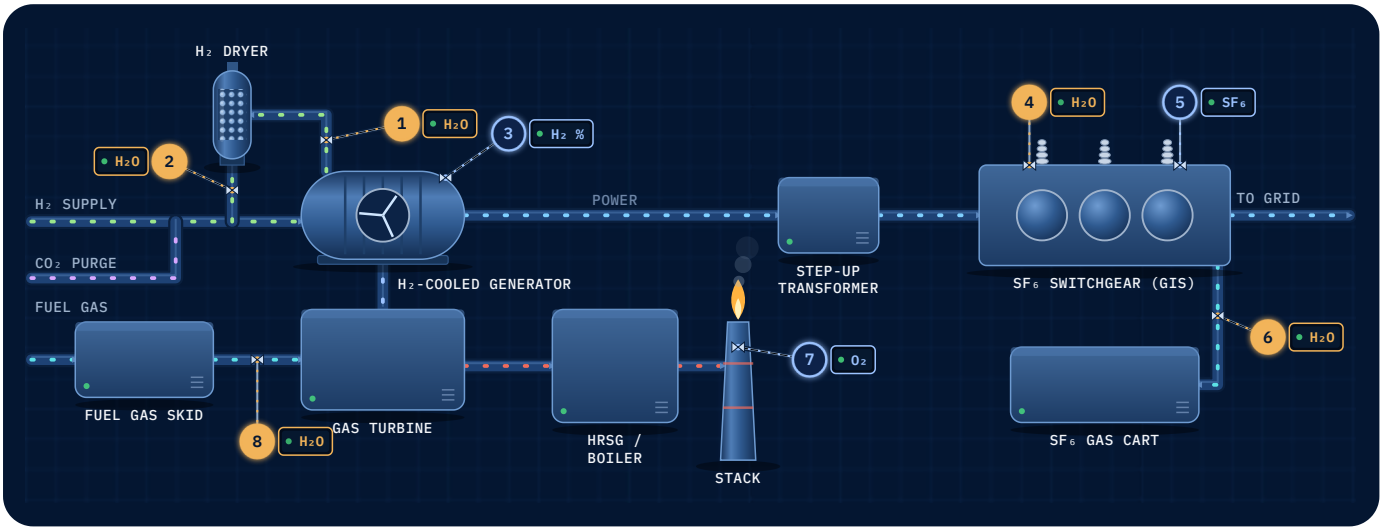
Power generation and grid: where to measure moisture, O_2 and SF_6

Follow fuel gas into the turbine, hydrogen around the generator and power out through the SF_6 switchgear. Each numbered point shows what is measured, the typical limit and the instrument that fits.



● YORK instrument ○ Integrated system (supplied through YORK)

How the process works

A gas-fired plant uses three gases that need watching: fuel gas going into the turbine, hydrogen cooling the generator, and SF_6 insulating the switchgear. Moisture is the main enemy in all three, so most of these points are dew point measurements, many of them made with portable instruments during maintenance.

1. **Fuel gas conditioning.** The fuel gas skid filters and heats the gas so that it reaches the turbine superheated above its water and hydrocarbon dew points.
2. **Gas turbine and heat recovery.** Exhaust from the turbine raises steam in a heat recovery boiler (HRSG). Flue gas oxygen shows how much excess air is used.
3. **Hydrogen-cooled generator.** Large generators are cooled with hydrogen because it cuts windage loss. A dryer keeps the hydrogen dry, and CO_2 is used to purge the casing before filling or opening it.
4. **Step-up and switchyard.** The transformer raises the voltage, and gas-insulated switchgear filled with SF_6 connects the plant to the grid.
5. **SF_6 handling.** Gas carts recover, filter and refill SF_6 during maintenance. Recovered gas is checked before it goes back into service.

Interactive version with animation:
https://www.yorkinstrument.ae/guides/power-generation-grid-measurement-points/

Measurement points

#	POINT	MEASURES	TYPICAL VALUE / LIMIT	RECOMMENDED SOLUTION
1	Generator casing gas (dryer inlet)	Water dew point of the hydrogen	No single OEM limit is published; one utility targets ≤ −18 °C (0 °F), preferably −29 °C (−20 °F). Field readings of −7 to +21 °C have been reported	DPT990-EX, DPT-600 Plus-EX
2	Hydrogen dryer outlet	Water dew point	Should read well below the casing gas: the difference shows the dryer is working	DPT990-EX
3	Generator casing gas	H_2 purity; H_2 in CO_2 and CO_2 in air during purging	One plant runs above 90 % and vents and refills below 90 %; each 1 % drop in purity adds about 1 % windage loss	Integrated system: thermal-conductivity H_2 purity analyzer with three ranges (H_2 in air, H_2 in CO_2, CO_2 in air)
4	SF_6 switchgear compartment	Moisture in SF_6 (ppmv / dew point)	Equipment dew points typically −60 to −5 °C. IEC 62271-1 reference ≈ 574 ppmv at 700 kPa; manufacturer limits 70–1000 ppmv by equipment type	DM9600P, DM9600PL, DPT-600 Plus
5	SF_6 compartment after faults	SF_6 purity and decomposition products (SO_2, SOF_2, HF)	Air + CF_4 ≤ 2 % for re-use; decomposition products tolerable to 100 ppmv, 50 ppmv for re-use (CIGRE)	Integrated system: SF_6 purity analyzer (speed of sound, thermal conductivity or NDIR) and decomposition-product analyzer
6	Recovered SF_6 for re-use	Moisture in SF_6	CIGRE re-use limits: 120 ppmv at 2 MPa, 320 ppmv at 500 kPa, 1600 ppmv at 100 kPa	DM9600P, DPT-600 Plus
7	HRSG / boiler flue gas	Excess oxygen	About 2–3 % O_2 for natural gas; each 15 % cut in excess air raises efficiency about 1 % (US DOE)	POA3500; Integrated system: in-situ zirconia O_2 probe for combustion control
8	Gas turbine fuel gas skid	Water dew point	Fuel must be supplied at least 11 °C (20 °F) above its highest dew point (one turbine OEM specification)	DPT810, DPT990-EX

Typical values from published standards, regulations and technical literature. Your contract, licensor or plant specification always governs. Integrated systems are supplied by YORK through its partner integration factory.

Key references

1. Hydrogen Dryers Cut Windage Loss at CP&L — Power Engineering
2. Water Contamination in Hydrogen-Cooled Generators — Power Engineering
3. Retrofitted Hydrogen Gas Analyzer Readings More Accurate and Reliable — Power Engineering
4. SF_6 moisture presentation, IEEE PES Substations Committee WG K6 (2012) — IEEE
5. SF_6 recycling and CIGRE re-use limits, SF_6 Emission Reduction conference (2000) — US EPA
6. TB 723 SF_6 Measurement Guide — CIGRE
7. Steam Tip Sheet #4: Improve Your Boiler's Combustion Efficiency — US DOE (NREL)
8. OEM natural gas fuel specification (utility RFP appendix) — Public Service Company of Oklahoma