Energy Innovation Basecamp 2024
Problem Statement EIP112

Transport, Hydrocarbon-Fuelled Mobile Plant and Portable Equipment

The following problem statement has been developed by the innovation teams within the UK's Gas and Electricity Networks for the 2024 Energy Innovation Basecamp.

Theme: Decarbonising Network Operations

Network Areas: Gas Distribution, Gas Transmission, Electricity Distribution, Electricity Transmission

What is the problem?

To maintain their above ground and underground pipework assets, all Gas Distribution Networks (GDN) operate substantial fleets of commercial vehicles (primarily vans, but also HGV's), together with mobile plant and powered equipment. This equipment is usually owned but may also be hired. Presently, there is a complete reliance on hydrocarbon fuels, primarily diesel and to a much smaller extent, petrol, the latter usually for portable (i.e., non-wheeled or tracked) equipment. Both fuel types are usually sourced via the public retail forecourt network.

Similar issues exist for other utility providers that operate underground and overground infrastructure.

Studies have shown that battery-electric technology is not suitable for many of these applications, nor is likely to be in the foreseeable future. Consequently, an alternative is required, to enable the transition to zero emissions to be accelerated. Hydrogen is the only alternative technology that could provide a suitable solution.

GDN's maintain their infrastructure on two main bases: long-term pipe renewal; and on a breakdown basis where appropriate ('emergency response').

The former case requires teams of operatives to be on site for extended periods – typically many days or for several weeks. This basis allows some flexibility of approach.

The latter case is more challenging, as the emergency response team must be able to bring to, and later remove from site, all necessary machinery, powered equipment, and tools on a single-visit basis.

In the case of WWU, two 3.5 tonne vehicles are provided for an emergency response team:

- A van with on-board power; and
- A light tipper with additional secure storage for tools and equipment

The provision of 'on-board power' allows full engine power to be available for the purpose of on-site air compression for pneumatic road breaking, rock drilling, 'moling' and mains-voltage electricity generation, for pipe fusion, pumping, lighting, and other functions.

Trials have shown that road-breaking via electric and hydraulic power is inefficient – whilst it can get the job done, it may increase the time taken and may increase overall operator exposure to HAVS, which is not acceptable.

What would be the alternatives available to GDN's and other utility operators?

What are we looking for?

The solution must be operable at scale.

Wales and West Utilities Ltd operates 1300 vans, of which around 700 are directly engaged on site operations, whether replacement or emergency. 450 of the 700 have 'on-board power', Other assets used on site include 150+ mini-diggers, 50+ towed compressor/generators, 100 mobile welfare units, 50+ 3t dumpers. Petrol – fuelled powered equipment includes 500+ vibrating trench rammers, 500+ tarmac saws, generators, and water pumps. Electrical equipment includes 500+ butt fusion boxes, floodlighting sets, submersible water pumps.

Other GDN's (and other utility operators) have similar fleets.

What are the constraints?

For emergency response working, the solution must allow for:

The parent van to:

- Not be captured by Goods Vehicle Operator Licencing legislation; i.e., ≤3.5 tonnes GVW
- Be zero tailpipe emission.
- Carry a range of tools and equipment including tarmac saw and/or trench rammer.
- Capable of towing a trailer carrying a mini-digger, or other trailers up to 3t.
- Act as an on-site power source for road breaking, rock drilling and 'moling' equipment.
- Act as an on-site power source for mains-voltage electricity generation, for pipe fusion, pumping, lighting, and other functions.
- Be capable of recharging multiple batteries for on-site portable equipment, where appropriate
- Be capable of being refuelled on site, if possible
- Provide heating for the cab for personnel and in the load space (for clothes drying) when stationary on site.

The light tipper to:

- Not be captured by Goods Vehicle Operator Licencing legislation; i.e., ≤3.5 tonnes GVW
- Be zero tailpipe emission.
- Capable of towing a trailer carrying a mini-digger, or other trailers up to 3t.
- Be capable of carrying a granular load (~ 0.75t) discharged by tipping to the rear
- Be capable of carrying other loads, including but lot limited to Sign, Lights and Guarding (SLG) equipment
- Offer secure storage for vibrating rammer, road breaker, rock drill and other tools and equipment
- Be capable of recharging multiple batteries for on-site portable equipment, where appropriate.

The mini-digger to:

- Be zero tailpipe emission.
- Offer a digging performance not less than that of a JCB 16C-1.
- Incorporate a range of 3 detachable bucket types.
- Operate and incorporate a detachable hydraulic breaker to minimise the need for excavation by hand.
- Have an operating duration equivalent to diesel.
- Be capable of being refuelled/recharged on site, or overnight if necessary.
- Preferably be capable of being carried on an existing WWU mini-digger trailer.

Road breaking, rock drilling and 'moling' equipment to:

- Be intrinsically safe, e.g., via on-site air compression.
- Operable on a continuous basis for an extended period, e.g., not less than 8 hours.
- In the case of road breaking and rock drilling equipment, minimise the risk of HAVS
- Ideally, the same equipment types as those used currently.

Powered tarmac cutting equipment to:

- Be sufficiently powerful to cut road and pavement surfaces quickly and effectively to the required depth/s and with operating duration equivalent to petrol (or where the energy source may be quickly exchanged, analogous to refuelling petrol from a can). HAVS not to exceed, and preferably better than, existing equipment.

Powered trench ramming equipment to:

- Deliver sufficient sustained blow energy to enable base layer reinstatement to be compacted with the same performance as for petrol and with an equivalent operating duration (or where the energy source may be quickly exchanged, analogous to refuelling petrol from a can). HAVS not to exceed, and preferably better than, existing equipment.

For planned replacement working, the solution must allow for:

All the above requirements and:

The on-site welfare facility to:

- Be secured from attack and vandalism when unattended
- Be capable of being towed on the highway by a vehicle ≤3.5 t
- Provide a secure messing facility for up to 6 people with basic food heating, hand/utensil washing, water boiling and lighting and space heating facilities
- Provide a toilet facility with hand washing and effluent retention
- Provide a clothes-drying capability
- Be zero-emissions
- Be self-powered, or powered from an external on-site source
- Maximise the opportunity for solar power.

The on-site power generation capability to:

- Be capable of movement around the site, e.g., being towed by a vehicle ≤3.5 t
- Be capable of recharging multiple batteries for on-site portable equipment, where appropriate
- Be capable of powering the on-site welfare unit/s where appropriate
- Be capable of providing air compression for road breaking, rock drilling and 'moling' equipment.
- Be capable of generating and storing mains-voltage electricity, for pipe fusion, pumping, lighting, and other functions.
- Be capable of being refuelled on site.

The 3t dumper to:

- Be capable of carrying a granular load of up to 3t, discharged by tipping to the front
- Be operable by the holder of a Category B driving entitlement
- Be as manoeuvrable as practicable
- Be road registered as a Works Truck
- Be zero tailpipe emission.
- Be capable of being refuelled on site.

The on-site refuelling facility to:

- Be capable of carriage on a vehicle ≤3.5 t (preferably) and/or a trailer of GVW 3t
- Be capable of refuelling all the asset types above where on-site refuelling is required to enable a significantly increased operational duration
- Be certified for use under ADR where appropriate
- Be capable of rapid replenishment at a suitable facility.

For all assets:

- The solution/s must be extensively tested to prove durability and performance.
- To be available for prototype testing within 24 and preferably within 12 months
- Available for extended testing in quantity within 24 months
- Available for widespread adoption within 48 months.

Who are the key players?

Key stakeholders are:

Gas engineers and operatives – in WWU, the 'Build and Replace' workstream.

Solutions are required from vehicle manufacturers, mobile plant manufacturers, equipment manufacturers, plant hire companies.

The target market is utility and construction/civil engineering organisations.

Does this problem statement build on existing or anticipated infrastructure, policy decisions, or previous innovation projects?

This work is linked to the development of:

- Battery-electric vehicles
- Hydrogen-fuelled vehicles
- Battery-electric or hydrogen-fuelled mobile plant
- Hydrogen-fuelled and solar on-site generation
- Battery-powered portable equipment

WWU is shortly to trial a hydrogen-fuelled van.

What else do you need to know?

N/A

Innovator submissions to this problem statement will be open here during March and April, but we encourage you to submit your response as early as possible, as networks will be able to review submissions as soon as they come in.

You can also use the virtual Q&A on the Smarter Networks Portal to ask for more information about this problem statement. Questions may be answered online or at the ENA Problem Statement Launch in March 2024. More information on last year's Basecamp programme can be found here.