



Cannibalization in Renewable Energies (Part I: Solar Energy)

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“ More and more, renewable energies are competing against each other, instead of against conventional energy sources

If you read the reports from major energy agencies and industry associations, you might be tempted to conclude there is a bright future where all types of renewable energies will flourish and coexist peacefully. Well, they will not. Much like in any other sector, some technologies will trump others. In this two-part article, we analyze how solar photovoltaic (PV) is beating concentrated solar power (CSP), and how offshore wind is doing the same to wave energy.

Borrowing the nomenclature from our good friends at Insead, the renewable energy sector is quickly moving from a blue to a red ocean. Solar and offshore are two striking examples of segments where different technologies compete for similar resources, investors and policy makers. Let's first look at the solar case:

In the 1980s, concentrated solar power (CSP) seemed set to beat solar photovoltaic power (PV). While the latter relied on expensive solar modules more often used in small consumer electronics than in power plants (Exhibit 1), the former used tried and true technology borrowed from coal plants in order to produce vapor and drive a turbine (Exhibit 2).



Source: Alan Radecki, Wikimedia Commons

Exhibit 1 - The 354MW SEGS CSP plant, built from 1984 to 1990 in California's Mojave Desert



Source: Sacramento Municipal Utility Distribution

Exhibit 2 - The 1MW Arco Solar PV plant, built in 1984 in Sacramento, the largest at the time

Twenty-five years later, the face of solar energy has changed dramatically. In 2010 PV had a global installed capacity of approximately 35 GW, compared with CSP's 1.5 GW (Exhibit 3).

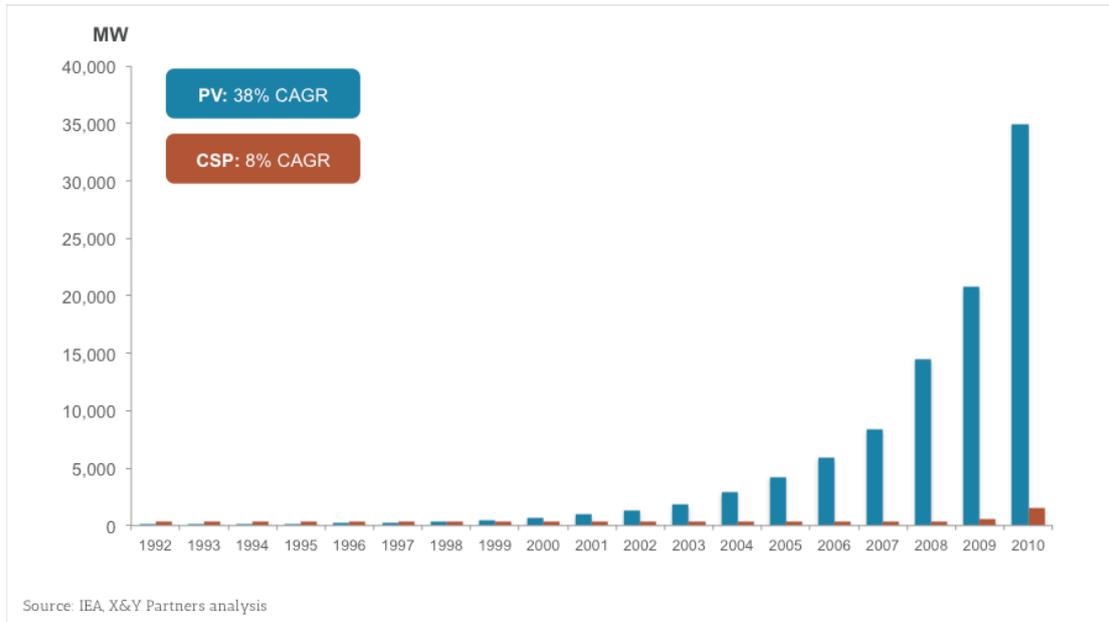


Exhibit 3 - Evolution of PV and CSP global installed capacity (MW)

Over the last years, we have had the privilege of working in these two sectors from multiple perspectives (supporting investors in selecting technologies and projects to invest on, helping start-ups in funding their ideas, and working with policy makers in defining incentive mechanisms) and believe that two factors have contributed the most for the dominance of PV over CSP:

- **Market size:** PV can be installed almost everywhere CSP can, but not the other way around. Current commercial CSP technology needs higher levels of irradiance (typically those of the sunbelt countries), access to water (just like a coal plant) and large-scale deployments (typically more than 20 MW, compared with the few kW of a residential PV system). This means that there are more tech companies, investors and policy makers interested in PV than in CSP (Exhibit 4);
- **Technological simplicity:** a PV system is like a quartz watch, whereas a CSP system is like a mechanical watch. The former revolves around the solar cell, while the latter is a combination of equally critical components. This has allowed the PV industry to focus on solving one issue – driving down the cost per Watt – while the CSP industry is spread across multiple challenges e.g. improving the optical efficiency of collectors, researching new heat transfer fluids or procuring higher efficiency turbines (Exhibits 5 and 6).

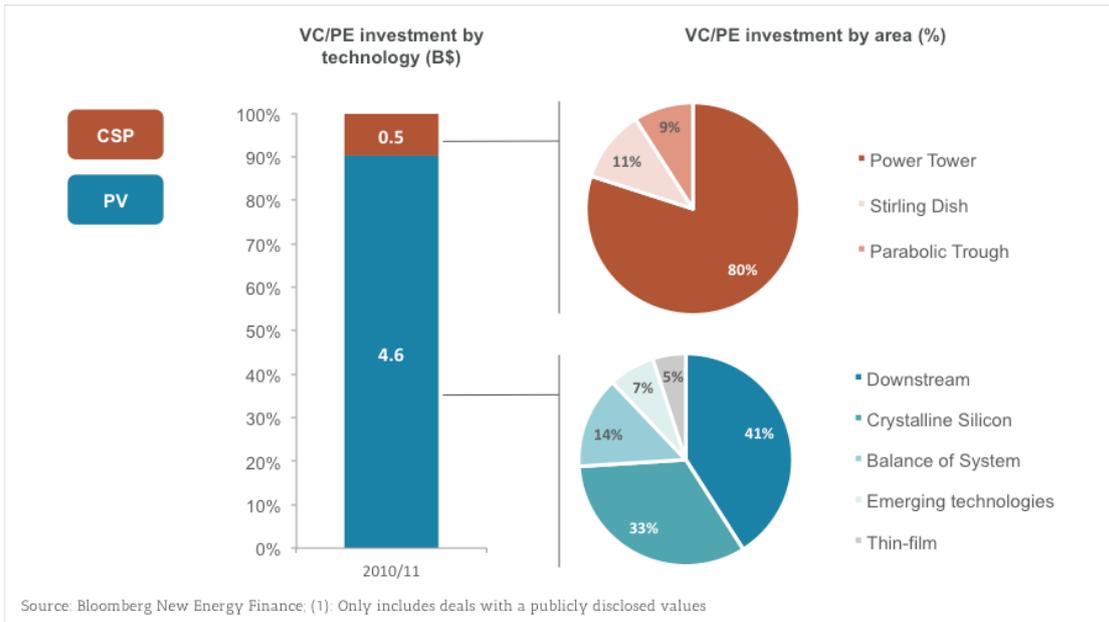


Exhibit 4 - Venture Capital and Private Equity investment in PV and CSP (2010/2011)



Exhibit 5 - Impact/Probability matrix for CSP technological developments

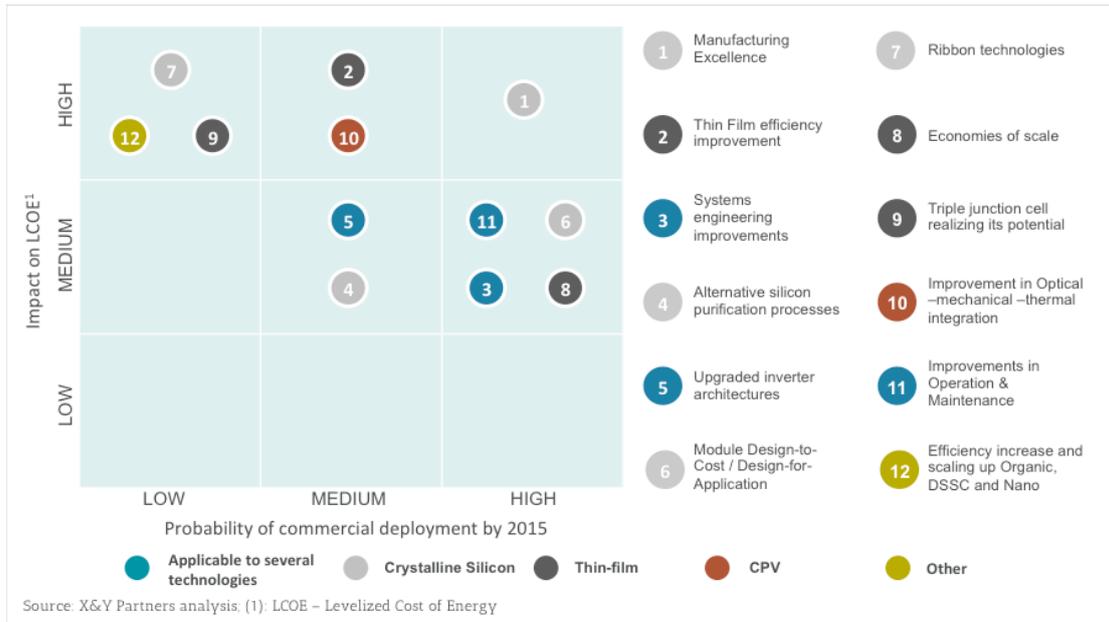
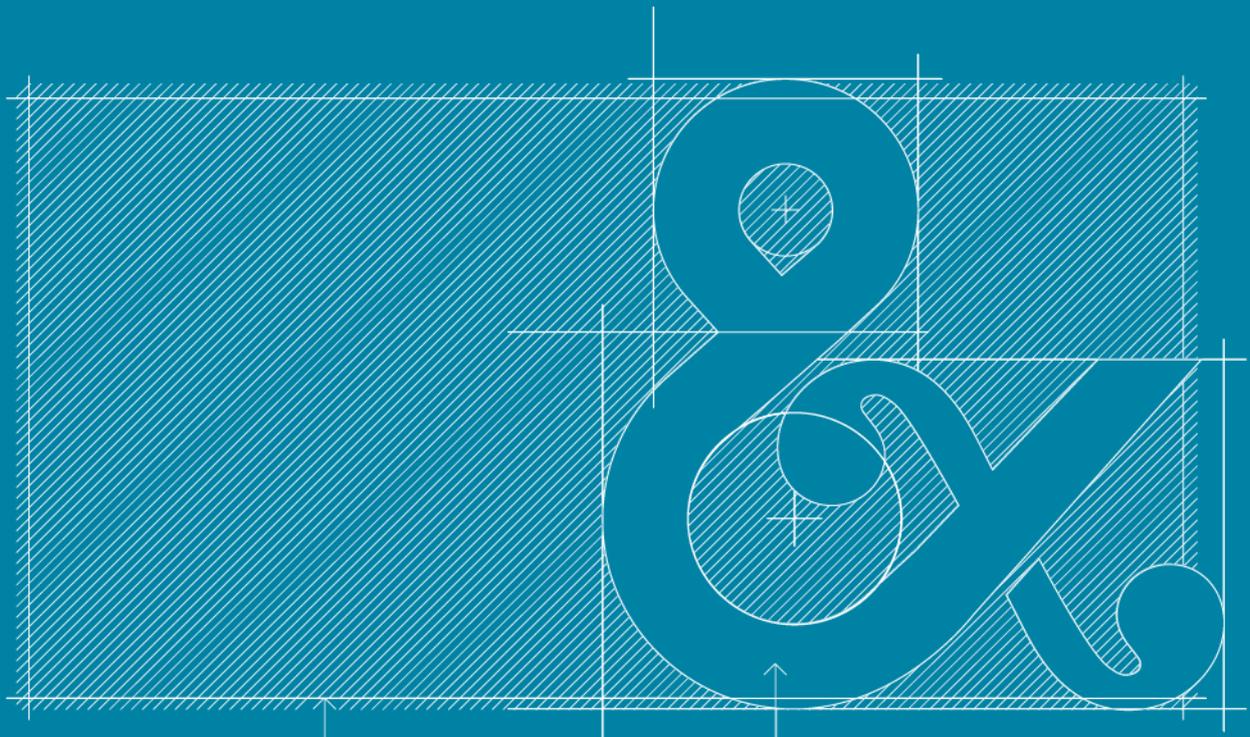


Exhibit 6 - Impact/Probability matrix for PV technological developments

Does this mean CSP will eventually disappear, trampled by PV? Not necessarily. CSP has one major advantage over PV: dispatchability. Current CSP plants can store thermal energy for up to 16 hours, which means that their production profile can match the demand profile (just like a conventional power plant). PV is not dispatchable, as a feasible commercial energy storage system does not yet exist. Dispatchability will be increasingly important when and where renewable energies achieve high penetration rates, so two things can happen: CSP becomes a commercially viable solution before a commercial PV storage system is developed, carving its own market segment; or the PV industry quickly solves the storage issue and becomes the solar technology of choice.

In the second part of this article, we look at the offshore market to analyze how wave energy and offshore wind are also competing for the same resources.



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