The University of Texas at Austin, Power Electronics Research Group
Natural Disasters Hardened Power Supply through Microgrids
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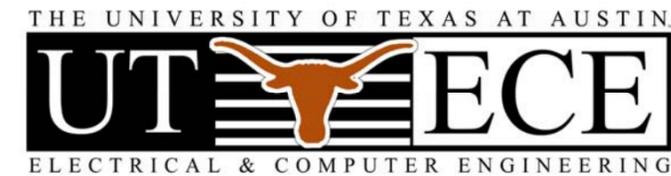
Power grids performance during natural disasters

Extreme damage is typically confined to relatively small areas

1	0-5%
2	5-10%
3	10-25%
4	25-50%
5	50-95%
6	>95%

HURRICANE IKE TRACK

HOUSTON

INFRASTRUCTURE DAMAGE (%)
< 1 %
1 TO 10 %
10 TO 50 %
> 50 %

Outage probability vs Hurricane intensity
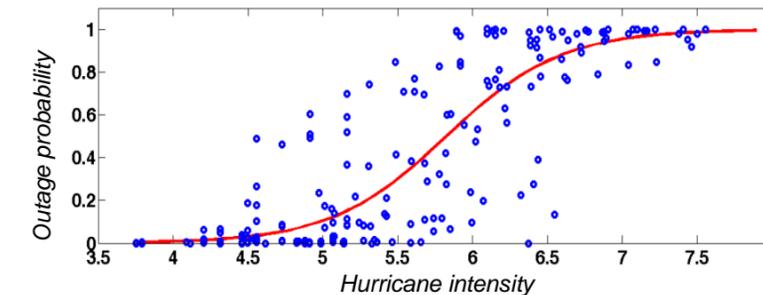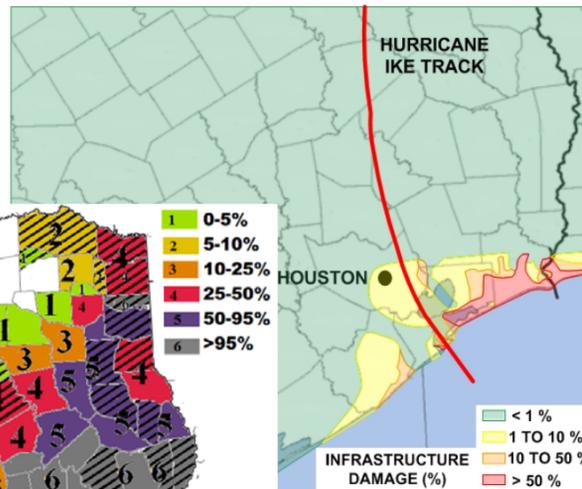
Conventional power grids are very fragile systems: less than 1 % of damaged components may still cause 100 % of outage incidence

Enhanced power availability through microgrids

Microgrid unavailability: $U_{MG,T} \cong \sum_{j=1}^{M_C} \prod_{l=1}^{c_j} u_{l,j} e^{-\mu_{FW} T_{BAT}}$

Renewable energy sources do not have lifelines but their output is variable and their footprint is large

Successful microgrids in disaster areas

Lifelines performance influences microgrid availability

*Lifeline dependencies can be decoupled using energy storage*
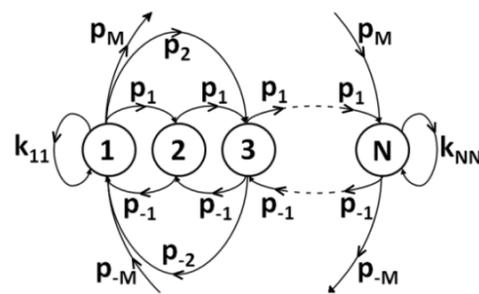
Markov chain model for PV + battery system

Source diversity with multiple-input converters

INPUT CELL (IC) #1
INPUT CELL (IC) #2
OUTPUT STAGE (OS)
INPUT CELL (IC) #3