
Supplementary Materials for Manuscript:

A review of multi-objective optimization in organic Rankine cycle (ORC) system design

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Table S1. List of reviewed papers.

	Year	Author	Ns	Optimization objective	Optimization method	Parameter level	Decision making
1	2021	[58]	2	Thermal efficiency+LEC	NSGA-II	System	TOPSIS
2	2021	[23]	2	Exergy efficiency+PBP+Carbon emission	NSGA-II	System	TOPSIS
3	2021	[60]	2+3	Power output+PBP+LCOE+SIC	NSGA-II	System	TOPSIS
4	2021	[22]	2	Exergy efficiency+SIC	OPPSS+MOPSO+NSGA-II	System+Heat exchanger	TOPSIS
5	2021	[126]	2	Thermal efficiency+TurbinePower output/Size	NSGA-II	System+Turbine	TOPSIS
6	2021	[45]	2	Exergy efficiency+EPC (Power output+EPC)	NSGA-II	System	TOPSIS
7	2021	[48]	2	NPV+Electricity generation	NSGA-II	System	LINMAP
8	2021	[62]	2	Power output-Thermal efficiency-Exergy efficiency+Carbon emission		System	TOPSIS
9	2021	[127]	2	Turbine efficiency+Turbine Power output	MOGA	Turbine	
10	2020	[134]	2	Thermal efficiency+Power output/Molar mass	MOGA	System+Fluid	
11	2020	[59]	2	Exergy efficiency+PBP+Carbon emission	NSGA-II	System	GRA
12	2020	[44]	2	Exergy efficiency+PBP	NSGA-II	System	TOPSIS+GRA
13	2020	[94]	2	Exergy efficiency+Thermal efficiency		System	
14	2020	[143]	3	Power output+Exergy efficiency+Thermal efficiency	NSGA-II	System	TOPSIS
15	2020	[112]	2	Custom:Thermal efficiency*Exergy efficiency, Total cost/PBP	NSGA-II	System	TOPSIS
16	2020	[113]	2	Custom:Thermal efficiency*Exergy efficiency, Total cost/PBP	NSGA-II	System	
17	2020	[90]	3	Power output+EPC+Carbon emission	MOGA	System	TOPSIS+MFE+VBR
18	2020	[18]	2	Exergy efficiency+PBP	NSGA-II	System	
19	2020	[20]	2	Exergy efficiency+SIC	WSM+GA	System	
20	2020	[1]	2	Exergy efficiency+PBP	MOGA	System	
21	2020	[97]	2	Thermal efficiency+LEC	MOHTS	System	
22	2020	[53]	2+3	Exergy efficiency +Exergoeconomic +Exergoenvironmental	MOGA	System	TOPSIS
23	2020	[114]	2	Exergy efficiency+Heat exchanger area	NSGA-II	System	TOPSIS
24	2020	[107]	2	Exergy efficiency+Heat exchanger area	NSGA-II	System	TOPSIS+LINMAP+ Shannon Entropy
25	2020	[128]	2	Cultom: Exergy efficiency+Heat exchanger area	NSGA-II	System+Turbine	LINMAP
26	2020	[116]	2	Electricity generation+NPV	NSGA-II	System	LINMAP
27	2020	[103]	2	Custom: MPO+LEC	NSGA-II	System	TOPSIS+LINMAP+ VIKOR+WASPAS
28	2020	[109]	3	Power output+Exergy efficiency+Exergoeconomic	NSGA-II	System	LINMAP
29	2020	[28]	2	Exergy efficiency+UA	NSGA-II	System	TOPSIS
30	2020	[147]	2	Power output+Thermal efficiency	NSGA-II	System	TOPSIS
31	2020	[91]	2	Exergy efficiency+Thermal efficiency	WSM+GRA	System	
32	2020	[83]	2	Exergy efficiency+Thermal efficiency	WSM	System	
33	2019	[36]	4	Exergy efficiency+Thermal efficiency+Cost+ Carbon emission	WSM+AHP	System	
34	2019	[69]	3	Entropy production rate+Cost+Volume	NSGA-II	Heat exchanger	
35	2019	[138]	2	Power output+Heat exchanger area	MOGA	System+Fluid	

	Year	Author	Ns	Optimization objective	Optimization method	Parameter level	Decision making
36	2019	.[122]	3	Power output+Total cost+SIC	NSGA-II	System+Heat exchanger+Fluid	
37	2019	.[98]	2	Exergy efficiency+SIC	ACS(Artificial Cooperative Search)	System+Heat exchanger	TOPSIS
38	2019	.[29]	2	Exergy efficiency+UA	NSGA-II	System	
39	2019	.[133]	2	Exergy efficiency+Expander volume flow ratio	MOGA	System	
40	2019	.[40]	3	Power output+Carbon cost+Water cost	MOGA	System	GRA
41	2019	.[100]	2	Exergy efficiency+Thermal efficiency	ABC (artificial bee colony)	System	
42	2019	.[129]	3	Power output+Thermal efficiency+UA	WSM+SANO+SLSQP	System+Turbine	
43	2019	.[110]	2	Thermal efficiency+Annual total cost		System	LINMAP
44	2019	.[102]	2	Exergy efficiency+SIC	MOGA	System	LINMAP
45	2019	.[99]	2	Thermal efficiency+SIC	MOGWO (multi-objective grey wolf optimizer)	System	LINMAP
46	2019	.[149]	2	Exergoeconomic+SIC	MOGWO	System	TOPSIS
47	2019	.[111]	2	Thermal efficiency+Exergoeconomic	NSGA-II	System	LINMAP
48	2019	.[75]	2	Exergy efficiency+Risk distance	NSGA-II	System	TOPSIS+LINMAP
49	2019	.[56]	2	Heat exchanger area/Power (APR) + SI	WSM	System	
50	2019	.[66]	2	Heat exchanger area/Power (APR) + SI	NSGA-II+WSM	System	
51	2019	.[73]	4	Power output+Cost+Mass+Volume	MOGA	System	
52	2019	.[123]	2	Power output+Heat exchanger area	WSM	System+Heat exchanger	
53	2019	.[101]	2	Custom: Utilization rate+SIC	SAFA (multi-objective self-adaptive firefly algorithm)	System	LINMAP
54	2019	.[46]	2	Power output+EPC	MOGA	System	TOPSIS
55	2019	.[32]	2	Custom: UA/Power output+Turbine size/Power output	NSGA-II	System+Turbine	TOPSIS
56	2019	.[70]	3	Electricity generation+Heat exchanger volume+ NPV	MOGA	System+Heat exchanger	
57	2018	.[84]	2	Exergy efficiency+Custom: Heat exchanger area/Power output	WSM	System	
58	2018	.[108]	2	Exergy efficiency+LEC	NSGA-II	System	Fuzzy set theory, GRA
59	2018	.[63]	2	Power output+Environmental	ε -constraint	System	LINMAP
60	2018	.[105]	2	Net profit+PBP		System	TOPSIS
61	2018	.[148]	2	Power output+Outlet temperature of heat source	MOGA	System	TOPSIS
62	2018	.[52]	2	Exergy efficiency+Exergoeconomic	NSGA-II	System	
63	2018	.[92]	2	Exergy efficiency+LCOE	MOPSO	System	LINMAP
64	2018	.[42]	2	Exergy efficiency+SIC	MOGA	System	
65	2018	.[93]	2	Power output+Heat exchanger area	MOEA	System	
66	2018	.[54]	2	Power output+Exergoeconomic	NSGA-II	System	
67	2018	.[25]	3	Power output+Exergy efficiency+UA	NSGA-II	System	
68	2018	.[61]	2	Exergy efficiency+ Custom: LCA/Heat absorption	MOGA	System	
69	2018	.[77]	2	Electricity generation+Custom: Power fluctuation	MOGA	System	
70	2018	[117]	2	Power output+Total cost	MOGA	System+Process	
71	2018	.[87]	2	Exergy efficiency+SIC	WSM	System	
72	2018	.[85]	2	Custom:area/Power+SI	WSM	System	
73	2018	.[104]	2	Exergy efficiency+SIC	NSGA-II	System	LINMAP

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74	2018	[.31]	2	Power output+Heat exchanger area	NSGA-II	System	
75	2018	[.55]	2	Exergy efficiency+Exergoeconomic	NSGA-II	System	LINMAP
76	2017	[.88]	2	LCOE+PBP/Usable heat factor	WSM+ α method	System	
77	2017	[.106]	2	Power output+Total cost	MOGA	System	TOPSIS
78	2017	[.115]	2	Exergy efficiency+ EPC	NSGA-II	System	GRA
79	2017	[.30]	2	Exergy efficiency+UA	MOGA	System	
80	2017	[.121]	2	Power output+Total cost	SNOPT +CPLEX	System+Turbine+Fluid	
81	2017	[.57]	3	Profit+Carbon emission+Safety	GAMS	System	
82	2017	[.82]	4	Power output+Exergy efficiency+Thermal efficiency+Cost	WSM	System	
83	2017	[.71]	3	Total cost+Evaporator volume+Pressure drop	WSM+PSO	Heat exchanger	
84	2017	[.24]	2	Thermal efficiency+Heat exchanger area	MOGA	System	
85	2017	[.15]	3	Exergy efficiency+Thermal efficiency+ Total cost	NSGA-II+MOPSO+MOEA	System	
86	2017	[.78]	2	Thermal efficiency+Variance of thermal efficiency	NSGA	System	
87	2017	[.26]	2	Thermal efficiency+UA	NSGA	System	
88	2017	[.141]	5	Power output+Exergy efficiency+ Thermal efficiency+Production cost+Exergoeconomic	MCDM	System	
89	2017	[.33]	2	Thermal efficiency+Turbine size/Power output	MOFA (firefly algorithm)	System+Turbine	TOPSIS
90	2017	[.130]	2	Turbine efficiency+Turbine power output	MOGA	Turbine	
91	2016	[.17]	2	Power output+Turbine size	MOGA	System	TOPSIS
92	2016	[.43]	2	Power output+ SIC		System	
93	2016	[.89]	2	Exergy efficiency+SIC	WSM	System	
94	2016	[.35]	3	SIC+Heat exchanger area+Turbine flow rate/Power output	MOGA-II	System	TOPSIS
95	2016	[.65]	3	Exergy efficiency+ Exergoeconomic+ Exergoenvironmental	MOPSO	System	Fuzzy method
96	2016	[.11]	2	Power output+Total cost	MOGA	System+Heat exchanger	
97	2015	[.10]	2	Power output+Total cost	MOGA	System	
98	2015	[.68]	2	SIC+SI	WSM	System	
99	2015	[.14]	2	Exergy efficiency+ Annual cash flow	MOGA	System	
100	2015	[.86]	4	Power output+Evaporator area+Condenser area+Speed	WSM	System	
101	2015	[.132]	3	Exergy efficiency+Thermal efficiency+LEC	NSGA-II	System	
102	2015	[.34]	2	Thermal efficiency+Turbine size	DIRECT	System+Turbine	
103	2015	[.6]	2	Power output+SIC	NSGA-II	System+Heat exchanger	
104	2015	[.64]	11	Power output+ efficiency+Total cost+PBP+NPV+Carbon emission+NOx	WSM+GA	System+Heat exchanger	
105	2015	[.124]	2	Evaporator cost+Pressure drop	NSGA-II	System+Heat exchanger	
106	2015	[.47]	3	Power output+Exergy efficiency +LEC	NSGA-II	System	
107	2015	[.27]	2	Exergy efficiency+APR (Heat exchanger area/Power output)	NSGA-II	System	TOPSIS
108	2015	[.13]	2	Exergy efficiency+LEC	NSGA-II	System	TOPSIS+LINMAP+ Shannon entropy

	Year	Author	Ns	Optimization objective	Optimization method	Parameter level	Decision making
109	2015	[12]	2	Exergy efficiency+LEC	NSGA-II	System	TOPSIS
110	2015	[131]	2	Turbine design efficiency+Off-design efficiency	MOGA	Turbine	
111	2015	[19]	2	Power output+Total cost	MOGA	System	
112	2014	[79]	2	Custom: Tracking error+ Entropy of superheat	EDA/PMBGA (Estimation of distribution algorithm)	System	
113	2014	[49]	3	Mass+Carbon emission+NPV	NSGA-II	System+Heat exchanger	
114	2014	[16]	2	Power output+Total cost	NSGA-II	System	
115	2014	[72]	2	Power output+Heat exchanger volume	NSGA-II	System+Heat exchanger	
116	2013	[8]	2	Exergy efficiency+Total cost	NSGA-II	System	LINMAP
117	2013	[125]	2	Heat exchanger area+Pressure drop	NSGA-II	Heat exchanger	
118	2013	[74]	3	Thermal efficiency+ Volume+ NPV	NSGA-II	System+Heat exchanger	
119	2013	[76]	4	Exergy efficiency+Thermal efficiency+ Flammability	SA (simulated annealing algorithm)	System+Fluid	
120	2012	[81]	2	Thermal efficiency+Heat exchanger area/Power output	WSM+SA	System	
121	2012	[9]	2	Thermal efficiency+Heat exchanger area/Power output	WSM+SA	System	
122	2010	[136]	5	Density+Latent heat+heat transfer coefficient+ Specific heat, viscosity	SA	System+Fluid	