Supplementary Information

Reconciling the strategic goals of irrigated food production, energy production with environmental flows under water transfer project in the Yellow River Basin

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Table S1. Costs, capacity factor and water intensity of energy technologies implemented in the model. Sources: ①*Vinca et al., 2020; **Webster et al., 2013; ***Parkinson et al., 2016. ②*Vinca et al., 2020; **Ye, 2013. ③*Liu et al., 2018; **Vinca et al., 2020.④*Parkinson et al., 2016; **Liao et al., 2021; ***Vinca et al., 2020. ST: Single-cycle, CC: Combined-cycle. OT: Once-through freshwater cooling, CL: Closed-loop freshwater cooling, AC: Air-cooled.

Technology	Investment cost [$/kW]①	Fixed cost [$/kW]②	Variable cost [$/kWh]②	Capacity Factor③	Water consumption [m^3/MWh]④
Coal st cl	2945**	24*	0.04861*	0.54*	1.93**
Coal st ac	3059**	25*	0.05396*	0.54*	-*
Gas st cl	1205*	17*	0.04861*	0.34*	2.10*
Gas st ac	1251*	18*	0.05396*	0.34*	-*
Gas gt	676*	7*	0.12222*	0.34*	-*
Gas cc ot	1023*	15*	0.03611*	0.34*	0.50*
Gas cc cl	1064*	16*	0.03687*	0.34*	0.60*
Gas cc ac	1105*	17*	0.03726*	0.34*	-*
Geothermal cl	6343*	135*	0.02500*	0.90**	0.71*
Hydro	5000*	15*	0.00700**	0.41*	-*
IGCC cl	4131*	32*	0.07917*	0.90**	1.47**
Solar pv	3873***	30**	0.00042**	0.18*	-*
Wind	2213***	44**	0.01400**	0.22*	-*
Electricity distribution	1120*	36*	0.03472*	0.90**	-***

Table S2. Costs and irrigation efficiency for irrigation technologies implemented in the model. Sources: ①Vinca et al., 2020. ②Rosa, 2022.

Technology	Investment cost [$/ha] ①	Fixed cost [$/ha] ①	Variable cost [$/(ha month)] ①	Irrigation efficiency②
Flood	460	10	14	0.7
Drip	2600	52	78	0.88
Sprinkler	1625	33	49	0.7

Table S3. Costs for crops implemented in the model. Source: Food and Agriculture Organization (FAO).

Crops	Investment cost [$/ha]	Fixed cost [$/ha]	Variable cost [$/(ha month)]
Wheat	341	36	72
Maize	1000	20	30
Rice	716	15	22
Cotton	416	9	13
Pulses	1320	26.4	39.6

Table S4. Costs for water diversion and treatment technologies implemented in the model. Source: Vinca et al., 2020. GW: groundwater, SW: surface water.

Technology	Investment cost [$/(mq/day)]	Fixed cost [$/(mq/day)]
Industry gw diversion	20	8.5
Industry sw diversion	57	3
Industry wastewater recycling	1350	99
Industry wastewater treatment	431	37
Irrigation gw diversion	8.5	1
Irrigation sw diversion	57	3
Rural gw diversion	8.5	1
Rural piped distribution	326	18
Rural sw diversion	57	3
Rural wastewater recycling	1350	99
Rural wastewater treatment	759	77
Urban gw diversion	20	8.5
Urban piped distribution	1013	252
Urban sw diversion	57	3
Urban wastewater collection	785	251
Urban wastewater irrigation	1350	99
Urban wastewater recycling	1350	99
Urban wastewater treatment	431	37

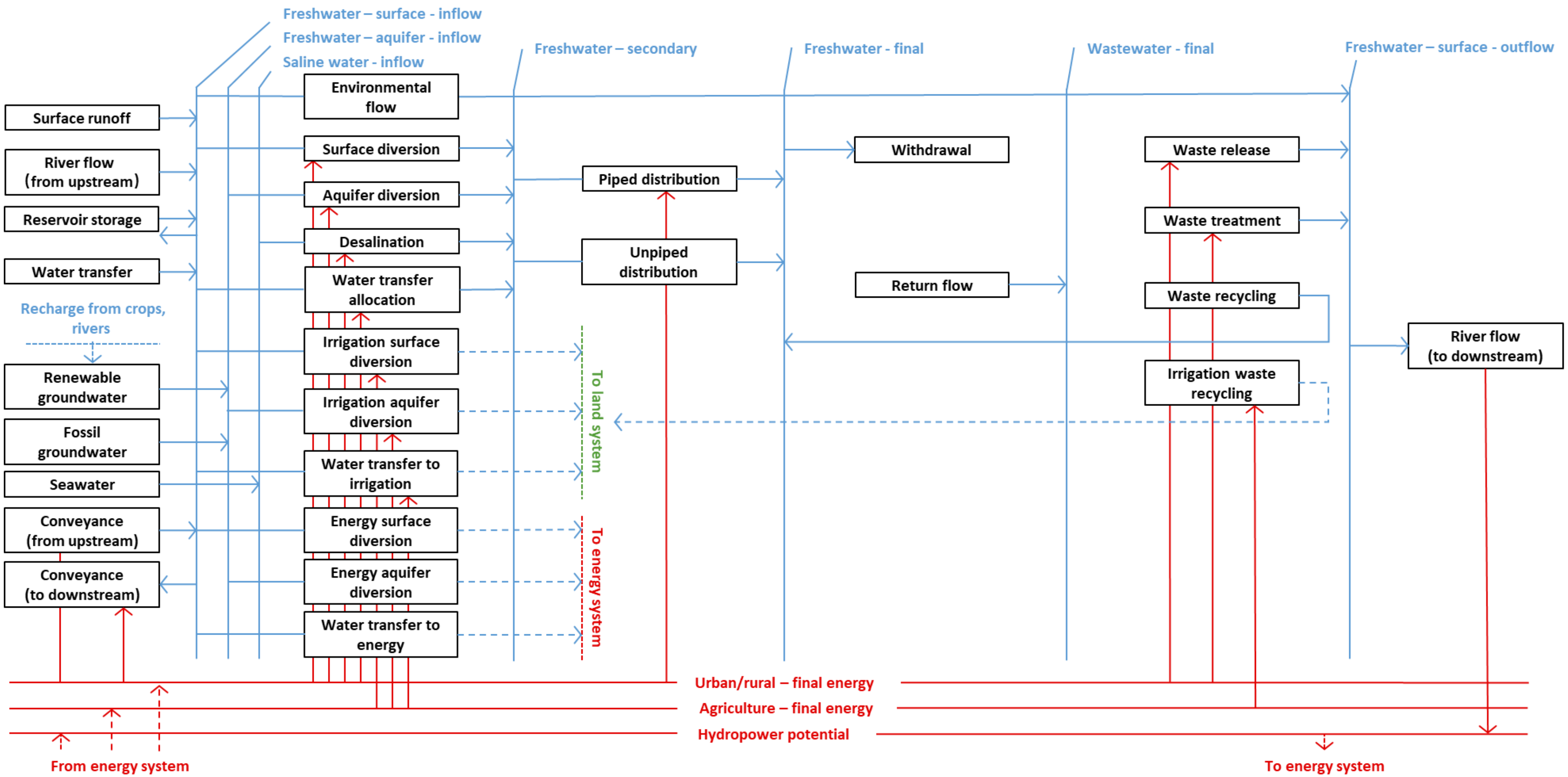

Figure S1. The water sector representation in each BPU using the MESSAGEix reference system scheme. The water sector is hard linked to the energy and land sector representations using the indicated interactions (Adapted from Vinca et al., 2020).

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