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Utility-scale PV challenges in the Australian market

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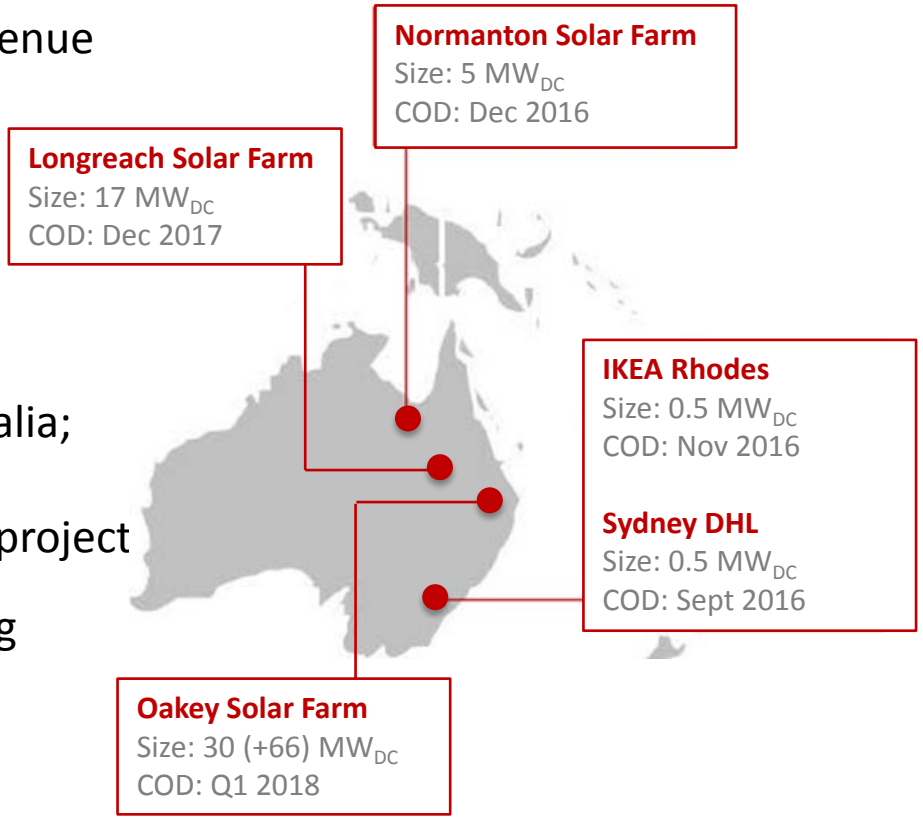
About Us

- 2nd largest solar company globally by revenue and profits in 2015.
- Highest bankability approval rating of all solar companies in 2015.
- 5.7 GW manufacturing capacity in 2016.
- Global project pipeline >13 GW. In Australia; 4.8 MW O&M care (DG), 5 MW in construction and 110 MW late-stage PV project
- 8,900 employees globally; with a growing team in Australia (currently 16 staff).

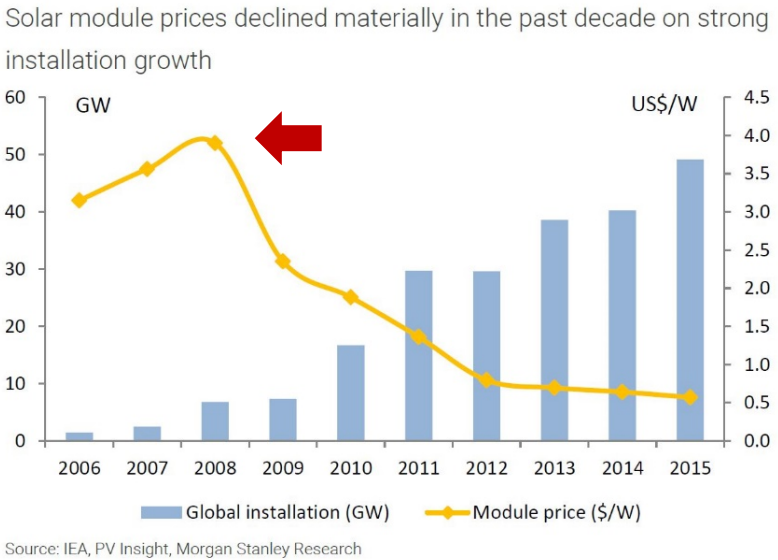


Global Trends – System Capital Expenditure Decrease

Key fact 1: In period of high demand, module costs continued to decrease.

Key fact 2: Due to the continuous increase of demand, in early 2016 several manufacturers announced expansion of manufacturing capacity, but several key markets are slowing down (China and US).

Result: 2017 will see an oversupplied market with module average selling price is under pressure.



Global Trends – System Capital Expenditure decrease

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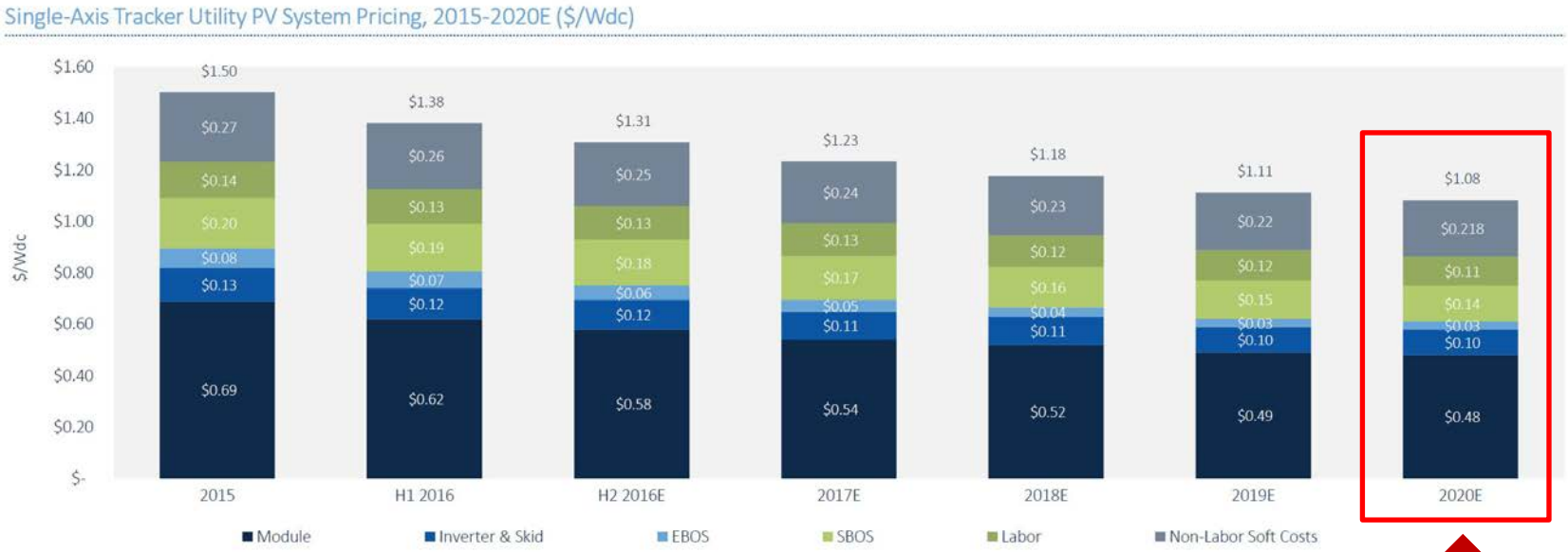

Source: GTM reports

Modules and BOS constitute for 60%-70% of project capex

Excluding import duties (not applicable here) and considering 2017 module ASP, projects with NTP in Q1-17 are reaching the 1,00-1,05 US/Wp target

Utility scale Solar PV in Australia: to date

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Despite Australia's excellent solar resource and fast-growing rooftop solar market (**5.0GW** installed capacity as at Aug 2016), there are, to date a limited number of utility scale solar projects in operation, with LCOE estimates around A$180-200/MWh. The majority of utility scale solar farms built or under construction have benefitted from substantial subsidies, these are:

Nyngan 102MW, Moree 56MW, Broken Hill 53MW and Greenough River 10MW

In 2016 only a few ground mounted solar farms are under construction:

- Normanton SF 5MW, Barcaldine SF 20MW, Valdora SF 15MW and Mugga Lane 13MW

- Total aggregate capacity: **276MW – 5.5%**

Utility scale Solar PV in Australia: LSSPV-CR

- Large Scale Solar PV – Competitive Round: In mid 2015 ARENA announced a funding round for utility scale projects. Winners recently announced, with an extremely positive result of **12 new solar farms** to go in construction in 2017, for a total of **482MW**

Applicant	Project Name	Size (MW AC)	ARENA Funding (Million)	Total Project Cost	Nearest Town	$/Wac	% of Highest
Goldwind Australia	White Rock Solar Farm	20.0	$6.0 million	$44.5 million	Glen Innes, NSW	$0.30	100%
APT Pipeline (APA Group)	Emu Downs Solar Farm	20.0	$5.5 million	$47.2 million	Cervantes, WA	$0.28	92%
Manildra Solar Farm	Manildra Solar Farm	42.5	$10.9 million	$109.3 million	Manildra, NSW	$0.26	85%
Neoen Australia	Dubbo Solar Farm	24.2	$5.5 million	$55.6 million	Dubbo, NSW	$0.23	76%
RATCH Australia Corporation	Collinsville Solar Power Station	42.0	$9.5 million	$95.9 million	Collinsville, QLD	$0.23	75%
Neoen Australia	Griffith Solar Farm	25.0	$5.0 million	$54.6 million	Griffith, NSW	$0.20	67%
Origin Energy	Darling Downs Solar Farm	110.0	$20 million	$216.7 million	Dalby, QLD	$0.18	61%
Genex Power	Kidston Solar Farm	50.0	$8.9 million	$126.2 million	Kidston, QLD	$0.18	59%
Whitsunday Solar Farm	Whitsunday Solar Farm	58.1	$9.5 million	$122.4 million	Collinsville, QLD	$0.16	55%
Neoen Australia	Parkes Solar Farm	50.6	$7.5 million	$107.9 million	Parkes, NSW	$0.15	49%
Canadian Solar (Australia)	Oakey Solar Farm	25.0	$2.2 million	$47.5 million	Oakey, QLD	$0.09	29%
Canadian Solar (Australia)	Longreach Solar Farm	15.0	$1.3 million	$28.7 million	Longreach, QLD	$0.09	29%
TOTAL		**482.0**	**$91.7 million**	**$1,056.4 million**		**$0.19**	

⇨ Canadian Solar secured two (2) out of twelve (12) projects awarded by ARENA.

⇨ Level of grant funding required dramatically reduced in 4-5 years. The whole program allocates a total of **92m**, less than the grant funds required for Moree Solar Farm.

Main metric was to define the **LCoE** (Levelised Cost of Energy) and funding requirement => initial cut-off at EOI 135 $/MWh
Based on the high level of competition, the LCoE at full application (June 2016) was in the range of 90-100 $/MWh, (based on ARENA's LCoE calculator).

Australia Favorable Aspects

Solar Resource:
Australia's insolation greatly exceeds the average values in Europe, Russia, and most of North America. Comparable levels are found in desert areas of northern and southern Africa, south western United States and adjacent area of Mexico, and regions on the Pacific coast of South America.

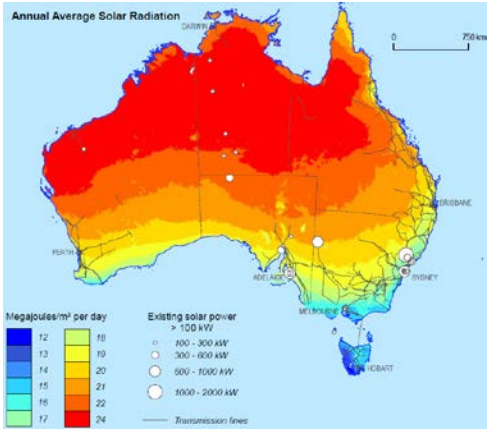
Country Rating: AAA

Demand: 200 TWh per year, “stable” as per AEMO 2016 national electricity forecast report. Queensland identified as main market for solar, as demand is increasing due to intense CSG activity an population growth.

Community acceptance:
PV has a very positive acceptance with the local communities.

Currency FX risk: Low

LRET Market:
Additional renewables capacity under the LRET is expected to deliver 15-16 million Large-Scale Generation Certificates. The discussion around a RET repeal has caused projects in the Development/investment phase of the program to stop. This has led to an annual under-supply, with participants relying on banked certificates to meet demand.



Country Risk		
Low	Medium	High
1		

Main challenges:

During the development process and site identification, several factors that are taken into consideration:

Irradiance levels, site access/remoteness, assessment of network infrastructure, access to local resources, preliminary flood prone assessments, cyclonic area assessment (SAT/FT evaluation).

- Several sites fail to pass the selection criteria

However, during the development of Oakey and Longreach Solar Farms, the **main challenges** were (or are):

- Grid Connection
- Development Approvals
- Loss factors
- Project offtake

Snapshot	Oakey
Site area	60 ha
Forecast output (SAT)	60 GWh
Estimated FC	31 Dec 2016
Expected Commercial Operating Date	Q1 2018

Snapshot	Longreach
Site area	30 ha
Forecast output (SAT)	40 GWh
Estimated FC	31 Dec 2016
Expected Commercial Operating Date	Q4 2017

Longreach Solar Farm

Location: Camden Park Station
Information: 10 minutes from Longreach

17MW

Oakey Solar Farm

Location: A few kilometres West of Oakey on the “Dalmeny” farm
Close to the township of Oakey

30MW (stage I)

Approvals

Several permits, licenses and approvals are required, however the **development approval** is one of the main milestones during the project development process.

Development Application requirements are generally different and documentation to be developed is general defined during the pre-lodgment meetings with local councils.

- Costs
- Timing and
- Conditions

vary from council to council.

Several studies may be required to be developed: biodiversity assessments, cultural heritage, traffic impact plan, stormwater management, glare studies, screening and visual impact plan etc etc.

Lesson learned:
Engage early with the local council, a competent site selection and initial due diligence allows for a trouble free permitting with reduced risk of conditions and ongoing compliance requirements.

Connection Processes

The following table summarizes the general steps required for a grid connection:

Step #	Details	Lead Time	Remarks/Comments
1	Preliminary Connection Enquiry	1 month	Minimal information required. No costs associated with the response, high level information provided by the DNSP/TNSP
2	Detailed Enquiry Response	4-6 months	SLD, half hourly generation profile, conceptual protection scheme, proposed connection arrangement and definition of scopes between NSP and proponent. Costs from the NSP $50k to $100k depending on connection arrangement. Scoping studies provide the cost associated with the grid connection costs.
3	Application to connect	1-2 months	Costs associated with consultants modelling and data requests
4	Generator Performance Standards negotiation and Power System Review	4-6 months	Numerous back and forth for design reviews and RFIs with AEMO and NSPs
5	Offer to connect - Connection Agreement	-	100% upfront payment of grid connection costs as identified in the DER
6	Coordination between Developer, EPC and DNSP/TNSP	6-8 months	Ongoing risk of variation from DNSP/TNSP - of appropriate coordination required
7	Testing and commissioning and energisation	2-3 months	Ongoing risk of variation from DNSP/TNSP - of appropriate coordination required

Lessons learned: Engage early with the NSP and allow significant financial commitment since project origination. From connection enquiry to COD: 2-2.5 years. Constant risks that other proponents will locate project in similar area.

Project Revenue – Loss Factors

Project revenue definition is the **key aspect** to be appropriately identified.

In this instance, Loss factors play an important role:
MLF and DLF Marginal Loss Factor (MLF) and the Distribution Loss Factor (DLF), define the losses within the National Electricity Market (NEM) these depend:

- Amount and time of the day that power is produced and coincidence of loads
- Coincidence of power produced by other generators
- Proximity of loads and other generators to the solar farm

Loss factors have a direct impact on the energy that the solar farm will be able to sell therefore influence the project's revenues. These change every year. Several consultants will be able to perform a load forecasts and analysing other connection aspects. It is important to perform a sensitivity analysis to ensure future project revenues can be largely defined, however, still a risk component will remain, as no forecast will be able to include solar developments in a same area and no official database is available.

Lessons learned: maintain an open communication with relevant parties. Engage with the local community and be proactive to inform on your plans.

Project revenue - Offtake agreements

Project revenue definition is the **key aspect** to be appropriately identified.

With policy stability, the market for PPAs is rapidly improving.

However:

- Limited number of bankable offtakers.
- PPA prices are driven by competition between other Renewable Energy sources with solar cutting the gap to wind.
- RET term to 2030 forces proponents to look at “merchant tail” post 2030.
- Too much solar in the same location will put pressure on NEM revenue.

Lessons learned:
State Schemes as the Solar150, with a contract for difference exclude this revenue risk providing a floor price, guaranteeing certainty of revenue. Furthermore, the quality of the offtaker will allow to reach adequate gearing levels and with finance cost reduced.

What's next after the LSSPV-CR?

- No grant funding for projects with NTP in H2-17:

ARENA has played a key role in establishing and maintaining global players into this market. However the lack of project support can be replaced by state based schemes like the Solar150. These constitute a good compromise between financial exposure and fill the gap between liable entities under RET and solar developers. Speculation with projects going merchant – however are still announcement.

- Integration of energy storage:

Rapidly decreasing capex and grid requirements open for implementation of energy storage. As new generation comes in with an intermittent output, grid support and market structure offer interesting upside opportunities.

- Transparency of information on proposed projects: loss factors and constraints issues.

Several hundreds of megawatts under development with many proponents securing land and grid capacity and "flipping" projects for a short term gain. But is a key risk for each individual proponent for loss factor calculation. Maintain an open communication with all interested partied is a key in an over-developed market.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