

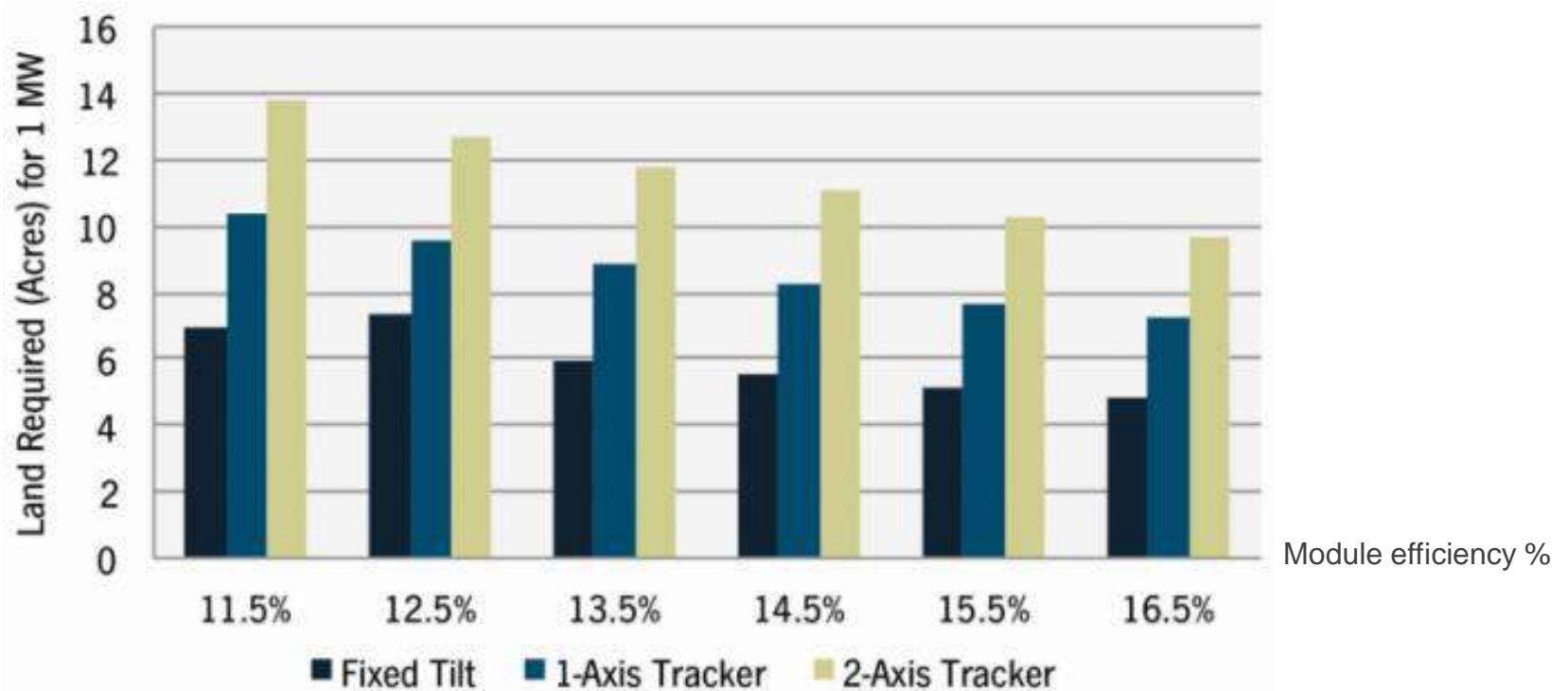
Tracker Insight: The Future of Large Scale Solar?



How Much Land Do You Need for Tracker

- Tracker requires about 50% more land than fixed tilt

Land Requirements by Mounting Structure Type & Module Conversion Efficiency

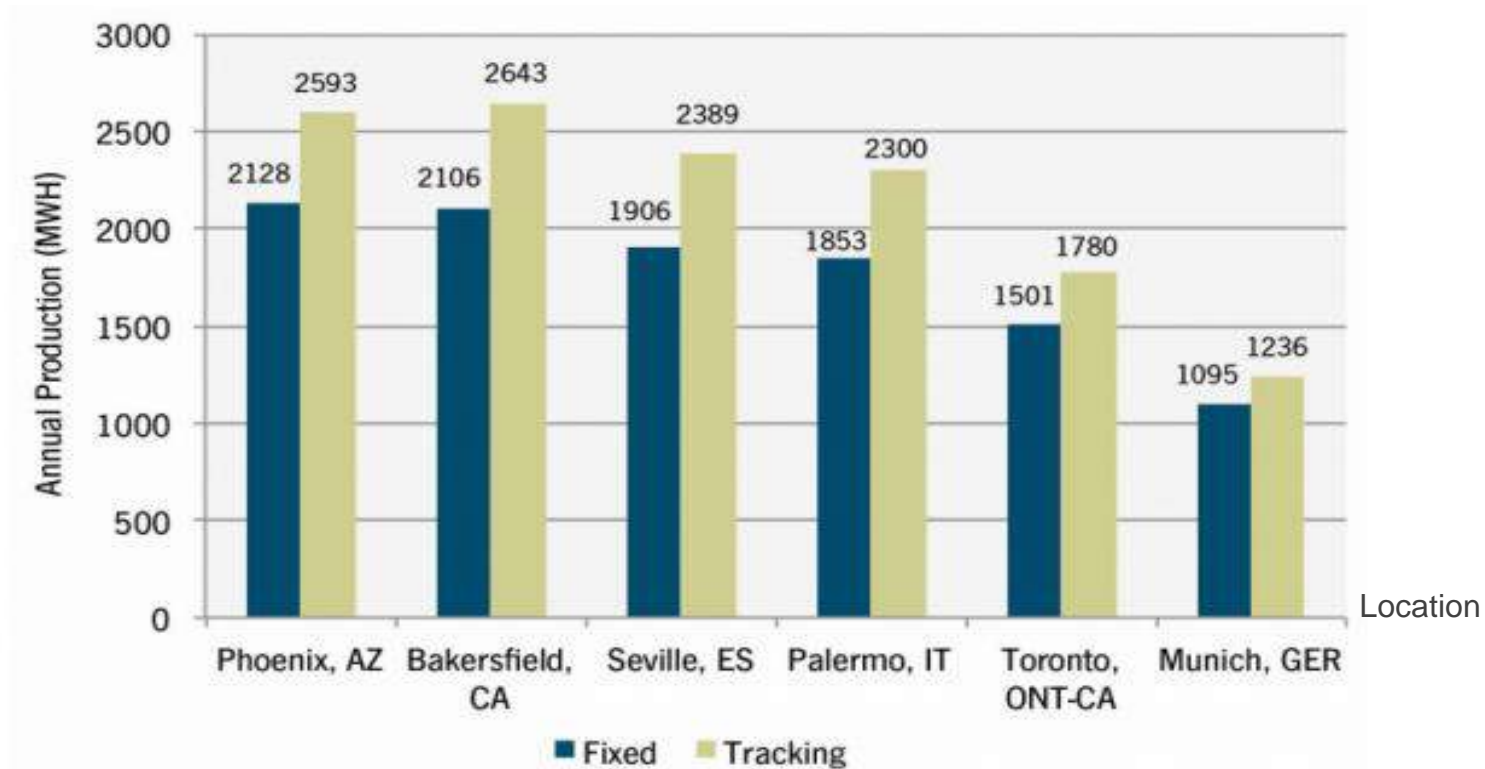


Source: Solar PV Balance of System (BOS) Markets: Technologies, Costs and Leading Companies, 2013-2016

Tracker and Fixed Tilt Energy Comparison

- Single axis tracker produces about 20% more energy
 - Depends on location (direct normal irradiation (DNI))

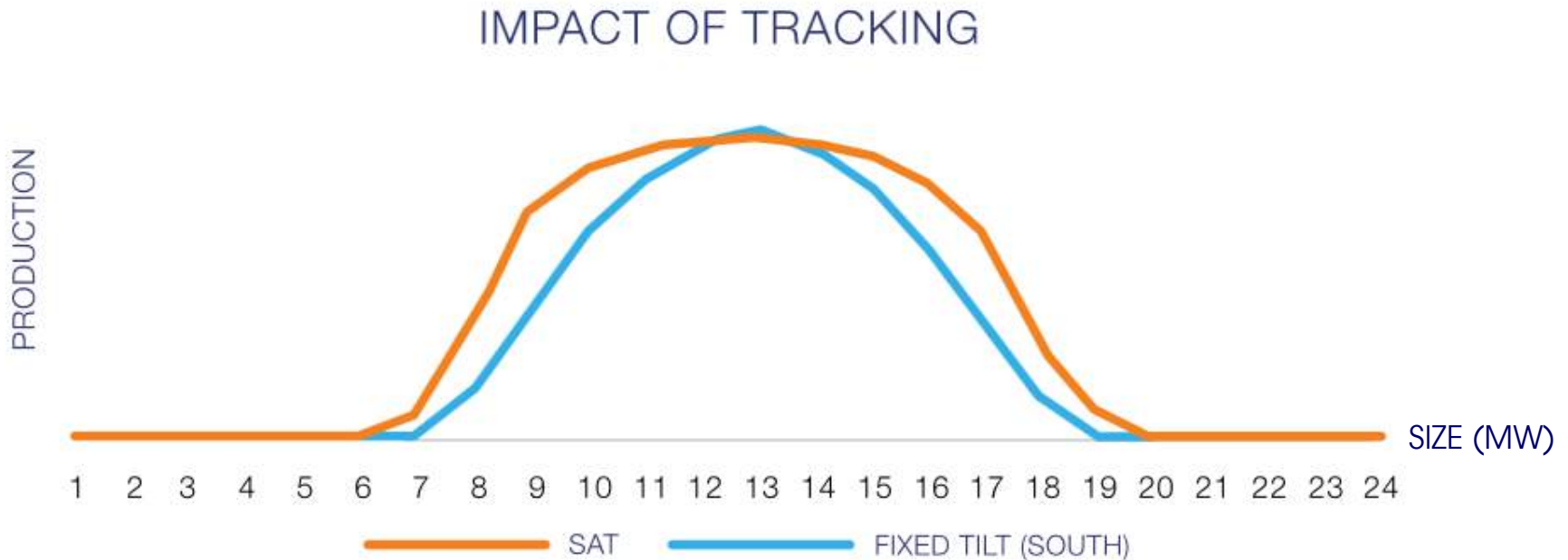
Efficiency Energy Harvest, 12.5 MW Fixed vs. 10 MW One-Axis Tracking



Source: Solar PV Balance of System (BOS) Markets: Technologies, Costs and Leading Companies, 2013-2016

Making Energy When Utilities Need It - Trackers Smooth Energy Output

Added Production from Single Axis Tracking



Source: SEPA 2016

Tracker Project Economics VS. Fixed Tilt

- Better energy yield – 15-25% more MWh/year/kw
- Fewer modules for the same energy output as fixed tilt
- Better average selling price/margin (though less so now that module prices are coming down)
- Better chance of shedding snow
- Less chances of soiling since it's constantly in motion and moves to greater tilt
- Better suited for larger projects (10MW+) - more scalable
- Cost more to build
- More complex engineering design



Picture: GameChange Genius Tracker™

Tracker and Fixed Tilt Economics

Impact of System Design on LCOE for a 20 MW Solar Project (Phoenix AZ)

	FIXED TILT	SINGLE-AXIS TRACKING
CAPACITY FACTOR	30.5%	36.0%
BUILD COST	\$1.60/Watt-dc	\$1.68/Watt-dc
LCOE	\$63/MWh	\$55/MWh

Source: SEPA 2016

Decentralized VS. Centralized

- Less O&M cost:
 - Easier to clean modules
 - Easier to cut grass
 - Easier to seed in case of erosion
 - Easier to drive through for inspection
- More flexibility with layout, for example, a non rectangular layout is possible
- Less concerns about terrain change
- No wires across the site for both power source and communication wires
- Less downtime
- Faster to install
- Fewer parts – less cost



Picture: GameChange Genius Tracker™

GameChange Genius Tracker™ System

- Breakthrough technology enables lowest cost and highest reliability tracker with fastest install and lowest O&M cost
- Black & Veatch technical assessment, CPP wind tunnel tested and rated 150mph, ETL /UL 2703 tested
- Highest power density of any single axis tracker, 99.3% panel density on rows vs. 94.0% best competitor
- Robust linear actuator drive system has 40 year operating life and is IP 66 rated for operation in harsh environmental conditions
- Every drive actuator has its own battery backup and wirelessly linked controllers, eliminating all trenching, tru3d-gimbal™ bearings account for pile installation being out of plumb, out of azimuth and out of vertical & east-west alignment
- Self-powered rows eliminate central drive, allow for uninterrupted grass cutting and panel washing
- Free installation training and tracker commissioning
- 10 person crew installs over 1 mw trackers and panels per week

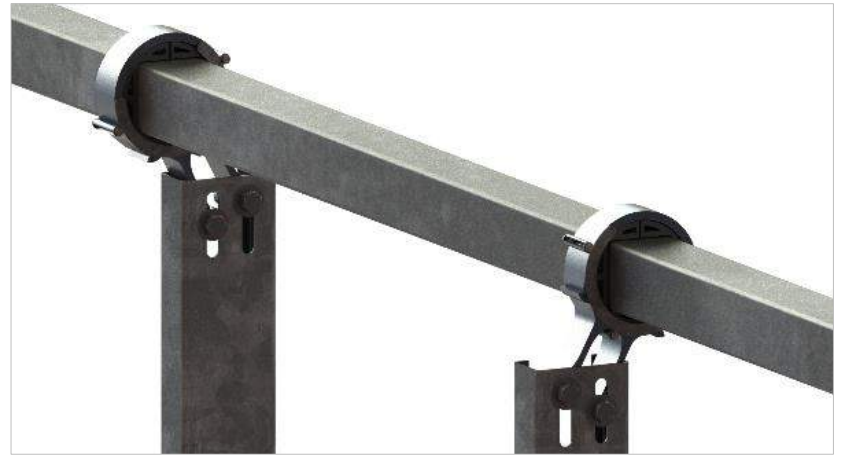


Picture: GameChange Genius Tracker™

Fast Installation, Optimal Performance



Tru3D-Gimbal™ bearings allow for 4.5% plumbness & azimuth tolerance, 2" vertical & 1.5" east-west adjustment



Bearings pivot to allow for up 4 inches east-west adjustment

Fast Installation, Optimal Performance



Linear actuator robust with 40 year operating life, IP 66 rated for operation in harsh environmental conditions

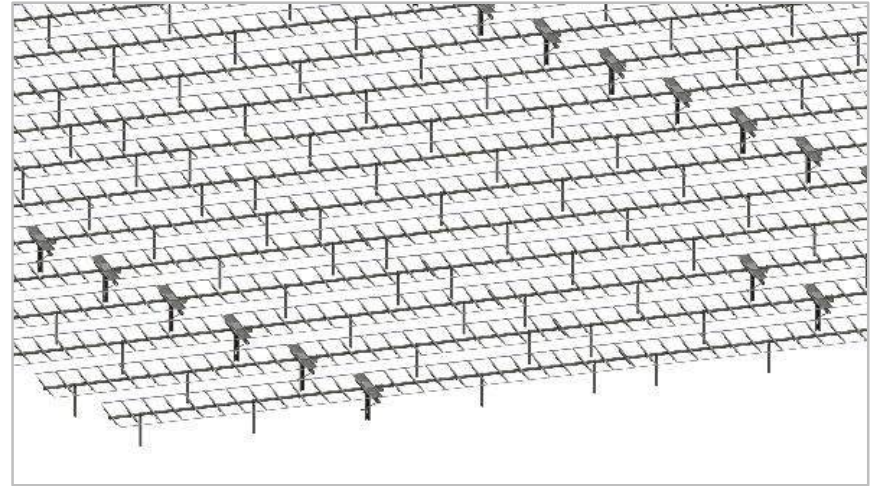


Purlins attach quickly onto row tubes

Fast Installation, Optimal Performance



Mounts all poly and thin film modules including First Solar Series 4



Self powered rows eliminate central drive, allow for easy maintenance

Genius Tracker™ System Features

- Encryption Protection: ZigBee® wireless network
- Tracking: Single axis horizontal
- Rotational Range (East/West): 90° standard 100° and 120° available
- Tracking Method: Time and location based algorithm (Based on NREL)
- Anti-Shading (Backtracking): Prevent panel shading for entire operational range
- Panel Mount: Large modules - portrait 1-2up, thin film First Solar series 4 modules-landscape 3-6up
- Array Configuration: Array may be built with complete flexibility in both east-west and north-south directions
- Table Length: Up to 90 72 cell modules driven by one actuator
- Slope Tolerance: Handles slopes north-south 7% and east-west of 13%

Genius Tracker™ System Features

- Remote Communication: Secure monitoring and control tracker array in real-time via an encrypted cloud portal full stop; SCADA solution available
- System Power Density: Highest power density of any single axis tracker, 99.3% panel density on rows versus 94.0% best competitor
- Ground Coverage Ratio: 0.25 to 0.65 (IAs required)
- Stow Windspeed: Varies with time of day, averages 70 mph +. typical stow time less than 2 min
- O&M Cost: 65% lower vegetation O&M cost than center drive trackers by eliminating weed wacking along drivelines. Overall 10% lower O&M cost
- Smart Stow Technology: Minimalize stow downtime
- Backup Power: Every linear actuator has integrated solar panel and battery providing integrated backup - typically 5 days
- Drive Type: Linear actuator robust stainless steel & aluminum, 40yr. Life IP rated for operation in harsh environmental condition

Genius Tracker™ System Features

- Linear Actuator Motor: 24 volt or 12 volt DC
- Controller: Microcontroller driven, field replaceable controller spares provided
- Control Board: PCB with standard semiconductors
- Warranty: 10yr structural components, 5yr warranty on control & drive systems (20yr/10yr also available)
- Grading Requirements: Least site grading required of any tracker system
- Monitoring: Operational alert emails and web portal for viewing site installations
- Parasitic Load: Zero draw on solar array - small solar panel charges battery
- Module Attachment: Bottom or top mount for framed and double glass modules
- Design Efficiency/Damping: Industry's highest intrinsic damping eliminates costly dampers and reduces material cost

Genius Tracker™ System Features

Test & Certification

- CPP wind tunnel tested and rated 150mph
- ETL/UL 2703 tested
- Black & Veatch technical assessment

Calculations

- Site specific code compliant system structural calculation based on values for any location

Material

- Post: G235 galvanized steel (or HDG option) channels, I beam option (HDG)
- Tubes, Purlins And Other Components: G90 galvanized steel
- Tracker Hardware: Magnacoat 3/8", 1/2" & 3/4" hex bolts, serrated flange hex nuts and washers, 1/2" & 3/4" threaded rods, 3/8" U bolts
- Panel Mounting Hardware: Stainless steel 1/4" - 20" serrated flange nuts 1/4" - 20" X 3/4" long bolts plus star washers for grounding
- Bearings: 6005A-T6 Aluminum and UV rated PP

Q & A

Changing the Game for Single Axis Solar Trackers

