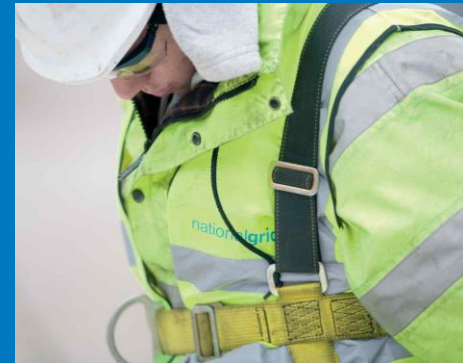
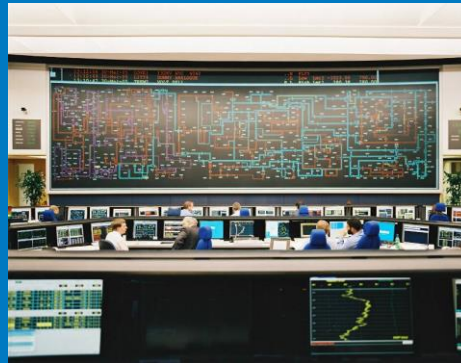


The opportunities for off grid monitoring of the UK Gas Transmission Network (NTS)



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National Grid Innovation

- **Background**

- Under the current RIIO regulatory framework, National Grid and other network licensees, were encouraged to invest in innovation activities.
- To ensure that there was transparency, a set of guidelines are defined:
 - The maximum allowed spend per annum was 0.7% of allowed revenue.
 - Clear set of defined areas would qualify.
 - There is a 9:1 funding leverage.
- There are two innovation schemes available to each licensee:
 - Network Innovation Allowance (NIA).
 - Small programmes (£10k – £1.5M).
 - NGGT portfolio of ~40 projects.
 - Very diverse range of topics.
 - Network Innovation Competition (NIC).
 - Larger demonstration programmes (£3M – £6M).
 - Recent awards for GRAID, CLoCC.

Introduction

- **Background**

- The National Transmission System (NTS) is 7654km of high pressure (>40barG) transmission pipelines.



Challenge – Third Party Interference (TPI)

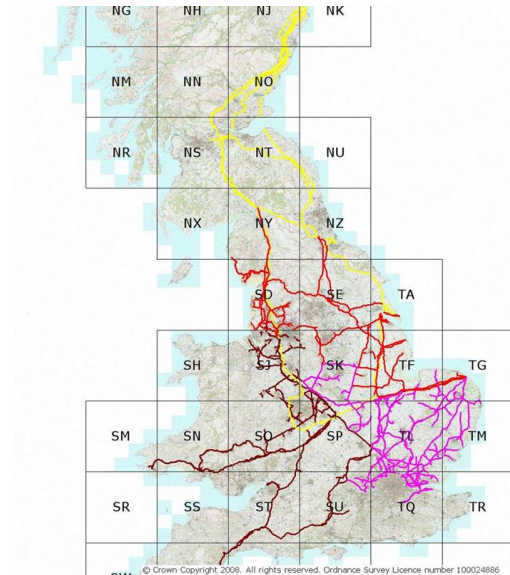
- Numerous issues related to TPI.
- HSE & UKPOA obligations.
- Fly the entire network.



Innovation Solutions

- **Third Party Interference (TPI)**

- Comprehensive aerial programme with annual figures:
 - 320,000km pipes flown.
 - 6,500 sightings.
 - 2010 flying hours.
- Business appreciation that there needed to be a more holistic review of the TPI provision.
 - Satellite Surveillance.
 - Alternative aerial options (fixed wing).
 - Ground based monitoring.

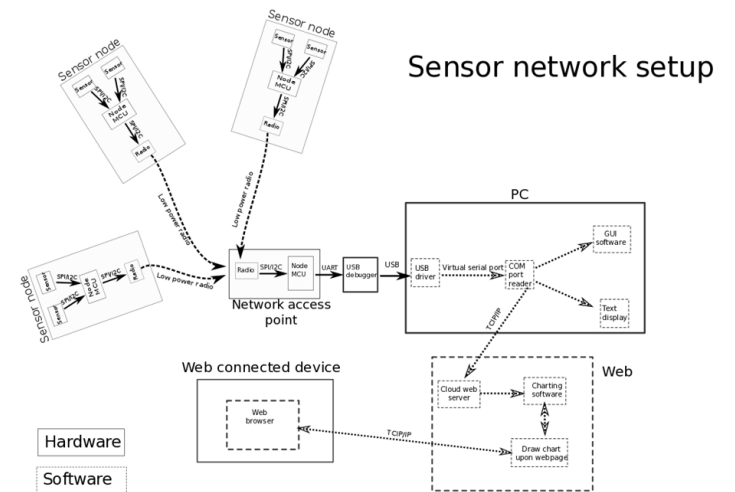


Energy Harvesting – TPI Solution?



Innovation Solutions

- **Energy Harvesting – a solution?**
 - National Grid has been looking at Energy Harvesting with a programme with Manchester University.
 - Focus was to marry sensors with EH units:
 - Temperature
 - Vibration
 - Humidity
 - Photographic
 - Initial focus was for Electricity Transmission asset monitoring.
 - Handed over ownership to Gas Transmission.....



Energy Harvesting – NGGT solution

Manchester Programme

- **Objective**

- To demonstrate a working EH unit with a simple 3 sensor hub and transfer data via short range communications protocol.
 - To develop the necessary sensor power balance.
 - To develop the necessary software/hardware to maximise the utilisation of harvested energy.
 - To provide the algorithms to maximise useful data capture and transmission.

- **Status**

- The laboratory field testing has been very encouraging.
- Initial EH sensor hubs have been developed and are to be field trialed at a National Grid Compressor site.

Energy Harvesting – NGGT solution

Future Programme

- **Objective**

- To develop a dedicated EH unit which will incorporate:
- The nodes/hubs need to have significant self-configuration potential.
- It is proposed that the range/number of sensors/hub can be changed without the need for external reconfiguration.
- The hub network will ‘repair’ in the event of individual hub failure or renewed availability to maintain network continuity.
- The monitoring software would be able to rationalise the collected data to ensure that interpretation of the results is not compromised as a consequence of sensor or hub behavior.
- The choice of network options is open but consideration of the latest opportunities of narrow band networks (such as the SIGFOX 868 MHz band) is of interest.
- Data to be uploaded to the National Grid ‘Uptime’ asset health data repository.

Energy Harvesting – NGGT solution

- **Status**
 - Currently National Grid are looking to develop a scope and programme with interested parties.
- **Summary**
 - National Grid Gas see huge potential of off grid remote monitoring utilising EH.
 - The company has funding opportunities which allow agile project development.
 - The use of the existing pipe marker community (19,000) as a consistent and wide coverage will ease installation and trial sites.