is your business sustainable?

inperpetuum

who we are

In Perpetuum is the newly created entity to deliver a Bio Energy Cluster investment portfolio around the Bio Power, Heat, Fuels and Chemicals markets globally.

Biomass and Biofuels are highly regulated global B2B commodity markets that have suffered from market disturbances.

Many have been constrained by market / country regulatory regimes, leaving them distressed or with any growth limited to short periods of profitability followed by turmoil.

what we do

In Perpetuum provides both a development engine and a marketplace for the Bio Mass, Fuel or Chemical outputs. All products and projects will deliver measurable sustainable benefits, meaning they have a positive and provable local and/or global effect on society and the environment.

The Biochemical market is an emerging sector driven by B2C demand and expectation that brands will “do the right thing” when it comes to looking after the planet.

This creates an opportunity for commercially competitive biogenic chemicals from established and novel feedstocks or technology routes.

Our analysis shows some of these opportunities will work efficiently when clustered around existing BioEnergy assets.

how we do it

Immediate opportunities exist around BioEnergy assets from field to fuel for heat, power and transport markets, where assets have become distressed in some way.

The precise investment / development solutions can only be defined following detailed investigation, analysis, “optioneering” and critical decision making to identify the most appropriate returns and societal benefits.

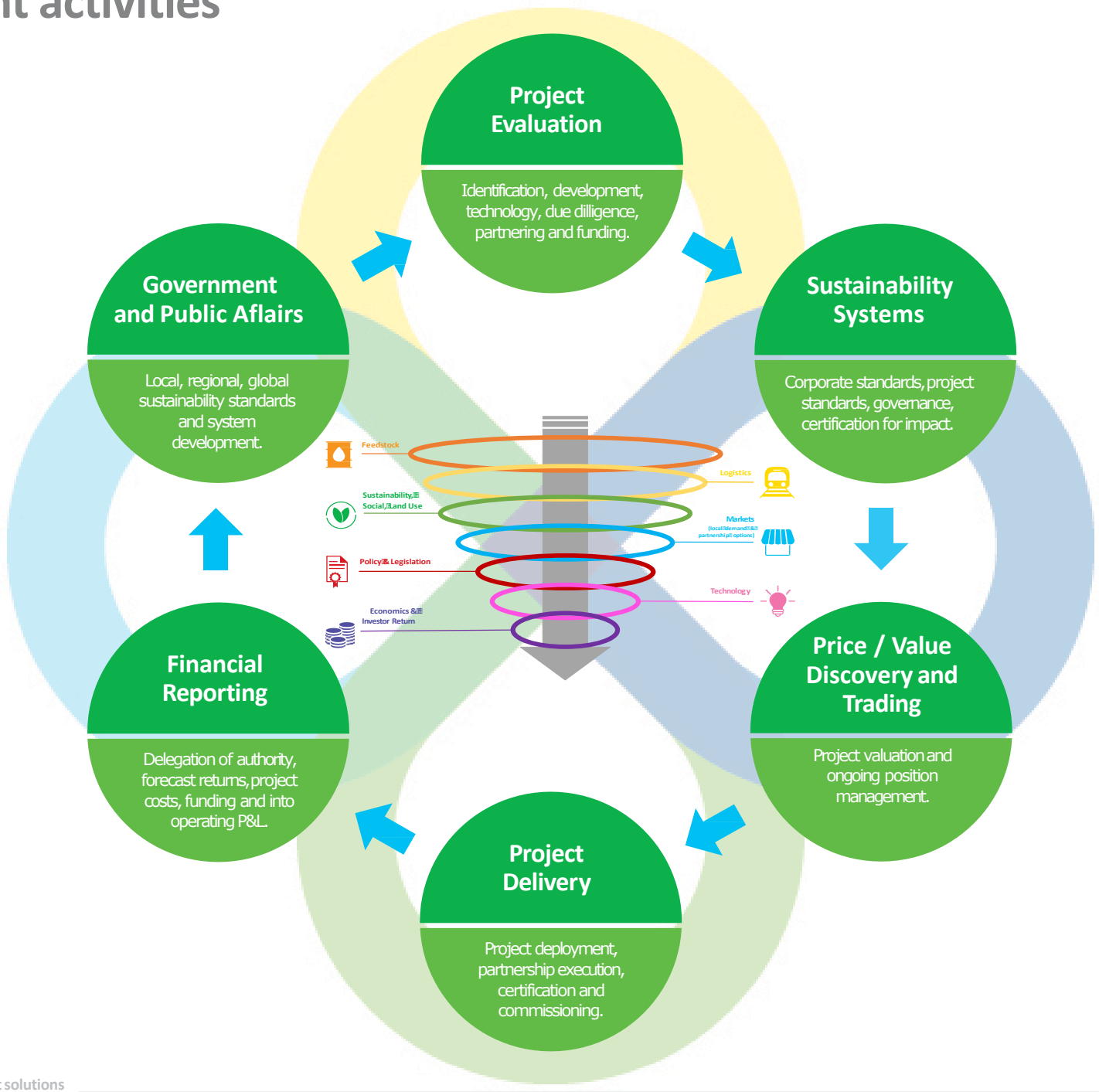
Optioneering will lead into consideration of a broad range of opportunities, including Bio chemicals as well as Biomass for heat and power and Biofuels for transport and power.

our experience

50 years of combined experience in this market sector

- Bio Mass / Fuels and Chemical markets
- New team / Market development
- Project evaluation & delivery
- Sustainability systems
- Price / value discovery and Trading
- Government and Public Affairs

development activities



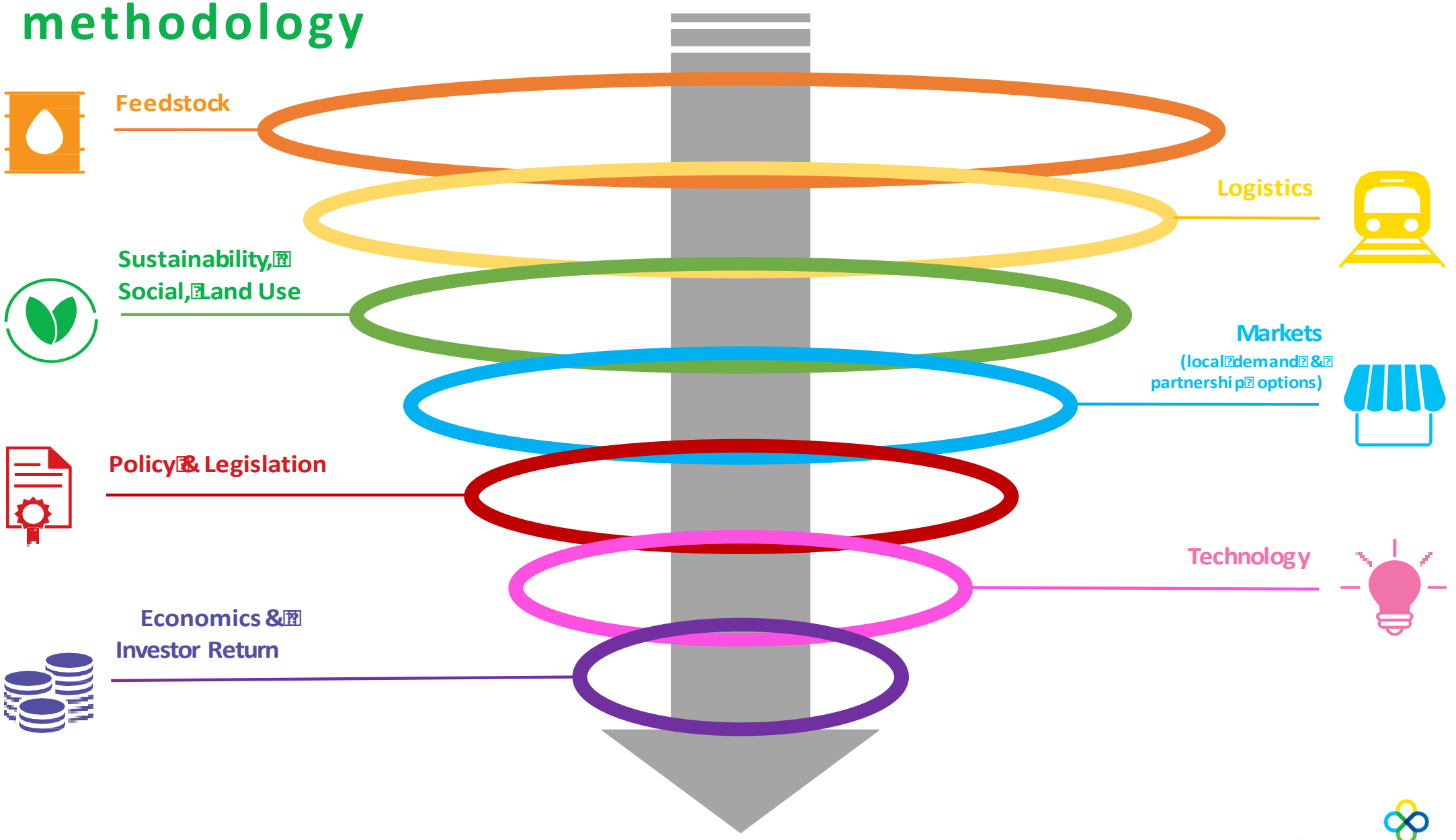
roadmap to a sustainable future

In light of BEIS intention to eliminate liquid fossil fuels, OFTEC recognises the potential demise of the oil heating sector unless an alternate feedstock is found. OFTEC and its members face potential loss of market and subsequent loss of income and business uncertainty without an alternate. Liquid biofuels may be an alternate. However, some work is needed to convince BEIS that they offer a sustainable and available solution given the policy uncertainty and flip flop around use of liquid biofuels in the transport energy sector.

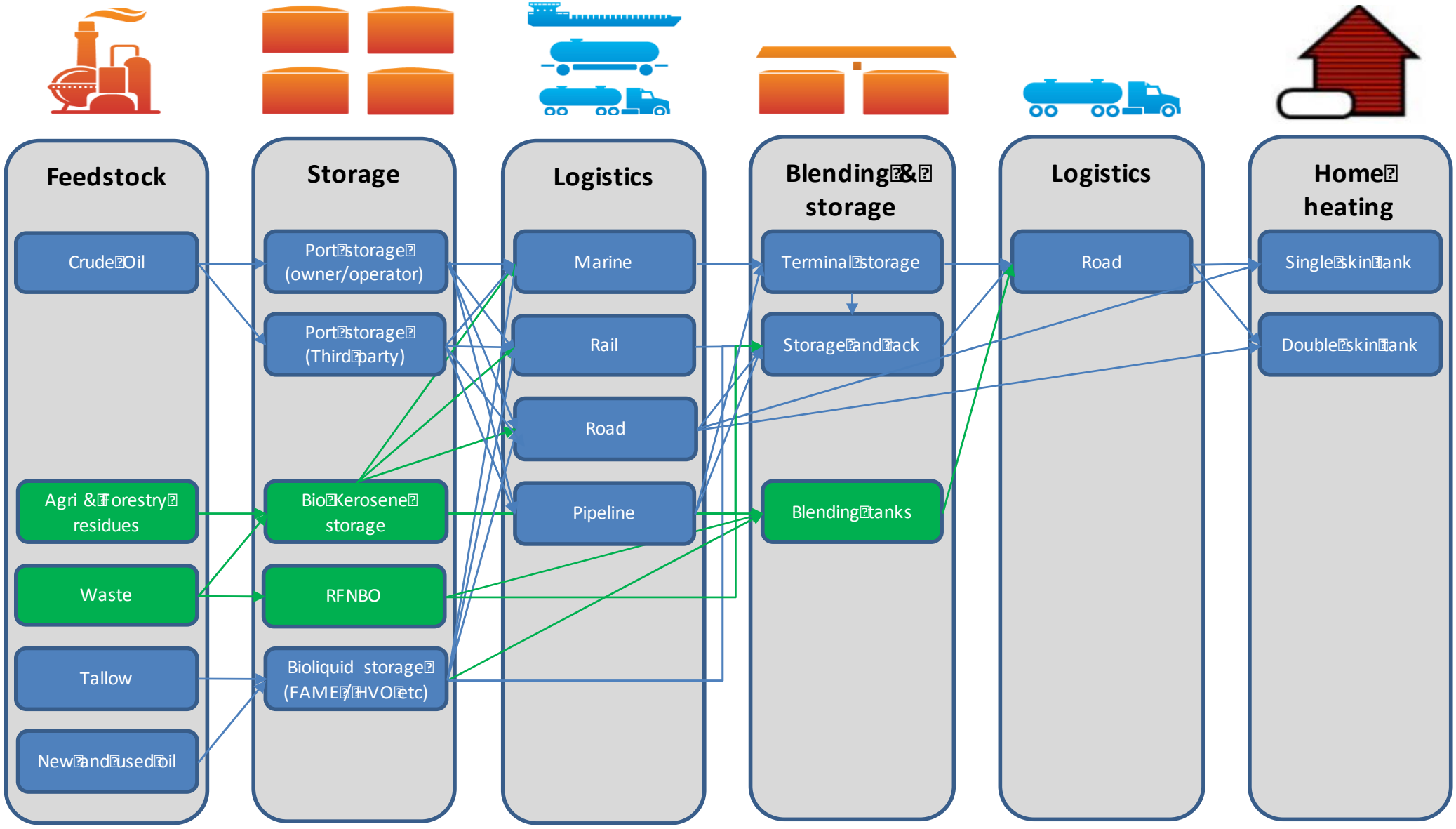
OFTEC intends to present to BEIS a roadmap of how to get to sustainable liquid biofuels in the off-gas heating network. This will be, by adopting In Perpetuum's approach to a robust analysis of the sector to underpin policy options. The approach will consider in full the following seven factors: Sustainability / Feedstocks / Technology / Logistics / Markets / Policy & Economics.

OFTEC

methodology



supply chain flowcharts



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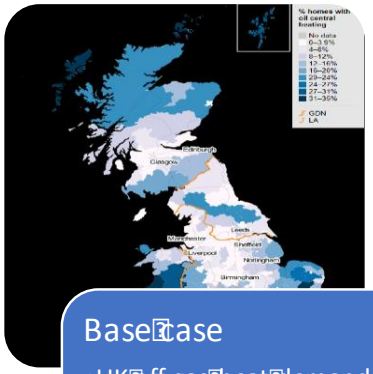
Overview of the technical methodology:

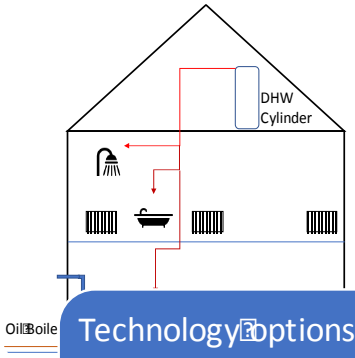


Base case

- UK off-gas heat demand
- English Housing Survey
- Typical housing stock
- Typical property heating solution

Energy reduction

- Reasonable improvements
- Deep improvements



Technology options

- ASHP
- GSHP
- LPG
- Biomass
- Sustainable liquids
- Electrical panel/ convection heaters

Costs/ impacts

- Capital costs
- Running costs
- Other factors

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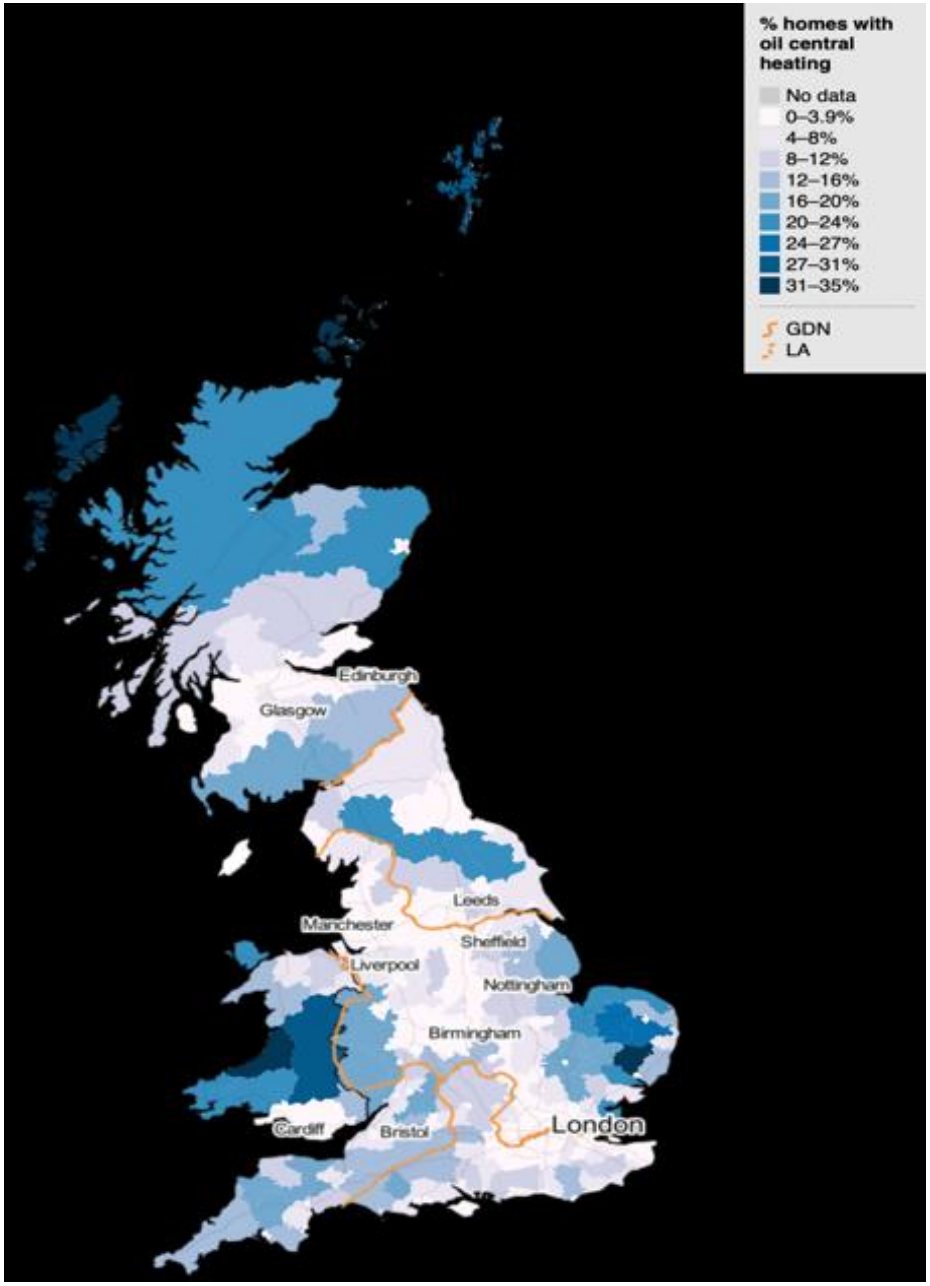
Current housing stock (England):



Estimated number of oil using homes by dwelling type and age profile

Group	Pre - 1919	1919 - 1944	1945 - 1964	1965 - 1980	Post - 1980	Total
Terraced house	80,600	4,500	6,750	10,000	6,700	108,550
Semi-detached house	81,900	23,600	40,150	27,500	14,400	187,550
Detached house	218,600	22,000	40,500	86,200	112,900	480,200
Bungalow	19,900	8,350	42,700	65,350	29,400	165,700
Total	401,000	58,450	130,100	189,050	163,400	942,000

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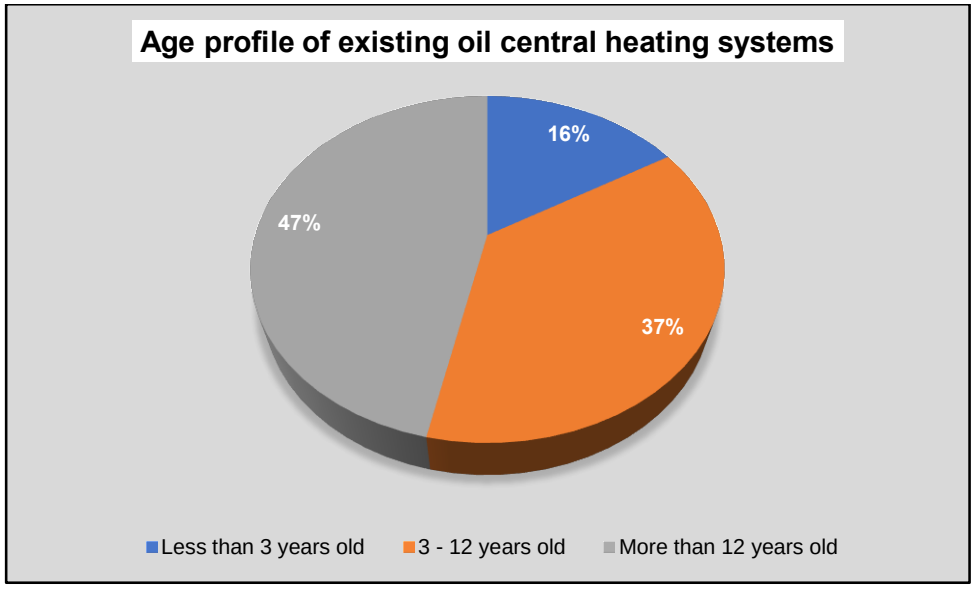
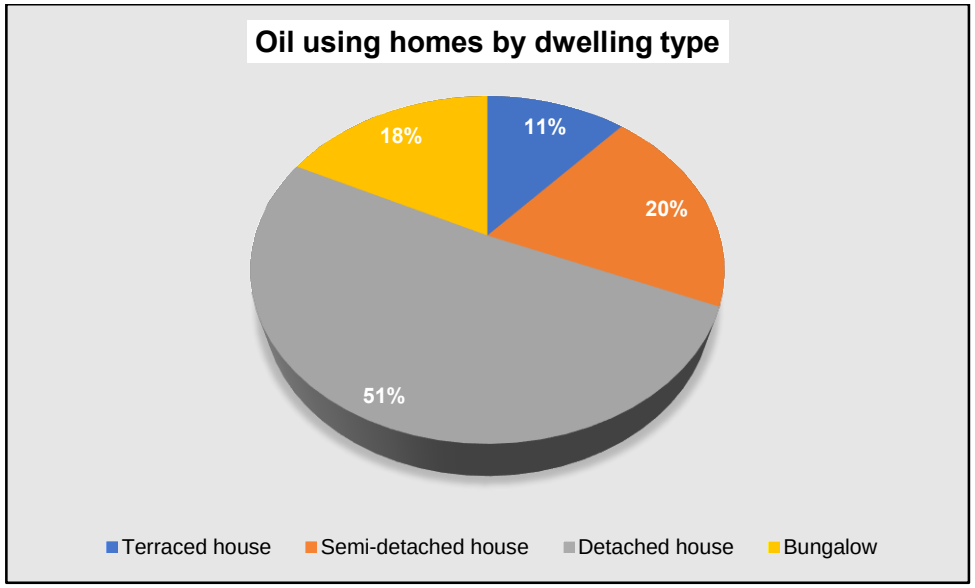
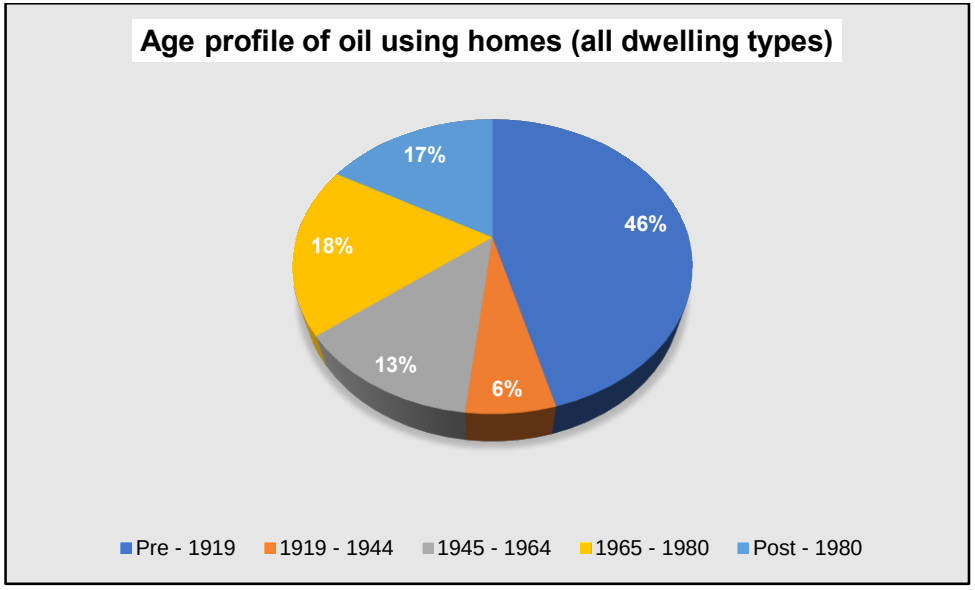
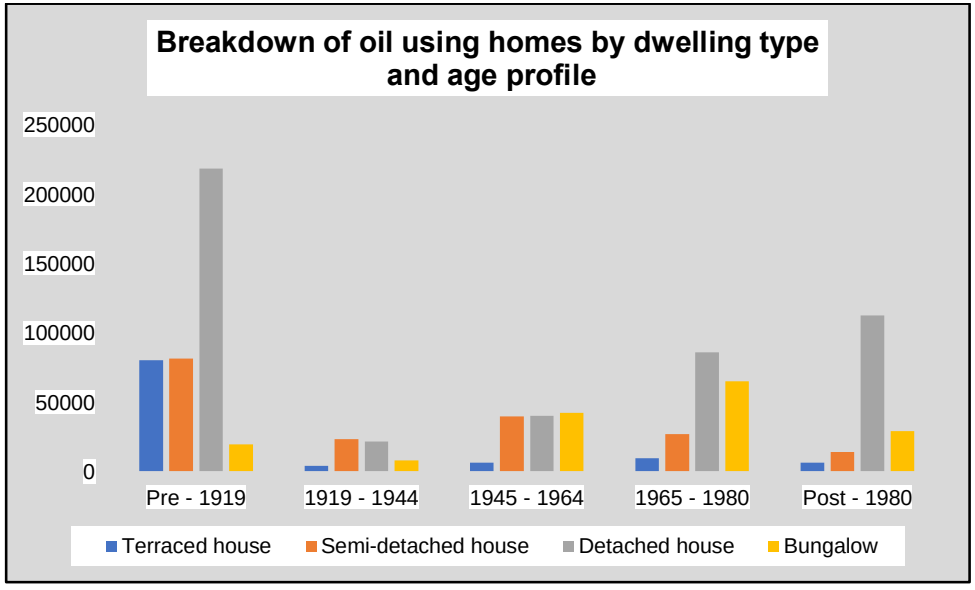
Current housing stock (England):









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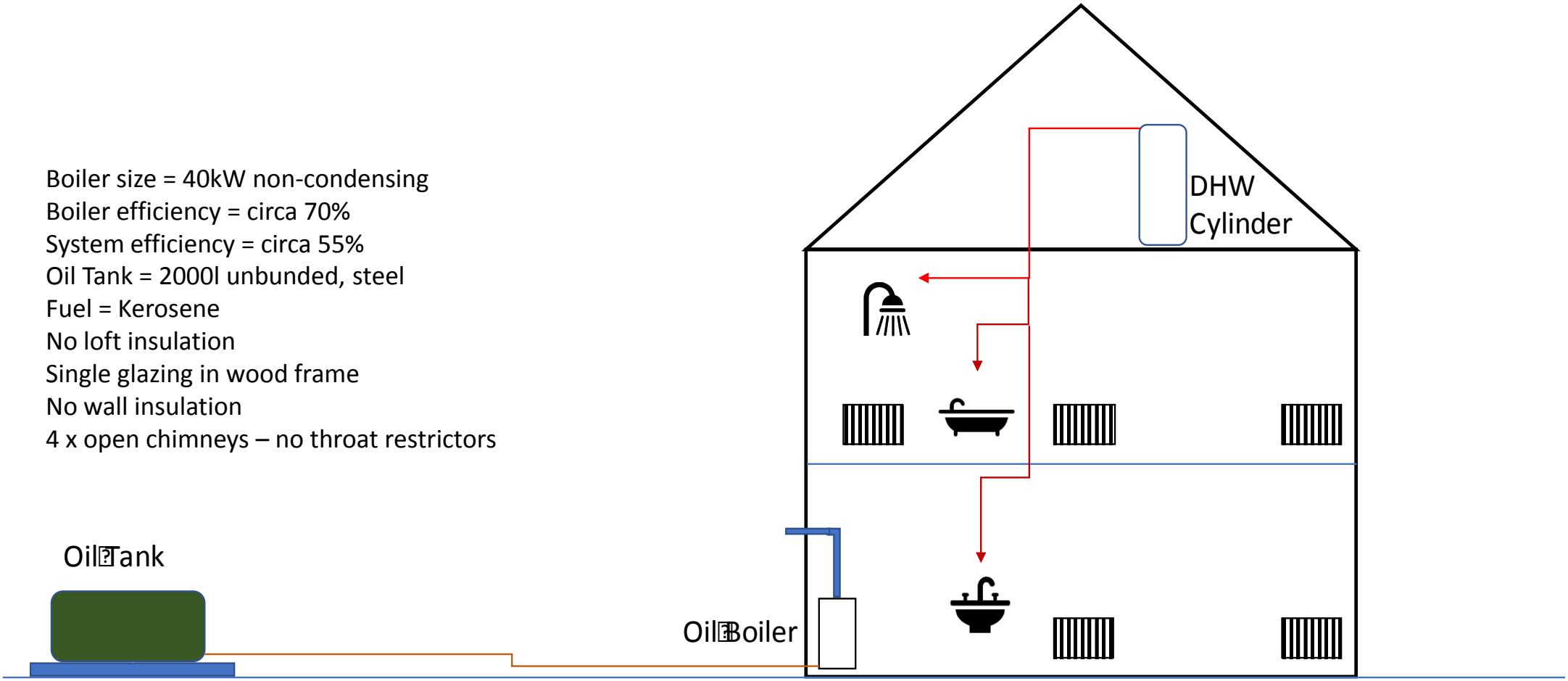
Existing heating system installed in pre 1919 detached property

Boiler size = 40kW non-condensing
Boiler efficiency = circa 70%
System efficiency = circa 55%
Oil Tank = 2000l unbunded, steel
Fuel = Kerosene
No loft insulation
Single glazing in wood frame
No wall insulation
4 x open chimneys – no throat restrictors



Total heat loss = 40kW/h
Annual Space Heat requirement = 49447kWh/Year

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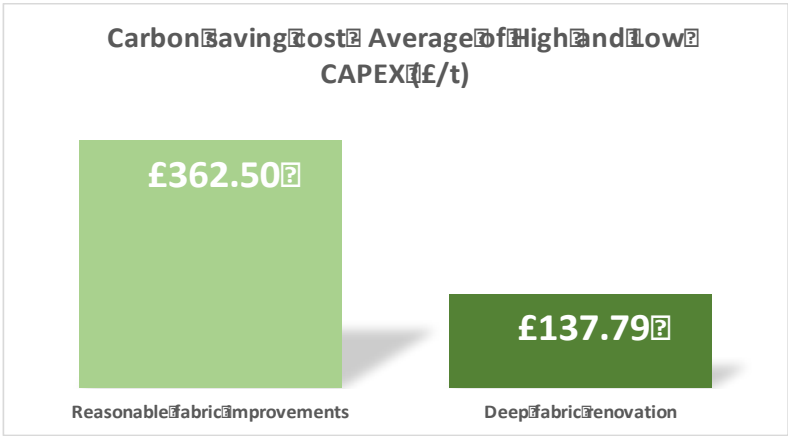
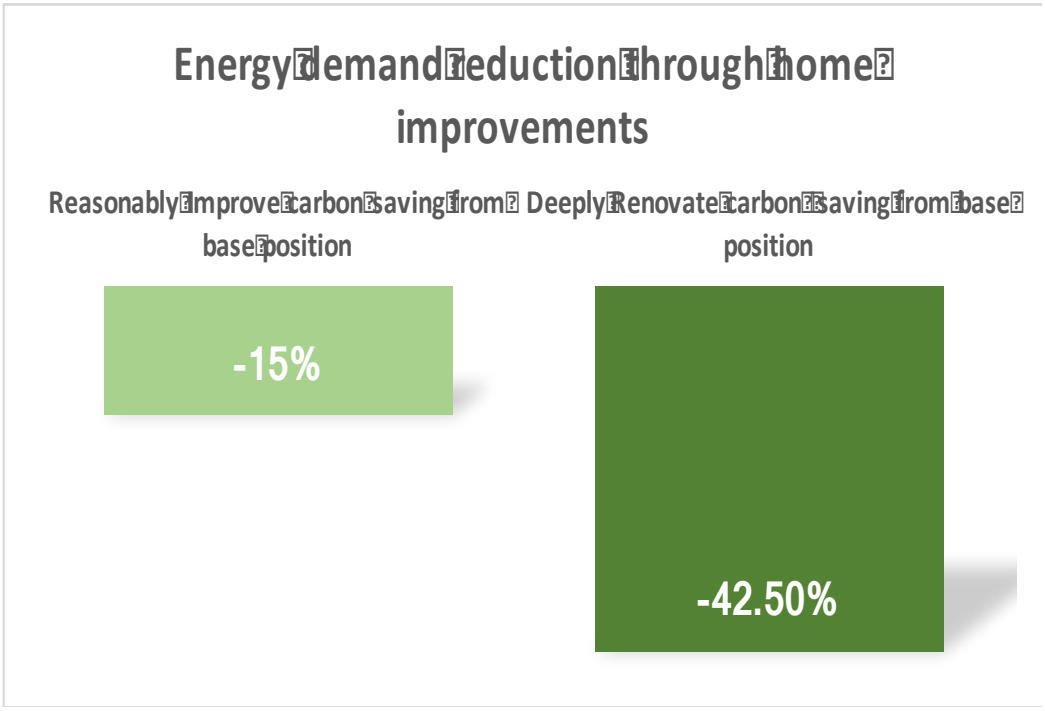
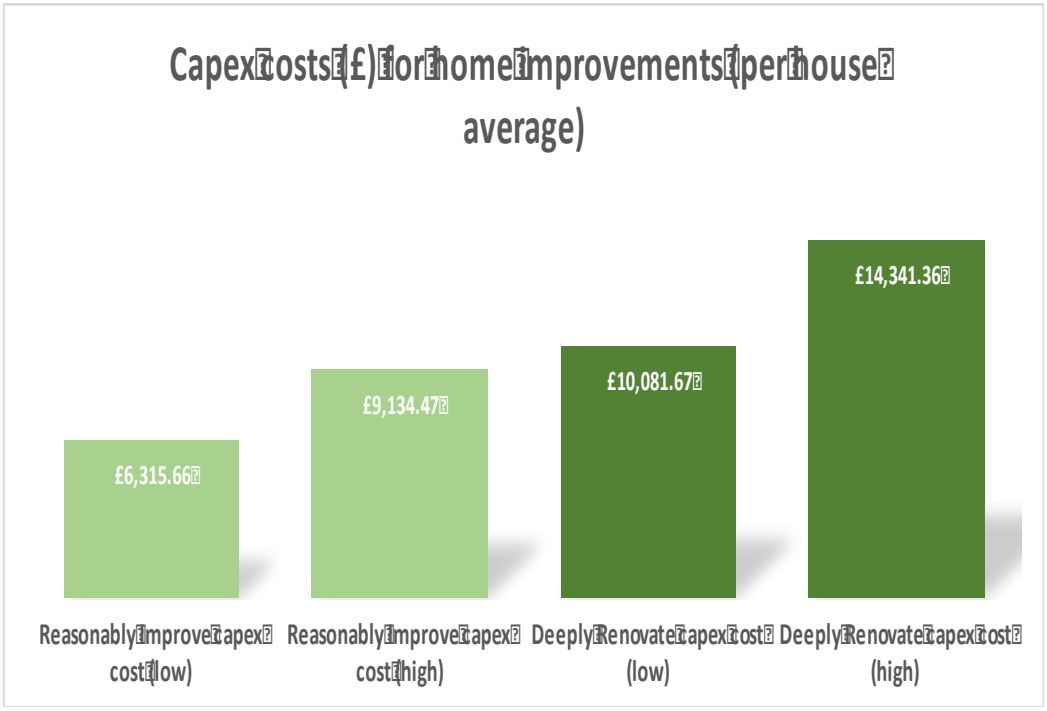
Energy Efficiency and Optimisation (England):

Estimated number of potential building energy efficiency improvements

	Reasonable < 5 days					Deep > 5 days	
Group	**First-time loft insulation**	**Loft insulation top-up**	**First-time double glazing**	**Double glazing upgrade**	**Cavity wall insulation**	**Solid wall insulation**	**Floor insulation**
Terraced house	18,370	87,835	20,370	85,835	10,050	85,100	101,850
Semi-detached house	29,130	153,380	34,630	147,880	40,590	105,500	173,150
Detached house	56,220	384,465	73,460	367,225	76,020	240,600	367,300
Bungalow	14,190	146,590	25,590	129,820	64,830	28,250	136,300
Total	117,910	772,270	154,050	730,760	191,490	459,450	778,600







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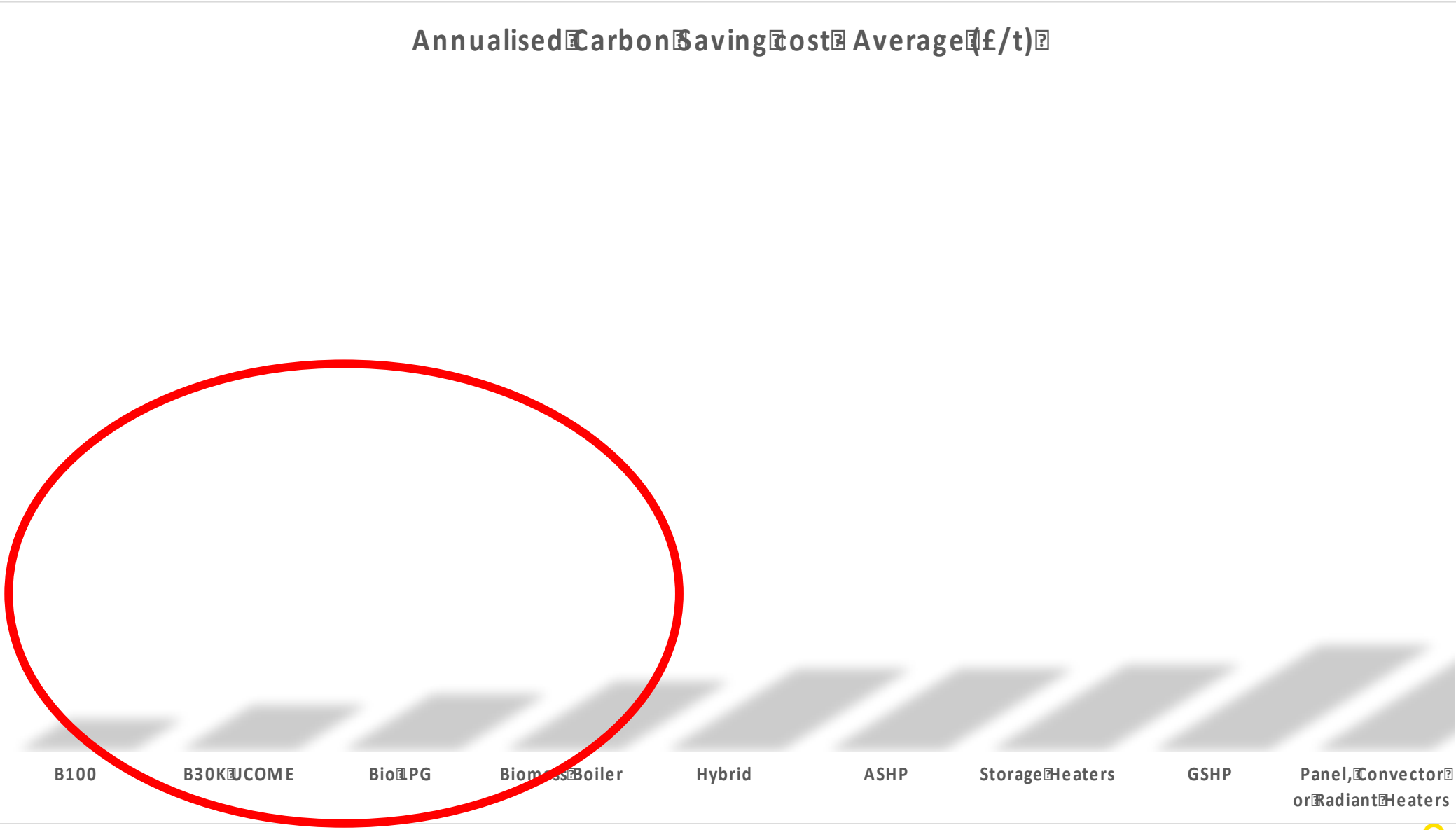
Carbon saving costs (average) per technology

(England): SAP10.1 basis



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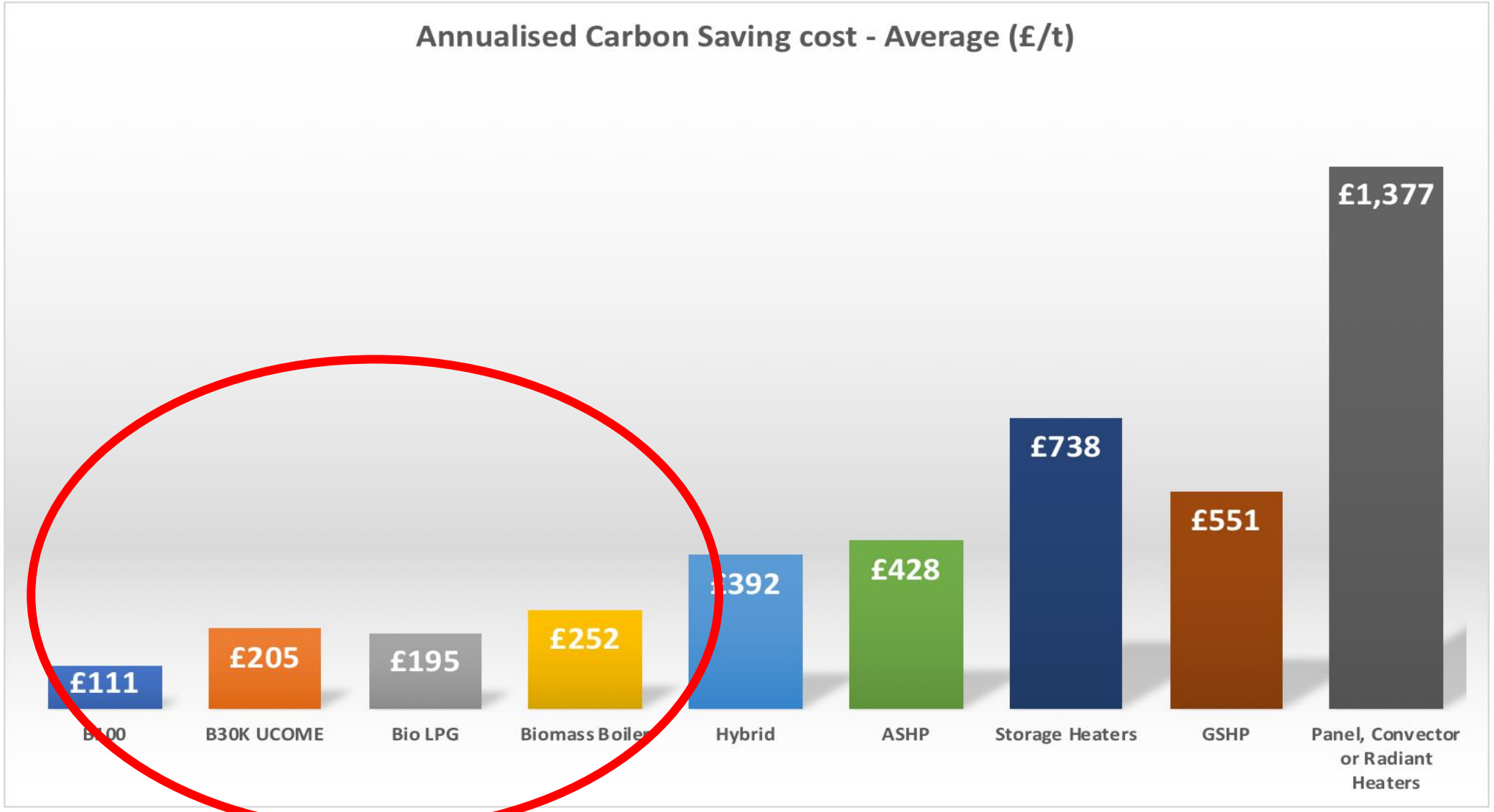
roadmap to a sustainable future

Questions raised:

- Pricing sensitivity
- Biomass availability
- Roadmap to truly low carbon power (cold, still, winters night scenario)

Carbon saving costs (average) per technology

(England): Current market prices and emission factors



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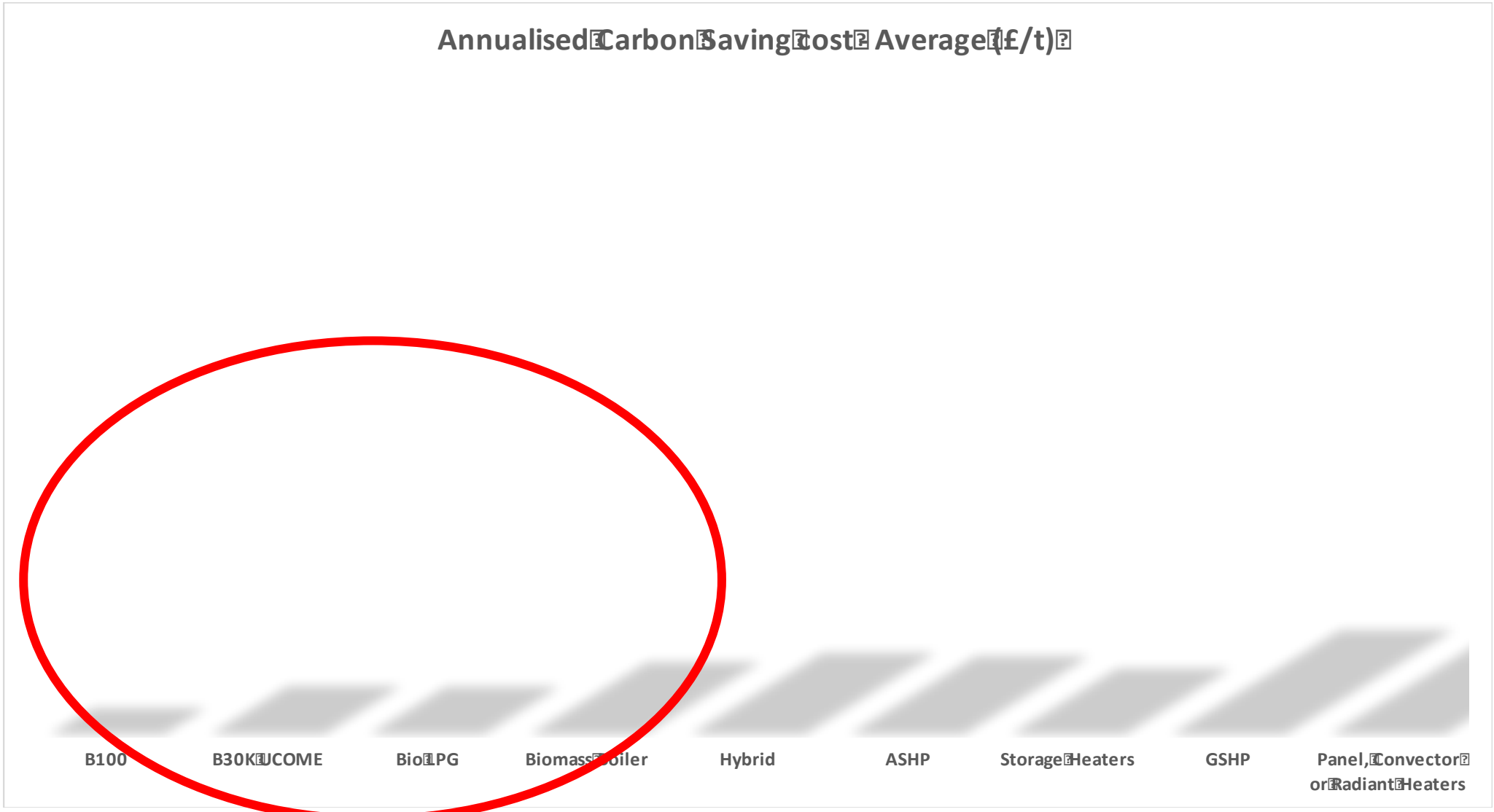
Carbon saving costs (average) per technology

(England): BEIS Green Book basis



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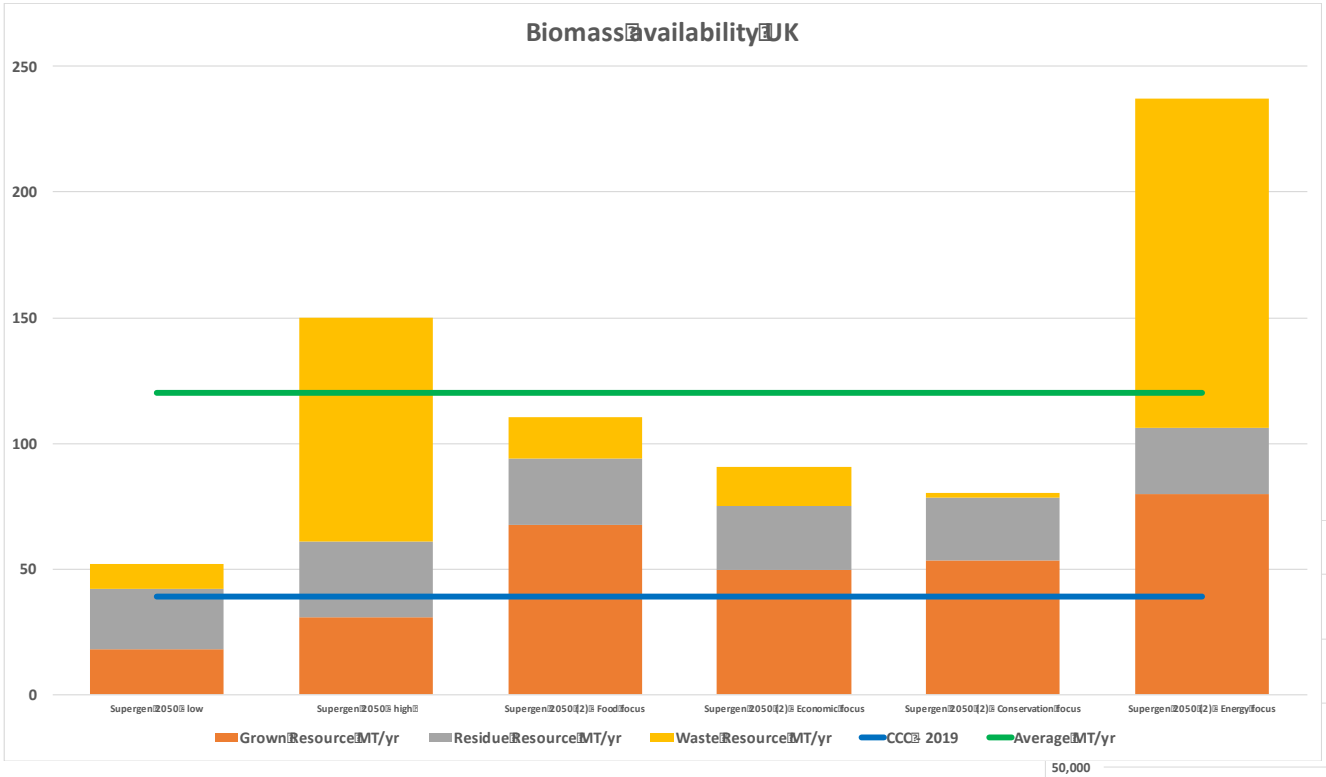
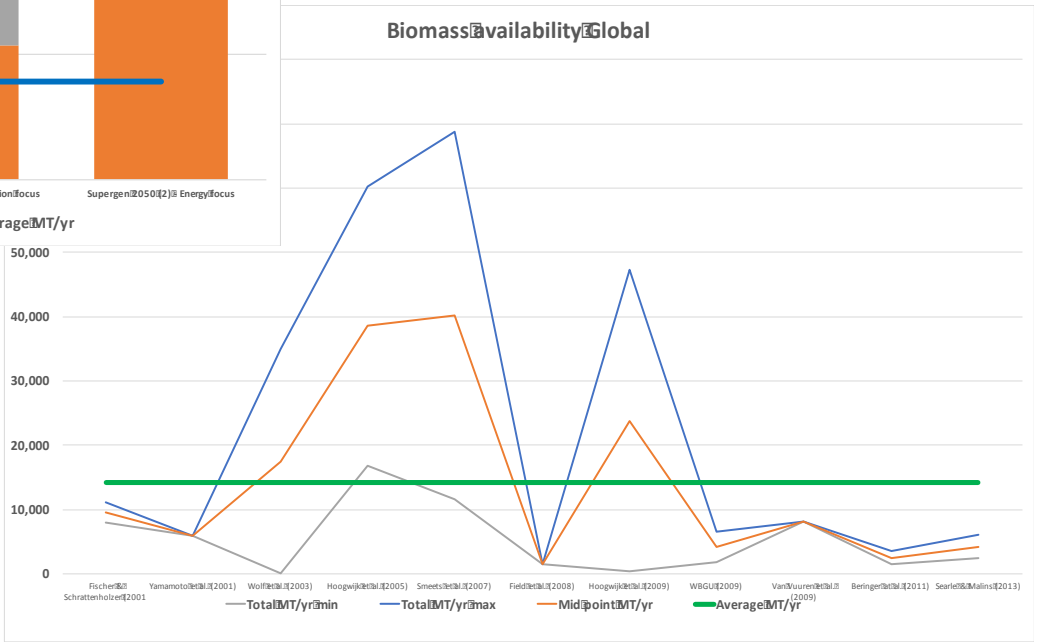
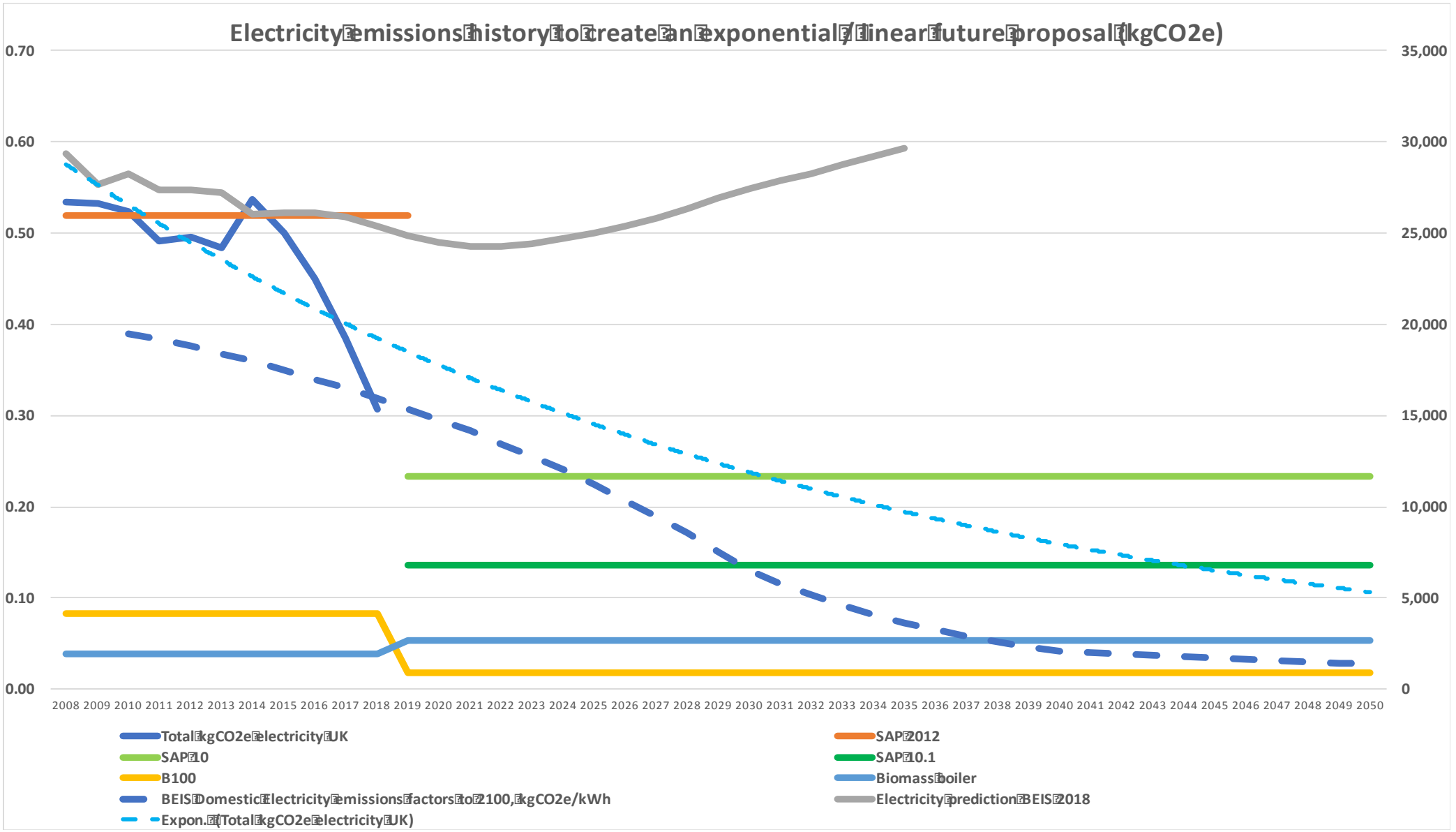
Biomass availabilities





Roadmap to truly low carbon power



build on bioenergy strategy

- Forward projection for grid emissions factors
  - Engaging with National Grid Future Energy Scenarios
  - Applying REA/ member competence

- Push for further work on biomass availability
  - CCC position seems to be conservative
  - CCC themselves now promoting greater adoption of energy crops
  - Danger of a view that biomass is scarce seems to be misdirecting policy

- Develop integrated REA position on Bioenergy for heat
  - Sustainable low carbon liquids
  - Sustainable low carbon gases
  - Sustainable low carbon solid biomass

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thank you

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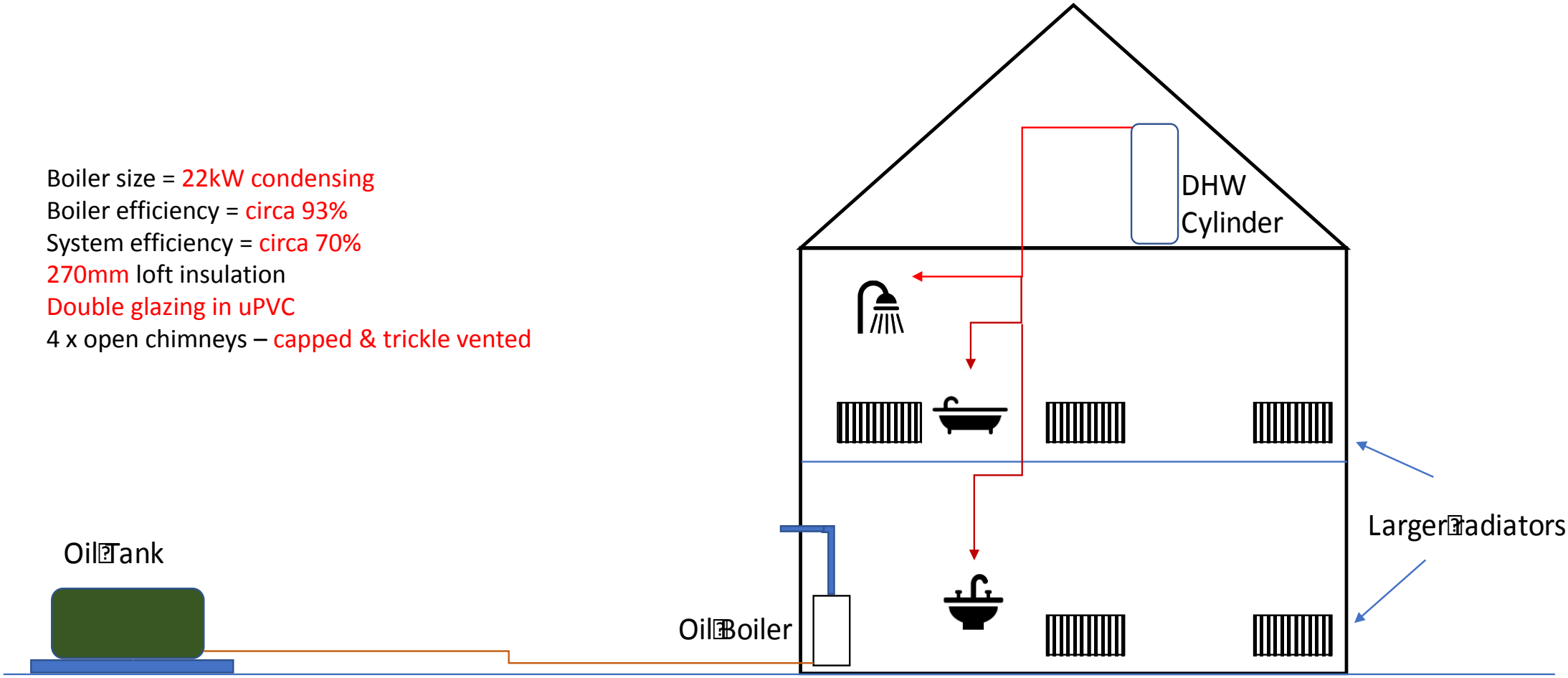
Reasonable improvements to fabric and heating system installed in pre 1919 detached property

Boiler size = 22kW condensing
Boiler efficiency = circa 93%
System efficiency = circa 70%
270mm loft insulation
Double glazing in uPVC
4 x open chimneys – capped & trickle vented



Total heat loss = 22kW/h
Annual Space Heat requirement = 24285kWh/Year

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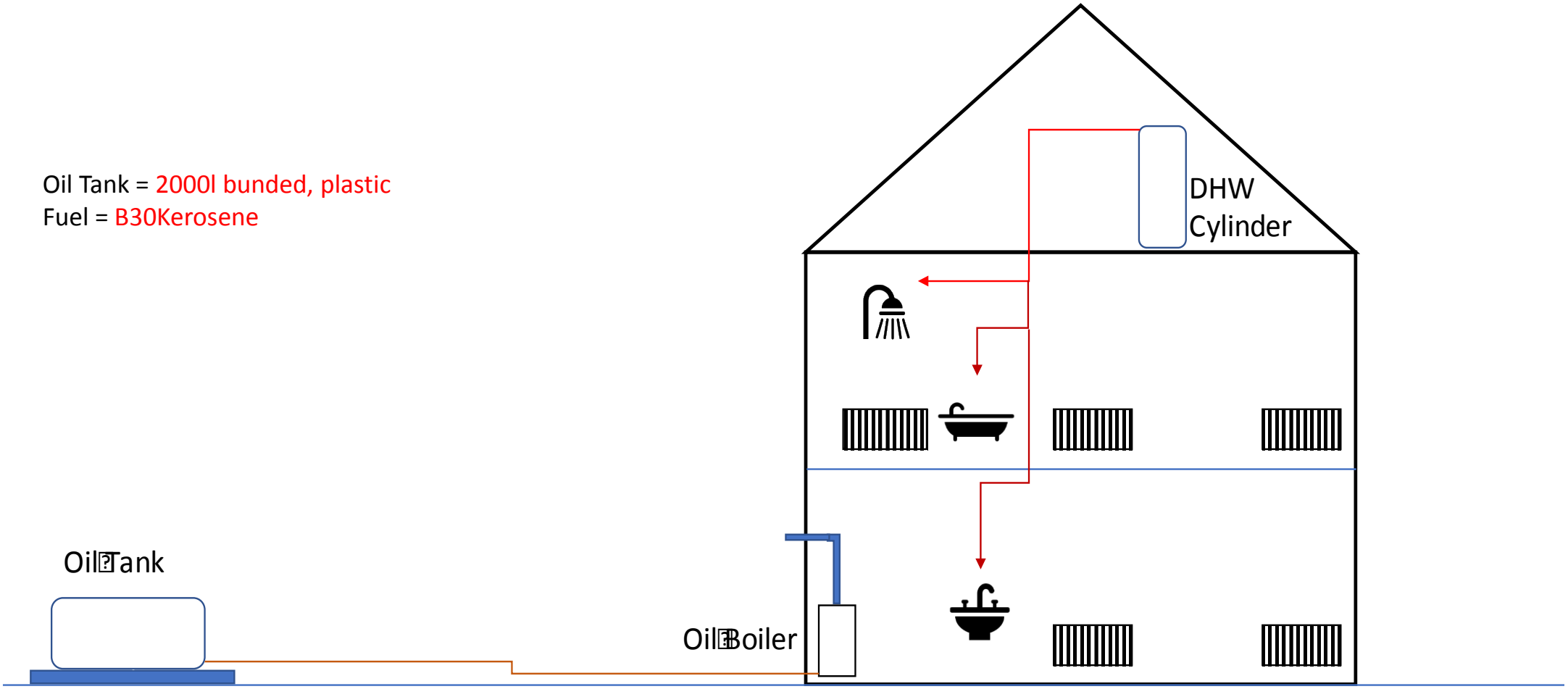
Reasonable improvements to fabric and heating system installed in pre 1919 detached property – B30K

Oil Tank = 2000l bunded, plastic
Fuel = B30Kerosene



CAPEX cost per house type		Low		High
Terraced house		£750		£3,610
Semi-detached house		£750		£3,970
Detached house		£750		£3,970
Bungalow		£750		£3,610

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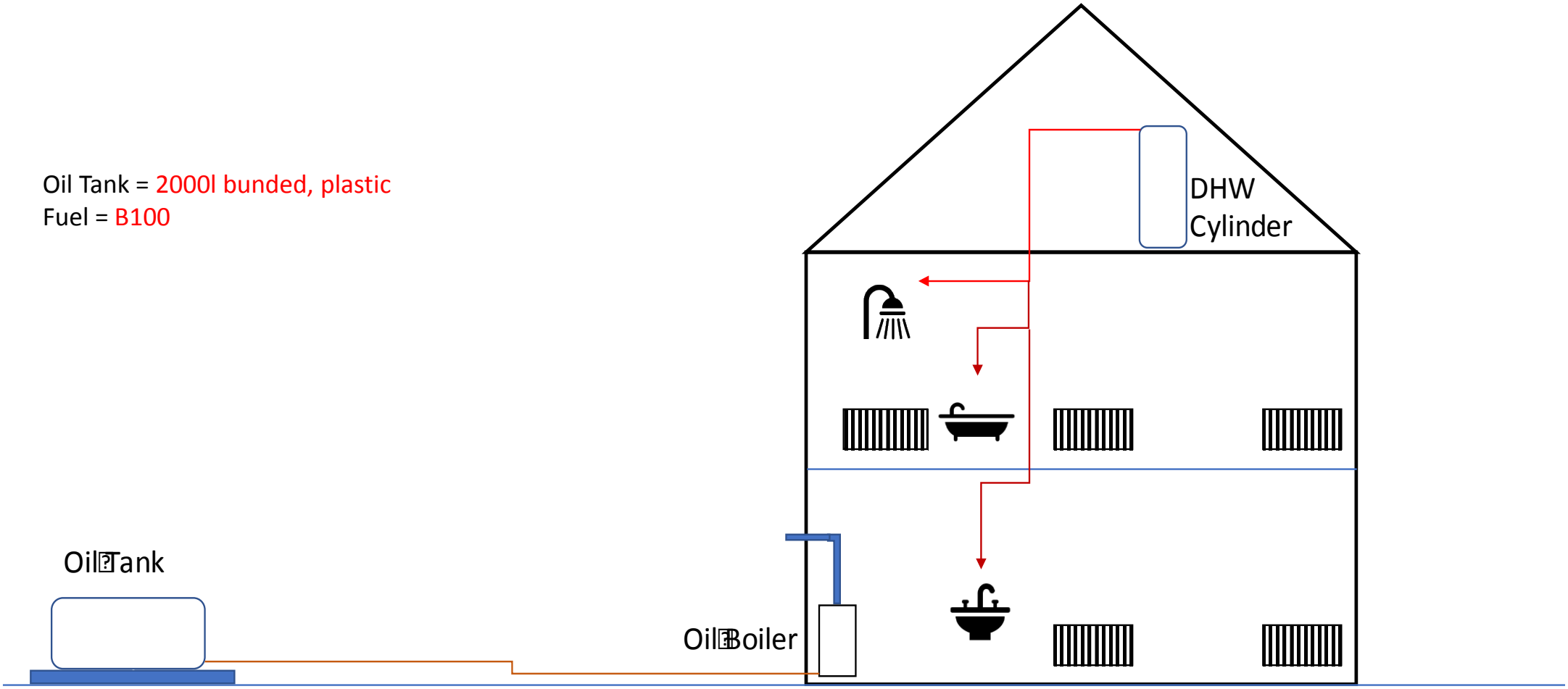
Reasonable improvements to fabric and heating system installed in pre 1919 detached property – B100

Oil Tank = 2000l bunded, plastic
Fuel = B100



CAPEX cost per house type		Low		High
Terraced house		£1,250		£3,610
Semi-detached house		£1,250		£3,970
Detached house		£1,250		£3,970
Bungalow		£1,250		£3,610

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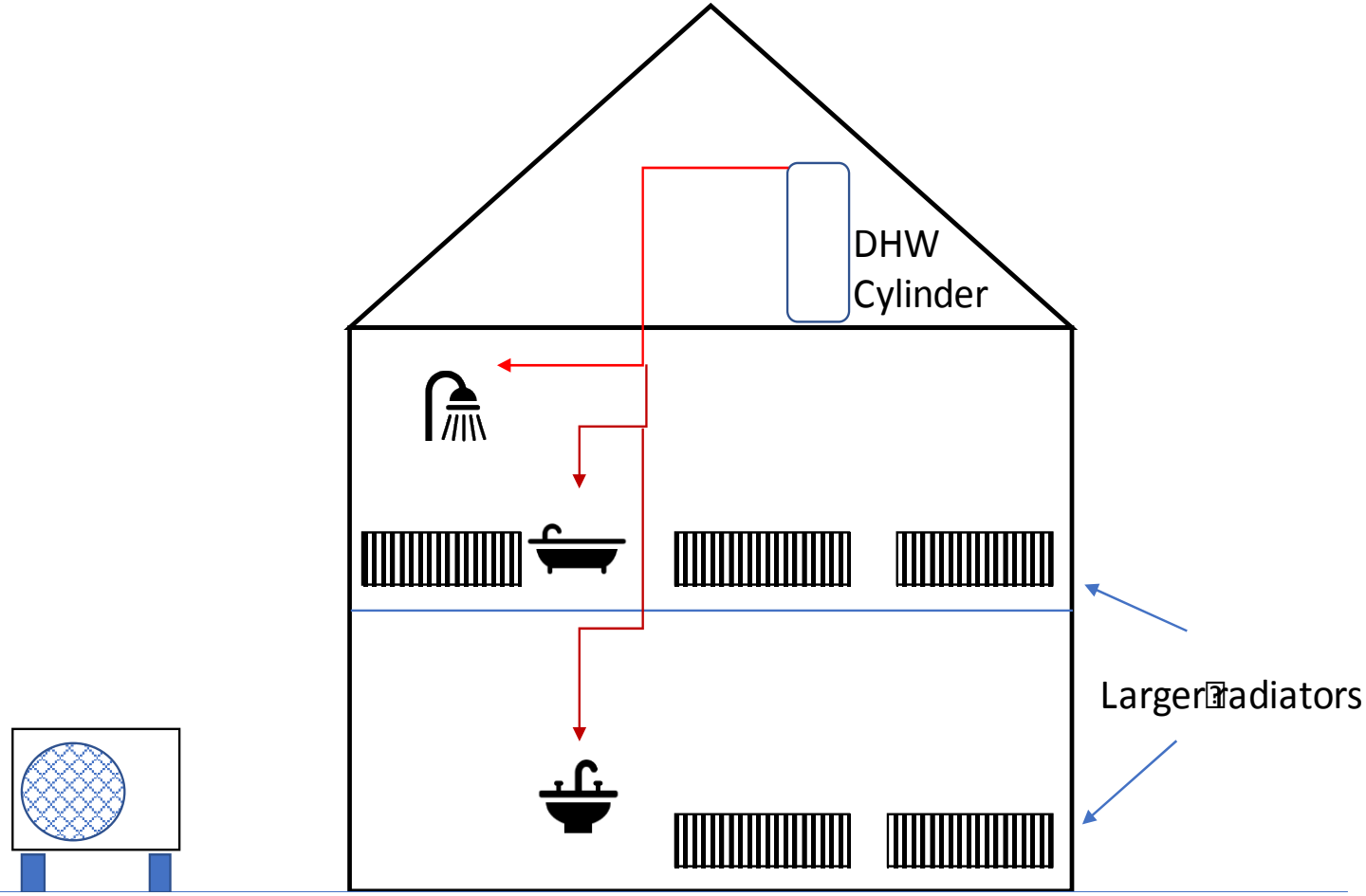
Reasonable improvements to fabric and heating system installed in pre 1919 detached property – ASHP

Heat pump size = 17kW
HP SCOP @55°C = circa 373%
System efficiency = circa 75%
Tank = None
Fuel = Electricity



CAPEX cost per house type		Low		High
Terraced house		£6,000		£7,495
Semi-detached house		£7,600		£9,195
Detached house		£9,200		£10,895
Bungalow		£8,100		£9,695

Note: Largest single phase heat pump currently available cannot satisfy the heat loss at the design conditions – supplementary heat source is required. DNO issues need to be addressed.

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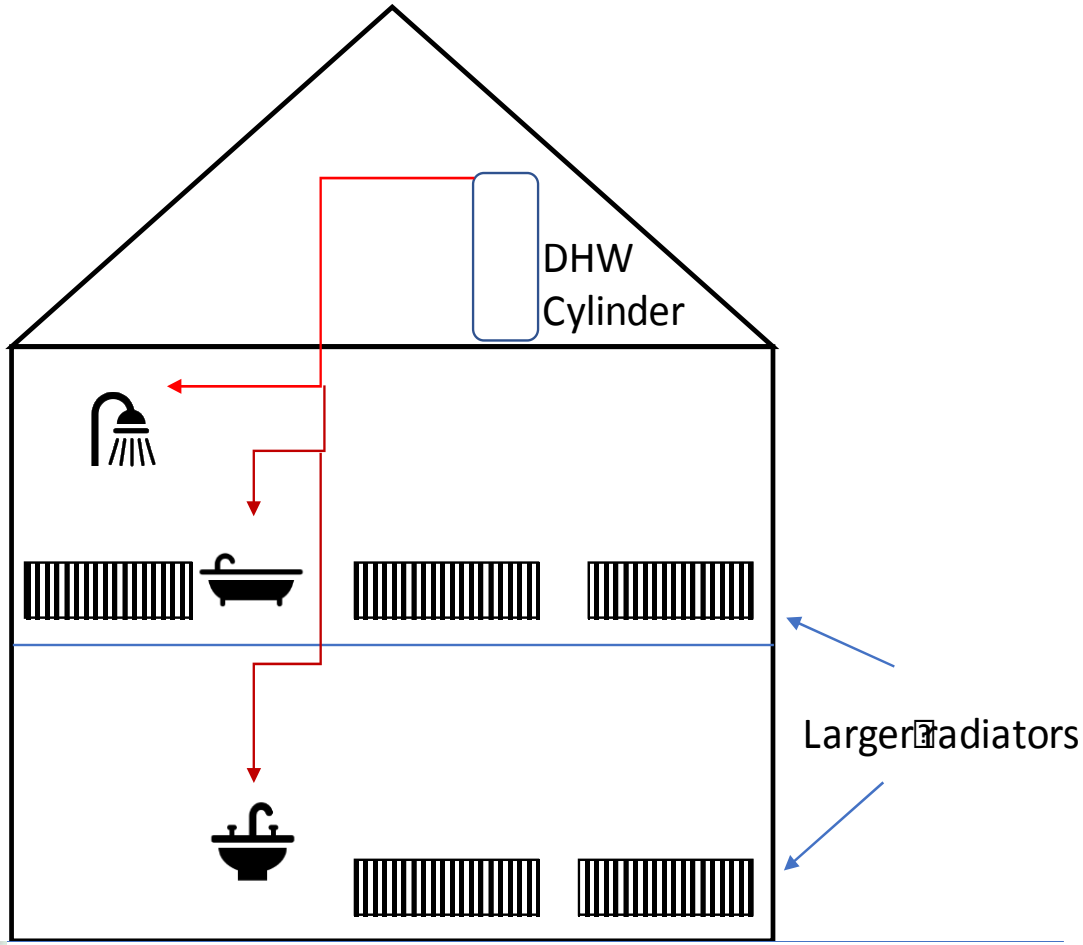
Reasonable improvements to fabric and heating system installed in pre 1919 detached property – GSHP

Ground source heat pump
Tank = None
Fuel = Electricity



CAPEX cost per house type		Low		High
Terraced house		£12,100		£21,295
Semi-detached house		£12,100		£21,295
Detached house		£12,100		£21,295
Bungalow		£12,100		£21,295

Note: DNO issues need to be addressed.

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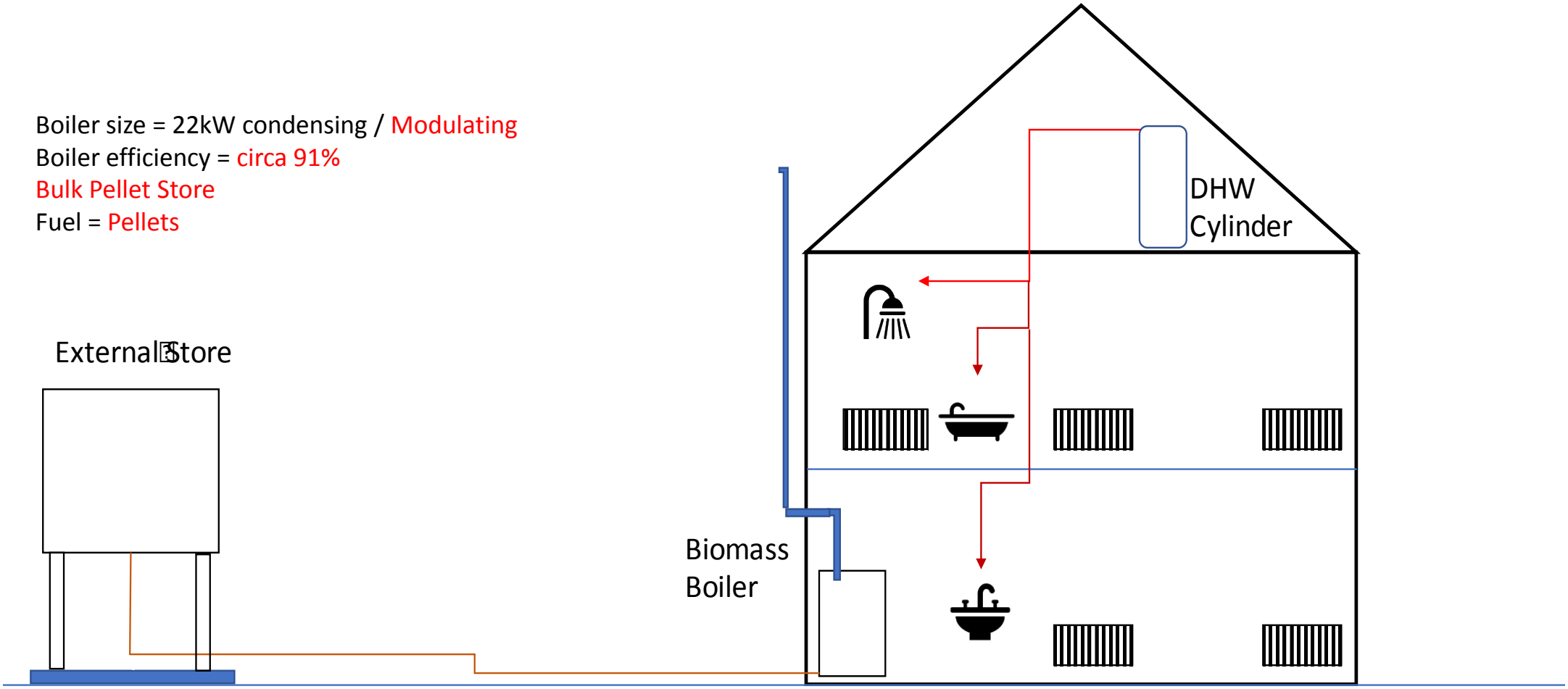
Reasonable improvements to fabric and heating system installed in pre 1919 detached property – Biomass

Boiler size = 22kW condensing / Modulating
Boiler efficiency = circa 91%
Bulk Pellet Store
Fuel = Pellets



CAPEX cost per house type		Low		High
Terraced house		£10,100		£18,295
Semi-detached house		£10,100		£18,295
Detached house		£10,100		£18,295
Bungalow		£10,100		£18,295

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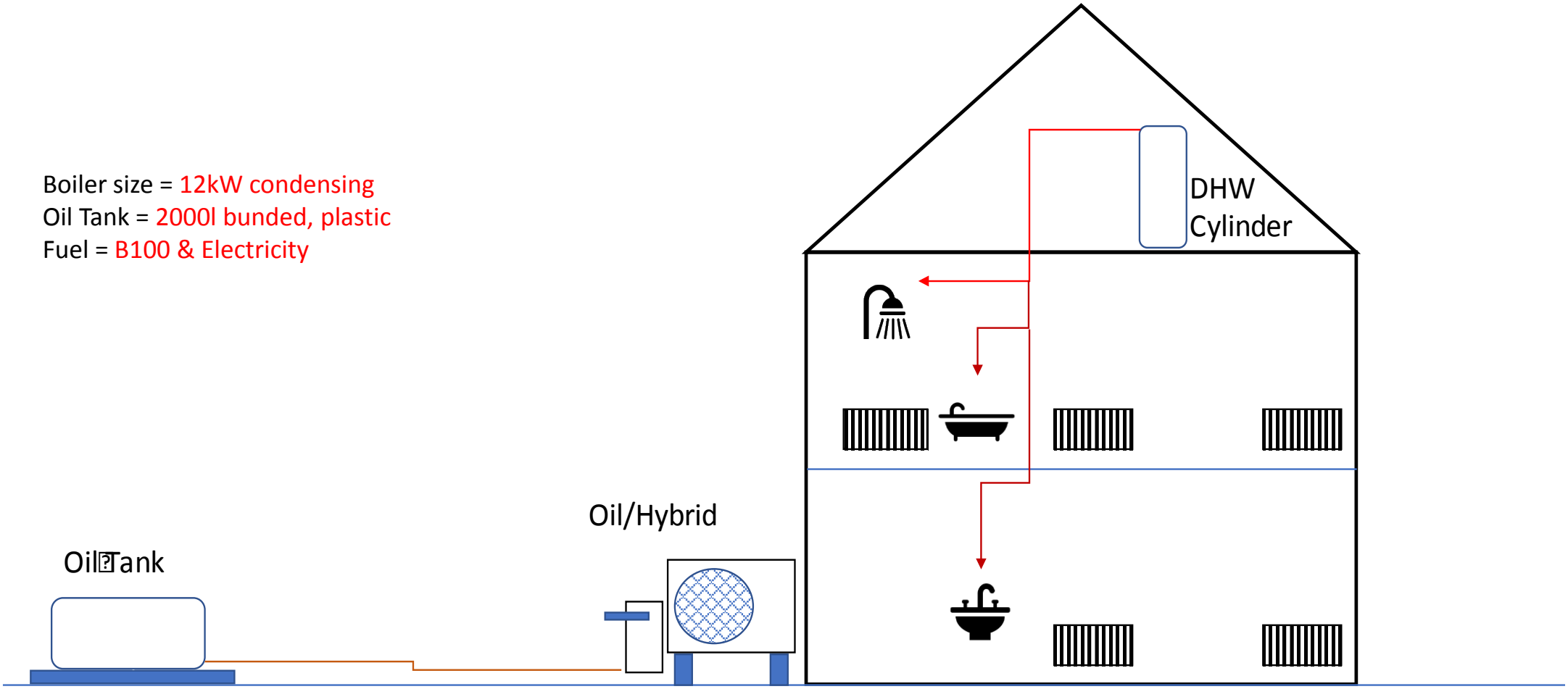
Reasonable improvements to fabric and heating system installed in pre 1919 detached property – Hybrid

Boiler size = 12kW condensing
Oil Tank = 2000l bunded, plastic
Fuel = B100 & Electricity



CAPEX cost per house type		Low		High
Terraced house		£12,350		£13,845
Semi-detached house		£12,700		£14,295
Detached house		£13,300		£14,995
Bungalow		£12,600		£14,195

Note: DNO issues need to be addressed.

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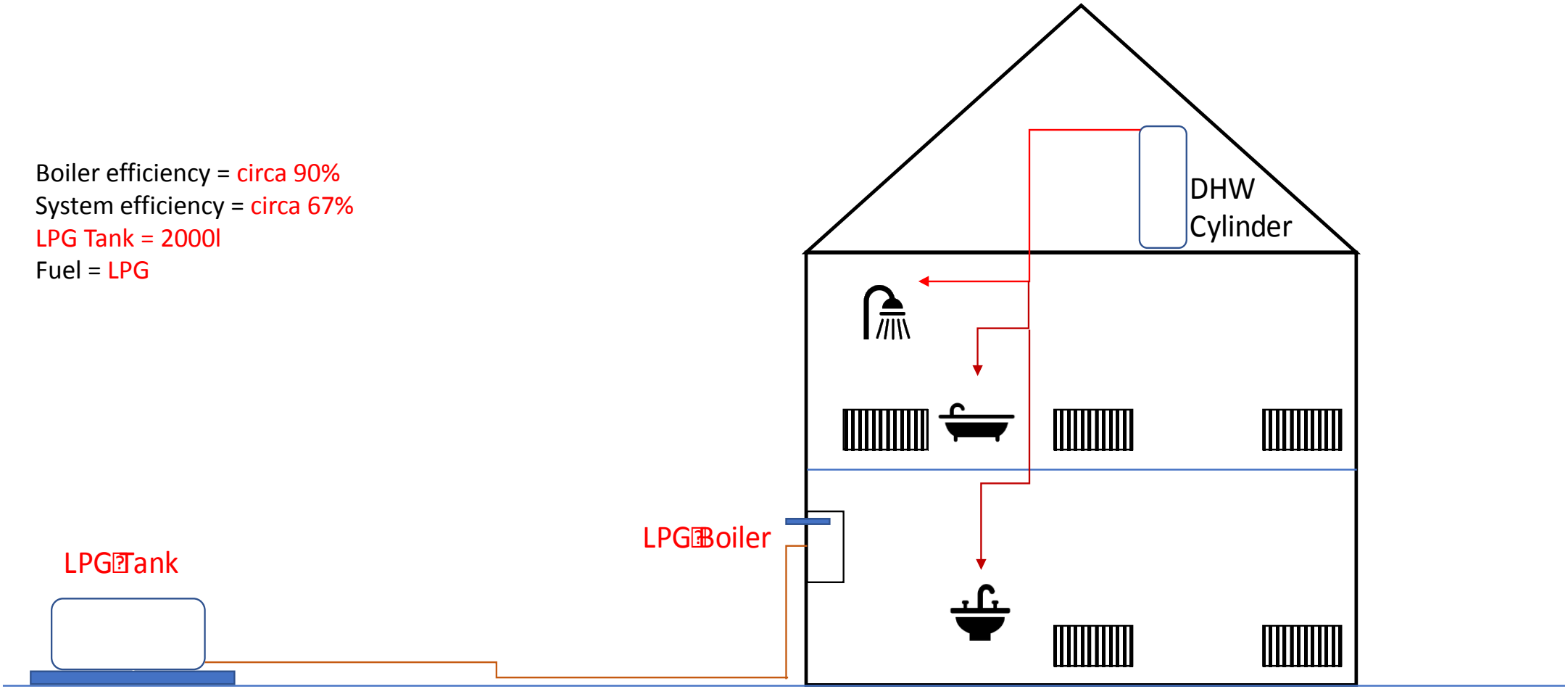
Reasonable improvements to fabric and heating system installed in pre 1919 detached property – LPG

Boiler efficiency = circa 90%
System efficiency = circa 67%
LPG Tank = 2000l
Fuel = LPG



CAPEX cost per house type		Low		High
Terraced house		£3,700		£6,795
Semi-detached house		£3,800		£8,295
Detached house		£3,800		£10,295
Bungalow		£3,800		£9,295

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