

**Table 4-3: Deployment: Refuelling Infrastructure Construction – Challenges and Best Practice Solutions.**

Challenges	Best Practice Solutions
<p><b>Location</b> The footprint of HRSs can be large when the hydrogen is produced on the same premises and will take up depot space which some sites may not have. For this reason, and for the reason of cost-efficient production of green hydrogen (avoiding certain levies on electricity by placing hydrogen production next to green power production), a few sites located their HRS outside and at distance from the depot. It was only during deployment and early operations that the effort required for refuelling the FCBs remotely (time, staff) became fully clear. As a result, some of the sites had to re-think their approach</p> <p><b>Backup planning</b> Sites have encountered frequent refuelling failures of:</p> <ul style="list-style-type: none"> <li>• H<sub>2</sub> supply (difficulty sourcing H<sub>2</sub>, problems with timely external delivery, problems with on-site generation)</li> <li>• HRS equipment (compressors/piping/refuelling nozzles)</li> <li>• Reliable filling of the tanks to the required pressure (data transfer Bus → HRS, see Table 4-9)</li> <li>• Long times to fill (software/precooling)</li> </ul> <p><b>Permitting</b> While most sites started this process during earlier stages, many were still involved in lengthy permitting negotiations well after their FCBs arrived. This involved sites having makeshift arrangements all of which made refuelling more complex</p>	<ul style="list-style-type: none"> <li>• When deciding the location of the HRS, have regard for the time taken to take buses to refuel off-site and any additional resources required</li> <li>• Location needs to consider possible future expansion</li> <li>• There are good resources to help a site decide what is the best option for their situation (see Table 4-13)</li> </ul> <ul style="list-style-type: none"> <li>• Have a Plan B (backup) refuelling arrangement – ideally mobile (trailer) and/or have access to multiple HRSs. Redundancy in HRS components is not always sufficient</li> <li>• Undertake a failure modes, effects, and criticality analysis (FMECA) to identify potential failures in systems and equipment to determine their effects and prioritise them based on how critical they are</li> <li>• Have a dedicated technician in the first months of running refuelling arrangements</li> </ul> <p>The lack of universal standards for hydrogen refuelling arrangements has required each site to negotiate with local authorities. Because the latter may have no experience with HRS it is important to <b>engage early and often</b> on this topic. Consider Table 2-4, item 9: “Educate your regulator” It is also useful to <b>learn from others</b> who have operated HRS, particularly if they are in your region or country</p>