



JIVE 2 - D2.7

HRS Dependability Study

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JIVEs / MEHRLIN
projects



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Agenda

—• What is the problem?

—• Project approach

—• What contributes to low HRS dependability?

—• What could help improve the HRS dependability?

Refuelling station dependability can be improved by a focus on some overarching principles

Incentives should encourage and reward steady performance

Enabling arrangements must support that alignment

Tendering and contracting need to address the needs of all HRS stakeholders

Learnings must be rapidly and widely disseminated

Resolving these principles will address several causes of low HRS dependability.

To date, 14 organisations have been interviewed across the HRS value chain to develop recommendations to improve station dependability

Guiding questions:

What goes wrong at HRS?

Why do these problems not get resolved?

What will help resolve them and improve dependability?

Stakeholder groups:

Hydrogen suppliers

Equipment suppliers

HRS integrators

HRS operators

HRS owners

Bus depot operators and other HRS users

Consultants/ Interest bodies

Geographies explored:



Stakeholders:



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- HRS operators
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Geographies explored:

Stakeholders:

Station dependability is a function of three main factors



Equipment reliability

- Failures in equipment such as compressors
- Breaking of dispensing nozzles
- Hydrogen leakages



Maintenance arrangement

- Delays in spare part supply
- Insufficient staff available for servicing the station



Hydrogen supply and delivery

- Lack of supply redundancy
- Unexpected use patterns
- Non-standard connections

Stakeholders do not have enough capacity or incentive to resolve the problems

What goes wrong?

HRS equipment reliability

- Station design may be overcomplicated and does not meet actual requirements
- The equipment is not suitable for how HRS currently operates
- Integration or installation expertise is limited

Maintenance arrangement

- There are not enough trained maintenance personnel
- Insufficient local spare parts storage
- Lack of training or knowledge sharing within or between organisations

Hydrogen supply and delivery

- Single hydrogen source is unavailable or used to satisfy competing demands
- Non-standardised delivery equipment makes delivery impossible

What leads to these failures?

What stops it being fixed?

- Station design approach is flawed
- Equipment is unavailable

- Cost of resolution is higher than overall benefit
- Other hydrogen supply clients take priority over HRS

- Training is not mandated
- No effective way to share learning



What can be done to improve HRS dependability?

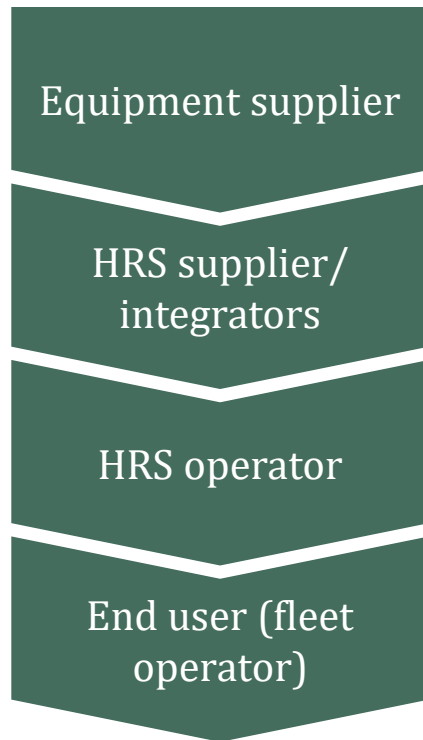
Recommendation: Align incentives and focus on uptime and throughput

If the HRS operator and OEM revenue is linked to ongoing performance, incentives should be aligned to keep stations functioning well

Who is involved?

What kind of incentives are needed?

Example flow of contractual relationships



- Growth in demand will incentivise investment in their improvement
 - Incentives and penalties are needed that:
 - Reduce the burden for developing new technologies
 - Impose sufficient consequences on breaches of performance requirements
 - Encourage early investment in supporting network
 - Push for dependability, and not just innovation
-
- Incentives are needed to increase customer confidence and drive uptake.

This could involve **funding** support during the **operational** phase, **streamlined regulations** to encourage deployment, etc.

Recommendation: Ensure contracting and tendering is fit for purpose

Overall,

**Station design specifications should reflect the market status and capabilities to maximise dependability.
Contracts should incentivise problem-solving over penalisation**

Specifically,
in Europe,

	Who?	Should do what?
<i>Tender/contract content</i>	HRS projects	Compile operational KPIs based on project experience to be used in tendering
	HRS owners	Future tenders and contracts should use best practices from demonstration projects on how to share penalty and risk between contractors.
	HRS integrators	Ensure that equipment warranties cover the expected operational phase
<i>How it is scored</i>	HRS owners	Increase weighting for the track record of HRS suppliers during tendering to ensure that the best supplier is selected, even if they are more expensive
<i>Rules</i>	European Commission, National ministries	Allow collaboration between HRS OEMs, owners and clients to develop the final tender specification in national tendering rules

Recommendation: Improve knowledge management and sharing

Overall,

Learnings and solutions need to be consistently captured, shared and incorporated into the design and operation of HRS

Specifically,
in Europe,

	Who?	Should do what?
Standardising approach	Professional organisations	Develop certifications for technicians working on HRS
	CH JU projects and other project developers	Create simplified reference designs for HRS, noting potential changes for different use cases and frequent failures
	Standardisation bodies e.g. ISO	Develop equipment standards for key HRS components to be used during design
Mandating knowledge sharing	Funding bodies e.g. CH JU	Mandate knowledge sharing workshops at project inception with previous project participants with prior experience
	HRS owners	Mandate training of staff and local maintenance workshops as tender condition
	HRS operators	Upskill local technicians in adjacent industries, such as high-pressure gas handling



Discussion

How can these recommendations be realistically implemented?

Thank you

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Thank you for your attention

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