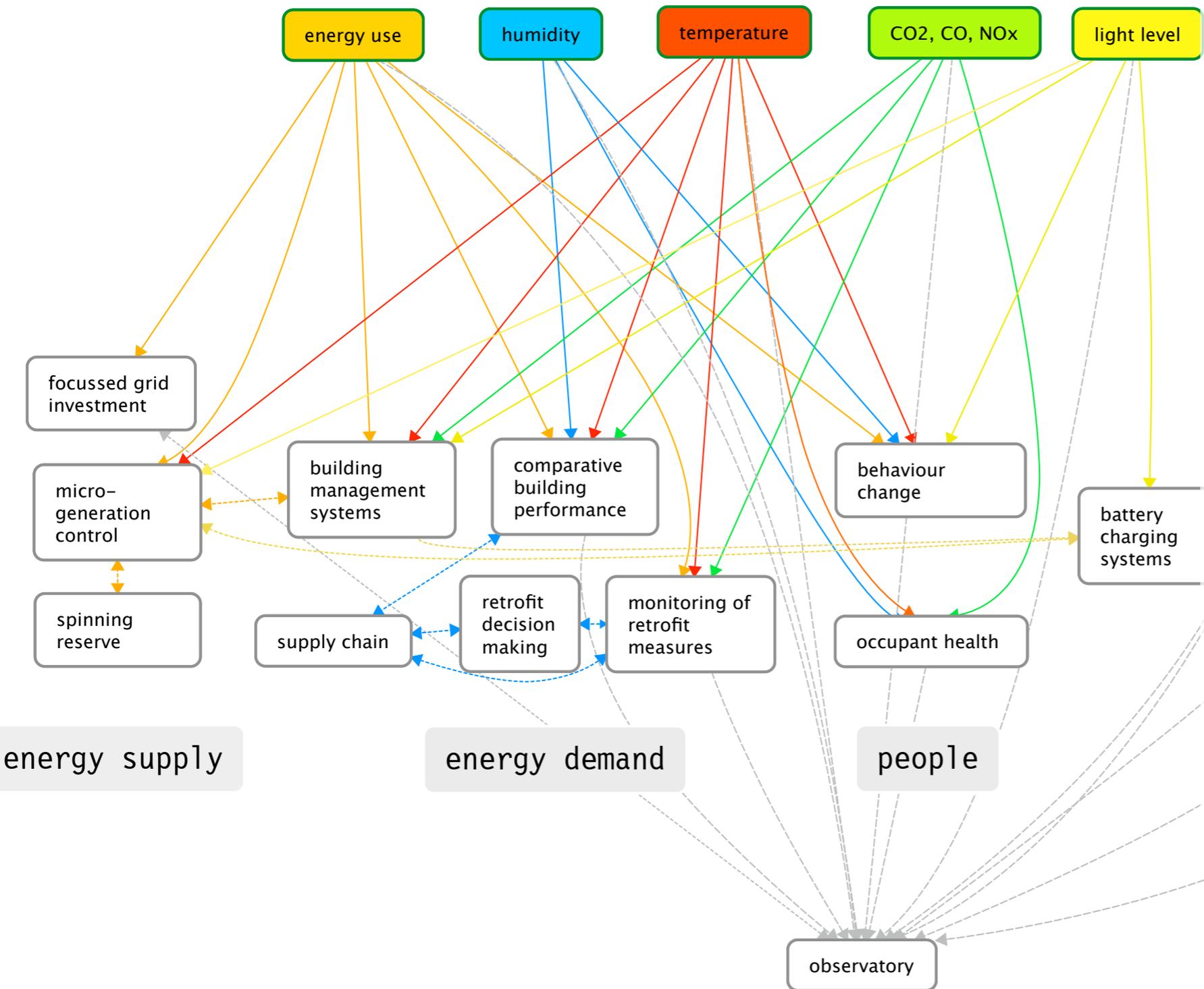
2

much better **data**

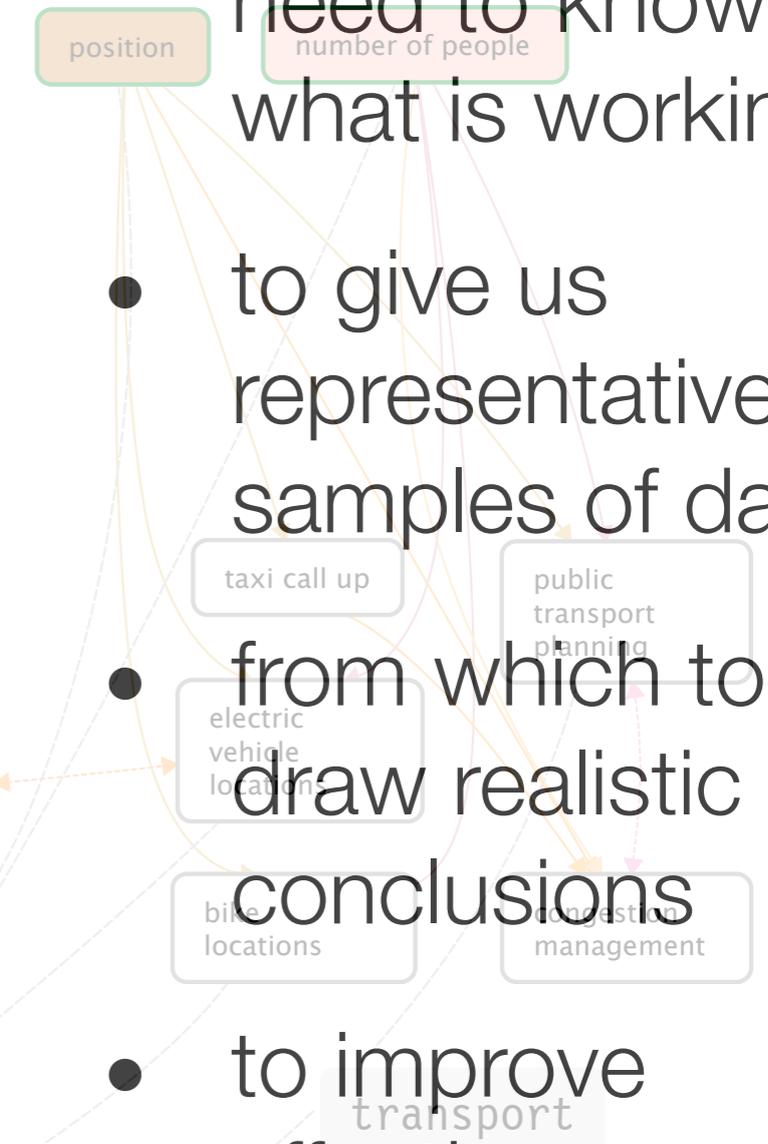
Pre- and post-works much lower cost, **monitoring**, on all properties as part of a project to develop, prove then disseminate best practice as well as identify problems.



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

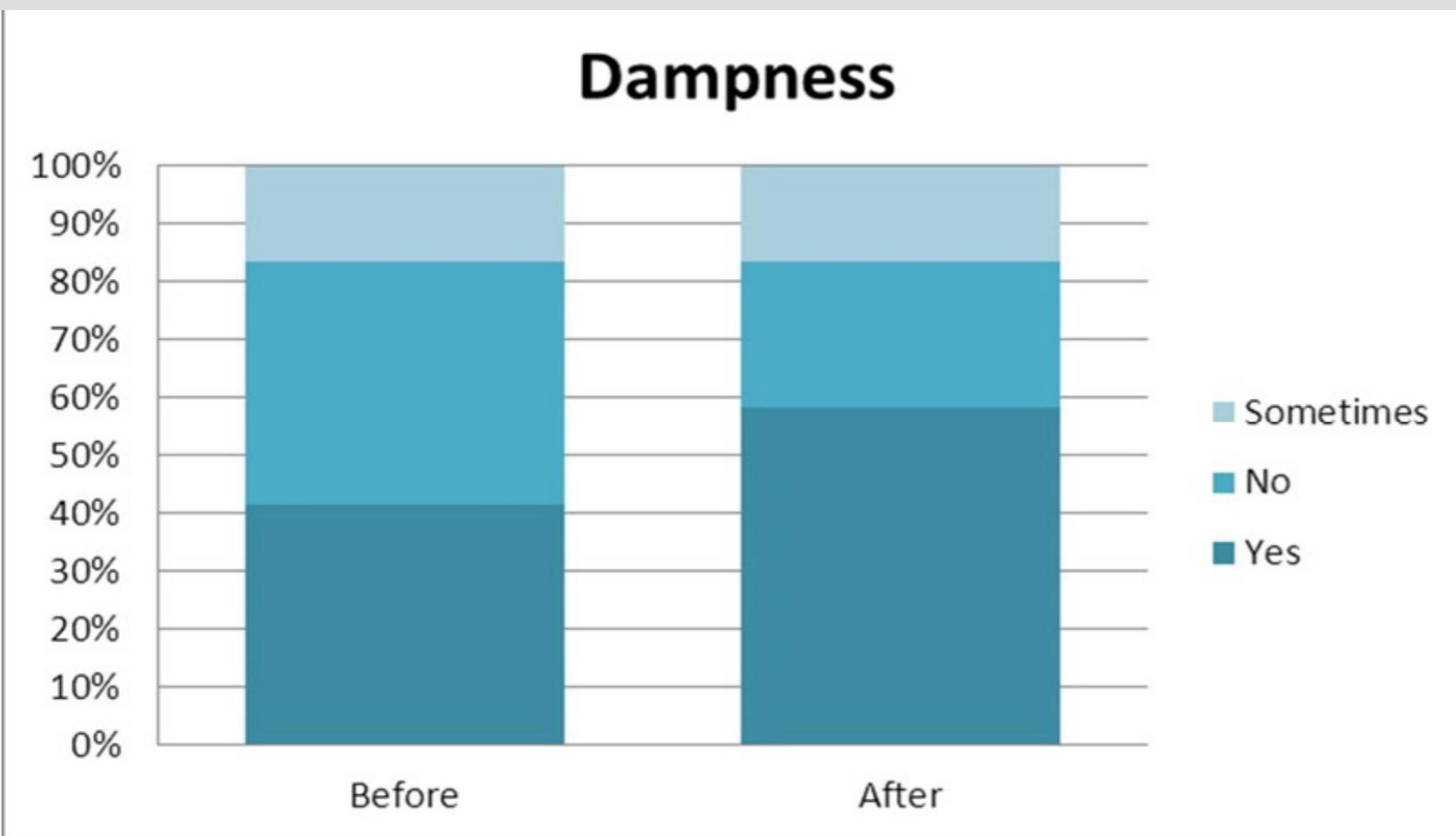


- we desperately need to know what is working
- to give us representative samples of data from which to draw realistic conclusions
- to improve effectiveness



3

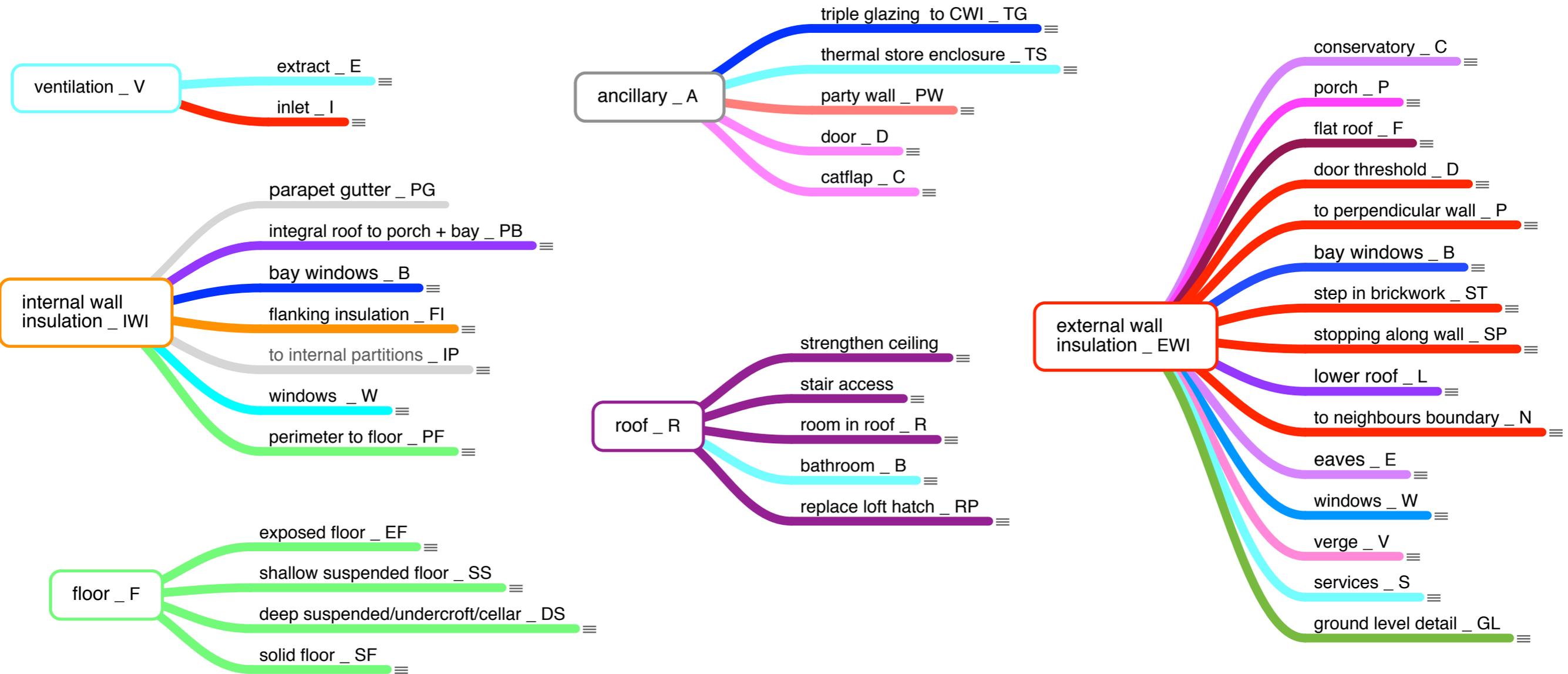
Proper science and risk based **specification**, not simply lowest cost based methods of material selection, and how they are put together to reduce underperformance, defects and health effects.

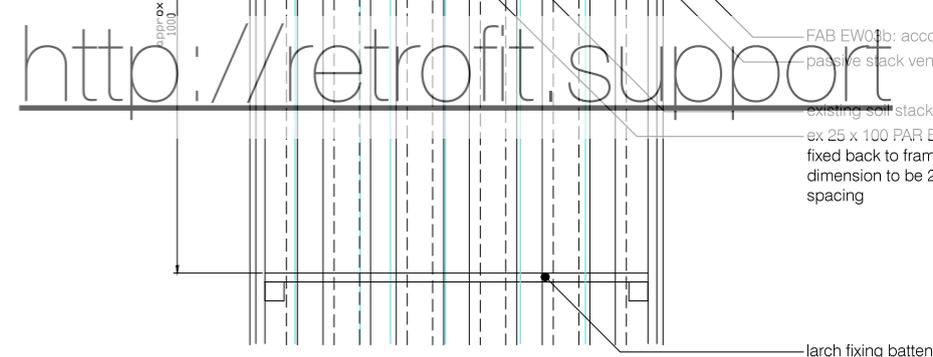


we cannot afford mass failure

BRE study for DECC

- subdivided into areas where they join other elements...





FAB EW03b: acco
passive stack ven
existing soil stack
ex 25 x 100 PAR E
fixed back to fram
dimension to be 2
spacing

You are in: [Home](#) / [Measures](#) / [external wall insulation](#) / [eaves](#) / [clipped](#) / [EWI to clipped eaves with room in roof \(insulation to rafters\)](#)

Original Author: Admin
Organisation: Retrofit Pattern Book

EWI to clipped eaves with room in roof (insulation to rafters)

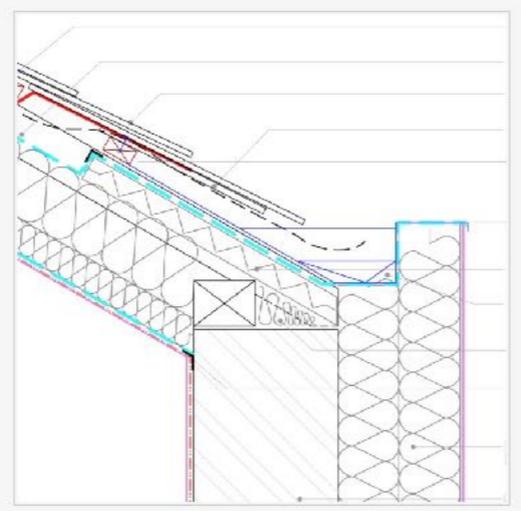
[Overview](#) [Revisions](#)

Detail summary

A detail for external wall insulation to deal with a potential cold bridge at eaves where new insulation to rafters meets external wall insulation. To be used where there is an existing room-in-roof or loft/roof insulation to be applied to existing rafters.

Where there is a limited overhang at the existing eaves, an integral gutter is required to enable water run-off. The EWI is used to form a verge, which is then capped with a Stainless steel gutter.

Target values:
Target Roof U-Value: 0.18 W/m²K
Target Wall U-Value: 0.18 W/m²K



Technical description

Section detail. EWI to existing wall. Up to eaves, clipped, with new/ existing loft insulation join to EWI. Loft insulation to rafters where existing room in roof

Suggested Installation Sequence:

Preparation of roof and loft space: Remove any existing loose material and prepare in accordance with manufacturer's requirements.

Any alterations to cabling, existing ventilation, drainage and other fixtures, affected by the work to be agreed with contract administrator prior to work being undertaken. Prior to start on site inspect the form and condition of the roof internally and externally, especially any structural timbers; institute repairs and/ or additional works necessary to make the substrate suitable to receive insulation.

Installation:

1. Carefully remove minimum 750mm of tiles or slates, putting to one side for reuse. Note positions of existing roofing battens.
2. Remove roofing battens to at least 600mm up the roof from the existing eaves. Roll existing membrane back but do not cut.
3. Insert rigid insulation (RF06) between rafters, allowing at least 125mm from the edge of insulation board to the next batten position up the roof.
4. Fix external wall insulation (EW01)- cut to fit to eaves insulation and cut back to form gutter parapet.
5. Install breathable membrane/ roof underlay (RF06c) approx 500mm up roof slope from front edge of EWI. Pin in place to rafters with galvanised clouts at upper edge. Dress over EWI outer layer so as not to protrude beyond the front face.
6. Insert stainless steel gutter system over the top of the breather membrane/ roof underlay and EWI as shown on drawing. Fix in place with self drilling fixings to every third rafter at inner upper edge.

Other details in the same category:
EWI to clipped eaves with hiddi ▾ →

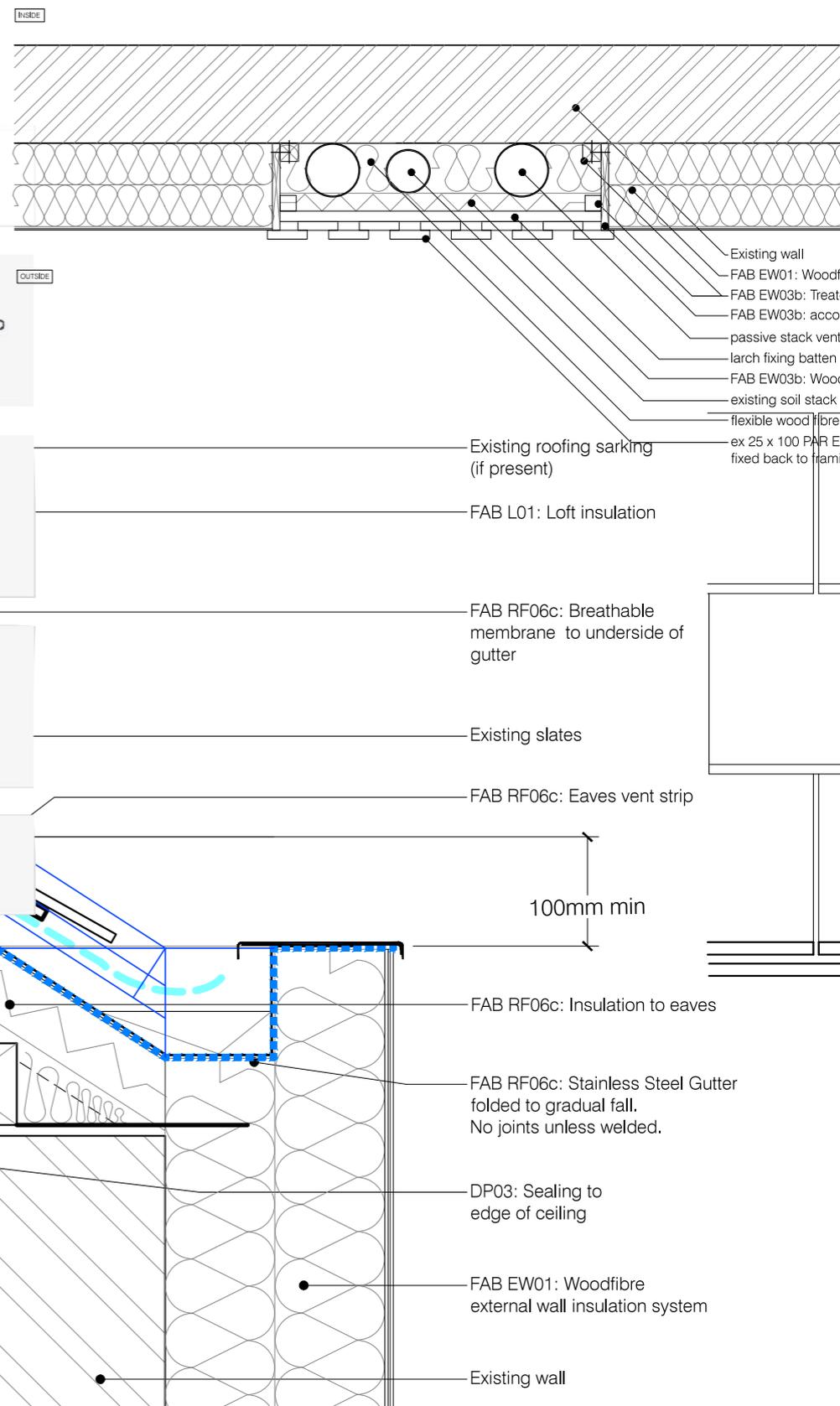
Add to detail set
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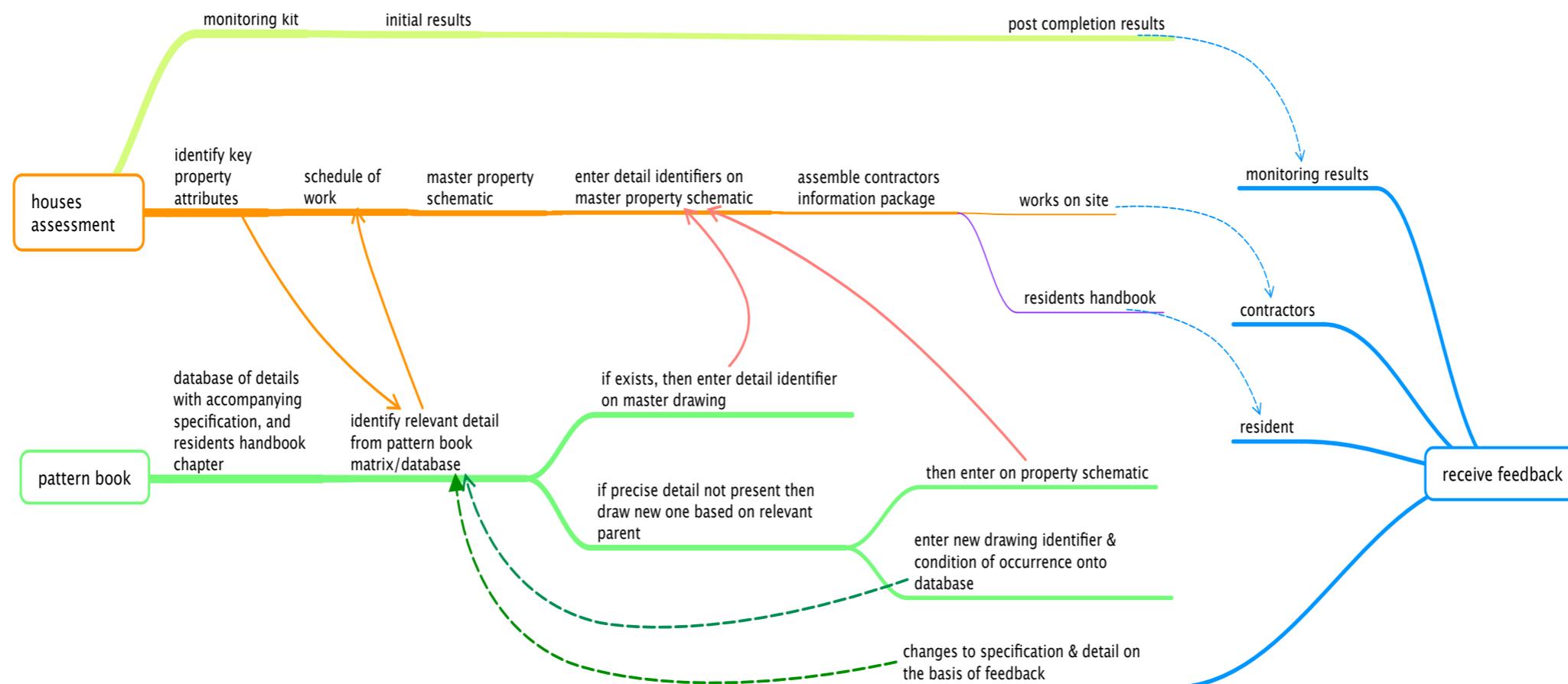
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Risk factors



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

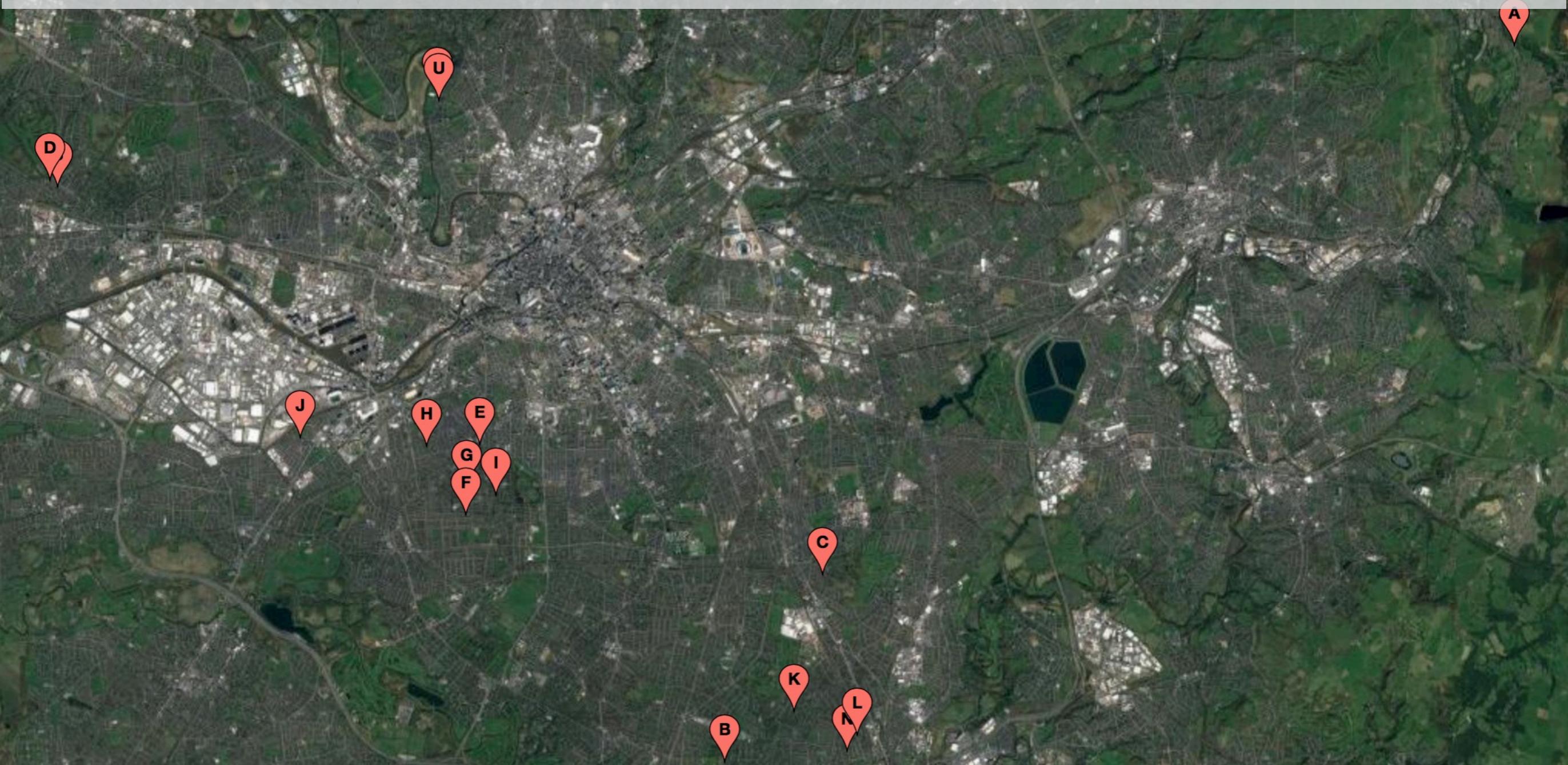


enhancements to learning what works, turnaround, efficiency & costs



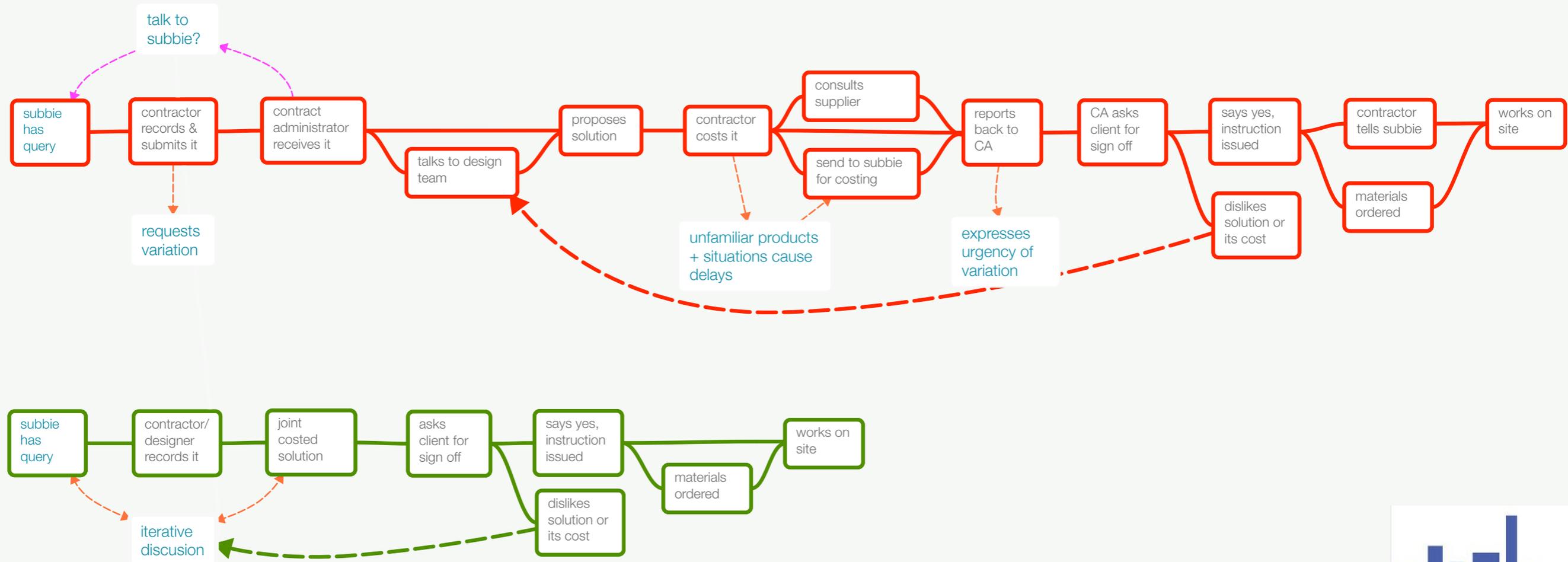
5

Developing **capacity**: Competitions or rolling competitive funds to develop designer/contractor teams capable of delivering deep retrofits that they would be prepared to then both warranty AND roll out at scale after further R&D.



6

Better contract models and delivery structures including energy performance guarantees.

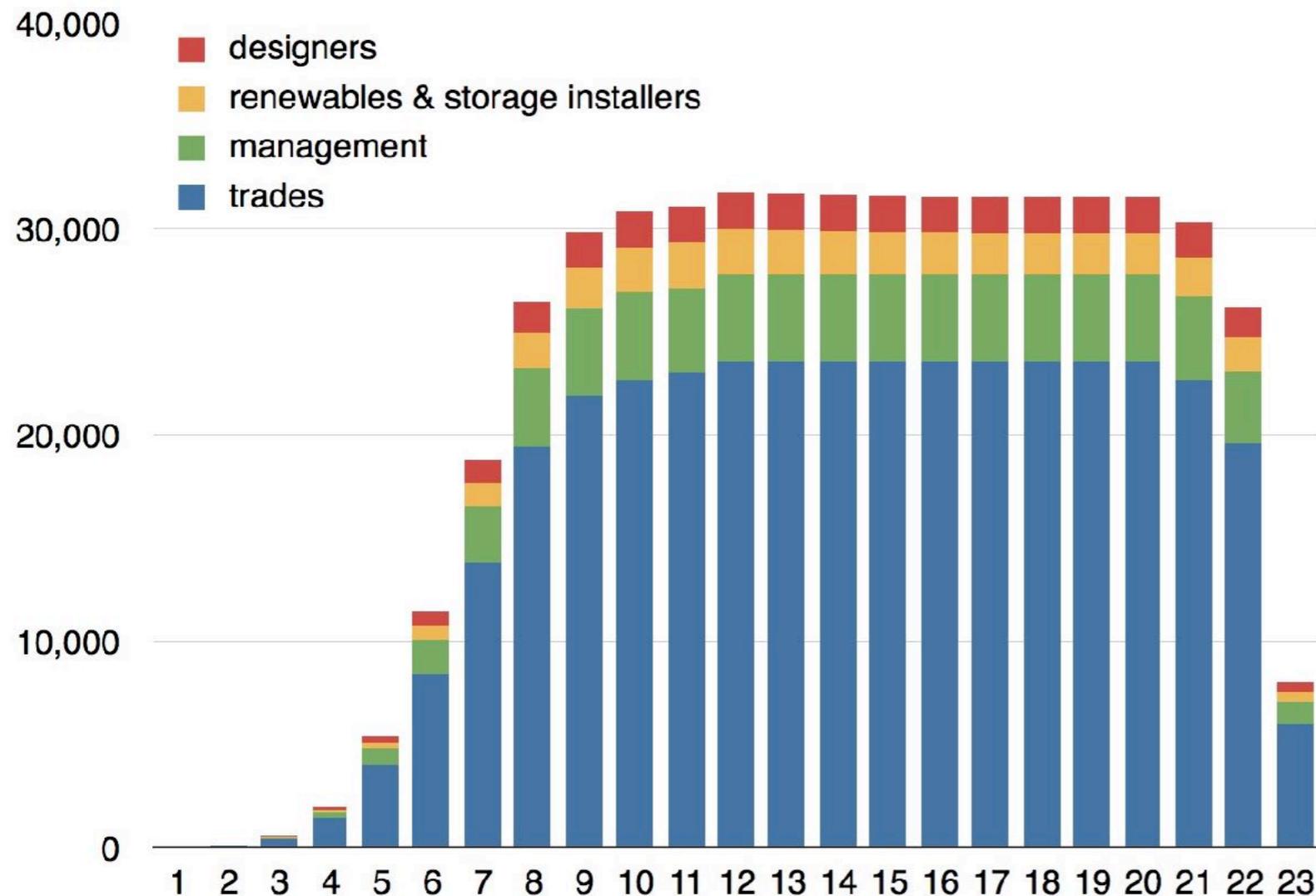


- the current models are not fit for purpose
- on-site access to project docs -Refurbify + Retrofitworks
- enabling problems to be spotted and sorted more effectively

the most important bit: 30 year performance guarantee



7 Workforce development: There are not enough people with the relevant skills. Training needs to be developed, and be scalable to respond.



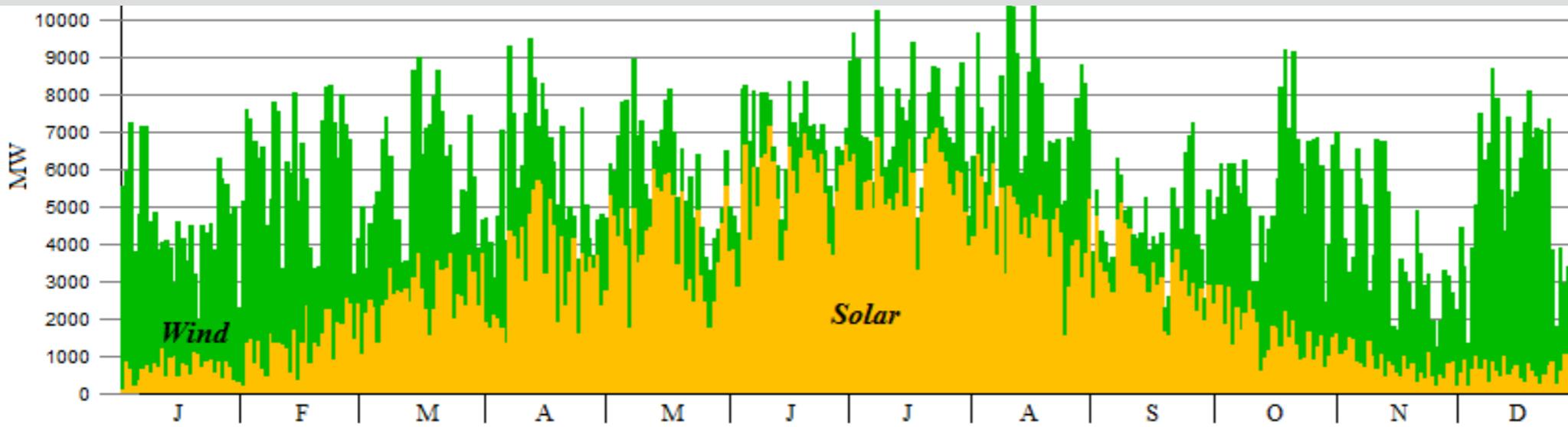
potentially 50-60,000 new jobs in GM where are they going to come from?



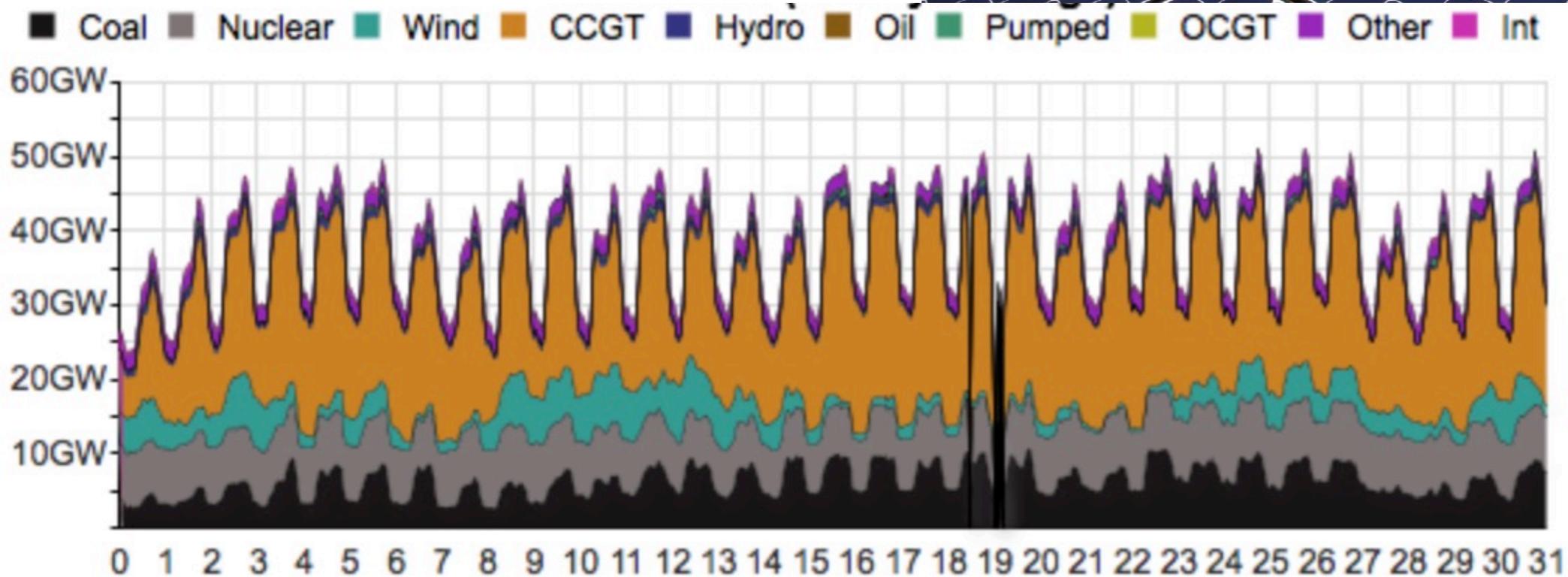


then we
have to do
something
about
industry
custom &
practice

8 renewable energy and storage rollout to develop additional income to help develop demand reduction



annual renewable energy variations



daily energy supply variations



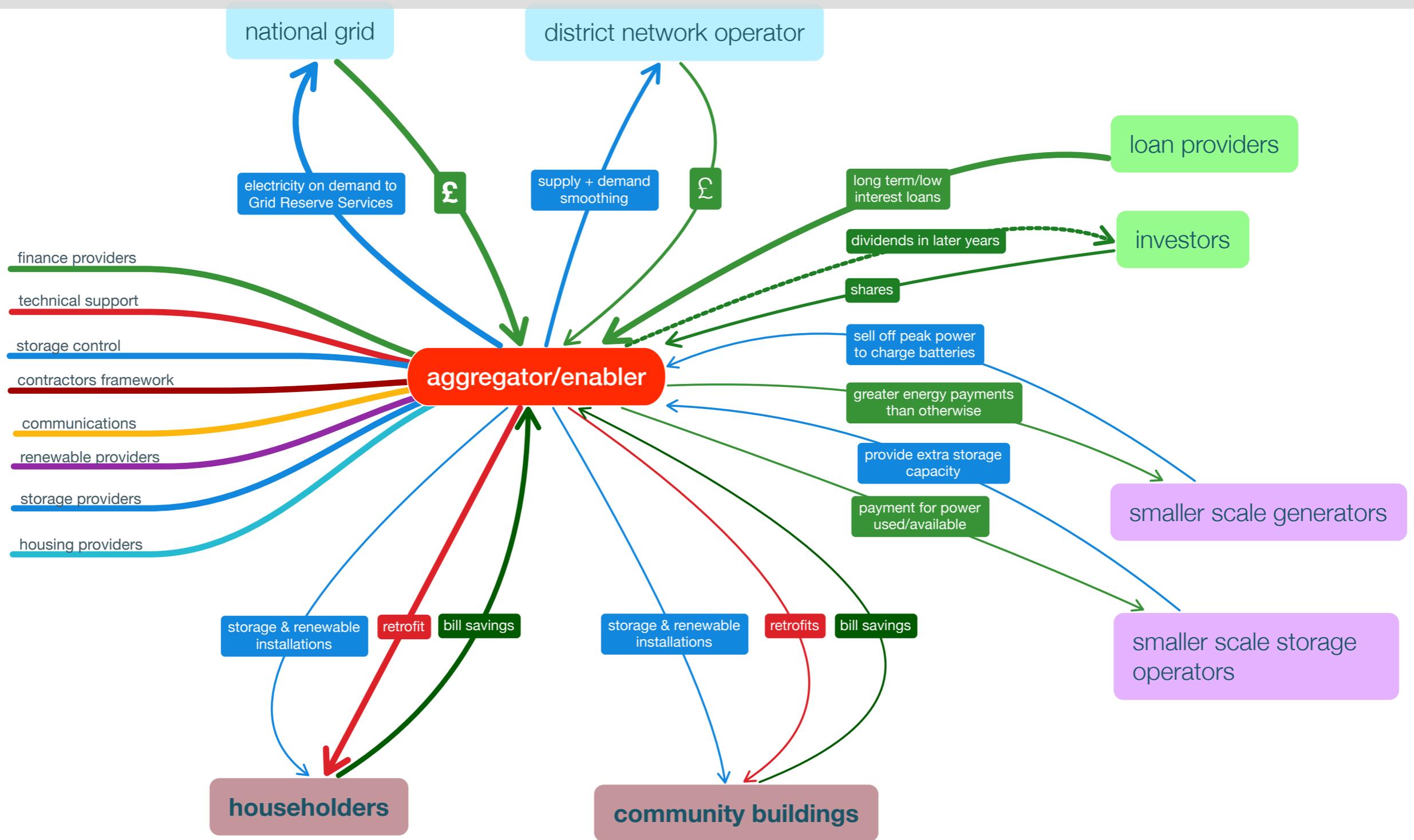
the new component is storage

1. **demand shifting**
£350
2. **supply shifting**
£160
3. **aggregated sales to grid**
Short Term Operating Reserve -
up to £350
or Frequency Response
up to £300
4. **Demand Side Management**
(possibly) DUoS Red band avoidance £60

Our early models
funded early retrofit
with Feed-In Tariff,
energy storage income
is not subsidy,
it is the energy market



9 Aggregation models: to take the individual batteries' energy & package it for sale to energy suppliers & the grid



10

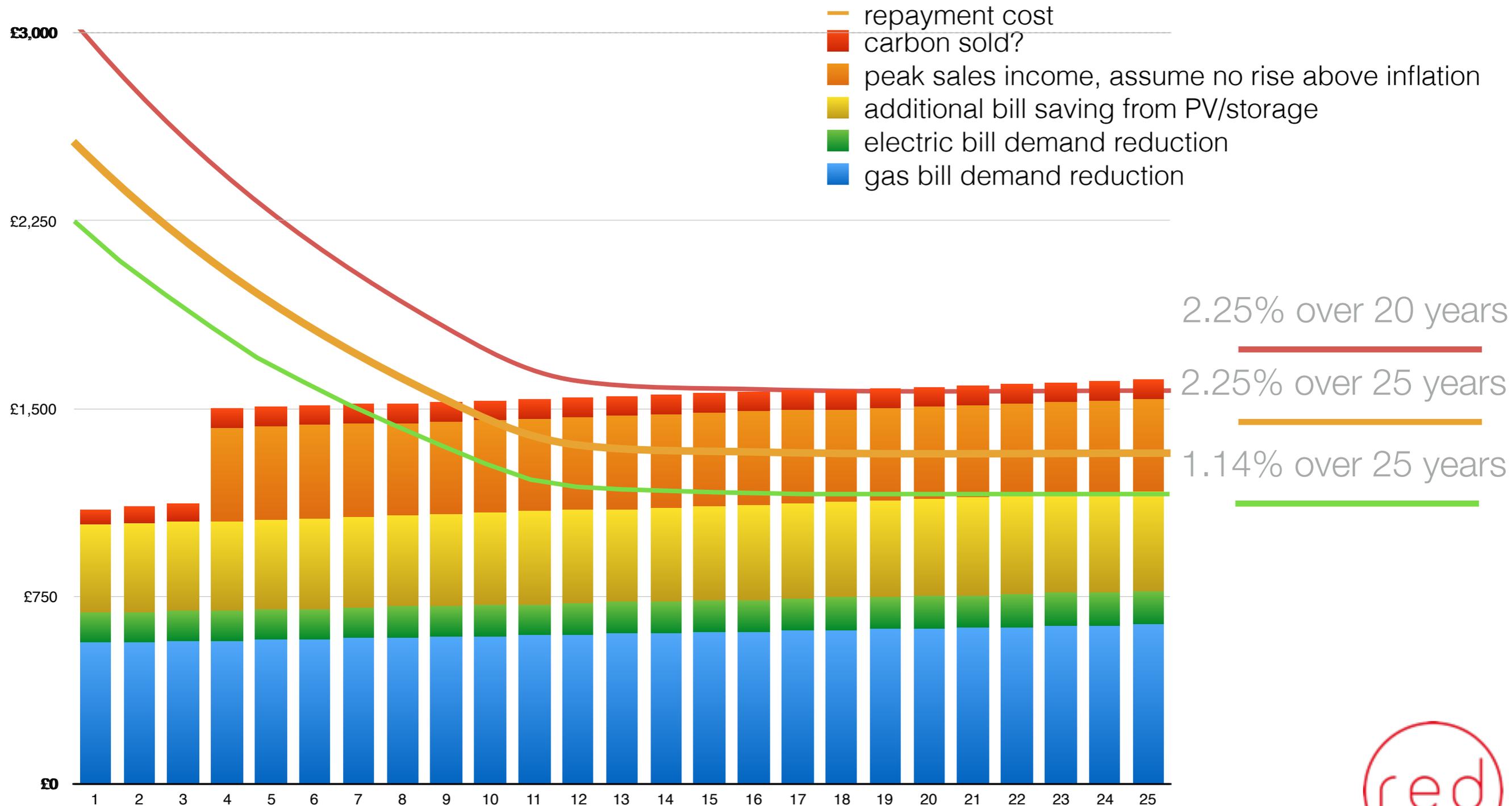
Financial vehicle:

- large scale low cost finance from multiple sources,
- distribute to fund householders works,
- equity loans to less well-off householders,
- hold, redeploy or share out surpluses



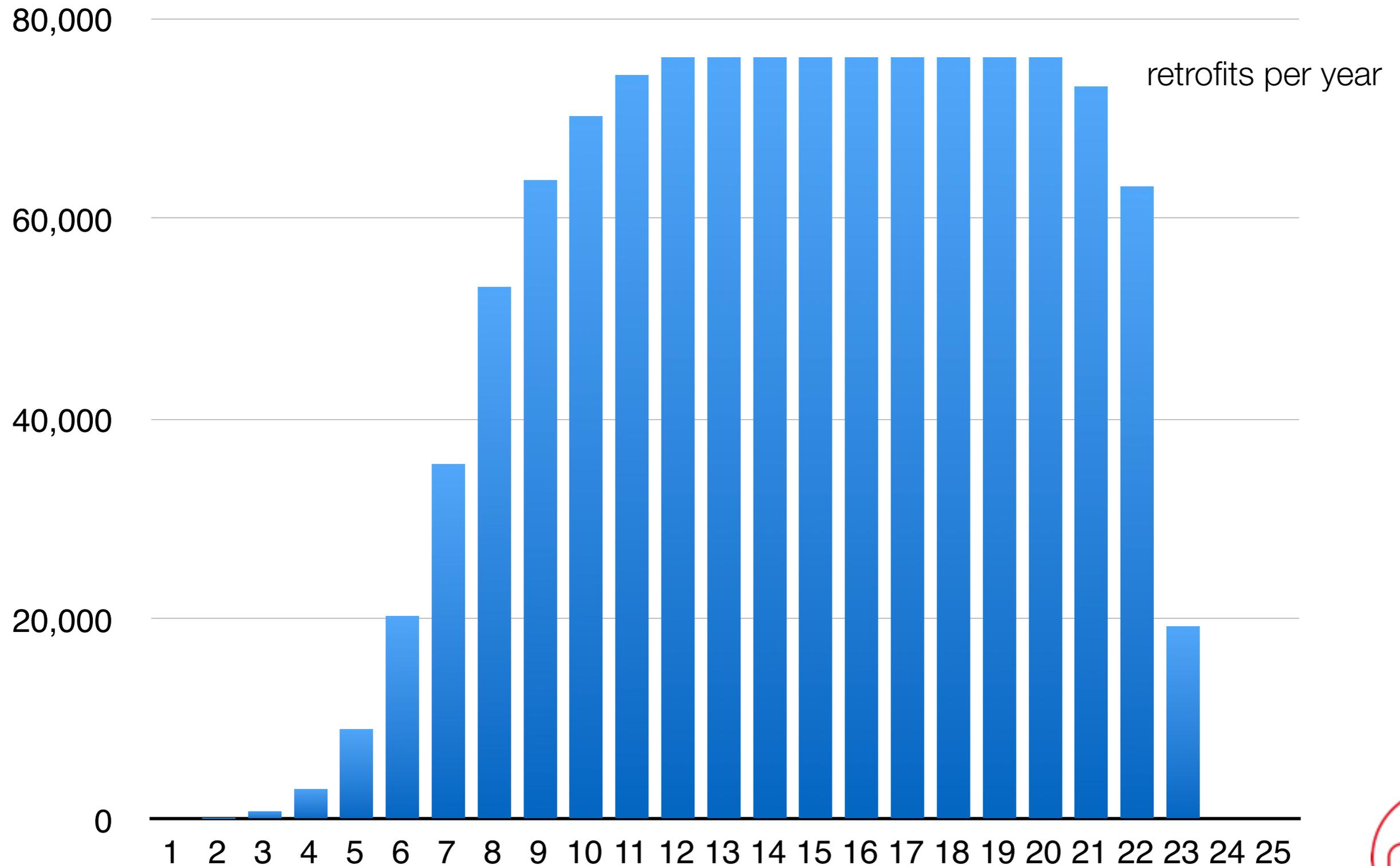
repayments & how they can be covered

- various sources cover declining repayments as efficiencies and scale grow
- cost of finance is key



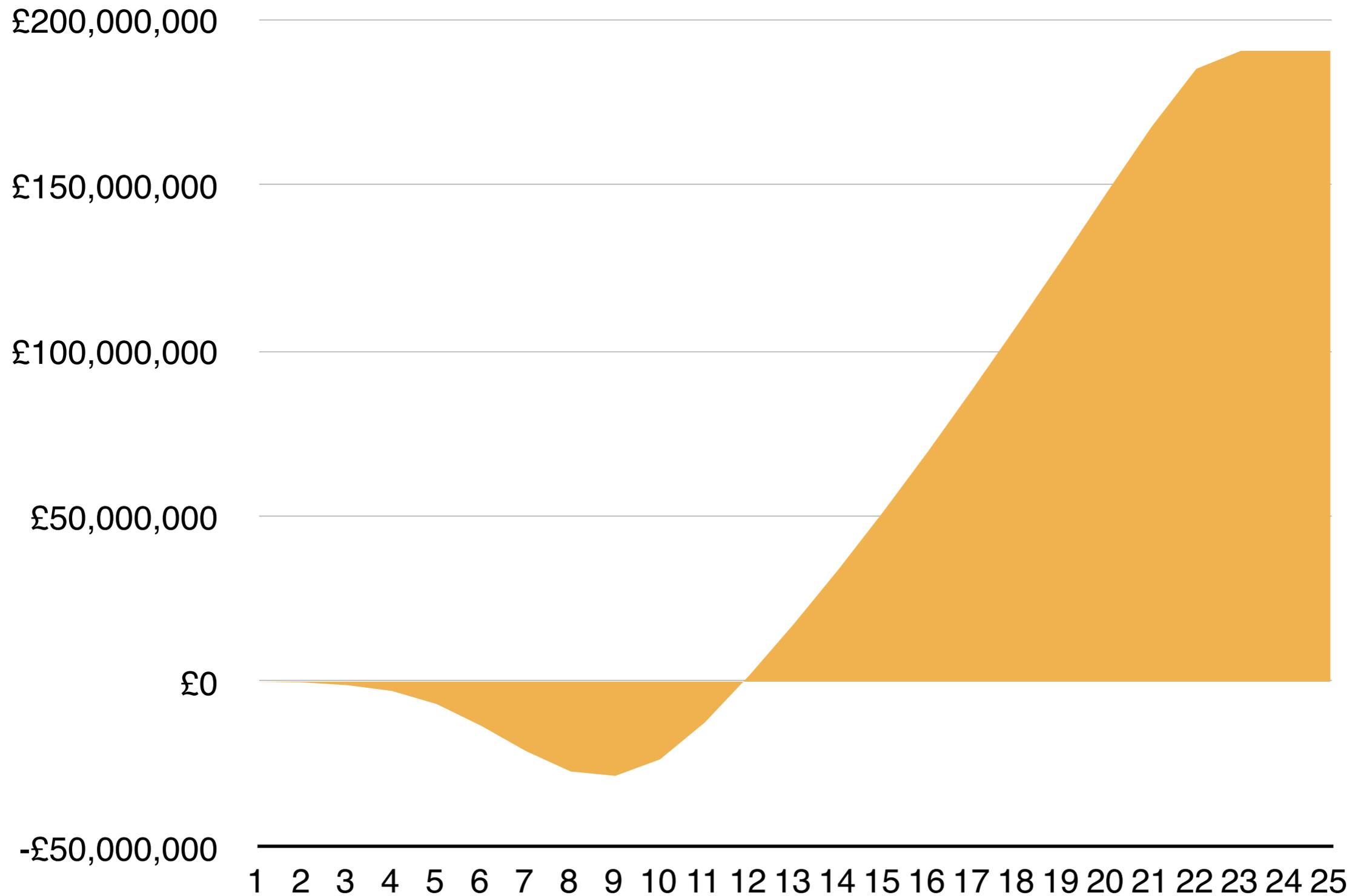
slow start retrofit programme

- rehearse + perfect, disseminate



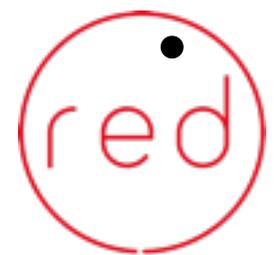
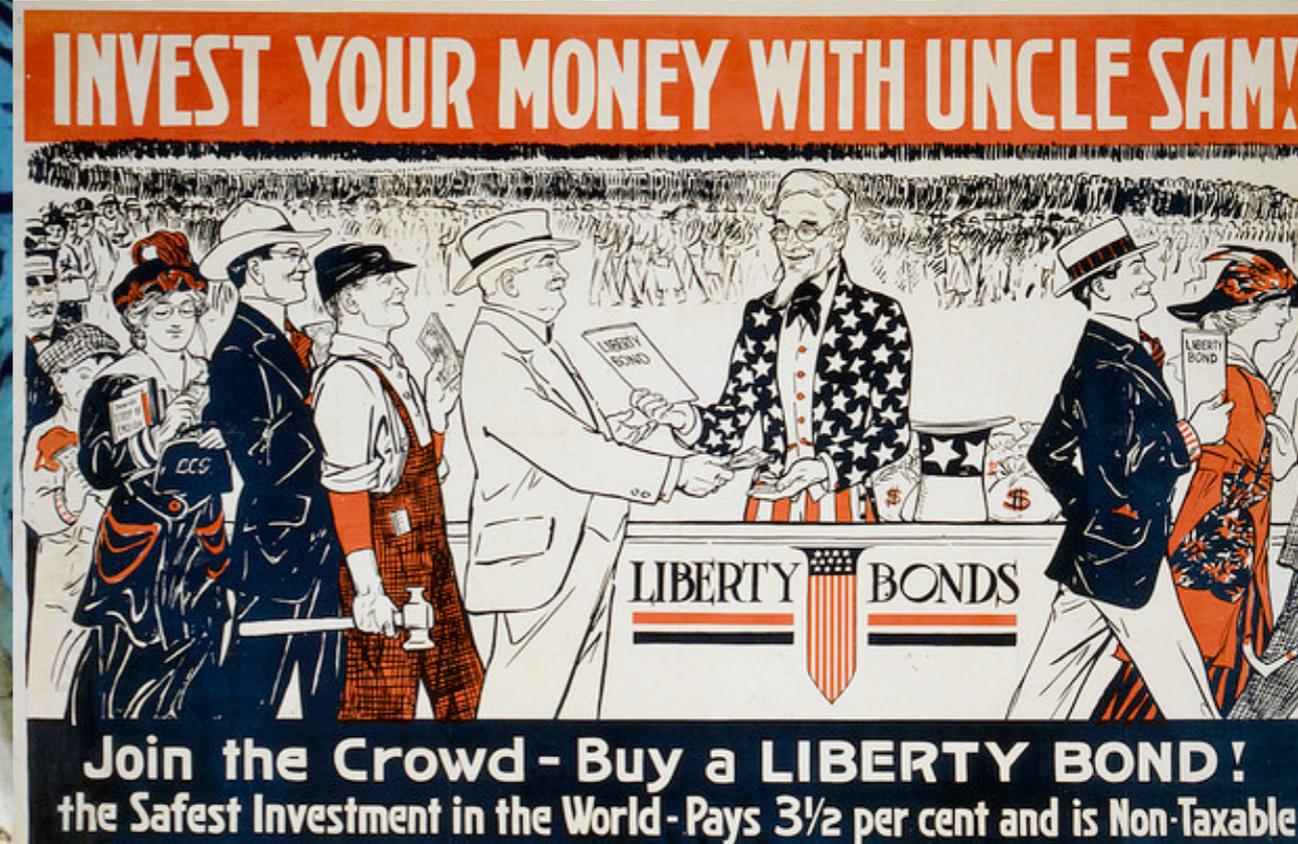
cumulative repayment balance

- the early deficits / later surplus



finance - a GM Green Bond, PWLB, Institutions?

- savers get 1%, 1.5% if lucky
- FTSE All Share performance since 2007 only 4.9%
- US bonds during the 1st world war only paid 3.5%.
- will PWLB become popular again post-Brexit?
- insurers have much to lose from Climate Change, what do they think?
- could crowdfunding help to kick start?
- upscaled community finance could shorten loops, so your money could help your community
- is it time for councils to invest for the long term?



the 10 point plan

1. **assessment + calculation**
2. **monitoring + data**
3. **specification + detailing**
4. **IT + software**
5. **capacity**
6. **contracting + guarantees**
7. **workforce development**
8. **renewable energy + storage**
9. **aggregation**
10. **financial vehicles**

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