

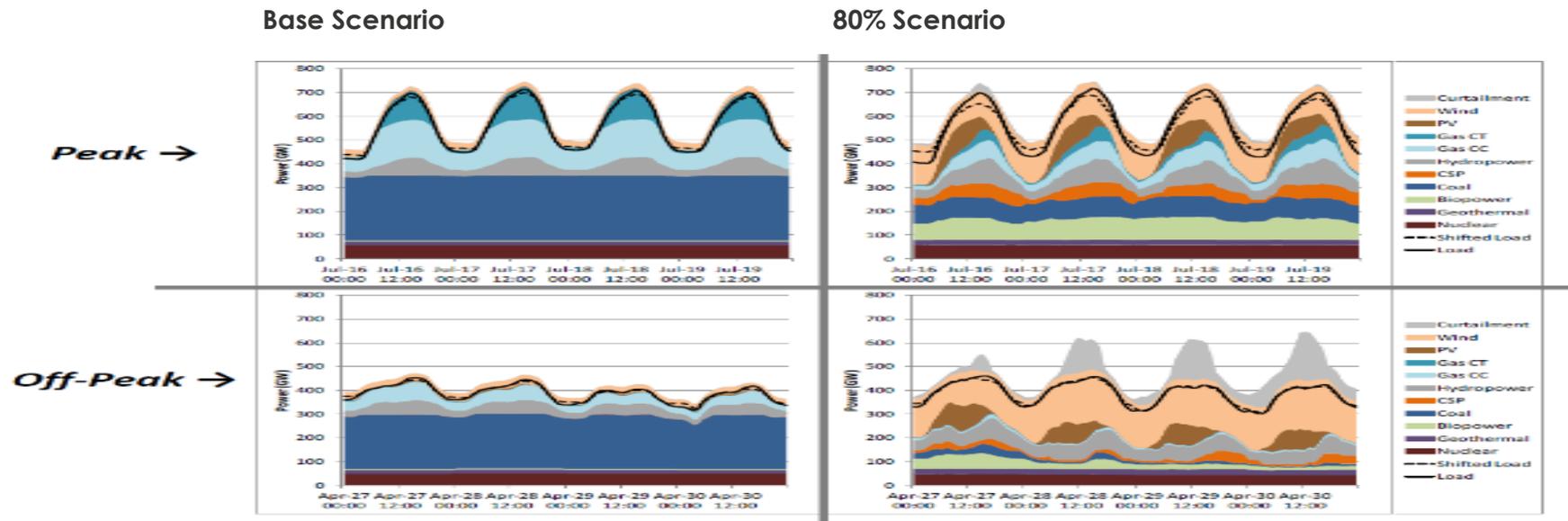
Technology Innovations Solar (PV): Grid Based

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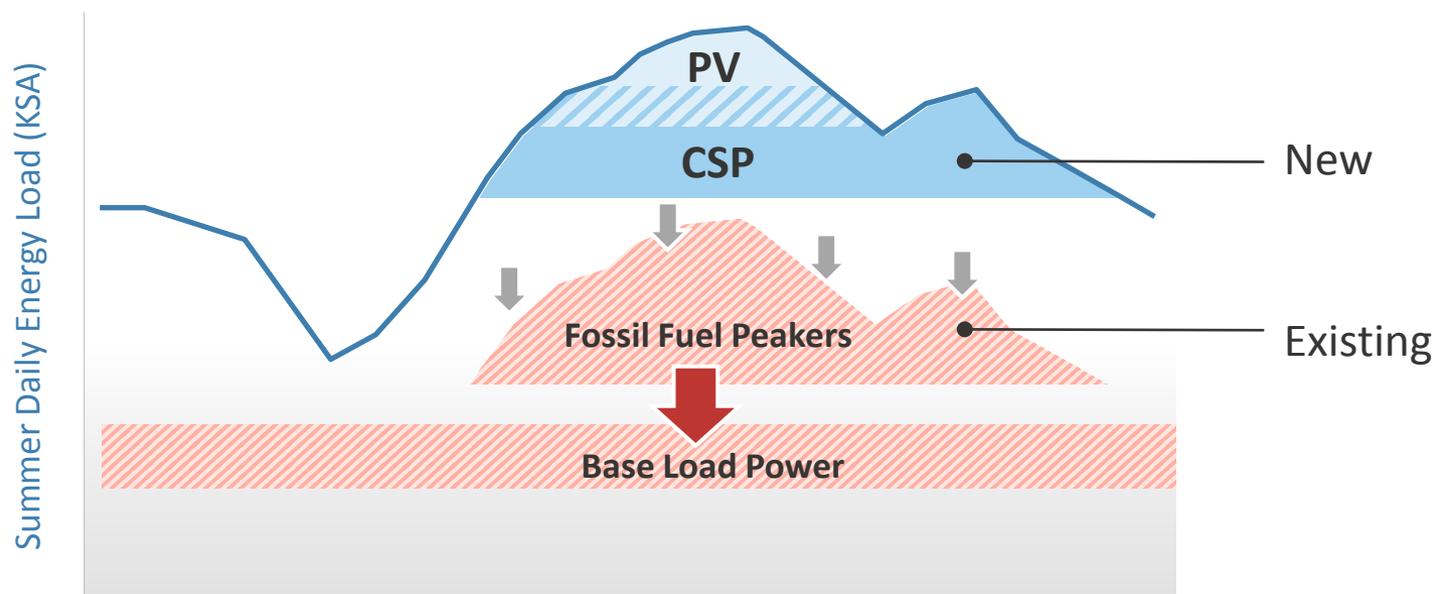


1. Flexibility needs to become a feature of future power systems. While the cost of PV has reduced significantly; given it's inflexibility how can we still take advantage of it?
2. Energy transition requires capital intensive investments but high cost of finance will make this transition more expensive. I.e.: High Cost of Capital could limit the pace of Renewable (and PV) uptake?
3. Just being cost competitive energy source is not enough as you need to contribute to other segments of the economy
4. Is economy of scale required to also capture manufacturing value and feed the job creation agenda.

- Experience in Germany shows that renewable penetration of 40% has little impact on grid.
- NREL Study 2013 of up to **80% Intermittent** Renewable scenario in USA concluded that cost impact can be contained in adjusting the grid to cope.



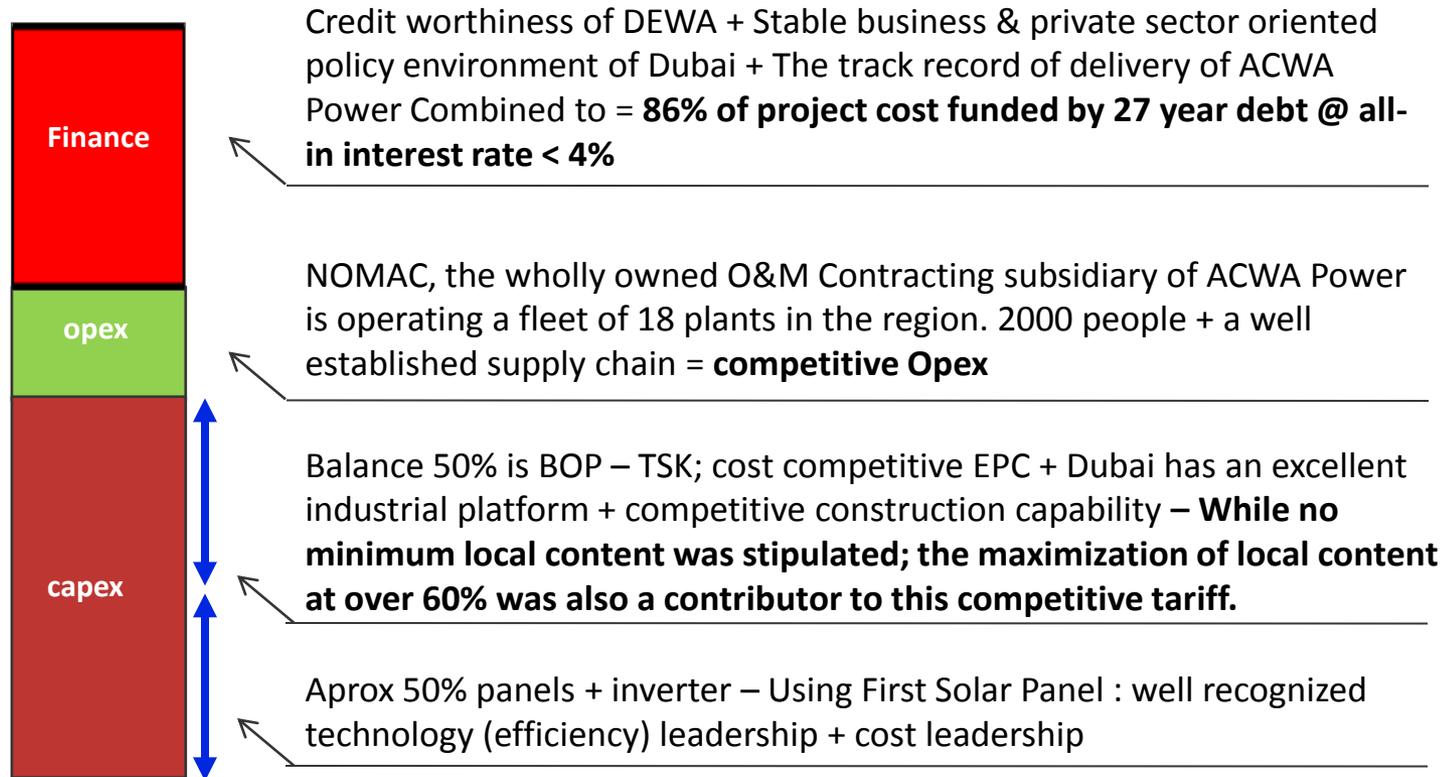
- In much of MENA and Africa PV when coupled with CSP can effectively serve the daily demand needs for 20 to 40% of the consumption.
- The typical load curve for a summer day in the Kingdom of Saudi Arabia illustrates this point.



- Given much of the penetration targets for year 2020 are below 40% the current focus should be on deploying renewables; there are a range of technical solutions that will help diminish the problem
- Generators frequency, capacity factor and ramp rate new capabilities
- Technical requirements for the PV plant inverters (capacity factor and frequency control)
- Grid planning and high resolution system simulators
- Advanced transmission facilities
- Demand response: Demand Side Management (DSM), smart grids
- Generation mix with complementary solutions such as integrating PV with CSP with storage.

Understanding cost divers – The US Cents 5.86/kWh tariff

How was this tariff achieved? – By taking advantage of each and every opportunity to drive down cost



DEWA's clear policy on renewable energy targets and their track record on maintaining stable policy environment is what contributed significantly to achieve this tariff.

- Quite apart from Fed rate and the country level risk rating; cost of financing is driven by many factors including
 - Policy stability
 - Self standing economic viability
 - Developer and supply chain reliability
- As renewables get efficiently deployed within a country, the track record will reduce the cost of finance. South Africa is an excellent example.
- But let us not underestimate the factor played by technology and construction costs on the tariff. While Capex is contributing approximately just over 50% of the tariff in PV, indirectly it is contributing more like 65% (as higher the capex the more funds are required).
- System efficiency is the other significant cost factor. A 2% increase in panel efficiency is equivalent to 50 bps increase in cost of financing.

3. 1 Renewable Energy Deployment as Enabler for Development⁰⁴

- Beyond the role adequate stable electricity supply plays in maintaining economic growth and contributing to social stability; meaningful levels of renewable energy deployment does also contribute to development.
- As PV is displacing more expensive (in many cases diesel driven) peaking power there is a net saving to the economy.
- Impact studies on the South African programme and the Moroccan Noor 1 project is showing:
 - Employment creation at a national level and more importantly at a local level;
 - Capacity building, skills development and entrepreneurship development; contributing to expanding future workforce.
 - Community development quite often at a very local level.
 - Industrial development which new product lines.
- While this is all very much work in progress; and there is considerable promise; much has been achieved.

- ACWA Power Experience on Noor 1 (CSP Plant and this was the first 160MW on a 500MW site and within a declared 2000MW programme)
- PV has two components that contribute to over 50% of capex; CSP also has a few components that contribute to just over 50% of capex.
- Noor 1 target was to achieve 30% local content. Project will be completed exceeding that target.
- Experience shows scale is of course helpful but attitude, willingness and being open minded are all bigger contributors.
- The starting position of an EPC Contractor to work within the zone of comfort and the established supply chain.
- A rigorous examination of local capability and capacity will show that many components can be manufactured even if for the first time at the required quality and to time with less risk locally and at lower overall cost.
- It is arguable if 2000MW is scale. But Noor 2 and 3 will end up achieving much higher local content rates; all being achieved with out compromising cost.

Thank you

