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Table S1: Single Utility Problem Table Algorithm (SU PTA) for Industrial Plant A from 0 to 24 h

$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$					$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Initial Heat Cascade	Single Utility Heat Cascade
		0.06	0.07	0.2	0.04	0.15				
160									0	9.4
	20						0.06	1.2		
140									1.2	10.6
	30						0.13	3.9		
110									5.1	14.5
	30						-0.11	-3.3		
80									1.8	11.2
	5						-0.07	-0.35		
75									1.45	10.85
	5						-0.22	-1.1		
70									0.35	9.75
	25						-0.28	-7		
45									-6.65	2.75
	5						-0.35	-1.75		
40									-8.4	1
	5						-0.2	-1		
35									-9.4	0

Table S2: Single Utility Problem Table Algorithm (SU PTA) for Industrial Plant B from 6 to 17 h

$T'(°C)$	$\Delta T(°C)$	$mCP(\frac{MW}{°C})$					$mCP(\frac{MW}{°C})$	$\Delta H(MW)$	Initial Heat Cascade	Single Utility Heat Cascade
		0.08	0.04	0.08	0.02	0.09				
195									0	0
	40						0.08	3.2		
155									3.2	3.2
	10						-0.01	-0.1		
145									3.1	3.1
	30						0.07	2.1		
115									5.2	5.2
	10						0.05	0.5		
105									5.7	5.7
	25						0.01	0.25		
80									5.95	5.95
	15						0.1	1.5		
65									7.45	7.45
	30						0.12	3.6		
35									11.05	11.05
	20						0.04	0.8		
15									11.85	11.85

Table S3: Single Utility Problem Table Algorithm (SU PTA) for Industrial Plant B from 17 to 20 h

$T'(°C)$	$\Delta T(°C)$	$mCP(\frac{MW}{°C})$				$mCP(\frac{MW}{°C})$	$\Delta H(MW)$	Initial Heat Cascade	Single Utility Heat Cascade
		0.08	0.04	0.08	0.09				
195								0	0
	40					0.08	3.2		
155								3.2	3.2
	10					-0.01	-0.1		
145								3.1	3.1
	40					0.07	2.8		
105								5.9	5.9
	25					0.03	0.75		
80								6.65	6.65
	45					0.12	5.4		
35								12.05	12.05
	20					0.04	0.8		
15								12.85	12.85

Table S4: Single Utility Problem Table Algorithm (SU PTA) for Industrial Plant B from 20 to 6 h

$T'(°C)$	$\Delta T(°C)$	$mCP(\frac{MW}{°C})$	$mCP(\frac{MW}{°C})$	$\Delta H(MW)$	Initial Heat Cascade	Single Utility Heat Cascade
		0.5				
125					0	10
	20		-0.5	-10		
105					-10	0

Table S5: Single Utility Problem Table Algorithm (SU PTA) for Industrial Plant C from 6 to 17 h

$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$									$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Initial Heat Cascade	Single Utility Heat Cascade
		5	10	2.58	0.24	0.14	50	0.85	7	0.05				
250													0	61
	40										-0.14	-5.6		
210													-5.6	55.4
	100										-0.19	-19		
110													-24.6	36.4
	35										-1.04	-36.4		
75													-61	0
	5										1.38	6.9		
70													-54.1	6.9
	5										11.14	55.7		
65													1.6	62.6
	5										13.72	68.6		
60													70.2	131.2
	17										6.72	114.24		
43													184.44	245.44
	3										6.96	20.88		
40													205.32	266.32
	2										7.95	15.9		
38													221.22	282.22
	3										-42.05	-126.15		
35													95.07	156.07
	4										7.95	31.8		
31													126.87	187.87
	1										8	8		
30													134.87	195.87
	2										-7	-14		
28													120.87	181.87

Table S6: Single Utility Problem Table Algorithm (SU PTA) for Industrial Plant C from 17 to 20 h

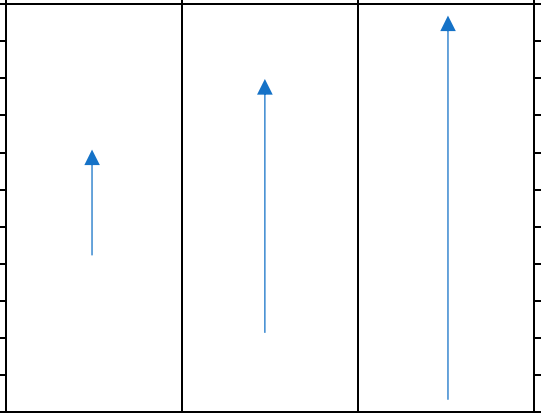
$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$			$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Initial Heat Cascade	Single Utility Heat Cascade
		2.58	0.85	0.05				
210							0	94.25
	100				-0.05	-5		
110							-5	89.25
	35				-0.9	-31.5		
75							-36.5	57.75
	10				-3.48	-34.8		
65							-71.3	22.95
	25				-0.9	-22.5		
40							-93.8	0.45
	9				-0.05	-0.45		
31							-94.25	0

Table S7: Single Utility Problem Table Algorithm (SU PTA) for Industrial Plant C from 20 to 6 h

$T'(°C)$	$\Delta T(°C)$	$mCP(\frac{MW}{°C})$						$mCP(\frac{MW}{°C})$	$\Delta H(MW)$	Initial Heat Cascade	Single Utility Heat Cascade
		35.1	0.59	2.58	2.2	0.85	0.05				
210										0	194.85
	100							-0.05	-5		
110										-5	189.85
	35							-0.9	-31.5		
75										-36.5	158.35
	5							-4.07	-20.35		
70										-56.85	138
	5							-6.27	-31.35		
65										-88.2	106.65
	25							-3.69	-92.25		
40										-180.45	14.4
	5							-2.84	-14.2		
35										-194.65	0.2
	4							-0.05	-0.2		
31										-194.85	0
	3							35.1	105.3		
28										-89.55	105.3

Table S8: Single Utility Problem Table Algorithm (SU PTA) for Industrial Plant D from 6 to 20 h

$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$		$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Initial Heat Cascade	Single Utility Heat Cascade
		3.33	7.92				
85						0	664.65
	20			-7.92	-158.4		
65						-158.4	506.25
	45			-11.25	-506.25		
20						-664.65	0

Table S9: Single Utility Problem Table Algorithm (SU PTA) for Industrial Plant D from 20 to 6 h

$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$	$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Initial Heat Cascade	Single Utility Heat Cascade
		3.33				
65					0	149.85
	45		-3.33	-149.85		
20					-149.85	0

Table S10: Multiple Utility Problem Table Algorithm (MU PTA) for Industrial Plant A from 0 to 24 h

$T'(℃)$	$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$					$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Multiple Utility Cascade	Utility Consumed/ Generated	Heat Sink/Source
			0.06	0.07	0.2	0.04	0.15					
	240									0		0
		80						0	0			
160	160									0		
		10						0.06	0.6			
	150									0.6		0
		10						0.06	0.6			
140	140									1.2		
		30						0.13	3.9			
110	110									5.1		
		20						-0.11	-2.2			
	90									2.9		8.65
		10						-0.11	-1.1			
80	80									1.8		
		5						-0.07	-0.35			
75	75									1.45		
		5						-0.07	-0.35			
70	70									1.1		
		25						-0.28	-7		5.9	
45	45									0		
		5						-0.35	-1.75		1.75	
40	40									0		
		5						-0.2	-1		1	
35	35									0		Pinch
		15						0	0			
	20									0		0

Table S11: Multiple Utility Problem Table Algorithm (MU PTA) for Industrial Plant B from 6 to 17 h

$T'(℃)$	$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$					$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Multiple Utility Cascade	Utility Consumed/ Generated	Heat Sink/Source
			0.08	0.04	0.08	0.02	0.09					
	240									0		0
		45						0	0			
195	195									0		Pinch
		40						0.08	3.2		-3.1	
155	155									-0.1		
		5						-0.01	-0.05			
	150									-0.05		-3.1
		5						-0.01	-0.05			
145	145									0		
		30						0.07	2.1		-2.1	
115	115									0		
		10						0.05	0.5		-0.5	
105	105									0		
		15						0.01	0.15			
	90											-2.6
		10						0.01	0.1		-0.1	
80	80									0		
		15						0.1	1.5		-1.5	
65	65									0		
		30						0.12	3.6		-3.6	
35	35									0		
		15						0.04	0.6		-0.6	
	20									0		-5.8
		5						0.04	0.2		-0.2	
15	15									0		
		5						0	0			
	10									0		-0.2

Table S12: Multiple Utility Problem Table Algorithm (MU PTA) for Industrial Plant B from 17 to 20 h

$T'(℃)$	$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$				$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Multiple Utility Cascade	Utility Consumed/ Generated	Heat Sink/Source
			0.08	0.04	0.08	0.09					
	240								0		
		45					0	0			
195	195								0		Pinch
		40					0.08	3.2		-3.1	
155	155								-0.1		
		5					-0.01	-0.05			
	150								-0.05		-3.1
		5					-0.01	-0.05			
145	145								0		
		40					0.07	2.8		-2.8	
105	105								0		
		15					0.03	0.45		-0.45	
	90								0		-3.25
		10					0.03	0.3		-0.3	
80	80								0		
		45					0.12	5.4		-5.4	
35	35								0		
		15					0.04	0.6		-0.6	
	20								0		-6.3
		5					0.04	0.2		-0.2	
15	15								0		
		5					0	0			
	10								0		-0.2

Table S13: Multiple Utility Problem Table Algorithm (MU PTA) for Industrial Plant B from 20 to 6 h

$T'(℃)$	$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$	$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Multiple Utility Cascade	Utility Consumed/Generated	Heat Sink/Source
			0.5					
	150					0		10
		25		0	0			
125	125					0		
		20		-0.5	-10		10	
105	105					0		Pinch
		15		0	0			
	90					0		0

Table S14: Multiple Utility Problem Table Algorithm (MU PTA) for Industrial Plant C from 6 to 17 h

$T'(℃)$	$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$									$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Multiple Utility Cascade	Utility Consumed/Generated	Heat Sink/Source
			5	10	2.58	0.24	0.14	50	0.85	7	0.05					
	250													0		17
		0										0	0			
250	250													0		
		40										-0.14	-5.6		5.6	
210	210													0		
		60										-0.19	-11.4		11.4	
	150													0		28.4
		40										-0.19	-7.6		7.6	
110	110													0		
		20										-1.04	-20.8		20.8	
	90													0		15.6
		15										-1.04	-15.6		15.6	
75	75													0		Pinch
		5										1.38	6.9		-6.9	
70	70													0		
		5										11.14	55.7		-55.7	
65	65													0		
		5										13.72	68.6		-68.6	
60	60													0		
		17										6.72	114.24		-24.87	
43	43													-89.37		
		3										6.96	20.88			
40	40													-110.25		
		2										7.95	15.9			
38	38													-126.15		
		3										-42.05	-126.15			
35	35													0		
		4										7.95	31.8		-25.8	
31	31													-6		
		1										8	8			
30	30													-14		
		2										-7	-14			
28	28													0		
		8										0	0			
	20													0		-181.87

Table S15: Multiple Utility Problem Table Algorithm (MU PTA) for Industrial Plant C from 17 to 20 h

$T'(°C)$	$T'(°C)$	$\Delta T(°C)$	$mCP(\frac{MW}{°C})$			$mCP(\frac{MW}{°C})$	$\Delta H(MW)$	Multiple Utility Cascade	Utility Consumed/Generated	Heat Sink/Source
			2.58	0.85	0.05					
	250							0		3
		40				0	0			
210	210							0		
		60				-0.05	-3		3	
	150							0		19
		40				-0.05	-2		2	
110	110							0		
		20				-0.85	-17		17	
	90									71.25
		15				-0.9	-13.5		13.5	
75	75							0		
		10				-3.48	-34.8		34.8	
65	65							0		
		25				-0.9	-22.5		22.5	
40	40							0		
		9				-0.05	-0.45		0.45	
31	31							0		Pinch
		11				0	0			
	20							0		0

Table S16: Multiple Utility Problem Table Algorithm (MU PTA) for Industrial Plant C from 20 to 6 h

$T'(℃)$	$T'(℃)$	$\Delta T(℃)$	$mCP(\frac{MW}{℃})$						$mCP(\frac{MW}{℃})$	$\Delta H(MW)$	Multiple Utility Cascade	Utility Consumed/ Generated	Heat Sink/Source
			35.1	0.59	2.58	2.2	0.85	0.05					
	250										0		3
		40							0	0			
210	210										0		
		60							-0.05	-3		3	
	150										0		20
		40							-0.05	-2		2	
110	110										0		
		20							-0.9	-18		18	
	90												171.85
		15							-0.9	-13.5		13.5	
75	75										0		
		5							-4.07	-20.35		20.35	
70	70										0		
		5							-6.27	-31.35		31.35	
65	65										0		
		25							-3.69	-92.25		92.25	
40	40										0		
		5							-2.84	-14.2		14.2	
35	35										0		
		4							-0.05	-0.2		0.2	
31	31										0		Pinch
		3							35.1	105.3		-105.3	
28	28										0		
		8							0	0			
	20										0		-105.3

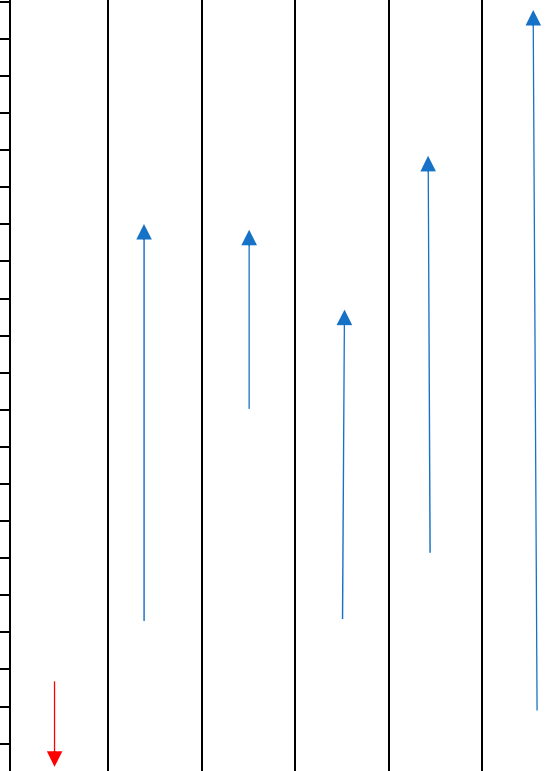


Table S17: Multiple Utility Problem Table Algorithm (MU PTA) for Industrial Plant D from 6 to 20 h

$T'(°C)$	$T'(°C)$	$\Delta T(°C)$	$mCP(\frac{MW}{°C})$		$mCP(\frac{MW}{°C})$	$\Delta H(MW)$	Multiple Utility Cascade	Utility Consumed/ Generated	Heat Sink/Source
			3.33	7.92					
	90						0		664.65
		5			0	0			
85	85						0		
		20			-7.92	-158.4		158.4	
65	65						0		
		45			-11.25	-506.25		506.25	
20	20						0	Pinch	
		0			0	0			
	20						0		0

Table S18: Multiple Utility Problem Table Algorithm (MU PTA) for Industrial Plant D from 20 to 6 h

$T'(°C)$	$T'(°C)$	$\Delta T(°C)$	$mCP(\frac{MW}{°C})$	$mCP(\frac{MW}{°C})$	$\Delta H(MW)$	Multiple Utility Cascade	Utility Consumed/ Generated	Heat Sink/Source
			3.33					
	90					0		149.85
		25		0	0			
65	65					0		
		45		-3.33	-149.85		149.85	
20	20					0		Pinch
		0		0	0			
	20					0		0