



Programme Area: Smart Systems and Heat

Project: WP3 Business Model Development

Title: Five promising consumer business models to transform low carbon heating and well-being in the home - engagement pack.

Context:

The case for heat decarbonisation is widely acknowledged, with studies showing that it is more cost effective to tackle CO₂ emissions from buildings than cutting more deeply in other sectors. The real challenge is establishing new heating solutions that substantially remove natural gas use from homes whilst making the solutions financially viable and attractive to consumers. Around 20,000 homes each week will need new heating system installations between 2025 and 2050 to meet decarbonisation targets; a rate fifty times greater than achieved to date. The current market will not deliver at scale for residential low carbon heat transition given: unappealing consumer propositions, a fragmented industry structure, a lack economic drivers and need for holistic policy framework. The Energy Technology Institute commissioned the Energy Systems Catapult to deliver a business model development project to develop a number of specific business propositions that could stimulate new thinking for models to be introduced into the market from just before 2020 through to the late 2020's.

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Five promising consumer business models to transform low carbon heating and well-being in the home



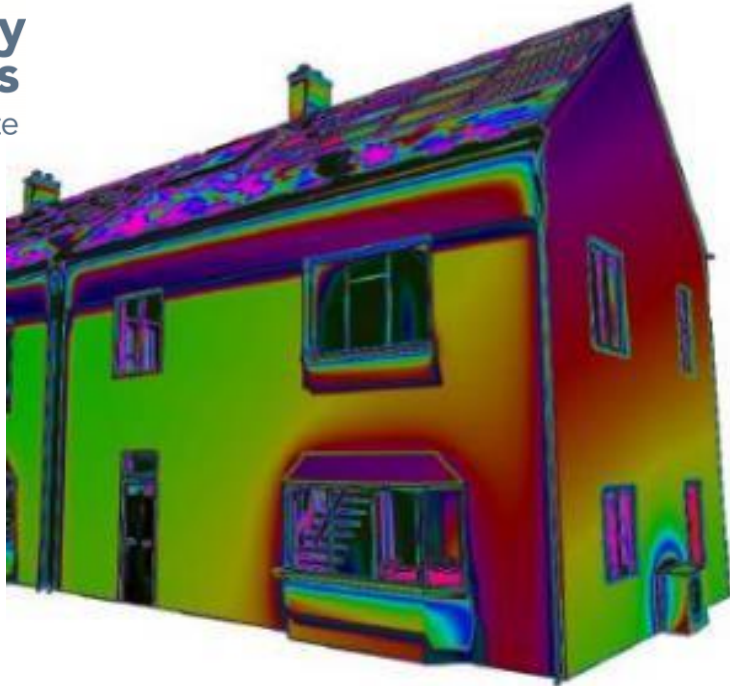
“a clean, intelligent, energy system that works for people, communities and businesses”



Smart Systems and Heat Phase 1

Engagement Pack

ETI's Smart Systems and Heat Programme



“Creating future-proof and economic local heating solutions for the UK”

- Connecting together – the understanding of consumer needs and behaviour with the development and integration of technologies and new business models into...
- Delivering enhanced knowledge amongst industry and public sector
- Resulting in industry and investor confidence to implement from 2020 which enables a UK heat transition

ETI members



CATERPILLAR®



Rolls-Royce



Department for
Business, Energy
& Industrial Strategy



Innovate UK
Technology Strategy Board

ETI programme associate

The Energy Systems Catapult will deliver Phase One of the SSH programme as a supplier to the ETI following the transition of the SSH programme team to the Catapult. From 2017 the Catapult will be responsible for delivery of Phase Two of the programme independently of the ETI.

Energy Systems Catapult



What are Catapults?

- World leading technology and innovation centres
- Government business innovation intervention

Aims:

- Generate sustainable economic growth
- Transform UK's ability to create new products & services
- Open up global opportunities for the UK

Energy Sector Challenge & Opportunities



Radical change is upon us, the future could be:

- multi-vector
- whole system
- distributed
- flexible
- smart

up to **£46bn**
of UK GDP impact*

up to **£27bn** in
efficiency savings*

Our Response



ESC will convene stakeholders and develop and apply **modelling and analytical capabilities** to help the UK make **strategic choices** in collaboration with industry, Gov't and academia

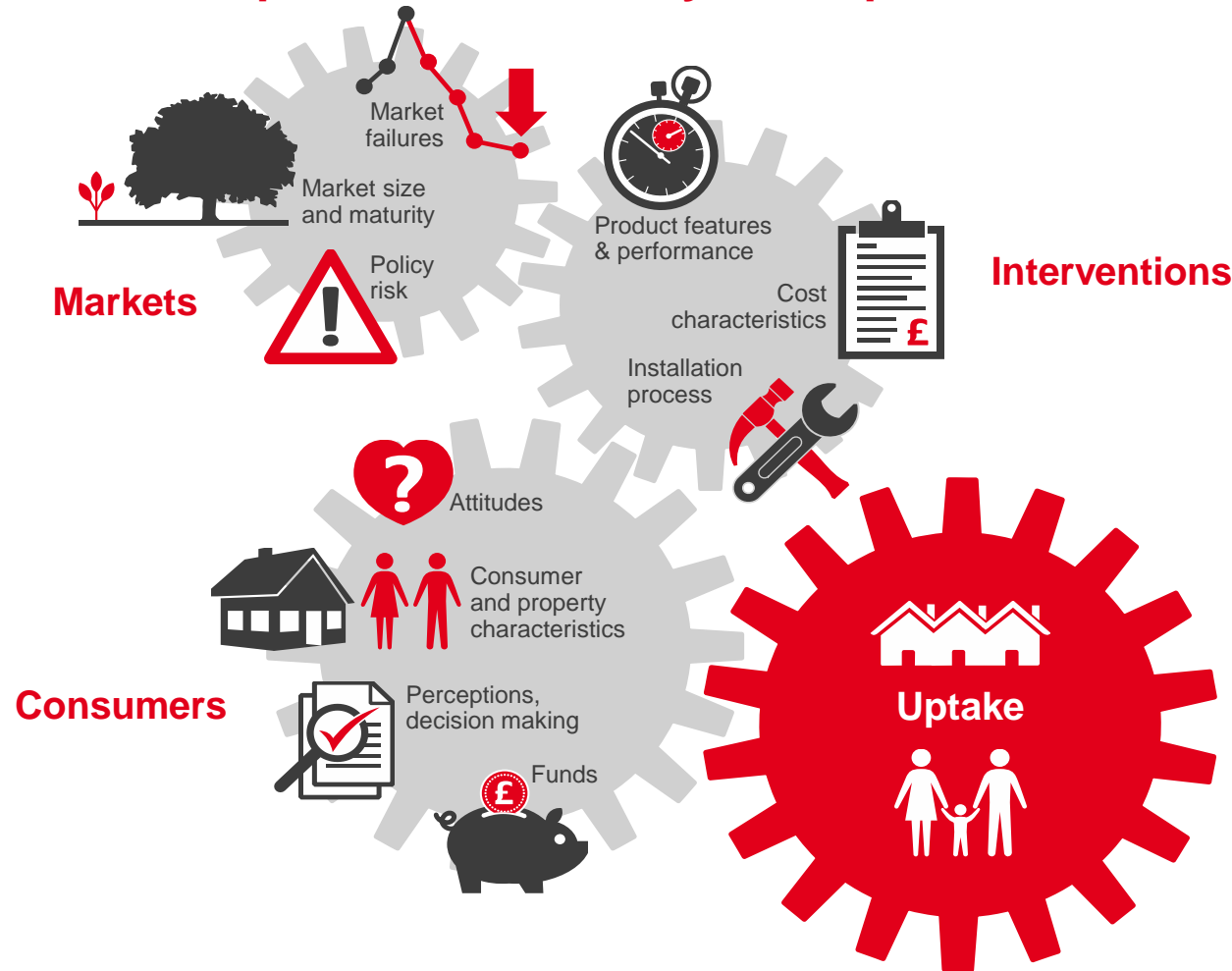
Innovation

Demonstration



*Sources: Low Carbon Innovation Coordination Group (LCICG) TINA (Technology Innovation Needs Assessment) Reports, NIC 2016 report "Smart Power"

Intervention uptake is affected by a complex set of barriers



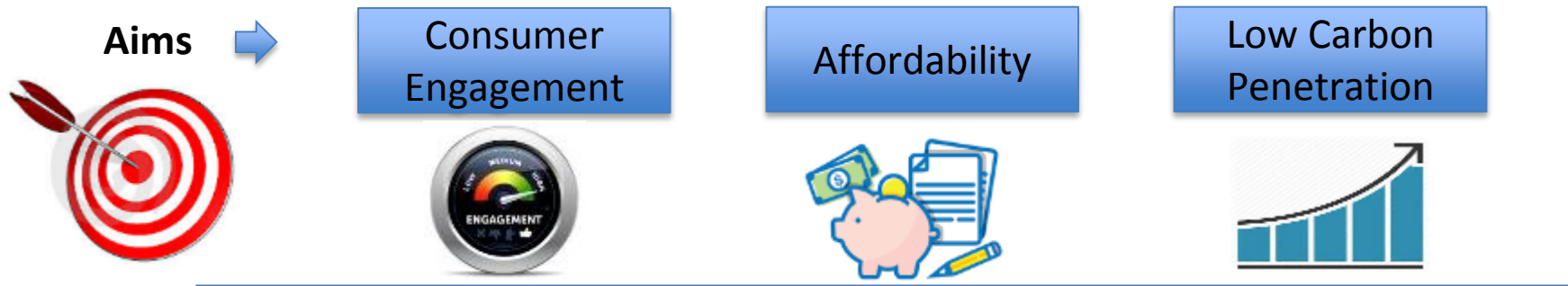
All barriers need addressing to maximise uptake

Business Model development project

Develop a number of specific business propositions that could:

- stimulate new thinking for business models to be introduced into the market from just before 2020 through to the late 2020's;
- be attractive to customers and investors to test thinking about wider policy and market development;
- provide options for large-scale demonstration projects with the new business models or components being piloted by existing or new market players.

Market will not deliver at scale for residential low carbon



Let us change the way we sell products & services for comfort ...



Consumer Orientated



Finance Options for all



integrator

Full System Approach

New Businesses Models can help overcome 'Barriers'

Our starting point: More value in well-being than kWh of heat...

Enablers

Home Energy Management

Energy Trading Platforms

Policy & Tax/Benefits Redistribution

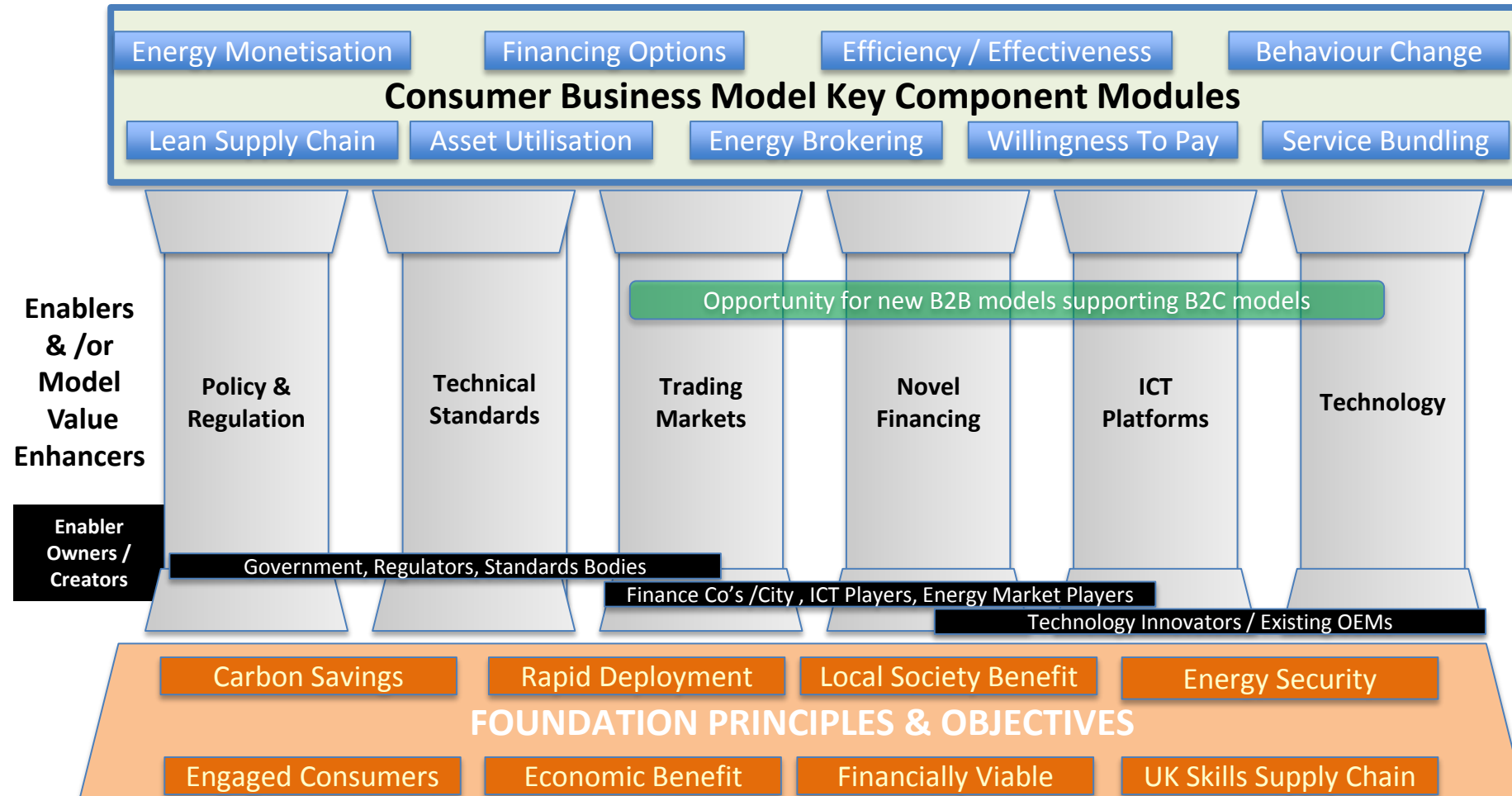
New Energy Technologies

New Business Models / Entrants



*Moving from Cost of Heating to **Cost of Wellbeing** in the home*

New Business Model architecture



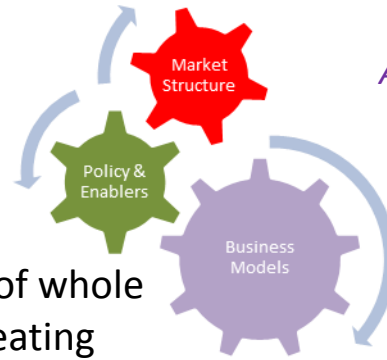
- Without enablers some business models may have only niche applicability
 - Enablers can come from private sector in many cases

Card game enabling building and refining of models from over 50 sub-modules



Output from a session with the three Local Authorities held in March

Key policy and market structure thinking



Auto sector successful with system integrator role (OEMs) and portfolio emissions thresholds



Integrators (Accredited Providers)

- Responsible for design & delivery of whole home system, optimising use of heating technology & insulation for best value
- Accountable for CO₂ reduction obligations for their customer / home portfolio
- Fuel poor – minimum well-being outcome
- Consumer protection

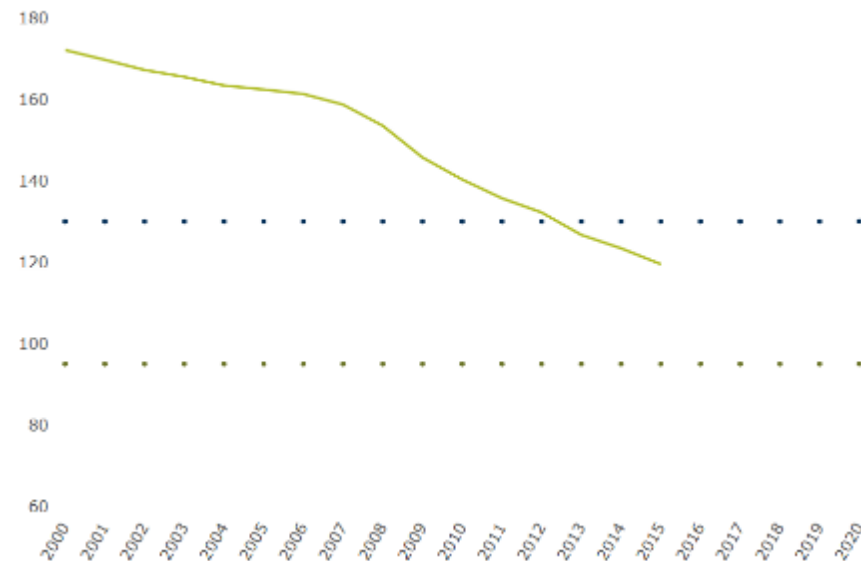
Internalising cost of carbon
for domestic heating solutions



Rebalancing environmental charges with greater weighting on gas



Chart – Average carbon dioxide emissions from new passenger cars

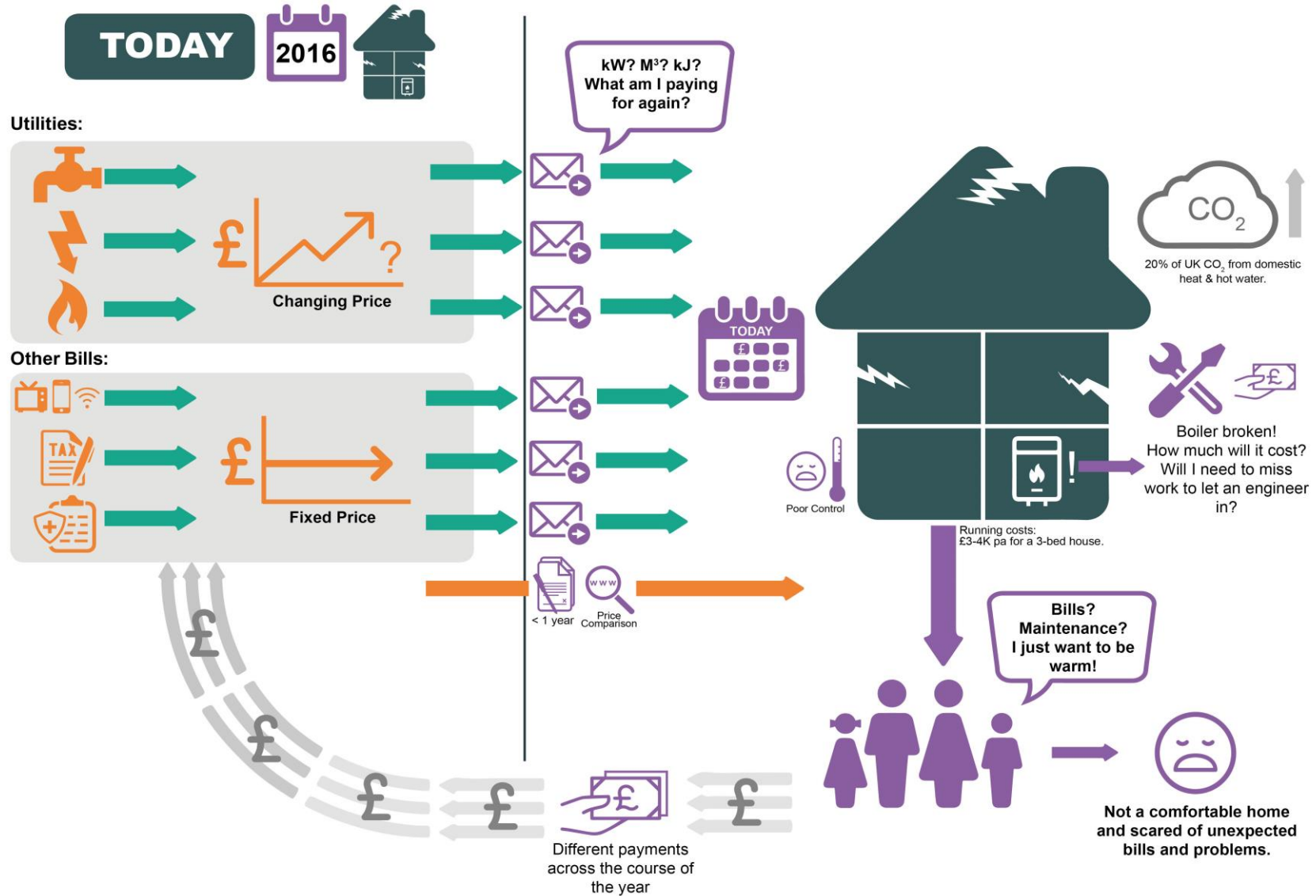


Monitoring of CO₂ emissions from passenger cars – Regulation 443/2009 provided by European Environment Agency (EEA)

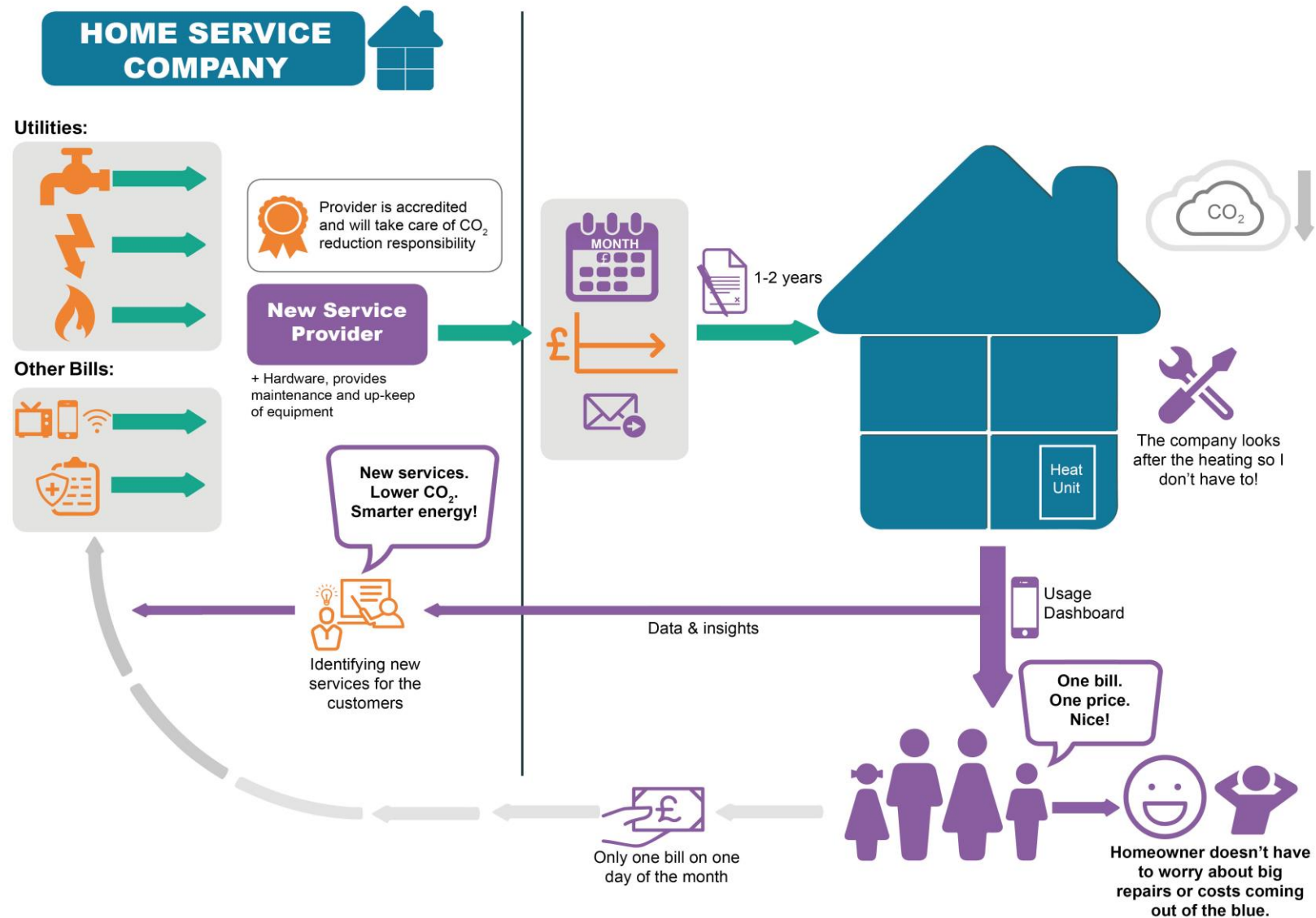
Top tier Business Models

Home Service Company	Consolidation of utilities, local taxes & other home running costs into a single monthly fixed charge whilst optimising efficiency and convenience. Akin to serviced accommodation but applicable to homeowner, rented and social sectors.
Home Comfort Contract	Long term contract, with flexibility, whereby the supplier undertakes to guarantee and cover all necessary investments for an agreed comfort / temperature level for a fixed monthly price. Electricity retail offer combined.
Home Moderniser	An aspirational home upgrade offering improved occupant well-being through major improvement of insulation, controls, low carbon heating system within a full home system approach. Financed via the mortgage and/or cash contribution from the homeowner
Neighbourhood Heat & Electricity	A community-scale low carbon heating & power solution option with a strong local identity. Using distributed generation and storage assets run for the community providing heat via local networks supplemented, as necessary, by in-home heating technologies.
Urban Renewal	Accelerated regeneration of old, poor quality & lower density housing stock to provide more housing, urban renewal & near zero carbon homes, funded in part from the value created by higher dwelling density & home value / rental enhancements & more efficient use of land.

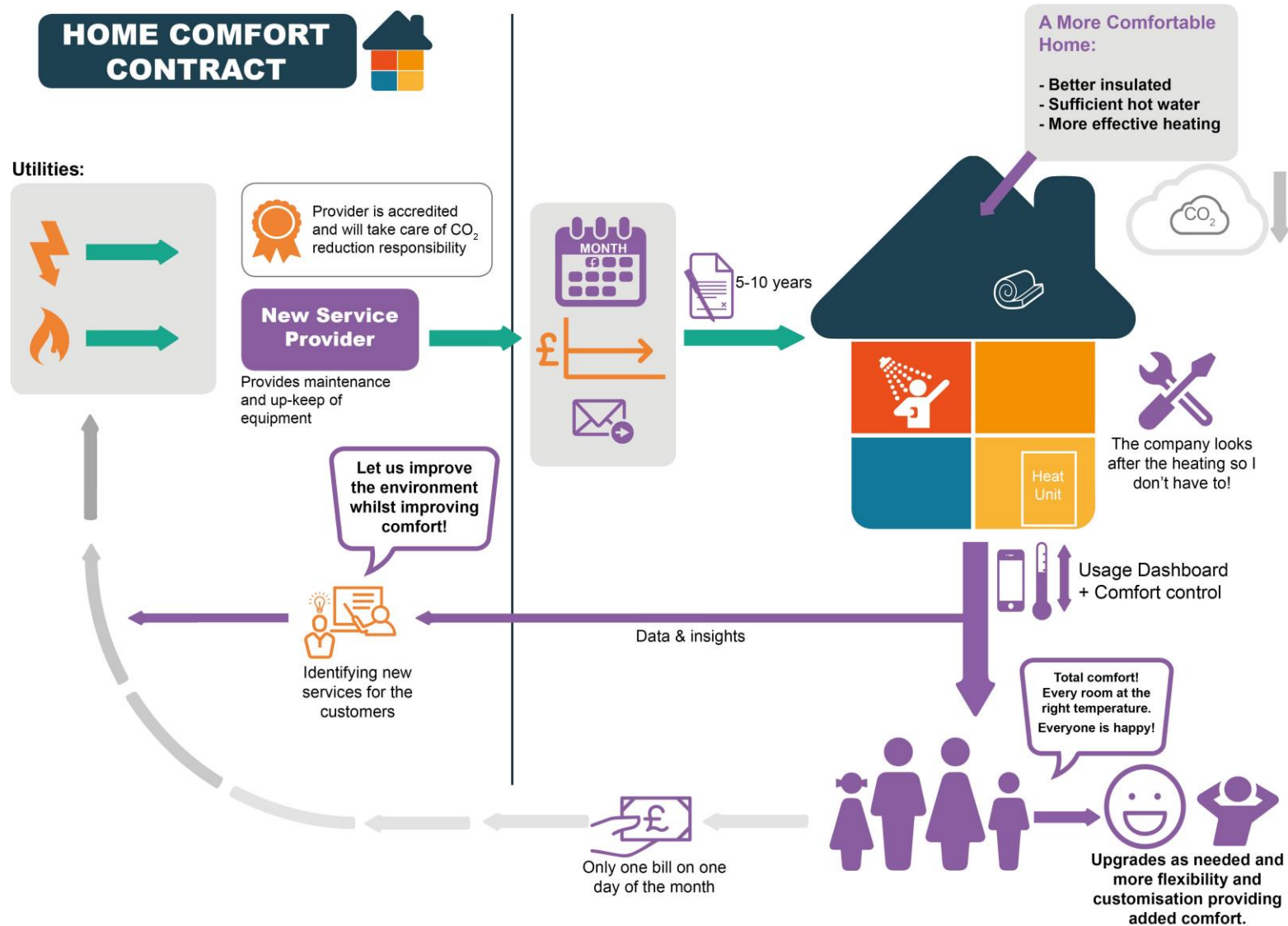
Simplified representation of Current State Business Model



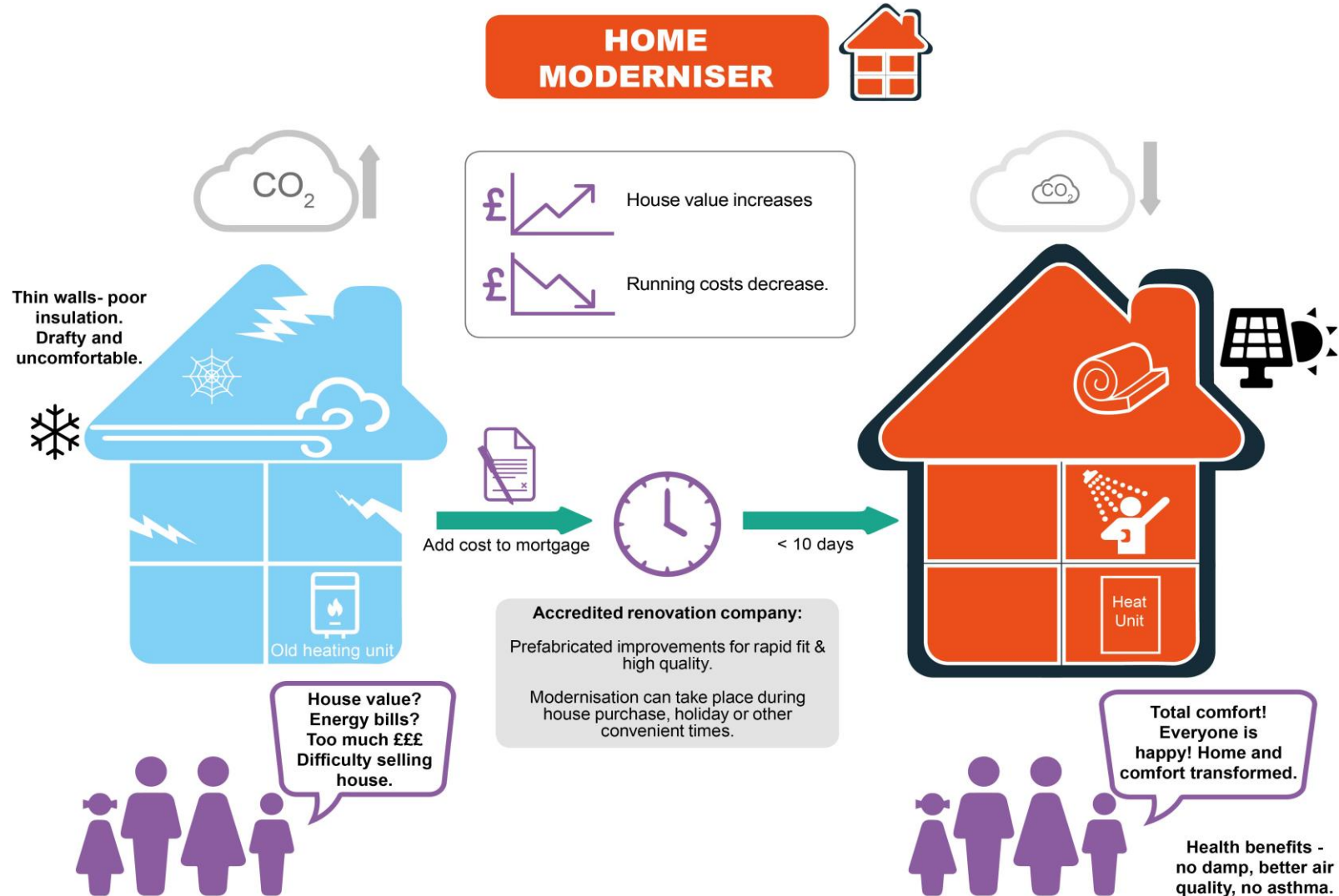
Simplified representation of Home Service Company Business Model



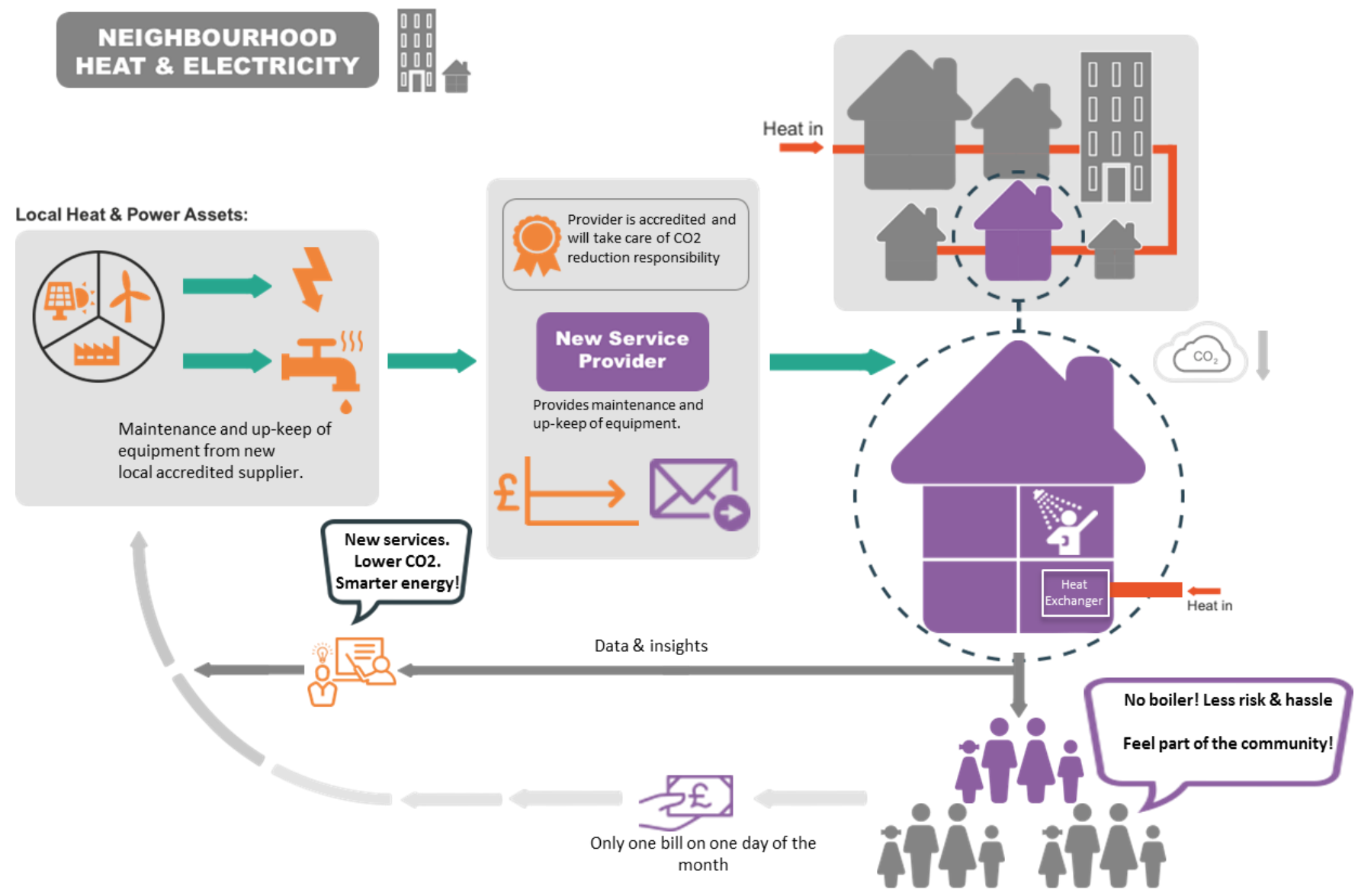
Simplified representation of Home Comfort Contract Business Model



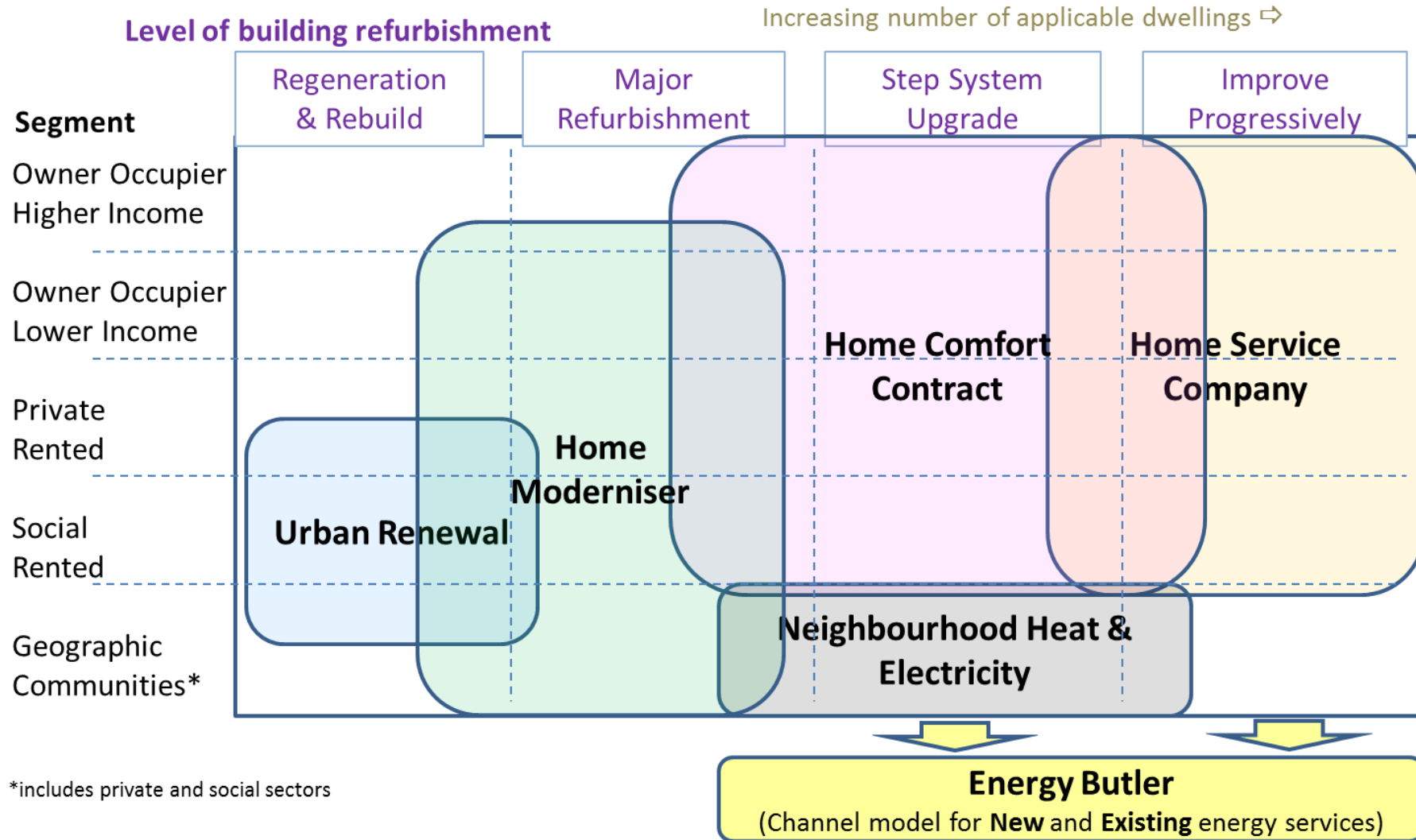
Simplified representation of Home Moderniser Business Model



Simplified representation of Neighbourhood Heat & Electricity Business Model



A business model for every home



Consumer feedback on top-tier models

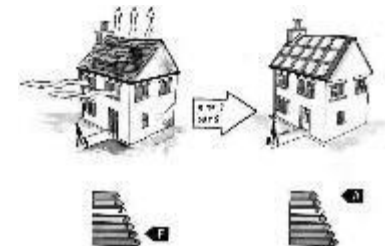
- Positive reaction to the business models – surprising level of engagement
- Fixed bills, paying for outcomes & neighbourhood aspects well received
- Need to develop implementation & communication of each model to address:

- Lack of trust in energy market players
- Fear of novelty and ability to deliver business models
- Provision of contractual safeguards and flexibility
- Clarity on estimated costs and financial obligations on consumer

COMFORT LEVEL	TEMP	NOISE	HEAT SYSTEM & MAINTENANCE	FIXED COST
GOLD	🔥	🌑	✓	£ x x x
SILVER	🔥	🌑	✓	£ x x
BRONZE	🔥	🌑	✓	£ x



- Successful 'show home' demonstrators will play a vital role



New models offer new possibilities of addressing fuel poverty

Three key elements of new approach



Business Models



Affordability & £ Smoothing



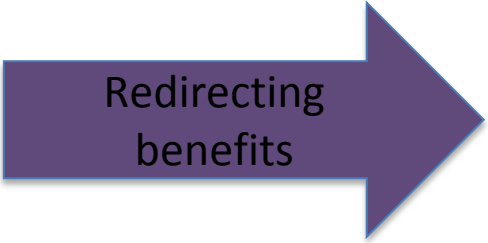
Assurance of Good Tariffs



Inclusive upgrade & maintenance



Targeted Policy



Benefits focussed vs need



Housing & Social Care Benefit Linking



Mortgage relief linked to refurb level (in rented sector)

£££ Opportunity to channelling payments? £££



Accredited Provider & Integrator



Full home care & system approach



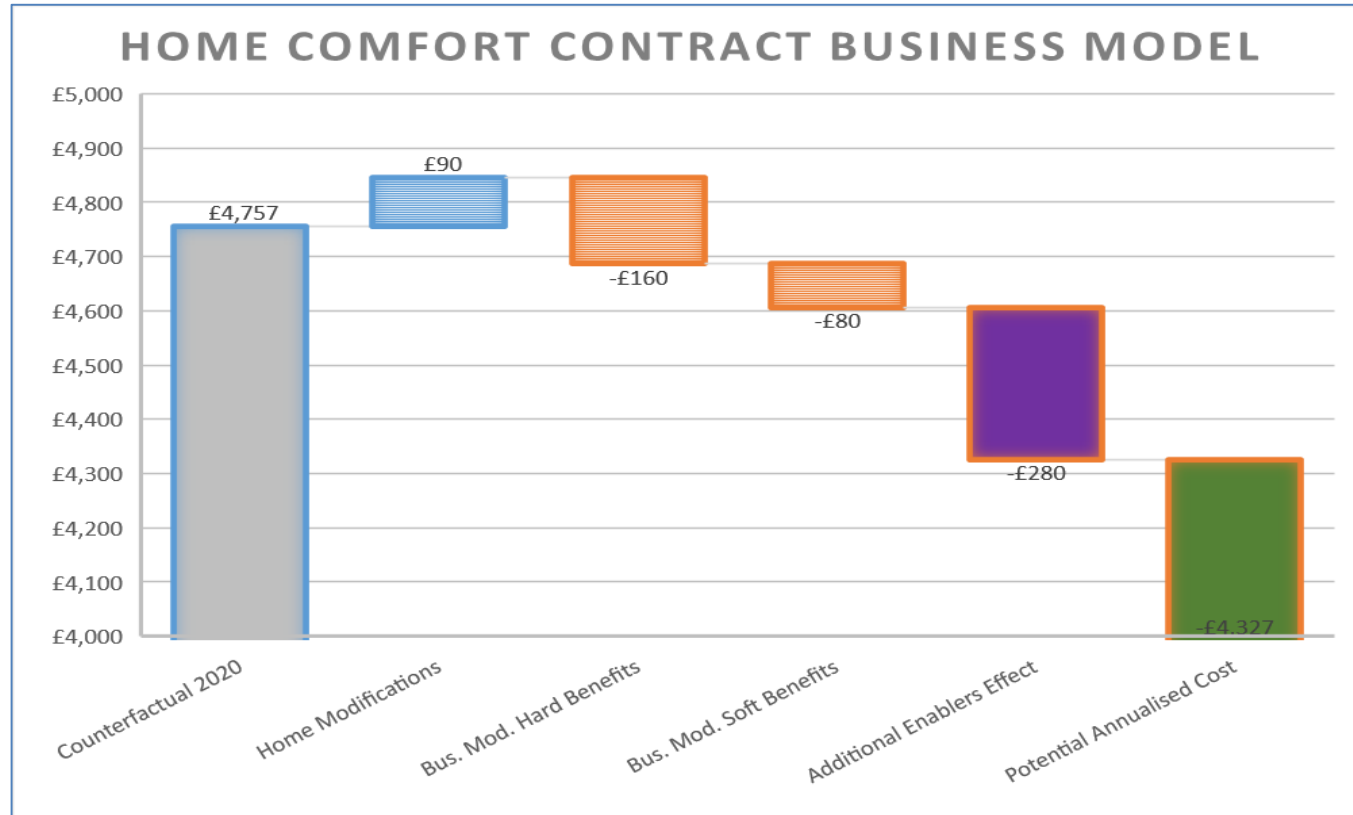
Trusted & accredited providers



Energy reduction obligation

Example of indicative annualised effect

Based on typical & applicable 3 bedroom semi-detached houses



Analysis at very high level.

Assessment of the soft (willingness to pay) benefits, in particular, being quite subjective.

Further consumer insight work is needed.

The approach of annualising the cost of well-being (rather than looking at payback periods) demonstrates that the business models may create a viable value proposition for the householder versus the 2020 counterfactual.

Note that the analysis does not attempt to present how any potential annualised value is spread or redistributed across the value chain.

Thank you



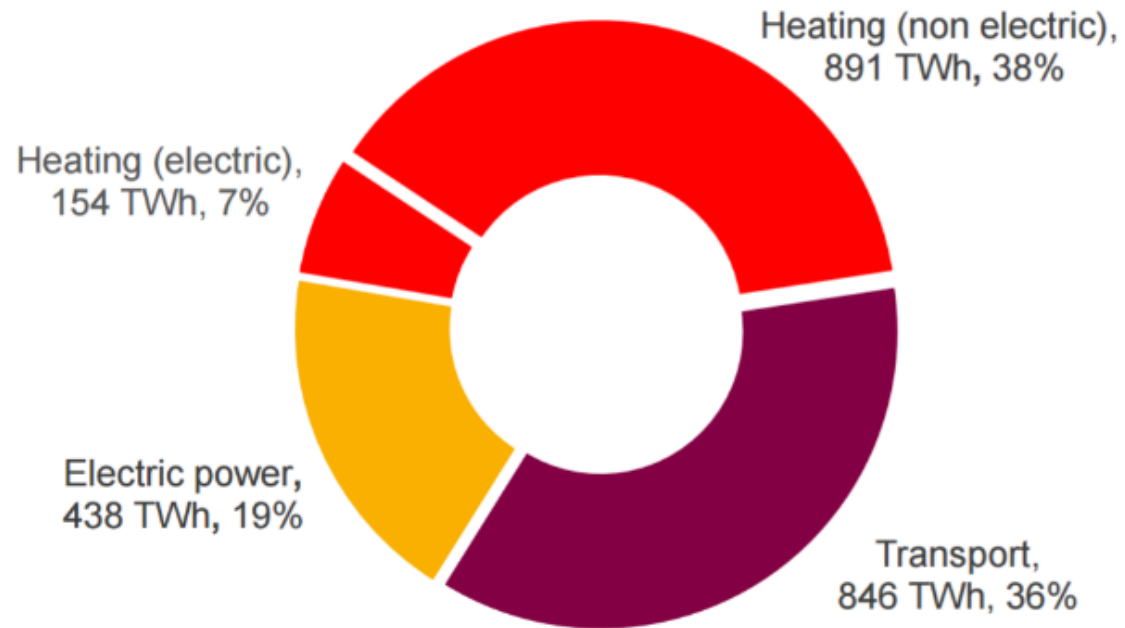
Questions?

Appendices

“a clean, intelligent,
energy system that
works for people,
communities and
businesses”



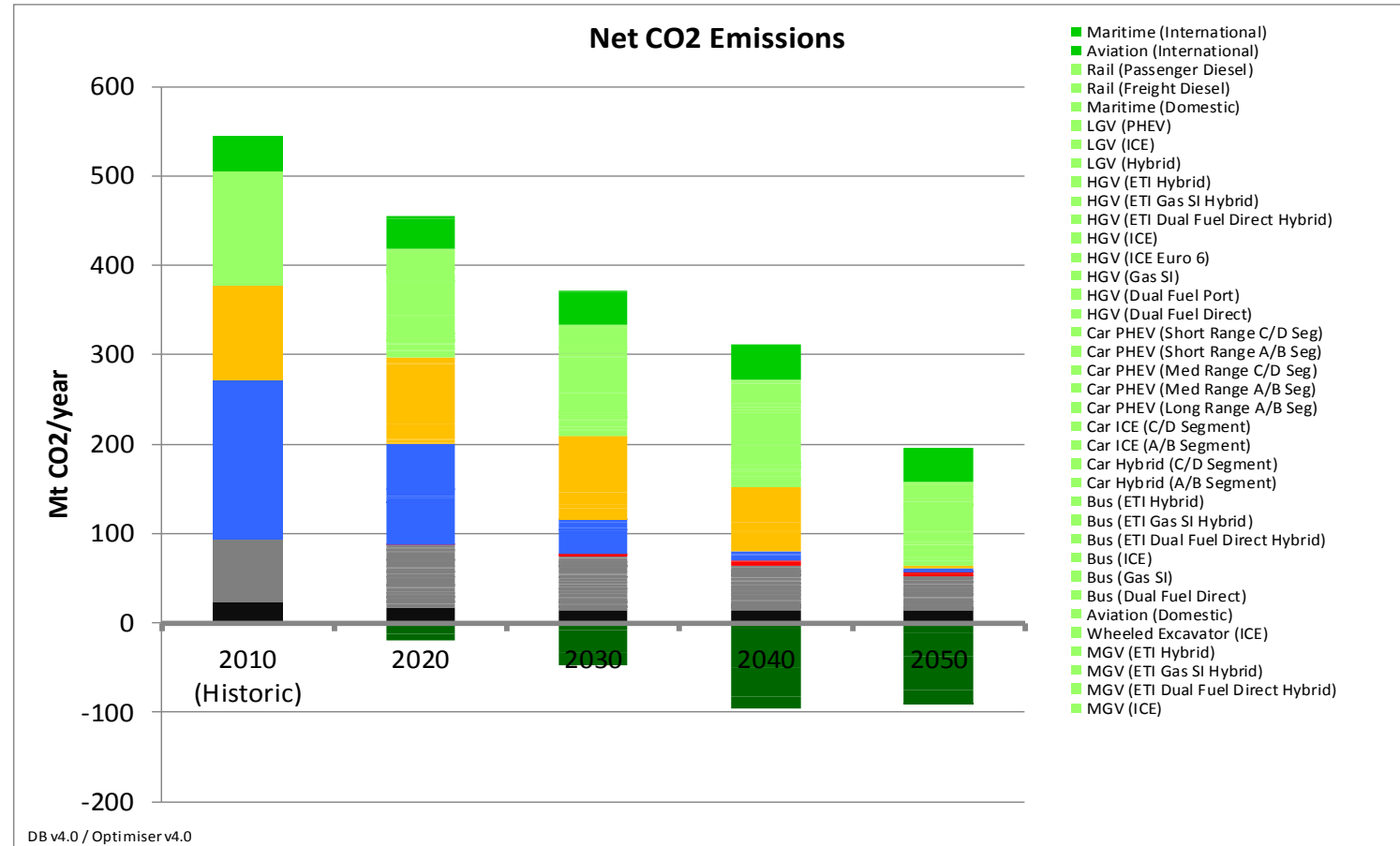
What do we use energy for? – 45% goes on heating



“On average, households use 80% of their energy for heat and hot water”

ETI SSH insight 'consumer challenges for low carbon heat' 2015

An emissions reduction plan – Power now, transport gradual – cost optimal

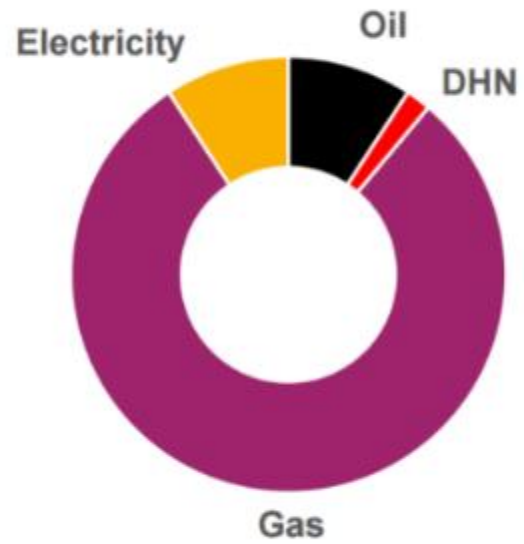


Decarbonisation of buildings is essential as part of least cost abatement – even if the cost of buildings abatement is substantially increased.

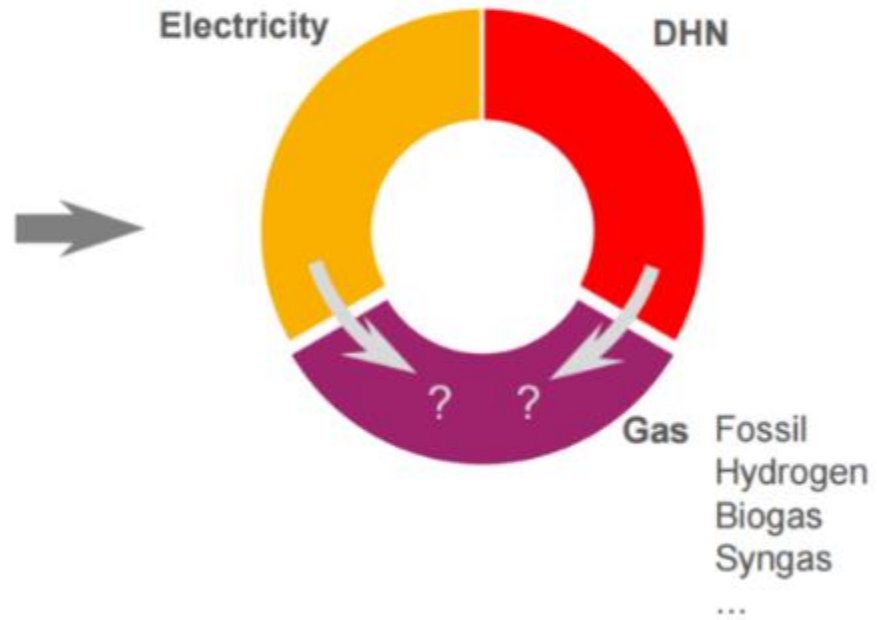
The requirement to fully decarbonise the heat sector in 2050 is very robust

Heat now and in the future

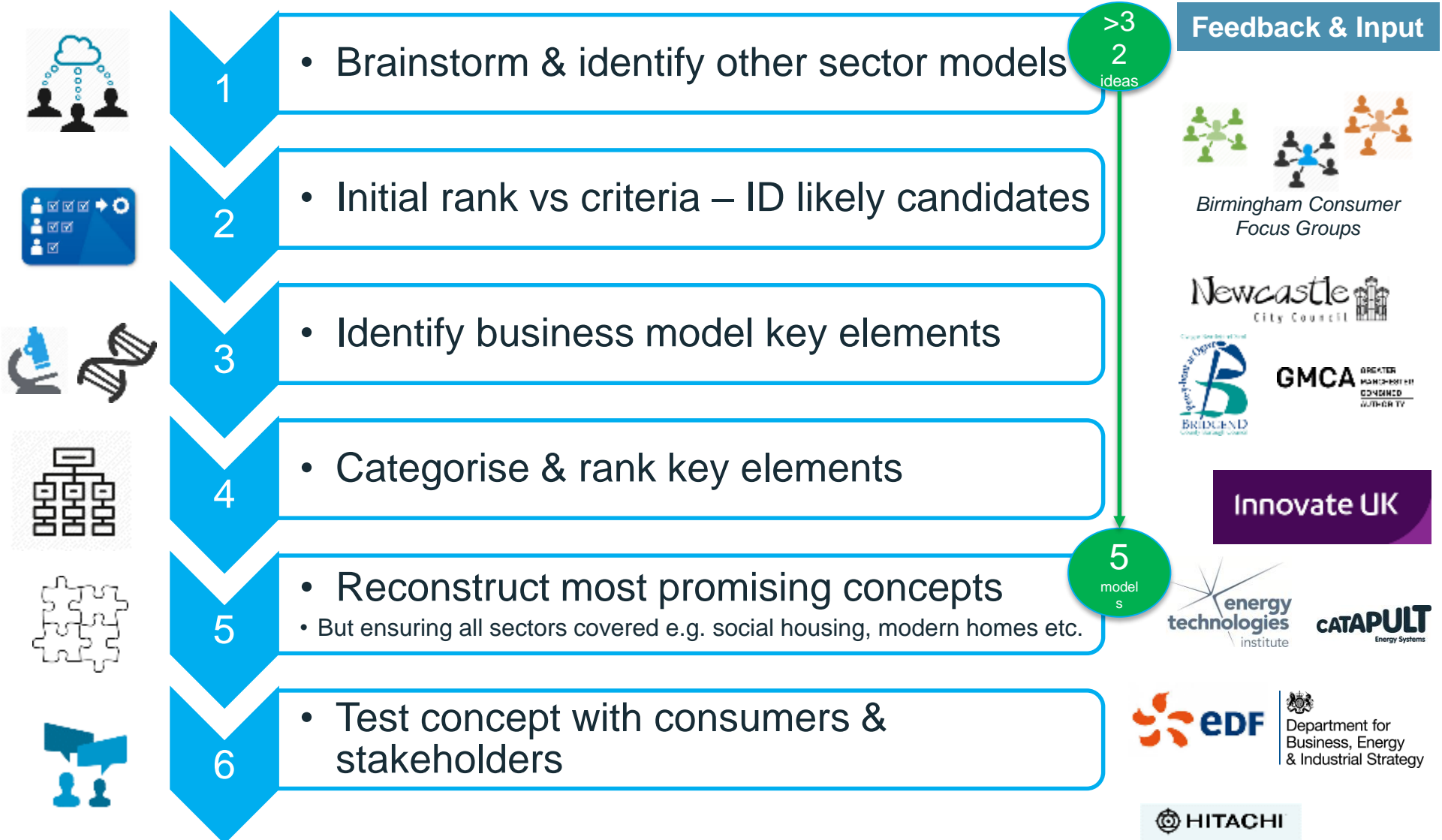
Today...



Cost optimal 2050...



Taking models from ideas through to consumer validation



Models are flexible & can be adapted easily using model architecture and card game

Ranking criteria for ideas Long List

Criterion	Assessment Guide	Weighting
CO ₂ reduction potential	Likely carbon savings at aggregate level from power source to home affected by business model	● ● ●
National Economic Benefit	Likely financial benefits in energy value chain – both hard & soft	● ● ●
Speed of Penetration	How quickly & widespread could model be implemented in UK to have a high level of impact	● ● ●
Likely Customer Acceptance	Likely appeal of proposition to consumers in relevant segments	● ● ●
Adaptability / Future Proof	How robust is model to changes in technology, market, demographics, policy etc	● ●
Local Economic & Social Benefit	Potential impact on local jobs when model deployed at scale	● ●
Financial Risk for Provider of Model	Level of risk to those providing the finance necessary to implement the business model	● ●
Policy Dependence	To what degree is model dependent on or vulnerable to policies in UK or EU	● ●
Proof of Concept Cost	Total funding likely to be needed to effect demonstrations prior to commercialisation	● ●

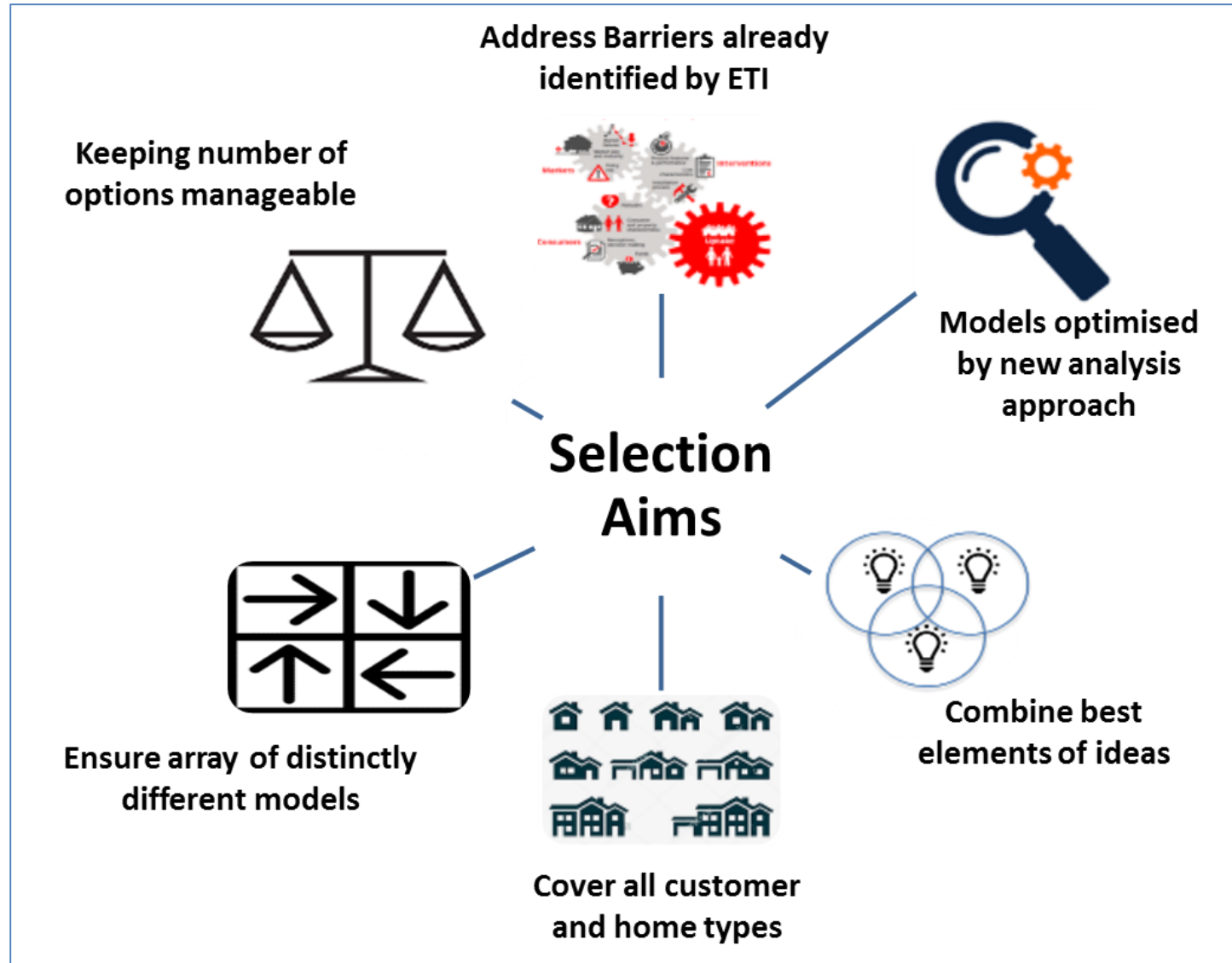
Criteria applied to ideas

Results of Ranking Matrix

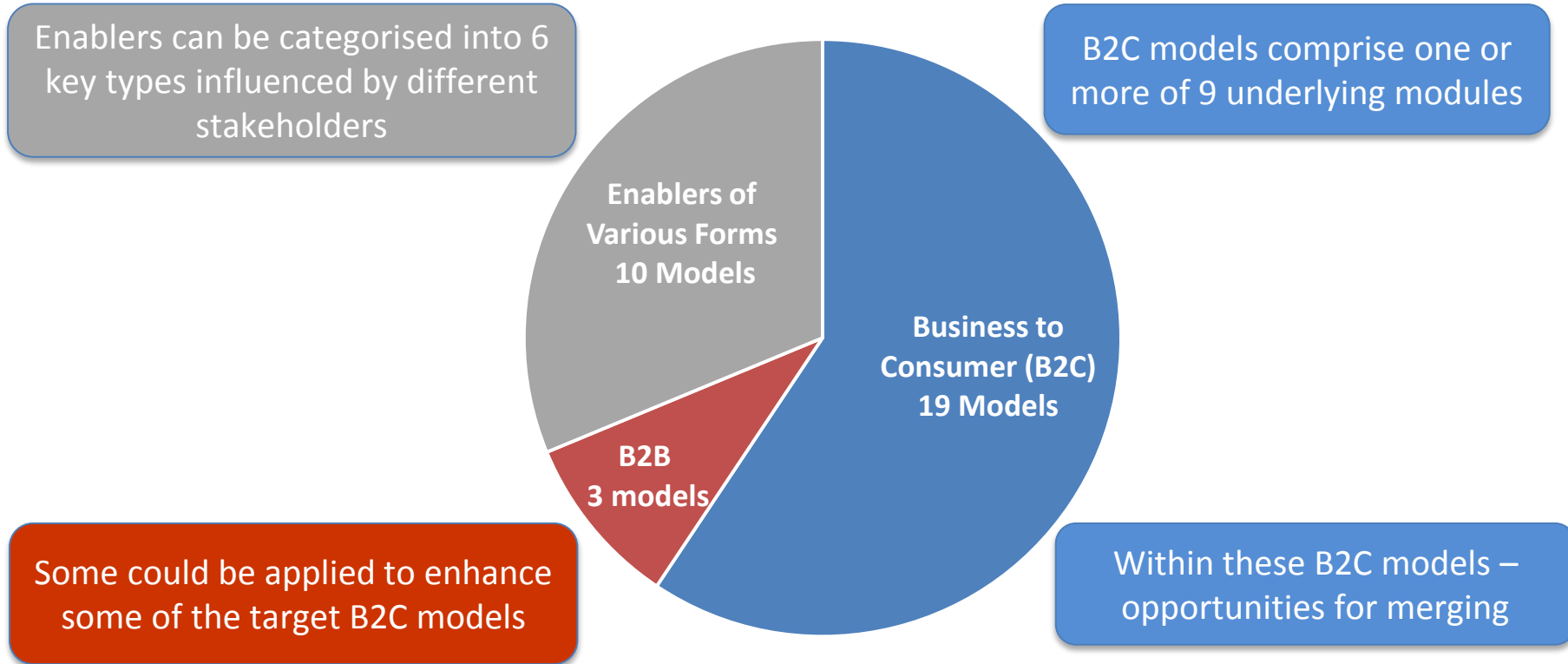
Customer Segment	Adaptability	Speed	Local	National	Financial	Policy	CO ₂	Weighted Score	Unweighted Score	Rank	Max
1	3	5	3	3	3	3	3	175	33	3	4
2	3	5	3	3	3	3	3	150	26	5.5	4
3	3	5	3	3	3	3	3	120	11	2	2
4	3	5	3	3	3	3	3	85	26	6.5	6
5	3	5	3	3	3	3	3	82	23	25	22
6	3	5	3	3	3	3	3	85	25	30	29
7	3	5	3	3	3	3	3	100	26	3.5	4
8	3	5	3	3	3	3	3	89	26	8	9
9	3	5	3	3	3	3	3	85	25	30	29
10	3	5	3	3	3	3	3	0	0	0	0
11	3	5	3	3	3	3	3	79	23	12.5	12
12	3	5	3	3	3	3	3	63	19	17	17
13	3	5	3	3	3	3	3	63	19	27	27
14	3	5	3	3	3	3	3	63	19	27	27
15	3	5	3	3	3	3	3	99	27	6	6.5
16	3	5	3	3	3	3	3	63	19	27	27
17	3	5	3	3	3	3	3	63	19	27	27
18	3	5	3	3	3	3	3	63	19	27	27
19	3	5	3	3	3	3	3	63	19	27	27
20	3	5	3	3	3	3	3	63	19	27	27
21	3	5	3	3	3	3	3	63	19	27	27
22	3	5	3	3	3	3	3	63	19	27	27
23	3	5	3	3	3	3	3	63	19	27	27
24	3	5	3	3	3	3	3	63	19	27	27
25	3	5	3	3	3	3	3	63	19	27	27
26	3	5	3	3	3	3	3	63	19	27	27
27	3	5	3	3	3	3	3	63	19	27	27
28	3	5	3	3	3	3	3	63	19	27	27
29	3	5	3	3	3	3	3	63	19	27	27
30	3	5	3	3	3	3	3	63	19	27	27
31	3	5	3	3	3	3	3	63	19	27	27
32	3	5	3	3	3	3	3	63	19	27	27

20	SmartTech Pension Builder	3	5	3	3	3	3	63	19	27	27
21	Home Office Heat Balance	3	5	3	3	3	3	79	23	12.5	12
22	Smartest Green Laundry	3	5	3	3	3	3	0	0	0	0
23	ESP Pension Refactor	3	5	3	3	3	3	63	19	27	27
24	Heat-e-wall	3	5	3	3	3	3	72	21	28	28.5
25	Private Rental Heat Trading	3	5	3	3	3	3	105	26	5	6
26	Close County Centrifuge	3	5	3	3	3	3	0	0	0	0
27	Close County Assessor	3	5	3	3	3	3	0	0	0	0
28	Local Saving Refactor	3	5	3	3	3	3	0	0	0	0
29	Energy Stockmarket	3	5	3	3	3	3	0	0	0	0
30	Winter Fuel to Refurbishment	3	5	3	3	3	3	0	0	0	0
31	Cloud AI Heat Heat	3	5	3	3	3	3	57	17	28	28
32	District Heat + Heat Pump Optimiser	3	5	3	3	3	3	0	0	0	0

Selection factors for Business Models



32 Business Model ideas in brainstorming phase (over 20 sources of input)



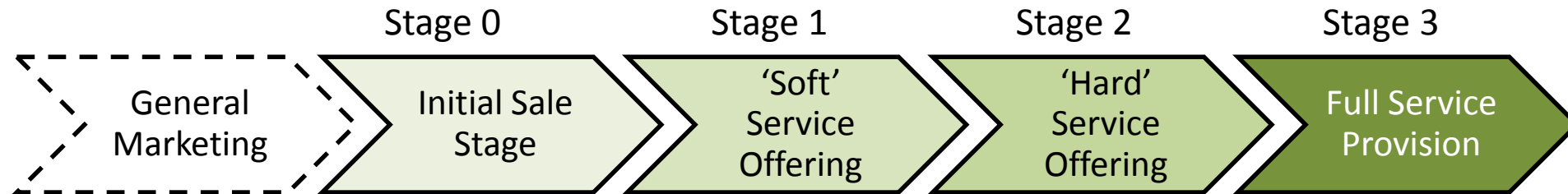
19 out of the 32 were strictly B2C models

Comparison of Business Models

	Home Service Company	Home Comfort Contract	Home Moderniser	Neighbourhood Heat & Electricity	Urban Renewal
Novelty	High	High	High	Medium	Medium
Service Aggregation	High	Medium	As-Is	Medium	Could vary
Degree of renovation	Low – Medium	Medium	Medium – High	Low-Medium	Total – rebuild
Contract term	12 months +	10 yrs + with flexibility	None	Continuing contract	n/a
Financing	Pay-as-you-go + lease option	Long Term Lease Contract	Upfront on mortgage	Pay-as-you-go	Via capital gains
Emotional outcome	Removal of hassle	Guarantee of comfort	Aspirational new feel home	Community empowerment	New homes
# of providers	Few nationals & some locals	Choice of local & nationals	Wide choice of accredited	Single provider	Regional / LA backed

Models covering all sectors with distinct features for consumer

Commercial offering transition (to test in demonstrator/trials)



Duration	1-3 months	After 1-6m	After 1-12m	After 1-24 m
Purpose	<ul style="list-style-type: none"> • Introduce suitable BM concept & benefits • Gain customer confidence • De-risk outcomes 	<ul style="list-style-type: none"> • Get customer used to remote control of heating • Build trust with provider • Show initial benefits 	<ul style="list-style-type: none"> • Introduce improved appliances where appropriate • Take over appliance ownership & service 	<ul style="list-style-type: none"> • Start extracting value from data, energy trading • Upsell other services / offerings
Changes Applied				
HEMS	○	●	●	●
Remote Control		○	○	○
Energy / Utility Sourcing		●	●	●
Appliance Service		○	●	●
Hardware Ownership Transfer		○	●	●
New Hardware in Home or DH connection		○	●	●
Energy Trading & Monetisation				●

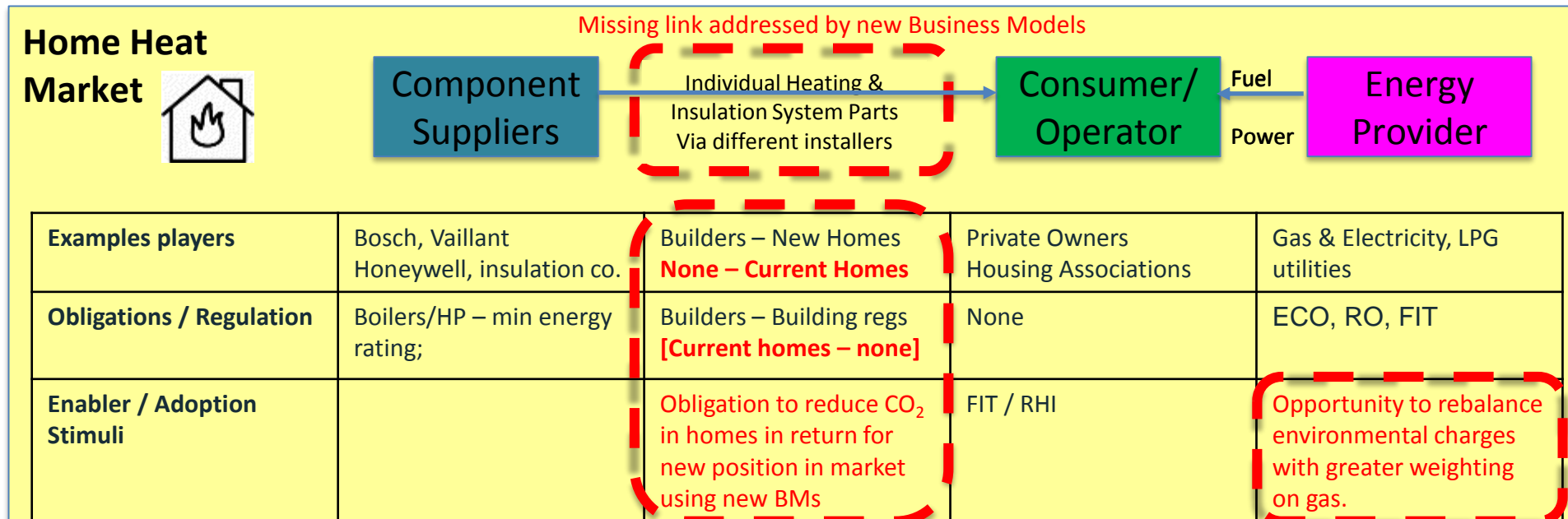
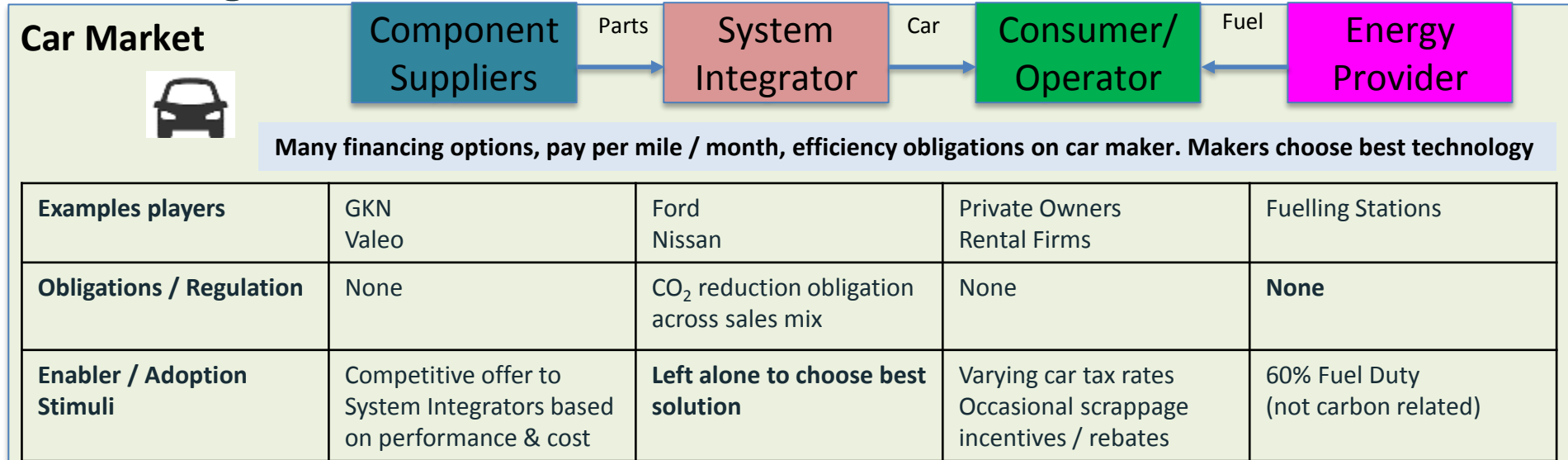
Effective policy and market structures are crucial for successful implementation of new Business Models

Let us look at how the car & residential heating markets compare ..

	Car Market (New)	Car Market (Old Stock)	Housing Market (New)	Housing Market (Old Stock)
Renewal Rate	HIGH Average age at scrappage 14 yrs Average age of vehicle 7.8 yrs*		VERY LOW 143k new homes in 2015 27m existing homes	
Government Intervention	Emissions Targets Trajectory	Scrappage incentives MOT checks	Building Regs Home Quality Mark Etc...	Various misaligned upgrade incentives
Efficient Solution Owner	System Integrator	None	System Integrator	None

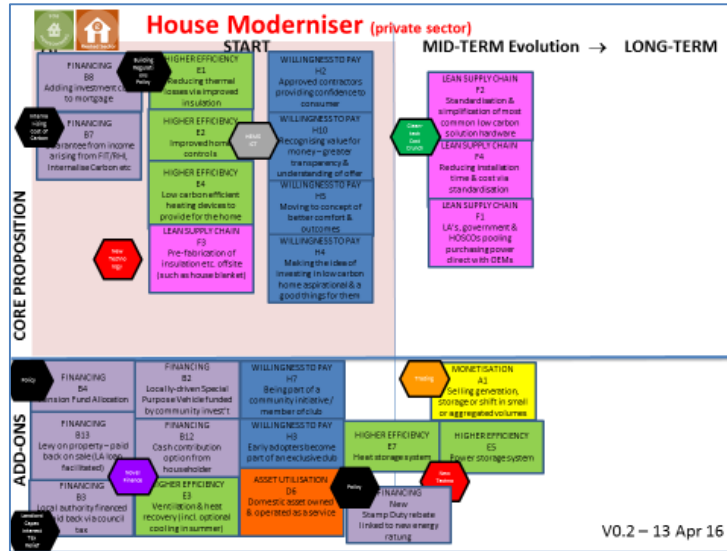
Large number of old housing stock demonstrates need for a system integrator to manage and deliver CO2 reduction

Effective Business Model deployment requires an integrator within the market structure for existing homes

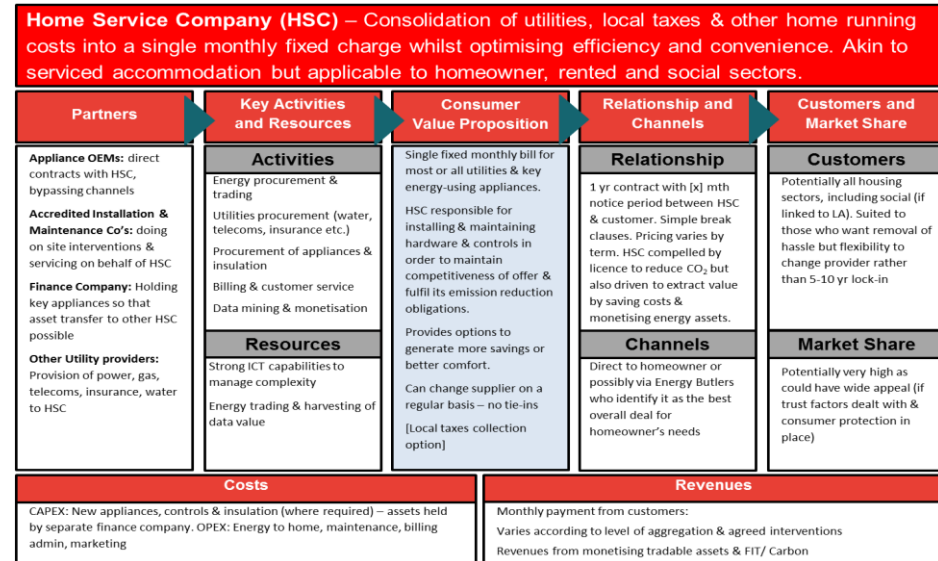


Describing the top-tier Business Models

A: Card deck: Business Model Elements



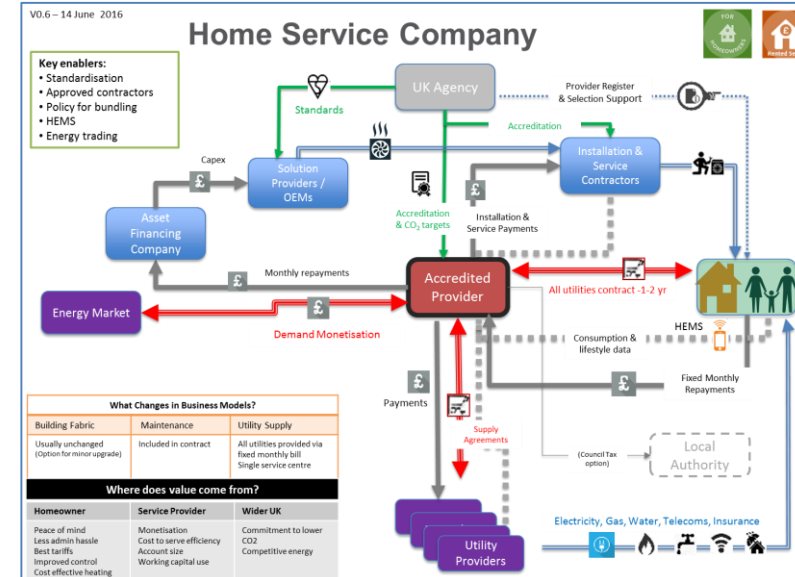
B: Business Model Canvass

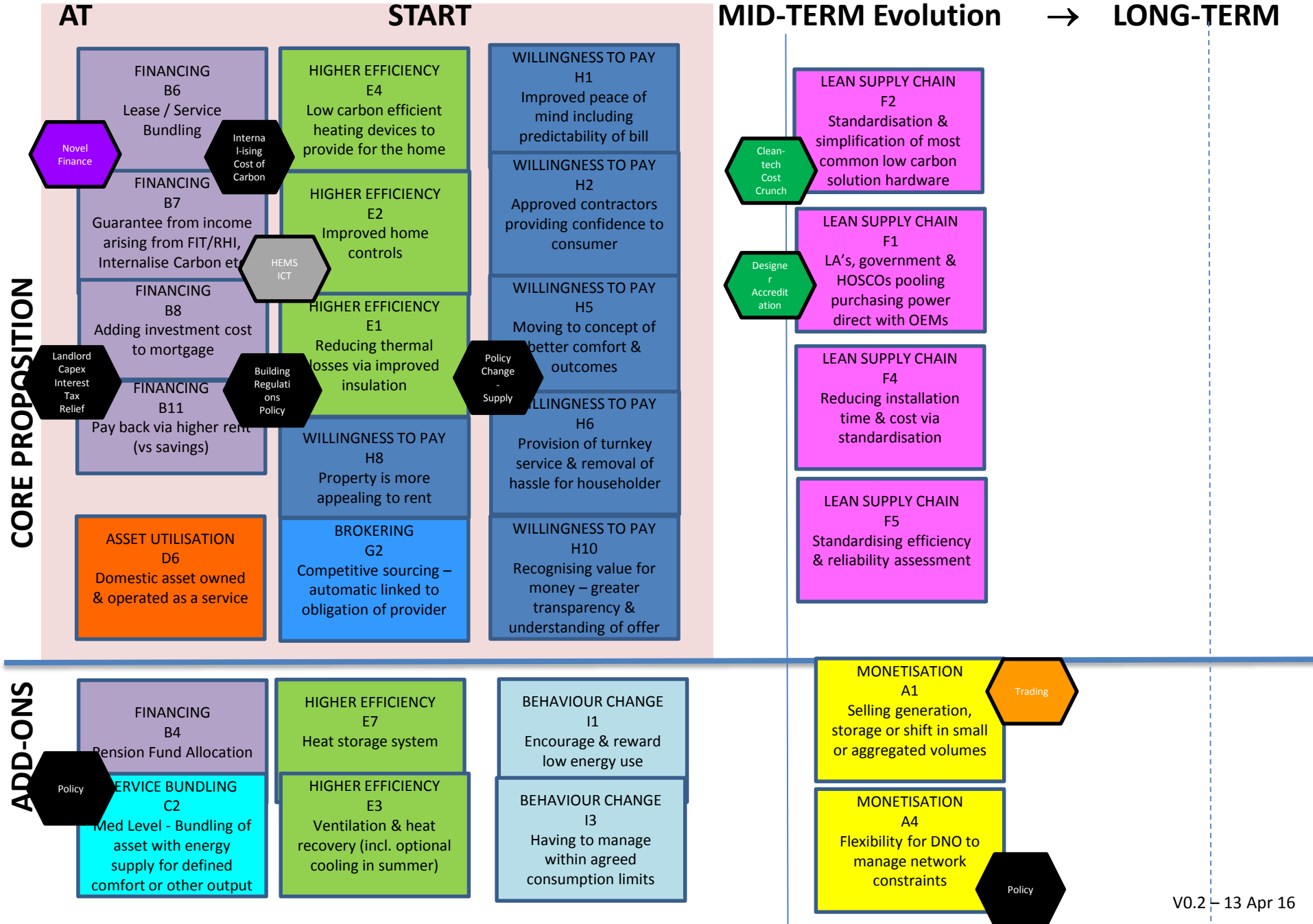


C: Participant Roles Overview

Party	Core Model Role	Options / future role
Accredited Provider	<ul style="list-style-type: none"> Procures at best cost & consolidates all utilities Manages all billing and customer service Monitors and manages home energy systems and procures service contracts from contractor Identifies and effects changes to meet its CO₂ reduction targets Assumes repayment responsibility for hardware changes in home Monetises demand shift, forecasting, data in the market 	<ul style="list-style-type: none"> Collects council tax on behalf of LA
Installation & Service Contractors	<ul style="list-style-type: none"> Install and manage any relevant energy appliances in home (paid for by Provider) 	
Utility Providers	<ul style="list-style-type: none"> Provide utilities to Homeowner via contract with Provider 	
Asset Financing Company	<ul style="list-style-type: none"> Provides finance for new low carbon systems in home Takes asset ownership with repayments via Provider 	
Hardware Providers	<ul style="list-style-type: none"> Manufacture heating hardware against standards set by UK agency Deliver direct to installers but paid by Financing Company 	
Catapult / UK Agency / Skills bodies	<ul style="list-style-type: none"> Provides licence to Provider to operate the multi-utility model and audits compliance with CO₂ reduction targets Providers accreditation for installer companies Provides low lifetime cost appliance standards to Hardware OEMs 	
Local Authority		<ul style="list-style-type: none"> May become a HSC itself Collects taxes via HSC

D: Business Model High Level Process Map





Business Model high level Process Maps

- The following process maps for the business models explain at a general level the flows of **money, approvals, data** and other information, **utility or service supply** and where there are **contracts** between parties.
- These flowcharts, combined with the business model canvasses provide a **starting point for the design** of the detailed processes necessary for implementation of the business models.
- **Enablers** that are key to the success of the business model are highlighted in the top left and in the lower left corner highlights of the key changes and benefits vs the status quo are given

Entities within the process maps:

UK Agency: An evolved or new standards and/or regulatory body which may act to accredit new providers or integrators, offer impartial advice to consumers and set technical standards governing new low carbon technology.

Solution Providers / OEMs: Companies involved in the design and manufacture of low carbon heating solutions, including heat pumps, other low carbon heat devices (possibly CHP), advanced controls, heat recovery systems, insulation and other materials for improving the energy efficiency of the home.

Asset Financing Company: A bank or other financial organisation that will fund the capital cost of low carbon solutions for the business model. This company will receive returns on the investment via monthly payments relating to the service provided to the consumers.

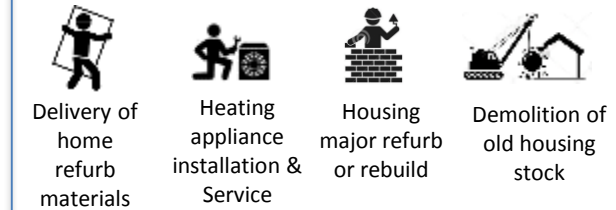
Accredited Provider: The entity selling services to the customer which acquires a certification of competence and integrity for delivery as per its licence conditions. Regular accreditation auditing of entity delivery to include customer feedback.

Installation & Service Contractors: These may be part of or contracted by the Accredited Provider and have a role to install and maintain the low carbon solutions in the home.

Utility Providers: In most cases the physical supplier of electricity, gas, water and telecoms (and onto which insurance could be added). They may themselves become Accredited Providers.

Icons used within flowcharts

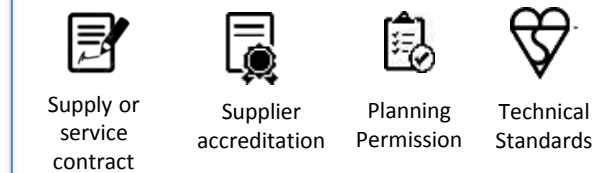
Home upgrade



Low Carbon Solutions



Contracts & Regulatory



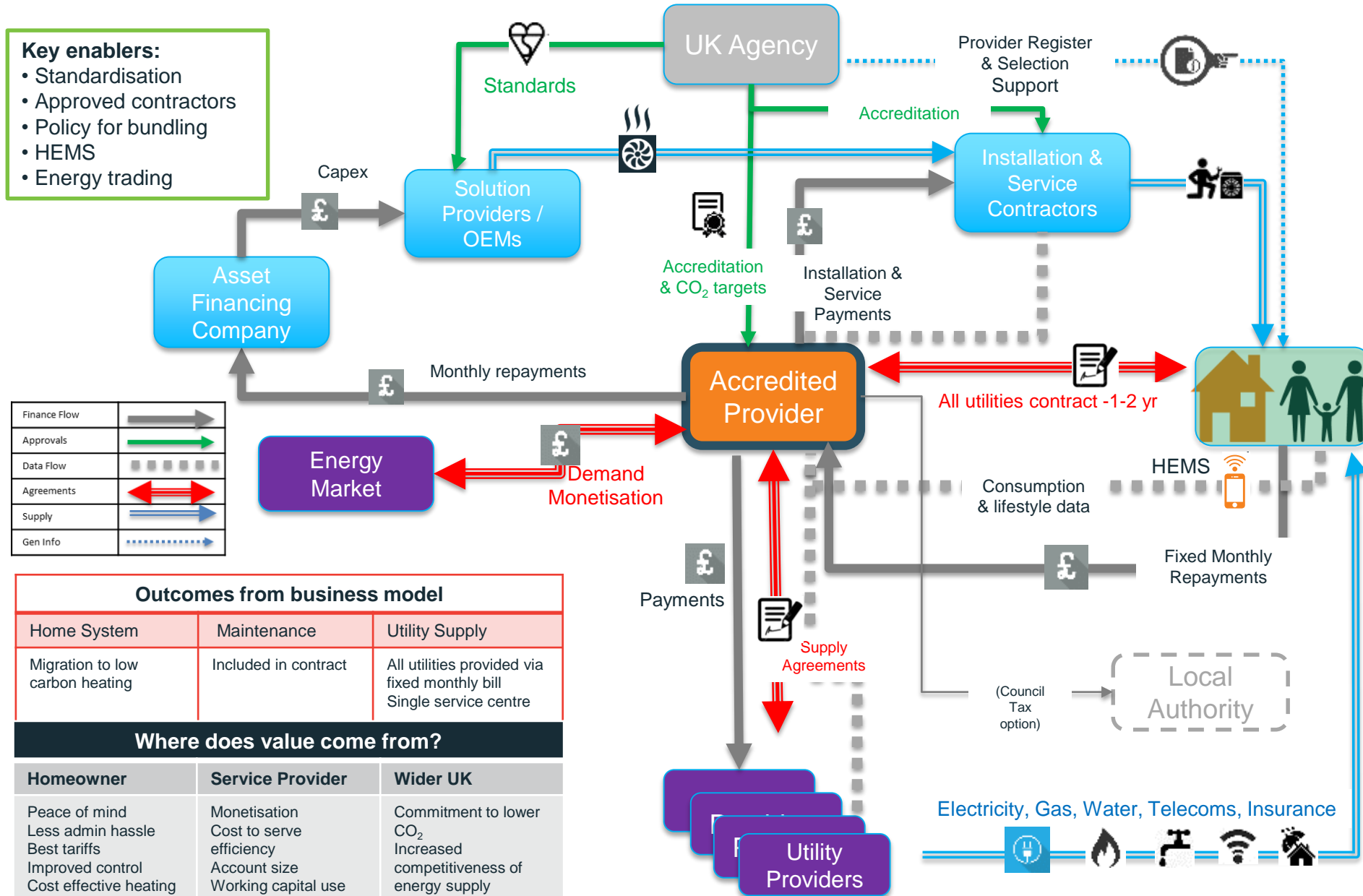
Utilities



Home Service Company – Process Map



- Key enablers:**
- Standardisation
 - Approved contractors
 - Policy for bundling
 - HEMS
 - Energy trading



Outcomes from business model

Home System	Maintenance	Utility Supply
Migration to low carbon heating	Included in contract	All utilities provided via fixed monthly bill Single service centre

Where does value come from?

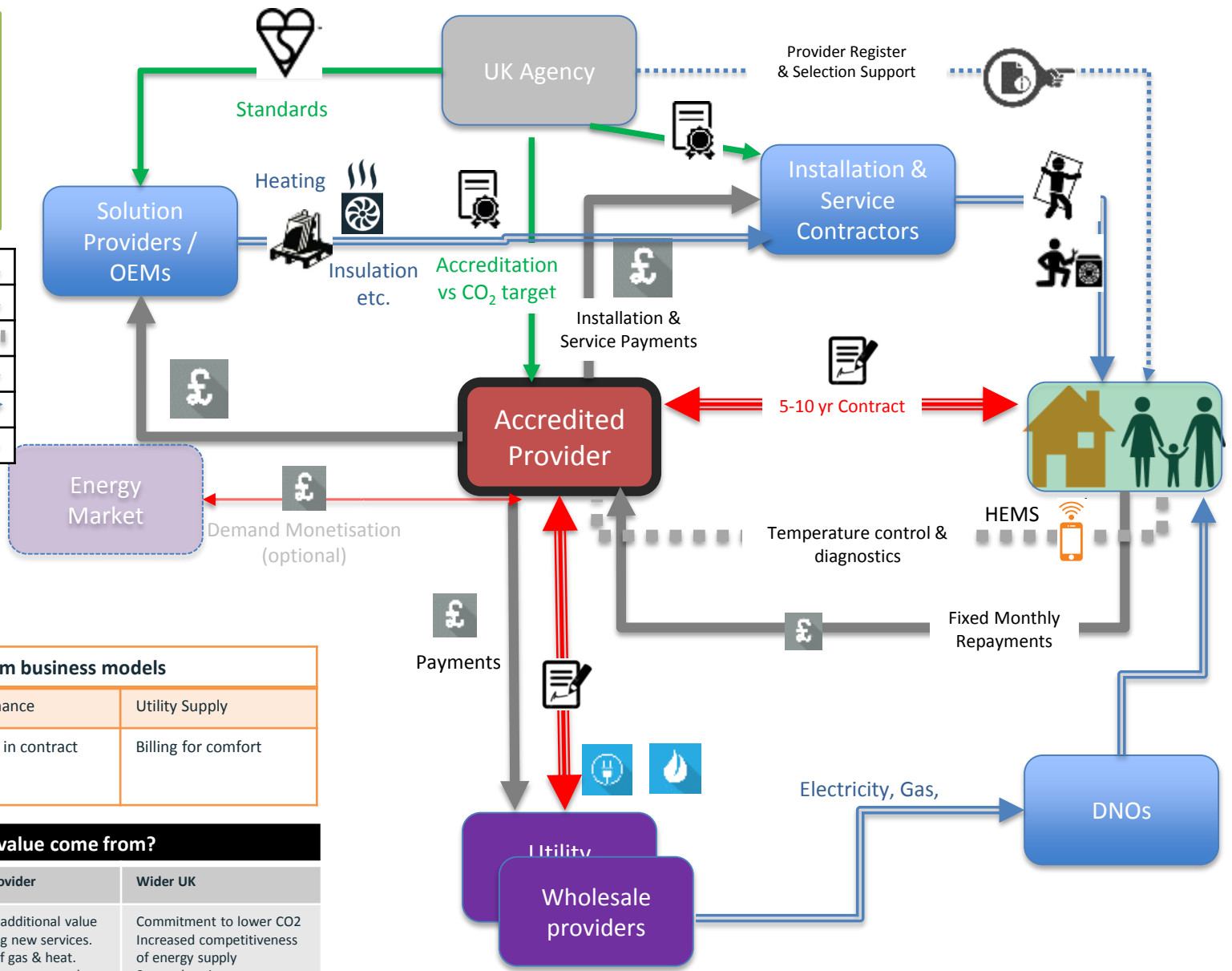
Homeowner	Service Provider	Wider UK
Peace of mind Less admin hassle Best tariffs Improved control Cost effective heating	Monetisation Cost to serve efficiency Account size Working capital use	Commitment to lower CO ₂ Increased competitiveness of energy supply

Home Comfort Contract – Process Map



- Key enablers:**
- Standardisation
 - Approved contractors
 - Approval to bill on outcome vs kWh
 - HEMS

Finance Flow	→
Approvals	→
Data Flow	⋯
Agreements	↔
Supply	→
Gen Info	⋯



Outcomes from business models		
Home System	Maintenance	Utility Supply
Usually upgraded to improve comfort & efficiency	Included in contract	Billing for comfort

Where does value come from?		
Homeowner	Service Provider	Wider UK
Comfort guarantee Peace of mind Less hassle Improved home	Extracting additional value from selling new services. Sourcing of gas & heat. Enhanced consumer value	Commitment to lower CO ₂ Increased competitiveness of energy supply Secure heating

Home Moderniser – Process Map

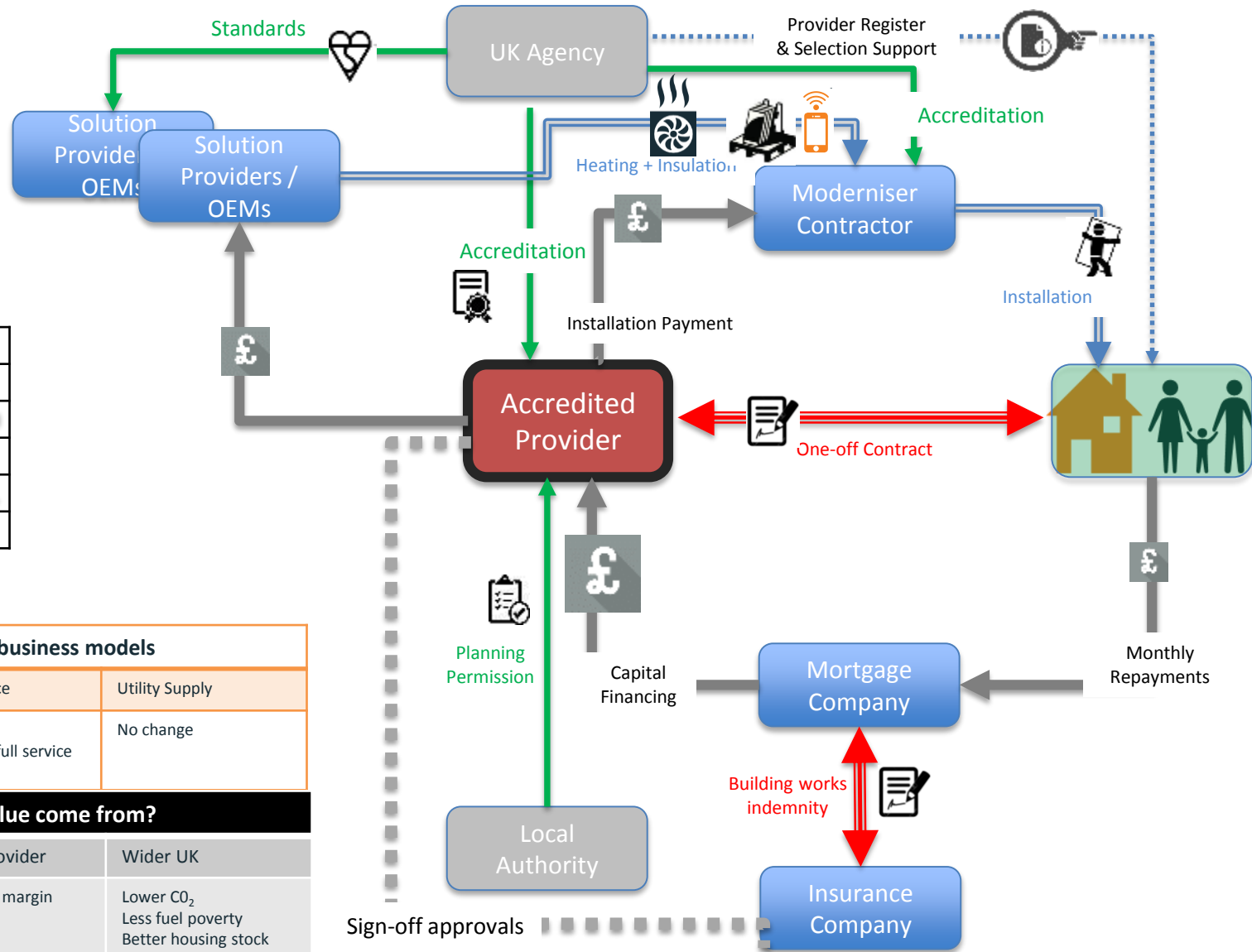


- Key enablers:**
- Standardisation
 - Approved contractors
 - Mortgage financing

Finance Flow	→
Approvals / Accred.	→
Data Flow	→
Agreements	↔
Supply	→
Information	→

Outcomes from business models		
Home System	Maintenance	Utility Supply
Completely modernised – v.low carbon	No change (Option for full service provision)	No change

Where does value come from?		
Homeowner	Service Provider	Wider UK
Lower bills Higher home value Better comfort Lower maintenance Lower cost of capital	Renovation margin	Lower CO ₂ Less fuel poverty Better housing stock Local jobs Lower peak demand



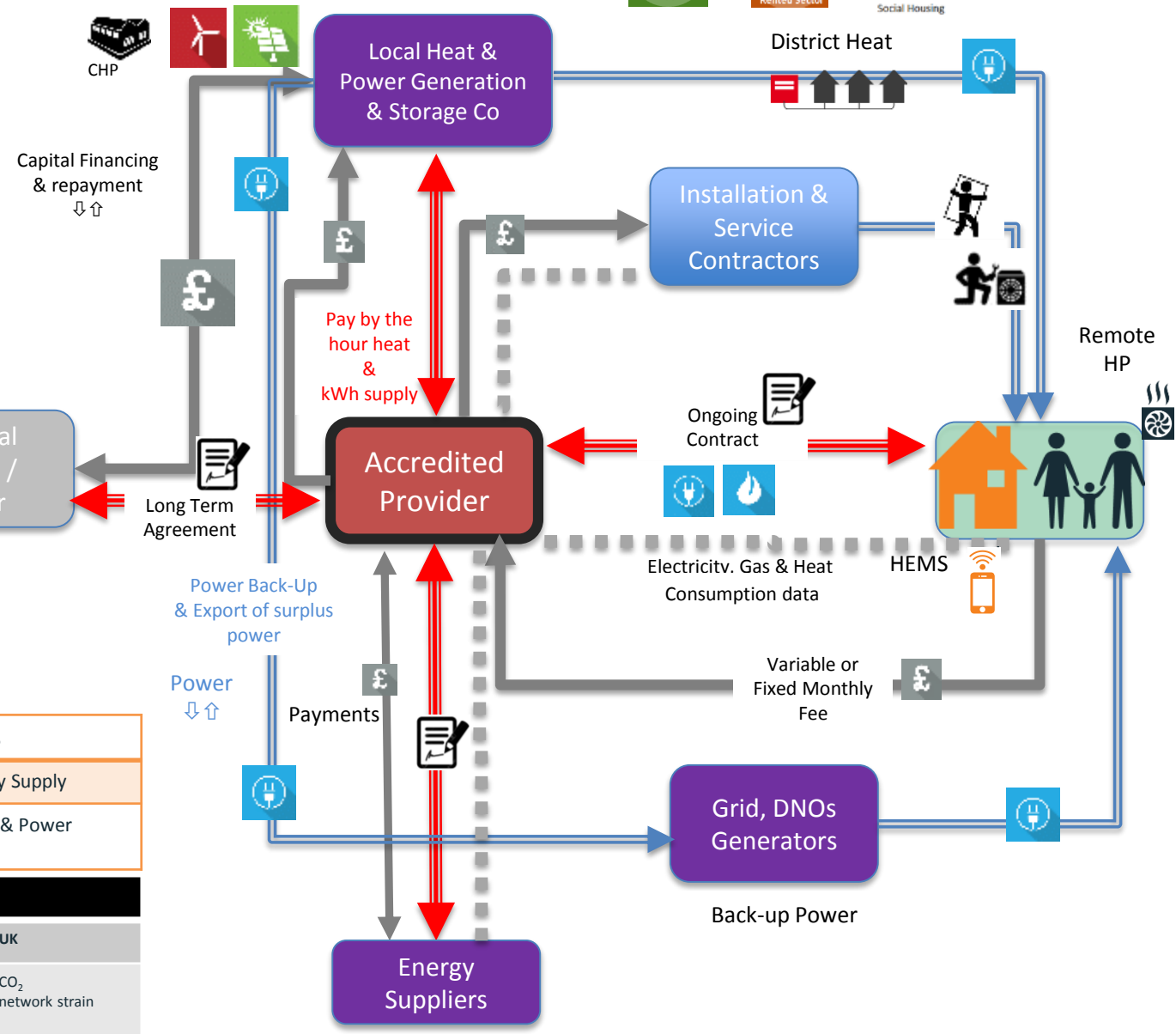
Neighbourhood Heat & Electricity – Process Map

- Key enablers:**
- Approved contractors
 - HEMS
 - Policy including regulation & consumer protection
 - Standardisation

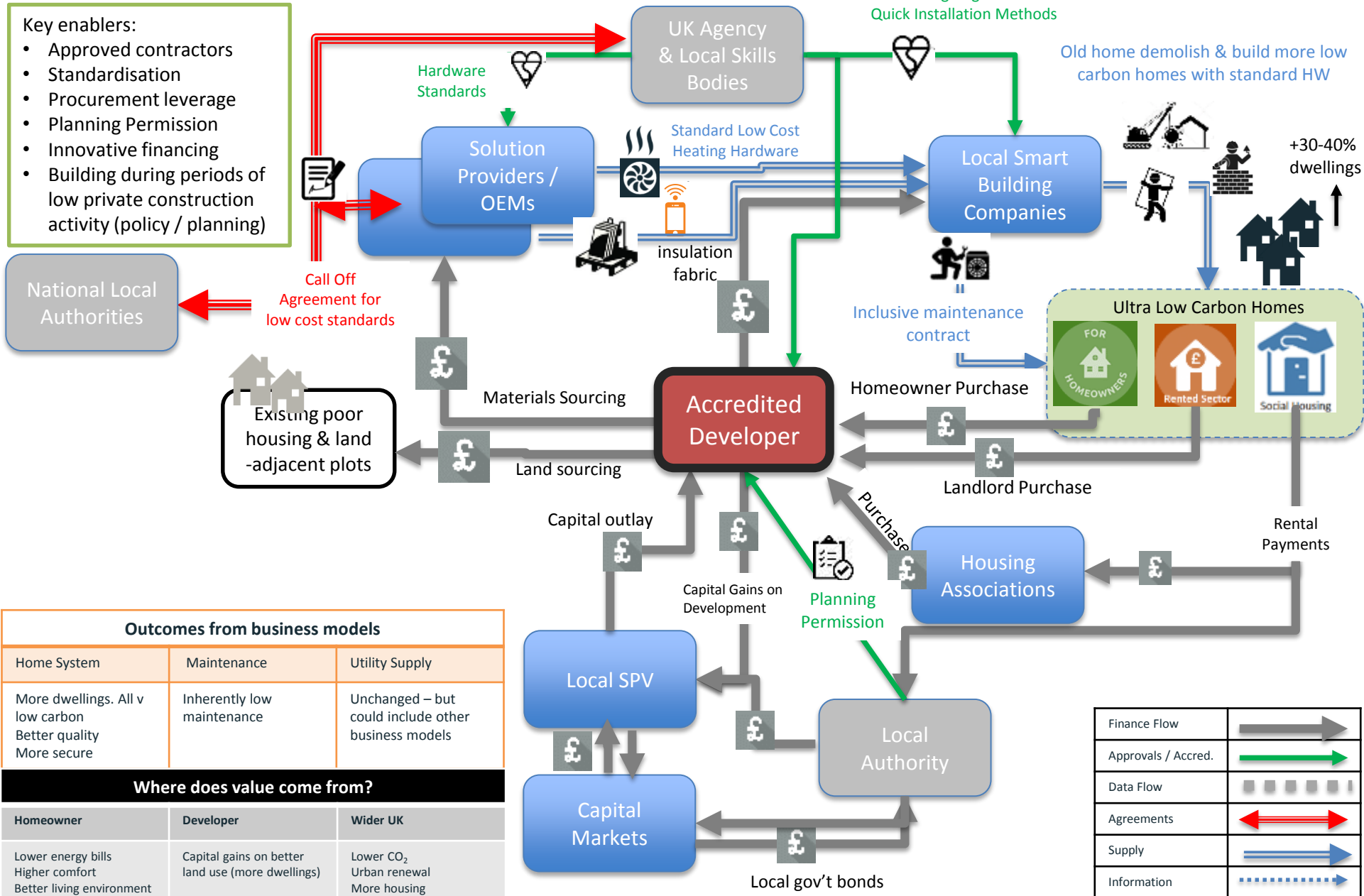
Finance Flow	→
Approvals	→
Data Flow	⋯
Agreements	↔
Supply	→
Gen Info	⋯

Outcomes from business models		
Home System	Maintenance	Utility Supply
Change to district heat or heat pump	Included in contract	Heat & Power

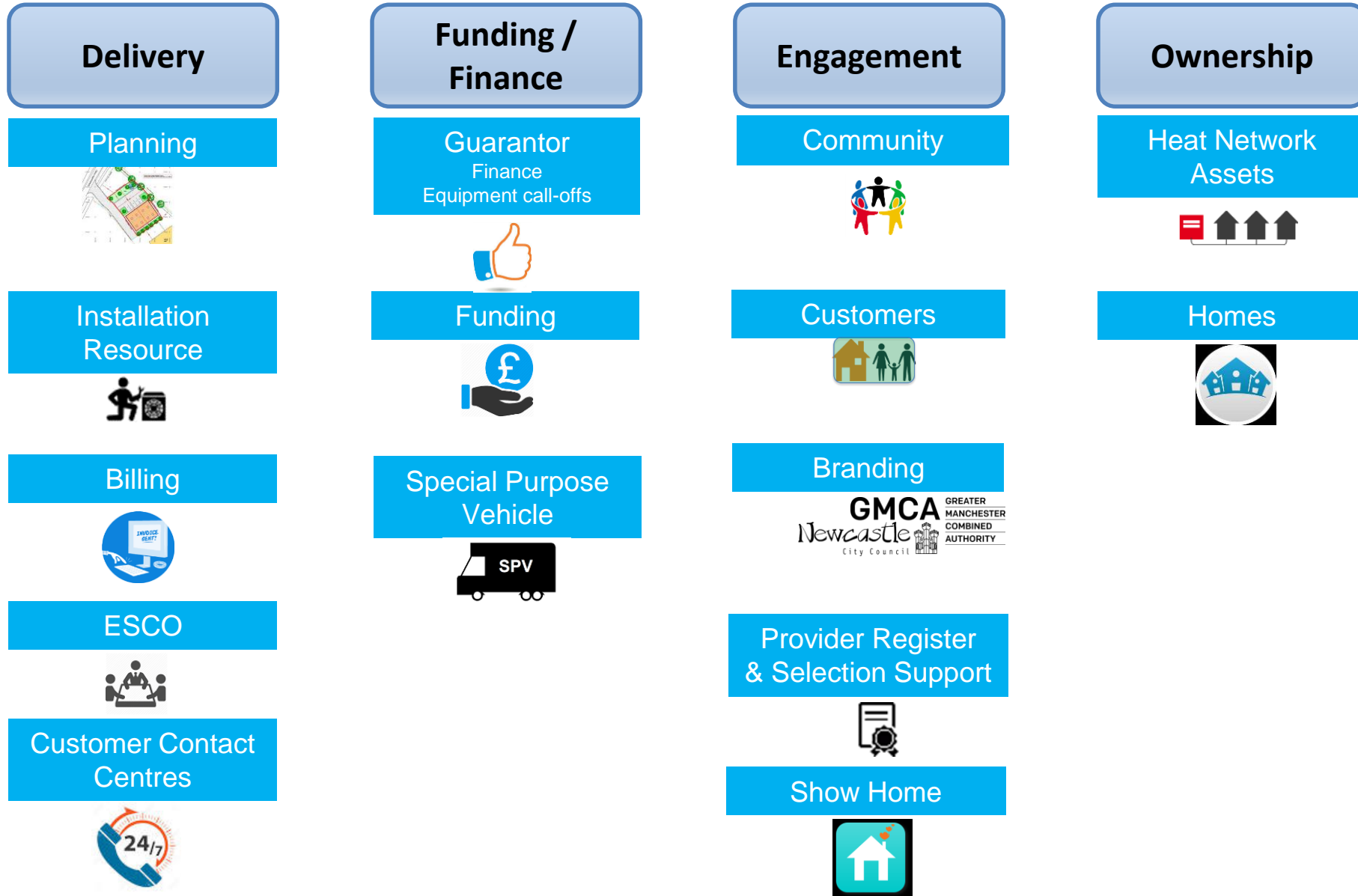
Where does value come from?		
Homeowner	Service Provider	Wider UK
Peace of mind Community provider Resilient supply	Selling heat & power Long term supply contract Monetising spare power	Lower CO ₂ Lower network strain (DG) Power security



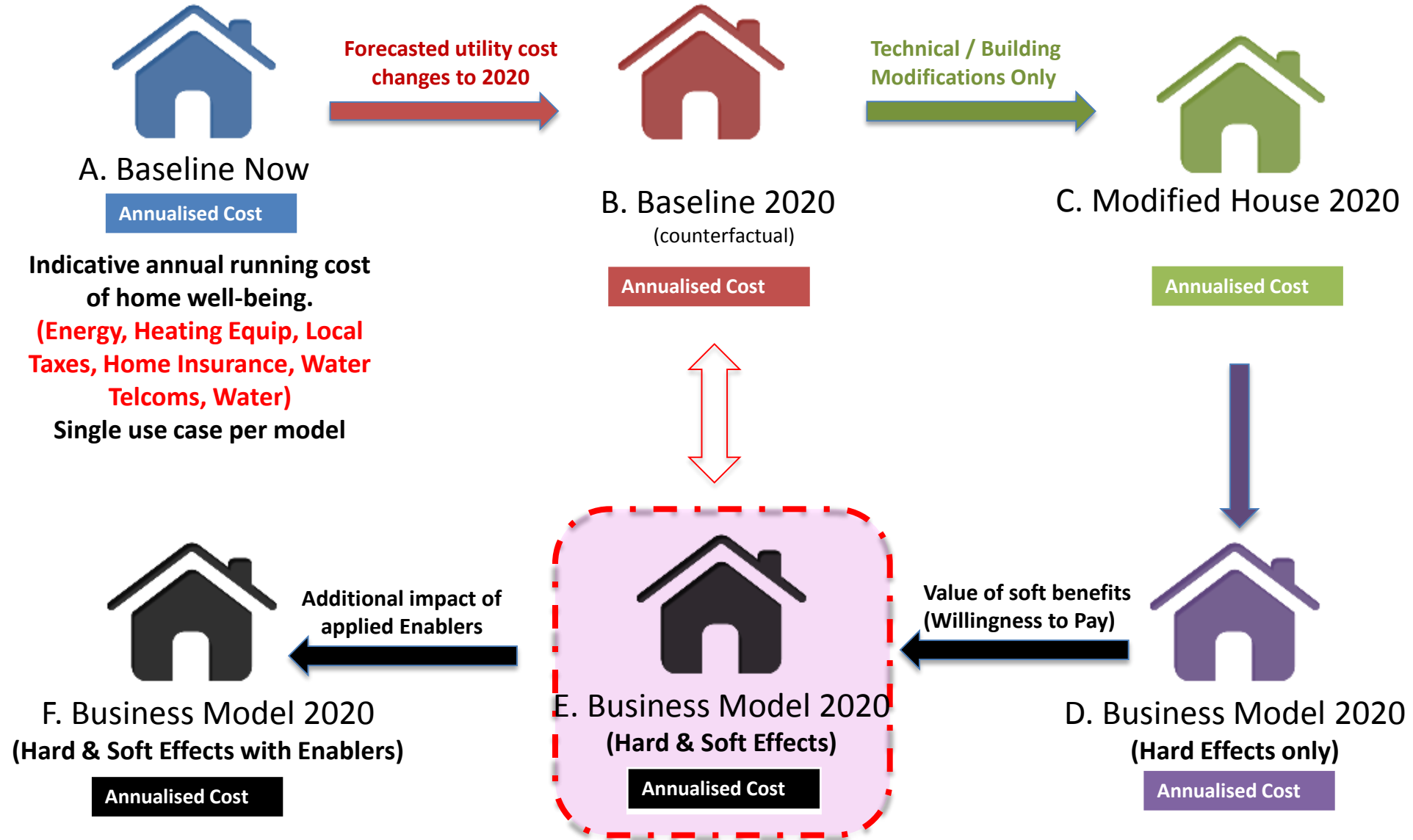
Urban Renewal – Process Map



Potential roles for the Local Authority in new Business Models



Triangulation analysis of the indicative analysed cost and value of each Business Model



Making progress towards commercialisation



Models are flexible & can be adapted easily using model architecture and card game