

Strafford County Solar Options

Preliminary Solar Options | November 1, 2023



4 MW Town of Skowhegan, ME

Background & Qualifications

REVISION ENERGY



15,000+

Clean energy systems installed since 2003

400+

Employee-owners across 5 branches in NH, ME, and MA

#1-rated

rooftop solar installer in New England (*SPW*)

100%

Employee-owned proudly certified B Corporation



REVISION ENERGY

Mission:

*Make like better by building
our just and equitable electric future.*



Industry Honors & Associations

ReVision Ranked #1 Rooftop Solar Contractor
in New England, #5 in U.S.

Solar Power World Magazine (2017, 2018, 2019, 2020)



Business
of the Year



#1 NH Solar Company



PV Installation
Professional



ReVision Energy
★★★★★ 4.90



Business Solar Partners include...

L.L.Bean



IDEXX
LABORATORIES



Bangor
Savings Bank



THROWBACK
BREWERY



CHAMBERLAIN



Nonprofit Solar Partners include...



Dartmouth



UNIVERSITY OF
NEW ENGLAND



Colby-Sawyer
College



MacDowell Colony



Wentworth
INSTITUTE OF TECHNOLOGY

Plymouth State
UNIVERSITY



PROCTOR



New Hampshire's
PALACE THEATRE
Where the arts come alive!



WOODS HOLE
OCEANOGRAPHIC
INSTITUTION



Nashua Soup
Kitchen &
Shelter



CHILDREN'S
MUSEUM
of NEW HAMPSHIRE



REVISION ENERGY

ReVision Municipal Case Studies



City of Keene
DPW-Police Building,
Wastewater Plant
2 MW (2018)



Town of Hanover
Water Department,
WWTF, Town Roofs
2 MW (2016-21)



City of Dover
Dover High School,
Indoor Pool, CMNH
1 MW (2018-9)



City of Lebanon
Wastewater Plant +
Town Roofs
836 kW (2019)



Town of Durham
Sand Pit, Police Dept,
Library, Ice Rink
780 kW (2014-16)



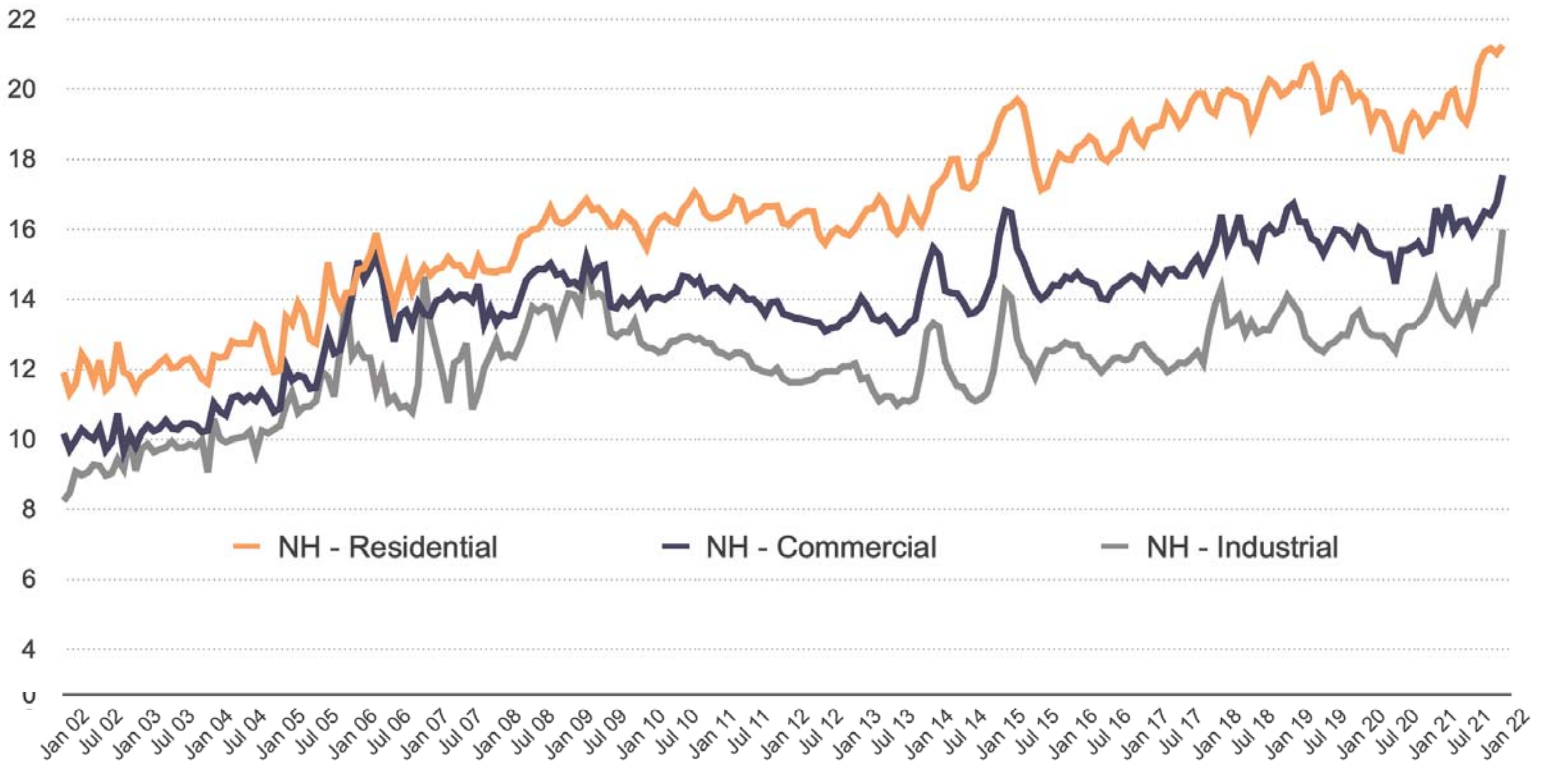
City of Nashua
City Roofs, Ice Arena,
Public Schools
3 MW (2019-22)

City of Dover Municipal Projects



Cost of Electricity NH, 2002-2022

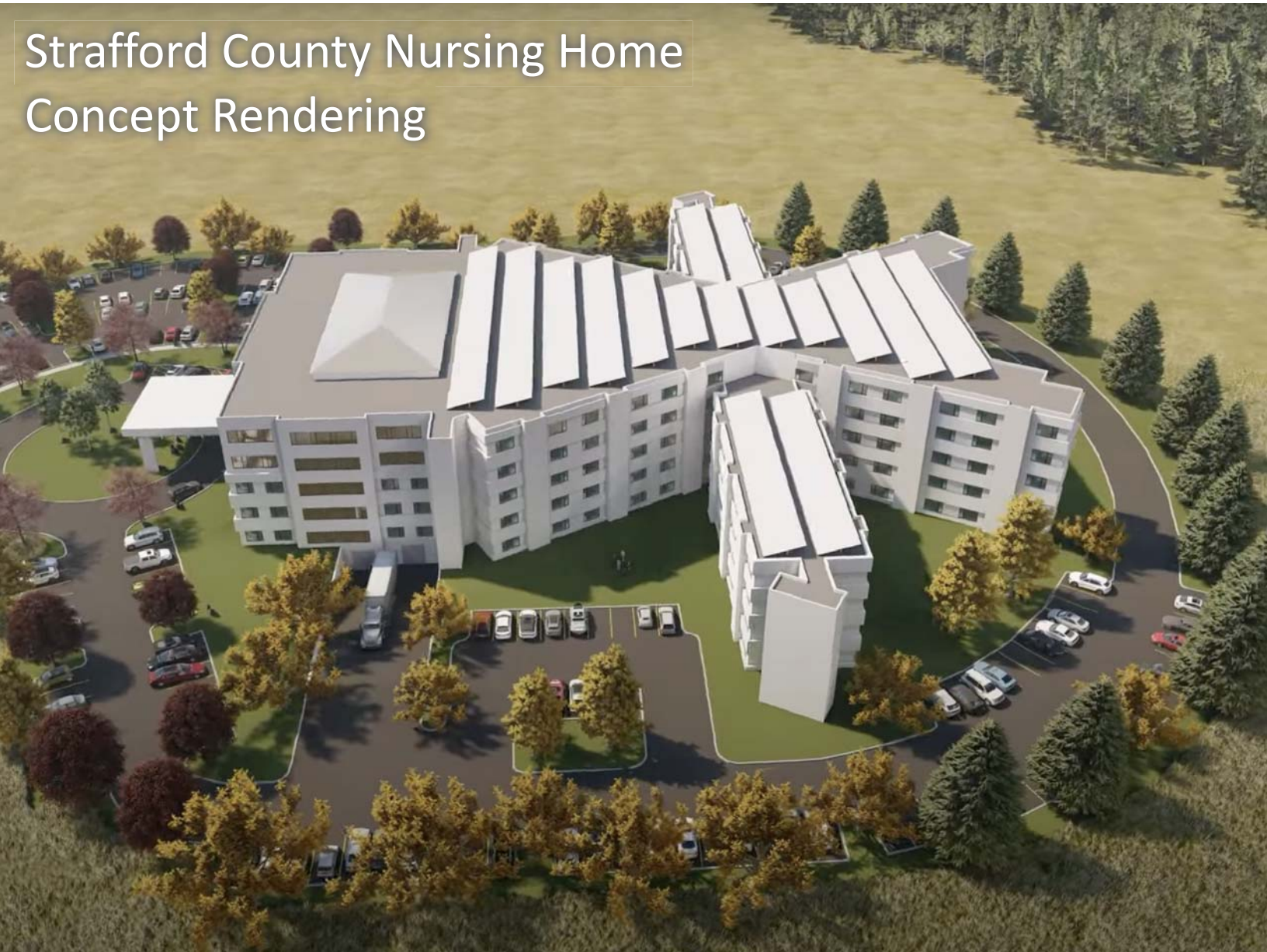
US Energy Information Administration (USEIA)



Design & Engineering

STRAFFORD COUNTY SOLAR OPTIONS

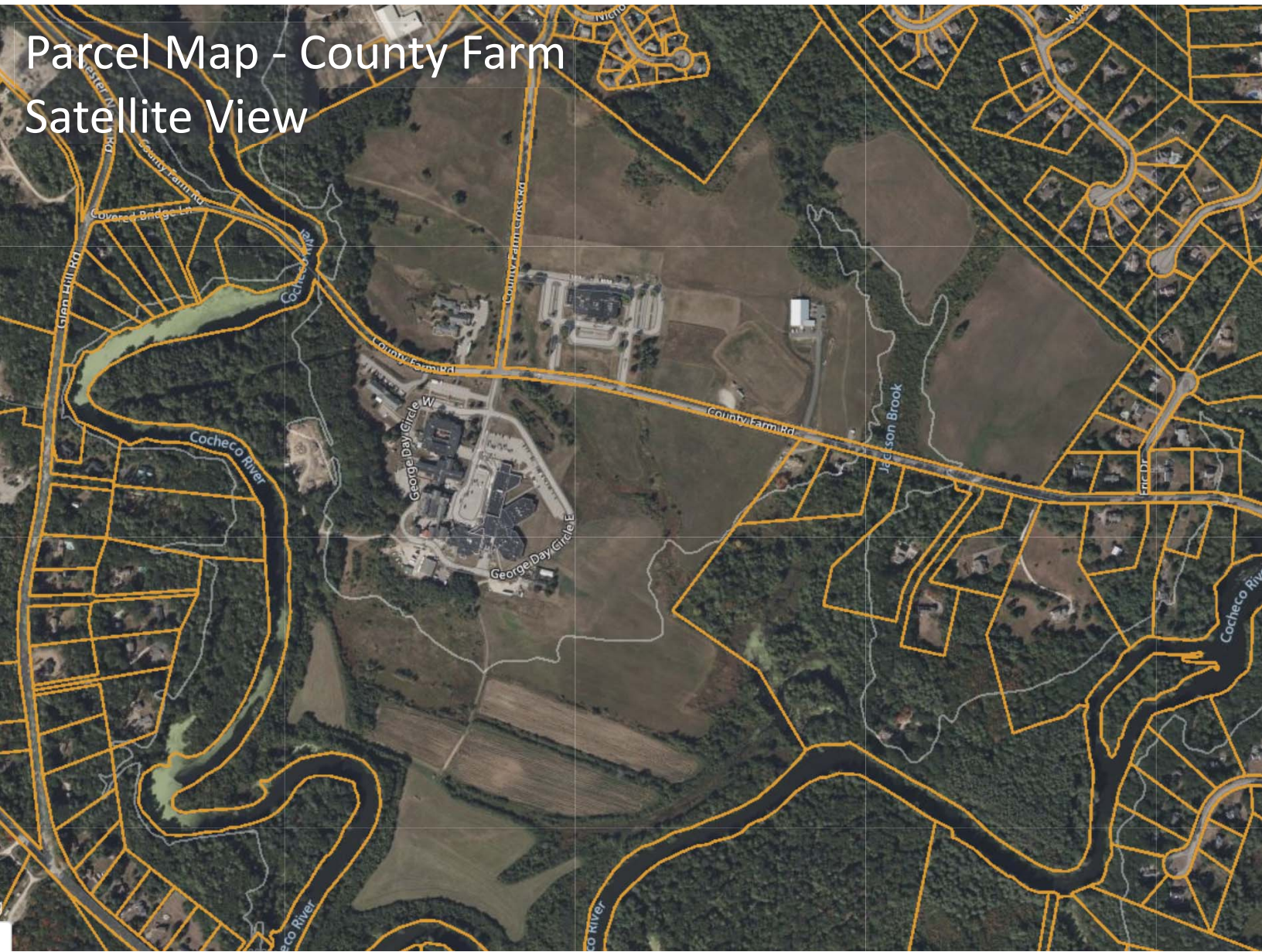
Strafford County Nursing Home Concept Rendering



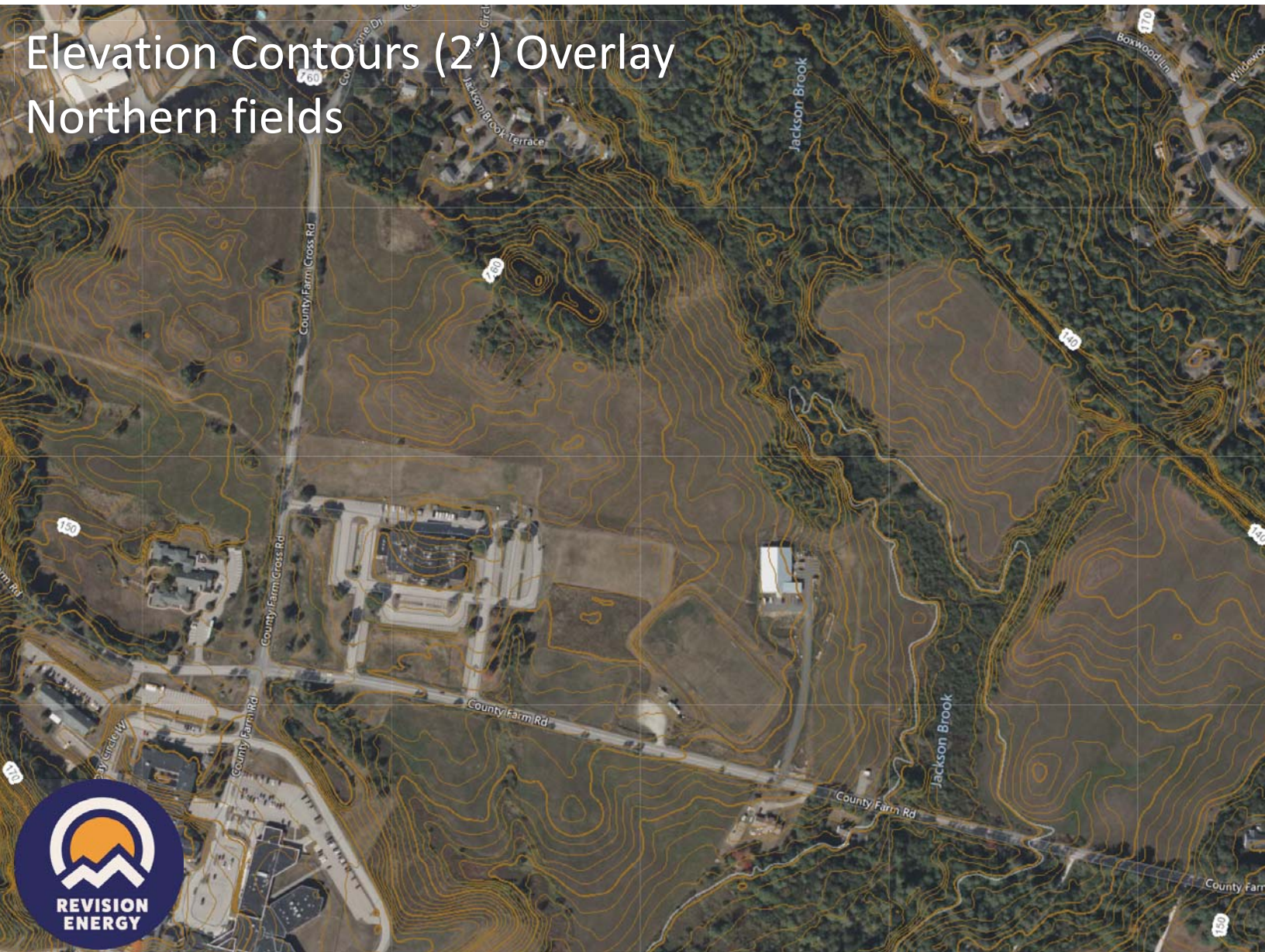
Strafford County Farm Satellite Overview



Parcel Map - County Farm Satellite View



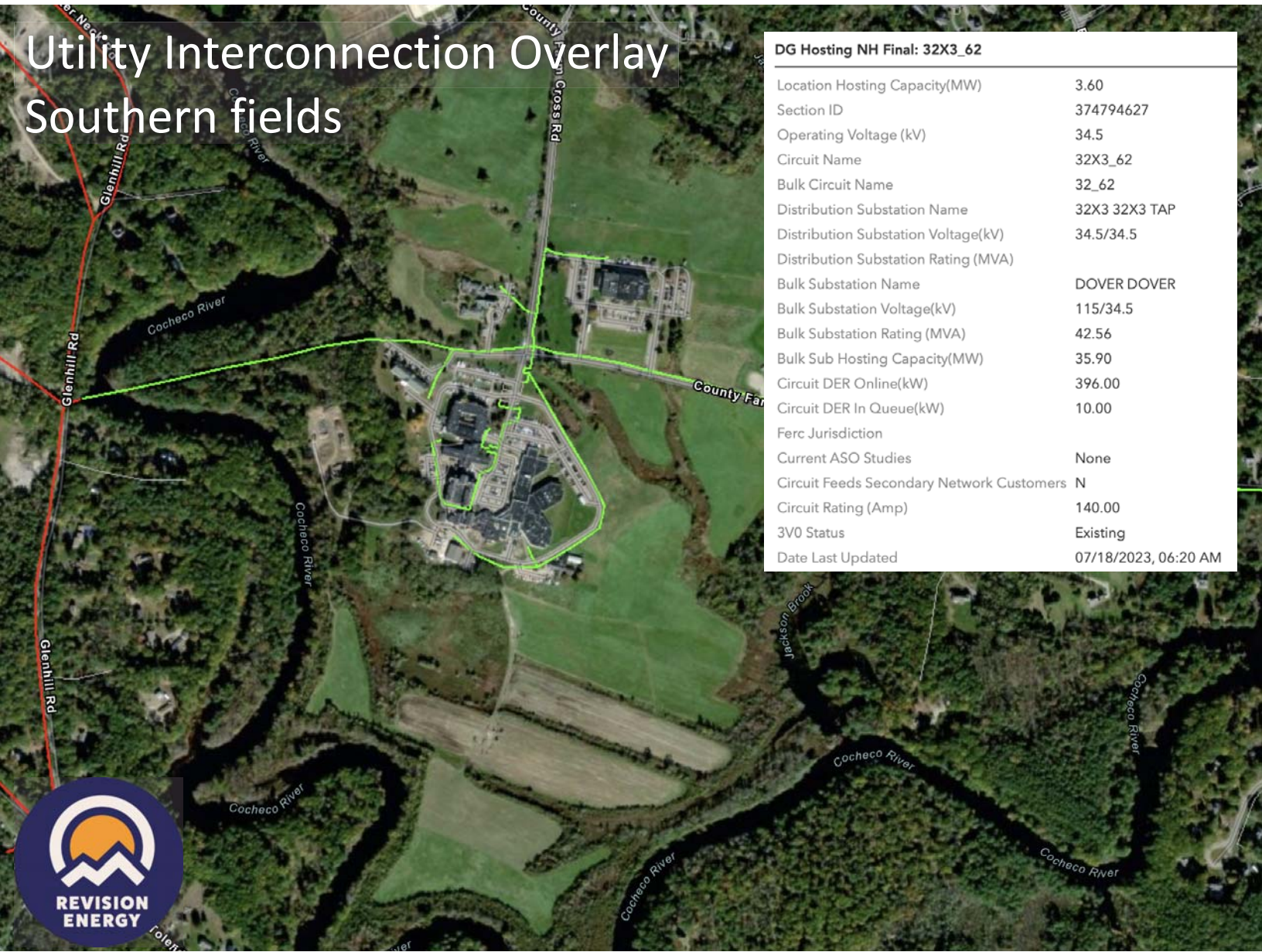
Elevation Contours (2') Overlay Northern fields



Elevation Contours (2') Overlay Southern fields



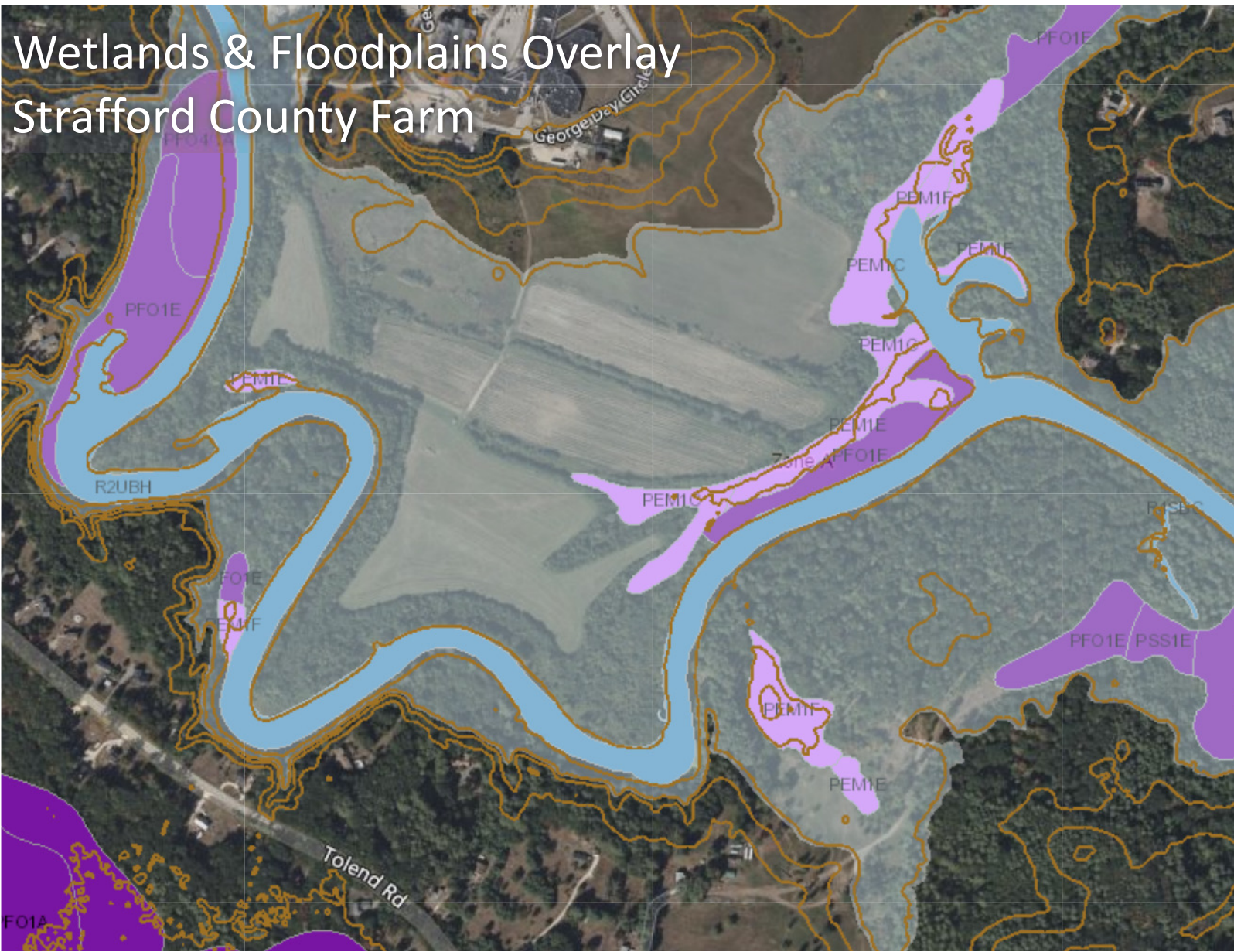
Utility Interconnection Overlay Southern fields



DG Hosting NH Final: 32X3_62	
Location Hosting Capacity(MW)	3.60
Section ID	374794627
Operating Voltage (kV)	34.5
Circuit Name	32X3_62
Bulk Circuit Name	32_62
Distribution Substation Name	32X3 32X3 TAP
Distribution Substation Voltage(kV)	34.5/34.5
Distribution Substation Rating (MVA)	
Bulk Substation Name	DOVER DOVER
Bulk Substation Voltage(kV)	115/34.5
Bulk Substation Rating (MVA)	42.56
Bulk Sub Hosting Capacity(MW)	35.90
Circuit DER Online(kW)	396.00
Circuit DER In Queue(kW)	10.00
Ferc Jurisdiction	
Current ASO Studies	None
Circuit Feeds Secondary Network Customers	N
Circuit Rating (Amp)	140.00
3V0 Status	Existing
Date Last Updated	07/18/2023, 06:20 AM



Wetlands & Floodplains Overlay Strafford County Farm

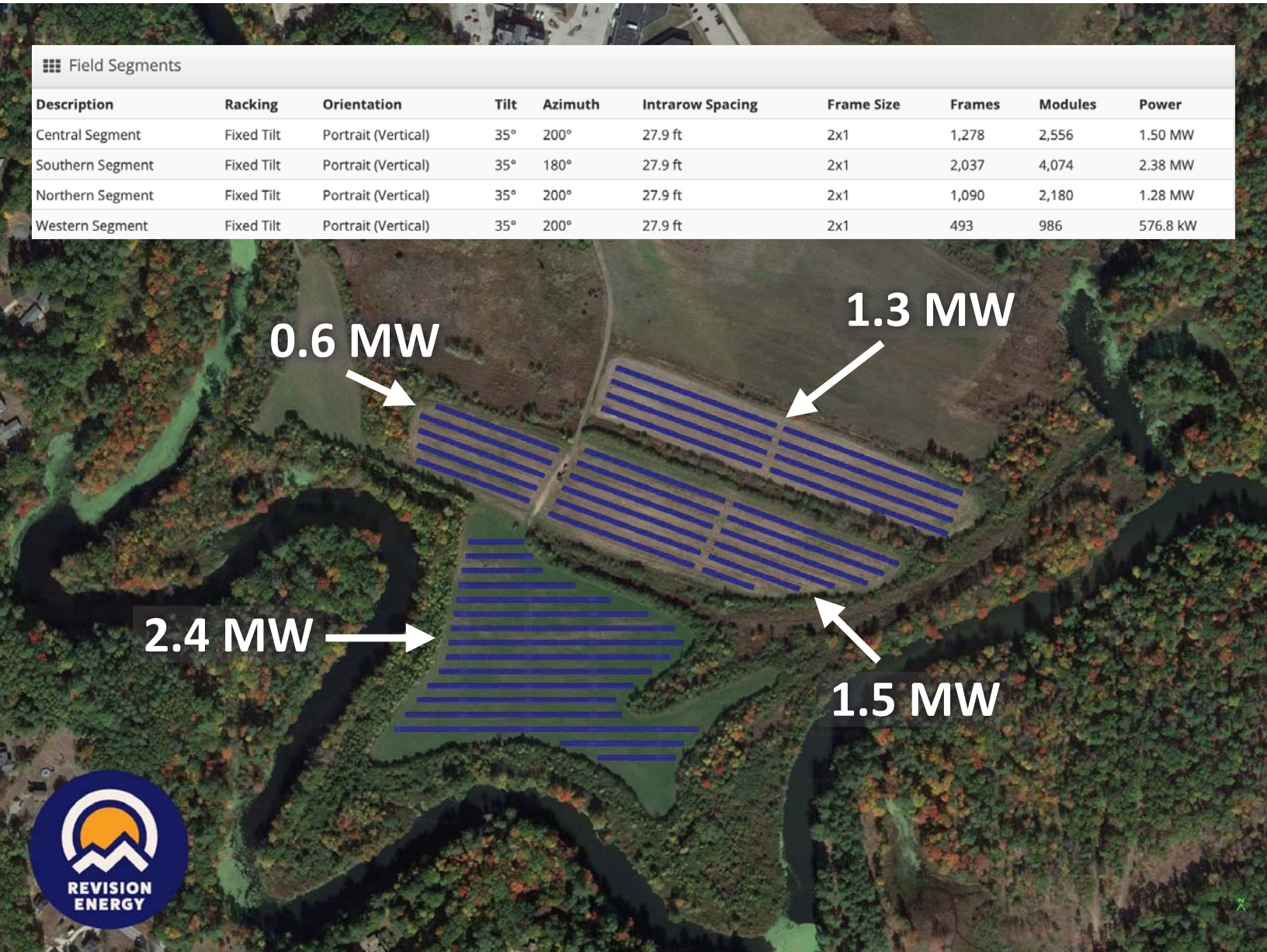


Engineer's Rendering
5.7 MWdc / 4.25 MW ac
9,796 modules
28 inverters



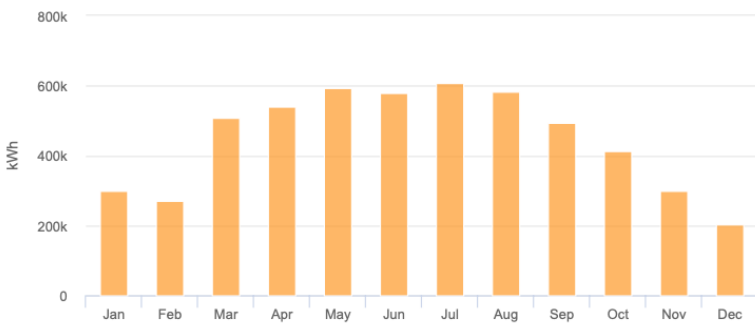
Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Central Segment	Fixed Tilt	Portrait (Vertical)	35°	200°	27.9 ft	2x1	1,278	2,556	1.50 MW
Southern Segment	Fixed Tilt	Portrait (Vertical)	35°	180°	27.9 ft	2x1	2,037	4,074	2.38 MW
Northern Segment	Fixed Tilt	Portrait (Vertical)	35°	200°	27.9 ft <td 2x1	1,090	2,180	1.28 MW	
Western Segment	Fixed Tilt	Portrait (Vertical)	35°	200°	27.9 ft	2x1	493	986	576.8 kW



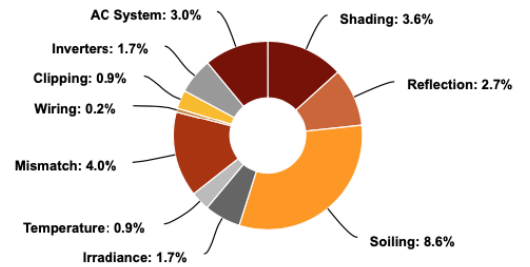
Solar Annual Production Model

Monthly Production



Month	GHI (kWh/m ²)	POA (kWh/m ²)	Shaded (kWh/m ²)	Nameplate (kWh)	Grid (kWh)
January	60.8	102.1	95.4	311,944.9	297,625.7
February	79.0	115.4	112.0	281,105.6	268,585.4
March	117.3	146.3	142.1	560,649.5	507,810.2
April	144.7	158.7	153.8	612,194.2	539,948.2
May	175.9	177.9	172.2	684,260.5	592,959.2
June	182.5	176.5	170.6	676,894.7	581,087.5
July	186.0	185.9	180.1	716,908.8	608,679.8
August	164.8	177.3	172.0	684,801.2	581,486.0
September	123.0	148.4	144.1	574,262.3	495,769.0
October	86.5	119.3	115.6	460,487.8	411,332.7
November	55.9	86.6	82.1	326,890.4	300,373.4
December	47.2	78.2	71.9	215,656.7	203,905.0

Sources of System Loss



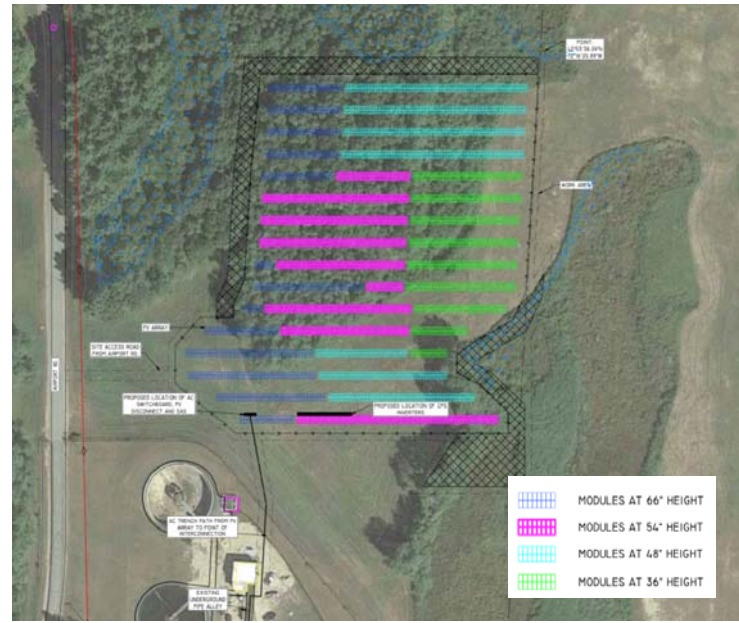
Annual Production

	Description	Output	% Delta
Irradiance (kWh/m ²)	Annual Global Horizontal Irradiance	1,423.6	
	POA Irradiance	1,672.6	17.5%
	Shaded Irradiance	1,612.0	-3.6%
	Irradiance after Reflection	1,567.8	-2.7%
	Irradiance after Soiling	1,432.5	-8.6%
	Total Collector Irradiance	1,432.4	0.0%
Energy (kWh)	Nameplate	6,106,056.6	
	Output at Irradiance Levels	6,002,573.0	-1.7%
	Output at Cell Temperature Derate	5,949,096.3	-0.9%
	Output After Mismatch	5,710,747.9	-4.0%
	Optimal DC Output	5,700,362.9	-0.2%
	Constrained DC Output	5,651,248.7	-0.9%
	Inverter Output	5,556,249.6	-1.7%
	Energy to Grid	5,389,562.0	-3.0%

Sample ReVision Ground Mounts



Sample ReVision Ground Mounts Design/Technical



Solar Site Sustainability Options

- **Pollinator Habitats:** Promote best practices from Center for Pollinators in Energy: deep-rooted native flowers/grasses that build top-soil, capture/filter storm water for erosion control, ensure ample healthy food for bees
- **Vegetation Management:** As member of the American Solar Grazing Association, we are soliciting northeastern sheep farms to offer cost-effective solar grazing services
- **Wetlands & Endangered Species:** Work with NH DES and environmental engineering partners to identify potential and mitigate any wetlands and RTE impacts through e.g. habitat creation/restoration, water resource protection, and ongoing habitat management



Operations & Maintenance (O&M)

Performance Monitoring



80-Point Inspections/Maintenance



Founding Member

Innovation Partner



Solar Development & Financing

STRAFFORD COUNTY SOLAR OPTIONS

Municipal Financing: Challenges

- **Incentives:** Tax-exempt entities cannot access federal solar investment tax credit (ITC) and federal/state depreciation
- **Capex/ROI:** Solar arrays require substantial upfront capital expenditure; outright ownership can result in extended payback absent incentives
- **Management:** Ongoing system O&M, net metering, etc.



Municipal Financing: Solutions

- 1. Power Purchase Agreements (PPA):** Municipalities go solar with \$0 cost by partnering with mission-aligned investors who utilize tax incentives and provide discounted energy rates, buyout options
- 2. Land Lease Options:** Municipalities with solar-ready land can enter into long-term lease/PILOT agreements with solar developers to offset municipal loads
- 3. Federal Supports:** IRA direct pay, grants, and/or low-interest muni bonds enable outright ownership on a cashflow-positive basis, with or without capex

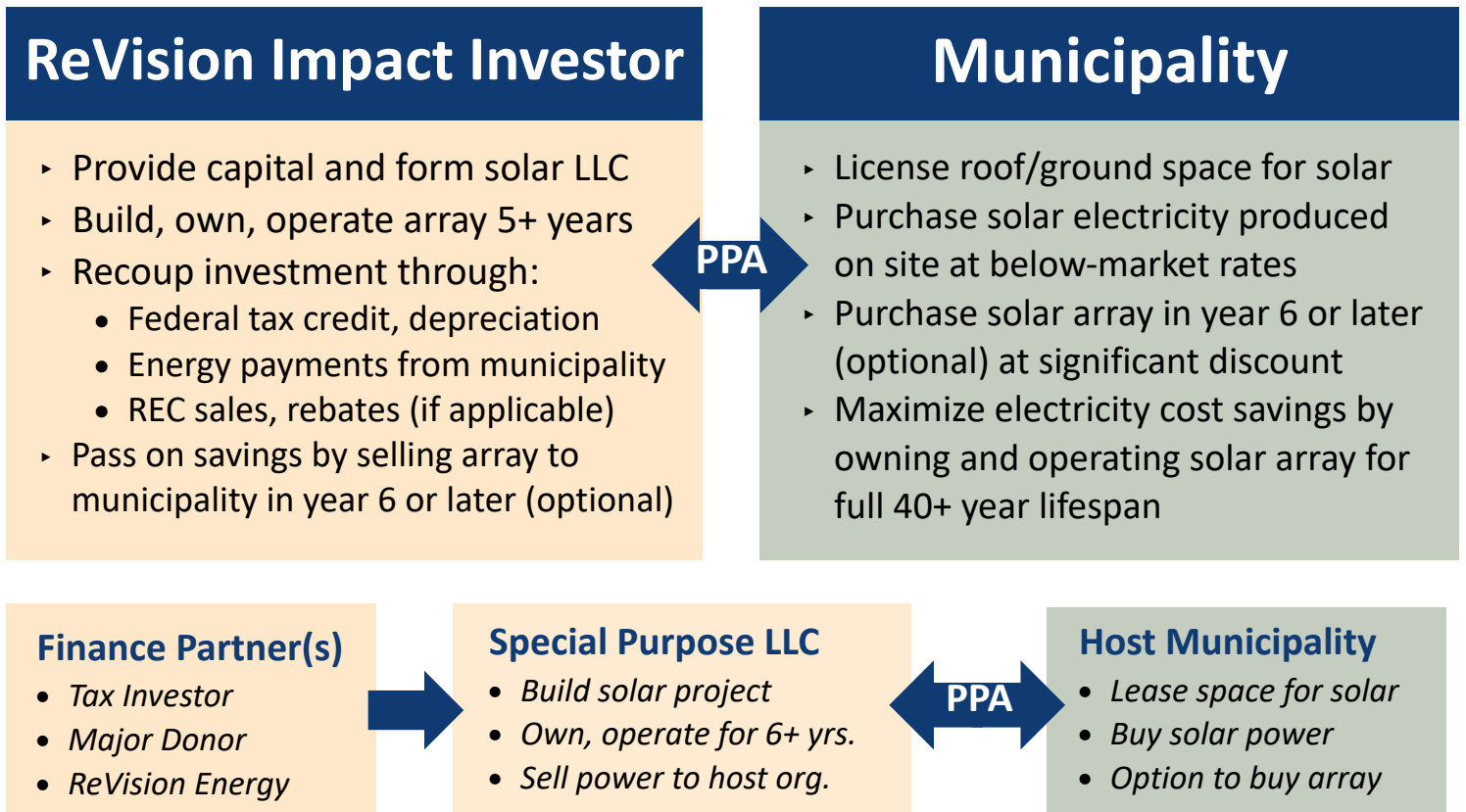


1. Municipal Solar PPAs

- **\$0 Upfront Cost:** Power purchase agreements or low-interest loans ensure a cashflow-positive investment with electricity savings greater than PPA cost from day 1
- **Impact Investor Financing:** Local, mission-driven impact investors cover system installation and full operations & maintenance throughout PPA term (25-year warranty)
- **Net Metering:** Solar offsets full retail electricity rates onsite, provides net metering revenue from excess or offsite generation
- **Levelized Cost of Energy:** Factoring in upfront cost and O&M, solar provides lowest average cost of energy at 4-7 cents per kWh over system life – 50%-75% lower than utility



Solar PPA Financial Structure



2. Municipal Land Lease Options

- Municipality leases solar-ready land to solar investor for 20+ year term
- Investor partner builds, owns, and operates solar array; owns the 'host meter' and associated risks
- Town assigns municipal loads to the host meter for 20+ year term
- Revenue from lease/PILOT and potential energy savings; option remains for competitive supply contract or community power



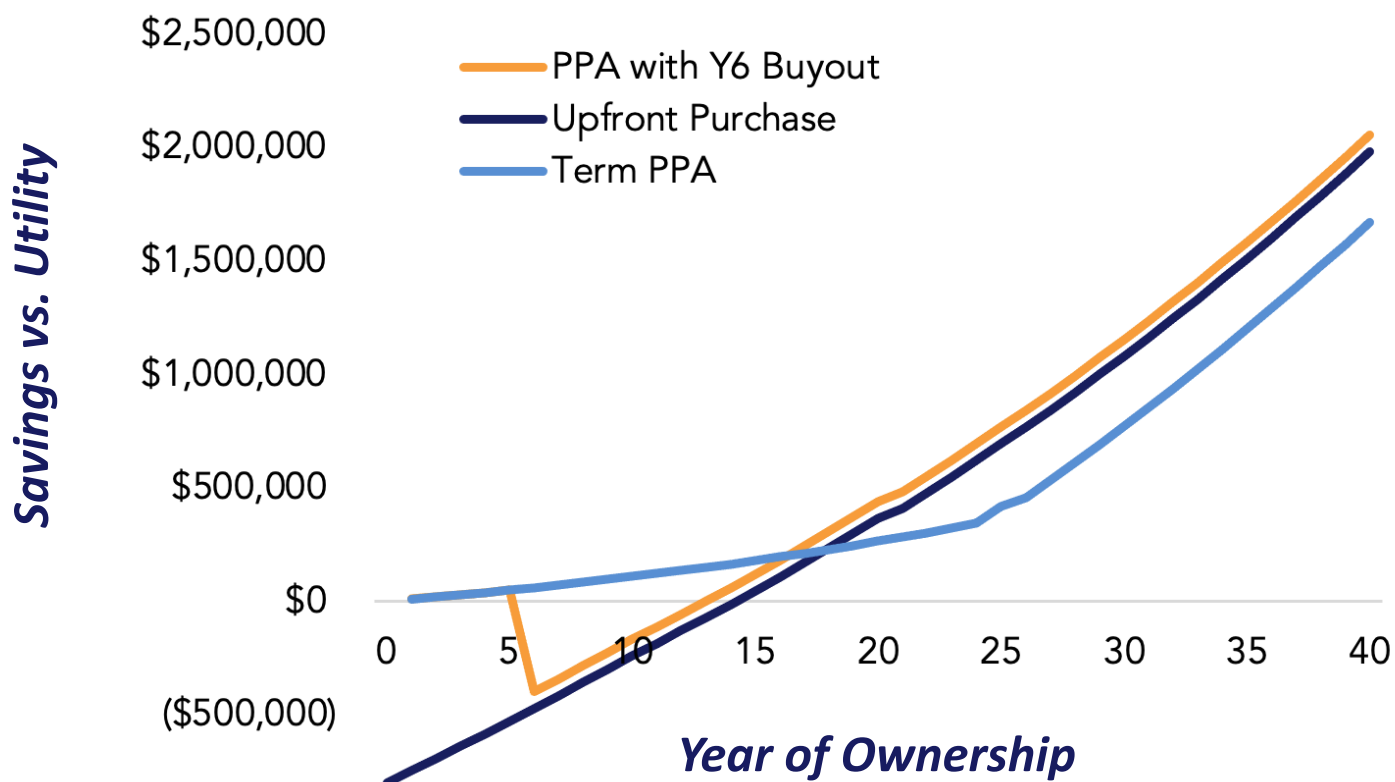
3. Federal Supports for Municipal Solar

- **Inflation Reduction Act** provides “direct pay” of 30% federal tax credit with potential 10% or 20% adders for brownfields, LMI and domestic content
- **American Rescue Plan Act (ARPA)** allocated \$350 billion to local governments (\$1.5 billion NH) for wide range of pandemic response/infrastructure improvements; US Treasury Interim Final Rule 31 (2021) permits green energy projects esp. in connection with water infrastructure; ARPA spending deadline of 12/31/24.
- **Municipal Bonds** cashflow-positive investments to offset municipal loads; owner derives further revenue from Renewable Energy Credits

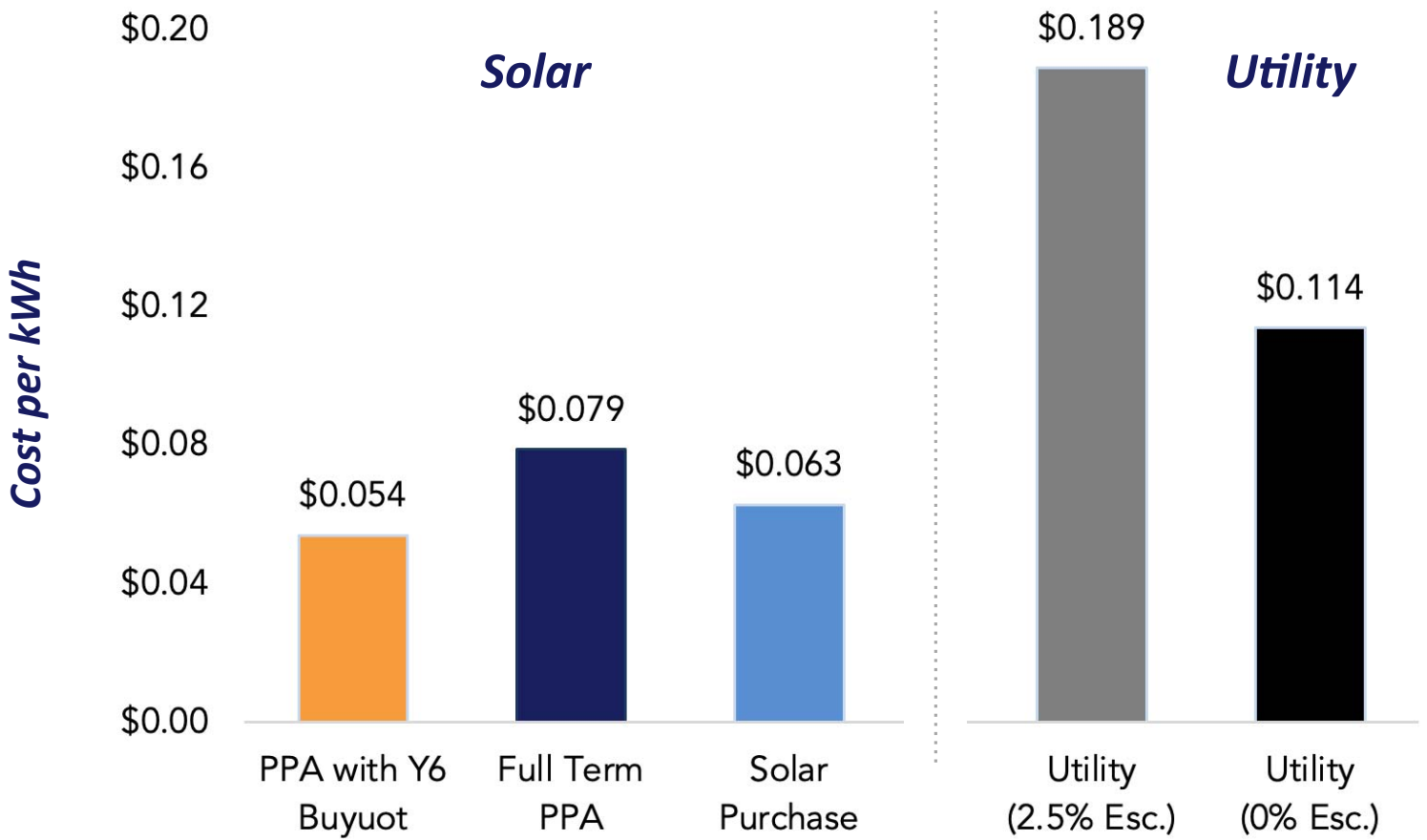


Solar Savings Projection vs. Utility

Sample 400 kW Rooftop PPA



Solar Long-Term Cost of Energy



Solar Development Process

1. County identifies **solar goals** and selects **solar development partner**
2. Partner conducts **load analysis to determine net meter strategy**
3. County and partner complete **detailed site assessments**
4. Partner commences **utility interconnection study procedures**
5. Partner finalizes **system design and engineering** for county approval
6. County and partner complete **local/state permitting** requirements
7. Partner commences **procurement, construction, and commissioning**



Dan Weeks
Employee-Owner
Vice President, Business Development

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Serving New England since 2003
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Polar Bear[®] III HD

10 Degree Flat Roof Mounting System

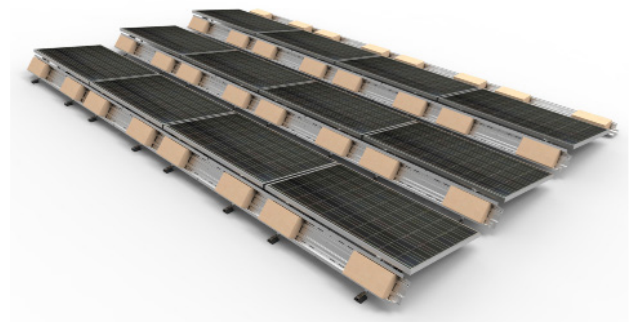
THE ENERGY DENSITY YOU NEED



Flat roof racking that delivers cost savings and peace of mind

The new Polar Bear III HD design draws on seven years of industry experience. It provides more design and energy density flexibility, improved constructability, universal framed module support, enhanced roof protection, better wire management, and a lower cost than Polar Bear III or any other reliable flat roof mounting solution in the market today. Combined with PanelClaw's project support team of flat roof experts, Polar Bear III HD is the obvious choice for your commercial flat roof projects.

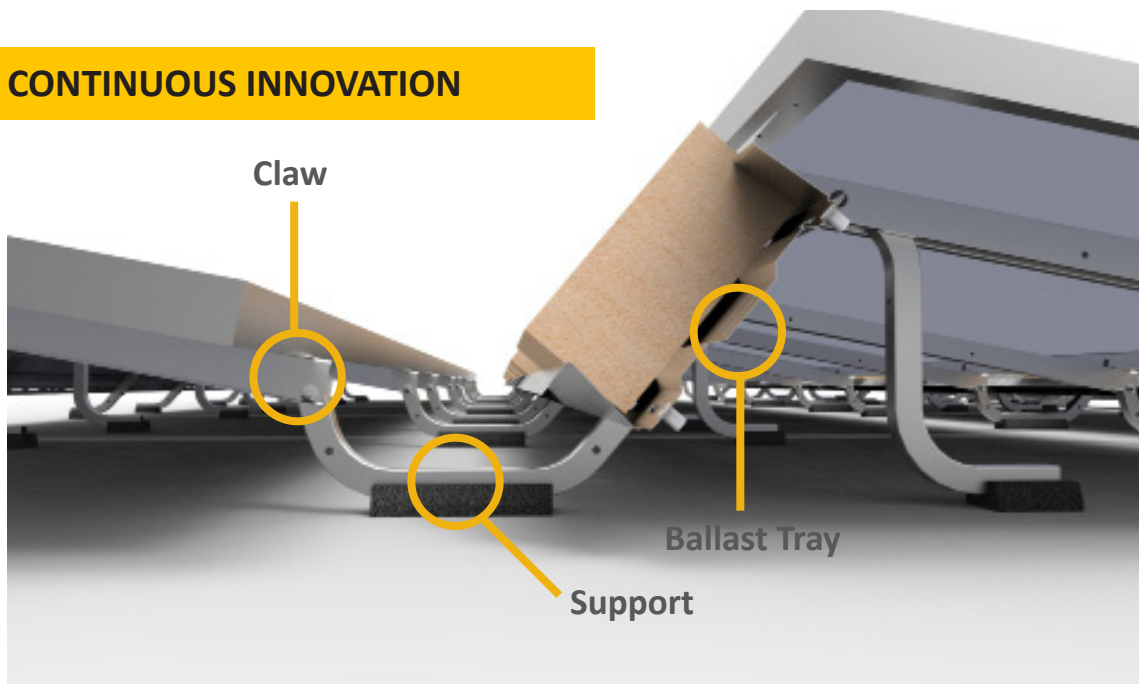
With over 9,000 flat roof projects completed around the world including more than 2,000 jurisdictions in 45 states in the US, we are your flat roof partners. Experience the PanelClaw[®] Advantage on your next flat roof project.



Polar Bear III HD

10 Degree Flat Roof Mounting System

CONTINUOUS INNOVATION



Trusted Roof Integrity

Polar Bear® III HD protects the roof with fully captured ballast, integrated recycled rubber roof protection pads and a system design that allows for free water flow.

Accelerated Construction

The engineered design emphasizes built-in features for construction efficiency:

- Three major components that are light-weight and easy to move
- Pre-installed bolts to quickly mount Ballast Trays
- Single-module tilt-up feature
- Enhanced wire management options

Safety and Reliability

PanelClaw's industry-leading reliability track record in the flat roof space is the result of our investment in an extensive test program that goes beyond existing codes and standards. We maintain long term partnerships with third party test laboratories and codes and standards bodies throughout the industry.

Three Components

Support

- Easy-to-handle components that weigh less than 2.5 pounds
- Integrated recycled rubber roof protection pads
- Pre-drilled holes for wire management cabling options

Ballast Tray

- Angled fit with locking end-tab to fully capture ballast blocks
- Hemmed edges and chamfered corners prevent wiring from coming into contact with sharp edges

Claw

- Attachment to module using standard module mounting holes
- UL 2703 certified for electrical bonding and grounding
- Two energy density mounting options
- Pre-drilled for E/W module-to-module wire management

Applications

Flat roof (max slope 5°)

Fully ballasted or mechanically attached

Module Tilt Angle

10° nominal

North/South Module to Module Repeat

52" or 56"

Platform Load

~1.9psf - 8 psf

Module Orientation

Landscape

Module Attachment

Standard module mounting holes

Basic Wind Speed

Up to 150 mph
(>150 mph by approval)

Wind Exposure Category

B and C (D by approval)

Seismic Compatibility

C, D, E and F

Material

G90 steel with stainless steel fastener

Warranty

25 years

Listings and Certifications

ANSI/UL 2703-2015 listed

UL 2703 System Fire Rating: Class A with Type 1 and Type 2 modules

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powered by

Q.ANTUM DUO Z

PRELIMINARY

Q.PEAK DUO XL-G11.2

570-590

ENDURING HIGH PERFORMANCE



BREAKING THE 21% EFFICIENCY BARRIER

Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 21.7%.



LOW ELECTRICITY GENERATION COSTS

Higher yield per surface area, lower BOS costs and up to 175 watts more module power than standard 144 half-cell modules.



ENDURING HIGH PERFORMANCE

Long-term yield security with Anti LID Technology, Anti PID Technology¹, Hot-Spot Protect and Traceable Quality Tra.Q™.



EXTREME WEATHER RATING

High-tech aluminium alloy frame, certified for high snow (5400 Pa) and wind loads (2400 Pa).



A RELIABLE INVESTMENT

Inclusive 12-year product warranty and 25-year linear performance warranty².



STATE OF THE ART MODULE TECHNOLOGY

Q.ANTUM DUO combines cutting edge cell separation and innovative 12-busbar design with Q.ANTUM Technology.

¹ APT test conditions according to IEC/TS 62804-1:2015, method B (-1500V, 168h)

² See data sheet on rear for further information.

THE IDEAL SOLUTION FOR:



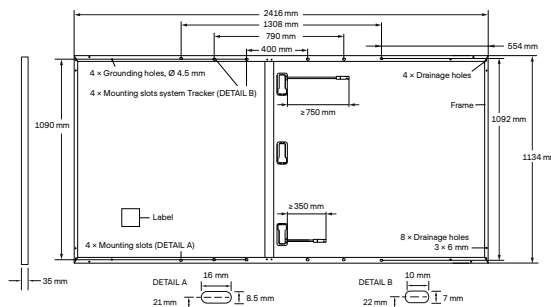
Ground-mounted solar power plants

Engineered in Germany

Q CELLS

MECHANICAL SPECIFICATION

Format	2416 mm × 1134 mm × 35 mm (including frame)
Weight	31.3 kg
Front Cover	3.2 mm thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Anodised aluminium
Cell	6 × 26 monocrystalline Q.ANTUM solar half cells
Junction box	53-101 mm × 32-60 mm × 15-18 mm Protection class IP67, with bypass diodes
Cable	4 mm ² Solar cable; (+) ≥ 750 mm, (-) ≥ 350 mm
Connector	Stäubli MC4-Evo2, Hanwha Q CELLS HQC4; IP68



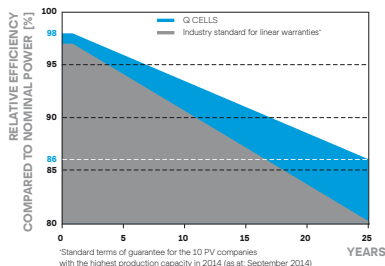
Drawing not to scale

ELECTRICAL CHARACTERISTICS

POWER CLASS		570	575	580	585	590	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC ¹ (POWER TOLERANCE +5 W / -0 W)							
Minimum	Power at MPP ¹	P_{MPP} [W]	570	575	580	585	590
	Short Circuit Current ¹	I_{SC} [A]	13.49	13.51	13.54	13.57	13.59
	Open Circuit Voltage ¹	V_{OC} [V]	53.59	53.62	53.64	53.67	53.70
	Current at MPP	I_{MPP} [A]	12.82	12.87	12.92	12.97	13.01
	Voltage at MPP	V_{MPP} [V]	44.46	44.68	44.90	45.12	45.33
	Efficiency ¹	η [%]	≥ 20.8	≥ 21.0	≥ 21.2	≥ 21.4	≥ 21.5
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT ²							
Minimum	Power at MPP	P_{MPP} [W]	427.6	431.4	435.1	438.9	442.6
	Short Circuit Current	I_{SC} [A]	10.87	10.89	10.91	10.93	10.95
	Open Circuit Voltage	V_{OC} [V]	50.54	50.56	50.59	50.62	50.64
	Current at MPP	I_{MPP} [A]	10.09	10.13	10.17	10.22	10.26
	Voltage at MPP	V_{MPP} [V]	42.39	42.58	42.77	42.96	43.14

¹Measurement tolerances $P_{MPP} \pm 3\%$; I_{SC} ; $V_{OC} \pm 5\%$ at STC: 1000 W/m², 25 ± 2°C, AM 1.5 according to IEC 60904-3 • 2800 W/m², NMOT, spectrum AM 1.5

Q CELLS PERFORMANCE WARRANTY

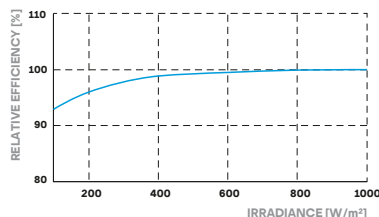


At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Q CELLS sales organisation of your respective country.

¹Standard terms of guarantee for the 10 PV companies with the highest production capacity in 2014 (as at September 2014)

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25°C, 1000 W/m²).

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I_{SC}	α [%/K]	+0.04	Temperature Coefficient of V_{OC}	β [%/K]	-0.27
Temperature Coefficient of P_{MPP}	γ [%/K]	-0.34	Nominal Module Operating Temperature	NMOT [°C]	43 ± 3

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage	V_{SYS} [V]	1500	PV module classification	Class II
Maximum Reverse Current	I_R [A]	20	Fire Rating based on ANSI / UL 61730	C / TYPE 1
Max. Design Load, Push / Pull	[Pa]	3600 / 1600	Permitted Module Temperature on Continuous Duty	-40°C - +85°C
Max. Test Load, Push / Pull	[Pa]	5400 / 2400		

QUALIFICATIONS AND CERTIFICATES

IEC 61215:2016;
IEC 61730:2016.
This data sheet complies
with DIN EN 50380.



www.tuv.com
ID 1111220277

Note: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

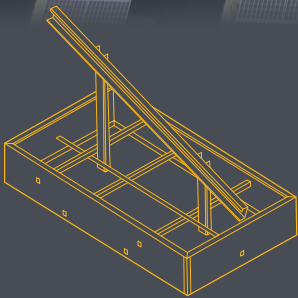
Hanwha Q CELLS GmbH

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FLEXRACK SERIES B

**SOLAR
FLEXRACK™**
A Division of Northern States Metals

*3MW Ballasted Project
New Jersey Meadowland's Kearny Landfill*



*FlexRack Series B
- Cast in Place*

+ TURN-KEY SERVICES

We're here for you because we care about your projects. From engineering to installation, you can leverage our expert turn-key services on any job from start to finish.

Contact us to see how our team of project engineers, field techs, geologists and other specialists can help make sure your next project is a success.

Experience the Flex

CALL US TO FIND OUT HOW THIS GROUNDBREAKING
RACK CAN IMPROVE HOW YOU DO SOLAR

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Pre-Cast

The FlexRack Series B pre-cast system makes use of a two-support system, rather than the one-support system of its contemporaries; transferring loads into the block through two supports instead of one reduces ballast block thickness. The two-support system also enables the use of a split block system, which requires lighter lifting machinery to accommodate sites with low bearing pressure requirements.

Cast in Place

- » Economical shipping - one piece pre-assembled form
- » Posts are set plumb prior to pouring concrete for ease of installation
- » Ability to level posts after form is set for tolerances in installation
- » Form is a customized roll form shape to optimize size and reduce wasted material
- » Requires only four screws for form assembly. Form assembly in under 3 minutes with 2 people
- » Customizable block size allows form to always be filled to the top
- » Internal bracing eliminates need for construction shoring or additional bracing requirements
- » Utilizes same two support system benefits as pre-cast solution

Reduced costs

Our system uses steel and concrete more efficiently, reducing the overall cost of the unit and allowing for a lower array profile. It's also custom engineered to make installation a breeze—no matter the conditions, the Series B can be installed quickly and efficiently, saving you money on labor costs.

Complete compatibility

The FlexRack Series B offers compatibility with all of our ground systems, including the G2 and G3. That means that all the innovative labor savings features and flexibility are still realized with the Series B. The Series B is offered as a pre-cast system or cast in place to meet project specific requirements.

MATERIALS	
Module Hardware	Magni 560 coating standard. Stainless available upon request
Racking Hardware	Hot Dip Galvanized coating is standard
Racking Structure	G90 galvanized steel standard. Higher coatings available for high corrosion areas
DESIGN	
Orientation	Portrait or Landscape
Tilt Angle	5° - 45° (custom tilts can be accommodated)
Racking Slope Tolerance	20% E/W
Local Ballast Slope	5% N/S, E/W
Wind Speed	Any
Snow Load	Any
Module Accommodation	Any 60 or 72 cell framed module along with any frameless module
Module Mounting Type	Direct bolt directly to horizontal rails (bonded connection)
Foundation Accommodation	Pre-cast or Cast in Place
Warranty	20 years
Design Life	30 year service life on all galvanized components
CERTIFICATIONS AND TESTING	
UL Certification	UL 2703 (Issue 2) compliant
Wind Tunnel Testing	CPP third party testing laboratory
Structural Connection Testing	Element Materials Technology
Code Compliance	Racks are designed using site specific loads (wind, snow, and seismic) per the governing local building codes
Finite Element Modeling	Risa 3D
Engineering	PE stamped drawings and calculations
SERVICES	
Geotechnical Engineering	Field investigation and engineering, laboratory testing, engineering analysis, push/pull tests, ballast design
Structural/Civil Engineering	Preliminary investigation, engineering
Installation	Foundation, racking, module, and module prewiring
Training	Onsite installation training at no additional cost

Solar FlexRack, a division of Northern States Metals, is an integrated solar company that offers custom-designed, fixed tilt ground mount and single-axis solar tracking systems in the commercial, community solar and utility-scale solar mounting industries. Solar FlexRack offers full turnkey packages including engineering, geotechnical, pullout testing, field, layout, and installation services to address the actual site conditions of an installation and provide a full scope of services from design to delivery and installation. Solar FlexRack has completed over 2 GW of solar racking installations in 40 states across America and five countries globally. Learn more at <http://solarflexrack.com>