HYDROGEN BLENDING AND THE GAS COMMERCIAL FRAMEWORK

Annex D

September 2020

These slides were developed in the course of undertaking the project and were used as working papers to facilitate discussion and analysis with various stakeholder groups. The slides were subsequently edited and iterated with stakeholders. However, the key substantive conclusions of our assessment are contained within the main report.

Contents

Our process for identifying the areas of change required to enable hydrogen blending

1 Detailed issues and challenges

We identified a full set of issues associated with the commercial framework that would need to be addressed to enable hydrogen blending across a wide range of circumstances

(see Annex of this slide pack)

2 Synthesis

- We identified issues that need to be addressed to enable hydrogen blending under a set of baseline circumstances…
- …and issues which may only arise under certain future circumstances; are of lower materiality; or require a technical solution.

Issues that need to be solved to enable the introduction of hydrogen blending in the near term

See numbered long list of issues in annex for more detail.

Area	Issue	Issue no.
Connections	how to ensure that the rules and charging methodology create a level playing field for hydrogen producers connected to transmission and distribution networks as well as across GDNs?	2, 3
Connections	how to ensure charges are cost-reflective and facilitate effective competition in a hydrogen blended system?	5
Connections	how is network capacity allocated to hydrogen producers?	4
System operation and dispatch	how is the hydrogen blend kept within the blend limit?	7, 8, 9, 13, 14, 15
System operation and dispatch	how are any specific gas requirements of certain user types managed?	16
Network pricing	how to ensure charges are cost-reflective and facilitate effective competition in a hydrogen blended system?	21, 23
Additional technical issue	Gas quality regulations may need to be adjusted to allow hydrogen blends into the system	12

This is a technical issue and therefore, we do not consider solutions to it as part of this project. We will note it in the roadmap.

Issues that might need to be solved under certain future scenarios

Connections	▪ how to ensure that the rules and charging methodology create a level playing field for hydrogen producers connected to transmission and distribution networks as well as across GDNs?	2, 3
	▪ how to ensure charges are cost-reflective and facilitate effective competition in a hydrogen blended system?	5
	▪ should there be locational signals for H2 injections (via connections)?	5
	▪ how is network capacity allocated to hydrogen producers?	4
System operation and dispatch	▪ how is the hydrogen blend kept within the blend limit?	7, 8, 9, 13, 14, 15
	▪ who should be the SO?	6, 11, 18
	▪ how are any specific gas requirements of certain user types managed?	16
Network pricing	▪ how to ensure charges are cost-reflective and facilitate effective competition in a hydrogen blended system?	21, 23, 24
	▪ should there be locational signals for H2 injections? If so, should this be via network pricing?	22
Billing	▪ should there be national smoothing of transportation cost and localised system operation/management relating to hydrogen blending?	31

Other technical or lower materiality issues that might need to be solved under certain future scenarios

Area	Issue	Ref
Connections	▪ The existing connection process may be disproportionate (in terms of time/costs) for hydrogen facilities ▫ The type of adjustment required will depend on the connection policy and capacity allocation approach.	1
System operation & dispatch	▪ If gas producers are not subject to a carbon price, policymakers may be looking to adapt the dispatch mechanism such that it encourages the efficient outcomes which would have occurred with a carbon price (across methane and H_2, but also across H_2 production technologies). ▫ This issue is policy related and should be considered after suitable dispatch mechanisms is identified	10
	▪ National Grid SO has incentives to carry out its SO role efficiently. Currently no incentives for efficient balancing of distribution networks. ▫ This issue will be best addressed once approaches to system operation have been identified.	20
	▪ Current monitoring may be too high level to detect localised issues in hydrogen blend. ▫ Determining monitoring requirements will require further technical work that will form part of our roadmap.	17
	▪ Properties of hydrogen may impact linepack thresholds. ▫ Impacts on linepack are not currently well understood, and will require further research and testing.	19
Shrinkage	▪ GDNs are responsible for buying shrinkage gas. Potential conflict of interest if GDNs become local SO. ▫ Likely to be a less essential issue as the issue already exists today at the NTS level.	28
	▪ Current shrinkage incentive under RIIO could encourage GDNs to delay/limit new hydrogen connection (depending on SLM assumptions to set allowances). May also affect GDN dispatch/operation behaviour. ▫ We expect that any distortion is unlikely (given practical application of SLM) or not material.	29
	▪ Environment Emissions Incentive - the value of carbon lost may need to be adjusted to reflect blended H_2. ▫ It depends on whether Ofgem retains this incentive (Ofgem is proposing to drop it).	30

Solution packages for system operation, dispatch and connections

	Connections	SO & Dispatch
Solution package 1	Producers connected subject to entry specifications that apply constraints on their rights to inject gas into the grid, for example: ▪ an injection blend constraint, meaning any gas injected must not cause the grid in their vicinity to breach the hydrogen blend limit; and ▪ constraints in relation to their impact on aspects of gas quality such as the Wobbe Index.	▪ The system operator (SO) and/or relevant GDN could play a "backstop" role to monitor grid blend and ensure safety. ▪ Powers to curtail production at short notice (possibly without compensation)… ▪ …but incentivised to manage grid flows to maximise H_2 injections.
Solution package 2	**As above, plus:** Producers connected subject to an evaluation by the SO of their impact on other users, for example showing that the connection is: ▪ unlikely to limit ability of other H_2 producers to inject; ▪ unlikely to cause disruption to users with specific requirements.	**As above**
Solution package 3	**As solution 2, plus:** ▪ Producers are connected on the agreement that if they do (on rare occasions) cause curtailment to producers connected before them, they will be asked to reduce injections. Referred to as Last In First Out (LIFO).	**As above, plus:** ▪ LIFO approach: on any occasions (e.g. periods of low demand) where producer A causes producer B that was connected earlier to be constrained, the SO can request that producer A reduce its injections.

Evaluation of solution packages for system operation, dispatch and connections

	Pros/cons of solution packages	Preferred option under the following assumptions
***SP1:* Injection constraints**	✓ Low cost solution to adhere to blending limits ✓ Quick and straightforward to implement ✓ Low regret option – limited cost and effort ⊗ Could create incentives to locate upstream (due to less likelihood of curtailment) which may be inefficient; and/or could mean producers require more Govt. support before investing, to compensate for risk of curtailment (the precise effect will depend on the details of the support scheme) ⊗ May result in inefficient dispatch of H_2 if more efficient producers are located downstream of less efficient producers	▪ H_2 connections are dispersed and unlikely to impact one another – and producers know this ▪ Low cost and high speed solutions are the priority
***SP2:* Injection constraints with impact assessment**	✓ Low cost solution to adhere to blending limits ✓ Reduces risk of H_2 connections causing constraints to other H_2 producers ⊗ Whether the assessment helps address inefficient incentives depends on how credible producers view it ⊗ Although SO/GDN will evaluate likely impact, cannot guarantee no impact ⊗ May result in inefficient dispatch of H_2 if more efficient producers are located downstream of less efficient producers	▪ H_2 connections are likely to interact with one another occasionally, so having just a simple blending constraint could result in significant risk of constraints on some producers
***SP3:* injection constraints, impact assessment and Last-In-First-Out**	✓ LIFO approach provides a guarantee to H_2 producers connecting early that they will not be constrained due to subsequent connections ⊗ Creates expectations/rights that may limit options in the longer term ⊗ Monitoring blends, understanding which producers are impacting other users, and implementing LIFO could create significant additional system operation cost ⊗ LIFO will not necessarily result in efficient dispatch (particularly if H_2 plants connecting later are more efficient)	▪ SP2 doesn't sufficiently protect producers from risk of constraints and leads to too little initial investment

Solution packages for transmission charges

	Connections	Network pricing
Solution package 1 (status quo)	Shallow entry connection charge	Postage stamp network prices at entry(1)
Solution package 2	Deep entry connection charge	**As above**

(1) We note that the postage stamp price at entry is a reserve price (i.e. the auction floor price for a specific entry/exit point and NTS user). If an NTS user triggers reinforcement costs, it may be required to pay a price above the reserve price.

Evaluation of solution packages for transmission charges

	Pros/cons of solution packages	Preferred option under the following assumptions
***SP1:* Status quo**	✓ Lower regrets option since a new framework might not be needed in a long-term net zero system ✓ Shallow connection boundary at the transmission level facilitates effective competition (e.g. more transparent, less uncertainty in relation to future connection costs, lowers upfront costs of connection) ⊗ If there are capacity constraints, the status quo charges may not fully reflect the forward looking marginal cost that users impose to the network ▫ This will not be a significant issue if the NTS has spare capacity and/or in a scenario with not many producers connection to the transmission level	▪ Network is largely operating below capacity in the near term ▪ Not many producers connecting at transmission level ▪ More weight applied to ease/speed of introduction
***SP2:* Deep connection boundary**	✓ Potential efficiency gains from providing locational signals in relation to network investment via the connection charges… ▫ …but gains will not be significant if NTS is largely operating below capacity with demand expected to decline ⊗ Some downsides associated with sending locational signals via a deep connection charge (e.g. case by case estimation of the relevant reinforcement costs caused by an individual user may be subjective, uncertainty in relation to future costs, high upfront costs of connection) ⊗ Require time and resources to implement and may also increase the administrative costs and complexity of networks ⊗ Might entail some regret if sending locational signals via network prices (rather than via connections) is more appropriate in a future net zero system (i.e. might raise some transition issues in order to avoid early connections being charged twice for reinforcement costs)	▪ Network will largely operate above capacity in the near term ▪ Many producers connecting at transmission level ▪ More weight applied to efficiency gains

Solution packages for distribution charges

	Connections	Network pricing
Solution Package 1 (status quo)	Deep entry connection charge	LDZ System Entry Commodity charge (LDZ SECC) applied at entry
Solution package 2	**As above**	Adjust LDZ SECC to: ▫ remove credits relating to cost recovery components of charges; ▫ reflect the different CVs of methane and H_2 injections; and ▫ reflect any additional costs/benefits of injections into the distribution network
Solution package 3	Shallow entry connection charge	Replace the LDZ SECC with an LRMC-based entry capacity charge. ▫ This entry capacity charge could also reflect the different CV of methane and H_2 and reflect any additional costs/benefits of injections into the distribution network

Note: A potential issue with either package is that the exit capacity charge per pressure tier is not adjusted for H_2 and methane CV differences. We do not consider this a significant issue (i.e. impact on efficiency likely to be immaterial).

Evaluation of solution packages for distribution charges

Note: The charging framework for H_2 injections should ideally be consistent with the framework for biomethane injections at the distribution level

	Pros/cons of solution packages	Preferred option under the following assumptions
***SP1:* Status quo**	✓ Lower regrets option since a new framework might not be needed in a long-term net zero system ✗ Current LDZ SECC would not be cost-reflective and could hinder effective competition ▫ Inefficiency will be more material the larger the number of injections (both biomethane and H_2) at distribution level ✗ Some downsides associated with sending locational signals via a deep connection charge (e.g. case by case estimation of the relevant reinforcement costs caused by an individual user may be subjective, uncertainty in relation to future costs, high upfront costs of connection)	▪ Relatively small number of injections (H_2 and biomethane) at the distribution level in the near-term – level of inefficiency is not significant ▪ More weight applied to ease/speed of introduction and practicality in the near-term
SP2: ▪ **Deep entry connection charge** ▪ **adjust LDZ SECC**	✓ Results in some efficiency gains by increasing cost reflectivity of LDZ System Entry Commodity Charge ▫ Efficiency gains will be more material the larger the number of injections (both biomethane and H_2) at distribution level ✗ Retains deep connection boundary – same downsides as SP1 above ✗ Less easy/quick to introduce than SP1 and involves higher administrative costs and complexity for the network (e.g. calculating level of costs and benefits associated with different injection points)	▪ Relatively high number of injections (H_2 and biomethane) at the distribution level in the near-term – level of efficiency gains are significant ▪ More weight applied to efficiency in the near-term
SP3: ▪ **Shallow entry connection charge** ▪ **LRMC-based entry capacity charge**	✓ Strong locational signals via network charges in relation to network investment - promotes the efficient use of network… ▫ Efficiency gains will be more material the larger the number of injections (both biomethane and H_2) at distribution level ✗ Difficult to predict future utilisation of network and therefore, signals might not always incentivise efficient behaviour ✓ Avoids downsides of deep connection boundary. Shallow boundary may also involve lower administrative costs/complexity for networks. ✗ Likely to take a long time to design and implement, with high associated resource costs across the industry.	▪ Relatively high number of injections (H_2 and biomethane) at the distribution level in the near-term – level of efficiency gains are significant ▪ Stronger efficiency gains from sending locational signals via network charges ▪ More weight applied to efficiency in the near-term

Solution packages for ensuring a level playing field between entry connections

Note: there is an interdependency between these solutions and the solutions for connection and network charging regimes (T and D). For instance, the connection charging boundary between the transmission and distribution networks will need to be consistent with the approach for cost reflective connection charges. We consider these interdependencies as part of our assessment.

	Connections
Solution Package 1 (status quo)	▪ No common charging methodology for entry connections across GDNs ▪ Inconsistent connection boundary between transmission and distribution networks
Solution package 2[(1)]	▪ Common charging methodology for entry connections across GDNs ▪ Inconsistent connection boundary between transmission and distribution networks
Solution package 3[(2)]	▪ Common charging methodology for entry connections across GDNs ▪ Consistent connection boundary between transmission and distribution networks

Note 1: Solution package 2 is consistent with either: (i) SP1 for Transmission (shallow connection boundary) and SP1/SP2 for Distribution (deep connection boundary); or (ii) SP2 for Transmission (deep connection boundary) and SP3 for Distribution (shallow connection boundary)

Note 2: Solution package 3 is consistent with either: (i) SP1 for Transmission (shallow connection boundary) and SP3 for Distribution (shallow connection boundary); or (ii) SP2 for Transmission (deep connection boundary) and SP1/2 for Distribution (deep connection boundary)

Evaluation of solution packages for ensuring a level playing field between entry connections

	Pros/cons of solution packages	Preferred option under the following assumptions
SP1: Status quo	✓ Feasibility and practicality: No framework adaptation costs ⊗ Lack of consistency in the transmission and distribution network connection boundary could hinder effective competition between entry injections. ▫ More material the larger the number of injections (both biomethane and H_2) at transmission and distribution level ⊗ Lack of a common charging methodology across GDNs could hinder effective competition between entry injections. ▫ More material the larger the number of injections (both biomethane and H_2) at distribution level	▪ Relatively small number of injections (H_2 and biomethane) at the distribution level in the near-term – level of inefficiency is not significant ▪ Producers not connecting at mix of T&D level in large numbers in the near-term – level of inefficiency is not significant ▪ More weight applied to ease/speed of introduction and practicality in the near-term
SP2: **Common charging methodology for connections across GDNs**	✓ Efficiency gains from ensuring level playing field for connections through common charging methodology ▫ Gains more significant if there are a larger the number of injections (both biomethane and H_2) at distribution level ⊗ As above, lack of consistency in T/D connection boundary could distort H_2 producers connection incentives ⊗ Feasibility and practicality: Could be lengthy and resource intensive to adopt a common charging methodology for connections across GDNs	▪ Relatively high number of injections (H_2 and biomethane) at the distribution level in the near term – significant gains from common rules ▪ Producers not connecting at mix of T&D level in large numbers in the near-term ▪ More weight applied to efficiency in the near-term
SP3: ▪ **Common charging methodology for connections across GDNs** ▪ **Consistent connection boundary**	✓ Efficiency gains from ensuring a level playing field (for connections across GDNs and between transmission and distribution level) ▫ Gains more significant if there are a larger the number of injections (both biomethane and H_2) at transmission and distribution level ⊗ Feasibility and practicality: Could be lengthy and resource intensive	▪ Efficiency gains are significant in the near-term: ▫ Relatively high number of injections (H_2 and biomethane) at the distribution level ▫ Producers connecting at mix of T&D level in large numbers ▪ More weight applied to efficiency in the near-term

Assessment of path dependency – how might future circumstances affect the approach in the near term?

System operation, dispatch and connections	The future system might require a different approach (e.g. market based approach) to curtailment to limit production to the blending cap. Enabling solutions should therefore avoid creating rights or expectations (in particular an expectation to be able to inject H_2 most of the time) that the SO may not be able to uphold in such scenarios.	▪ If possible, it may make sense to avoid SP3 in the near term - LIFO is likely to create expectations that may not be sustainable in all scenarios. ▪ In general, rights and expectations should be assessed carefully under all enabling solution packages.
Transmission charges	Future system might include an entry capacity charge based on LRMC. This would have efficiency benefits if NTS has significant capacity constraints and a large number of new entry points at the transmission level.	If SP1 (deep connection boundary) is implemented in near term, then any future LRMC entry capacity charges would need to ensure producers are not effectively charged twice for grid reinforcement. This might make switching to LRMC capacity charges challenging (but not impossible).
Distribution charges	▪ As above, the future might involve an entry capacity charge based on LRMC. ▪ The charging framework for H_2 injections should ideally be consistent with the framework for biomethane injections at the distribution level	▪ Both status quo and SP1 involve deep connection boundary. Therefore, a possible future switch to LRMC entry charges will entail similar transitional issues as described above… ▪ …SP3 involve a shallow connection boundary and entry capacity charge based on LRMC and therefore, is in line with a potential future solution ▪ Review of charging framework for biomethane and hydrogen injections need to be closely coordinated.
Level playing field	The future might require consistency in the application of cost recovery charges at distribution and transmission injections (e.g. a single cost recovery pot *or* no cost recovery charges applied to injections)	No path dependency issues

Connections

Note: some overlap between connection and dispatch framework. Under connections we identify issues relating to the connections process and connection charging. Under dispatch we consider operation (e.g. interruptability) and connection requirements (e.g. gas spec).

Process for connection	The existing connection process for injections might be considered lengthy and could involve high costs and complexity (e.g. gas quality monitoring) for transmission and distribution. It will need to be considered whether this may be disproportionate (in terms of both time and costs) for hydrogen facilities (e.g. with more/smaller injections).	1
Charging arrangements	The connection charging boundary is not consistent between the distribution and transmission networks (i.e. there is a deep connection charge for entry connections at distribution and a shallow connection charge for entry connections at transmission). If a larger number of (H2 and biomethane) are connecting at the distribution and transmission levels, it will need to be considered whether these inconsistencies hinder effective competition across entry connections at the different voltage levels.	2
	There is no common charging methodology for entry connections across GDNs. Each network has a Connection Charging Methodology which is approved by Ofgem. As above, If a larger number of (H2 and biomethane) are connecting at the distribution and transmission levels, it will need to be considered whether these inconsistencies hinder effective competition for entry connections across GDNs.	3
	Currently, capacity for new injections onto the distribution network (primarily biomethane) is allocated on a first come, first served basis. This may no longer be appropriate for H2 injections if there are multiple possible producers/technologies potentially competing for access at a site.	4
	The connections regime does not currently provide locational signals – e.g. to encourage/discourage new connection at specific locations given existing production facilities (H2 or biomethane) and existing network capacity. This might require coordination between the TSO and GDNs to ensure whole system optimisation in the allocation of blending capacity.	5

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Dispatch

Roles	Lack of clarity on who is responsible for making dispatch decisions (and communicating these) for distribution connected hydrogen production: National Grid SO or individual networks under a separate SO function. This decision may be affected by GDNs' obligation to protect the premises they transport gas to.	6
	The additional complexity of blending constraints could mean there is a need for direct relationships between producers and networks (rather than via shippers), so networks can instruct producers to take certain actions quickly. A further challenge would be to set up these relationships where there are multiple producers behind a grid entry point connection.	7
	Different producers may want different types of contracts – some will be able to produce more stably while others may want more flexibility (particularly if they produce intermittently). Intermittent production may pose challenges to security of supply.	8
Monitoring and data	If there is an injection blending constraint on producers (i.e. producers are only able to inject blends up to the level of the cap; or they need to demonstrate that the injection will not breach the blending cap in the locality that they injects into), then in theory a hydrogen producer downstream of other producers may receive gas already at 20%, and may not be able to inject (unless it has its own source of methane). A mechanism may be needed to manage dispatch so that blend capacity is distributed in an economic way. Without injection blend constraints, there is still a lack of commercial information to carry out dispatch on an economic basis, particularly for distribution networks where there is no locational trading. If hydrogen producers receive a per MWh subsidy, a market-based approach to dispatch is likely to maximise injections of hydrogen, because it would be expensive to constrain hydrogen off.	9
	If gas producers are not subject to a carbon price, policymakers may be looking to adapt the dispatch mechanism such that it encourages the efficient outcomes which would have occurred with a carbon price (e.g. to prioritise between different H2 production technologies).	10
	Current levels of data sharing between NTS and GDNs may not be sufficient to ensure economic and environmental dispatch across the whole system.	11
	Gas quality regulations may need to be adjusted to allow hydrogen blends onto the system.	12

System Operation

Area	Challenge	No.
Roles	On the NTS, NG's current tools (OCM, locational trades, interruption, etc.) are at a high level sufficient to balance NTS with new constraints. However, the specifics may need to change, e.g. more frequent use of locational trades. This is particularly relevant in a world without injection blending constraints on producers, but may still be needed in a world of with injection blending constraints if producers inject gas over 20% into an area.	13
	Blending constraints will also need to be managed on distribution networks; however GDNs currently have limited tools to manage injections and loads, e.g. no interruptible entry capacity or ability to increase loads.	14
	Hydrogen blend will need to be controlled on both the NTS and distribution networks, and there may be different options for managing the same constraints. There would need to be a mechanism to prioritise blend management actions taken by NG SO and GDNs.	15
	Blending hydrogen into the grid will impact certain characteristics of the gas received by users and there may be a need to manage these impacts for certain large users.	16
Monitoring and data	Current monitoring may be too high level to detect localised issues in hydrogen blend.	17
	Informational barriers limit ability for different SOs (e.g. gas and elec) to share information and achieve efficient outcomes.	18
	Properties of hydrogen may impact linepack thresholds.	19
Incentives	National Grid SO has incentives to carry out its SO role efficiently, e.g. minimising linepack changes day-to-day, and minimising its impact on the market when carrying out residual balancing actions. Currently no incentives for efficient balancing of distribution networks.	20

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Network Pricing

Cost reflectivity	Current arrangements may not ensure cost reflectivity in a H2 blended system. For instance: ▪ Hydrogen has a lower Calorific Value (CV) than methane. Therefore, a given level of demand for energy (kWh/day) implies a larger hydrogen volume. If, as a result of CV differences, the networks become more capacity constrained then the existing transmission and distribution charges may no longer be cost reflective (i.e. they would not fully reflect the forward looking marginal cost that users impose to the network). ▪ The credits included in the LDZ SECC relate to charges which include a cost recovery component (i.e. charges that recover historic costs of the network, as well as or instead of forward looking marginal costs imposed by injections). This means that direct connections at the distribution network may receive benefits (equal to the cost recovery component of charges) which do not reflect forward looking costs but rather costs that have already been incurred and cannot be changed irrespective of what new producers do. There is no value in terms of economic efficiency in sending a signal related to these costs and in fact, doing so may distort incentives and change behaviour in a way that reduces efficiency. 21
	Current network charges will not provide signals to disincentivise new hydrogen injections at points on the system, or at times, where hydrogen supply is already high, and vice versa where existing hydrogen supply is low. Such signals could alternatively be sent through entry connection charges (or not at all) and might require coordination between the TSO and GDNs to ensure whole system optimisation in the allocation of blending capacity. 22
Effective competition	A potential shift away from cost-reflective tariffs in a hydrogen blended system for the reasons described above could create distortions and therefore, reduce effective competition. 23
	There should be a level playing field in relation to how residual network cost recovery charges are applied to hydrogen and methane injections at the distribution and transmission levels. No easy like for like comparison between transmission and distribution injections in the current regime. 24

1 List of potential challenges

Shrinkage

Note: we understand that early testing indicates up to 20% blend may not alter shrinkage rates materially. However further testing will be needed to verify this. A lot of the issues set out below assume that hydrogen blending alters shrinkage rates materially and as such, would fall away if there is no difference. We are also aware that shrinkage incentives under RIIO are likely to change.

Monitoring and data

- Shrinkage measurement (e.g. SLM for GDNs) & shrinkage factors not based on physical properties of H2 (25)
- Shrinkage factors might need to vary in a more granular manner across time and locations (26)
- Changing shrinkage measurement may create issues in settlement process (e.g. unaccounted for gas) (27)

Roles

(28)

- GDNs are currently responsible for buying shrinkage gas. Potential conflict of interest if GDNs are also to become local system operator (e.g. in electricity it is suppliers not networks who buy losses) – albeit this conflict might arguably already exist at the NTS level.
- Policymakers may oblige GDNs to buy hydrogen to cover shrinkage gas requirements if that is considered environmentally important.

GDN incentives under RIIO

(29)

- Current shrinkage incentive under RIIO could (in theory) encourage GDNs to delay/limit new hydrogen connection (depending on SLM assumptions to set allowances and if/when these are updated). If shrinkage allowance is based on projection of new hydrogen, delaying the connection may give a shrinkage benefit. However, we currently expect this is unlikely (given practical application of SLM) or at least, not material.
- May also affect GDN dispatch/operation behaviour (if these roles are performed by GDN) i.e. GDNs could interrupt hydrogen more often than needed to benefit from shrinkage reduction. But this seems unlikely - subsidised H2 production would quote high price to be curtailed (and Ofgem would likely give GDNs incentives to avoid inefficient curtailment).

(30)

- Environment Emissions Incentive. Ofgem proposing to drop this but it could be retained. If so, it is currently based on value of carbon lost - may need to be adjusted to reflect blended hydrogen. Networks would then be incentivised to e.g. phase mains replacement and target leakage actions at points on grid where less hydrogen is blended (i.e. where leakage has most environmental impact).

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Billing

Note that the aspect of billing related to Calorific Value (CV) is out of scope, as it is considered by a separate NIC project

Charging arrangement

- The cost of transportation and localised system operation/management to end-users in different parts of the network may vary significantly depending on the blend level of hydrogen in that area.
- End users will not have a choice over the blend of gas that is supplied to them
- This raises a question – should additional costs in higher hydrogen areas continue to be charged only to customers in that area, or should there be some national smoothing of these costs (given customers have no choice).

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