National Physical Laboratory

# Online $H_2$ Sensor

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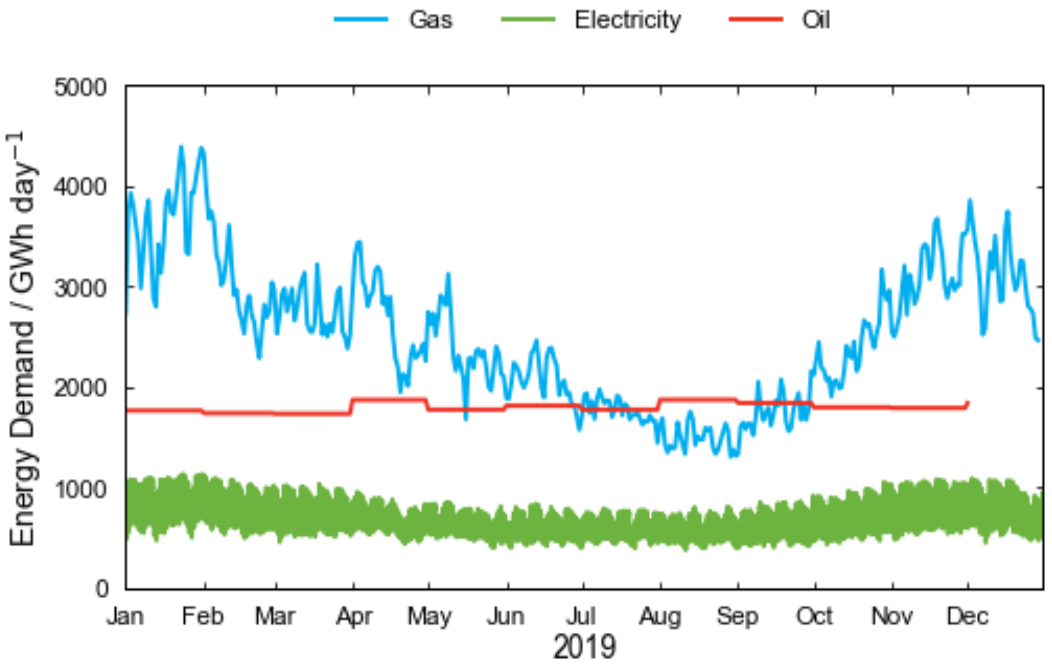
# INTRODUCTION

# Need For Hydrogen Energy Technologies

- Hydrogen will be a key energy vector in two sectors:
  - Heating
  - Heavy Duty Vehicles
  - (+ chemicals, industry, grid balancing, light duty vehicles, combined heat and power, …)
- UK has some globally leading companies & government ambition
  - BEIS's plans to release UK $H_2$ strategy in Q1-2021
  - Strong support in Green Infrastructure Plan
- Hydrogen Quality Monitoring A Challenge:
  - Fuel Cells (PEM)



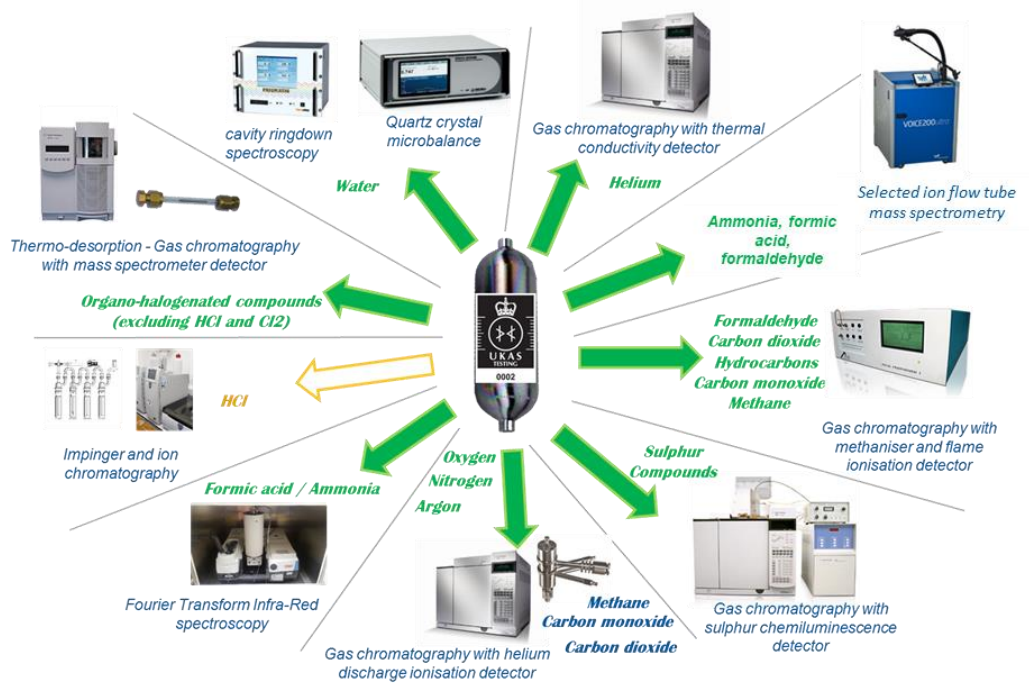






# HRS Hydrogen Quality – State of the Art

- $H_2$ Quality for automotive is defined by ISO14687
- 1 or 2 samples per year per station
- ~3 labs in Europe
- ~£5k per sample
- Long delay
- Limited information

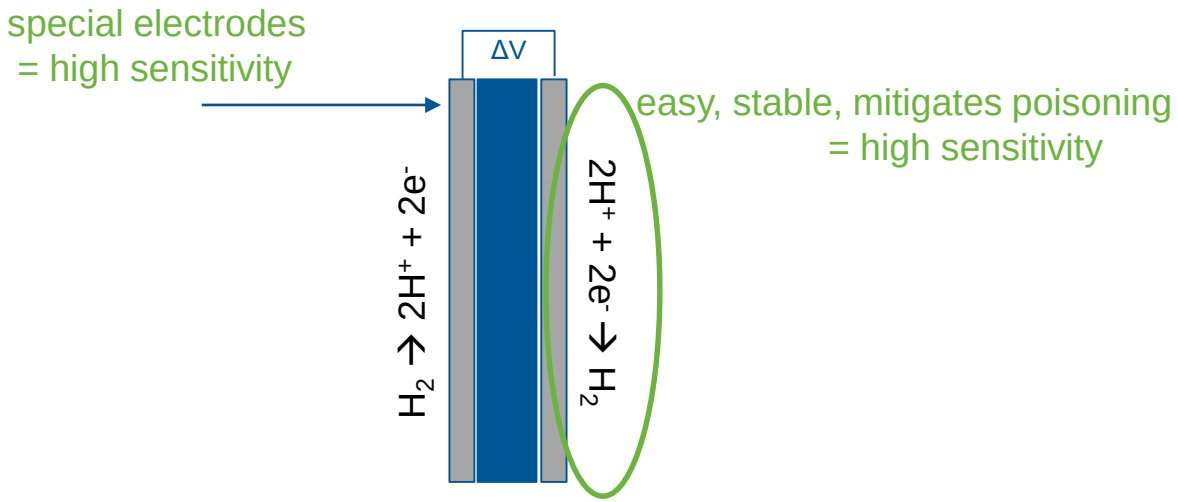



Hydrogen sampling at Hydrogen refuelling stations and other locations

# SBRI Phase 1: Sensor Proof of Principle

## Sensor 1: Electrochemical

- Proton pump style electrochemical sensor.
- Universal sensor




## Sensor 2:

- Details still confidential
- Imaging required

## Sensor 3: TBA

- Off the shelf sensor

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# PHASE 2

# SBRI Scope

- *‘Phase 2 … aims to produce a well-defined prototype. At the end of Phase 2 it is intended that what has been developed will be manufactured and marketed as a way of fulfilling requirements’*

- *‘Have a project which demonstrates new products or services which: help UK business, the public sector or both, recover from the pandemic and; protects the climate and environment which we and future generations depend upon’*

# SBRI Call Details

- Up to £2.4 Million (plus VAT)
- 30-40 projects to be created from 179 Phase 1 winners
- Short project: 12 months

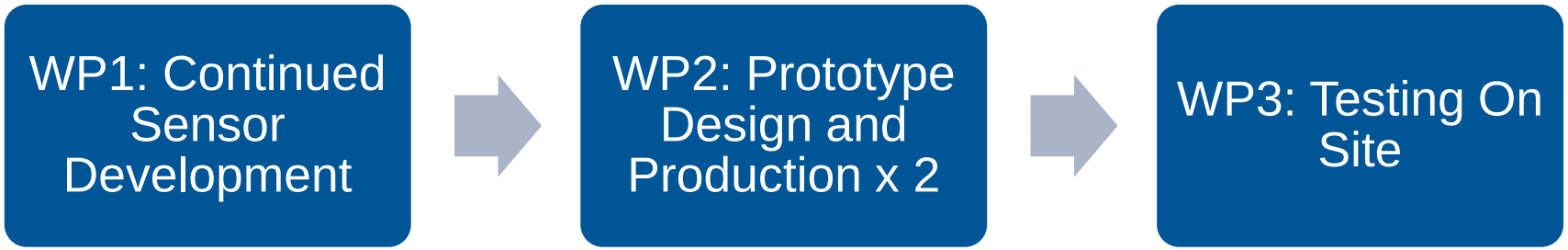
  Deadline: 13th January 2021 11am

  Notification: 1st March 2021

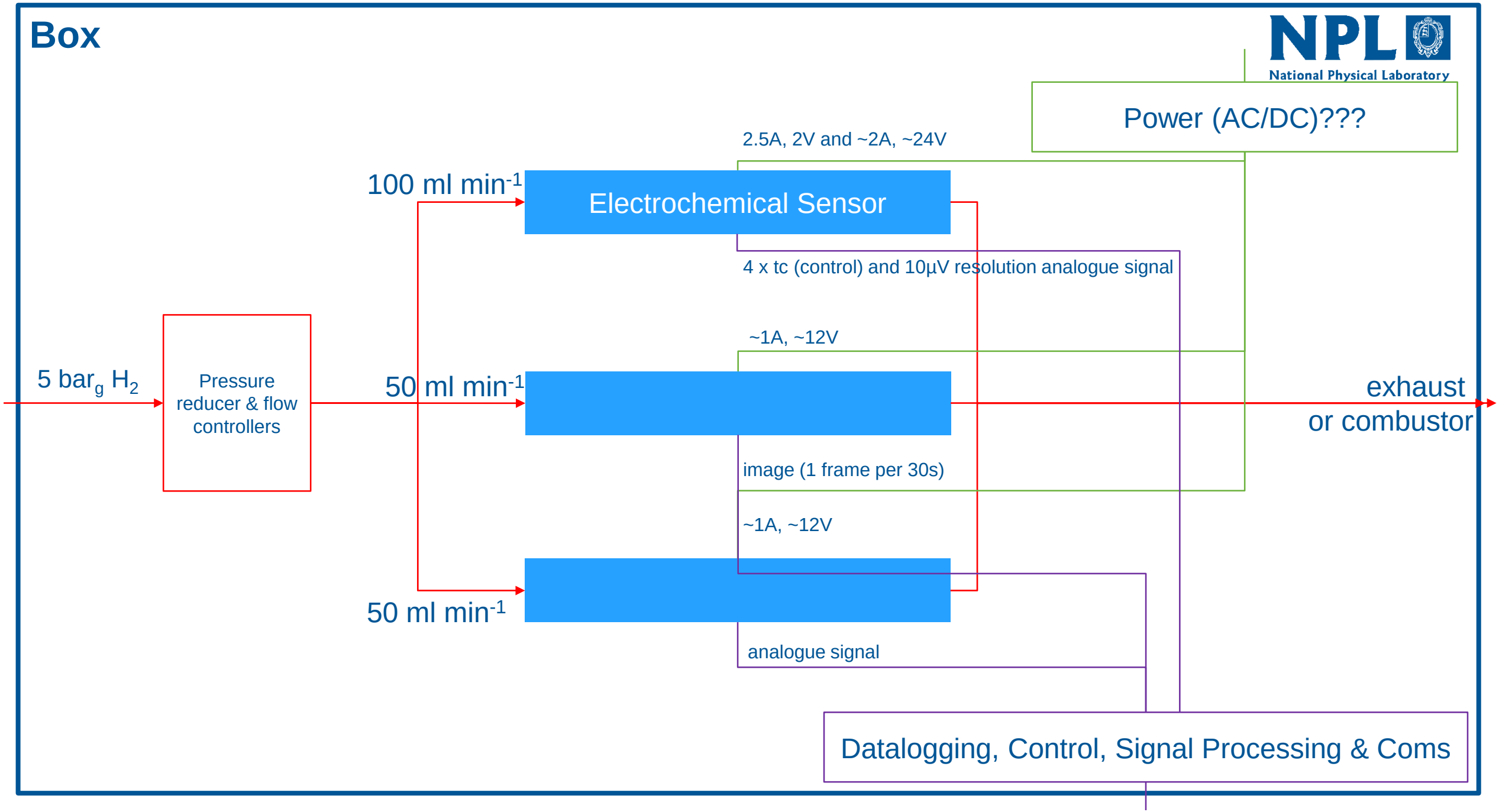
  Start: 1st April 2021

  End: 31st March 2022
- Must demonstrate technology at COP26
- SBRI terms to be flowed down and are non negotiable
- Sub-contract procurement process being determined

# Project Outline




- NPL: Sensor Development
- ITM Power: Electrolyser producer, refuelling station supplier and operator
- Haskell: Refuelling station component supplier and integrator
- XXX : Integrator – end to end ***or*** NPL manages sub contracts, route to market


Box
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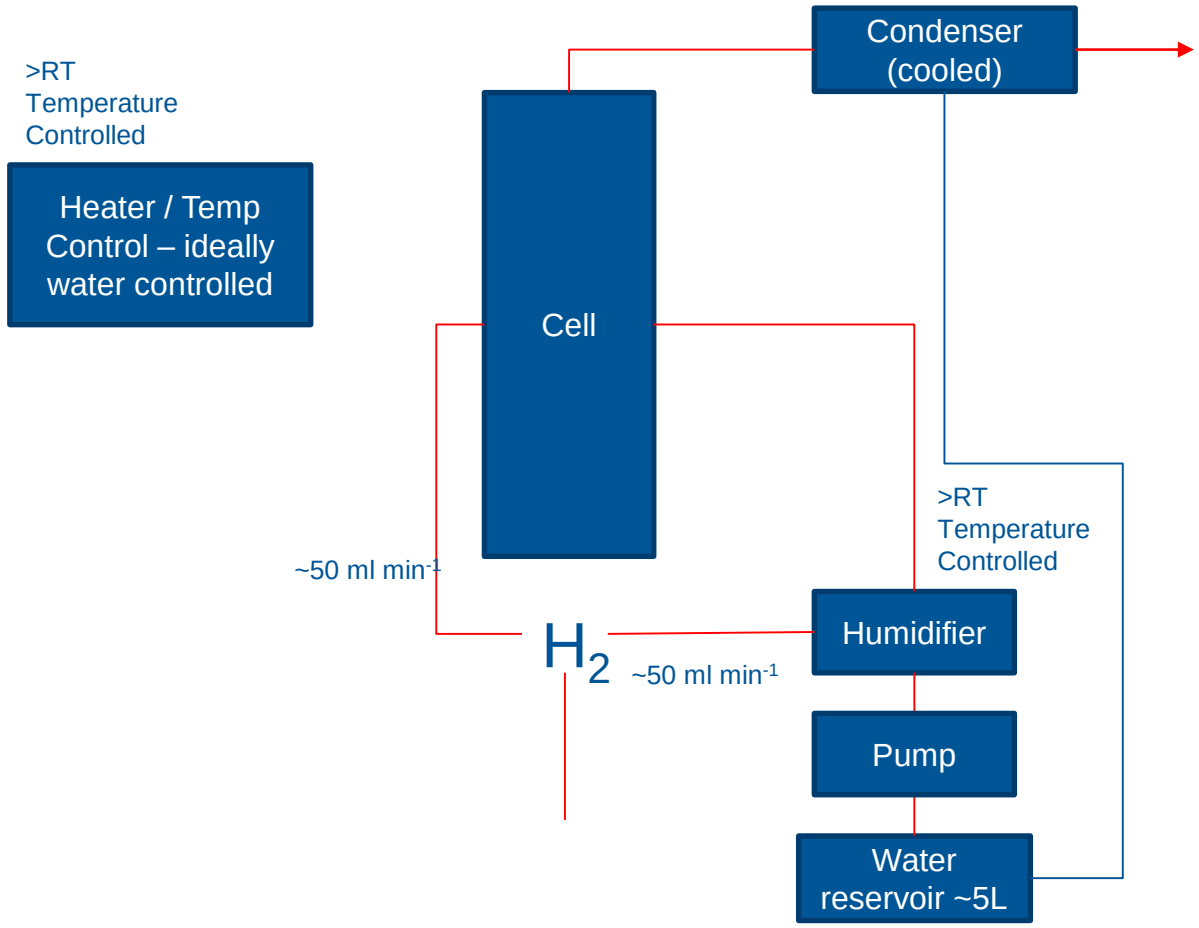
Power (AC/DC)???
2.5A, 2V and ~2A, ~24V
100 ml min-1
Electrochemical Sensor
4 x tc (control) and 10µV resolution analogue signal
~1A, ~12V
5 barg H2
Pressure reducer & flow controllers
50 ml min-1
exhaust or combustor
image (1 frame per 30s)
~1A, ~12V
50 ml min-1
analogue signal
Datalogging, Control, Signal Processing & Coms

# Electrochemical Sensor



# Key Questions

- Do you have experience of designing and building gas sensing instruments with < 1 ppm levels of detection?
- Do you have experience of working with hydrogen or similar flammable/explosive gasses or producing equipment to be used in a process chemistry environment?
- Do you have the resources to begin the project in Q2-2020 with the scope running for 12 months?
- Is this of commercial interest to you beyond SBRI project – looking for route to market

# Scope

- Work with NPL and end users to develop detailed functional and technical specifications of the instrument
- Carry out the detailed design of the instrument. Likely subsystems:
    - Gas pressure reduction and flow rate regulation;
    - Gas conditioning - temperature, relative humidity;
    - Interface with optical/imaging sensor (image processing);
    - Interface with electrochemical sensor (current supply, voltage monitoring);
    - Control and communication
    - Enclosure, alarms, power supply, etc
- Produce two prototypes of the designed system, with support and sensors to be supplied by NPL
- Support the integration of the system at end users' facilities and during a 1 month long field trials
- Ensure that design and prototypes conform to best industry practice and any regulations
- Support financial and technical reporting and publicity activities (e.g. COP26)