# Solar summary

SAMPLE PROPERTY · screening estimate from public LiDAR, aerials and NREL models

| BEST AVAILABLE ARRAY | ESTIMATED PRODUCTION | TSRF, BEST FACE D | SIMPLE PAYBACK (EST.) |
|---|---|---|---|
| **17.6** kW DC | **16,694** kWh/yr | **67%** | **over 25** years |
| 44 panels on faces D (26) + E (18) | NREL PVWatts v8, this location | solar access 67% x TOF 99% | $43,120 at $2.45/W, no federal credit |

| YEAR-1 BILL SAVINGS (EST.) | 25-YEAR NET SAVINGS (EST.) | USABLE ON ARRAY FACES | 1,000 KWH/KW SCREEN |
|---|---|---|---|
| **$1,453** /yr | **$-7,972** | **1,173** sf | **Below** |
| Duke Energy Carolinas, hourly model | $35,148 saved less system cost | R324.6: 18 in. ridge, 36 in. pathway | best face 956 kWh/kW |

## What this means for the project

**The roof faces the right way, but the trees cost it about a third of its sun.** Both main ridges run east-west, so the two south slopes face due south at 5/12: **D** on the new west wing (26 panels) and **E** on the original house (18 panels). After tree shading they keep 67% and 66% of their sun, so they produce 956 and 938 kWh per kW a year. That is just under our 1,000 kWh/kW screening bar, so this layout is the **best available array, not a clear recommendation**.

**Best available array: 44 panels / 17.6 kW DC, about 16,694 kWh a year**, roughly 137% of a typical NC home's use (EIA average 1,015 kWh a month). The north slopes C, F and I and the small faces add little: every face that fits a panel gives 93 panels and 26,883 kWh, with the extra panels producing 400-560 kWh per kW.

**Payback is more than 25 years** on the hourly bill model at today's Duke Energy Carolinas rates (Schedule RS + Rider NMB while it is open; the Savings sheet also shows Schedule RSTC + Rider RSC). The full array makes more power than a typical home uses, and the surplus earns little, so a smaller array sized to 12 months of bills should pay back faster. The homeowner federal credit (25D) ended for systems installed after December 31, 2025, so it is not included.

**The big lever is one tree.** The 68 ft crown about 20 ft south of the house shades both array faces; removing or topping it would add about 3,745 kWh a year and lift both faces above the screening bar.

All figures are estimates for screening and proposals. Structural capacity, electrical service and interconnection were not evaluated. Confirm setbacks with City of Durham / Durham County Inspections.

**SOLAR VERDICT**

## Not worth it

for this home, best available array

- Payback: no payback within 25 years at today's rates
- Shade: best face keeps 67% of its sun (TSRF)
- Covers about 137% of the home's yearly electricity use

How the ruling works: Not worth it if there is no payback within 25 years, payback is over 20 years, or the best face's TSRF is under 60%. Yes if payback is 12 years or less, TSRF is 75% or more and solar covers 60% or more of yearly use. Otherwise Maybe.

**SOLAR FEASIBILITY REPORT**

INDEPENDENT SOLAR REPORT

SITE
Single-family house with new west wing
Address withheld
9 roof faces

OWNER OF RECORD
Not shown (privacy)

REPORT DATE
November 20, 2026

MEASUREMENT BASIS
NC 2024 Phase 3 QL1 LiDAR
NC OneMap 2024-2027 aerial
NREL PVWatts v8 (NSRDB TMY)
No site visit

REPORT ID
CC-SAMPLE-SOLAR-2026-11

SHEETS


| | |
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| SF-03 | 3D View |
| SF-04 | Facets & TSRF |
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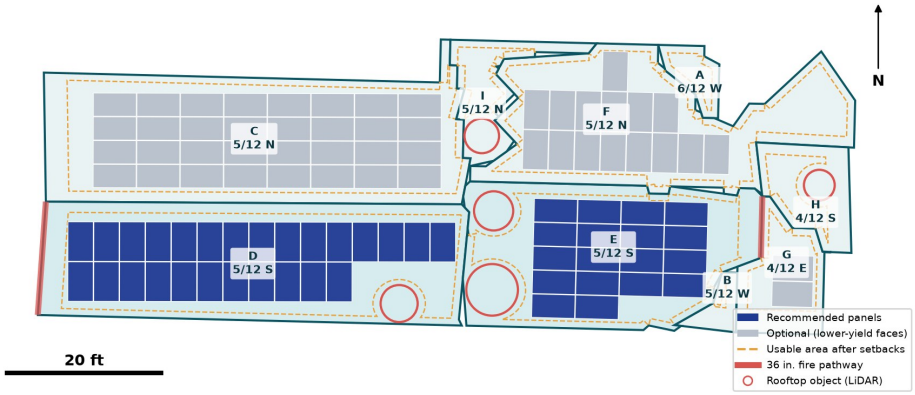

SHEET
**SF-01**


*Public-source measurements and calculations.*

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# Layout & setbacks

Estimated panel placement on the roof plan, ~400 W modules, 1.0 x 1.7 m; NC Residential Code R324.6 setb




## Reading the layout

**Blue panels** are the best available array (D (26) + E (18)). **Grey panels** fit on the lower-yield north and east faces; add them only for maximum offset.
Faces are labeled with pitch and the direction they face.
**Gold dashed lines** are the usable area after setbacks. **Red bars** are the 36 in. eave-to-ridge fire pathways. Red circles are rooftop objects found in the LiDAR.

## Setbacks used (NC R324.6)

**Ridge:** 18 in. clear on both sides of each ridge. The array covers 22% of the roof's plan area, under the 33% line where R324.6.2 allows 18 in.
**Pathways:** a 36 in. pathway from eave to ridge on each array face (R324.6.1), placed on one side edge.
**Other edges:** 12 in. at eaves and rakes and 18 in. at valleys. These are installer practice, not code, and leave room for racking.

## Rooftop objects

LiDAR found 5 raised object(s) on the roof planes, including the step where the taller west wing meets the original roof over face E; panels are kept clear of them. Small vents and pipes are not clearly visible in the 2024-2027 aerial, so **check vent locations before final design**; one or two panels may move.
Face letters match the roof model used throughout this report.

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Address withheld
9 roof faces

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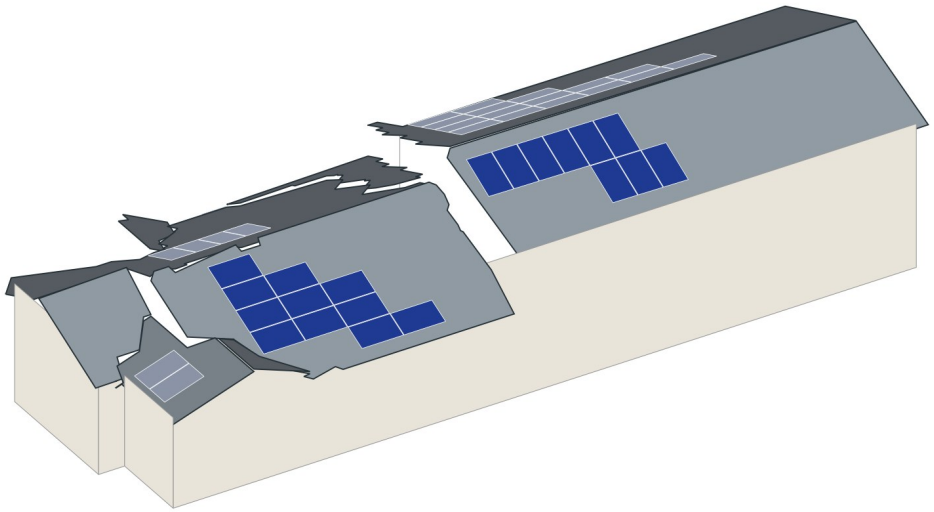
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# 3D view

Array on the roof model, seen from the south-east



## What you are looking at

The roof faces are the planes used for every number in this report, with the 44 array panels placed exactly as on the layout sheet. Faces turned away from the viewer are drawn darker.

The taller west wing (faces C and D) sits about 6 ft above the original ridge.

Walls are simplified (straight down from the eaves to the ground level found in the LiDAR); windows, trim and trees are not shown. Panel color and frame are generic.

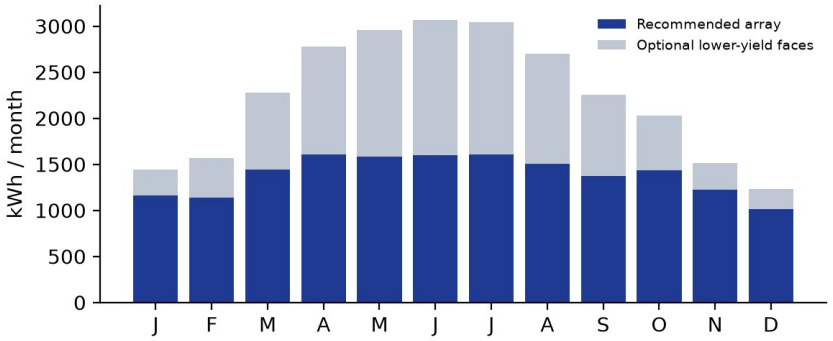


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# Facets, TSRF & production

Per-face solar numbers; TSRF = solar access x tilt-and-orientation factor (TOF)

| Facet | Faces | Pitch | Az. | Area sf | Usable sf | Panels | kW DC | kWh/yr | kWh/kW | Solar access | TOF | TSRF | TSRF May-Oct | TSRF Nov-Apr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | W | 6/12 | 271° | 49 | 22 | 0 | 0.0 | 0 | 706 | 61% | 82% | 50% | 54% | 44% |
| B | W | 5/12 | 271° | 32 | 2 | 0 | 0.0 | 0 | – | – | 83% | – | – | – |
| C | N | 5/12 | 0° | 971 | 766 | 32 | 12.8 | 7,116 | 556 | 60% | 66% | 40% | 47% | 31% |
| D * | S | 5/12 | 180° | 910 | 688 | 26 | 10.4 | 9,941 | 956 | 67% | 99% | 67% | 83% | 48% |
| E * | S | 5/12 | 181° | 703 | 485 | 18 | 7.2 | 6,753 | 938 | 66% | 99% | 65% | 68% | 62% |
| F | N | 5/12 | 1° | 662 | 505 | 15 | 6.0 | 2,652 | 442 | 48% | 67% | 32% | 38% | 25% |
| G | E | 4/12 | 91° | 157 | 84 | 2 | 0.8 | 421 | 526 | 43% | 86% | 37% | 35% | 38% |
| H | S | 4/12 | 181° | 135 | 42 | 0 | 0.0 | 0 | 37 | 4% | 98% | 3% | 4% | 3% |
| I | N | 5/12 | 4° | 120 | 40 | 0 | 0.0 | 0 | 276 | 30% | 67% | 20% | 24% | 16% |
| **Total** | | | | **3,739** | **2,634** | **93** | **37.2** | **26,883** | | | | | | |




## How to read it

* = best available array; – = face too small to sample for shade. **Solar access** is the share of sun the face keeps after shading. **TOF** compares the face's tilt and direction to the best fixed orientation here (30° tilt, due south). **TSRF** combines the two. Faces D and E have near-ideal TOF (99%); shade is what holds them back.

Panels ~400 W. PVWatts v8: fixed roof mount, DC/AC 1.2, inverter 96%, standard 14% losses with the 3% shading term replaced by the LiDAR solar access per face.

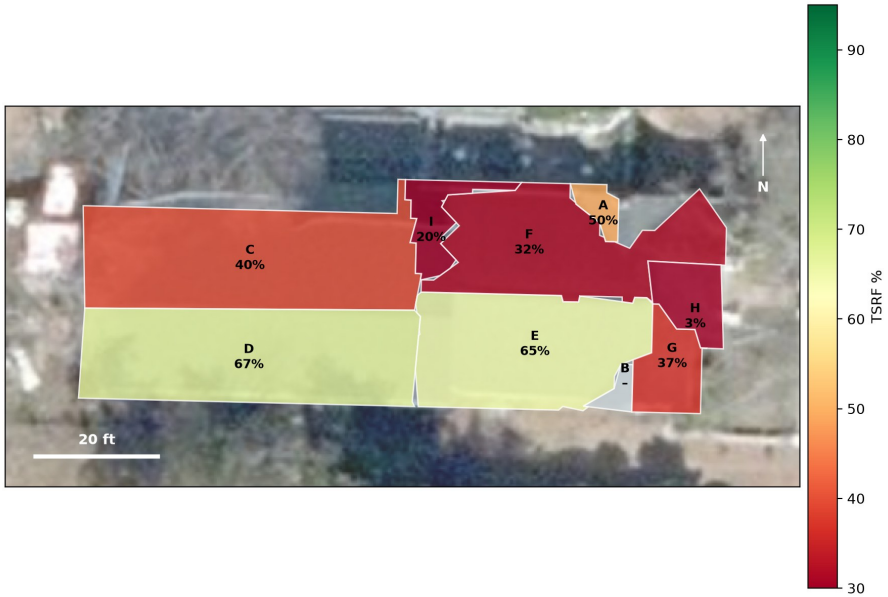
Weather: NSRDB PSM v3 TMY, 1.9 km from the house.



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# Shade map & seasons

TSRF by roof face, with summer and winter solar access




## Shading method

Solar access comes from the 2024 NC Phase 3 QL1 LiDAR surface (trees, neighboring houses and this roof) out to 200 ft. Every 4 ft on each face, the sun is traced every half hour on a typical day each month (sun above 5°), and each sun position is weighted by how squarely it hits the face.

## Seasons

Face D on the west wing keeps 82% of its sun May-October but only 50% November-April, when the low winter sun passes through the tall crown to the south. Face E on the original house keeps 67% in summer and 65% in winter. The north slopes C and F keep 60% and 48%, and the small south face H is almost fully shaded by the taller wing.

The 2024 LiDAR was flown on February 5, 2024, with leaves off. Bare deciduous crowns still return points, but leaf-on summer shade can be somewhat higher than shown; the Tree check sheet tests this against the leaf-on 2022 NAIP aerial. Shading uses direct sun only; diffuse light is not reduced.

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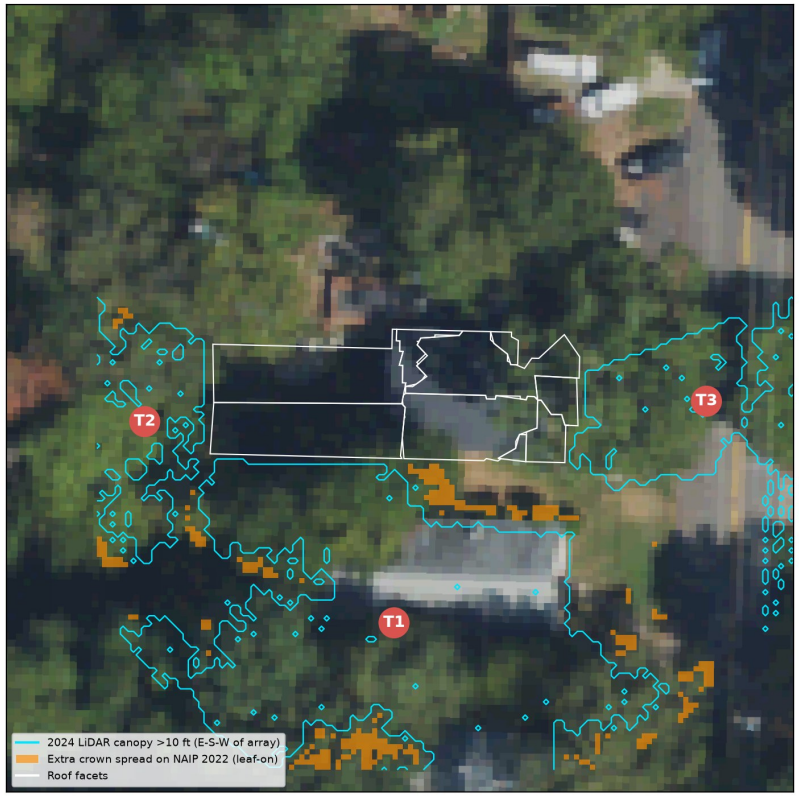
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# Tree check 2024 vs 2022

Is the leaf-off 2024 LiDAR shading still right in summer? Canopy compared with the leaf-

USDA NAIP Sep 14, 2022 (leaf-on, 0.6 m) with 2024 LiDAR canopy




## What the leaf-on aerial adds

Within 110 ft to the east, south and west of the array, the 2024 LiDAR shows about 11,848 sf of tree canopy taller than 10 ft. The September 2022 NAIP leaf-on aerial shows about 639 sf of extra crown at the edges of those trees (orange).

**Effect on the array:** extending those trees into the extra crown area cuts production by about 40 kWh a year, so the LiDAR shading numbers hold.

## Trimming candidates

| Tree | Height (2024) | Distance | Direction | Gain if removed |
|---|---|---|---|---|
| T1 | 68 ft | 20 ft | S | 3,745 kWh/yr |
| T2 | 70 ft | 69 ft | W | 427 kWh/yr |
| T3 | 72 ft | 38 ft | E | 258 kWh/yr |

Removing or topping **T1**, the 68 ft crown 20 ft to the south, would add about 3,745 kWh a year (about $326) and raise solar access on D to 87% and on E to 74%.

Aerials show crown spread, not height; tree heights are from the 2024 LiDAR. The 2024-2027 aerial was flown leaf-off and cannot show canopy. Shadows can hide crowns in the aerial.

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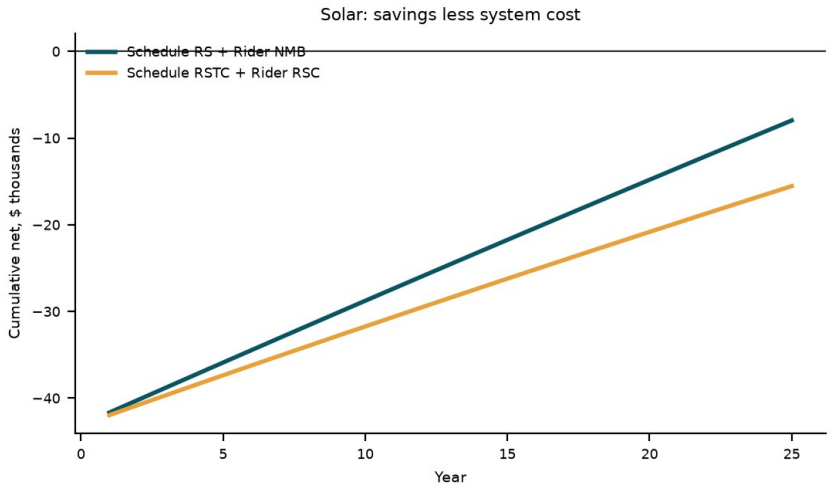
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# Savings & payback

Hourly bill model, recommended array, both Duke tariff pairings; every figure is an estimate

| | |
|---|---|
| System size | **17.6 kW DC, 44 panels** |
| Installed cost (est.) | **$43,120 at $2.45/W** |
| Federal tax credit | **$0 (25D ended 12/31/2025)** |
| Usage basis | **EIA NC average, 1,015 kWh/mo** |
| Today's bill, Schedule RS | **$1,722/yr** |
| Non-bypassable charge | **$209/yr ($0.99 per kW DC per month)** |
| Solar used in the home | **5,352 kWh/yr** |
| Solar sent to the grid | **11,342 kWh/yr** |
| All faces (max fit), NMB | **37.2 kW, 25-yr net -$50,856** |

| | RS + Rider NMB | RSTC + Rider RSC |
|---|---|---|
| Who can take it | Applications filed before Jan 1, 2027 | New solar customers after that |
| Year-1 bill with solar | $269 | $561 |
| Year-1 bill savings | $1,453 | $1,160 |
| Simple payback | over 25 years (cost / year 1 = 30) | over 25 years (cost / year 1 = 37) |
| 25-year savings | $35,148 | $27,576 |
| 25-year net (after cost) | -$7,972 | -$15,544 |
| Value per solar kWh, year 1 | 8.7¢ | 6.9¢ |




## What it means

On Schedule RS + Rider NMB the array saves about **$1,453 in year 1**. Savings depend on when the home uses power: the more solar used in the home or inside the same time-of-use period, the higher the value, because exports earn only 4.53¢.

Utility rebates are not included because program capacity changes.

## How it is figured

Each of the 8,760 hours of the year, this report's NREL PVWatts v8 solar output is set against an hourly household load (NREL ResStock North Carolina single-family shape, scaled to 1,015 kWh a month). The bill is then priced on each Duke Energy Carolinas tariff pairing and compared with today's bill on Schedule RS with no solar.

**Rider NMB** nets use and exports over the whole month; it is open only to interconnection applications filed before Jan 1, 2027 while its 2026 cap lasts. **Rider RSC** requires time-of-use Schedule RSTC and nets within each time-of-use period, so midday solar offsets cheaper hours. Both credit net excess at 4.53¢/kWh and carry a $22 minimum bill and the $0.99/kW-month charge.

**Headline figures use Schedule RS + Rider NMB** because it is still open on the report date. Assumptions: rates held at 2026 levels, panel output -0.5% a year, 20 critical-peak days on RSTC, same pairing for 25 years. Maintenance, inverter replacement and financing are not included.

Sources: Duke Energy Carolinas NC Schedule RS and Schedule RSTC (Leaf 136), effective Jan 1, 2026; Rider RSC (Leaf 141) and Rider NMB (Leaf 143), effective Sep 1, 2026 (NCUC E-7 Sub 1333); OpenEI rider adjustment 0.4951¢/kWh (1/1/2026); NREL PVWatts v8 hourly; NREL ResStock 2024 release 2 NC single-family load shape; NC market cost data, Oct 2026; IRS 25D FAQ. Full tariff detail: Time-of-use comparison sheet.



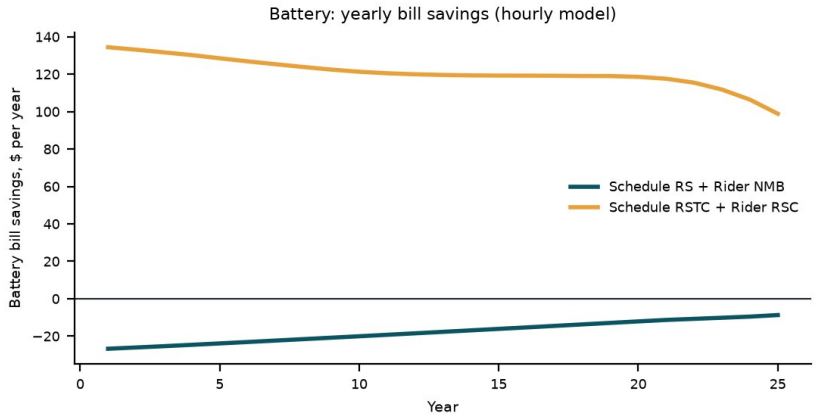
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# Battery savings

One home battery added to the recommended array, hourly bill model; estimates and labeled assumptions

| | |
|---|---|
| Battery (assumed) | **13.5 kWh home battery class, 13.5 kWh usable** |
| Installed cost (est.) | **$15,647 ($1,159/kWh, NC market data, 2026)** |
| Federal tax credit | **$0 (25D ended 12/31/2025)** |
| Duke PowerPair incentive | **Not included (capacity not confirmed)** |
| Round-trip efficiency | **89% (manufacturer datasheet)** |
| Capacity wear | **3%/yr to the 70% warranty floor** |
| Battery control credit | **$53/mo CONDITIONAL, not counted** |

| | RS + Rider NMB | RSTC + Rider RSC |
|---|---|---|
| Stored and used, year 1 | 4,387 kWh | 3,937 kWh |
| Year-1 battery savings | -$27 | $134 |
| 25-year battery savings | -$442 | $3,021 |
| Battery simple payback | none (no bill savings) | over 25 years (cost / year 1 = 116) |
| 25-year net (after cost) | -$16,089 | -$12,626 |
| Payback if the credit is confirmed | 26 years | 20 years |




## How the battery is valued

The battery is run hour by hour in the same bill model as the Savings & payback sheet: it charges only from solar the home is not using and discharges into household use. Savings are the solar-only bill minus the solar-plus-battery bill on each tariff. **On Rider NMB** exports are netted over the month, so a stored kWh is worth no more than an exported one and the 89% round-trip efficiency makes the battery cost about $27 a year. **On Rider RSC** (Schedule RSTC) the battery moves midday solar into on-peak and critical-peak hours, worth about $134 a year. Headline: Schedule RS + Rider NMB. **Battery control credit:** Duke's Power Manager Battery Control credit (about $636 a year from third-party sources) is CONDITIONAL until Duke confirms the rate, so it is not in the base figures; the last row shows payback if it is confirmed. **Federal:** no 25D credit for installs after Dec 31, 2025 (IRS). **Duke PowerPair:** not counted.

Assumption: same battery schedule every day; capacity straight-line to the warranty floor, continued after year 10; rates held at 2026 levels; no replacement, maintenance or financing. Backup power during outages has value to many owners but is not priced here. Sources: battery manufacturer datasheet: 13.5 kWh usable AC energy; battery manufacturer datasheet: 89% solar-to-battery-to-home round-trip efficiency; battery manufacturer limited warranty (USA): 70% of 13.5 kWh retained at 10 years; applied as a straight-line 3%/yr capacity loss (assumption: the warranty floor, continued after year 10); consumer guide, "Your guide to home batteries in 2026" (updated Aug 26, 2026): $1,159/kWh average, $15,647 installed for 13.5 kWh, before incentives; IRS, Residential Clean Energy Credit page and Public Law 119-21 (OBBB) FAQ: no 25D credit for expenditures after Dec 31, 2025; a battery counts when its installation is completed, so 2026 installs get $0.



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# Battery control credit

Duke Power Manager Battery Control and PowerPair: confirmed vs. conditional

BATTERY CONTROL CREDIT
**$53** /mo
CONDITIONAL: rate not on a Duke page

IF ENROLLED, PER YEAR
**$636** /yr
13.5 kWh battery at 11.5 kW

POWER MANAGER BATTERY CONTROL
**Open**
Duke page: enroll online

POWERPAIR (UP TO $9,000)
**Not counted**
capacity not confirmed

| Item | Value used | Status | Source |
|---|---|---|---|
| Credit rate | $6.50 per kW-month x 70.9% | Conditional | an industry newsletter (Oct 29, 2026); an installer guide (Jul 2, 2026). another installer guide (Feb 9, 2026) lists about $4.50/kW-month |
| Battery size for credit | 11.5 kW continuous | Confirmed | battery manufacturer datasheet (US) |
| Program open | Yes, enroll online; 30-36 events a year | Confirmed | Duke Energy Battery Control page, read Nov 12, 2026 |
| NMB customers | Must enroll in Battery Control with PowerPair | Confirmed | Duke Energy news release, Apr 4, 2024 |
| PowerPair incentive | Up to $9,000 one time | Not counted | Duke news release; capacity near full in 2026 per installer sources |
| Battery payback, credit counted | 26 years | Conditional | $15,647 battery / (bill savings + credit) |
| Battery payback, no credit | not recovered | Base case | Battery savings sheet, year 1, headline tariff |

## How to read this sheet

Duke pays a monthly bill credit when it can call on a home battery up to 30-36 times a year. The published third-party rate works out to about **$53 a month** for a 13.5 kWh home battery, but Duke's own page did not show the rate when we read it on Nov 12, 2026, and one installer guide lists a lower rate. **The credit is shown as conditional and is not added to any total in this report.**

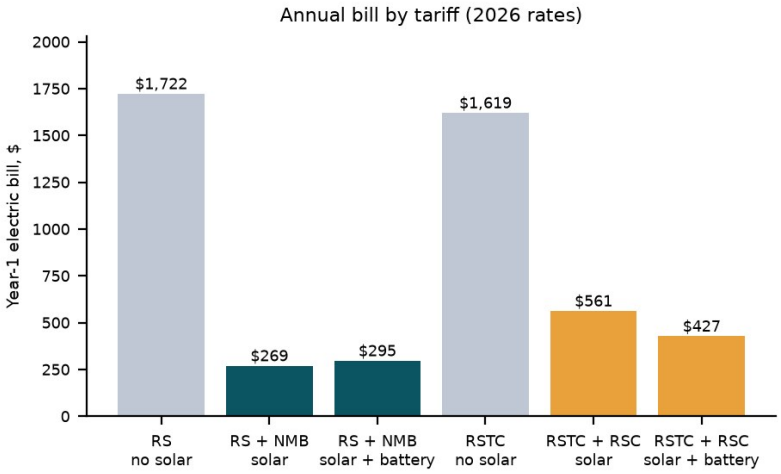
Whether a home on Schedule RSTC with Rider RSC can also take Battery Control was not confirmed in the sources read. Homes that take PowerPair on Rider NMB must enroll in Battery Control. Ask the installer to confirm the rate, eligibility and any PowerPair reservation in writing before signing.

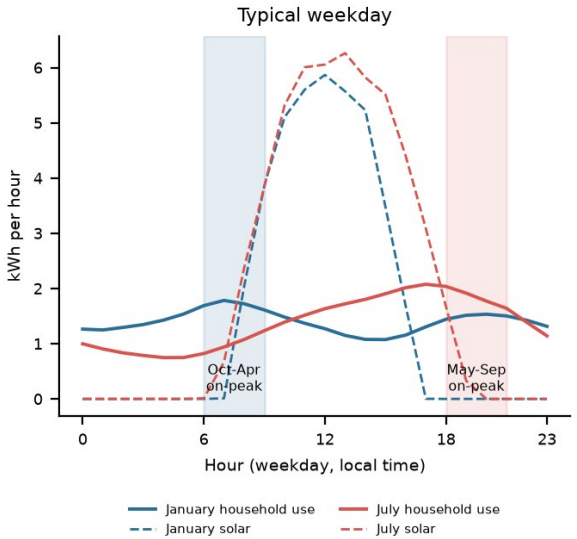
Sources: Duke Energy, Power Manager Battery Control page (duke-energy.com/home/products/power-manager/battery-control, read Nov 12, 2026): enrollment open online; monthly bill credits for each month of participation; battery control events up to 30-36 times a year; Duke Energy news release, Apr 4, 2024 (PowerPair approved by NCUC Jan 11, 2024): PowerPair customers enroll on Rider RSC or on Rider NMB; NMB customers must enroll in the Power Manager Battery Control option and receive the monthly credits; customers may opt out of four events a year; Duke Energy news release, Apr 4, 2024: PowerPair one-time incentive of up to $9,000 for a new solar plus battery system, based on the array and battery installed; Third-party summaries, not a Duke tariff: an industry newsletter, Duke Energy Carolinas residential page (terms checked Oct 29, 2026): $6.50 per kW-month x 70.9% capability factor, about $52 a month for a 13.5 kWh home battery; an installer guide (Jul 2, 2026): $6.50 per kW a month, $52-$91 a month. another installer guide (Feb 9, 2026) lists about $4.50/kW-month. Duke's public page did not show the rate when read; PowerPair capacity: an industry newsletter (Oct 2026) reports under 3% of capacity left and the pilot ending December 2026; an installer guide (Nov 2, 2026) reports DEC capacity remaining under the Choice (TOU) option only. Not confirmed on a Duke page this run; battery manufacturer datasheet (US): continuous on-grid output configurable up to 11.5 kW

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# Time-of-use comparison

RS + Rider NMB vs. RSTC + Rider RSC, with and without a battery; 2026 rates




| Tariff | No solar | Solar | Solar + battery | Solar saves | Battery adds |
|---|---|---|---|---|---|
| Schedule RS + Rider NMB | $1,722 | $269 | $295 | $1,453/yr | -$27/yr |
| Schedule RSTC + Rider RSC | $1,619 | $561 | $427 | $1,160/yr | $134/yr |

## What it shows

Savings are compared with today's bill on Schedule RS with no solar ($1,722 a year at 12,180 kWh). This 17.6 kW array makes 16,694 kWh; the home uses 5,352 kWh of it as it is made and sends 11,342 kWh to the grid.

**Rider NMB** nets the whole month, so a battery cannot raise the credit and its losses cost about $27 a year. **Rider RSC** nets each time-of-use period separately, so moving midday solar into the on-peak hours is worth about $134 a year here. NMB closes to new applicants on Jan 1, 2027.

## Method and assumptions

Hourly solar: this report's NREL PVWatts v8 run for faces D and E (8,760 hours).

Hourly use: NREL ResStock NC single-family load shape, scaled to the usage used in this report. Bills use the tariff leaf rates, riders, $0.99/kW non-bypassable charge and $22 minimum bill.

Assumption: Duke calls all 20 critical peak days, on the 20 non-holiday weekdays with the highest household on-peak use (the tariff maximum; Duke chooses the actual days). Assumption (battery schedule): charges only from solar the home is not using; on RSTC it discharges into on-peak and critical peak use first and keeps enough charge overnight for the next winter morning peak; on RS it discharges whenever use exceeds solar. Fixed monthly rider charges are the same in every case and are left out.

Sources: Duke Energy Carolinas NC Schedule RS and Schedule RSTC (Leaf 136), effective Jan 1, 2026; Rider RSC (Leaf 141) and Rider NMB (Leaf 143), effective Sep 1, 2026 (NCUC E-7 Sub 1333); OpenEI URDB rider adjustment 0.4951¢/kWh (RS and RSTC, 1/1/2026); NREL ResStock 2024 release 2; NREL PVWatts v8; battery manufacturer datasheet. Critical peak hours are their own netting period.

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# Roof covering history

County records and government aerials 2012-2024; a flag, not a roof inspection




| | |
|---|---|
| Year built (county) | **1920** |
| Original house permit | **None found** |
| Re-roof permit on record | **None found** |
| Aerials compared | **4 government aerials** |
| Brightness step | **none** |
| Flag | **Inspect covering before install** |

## What we found

The Durham County tax card lists the house as built in 1920. No re-roof permit is on record in the Durham LDO portal or the county building permit layer.
No step in roof brightness was found between aerials.

## What to do

If the covering is original, it has been in service since 1920. Have the installer or a roofer inspect the roof covering before the array goes on.

Sources: Durham County tax card (taxcama.dconc.gov, REID from the parcel record): year built, read Nov 12, 2026; Durham LDO portal permit search and Durham GIS All Building Permits layer (PublicServices/Inspections), searched Nov 12, 2026; Durham County / City GIS orthophotos 2002-2025, NC OneMap statewide orthos, USDA NAIP 2022 (government aerials only). No commercial imagery, no owner photos.

Brightness = mean roof brightness inside the LiDAR outline divided by the median of the whole aerial tile, after each aerial's registration shift. Aerials differ in season, sun angle and processing, so the trend is evidence, not a measurement of the roof covering.

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# Wind & snow loads

Mapped ASCE 7 values at the address (ASCE Hazard Tool), for racking design

**BASIC WIND SPEED**
**114 mph**
ASCE 7-16, Risk Category II

**GROUND SNOW LOAD**
**15 psf**
ASCE 7-16 map

**BASIC WIND SPEED**
**113 mph**
ASCE 7-22, Risk Category II (reference)

**GROUND SNOW LOAD**
**26 psf**
ASCE 7-22, Risk Category II (reference)

| Value | At this address | Standard | Where it is used |
|---|---|---|---|
| Basic wind speed V | 113.8 mph | ASCE 7-16 Fig. 26.5-1B (RC II) | 2018 NC codes in force; racking and attachment design |
| Ground snow load pg | 15 psf | ASCE 7-16 Fig. 7.2-1 | Roof snow load on the array |
| Basic wind speed V | 112.7 mph | ASCE 7-22 (RC II) | Reference only; not yet adopted in NC |
| Ground snow load pg | 26.2 psf | ASCE 7-22 risk-targeted (RC II) | Reference only; not yet adopted in NC |

## Notes

NC permits are still reviewed under the 2018 NC codes (NC OSFM, March 2026), which use ASCE 7-16 loads. A third-party listing for the City/County of Durham notes plan reviews at 115 mph, Exposure B and 15 psf snow; the county table in the NC code governs, and the engineer of record sets exposure, topography and roof-zone pressures.

The mapped ASCE 7-22 snow value is higher because 7-22 uses risk-targeted snow maps. It is shown so the installer knows the newer standard, not as a design value.

Sources: ASCE Hazard Tool GIS services (gis.asce.org/arcgis/rest/services: ASCE/wind2016_700, ASCE722/w2022_mri700, ASCE/SnowLoad, ASCE722/s2022_RiskCategory2), queried at the address point Nov 12, 2026; NC OSFM Engineering Newsletter, March 2026: construction and code enforcement continue under the 2018 NC Building Code; the 2024 code is not yet effective; a third-party AHJ listing for City/County of Durham (third-party compilation, 2026): plan review notes 115 mph, Exposure B, 15 psf snow; ASCE 7-16. Not an official Durham page

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Address withheld
9 roof faces

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REPORT DATE
November 20, 2026

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NC OneMap 2024-2027 aerial
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# Permit checklist

Durham City-County: office, submittals and links (links checked Nov 20, 2026)

## Permit office

**City-County Building & Safety Department (serves the City and County of Durham)**

101 City Hall Plaza, Ground Floor, Suite 400, Durham, NC 27701 • 919-560-4144

## What the permit needs

• Building permit and electrical permit for the PV system, applied for online through Dplans by a licensed contractor (or a homeowner acting as own contractor).
• Plans: one set showing array layout, wiring, overcurrent protection, inverter, disconnects, required signs, AC connection and roof attachment detail; engineer-stamped plans are expected.
• Spec sheets and installation manuals for modules, inverter, combiner, disconnects and racking.
• Code: 2018 NC Residential Code for one- and two-family dwellings (2018 NC Building and Fire Codes for commercial).
• Fees: Building Permit Fee Schedule G and Electrical Permit Fee Schedule G (City fee schedule page).
• Inspections: scheduled by the permit applicant in the Land Development Office (LDO) portal; two inspections for small rooftop solar; the NC rooftop PV inspection procedure applies.
• Permits expire six months after issue if no inspection is made.
• Utility: Duke Energy Carolinas interconnection request and Rider RSC or NMB enrollment are separate from the building permit.

## Fast-track status

**SolarAPP+:** Not live. SolarAPP+ lists 491 live jurisdictions and none in North Carolina (gosolarapp.org, read Nov 12, 2026). A third-party AHJ listing marks Durham as "targeted", which is not a live program.

**NC fast-track:** No statewide NC solar fast-track. NC G.S. 160D-1110: when a local government reviews residential plans, the initial review must be done within 15 business days, with a partial fee refund after 20 business days.

| Link | Checked |
|---|---|
| Solar PV System Permitting Requirements (PDF)<br>https://www.durhamnc.gov/DocumentCenter/View/26268/Solar-Photovoltiac-PV-System-Permitting-Requirements | Opens |
| Application forms (City-County Building & Safety)<br>https://www.durhamnc.gov/295/Application-Forms | Opens |
| Dplans online permit portal<br>https://www.durhamnc.gov/467/Dplans | Opens |
| Land Development Office (LDO) portal, inspections and status<br>https://ldo4.durhamnc.gov/DurhamWeb/ | Opens |
| Residential Rooftop Solar PV Inspection Procedure (PDF)<br>https://www.durhamnc.gov/DocumentCenter/View/27886/Residential-Rooftop-Solar-Photovoltaic-Inspection-Procedure-April-23-2019 | Opens |
| Durham County Going Solar page<br>https://dconc.gov/Engineering-and-Environmental-Services/Sustainability/Community-Resources/Going-Solar | Opens |
| City-County Building & Safety Department<br>https://dconc.gov/PublicSite/Departments/CityCountyBuildingandSafety | Opens |
| Duke Energy Solar Choice net metering<br>https://www.duke-energy.com/Home/Billing/Solar-Choice-Net-Metering | Opens |
| NC G.S. 160D-1110 (building permits; 15-business-day initial review)<br>https://www.ncleg.gov/EnactedLegislation/Statutes/HTML/BySection/Chapter_160d/GS_160d-1110.html | Opens |
| SolarAPP+ live jurisdictions list<br>https://www.gosolarapp.org/where-is-solarapp-available | Opens |

Jurisdiction from the Durham County parcel record (city: Durham; ETJ: Durham City). Requirements change; the permit office has the final word. Sources: Durham County, City-County Building & Safety page and the Solar PV System Permitting Requirements sheet (read Nov 12, 2026).

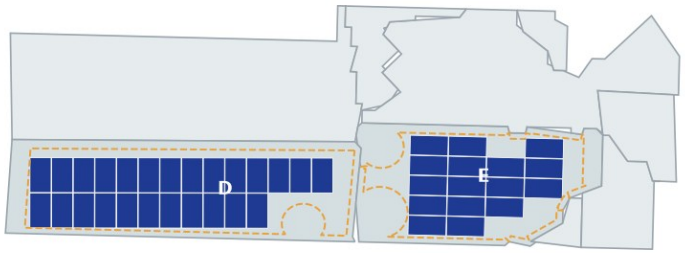


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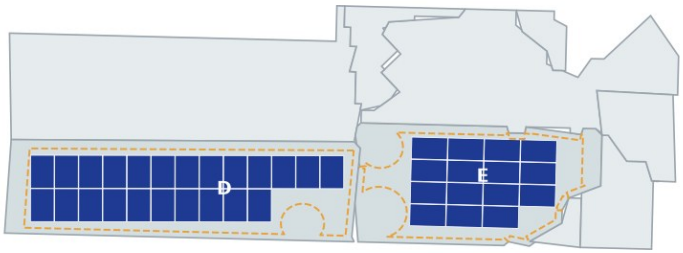
# Panel options

Same usable roof area and setbacks, two module sizes: count, size and yearly output

400 W module: 41 panels, 16.4 kW




430 W module: 38 panels, 16.3 kW




| Module | Size | Face D | Face E | Panels | kW DC | kWh / yr | Roof share |
|---|---|---|---|---|---|---|---|
| 400 W module | 1.821 x 1.016 m | 25 | 16 | 41 | 16.4 | 15,563 | 22% |
| 430 W module | 1.722 x 1.134 m | 23 | 15 | 38 | 16.3 | 15,505 | 21% |

## What it means

The wider 430 W module fits fewer rows inside the same setbacks, so this roof holds 38 of them (16.3 kW) against 41 of the 400 W size (16.4 kW). The 400 W layout makes about 58 kWh a year more here. Both stay under the 33% roof share, so the 18 in. ridge setback holds.

Output uses each face's own PVWatts yield with LiDAR shading from this report, so the comparison is about fit, not panel efficiency. Installers may offer other sizes; ask for the layout with their module.

Sources: module manufacturer datasheet : 400 W, 1821 x 1016 mm; module manufacturer datasheet (2026-04 Rev02, NA): 430 W, 1722 x 1134 mm; Annual kWh = kW DC x each face's PVWatts v8 specific yield with LiDAR shading, from this report (no temperature-coefficient differences between modules)

SOLAR FEASIBILITY REPORT

INDEPENDENT SOLAR REPORT

SITE

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Address withheld
9 roof faces

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MEASUREMENT BASIS

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NC OneMap 2024-2027 aerial
NREL PVWatts v8 (NSRDB TMY)
No site visit

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SF-14



*Public-source measurements and calculations.*

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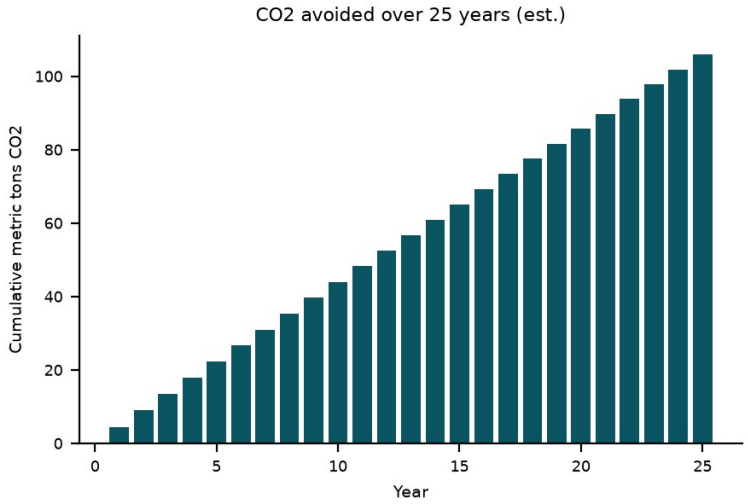
# Carbon offset

CO2 the recommended array keeps off the Duke Energy Carolinas grid, EPA eGRID rate

**CO2 AVOIDED, YEAR 1**
**4.5** t/yr
metric tons

**CO2 AVOIDED, 25 YEARS**
**106** t
with 0.5%/yr panel wear

**GRID CO2 RATE**
**593.4** lb/MWh
eGRID2023 SRVC




## How it is figured

Year-1 production of 16,694 kWh x 593.419 lb CO2 per MWh = 5.0 short tons, or 4.5 metric tons, of CO2 a year.

Duke Energy Carolinas is in the EPA eGRID subregion SRVC (SERC Virginia/Carolina). eGRID2023 is the latest release on the EPA site (Revision 2, June 12, 2025).

Assumption: each solar kWh displaces one kWh at the SRVC average output rate, held at the 2023 rate for 25 years.

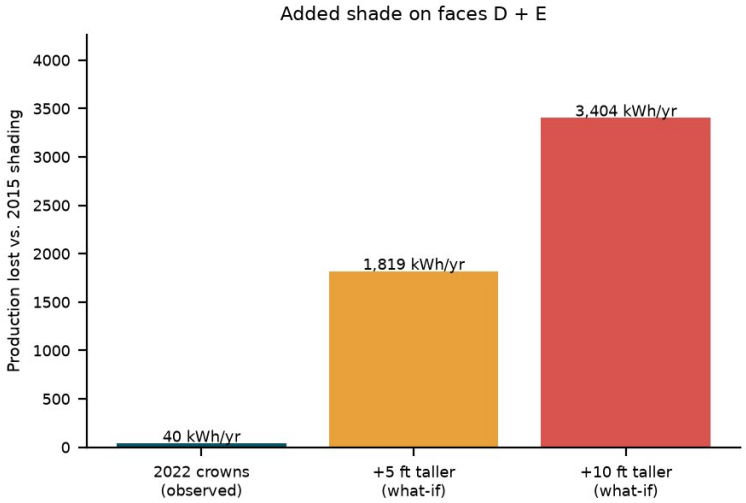
Sources: US EPA eGRID2023 Rev 2 (released Jun 12, 2025; latest on epa.gov/egrid/summary-data, read Nov 12, 2026): SRVC total output CO2 emission rate 593.419 lb/MWh. Duke Energy Carolinas plants are in SRVC (eGRID2023 PLNT23 sheet, utility service territory); Assumption: each solar kWh displaces one kWh at the SRVC average output rate, held at the 2023 rate for 25 years



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# Tree growth & future shade

2015 LiDAR crowns vs. newer aerials, and added shade if trees grow




| Case | Face D access | Face E access | Lost kWh/yr | Share |
|---|---|---|---|---|
| 2022 crowns (observed) | 67.1% | 66.0% | 40 | 0.2% |
| +5 ft taller (what-if) | 57.4% | 62.6% | 1,819 | 10.9% |
| +10 ft taller (what-if) | 49.5% | 58.5% | 3,404 | 20.4% |

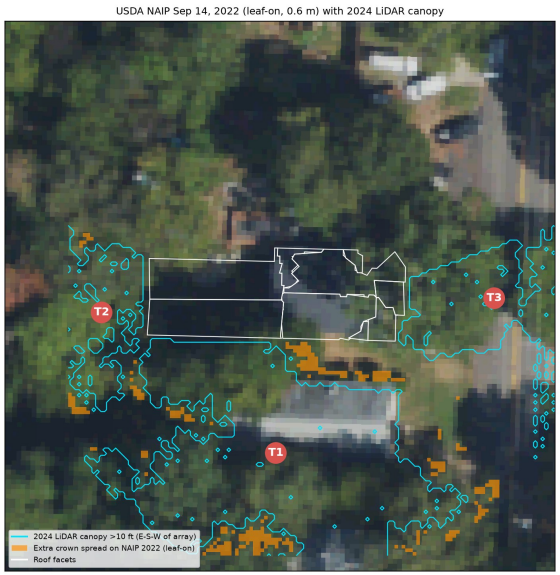
## Observed

The 2015 NC LiDAR shows about 11,848 sf of canopy over 10 ft around the array; the nearest crowns are 20-70 ft away and 68-72 ft tall. The 2022 NAIP leaf-on aerial shows about 639 sf of new crown at their edges, which costs only about 40 kWh a year.

## What if the trees keep growing

If every nearby crown were 5 ft taller, the array would lose about 1,819 kWh a year (10.9%); at 10 ft taller, about 3,404 kWh (20.4%). These are scenarios, not forecasts: tree species and growth rates are not known from public data.

Newer LiDAR: the 2024 NC QL1 survey covers Durham but its point cloud is not openly downloadable yet, so crown heights are from 2015. Sources: NC 2015 QL2 LiDAR (NOAA Digital Coast 6209) crown heights; USDA NAIP 2022 leaf-on and Durham County 2025 ortho crown extent; What-if scenarios: every 2015 crown near the array grows +5 ft and +10 ft taller (assumption, not a forecast)





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**SF-16**

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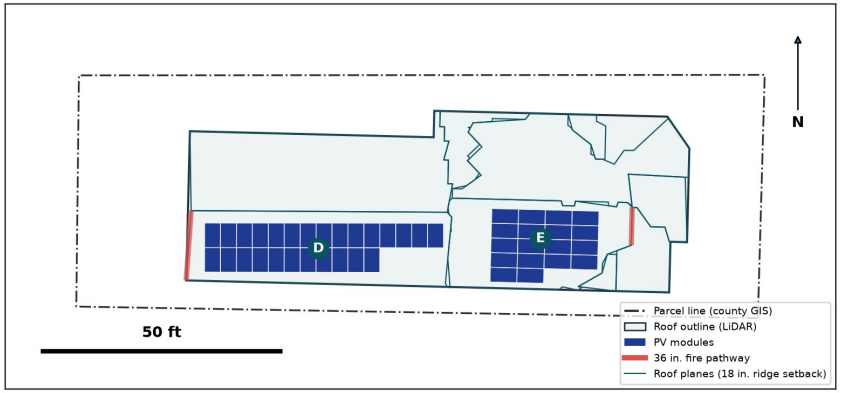
# Permit starter

Site plan and array data, laid out for NC residential PV permit review

## ARRAY SUMMARY

| Plane | Pitch | Tilt | Az. | Panels | kW DC | Array sf |
|---|---|---|---|---|---|---|
| D | 5/12 | 23° | 180° | 26 | 10.4 | 476 |
| E | 5/12 | 23° | 181° | 18 | 7.2 | 329 |
| **Total** | | | | **44** | **17.6** | **805** |

| | |
|---|---|
| Module (assumed) | **~400 W, 1.0 x 1.7 m (18.3 sf)** |
| Roof area (plan) | **3,449 sf** |
| Array share of plan roof | **22% (R324.6.2)** |
| Ridge setback | **18 in. both sides** |
| Fire pathways | **36 in. eave to ridge (R324.6.1)** |
| Roof covering | **Asphalt shingle (check at site visit)** |
| Utility | **Duke Energy Carolinas** |
| Jurisdiction | **City of Durham (Durham City-County Inspections)** |




Starter only: structural review (rafters, attachments, wind and snow loads) and the electrical design (single-line diagram, conductor and OCPD sizing, rapid shutdown, labels) are by others and must be stamped or signed as the permit office requires. County GIS parcel lines are approximate; check them against the recorded plat (reference withheld).

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# Design files & sources

Files delivered with this report, and where every number comes from

## Design files (in the report package)

sample_solar.dxf: DXF R2010, NC State Plane (EPSG:2264), feet. Layers: roof facets (2D), roof facets 3D (polylines with elevations), usable areas, recommended panels, optional panels, obstructions and labels (pitch, azimuth, TSRF).

sample_solar.geojson: GeoJSON (RFC 7946, WGS84 lat/lon) with facets (pitch, azimuth, solar access, TOF, TSRF, production), usable areas, panels and obstructions. Opens in most GIS tools. sample_solar.json: the same data in plain JSON.

Solar design tools that build their own roof models can use the DXF as a scaled trace layer or reference, or the layout sheet as a roof plan.

Curb view: No Mapillary street photos near this house; curb view not included.

Remote measurement from public data.

## Data sources

NC 2024 Phase 3 QL1 LiDAR (NC Spatial Data Download, tile LA_37_20082113_20251031, flown Feb 5, 2024): roof planes, pitch, azimuth, shading, rooftop objects. NC OneMap 2024-2027 aerial: roof outline check. USDA NAIP Sep 14, 2022: leaf-on tree check. NREL PVWatts v8 API (NSRDB PSM v3 TMY): production and plane-of-array sun for TOF.

Duke Energy Carolinas NC Schedule RS, effective Jan 1, 2026 (duke-energy.com, ncschedulers.pdf): $14.00/month, 12.2603¢/kWh. Rider adjustments 0.4951¢/kWh: OpenEI Utility Rate Database, DEC RS 1/1/2026. Schedule RSTC (Leaf 136, Jan 1, 2026), Rider RSC (Leaf 141) and Rider NMB (Leaf 143), effective Sep 1, 2026: $22 minimum bill, 4.53¢ net excess credit, $0.99/kW non-bypassable charge; NMB closed to applications on and after Jan 1, 2027. Hourly load: NREL ResStock 2024.2. Installed cost $2.45/W: North Carolina market solar cost data, October 2026. Federal credit: IRS FAQ on Public Law 119-21 and 26 U.S.C. 25D(h): no 25D credit for expenditures after Dec 31, 2025. Setbacks: NC Residential Code R324.6.1 and R324.6.2. Year built and addition permit: Durham County tax card REID withheld and Durham permit withheld (Nov 29, 2022).

Disclaimer: this report is an estimate from public LiDAR, aerial imagery, published tariffs and NREL models, prepared by Solar Feasibility Report without a site visit. It is not a design, structural or electrical evaluation, tax advice or a savings guarantee. Check all dimensions, setbacks, shading and rates before design or sale.

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**SOLAR FEASIBILITY REPORT**

INDEPENDENT SOLAR REPORT

SITE
Single-family house with new west wing
Address withheld
9 roof faces

OWNER OF RECORD
Not shown (privacy)

REPORT DATE
November 20, 2026

MEASUREMENT BASIS
NC 2024 Phase 3 QL1 LiDAR
NC OneMap 2024-2027 aerial
NREL PVWatts v8 (NSRDB TMY)
No site visit

REPORT ID
CC-SAMPLE-SOLAR-2026-11

SHEETS

SF-01 Solar Summary
SF-02 Layout & Setbacks
SF-03 3D View
SF-04 Facets & TSRF
SF-05 Shade Map & Seasons
SF-06 Tree Check 2024 vs 2022
SF-07 Savings & Payback
SF-08 Battery Savings
SF-09 Battery Control
SF-10 Time-of-Use
SF-11 Roof History
SF-12 Wind & Snow
SF-13 Permit Checklist
SF-14 Panel Options
SF-15 Carbon Offset
SF-16 Tree Growth
SF-17 Permit Starter
**SF-18 Design Files & Sources**
SF-19 Gutters & Downspouts

# Gutters & Downspouts

Included eave-based estimate; downspouts excluded

GUTTER LENGTH (ESTIMATED FROM EAVES)

**186.3** lf

Modeled eave length

| Run | Estimated length lf |
|---|---|
| **Total** | **186.3** |

## Gutters included

Estimated from modeled eaves; assumes gutters along all eligible eaves.
Downspouts excluded.

## Gutter length (estimated from eaves)

Estimated from modeled eaves; assumes gutters along all eligible eaves.
Downspouts excluded.

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SHEET

**SF-19** 19 of 19

*Public-source measurements and calculations.*

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