Real Time Settlement Methodology (RTSM) Programme – Session 1

Stakeholder Engagement Forum

26th August 2025

SGN bip. correla

Welcome and Introductions

SGN

Meet the Team

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Expectations for the Sessions

1. RTSM awareness
2. Interactive deep-dives
3. Your insights matter
4. Learn and refine together

Agenda

Time	Topic	Lead
14:00 – 14:10	Welcome and Introduction	SGN
14:10 – 14:20	The Challenge	SGN
14:20 – 14:25	Future Billing Methodology	SGN
14:25 – 14:30	RTSM Programme	SGN
14:30 – 14:35	Phase 1 Overview	SGN
14:35 – 14:40	Stakeholder Engagement Approach - Phase 1	Correla
14:40 – 14:45	Checkpoint	All
14:45 – 14:50	Break	All
14:50 – 15:50	Work Package 1 Overview	BIP
15:50 – 16:00	Q&A and Closing Remarks	All

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Ask Questions

Join at
slido.com

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Have you heard about the RTSM programme?

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The Challenge

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The Gas Network

Natural gas combustion for domestic, commercial, and industrial users accounts for around **40% of national GHG emissions**, underscoring the need to decarbonise the sector.

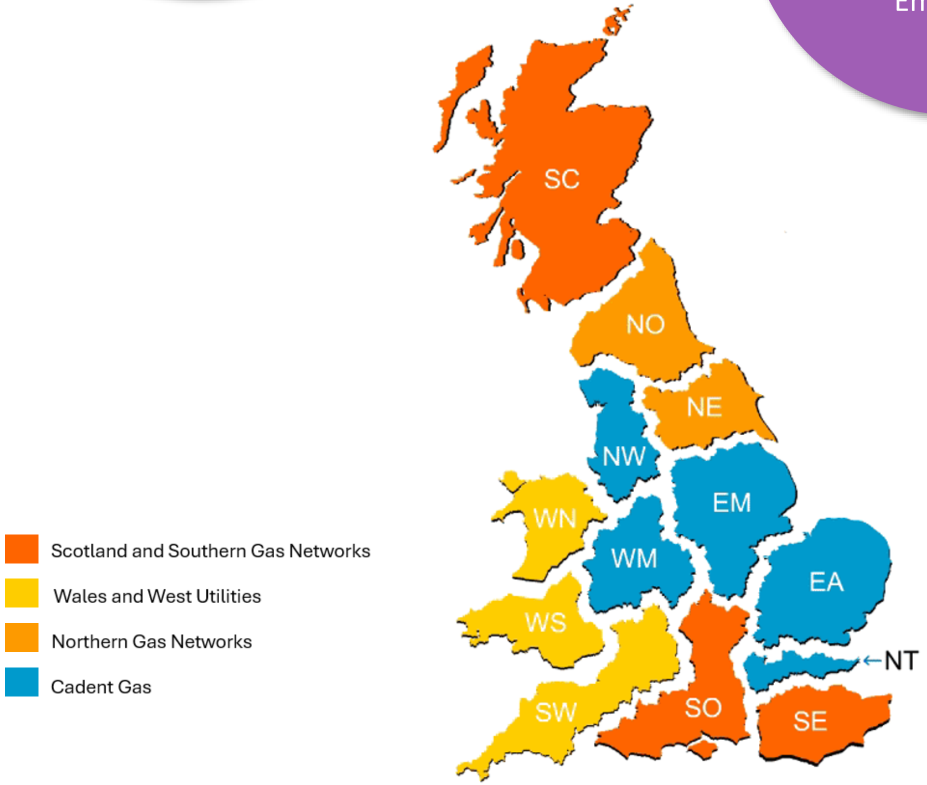
Customers consume gas in **cubic meters**, then this volume is converted to **kWh**, and this is how they are **billed**.

The network is owned and operated by **4 Gas Distribution Networks (GDN)** and **National Gas Transmission (NGT).**

23m
Customers connected to the gas network

13 LDZs*
and 7 SIUs**

40%
National Greenhouse Gas Emissions



*Local Distribution Zone
**Statutory Independent Undertaking – Independent gas networks that are not connected to GDNs main pipeline systems.

Regulations

Gas (Calculation of Thermal Energy) Regulations (GCoTER)

Consumers are billed using the Flow Weighted Average Calorific Value (FWACV) for their LDZ.

FWACV is used to calculate the **average energy content of gas in an LDZ**. It weights CVs by gas flow volume to ensure fair billing.

However, the **maximum allowable difference** between the CV of the gas received and the FWACV used for billing is **capped at 1 MJ/m³** to prevent unbilled energy.

Gas Safety (Management) Regulations (GS(M)R)

Limiting the hydrogen content to ≤0.1% molar.

FWACV Capping and Biomethane

All GDN's currently inject biomethane into the gas network.

To prevent FWACV capping:

- Propane enrichment
- Target CV
  - Stipulate
  - Monitor and control on target CV
- Site-specific CV
- Blending

- Propanation adds significant costs to biomethane producers
- Not economically viable for hydrogen

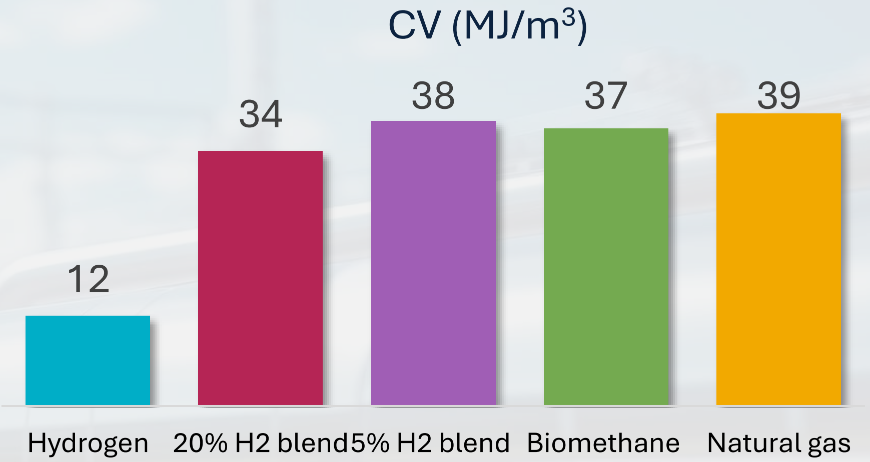
* CV reflects the energy content of a gas (MJ/m³) and is used for billing

Decarbonising Our Network

When exploring green gases that could help us decarbonise the industry, it's evident that the energy content or **Calorific Value (CV)** of these gases vary considerably.

Gases with a higher CV carry more **energy by volume**. This is especially important when we consider how customers pay for gas in our network.

Under the existing framework, biomethane and hydrogen blends are likely to **trigger CV capping** and billing challenges.



How will customers be billed fairly and equitably for their gas usage in a multi-CV system?

Requires a flexible, fit-for-purpose and fair settlement and billing framework

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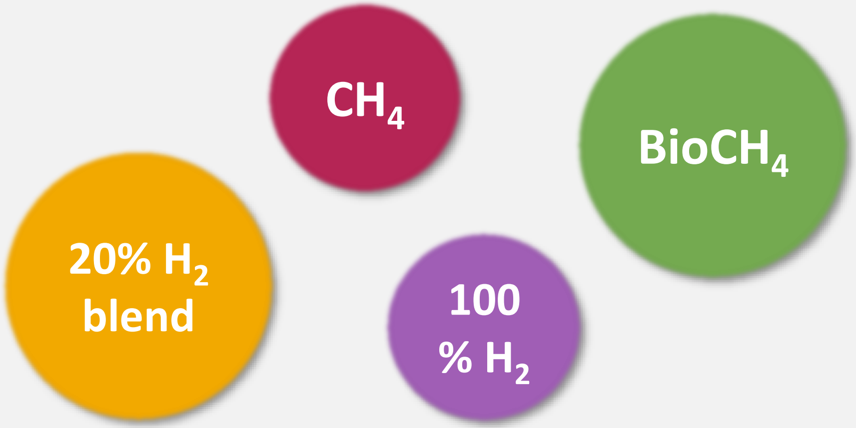
Decarbonising Our Network

Decisions from the government regarding policy change will play a vital role in permitting **increased injection of green gas** in the network.

- In December 2023, the UK government announced support for blending ≤20% hydrogen by volume.
- Various industry consultations are underway and a decision on hydrogen for heating is expected in 2026.

A combination of **gases** are expected as part of the decarbonisation journey

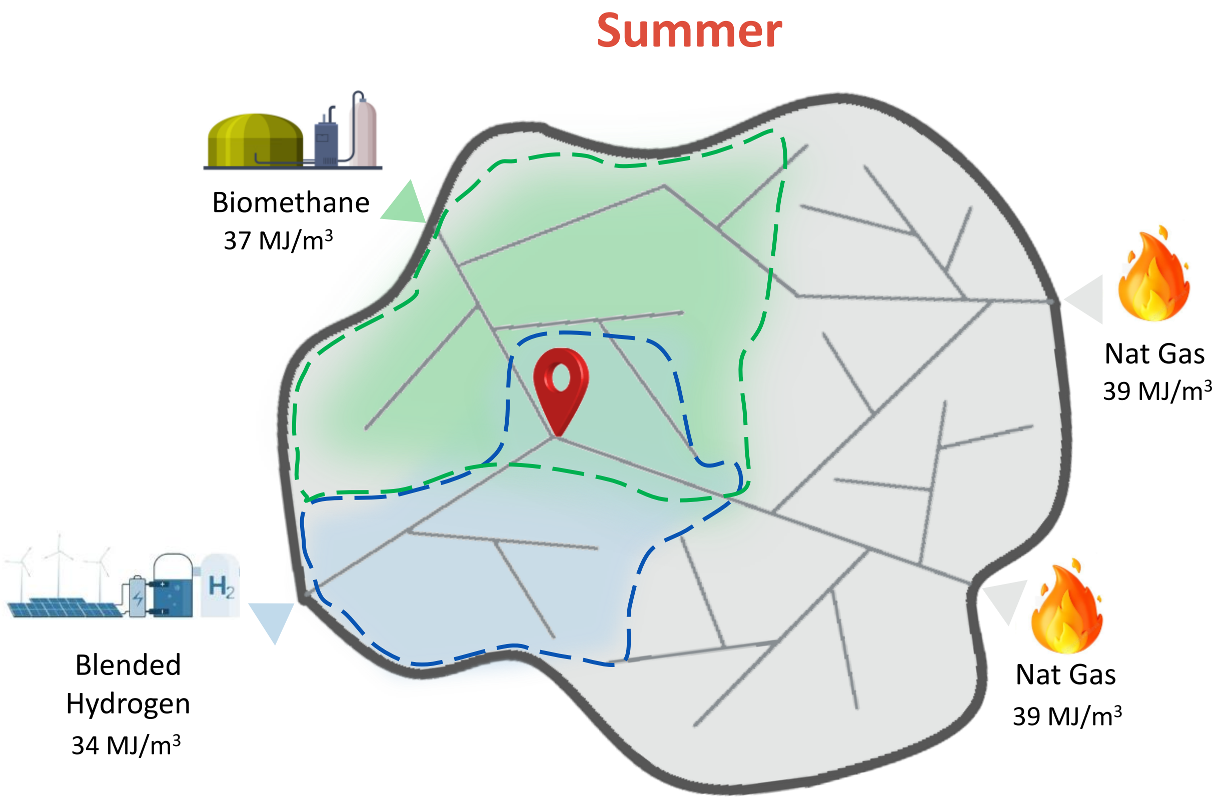


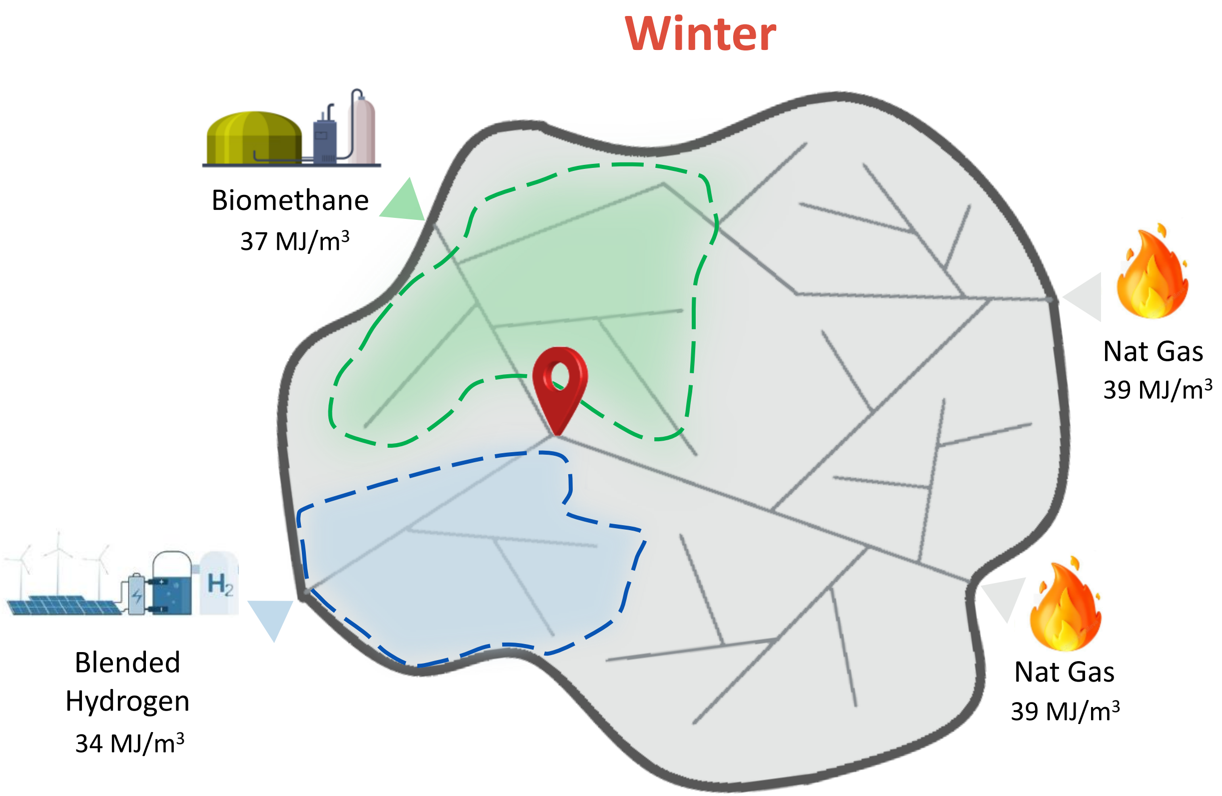
Multi-energy system → Multiple CVs across the network and within LDZs

Transitional stages → To achieve 100% low-carbon gases

Free Market → Dynamic network

Within-Year Gas Demand





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Zone of Influence = the maximum extent that a gas disperses into the network from an injection point.

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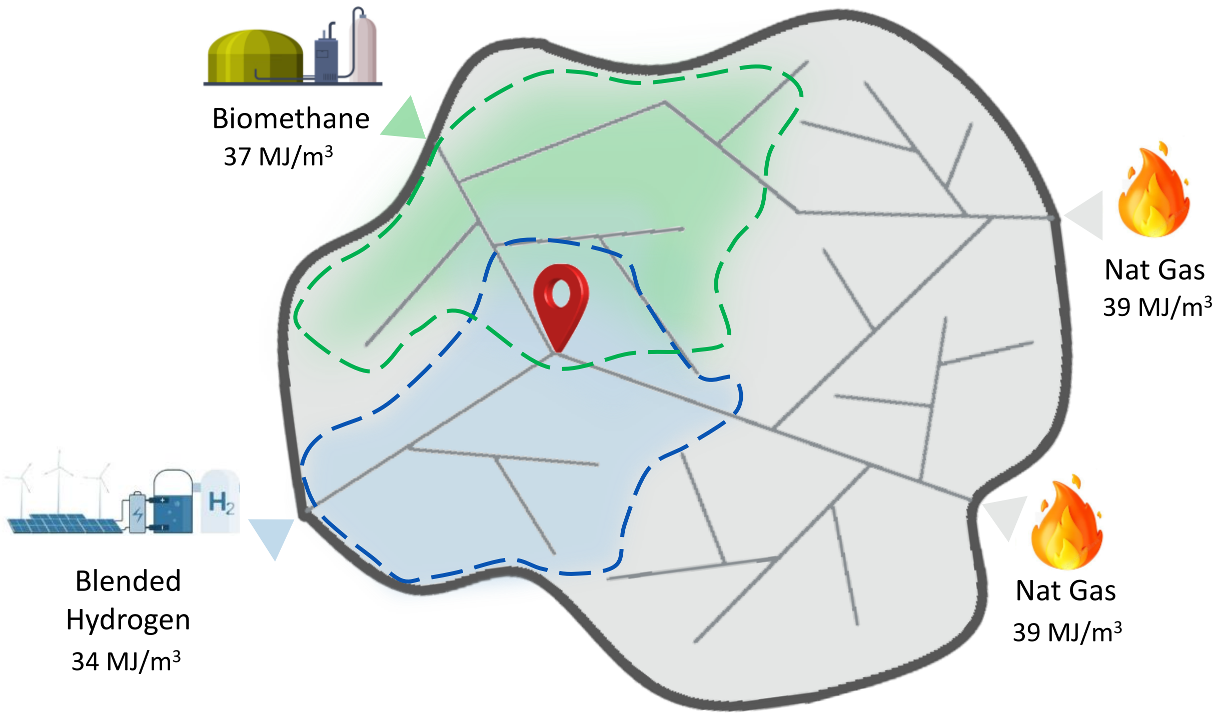
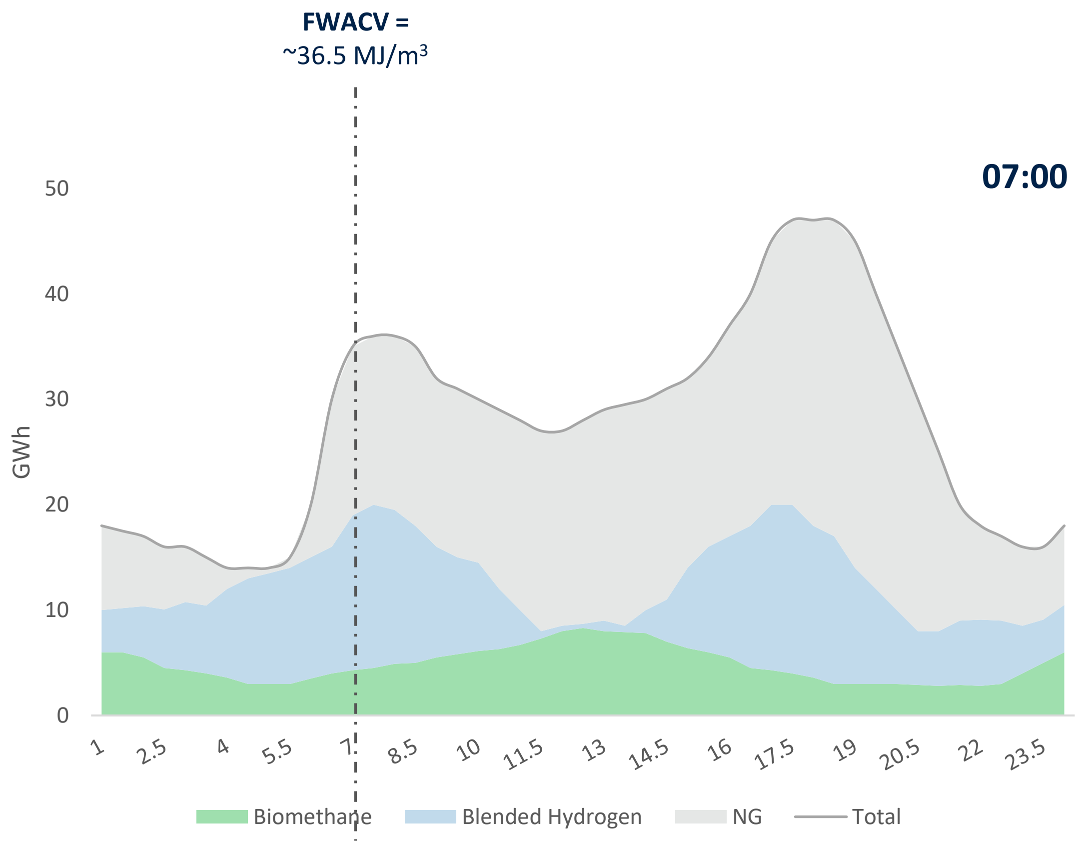
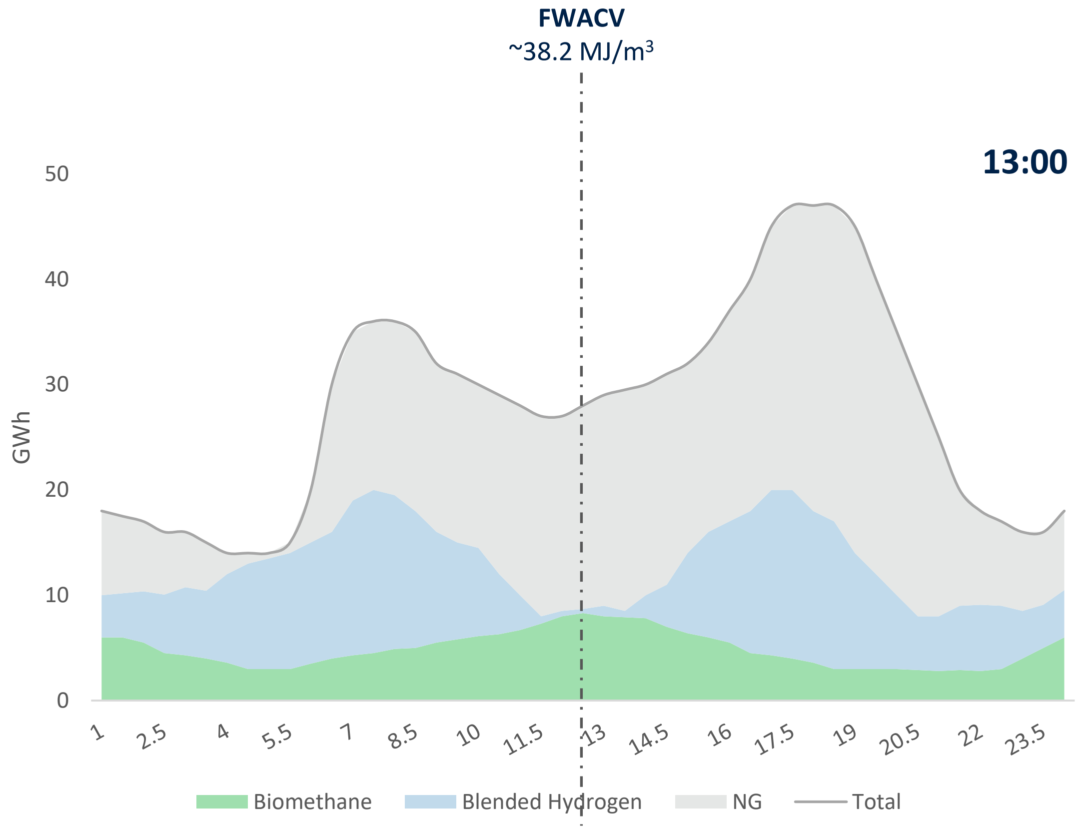
Within-Day Gas Demand





Zone of Influence = the maximum extent that a gas disperses into the network from an injection point.

Within-Day Gas Demand



Zone of Influence = the maximum extent that a gas disperses into the network from an injection point.

Weather
Seasonal demand
Production failure

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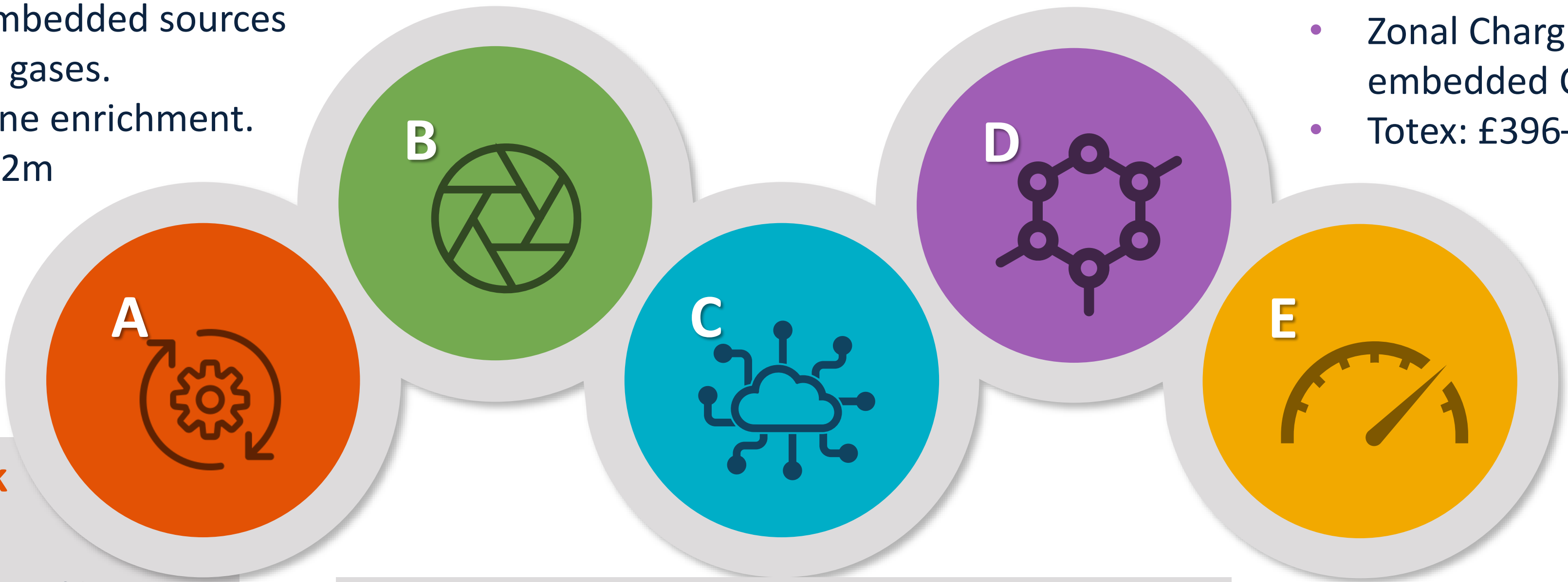
Future Billing Methodology

Recap

Future Billing Methodology

- ‘Proof of Concept’ analysis of 5 future billing options.
- Carried out network modelling analysis, giving confidence to CV prediction.
- Cost Benefit Analysis (CBA) of options suitable for a low-carbon system.
- Industry-wide consultation.

Future Billing Methodology



A. Existing Framework

- First step ≤5% H_2.
- To increase the injection of low-carbon gases we will require a consistent lowering of the FWACV across the network.
- Minimal change and cost.

B. Embedded Zone Charging

- Suitable for embedded sources of low-carbon gases.
- Reduce propane enrichment.
- Totex: £58–162m

C. Online CV Modelling

- CVs and volumes at LDZ offtakes and embedded injection points.
- Processed in a modelling solution
- Attribution of CVs to system nodes.
- Potential for strategic CV measurement points.
- Totex: £ 86–190m

D. Zonal CV Measurement

- Zonal Charging Areas with embedded CV measurement.
- Totex: £396–500m

E. Local CV Measurement

- Local CV measurement at system node level.
- Close to the point of use.
- Totex: £806–910m

Future Billing Methodology

Recommendations:

Implement Option A: GDNs should immediately proceed with developing the minimal changes required to deliver Option A.

Conduct feasibility study for Option C: Working within existing regulations has limitations of scale. Billing reform required to realise full benefits of biomethane & H_2 blending.

RTSM – Phase 1

The RTSM Programme

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Demonstrating an end-to-end system

RTSM Programme

RTSM is building on the outputs of FBM and leveraging existing solutions with the aim of **developing and demonstrating a fit-for-purpose solution** that will enable the characterisation, settlement, and billing process of multi-CV gas across the GB Gas Network

2024

Initial Engagement

Virtual Sessions

Phase 0
3 months
Complete

2024/2025

Phase 1
14 months
In progress

Methodology Development

Market Research

Modelling Solutions

Feasibility Study + Roadmap

Rollout Strategy for demonstration

Dissemination

2026

Front-End Engineering Design

Design, Cost and Risks

Execution strategy for the live trial

Phase 2
7 months

2026/2027

Phase 3
12 months

Pilot Deployment

Test the RTSM solution and make any necessary amendments

2030

Implementation

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RTSM Phase 1 - Overview

Phase 1 – Methodology Development

Objective:

To develop the BoD for a **modelling solution** that accurately determines energy content for **billing and settlement** purposes, assess its **feasibility** through comprehensive economic, technical, and regulatory analysis, and a plan for its seamless **integration and demonstration** across GB.

Nov 2023 — Nov 2025

Tender	Contracting	Development	Dissemination
Complete	Sep 2024	Sep 2024 – Nov 2025	Aug - Nov 2025

Scope:

- **WP1 (BIP) Market research** to identify existing solutions.
- **WP2 (Correla)** Develop the **Basis of Design** of a fit-for-purpose modelling solution.
- **WP3a (BIP) Feasibility study:** economic, technical, regulatory and operational.
- **WP3b (BIP) Roadmap** for a seamless integration across GB.
- **WP4 (BIP) Rollout strategy** to assess the requirements for a potential demonstration.
- **WP5 (Both)** Dissemination.

Project Delivery:

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Phase 1 - Project Partners

Project Lead:

SGN

Project Sponsors:

WALES&WEST UTILITIES

Northern Gas Networks

Project Supporters:

Cadent

national gas transmission

NESO National Energy System Operator

XOSERVE

ofgem

Department for Energy Security & Net Zero

RTSM Phase 1 Project Delivery:

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Stakeholder Engagement Approach

Stakeholder Engagement

- We are hosting targeted engagement sessions throughout Phase 1 to share findings from a desktop study exploring the feasibility of future changes to calorific value processes that support increased uptake of green gases.
- These sessions invite input from stakeholders involved in the full settlement and billing process to help shape a solution that meets industry needs and supports gas network decarbonisation.
- During 2024, SGN and Xoserve provided introductory presentations on RTSM to key stakeholders.
- Earlier this year, Correla and BIP attended numerous existing scheduled industry meetings to give updates on RTSM Phase 1.

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Stakeholder Engagement Approach

- One workshop for all stakeholders. This will help with discussions with different parties and help to draw out and identify any stakeholder concerns, insights etc.

- This approach will provide consistency throughout RTSM Phase 1, sufficient time to deliver information & stakeholder interaction to gain valuable feedback, particularly around:
  - The proposed solution
  - Potential impacts to stakeholders
  - Assumptions
  - roadmap for implementation
  - Insights into the potential trial

- We would like Stakeholders to raise any recommendations for future phases. These will be captured on a log and fed into the Programme.

- SGN RTSM website set up which will provide updates & material presented in meetings.

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Meeting Format and Intended Audience

- Monthly on the 4th Tuesday of the month, 2-4 pm
- Four meetings are planned for Phase 1. More meetings will be scheduled once Phase 2 timetable is finalised.
- SGN will chair the meetings, Correla & BIP will present findings from Work Packages delivered.
- The desired attendees are industry Stakeholders, e.g. Gas Shippers, Suppliers, Independent Gas Transporters, industry representatives and trade/consumer bodies, especially those who are involved in gas billing, settlement and gas nomination/balancing activities (*Ofgem and all the Gas Networks are already involved in the Programme*)

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Objective & Output from Meetings

- Objective
  - To provide stakeholders with the aim of the programme & to provide an update on progress
  - Collaboration with key stakeholders.
  - Raise awareness of the issues and challenges
  - Address concerns and to foster active feedback & insights

- Output:
  - Meeting notes, actions & material presented will be published 5 business days post the meeting at RTSM and Xoserve RTSM.
  - Action log will be maintained and presented during the meeting.
  - Insights, concerns & feedback will be captured, maintained & fed into the programme.

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Proposed Agenda for Future Meetings

- Session 2, 23rd September : WP2 Deep Dive:
    - Recap of Session one
    - Present findings from Work Package 2
    - Q&A
- Session 3, 28th October : WP3 Deep Dive
    - Recap of session two
    - Present findings from Work Package 3
    - Q&A
- Session 4, 25th November : WP4 Deep Dive
    - Recap of session three
    - Present findings from Work Package 4
    - Q&A

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Checkpoint

Any Questions?

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Break

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5 minutes (14:50)

Work Package 1 - Market Research

Overview of key WP1 activities

	1. GAS NETWORKS ASSESSMENT	2. MODELING OPTIONS SEGMENTATION	3. FIT FOR PURPOSE ASSESSMENT	4. RECOMMENDATIONS
Objective	› **Assessment of EU multi-energy gas network systems**	› **Mapping of modelling options based on complexity & accuracy**	› **Fit for purpose analysis based on the transitional stage of GB's gas network**	› **Provide recommendations to GB gas networks on the modelling options to adopt**
Key activities	› Identification of EU gas network that foresee the integration of green gases › Mapping of EU TSOs and DSOs targets for green gas blending › Assessment of the UK's positioning based on the transitional stage of its gas network	› Conduct research on annual reports of players identified in Phase 1 › Perform interviews and distribute questionnaires to selected players › Assess available modelling options	› Compare gas networks and modelling strategies identified in › Development of a fitting model to identify the best solution for SGN › Assess feasibility, effectiveness and risks for implementation › Gap analysis to identify potential requirement	› Summarize the main evidence from the fit for purpose analysis, assumptions, risks and scenarios

Gas Network Assessment

Market Research

Objective:
To conduct an analysis on how global gas network operators are addressing hydrogen and biomethane blending and related implications on CV variation to ensure a fair billing and settlement and provide useful insights for the RTSM Programme.

Players analysed

Rest of the world

Interviewed players

Market Research | Key findings

1

Few comparable projects

Currently most of the blending projects are focused on hydrogen compatibility with existing gas network rather than on CV tracking for billing and settlement

2

Transparency and accuracy

Critical requirements for the adoption of a CV tracking model for billing and settlement are related to the level of accuracy and transparency toward final costumers

3

Different approaches

Alternatively to CV tracking, some players suggested the installation of CV meter devices or the injection of synthetic methane to integrate hydrogen in the network

The Real Time Settlement Methodology Programme is one of the most innovative project addressing the implications of high CV variations, resulting from the injection of low carbon gases, on the billing and settlement processes.

The Green Pipeline Project by Floene will adopt a software solution for CV tracking to ensure fair billing to end costumers.

Players involved	Description
FLOENE DISTRIBUÍMOS ENERGIAS DE FUTURO	**The Green Pipeline Project** is a pioneering initiative introducing Green Hydrogen into Portugal's gas network. Launched in Seixal, **it serves 82 customers with an initial 2% hydrogen blend, set to increase to 20%**

Key objectives

The Natural Energy of Hydrogen **aims to assess the impact of hydrogen injection on gas distribution and consumer heating systems**.

- Polyethylene (PE) network behaviour with 100% Hydrogen
- Suitability of H2/NG mixing controls
- Operational procedures for H2/NG transport
- **Methods for energy billing and balancing**
- Performance of consumer appliances like stoves and boilers

Approach to CV estimation	Gas CVs will be **simulated through the adoption of a CFD simulation software**. The Portuguese regulator has **approved the use of estimated CV for billing purposes**
Key modelling features	› Hourly CV estimation › Daily simulation of the day before is performed › GIS and SCADA data integration › Maximum 2% margin of error expected in CV estimate › Nodes aggregation, where feasible, to simplify calculations while maintaining accuracy
Results	Results and feedback on software performances are expected **from Q1 2025**

The live trial started in Q1 2025, and initial results will be shared by the end of the 2025.

Gas Network Assessment | Key Take Away

- **Strategy: Different approaches** to hydrogen have been observed: creation of **dedicated pipelines**, injection of **synthetic methane**, installation of **smart meter** capable of measuring CVs, adoption of **CV tracking models**

- **Pilots:** Most of the blending projects are not focused on CV tracking but on **material compatibility**

- **Portugal:** the Portuguese network operators (REN, Floene) are developing **comparable projects that provide useful insights**

- **CV tracking requirements**: many operators have expressed the need to ensure a **high level of transparency of the CV modelling** mainly toward final costumers

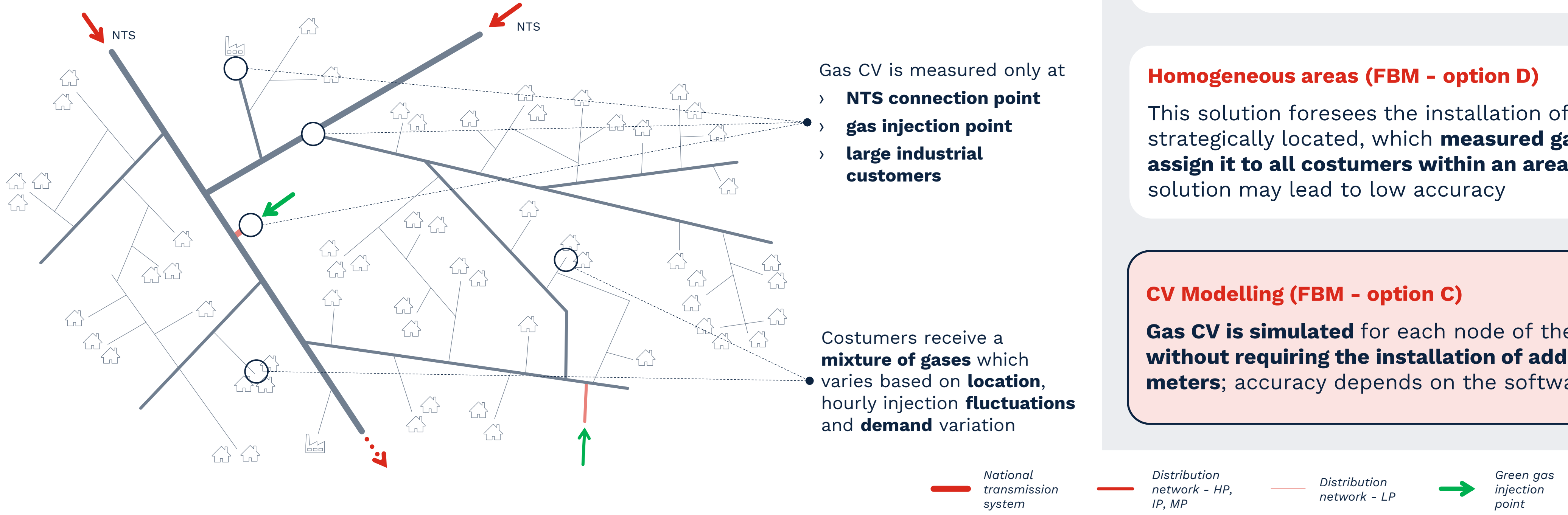
Modelling option segmentation

The need for CV tracking

Overview of CV tracking problem

- **Multiple gas injection points with different CVs**
- Renewable gases **injection in *HP, IP, MP*.**
- **Fluctuations** in green gas injection
- **A lack of smart meters and CV measurement devices**

- Customers will require **different gas volume for the same energy need;**
- Billing should be based on **energy consumption** not on volume
- **CV tracking** becomes critical for **fair billing and settlement**



Alternative solutions

The problem of gas quality tracking can be solved through different approaches:

Extensive installation of CV meters (FBM - option E)

This solution guarantees the **highest level of accuracy**, but it's not viable due to **high costs and maintenance required**

Homogeneous areas (FBM - option D)

This solution foresees the installation of few meters, strategically located, which **measured gas CV and assign it to all costumers within an area**; this solution may lead to low accuracy

CV Modelling (FBM - option C)

Gas CV is simulated for each node of the network **without requiring the installation of additional meters**; accuracy depends on the software adopted.

Key Requirements for the Desired Solution

Input integration

The proposed solution should be integrated with existing systems which will provide input data required to perform the simulation

SCADA & Telemetry
- Pressure
- Volumetric flow
- Gas CV

GIS
- Network topology
- Asset location
- Pipe diameter

Gas demand
- Measured volume for daily metered
- Hourly gas demand estimation for NDM* costumers

CV simulation software

The new software should be able to estimate the calorific value of the gas mixture for each delivery point of the network

Software features
- *Modelling option*: CFD, Machine Learning, Hybrid
- *Gas flow*: Steady state vs Unsteady representation
- *Gas flow*: Uniform vs Non-Uniform representation
- *Pipe representation*: 1D vs 3D modelling

Settlement & Billing Integration

The output of the model (CVs) should be integrated with the current billing and settlement systems to account for the energy balance

Settlement
CVs must be provided daily at distribution zone level

Billing
The CVs for each delivery point should be provided for the period of the readings

Key requirements

Topology data	The model requires reliable GIS data to replicate the network topology
SCADA & Telemetry data	The model should integrate data from SCADA and Telemetry with the time resolution available
Transparency	As the purpose of the model is settlement and billing, transparency of the result is a key aspect
Accuracy test	The adoption of CV modelling implies the use of a simulated CV instead of a measured CV; accuracy level is therefore a critical factor
Adaptability	The model should be able to adapt to network changes (new injection point, new infrastructures, demand variation, maintenance, gas escapes etc.)
Billing & Settlement integration	Ultimately, the model should be integrated into a billing and settlement process

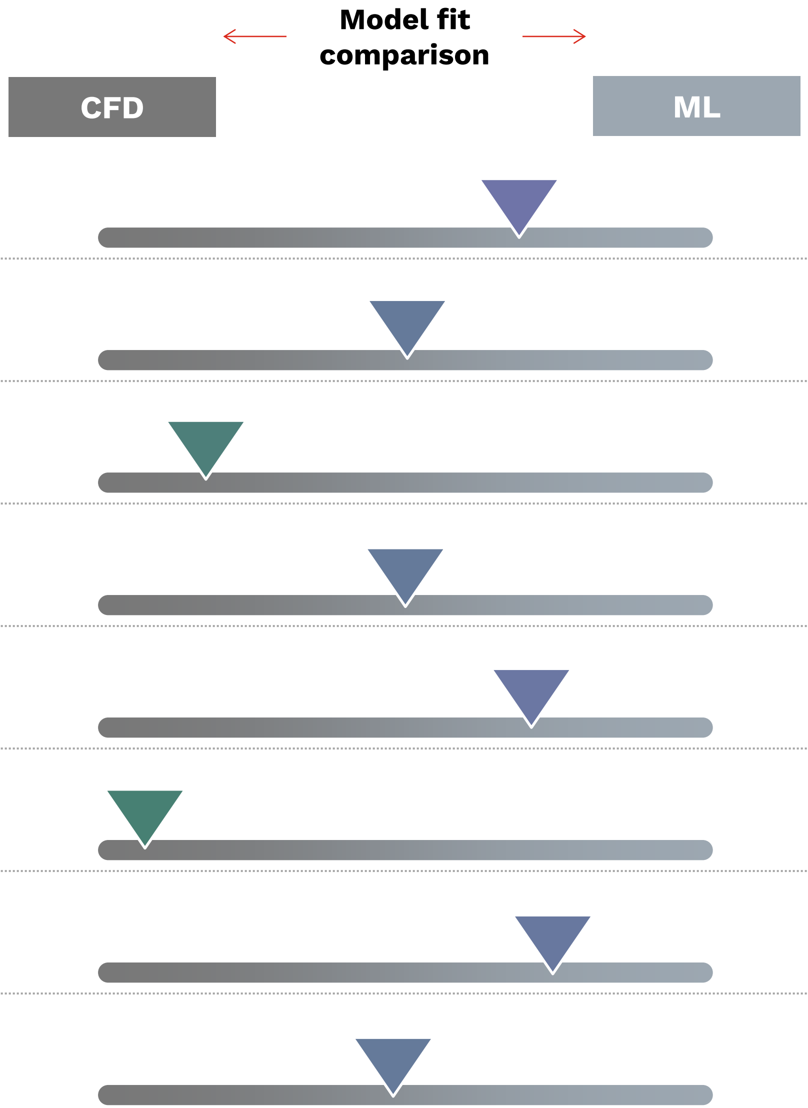
*Non-daily-metered

Comparison of alternative models

	Description	Pros	Cons
CFD Models	**Physics-based simulations** that **rely on fluid dynamic equation** (i.e. the Navier-Stokes), to predict fluid behaviour	• **Easy formulation:** simulation is based on **well known formulas** that govern fluid dynamic • **Diffusion:** CFD models are the **most used solutions** in the market • **Transparency**: it is possible to **demonstrate** the resulting customer billing	• **Topology representation: high implementation time** due to preliminary activity for topology design • **Input data:** if **input data** from SCADA and network topology are **not reliable and consistent** the model does not perform correctly • **Granularity**: the simulation of CVs for each **delivery point requires huge computational resources** (!)
Machine Learning Models	Learn patterns and make predictions or classifications from data without explicit programming. They excel at capturing **complex, non-linear relationships** and identifying hidden patterns	• **Model development:** the development of the model requires **short time** • **Fast: much easier and faster** to run and compute the CV	• **Transparency:** ML models are a "black box" - the **correlation between input and output** is not demonstrable; • **Model training:** the model should be trained to replicate several scenarios in gas networks and no historical data are available; **its reliability under different conditions it's not guaranteed** (!)
Stochastic Models	**Incorporate random variables and probabilistic distributions** to account for uncertainty and variability in the systems they represent.	• **Fast deployment:** doesn't require to develop a mathematical model or to train the model • **Few data required:** less data are required **compared to machine learning** • **Reliability:** results are given in a **range of probability**	• **Data availability: lack of sufficient historical data** • **Flexibility:** if conditions changes, historical data become useless • **Range**: solution it's **not uniquely defined**, but a range with a specific probability is given *For such reasons, stochastic models alone do not represent a viable solution, while they can be coupled with other model to test their reliability.* (!)
Hybrid Approach	**Combines the strengths of different modelling techniques**, such as physics-based models and data-driven methods.	• **Low data dependency:** exploitation of fluid dynamic laws that regulates gas behavior • **Input data:** able to **adapt to inconsistent input** data	• **Model Complexity:** integration of CFD and Machine Learning models

(!) *Attention point*

CFD vs Machine Learning



		Considerations
Input	Data availability and reliability	While ML models don't require topology details and are able to "clean" SCADA data, **CFD** models require **accurate and reliable input data to perform correctly**
	Data integration	**Independently** from the solution identified, data **integration capabilities should be developed**
Model solution	Modelling solution	In the design phase **ML models require a large dataset for training**, while CFD relies on mathematics
	Time resolution	**Independently** from the solution identified, the best time resolution should be defined for billing purposes
	Granularity	As less data have to be managed, **ML models allow for higher efficiency** if granularity increases
	Transparency (!)	While **ML models are "black box"**, CFD simulations allow to demonstrate the **correlation between input and output**
	Computational resources	**ML models are more efficient** in terms of computational resources required
Output	Billing system integration	**Independently** from the solution identified, the integration with the billing and settlement system **should be designed**

(!) *Key requirement*

Hybrid Models

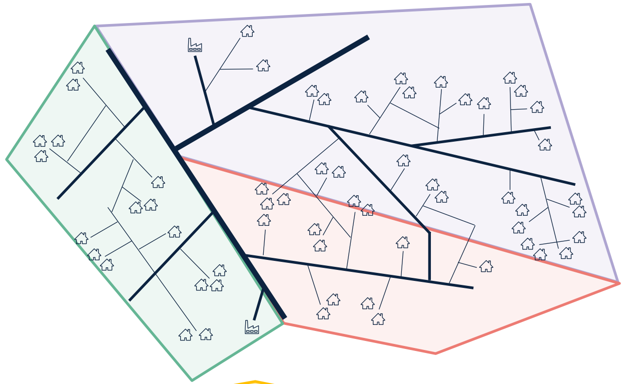
Phase	Phase	Activity	ML
Design	*Improving topology import*	Machine Learning allows to **overcome possible issues of inconsistent topology data**	✓
Operation	*Completing missing data*	Machine Learning model can be adopted to **simulate daily and hourly demand** which is provided as input to the CFD model	✓
Operation	*Fixing anomalies*	Machine Learning could be deployed to **identify anomalies in input data** and improve the quality of data input in the model	✓
Operation	*CV estimation*	The **CVs simulation is performed by the CFD model**, fluid dynamic formulas are applied to be consistent with the physic phenomenon	
Operation	*Sensitivity & accuracy*	ML may support the **development of sensitivity analysis** and scenarios to guarantee the development of a more consistent and reliable modelling	✓

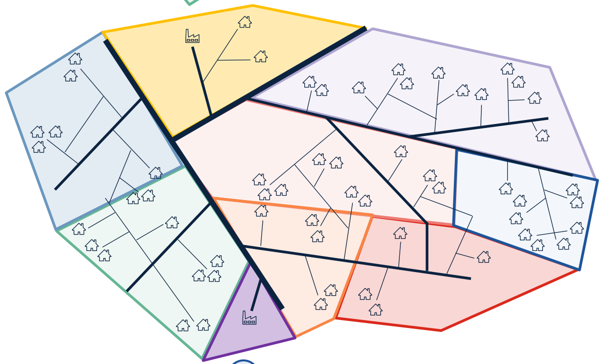
Modelling options segmentation – key takeaways

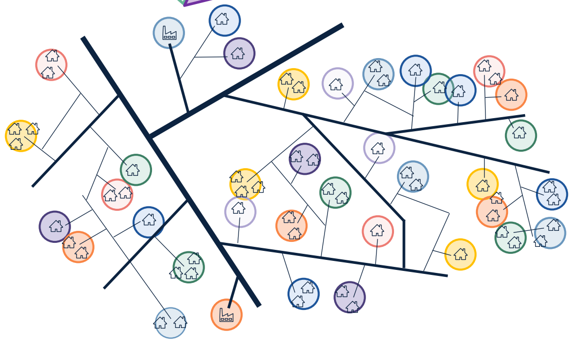
- **Integration with existing systems:** The proposed solution for CV modelling should be **integrated with SCADA, telemetry, GIS** to collect input data for the network simulation
- **ML models:** ML solutions offer **higher performances** but historical data for building the model are not available **and transparency on CV determination is a key issue**
- **CFD models:** **CFD models are preferred compared to ML** since they are the standard in the market and **ensure transparency** on the calculation of CV
- **Hybrid approach**: CFD modelling solution could be **combine with ML model**, which can be deployed for **data cleaning and error fixing**

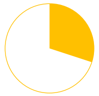
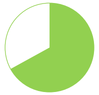
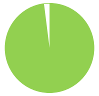
Fit for Purpose Assessment

Node Granularity







		#CVs calculation	Computational requirement	Accuracy
1	The CV is computed at **macro area level.** This approach implies the identification of **homogeneous area within the local network** for which the same value is assigned; this approach may reduce the accuracy of the calculation.	***x10s***	**Low**	
2	The CV is computed at **strategic nodes.** It requires the identification of the strategic nodes and the assignment of the **same CV to all the meters directly linked to it.**	***x1,000s***	**Medium**	
3	The CV is computed at **each delivery point.** This approach computes a **different CV for each customers**. It provides high level of detail and accuracy but requires huge computational power.	***x10,000,000s***	**High**	

Areas may be defined based on **network topology or political boundaries**

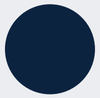
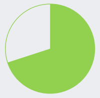
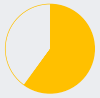
High numerosity of CVs implies the need **to manage huge amount of data** by the parties involved

Mixed approach
It is also possible to mix different granularity to **reduce complexity**: **areas particularly interested by renewable gases injection can be modelled with high detail** while areas not affected can be modelled as homogeneous zones.

Low *Medium* *High*

Time resolution

Time resolution

Time resolution[1]	*Accuracy*	*Computational capacity*
Less than an hour Not advised due to the high computational cost and **limited added value compared to hourly** resolution.		
Hourly resolution Optimal compromise for **capturing intraday fluctuations,** without overwhelming computational resources. However, **hourly demand profiles are not available.**		
Daily resolution **Currently used for settlement processes.** It offers a practical approach with reasonable accuracy and low computational cost.		

When is the simulation performed ?

Monthly: **Monthly intervals are suitable for billing but not for settlement.** The billing process occurs monthly; moreover, data from NDM points are not available daily.

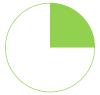
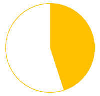
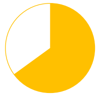
Daily: **Daily runs are required to perform the settlement process. On day D**[2], the process **simulates the activities of D-1**. Preliminary simulation for billing must be adjusted monthly based on measured data.

Real time - *hourly*: Real time simulation implies **high complexity and is not strictly necessary** for billing and settlement (it may be more useful for network monitoring instead). Moreover, **not all data are often available hourly.**

1) Gas demand at each delivery point should be provided with the same time resolution adopted to run the model. Where demand is not known standard profiles could be used
2) Day D = Today

Low *Medium* *High*

Impact on regulations and process

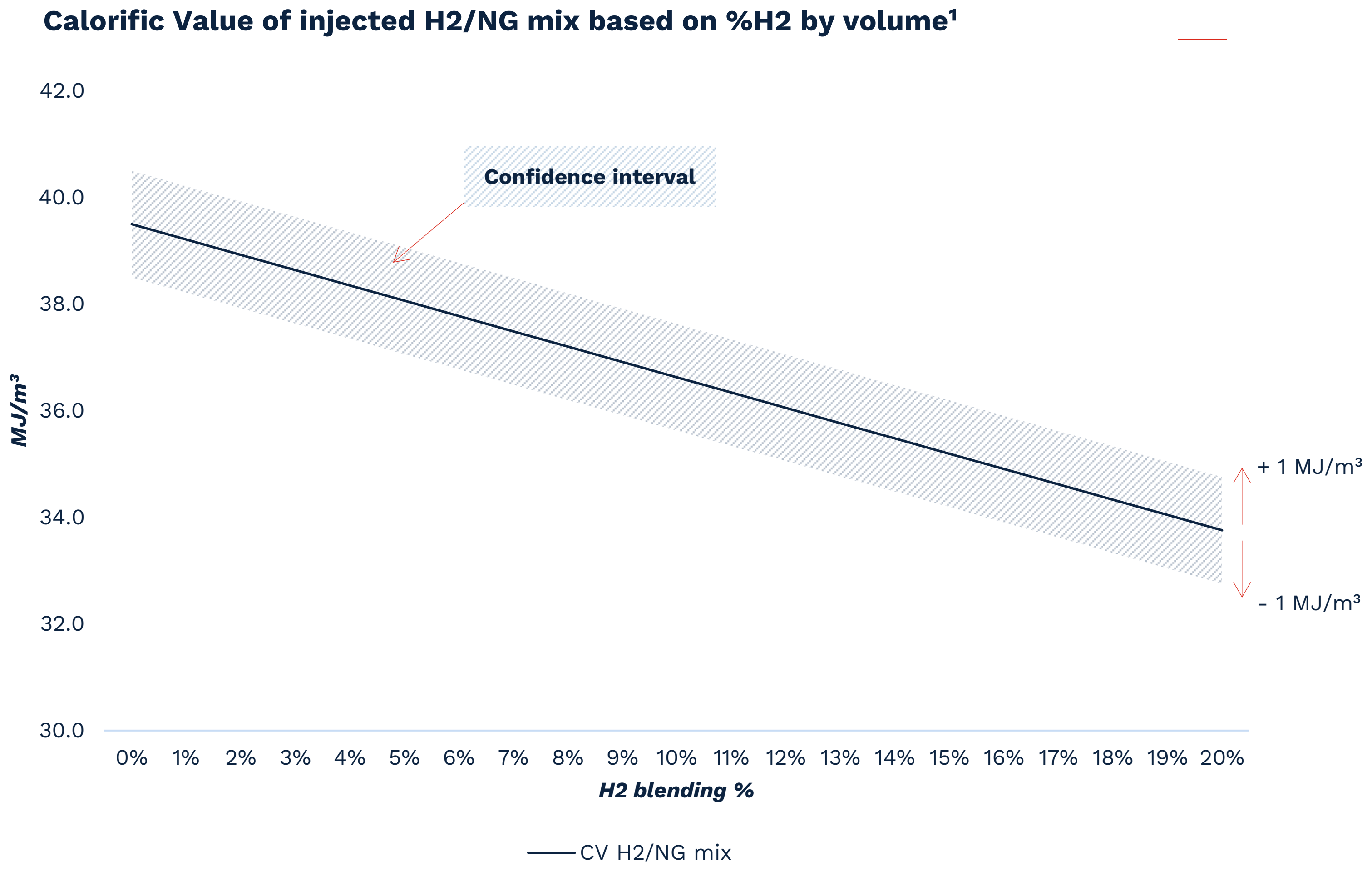
Topic	Current situation	Future scenario	Impact	Possible approach	Change readiness
Wobbe Index	Gas Safety (Management) Regulations limits the Wobbe Index between 46.5 MJ/m^3 and 51.41 MJ/m^3	Renewable gases with **varying CVs** will be injected into the network	The current regulations **don't allow the injection of hydrogen above 0.1%**	**Update of the regulation**; predicted 3-5 years is a sufficient time span to develop a regulation	
FWACV CAP	Gas Calculation of Thermal Energy Regulations (GCoTER) caps the network FWACV[1] at 1 MJ/m^3 above the lowest source CV	CVs of the injected gases will **vary significantly across a broad spectrum**	It is essential **to move beyond the current FWACV[1]** calculation method and the associated network cap, limited to 1 MJ/m^3 above the lowest source CV	**Update of the regulation**; predicted 3-5 years is a sufficient time span to develop a regulation	
CV determination	CVs are measured at entry points and offtakes	With the implementation of a simulation model, **CVs will be estimated, not measured**	**Lower accuracy** of the simulated CVs and consequent billing **may be perceived**, leading to **low acceptance** by costumers and regulator	**Acceptance of the use of simulated CV** for billing purposes, in a range of accuracy	
CV numerosity	13 daily CVs, one for each Local Distribution Zone, are provided to gas suppliers	**Multiple CVs** within a single Local Distribution Zone will be identified	**Higher complexity in data handling** and operations for CDSP, shippers and suppliers	**Automation** should be implemented to ensure the correct CV to each gas supplier	

Low complexity in managing impacts

High complexity in managing impacts

[1]Flow Weighted Average CV
[2]Central Data Service Provider

Target accuracy and margin of error of the modelling solution



Using the current FWACV methodology and a GCoTER cap of 1 MJ/m³ above the lowest source CV, **the injection of H_2 blends at concentrations higher than 4% leads to an underestimation of the delivered energy**, thereby creating a market distortion.

The possibility of **accepting a CV that is at most ±1 MJ/m³** from the actual value should be discussed with the **regulator**. This would result in a **target model accuracy of 2.5%.**

Although no real-world applications have been observed yet, **software providers anticipate an expected margin of error below 2%.**

*If we also include the margin of error of CVDDs (0,26%) the target accuracy of the model results in **2,2%**. However, **the margin of error of CVDDs device is already integrated in the current calculation** of CV and FWACV, thus we may consider it as non-differential*

[1]Assuming Natural Gas CV equal to 39,5 MJ/m³

Software solutions assessment | Methodology

1. Selection of relevant SW solutions

*Scouting of the main software solutions adopted at **European level and worldwide** for gas flow simulations*

2. RFI development

*Definition of **key questions** to evaluate the solutions identified in the Request for Information (RFI)*

3. Interviews and RFI submission

*Conduct interviews with software providers and submit the RFI, to gather valuable **information on modelling alternatives***

4. Assessment and scoring model

*Assessment of the **suitability of various software solutions** for simulating CVs for billing purposes*

Software solutions assessment | Players analysed

Selection of providers	HQ	Model adopted	CV tracking	Real world application[1]	Global presence	Currently used in UK
SmartSim	Germany	CFD	✓	✓	◑	✗
SIMONE Research Group	Germany	CFD	✓	✓	●	✓
DCbrain	France	Hybrid[2]	✓	✓	◔	✗
hr wallingford	UK	CFD	✗	✗	◔	✗
DNV·GL	Norway	Hybrid	✓	✗	◕	✓
ATMOS International	UK	Hybrid	✓	✗	◑	✗
Schneider Electric	France	Hybrid	✓	✗	◑	✓
EMERSON	USA	Hybrid	✓	✗	◑	✗

[1]*Software adopted for CV simulation in context of green gas injection*
[2]*Hybrid models combine CFD or hydraulic model with Machine Learning*

Shortlist of vendors

Macro category	Subcategory	Indicator	Description
Suitability based on requirements ***85%***	**Data input integration - 20%**	GIS integration *(40%)*	Fast and automatic integration of GIS data Automatic topology correction
		SCADA integration *(50%)*	Real-time data update frequency and latency. Support for diverse protocols (OPC, MQTT..)
		Other data integration *(10%)*	Weather and environmental data integration, demand forecasting, IoT data support
	CV Modelling - 40%	CV Calculation *(40%)*	Flexibility in CV calculation points (e.g., inlets, nodes, outlets). Ability to handle gas blends
		Transparency *(20%)*	Availability of detailed calculation methodologies.
		Accuracy test *(15%)*	Built-in tools for calibration and tuning. Validation mechanisms against real-world
		Scalability *(10%)*	Ability to expand models with minimal performance impact.
		Scenario Analysis *(5%)*	Support for diverse scenarios simulation. Sandbox environments for safe scenario testing
		Computational capability *(10%)*	Calculation lead time and reliability. Hardware requirements (e.g., local servers, cloud, GPUs).
	Output integration - 15%	Usability & visualization *(35%)*	Intuitive user interfaces for operators. Real-time graphical representation and export options
		Billing integration *(65%)*	Seamless integration with billing systems (e.g., APIs). Adherence to local regulations
	Security and compliance - 10%	Regulatory compliance *(50%)*	Adherence to ISO standards. Compatibility with Gas Safety Management Regulations.
		Cybersecurity *(50%)*	Data encryption, access control, and intrusion prevention mechanisms.
Market presence and readiness ***15%***	**Experience and market presence - 45%**		Track record in the gas industry. Adoption by key players (e.g., UK DSOs, TSOs).
	References & validation - 55%		Renewable gases case studies and pilot projects demonstrating software's performance

Shortlist

Following the analysis conducted in WP1, a shortlist of software providers has been further investigated in WP3

Fit for purpose | Key Take Away

- **Node Granularity:** the **trade-off between model accuracy and node granularity** for CV calculation must be optimized
- **Time resolution:** real time simulation is not strictly necessary for billing, while **hourly resolution offers a good level of accuracy**
- **Regulations:** the shift **from a measured CV to a simulated CV** requires acceptancy from a regulatory point of view
- **CV numerosity:** a **larger number of CVs and charging areas** may be identified compared to the current situation, which will result **in higher complexity** for all the players involved in billing and settlement
- **Vendors:** based on the analysis, a **shortlist of vendors** has been identified and will be **further explored in WP3**

Recommendations

Key take away from WP1

Modelling options
A hybrid model that combines CFDs for simulation, and Machine Learning for demand estimation and data cleaning represents the optimal solution. This approach effectively balances **transparency, accuracy, and reliability.**

Time resolution
Daily resolution is sufficient for **settlement** purposes, while **hourly resolution** is more appropriate for **billing**.

Node granularity
Calculations at the delivery point level are possible but may **lead to challenges** in managing and exchanging large volumes of data.
Node-level calculations are a **viable alternative**, as **accuracy is not expected to be significantly impacted**.

Regulation update
The increased injection of green gasses and adoption of a modelled CV solution may require changes to key legislation such as GS(M)R, GCoTER and UNC.
Further in-depth analysis will be presented in WP2 – Modelling Solution and WP3 – Feasibility Study

Market overview
Network operators adopt **various strategies for integrating renewable gases** (100% H_2, biomethane, 20% H_2 blend, e-CH_4, smart meters). From a modelling perspective, **most software solutions are either CFD-based or hybrid;** only **a few comparable pilot projects** have been observed in Europe.

Q&A

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Next Session

23rd September 14:00 – 16:00

WP2: Modelling Solution

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Useful Links

- **RTSM (SGN webpage):** https://www.sgn.co.uk/about-us/future-of-gas/rtsm-programme
- **RTSM (XoServe webpage)** - https://www.xoserve.com/decarbonisation/decarbonising-gas/decarbonisation-knowledge-centre/real-time-settlement-methodology-rtsm/
- **Future Billing Methodology**: https://www.xoserve.com/decarbonisation/decarbonising-gas/future-billing-methodology-project/
- https://www.xoserve.com/media/15dp3jfe/rtsm-network-scenarios.pdf
- https://smarter.energynetworks.org/projects/nia2_sgn0046/

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