Future Billing Methodology

Consultation on Options for Attributing Energy Content of Green Gas in the Transition to Net Zero

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Agenda

1. Welcome, admin. & introductions
2. Background & challenge
3. Consultation scope & present regime
4. Key project findings
5. The consultation options – description
6. Changes to regulations & billing systems for Options B – E
7. Options scenarios, cost benefit analysis & timeline
8. Q & A
9. Options recap
10. Consultation questions
11. How to respond to this consultation
12. Close

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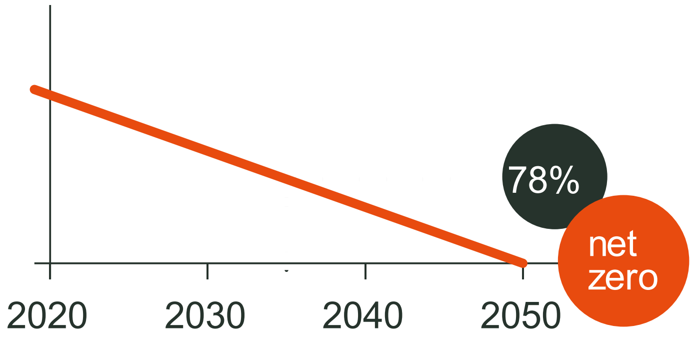
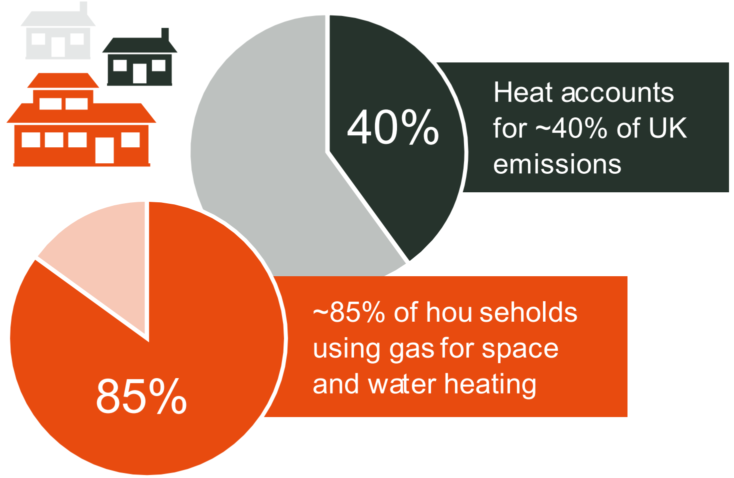
2.

Background & Challenge

Why are we consulting?



The UK Government has legally committed to achieving **net zero by 2050** and is expected to further commit to achieving **78% of this by 2035**.



Gas networks in Great Britain supply **c. 24 MILLION consumers** **24/7** with virtually no interruption.

To decarbonise heat both at the scale and rate required, we must begin to decarbonise Great Britain's gas networks

Starting this transition will require maximising the use of **renewable-source gases** such as biomethane and introducing hydrogen-methane blends, both of which have a lower carbon and energy content than natural gas, and with the ultimate aim of distributing **100% hydrogen** where practicable.

But there's a problem we need to overcome first…

The current billing methodology **doesn't allow for varying calorific values**.

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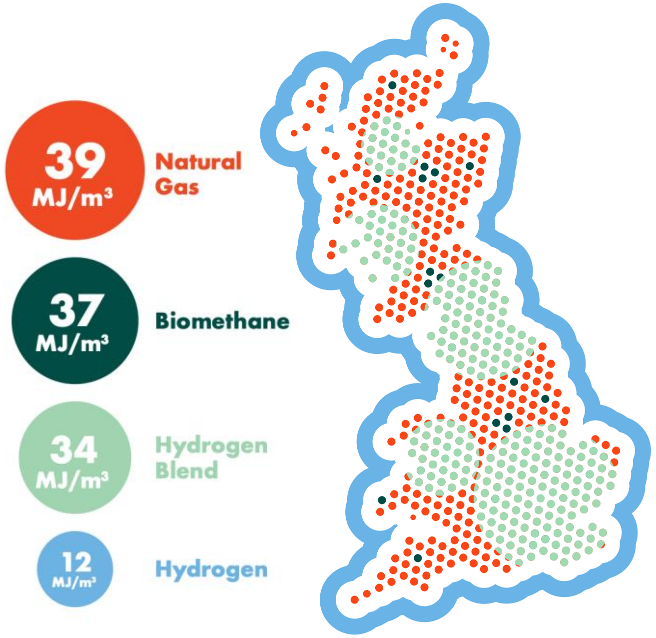
Why are we consulting?

Industry Consultation

- Option A
- Option B
- Option C
- Option D
- Option E

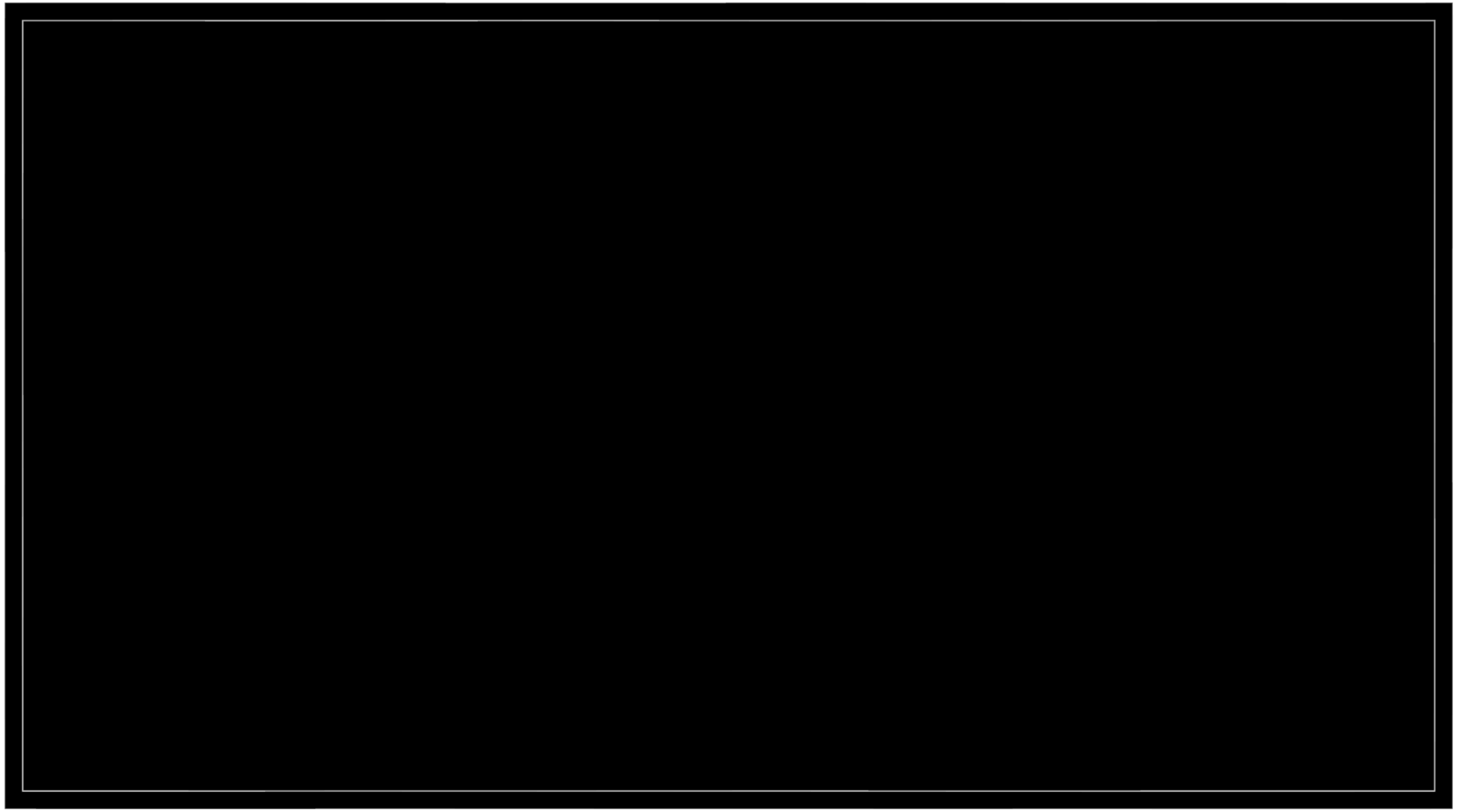
Recommendation: March 22

Support policy decisions on heat



Decarbonise heat in the UK

Challenge Summary



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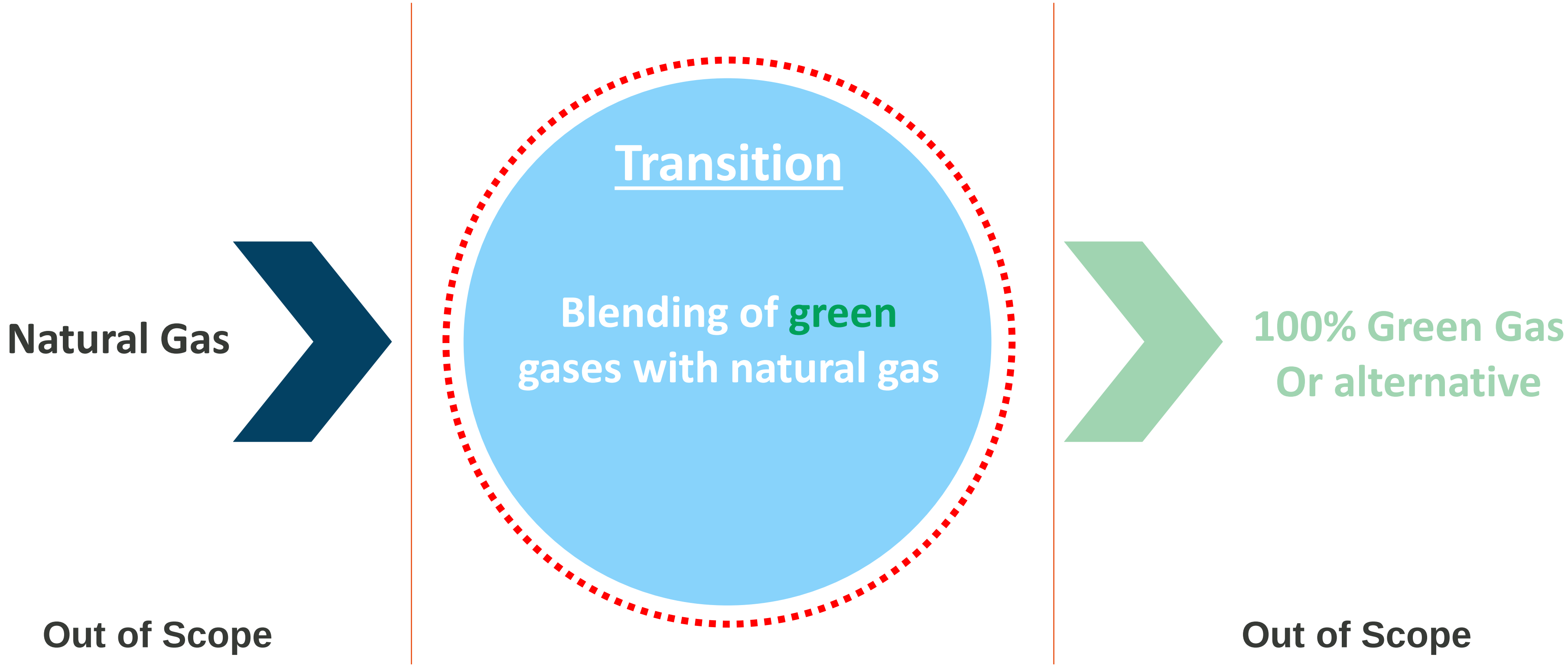
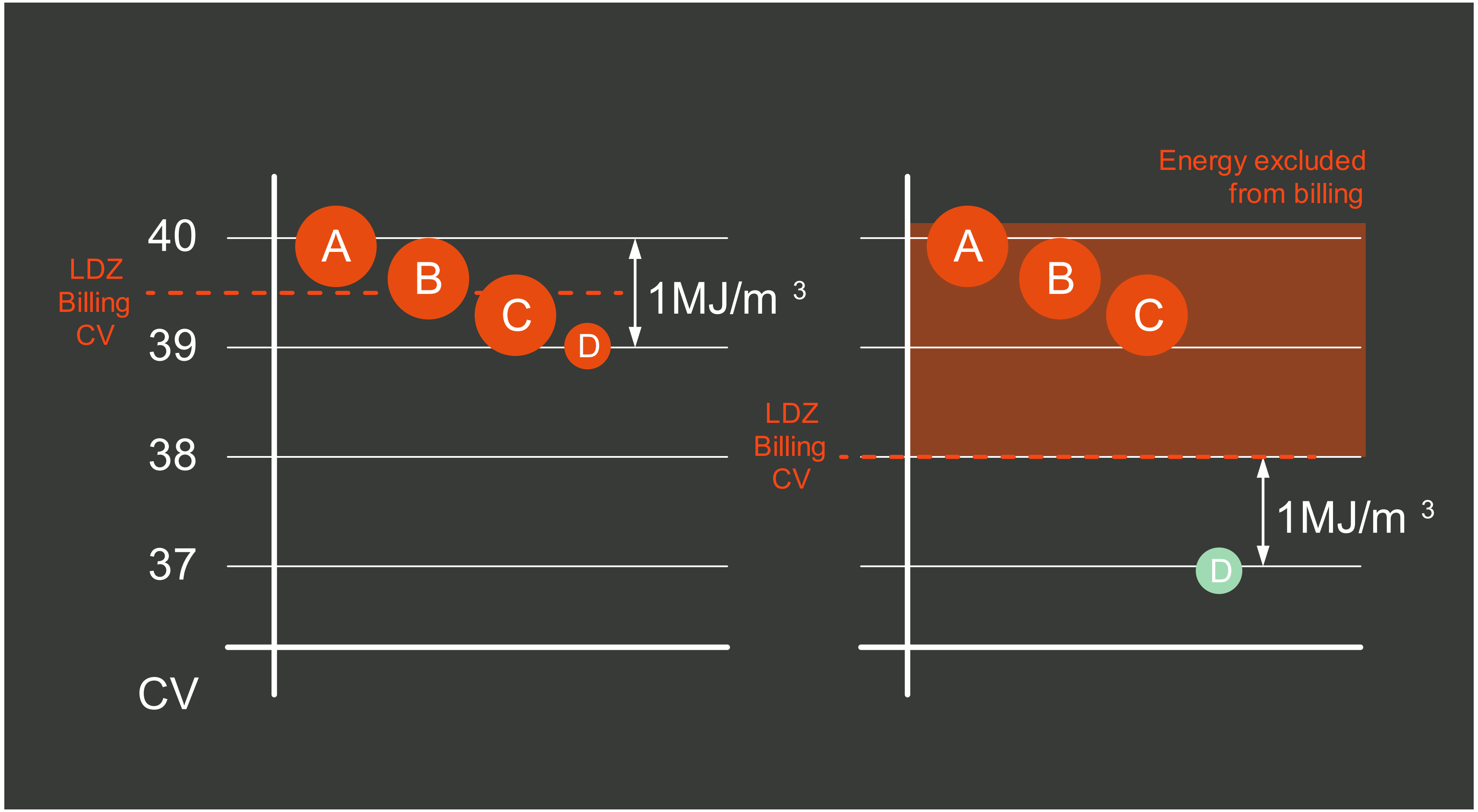
Consultation scope & present regime

Consultation Scope:
Gas energy attribution during the energy transition to Net-Zero



Present regime: Flow Weighted Average Calorific Value (FWACV)



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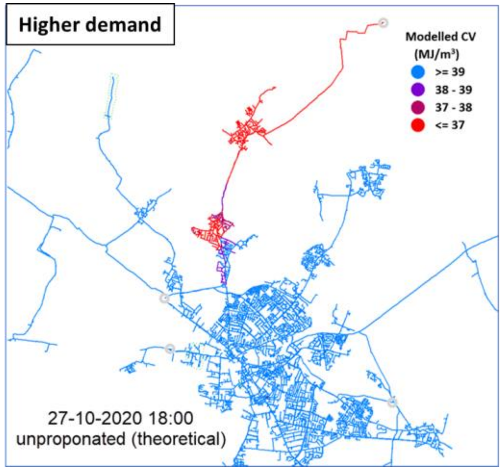
Key project findings

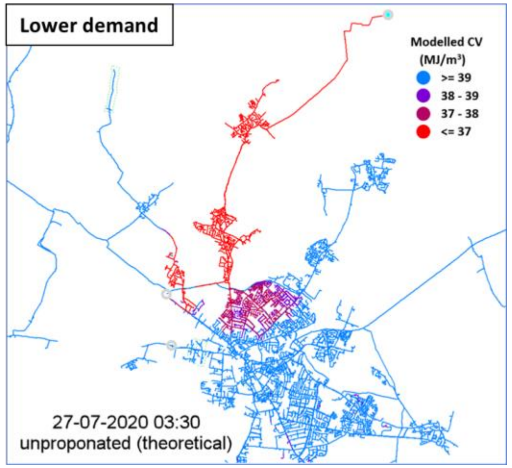
NIC: Future Billing Methodology

NIA: Calorific Value and Gas Quality Impact Assessment of Hydrogen and Biomethane Blends.

Project Findings: NIC Future Billing Methodology

- Seasonally representative body of data obtained
- Oxygen tracking of biomethane successful
- Dynamic zones of influence observed
- Strong model correlation to field measurements
- Successful network & CV modelling of zone of influence & gas mixing
- Embedded charging area could be created
- High-level methods for identifying charging areas set out
- Key factors for consideration in determining a charging area identified





Monitoring Point	Average measured O2 Concentration (ppm)	Model Accuracy
FBM42	191.9	91.20%
FBM43	110.1	96.60%
FBM44	107.4	100.00%
FBM45	79.6	92.40%
FBM46	79.3	96.80%
FBM47	4.3	81.80%
FBM49	38.1	80.90%
FBM50	66.8	92.00%
FBM51	32.7	93.30%
FBM52	3.1	0.00%
FBM53	6.8	0.00%

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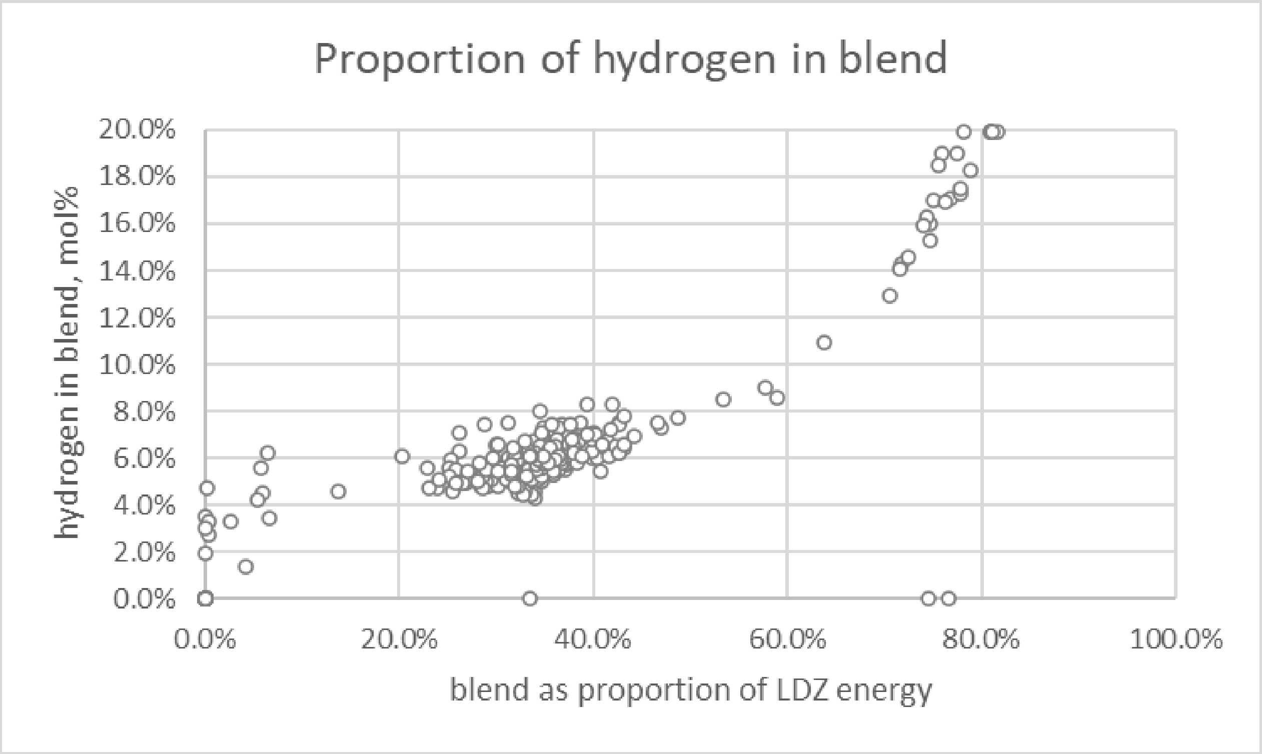
Project Findings:

NIA: Calorific Value and Gas Quality Impact Assessment of Hydrogen and Biomethane Blends



- Blend % is constrained by the LDZ FWACV (i.e. avoiding the cap)
- Higher proportion of LDZ energy supplied with a blend = high % of hydrogen blend
- 20-40% proportion of LDZ supplied = around 5% hydrogen blend
- 80% proportion of LDZ supplied = 20% hydrogen blend
- As FWACV is reduced, the requirement for biomethane enrichment is reduced

Checkpoint

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Consultation Options

Consultation Options for Future Billing

Option A	Work within existing frameworks
Option B	Embedded zone charging
Option C	Online CV modelling
Option D	Zonal CV measurement (Not recommended at this time)
Option E	Local CV measurement (Not recommended at this time)

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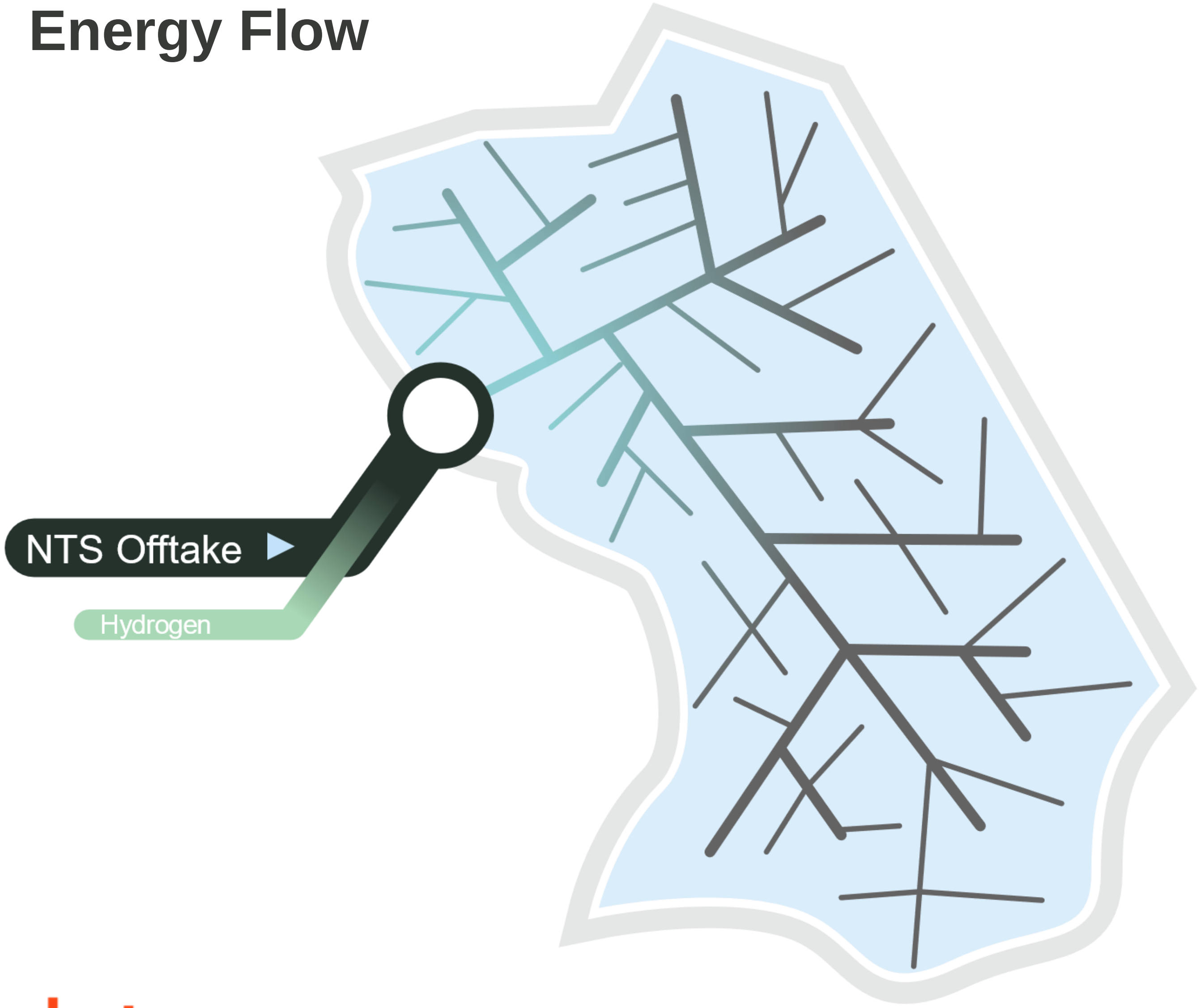
Option A:
Work within existing frameworks

Option A: Initial phase – Blending at Minority Energy Flow



Hydrogen blend **≤5%** at NTS/LDZ offtake C with min. CV = 38.6 MJ/m^3 maintains LDZ FWACV within 1 MJ/m^3 cap.

Blending of biomethane with system gas to avoid LDZ CV capping, or propane-enrichment, if blending unfeasible.

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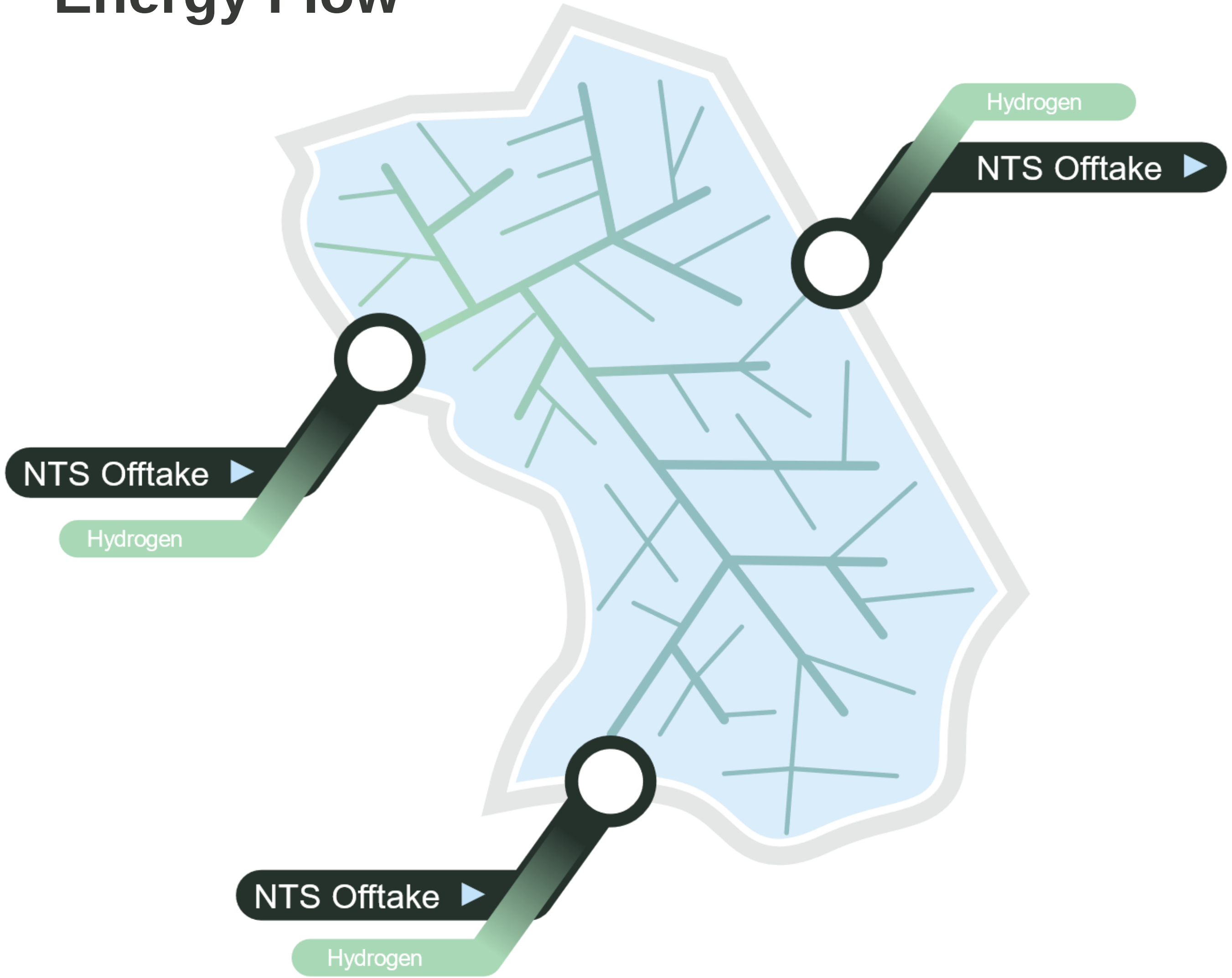
Option A: Later phase – Blending at Majority Energy Flow



Hydrogen blend at **CV = 34 / 35 MJ/m³** from other input points supplies **>80%** of LDZ gas energy and so brings LDZ FWACV down to 35 MJ/m³, so avoiding CV cap.

Biomethane enrichment reduced or switched off as H_2 blend at primary offtakes lowers LDZ FWACV.

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Option A: Work within existing frameworks

- Controlled blending of green gases to maintain FWACV
- If Minority Flow… <=5% H2 at strategic locations = significant H_2 volumes
  (1 example offtake <= 400 GWh/yr ~57,000 tCO2e abated)
- Majority Flow (~80% of LDZ energy as a blend) required to achieve 20% H_2
- Majority Flow would reduce / eliminate need for biomethane enrichment
- Additional system controls required to maintain FWACV
- No changes to Regulations or Billing Systems

Checkpoint – Option A

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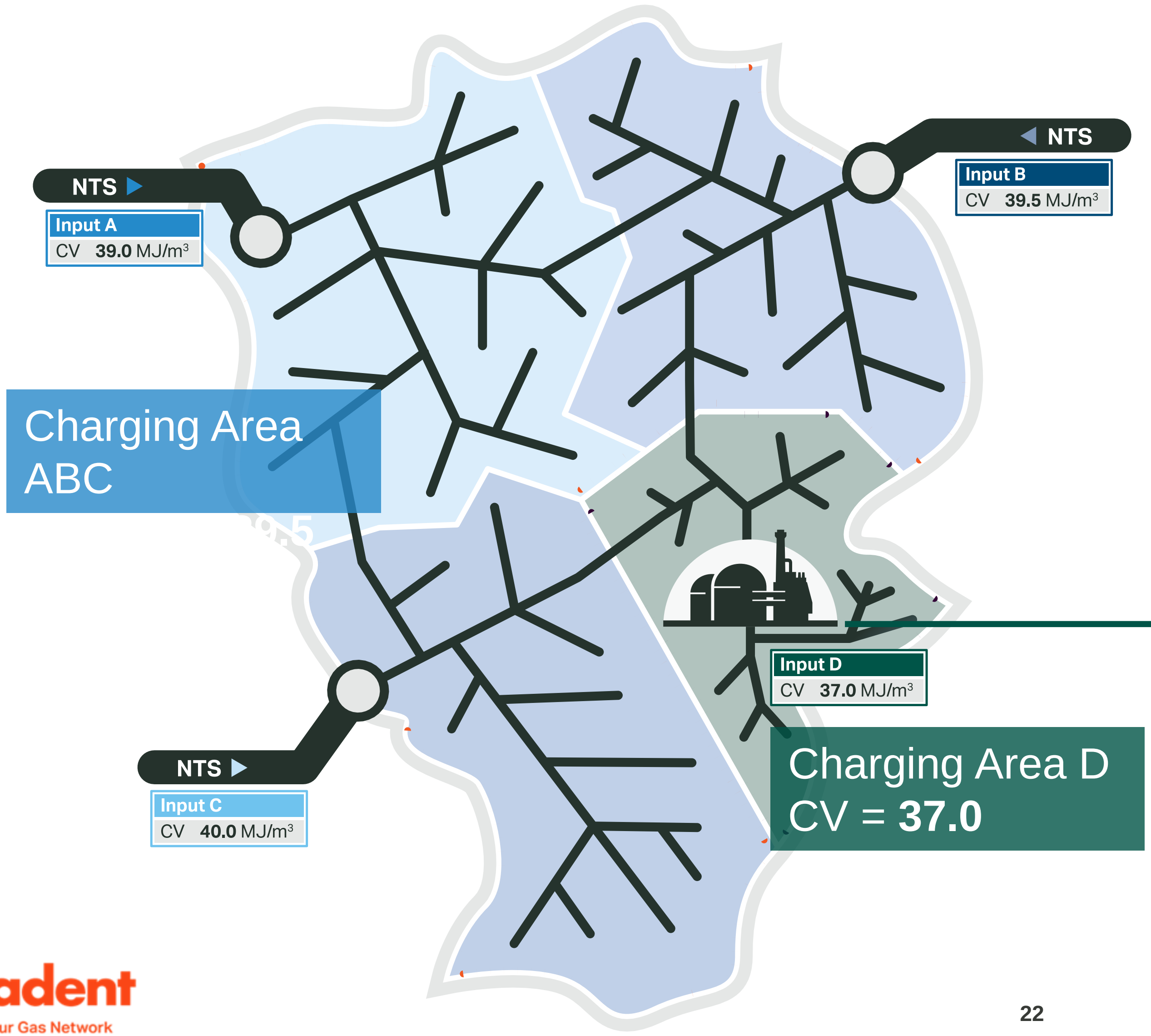
Option B:
Embedded Zone Charging

Option B: Embedded Zone Charging



Measured CV assigned to Supply Meter Points

Penetration of biomethane from embedded fixed-flow source D extends further out at lower demand, but is quickly absorbed once demand picks up – so limited bill-impact.

Zone of influence exerted by embedded input D identified by network modelling. Charging area D virtually separated from LDZ by one of two methods:

1. Using CV modelling and typical demand profiles to inform a typical bill analysis at system node level to allocate in or out of zone D on bill-impact of different CV.

2. Using a lower-than-average demand level to determine zone boundary, providing systematic protection to customers who receive biomethane some of the time

Option B: Embedded zone charging

- Focuses on embedded green gas supplies only
- Conceived to deliver early wins on propane reduction for biomethane
- Could also support embedded hydrogen blending
- Uses network and CV modelling to define charging area
- Customers within the charging area assigned to CV measurement device at embedded entry

Checkpoint – Option B

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Option C:
Online CV Modelling

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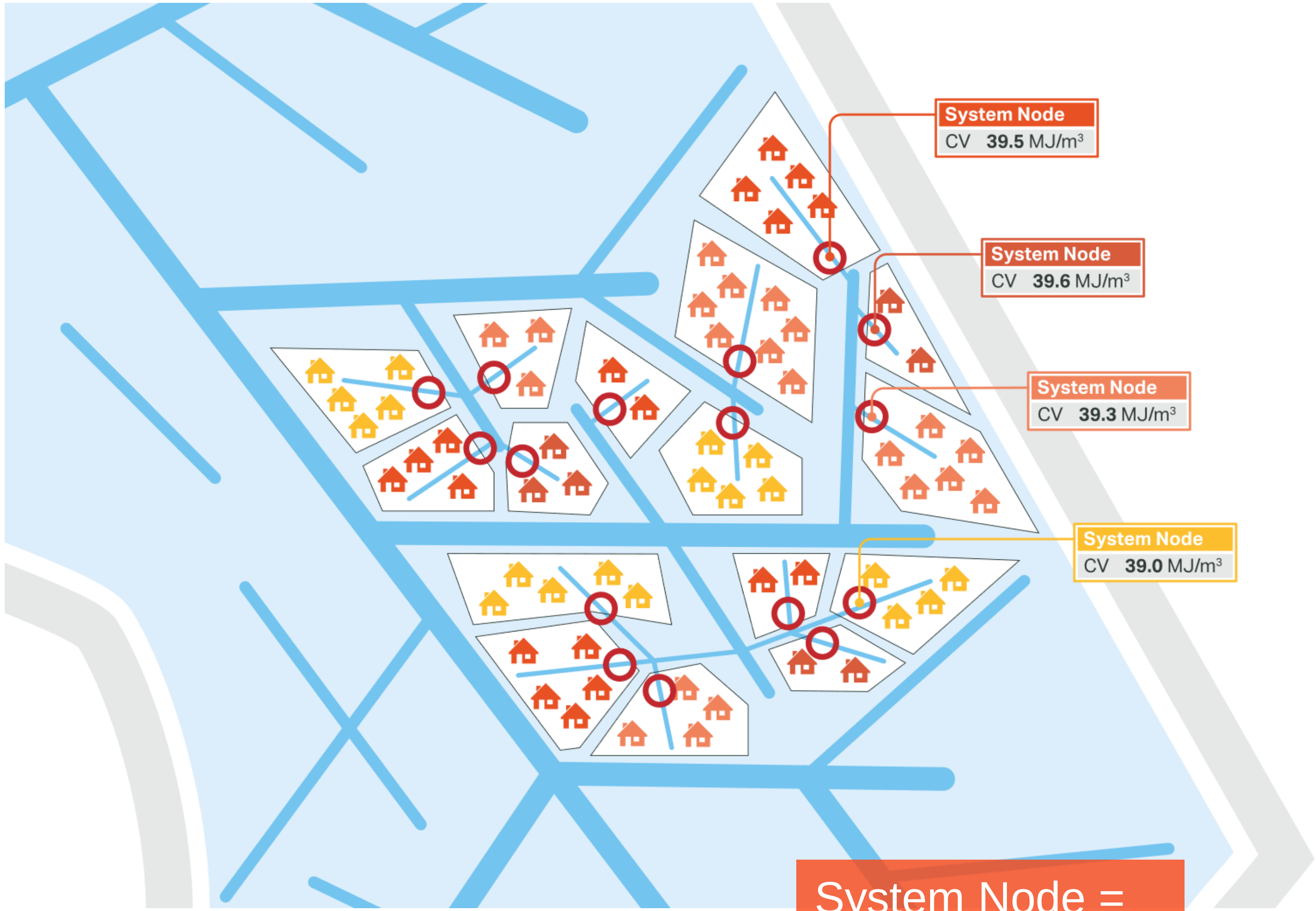

System Node = Charging Area

Measured CV and volumes at LDZ offtakes from NTS are inputs to online LTS model

Online modelling of Local Transmission System (LTS) generates output CV values at exit points (PRS) into the downstream network, which informs (2)

Attribution of output modelled CV at each system node using one of two methods:

Before the day – offline modelling of lower pressure tiers to allocate consumers to a LTS PRS offtake Charging Area and bill using the online LTS PRS modelled value, or

After the day – recreate the lower pressure tiers network state and bill using a modelled CV at each system node, closer to the consumer's point of use

Modelled CV assigned to Supply Meter Points

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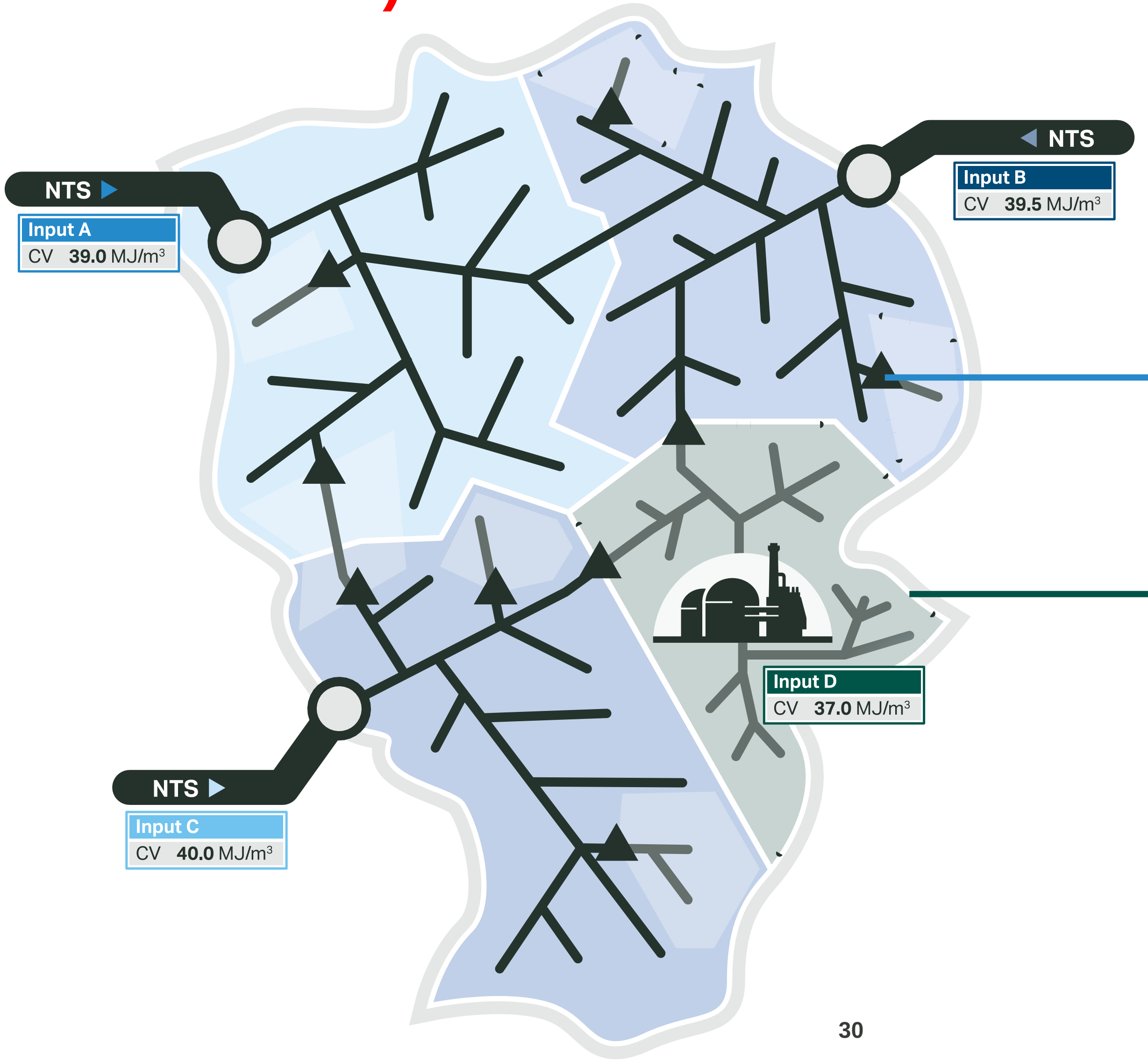
Option C: Online CV modelling

- Could provide one consistent method for all gas transition scenarios
- Conceived after review of Options B, D and E.
- Uses CV measured at network inputs, online modelling of LTS and integrated offline models to generate CV at each system node.
- Supported by strategic embedded CV measurement.

Checkpoint – Option C

Option D & E:
Not recommended at this time

Option D: Zonal CV Measurement (not recommended)

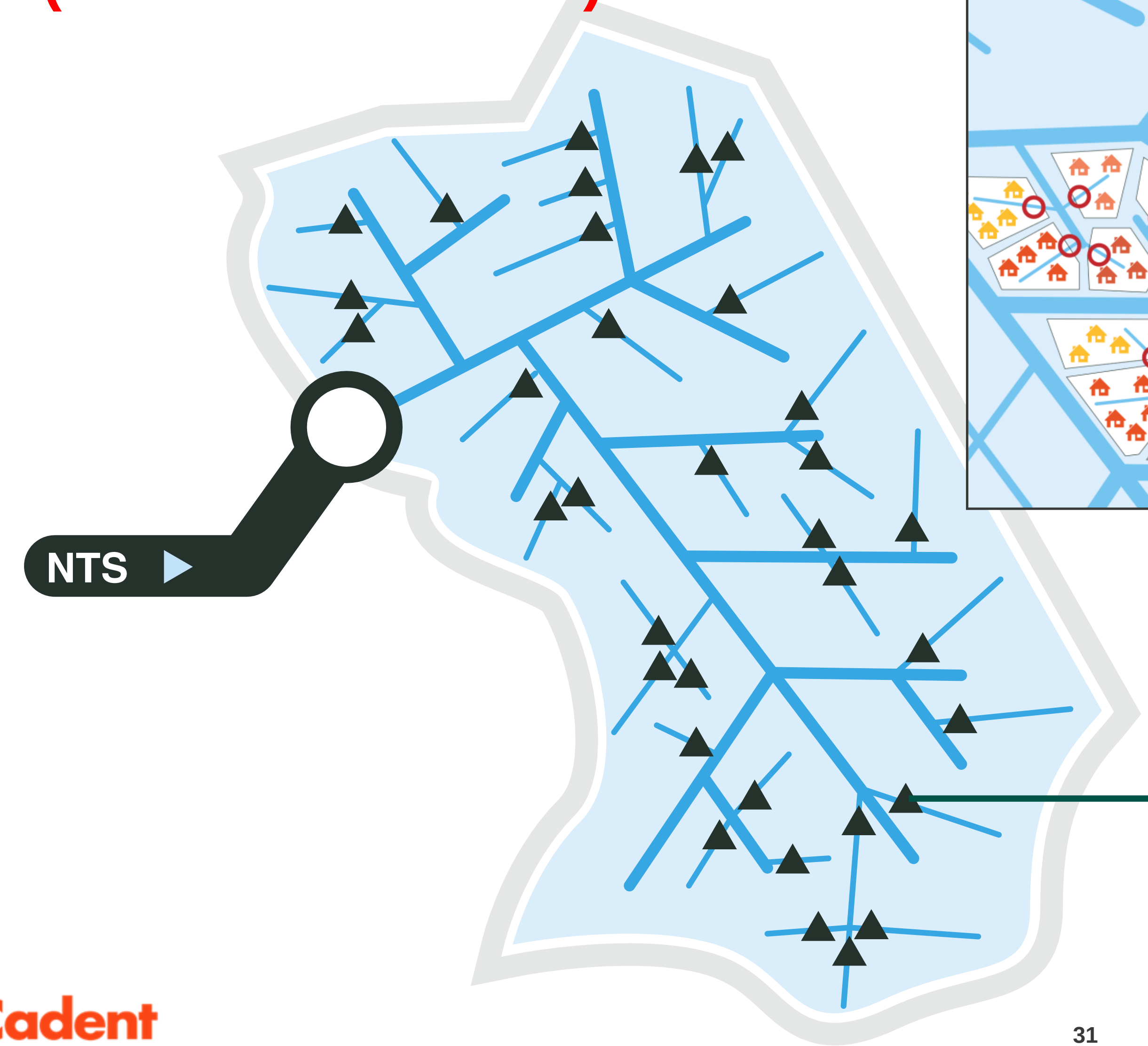


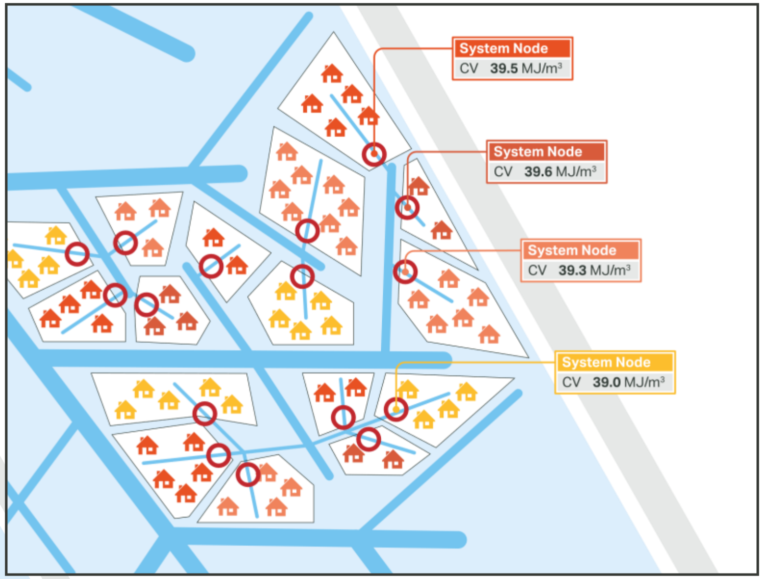
In-network CVDDs create charging areas for discrete sub-networks

Virtual separation of each LDZ input's zone of influence into separate charging areas

Measured CV assigned to Supply Meter Points

Option E: Local CV Measurement (not recommended)





Within network measured CV close to point of use

Measured CV assigned to Supply Meter Points

Options D and E: Not recommended at this time

- These two options involve significant installation of CV measurement within the LDZ network
- Not recommended due to **cost** and **complexity** of installing equipment*
- Included here for completeness

*Based on current CVDD technology

Checkpoint – Options D & E

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Changes to regulations & billing systems for Options B – E

Gas Thermal Energy Regulations (GCoTER)

Initial view:	Charging areas not geographically defined, so could be modelled, with CV for billing based on measurement at relevant input points.
Detailed review:	Regulation 4A(3)(b) appears to mandate CV and volume measurement at all input / output points for any charging area.
Conclusion:	Use of modelling to create charging areas within LDZs and/or to apply modelled CV for billing would require changes to GCoTER.

Key billing system changes (Options B – E)

Sub-LDZ charging areas:	Requires changes to energy tracking systems and to Gemini to keep energy attribution whole at LDZ level and for energy balancing
Meter Point specific CV:	Variable zones of influence from LDZ inputs → varying CV at system nodes → system nodes could switch between charging areas* → Meter Point specific CV required
NDM Settlement & AQ update:	• Currently uses an energy factor at LDZ/EUC level • Meter Point specific CV would require energy factor to be calculated at Meter Point Level
CV Data:	• Requires daily CV data provision at Meter Point Level to Shipper / Supplier systems

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Options scenarios, cost benefit analysis & timeline

Options Cost Benefit Analysis (1)

Green gas scenarios applied:

Green gas scenarios applied in CBA	High	Central	Low
Hydrogen in blend from 2035 (TWh)	30.6	13.5	5.9
Biomethane Projection for 2050 (TWh)	125.0	62.5	31.3

- Hydrogen based on Hydrogen UK report November 2021 report, *Hydrogen in the UK: Moving from Strategy to Delivery*
- Biomethane based on October 2019 ENA report, *Pathways to Net-Zero: Decarbonising the Gas Networks in Great Britain*

Options CBA (2) Results: High scenario

BILLING OPTIONS CBA: SUMMARY TABLE OF OPTIONS, PROJECTED NPV AND KEY INDICATORS

HYDROGEN BLEND SCENARIO:	CENTRAL	
Hydrogen within blend peak reached at 2035:	13.5	TWh/a
BIOMETHANE SCENARIO	CENTRAL	
Biomethane peak reached at 2050:	62.5	TWh/a

OPTION	DESCRIPTION	IMPLEMENTATION COSTS *(2021-22 Prices RPI = 304.4)* CAPEX (High case) (£M)	OPEX (Set-up) (£M)	OPEX (Ongoing) (£M/a)	*WITHIN WHICH: CLIENT SYSTEMS COSTS*	GO LIVE YEAR	CUMULATIVE NPV AT YEAR 2030 (£M)	2040 (£M)	2050 (£M)	FINAL BENEFIT : COST RATIO	BREAK-EVEN YEAR	TOTAL CARBON ABATED AT 2050 (mtCO2e)	CARBON ABATED: COST PER TONNE (£)	Option Cost per Consumer to 2050 (£)
A	WORK WITHIN EXISTING FRAMEWORKS	2.26	0.65	0.65	*N/A*	2023	146.4	3,817.8	8,067.4	628 : 1	2025	44.981	0.29	0.52
B	EMBEDDED ZONE CHARGING	162.20	0.3	2.4	*33.2*	2026	143.1	1,628.0	4,106.4	22 : 1	2028	23.338	8.46	7.99
C	ONLINE CV MODELLING	185.60	3.6	5.35	*33.2*	2027	416.1	4,985.6	10,302.3	37 : 1	2028	57.827	4.96	11.60
D	ZONAL CV MEASUREMENT	499.40	1.2	7	*33.2*	2030	-414.4	613.2	2,574.5	4 : 1	2036	16.980	59.33	40.78
E	LOCAL CV MEASUREMENT	906.00	3.6	16.7	*49.8*	2035	-529.0	1,705.3	6,083.5	4 : 1	2036	39.559	60.73	97.26

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Options CBA (3) Cost per tonne (range)

CARBON ABATED: COST PER TONNE (£)				
SCENARIO	Hydrogen Blend	HIGH	CENTRAL	LOW
	Biomethane	HIGH	CENTRAL	LOW
FUTURE BILLING OPTION	A	0.13	0.29	0.63
	B	4.44	8.46	16.40
	C	2.29	4.96	10.69
	D	27.93	59.33	135.44
	E	25.07	60.73	176.63

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Options CBA (4) – Options Timeline

FUTURE BILLING OPTIONS TIMELINE TO BREAK EVEN - CENTRAL CASE SCENARIO FOR HYDROGEN & BIOMETHANE																		Carbon Abated to 2050: Cost / tonne (£)
OPTION		TECH READINESS LEVEL (TRL)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	
A	EXISTING FRAMEWORKS	6	SYSTEM CTRL UPDATES	GO LIVE		BREAK-EVEN												0.29
B	EMBEDDED CHARGING	2 / 3	FEASIBILITY STUDY	SYSTEM DEV'T & REGS CHANGES			GO LIVE		BREAK-EVEN									8.46*
C	MODELLED CV	2	FEASIBILITY STUDY	SYSTEM DEV'T & REGS CHANGES			CVDD INSTALL ETC.	GO LIVE	BREAK-EVEN									4.96
D	ZONAL CV MEASUREMENT	2	FEASIBILITY STUDY	SYSTEM DEV'T & REGS CHANGES			CVDD INSTALLATION, POWER & COMMS PROGRAMME				GO LIVE						BREAK-EVEN	59.33
E	LOCAL CV MEASUREMENT	2	FEASIBILITY STUDY	SYSTEM DEV'T & REGS CHANGES			CVDD INSTALLATION, POWER & COMMS PROGRAMME									GO LIVE	BREAK-EVEN	60.73

* Cost of carbon abated calculated for Option B in isolation from Option C

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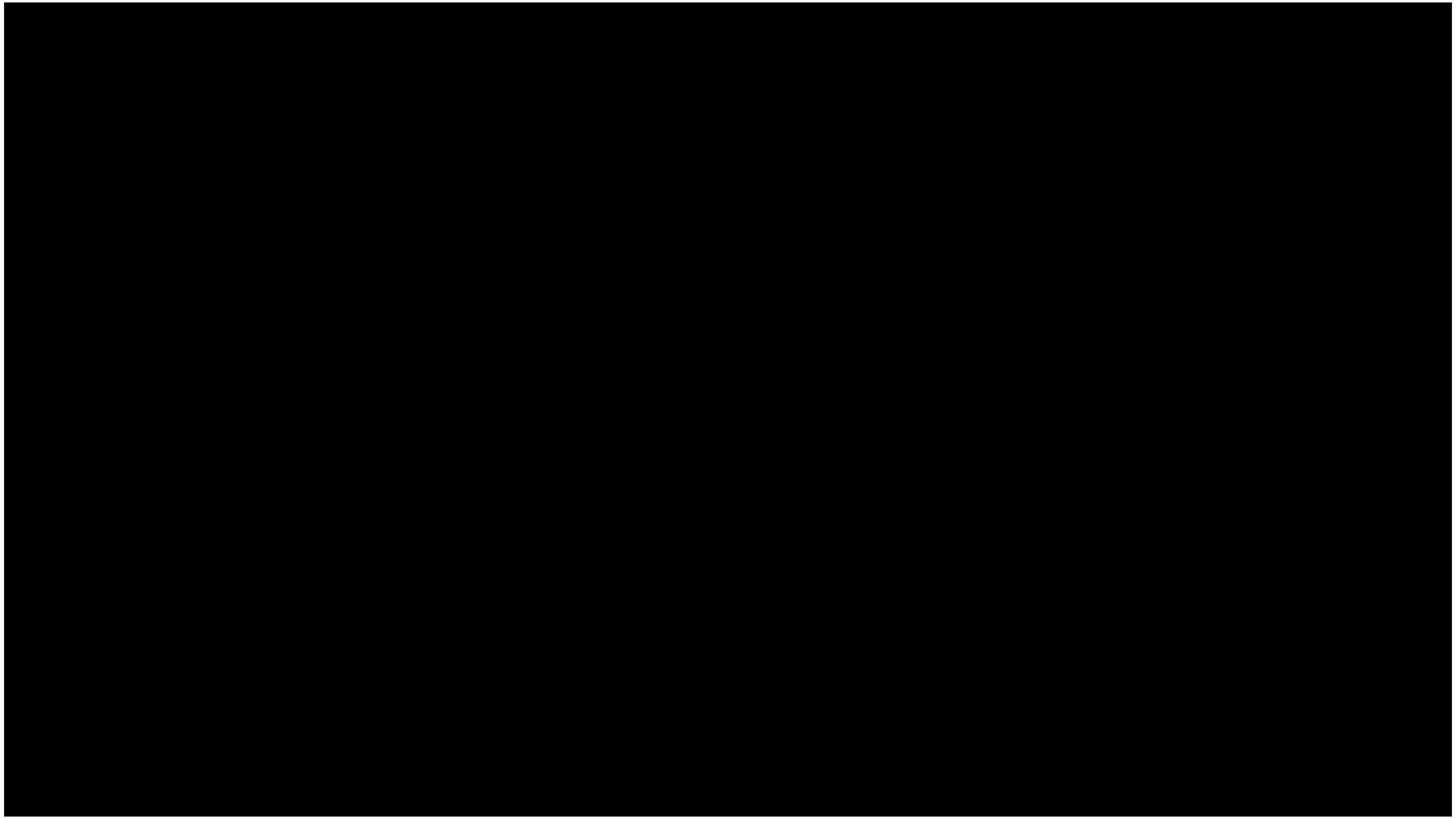
Q & A

Session Break

Welcome Back – Options Recap



Consultation Questions

How to respond to this consultation:

Respond online at: [Consultation Survey (surveymonkey.co.uk)]

Email to: Email victoria.mustard@xoserve.com

Final date for consultation responses: Tuesday 1st March 2022

Session Close

Thank you