CLIMATE ENERGY FINANCE

Northern Beaches Indoor Sports Centre: A Case Study in Commercial and Industry (C&I) Rooftop Solar

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Key points

- This case study of the installation of 2 x 30kW solar arrays in 2017 and 2018 on the roof of Northern Beaches Indoor Sports Centre Ltd shows that mid-sized solar systems on industrial or commercial buildings can generate significant returns on capital through savings on electricity. The installation is not complex and can be done without compromising the core business. As part of the electrification of NBISC, gas, used to run hot water heaters for the change rooms, was eliminated.
- The key is to replace power purchased at high marginal costs (eg, 25c/kWh) with zero cost solar (once installed). Selling surplus power to the grid is not a particularly profitable enterprise and will likely become progressively less so over time (absent batteries).
- Despite (perhaps because of) benign neglect from Government small scale rooftop solar has become a major force in Australian electricity production. In CY2023 Australia installed 3.16GW of rooftop solar, +14% year-on-year, to be the second highest installs in Australian history, according to SunWiz. It is now bigger than utility solar and hydro. In a year or so it will be bigger than wind and possibly brown coal.
- The key benefit of small scale solar is speed to market. Panels can be installed in three or four days, systems accredited in a further week and power flowing the next day. Utility scale renewables infrastructure, eg. Snowy Hydro II, will likely be 15 years from announcement to full capacity, presuming transmission can be built in time.
- Some very minor Government tweaks could see a large increase in solar in C&I at minimal cost to the taxpayer. This would be an unambiguously good thing.
- Batteries are much more complicated. Absent further capital cost reductions, and/or better time of day retail price signals, and/or enhanced government incentives to value their grid reliability and stability enhancing values, batteries are not yet an attractive investment proposition. A subsidy based on combined solar/battery systems might be useful in kick-starting demand to establish supply chains and build skills capacity via learning by doing.
- EV chargers, like solar panels, appear to be viable on a stand alone basis. Modest encouragement from state governments would likely incentivise roll outs linked to

distributed small and medium scale solar arrays, with the potential that exists at sites like NBISC a case in point.

Introduction

Northern Beaches Indoor Sports Centre Ltd (NBISC Ltd) is a not for profit company funded entirely by members. It was formed in 2001. Its purpose was to build, own, operate and in 2041 transfer back a four court indoor sports facility (the NBISC facility) located on Department of Education land at Narrabeen on the northern beaches of Sydney.

The original construction of the facility was funded by the State Government (55%), Council (13%), borrowings (26%) and NBISC users (6%). All operations, maintenance, debt repayments and stay in business capex are funded by NBISC from court hire fees paid by users.

NBISC is managed by three volunteer directors. It has one full time employee who manages the building. It has contractors who do the finances, cleaning and regular floor maintenance.

In 2015 the board of NBISC committed to a $3.4m 50% expansion of the facility. The expansion was funded by Council (13%), users (23%), borrowings (25%) and cash generated by NBISC (39%).

As part of the expansion the board committed to a number of upgrades to reduce the environmental footprint and operating costs of the facility.

Removal of Gas From Site

Gas was a relatively modest operating cost, being $1.9k pa in the years prior to the expansion. It was used solely to run hot water heaters for the change rooms. It accounted for about 7% of energy usage on site. As part of the expansion new hot water heaters were required. It was decided to eliminate gas from the site.

Solar Installation Stage I

The expanded facility faces almost due north. The roof slopes slightly to the north and is 8.1m above ground level at its lowest point. Adding solar was an obvious option. The issue was what would power consumption look like post the expansion. The expansion opened in mid July 2016 and was running full bore by August.

Swapping the hot water heaters from over night to daytime running would likely create a situation in which 100,000kWh was being used during the day. This would comfortably support a 30kW system. In early 2017 NBISC committed $32k (ex GST) for a 30kW system. The contractor was a small Frenchs Forest based family business. We would happily recommend them, however they now only do quite large projects.

The important issue for stage I was that it primarily serviced in-house needs. The facility is used seven days a week year round except for two weeks at Christmas (a major advantage over schools). As a result 80% of output was consumed by NBISC at an average value of 25c/kWh. The 20% sold into the grid generated 12.5c/kWh.

Table 1: NBISC Electricity Consumption Pre & Post Expansion (kWh)

Grid Consumption		
Usage	July-Dec 15	July-Dec 16
Power from grid kwh	40,008	76,171
Grid consumption by time		
Peak (2pm-8pm M-F, 30hrs/wk)	11,941	22,596
Shoulder (all others; 98 hrs/wk)	14,424	29,167
Off Peak (10pm-8am M-F; 40hrs/wk)	13,642	24,408
	40,008	76,171
Price & Cost		
Total usage	6,728	12,783
Solar sales	0	0
Net usage	6,728	12,783
Fixed costs	2,856	4,079
Total costs pre GST	9,584	16,863

Financial returns from stage I were excellent. In the first few months savings were over $3k. In the first full year savings were over $9,500, a tax free return of 30%.

Table 2: Savings from Stage I Solar

12 Months to	Aug-17	Aug-18
Solar Output & Use		
Solar output kwh	17,600	42,166
Sold to grid kwh	1,359	8,566
$ value	170	1,071
Used by NBISC kwh	16,241	33,600
$ value	3,397	8,430
Total value	3,567	9,501
Grid Consumption		
Usage	Aug-17	Aug-18
Power from grid kwh	128,716	107,323
Grid consumption by time		
Peak (2pm-8pm M-F, 30hrs/wk)	40,903	36,748
Shoulder (all others; 98 hrs/wk)	41,564	31,808
Off Peak (10pm-8am M-F; 40hrs/wk)	46,249	38,767
	128,716	107,323

Return & Earn

In early 2018 the NSW Government executed the Return and Earn scheme. The NSW Education Minister (the local member) facilitated two machines being located at NBISC. The two generally operated in the top decile of machines over the next five years, reaching average daily volumes of 12,000.

Importantly for NBISC the machines used around 6,000 kWh of power and paid 20c per unit, CPI indexed. Their usage was primarily during daylight hours, they operated every day and were busiest in December and January, a perfect alignment for rooftop solar.

Solar Installation Stage II

The initial system sold 80% of output internally. We calculated that using a 15% hurdle rate required selling 30% of output internally. For a 30kW system this required 12,600kWh of internal consumption. The Return & Earn machine would provide half the required demand.

This, combined with the exceptional returns from stage I, convinced NBISC directors to add a second 30kW system. This was installed in August 2018 at a cost of $34.2k (pre GST). Energy Australia was used for this installation. As my late mother used to say, if you have nothing nice to say about someone, don't say anything at all. We will remain silent regarding the capabilities of EA.

Outcomes

Financial

Covid significantly impacted the 16 month period from March 2020 through mid 2021, as the facility was closed for five months and operated under capacity restraints for a number of months.

What we can say is that output from the system has been consistent with design levels but surprisingly erratic. It turns out that sunshine is more volatile year to year than one might imagine. Having a model of using at least 50% of output internally has generated excellent returns.

A total of $66k has been invested in a system that generates tax free savings of $13.5k pa and electricity sales of $3.2k pa. NBISC as a not for profit does not pay tax on sales, but a normal company would.

The return on capital has been 25% pa. Over five years earnings have equaled 127% of capital costs despite reduced in-house demand during covid. This has been an exceptional investment. These returns do not allow for the savings over five years of more than $10k from the elimination of methane gas from the site.

Environmental

All gas has been eliminated from the site without requiring the intervention of Government. When markets are allowed to operate freely in general good things happen.

Grid based power has halved from an annualized 152 kWh. As the NSW grid is 60-65% coal this has been a significant improvement in emissions intensity of energy use. Sales into the grid would comfortably power six large houses.

The Return & Earn machines collected more than 4m bottles a year (12,000 per day). The impact of this on energy consumption in the production of glass, aluminum and plastics packaging would be profound. A new industry has been created in using recycled glass and plastics, creating thousands of jobs and over $1bn in economic benefit to the country. This was probably the most enduring policy success of the previous NSW government.

Unfortunately in February 2023 the NSW Department of Education as land owner declined permission to extend the agreement between NBISC and Tomra and the machines were closed. The DoE struggles to teach mathematics to our children. That they demonstrably are unable to utilize it themselves should come as no surprise.

In February 2021 all lighting was converted to LED at a capital cost of $46k. Any reduction in usage has been somewhat camouflaged in the data by covid restrictions but one would normally anticipate a material decline in usage.

Table 3: Long Term Returns From Solar

12 Months to	Aug-17	Aug-18	Aug-19	Aug-20	Aug-21	Aug-22
Solar Output & Use						
Solar output kwh	17,600	42,166	78,914	84,240	84,290	78,820
Sold to grid kwh	1,359	8,566	31,166	38,940	38,252	35,050
$ value	170	1,071	3,896	4,466	3,784	2,738
Used by NBISC kwh	16,241	33,600	47,748	45,300	46,038	43,770
$ value	3,397	8,430	11,769	11,216	11,014	9,112
Total value	3,567	9,501	15,665	15,682	14,799	11,850
Grid Consumption						
Usage	Aug-17	Aug-18	Aug-19	Aug-20	Aug-21	Aug-22
Power from grid kwh	128,716	107,323	96,594	72,274	76,607	77,196
Grid consumption by time						
Peak (2pm-8pm M-F, 30hrs/wk)	40,903	36,748	22,189	18,171	13,677	18,249
Shoulder (all others; 98 hrs/wk)	41,564	31,808	38,797	25,474	29,702	26,873
Off Peak (10pm-8am M-F; 40hrs/wk)	46,249	38,767	35,608	28,629	33,228	32,074
	128,716	107,323	96,594	72,274	76,607	77,196
Price & Cost						
12 Months to	Aug-17	Aug-18	Aug-19	Aug-20	Aug-21	Aug-22
Price net of disc						
Peak	0.240	0.281	0.287	0.283	0.281	0.229
Shoulder	0.179	0.216	0.223	0.222	0.220	0.193
Off Peak	0.109	0.139	0.138	0.137	0.135	0.129
Ave ex Off Peak	0.209	0.251	0.246	0.248	0.239	0.208
Usage Costs						
Peak	9,808	10,344	6,367	5,144	3,843	4,185
Shoulder	7,442	6,856	8,666	5,663	6,535	5,174
Off Peak	5,039	5,381	4,923	3,909	4,493	4,149
Total usage	22,288	22,582	19,955	14,715	14,871	13,507
Solar sales	-170	-1,071	-3,896	-4,466	-3,784	-2,738
Net usage	22,118	21,511	16,060	10,249	11,087	10,770
Fixed costs	8,761	9,211	9,518	9,459	9,082	8,599
Total costs pre GST	30,880	30,722	25,577	19,708	20,168	19,368

Implications

Business

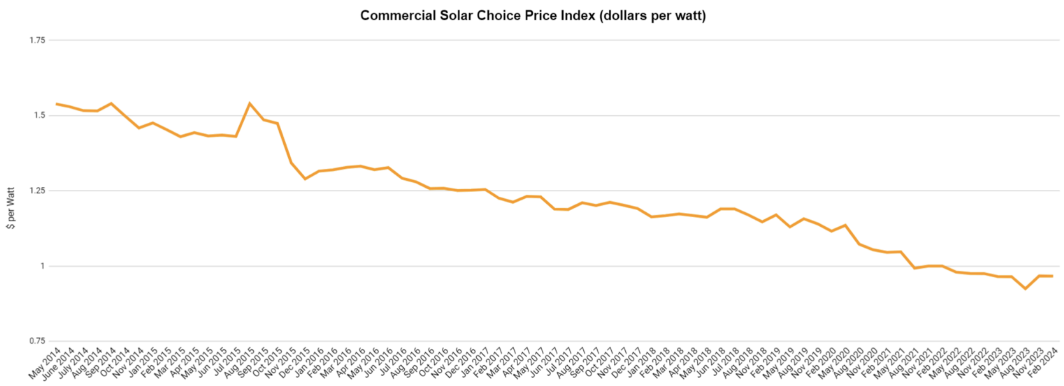
The returns from these types of projects are excellent. If one owns or operates a business based in a large building with a roof it makes excellent sense to spend some money understanding whether a sizable system is possible.

If the business uses electricity pretty much every day and does not shut for an extended period in summer the economics are likely to be quite good. The projects are quick and easy to install so long as you utilize a well credentialled installer.

The critical risk is at least 50% of output needs to be consumed on site. Selling into the grid is, in our view, a fool's errand until battery costs decline materially. In 2018 NBISC generated 12.5c/kW for grid sales. In 2019 the price was 11.5c. In 2022 it was 7.8c. We expect in two or three years time it will be 2.5c/kWh or lower.

Capital costs have declined dramatically over the last decade.

<u>**Figure: Historic average commercial solar panel costs (August 2012 – February 2024)**</u>



Average commercial solar payback periods by state

Source: [Solar Choice]

Despite falling feed-in Tariffs (FiT), still strong returns can be generated. Using the above parameters the basic return template would look as follows

System Returns

System size	50
Cost/unit	1.5
Capital cost ($ '000)	75
Output per kw	4.5
Daily Prodn kwh	225
Total output	80.5
Internal price	0.25
Grid price	0.025
% internal	50
Value ($ '000)	11.1
Return (%)	14.8

Regulators

For small scale industrial projects the two regulatory issues are the variable cost of power vs the fixed cost and the FiT.

The economics of rooftop solar depend on replacing internal consumption. If the variable price of power is low there and there is no price on carbon emissions for thermal power plants, there are no incentives for zero emissions behind the meter investments. This is the primary regulatory issue. When the AER sets revenues allowed to infrastructure owners it generally is agnostic about how they generate their revenues. There needs to be a structure that at the very least investigates the share of revenue coming from fixed charges for what are medium sized to small consumers, and determines what if any outcomes are being generated.

For smaller installs, of less importance is the feed in tariff. In NSW IPART recommends a FiT and retailers are free to do whatever they please. This is silly. Either IPART saves money and ceases to write on the issue or they develop a formula that provides a minimum price. We would propose that the minimum feed in tariff be 10% of the peak period variable tariff.

So if the peak fee is 45c/kWh the feed in tariff would be 4.5c. If it is 25c the feed in tariff would be 2.5c. Simple.

Realistically the regulatory issues around this part of the industry are not overly onerous. NBISC generates returns that are consistent with the top quartile of ASX 200 companies. A greenfield midsized solar array with mediocre levels of internal use will generate a return better than the ASX 200 average and miles better than Origin Energy.

Policy Makers

Policy makers, be they state or federal, love big projects, irrespective of who executes them. Unfortunately large projects have three large problems:

- First, they take forever. Snowy Hydro II, announced three Prime Ministers ago in March 2017, was originally planned to open prior to the 2023 closure of Liddell. Then it was prior to Western Sydney Airport in 2026. Now it is in a race to see if it can beat the 2032 scheduled opening of Sydney West Metro;
- Second, because they take forever they cost the earth. As a consequence they require direct or indirect subsidies on a massive scale. Not to flog a dead horse but Snowy II began life as a $1.9bn project. After a depressingly consistent period of blowouts the project cost reached $5.6bn six months ago. In September the Government announced the costs would likely exceed $12bn. The good news is the Government is confident the project will open in 2028. The rest of us can be confident it probably will not get much worse; and,
- Third, these projects not only take forever and cost the earth but they are being developed in areas remote from transmission infrastructure. Transmission infrastructure is also expensive and slow, with large environmental impacts and adverse local community views absent appropriate financial incentives.

At the State level policy makers have been very slow to understand the potential of small scale C&I rooftop solar. Despite lack of interest the fundamental economics are so powerful that rooftop solar now accounts for more than 11% of NEM volumes having grown by 71% over the past two years. It is now larger than hydro and utility solar. At present growth rates it is a year or so away from overtaking wind and brown coal and six to eight years away from overtaking black coal. The latter eventuality presumes more roofs than Australia is ever likely to have, but suggests the potential.

The NBISC experience strongly suggests to us that virtually all community sporting facilities (particularly pools, which are energy black holes) ought to be actively encouraged to install large solar arrays. The State could help by offering small scale subsidies to get basic professional studies done covering engineering and the economics of solar. In metro Sydney there must be 100 such public facilities that could comfortably support and fund 6500-8000kW of capacity each producing enough power to service 1250 houses pa at a cost to the community of less than $0.5m.

The other core role the State could play would be in planning. Virtually every commercial and industrial DA in metropolitan Australia requires studies on traffic management, parking and water use. Surely a requirement to invest in solar (or at least demonstrate why it is not feasible) would not be an excessively onerous burden.

Next Steps for NBISC

NBISC has a roof that covers roughly 5000 square meters. The existing 60kW system covers about 8% of the roof. They can, should they wish, probably support a 600kW system capable of producing 900,000 kWh pa. They have, of course, no way of selling that sort of volume and will likely never execute such a project absent a financial incentive to reflect the wider community benefits of increased power supply, supported by batteries to time-shift into evening peaks.

The obvious next step would be adding 40kW, which would leave NBISC at the 100kW threshold for RECs, at least until the Australian government lifts the SRES limit from 100kW to 200-1,000kW to accelerate commercial and industrial deployments tenfold. The difficulty is that in the absence of more internal consumption it is likely that 75% of volumes would be sold to the grid at low and declining prices.

The two options to add to this would be batteries and EV charging.

Batteries

The premise of batteries is that one can load up with low cost solar during the day and consume the electricity during the evening peak. As NBISC is inevitably full from 5-10pm weekdays there is a natural attraction to storing solar and reusing it later in the day.

The difficulty is that at present around a third of grid sales occur in December and January when usage is relatively light. This is an insurmountable issue at present. The net outcome is that a four hour battery system costing $55-60k would generate savings of less than $3k. As battery prices fall (or electricity prices continue to rise) this equation will look much better. But in the absence of material subsidies batteries do not appear sensible other than for businesses with a bias towards summer usage (eg, pubs).

The NSW Government subsidizing batteries for small scale solar would probably be an excellent idea if it would preclude the requirement of a new transmission asset elsewhere in regional NSW. This would have to tie battery subsidies to thousands of new solar arrays in the 50-100kW range.

EV Charging

Public sporting facilities should be excellent locations for EV charging. In general people with above average disposable incomes drive to a facility, watch their children for an hour or so and leave. With installation of EV charging they could arrive, charge while watching and leave.

Chargers can be as low as $6k to install. In a site with good volumes they ought to generate returns in the mid teens. As NBISC has 120 parking spaces it can progressively roll out small numbers on a regular basis. This is likely something that can be done without subsidies.

Given the size of unused rooftop capacity and the absence of a price signal to value the wider community benefits and value of avoided carbon emissions, we have not considered carpark awnings covered in solar, but this is a longer term option of massive additional scale. France has now mandated this for all carparks, and Australian solar radiation is superior to that in France.