Supplementary Table S1
General specifications of the model FSRU.

Item	Value
Type of LNG storage tanks	MARK III, maximum vapour pressure of 0.7 bar(g) and boil off rate (BOR) of 0.15 %
Cargo capacity	170 000 m^3
Type of LD compressor	2 stage centrifugal compressor with pre-cooling
Maximum / baseload regasification capacity	750 mmscfd / 500 mmscfd
Propulsion system	Dual fuel diesel electric (DFDE)
Engines	3 x Wärtsilä 12V50DF (11.4 MW) 1 x Wärtsilä 6L50DF (5.7 MW)

Supplementary Table S2
NG composition measured on board an FSRU.

Component	Mole fraction
Methane (CH_4)	0.89018
Nitrogen (N_2)	0.00007
Carbon dioxide (CO_2)	0.00000
Ethane (C_2H_6)	0.07974
Propane (C_3H_8)	0.02291
i-Butane (i-C_4H_{10})	0.00322
n-Butane (n-C_4H_{10})	0.00371
i-Pentane (i-C_5H_{12})	0.00014
n-Pentane (n-C_5H_{12})	0.00002
n-Hexane (n-C_6H_{14})	0.00001

Supplementary Table S3
General parameters assumed for the regasification system.

Parameter	**Value**
LNG tank pressure	1.16325 bar
BOG temperature from tank	-100 ºC
Regasified NG mass flow rate	111.19 kg/s
Regasified NG pressure	85 bar
Regasified NG temperature	10 ºC
Pumps and turbines isentropic efficiency	80 %
Pumps and turbines electromechanical efficiency	90 %
Feed pump discharge pressure	9 bar
LD isentropic efficiency	55 %
LD electromechanical efficiency	80 %
BOG temperature after the mixer	-120 ºC
LD discharge pressure	6 bar
Recondenser pressure	5.5 bar
Minimum temperature difference in heat exchangers	5 ºC
Pressure drop in heat exchangers	0.5 bar
Condensation pressure	1.5 bar
LNG pressure drop through CD-1	21 bar
NG pressure drop through heat exchangers	2 bar
Sea water inlet temperature	15 ºC
Sea water outlet temperature	10 ºC
Sea water inlet pressure	1.01325 bar
Sea water pump discharge pressure	7.5 bar

Supplementary Table S4
Effect of the LNG composition on the optimisation variables for each power cycle.

Cycle	1st stage (C_2H_6 mole fraction)		2nd stage (C_3H_8 mole fraction)		3rd stage (n-C_4H_{10} mole fraction)		Open cycle flow rate (kg/s)	
	Methane	**LNG**	**Methane**	**LNG**	**Methane**	**LNG**	**Methane**	**LNG**
1ORC	0.76	0.74	-	-	-	-	-	-
1ORC-OC	0.73	0.64	-	-	-	-	9.18	19.08
2ORC	0.94	0.92	0.54	0.81	-	-	-	-
2ORC-OC	0.94	0.88	0.54	0.81	-	-	1.27	13.83
3ORC	0.95	0.95	0.47	0.50	0.12	0.11	-	-
3ORC-OC	0.95	0.95	0.47	0.50	0.12	0.11	5.51	5.51

Supplementary Table S5
Thermodynamic data of the 2ORC-OC system.

State	Quality (-)	T (ºC)	p (bar)	h (kJ/kg)	s (kJ/kg-K)	e^{ph} (kJ/kg)	$\dot{m}$ (kg/s)
1	0.0000	-159.89	1.16325	-5573.11	4.8145	1071.14	110.44
2	0.0000	-159.49	9.00	-5570.79	4.8205	1071.68	110.44
3	0.0000	-159.37	5.50	-5570.79	4.8269	1069.75	110.44
4	0.0000	-156.81	5.50	-5561.79	4.9051	1055.43	120.27
5	0.0000	-151.18	112.00	-5529.85	4.9842	1063.79	120.27
6	0.0000	-138.83	91.00	-5489.49	5.3347	999.65	120.27
7	0.0000	-159.89	1.16325	-5573.11	4.8145	1071.14	0.05
8	0.0000	-159.89	1.16325	-5573.11	4.8145	1071.14	0.05
9	0.0000	-159.89	1.16325	-5573.11	4.8145	1071.14	0.00
10	1.0000	-120.00	1.16325	-4979.77	9.9474	134.10	0.00
11	1.0000	-100.00	1.16325	-4938.05	10.2034	99.48	0.70
12	1.0000	-100.00	1.16325	-4938.05	10.2034	99.48	0.70
13	1.0000	-120.00	1.16325	-4979.77	9.9474	134.11	0.75
14	0.0000	-120.00	1.16325	-5418.49	5.9764	879.33	0.00
15	1.0000	-120.00	1.16325	-4979.77	9.9474	134.10	0.75
16	1.0000	17.43	6.00	-4692.66	10.4433	273.35	0.75
17	1.0000	17.43	6.00	-4692.66	10.4433	273.35	0.75
18	1.0000	17.17	5.50	-4692.66	10.4878	260.10	0.75
19	1.0000	17.43	6.00	-4692.66	10.4433	273.35	0.00
20	1.0000	32.00	5.90	-4659.37	10.5637	270.76	0.00
21	1.0000	32.00	5.90	-4659.37	10.5637	270.76	0.00
22	1.0000	32.00	5.90	-4659.37	10.5637	270.76	0.00
23	1.0000	10.00	85.00	-4807.86	8.7622	659.37	9.08
24	1.0000	-117.34	6.00	-4989.16	9.0731	385.37	9.08
25	0.0000	-146.18	5.50	-5523.70	5.2183	1000.15	9.08
26	0.0000	-71.62	89.00	-5191.95	7.0994	771.03	120.27
27	1.0000	-42.88	87.00	-5002.55	7.9861	696.09	120.27
28	1.0000	10.00	85.00	-4807.86	8.7622	659.37	120.27

Supplementary Table S5
Thermodynamic data of the 2ORC-OC system.

State	Quality (-)	T (ºC)	p (bar)	h (kJ/kg)	s (kJ/kg-K)	e^{ph} (kJ/kg)	$\dot{m}$ (kg/s)
29	1.0000	10.00	85.00	-4807.86	8.7622	659.37	111.19
30	0.0000	-79.47	1.50	-3408.02	3.0462	314.06	80.23
31	0.0000	-78.06	25.24	-3402.56	3.0535	317.33	80.23
32	1.0000	10.05	24.74	-2861.80	5.1370	236.89	80.23
33	0.9119	-66.62	2.00	-2962.00	5.2586	100.43	80.23
34	0.0000	-65.33	1.50	-3109.10	2.1157	211.38	48.01
35	0.0000	-64.80	10.61	-3107.12	2.1181	212.64	48.01
36	1.0000	10.05	10.11	-2570.51	4.1506	143.28	48.01
37	0.9763	-37.88	2.00	-2634.67	4.2188	58.79	48.01
38	0.0000	15.00	1.01325	-15907.22	5.0369	0.72	4251.61
39	0.0000	15.05	7.50	-15906.41	5.0375	1.36	4251.61
40	0.0000	15.05	7.50	-15906.41	5.0375	1.36	1075.53
41	0.0000	10.00	1.01325	-15928.18	4.9635	1.64	1075.53
42	0.0000	15.05	7.50	-15906.41	5.0375	1.36	1183.38
43	0.0000	10.00	1.01325	-15928.18	4.9635	1.64	1183.38
44	0.0000	15.05	7.50	-15906.41	5.0375	1.36	1992.69
45	0.0000	10.00	1.01325	-15928.18	4.9635	1.64	1992.69

Supplementary Table S6
Thermodynamic data of the 3ORC-OC system.

State	Quality (-)	T (ºC)	p (bar)	h (kJ/kg)	s (kJ/kg-K)	e^{ph} (kJ/kg)	$\dot{m}$ (kg/s)
1	0.0000	-159.89	1.16325	-5573.11	4.8145	1071.14	110.44
2	0.0000	-159.49	9.00	-5570.79	4.8205	1071.68	110.44
3	0.0000	-159.37	5.50	-5570.79	4.8269	1069.75	110.44
4	0.0000	-157.15	5.50	-5563.00	4.8947	1057.32	116.70
5	0.0000	-151.44	114.00	-5530.50	4.9754	1065.77	116.70
6	0.0000	-143.37	93.00	-5505.20	5.2124	1020.41	116.70
7	0.0000	-159.89	1.16325	-5573.11	4.8145	1071.14	0.05
8	0.0000	-159.89	1.16325	-5573.11	4.8145	1071.14	0.05
9	0.0000	-159.89	1.16325	-5573.11	4.8145	1071.14	0.00
10	1.0000	-120.00	1.16325	-4979.77	9.9474	134.10	0.00
11	1.0000	-100.00	1.16325	-4938.05	10.2034	99.48	0.70
12	1.0000	-100.00	1.16325	-4938.05	10.2034	99.48	0.70
13	1.0000	-120.00	1.16325	-4979.77	9.9474	134.11	0.75
14	0.0000	-120.00	1.16325	-5418.49	5.9764	879.33	0.00
15	1.0000	-120.00	1.16325	-4979.77	9.9474	134.10	0.75
16	1.0000	17.43	6.00	-4692.66	10.4433	273.35	0.75
17	1.0000	17.43	6.00	-4692.66	10.4433	273.35	0.75
18	1.0000	17.17	5.50	-4692.66	10.4878	260.10	0.75
19	1.0000	17.43	6.00	-4692.66	10.4433	273.35	0.00
20	1.0000	32.00	5.90	-4659.37	10.5637	270.76	0.00
21	1.0000	32.00	5.90	-4659.37	10.5637	270.76	0.00
22	1.0000	32.00	5.90	-4659.37	10.5637	270.76	0.00
23	1.0000	10.00	85.00	-4807.86	8.7622	659.37	5.51
24	1.0000	-117.34	6.00	-4989.16	9.0731	385.37	5.51
25	0.0000	-146.44	5.50	-5524.67	5.2107	1001.45	5.51
26	0.0000	-74.80	91.00	-5213.64	6.9871	782.84	116.70
27	1.0000	-46.32	89.00	-5025.24	7.8801	704.99	116.70
28	1.0000	-19.50	87.00	-4906.23	8.3855	673.32	116.70

Supplementary Table S6
Thermodynamic data of the 3ORC-OC system.

State	Quality (-)	T (°C)	p (bar)	h (kJ/kg)	s (kJ/kg-K)	e^{ph} (kJ/kg)	$\dot{m}$ (kg/s)
29	1.0000	10.00	85.00	-4807.86	8.7622	659.37	116.70
30	1.0000	10.00	85.00	-4807.86	8.7622	659.37	111.19
31	0.0000	-80.09	1.50	-3430.16	3.1074	321.57	77.27
32	0.0000	-78.55	27.22	-3424.21	3.1154	325.11	77.27
33	1.0000	10.05	26.72	-2888.07	5.1816	245.23	77.27
34	0.9027	-69.80	2.00	-2989.82	5.3069	106.12	77.27
35	0.0000	-68.84	1.50	-3159.23	2.2712	228.73	46.25
36	0.0000	-68.24	11.95	-3156.94	2.2741	230.17	46.25
37	1.0000	10.05	11.45	-2613.60	4.3452	155.99	46.25
38	0.9686	-41.32	2.00	-2683.81	4.4210	63.18	46.25
39	0.0000	-30.10	1.50	-2831.50	1.4327	117.73	31.97
40	0.0000	-29.88	5.14	-2830.71	1.4336	118.27	31.97
41	1.0000	10.05	4.64	-2366.66	3.1199	79.54	31.97
42	1.0000	-13.98	2.00	-2397.07	3.1493	40.38	31.97
43	0.0000	15.00	1.01325	-15907.22	5.0369	0.72	4265.69
44	0.0000	15.05	7.50	-15906.41	5.0375	1.36	4265.69
45	0.0000	15.05	7.50	-15906.41	5.0375	1.36	527.28
46	0.0000	10.00	1.01325	-15928.18	4.9635	1.64	527.28
47	0.0000	15.05	7.50	-15906.41	5.0375	1.36	681.40
48	0.0000	10.00	1.01325	-15928.18	4.9635	1.64	681.40
49	0.0000	15.05	7.50	-15906.41	5.0375	1.36	1154.16
50	0.0000	10.00	1.01325	-15928.18	4.9635	1.64	1154.16
51	0.0000	15.05	7.50	-15906.41	5.0375	1.36	1902.85
52	0.0000	10.00	1.01325	-15928.18	4.9635	1.64	1902.85

Supplementary Table S7
Composition and chemical exergy of the 2ORC-OC states.

State	Composition (mol%)					e^{ch} (kJ/kg)
	CH_4	C_2H_6	C_3H_8	n-C_4H_{10}	H_2O	
1-29	100.00	0.00	0.00	0.00	0.00	51 480.00
30-33	0.00	94.00	6.00	0.00	0.00	-
34-37	0.00	46.00	54.00	0.00	0.00	-
38-45	0.00	0.00	0.00	0.00	100.00	-

Supplementary Table S8
Composition and chemical exergy of the 3ORC-OC states.

State	Composition (mol%)					e^{ch} (kJ/kg)
	CH_4	C_2H_6	C_3H_8	n-C_4H_{10}	H_2O	
1-30	100.00	0.00	0.00	0.00	0.00	51 480.00
31-34	0.00	95.00	5.00	0.00	0.00	-
35-38	0.00	53.00	47.00	0.00	0.00	-
39-42	0.00	0.00	88.00	12.00	0.00	-
43-52	0.00	0.00	0.00	0.00	100.00	-

Supplementary Table S9
Exergy destruction and exergy efficiency by equipment of the 2ORC-OC system.
(1) ORC includes all components associated with the working fluid.

Equipment	**Input exergy (kW)**	**Output exergy (kW)**	**Irreversibilities (kW)**	**Exergy efficiency (%)**
CD-1	7714.13	5582.21	2131.92	72.36
CD-2	27 496.21	17 139.10	10 357.10	62.33
CD-3	9013.07	7326.37	1686.70	81.29
LD	214.08	103.83	110.25	48.50
MX	45.90	24.12	21.78	52.55
ORC-1 (1)	27 496.21	7600.41	19 349.54	27.64
ORC-2 (1)	9013.07	2985.27	5703.39	33.12
P-1	256.99	58.86	198.12	22.91
P-2	3841.76	1005.88	2835.89	26.18
P-3	438.19	262.35	175.84	59.87
P-4	95.15	60.60	34.55	63.69
P-5	3450.51	2736.76	713.75	79.31
R	1581.52	1094.99	486.53	69.24
T-1	2487.91	1646.22	841.69	66.17
T-2	10 948.26	8038.60	2909.66	73.42
T-3	4056.58	3080.42	976.16	75.94
TH	4416.83	294.84	4122.00	6.68
V-1	212.73	0.00	212.73	-
V-2	9.88	0.00	9.88	-
VP-1	6453.19	546.26	5906.93	8.46
VP-2	3330.38	324.40	3005.98	9.74

Supplementary Table S10
Exergy destruction and exergy efficiency by equipment of the 3ORC-OC system.
(1) ORC- includes all components associated with the working fluid.

Equipment	**Input exergy (kW)**	**Output exergy (kW)**	**Irreversibilities (kW)**	**Exergy efficiency (%)**
CD-1	5292.74	3396.04	1896.70	64.16
CD-2	27 724.76	16 648.21	11 076.55	60.05
CD-3	9086.07	7656.40	1429.67	84.27
CD-4	3695.79	2472.89	1222.89	66.91
LD	214.08	103.83	110.25	48.50
MX	45.90	24.12	21.78	52.55
ORC-1 (1)	27 724.76	7402.78	19 800.35	26.70
ORC-2 (1)	9086.07	3141.33	5628.35	34.57
ORC-3 (1)	3695.79	946.77	2562.22	25.62
P-1	256.99	58.86	198.12	22.91
P-2	3793.04	985.09	2807.95	25.97
P-3	459.55	274.08	185.47	59.64
P-4	105.90	66.36	39.54	62.66
P-5	25.24	17.48	7.76	69.24
P-6	3461.94	2745.83	716.11	79.31
R	1372.27	902.44	469.82	65.76
T-1	1510.36	999.39	510.98	66.17
T-2	10 749.96	7862.33	2887.63	73.14
T-3	4292.10	3247.23	1044.88	75.66
T-4	1252.13	972.01	280.12	77.63
TH	1628.17	144.54	1483.63	8.88
V-1	212.73	0.00	212.73	-
V-2	9.88	0.00	9.88	-
VP-1	6172.33	521.63	5650.70	8.45

Supplementary Table S10
Exergy destruction and exergy efficiency by equipment of the 3ORC-OC system.
(1) ORC- includes all components associated with the working fluid.

Equipment	**Input exergy (kW)**	**Output exergy (kW)**	**Irreversibilities (kW)**	**Exergy efficiency (%)**
VP-2	3430.66	316.39	3114.27	9.22
VP-3	1238.24	186.79	1051.45	15.09

Supplementary Table S11
Economic results of the 2ORC-OC system obtained from the APEA. Centrifugal pump (CP), shell and tube heat exchanger (S&T) and plate heat exchanger (PHE).

Module	Equipment	n. º	Type / Material	Equip. cost (USD)	Installed cost (USD)	Total capital cost (USD)
Propane	Booster pump	2	CP / SS304	2 774 000	3 494 600	84 887 700
	LNG vaporizer	1	S&T / SS316L	350 600	748 300	
	Trim heater	1	S&T / Titanium	666 700	2 572 000	
	Propane pump	1	CP / SS304	37 600	225 200	
	Propane vaporizer	3	PHE / Titanium	865 800	2 342 500	
2ORC-OC	P-2	4	CP / SS304	5 996 800	7 614 400	
	P-3	2	CP / SS304	367 400	686 400	
	P-4	2	CP / SS304	93 000	257 300	
	CD-1	2	S&T / SS316L	325 200	2 025 600	
	CD-2	2	S&T / SS316L	1 867 000	5 848 900	
	CD-3	2	S&T / SS316L	2 955 800	6 454 300	
	T-1	2	-	1 583 800	1 718 700	
	T-2	2	-	4 112 000	4 374 800	
	T-3	2	-	2 308 800	2 496 000	
	VP-1	4	PHE / Titanium	818 800	2 550 800	
	VP-2	2	PHE / Titanium	425 600	1 192 500	
	TH	2	S&T / SS316L	1 422 800	6 447 700	

Supplementary Table S12
Economic results of the 3ORC-OC system obtained from the APEA.

Module	Equipment	n. º	Type / Material	Equip. cost (USD)	Installed cost (USD)	Total capital cost (USD)
Propane	Booster pump	2	CP / SS304	2 774 000	3 494 600	102 591 000
	LNG vaporizer	1	S&T / SS316L	350 600	748 300	
	Trim heater	1	S&T / Titanium	666 700	2 572 000	
	Propane pump	1	CP / SS304	37 600	225 200	
	Propane vaporizer	3	PHE / Titanium	865 800	2 342 500	
3ORC-OC	P-2	4	CP / SS304	3 110 800	3 834 400	
	P-3	2	CP / SS304	373 400	692 800	
	P-4	2	CP / SS304	96 400	262 400	
	P-5	2	CP / SS304	24 000	181 000	
	CD-1	2	S&T / SS316L	203 400	1 897 400	
	CD-2	2	S&T / SS316L	1 551 200	5 522 400	
	CD-3	2	S&T / SS316L	6 513 000	16 473 800	
	CD-4	2	S&T / SS316L	3 087 000	5 993 400	
	T-1	2	-	575 800	887 800	
	T-2	2	-	4 068 600	4 329 700	
	T-3	2	-	2 383 400	2 572 900	
	T-4	2	-	564 800	1 168 200	
	VP-1	4	PHE / Titanium	948 000	2 719 500	
	VP-2	2	PHE / Titanium	370 800	1 113 000	
	VP-3	2	PHE / Titanium	265 400	865 000	

Supplementary Table S12
Economic results of the 3ORC-OC system obtained from the APEA.

Module	Equipment	n. º	Type / Material	Equip. cost (USD)	Installed cost (USD)	Total capital cost (USD)
	TH	2	S&T / SS316L	930 600	4 805 600	