

Energy Storage: Towards Social Equity Urban, Rural, and Tribal

IMRE GYUK, DIRECTOR,
ENERGY STORAGE RESEARCH, DOE-OE

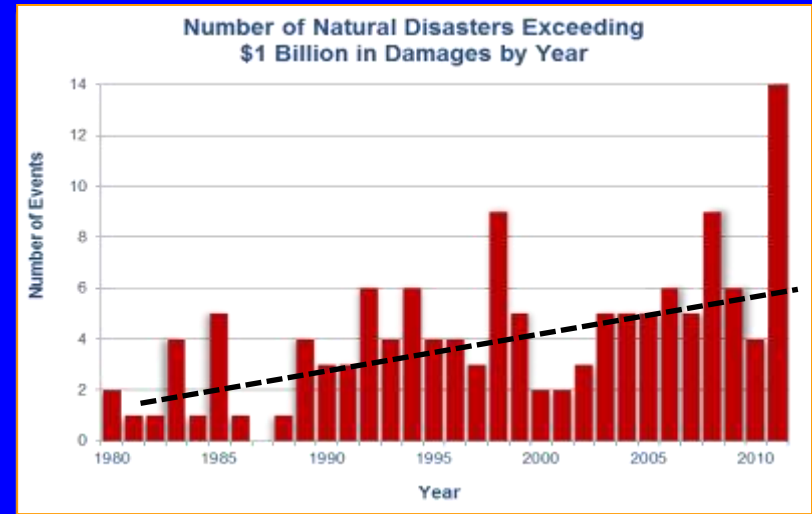
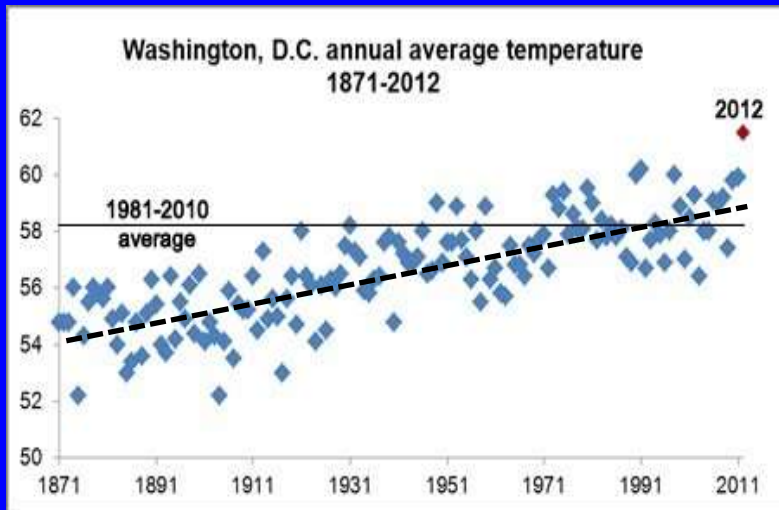
Global Warming is Real!



Florida, Harvey, 2017



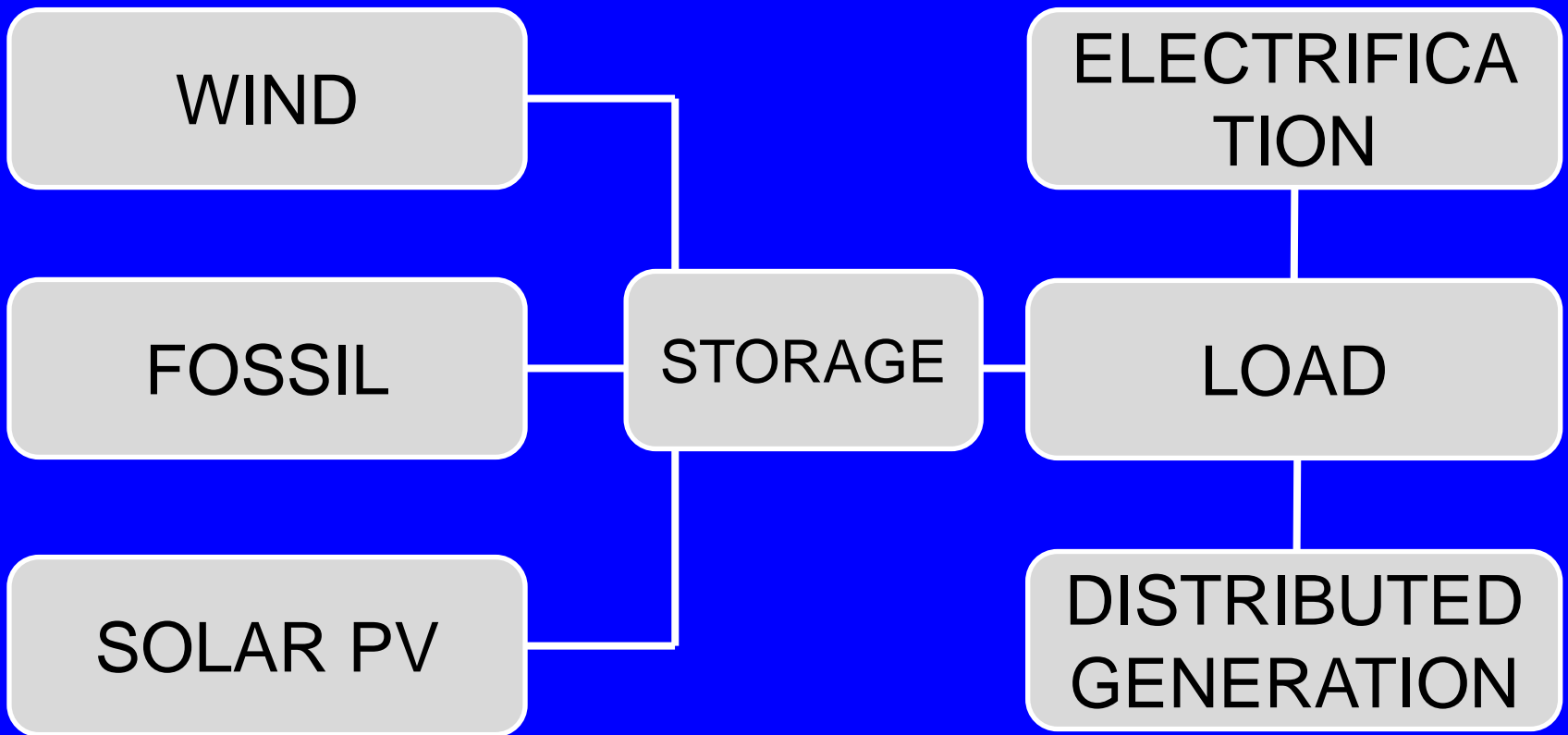
Now! Worst Drought for 400 years



Global Warming has Emerged
as a Paramount Issue - World Wide!

We must Decarbonize
We must change to Renewable
Energy!

Variable Generation - Variable Load



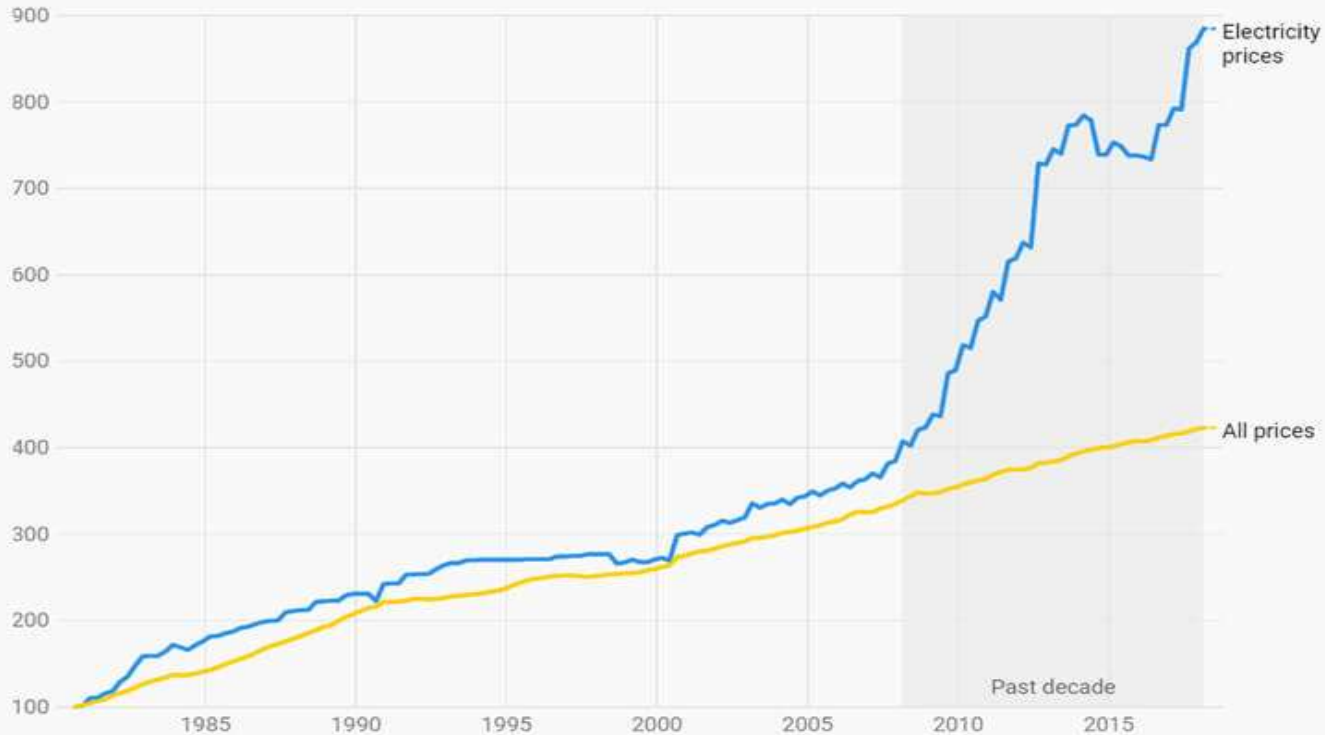
For 100% Decarbonization we will need
to overbuild Renewable Power
and use Large Amounts of Energy
Storage
to Balance Load and Generation

This will entail a vast Reorganization
of the entire Electricity Industry.

It is important that we not
create or proliferate an “Energy Divide”
which leaves behind
less affluent communities

Electricity price trends

Quarterly change in consumer price index of electricity prices compared with all prices since September 1980.

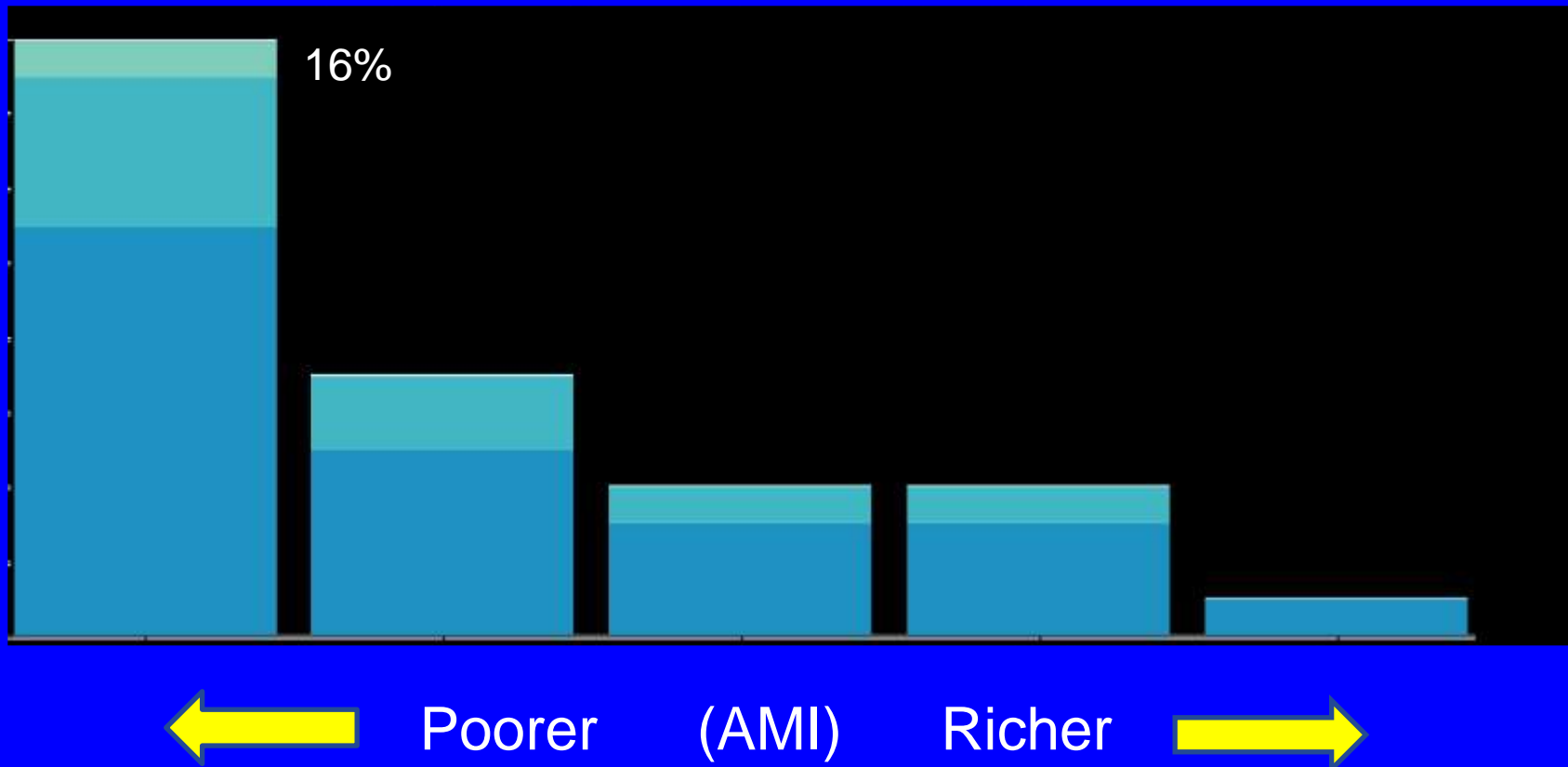


Prices at 1980 Q3 are indexed to 100. Chart shows percentage change per quarter of each price group.

Source: ABC News

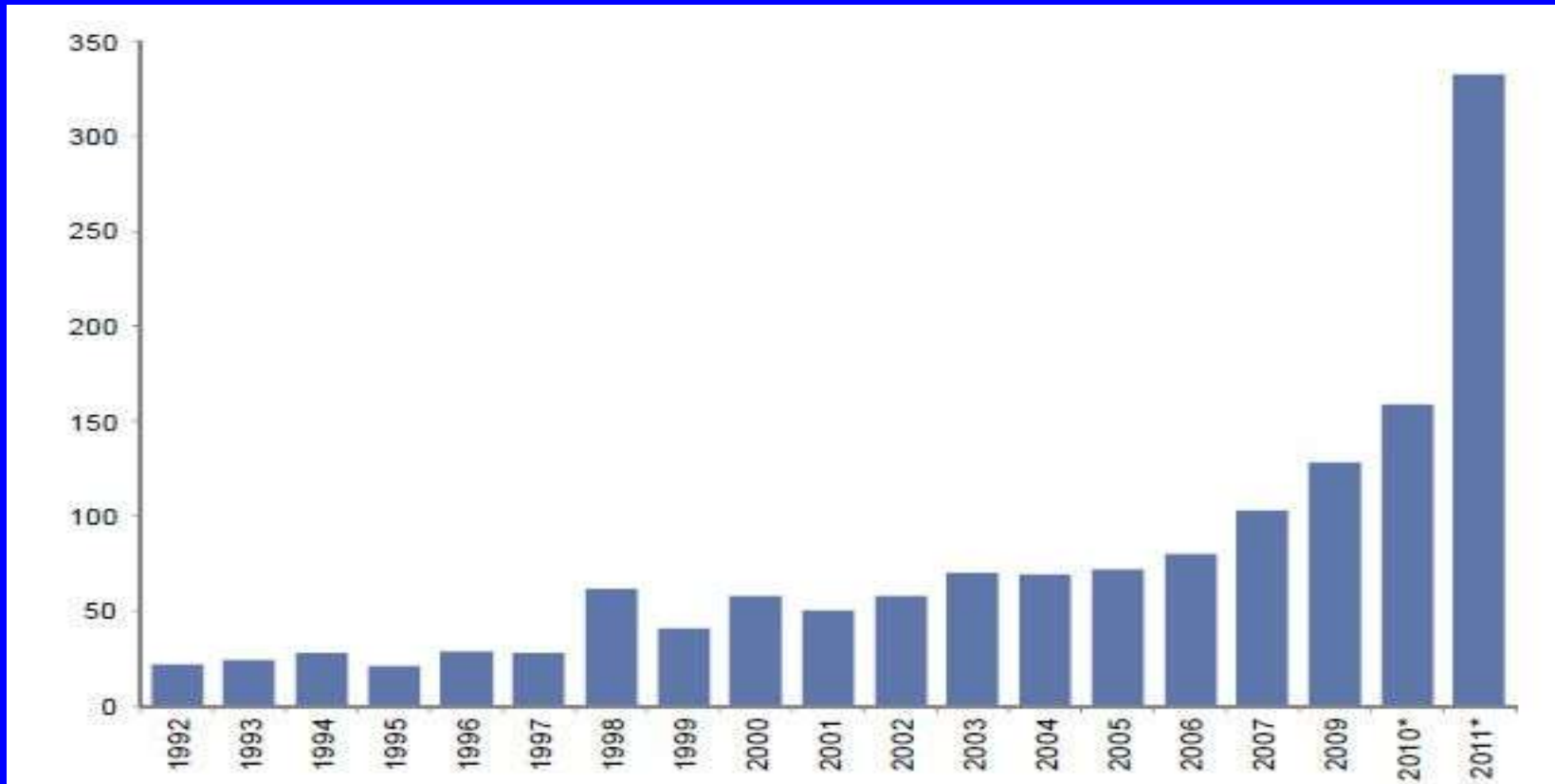
For the past decade electricity prices have been rising substantially

Average Energy Burden (% of Income)



From S. Baker/Yale

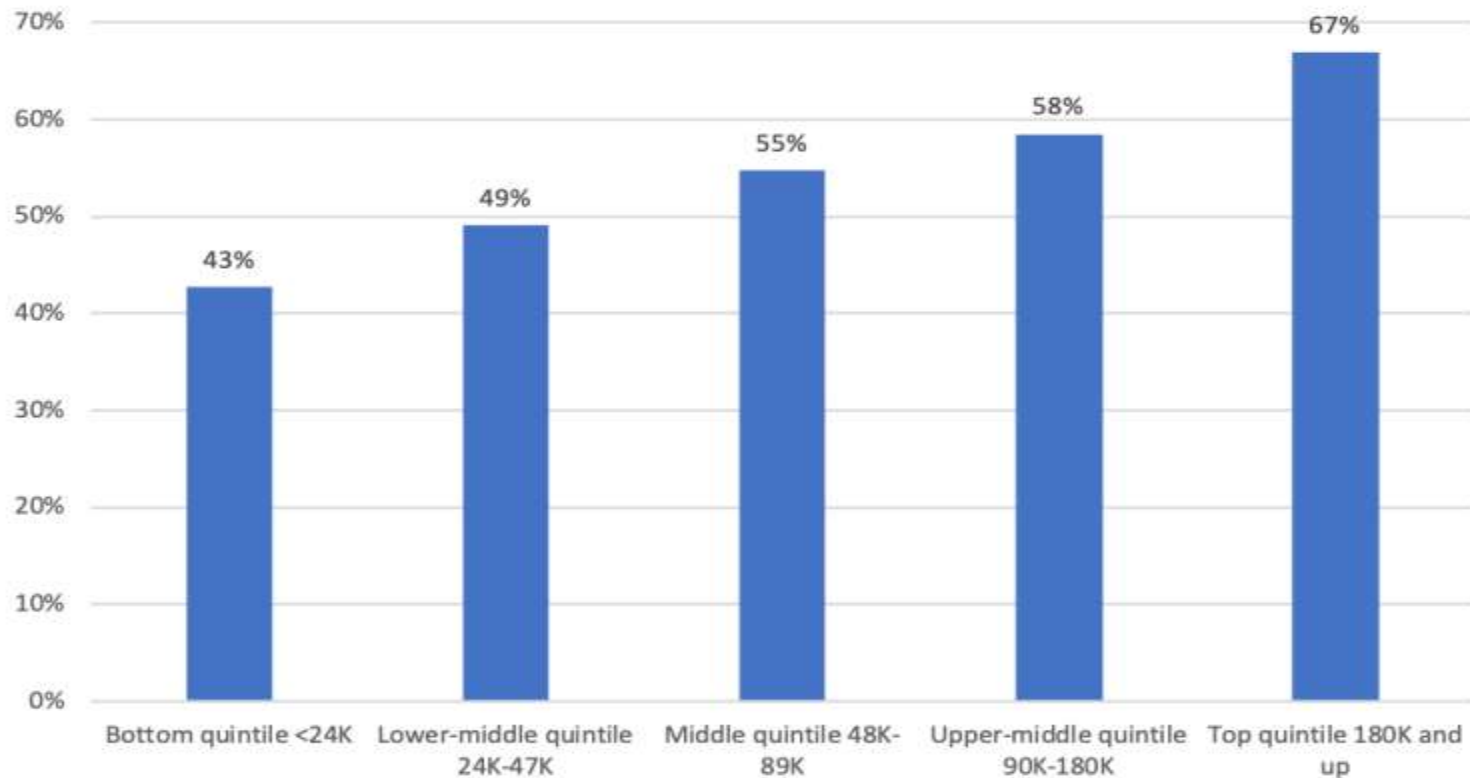
Major Power Outages in North America



NERC

Power outages are increasing, partially due to Global Warming

The Affluent are able to stock up most



Source: Sample of 8572 randomly selected adults from the Gallup Panel, interviewed over the phone from March 16 to March 22, 2020.

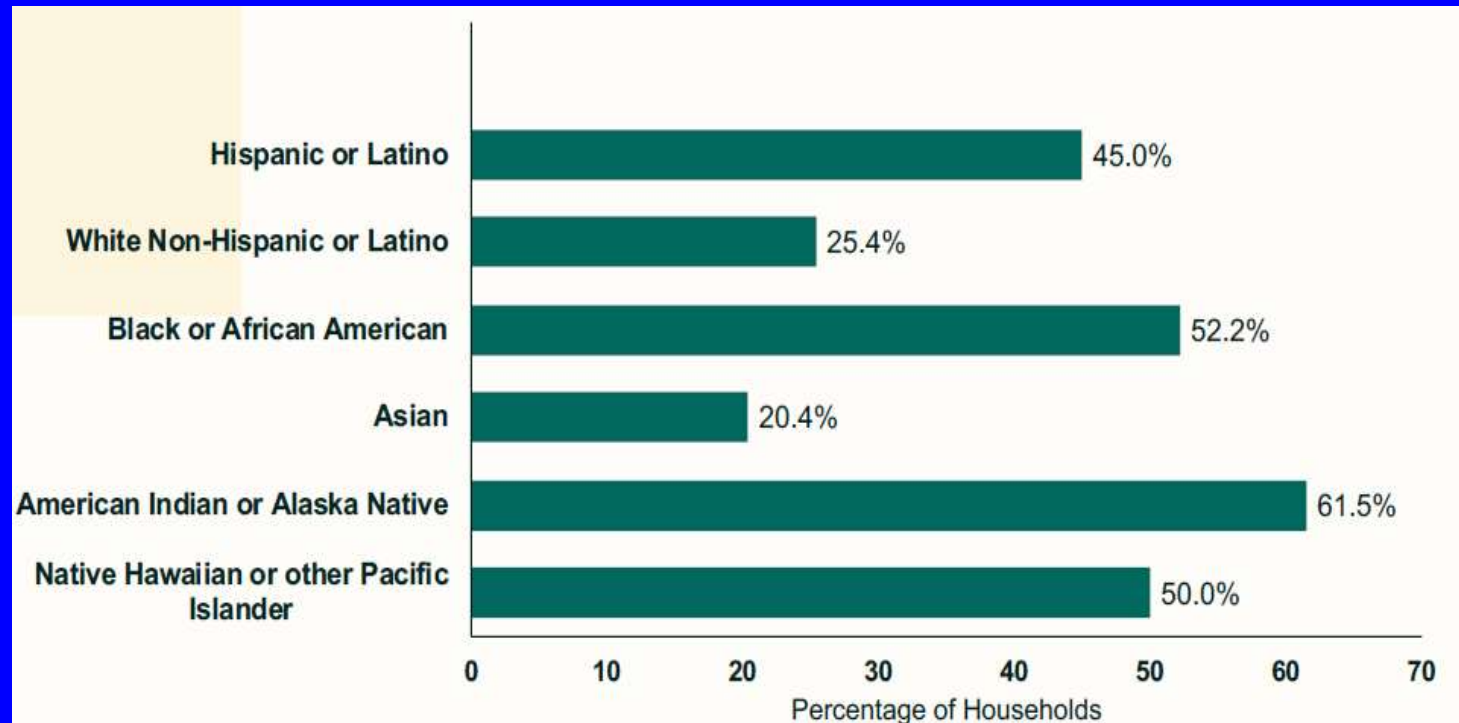
BROOKINGS

If the refrigerator stops functioning
the loss of food supply will be
disastrous to a lower income family!

Particularly if that food supply
has been attained with food stamps!

Outages and electricity prices
affect the poor disproportionately!

Households Experiencing Energy Insecurity (2015)



From: S. Baker/Yale

Lower income households are disproportionately non-white

Extreme heat causes more deaths
than any other natural disaster.

Studies show that temperatures
in less affluent neighborhoods of cities
may be 15-20 deg F higher than
in tree shaded suburbs.

Outages tend to be more frequent in poor areas and take longer to resolve

Electricity Assets are often located in the least affluent neighborhoods leading to health issues.

Resiliency Measures like rooftop solar and behind the meter storage tend to be installed by the more affluent

Electrification (e.g. EV) benefits the more affluent, but infrastructure costs are borne by all !

Energy Storage offers itself
as a tool to alleviate
many of these problems

e.g. Storage to replace
Fossil Fuel Peakers

Microgrids with Storage
for outage mitigation

Solar + Storage for
Remote Tribal communities

Oakland, CA Peaker and DAC Area



40 year old Peaker
168MW Jet Fueled, using
868,000 gallons / year

Nearby DAC Areas are
exposed to Nox, Sox,
and Particulates causing
Respiratory Problems



Replacement Options:

- New Fossil Fuel Plant
- New Transmission Lines
- ▶ Renewables + Storage



Vistra 300MW / 1200MWh

Substation Storage:

36.25MW / 145MWh

Distributed Storage:

500 Low Income Homes

- Cleaner Air
- Improved Health
- Green Jobs
- Cost Effective!

Bad River Band of Lake Superior Chippewa in Wisconsin (DOE Indian Energy)

July 2016 Flood caused
Multiday Power Outage

Energy Sovereignty: \$2M Microgrid

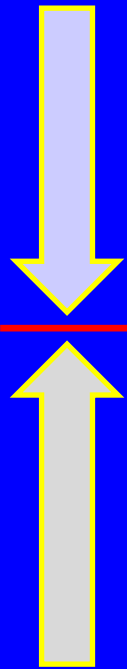
- Admin. Building
- Wastewater Treatment Plant
- Health & Wellness Center

May 2021: 500 kW Solar
 500kW/1 MWh Storage



Resiliency, Sustainability, Predictable Budget

Designing a Business Case:



The **Cost** of a Storage System depends on the Storage Device, the Power Electronics, and the Balance of Plant

The **Value** of a Storage System depends on Multiple Benefit Streams, both monetized and unmonetized

Metrics will depend crucially on Regulatory Structure and Locality!

Power Electronics
20-25%

Energy Storage Device
25-50%

Facility 20-25%

Arbitrage

Frequ. Reg.

Dem. Charges
month, year

Resiliency

We need to develop new metrics
and new models that allow
inclusion of Social Equity
in the operation of Utilities
and in Statewide
Integrated Resource Planning

Assuring Energy Equity
for Urban, Rural, and Tribal
Disadvantaged Communities
should be a High Priority for the U.S.

We need to take care
of the Environment
but we must also take care
of each other!