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PANELCLAW clawFRplus DUAL TILT AND SOLAREDGE DUO POWER OPTIMIZER: BETTER TOGETHER

by PanelClaw and SolarEdge

Introduction

Dual Tilt (East-West) rooftop PV systems are very common across Europe but represent only a small percentage of projects in the U.S. market where single tilt systems dominate. This difference is driven by practical, economic and geographic requirements.

The most persistent practical barriers are system design and installation due to stringing limitations with current technologies. Co-authored by PanelClaw and SolarEdge, this white paper shows how PanelClaw dual tilt racking and the SolarEdge Duo power optimizer work together to remove these barriers. This paper also outlines the roof area, structural, and racking cost advantages that make dual tilt worth a second look for commercial and industrial roofs in the U.S.

Advantages of rooftop PV systems built with clawFRplus Dual Tilt and SolarEdge Duo include:

01 | Total Energy

Dual tilt systems often maximize roof area utilization and system size (energy output). South-facing systems require larger gaps between rows to prevent self-shading, reducing the number of panels that can fit in the available roof area. Dual tilt systems minimize shading and provide the highest possible ground coverage ratio (GCR) for 10-degree tilt designs (the 'sweet spot' for rooftop PV today). The exception is when roof space is highly fragmented due to obstructions such as HVAC units and skylights. Dual tilt (DT) racking systems usually require the placement of two modules at a time whereas single tilt (ST) systems provide single module layout flexibility. As a result, single tilt configurations may enable equal or more modules when array layouts are broken up.

Consider two different sites to quantify the value of increased energy density – PVSyst was used for production simulations:

Sample system A (Massachusetts) – 118 kWdc ST vs 135 kWdc DT



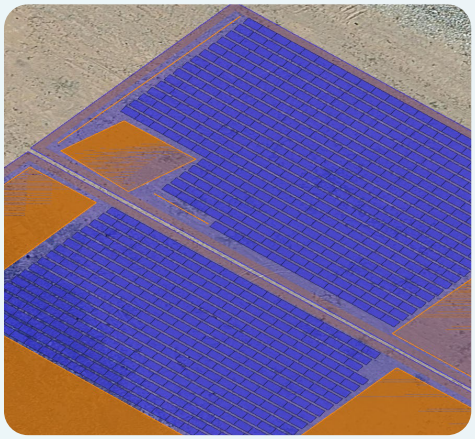
118 kWdc ST



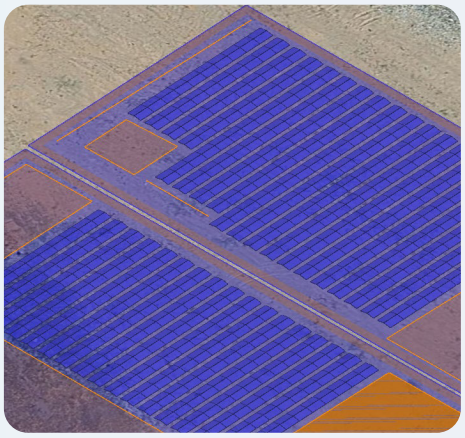
135 kWdc DT

With a greater DC capacity in the same rooftop area, DT system production exceeds ST production by **~8.2% per year.**

Sample system B (Texas) – 374 kWdc ST vs 408 kWdc DT



374 kWdc ST



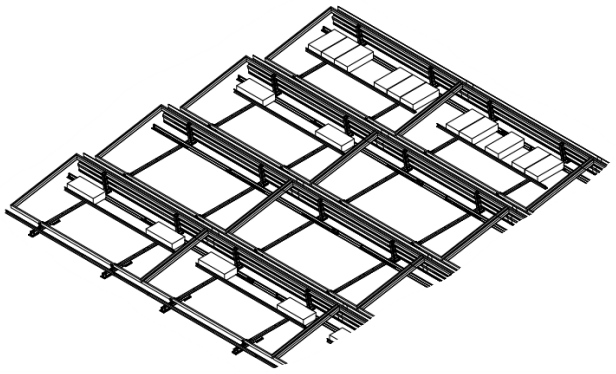
408 kWdc DT

With a greater DC capacity in the same rooftop area, the DT system production exceeds ST production by ~6.0% per year. The estimated value of the added production revenue is[1] **$1,700,000 ($5.6/W)** over 20 years.

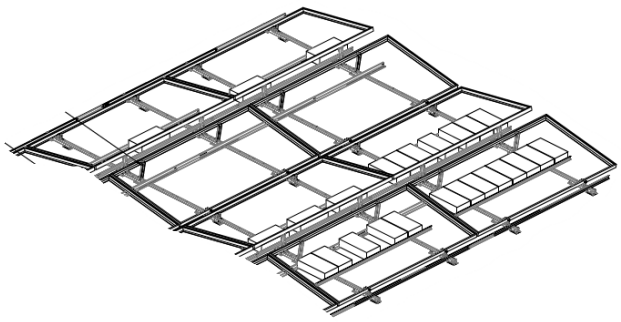
(1)Assumes $0.12/kWh PPA rate

02 | Structural Loading

Better aerodynamics: The hat shape of dual tilt systems minimizes wind loading and results in significantly lower ballast and attachment requirements compared to single tilt designs. Each module acts as a highly effective wind deflector. **If a building has strict roof-load limits, the aerodynamic profile of dual tilt may be the only viable engineering solution.** Sometimes, the orientation of roof structural members favors dual tilt systems because the racking 'feet' are rotated 90 degrees from their orientation in a single tilt setup.



Single-Tilt



Dual-Tilt

03 | Racking Cost Optimization

Lower balance-of-system costs: Dual tilt systems require less mounting material per installed kW than single tilt systems primarily because they exclude wind deflectors. Single tilt structures typically need wind deflection to reduce module wind loads. Wind deflectors are relatively costly system components due to their large size, especially when using today's commercial PV modules with lengths approaching 8 ft.

The potential CAPEX savings for the Texas sample system was calculated using a head-to-head cost breakdown of the equipment and estimated installation labor while maintaining the same yearly production output. Despite the addition of DC capacity to match energy yield, analysis shows an estimated CAPEX reduction of ~$8,700 (2.9¢/W) using DT.

System	Dual Tilt (East-West)	Single Tilt (South-Facing)
Modules	48 c/W AC	47 c/W AC
Racking	17 c/W AC	22 c/W AC
Inverters + Optimizers	17 c/W AC	17 c/W AC
Electrical BoS	8.1 c/W AC	7.3 c/W AC
CAPEX TOTAL	**90.1 c/W AC**	**93.0 c/W AC**

Straightforward installation: Some dual tilt racking systems are difficult to install but the clawFR platform design solves the mechanical challenges by enabling the installation of all racking components before modules, requiring no tools for module attachment, and facilitating installation and maintenance with its module tilt-up feature. Together, these features make dual tilt installation as simple as single tilt.

04 | Electrical System Design Benefits Unlocked by SolarEdge Duo

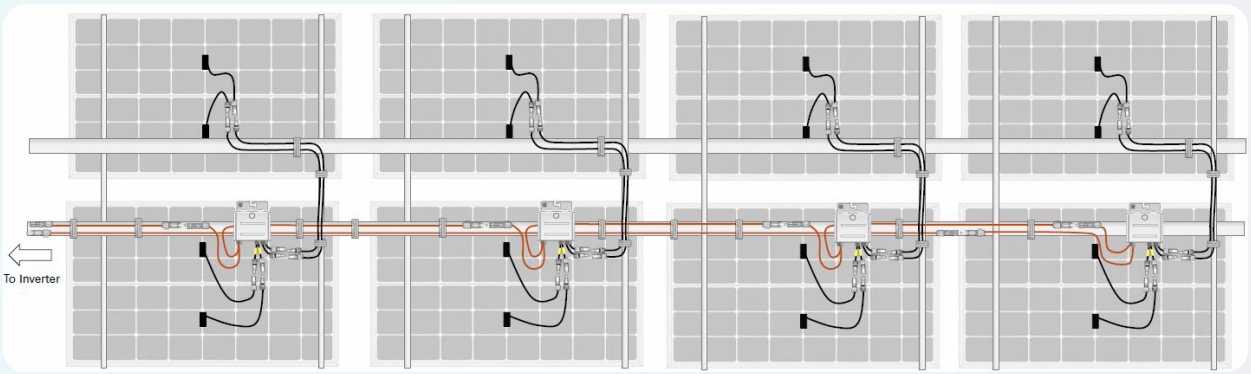
Designing and building electrical subsystems for dual tilt projects has been inherently more complicated than for single tilt designs. With a string inverter, east-facing and west-facing modules must be strung separately, a constraint single tilt systems do not face.

SolarEdge Duo eliminates this complication. Independent Maximum Power Point Trackers (MPPTs)[2] allow the east and west facing modules in a dome to share one optimizer while each module operates at its maximum power point. This capability unlocks three benefits only possible with Duo:

2 Each input features individual Maximum Power Point Tracking (MPPT), ensuring module-level optimization. Each MPPT stage supports up to 650W; however, certain operational limitations apply. For more details, refer to Application Note – Module-level Optimization in SolarEdge Duo Power Optimizer.

A. Strings like any other rooftop PV system

- **String inverter:** Strings must be all east or all west-facing modules.
- **With Duo:** Optimizer strings are built as on any other rooftop PV system, one optimizer per dome (1 east + 1 west).

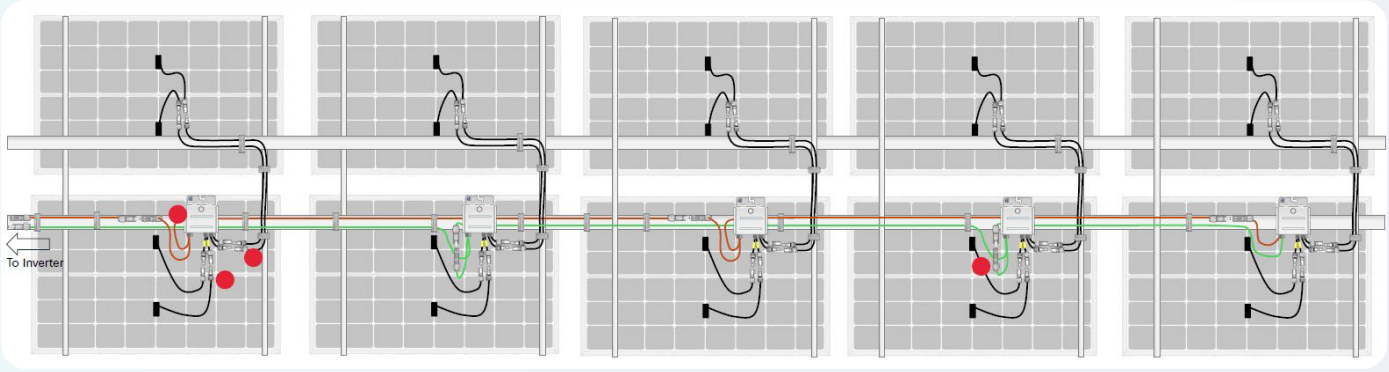


Typical Duo optimizer stringing on Dual tilt array

B. Skip-stringing for lower homerun cost

- **String inverter:** Homeruns return from opposite ends of each string.
- **With Duo:** Skip-stringing on large, clean arrays cuts homerun cost by around 66%

With Duo optimizers close together on PanelClaw's dual tilt racking system, a string can skip every other optimizer on the way out and pick them up on the way back, so homeruns start and end on the same side:



Skip-stringing with Duo Optimizer on Dual tilt array

Estimated homerun cost on a clean rectangular dual tilt array[3]:

Homerun BoS	Cost ($/Wdc)	vs. String Inverters
String Inverters	$8.0	Baseline
SolarEdge Duo, traditional stringing	$5.1	36% lower
SolarEdge Duo, skip-stringing	**$2.7**	**66% lower**

[3]Assumes $1.0/ft #8Cu PV wire.

Summary

Core Metrics of Single Tilt and Dual Tilt Systems

Metric	Single Tilt (South-Facing)	Dual Tilt (East-West)
Performance	High Specific Yield (kWh/kWp)	High Energy Density (kWh/sqm)
System Production	Limited by Shading Gaps (Walkways)	Maximized (Highest GCR)
System Weight (Roof Loading)	High Wind Uplift / High Ballast, More Attachments	Aerodynamic / Low Ballast, Fewer / No Attachments
SolarEdge Duo Advantage Over Traditional String Inverters	Maximize Energy Production, BoS Savings	Maximize energy production, further BoS Savings due to simpler stringing and skip-stringing

Dual tilt rooftop PV systems offer several compelling advantages over single tilt systems, and SolarEdge Duo makes dual tilt electrical design and installation as simple as single tilt. If you are developing C&I rooftop PV projects that may benefit from the advantages outlined in this paper, **contact your PanelClaw and SolarEdge sales representatives to learn more.**