TSP THE SOLAR PROJECT

Energise Your Winery: Solar Power Procurement strategies for Australian Wineries toward 2020

David Buetefuer, Director of Sales and Business Development

WEA Conference 2016 | *The Solar Project* | 08 Sep 2016

Central Question: How Can I implement successful solar energy projects?

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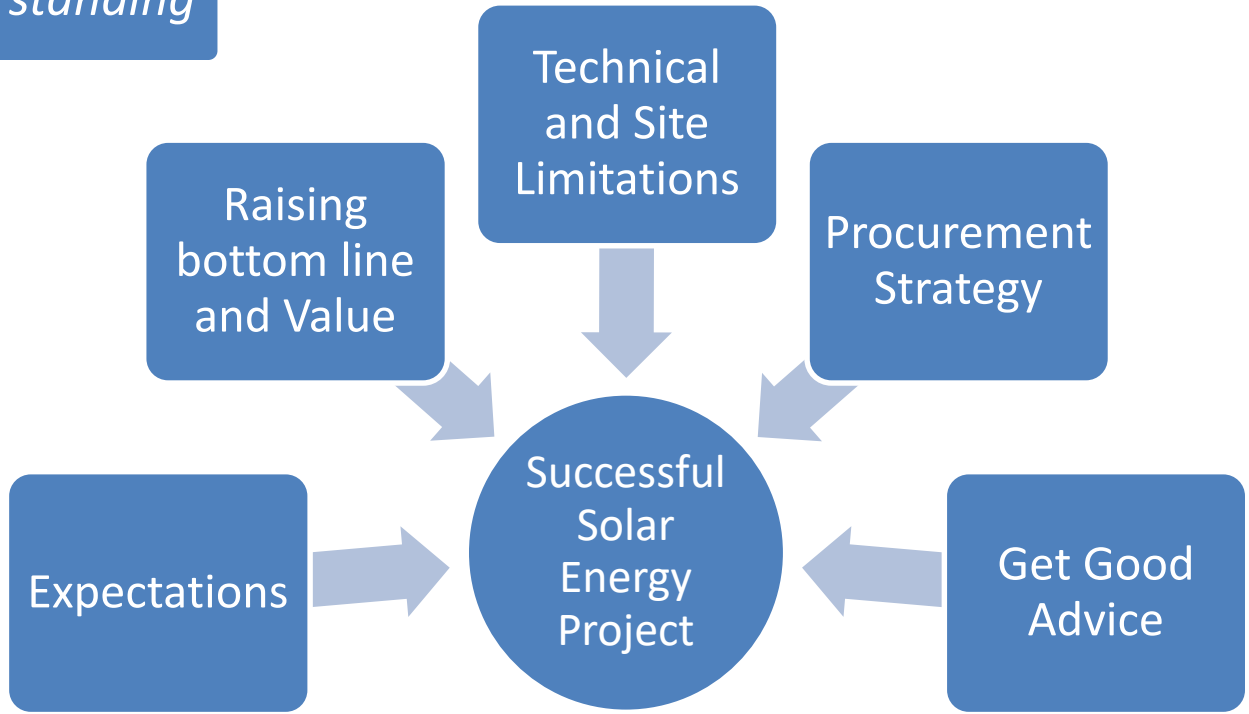
Understanding



POWERING AUSTRALIAN *WINE* INDUSTRY

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Company Expectations

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Company Expectations

- One Stakeholder or many?
- Different views of corporate priorities
- Varying opinions
- Resistance to financed/long term contract solutions
- Most businesses are unclear how solar power fits their strategy
- Compliance

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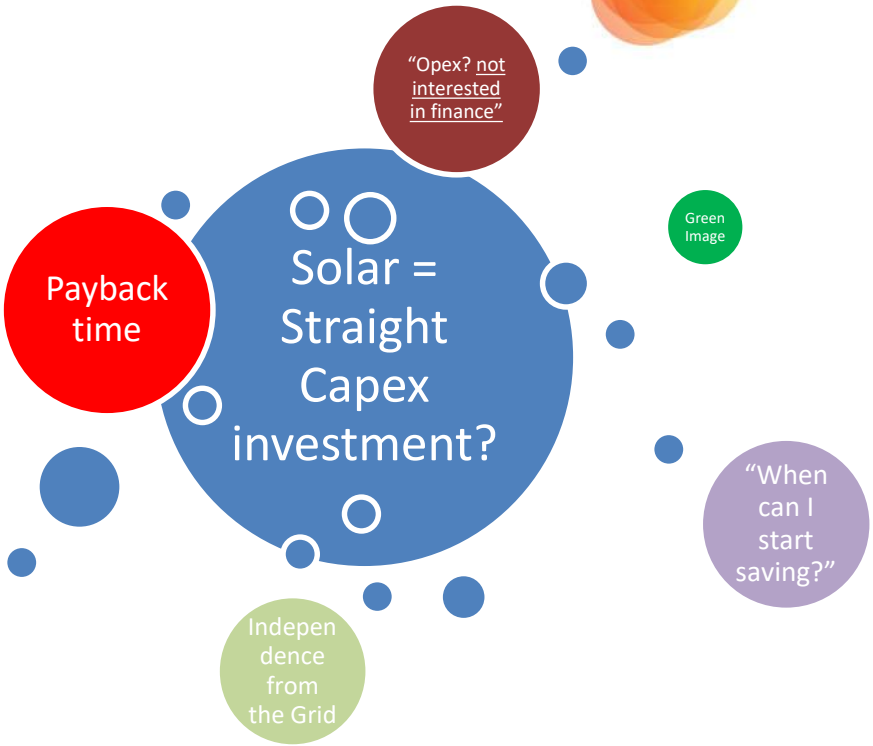
Company Expectations



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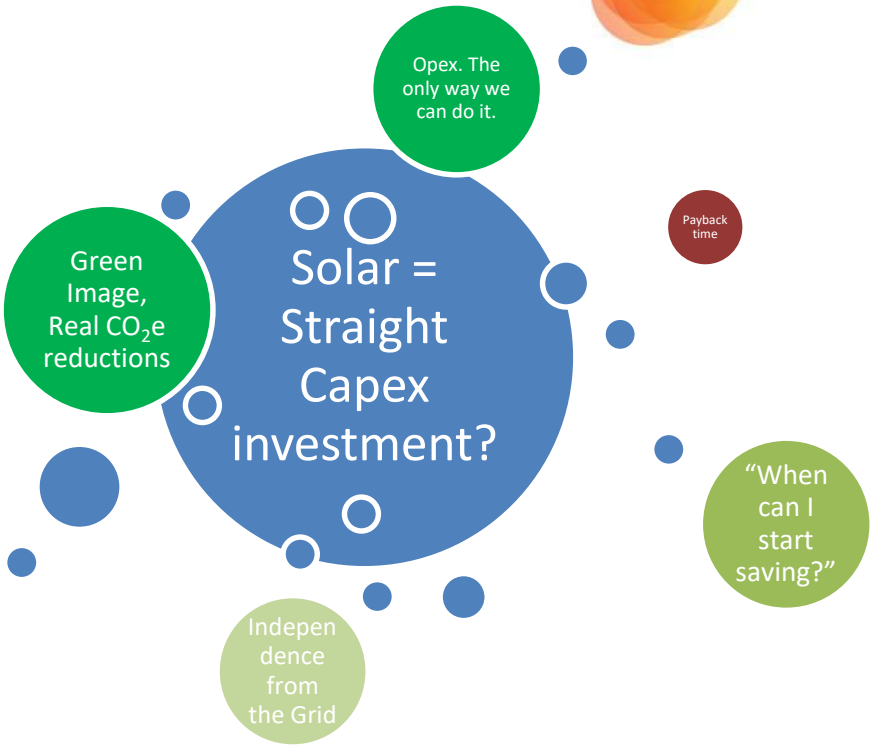
Company Expectations



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Raising bottom line and Value

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Raising bottom line and Value

- Operating costs continually under pressure
- Energy costs increasingly volatile and with upward pressure in all states (SA particularly)
- Solar is for many wineries a valid mitigation to energy cost volatility
- Lowering Opex builds value

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Raising bottom line and Value

What's the cost of electricity

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Raising bottom line and Value

What's the cost of electricity

Misunderstanding the full electricity costs

"Why would I get solar power? I only pay 7 cents per kWh"

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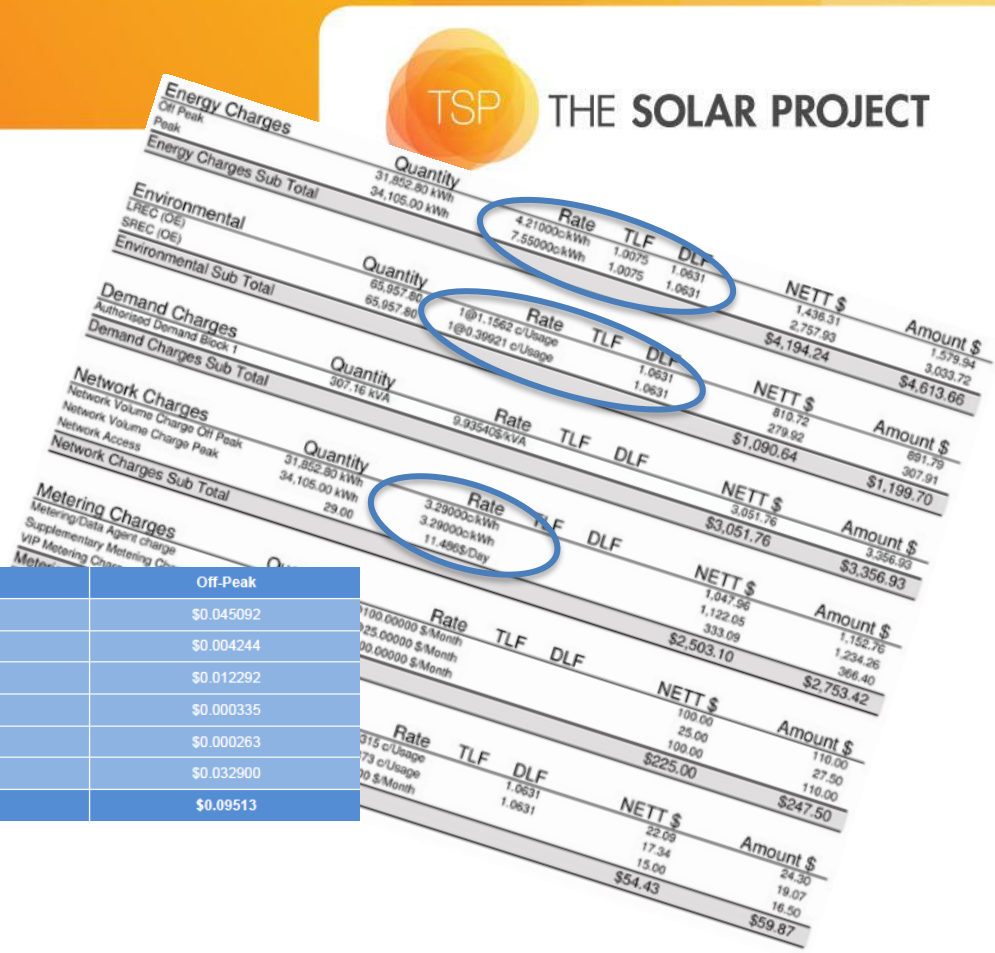
Raising bottom line and Value

What's the cost of electricity

Electricity Cost Item per kWh	Peak	Off-Peak
Energy Cost	$0.080866	$0.045092
SRES	$0.004244	$0.004244
LRET	$0.012292	$0.012292
AEMO Pool Fees	$0.000335	$0.000335
AEMO Ancillary	$0.000263	$0.000263
Network Charges	$0.032900	$0.032900
Total	**$0.13090**	**$0.09513**



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Raising bottom line and Value

What's the cost of electricity

Energy Charges	Quantity	Rate	TLF	DLF	NETT $	Amount $
Off Peak	31,852.80 kWh	4.21000c/kWh	1.0075	1.0631	1,436.31	1,579.94
Peak	34,105.00 kWh	7.55000c/kWh	1.0075	1.0631	2,757.93	3,033.72
Energy Charges Sub Total					$4,194.24	$4,613.66

Environmental	Quantity	Rate	TLF	DLF	NETT $	Amount $
LREC (OE)	65,957.80	1@1.1562 c/Usage		1.0631	810.72	891.79
SREC (OE)	65,957.80	1@0.39921 c/Usage		1.0631	279.92	307.91
Environmental Sub Total					$1,090.64	$1,199.70

Demand Charges	Quantity	Rate	TLF	DLF	NETT $	Amount $
Authorised Demand Block 1	307.16 kVA	9.93540$/kVA			3,051.76	3,356.93
Demand Charges Sub Total					$3,051.76	$3,356.93

Network Charges	Quantity	Rate	TLF	DLF	NETT $	Amount $
Network Volume Charge Off Peak	31,852.80 kWh	3.29000c/kWh			1,047.96	1,152.76
Network Volume Charge Peak	34,105.00 kWh	3.29000c/kWh			1,122.05	1,234.26
Network Access	29.00	11.486$/Day			333.09	366.40
Network Charges Sub Total					$2,503.10	$2,753.42

Metering Charges	Quantity	Rate	TLF	DLF	NETT $	Amount $
Metering/Data Agent charge	1.00	1@100.00000 $/Month			100.00	110.00
Supplementary Metering Charge	1.00	1@25.00000 $/Month			25.00	27.50
VIP Metering Charge	1.00	1@100.00000 $/Month			100.00	110.00
Metering Charges Sub Total					$225.00	$247.50

Service Charges	Quantity	Rate	TLF	DLF	NETT $	Amount $
AEMO Charge (OE)	65,957.80	1@0.0315 c/Usage		1.0631	22.09	24.30
Ancillary Services Charge (OE)	65,957.80	1@0.02473 c/Usage		1.0631	17.34	19.07
Service Charge	1.00	1@15.00000 $/Month			15.00	16.50
Service Charges Sub Total					$54.43	$59.87

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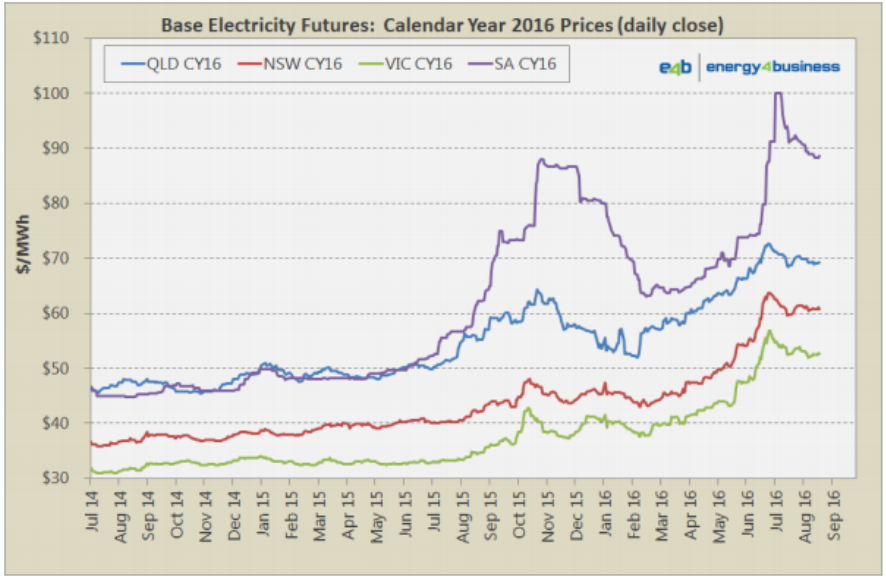
Raising bottom line and Value

What's the cost of electricity

Wholesale Market Forward Prices

NEM Electricity Forward Prices for Calendar Year 2016



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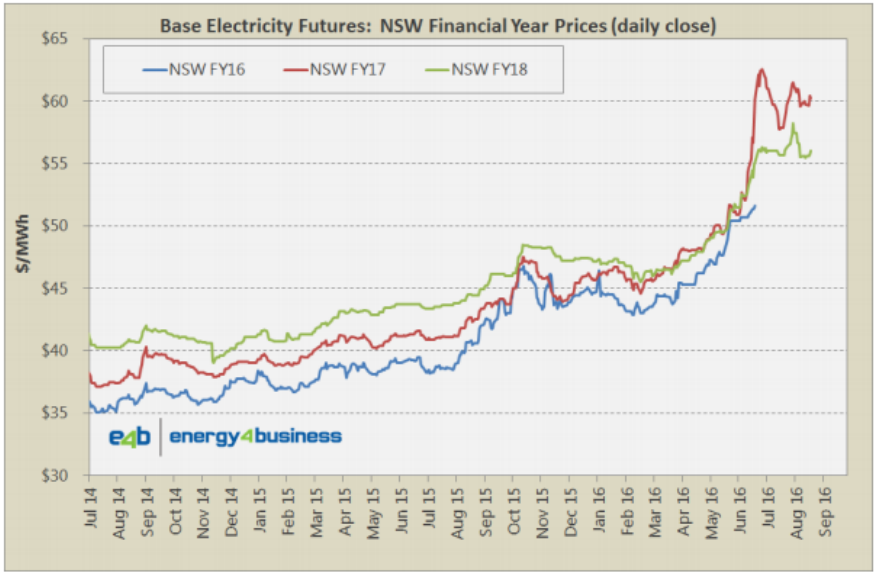
Raising bottom line and Value

What's the cost of electricity

Wholesale Market Forward Prices

NSW Electricity Forward Prices by Financial Year



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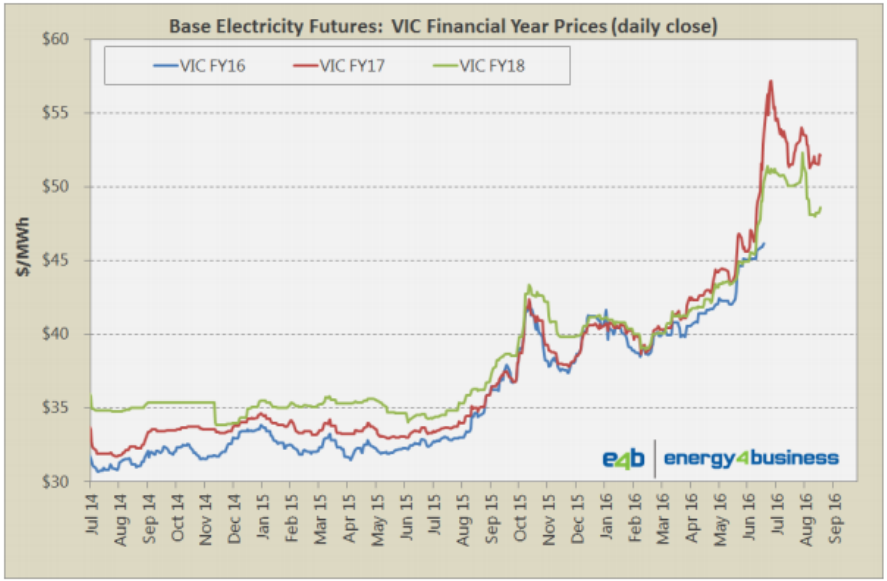
Raising bottom line and Value

What's the cost of electricity

Wholesale Market Forward Prices

VIC Electricity Forward Prices by Financial Year



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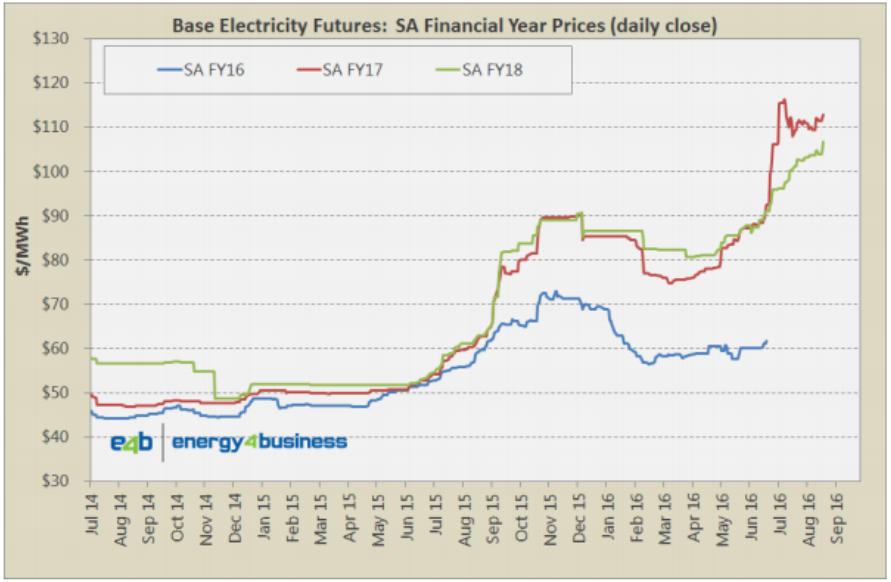
Raising bottom line and Value

What's the cost of electricity

Wholesale Market Forward Prices

SA Electricity Forward Prices by Financial Year



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Raising bottom line and Value

Understand the savings

Misunderstanding the savings

“So, back of hand… it should pay for itself in 3 years!... Right?”

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Raising bottom line and Value

Understand the savings

System Details		Expenses		Estimated Project Returns	Pre Tax	After Tax
System Size (KW)	300.0	Monitoring & Maintenance	$12	Payback Period	4 years 11 months	5 years 12 months
System Cost net of STCs	$585,998	Insurance	0.25%	Internal Rate of Return	20.69%	16.26%
Project Cost $/KWdc	1,953	Licensing	$500	Net Present Value	$893,132	$555,079
Total Yield/Output per annum (KWh)	517,800	Roof Lease	$0	Cash Drawdown	$585,998	$585,998
Panel Degradation (p.a.)	0.30%			Levelised Cost of Electricity ($/kWh)	$0.063	
		Assumptions				
Energy Offset		STC Value	$38	Annual Electricity Consumption (kWh)	1,422,162	
Peak Energy Price (offset) per KWh	$0.196	LGC Value	$85	Solar Production (kWh) (and % of consumption)	517,800	36%
% of peak energy offset	58%	Capacity Factor	17%			
Off-Peak Energy Price (offset) per KWh	$0.135	State Emissions Factor (t/MWh)	0.65	Current Electricity Bill	$303,070	
% of off-peak energy offset	23%	Carbon Reductions (tCO2e)	8118	Annual Savings (and % reduction)	$123,654	41%
Estimated Export Price per kWh	$0.050	Tax Rate	30%	Predicted Electricity Bill	$179,416	
% of energy exported	19%	Electricity Cost Increase	4.0%			
Total average estimated revenue per KWh	$0.154	CPI Inflation	3.0%			

Plant Operations											
Operating Statement	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Project Year	0	1	2	3	4	5	6	7	8	9	10
Yield		517,800	516,247	514,698	513,154	511,614	510,079	508,549	507,024	505,503	503,986
Revenue											
Peak Energy Saving Revenue		58,733	60,899	63,145	65,474	67,888	70,392	72,988	75,680	78,471	81,365
Off-Peak Energy Saving Revenue		16,179	16,776	17,395	18,036	18,701	19,391	20,106	20,848	21,617	22,414
Energy Exported Revenue		4,919	5,101	5,289	5,484	5,686	5,896	6,113	6,338	6,572	6,815
LGC Income		44,013	41,687	39,484	37,397	35,421	33,549	31,776	30,096	28,506	26,999
Peak Demand Savings (Solar)		11,066	11,508	11,969	12,447	12,945	13,463	14,002	14,562	15,144	15,750
Adjustment for change in tariff		-11,843	-12,317	-12,810	-13,322	-13,855	-14,409	-14,985	-15,585	-16,208	-16,857
Total Revenue		**123,067**	**123,654**	**124,471**	**125,516**	**126,787**	**128,281**	**129,999**	**131,939**	**134,101**	**136,486**
Expenses											
Monitoring & Maintenance			3,600	3,708	3,819	3,934	4,052	4,173	4,299	4,428	4,560
Expected Increase in Insurance Premium		1,465	1,509	1,554	1,601	1,649	1,698	1,749	1,802	1,856	1,911
Licencing		500	515	530	546	563	580	597	615	633	652
Land Lease		0	0	0	0	0	0	0	0	0	0
Depreciation		58,600	52,740	47,466	42,719	38,447	34,603	31,142	28,028	25,225	22,703
Total Expenses		**60,565**	**58,364**	**53,259**	**48,686**	**44,593**	**40,932**	**37,662**	**34,743**	**32,142**	**29,827**
Profit & Loss											
Operating P&L		62,502	65,290	71,212	76,830	82,194	87,349	92,337	97,196	101,959	106,659

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System Details	
System Size (KW)	300.0
System Cost net of STCs	$585,998
Project Cost $/KWdc	1,953
Total Yield/Output per annum (KWh)	517,800
Panel Degradation (p.a.)	0.30%

Energy Offset	
Peak Energy Price (offset) per KWh	$0.196
% of peak energy offset	58%
Off-Peak Energy Price (offset) per KWh	$0.135
% of off-peak energy offset	23%
Estimated Export Price per kWh	$0.050
% of energy exported	19%
Total average estimated revenue per KWh	$0.154

Expenses	
Monitoring & Maintenance	$12
Insurance	0.25%
Licensing	$500
Roof Lease	$0

Assumptions	
STC Value	$38
LGC Value	$85
Capacity Factor	17%
State Emissions Factor (t/MWh)	0.65
Carbon Reductions (tCO2e)	8118
Tax Rate	30%
Electricity Cost Increase	4.0%
CPI Inflation	3.0%

Estimate
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Current E
Annual Sa
Predicted

Plant Operations

Operating Statement	2016	2017	2018	2019	2020	2021	
Project Year	0	1	2	3	4	5	
Yield		517,800	516,247	514,698	513,154	511,614	51
Revenue							
Peak Energy Saving Revenue		58,733	60,899	63,145	65,474	67,888	7
Off-Peak Energy Saving Revenue		16,179	16,776	17,395	18,036	18,701	1
Energy Exported Revenue		4,919	5,101	5,289	5,484	5,686	
LGC Income		44,013	41,687	39,484	37,397	35,421	3
Peak Demand Savings (Solar)		11,066	11,508	11,969	12,447	12,945	1
Adjustment for change in tariff		-11,843	-12,317	-12,810	-13,322	-13,855	-1
Total Revenue		**123,067**	**123,654**	**124,471**	**125,516**	**126,787**	**12**

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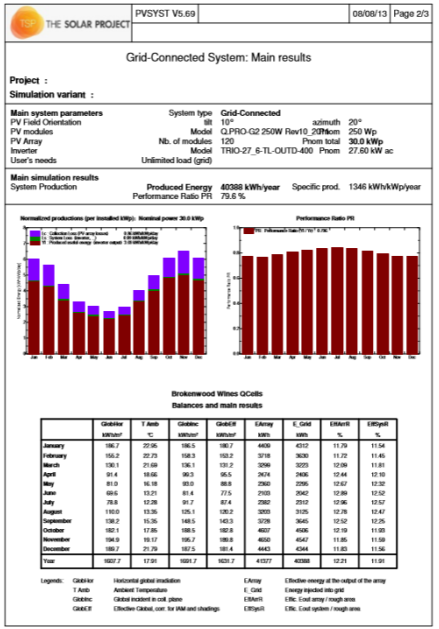
Raising bottom line and Value

Understand the savings

- Is the energy yield expectation accurate for your location?
- Is there site specific energy modelling to support the assumptions?
- Don't forget to discount for weekend off-peak
- What is the project design life – lower price/quality, shorter life expectancy?
- Have you allowed for network tariff change cost adjustments?



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Grid-Connected System: Main results

Project :

Simulation variant :

Main system parameters	System type	**Grid-Connected**		
PV Field Orientation	tilt	10°	azimuth	20°
PV modules	Model	Q.PRO-G2 250W Rev10_2011	Pnom	250 Wp
PV Array	Nb. of modules	120	Pnom total	30.0 kWp
Inverter	Model	TRIO-27_6-TL-OUTD-400	Pnom	27.60 kW ac
User's needs	Unlimited load (grid)			

Main simulation results

System Production — **Produced Energy** 40388 kWh/year — Specific prod. 1346 kWh/kWp/year

Performance Ratio PR 79.6 %

Normalized productions (per installed kWp): Nominal power 30.0 kWp

Performance Ratio PR

Brokenwood Wines QCells

Balances and main results

	GlobHor kWh/m²	T Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	EffArrR %	EffSysR %
January	186.7	22.95	186.5	180.7	4409	4312	11.79	11.54
February	155.2	22.73	158.3	153.2	3718	3630	11.72	11.45
March	136.1	21.69	136.1	131.2	3299	3223	12.09	11.81
April	91.4	18.66	96.3	95.5	2474	2406	12.44	12.10
May	81.0	16.18	93.0	88.8	2360	2295	12.67	12.32
June	69.6	13.21	81.4	77.5	2103	2042	12.89	12.52
July	78.8	12.28	91.7	87.4	2382	2312	12.96	12.57
August	110.0	13.35	125.1	120.2	3203	3125	12.78	12.47
September	138.2	15.35	148.5	143.3	3729	3645	12.52	12.25
October	182.1	17.85	188.5	182.8	4697	4595	12.19	11.95
November	194.9	19.17	195.7	189.8	4650	4547	11.85	11.59
December	188.7	21.79	187.5	181.4	4443	4344	11.83	11.56
Year	1657.7	17.91	1691.7	1620.7	41577	40388	12.21	11.91

Legends: GlobHor Horizontal global irradiation; T Amb Ambient Temperature; GlobInc Global incident in coll. plane; GlobEff Effective Global, corr. for IAM and shadings; EArray Effective energy at the output of the array; E_Grid Energy injected into grid; EffArrR Effic. Eout array / rough area; EffSysR Effic. Eout system / rough area

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Technical and Site Limitations

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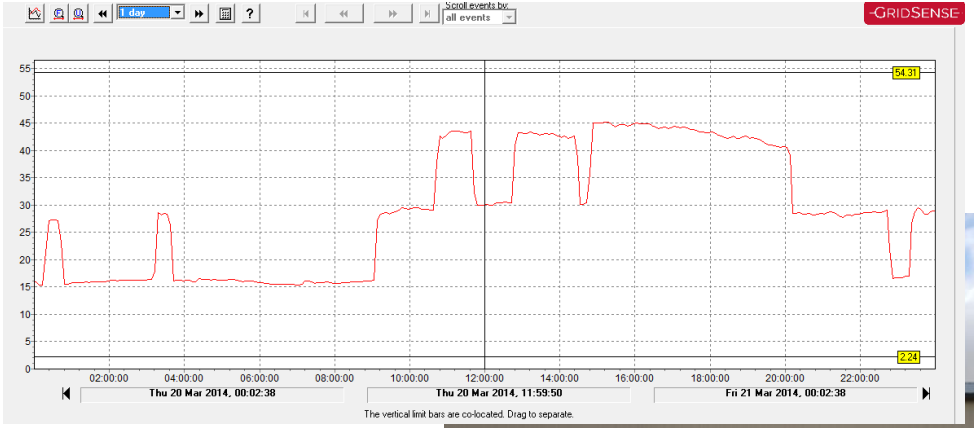
Technical and Site Limitations

Electrical Load and Connections



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Technical and Site Limitations

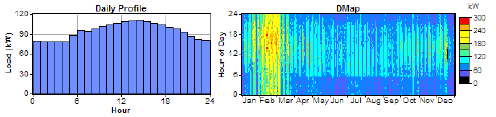
Electrical Load and Connections

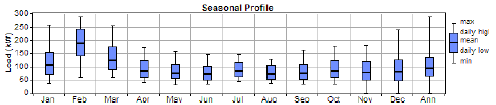
- One network connection or many
- Connection Capacity – network and internal distribution
- Model the load, half hour interval data
- Model the solar behaviour against site load
- Optimal ROI or maximum generation for capacity?

Electrical Load Analysis

Peak Consumption	Off Peak Consumption	Total Annual Consumption	Average kW	Peak Demand	Average Power Factor
415,084 kWh	412,398 kWh	827 MWh	94	287 / 323.38	0.95

The load could be described as a fairly consistent perennial 24-hour load with marginally higher load during the day on weekdays and a seasonal peak during February.

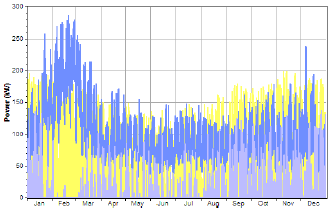


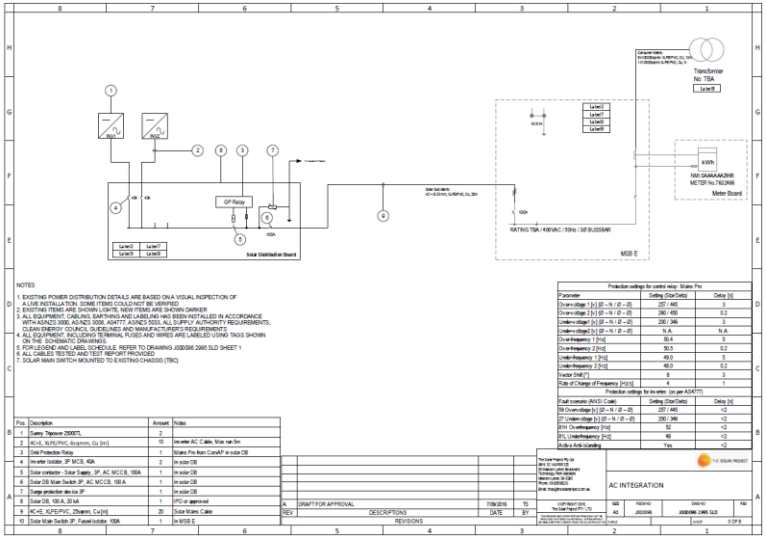


Solar PV Analysis

Proposed System Size	Annual Solar Production	% of NMI Consumption	Grid Export	New Peak Demand (kW)	Peak Demand Reduction
200 / 180	283MWh	34%	16%	276	12kVA
250 / 200			23%	276	

The chart below plots the solar output of a **200kW** solar PV system (yellow) against the connection load (blue) and shows the expected grid export (light blue).





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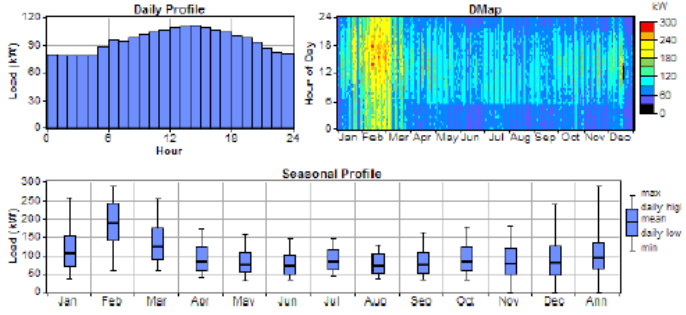

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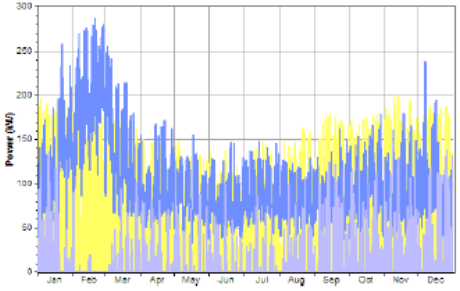

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Technical and Site Limitations

Physical and Civil/Structural conditions

- Location of electrical load centres and connection relative to the solar array
- Roof space and structural suitability?
- Near shadings/plant and equipment
- Safe future access/equipment
- Land space/availability?

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Technical and Site Limitations

Physical and Civil/Structural conditions

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Technical and Site Limitations

Regulatory

- Distribution Network Operator rules/ threshholds
  - Ie. 30kW, 200kW, 1MW, 5MW
- Clean Energy Regulator REC thresholds – 100kW/STC; >100kW LGC
- Embedded (back of meter) generator or not? Registration fees
- Compelled network tariff change?

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Procurement Strategy

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Procurement Strategy

What you want:

- Feasibility Study
- Pilot Project
- Specification

How to pay:

- Capex Project
- Opex Project, ie. Solar Equipment Rental
- Opex Project, ie Solar Power Purchase Agreement (Solar PPA)

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Procurement Strategy

Capex Project

Contract form and Specification

- Just get quotes/vendor provided contract with/without amendments
- Get professional advice, specification, take to market with your preferred contract form, ie. AS 4902-2000 General conditions of contract for design and construct
- Include maintenance contract
- Does it capture the full scope?

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Procurement Strategy

Opex Project – Solar Equipment Rental

Contract form

- Often similar to Capex contract, but with third party owner (ie. Bank) and rental agreement
- Allows straight expensing of costs (ie. No capital depreciation, more tax effective).
- Cheaper than a solar PPA, O&M your responsibility
- Off-balance sheet, terms typical 5-7 years
- Careful about end of term costs/clauses in your favour – generally quicker ownership than solar PPA
- Does it capture the full scope?

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Procurement Strategy

Opex Project – Solar PPA

Contract form

- Third party owner-operator
- Agreed rates per kWh subject to CPI or other increases
- Generally 10-20 years (longer the term, lower the price per kWh)
- Take-or pay
- Low risk, low return
- Options for buyin
- Incentivises lower cost tech specification due to end of life responsibility with you

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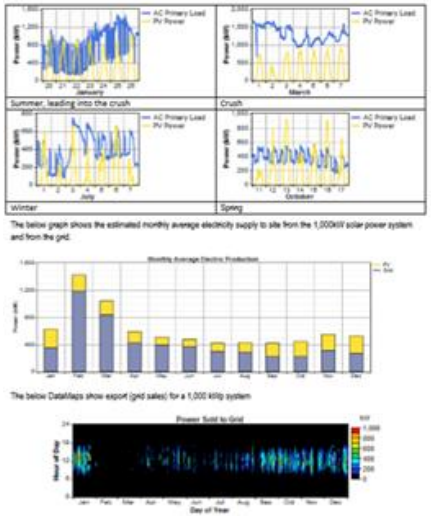
Get Good Advice

- If its unpaid vendor advice, don't expect it to be accurate/ apply a discount to ROI/ Contingency budget. Ask for evidence to support claims
- Problem: consulting engineers and energy consultants tend not to provide the best advice either
- Engage subject matter/technical expert consultants with practitioner level experience



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Get Good Advice

- Stage-gate costs, feasibility:
  - Stage 1: financial feasibility/modelling – shut down or further investigations
  - Stage 2: structural & electrical engineering, regulatory
  - Specification: take to market with set quality baselines/technical requirements for apples for apples pricing that won't lead to variations

TSP THE SOLAR PROJECT

About The Solar Project:

- **Wine Industry Suppliers Association award-winner**
- **Adelaide-based national contractor and consulting services business**
- **Major supplier to the SA Wine Industry**
- **Wine Industry Clients include** Pernod Ricard, De Bortoli Wines, Angove's, Yangarra Estate, D'Arenberg, Torresan Estate, Wine Works Australia, Barossa Vintners, Lloyd Brothers, Primo Estate and many others… ***projects ranging from 30kW – 1.3MW***
- Owners David Buetefuer and Theo Strecker 35 years combined solar industry experience and **joint authors of *Energise Your Business***: Solar Power Procurement Strategies For Australian Corporates Toward 2020, publishing early 2017

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