

Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

- |                                     |                                                                                                                                                                                                                                                                                     |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| n/a                                 | Confirmed                                                                                                                                                                                                                                                                           |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> The exact sample size ( <i>n</i> ) for each experimental group/condition, given as a discrete number and unit of measurement                                                                                                                               |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly                                                                                                                                    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> The statistical test(s) used AND whether they are one- or two-sided<br><i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i>                                                               |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> A description of all covariates tested                                                                                                                                                                                                                     |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons                                                                                                                                        |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals) |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For null hypothesis testing, the test statistic (e.g. <i>F</i> , <i>t</i> , <i>r</i> ) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> value noted<br><i>Give P values as exact values whenever suitable.</i>                     |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings                                                                                                                                                           |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes                                                                                                                                     |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Estimates of effect sizes (e.g. Cohen's <i>d</i> , Pearson's <i>r</i> ), indicating how they were calculated                                                                                                                                               |

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data collection | No software was used for data collection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Data analysis   | The code with which the optimization study was carried out is available at <a href="https://zenodo.org/records/11383276">https://zenodo.org/records/11383276</a> . The optimization method is based on an evolutionary algorithm developed specifically for the project. The free geoinformation system QGIS version 3.26.1 was used to visualize the results. The code for conducting the Monte Carlo simulation to assess well-being losses was developed in Python, available in QGIS 3.26.1, and executed within QGIS 3.26.1. The results were also visualized using QGIS 3.26.1. Since the code can be used to draw conclusions about the power outages caused by Hurricane Florence and this data is classified as sensitive information, this code is not publicly available, but can be requested from the corresponding author. |

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [guidelines for submitting code & software](#) for further information.

## Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

Data on critical infrastructure and the built environment are from the utility and the cadaster, respectively, and were collected as part of the DOE project 'Planning an Affordable, Resilient, and Sustainable Grid in North Carolina' (<https://nccleantech.ncsu.edu/our-work/center-projects/planning-an-affordable-resilient-and-sustainable-grid-in-north-carolina/>). The free NCFMP LiDAR dataset (<https://noaa-nos-coastal-lidar-pds.s3.amazonaws.com/laz/geoid18/4957/index.html>) from 2014 was used to reconstruct triangular roof structures and to estimate the rooftop PV potential. Furthermore, the Social Vulnerability Index is publicly available (<https://www.atsdr.cdc.gov/placeandhealth/svi/index.html>) and has been scoped to New Hanover County, North Carolina. This data was used in pre-processed format for the optimization study and is available in this form at <https://zenodo.org/records/11383276>. Power outage data used in this study to assess well-being losses is considered sensitive information and may be provided on a case-by-case basis by the corresponding author. In addition, details of the data related to the DOE project will be available in a final report to be published in June 2024 or available through the corresponding author.

## Research involving human participants, their data, or biological material

Policy information about studies with [human participants or human data](#). See also policy information about [sex, gender \(identity/presentation\), and sexual orientation](#) and [race, ethnicity and racism](#).

Reporting on sex and gender

Reporting on race, ethnicity, or other socially relevant groupings

Population characteristics

Recruitment

Ethics oversight

Note that full information on the approval of the study protocol must also be provided in the manuscript.

## Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☐ Life sciences ☒ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

## Behavioural & social sciences study design

All studies must disclose on these points even when the disclosure is negative.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Study description | The study is based on mixed qualitative and quantitative methods. The study was conducted for New Hanover County, North Carolina. The study refers to data that were publicly available or obtained through stakeholder engagement (e. g. for criticality assessments). Criticality and vulnerability data and metrics were expressed numerically and unit-free through a mixed qualitative and quantitative method. Loss of well-being for households was accounted for in terms of the forms of availability and accessibility of critical services. No further types of research samples were necessary. |
| Research sample   | The study used different representative data sets for New Hanover County. The data comprises critical infrastructure data, information on the built environment, social vulnerability data, data on power outage due to a hurricane, and representative survey data on criticality of infrastructure allowing this comprehensive study.                                                                                                                                                                                                                                                                     |
| Sampling strategy | All data that were available and relevant for the metric-based evaluations were collected or produced                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Data collection   | Raw data used is largely publicly available; criticality assessments were conducted through stakeholder integration; all this data is without bias and is formula-based and neutral in this sense.                                                                                                                                                                                                                                                                                                                                                                                                          |
| Timing            | Data collected and analyzed between 2021 and 2023. Data based on stakeholder integration and survey: starting May, 2021 and ending October, 2022; 2021: start of collection of cadaster, infrastructure data and updates by the end of 2022. December 2022-March 2023 evaluation and use of all available data (as mentioned above) for the study; the LiDAR data is from 2014 since no better                                                                                                                                                                                                              |

data source was available: this in connection with OSM data was applied for a first robust assessment of rooftop pv potentials.

Data exclusions

No data was excluded

Non-participation

Not applicable since no participants involved

Randomization

Randomization of the power failure scenarios was used in the Monte Carlo simulation for achieving robust results

## Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

### Materials & experimental systems

| n/a                                 | Involvement in the study                               |
|-------------------------------------|--------------------------------------------------------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Antibodies                    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Eukaryotic cell lines         |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Palaeontology and archaeology |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Animals and other organisms   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Clinical data                 |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Dual use research of concern  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Plants                        |

### Methods

| n/a                                 | Involvement in the study                        |
|-------------------------------------|-------------------------------------------------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> ChIP-seq               |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Flow cytometry         |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> MRI-based neuroimaging |

## Plants

Seed stocks

N/A

Novel plant genotypes

N/A

Authentication

N/A