

International Solar Alliance Expert Training Course: Session 15

Subsidy-Free Solar

In partnership with the Clean Energy Solutions Center (CESC)

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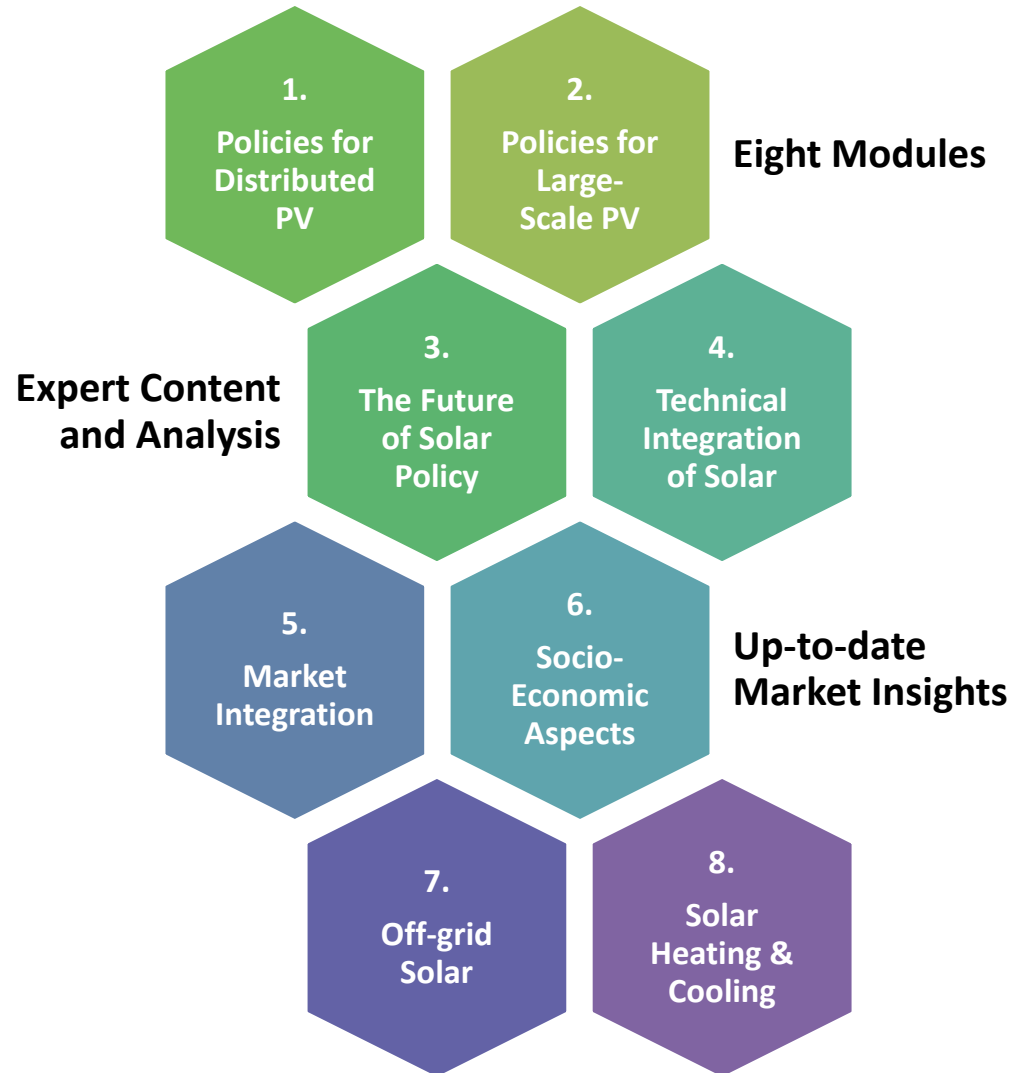
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ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

Overview of Training Course Modules

This Training is part of Module 3, and focuses on the issue of **the Future of Solar Policy**



Overview of the Presentation

- 1. Introduction: Learning Objective**
- 2. Trend toward subsidy-free solar**
- 3. Overview of key markets with subsidy-free solar**
- 4. Concluding Remarks**
- 5. Further Reading**
- 6. Knowledge Check: Multiple-Choice Questions**

1. Introduction: Learning Objective

Learning Objectives

- ❖ **Understand the rise of subsidy-free solar**
- ❖ **Understand what is meant by "subsidy-free" in different market segments (residential vs. wholesale)**
- ❖ **Understand the different markets where subsidy-free solar has emerged**
- ❖ **Understand what the rise of subsidy-free solar means**

2. Subsidy-Free Solar

Subsidy-Free Solar

- For most of the last 3-4 decades, solar policy has involved tax incentives, rebates, grants, mandates, preferential treatment (e.g. priority grid access), feed-in tariffs, net metering, among others (see **Session 14 on the Introduction to Solar Subsidies**)
- However, in recent years, solar policy has begun to evolve, and often requires little or no explicit subsidy
- Some solar PV projects are becoming “**subsidy free**”.

Subsidy-Free Solar

- Recent solar PV auctions in Europe have resulted in contracts with zero premium attached: in other words, projects bid in a competitive auction to obtain the wholesale spot market price
- Subsidy-free solar PV projects are now being built in a wide range of markets throughout the EU



Sources: <https://www.baywa-re.com/en/news/details/baywa-re-builds-first-subsidy-free-solar-park-in-germany/>
<https://www.renewableenergyworld.com/articles/2018/09/subsidyfree-solar-farms-popping-up-from-britain-to-italy.html>
<https://www.pv-tech.org/news/investors-ready-to-pounce-on-subsidy-free-solar-momentum>

Subsidy-Free Solar

- In theory, the move beyond subsidies could put the industry on a more stable footing: less reliant on government support
- Less exposed to the risks of **start-and-stop cycles** caused by inconsistent government policy (e.g. Australia, Spain, US, Germany)
- In the absence of clear subsidies, investors are starting to assess solar PV on its own economic merits and financial fundamentals: **can solar projects produce sufficient cash flows to pay for themselves in a reasonable timeframe?**
- Do solar projects offer other hedging, portfolio, branding, or energy security-related benefits?

Subsidy-Free Solar

- Thus far, however, many subsidy-free solar projects have not been true “merchant” power plants, selling 100% of their output directly on the spot market
- The term “subsidy-free” continues to be used quite loosely (What constitutes a subsidy? See Session 14 on Subsidies)
- Most have succeeded in locking in partial, or full, PPAs with corporate off-takers, or with institutional buyers (e.g. municipalities)
- The ability to lock-in a portion of a project’s sales at a firm PPA price reduces the risks, and can even improve the returns, versus a long-term, fixed Feed-in Tariff

Subsidy-Free Solar

Important to distinguish between different market segments:

1. Residential and Commercial Market:

- a. PV-only
- b. PV with storage



2. Wholesale market:

- a. Corporate PPAs
- b. Pure merchant sales



3. Residential and Commercial Market

Subsidy-Free Solar

1.a. Residential and commercial market, PV-only: subsidy-free solar in this market segment means that customers can save money on their power bills by investing in solar, even without explicit subsidies, rebates, or tax incentives

Can be achieved via **solar leasing**: except that currently, most solar leasing companies still benefit from a wide range of tax incentives (e.g. in the US)

This market segment is also reliant on the grid to continue accepting the power

Solar PV is well below retail prices in a growing number of markets (updated to 2019)

Country	Current Retail Rate (EUR/kWh)	Approximate LCOE of customer-sited solar PV (EUR/kWh)	PV LCOE as a Percentage of Retail Rate
Germany	0.30/kWh	0.8/kWh	~27%
Hawaii	0.33/kWh	0.6/kWh	~20%
Australia	0.20/kWh	0.5/kWh	~25%
New York (U.S.)	0.18/kWh	0.8/kWh	~44%
Cape Verde	0.27/kWh	0.11/kWh	~41%

Subsidy-Free Solar

However, even if the levelized cost of solar is significantly below retail prices, this does not automatically translate into rapid, sustained market growth

Solar PV projects still rely on the grid to export their excess generation: however, the calculus arguably changes with the addition of storage

Yet, many **barriers** continue to hold back customer-sited solar PV, even when it is economic: upfront cost, awareness, access to financing, suitable roof space, renters vs. owners, etc.

Subsidy-Free Solar

1.b. Residential market: Solar + Storage

The addition of storage opens up a new category of “subsidy-free solar”

Particularly cost-competitive in island regions (where electricity retail prices are higher), as well as in markets with high demand charges (\$/kW of peak demand)

Also attractive in markets with costly, diesel-based, and/or fundamentally unreliable power supply: e.g. Nigeria, off-grid markets, peri-urban markets, etc.

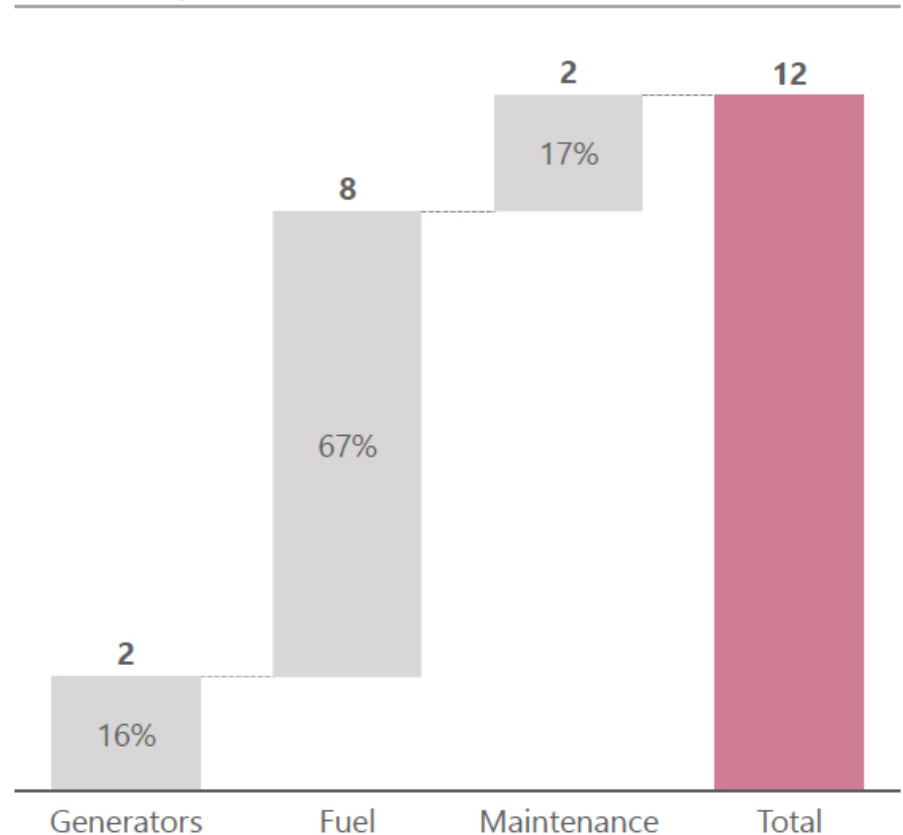
In such contexts, solar PV can be competitive even without subsidies: the challenge remains the high upfront costs

Subsidy-Free Solar

In Nigeria, customers spend over USD 12 billion per year on small gasoline generator use

Fossil fuel subsidies for gasoline used in generators represents an additional ca. USD 2 billion

Total expenditure on small gasoline generators
USD billions, 2018



Source: https://africa-energy-portal.org/sites/default/files/2019-08/A2EI_Dalberg_Putting_an_End_to_Nigeria%e2%80%99s_Generator-Crisis_The_Path_Forward.pdf

Subsidy-Free Solar

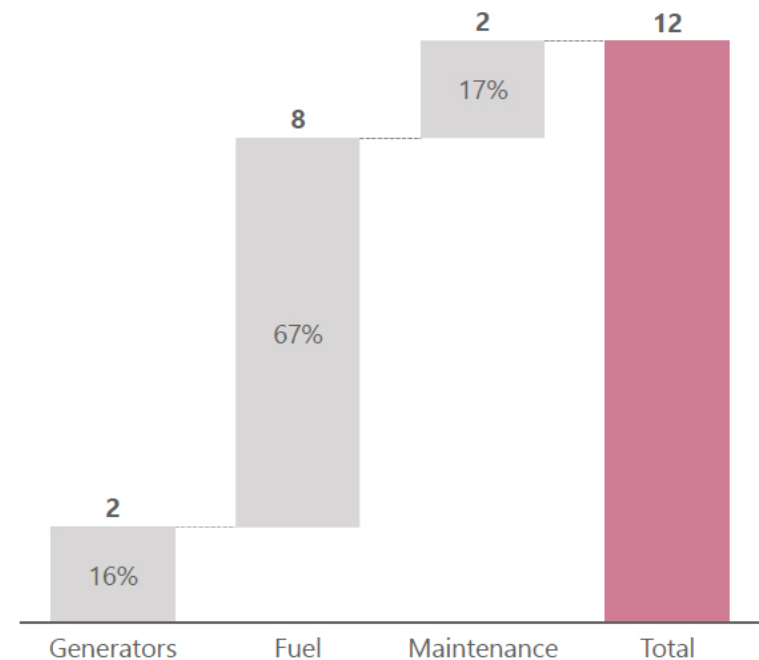
And yet:

1.5kVA generator costs approx.
USD \$150

Equivalent solar+storage
system costs USD \$2.500

Even if solar+storage systems
are cost-competitive (6-9 year
pay-back) the upfront cost
makes them too expensive for
most households

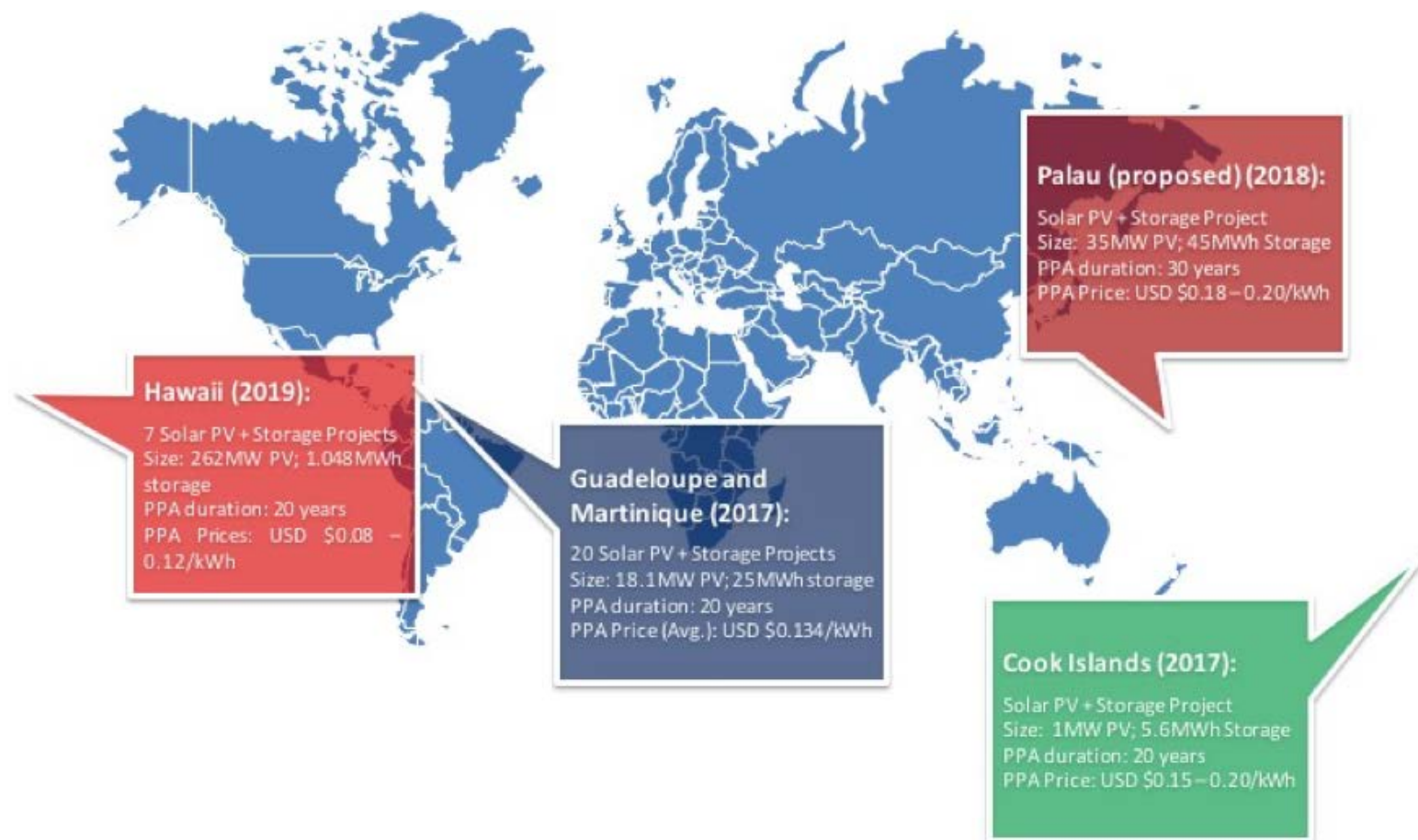
Total expenditure on small gasoline generators
USD billions, 2018



Source: https://africa-energy-portal.org/sites/default/files/2019-08/A2EI_Dalberg_Putting_an_End_to_Nigeria%e2%80%99s_Generator-Crisis_The_Path_Forward.pdf

Subsidy-Free Solar

1.b. Solar + Storage costs worldwide (utility-scale)



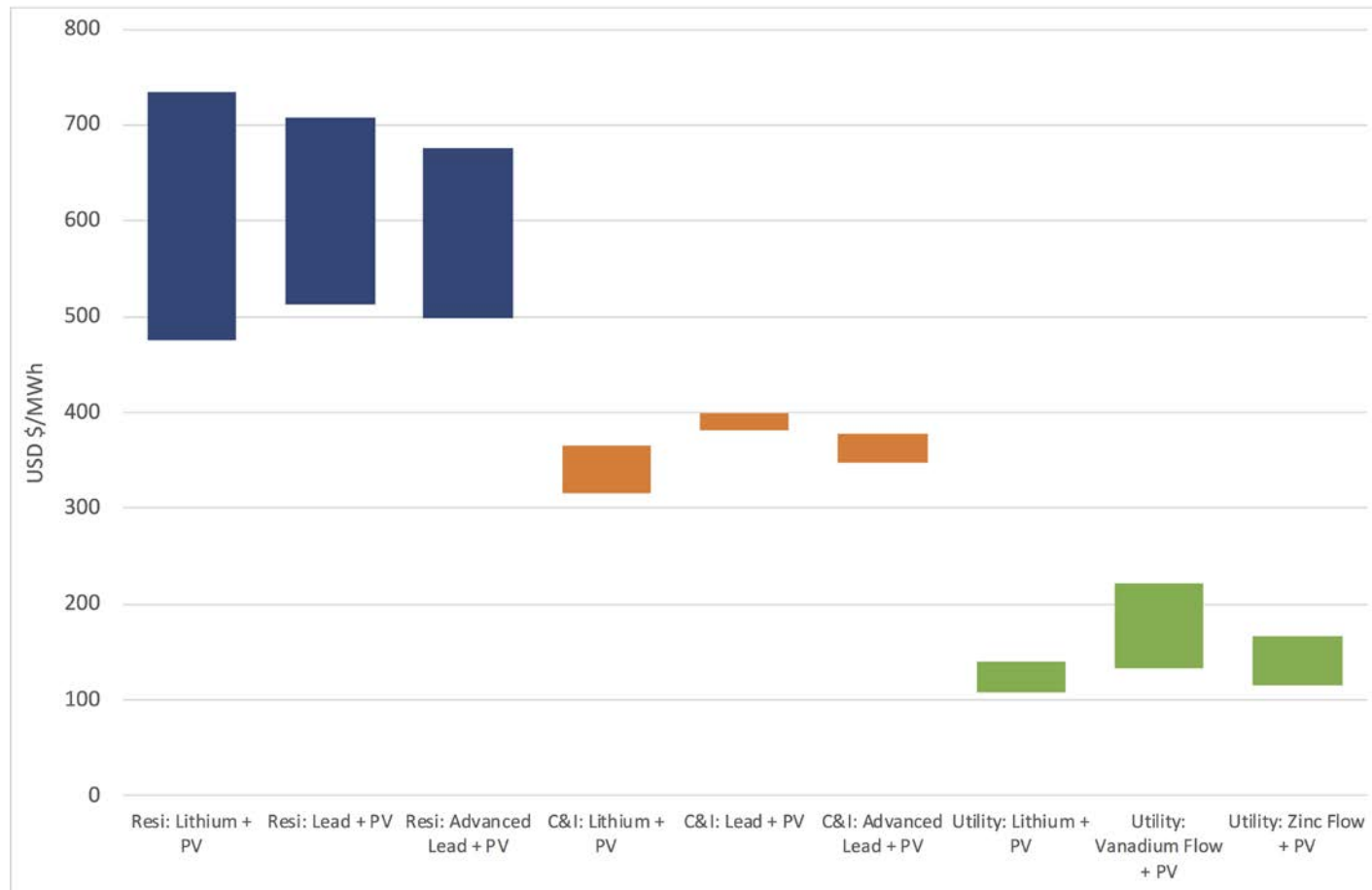
Subsidy-Free Solar

1.b. Solar + Storage costs worldwide (all 3 market segments)

Residential solar+storage still above electricity prices in most markets:

However, getting close in **Hawaii**, as well as in other island markets

Source: own depiction, based on Lazard 2018



Subsidy-Free Solar

Solar PV with storage is also starting to emerge as a cheaper way to supply remote communities, even without subsidies

Australia's national regulator recently found that solar+storage is cheapest way to maintain electricity access in remote communities



Source: <https://reneweconomy.com.au/off-the-grid-aemc-paves-way-for-stand-alone-systems-to-replace-poles-and-wires-44240/>

Photo: Sunrun

Subsidy-Free Solar

Once solar+storage is cost-competitive with grid supply, and can offer the same reliability as the grid, **all bets are off**

Challenges remain: upfront cost, operations & maintenance risk, battery replacement, etc.



Photo: Sunrun

4. Wholesale Market

Subsidy-Free Solar

Subsidy-free solar has started to emerge in a growing number of wholesale markets, notably in Europe

Broadly two types:

1. **Direct wholesale price competition** (often with partial PPA)
2. **Corporate or institutional PPA** (100% of the output sold to a corporate or other buyer)



Subsidy-Free Solar

In the deal announcements, it is sometimes unclear whether the project has secured a PPA, or whether it involves pure merchant sales

As such, the country examples to follow include a mix of both



Subsidy-Free Solar: Spain

- Spain has gone from “*European symbol of policy U-turns to the continent’s zero-subsidy hotspot*”
- 50MW PV plant near Madrid recently (July 2019) secured debt financing (roughly 50% debt, 50% equity)
- Another 50MW project (Aug 2019) is being developed near Seville: combined with a 12-year corporate PPA
- 79MW pure merchant project recently signed (August 2019) with 75% debt, 25% equity: power sold directly on the spot market

<https://www.pv-tech.org/news/subsidy-free-50mw-project-finds-lender-in-spain>

<https://www.pv-tech.org/news/baywa-r.e.-statkraft-team-up-for-spanish-subsidy-free-solar-successor>

Subsidy-Free Solar: Portugal

- Portugal has recently finalized the largest subsidy-free solar PV projects in Europe (September 2019)
- 221MW project, built via an international consortium



<https://www.pv-magazine.com/2019/06/26/europes-biggest-subsidy-free-solar-project-nears-completion-in-portugal/>

Subsidy-Free Solar: Italy

- Italy has recently seen 5 new solar PV projects with 64MW of installed capacity financed without subsidies
- Developers managed to secure project finance debt for the project without subsidies
- The developer is expanding to a range of other sites across the country

<https://www.pv-magazine.com/press-releases/octopus-completes-landmark-refinancing-of-subsidy-free-italian-solar-projects/>

Subsidy-Free Solar: Germany

- Germany has seen a few subsidy free projects signed in recent months
- 8.8MW plan (May 2019) signed via a long-term corporate PPA
- Project consists of an expansion of an existing project: less construction risk, guaranteed grid access, reliable off-taker, etc.
- Also, 500MW of solar PV being developed across a range of sites in Brandenburg and Meck-Pom
- And, EnBW announced a single 175MW PV project slated to start construction end-2019

<https://www.baywa-re.com/en/news/details/baywa-re-builds-first-subsidy-free-solar-park-in-germany/>

<http://taiyangnews.info/markets/agreement-for-500-mw-subsidy-free-solar-in-germany/>

<http://taiyangnews.info/markets/175-mw-subsidy-free-pv-park-for-germany/>

Subsidy-Free Solar: Cyprus

- Cyprus currently relies heavily on heavy-fuel oil and diesel to power its grid: currently 120MW of solar PV, targets of 360MW by end-2020
- PV used to rely on either net metering, FITs, or auctions: last round of auction yielded prices between EUR 7-10 cents
- New projects starting to be built relying strictly on the "variable avoided costs", which range from EUR 0.12/kWh to 0.046/kWh
- Similar to PURPA in the U.S: avoided cost pricing

https://www.solarpowerportal.co.uk/news/uk_to_join_europes_subsidy_free_solar_vanguard_in_2019

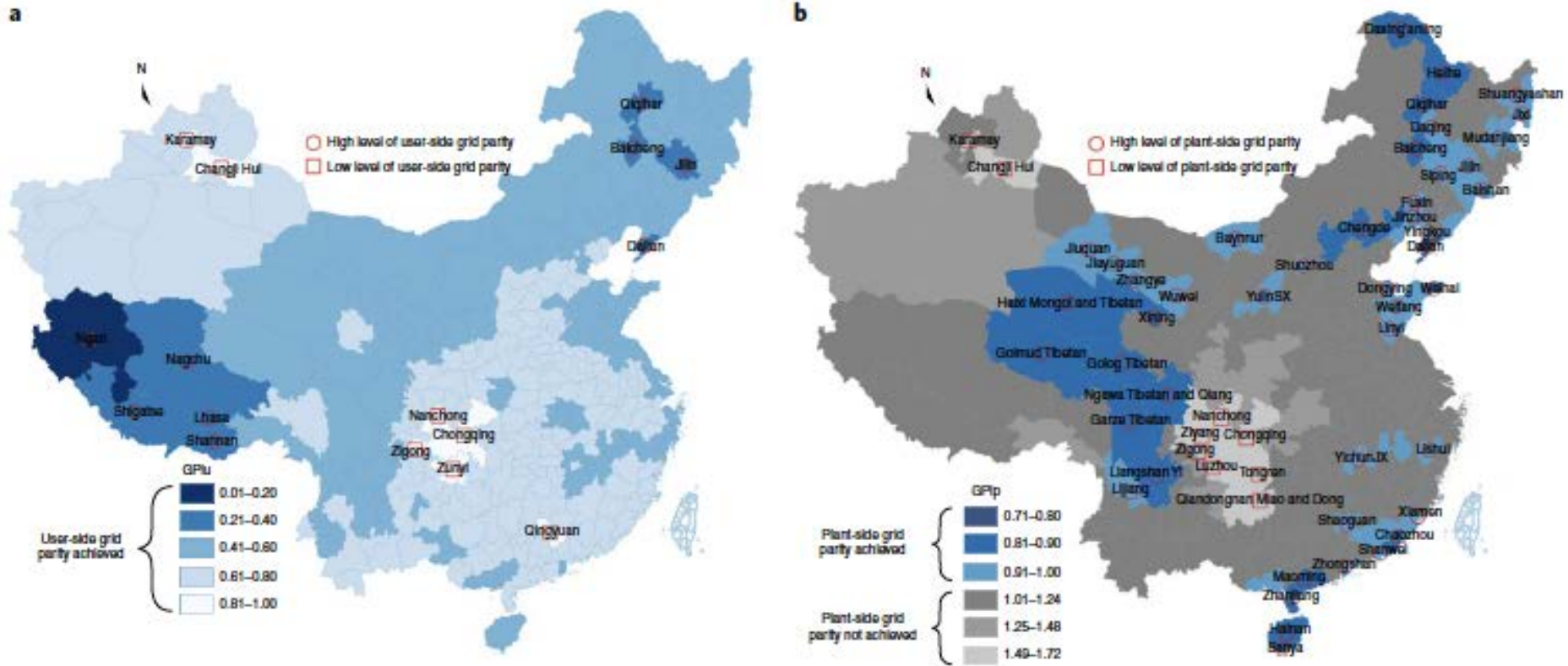
Subsidy-Free Solar: China

- China's National Energy Administration has published an 18-month roadmap to transition to unsubsidized solar PV
- Some projects are already going ahead outside of the official quotas
- Grid parity is increasingly widespread across the country

<https://www.pv-magazine.com/2019/04/11/china-enters-18-month-transition-to-subsidy-free-solar/>

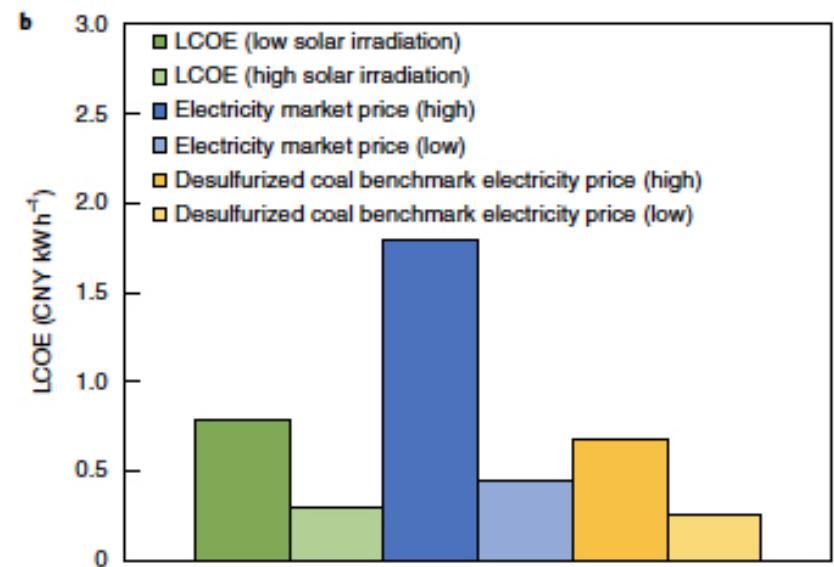
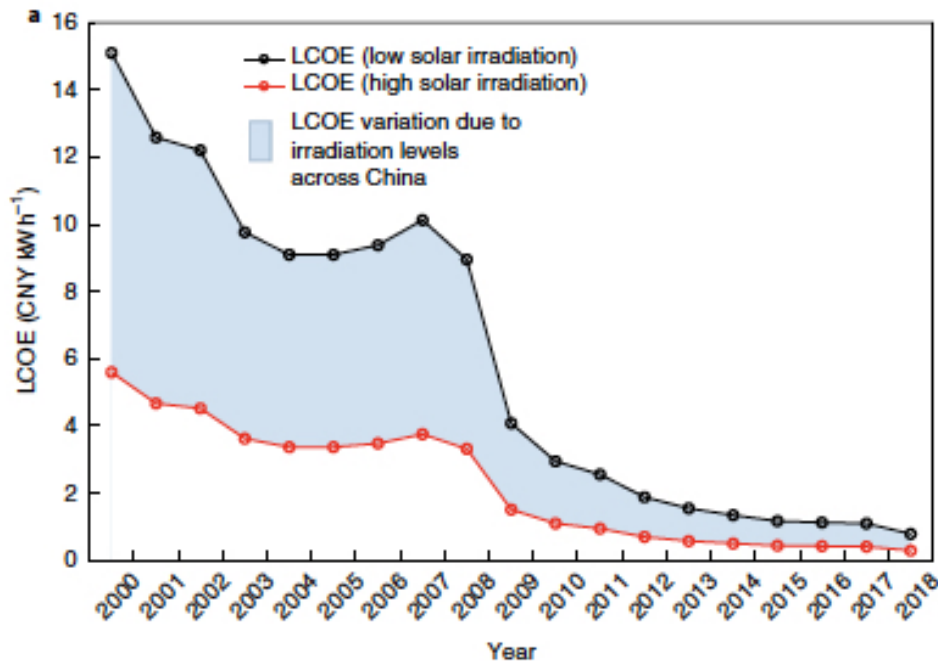
<https://reneweconomy.com.au/china-prepares-transition-to-subsidy-free-solar-and-wind-by-2021-2021/>

Subsidy-Free Solar: China



Jan et al. 2019. Nature Energy. <https://www.nature.com/articles/s41560-019-0441-z>

Subsidy-Free Solar: China



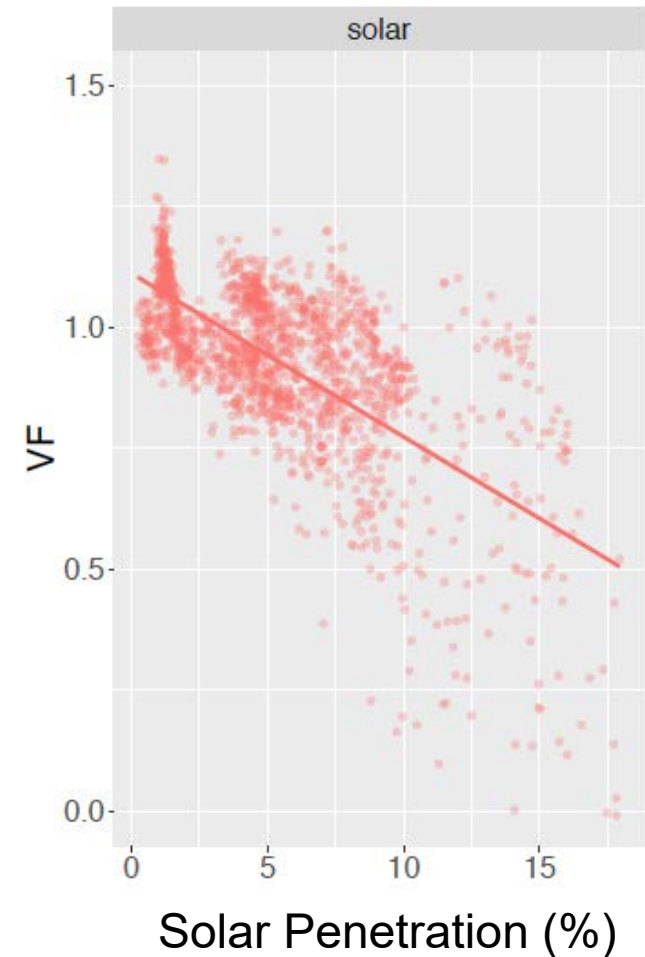
Solar PV is now broadly competitive with coal in China, even without pricing in externalities

Jan et al. 2019. Nature Energy. <https://www.nature.com/articles/s41560-019-0441-z>

4. Concluding Remarks

Challenges for subsidy-free solar remain...

- Rising shares of solar PV push wholesale market prices down
- "Cannibalisation effect"
- Raises problems for "subsidy-free" solar projects
- Most use hedging strategies: **hybrid PPAs with partial market exposure**



Source: https://www.eeg.tuwien.ac.at/conference/iaee2017/files/presentation/Pr_580_Lopez_Prof_Javier.pdf

Reflections on Subsidy-Free Solar

- Critical to keep the flow of low-cost finance to the sector open:
- It is unclear spot-market prices alone can provide the long-term investment certainty that the sector needs
- Solar must remain **bankable** (even if it's the cheapest source of new electricity supply!) (see **Session 18 on the Future of Solar Policy**)
- Whether wholesale markets alone can provide adequate revenues to support PV projects **at scale** remains to be seen

5. Further Reading

Further Reading

- Jacobs, D., Couture, T.D., Zinaman, O., Cochran, J., (2016). “RE-TRANSITION: Transitioning to Policy Frameworks for Cost-Competitive Renewables,” IEA-RETD, Paris. Available at: http://iea-retd.org/wp-content/uploads/2016/03/IEA-RETD_RE-TRANSITION.pdf
- IRENA, REN21, IEA (2018). Renewable Energy Policies in a Time of Transition, Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_IEA_REN21_Policies_2018.pdf
- Analysis of the Scope of Energy Subsidies and Suggestions for the G-20 Initiative (2010)., IEA, OPEC, OECD, World Bank Joint Report. Available at: https://www.iea.org/media/weowebiste/energysubsidies/G20_Subsidy_Joint_Report.pdf
- Can the Solar Industry Survive Without Subsidies (June 2018). The Economist. Available at: <https://www.economist.com/business/2018/06/14/can-the-solar-industry-survive-without-subsidies>

Thank you for your time!



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6. Knowledge Checkpoint: Multiple Choice Questions