Table S1. Binary interaction parameters of the NRTL thermodynamic system, specific for the components implied in the IPA-water dehydration process by extractive distillation with 12PG as a solvent

Binary interaction parameter	**IPA+water**	**IPA+12PG**	**Water+12PG**
a_{ij}	1.058520	0	0
a_{ji}	0.753267	0	0
b_{ij}	461.7190	-41.2840	583.26
b_{ji}	-267.1320	300.4080	-376.56
c_{ij}	0	0	0
c_{ji}	0	0	0
α	0.3111	0.3007	0.2926
β	0	0	0

Table S2. Formulas and data utilized for the economic evaluation

Parameter and unit measure	**Formulas or data**
Condenser	
Heat transfer coefficient, U_c, kW/(K·m^2)	0.852
Heat transfer area, A_c, m^2	$\frac{Q_C}{U_C \times \Delta T}$
Capital cost, $	$\frac{M\&S}{280} \times 3489.996 \times {A_c}^{0.65}$
Reboiler	
Heat transfer coefficient, U_r, kW/(K·m^2)	0.568
Heat transfer area, A_r, m^2	$\frac{Q_r}{U_r \times \Delta T}$
Capital cost, $	$\frac{M\&S}{280} \times 3489.996 \times {A_r}^{0.65}$
Cooler/Heater	
Heat transfer coefficient, $U_{c/h}$, kW/(K·m^2)	0.570
Heat transfer area, $A_{c/h}$, m^2	$\frac{Q_{c/h}}{U_{c/h} \times \Delta T}$
Capital cost, $	$\frac{M\&S}{280} \times 3489.996 \times {A_{c/h}}^{0.65}$
Column vessel	
H	$1.2 \times 0.6069 \times (N_T - 2)$
TC_{inst}	$\frac{M\&S}{280} \times 262.556 \times ID^{1.55} \times H$
CSC_{inst}	$\frac{M\&S}{280} \times 5485.171 \times ID^{1.066} \times H^{0.802}$
Capital cost	$TC_{inst} + CSC_{inst}$
Energy cost, $/GJ	
LP steam (433 K)	7.72
MP steam (457 K)	8.22
HP steam (527 K)	9.88
Cooling water	0.354
M&S (2020)	2171
Payback period	3
l	$\frac{Total\ capital\ cost}{payback\ period} + annual\ energy\ cost$

Table S3. Design parameters for the Conventional TCED

Design parameter	**Value**
PC ID, m	1.067
PC H, m	31.57
Q_{c1}, kW	3070
A_{c1}, m^2	87.90
Q_{r1}, kW	3407
A_{r1}, m^2	116.31
EDC ID, m	1.676
EDC H, m	53.73
Q_{c2}, kW	2998
A_{c2}, m^2	86.63
Q_{r2}, kW	6639
A_{r2}, m^2	344.55
SRC ID, m	1.219
SRC H, m	44.78
Q_{c3}, kW	1928
A_{c3}, m^2	39
Q_{r3}, kW	2723
A_{r3}, m^2	94
Q_{cooler}, kW	4418
A_{cooler}, m^2	101

Table S4. Design parameters for the SH1

Design parameter	**Value**
PC ID, m	1.067
PC H, m	31.57
Q_{c1}, kW	3070
A_{c1}, m^2	88
Q_{r1}, kW	3307
A_{r1}, m^2	112.9
EDC ID, m	1.524
EDC H, m	55.61
Q_{c2}, kW	2999
A_{c2}, m^2	86.7
Q_{r2}, kW	4664
A_{r2}, m^2	255.9
SRC ID, m	1.219
SRC H, m	44.78
Q_{c3}, kW	1927
A_{c3}, m^2	39
Q_{r3}, kW	2723
A_{r3}, m^2	94
Q_{cooler}, kW	2441
A_{cooler}, m^2	71.3
$Q_{heater1}$, kW	100
$A_{heater1}$, m^2	7.9
$Q_{heater3}$, kW	1977
$A_{heater3}$, m^2	53.3

Table S5. Design parameters for the SH2

Design parameter	**Value**
PC ID, m	1.067
PC H, m	31.57
Qc_1, kW	3070
Ac_1, m^2	88
Qr_1, kW	3060
Ar_1, m^2	104.5
EDC ID, m	1.524
EDC H, m	55.61
Qc_2, kW	2999
Ac_2, m^2	86.7
Qr_2, kW	4664
Ar2, m^2	255.9
SRC ID, m	1.219
SRC H, m	44.78
Qc_3, kW	1927
Ac_3, m^2	39
Qr_3, kW	2723
Ar_3, m^2	94
Q_{cooler}, kW	2194
A_{cooler}, m^2	66.7
$Q_{heater1}$, kW	100
$A_{heater1}$, m^2	7.9
$Q_{heater2}$, kW	247
$A_{heater2}$, m^2	6.34
$Q_{heater3}$, kW	1977
$A_{heater3}$, m^2	53.3

Table S6. Design parameters for the LH-SH1

Design parameter	**Value**
PC ID, m	1.524
PC H, m	31.57
Q_{c1}, kW	3227
A_{c1}, m^2	255.1
$Q_{r1\text{-}1}$, kW	1499
$A_{r1\text{-}1}$, m^2	117
$Q_{r1\text{-}2}$, kW	1771
$A_{r1\text{-}2}$, m^2	34.73
EDC ID, m	1.724
EDC H, m	55.61
Q_{c2}, kW	2999
A_{c2}, m^2	86.7
Q_{r2}, kW	4730
A_{r2}, m^2	255.21
SRC ID, m	1.219
SRC H, m	44.78
Q_{r3}, kW	2789
A_{r3}, m^2	96.4
Q_{cooler}, kW	586.5
A_{cooler}, m^2	25.65
$Q_{heater3}$, kW	2061
$A_{heater3}$, m^2	89.75

Table S7. Design parameters for the LH-SH2

Design parameter	**Value**
PC ID, m	1.524
PC H, m	31.57
Q_{c1}, kW	3227
A_{c1}, m^2	255.1
$Q_{r1\text{-}1}$, kW	1499
$A_{r1\text{-}1}$, m^2	117.48
$Q_{r1\text{-}2}$, kW	1867
$A_{r1\text{-}2}$, m^2	87.32
EDC ID, m	1.724
EDC H, m	55.61
Q_{c2}, kW	2999
A_{c2}, m^2	86.7
$Q_{r2\text{-}1}$, kW	1810
$A_{r2\text{-}1}$, m^2	295.74
$Q_{r2\text{-}2}$, kW	4157
$A_{r2\text{-}2}$, m^2	215
SRC ID, m	1.219
SRC H, m	44.78
Qr_3, kW	2789
Ar_3, m^2	96.4
$Q_{heater3}$, kW	740.6
$A_{heater3}$, m^2	113