ResilientSEE-PR:
A multidisciplinary lens for rebuilding communities in Puerto Rico

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UMASS BOSTON Sustainable Solutions Lab

Quarterly Climate Adaptation Forum | November 30, 2018


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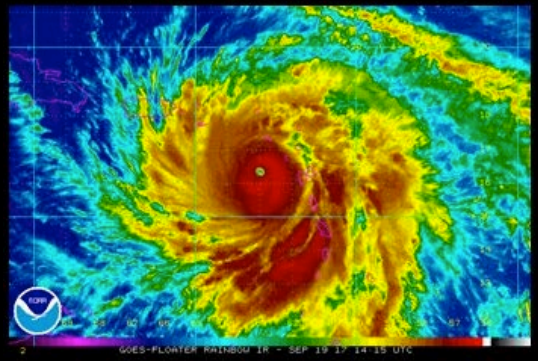
HURRICANE MARIA LANDFALL
SEPTEMBER 20, 2017

HURRICANE MARIA

PUERTO RICO & VIRGIN ISLANDS

11 AM AST TUE SEP 19 2017

Tuesday night into Thursday



WINDS: *Devastating to Catastrophic*

- **90 to 125 mph** with gusts up to **175 mph**
- **Impacts:** Widespread power outages. Impassible roads & bridges. Structural damage to buildings with complete wall & roof failure.

STORM SURGE: *Extensive*

- **6 to 9 feet**
- **Impacts:** Large areas with coastal flooding. Structural damage to buildings, with several washing away. Roads washed out or severely flooded. Severe beach erosion. Damage to marina structures, as well as overturned or broken boats.

FLOODING: *Devastating to Catastrophic*

- **12 to 18 inches** with isolated amounts of **20 to 25 inches**
- **Impacts:** Rivers & tributaries ranging out of their banks. In mountain areas, runoff may rage down valleys while increasing susceptibility to rockslides & mudslides. Flood waters can enter numerous structures. Roads & bridges closures. Driving conditions become extremely dangerous.

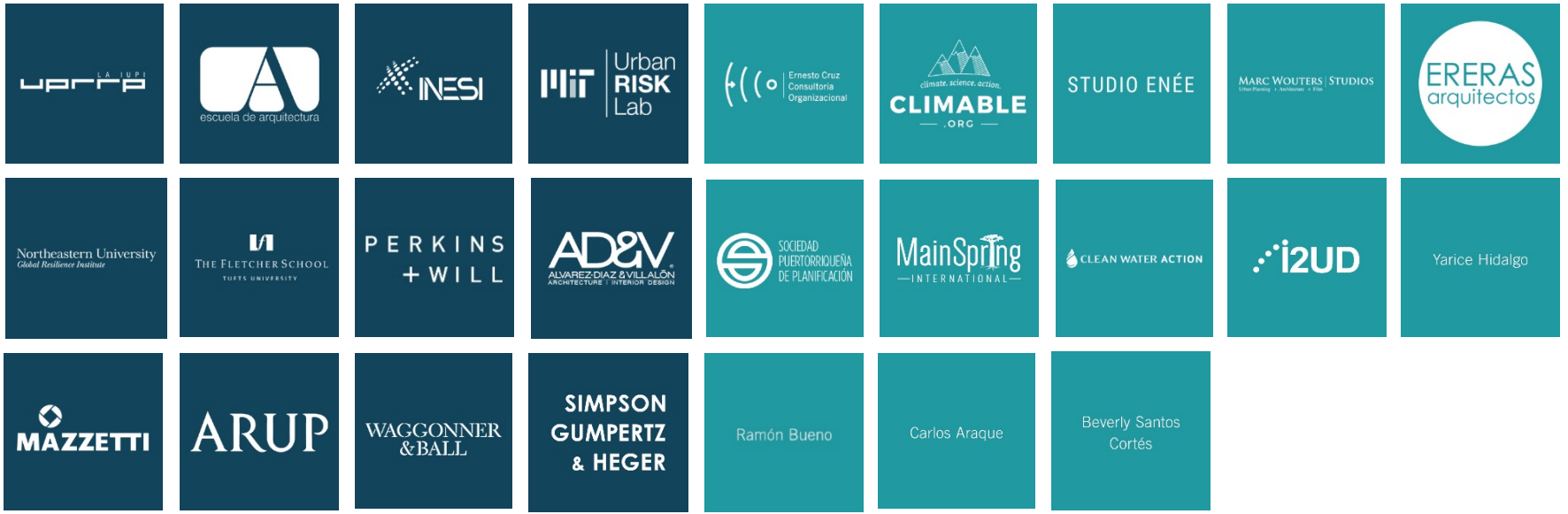
MARINE CONDITIONS: *Dangerous*

- Seas of **20 to 30 feet** with occasional seas of **40 feet or higher**
- Life-threatening rip currents & surf conditions.


We’re a global alliance committed to designing and rebuilding a resilient, sustainable Puerto Rico.
resilientSEE™
www.resilientSEE-PR.com

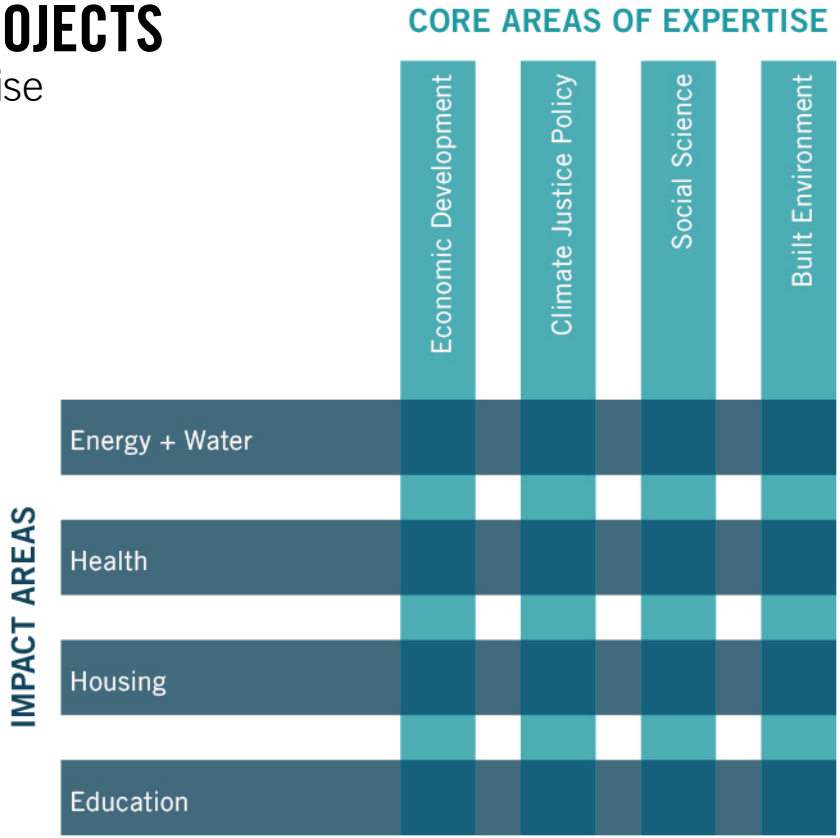
OUR GLOBAL ALLIANCE

Academic / Private Industry / Non-Profit Orgs



IDENTIFYING PROJECTS

Core areas of expertise



A HOLISTIC APPROACH TO RESILIENCE

SOCIAL RESILIENCE

Population health, environmental justice, social equity, community cohesion, and inclusivity of vulnerable populations

ENVIRONMENTAL RESILIENCE

Strategies to balance natural systems and man-made environments

ECONOMIC RESILIENCE

Business continuity, economic stability, developmental opportunity, benefit cost analysis

Education and community empowerment are, and will continue to be, critical components of a successful rebuilding strategy for Puerto Rico.

OUR COMMITMENT

We're in this together, for as long as it takes

We empower local communities

We design and build partnerships

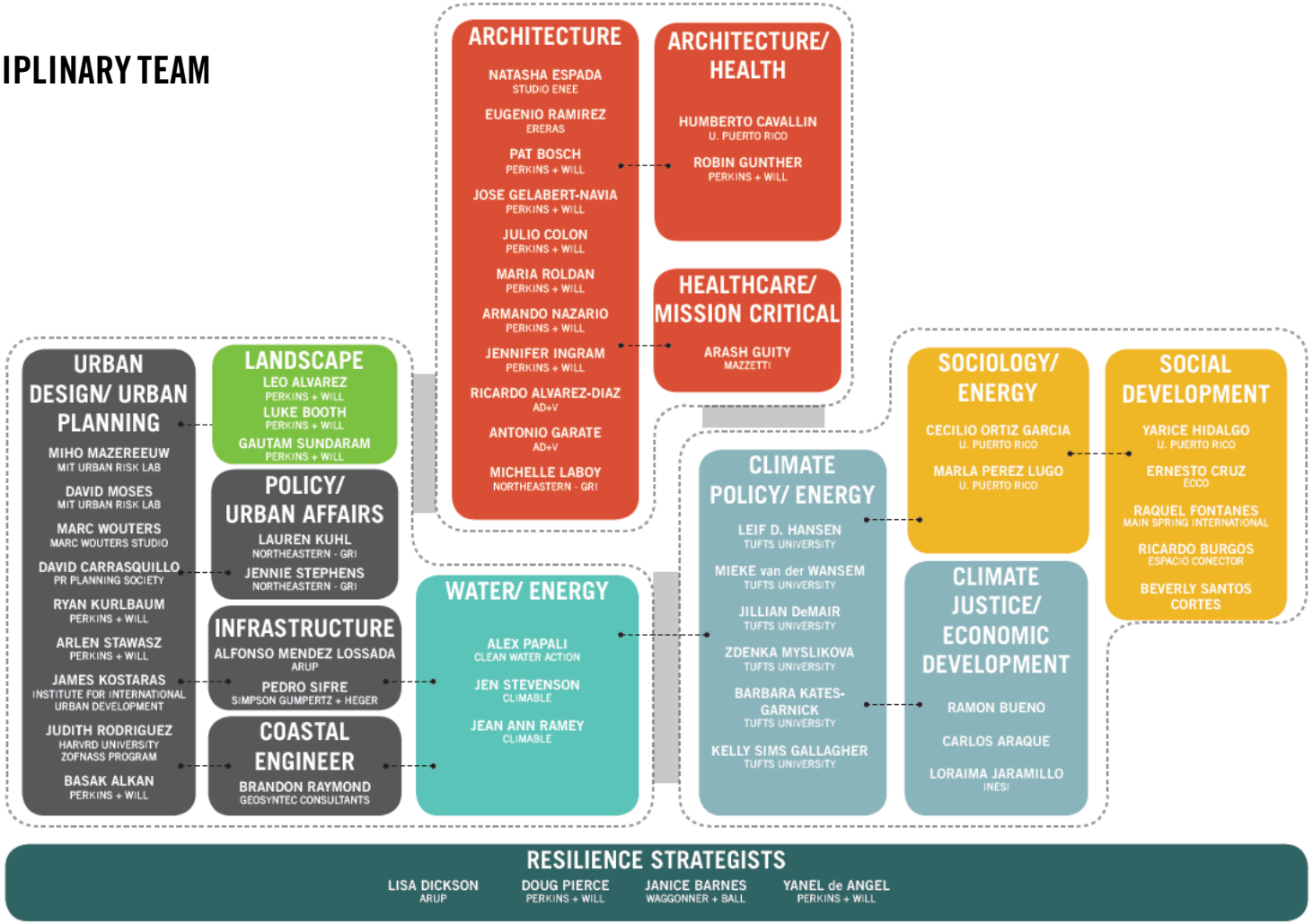
We see the whole-community perspective

We collaborate with policymakers

We support economic development

We grow together

MULTIDISCIPLINARY TEAM




Maria
Puerto Rico Flood
9-20-2017
Hurricane path
112 mph wind gusts
10-15 in. rainfall
1-3 feet surge
Caribbean Sea
110 mph wind gusts
10-15 in. rainfall
4-7 feet surge
KatRisk

RESILIENTSEE INVOLVEMENT

TOA BAJA MUNICIPALITY


Villas del Sol
Balneario Punta Salinas
Comfort INN & Su
Relaxed beach hotel
with free breakfast
Levittown
Sabana Seca
Pista Levitt
Campanilla
Candelaria
Arenas
TOA BAJA
BAYAMÓN
PR-22-Express
Iglesia Monte Hebron
Villa Calma
867
Community Center
Villa Calma 1
INGENIO
Pabellones
Villa Calma 2
867
URBAN
CAMP

TOA BAJA PILOT PROJECTS SCOPE

Ingenio Community, Toa Baja

- Villa Calma
- Villas del Sol

3 MAIN PROBLEMS

- Communities living in vulnerable floodplains
- Communities in need to rebuild in place with resilient design
- Lack of a community resilient hub

TOA BAJA PILOT PROJECTS SCOPE

SCOPE

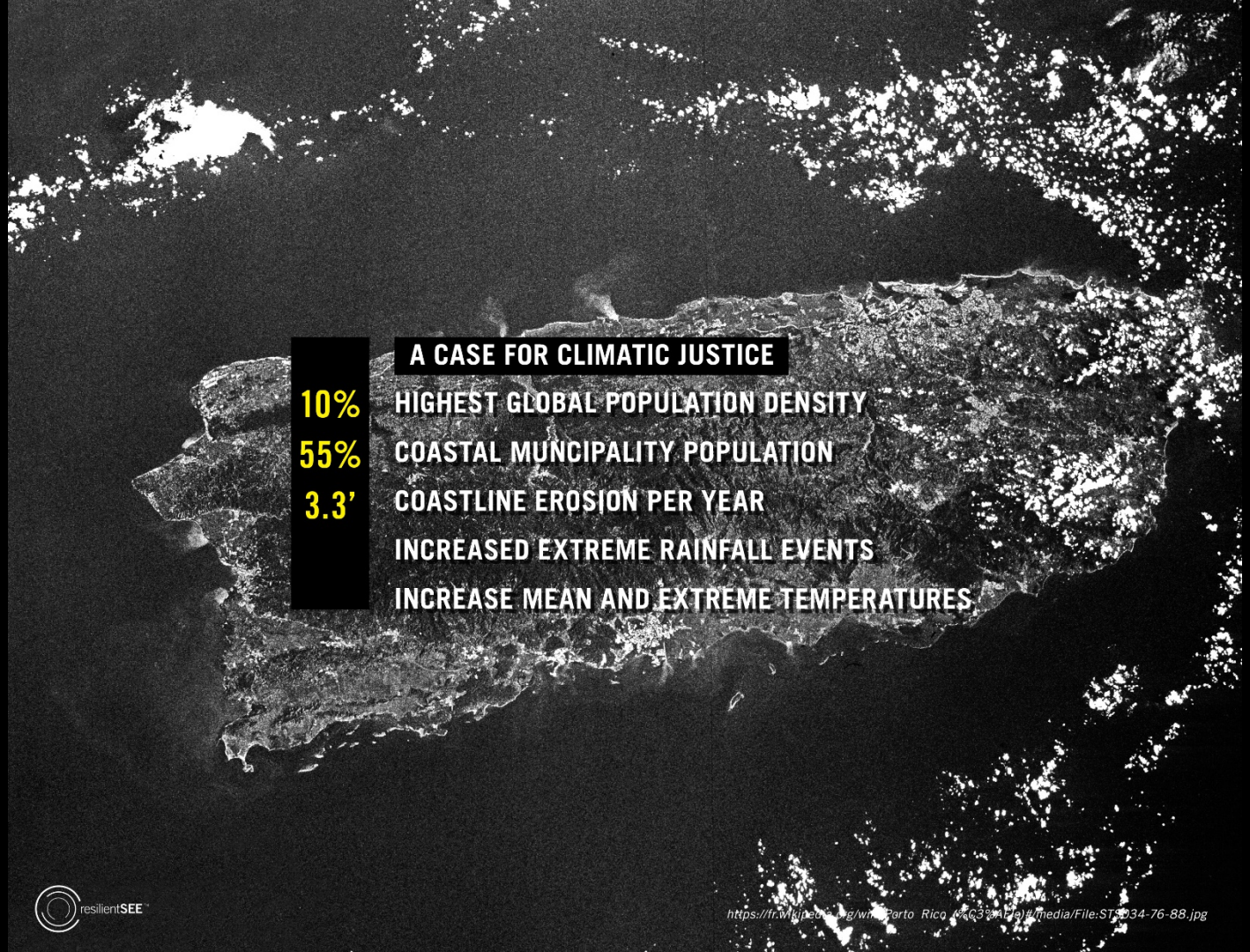
- A Place of Unity – A Community Resilient Hub (Disaster Preparedness Center): services the Ingenio Neighborhood
- Villas del Sol – Resilient Framework Plan with special focus on:
    - Storm Water Management
    - Green Infrastructure
    - Electric Infrastructure

VILLAS DEL SOL

VILLAS DEL SOL

INGENIO COMMUNITY CENTER

INGENIO COMMUNITY CENTER


A CASE FOR CLIMATIC JUSTICE
10%
HIGHEST GLOBAL POPULATION DENSITY
55%
COASTAL MUNCIPALITY POPULATION
3.3'
COASTLINE EROSION PER YEAR
INCREASED EXTREME RAINFALL EVENTS
INCREASE MEAN AND EXTREME TEMPERATURES
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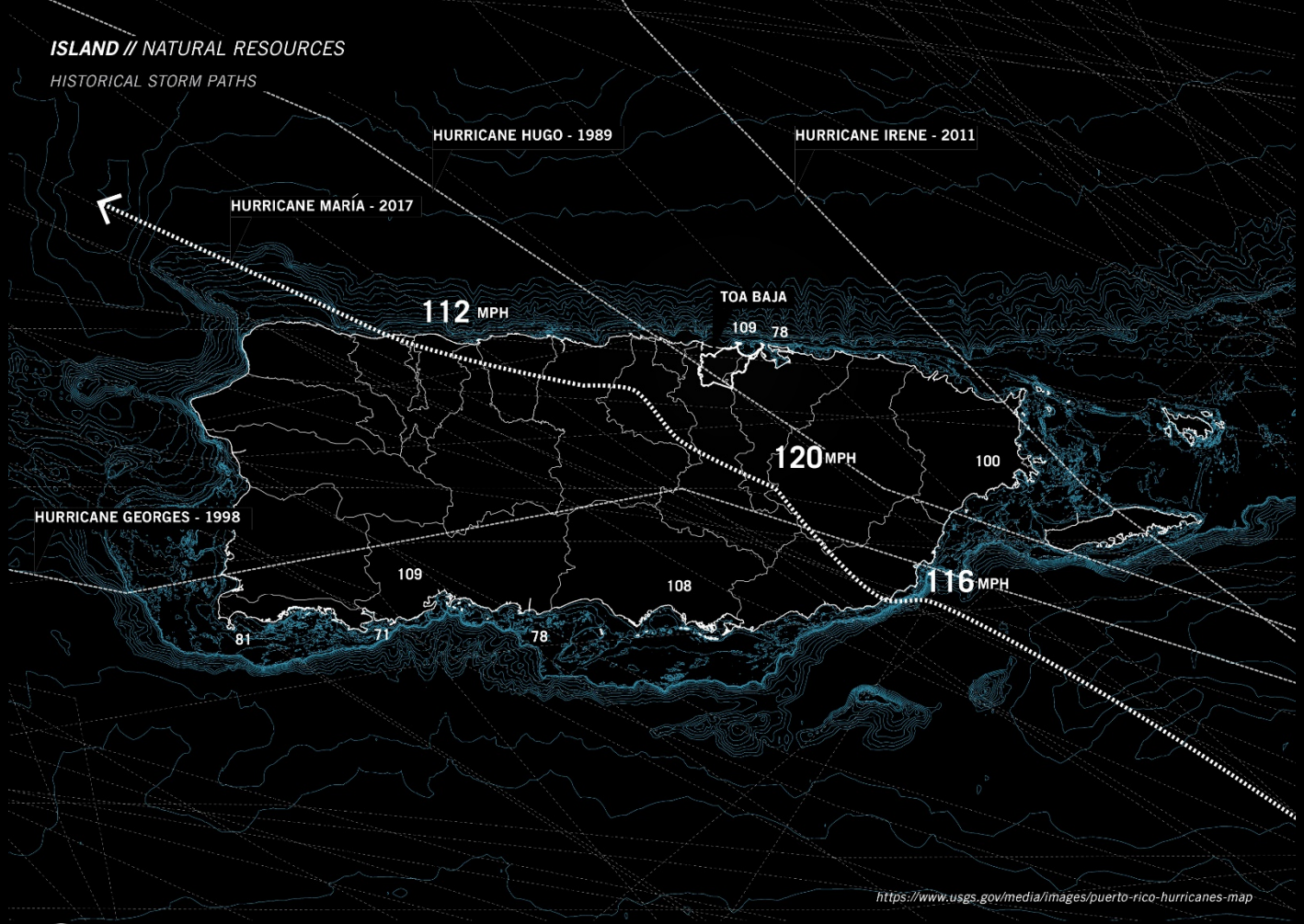
https://fr.wikipedia.org/wiki/Porto_Rico_(Q33#/media/File:STS034-76-88.jpg


ISLAND // NATURAL RESOURCES
HISTORICAL STORM PATHS
HURRICANE HUGO - 1989
HURRICANE IRENE - 2011
HURRICANE MARÍA - 2017
112 MPH
TOA BAJA
109
78
120 MPH
100
HURRICANE GEORGES - 1998
109
108
116 MPH
81
71
78
https://www.usgs.gov/media/images/puerto-rico-hurricanes-map
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MAJOR HURRICAN EVENT PATHS
HISTORICAL STORM EVENT PATHS


TOA BAJA //
TOA BAJA DISTRICTS
TOA BAJA
resilientSEE

WHAT IS RELi

RELi (pronounced rely) is a project rating system that combines a holistic list of resilient design criteria with the latest in integrative design process for developing next generation neighborhoods, buildings, homes and infrastructure.

C3 Living Design Project

Capital Markets Partnership

area research

AIA Minnesota
A Society of The American Institute of Architects

Minnesota

Minnesota GreenStep Cities

Minnesota Pollution Control Agency

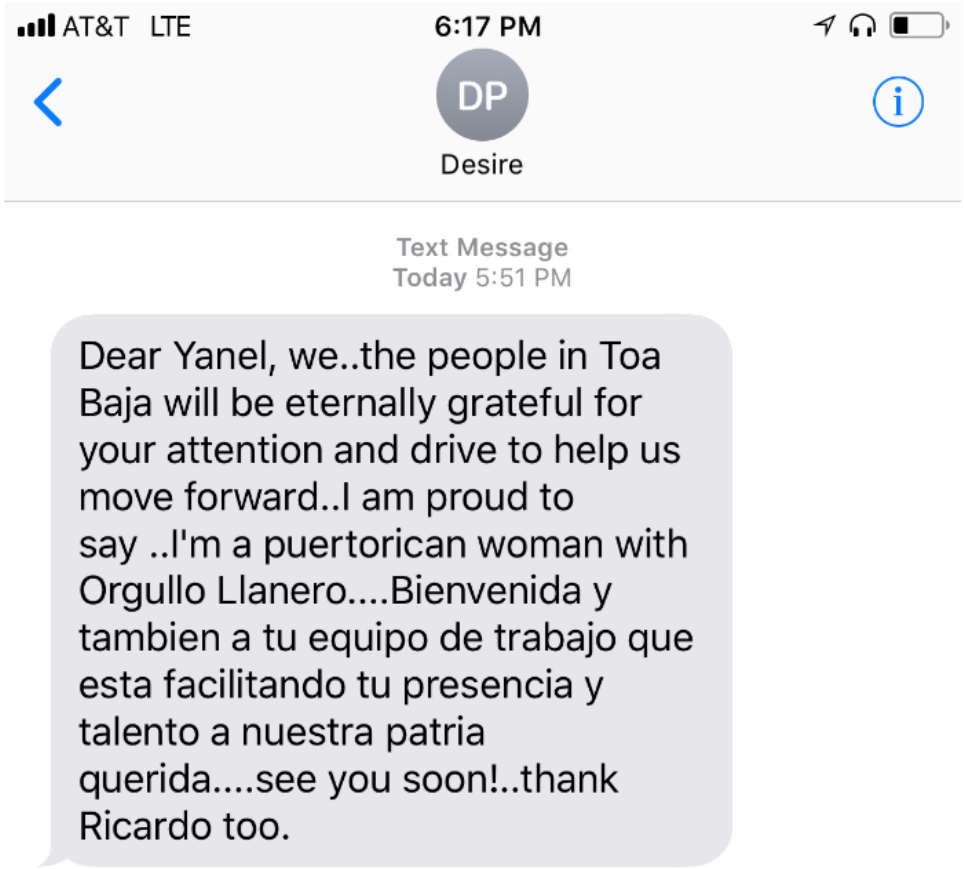
PERKINS+WILL

University of Minnesota
Driven to Discover℠

WORK SESSION

REBUILDING IN PARTNERSHIP

Yanel de Angel and Bernardo (Betito) Marquez Garcia



KEEP SAFE PUERTO RICO

Guide for Housing Resiliency

A Safer Site

Building Protection

Adaptive Design

Water Management

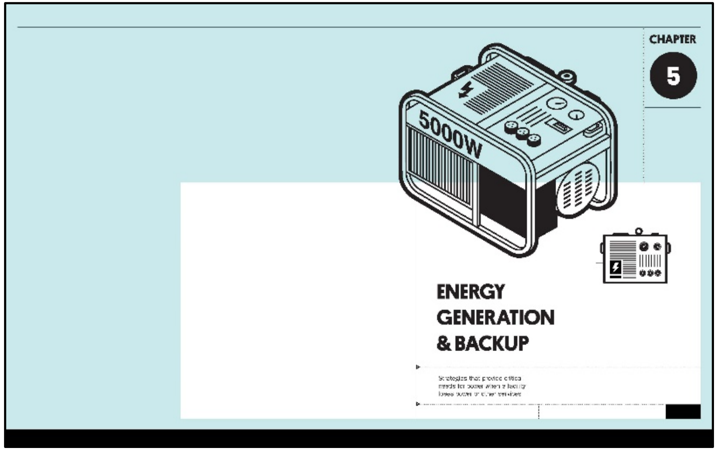
Power Generation + Backup

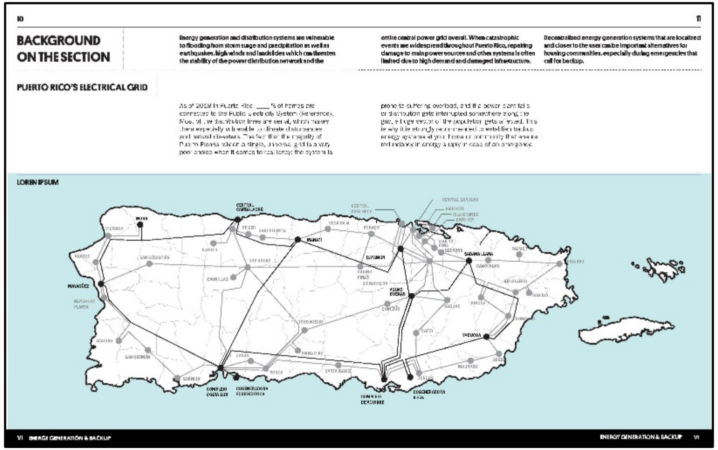
Household Preparedness And Response

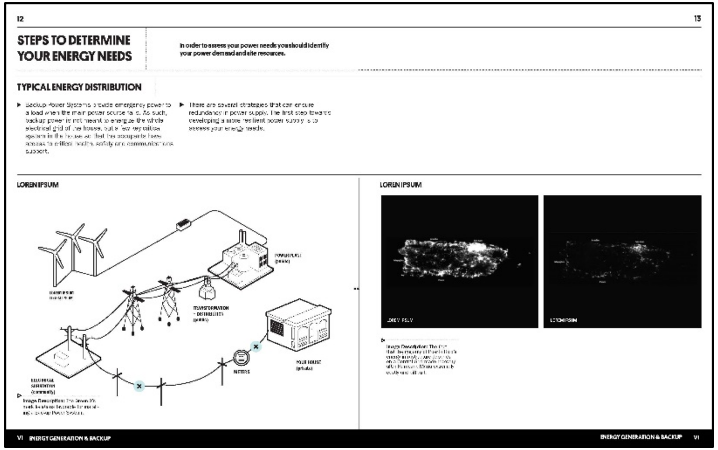
Community Preparedness And Response

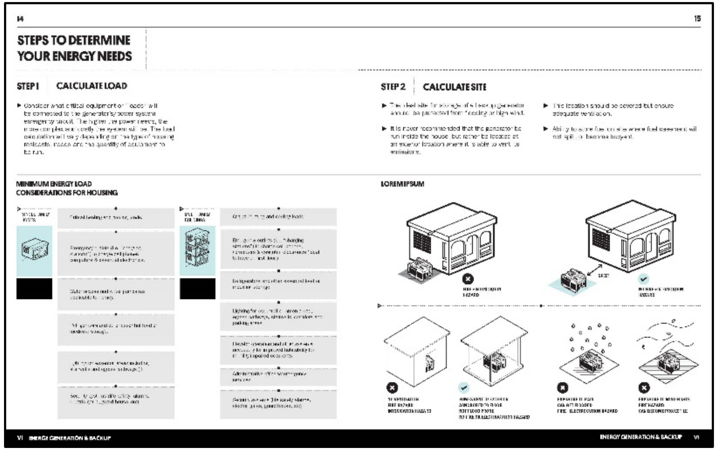
All combined, a total of 30 strategies!

Enterprise

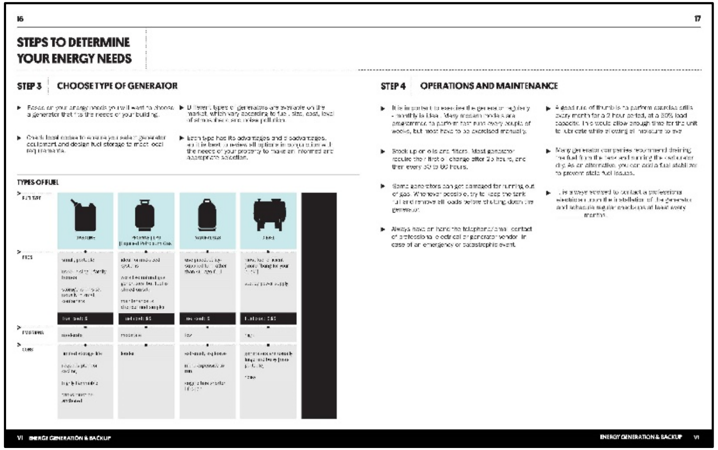

CHAPTER
5
5000W
ENERGY
GENERATION
& BACKUP

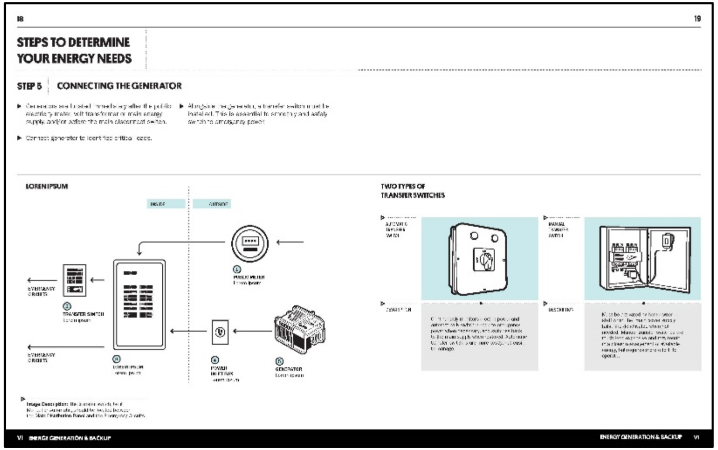

10
11
BACKGROUND
ON THE SECTION
Energy generation and distribution systems are vulnerable to flooding from storm surge and precipitation as well as earthquakes, high winds and landslides which can threaten the stability of the power distribution network and the
entire central power grid overall. When catastrophic events are widespread throughout Puerto Rico, repairing damage to main power sources and other systems is often limited due to high demand and damaged infrastructure.
Decentralized energy generation systems that are localized and closer to the user can be important alternatives for housing communities, especially during emergencies that call for backup.
PUERTO RICO'S ELECTRICAL GRID
LOREN IPSUM
ENERGY GENERATION & BACKUP


12
13
STEPS TO DETERMINE
YOUR ENERGY NEEDS
In order to assess your power needs you should identify your power demand and site resources.
TYPICAL ENERGY DISTRIBUTION
LOREN IPSUM
LOREN IPSUM
ENERGY GENERATION & BACKUP


14
15
STEPS TO DETERMINE
YOUR ENERGY NEEDS
STEP 1
CALCULATE LOAD
STEP 2
CALCULATE SITE
MINIMUM ENERGY LOAD
CONSIDERATIONS FOR HOUSING
LOREM IPSUM
ENERGY GENERATION & BACKUP

Enterprise


16
17
STEPS TO DETERMINE
YOUR ENERGY NEEDS
STEP 3
CHOOSE TYPE OF GENERATOR
STEP 4
OPERATIONS AND MAINTENANCE
TYPES OF FUEL
ENERGY GENERATION & BACKUP


18
19
STEPS TO DETERMINE
YOUR ENERGY NEEDS
STEP 5
CONNECTING THE GENERATOR
LOREN IPSUM
TWO TYPES OF
TRANSFER SWITCHES
ENERGY GENERATION & BACKUP

RESILIENT COMMUNITY HUB

Set of Guidelines / Checklist

Operations

Physical Environment

Community Engagement

REIMAGINA Puerto Rico

MERCY CORPS

Enterprise

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escuela de arquitectura

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STUDIO ENÉE

PERKINS + WILL

WAGGONNER & BALL