

Bicriteria Optimization Approach to Analyze Incorporation of Biofuel and Carbon Capture Technologies

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Supplementary Material 2:
 Data for the Bicriteria Optimization Problem
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In this supplementary material, data for the bicriteria optimization problem is presented.

Table 1: Parameters related to boilers and turbines.

	Start Up Costs ¹	Operation Cost ²	Gener. LB ³	Gener. UB ⁴	El. Cons. ⁵	MP Cons. ⁶	Eff. ⁷
Boiler 1	60	9600	100	250	0.0028	0.08	85%
Boiler 2	60	7200	80	200	0.0025	0.09	75%
HP Tu1	20	14400	5	25	-	-	40%
HP Tu2	20	14400	10	30	-	-	35%
MP Tu1	20	14400	7	20	-	-	40%
MP Tu2	20	14400	10	25	-	-	35%
GT	40	16000	15	30	0.0012	-	50%

¹ (w_i^{SU}), (\$)

² (fc_i), (\$)

³ For boiler 1 and boiler 2, high pressure steam generation lower bound, (Xhp_i^L), (ton); for turbines, electricity generation lower bound, (Xel_i^L), (MWh)

⁴ For boiler 1 and boiler 2, high pressure steam generation upper bound, (Xhp_i^U), (ton); for turbines, electricity generation upper bound, (Xel_i^U), (MWh)

⁵ ($cpEL_i$), (MWh/ton)

⁶ ($cpMP_i$), (ton/ton)

⁷ η_i

Table 2: CCS parameters.

Investment cost, (ic_i), \$	8547100
Operation Upper bound (θ)	90%
Electricity Penalty (γ)	0.1906

Table 3: Fuel oil and biodiesel parameters.

	Fixed Cost of Order ⁸	Holding Cost ⁹	Order LB ¹⁰	Order UB ¹¹	Steam Generation Parameter ¹²
Fuel-1	100	100	10	50	20.2
Fuel-2	100	150	10	40	18.7
Biodiesel	100	200	2	15	18

⁸ (v_j), (\$)⁹ (ch_j), (\$)¹⁰ (p_j^L), (ton)¹¹ (p_j^U), (ton)¹² (sg_j)

Table 4: Fuel oil, biodiesel and natural gas parameters.

	SO_x Generation	NO_x Generation	CO_2 Generation	Variable Cost
Fuel-1	0.02	0.023	3.117	820
Fuel-2	0.03	0.025	3.47	720
Biodiesel	0.001	0.030	0.6	980
Natural Gas	-	0.008	2.78	230

¹³ (gs_j), (m^3/ton)¹⁴ (gn_j), (m^3/ton)¹⁵ (gc_j), (ton/ton)¹⁶ (c_j), for fuel-1, fuel-2 and biodiesel (\$/ton), for natural gas (\$/10³m³)¹⁷ (p_j^U), (ton)¹⁸ (sg_j)

Table 5: High, medium and low pressure steam parameters.

Steam Enthalphy, (h_j), (MWh/ton)	
HP	0.623
MP	0.311
LP	0.012

Table 6: Other parameters.

Lenght of Time Periods, (n_t), (h)	720
Biodiesel Limit, (λ_{Bio})	0.2
SO_x Upper Bound, ($s_{SO_x}^U$)	6000
SO_x Penalty, (σ_{SO_x})	40
NO_x Upper Bound, ($s_{NO_x}^U$)	5000
NO_x Penalty, (σ_{NO_x})	10

Table 7: Tank parameters.

	Safety Stock (I_{ijt}^U)	Capacity (I_{ijt}^U)
Tank 1	15	150
Tank 2	10	100
Bio Tank	0	100

Table 8: Electricity demand.

Period, (t)	Demand, (d_t), (MWh)	(t)	Demand, (d_t), (MWh)
1	78	7	65
2	80	8	70
3	85	9	62
4	80	10	75
5	79	11	78
6	66	12	86