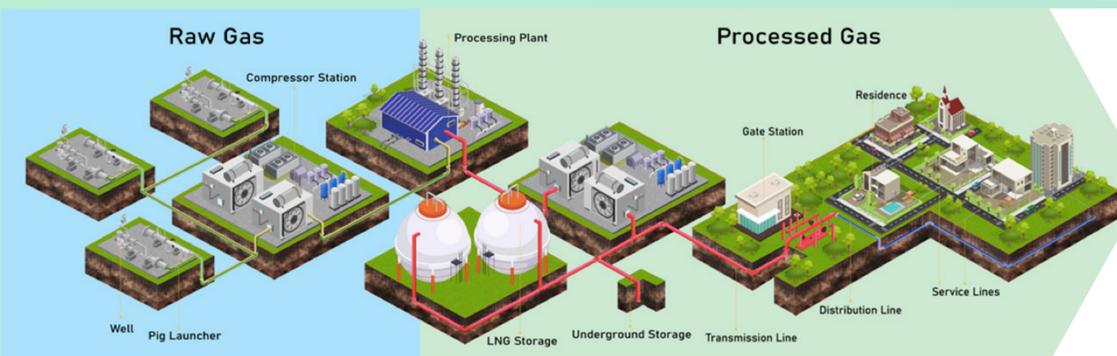


# Development of a light-powered battery-less sensor for methane gas detection



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## Methane sensor options

Various low-cost sensor technologies have been applied to methane sensing (catalytic, optical (NDIR), semiconducting metal oxide and electrochemical) with catalytic/pellistor sensors formerly being dominant but in recent years replaced by NDIR sensors overcoming issues of accuracy, susceptibility to cracking, poisoning, short lifetimes, power consumption, recalibration and requirement for oxygen presence. It also has the advantage of being a fail-to-safe technology.

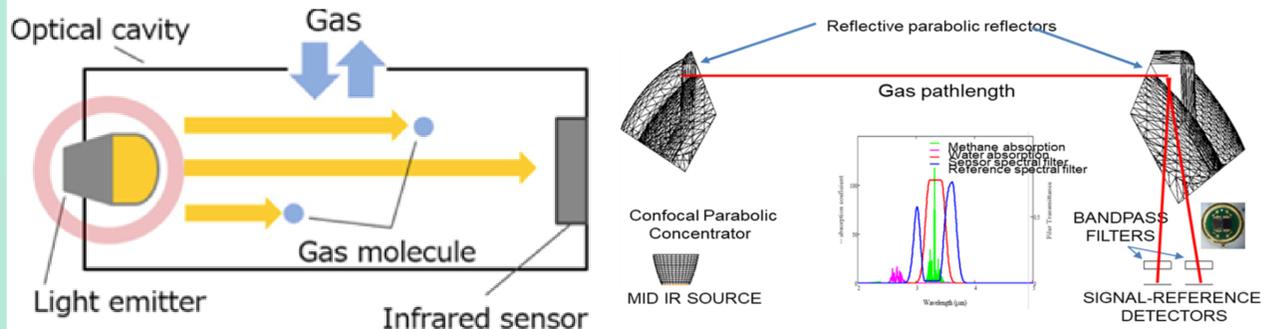
## Example illustration of the extent of the methane monitoring challenge

### Underlying gas sensor technology

Albasense have developed IV-VI based fast response semiconductor light source/detector optopairs as a key enabling technology for use within autonomous (self-powering) non-dispersive infrared (NDIR) gas sensors. Albasense developed physical vapour deposited IV-VI semiconductor photoluminescent (PL) light source/photovoltaic detector optopairs are much lower cost/higher throughput to produce than current epitaxially grown III-V optopairs. Moreover, Albasense IV-VI material approach increases operating efficiency up to 10-30x achieved as a consequence of IV-VI direct bandgap and reduced Auger non-radiative recombination. This provides a power consumption reduction from typically 5mW for methane sensors based on III-V optopairs to 0.5mW for the Albasense methane sensor. The current Albasense sensor has been demonstrated in a laboratory and is now being optimised for commercial applications. Albasense involvement in the InnovateUK project will focus on optimising the light source/detector optopairs for detection of methane gas.

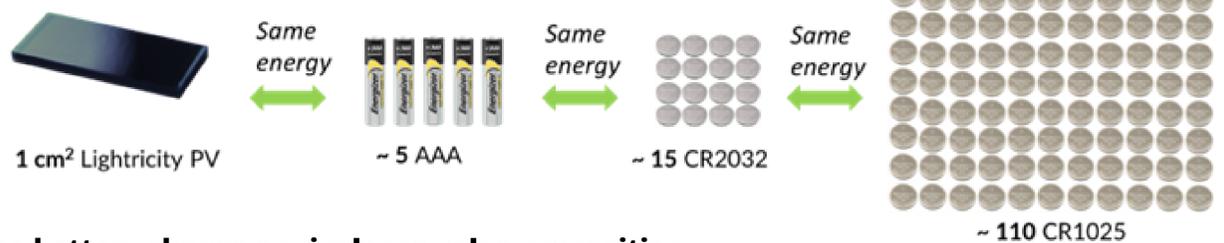
### Further PV advantages vs batteries:

- Retains Performance -35°C to +150°C
- Operation Temperature at 15 - 35°C
- Supports ATEX compliance – non-sparking source
- No Recharge Below 0°C
- Non support to ATEX Compliance



### Non-dispersive infrared (NDIR) gas sensor schematic and operation

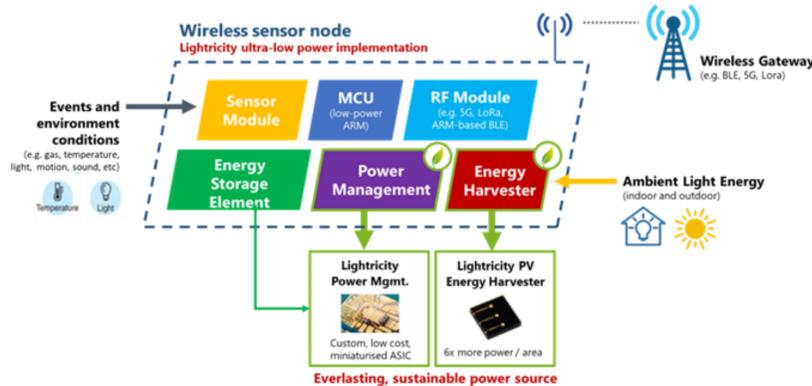
At 1000 lux average illumination (bright indoor conditions), over 10 years:



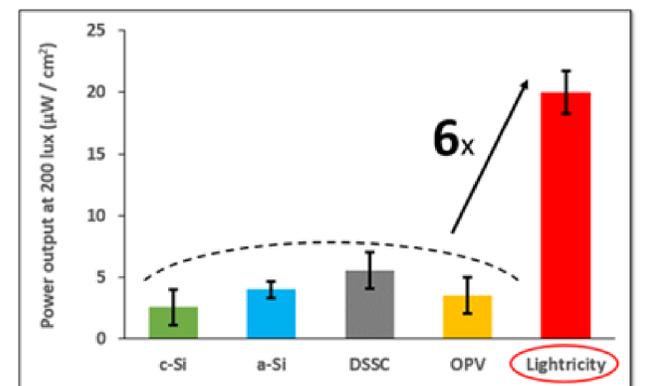
### The battery change equivalence value proposition



Light-Emitting Diode Representation



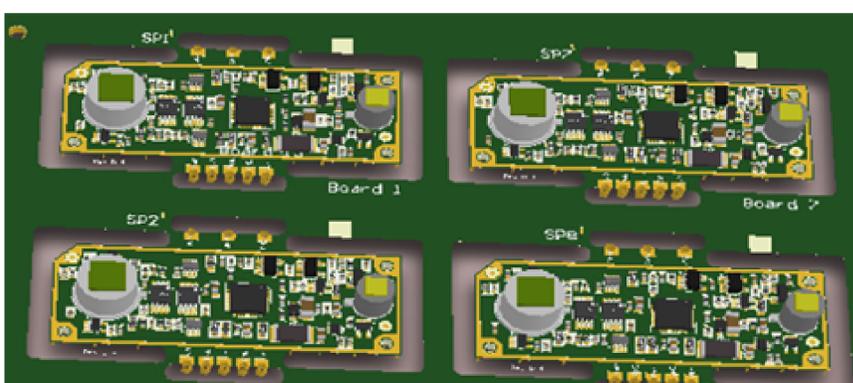
### Light-powered wireless sensor node architecture



### Comparison under indoor low-light conditions

### IP and FTO:

Lightricity have two granted patents (EP2927968A1, TW1590483B) and one in evaluation (US20150280025A1) covering device design parameters for high efficiency at low light level for the energy-harvesting device, including contact design and material considerations. Lightricity has recently filed (2021) 3 additional patent applications in the UK (application numbers: 2115650.0 and 2115648.4); covering manufacturing aspects of the energy harvesting device and the overall system architecture of an ultra-low power photovoltaic tag device (2118766.1). Albasense IP includes patents (assigned from UWS) relating to innovative optical design (conformal parabolic concentrator) that significantly increases throughput and sputtering deposition techniques that enable the low-cost non-epitaxy-based approach to LED manufacture with IV-VI materials.



AlbaSense Methane Sensor



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