Fuel Change Effects for Syngas Turbines

Combustion, Thermodynamic cycle, Blade Cooling

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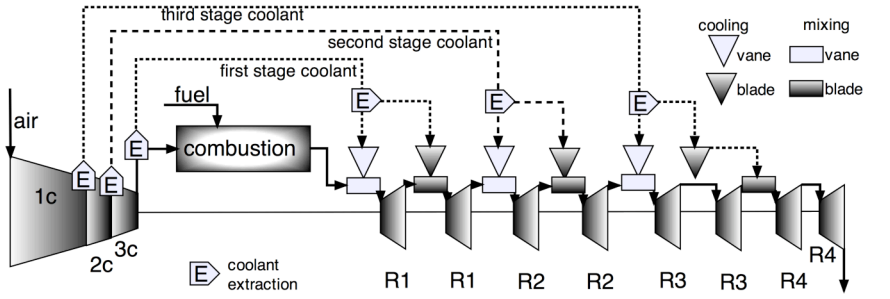


More coolant is required for the syngas than for the NG

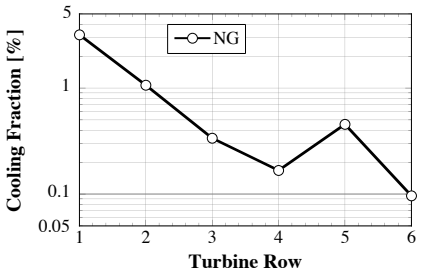
NG- Natural Gas; SG - Syngas

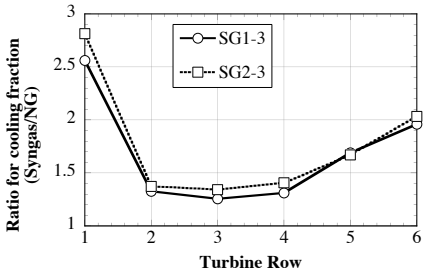
Case	Cooled rows	Film cooled rows	Air flow rate [kg/s]	Fuel flow rate [kg/s]	FAR [%]	Tcomb [^oC]	RIT [^oC]
NG	6	4	440	10.8	2.739	1646	1560
SG	6	4	380	89	26.24	1626	1577

Hot gas composition

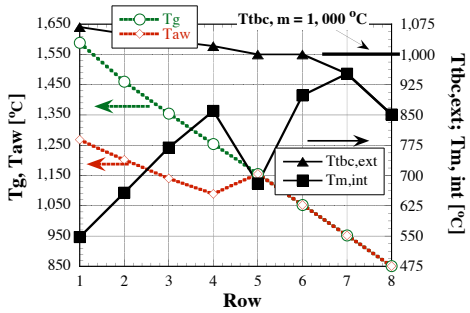
Specie	*NG2-3 moles*	*SG2-3 moles*	*% change*
Excess air	7,959	5,237	34
CO_2	675	2,027	200
H_2O	1,346	1,889	40
N_2	5,018	5,207	3.8
Ar	60	59	1.7

- **The same compressor ratio.**
- **Coolant extraction points are the same for NG and syngas.**

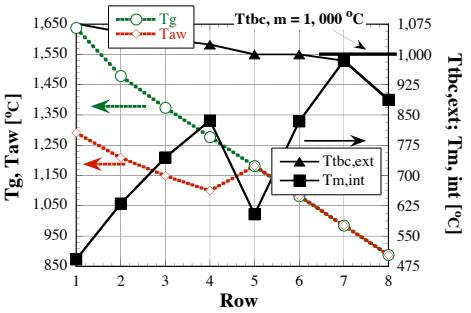




The last stage components experienced higher inner wall temperatures than those for the NG case



Results for NG



Results for SG

Tg - hot gas
Taw - mean adiabatic wall
Ttbc, ext - surface of TBC
Ttbc, m - interface TBC with metal
Tm, int - interior metal surface (in contact with coolant)

Taw - introduced to deal with film cooling effects

Maximum allowable temperature
Ttbc, m = 1,000 C