

Form E -- Equipment Proposal for Solarize Dummerston
Bidding company or consortium: Solaflect Energy (ground proposal)

All information provided in form E for the successful bidder would be publicly available throughout the Solarize program.

The equipment on this form is associated with a (check all that apply);

- ~~Single discounted price~~
- Tiered pricing that reduces as the total KW contracted increases
- ~~Community Solar~~

Proposed Standard Equipment

The chart below must include all equipment required for a typical Solarize solar PV installation (all-inclusive) as represented in the associated pricing proposal outlined on E1 and/or E2.

If more than one variety of equipment might be used without impacting project cost, please indicate below. Please also write in any relevant items not listed here and any available warranties on individual components.

Include a description of why you have chosen those brands/manufacturers.

Describe warranty provided for Proposer's labor and workmanship.

Describe and list all model names/numbers of equipment and components installer intends to install including panels, roof attachments, type of racking system, and type of inverters.

Form E -- Equipment Proposal for Solarize Dummerston
Bidding company or consortium: Solaflect Energy (ground proposal)

Please provide a narrative outlining the features and merits of the equipment you have proposed for standard equipment in terms a layperson would understand. Please also comment on any possible product sourcing issues, which might arise, including your contingency plan should any of the promised equipment become unavailable during the program.

Solaflect Energy is the developer and manufacturer of an improved dual-axis solar tracker, the Suspension PV Tracker. Our design reduces the use of steel by nearly 75% as compared to alternatives, without any reduction in structural integrity. Development of our tracker has been supported by two \$1 million research grants from the US Department of Energy's SunShot program.

Compared to fixed-mount solar arrays of the same capacity, our trackers generate from 30% to 45% more energy, depending on site specifics. This efficiency gain is due to three factors.

- 1) When a solar panel is aimed directly at the sun, it receives the full power density of the light. Fixed-mount solar panels are aimed directly at the sun at only two moments of time in the entire year. Seasonally tilted panels will be aimed directly at the sun at four moments. At all other times, sunlight on the panels lands at an indirect angle. (Because tracker panels always face the sun, they do not create any glare for neighbors.)
- 2) From the day after the spring equinox until the day before the autumn equinox, the sun rises somewhat to the north and sets somewhat to the north. All of the time that it is shining from north of the east-west line, it is shining on the back of a fixed-mount solar array, which will then produce nothing. The tracker turns to face the sun at all times. At and near the summer solstice, this amounts to more than 3 hours of additional sunlight per day.
- 3) Our tracker spends every night in a vertical orientation. Any snow that might have fallen on it during the day sloughs off. Any snow falling during the night falls right past it. As a result, our trackers lose almost no production to snow cover. For example, this past February—which had 15 days of snowfall and temperatures consistently cold enough to prevent snow from melting and sliding off of fixed solar arrays—our trackers produced nearly as much energy as in an average month of the year, without anyone ever having to go near them with a broom.

Solaflect is based in the Upper Valley, with our business office in Norwich (where the company was founded) and our engineering and manufacturing facility in White River Junction. We use local suppliers whenever possible. Our steel components are fabricated in St. Johnsbury and our circuit board control box is manufactured in Springfield, VT. All told, a good two-thirds of the cost of a complete and installed Solaflect tracker goes to Vermont and New Hampshire businesses.

Form E -- Equipment Proposal for Solarize Dummerston

Bidding company or consortium: Solaflect Energy (ground proposal)

We use Axitec PV panels. Axitec is a lesser-known but well-established German company with an excellent warranty (maximum performance decline over 25 years of 15%). We use SolarEdge inverters and optimizers, which function in tandem to provide 98% efficiency in converting the DC output of the panels into AC electricity for the grid.

We have the in-house capacity and supply chain relationships to ensure production and installation of all the trackers we may need to meet the demands of Solarize Dummerston.

In addition to the current advantage of our tracker over fixed-mount solar, the Solaflect Suspension PV Tracker is designed to be fully compatible with advances in PV module technology that are on the horizon. Standard PV panels are based on crystal silicon. The world record efficiency for this technology has hardly improved in the past 20 years. Scientists have gotten it about as close to its theoretical efficiency limit as is possible. However, there are other PV chemistries that are more efficient. The most efficient PV cells are “multi-junction.” They use extremely thin layers of different materials sandwiched together, each layer being tuned to a different portion of the solar light spectrum. To achieve their best efficiency, multi-junction PV cells need to have large quantities of sunlight concentrated onto them, using either lenses or mirrors. Modules of this type are therefore called “concentrated PV” or CPV. Laboratory versions of CPV are nearly three times as efficient as standard PV panels, with new records announced on a regular basis, and there are CPV modules being manufactured that are about twice as efficient as standard PV panels.

Currently, the cost of these CPV modules is too high to make them worth using in residential or community solar applications. But as with all of these technologies, the costs are falling even as the technologies improve. There will come a time when CPV crosses the value threshold and becomes the most affordable source of solar energy.

But remember—CPV’s high efficiency depends on concentrating light onto the PV cell. When you use lenses or parabolic mirrors to concentrate light on a target, you must keep the system oriented properly at all times, or else the sunlight will miss the target and you won’t generate any energy. In other words, CPV cannot be used in fixed mount solar arrays. It can only be used in dual-axis trackers, and not just any trackers. It can only be used in *highly accurate* trackers, such as the Solaflect Suspension PV Tracker.

What this all means is that owners of Solaflect trackers are “future proofed” in the sense that they will be able to retrofit their trackers with CPV modules in the future if and when it makes sense to do so. We don’t know if that will be in 5 years or 8 years or 12 years, but the time will come when CPV is affordable and our customers will have the option to more-or-less double the productivity of their

Form E -- Equipment Proposal for Solarize Dummerston
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trackers for the fractional cost of an upgrade.

Another possible “future proofing” advantage of the tracker is in case Green Mountain Power switches customers from the current flat rate tariff to a time-of-day or otherwise variable rate structure (and further that net metering is credited at the time-of-day rates). Utilities with time-of-day rate structures commonly charge high rates during Peak hours—mornings and late afternoons—and lower rates at other, Off-peak times. Because the tracker always faces the sun, it produces at nearly full power from close to sun up through sundown (assuming clear skies). That is, it produces significant energy during many of the Peak hours, whereas fixed solar arrays typically have highest production at noon (when rates are often Off-peak) and significantly reduced production during Peak hours.

When calculated against Green Mountain Power’s Rate 11, a time-of-day rate that is no longer available (but still used by some customers who are grandfathered), the Solaflect PV Tracker generates 49% more energy during Peak hours than a fixed array of the same capacity. In other words, *if rates and net metering are changed to a time-of-day structure*, the Solaflect PV Tracker will provide not only more total energy compared to an equivalent fixed array, it will provide energy with more value.

Form E -- Equipment Proposal for Solarize Dummerston
Bidding company or consortium: Solalect Energy (ground proposal)

Major Component (Standard Equipment)	Manufacturer, Model #	Country Where Produced	Warranty	Notes
Inverter(s) Specify Type's (I.E. Micro, String)	SolarEdge 3800A-US (string inverter) ; SolarEdge P300 (optimizer)	Hungary, China, some assembly in Canada	12 yr (inverter) ; 25 yr (optimizers)	Like microinverters, optimizers allow each PV panel to perform individually. The combination of SolarEdge inverters and optimizers provides higher efficiencies than from microinverters. Each module includes an integrated optimizer.
PV Modules	Axitec AXIplus SE AC-250P/156-60S	China, Taiwan	12 yr materials/workmanship, 25 yr performance	Each module is 250 watts, polycrystalline. A Solalect trackers holds 16 modules, for total capacity of 4 kW.
Roof Mounting System	N/A			
Ground Mounts	Solalect Suspension PV Tracker	USA (Vermont)	10 yr	Warranty requires customer to have annual service check. No charge for first three years. After that, approx. \$125/yr.
Data Acquisition System	Via SolarEdge inverters			Included at no extra charge.
Meters	N/A			Production meter is provided by Green Mountain Power for one-time charge to the customer of \$110.

Note: Prices indicated above do not take into account system size. Any variations in installed cost resulting from system size should be defined in the next section under "Adjusted Pricing Factors."

Form E -- Equipment Proposal for Solarize Dummerston

Bidding company or consortium: Solaflect Energy (ground proposal)

Adjusted Pricing Factors Chart (a.k.a. System Cost Add ons)

- It is understood that features of certain installations will result in higher costs.
- The assumption is that all costs to most homeowners are factored into the base price, and that an additional charge, if necessary, is reserved for unique homeowner circumstances and options.
- Installers are highly encouraged to keep their pricing proposals and list of adders **simple**. While a comprehensive list of adders may provide homeowners with many options, community representatives and homeowners can perceive some adders negatively. Adders should be for unusual circumstances or to satisfy customer preferences, **NOT** to address common issues that many or all projects will require. For example, installers should avoid adders for items such as “steep roofs,” but should consider this a factor in establishing their base pricing based on the installers assumptions about the frequency of such roof types. Avoiding a perception of “nickel and diming” will lend credibility and favorability to your proposal.
- Any additional charges not included in the \$/watt price must be explicitly explained and quantified in the proposal (either \$/W or flat fee) (e.g., charges for electrical upgrades, steep roofs, specific roofing types/materials, multiple array locations, small system size, customized racking, tree trimming, etc).
- Please specify any additional cost to the homeowners for securing historic permits, or other permits or approvals that go above and beyond normal permitting requirements.
- Should a participant require roof repairs or replacement at a later date independent of Proposer’s PV installation, please specify if Proposer is able to remove and reinstall the original PV installation, and at what cost to the participant.
- If you offer multiple options for panels (i.e. American-made vs. not American- made), inverters (i.e., central inverters vs. micro-inverters) or roof attachments/racking, please specify components and costs for each option in the second table.
- Please also list any services not provided by the installer that, if required, could add to total project cost (e.g. tree removal or structural reinforcement of rafters):

Equipment Add-on’s required for some systems

Form E -- Equipment Proposal for Solarize Dummerston
Bidding company or consortium: Solaflect Energy (ground proposal)

Example Required Add-ons	Description of Cost Adder	Increased Cost \$/W or flat rate (*1)	Notes
Electrical	Distance from tracker to point of tie-in greater than 200 ft.	\$4/ft. from 201 to 275 ft. ; \$5/ft. + \$300 for distances beyond 275 ft.	To cover cost of additional trenching and wiring, and upgrade to 6 ga wire if over 275 ft. Maximum distance we can go is approximately 450 ft.
Electrical	Breaker panel upgrade	At cost (to be charged by customer-selected contractor*)	Rarely required. If required, responsibility of customer to ensure completion of upgrade prior to tracker installation. * Unless customer asks our electrical subcontractor to perform the upgrade, in which case we can combine billing.
System Size	Installations of 2 or more trackers at one location and time	Subtract \$500 per additional tracker	But total discount for customer, combining multi-tracker discount and Tiered pricing, not to exceed \$1,000 per tracker.
Other	Unavoidable ledge hindering code-compliant trenching	At cost, usually around \$300	Cost of truck of soil fill or concrete capping of conduit.
Other	Tree removal	At cost (to be charged by customer-selected contractor)	We will discuss the solar value to be gained with potential tree removal. Decision to remove and performance of removal is at the discretion of the customer.
Other	Crushed stone beneath foundation	\$100	If required due to uncommonly wet location.
Other	Difficult access requiring non-standard equipment for installation	\$100	If access to site is steep or otherwise beyond capacity of the normal truck delivering the foundation, small surcharge to cover our need to hire a larger, tracked delivery vehicle.

[1] Including system design, permitting, applicable materials and equipment, transportation, labor, and all equipment and workmanship warranties. Price should be independent of any available tax credits or incentives.

Form E -- Equipment Proposal for Solarize Dummerston
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Optional Equipment Add-on's

Describe any Optional Add-on's that you will offer.

Describe if proposed system components offer online monitoring, and if such services are included in the cost of installation, or are optional. Please specify if such monitoring would be on the system level or panel-by-panel.

Example Optional Add-ons	Description of Cost Adder	Increased Cost \$/W or flat rate (*1)	Country Where Produced	Warranty	Notes
Panels	Axitec AXIplus SE AC-250M/156-60S	\$300 flat per tracker	China or Taiwan	12 yr materials/workmanship ; 25 yr performance	These are an all-black, monocrystalline alternative module, same capacity and warranty as our standard module.
Optional or enhanced System Monitoring	N/A				Monitoring is included at no charge.

[1] Including system design, permitting, applicable materials and equipment, transportation, labor, and all equipment and workmanship warranties. Price should be independent of any available tax credits or incentives.

Form E -- Equipment Proposal for Solarize Dummerston
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Please provide a narrative outlining the features and merits of the equipment you have proposed for equipment add-on's in terms a layperson would understand. Please also comment on any possible product sourcing issues, which might arise, including your contingency plan should any of the promised equipment become unavailable during the program.

The only option we offer is to substitute a monocrystalline PV module for our standard polycrystalline module. The optional mono version is from the same manufacturer and has the same capacity and warranty. Performance of the mono and poly modules should be nearly identical. The mono module may have a little bit better long-term performance, i.e., beyond 25 or 30 years. It seems likely that the owner will want to upgrade the modules before 30 years pass, so that advantage to the mono may be moot. We offer it primarily as an aesthetic option. The standard modules are blue in front and white in back, while the mono modules are black in front and back. Some of our customers—especially those whose primary view of the tracker is of the back—feel that the black backs of the mono modules are gentler on the eyes and upgrade for that reason.