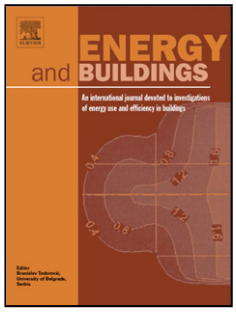

Title: A novel multi-objective optimization method for CCHP-GSHP coupling systems

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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			
ATC	annual total cost ($)	λ	critical value
ATCSR	annual total cost saving rate (%)		
CCHP	combined cooling , heating and power	Subscripts	
CHP	combined heating and power	a	additional electricity
CO_2E	carbon dioxide emission (g)	ar	absorption refrigerator
CO_2ERR	carbon dioxide emission reduction rate (%)	b	boiler
COP	coefficient of performance	c	cooling
HP	heat pump	cchp	combined cooling, heating and power
GA	genetic algorithm	cchp+gshp	combination of cchp and gshp
GSHP	ground source heat pump	e	electricity
PESR	primary energy saving rate (%)	er	electricity refrigerator
SG	separated generation	f	fuel
TST	thermal storage tank	gas	natural gas
		pgu	power generation unit
		grid	electricity grid
Symbols		gshp	ground source heat pump
C	cost ($)	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
		total	total energy consumption
β	emission factor	tst	thermal storage tank