

Supplementary material: Environmental impacts of a solar dish coupled with a micro-gas turbine for power generation

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Table A.1 – Inventory of the built prototype (OMSoP 1).

OMSoP 1			
OMSoP1: Solar dish coupled with a 5 kW MGT.			
POWER OUTPUT: 7.72MWh / year			
Optical efficiency = 35%			
Energy Conversion Efficiency=20% (TIT = 800C°; Compressor Pressur Ratio = 2.5)			
Foundation			
Component	Material	Weight (kg)	Comment
Concrete	Concrete	12800	
Steel bars	Steel	2200	
Steel plates	Steel	414	
Anchor bolts	Reinforced steel	128	
Frame			
Component	Material	Weight (kg)	Comment
Solar dish	Steel	2250	
Centering slats	Steel	841	
Central slats support box	Steel	726	
Support arm	Steel	543	
Supporting pole	Steel	832	
Tracking system	Steel	100	
Power system			
Component	Material	Weight (kg)	Comment
Compressor	Aluminum	2.62	
Turbine	Steel	0.19	Niresist
Rotor	Neodymium	0.25	
Stator	Copper	4.56	
Recuperator	Steel	70	Niresist
Cavity absorber	Aluminum	43.25	includes casing and screws
Receiver box & piping	Steel	270	
Reflective surface			
Component	Material	Weight (kg)	Comment
Reflective surface	Almirr®	342	
Total Weight		21566.87	

Table A.2 - Inventory of the modelled system (OMSoP 2).

OMSoP 2			
OMSoP2: Solar dish coupled with a 10 kW MGT.			
POWER OUTPUT: 18.3 MWh / year			
Optical efficiency = 65%			
Energy Conversion Efficiency=20% (TIT = 800C°; Compressor Pressur Ratio = 2.5)			
Foundation			
Component	Material	Weight (kg)	Comment
Concrete	Concrete	12800	
Steel bars	Steel	2200	
Steel plates	Steel	414	
Anchor bolts	Reinforced steel	128	
Frame			
Component	Material	Weight (kg)	Comment
Solar dish	Steel	2250	
Centering slats	Steel	841	
Central slats support box	Steel	726	
Support arm	Steel	543	
Supporting pole	Steel	832	
Tracking system	Steel	100	
Power system			
Component	Material	Weight (kg)	Comment
Compressor	Aluminum	3.15	
Turbine	Steel	0.23	Niresist
Rotor	Neodymium	0.29	
Stator	Copper	5.47	
Recuperator	Steel	84	Niresist
Cavity absorber	Aluminum	43.25	includes casing and screws
Receiver box & piping	Steel	270	
Reflective surface			
Component	Material	Weight (kg)	Comment
Reflective surface	Almirr®	342	
Total Weight		21582.39	

Table A.3 - Inventory of the modelled system (OMSoP 3).

OMSoP 3			
OMSoP3: Improved solar dish (30% smaller) coupled with a 10 kW MGT.			
POWER OUTPUT: 18.3 MWh / year			
Optical efficiency = 80%			
Energy Conversion Efficiency=24% (TIT = 800C°; Compressor Pressur Ratio = 3)			
Foundation			
Component	Material	Weight (kg)	Comment
Concrete	Concrete	8960	
Steel bars	Steel	1540	
Steel plates	Steel	289.80	
Anchor bolts	Reinforced steel	89.60	
Frame			
Component	Material	Weight (kg)	Comment
Solar dish	Steel	1575	
Centering slats	Steel	588.70	
Central slats support box	Steel	508.20	
Support arm	Steel	434.40	
Supporting pole	Steel	582.40	
Tracking system	Steel	80	
Power system			
Component	Material	Weight (kg)	Comment
Compressor	Aluminum	3.15	
Turbine	Steel	0.23	Niresist
Rotor	Neodymium	0.29	
Stator	Copper	5.47	
Recuperator	Steel	84	Niresist
Cavity absorber	Aluminum	43.25	includes casing and screws
Receiver box & piping	Steel	270	
Reflective surface			
Component	Material	Weight (kg)	Comment
Reflective surface	Almirr®	239.40	
Total Weight		15293.89	

Table A.4 - Inventory of the modelled system (OMSoP 4)

OMSOP 4			
OMSoP4: Improved solar dish (30% smaller), improved design, coupled with a 10 kW MGT.			
POWER OUTPUT: 18.3 MWh / year			
Optical efficiency = 85%			
Energy Conversion Efficiency=30% (TIT = 900C°; Compressor Pressur Ratio = 3)			
Foundation			
Component	Material	Weight (kg)	Comment
Concrete	Concrete	6400	
Steel bars	Steel	1100	
Steel plates	Steel	207	
Anchor bolts	Reinforced steel	64	
Frame			
Component	Material	Weight (kg)	Comment
Solar dish	Steel	1575	
Centering slats	Steel	588.70	
Central slats support box	Steel	363	
Support arm	Steel	434.40	
Supporting pole	Steel	416	
Tracking system	Steel	80	
Power system			
Component	Material	Weight (kg)	Comment
Compressor	Aluminum	3.15	
Turbine	Steel	0.23	Niresist
Rotor	Neodymium	0.29	
Stator	Copper	5.47	
Recuperator	Steel	84	Niresist
Cavity absorber	Aluminum	43.25	includes casing and screws
Receiver box & piping	Steel	270	
Reflective surface			
Component	Material	Weight (kg)	Comment
Reflective surface	Almirr®	239.40	
Total Weight		11873.89	

Table A.5 - Inventory of the modelled system (OMSoP 5)

OMSoP 5			
OMSoP5: Improved solar dish (30% smaller), improved design, aluminum instead of steel for the dish, coupled with a 10 kW MGT.			
POWER OUTPUT: 18.3 MWh / year			
Optical efficiency = 85%			
Energy Conversion Efficiency=30% (TIT = 900C°; Compressor Pressur Ratio = 3)			
Foundation			
Component	Material	Weight (kg)	Comment
Concrete	Concrete	6400	
Steel bars	Steel	1100	
Steel plates	Steel	207	
Anchor bolts	Reinforced steel	64	
Frame			
Component	Material	Weight (kg)	Comment
Solar dish	Aluminum	409.50	
Centering slats	Steel	588.70	
Central slats support box	Steel	363	
Support arm	Steel	434.40	
Supporting pole	Steel	416	
Tracking system	Steel	80	
Power system			
Component	Material	Weight (kg)	Comment
Compressor	Aluminum	3.15	
Turbine	Steel	0.23	Niresist
Rotor	Neodymium	0.29	
Stator	Copper	5.47	
Recuperator	Steel	84	Niresist
Cavity absorber	Aluminum	43.25	includes casing and screws
Receiver box & piping	Steel	270	
Reflective surface			
Component	Material	Weight (kg)	Comment
Reflective surface	Almirr®	239.40	
Total Weight		10708.39	