

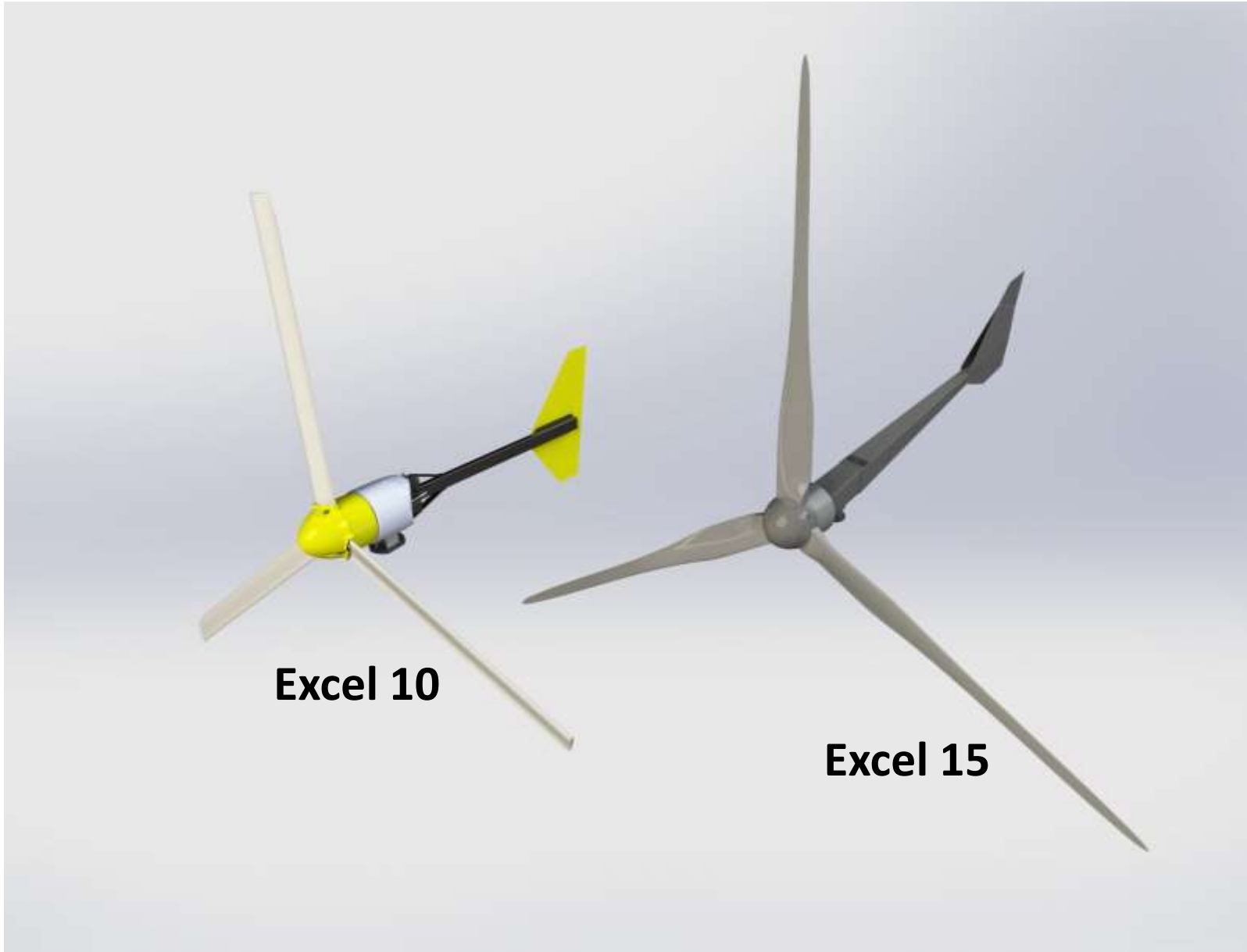
Lowering the Time and Costs of Small Wind Installations

Small Wind
Conference
2018

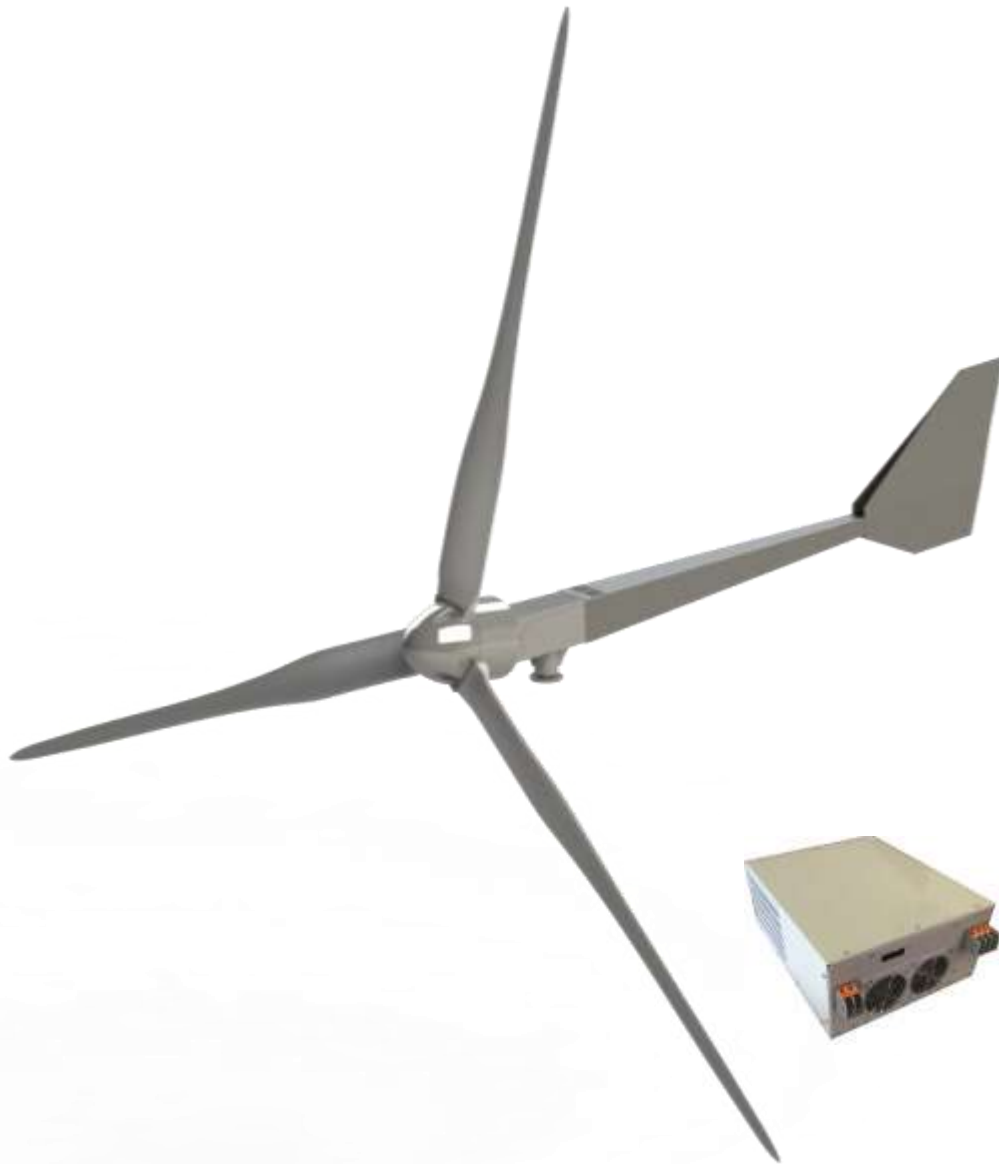
Mike Bergey
President & CEO



Next-Gen Turbine: Excel 15



Excel 15 - Advanced Technology

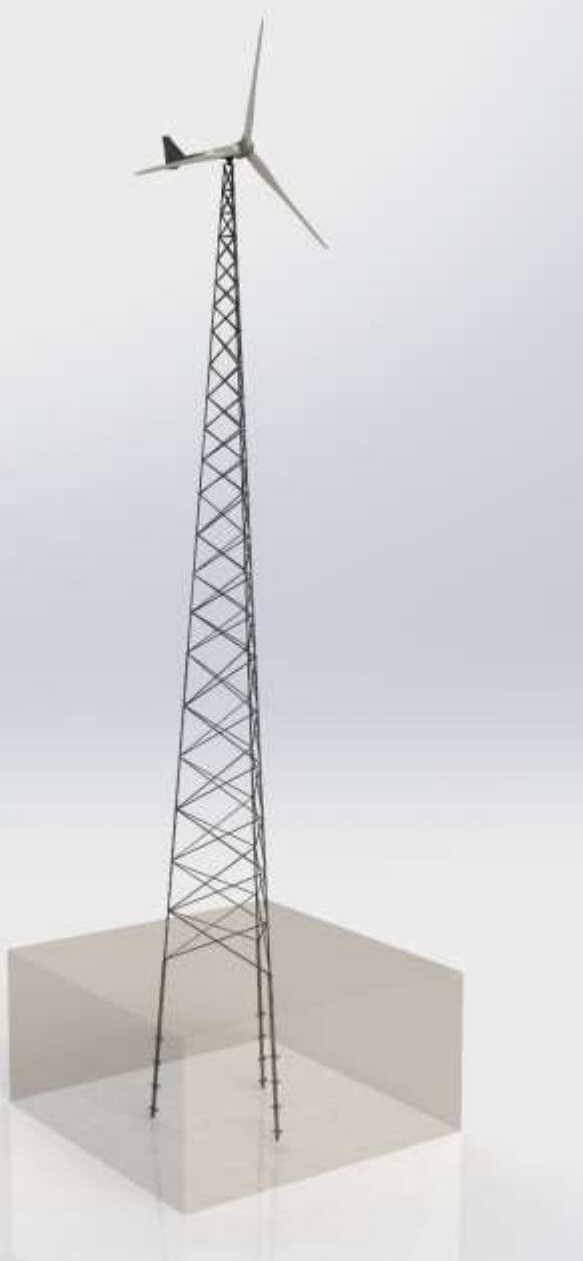


- Tailored Aerodynamics
- Carbon Fiber Blades
- Stall Control
- 2 Moving Parts (Rotor & Yaw)
- Limited – Range
Variable Speed (0 – 140 RPM)
- 25 kW Intergrid Inverter (“single box”), with 8.8 kW dump load

Excel 15 – Superior Economics

	Excel 10	Excel 15	Change
Rotor Diameter	7m (23 ft)	9.6m (31.5 ft)	+ 37%
Rotor Area	38.5m ²	72.4m ²	+ 88%
Ref. Power (11 m/s)	8.9 kW	15.6 kW	+ 75%
Max. Cp	0.30	0.42	+ 40%
Max. RPM	450	140	- 69%
AEO at 6 m/s (NREL LCOE)	18,825 kWh (CF = 21.5%)	39,300 kWh (CF = 30%)	+ 109%
MSRP, with inverter	\$31,770	\$37,500	+ 18%
CAPEX, 30m SSL Tower	\$71,500	\$82,300	+ 15%
LCOE, 30m SSL Tower	20.0¢	10.8¢	- 46%

Next – Installation Cost Reductions

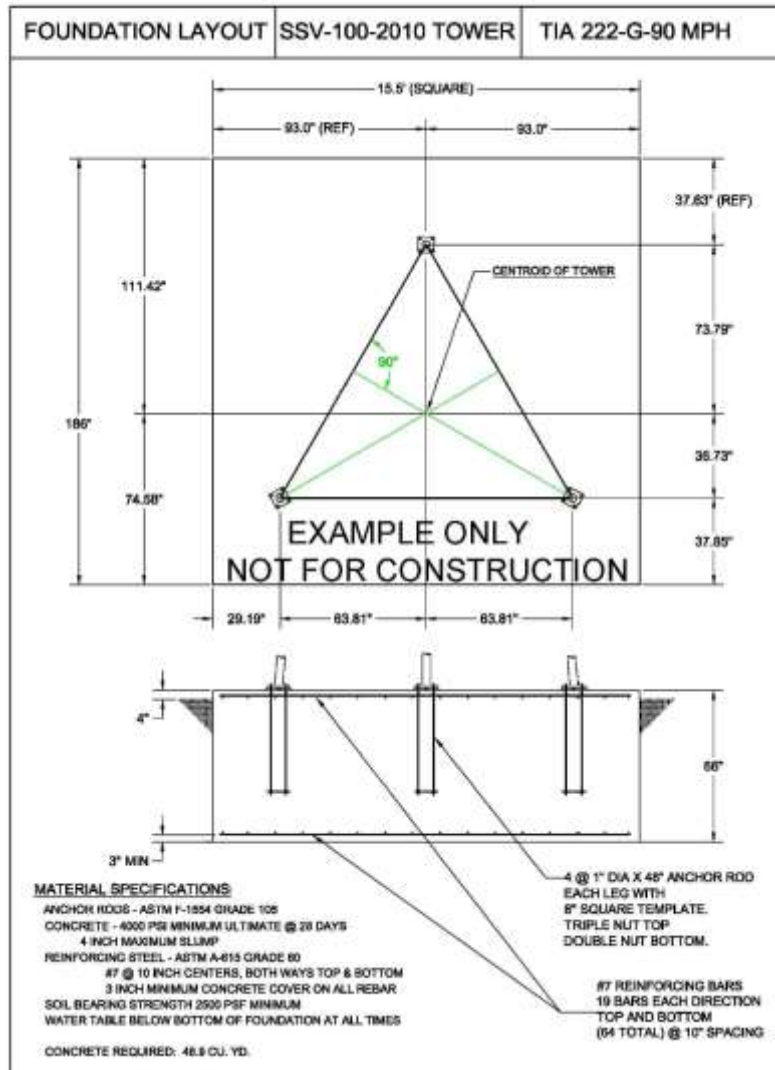


- Focus on 100 ft. Self-Supporting Lattice Towers
- Helical Anchors
- Welded Tower Sections
- Plowed Wire Run
- Outdoor Electricals and Intertie

- **Lowers CAPEX by 16%**
- **One Day Install Possible**

- **Supported by US-DOE under CIP**

100' SSL Concrete Foundations



Helical Anchors

- ❖ Desktop Geotech
- ❖ Complex engineering for very high loads and structural dynamics – unprecedented in helical pile industry



Hydraulic
Torque Motor

Helical
Anchor

Tracked Skid-
Steer

Helical Anchors – Cost Comparison

Concrete Foundation

Description	Qty	Unit Cost	Cost
Concrete, cu yd	50	\$90	\$4,500
Rebar, #7, 15' L	64	\$16	\$1,024
Rebar, #7, bent	9	\$8	\$72
9" Bar Ties, Bag	1	\$65	\$65
Misc. Wood Mat'l	1	\$125	\$125
Labor, Man-hour	96	\$30	\$2,880
Vehicle Cost	1	\$200	\$200
Ecavation	1	\$600	\$600
Dirt Disposal	1	\$300	\$300
Vibrator Rental	1	\$100	\$100
Total			\$9,866
		30% Mark-up:	\$2,960
		Total:	\$12,826

Helical Anchors

Description	Qty	Unit Cost	Cost
10' Anchor, Helices	3	\$267	\$801
10' Anchor Extension	3	\$212	\$636
Anchor Connectors	3	\$25	\$75
Connector Bolts	9	\$2	\$18
End Fittings	3	\$80	\$240
Labor, Man-hour	6	\$30	\$180
Vehicle Cost	1	\$200	\$200
Skid Steer Rental	1	\$200	\$200
Torque Motor Rig	1	\$150	\$150
Torque Monitor	1	\$100	\$100
Misc. Cost	1	\$250	\$250
Total			\$2,850
		30% Mark-up:	\$855
		Total:	\$3,705

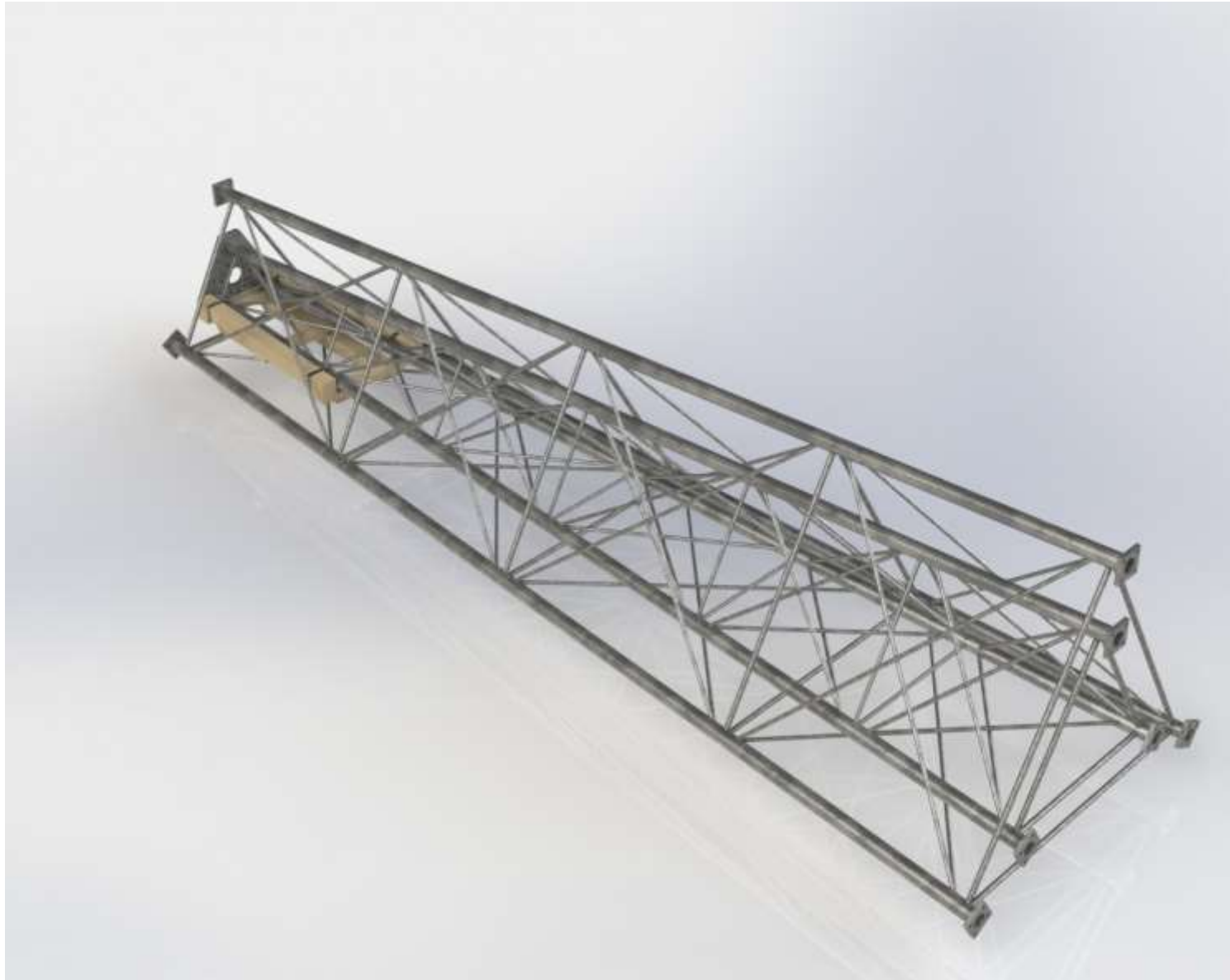
Projected Savings: \$9,100 (at retail) + 3 days

Welded Tower

- ❖ 5 x 19.5 ft sections
- ❖ Top 4 are welded
- ❖ Bottom section is a bolt-up
- ❖ 78% fewer fasteners

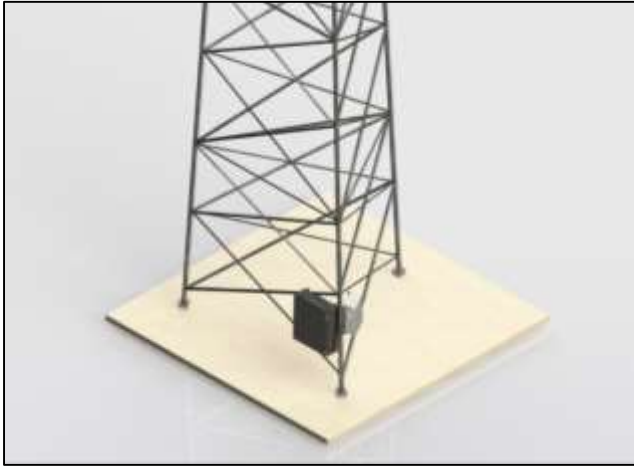


Welded Tower – Nested Shipment



Electrical Installation

**Tower Mounted
Electronics**



**Plowed Cable-in
Conduit**



**External
Intertie**



Cost Impacts

Proposed Improvement	Estimated Savings	Percent of Baseline CAPEX
Helical Anchors	\$9,121	11%
Plowed CIC Wire Run	\$431	0.5%
Outdoor Equipment Pedestal	\$780	0.9%
Welded Tower Sections	\$2,699	3.3%
Outdoor Grid Intertie	\$358	0.4%

Predicted Total Savings: \$13,400 or ~16%

Importance of DOE Wind Program



- **Competitiveness Improvement Program (CIP)** is prime example of value of public-private partnering
- Need more DOE funding for manufacturing, soft costs and deployment
- DOE spends 100 times more on solar RD&D than Distributed Wind, despite its predominance of imports
- **DWEA is our critical voice for advocacy**