After ethylene, propylene is the second most important starting product produced by the petrochemical industry. Propylene is the fundamental constituent of polypropylene plastic, which accounts for nearly two-thirds of all propylene demand and is used to manufacture a wide range of products including films, packaging, caps and closures. Global demand for propylene continues to rise, as polypropylene replaces polyethylene and polystyrene in many manufacturing processes.

A process that converts propane into propylene (propene) while producing hydrogen ($H_2$) as a by-product is a Propane Dehydrogenation (PDH) plant, which requires about 1/3 of the capital needed for a Naphtha cracker and gives the highest possible yield of propylene. As a consequence, this process has become popular in regions where there is an abundance of propane from oil/gas operations, where output is expected to be capable of supplying not only domestic needs but also demand from China. PDH plants are also planned for the USA, where manufacturers can take advantage of the low price raw material obtained from shale gas.

By offering operators the widest available range of gas measurement technologies, including a breakthrough measurement for light hydrocarbons, Servomex delivers the precise correct measurement for each point in the Propane Dehydrogenation process. Combined in multiple points of measurement by Servomex Systems, and supported by Servomex’s global Service Network, Servomex brings the complete, efficient and reliable gas analysis solution for Propane Dehydrogenation.
Fresh propane feed (1) is monitored using a SERVOMEX SpectraExact 2500 to measure percent level propane purity. This feed is then mixed with recycled feed from the propylene-propane splitter (P-P Splitter) bottoms using a SpectraExact (2) to measure percent carbon monoxide (CO) and carbon dioxide (CO₂) and a SERVOTOUGH Oxy 1900 (3) for O₂, and vaporized by exchange with process streams. To achieve reaction temperature, feed is then heated in the charge heater, where the SERVOTOUGH FlueGasExact 2700 (4) helps optimize the combustion process measuring both O₂ and COe; the reaction step is monitored for percent propane (C₃H₈) using the SpectraExact (5). This continuous reaction uses a cyclic reactor operation, in which multiple reactors go through a controlled sequence of reaction and fixed catalyst bed regeneration, with percent propylene measured using the SpectraExact for effective process control (6). The reactor effluent is routed to the compressor, and the compressor discharge cooled, dried and routed to a low temperature separation unit to reject light ends.

In the low temperature section, light ends are recovered to be used as fuel, while the hydrogen-rich off-gas is sent to a Pressure Swing Adsorption (PSA) unit and the H₂ measured for quality using the SERVOPRO MonoExact TCD (7) (8). The PSA separates high-purity hydrogen by-product from light fuel gas. The liquid stream from low temperature separation is fed to distillation facilities for product recovery. The distillation facilities mainly consist of a deethanizer and propylene-propane splitter. The deethanizer recovers fuel C₂, using the SERVOTOUGH SpectraScan 2400 to measure C₂-C₅ and lighter hydrocarbons C₁-C₃ as the top product (11) and C₃-C₅ as the bottom product (12). Propylene and propane are obtained as the bottom product, with the SpectraScan measuring C₃-C₅ (13). The P-P splitter produces pure grade propylene, which has quality measurements for percent C₃H₆/C₃H₈ and C₂-C₅ provided by the SpectraExact (13) and SpectraScan (14) respectively; the process recycles propane as bottom product to the reaction area, with the SpectraScan (15) again measuring percent levels of C₂-C₅.