Infrastructure for Fuel Cell Electric Buses

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Session on Clean Bus Technologies: Insights into Alternative Fuels Infrastructure

Topic I: Planning & Procurement



MEHRLIN, JIVE and JIVE 2 projects

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Engineering and Consulting in Energy

Projects on hydrogen for mobility include:

- Demonstration of fuel cell road vehicles and hydrogen stations Partner in fuel cell bus projects since 2001 (from CUTE to JIVE)
 - Performance assessment and technology validation
 - Documentation of best practice and recommendations
- Consulting for hydrogen-ready bus depots



- 1. Introduction: Analysis Work in JIVE, JIVE 2, and MEHRLIN
- 2. Planning for Hydrogen Refuelling Stations (HRSs)
 - Challenges
 - Solutions and Recommendations
- 3. Procurement of HRSs
 - Challenges
 - Solutions and Recommendations
- 4. Best Practice Overall

1. Introduction: Analysis Work in JIVE & JIVE 2





1. Methodology and Rationale



- Online questionnaires to local site coordinators, biannually
- Phone interviews with selected sites
- Present and discuss findings at consortium meetings
- Forward results externally, including suppliers, policy makers and the User Group
 - JIVE first Best Practice Report soon
 - Joint JIVE / JIVE 2 Best Practice Report December 2019
- ✓ <u>Today</u>: Focus on HRS Planning & Procurement
- ✓ Typically, the local site coordinators consider the HRS side more challenging than the bus side







- Specifying the HRS so that it meets the operator's/vehicles' requirements
- <u>Identifying the best site</u>: In the depot or elsewhere; Where in the depot; Siting determines many planning and operational constraints, including permitting
- Considering <u>scale-up</u> in future
- <u>Calculating costs</u>: Accuracy; Pricing parity with diesel; Optimising TCO
- <u>Determining size</u>: Optimising size (not too big not too small); Planning for seasonal fluctuations in fuel demand
- <u>Matters of Risk</u>: Risk assessments difficult; Determining risk sharing; Chicken-egg problem: Permitting and risk assessment only after full specs of HRS, but full specs of HRS to be designed to fit within tolerable risk contour
- <u>Numbers & Complexity of Decisions</u>: Interdependency of above aspects; Technical planning affected by changing national regulations

2. Solutions and Best Practice HRS



Planning

- <u>Make early decisions</u>: Define "must haves" to guide decisions; Decide on scale; Know permitting requirements; Develop strategies to address TCO
- <u>Engage early, often and widely</u>: City administration, local authorities (including firefighters etc.), potential industry partners
- Make sure to understand the pros and cons of on-site or off-site hydrogen production; Be open minded to all hydrogen supply chain solutions and locations
- <u>Consider all hydrogen sources</u> an electrolyser is not always the most environmentally friendly source of hydrogen. Do a proper well-to-wheel emission calculation to evaluate benefits of every proposal
- Try to <u>get technical concepts from more than one potential supplier</u> in the pre-tender stage
- <u>Sell the vision</u>: Set the HRS operation in context of city or regional social/ economic development or part of overall "carbon reduction" strategy; Know and sell broader opportunities

3. Challenges



Tender Documents:

- Lack of HRS standardisation
- Implementation in bus depot with limited space and coordination with other new technologies [including battery electric buses with FC range extender]
- Drafting and agreeing contract terms and conditions; Evaluation criteria

Selecting Suppliers:

- Lack of feedback, poorly written proposals
- Technology offered not meeting expectations/specifications
- Due to quite different concepts presented, deciding which supplier is best choice

Contract Development:

- Ensuring that risk and responsibilities are correctly apportioned amongst the partners under the contract and that partners are fully aware of these
- Complying with national and EU regulations (triangle PTA-PTO-HRS supplier)

3. Solutions and Best Practice HRS



- Soft market testing / pre-engagement to <u>ensure that suppliers fully understand</u> your requirements before entering into the tender process
- <u>Ensure that no micro and start-up entities are excluded</u> during supplier selection phase which may be able to provide a suitable HRS too
- Set up fuel <u>supply contracts for as long a term as possible</u> (15 years) to help encourage new investors
- "Consider whether to separate into two (HRS build and fuel supply contracts)" vs. "Tender for complete system, i.e. buses with fuel supply & maintenance"
- "Be clear on <u>outcomes</u> required and have them confirmed by supplier (Revenue implications, warranties, maintenance), particularly where there are sub-contracted suppliers to the main supplier"
- Also opposite view: "Have very <u>precise specifications</u>, and be ready to adjust some expectations to the standards of the market"



Why did it go so well? What did you or your organisation do to make it happen? (sample responses below, headlines by evaluation team)

People make hydrogen happen:

- Knowledgeable, experienced staff
- Good project team in place
- Team working effectively to develop tender documentation despite considerable internal legal and assurance challenges
- Committed organisational decision makers, committed elected officials

Being organised is important:

- Do your homework and use experience of previous projects
- Create a strong business case and be clear with outcomes
- → Hydrogen is new but it is not extraordinary in terms of project management. Its introduction poses challenges very similar to other innovative projects.

Thank you for your attention!

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