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Title: A novel multi-objective optimization method for CCHP-GSHP coupling systems

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Highlights

A novel multi-objective method is presented to optimize CCHP-GSHP coupling system.

Genetic algorithm is used to solve the optimal method.

The sensitivity analysis of gas and electricity cost is proposed.

Nomenclature			
Abbreviation		λ	critical value
ATC	annual total cost (\$)		
ATCSR	annual total cost saving rate (%)	Subscripts	
CCHP	combined cooling , heating and power	a	additional electricity
CHP	combined heating and power	ar	absorption refrigerator
CO ₂ E	carbon dioxide emission (g)	b	boiler
CO ₂ ERR	carbon dioxide emission reduction rate (%)	c	cooling
COP	coefficient of performance	cchp	combined cooling, heating and power
HP	heat pump	cchp+gshp	combination of cchp and gshp
GA	genetic algorithm	e	electricity
GSHP	ground source heat pump	er	electricity refrigerator
PESR	primary energy saving rate (%)	f	fuel
SG	separated generation	gas	natural gas
TST	thermal storage tank	pgu	power generation unit
		grid	electricity grid
Symbols		gshp	ground source heat pump
C	cost (\$)	h	heating
E	electricity (kW h)	he	heating exchanger
d	life expectancy of equipments	k	number of equipments
F	fuel (kW)	i	day
l	number of equipments in CCHP-GSHP	in	thermal input to tst
m	number of equipments in SG	j	hour
N	installed capacity (kW)	n	rated condition
I	interest rate (%)	out	thermal output from tst
P	capital recovery factor	rec	recovery heat of pgu
Q	heat (kW)	s	supplied heat
y/z	the cooling/heating provided by GSHP to total cooling/heating load respectively	sg	separated generation
β	emission factor	total	total energy consumption
		tst	thermal storage tank

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