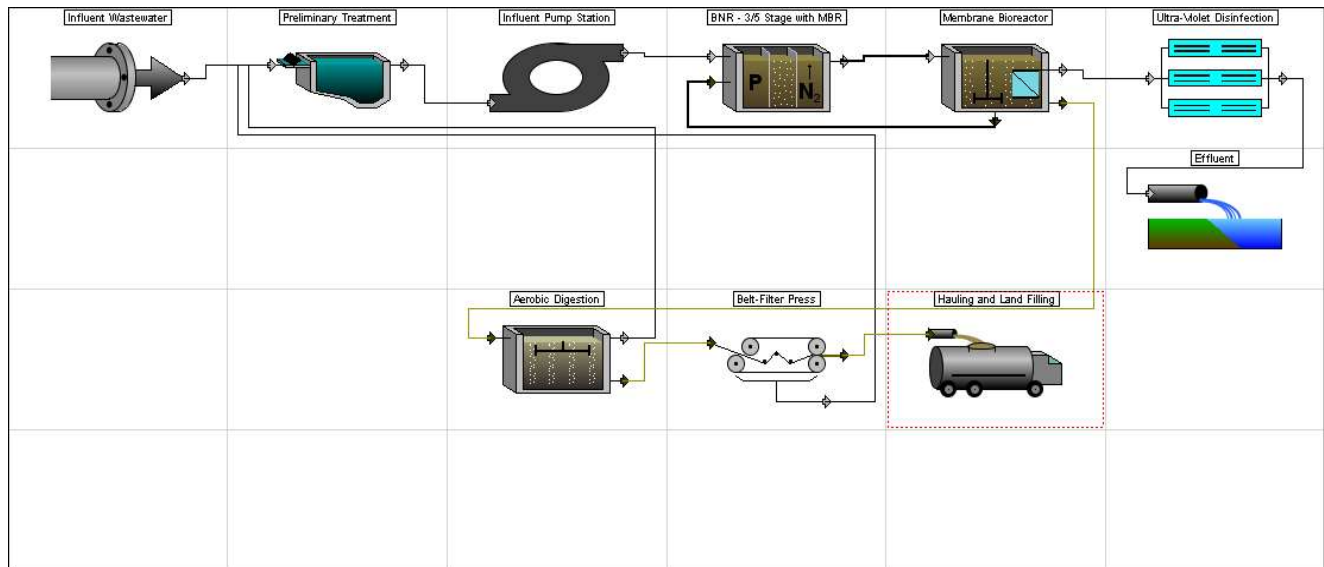


Layout 1 - Hyrum City



Summary

Equipment Database

Hydromantis 2014, (USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	\$11,200,000	\$
Other direct construction costs	\$3,340,000	\$
Other indirect construction costs	\$10,900,000	\$
Total construction costs	\$25,500,000	\$

ANNUAL COSTS

LABOR COSTS

Administration labor cost	\$30,900	\$/yr
Laboratory labor cost	\$140,000	\$/yr
Unit process operation labor cost	\$617,000	\$/yr
Unit process maintenance labor cost	\$301,000	\$/yr
Total labor costs	\$1,090,000	\$/yr

MATERIAL COSTS

Total material cost	\$242,000	\$/yr
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CHEMICAL COSTS

Total chemical cost	\$42,000	\$/yr
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ENERGY COSTS

Total energy cost	\$359,000	\$/yr
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Total operation and maintenance	\$1,730,000	\$/yr
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CONSTRUCTION COST AMC

Amortization cost for total construction	\$2,410,000	\$/yr
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Total annual project cost	\$4,150,000	\$/yr
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PROJECT SUMMARY

Present worth	\$49,600,000	\$
Total project cost	\$25,500,000	\$
Total operation labor cost	\$788,000	\$/yr
Total maintenance labor cost	\$301,000	\$/yr
Total material cost	\$242,000	\$/yr
Total chemical cost	\$42,000	\$/yr
Total energy cost	\$359,000	\$/yr
Total amortization cost	\$2,410,000	\$/yr

Process Summary

Process	Construction (\$)	Operation (\$/yr)	Maintenance (\$/yr)	Material (\$/yr)	Chemical (\$/yr)	Energy (\$/yr)	Amortization (\$/yr)
Preliminary Treatment	437000	39300	17800	10900	0	2230	36700
Influent Pump Station	1240000	29600	20700	8700	0	16500	107000
Aerobic Digestion	571000	84100	35700	45700	0	91500	50500
BNR - 3/5 Stage with MBR	1930000	191000	98800	38600	0	137000	182000

Belt-Filter Press	812000	4330	892	0	14300	2730	74300
Membrane Bioreactor	4330000	245000	121000	42400	25900	96800	593000
Hauling and Land Filling	321000	24000	0	90400	0	0	64400
Ultra-Violet Disinfection	501000	0	5350	5010	1740	12500	42500
Effluent	0	0	0	0	0	0	0
Blower System	1040000	0	0	0	0	0	86900
Other Costs	14300000	171000	0	0	0	0	1180000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	12	acre
Administration labor hours	600	hr/yr
Laboratory labor hours	2720	hr/yr
Costs		
DIRECT COSTS		
Mobilization	296000	\$
Site preparation	477000	\$
Site electrical	802000	\$
Yard piping	545000	\$
Instrumentation and control	387000	\$
Lab and administration building	836000	\$
Total direct construction costs	3340000	\$
INDIRECT COSTS		
Cost of land	240000	\$
Miscellaneous cost	835000	\$
Legal cost	334000	\$
Engineering design fee	2510000	\$
Inspection cost	334000	\$
Contingency	1670000	\$
Technical	334000	\$
Interest during construction	2490000	\$
Profit	2180000	\$
Total indirect construction cost	10900000	\$
Total of other construction costs	14300000	\$
LABOR COSTS		
Administration labor cost	30900	\$/yr
Laboratory labor cost	140000	\$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	13000	scfm
Safety factor	1.5	
Requested air flow capacity	19500	scfm
Total capacity of blowers	19500	scfm
Number of blowers in use	3	
Total number of blowers	4	
Capacity of individual blowers	6490	scfm
Estimated cost of an installed blower	189000	\$
Blower building area	1600	sqft
Costs		
Construction and equipment cost	1040000	\$
Installed Blower Cost	757000	\$
Building Cost	176000	\$
Misc Costs	103000	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	0	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	86900	\$/yr

Notes
Energy costs are shown at the individual unit processes that require air

Influent Wastewater Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	0.375	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.444	ft
Approach velocity	2.5	ft/s

Average flow through velocity (2.5 ft/s
Maximum flow through velocity	3 ft/s
Screen channel width	1.26 ft
Average channel depth	1 ft
Horizontal Flow Grit Chamber	
Maximum flow	7.77 cuft/s
Average flow	3.15 cuft/s
Minimum flow	1.3 cuft/s
Temperature	10.3 deg C
Maximum flow through velocity	1.5 ft/s
Average flow through velocity (1 ft/s
Size of smallest particle 100%	0.2 mm
Specific gravity of particle	2.65
Number of units	2
Maximum flow/unit	3.88 cuft/s
Width of channel	0.647 ft
Depth of channel	4 ft
Length of channel	143 ft
Settling velocity of particle	0.0711 ft/s
Slope of channel bottom	0.00294
Allowance for currents	1.7
Manning coefficient	0.035
Hydraulic retention time	1.59 min
Volume of grit	8.17 cuft/d
Costs	
Construction and equipment co	437000 \$
Operational labor cost	39300 \$/yr
Maintenance labor cost	17800 \$/yr
Material and supply cost	10900 \$/yr
Chemical cost	0 \$/yr
Energy cost	2230 \$/yr
Amortization cost	36700 \$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	14800	cuft
Width of wet well	130	ft
Depth of the pumping station	26.9	ft
Length of the pumping station	18.8	ft
Width of the pumping station	158	ft
Minimum depth of water in wet	5.92	ft
Area of pump building	553	sqft
Peak capacity of pumps	7.36	MGD(US)
Firm pumping capacity	7.36	MGD(US)
Total dynamic head - average	44.9	ft
Quantities		
Operation labor required	574	pers-hrs/yr
Maintenance labor required	488	pers-hrs/yr
Electrical energy required	165000	kWh/yr
Volume of earthwork required	387000	cuft
Volume of slab concrete requir	25300	cuft
Volume of wall concrete requir	13000	cuft
Capacity per pump	5110	gpm(US)
Number of constant speed pur	2	
Number of variable speed purr	0	
Diameter of discharge header	16.2	in
Total dynamic head	66	ft
Size of selected pump	14	in
Specific speed of pump	3700	
Pump rotating speed	1300	rpm
Motor size required	113	HP
Size of selected motor	125	HP
Width of pump system	3.4	ft
Length of pump system	19	ft
Length of the dry well	18.8	ft
Width of the dry well	28	ft
Costs		
Construction and equipment co	1240000	\$
Earthwork Cost	115000	\$
Wall Concrete Cost	313000	\$
Slab Concrete Cost	329000	\$
Building Cost	60800	\$
Installed Pump Equipment C	236000	\$
Misc Costs	190000	\$
Operational labor cost	29600	\$/yr
Maintenance labor cost	20700	\$/yr
Material and supply cost	8700	\$/yr
Chemical cost	0	\$/yr
Energy cost	16500	\$/yr

Amortization cost 107000 \$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	17	d
Design SS	12000	mg/L
Calculated VSS	6080	mg/L
Calculated VSS:TSS ratio	0.507	mg VSS/mg SS
Total volume of reactors	1700	m ³
Length of parallel train	18	m
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	2	
Oxygen requirement to meet a	1030	kg/d
Air flow required to meet avera	5710	N m ³ /hr
Design air flow	55.9	N m ³ /min/1000 m ³
Volatile solids loading	0.0496	lb/(cuft·d)
Solids accumulated	2650	lb/d
Digester capacity	45000	lb
Volume of wasted sludge	205000	gal(US)
Quantities		
Operation labor required	1630	pers-hrs/yr
Maintenance labor required	842	pers-hrs/yr
Electrical energy required	915000	kWh/yr
Volume of earthwork required	44300	cuft
Volume of slab concrete requir	9600	cuft
Volume of wall concrete requir	7250	cuft
Handrail length	198	ft
Number of diffusers per train	149	
Number of swing arm headers	3	
Costs		
Construction and equipment co	571000	\$
Earthwork Cost	13100	\$
Wall Concrete Cost	174000	\$
Slab Concrete Cost	124000	\$
Handrail Cost	14900	\$
Installed Aerator Equipment	131000	\$
Air Piping Cost	56800	\$
Misc Costs	56600	\$
Operational labor cost	84100	\$/yr
Maintenance labor cost	35700	\$/yr
Material and supply cost	45700	\$/yr
Chemical cost	0	\$/yr
Energy cost	91500	\$/yr
Amortization cost	50500	\$/yr

BNR - 3/5 Stage with MBR

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
3-Stage Biological Phosphorus		
Max. specific growth of nitrifier	0.381	1/d
Death rate of nitrifiers at winter	0.0606	1/d
Minimum aerobic SRT for nitrif	4.67	d
Design aerobic SRT for nitrific	6.43	d
Total reactor SRT	10.5	d
Design SS	9000	mg/L
Calculated VSS	5680	mg/L
Calculated VSS:TSS ratio	0.631	mg VSS/mg SS
Total volume of anaerobic reac	368	m ³
Total volume of anoxic reactor	581	m ³
Total volume of aerobic reacto	1500	m ³
Total volume of all reactors	2450	m ³
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	3	
Number of anoxic cells within c	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	1.14	hr
Anoxic hydraulic retention time	1.8	hr
Aerobic hydraulic retention tim	4.66	hr
Amount of sludge generated	2100	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	23200	m ³ /d
Nitrogen required for biomass	21.9	mg/L
Phosphorus required for bioma	4.38	mg/L

Oxygen required to meet average	2240 kg/d
Air flow required to meet average	3720 N m3/hr
Design air flow	41.3 N m3/min/1000 m3
Quantities	
Operation labor required	2240 pers-hrs/yr
Maintenance labor required	1110 pers-hrs/yr
Electrical energy required	820000 kWh/yr
Volume of earthwork required	61500 cuft
Volume of slab concrete required	13500 cuft
Volume of wall concrete required	10500 cuft
Handrail length	361 ft
Number of diffusers per train	401
Fine bubble diffuser floor coverage	15 %
Number of swing arm headers	3
Required mixing power	13.7 kW
Total number of mixers	6
Design mixing power per mixer	3.73 kW
Mixing power for each anaerobic	2.28 kW
Costs	
Construction and equipment costs	1120000 \$
Earthwork Cost	18200 \$
Wall Concrete Cost	254000 \$
Slab Concrete Cost	175000 \$
Handrail Cost	27000 \$
Installed Aerator Equipment	258000 \$
Air Piping Cost	171000 \$
Installed Mixer Equipment Costs	103000 \$
Misc Costs	111000 \$
Operational labor cost	115000 \$/yr
Maintenance labor cost	47100 \$/yr
Material and supply cost	32900 \$/yr
Chemical cost	0 \$/yr
Energy cost	82000 \$/yr
Amortization cost	105000 \$/yr
Internal Recycle Pumping	
Design Information	
Average daily pumping rate	2.04 MGD(US)
Total pumping capacity	2.04 MGD(US)
Design capacity per pump	709 gpm(US)
Number of pumps	9
Number of batteries	1
Firm pumping capacity	2.04 MGD(US)
Quantities	
Operation labor required	482 pers-hrs/yr
Maintenance labor required	400 pers-hrs/yr
Electrical energy required	205000 kWh/yr
Volume of earthwork required	1920 cuft
Area of pump building	240 sqft
Costs	
Construction and equipment costs	333000 \$
Earthwork Cost	1710 \$
Pump Building Cost	79300 \$
Installed Pump Cost	201000 \$
Misc Costs	50800 \$
Operational labor cost	24800 \$/yr
Maintenance labor cost	17000 \$/yr
Material and supply cost	2330 \$/yr
Chemical cost	0 \$/yr
Energy cost	20500 \$/yr
Amortization cost	31500 \$/yr
Internal Recycle Pumping	
Design Information	
Average daily pumping rate	2.72 MGD(US)
Total pumping capacity	2.72 MGD(US)
Design capacity per pump	946 gpm(US)
Number of pumps	9
Number of batteries	1
Firm pumping capacity	2.72 MGD(US)
Quantities	
Operation labor required	500 pers-hrs/yr
Maintenance labor required	417 pers-hrs/yr
Electrical energy required	273000 kWh/yr
Volume of earthwork required	2030 cuft
Area of pump building	254 sqft
Costs	
Construction and equipment costs	371000 \$
Earthwork Cost	1800 \$
Pump Building Cost	83700 \$
Installed Pump Cost	229000 \$
Misc Costs	56500 \$
Operational labor cost	25800 \$/yr
Maintenance labor cost	17700 \$/yr

Material and supply cost	2590 \$/yr
Chemical cost	0 \$/yr
Energy cost	27300 \$/yr
Amortization cost	35000 \$/yr
Sludge Recycle Pumping	
Design Information	
Average daily pumping rate	2.04 MGD(US)
Total pumping capacity	2.04 MGD(US)
Design capacity per pump	709 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	2.04 MGD(US)
Quantities	
Operation labor required	482 pers-hrs/yr
Maintenance labor required	400 pers-hrs/yr
Electrical energy required	68300 kWh/yr
Volume of earthwork required	1920 cuft
Area of pump building	240 sqft
Costs	
Construction and equipment cost	111000 \$
Earthwork Cost	570 \$
Pump Building Cost	26400 \$
Installed Pump Cost	67100 \$
Misc Costs	16900 \$
Operational labor cost	24800 \$/yr
Maintenance labor cost	17000 \$/yr
Material and supply cost	777 \$/yr
Chemical cost	0 \$/yr
Energy cost	6830 \$/yr
Amortization cost	10500 \$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	1	m
Number of units	1	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	35.3	gpm(US)
Final solids content	15	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	84	pers-hrs/yr
Maintenance labor required	21	pers-hrs/yr
Power	27300	kWh/yr
Polymer required	11000	lb/yr
Dry solids produced	3020	lb/d
Belt filter(s)	275000	\$
Building	279000	\$
Installation	68800	\$
Polymer system	82500	\$
Feed pumps	30300	\$
Conveyor system	77000	\$
Costs		
Construction and equipment cost	812000	\$
Building Cost	279000	\$
Polymer System Cost	82500	\$
Feed Pumps Cost	30300	\$
Conveyor System Cost	77000	\$
Installed Belt Filter	344000	\$
Operational labor cost	4330	\$/yr
Maintenance labor cost	892	\$/yr
Material and supply cost	0	\$/yr
Chemical cost	14300	\$/yr
Energy cost	2730	\$/yr
Amortization cost	74300	\$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	31200	cuft
Length of parallel train	35.6	ft
Width of parallel train	17.8	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	3	
Total Membrane Area	39800	m2
Total Scour Air Requirement	7950	N m3/hr
Quantities		

Operation labor required	3920 pers-hrs/yr
Maintenance labor required	2170 pers-hrs/yr
Electrical energy required	904000 kWh/yr
Volume of earthwork required	27600 cuft
Volume of slab concrete requir	5790 cuft
Volume of wall concrete requir	6970 cuft
Handrail length	398 ft
Number of diffusers per train	196
Number of swing arm headers	2
Costs	
Construction and equipment cc	4040000 \$
Earthwork Cost	8170 \$
Wall Concrete Cost	168000 \$
Slab Concrete Cost	75100 \$
Handrail Cost	29800 \$
Membrane Cost	3430000 \$
Installed Aerator Equipment	143000 \$
Air Piping Cost	123000 \$
Misc Cost	75800 \$
Operational labor cost	202000 \$/yr
Maintenance labor cost	92000 \$/yr
Material and supply cost	40400 \$/yr
Chemical cost	25900 \$/yr
Energy cost	90400 \$/yr
Amortization cost	565000 \$/yr
Permeate Pumping	
Design Information	
Average daily pumping rate	1.02 MGD(US)
Total pumping capacity	2.52 MGD(US)
Design capacity per pump	973 gpm(US)
Number of pumps	6
Number of batteries	1
Firm pumping capacity	5.6 MGD(US)
Quantities	
Operation labor required	549 pers-hrs/yr
Maintenance labor required	464 pers-hrs/yr
Electrical energy required	61600 kWh/yr
Volume of earthwork required	2040 cuft
Area of pump building	255 sqft
Costs	
Construction and equipment cc	250000 \$
Earthwork Cost	1210 \$
Pump Building Cost	56200 \$
Installed Pump Cost	154000 \$
Misc Costs	38100 \$
Operational labor cost	28300 \$/yr
Maintenance labor cost	19700 \$/yr
Material and supply cost	1750 \$/yr
Chemical cost	0 \$/yr
Energy cost	6160 \$/yr
Amortization cost	23600 \$/yr
Waste Sludge Pumping	
Design Information	
Average daily pumping rate	0.0449 MGD(US)
Total pumping capacity	0.0449 MGD(US)
Design capacity per pump	15.6 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	0.0449 MGD(US)
Quantities	
Operation labor required	295 pers-hrs/yr
Maintenance labor required	228 pers-hrs/yr
Electrical energy required	1520 kWh/yr
Volume of earthwork required	1610 cuft
Area of pump building	201 sqft
Costs	
Construction and equipment cc	41400 \$
Earthwork Cost	476 \$
Pump Building Cost	22100 \$
Installed Pump Cost	12500 \$
Misc Costs	6310 \$
Operational labor cost	15200 \$/yr
Maintenance labor cost	9660 \$/yr
Material and supply cost	290 \$/yr
Chemical cost	0 \$/yr
Energy cost	152 \$/yr
Amortization cost	3910 \$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		

Design Information		
Volume of sludge hauled	9.95	cuyd/d
Truck capacity	19	cuyd
Round trip time to disposal site	1	hr
Truck loading time	0.75	hr
Operational hours per day	8	hr
Number of trucks required	1	
Distance to disposal site	30	miles
Quantities		
Total sludge volume hauled	9.95	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	1010	sqft
Width of sludge storage shed	22.4	ft
Length of sludge storage shed	44.9	ft
Volume of earthwork required	2960	cuft
Volume of slab concrete requir	1320	cuft
Surface area of canopy roof	1010	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	8.8	ton(short)/d
Operation labor required	467	pers-hrs/yr
LandFilling cost	35200	\$/yr
Costs		
Construction and equipment c	321000	\$
Earthwork Cost	876	\$
Slab Concrete Cost	17100	\$
Canopy Roof Cost	20100	\$
Vehicle Cost	283000	\$
Operational labor cost	24000	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	90400	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	64400	\$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calca	2.12	gal(US)/(min·W)
Total number of lamps needed	124	
Number of spare channels	1	
Total number of lamps used in	168	
Number of excess lamps	44	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	7	
Number of channels	4	
Calculated headloss	158	in
Costs		
Construction and equipment c	501000	\$
Cost of installation	301000	\$
Total cost of UV lamps	200000	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	5350	\$/yr
Material and supply cost	5010	\$/yr
Chemical cost	1740	\$/yr
Energy cost	12500	\$/yr
Amortization cost	42500	\$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment c	0	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	0	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	0	\$/yr