H2scan Process Analyzer Applications	
Oil & Gas Industry	
Reformer Recycle Hydrogen	A reformer converts low octane petroleum refinery naphthas into high octane reformates (components of high octane gasoline). This is done by re-structuring the hydrocarbon molecules, of which hydrogen is separated out. Hydrogen, in a mixture with 80% hydrocarbons is recycled to the catalytic reformer from a product separator. Monitoring the hydrogen assists in the overall process control of the unit, ensuring maximum process efficiency.
Isomerization Recycle Hydrogen	Isomerization is used primarily for upgrading the octane of C5/C6 gasoline and for benzene saturation. Hydrogen is combined with the C5/C6 charge feed to the isomerization reactor. Without knowing the composition of the recycle hydrogen, the partial pressure of hydrogen across the catalyst is unknown. If this partial pressure drops below 125 psia, rapid coking of the isomerization catalyst occurs. Hydrogen measurement provides critical information on condition of the catalyst or any potential upsets.
Butamer Off Gas	The butamer process is a high efficiency/cost effective method for the isomerization of normal butane to isobutane. In this process an analyzer is used to measure low-level hydrogen concentration at the stabilizer offgas to ensure that adequate hydrogen is available in the reactor for the desired isomerization reactions. Insufficient hydrogen in the offgas is a fast and critical indication of changes in the feed composition which could result in undesirable reactions.
Hydrocracker Recycle & Make-Up Hydrogen	A hydrocracker takes heavy oil fractions recovered from crude and mixes with hydrogen. This is then subjected to very high pressures and temperatures in giant reactors in which multimillion dollar catalysts are implemented. This breaks (cracks) long chain molecules into short chain molecules (naphtha, kerosene, and gas oil components); Hydrogen atoms attach to the new molecules to create lighter products. The newly formed molecules are then used to make jet fuel, diesel, and gasoline. The low octane molecules are sent to the plattfomer to increase the octane level. Hydrogen measurement within the recycle and make-up hydrogen streams is a critical operating criteria for the hydrocracker. A miss on H2 purity can cost millions in diminished hydrocracker rate.
Tail Gas	Tail gas units provide the overall recovery of sulfur in refineries and gas plants. Part of the functionality of the tail gas unit is to convert SO2 back into H2S in order to be scrubbed out of the process. Hydrogen is used in this conversion process and has to be in a sweet spot (approximately 5%) to ensure the best conversion rate. Hydrogen measurement ensures overall process efficiency.

PSA Hydrogen Purity	Pressure Swing Adsorbers are used to separate some gas species from a mixture of gases under pressure (according to the species' molecular characteristics). Refineries will input a stream containing (for example) 80% hydrogen through a PSA to increase the hydrogen purity to 99.99%. This then, is fed into other processes within the refinery. Measuring the hydrogen purity is essential to ensure that the PSA is operating efficiently.
Hydrodesulphurization/Hydrotreater Recycle Hydrogen	Hydrodesulphurization is a catalytic chemical process used to remove sulfur from gasoline, jet fuel, diesel fuel, etc. The end purpose is to reduce the SO2 emissions from the fuels. A hydrotreater is used in the hydrodesulphurization process. Recycle and make-up hydrogen is fed into the hydrotreater to remove the sulfur by way of hydrogenolysis. This reaction takes place in a fixed bed reactor at elevated temperatures and pressures. H2 measurement is required to ensure overall process control and efficiency of the reaction.
Fuel Gas	Off gas from a refinery is taken and mixed with natural gas to increase/decrease BTU value. This is then sent to combustors to create steam using boilers to fuel a refinery. Hydrogen measurement is used in conjunction with a BTU analyzer. Measuring the hydrogen in refinery fuel gas provides information on the trending of the BTU value as hydrogen directly effects the BTU content within the process. The BTU value is tweaked by adding or reducing natural gas from the process. This ensures the BTU value is in the “sweet spot” enabling the turbine to run at maximum efficiency. When the turbines run at maximum efficiency, the boilers in turn also run at the maximum efficiency which heat water to make steam. Steam is then used all over the refinery for: heat tracing, heat exchangers, heating up crude, stripping components, and many other functions.
Other Industries	
Hydrogen Cooled Generators	Hydrogen is used as the cooling medium in electricity generators due to its high thermal conductivity and low viscosity. Hydrogen also reduces the amount of wind resistance and friction on the spinning generator shaft, thus increasing the generator's efficiency. In-line hydrogen purity measurement is important to ensure maximum efficiency during run-mode and for safety precautions during maintenance, when hydrogen is purged out of the process via CO2 and then air.
Electrolyzer Monitoring	Electrolyzers produce hydrogen by means of the electrolysis of water (water splitting). The H2 and O2 are separated out during this process. Measurement of hydrogen is performed on the outlet of the electrolyzer to confirm the % being produced and on the O2 side, for safety purposes. Hydrogen is flammable at 4% and in an O2 rich environment, it is critical to ensure hydrogen is not leaking into this area.

Polymer Plant Hydrogen Feed	Hydrogen is measured in the feed into the polymer process within the polymer plant. Hydrogen is introduced as one of the primary chemical feeds, and is measured to ensure the ratio of H2 to monomer is as stable as possible in the process, hence, greater efficiency. As this is a batch process, there will be different amounts of H2 per different recipes used, and different feeds. The H2 analyzer is important due to high autocorrelation of data and fast response time.
Air Separation Plants	The process of air separation involves the intake of huge amounts of air from the atmosphere. Argon is produced by ASU's and hydrogen is used in this process to ensure maximum quantities of Argon produced. H2 is introduced into the process to remove the excess O2. H2 must be monitored to ensure removal of O2 and for safety purposes as ASU's are known to leak and confirming the H2 in the process ensures fast response time to potential leaks.
Syngas	Syngas (synthesis gas) refers to a gas mixture that contains varying amounts of carbon monoxide, hydrogen and very often CO2. Production methods include steam reforming of natural gas or liquid hydrocarbons to produce hydrogen, partial oxidation, the gasification of coal, biomass, and in some types of waste-to-energy gasification facilities. Hydrogen measurement is important as it indicates the quality of the syngas produced and for overall process efficiency.
H2scan Leak Detection Applications	
Hydrogen Cooled Generators	Hydrogen is used as the cooling medium in electricity generators due to its high thermal conductivity and low viscosity. Hydrogen also reduces the amount of wind resistance and friction on the spinning generator shaft, thus increasing the generator's efficiency. If hydrogen were to leak out of the generator, it could prove potentially life-threatening, hence the requirement for leak detection.
Battery Room Monitoring	The charging of lead-acid batteries can be hazardous. When batteries are being recharged, they generate hydrogen gas that is explosive in certain concentrations in air (the flammability or explosive limits are 4.1% to 72% hydrogen in air). The spark-retarding vents help slow the rate of release of hydrogen, but the escaping hydrogen may form an explosive atmosphere around the battery if ventilation is poor. It is essential for H2 detection in such environments.
Cask Welding	Spent nuclear fuel containers require welding of the lid to contain the nuclear fuel for storage. During this time the fuel, sitting in its cask full of water, is turning water molecules into hydrogen gas and oxygen ions. The hydrogen, if left to collect at the top of the cask where the welding is in progress, could burn, in the presence of atmospheric Oxygen and heat from the automatic welder. Means of H2 measurement is required to ensure safety.
Laboratories	Safety/Area monitoring - various applications.