Organic Rankine Cycle: an effective solution for heat recovery from open-cycle gas turbines

When looking at the gas turbine worldwide market, it is clear that small-to-medium size open-cycle gas turbines are becoming the preferred solution in many realities. On the one hand, gas compressor stations maintain their typical configuration where several gas turbines with limited capacity (< 50 MW each) work in parallel to drive natural gas compressors. On the other hand, the power generation sector needs to adjust itself to the increasing flexibility requirements either due to the intermittent renewable sources or to the development of highly diversified decentralized power islands. In this scenario, smaller decentralized power plants, based on multiple gas turbines with individual outputs below 100 MW, appear to be the right choice in order to provide operational flexibility and to maintain a high efficiency and low emissions profile over a wide load range.

Both in gas compressor stations and in small power plants, such small-to-medium size gas turbines do not allow implementing traditional combined Rankine Cycle, because their exhaust gas temperatures may not be sufficiently high, especially under part load conditions, to generate steam at the conditions needed to achieve a high overall electrical efficiency while maintaining good flexibility. An alternative, viable and effective solution is the implementation of a combined cycle based on the Organic Rankine Cycle (ORC).

ORC technology, thanks to the use of specific organic working fluids, permits an efficient exploitation of high-to-low temperatures exhaust gas streams, as it could be the case for smaller gas turbines, especially when working on poor quality fuels. In addition, the specific features of the organic fluids used lead to some technical advantages, such as high turbine efficiency (up to 90%), low mechanical stress of the turbine (low rotational speed, low tip speed, moderate temperatures), no blades erosion, no oxidation, high efficiency at partial loads and with low temperature sources. These characteristics result in an overall heat recovery system that is completely automatic, with simple start-stop procedures and quiet running, and that has high availability and flexibility while maintaining long lifetime (> 20 years) and minimum O&M requirements and costs.

Depending on the characteristics of each specific project, i.e. number of gas turbines available for heat recovery, possible layout constrains, water availability on site etc., the ORC solution is designed to best fit with such characteristics. The indirect exchange solution, where an intermediate thermal oil circuit acts as heat carrier from the gas turbines to the ORC unit, is the most common solution, especially with several heat sources available (> 3).

gas compressor station

refinery skyline

Turboden ORC unit

On the counterpart, the direct exchange solution, where the exhaust gas of the gas turbine directly heats up and evaporates the ORC fluid, can be the right choice to optimize ORC power output and reduce the overall cost. The ORC unit can be either water condensed or air condensed: the latter option allows having a water-free heat recovery system and it makes the technology suitable for application in remote and desert areas with lack of water.

Among its 280 ORC plants operating worldwide and the other 50 under construction, Turboden has field-proven experience in combined cycle projects with more than 12 projects in operation and further 3 under construction.

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FLASH NEWS

Iran Sees Oil Output Reaching 4 mln bpd by April

TEHRAN (NIOC) _ Iran expects its oil production to reach 4 million barrels per day by mid-April, and plans to drill 500 new wells over the next five years to raise output to 4.7 million bpd, a senior oil official said on Saturday.

Iran's daily output in January was close to 3.9 million barrels.

"We were due to reach 4 million barrels ...by the end of the (Iranian) year (March 20). This will be realized with a one-month delay," said Ali Kardor, head of National Iranian Oil Company (NIOC).

"Of course, Iran's crude oil production reached 4.2 million barrels at a certain stage, but later fell," he added, without giving further details.

Kardor said Iran's next five-year plan which starts in March predicted the drilling of 500 new wells.

"This will be needed in order to reach a production of 4.7 million bpd", Kardor as saying.

Under a deal agreed to cut production by the Organization of the Petroleum Exporting Countries in December, Iran was allowed to boost output slightly from its October level. Tehran has long argued it needs to regain market share lost under Western sanctions.