

Supplementary material to

SIMULTANEOUS MULTI-OBJECTIVE FRAMEWORK OF NATURAL GAS PIPELINE NETWORK OPERATIONS

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Chem. Ind. Chem. Eng. Q. 31 (1) 83–92 (2025)

Table S1. The normalized decision matrix, Standard deviation (σ_i), objective weight (τ_i) results, and the weighted normalized decision matrix for Case 1

The normalized decision matrix for Case 1			
Scenario	Flowrate	Power	Line pack
1	1.00000	0.00000	0.00000
2	0.81061	0.60303	0.25597
3	0.63876	0.30588	1.00000
4	0.00000	0.93193	0.36039
5	0.41389	1.00000	0.78079
Standard deviation (σ_i) and objective weight (τ_i) results			
	Flowrate	Power	Line pack
Standard Deviation (σ_i)	0.38624	0.42179	0.40489
Objective weight (τ_i)	0.31844	0.34774	0.33382
The weighted normalized decision matrix for Case 1			
Scenario	Flowrate	Power	Line pack
1	0.31844	0.00000	0.00000
2	0.25813	0.20971	0.08545
3	0.20341	0.10637	0.33382
4	0.00000	0.32408	0.12031
5	0.13181	0.34775	0.26065

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Table S2. The relative closeness and total cost results of each scenario for Case 1

Scenario	α_i^+	α_i^-	$\theta_i = \alpha_i^- / (\alpha_i^- + \alpha_i^+)$	Total Cost (M\$Yr ⁻¹)
1	0.48204	0.31845	0.39782	8,361
2	0.29049	0.34338	0.54173	4,956
3	0.26739	0.40512	0.60241	6,634
4	0.38413	0.34569	0.47367	3,099
5	0.20048	0.45413	0.69375	2,714

Table S3. The normalized decision matrix, Standard deviation (σ_i), objective weight (τ_i) results, and the weighted normalized decision matrix for Case 2

The normalized decision matrix for Case 2				
Scenario	Flowrate	Power	Line pack	
1	1.00000	0.00000	0.00000	
2	0.00000	0.82210	0.08652	
3	0.73864	0.40781	0.44552	
4	0.10259	0.33541	0.58770	
5	0.43208	1.00000	1.00000	
Standard deviation (σ_i) and objective weight (τ_i) results				
	Flowrate	Power	Line pack	
Standard Deviation (σ_i)	0.42107	0.39952	0.40394	
Objective weight (τ_i)	0.34386	0.32626	0.32987	
The weighted normalized decision matrix for Case 2				
Scenario	Flowrate	Power	Line pack	
1	0.34386	0.00000	0.00000	
2	0.00000	0.26822	0.02854	
3	0.25398	0.13305	0.14696	
4	0.03527	0.10943	0.19386	
5	0.14857	0.32626	0.32987	

Table S4. The relative closeness and total cost results of each scenario for Case 2.

Scenario	α_i^+	α_i^-	$\theta_i = \alpha_i^- / (\alpha_i^- + \alpha_i^+)$	Total Cost (M\$Yr ⁻¹)
1	0.46396	0.34386	0.42566	4,848
2	0.46087	0.26973	0.36919	2,530
3	0.28082	0.32220	0.53430	3,698
4	0.40092	0.22539	0.35987	3,902
5	0.19528	0.48717	0.71385	2,028

Table S5. The normalized decision matrix, Standard deviation (σ_i), objective weight (τ_i) results, and the weighted normalized decision matrix for Case 3.

The normalized decision matrix for Case 3				
Scenario	Flowrate	Power	Line pack	
1	0.03199	0.72678	1.00000	
2	0.00000	0.93980	0.65601	
3	1.00000	1.00000	0.53600	
4	0.94023	0.03375	0.26532	
5	0.87961	0.00000	0.00000	
Standard deviation (σ_i) and objective weight (τ_i) results				
	Flowrate	Power	Line pack	
Standard Deviation (σ_i)	0.50798	0.48743	0.38090	
Objective weight (τ_i)	0.36908	0.35416	0.27675	
The weighted normalized decision matrix for Case 3				
Scenario	Flowrate	Power	Line pack	
1	0.01180	0.25739	0.27675	
2	0.00000	0.33284	0.18155	
3	0.36908	0.35416	0.14834	
4	0.34703	0.01329	0.07342	
5	.032465	0.00000	0.00000	

Table S6. The relative closeness and total cost results of each scenario for Case 3.

Scenario	α_i^+	α_i^-	$\theta_i = \alpha_i^- / (\alpha_i^- + \alpha_i^+)$	Total Cost (M\$Yr ⁻¹)
1	0.37015	0.31790	0.46203	1,772
2	0.38176	0.33734	0.46911	1,713
3	0.12841	0.50796	0.79821	1,696
4	0.39751	0.34703	0.46609	1,965
5	0.45165	0.33311	0.42447	1,976