Chapel Solar PV assessment

King’s College

06.10.2022

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Panel options

Panel	Width (m)	Height (m)	Area (m2)	Cell technology	Colour	Output (Wp)	Output density (Wp/m2)
REC Alpha Pure 400	1.016	1.821	1.850136	Heterojunction	black	400	216
REC Alpha Pure 410	1.016	1.821	1.850136	Heterojunction	black	410	222
REC Alpha Pure-R 430	1.118	1.73	1.93414	Heterojunction	black	430	223
REC Alpha 72 Series 450	1.026	2.063	2.116638	Heterojunction	black with white frame	450	213
Polysolar - PS-CT - 10% transparency	0.6	1.2	0.72	Polyvinyl butyrate (PVB)	transparent	72	100
Polysolar - PS-CT - 50% transparency	0.6	1.2	0.72	Polyvinyl butyrate (PVB)	transparent	40	56
Bisol Spectrum - deep red	1.05	1.77	1.8585	120 Half-Cut mono PERC c-Si	deep red	320	172
Kromatix - brass	0.992	1.64	1.62688	monocrystalline Si	brass	255	157
Kromatix - bronze	0.992	1.64	1.62688	monocrystalline Si	bronze	255	157
Colored Solar - Earth Brown	0.99	1.652	1.63548	Polycrystalline silicon	earth brown	260	159
Sunpower P3 COM - SPR P3 410 COM 15	0.998	2.066	2.061868	Monocrystalline PERC	black	410	199

- REC Alpha Pure 410
  Selected on the basis of
  - High output density
  - Coordination with roof
  - All-black appearance
  - Commercial availability

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PV shading and generation

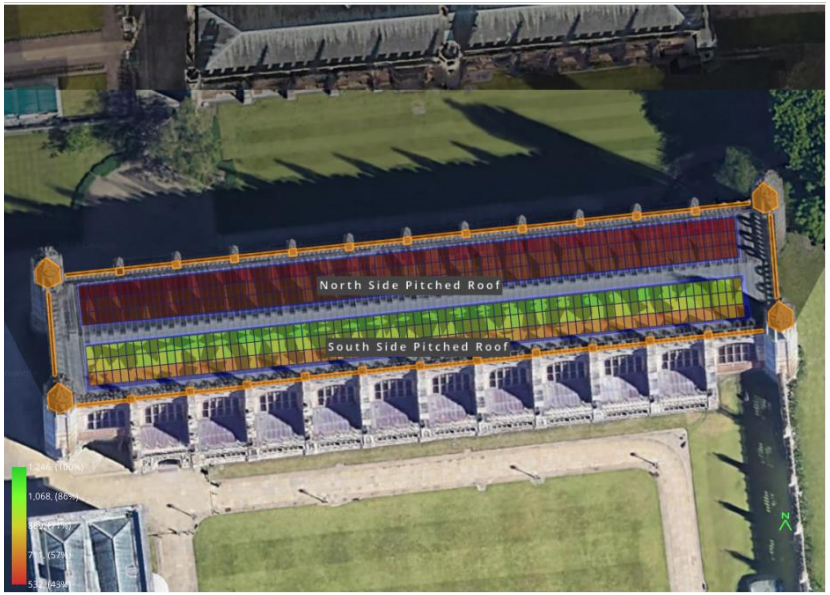
Shading by Field Segment

Description	Tilt	Azimuth	Modules	Nameplate	Shaded Irradiance	AC Energy	TOF[2]	Solar Access	Avg TSRF [2]
South Side Pitched Roof	24.0°	174.0°	246	99.6 kWp	913.5kWh/m²	74.3 MWh[1]	99.6%	73.6%	73.3%
North Side Pitched Roof	24.0°	354.0°	246	99.6 kWp	635.4kWh/m²	52.2 MWh[1]	60.0%	84.9%	51.0%
Totals, weighted by kWp			**492**	**199.3 kWp**	**774.4kWh/m²**	**126.4 MWh**	**79.8%**	**77.9%**	**62.2%**

[1] approximate, varies based on inverter performance
[2] based on location Optimal POA Irradiance of 1,245.9kWh/m² at 40.4° tilt and 182.6° azimuth

Solar Access by Month

Description	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
South Side Pitched Roof	62%	69%	68%	72%	80%	82%	81%	77%	67%	66%	63%	62%
North Side Pitched Roof	83%	83%	85%	86%	86%	84%	84%	86%	86%	83%	84%	84%
Solar Access, weighted by kWp	65.5%	73.1%	73.2%	77.2%	82.2%	82.9%	82.2%	80.7%	73.3%	70.3%	67.3%	65.7%
AC Power (kWh)	2,856.5	4,005.8	8,586.1	15,067.1	18,643.0	20,721.0	19,402.6	14,338.9	10,512.2	6,267.6	3,539.1	2,508.5



- Shading and output calculated for REC Alpha Pure 405 (available on HelioScope database), corrected for REC Alpha Pure 410

Roof Slope	Rated panel output REC 405	Annual output REC 405	Rated panel output REC 410	Annual output REC 410
	W	kWh/y	W	kWh/y
South	405	74,300	410	75217.3
North	405	52,200	410	52844.4

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Embodied carbon and carbon payback

- Embodied carbon of PV array (from 17094 (willmottdixon.co.uk))
  - 710kg CO2/kWp
- Carbon payback periods
  - South slope – 4.5 years
  - North slope – 6.4 years

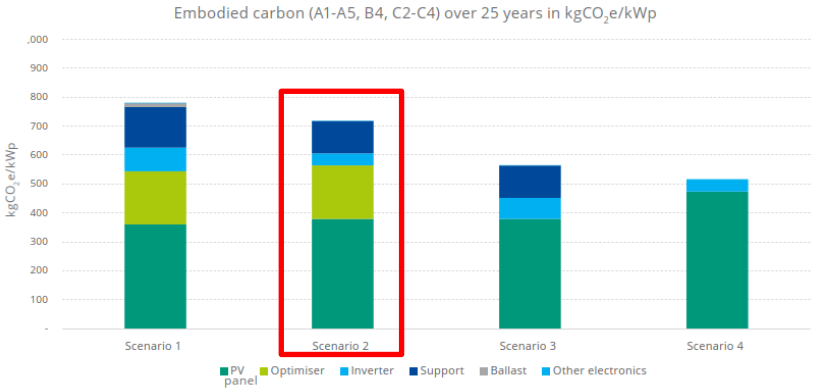

Figure 4 - Embodied carbon over 25 Years
Scenario 1: Project A, Flat roof, PV monocrystalline, Optimisers
Scenario 2: Project B, Pitched roof, PV monocrystalline, Optimisers
Scenario 3: Project B, Pitched roof, PV monocrystalline, No optimisers
Scenario 4: Project B, Pitched roof, PV thin-film, No optimisers

Roof Slope	Rated panel output REC 410	Annual output REC 410	Number of panels	Panel area	Array area	Array maximum rated output	Annual CO2 reduction	Embodied carbon	Embodied carbon	Carbon payback
	W	kWh/y		m2	m2	kWp	kg CO2/y	kg CO2/kWp	kg CO2	y
South	410	75217.3	246	1.82	448	101	15969	710	71611	4.5
North	410	52844.4	246	1.82	448	101	11219	710	71611	6.4

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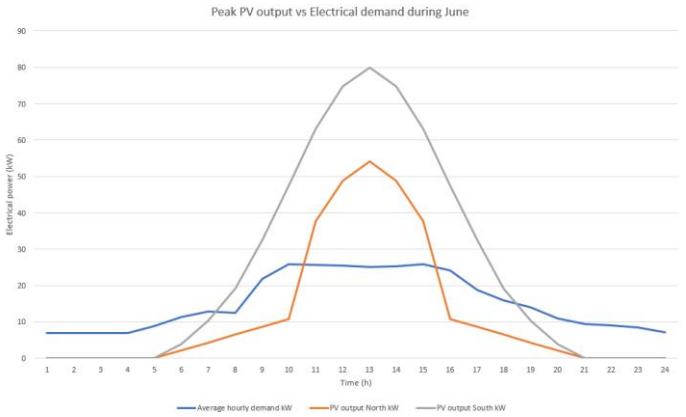
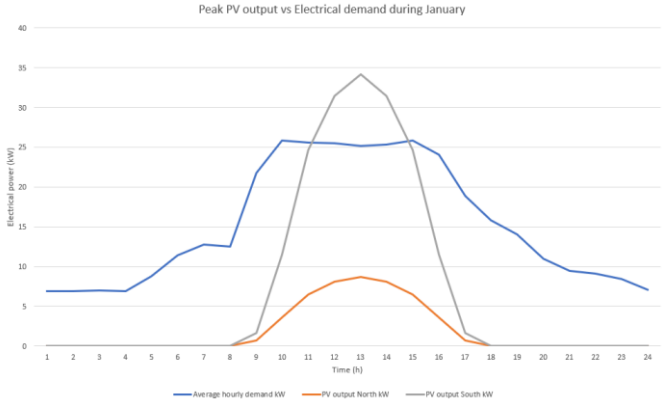
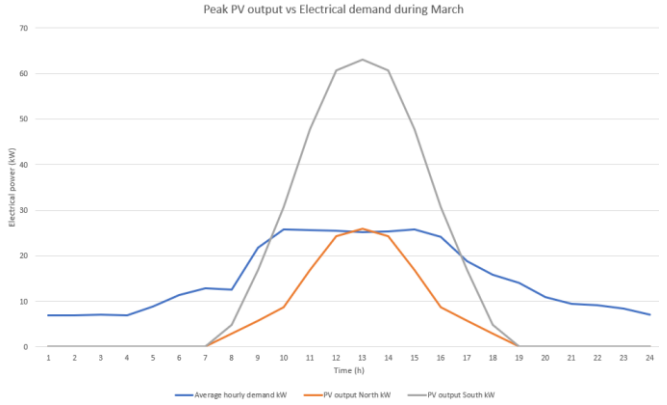
Use of PV generated electricity

- Maximum peak output exceeds chapel demand
- Chapel demand is approximately 15% of main College demand
- The electrical supply to the chapel will be re-configured to ensure all generated energy is used within the main College site







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