

Milwaukee® Tool's Controlled Torque Impact Wrench with TORQUE-SENSE™ saves 27.1 person-hours per MW in tests on Nevados' TRACE™ All Terrain Tracker®

Smart tool offers up to 3x faster installation of bolts on utility-scale solar projects

Executive summary

A new smart impact wrench from Milwaukee® Tool can save solar installers 27.1 person-hours per megawatt, independent testing on Nevados trackers has found.

Nevados in August 2024 became the first solar tracker OEM to formally test and qualify the Milwaukee® M18 FUEL Controlled Torque Impact Wrench (CTIW) with TORQUE-SENSE™ technology on the state-of-the-art Nevados TRACE™ All Terrain Tracker®, in an independent study by Eclipse-M.

The innovative tool employs machine learning to finetune its performance, eliminating the traditional two-step torquing method and delivering up to 3x faster installation speeds of bolts on utility-scale solar projects, Eclipse-M reported.

The wrench saved approximately 27.1 person-hours per MW on the Nevados system, offering substantial reductions in labor costs while enhancing the reliability and repeatability of solar installations by ensuring that fasteners are torqued to the right specification, based on results obtained at a 400+ MW site.



Figure 1: Technicians utilizing Milwaukee's CTIW on the Nevados tracker in the field



Background

Nevados' TRACE™ All Terrain Tracker®, recognized for its superior performance on challenging and undulating terrains, was selected for the testing. It took place at the PVUSA test site in Davis, California, and a 400 MW solar project in, Utah.

Driven by a commitment to provide the best solar tracker solutions, Nevados collaborated with Milwaukee® on this initiative to explore how the CTIW would enhance the installation experience for our customers.

Milwaukee® Tool enlisted Eclipse-M, a team of solar industry veterans with over 80 years of combined experience, to conduct a third-party assessment of their revolutionary M18 FUEL™ Controlled Torque Impact Wrench, developed specifically for the solar industry.

The smart tool features Milwaukee's TORQUE-SENSE™ technology to ensure unparalleled consistency in maintaining target torque. It uses new sensors developed inhouse, a gyroscope, and sophisticated machine learning algorithms to automatically account for variation commonly seen on solar jobsites and deliver best-in-class torque repeatability.

Every trigger pull is logged, and the data can be downloaded for customizable reporting, ensuring precise and confident installations.

It's ideal for utility-scale solar projects, where Milwaukee® says eliminating the two-step torquing method can deliver up to 3x faster installation speed. The two-step process involves an initial tightening with a standard impact wrench which is uncalibrated, followed by often considerable effort to finish the torque process with a click-wrench, or worse, over-torquing which is hard to measure. However, with the CTIW, torquing is quicker, more reliable, and consistently repeatable, unaffected by the operator's level of expertise.

Nevados has approached this collaboration by establishing suitable and achievable torque targets and addressing hardware quality and product design that supports obtaining these results.



Methodology

Testing focused on the midrange CTIW unit, capable of delivering 50–150 ft. lbs. of torque. The target torque range for TRACE™ installations was set between 92–120 ft. lbs., and three different types of joints in the Nevados trackers were tested, specifically on the couplers:

- White: Upper cradle bolts (loaded plate joint)
- Yellow: Lower cradle bolts (spring joint)
- Green: Bearing assembly (BA) to post bolts (loaded plate joint)

Quality assurance checks were performed using a Desoutter Q-Shield digital smart torque wrench, which measured residual torque per angle to ensure all joints were tightened to within specifications.

The performance evaluation was conducted in two phases:

1. Feasibility assessment: An initial go/no-go assessment at the PVUSA testing site in Davis, California.
2. Extended production testing: In-depth testing at a 400 MW site in Utah, featuring the Nevados tracker in collaboration with the installation subcontractor and EPC (Engineering, Procurement, and Construction) firm.

Results

PVUSA site: Excellent performance

The impact wrench demonstrated excellent performance at the PVUSA testing site, according to the EPC and owner, consistently delivering torque within the target range of 92–120 ft. lbs. to pass the initial feasibility assessment with flying colors. The CTIW's accuracy remained consistent, and the transfer of calibration between tools was seamless.

The White and Green joints were suitable for a standard one-step application, while the Yellow spring joint by virtue of its design, required a double cycle of the CTIW to achieve the desired torque result, and finish with a click wrench.

Utah site: Promising preliminary results

Extended production testing at the customer site in Utah is currently ongoing, with promising preliminary results. The CTIW has been successfully used across 10s of MWs of production, with zero reported torque failures during block QA, proving the robustness of the tool.



Instances of results falling below 92 ft. lbs. were minimal, typically within a 5% margin of measurement error, and considered to be within spec.

Labor savings: 27.1 person-hours per MW

The CTIW reduced TRACE™ All Terrain Tracker® installation time an average of 26.1 seconds per bolt for the three applications. With 3,629 bolts per MW, this translates to an estimated labor savings of 27.1 person-hours per MW*, a significant efficiency gain.

Eclipse-M found the tool to be 3.4 times faster than torquing methods observed, validating Milwaukee's claim of up to 3x faster fastener installation speeds.

The Green and White joints were 344% faster to install compared to conventional methods, while the Yellow joints were still 335% faster, despite requiring a double cycle of the CTIW.

*Note: This calculation assumes 84 S7 First Solar modules at 550 W per row, with 21.6 rows per MW, and 168 bolts per row.

Conclusion

Milwaukee's CTIW has proven to be an invaluable tool for improving the efficiency and reliability of solar tracker installations. The Milwaukee® Controlled Torque Impact Wrench's performance across both testing sites indicates significant labor savings, with an estimated 27.1 person-hours saved per MW. The smart tools' ability to cut installation times by 26.1 seconds per bolt led to a 3.4-fold increase in installation speed, confirming Milwaukee's claim of up to 3x faster performance.

Nevados undertook this effort in line with our philosophy of collaboration and exceptional service, aiming to deliver greater value to our customers. Now officially qualified for use with the TRACE™ system using appropriate QA methods, the Milwaukee® CTIW allows solar installers and EPCs to achieve faster, more reliable installations, contributing to the overall constructability and cost-effectiveness of utility-scale solar projects.

This qualified smart tool further solidifies Nevados' TRACE™ All Terrain Tracker® as the industry leader, providing up to 38% overall faster installation times compared to three other leading trackers studied by Eclipse-M.

To learn more about how our second-generation TRACE™ solar tracker and the CTIW smart tool can optimize your solar installations, contact our team of experts today.