SSH Insights & Forward Look

SSH Strategy Manager
Andrew Haslett

Smart Systems & Heat Programme

Realising Benefits

Industry having a route to deliver energy services that decarbonise heat in **local areas** that people and communities support and value

Establishing a *Shared Ecosystem*

Living Lab to help others test new energy services

Planning evidence and dialogue to make infrastructure decisions

Informing **future energy system** architectures

100 home living lab

30 home field trial

1 Consumer Solutions

2 Local Area Strategies

3 Market, Business and ICT Solutions

Establishing the knowledge tools and capability

Software platform and supporting design and integration capabilities to gather, process and use data to help service providers **create and deliver better domestic energy services**

Local energy transition planning capability, building consensus among stakeholders to **make local infrastructure investment decisions with confidence**

System operations design capability, trading-off commercial, information and physical domains across gas, heat and power to **enable effective multi-party systems integration**

Department for Business, Energy & Industrial Strategy

Delivered by CATAPULT Energy Systems

Phase 2

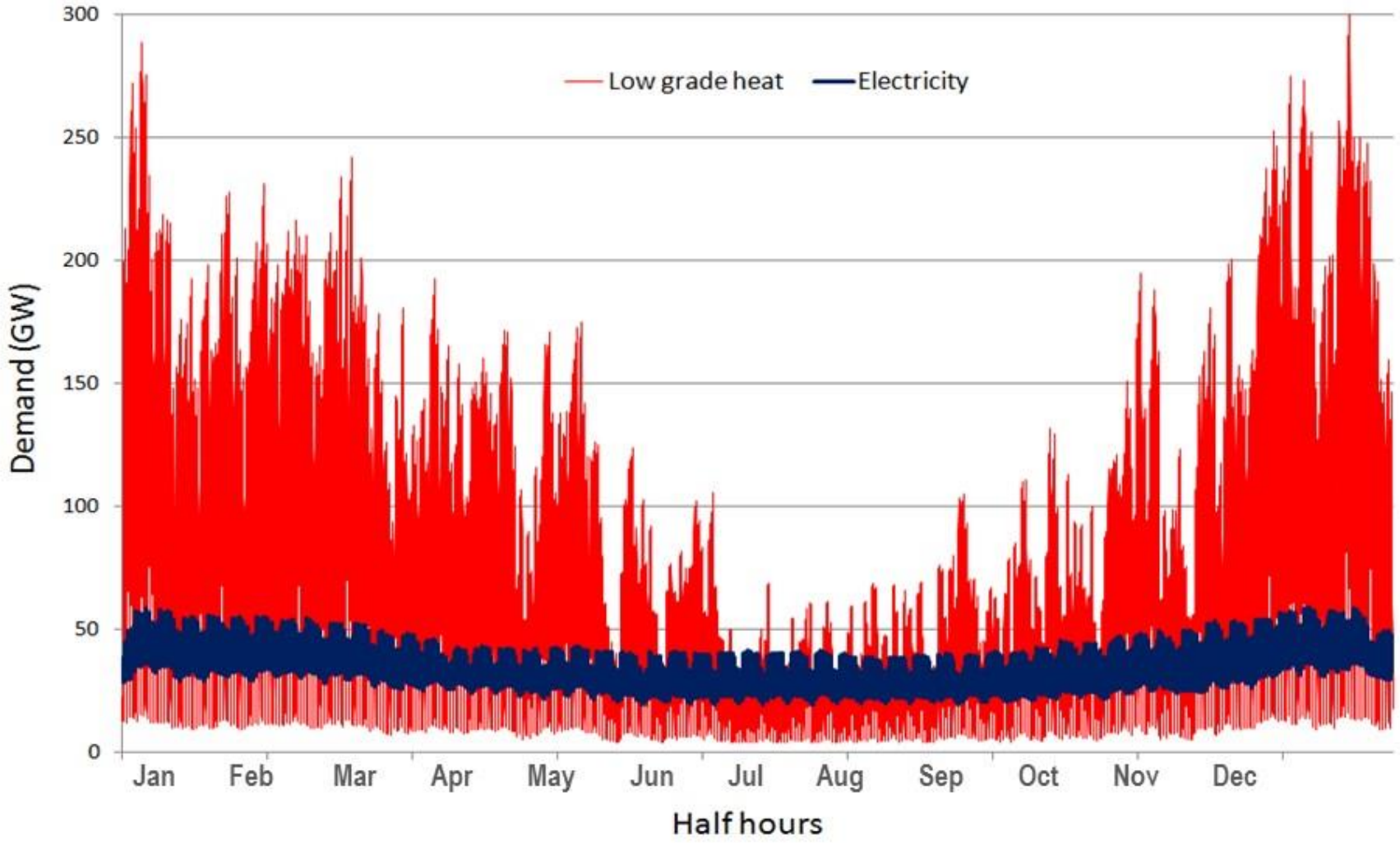
energy technologies institute

Delivered by CATAPULT Energy Systems

Phase 1

Dialogue with Future Power Systems Architect project team

Heat demand is highly variable (2010 data)

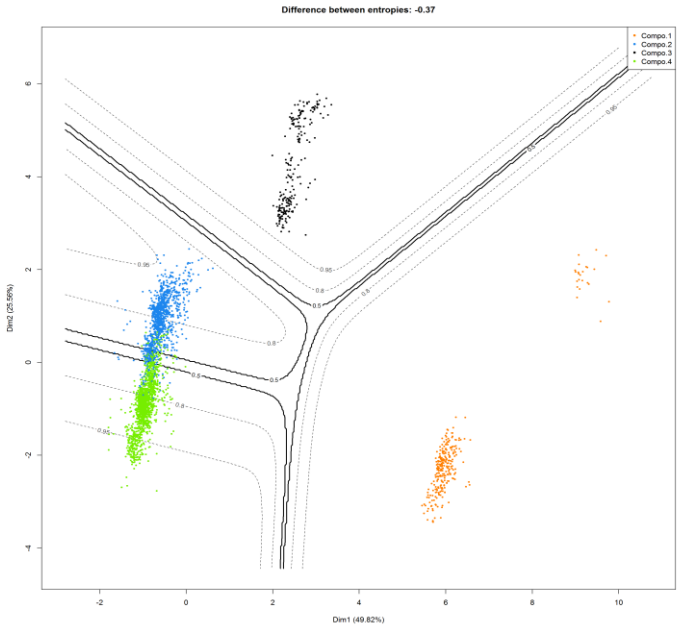


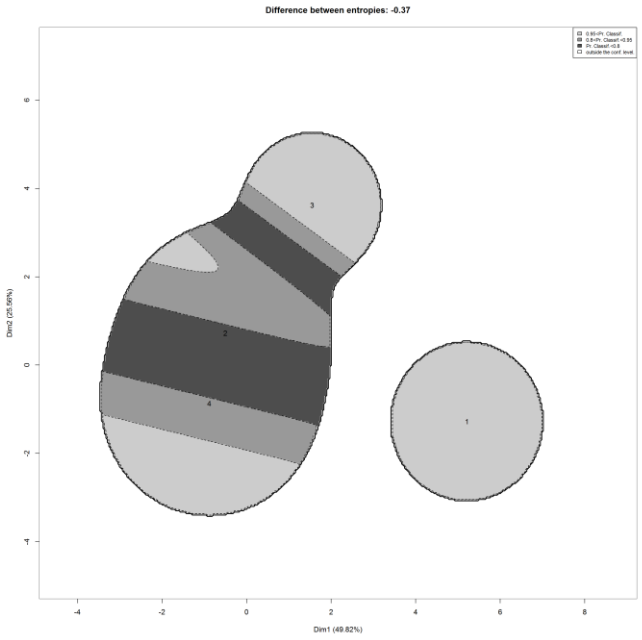
By kind permission of Robert Sansom, UKERC

How was it for you?

Clustering via a mixture model

- Allows us to use a mixture of data types with a mixture of distributions
- It gives us a soft output - respondent *x* has *y* probability of being in cluster 1, and *z* probability of being in cluster 2
- Shows which variables have effected clustering, and the probability that each cluster will respond to each question with a given response
- There are also packages which allow us to plot our cluster solutions.

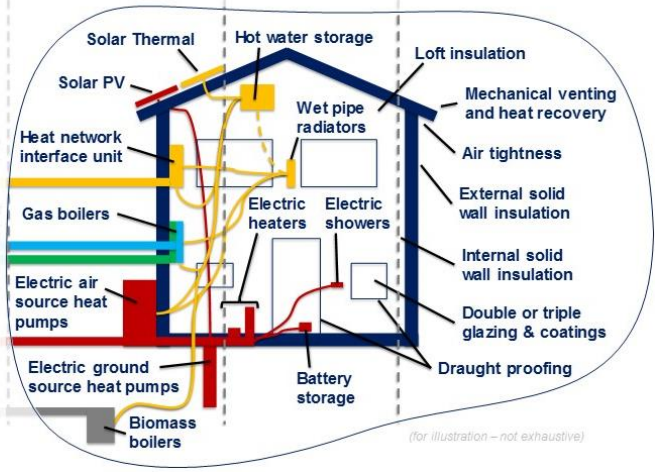


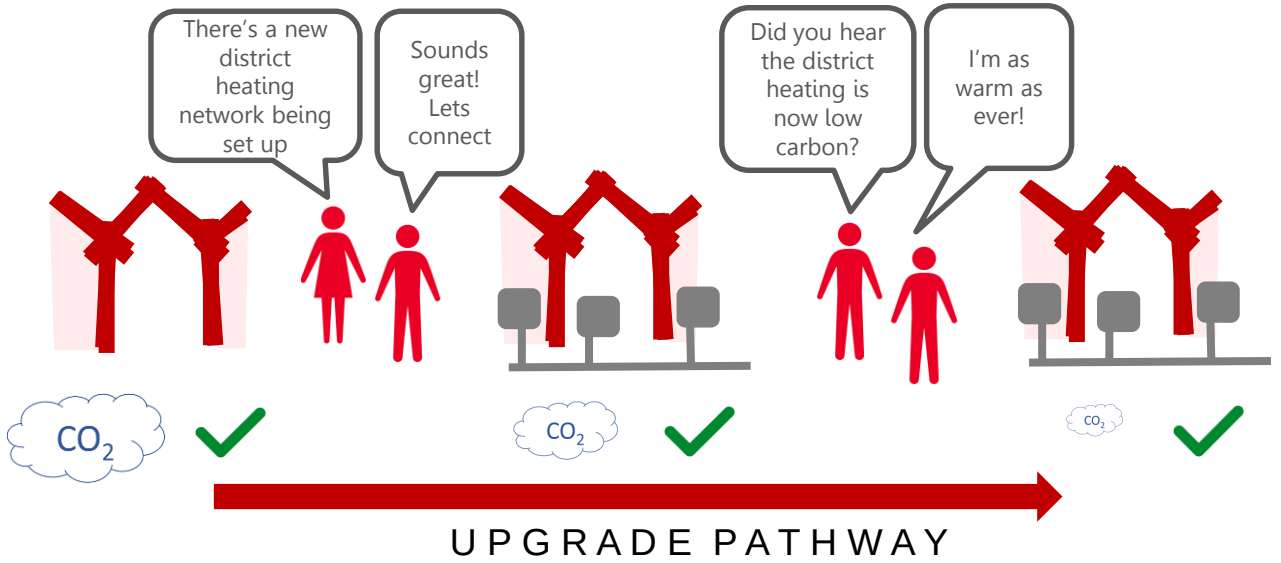


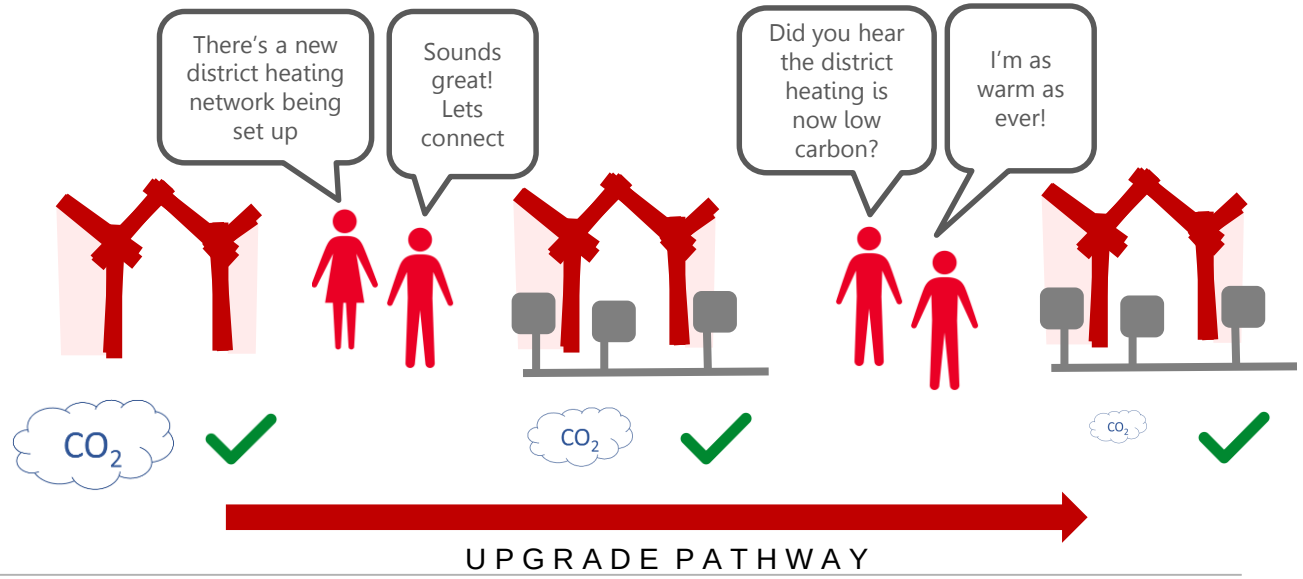
Change supply | Change vector | Change appliances | Change delivery | Change heat losses

Home choices are driven by:

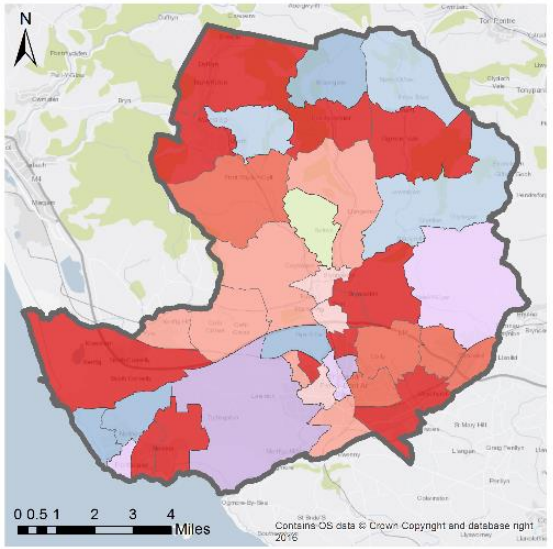
- **Technical factors,** such as the condition of the fabric
- **Commercial factors,** such as split incentives between owners and occupiers
- **Consumer factors,** such as aesthetics, use of space, willingness / ability to invest, symbolic value of home, etc







Predominant Heating System Comparison

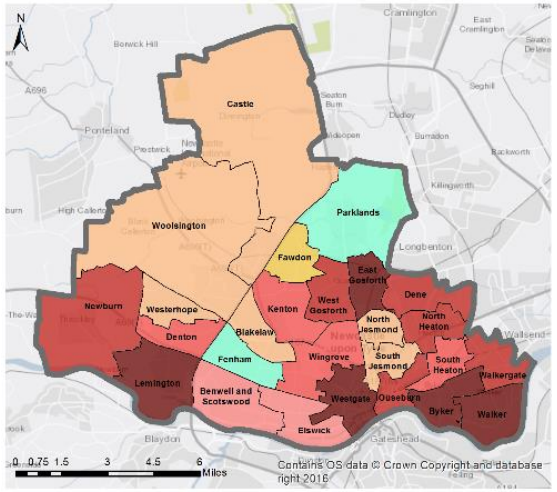


Biomass Boiler
- 80% - 100%
- 60% - 80%
- 40% - 60%
- 20% - 40%

GSHP
- 80% - 100%
- 60% - 80%
- 40% - 60%
- 20% - 40%

District Heat
- 80% - 100%
- 60% - 80%
- 40% - 60%
- 20% - 40%

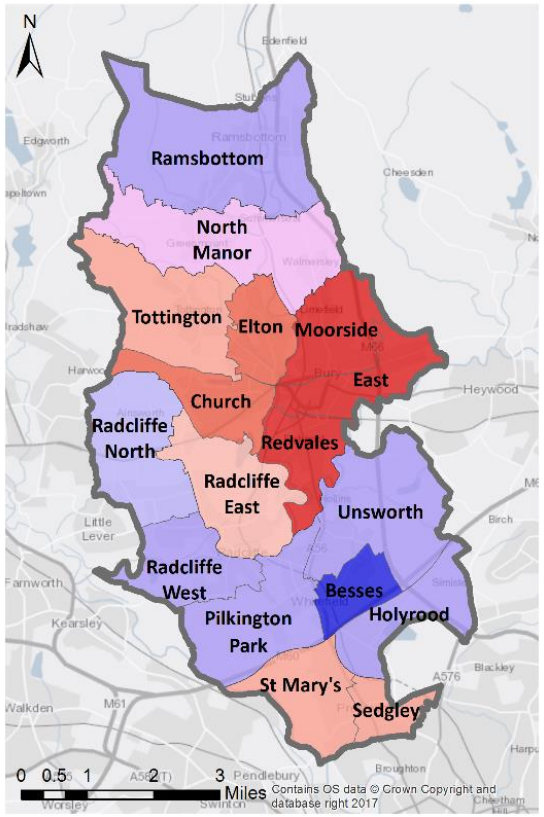
Hybrid Heat Pump
- 80% - 100%
- 60% - 80%
- 40% - 60%
- 20% - 40%



Hybrid Heat Pump
- 20% - 40%
- 41% - 60%
- 61% - 80%
- 81% - 100%

District Heating
- 20% - 40%
- 41% - 60%
- 61% - 80%
- 81% - 100%

High Temperature ASHP
- 20% - 40%
- 41% - 60%
- 61% - 80%
- 81% - 100%

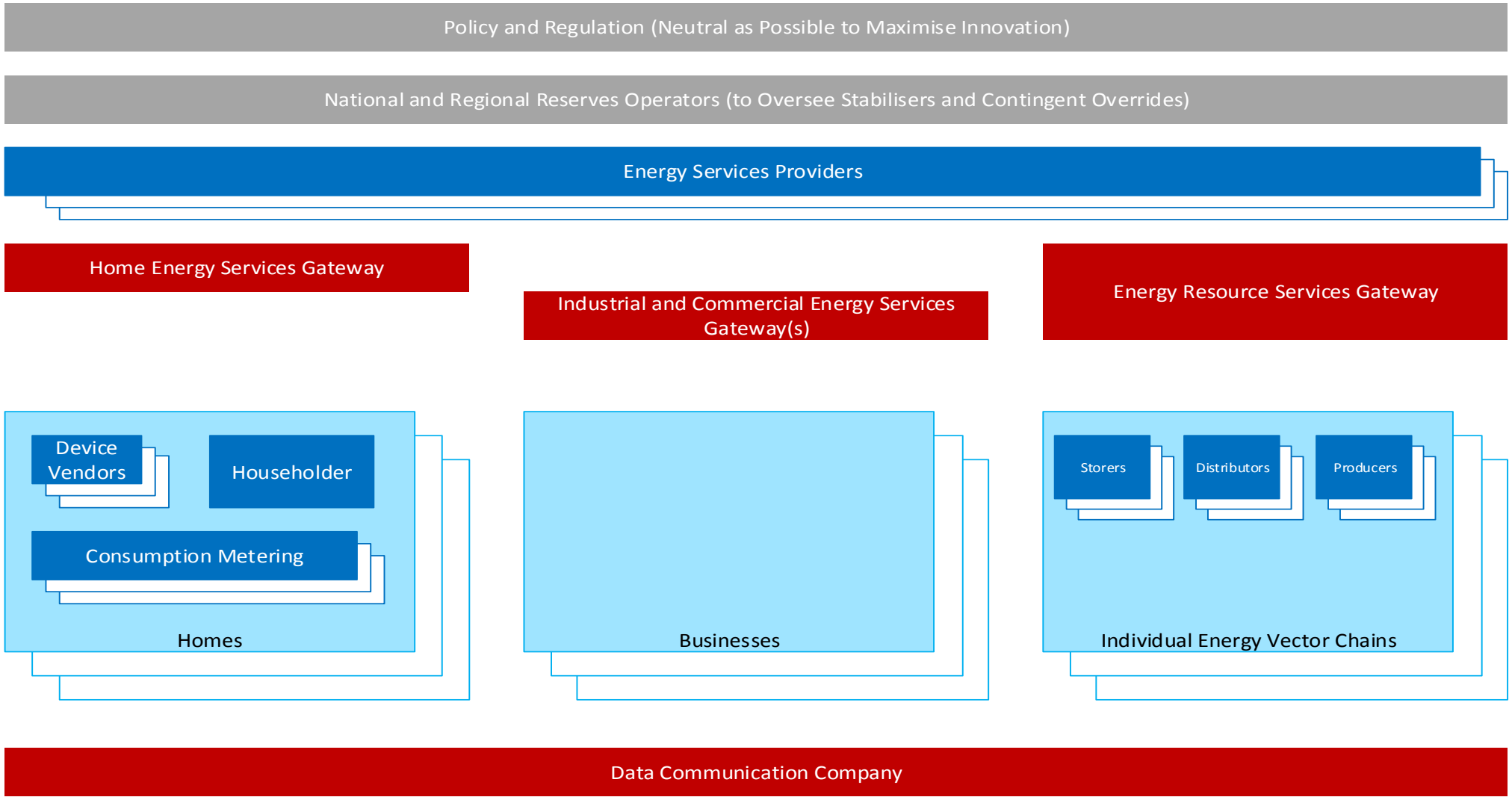


District
- 80% - 100%
- 60% - 80%
- 40% - 60%
- 20% - 40%

Gas
- 80% - 100%
- 60% - 80%
- 40% - 60%
- 20% - 40%

Ground Source Heat Pumps
- 80% - 100%
- 60% - 80%
- 40% - 60%
- 20% - 40%

Architecture 10 - business system mapping

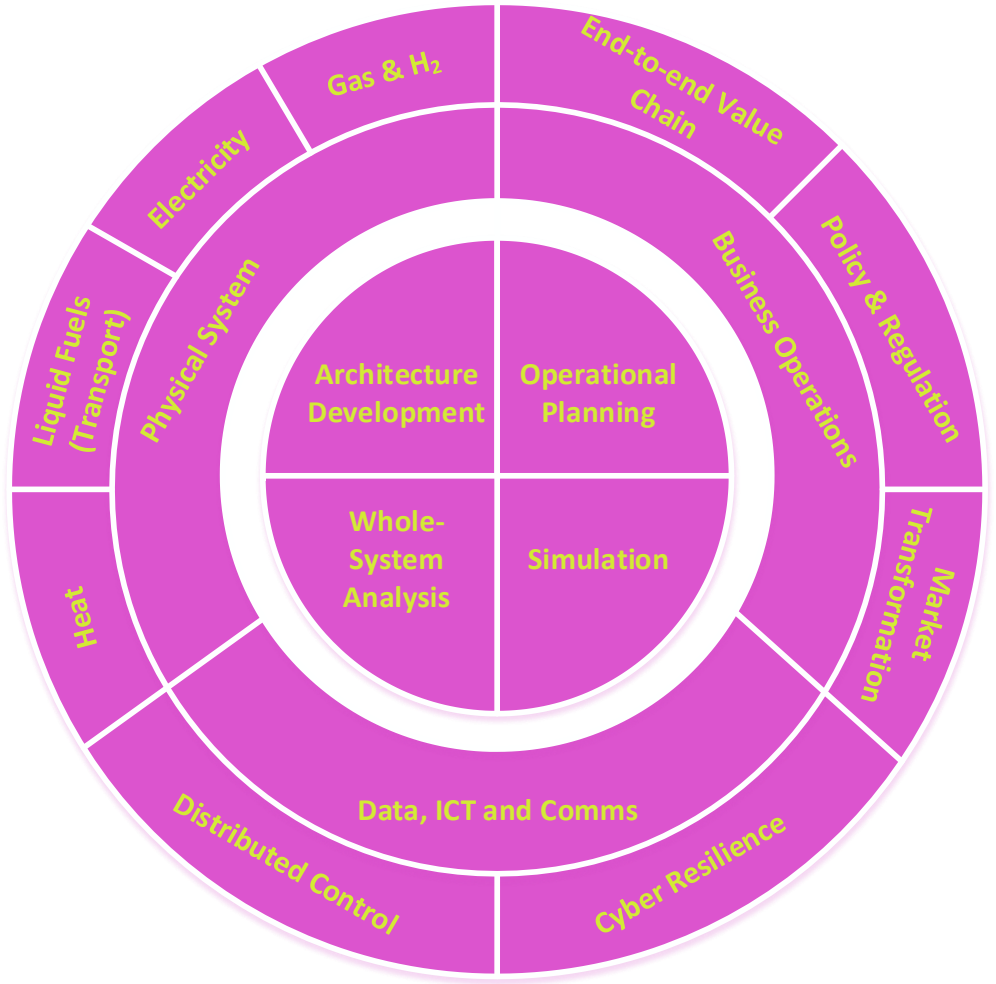


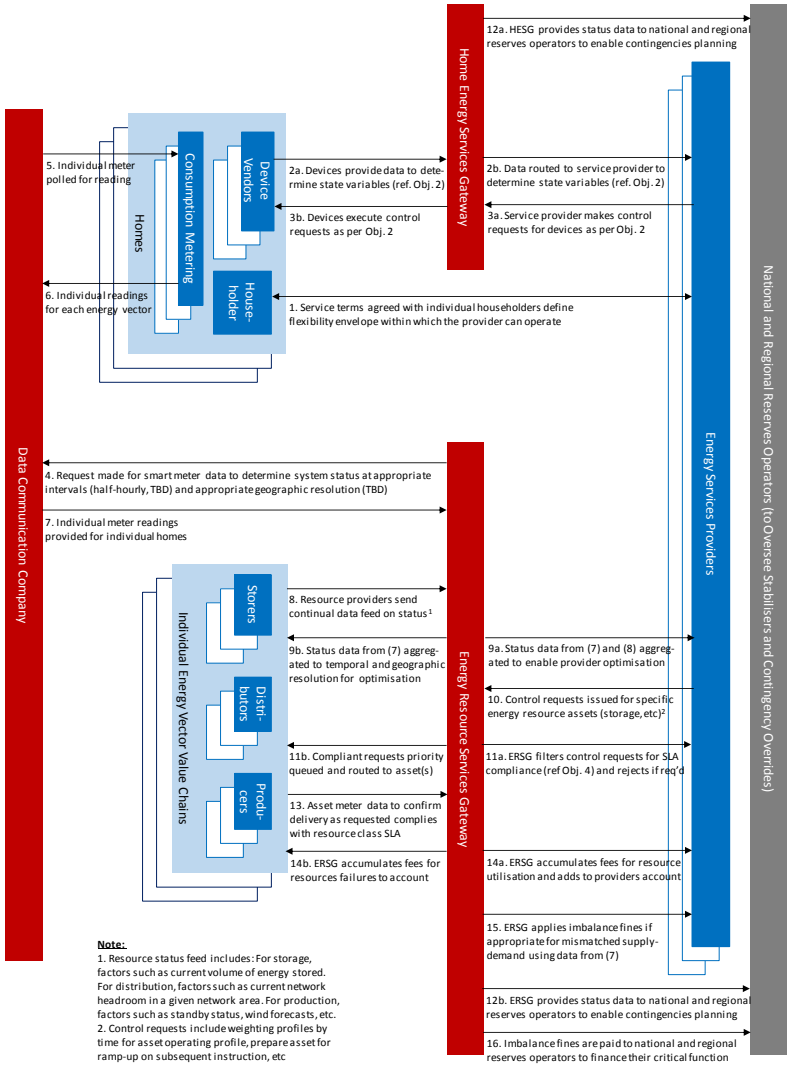
Constructing and ranking architectures

UK Business As Usual

	1	2	3	4	5	6	7	8	9	10	11	12
	Vertically integrated state company (multi-vector)		Regional companies for distribution and retail (multi-vector)						Fully unbundled competitive retail			
	Commodity consumed retail	Experience services retail	Commodity consumption retail			Experience based services retail			Commodity consumed retail	Experience based services retail	Direct peer-peer (no retail function	Commodity consumed retail
	Central procurement body for energy production			Production cost recovery via commodity retail fees	Production cost recovery via service level agreements	Central procurement body for energy production	Production cost recovery via commodity retail fees	Production asset cost recovery via service level agreements			Production cost recovery via commodity retail fees	
Consumer centricity	X (no insight on consumer preferences)	? (risk of tendency to counterproductive political directives)	X (no insight on consumer preferences)	X (no insight on consumer preferences)	X (no insight on consumer preferences)	? (risk of tendency to counterproductive political directives)	? (risk of tendency to counterproductive political directives)	? (risk of tendency to counterproductive political directives)	X (no insight on consumer preferences)	✓ (improving quality of service delivery drives profits)	X (extremely complex for individual consumers to match supply-demand)	X (no insight on consumer preferences)
Resource constraints	X (lack of demand side flexibility)	? (lack of competition to drive innovation)	X (achieves capacity investment, but lack of demand side flexibility)	X (evidence so far shows unlikely to secure capacity investment)	X (achieves capacity investment, but lack of demand side flexibility)	? (competition drives supply side innovation; but limited supply side flexibility)	X (evidence so far shows unlikely to secure capacity investment)	✓ (competition drives supply side innovation; SLAs define flexibility supply-demand)	X (lack of demand side flexibility)	✓ ✓ (competition drives demand and supply side innovations; and SLAs define flexibility on supply and demand)	X (highly unlikely to secure capacity investment, given lack of any long-term counterparty)	X (evidence so far shows unlikely to secure capacity investment; lack of demand side flexibility)
Security and stability	✓ ✓ (very few interfaces to expose risks, few supply-demand closed loop risks)	✓ (few interfaces to expose risks, but introduces closed-loop cyber-security)	✓ ✓ (very few interfaces to expose risks, little supply-demand closed loop risks)	X (highly unlikely to build surplus required to give margin needed)	✓ ✓ (very few interfaces to expose risks, few supply-demand closed loop risks)	✓ (limited interfaces to expose risks, but introduces closed-loop cyber-security needing robust architecture)	X (highly unlikely to build surplus required to give margin needed)	✓ (limited interfaces to expose risks, but introduces closed-loop cyber-security needing robust architecture)	? (many more actors and many more interfaces exposing more risks, but few supply-demand closed loop risks)	? ? (requires robust architecture for distributed multi-actor complex control)	? ? ? (requires robust architecture for distributed multi-actor complex control; lack of clear responsibilities)	X (highly unlikely to build surplus required to give margin needed)
Commercial alignment	✓ (commercial interfaces all sub-contracted)	X (requires significant state mandating to ensure devices support service execution despite warranty issues, etc)	✓ (motives-levers and benefits-liabilities fixed into alignment by regional utilities and central buyer)	X (risks investing in capacity can't be passed on in value chain)	? (requires robust architecture to align motives-levers and benefits-liabilities)	? (requires robust architecture align of motives-levers and benefits-liabilities)	X (risks investing in capacity can't be passed on in value chain)	? (requires robust architecture and transaction gateways to enable alignment of motives-levers and benefits-liabilities)	? (requires robust architecture and transaction gateways to enable alignment of motives-levers and benefits-liabilities)	? (requires robust architecture and transaction gateways to enable alignment of motives-levers and benefits-liabilities)	? ? ? (highly unlikely to be possible to align motivations give extremely large number of very low value peer-to-peer transactions)	X (risks investing in capacity can't be passed on in value chain)
Social objectives	X (fuel poverty dealt with by directives; but carbon unlikely politically viable given lack of ability for consumer focus)	? (fuel poverty dealt with by directives; service model may help with carbon, depending on how motives perceived)	X (fuel poverty dealt with by directives; but carbon unlikely politically viable given lack of ability for consumer focus)	X (evidence so far shows unlikely to secure high capital low carbon asset investment)	X (fuel poverty dealt with by directives; but carbon unlikely politically viable given lack of ability for consumer focus)	? (fuel poverty dealt with by directives; service model may help with carbon, depending on how motives perceived)	X (evidence so far shows unlikely to secure high capital low carbon asset investment)	? (fuel poverty dealt with by directives; service model may help with carbon, depending on how motives perceived)	X (fuel poverty dealt with by directives; but carbon unlikely politically viable given lack of ability for consumer focus)	✓ (scope for payment on results; enables neutral carbon policy similar to automotive to drive industry investment in low carbon innovation)	X (assumes consumers are 'savvy' enough to sort out issues on their own, given lack of a party taking performance risk)	X (fuel poverty dealt with by directives; but carbon unlikely politically viable given lack of ability for consumer focus)

Multi-vector, distributed business operations simulation





EnergyPath Operations

Thank You

Speak to our analysts and developers in the modelling zone to get more details