

Swadlincote Energy Recovery Facility

Cost Benefit Assessment

Appendix 3


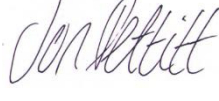

CBA Calculations

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Prepared By



Project Quality Control Sheet

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Grid Reference: SK268190
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1 Introduction

R&P Clean Power Ltd are applying for an environmental permit for a facility known as the Swadlincote Energy Recovery Facility (SERF) which will be located at Keith Willshee Way, to the south-west of Swadlincote in South Derbyshire. The postcode for the site is DE11 9EN and the grid coordinates for the centre of the site are SK267190.

SERF comprises of an Energy Recovery Facility (ERF) designed to accept up to 186,000 tonnes of Refuse Derived Fuel (RDF) per annum, and will generate approximately 20.5MW of electricity (gross), of which 18.5MW will be exported to local industrial users and public electricity distribution network operated by National Grid Energy Distribution (NGED).

It is required that the Best Available Techniques (BAT) are used for new energy from waste facilities and one element of BAT is that the plant should operate with as high an energy conversion efficiency as possible and this is demonstrated by the undertaking of an assessment of the potential for the plant to operate in a way that it can supply heat as well as electricity to customers as combined heat and power (CHP).

In circumstances that a heat load cannot be identified at the outset of the plant operation, for facilities with a throughput of greater than 3 tonnes per hour of non-hazardous waste it is required that it is demonstrated that the plant is substantially ready to supply heat should the opportunity arise in the future and thus be 'CHP ready' (CHP-R). This report presents the required calculations on the costs and benefits of a connection to the most likely heat load and has been completed in line with the guidance provided by the Environment Agency¹.

¹ CHP Ready Guidance for Combustion and Energy from Waste Power Plants V1.0, Environment Agency, 2013

2 SERF Cost Benefit Analysis Calculations

Capital Costs

Civil Engineering and Construction Costs			
Substructures	5,000	Foundations to heat exchanger/pump buildings	
Superstructures (buildings & tunnels etc)	17,500	Building envelope/cabin	
Making good landscaping etc	5,000	Provisional sum	
Total Civil Engineering and Construction Costs			27,500
Heat Exchangers			
Design Costs	75,000		
Modifications within turbine hall	175,000	Including modifications to turbine casing	
Steam-water heat exchanger	227,500	At SERF	
Ancillary steam plant	95,000		
Pumping station (duty + standby)	98,000	Duty + standby circulation pumps and controls	
Cost of heat interface unit	95,000	For a single customer	
Back up boiler at customer	46,000	For a single customer	
Customer pipework modifications	75,000	Assumed within existing boiler room @ IVC	
Total heat exchanger plant			886,500
Heat Transmission			
Distance of piperun - hard ground	505	m - Includes road crossings at 2x roundabout and A544	
Distance of piperun - soft ground	1765	m - Assume permission granted to lay within A544 verge and Tetron Point	
Cost of piperun - hard ground	425	£/m - laid in payment or roadway	
Cost of piperun - soft ground	150	£/m - laid in verge or across field	
			479,375
Development Costs			
Consenting consultants fees	65,000	For planning application and traffic management scheme	
Application Fees	16,000	For planning application	
Project Management	35,000	Incl tendering costs	
Legal fees	45,000	Including any wayleave payments	
Development Cost Total			161,000
Total Capital Cost			1,554,375
Residual value of plant after 30 years	2%	of CAPEX (scrap value of heat exchangers and pumps)	31,088

Operating Costs

Routine Maintenance			
Pipeline	24,000	£/yr	Annual inspections
Pumping station	12,000	£/yr	Inspections and seals etc
Heat exchanger	12,000	£/yr	Annual inspections
IT/Control System	2,500	£/yr	Upgrades and remote access
			50,500
Plant Replacement			
Heat exchanger replacement	886,500	£	Replacement costs
Replacement period	18	yrs	30 year asset life
Annualised replacement fund	59,100	£/yr	
			59,100
Electricity Purchased			
Plant load	75	kW	Main circulation pumps
Operating hours	8,000	hr	ERW operating hours
Imported electricity	600,000	kWh/yr	Assuming 24/7 heat load
Cost of imported electricity	0.15	£/kWh	Purchase price supply
			90,000
Office, Rent, Rates, Insurance			
Office			
General	3,000	£/yr	Includes billing management etc
Communications	1,200	£/yr	SIM cards for control points
Rental			
Heat exchanger building	0	£/yr.	Assume FOC from SRRP & Client
Wayleaves rental costs	5,000	£/yr.	Assumes some private land crossed
Rates			
Rateable value			Not assessed
Insurance			
Public & Environmental Liability	12,500	£/yr	May be combined with SRRP policies
			21,700
Total Operating Costs			221,300

Revenue

Heat supplied			
Extraction from SERF	4.8	MW/th - From CHP-R calculations	
Losses in exchanger, pipeline	0.5	MW/th - Estimates based on best practice	
Total maximum supply to Customer	4.3	MW/th - Assuming a single customer	
Value of Heat			
Hours of supply	8,000	hrs - Total operating hours of when SRRP can supply heat	
Load factor of supply	50%	Partially Process Heat, some space heating	
Total chargeable supply	17,280	MW/wh - annual supply assuming all can be consumed	
Value of supply	45	£/MWwh - Equivalent to equivalent heat supply from gas boiler	
Discount/uplift	0%	Any discount or profit to be applied to value	
Total Value of supply			777,600 £/yr - assuming commercial terms seek to match market

Foregone income

Performance			
Electrical export prior to CHP adaptation	18.5	MWe	
Electrical export with CHP adaptation	17.76	MWe	
Reduction in electrical export	0.74	MWe	
Value of Electricity foregone			
Assumed value of electricity sales	90	£/MWh - wholesale price, no subsidy	
Operating hours	8,000	hrs	
Total generation foregone	5,920	MWh	
Value of generation foregone			532,800 £/yr

Swadlincote Energy Recovery Facility – CBA Calculations

SERF - COST BENEFIT ANALYSIS

Customer: IVC Brunel Process/Space Heating Loads

Capital Cost		
Civil Engineering and Construction Costs	27,500	£
Heat Exchangers	886,500	£
Heat Transmission	479,375	£
Development Costs	161,000	£
	1,554,375	£
Operational Costs		
Routine Maintenance	50,500	£/yr
Electricity Purchased	90,000	£/yr
Office, Rent, Rates, Insurance	21,700	£/yr
Annualised replacement fund	59,100	£/yr
	221,300	£/yr
Foregone Export		
Reduction in electrical export	0.7	MW
Value of generation forgone	532,800	£/yr
Revenue		
Total Heat Supply	17,280	MWh/yr
Value of heat Supply	777,600	£/yr

Project Assessment		
Capital Cost	1,554,375	Including civil, M&E and development costs
Operational Costs	221,300	Including annualised component replacement fund
Net income	23,500	Revenue from heat sales, less generation income forgone and operating costs
Simple payback (first year)	66.14	Years
IRR	3.35%	
NPV @ 17%	(1,089,222)	EA provides discount rate of competing investment at 17%

Key Assumptions	
>	Customer provide fuel to standby boiler when SERF unavailable
>	Standby boiler provided by SRRP
>	Lifetime of asset 30 years, with refurbishment at 15 yrs
>	Energy price inflation 2.5%, other items 3.0%

Period Ended	Factors		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
	Sensitivity	Escalation																																			
Plant capital cost	0.00%	n/a	1,554,375																																-31,089		
Income																																					
Heat Sales to Customer	0.00%	3.00%	0	777,600	800,928	824,956	849,705	875,196	901,452	928,495	956,350	985,040	1,014,592	1,045,029	1,076,380	1,108,672	1,141,932	1,176,190	1,211,475	1,247,820	1,285,254	1,323,812	1,363,526	1,404,432	1,446,565	1,489,962	1,534,661	1,580,701	1,628,122	1,676,965	1,727,274	1,779,093					
Total income			0	777,600	800,928	824,956	849,705	875,196	901,452	928,495	956,350	985,040	1,014,592	1,045,029	1,076,380	1,108,672	1,141,932	1,176,190	1,211,475	1,247,820	1,285,254	1,323,812	1,363,526	1,404,432	1,446,565	1,489,962	1,534,661	1,580,701	1,628,122	1,676,965	1,727,274	1,779,093					
Costs																																					
Operational Costs	0.00%	3.00%	0	221,300	227,939	234,777	241,820	249,075	256,547	264,244	272,171	280,336	288,746	297,409	306,331	315,521	324,987	334,736	344,778	355,122	365,775	376,748	388,051	399,692	411,683	424,034	436,755	449,857	463,353	477,254	491,571	506,318					
Foregone Export	0.00%	2.50%	0	532,800	546,120	559,773	573,767	588,112	602,814	617,885	633,332	649,165	665,394	682,029	699,080	716,557	734,471	752,832	771,653	790,945	810,718	830,986	851,761	873,055	894,881	917,253	940,185	963,689	987,781	1,012,476	1,037,788	1,063,733					
Total costs			0	754,100	774,059	794,550	815,588	837,187	859,362	882,128	905,503	929,501	954,140	979,438	1,005,411	1,032,078	1,059,457	1,087,569	1,116,431	1,146,066	1,176,493	1,207,735	1,239,812	1,272,747	1,306,564	1,341,287	1,376,939	1,413,547	1,451,134	1,489,730	1,529,359	1,570,051					
Gross Income			(1,554,375)	23,500	26,869	30,406	34,117	38,009	42,090	46,367	50,847	55,539	60,451	65,592	70,970	76,594	82,475	88,621	95,044	101,754	108,761	116,077	123,715	131,685	140,001	148,675	157,722	167,154	176,987	187,236	197,915	240,129					