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## Study on different heat supplementation strategies for a combined cooling, heating and power system

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**Abstract:** The small CCHP system is adopted by majority of office buildings and markets. The heat supplementation under partial load is a problem for CCHP systems. In this research, a partial load model of a combined cooling, heating and power (CCHP) system was established. The CCHP system's partial load analysis showed that the micro gas turbine (MGT) and the bottom absorption chiller were coupled by flue gas energy. Based on the coupling effects analysis, four different supplementary strategies (load adjustment method (LAM), mass flow first method (MFM), temperature first method (TFM) and maximum coefficient of performance (COP) method (MCOPM)) had been proposed and analyzed when flue gas heat was insufficient. The results showed that the CCHP system's supplemental fuels under MFM, TFM and MCOPM were all less than that under LAM. And the additional fuel under the TFM was the least among the four different strategies. The CCHP system's heating capacity under TFM was smaller than that under MFM and MCOPM, while the CCHP system's primary energy and exergy efficiencies under the TFM were larger than that under MFM and MCOPM, at the same cooling load, when supplement heat was needed. The CCHP system's total exergy destruction under TFM (106.236 kW) was smaller than that under the LAM (110.309 kW). So when the flue gas heat was insufficient, the TFM supplementation strategy was recommended.

**Keywords:** combined cooling, heating and power; coupling effect; heat supplementation strategies; partial load model; exergy efficiency;

### Nomenclature

A (m <sup>2</sup> )	heat transfer area	<b>Greek letters</b>	
ABS	Absorber	$\Delta t$ (K)	temperature difference
ARC	absorption refrigeration chiller	$\eta$	efficiency
Burner	burner	$v$ (m <sup>3</sup> ·kg <sup>-1</sup> )	specific volume
CC	combustion chamber	$\zeta$	concentration of the solution
CCHP	combined cooling, heating and power	<b>Subscripts</b>	
CMP	compressor	0	reference
CON	condenser	1,2,3...	sub flows
COP	efficient of performance	air	fresh air
DHW	domestic hot water	c	cooling load
EVA	evaporator	cm	cooling capacity under the MFM
Ex (kJ/kg)	exergy	ct	cooling capacity under the TFM
HPG	high pressure generator	cur	current state
HTHE	high temperature heat exchanger	e	electricity
IHE	internal heat exchanger	exh	exhaust gas
LPG	low pressure generator		

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