

Option 7 – Bidirectional Communication between Vehicle and Filling Station

Description of Technology

This solution centres on three key functionalities:

- Implementing Near Field Communication (NFC) between the fuel nozzle and the vehicle's filler neck to guarantee the correct nozzle is utilized throughout the refuelling process, thereby preventing tampering. The NFC system is used to trigger to initiate the OTA communication.
- Establishing bidirectional Over-The-Air (OTA) communication via Bluetooth or Wi-Fi with the CO₂ neutral fuel (CNF) filling station to authenticate the partner and build trust before commencing fuel transfer.
- Implementing a Refill Release Valve (RRV) between filler neck and tank to prevent the vehicle from being refilled with the incorrect fuel.

The combination of these functionalities leads to tamper-proof solution which can be easily combined with other solutions and the principle can be reused at any CNF transition point in the supply chain.

Customer & Retail Perspectives

Advantages:

- Prevention of misfuelling prior to filling (intentional or unintentional)
- Instant alerts for drivers regarding incorrect nozzle usage
- Communication between vehicle and filling station enables additional features
- Supports modular integration with other digital or physical CNF verification systems across the supply chain

Disadvantages:

- Increased costs due to additional hardware
- Susceptibility to data transmission errors
- Data latency concerns
- Dependence on stable connectivity (internet or Wi-Fi) may limit functionality in remote or low-signal areas

Implementation requirements:

- Additional regulatory geofencing functionality to switch off the system outside the EU
- Additional solution to enable voluntary refilling of legacy cars with CNF
- Workaround for emergency refilling (closed RRV)

Regulatory Assessment

- Security & Fraud Resistance: High security with digital certificates required but adds complexity
- Implementation Complexity: Moderate due to required NFC infrastructure and certification
- Fuel Detection Accuracy: Good but lacks fuel composition verification
- Cost of Deployment: Moderate with potential for shared costs
- Real-Time Fuel Validation: Ensures CNF use with cybersecurity compliance
- Flexibility & Scalability: High scalability but needs global/regional standards