Supplemenatary materials:
Nature-based Secondary Resource Recovery Climate Change Uncertainty: A Robust Multi-Objective Optimisation Methodology

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Supplementary Tables

Table S. 1 Top 5 solutions TOPSIS, VIKOR, and PROMETHEE-II rankings: CoO under the present climate change projection

Resource	climate change scenario	Objective	Weight	TOPSIS ranking	VIKOR ranking	PROMETHEE-II ranking	Spearman coefficient	Kendall Tau coefficient
CoO	*Present*	economic	10%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.94775	0.86032
		economic	20%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.95187	0.86349
		economic	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.95804	0.87302
		economic	40%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97992	0.90476
		economic	50%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	0.99562	0.96825
		economic	60%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99897	0.99048
		economic	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99949	0.99365
		economic	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99974	0.99683
		economic	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	1	1
		economic	100%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	10%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.98121	0.90476
		social	20%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97658	0.89524
		social	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.96345	0.86349
		social	40%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97864	0.90159
		social	50%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99022	0.94286
		social	60%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99665	0.9746
		social	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99974	0.99683
		social	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	100%	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	1	1
		climate	10%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99691	0.98095
		climate	20%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99279	0.94921
		climate	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97091	0.87619
		climate	40%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97117	0.88571
		climate	50%	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.9879	0.92698
		climate	60%	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.99434	0.95873
		climate	70%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_35	Sol_36>Sol_30>Sol_24>Sol_35>Sol_18	0.99949	0.99365
		climate	80%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_12>Sol_18	1	1
		climate	90%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_12>Sol_36>Sol_30>Sol_24>Sol_18	1	1
		climate	100%	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	1	1

Table S. 2 Top 5 solutions TOPSIS, VIKOR, and PROMETHEE-II rankings: CoO under the 2°C climate change projection

Resource	climate change scenario	Objective	Weight	TOPSIS ranking	VIKOR ranking	PROMETHEE-II ranking	Spearman coefficient	Kendall Tau coefficient
CoO	*2C*	economic	10%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.94775	0.86032
		economic	20%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.95187	0.86349
		economic	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.95804	0.87302
		economic	40%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97992	0.90476
		economic	50%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	0.99562	0.96825
		economic	60%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99897	0.99048
		economic	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99949	0.99365
		economic	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99974	0.99683
		economic	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	1	1
		economic	100%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	10%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.98121	0.90476
		social	20%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97658	0.89524
		social	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.96345	0.86349
		social	40%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97864	0.90159
		social	50%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99022	0.94286
		social	60%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99665	0.9746
		social	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99974	0.99683
		social	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	100%	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	1	1
		climate	10%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99691	0.98095
		climate	20%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99279	0.94921
		climate	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97091	0.87619
		climate	40%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97117	0.88571
		climate	50%	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.9879	0.92698
		climate	60%	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.99434	0.95873
		climate	70%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_35	Sol_36>Sol_30>Sol_24>Sol_35>Sol_18	0.99949	0.99365
		climate	80%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_12>Sol_18	1	1
		climate	90%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_12>Sol_36>Sol_30>Sol_24>Sol_18	1	1
		climate	100%	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	1	1

Table S. 3 Top 5 solutions TOPSIS, VIKOR, and PROMETHEE-II rankings: CoO under the 4°C climate change projection

Resource	climate change scenario	Objective	Weight	TOPSIS ranking	VIKOR ranking	PROMETHEE-II ranking	Spearman coefficient	Kendall Tau coefficient
CoO	*4C*	economic	10%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.94775	0.86032
		economic	20%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.95187	0.86349
		economic	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.96139	0.87937
		economic	40%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97658	0.89524
		economic	50%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	0.99665	0.97143
		economic	60%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99897	0.99048
		economic	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99974	0.99683
		economic	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99923	0.99048
		economic	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.9964	0.97778
		economic	100%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	10%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.98353	0.91429
		social	20%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97709	0.89524
		social	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.96757	0.86984
		social	40%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97761	0.90159
		social	50%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99022	0.94286
		social	60%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99665	0.9746
		social	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99923	0.99365
		social	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	100%	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	1	1
		climate	10%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99665	0.97778
		climate	20%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99254	0.94921
		climate	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97246	0.87937
		climate	40%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97117	0.88571
		climate	50%	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.98893	0.93016
		climate	60%	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.99459	0.9619
		climate	70%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_35	Sol_36>Sol_30>Sol_24>Sol_35>Sol_18	0.99949	0.99365
		climate	80%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_12>Sol_18	1	1
		climate	90%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_12>Sol_36>Sol_30>Sol_24>Sol_18	1	1
		climate	100%	Sol_18>Sol_30>Sol_24>Sol_12>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	0.99901	0.9954

Table S. 4 Top 5 solutions TOPSIS, VIKOR, and PROMETHEE-II rankings: NiO under the present climate change projection

Resource	climate change scenario	Objective	Weight	TOPSIS ranking	VIKOR ranking	PROMETHEE-II ranking	Spearman coefficient	Kendall Tau coefficient
NiO	*Present*	economic	10%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.94775	0.86032
		economic	20%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.9529	0.86984
		economic	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.96319	0.88254
		economic	40%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.98069	0.90476
		economic	50%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	0.99485	0.95556
		economic	60%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99897	0.9873
		economic	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	1	1
		economic	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99974	0.99683
		economic	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99949	0.99365
		economic	100%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	10%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.98301	0.91746
		social	20%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97967	0.90476
		social	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97117	0.87619
		social	40%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97889	0.90476
		social	50%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99022	0.94286
		social	60%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99588	0.97143
		social	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99923	0.99365
		social	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	100%	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	1	1
		climate	10%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99794	0.98413
		climate	20%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99254	0.94921
		climate	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.9758	0.88571
		climate	40%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97503	0.89524
		climate	50%	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.98867	0.93333
		climate	60%	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.99614	0.96825
		climate	70%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_35	Sol_36>Sol_30>Sol_24>Sol_35>Sol_12	0.99949	0.99365
		climate	80%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_12>Sol_24>Sol_18	1	1
		climate	90%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_12>Sol_36>Sol_30>Sol_24>Sol_18	1	1
		climate	100%	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	1	1

Table S. 5 Top 5 solutions TOPSIS, VIKOR, and PROMETHEE-II rankings: NiO under the 2°C climate change projection

Resource	climate change scenario	Objective	Weight	TOPSIS ranking	VIKOR ranking	PROMETHEE-II ranking	Spearman coefficient	Kendall Tau coefficient
NiO	*2C*	economic	10%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.94775	0.86032
		economic	20%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.95187	0.86349
		economic	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.95856	0.87619
		economic	40%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97992	0.90476
		economic	50%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	0.99511	0.9619
		economic	60%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99897	0.99048
		economic	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99949	0.99365
		economic	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99974	0.99683
		economic	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	1	1
		economic	100%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	10%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.98121	0.90476
		social	20%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97838	0.89841
		social	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.96499	0.86667
		social	40%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97864	0.90159
		social	50%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99022	0.94286
		social	60%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99665	0.9746
		social	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99974	0.99683
		social	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	100%	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	1	1
		climate	10%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99691	0.98095
		climate	20%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99279	0.94921
		climate	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97091	0.87619
		climate	40%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97117	0.88571
		climate	50%	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.9879	0.92698
		climate	60%	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.99459	0.9619
		climate	70%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_35	Sol_36>Sol_30>Sol_24>Sol_35>Sol_18	0.99949	0.99365
		climate	80%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_12>Sol_18	1	1
		climate	90%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_12>Sol_36>Sol_30>Sol_24>Sol_18	1	1
		climate	100%	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	1	1

Table S. 6 Top 5 solutions TOPSIS, VIKOR, and PROMETHEE-II rankings: NiO under the 4°C climate change projection

Resource	climate change scenario	Objective	Weight	TOPSIS ranking	VIKOR ranking	PROMETHEE-II ranking	Spearman coefficient	Kendall Tau coefficient
NiO	*4C*	economic	10%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.94775	0.86032
		economic	20%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.95187	0.86349
		economic	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.96139	0.87937
		economic	40%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97658	0.89524
		economic	50%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	0.99665	0.97143
		economic	60%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99897	0.99048
		economic	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99974	0.99683
		economic	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99923	0.99048
		economic	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.9964	0.97778
		economic	100%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	10%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.98353	0.91429
		social	20%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97709	0.89524
		social	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.96757	0.86984
		social	40%	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97761	0.90159
		social	50%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99022	0.94286
		social	60%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	Sol_36>Sol_35>Sol_34>Sol_33>Sol_30	0.99665	0.9746
		social	70%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99923	0.99365
		social	80%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	90%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	1	1
		social	100%	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	Sol_36>Sol_31>Sol_32>Sol_35>Sol_34	1	1
		climate	10%	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	Sol_36>Sol_35>Sol_34>Sol_33>Sol_32	0.99665	0.97778
		climate	20%	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_29	Sol_36>Sol_35>Sol_34>Sol_30>Sol_33	0.99254	0.94921
		climate	30%	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_29>Sol_34	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97246	0.87937
		climate	40%	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_30>Sol_35>Sol_29>Sol_24	Sol_36>Sol_35>Sol_30>Sol_34>Sol_29	0.97117	0.88571
		climate	50%	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.98893	0.93016
		climate	60%	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_24>Sol_35>Sol_29	Sol_36>Sol_30>Sol_35>Sol_24>Sol_29	0.99459	0.9619
		climate	70%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_35	Sol_36>Sol_30>Sol_24>Sol_35>Sol_18	0.99949	0.99365
		climate	80%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_12>Sol_18	1	1
		climate	90%	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_36>Sol_30>Sol_24>Sol_18>Sol_12	Sol_12>Sol_36>Sol_30>Sol_24>Sol_18	1	1
		climate	100%	Sol_18>Sol_30>Sol_24>Sol_12>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	Sol_12>Sol_18>Sol_30>Sol_24>Sol_6	0.99901	0.9954

Supplementary Figures

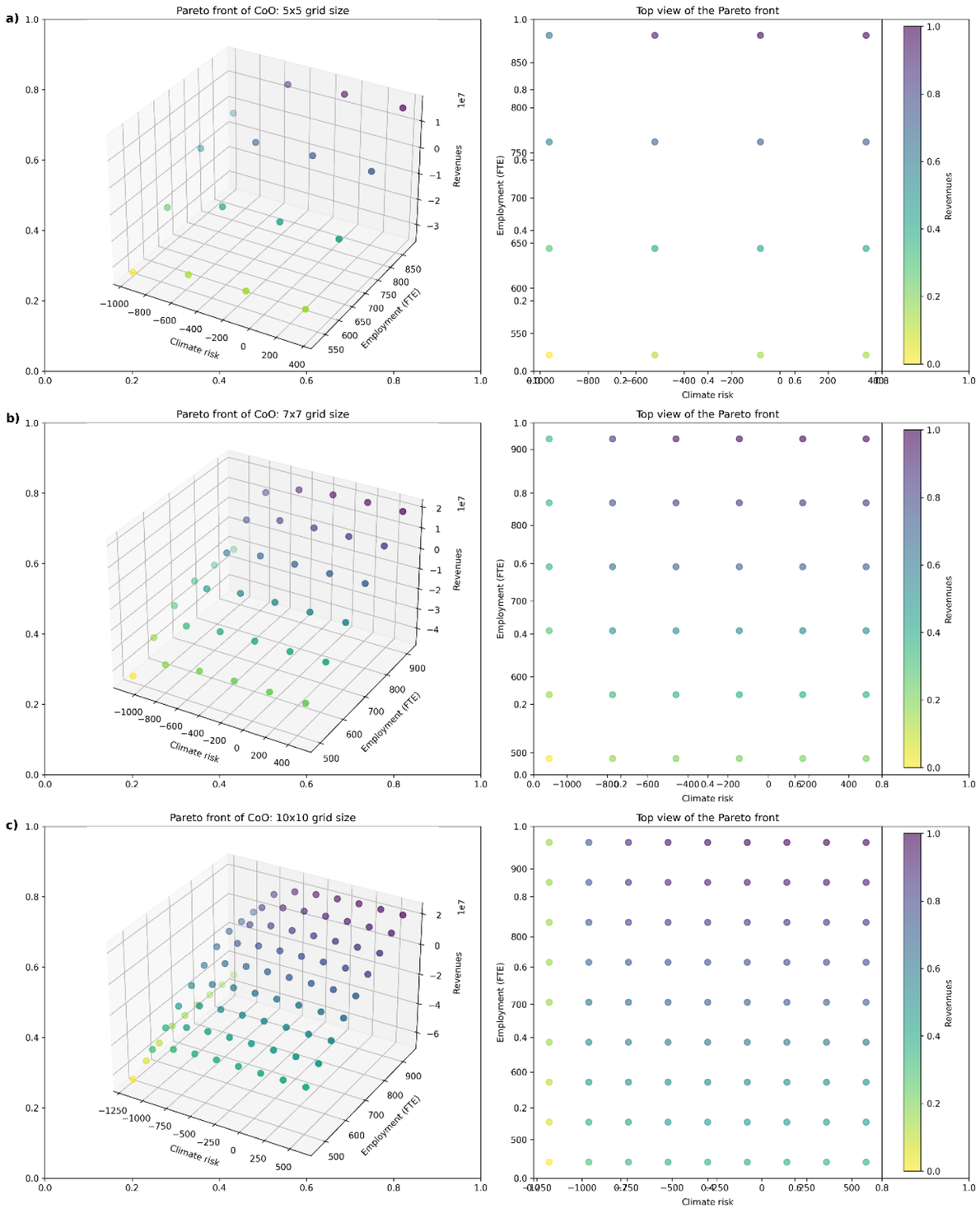

Figure S. 1 Pareto front of CoO assuming central economic factors: a) 5x5 grid size, b) 7x7 grid size, c) 10x10 grid size

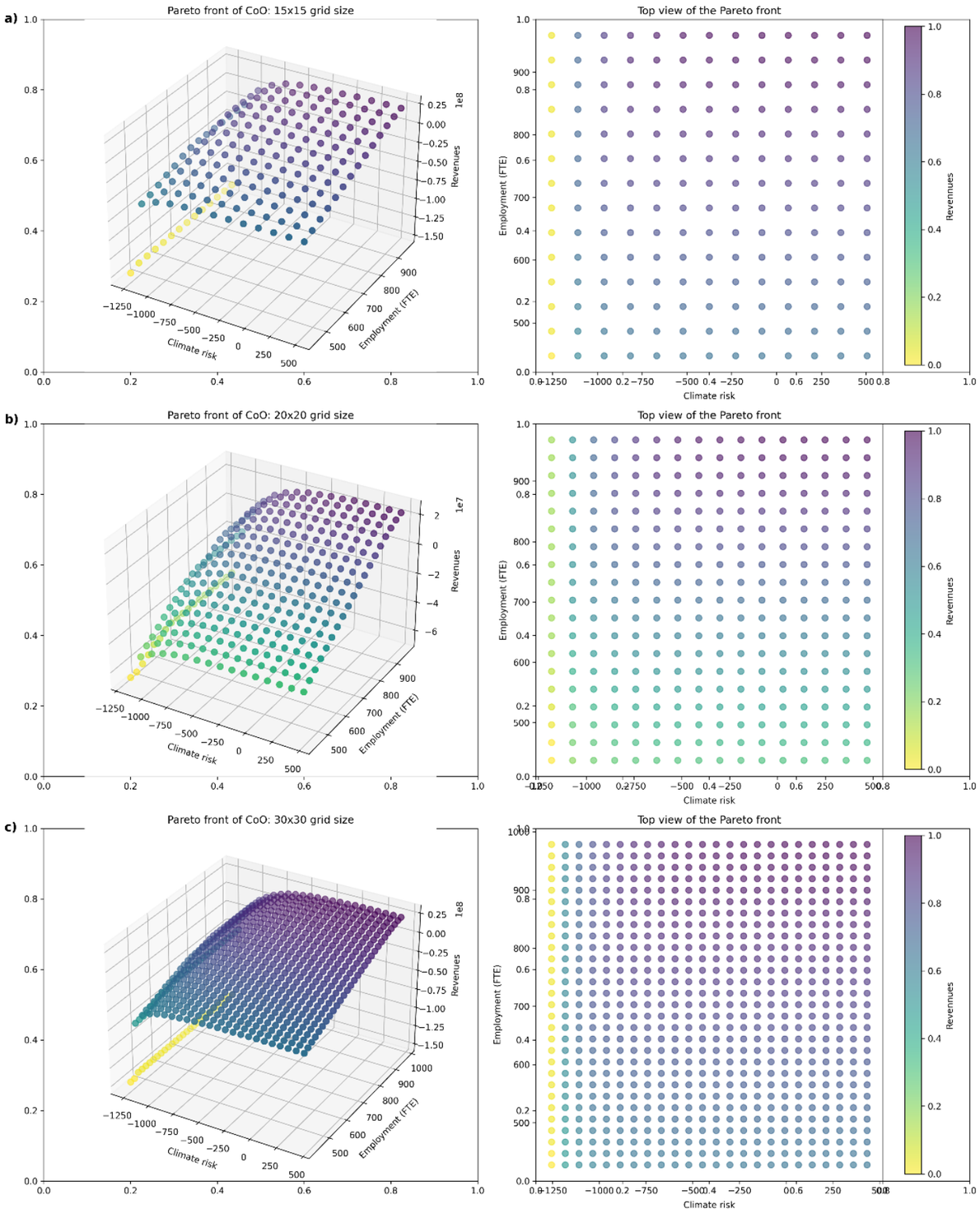

Figure S. 2 Pareto front of CoO assuming central economic factors: a) 15x15 grid size, b) 20x20 grid size, c) 30x30 grid size

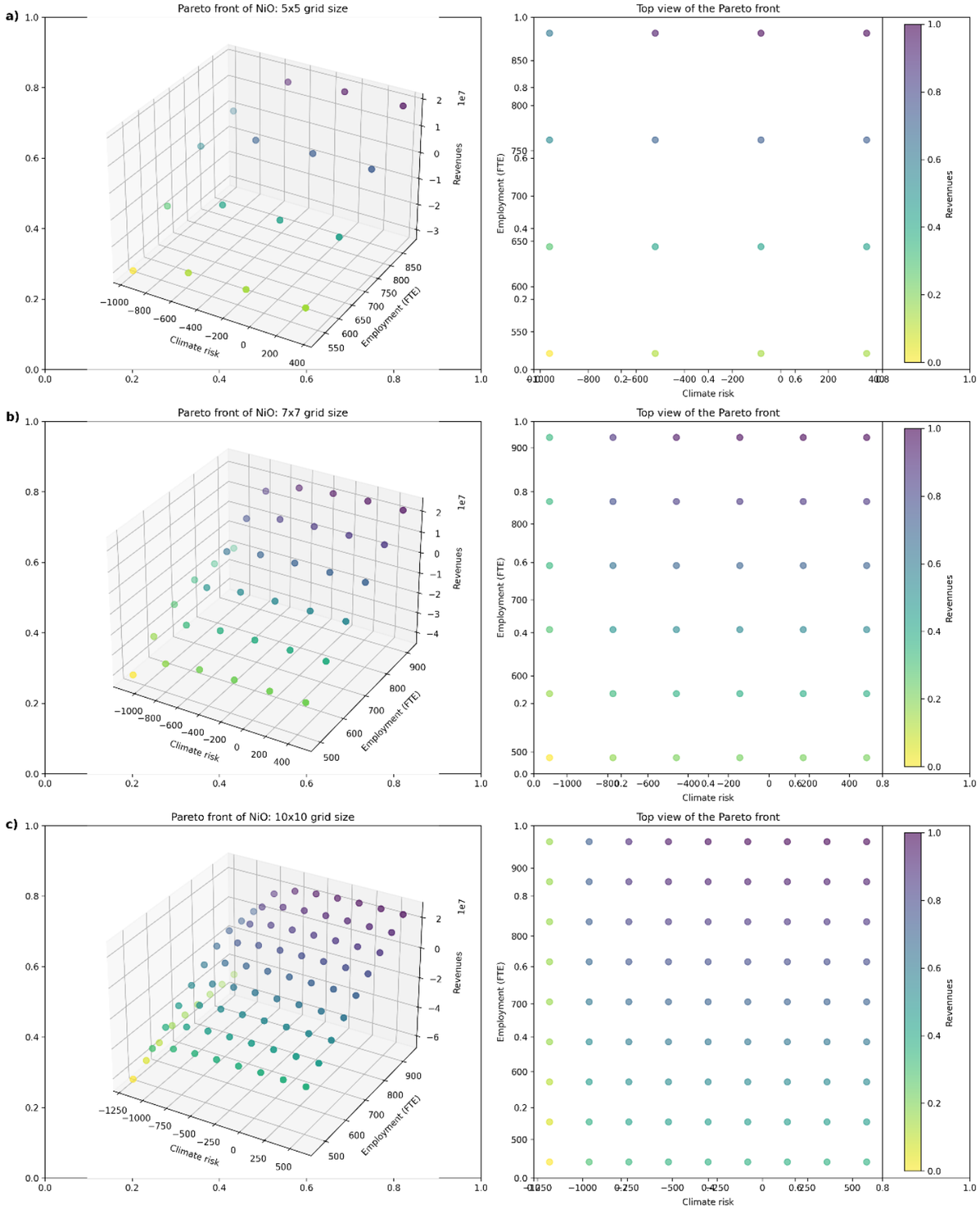

Figure S. 3 Pareto front of NiO assuming central economic factors: a) 5x5 grid size, b) 7x7 grid size, c) 10x10 grid size

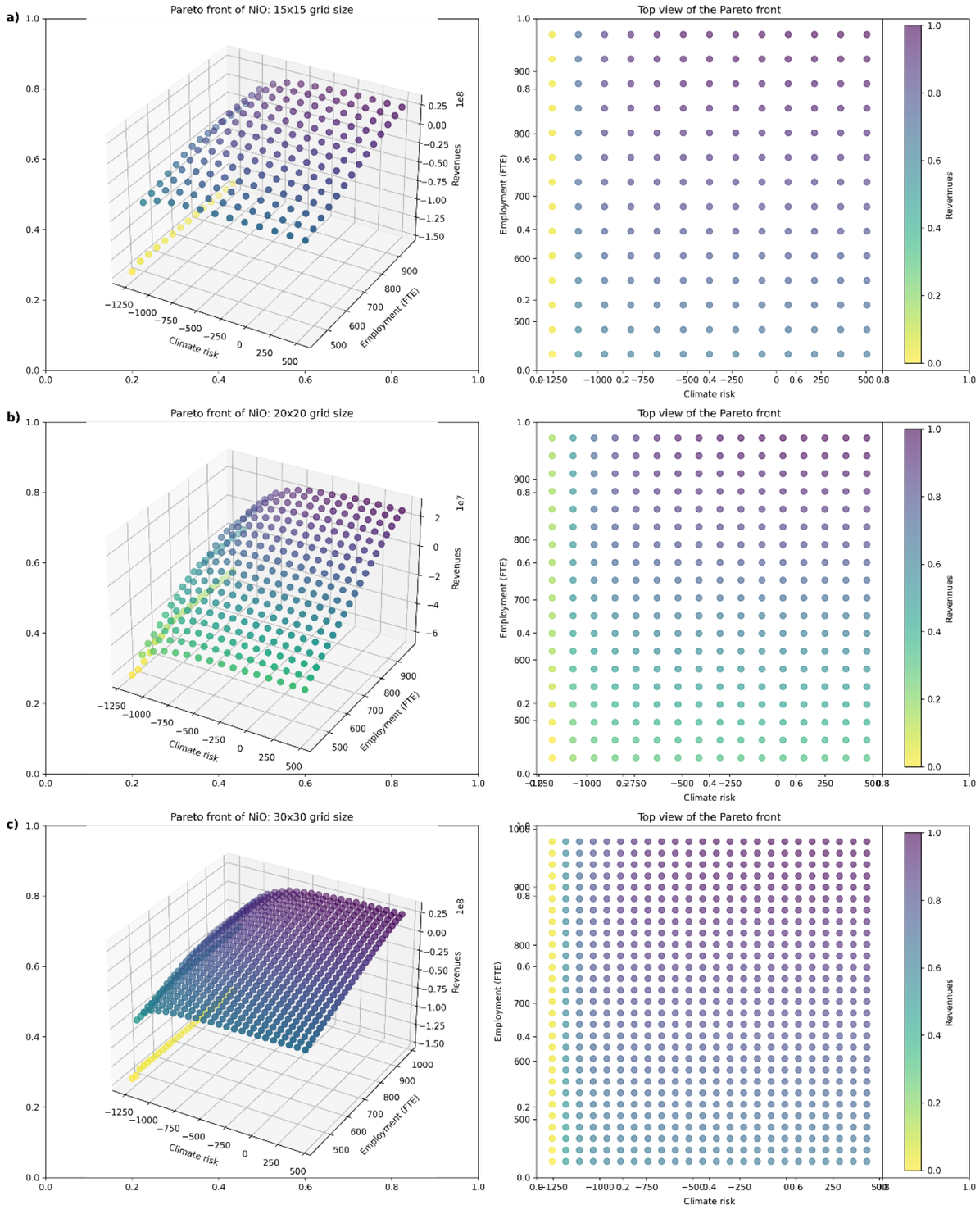

Figure S. 4 Pareto front of NiO assuming central economic factors: a) 15x15 grid size, b) 2x20 grid size, c) 30x30 grid size

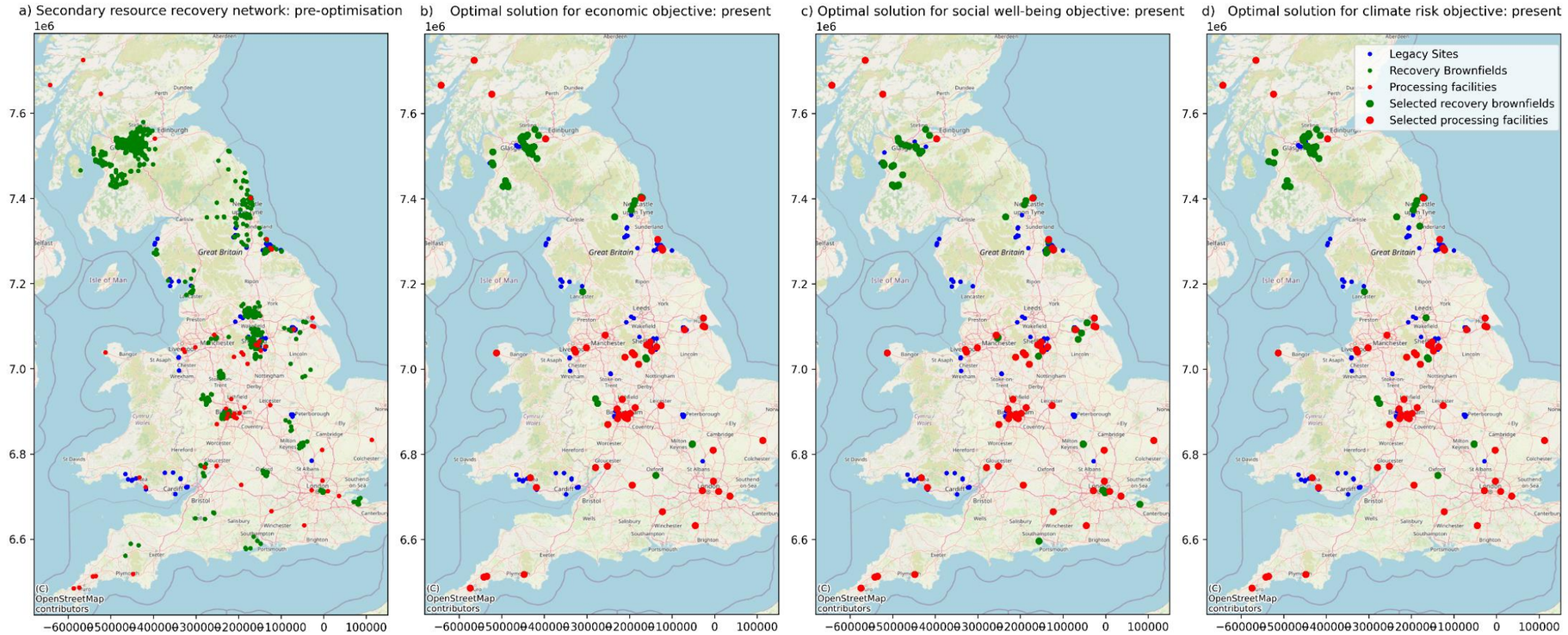

Figure S. 5 Maps of the optimal solutions for CoO: present temperature scenario

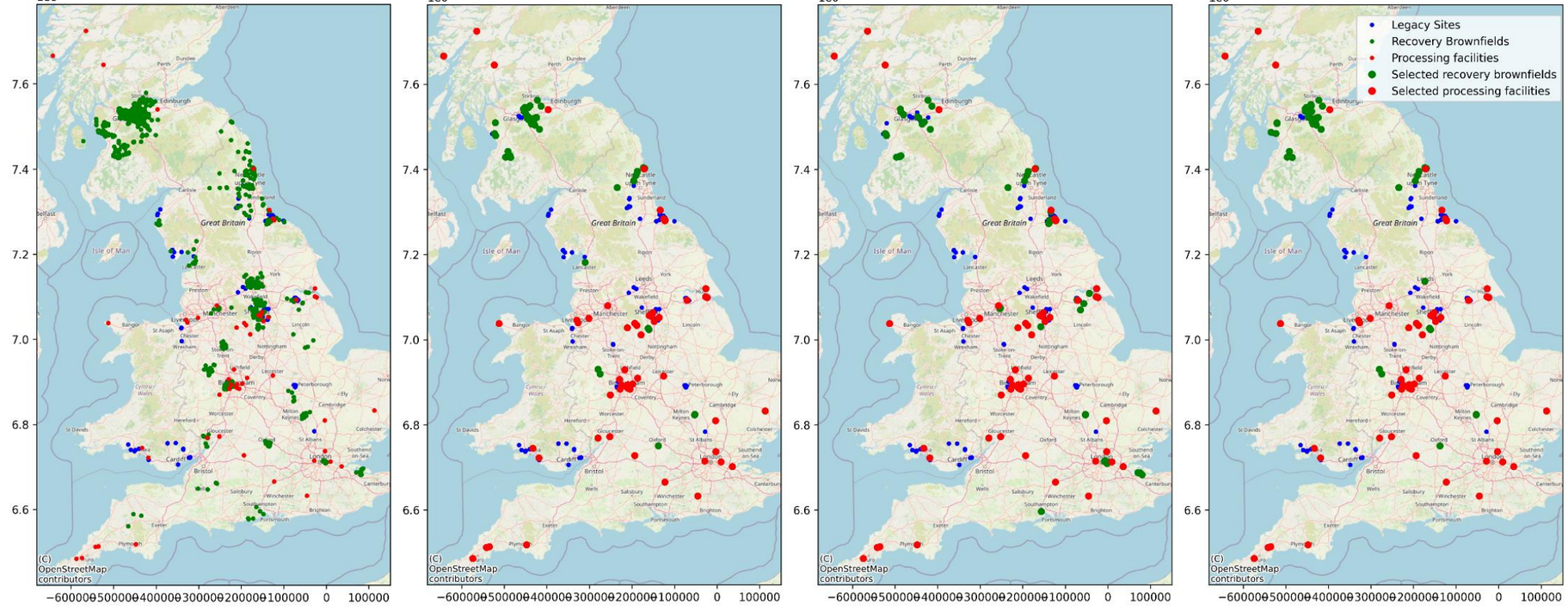

Figure S. 6 Maps of the optimal solutions for CoO: 2°C scenario

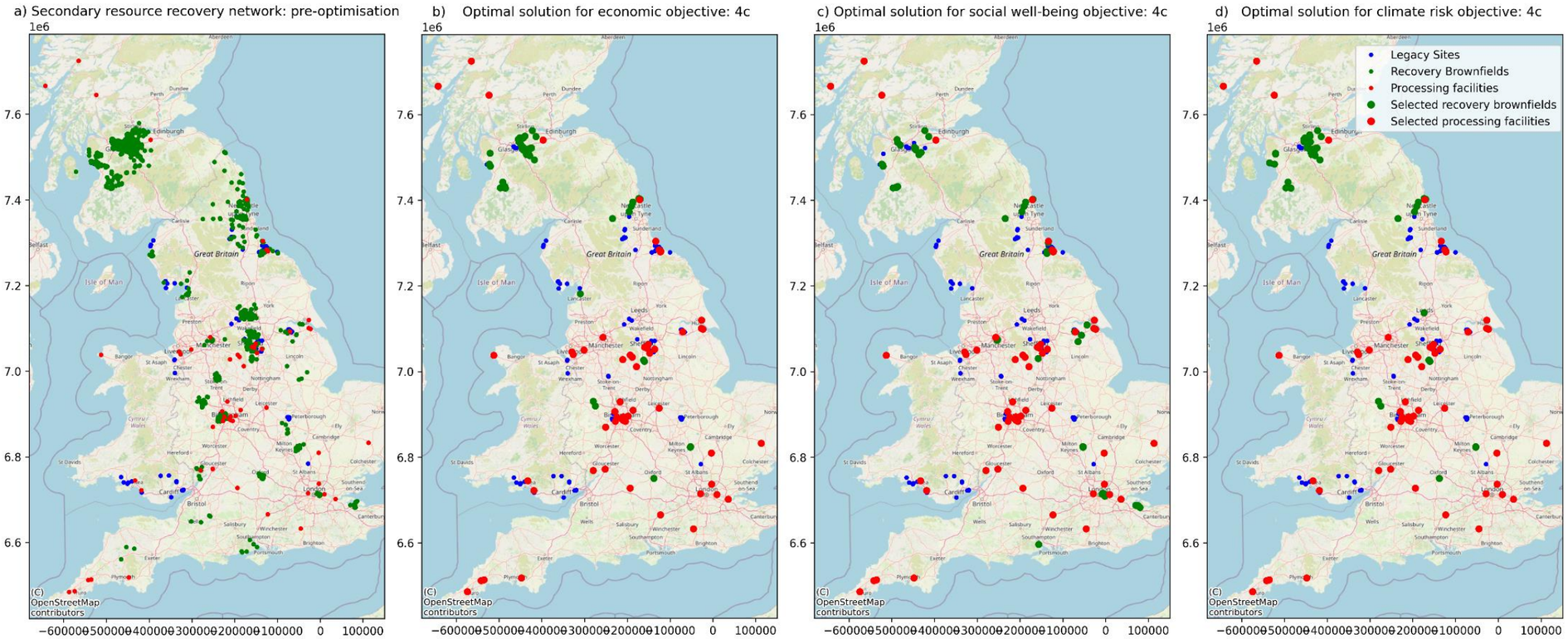

Figure S. 7 Maps of the optimal solutions for CoO: 4°C scenario

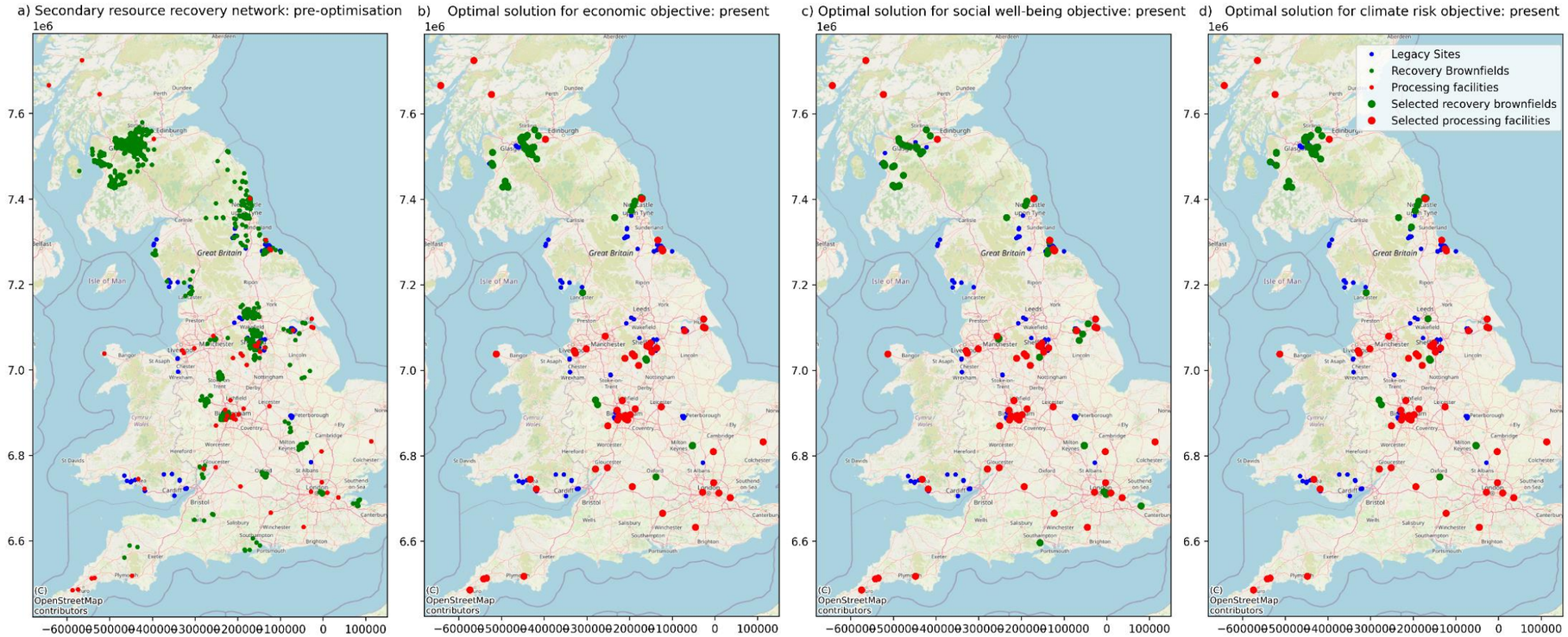

Figure S. 8 Maps of the optimal solutions for NiO: present temperature scenario

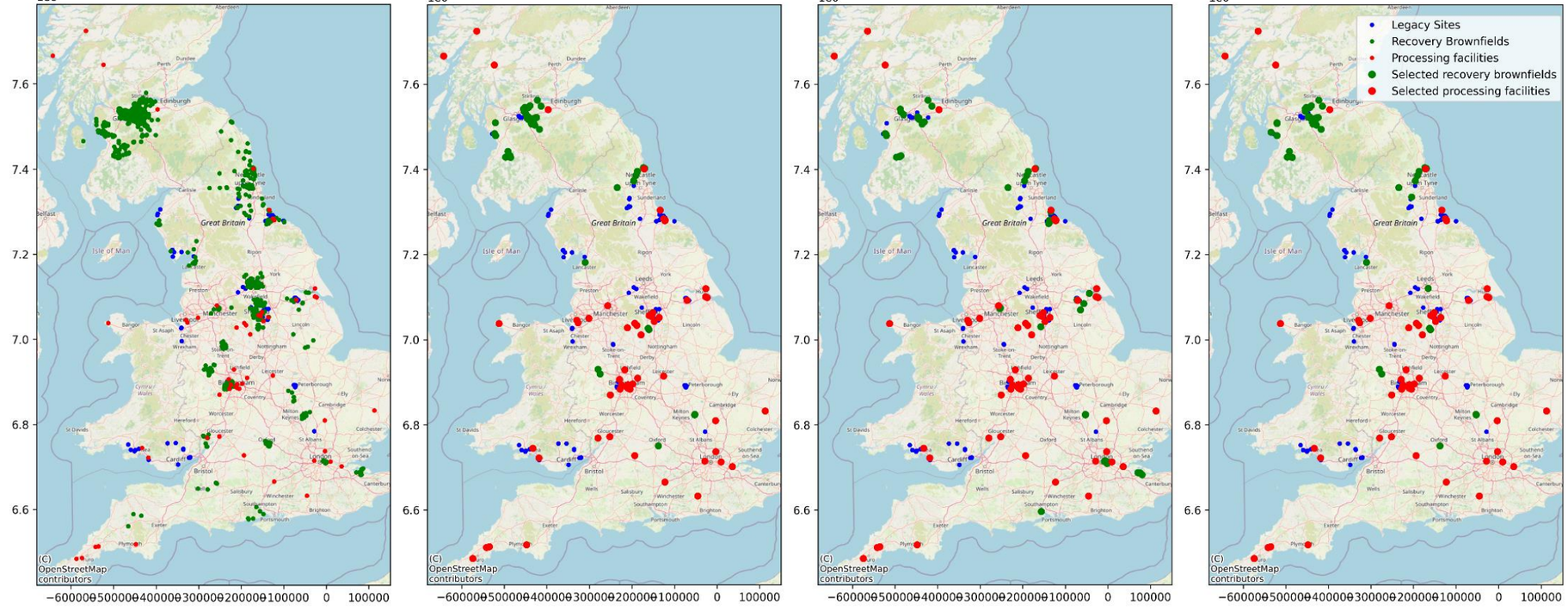

Figure S. 9 Maps of the optimal solutions for NiO: 2°C scenario

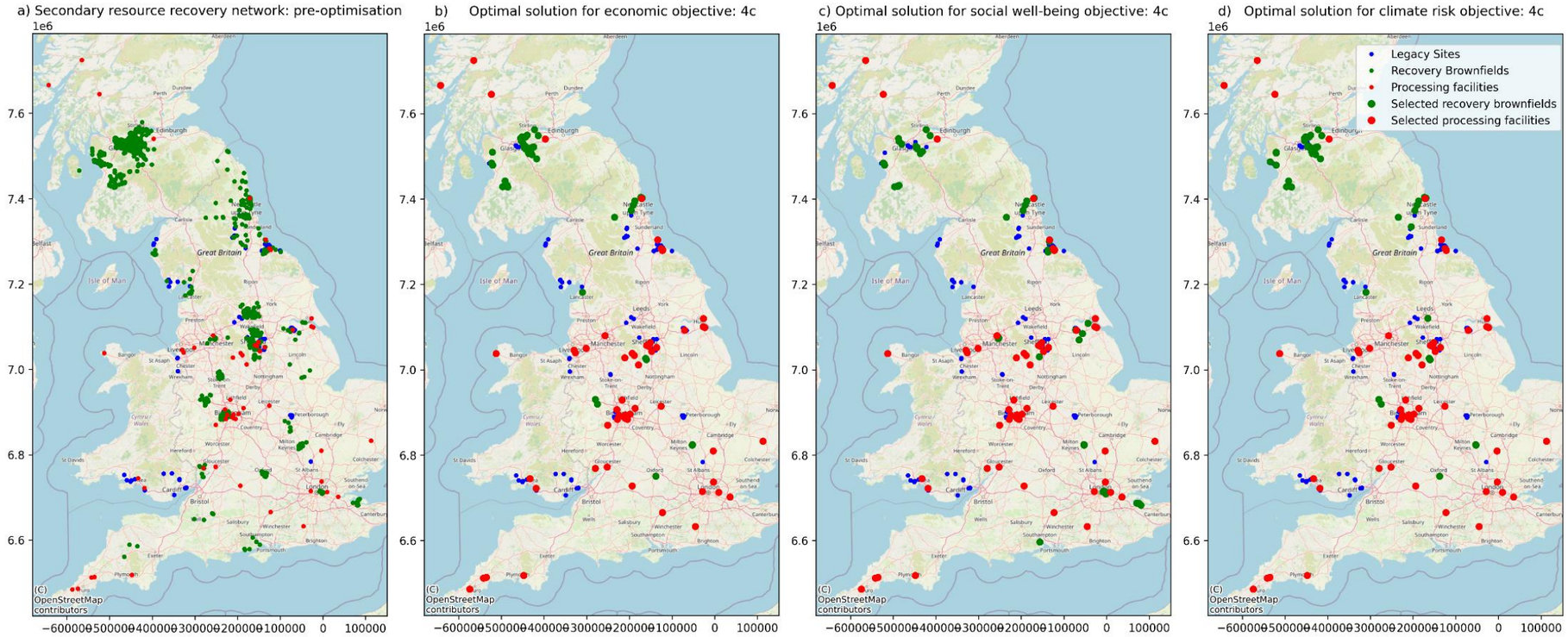

Figure S. 10 Maps of the optimal solutions for NiO: 4°C scenario