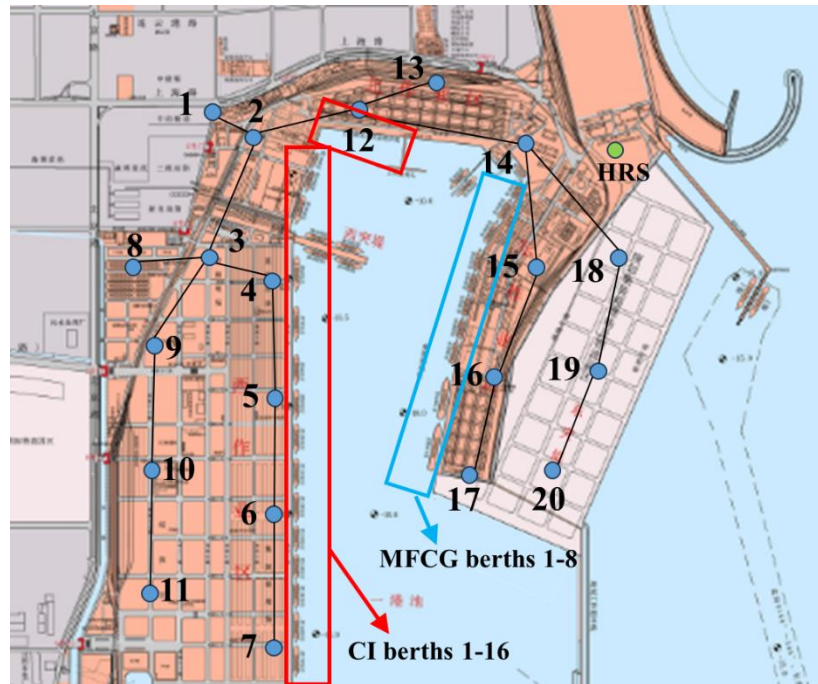


This file is the data of the article:

Y. Huang, W. Huang, R. Li, et al., “Multistage Distributionally Robust Dynamic Logistics-Energy Coordination in Fully Integrated Hydrogen-Electric Seaports.”

## 1、System Topology

There are 16 CI berths, 8 MFCG berths, 25 EQCs, 15 HQCs, 40 EAGVs, 20 HAGVs, 3 MHRs, 1 BCS with several charging connectors, 1 electrolyzer, 1 hydrogen tank, 1 hydrogen refueling station with several dispensers.



Connection between electrical bus and equipment

Electrical Bus Index	CI Berth	EQC	BCS	RES Generator (Wind Turbine)	Electrolyzer	Substation (Main Grid)
1	-	-	-	-	-	1
3	-	-	-	5 MW	-	-
4	13, 14	24, 25	1	-	-	-
5	9, 10	17, 18, 19, 20	-	-	-	-
6	5, 6	9, 10, 11, 12	-	-	-	-
7	1, 2	1, 2, 3, 4	-	5 MW	-	-
9	11, 12	21, 22, 23	-	-	-	-
10	7, 8	13, 14, 15, 16	-	-	-	-
11	3, 4	5, 6, 7, 8	-	-	-	-
12	15, 16	-	-	-	-	-
14	-	-	-	-	1	-
20	-	-	-	5 MW	-	-

## Node information

Node Index	Location	Node Index	Location
1	HRS	14	CI berth 12
2	MFCG berth 8	15	CI berth 11
3	MFCG berth 7	16	CI berth 10
4	MFCG berth 6	17	CI berth 9
5	MFCG berth 5	18	CI berth 8
6	MFCG berth 4	19	CI berth 7
7	MFCG berth 3	20	CI berth 6
8	MFCG berth 2	21	CI berth 5
9	MFCG berth 1	22	CI berth 4
10	CI berth 16	23	CI berth 3
11	CI berth 15	24	CI berth 2
12	CI berth 14	25	CI berth 1
13	CI berth 13		

## 2、System Data

Arrival AES Parameters		
Property	Symbol	Value
Total number	-	15
Arrival time (hour)	$t_s^a$	[1, 2, 4, 4, 5, 5, 6, 6, 7, 7, 8, 10, 11, 11, 12]
Latest departure time (hour)	$t_s^{d,max}$	[11, 14, 15, 16, 18, 19, 16, 17, 17, 18, 20, 20, 22, 21, 24]
Basic load (MW)	$P_s^{AES}$	[3.0, 3.5, 3.0, 3.5, 4.0, 3.5, 4.5, 4.0, 3.5, 4.0, 3.5, 4.5, 4.0, 3.0, 4.0]
Maximum/minimum number of QCs that can be assigned for AES	$Q_s^{max/min}$	Maximum [5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5] Minimum [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
Total number of cargoes (TEU)	$TEU_s$	[1200, 1060, 950, 850, 880, 1070, 1000, 950, 800, 1100, 1050, 1150, 900, 850, 800]
Coefficient for waiting cost	$c_s^W$	[1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Coefficient for berthing cost	$c_s^B$	[1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

MFCG Parameters (All MFCGs are considered homogeneous)		
Property	Symbol	Value
Maximum/minimum hydrogen content (kg)	$H_b^{MFCG,max/min}$	700, 70

Initial hydrogen content (kg)	$H_b^{MFCG,init}$	700
Hydrogen input/output efficiency	$\eta_b^{MFCG,in/out}$	0.7

QC Parameters (All QCs are considered homogeneous)		
Property	Symbol	Value
Maximum cargo handling efficiency (TEU/hour)	$\gamma_q^{E/H,QC,max}$	50
Rated power (MW)	$P_q^{QC}$	0.3
Maximum number of QCs a node can accommodate	$Q_n^{QC,max}$	5
Maximum/minimum hydrogen content (kg)	$H_q^{QC,max/min}$	350, 35
Initial hydrogen content (kg)	$H_q^{QC,init}$	350
Hydrogen input/output efficiency	$\eta_q^{QC,in/out}$	0.7

AGV Parameters (All AGVs are considered homogeneous)		
Property	Symbol	Value
Maximum transport efficiency (TEU/hour)	$\gamma_v^{E/H,AGV,max}$	25
Maximum/minimum battery energy content (MWh)	$E_v^{AGV,max/min}$	0.1672, 0.0088
Maximum charging power (MW)	$P_v^{AGV,max}$	0.1056
Initial battery energy content (MWh)	$E_v^{AGV,init}$	0.1672
Battery energy consumption for transporting one cargo (MWh)	$\Delta E_v$	0.000792
Charging efficiency	$\eta_v^{AGV,ch}$	0.95
Maximum/minimum hydrogen content (kg)	$H_v^{AGV,max/min}$	20, 2
Maximum refueled hydrogen within one coarse time period (kg)	$R_v^{AGV,max}$	128

Initial hydrogen content (kg)	$H_v^{AGV,init}$	20
Hydrogen consumption for transporting one cargo (kg)	$\Delta H_v$	0.048
Refueling efficiency	$\eta_v^{AGV,in}$	0.7
Efficiency coefficient caused by hydrogen refueling	$\alpha_v$	0.8
Maximum number of AGVs a BCS/HRS can accommodate within one coarse time period	$V_l^{E,max}, V_h^{H,max}$	30, 40

MHRs Parameters (All MHRs are considered homogeneous)		
Property	Symbol	Value
Preparation time for MFCG hydrogen refueling (mins)	$T_{m,b}^{MFCG,P}$	2
Time for refueling 1 kg hydrogen to MFCG (mins)	$T_{m,b}^{MFCG,R}$	0.25
Maximum refueled hydrogen for MFCG within one fine time period (kg)	$R_{m,b}^{MFCG,max}$	52
Preparation time for HQC hydrogen refueling (mins)	$T_{m,q}^{QC,P}$	2
Time for refueling 1 kg hydrogen to HQC (mins)	$T_{m,q}^{QC,R}$	0.25
Maximum refueled hydrogen for HQC within one fine time period (kg)	$R_{m,q}^{QC,max}$	52
Preparation time for refueling itself (mins)	$T_m^{self,P}$	2
Time for refueling 1 kg hydrogen to itself (mins)	$T_m^{self,R}$	0.25
Maximum refueled hydrogen for itself within one fine time period (kg)	$R_m^{self,max}$	52
Hydrogen input/output efficiency	$\eta_m^{MHRs,in/out}$	0.7
Maximum/minimum hydrogen content (kg)	$H_m^{MHRs,max/min}$	500, 50
Initial hydrogen content (kg)	$H_m^{MHRs,init}$	500

PDN Parameters		
Property	Symbol	Value
Conventional power loads (MW, MVar)	$P_{j,t}^{c,load}, Q_{j,t}^{c,load}$	[1.25251,1.34486,1.34097,1.35274,1.36606,1.39703,1.56223,1.65943,1.62034,1.60686,1.87777,1.87486,1.86389,1.84914,1.86777,1.64451,1.48571,1.40994,1.46269,1.35629,1.39034,1.61794,1.61743,1.42143] [0.62626,0.67243,0.67049,0.67637,0.68303,0.69851,0.78111,0.82971,0.81017,0.80343,0.93889,0.93743,0.93194,0.92457,0.93389,0.82226,0.74286,0.70497,0.73134,0.67814,0.69517,0.80897,0.80871,0.71071]
Maximum/minimum voltage magnitude (p.u.)	$U_j^{max}, U_j^{min}$	1.05, 0.90
Maximum line capacity (MVA)	$S_{ij}^{max}$	100
Electricity purchase price (\$/MWh)	$c_t^{grid}$	[67.30000, 67.30000, 67.30000, 67.30000, 67.30000, 128.57143, 128.57143, 128.57143, 128.57143, 128.57143, 128.57143, 128.57143, 128.57143, 257.14286, 257.14286, 257.14286, 257.14286, 257.14286, 257.14286, 128.57143, 128.57143, 67.30000, 67.30000, 67.30000, 67.30000]
Electrolyzer efficiency	$\eta_h^{ELZ}$	0.7
Maximum and minimum content of hydrogen tank (kg)	$H_h^{HT,max/min}$	3000, 300
Initial content of hydrogen tank (kg)	$H_h^{HT,init}$	3000
Coefficient for voltage deviation penalty	$c^U$	20000
Hydrogen purchase price (\$/kg)	$c^H$	2.5