Exploring retrofit options on a 1930s home

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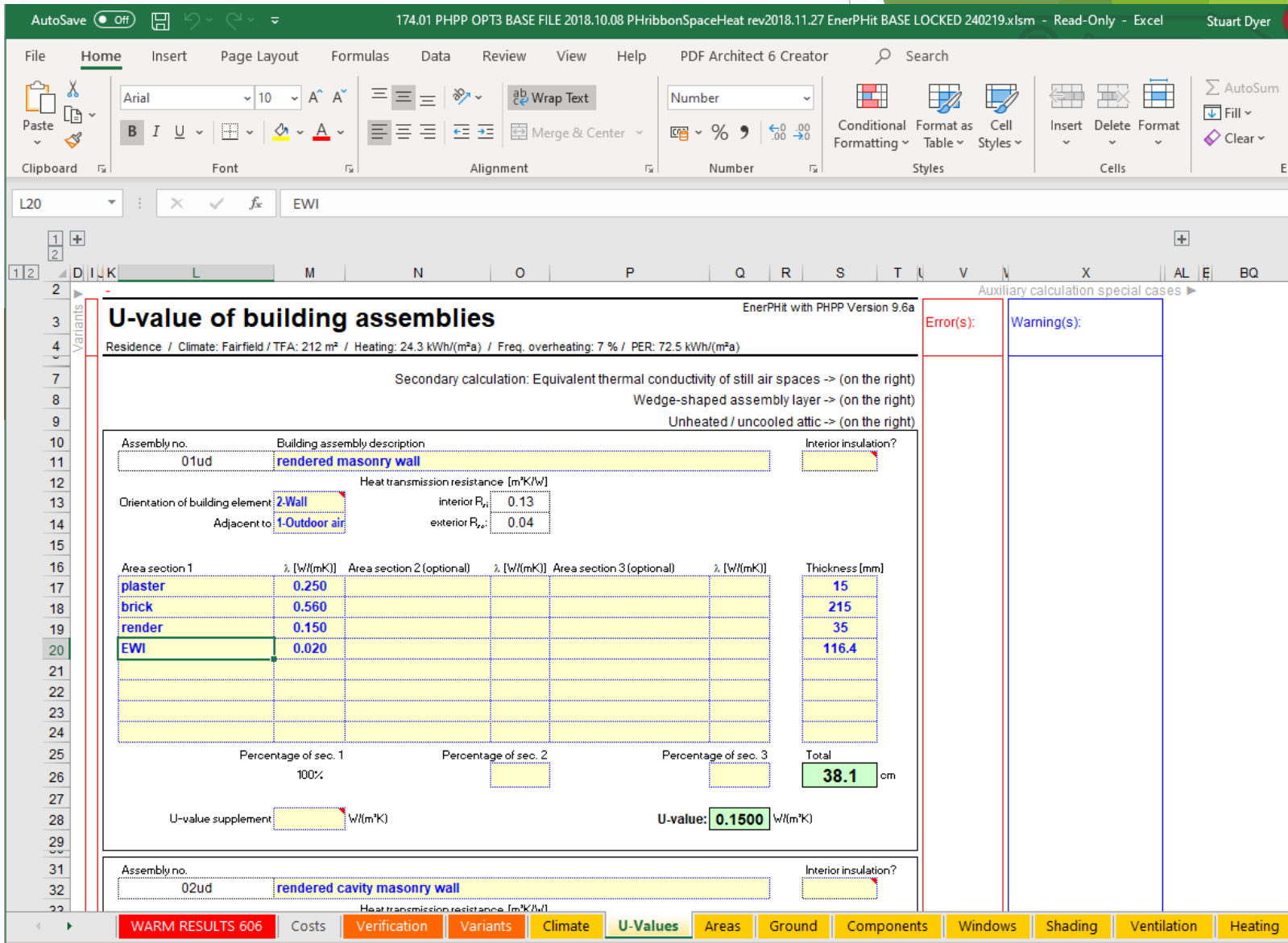
@cswd

Exploring retrofit options on 1930s home

- Extending & retrofitting 1930s detached home
  - Currently cold & some damp issues
- Want to answer questions such as:
  - Where should I concentrate my effort – best return on expenditure?
  - What should I insulate (loft, walls, floors?)
  - What should I spend on windows vs other options?

Passive House Planning Package (PHPP)

- Great big spreadsheet developed & improved over 20+ years covering:
  - U-values of ‘components’ e.g. walls, loft, floors etc.
  - Heating
  - Ventilation
  - Windows
  - Shading…
- Models the house, predicts performance



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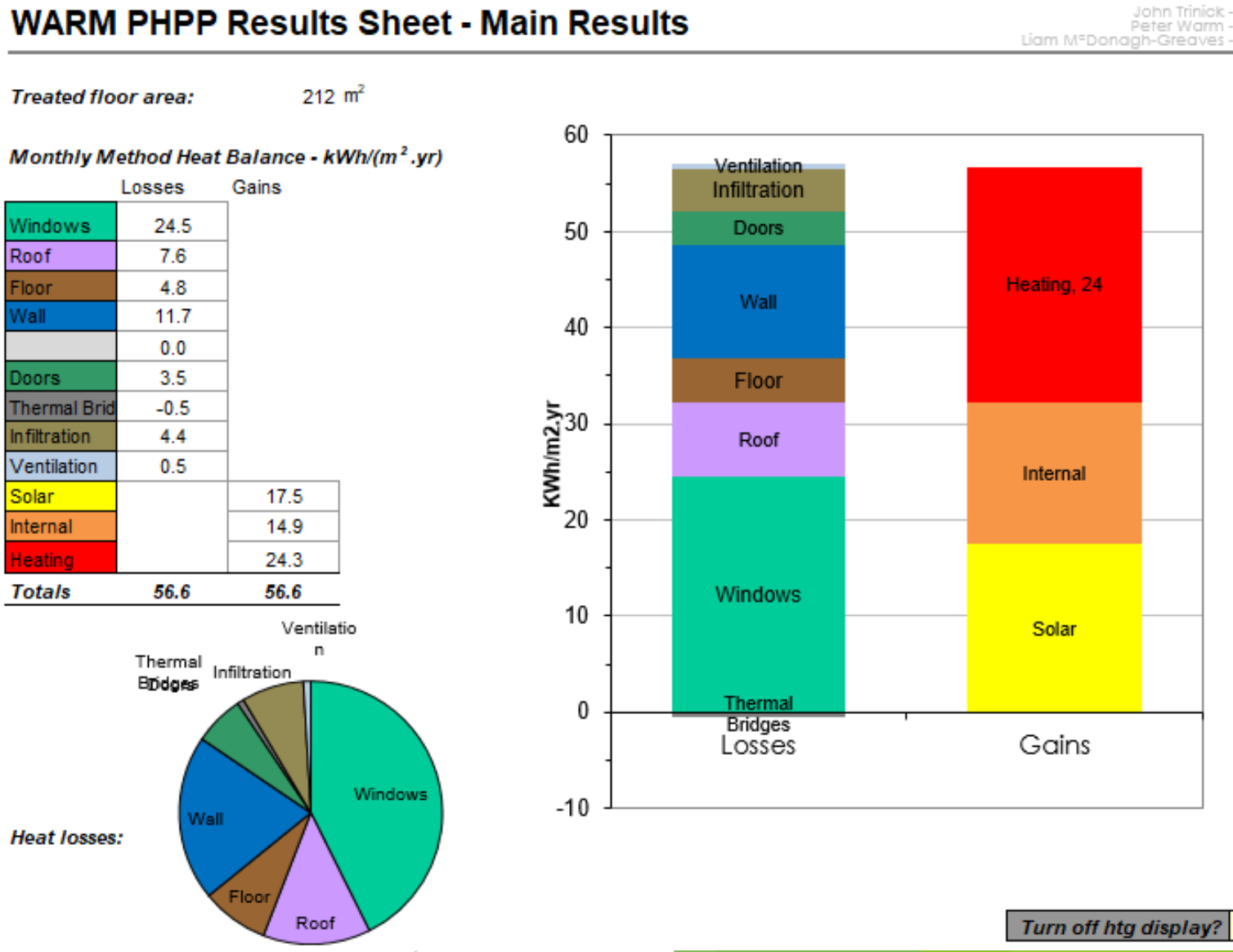


WARM PHPP Results Sheet - Main Results

John Trinick - Peter Warm - Liam M°Donagh-Greaves -

Treated floor area: 212 m²

Monthly Method Heat Balance - kWh/(m².yr)

	Losses	Gains
Windows	24.5	
Roof	7.6	
Floor	4.8	
Wall	11.7	
	0.0	
Doors	3.5	
Thermal Brid	-0.5	
Infiltration	4.4	
Ventilation	0.5	
Solar		17.5
Internal		14.9
Heating		24.3
Totals	***56.6***	***56.6***

Heat losses:

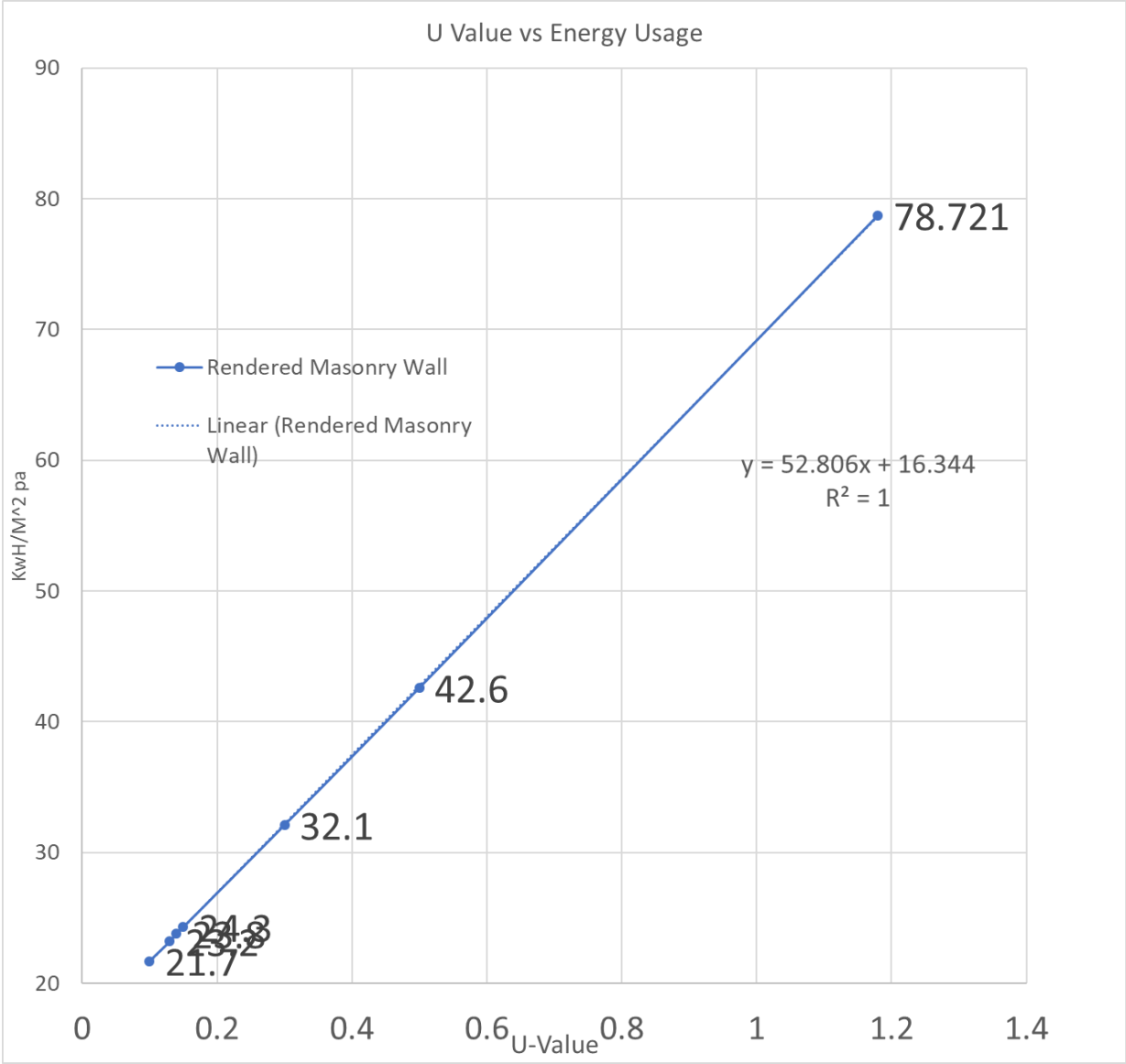
Turn off htg display?

PHPP component EnerPHit values

1. EnerPHit requires certain criteria are met:
    1. Space heat demand <25 kWh/m2.a
    2. Airtightness normally 0.6ach
    3. Proof moisture management issues have been adequately addressed
2. If 25kWh/m2.a is exceeded then they recommend U-values:
    - Walls EWI U values below 0.15 W/m2K (>75% of wall area)
    - Roofs / top floor ceiling - U <= 0.12
    - Windows - installed whole windows U <= 0.85 etc
- Use numbers in (2) as **default U-values** and explore effect of changes from there

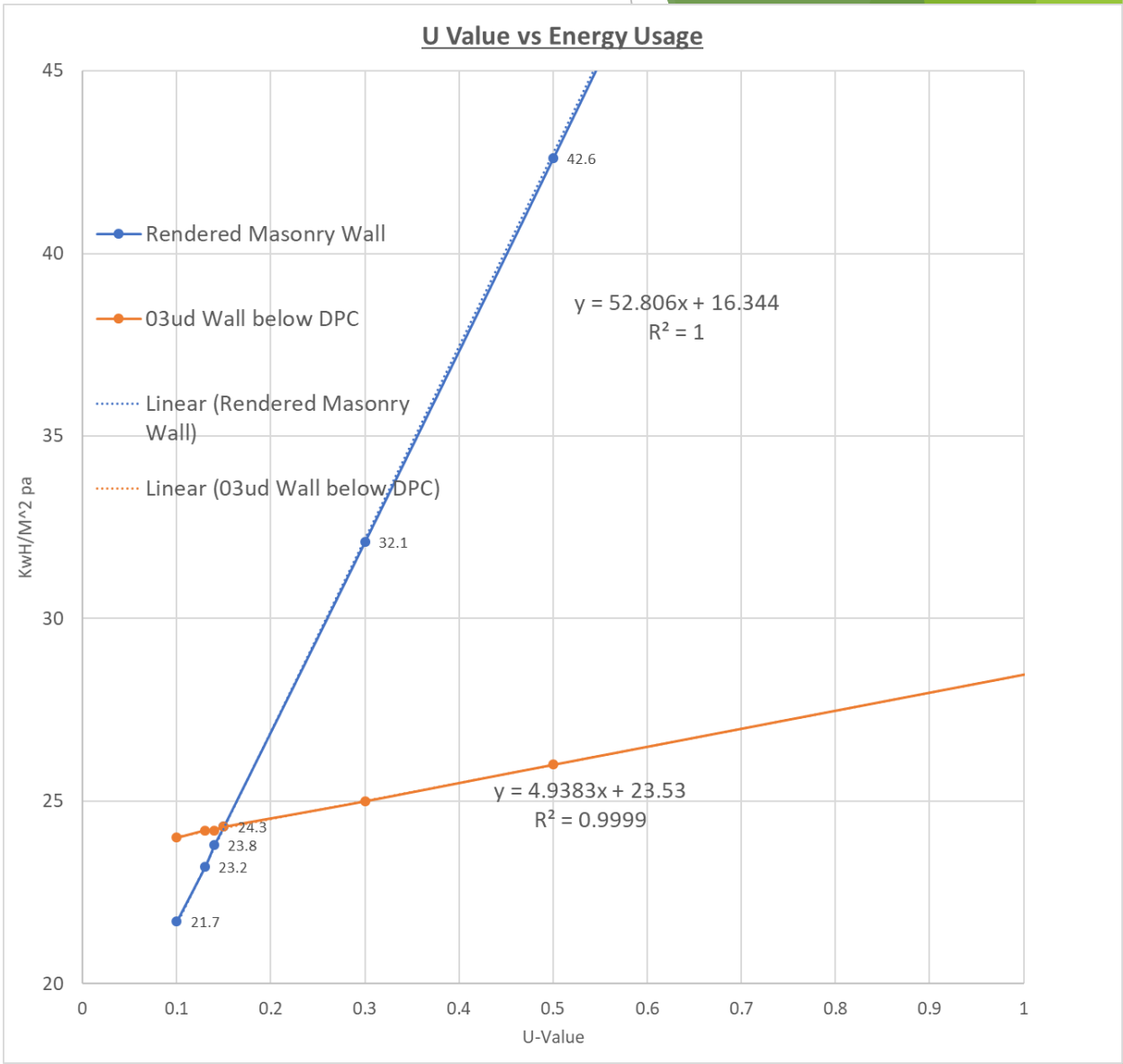
Vary each component individually around EnerPHit ‘default’ value

- Pick 1st component, vary U-value
- Rendered Masonry Wall: Test at U-value of :
  - 0.239, 0.15, **0.12**, 0.11, 0.1
  - Bold & underlined number = default EnerPHit value
- Take readings of kWh/m^2 pa & Overheating at different U-values
- Plot on graph & get equation



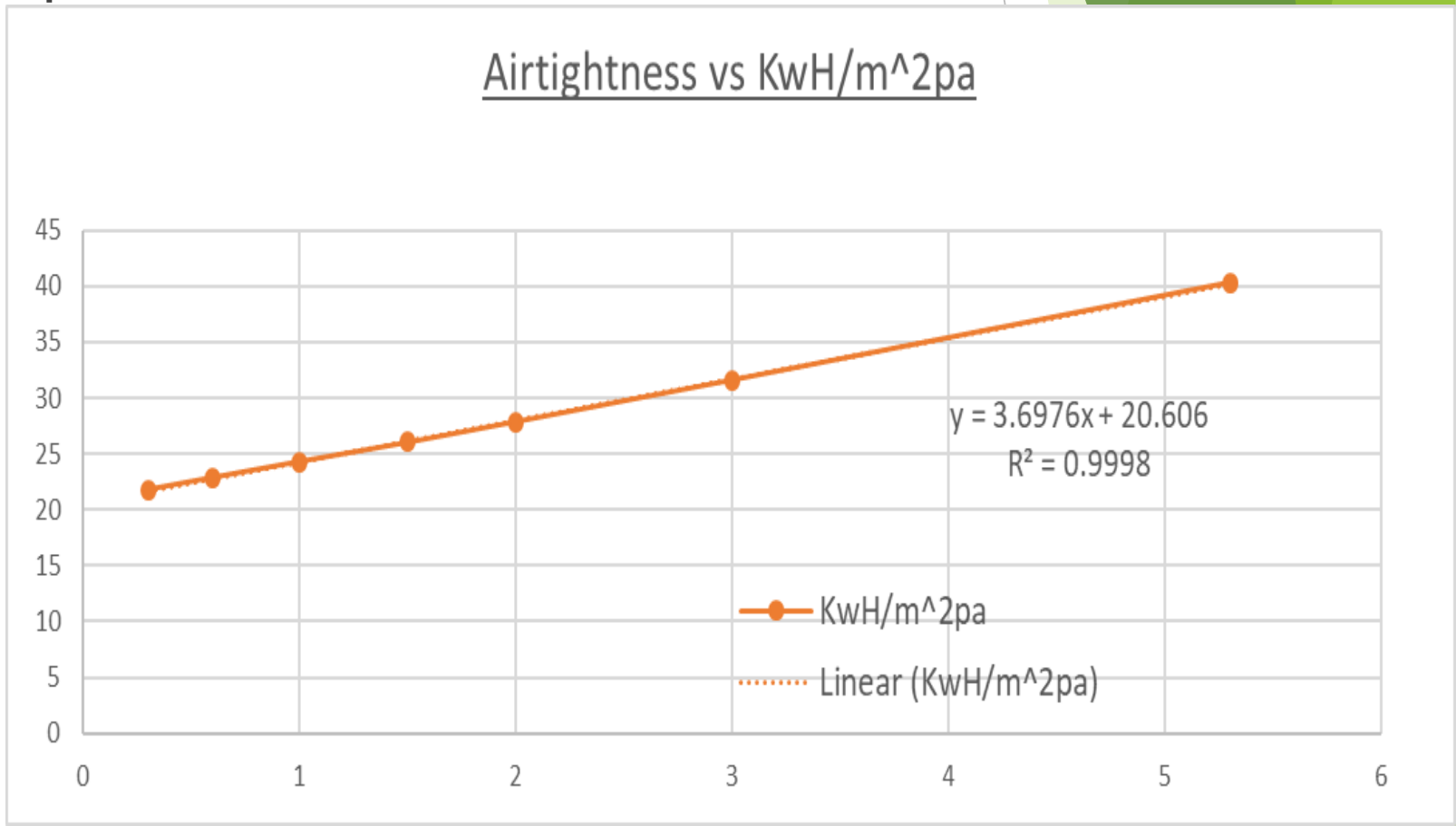
Vary each component individually around EnerPHit

- Repeat for other components:
- 03ud Wall below DPC: Test at U-value of :
  - 1.553, 0.5, 0.3, **0.15**, 0.14, 0.13, 0.1
- Take readings of kWh/m^2 pa & Overheating
- Plot on graph & get equation
- Tells us:
  - Each Unit change in U-Value for Wall saves 53 kWh/m2pa
  - Each Unit change in U-value for Wall below DPC saves only 5kWh/m2pa
  - The variation is linear



Can also analyse Airtightness

- Each unit change in Air tightness =3.7 kWh/m2pa
- Obviously not directly comparable with unit change in U-value!



Vary each component individually around EnerPHit

- Repeat for all components
- Savings:

Component	Saving per Unit Change in U-value
01ud Rendered Masonry Wall	52.8
04ud Clay Tile Pitched Roof	45.8
05ud Suspended Floor	16.9
10ud New Roof	11.1
03ud Wall below DPC	4.94
Air Tightness	3.70*

* = Saving per Unit Change in ACH (not U-value)

Can also use this for prediction

Component	U-value	Effect	Total	
01ud Rendered Masonry Wall	0.15	52.81	7.92	
03ud Wall below DPC	0.15	4.94	0.74	
04ud Clay Tile Pitched Roof	0.12	45.77	5.49	
05ud Suspended Floor	0.15	16.90	2.53	
10ud New Roof	0.12	11.10	1.33	
Air Tightness	1	3.70	3.70	
			21.72	Sub-total
			2.6	Adjust
			24.3	Predicted kWh/m2pa

What effect would these changes have on energy usage?

Component	U-value (Existing/ as designed)	U-value (EnerPHit)	Savings (kwh/M2pa)	
01ud Rend Masonry Wall	1.18	0.15	54.4	
03ud Wall below DPC	1.553	0.15	6.9	
04ud Clay Tile Pitched Roof	0.239	0.12	5.4	
05ud Suspended Floor	0.244	0.15	1.6	
10ud New Roof	0.219	0.12	1.1	
Air Tightness	5.3	1	15.9*	
			85.4	Total

* = Saving per Unit Change in Air Changes per Hour (not U-value)

Results & next steps

- Results:
  - I have worked out the relative importance of each set of options
  - Focus on walls & loft
  - Don’t insulate under the Damp Proof Course – lots of effort, little return
- What’s next?
  - Check practicality of insulation depths (is roof overhang enough?)
  - Try to align with costs? Work out change per £ ?
  - E.g. have window quotes – is it worth spending more on windows or insulation?
  - Work out which materials to use (performance vs cost vs sustainability etc)

The End