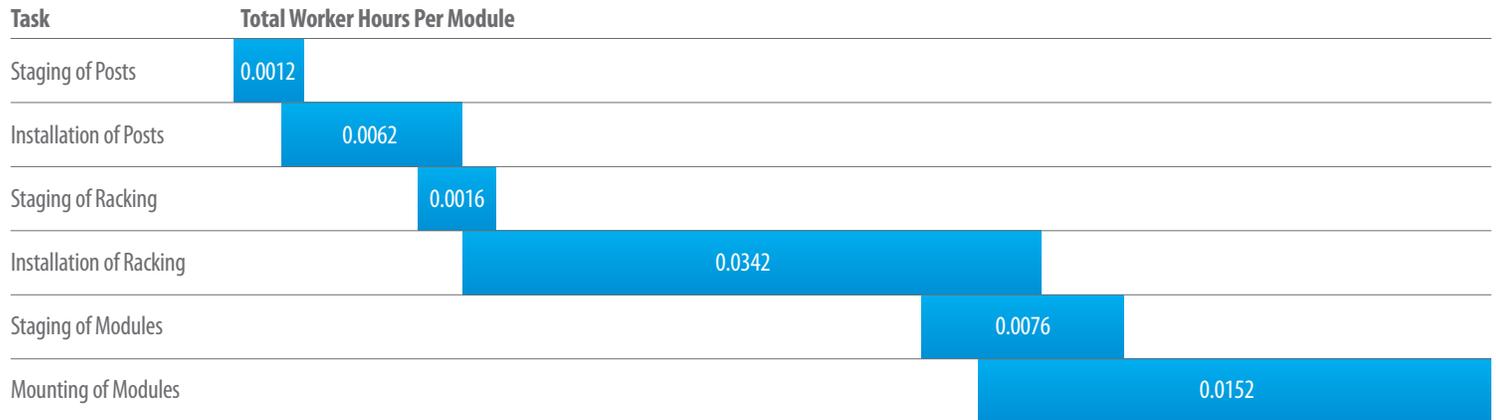


MAXSPAN™ SYSTEM INSTALL WITH TWISTCLAMP™ AND PREASSEMBLED A-FRAME



Modules: Polysilicon framed modules 430 Watts
 Site Conditions: Flat to slightly rolling topography
 Wind: 97 mph ASCE-5 Snow: 15 psf
 Design Specifications: 54.7 MW, 20 degree tilt, 5', 6' and 8.5' embedment depth for posts. 238.8 posts per MW average

STUDY RESULTS:

**Complete install rate including moving materials from staging area:
 .0648 worker hours per module equivalent
 Complete install rate with 20 workers per week: 4.510 MW**

ABOUT THE STUDY

The following time study project was conducted to develop a valid assessment of the work content of the labor related to installation tasks in terms of hours spent on each task and total hours spent per module equivalent for installation of the completed system. The study was conducted by interviewing site supervisors and other industry professionals regarding workplace production on hourly and daily basis with employees assigned to perform specific tasks as well as by timed studies of both GameChange Solar (“GCS”) and other personnel observed. Hours noted were based on a 6.8 hour workday. The study analyzes each operation in terms of completed units, each unit being one installed module equivalent. Please note that installation rate may vary from site to site and installer to installer. It is advisable to receive training from GCS personnel for first time installers of GCS systems.

Installation of the MaxSpan™ System included installation of posts, racking, and mounting of modules. A previously conducted time study from a group of projects totaling 54.7 MW was utilized for the installation rates for posts and racking. The study was adjusted to actual rates derived from a timed installation under similar working conditions for module installation reflecting time savings from utilizing preassembled TwistClamps™ for module mounting, which include self-grounding clamps with integrated teeth, eliminating need for star washers (for grounding). The study was further adjusted to include estimated time savings for staging and racking utilizing preassembled A-frames. In addition, the per MW installation rates have been adjusted as if using current 430 watt modules.

STUDY DETAILS

The employee work hours were studied relating to six principal tasks.

Task 1: Staging of Posts

This task consists of staging channel posts at marked locations throughout the site. One team of three workers conducted layout of 1,300 posts per 6.8 hour work day, one worker driving tracked skidsteer backwards, other two workers unloading posts at rooster tail flag locations.

Worker hours per module equivalent for post, which supported 13.443 modules average:

$$\begin{aligned} &= (3 \text{ workers} \times 6.8 \text{ hours} \times 244.8 \div 1,300) \div \\ &(244.8 \text{ posts} \times 13.443 \text{ modules per post}) \\ &= 0.0012 \text{ worker hours per module equivalent} \end{aligned}$$

Task 2: Installation of Posts

This task entailed driving channel posts at marked locations on the site. Post driving team of one post driving machine operator and two workers drove posts at rooster tail flag locations and moved to next post location at rate of 1 minute and 40 seconds per post average, or 244.8 per 6.8 hour work day.

Worker hours per module equivalent for post, which supported 13.443 modules average:

$$\begin{aligned} &= (3 \text{ workers} \times 6.8 \text{ hours}) \div (244.8 \text{ posts} \times 13.443 \text{ modules per} \\ &\text{post}) = 0.0062 \text{ worker hours per module equivalent} \end{aligned}$$

Task 3: Staging of Racking

This task consists of staging racking at marked locations throughout the site. One team of three workers did layout of 640 beams and braces in half on one 6.8 hour work day, one worker driving tracked skidsteer backwards, other two workers unloading posts at post locations. One team of three workers did layout of 6 MW (20,275.5 module equivalents) of purlins, purlin angles and other components in one 6.8 hour work day, one worker driving tracked skidsteer backwards, other two workers unloading between post locations. Utilization of preassembled A-frames was estimated to save 24.77% of the time required for both staging and installation due to a reduction in part count on the BOM of 49.54%.

Worker hours per module equivalent for movement from staging area of racking:

$$\begin{aligned} &= ((3 \text{ workers} \times 3.4 \text{ hours}) \div (640 \times 13.443 \text{ modules}) \\ &+ (3 \text{ workers} \times 6.8 \text{ hours}) \div (20,275.5 \text{ modules})) \times 0.7523 \\ &= 0.0016 \text{ worker hours} \end{aligned}$$

Task 4: Installation of Racking

Two worker crews installed 640 sets of beams and braces per 6.8 hour workday (8,603.7 module equivalents). Six four worker crews installed 1.1 MW (3,717 module equivalents) per day purlins, purlin angles and other components. First crew attached purlins, next crew attached purlin angles and other components finger tight and the final crew did alignment, squaring, torque to specification and torque marking. Utilization of preassembled A-frames was estimated to save 24.77% of the time required for both staging and installation due to a reduction in part count on the BOM of 49.54%.

Worker hours per module equivalent for installation of racking:

$$\begin{aligned} &= (2 \text{ workers} \times 6.8 \text{ hours}) \div (8,603.7 \text{ modules}) \\ &+ (24 \text{ workers} \times 6.8 \text{ hours}) \div (20,275.5 \text{ modules} \times 1.1 \div 6) \times 0.7523 \\ &= 0.0342 \text{ worker hours} \end{aligned}$$

Task 5: Staging of Modules

This task entailed moving from staging area. Staging of modules took 0.0076 worker hours based on 10% of total time for staging and installation.

Worker hours per module equivalent for staging of modules:

$$\begin{aligned} &= ((24 \text{ workers} \times 6.8 \text{ hours}) \div (2,160 \text{ modules})) \times 10\% \\ &= 0.0076 \text{ worker hours} \end{aligned}$$

Task 6: Mounting of Modules

This task entailed mounting modules onto purlins. Two workers carry the module, place it on the top, then slide it under the TwistClamps™. One worker uses programmable impact driver (pre-programmed to the required torque) on the TwistClamp's pre-attached serrated flange nut which secures and grounds the module. The workers then retrieve the next module and repeat the steps for the bottom module. Two workers installed one module every 18.25 seconds, or 670.7 modules per worker per day. However, these numbers were reduced for purposes of the time study by 33% to 447.1 per worker per day to factor in worker fatigue.

Worker hours per module equivalent for mounting of PV modules:

$$\begin{aligned} &= (2 \text{ workers} \times 18.25 \text{ seconds}) \times 1.5 \div (60 \times 60 \text{ minutes}) \\ &= 0.0152 \text{ worker hours} \end{aligned}$$