

Future costs for large scale solar in UK

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Outline of presentation

- 2018 STA cost estimates for large-scale PV
- Policy options to reduce cost of capital
 - Access to CfD with a floor price
 - Facilitation of corporate PPAs
- STA actions to reduce costs and increase revenues for UK solar:
 - Distribution network outage mitigation
 - Reducing Assessment & Design (A&D) fees
- Network charging reform Balancing Services Use of System (BSUoS)

Overview of cost decrease scenarios

Unsubsidized Solar PV LCOE





How much has the landscape changed since 2014?

2014 central assumptions for new-build 10+ MW PV installation in south of England, commissioning in:

Cost per MW of installed capacity (£2017/MWp unless otherwise stated)	2014	2019	2030
Operational lifespan (years)	25	25	25
Annual system degradation (%)	0.5	0.5	0.5
Annual availability (hours)	8760	8760	8760
Load Factor (%)	11	11	11
Modules	478,960	269,280	209,680
Inverters	73,440	46,830	30,870
Grid costs	56,400	64,925	64,925
Other CAPEX – Balance of System (BOS)	485,200	409,965	382,095
OPEX per annum (2017£/MWp/year) – excluding Business Rates	23,200	20,670	18,300
Business Rates (2017£/MWp/year)	4,000	2,000	1,700
LCOE estimate (2017£/MWh)	84	75.5	69



How much has the landscape changed since 2014?

What we said in 2014:

"These values are based on the assumption that the EU/China Anti-dumping tariffs are removed in January 2016 and that solar financial support and policy stability is re-instated into the market."

What actually happened:

- EU anti-dumping tariffs remained partially in place up until Sept. 2018
- Instead of decreasing as predicted, Business Rates <u>increased</u> 23% for the average solar farm (5-10 MW, built 1 April 2015 onwards) following 2017 revaluation
- RO permanently closed to all new generating capacity on 31 March 2017
- With the exception of offshore wind, UK renewables sector remains in the midst of a protracted period of policy chaos and regulatory uncertainty
- Total UK renewable energy investment has plummeted, falling 43% yearon-year in Q3 2018





... And yet, somehow project cost decreases have still managed to beat our expectations.

Our scenario analysis suggests that the median LCOE for large-scale ground mount PV will likely be 35% lower by 2030 than we had predicted in 2014:



How much has the landscape changed since 2014?

Project Parameters – STA's 2014 vs. 2018 projections:

Project parameters	2019	2019 Revised	2030	2030 Revised
Operational lifespan (years)	25	∧ 30	25	A 35
Annual system degradation (%)	0.5	v 0.39	0.5	0.39
Annual availability (hours)	8760	v 8672	8760	8672
Load Factor (%)	11	12	11	13

How much has the landscape changed since 2014?

With longer asset lifespans, continued decrease in module prices and more modest but still consistent decrease in other CAPEX components, operational costs (including business rates) quickly come to make up a significant majority total lifetime costs. By the late 2020s, Business Rates will likely be a larger proportion of total lifetime costs than modules.



CAPEX assumptions:





Sensitivity analysis – CAPEX range



Key CAPEX assumptions

- A global surplus of modules plus the end of EU Minimum Import Pricing (MIP) will likely drive a onetime price decrease of approx. 20% in 2019. Going forward, we conservatively estimate that module prices will continue to fall at approximately 10% per annum (keeping in mind potential currency risks)
- We assume that the same economies of scale that have driven the dramatic decrease in module prices are for the most part not realistic for BOS CAPEX, but that continued modest improvements are achievable
- Continued distribution network congestion will drive increases in grid connection costs, but we factor in some mitigation of this effect in future as a result of increased availability of more flexible network connection options (see Ofgem's Network Access and Forward-Looking Charges consultation (2018))
- Developer margins could gradually decrease as project risks become better understood

OPEX assumptions:





Other (Administration, Contingency and Community Benefit payments)

- Land management and vegetation
- Technical O&M contract (Including)

Sensitivity analysis – OPEX range



Key OPEX assumptions

- Following the 2017 VOA Memorandum of Agreement on Business Rates, groundmount PV commissioned after 1 April 2015 is subject to Business Rates of £4,700 to £6,660 per MW depending on size and location; We here factor in a 30% reduction following the 2021 revaluation, applying to new-build, unsubsidised developments
- Increasing use of UAV monitoring coupled with AI technology, improved inverter reliability, an increase in robotic cleaning, and continued economies of scale could drive further decrease in price of technical O&M contracts, but there is limited scope for reducing costs of some fundamentals (vegetation management, spare parts storage and installation)
- Insurance costs likely to increase, and to place pressure on site security requirements. On the other hand, technological innovation could bring down the costs of monitoring large sites

Cost of capital assumptions



DescriptionWACCOne-way CfD
- Low4%One-way CfD
- High6%

Description	WALL
One-way CfD - Low	4%
One-way CfD - High	6%
Long-term PPA	6 – 9%
Short- term/flexible PPA	7 – 10%
Pure merchant	8 - 11%

(Based on illustrative central estimates for CAPEX and OPEX)

How can policy help drive down costs?



- The LCOE decreases we project for large-scale PV are achievable, but reaching them will require rebuilding investor confidence in the sector. This can be done by:
 - Implementing a technology-neutral floor-price CfD mechanism, or a constrained floor price CfD with a specific allocation for solar
 - Reducing costs and removing regulator barriers for solar-plus-storage to fully participate in capacity, arbitrage and ancillary services markets
 - A Climate Chang Levy exemption for new-build corporate PPA-backed solar developments

1. Allow PV bids in a technology-neutral floor price CfD



BEIS allocation notice for 2023-25 delivery indicates \pm 53-56/MWh administrative strike price for offshore wind⁶

If they were to benefit from the the lower-cost capital enabled by a CfD guarantee, it is likely that PV projects could be delivered for less than ± 40 /MWh within the same period.

This effectively means that, depending on wholesale price dynamics and offshore wind cost reduction, procuring a proportion of solar could potentially save consumers £100s millions per year vs. a 100% offshore wind procurement approach

Floor price CfD: A low-cost, practical revenue stabilisation mechanism





When wholesale power prices rise above the floor again, the generator would not retain the upside until the value of CfD top-up payments received had been reimbursed

- Investors benefit from lower average cost of capital, whilst capturing potential upside in return for taking on merchant risk
- Consumers benefit from lowest possible floor price bids, whereas under 2-way CfD there is less incentive for developers to drive down bids⁷

Establish incentives for new-build corporate PPAs

- There has been a surge in interest over the past year in corporate PPAs as a means of both hedging against higher and more volatile power prices as well as reducing operational footprints. However, outside of the US the global PPA market remains in its infancy
- Compared to rest of Europe, the UK has fewer regulatory barriers to a PPA market. There is also interest from public sector and local authorities.
- STA are planning more activity in 2019 the UK to promote this market.





Establish fair and reasonable incentives for new-build corporate PPAs

Today, direct-wire renewable energy PPAs are rightfully exempt from the Climate Change Levy (CCL). Next year the CCL will increase by 45%, as it absorbs the closing Carbon Reduction Commitment (CRC) energy efficiency scheme

Going forward, this same exemption should be extended to new-build solar PV developments to incentivise PPA additionality (as opposed to investment in existing sites or purchasing credits), as well as the growth of the UK corporate PPA market overall. This will help to build up experience in the PPA model among both developers and corporates, further enabling future cost reductions. Climate Change Levy cost per MWh – Commercial/Industrial consumer



Impact of Network Outages on Solar



- Constraints on PV generation due to planned and unplanned network outages, typically for maintenance work, are the most significant cause of lost power production for UK PV generators
- Between 2015 and 2017, these losses were equivalent to approx. 1% of total installed solar capacity, or £10m per year in foregone revenues across the solar industry.









Foresight

- STA commissioned EA Technology to write a Best Industry Practice Manual (BIPM) for dealing with network outages.
- Process involved detailed discussions with STA members and two leading DNOs: UKPN & WPD
- First of its kind, and will fill a crucial gap in providing guidance to both DNOs and asset owners/managers.

Bluefield

lightsource bp



BIPM on Managing Network Constraints Objectives

- Improve communications between DNOs and solar generators on outages
- Develop a means of triggering discussion between DNOs and solar generators on possible mitigating action for individual outages
- Detail possible methods of mitigation
- Promote the sharing of information where there are no confidentiality issues.
- Address confidentiality issues for sharing information
- Provide case studies



Endorsed by:





Impacts on outages for 2018



- Unpublished analysis is showing modest increase in <u>number</u> of disconnections in 2018, but a significant decrease in total amount of time lost to outages,
- Anecdotally, less maintenance happening in peak summer months; DNOs are working to mitigate outages (including by better co-ordination of maintenance schedules with National Grid's transmission works)

DNO A&D Charging



- Since April 2018, DNOs have been able to charge Assessment & Design fees to applicants as part of connection application process
- Initially there was a lot of variation between different DNOs' charging methodologies with no transparency in terms of rationale
- STA successfully lobbied for these fees to be revisited, made more transparent, and applied uniformly across DNO regions

DNO A&D Charging



- STA engaged in consultation with ENA and Ofgem over reform and standardisation of the charges
 - Our preferred option would see a higher proportion of costs paid on cost-recovery (i.e. projects that proceed from offer-acceptance to actual construction), and minimal frontloading of costs
 - Also support an "optioneering" approach, where applicants pay a higher up-front, fixed fee so as to submit multiple connection applications and secure a position in the connection queue
 - Opposing any charge for "Budget offers", the first step in connection application process, which do not include a queue position reservation

DNO A&D Charging

 But ultimately, we believe the best way to mitigate A&D fees would be for DNOs to make more information on network congestion available freely to prospective connection applicants and the general public through detailed and up-to-date "heat maps"

• This approach currently being advanced in Australia:



Figure 1: Generation connection opportunities and risks[4]



Source: Energy Networks Australia

Network charging reform: Balancing Services Use-of-System (BSUoS)





- BSUoS is the sum of 14 separate charges for balancing electricity volumes on the grid within each halfhourly settlement period
- Paid by electricity suppliers and transmission-connected generation on a net volumetric basis, billed daily

Network charging reform: Balancing Services Use-of-System (BSUoS)



Two separate Embedded Benefits accrue to Distribution-connected generation (DG <100 MW), including all GB solar, with regard to BSUoS:

- 1. DG <100 MW is currently exempt from BSUoS charges
- 2. DG <100 MW can receive payment from electricity suppliers for offsetting their own BSUoS charge liability

Ofgem are now proposing to implement either Partial (removal of second embedded benefit) or Full (removal of both first and second) BSUoS reform.

These proposed reforms would each reduce PV generators' net revenues by approximately by 5% and we have written to Claire Perry to raise our urgent concerns and members of an Ofgem taskforce on these reforms

Impact of BSUOS reforms on potential solar revenues



Conclusions



- Costs for large-scale PV in the UK have fallen enough to mean subsidy-free projects are possible in 2019 (300-500MW?)
- Sustained growth will happen if cost of capital can be reduced by:
 - Access to CfD with a floor price
 - Facilitation of corporate PPAs
- STA taking action to cut costs & increase revenues existing and new assets
 - Better dialogue with DNOs to reduce maintenance outages
 - Reducing and improving Assessment & Design (A&D) fees
 - Lobbying against the BSUOS reforms



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