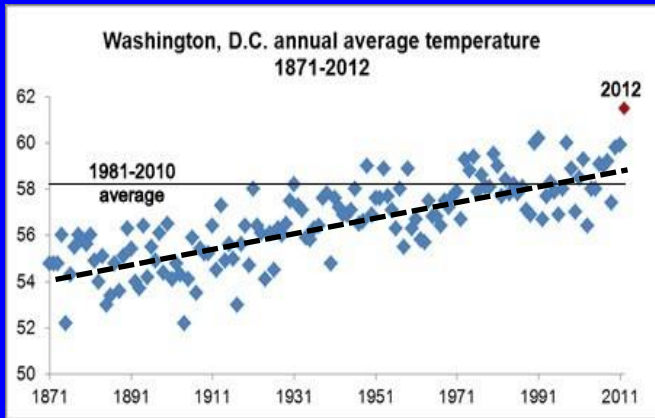


# Energy Storage: Towards Social Equity

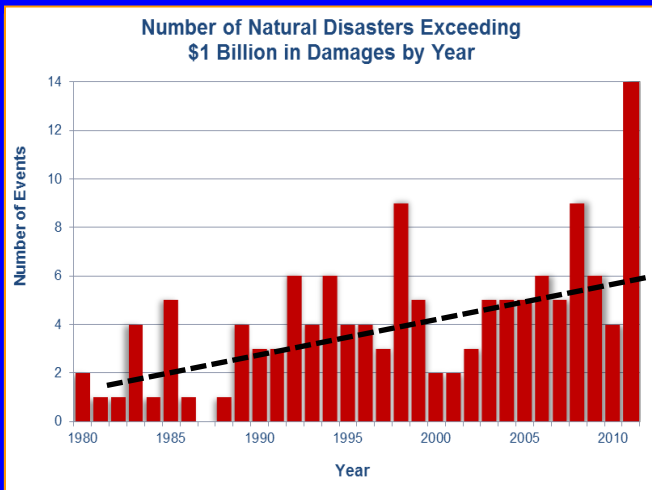
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IMRE GYUK, DIRECTOR,  
ENERGY STORAGE RESEARCH, DOE-OE

# Trends indicate things will get worse not better!!



Florida, Harvey, 2017



Now! Worst Drought for 400 years

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

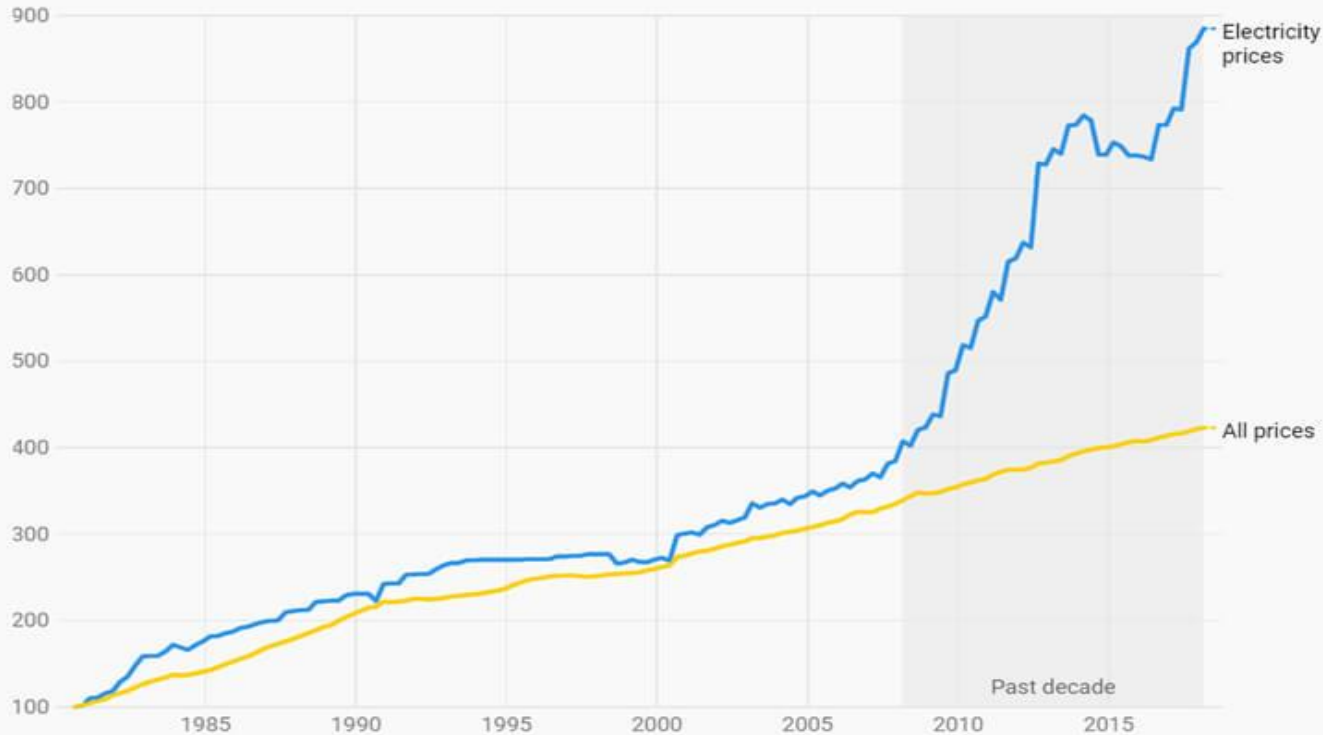
We must Decarbonize  
We must change to Renewable Energy!

But we must also Assure  
that the Advantages of  
Electrification are shared by All!

Energy Equity is essential  
and Energy Storage  
can Contribute towards  
making it happen!

# Electricity price trends

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

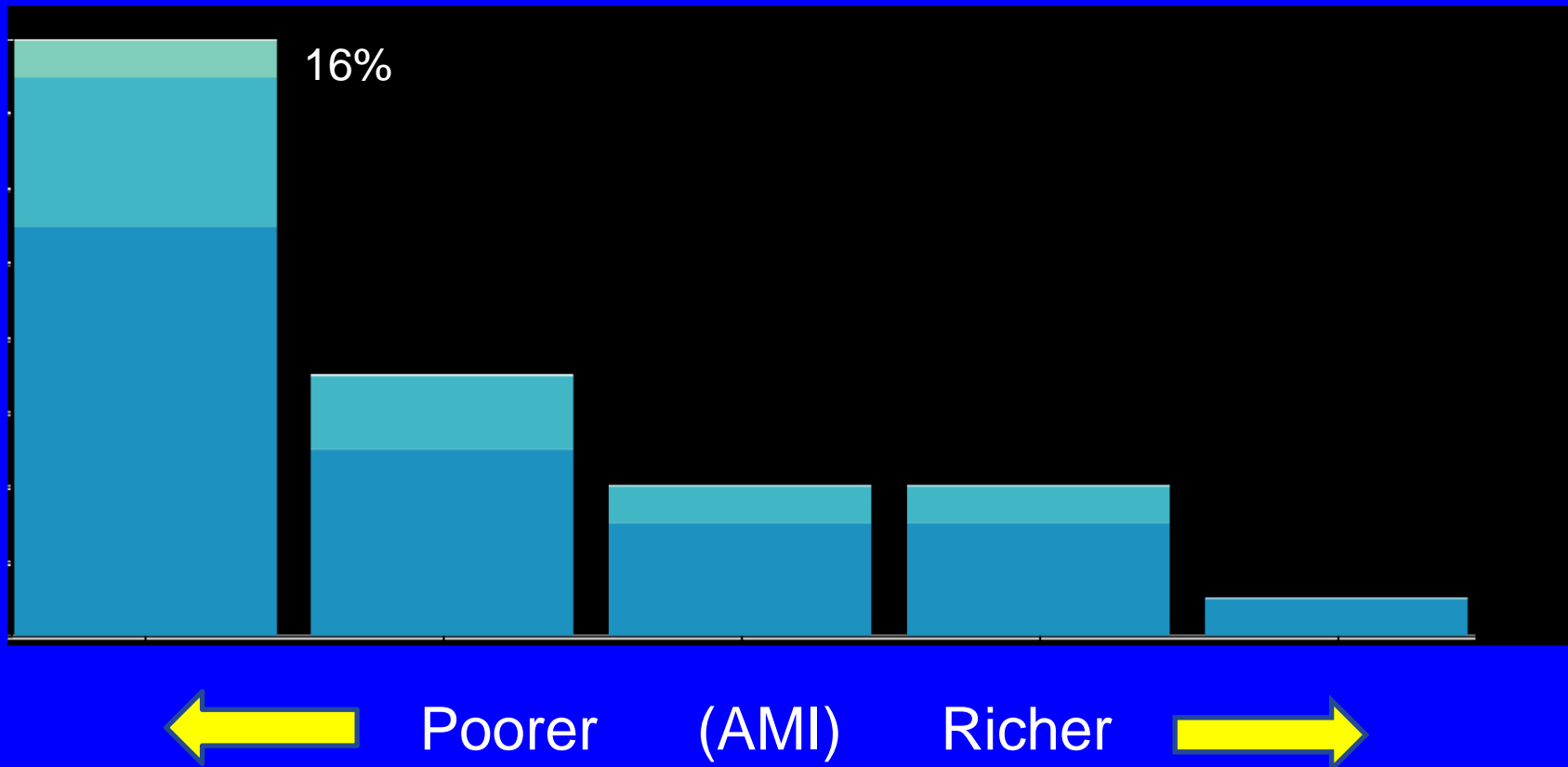


Prices at 1980 Q3 are indexed to 100. Chart shows percentage change per quarter of each price group.

Source: ABC News

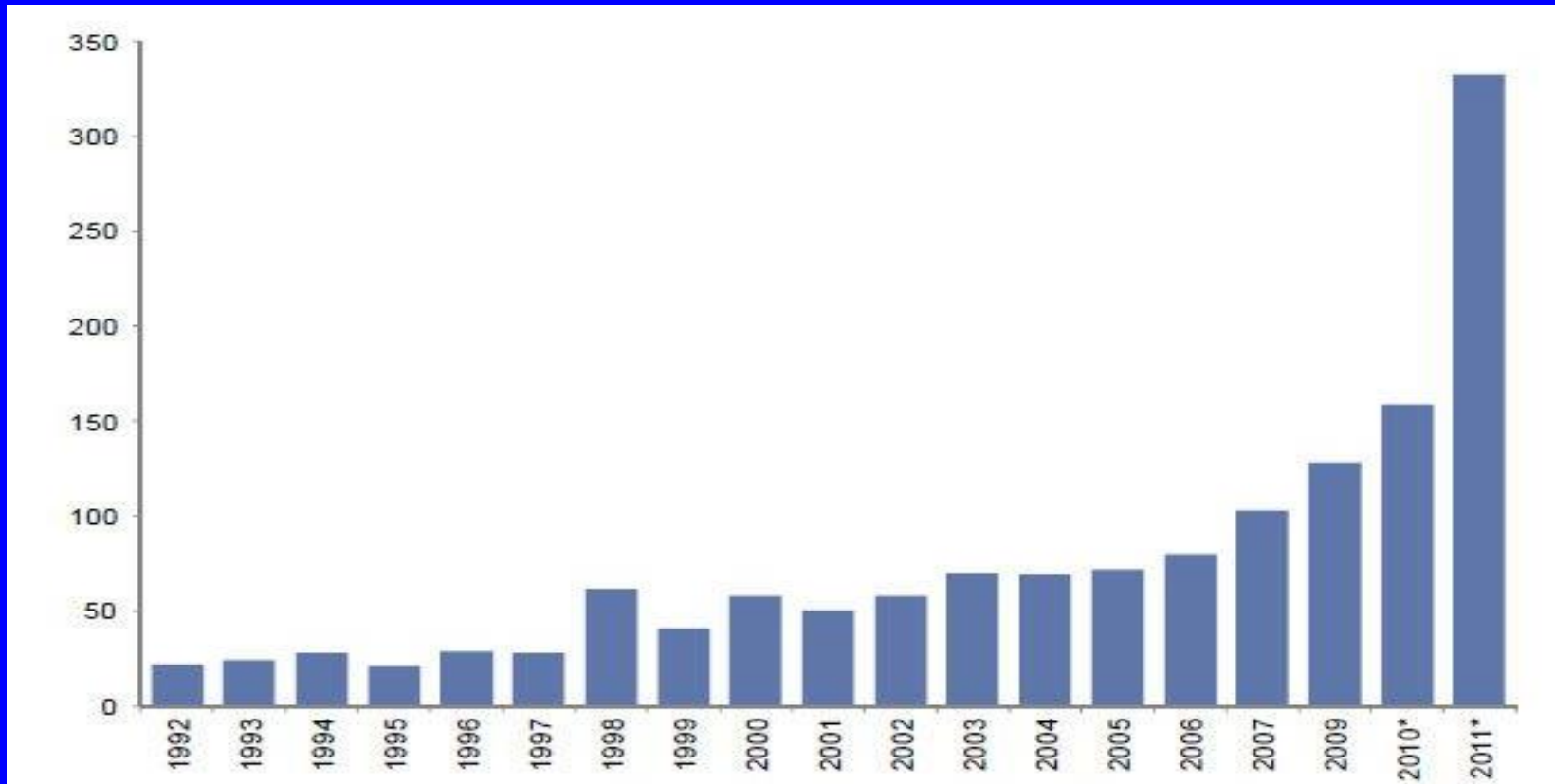
For the past decade electricity prices have been rising substantially

# 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

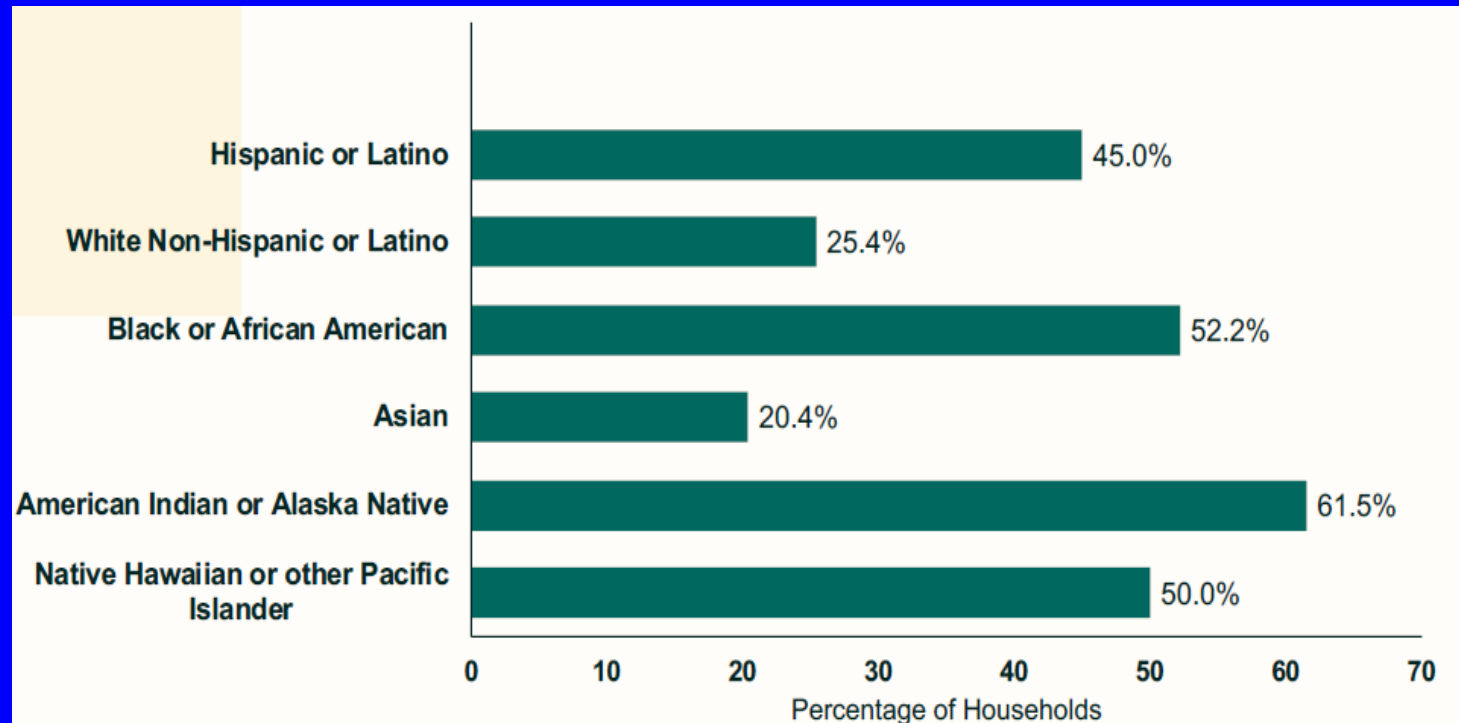
If the refrigerator stops functioning  
the loss of food supply will be  
disastrous to a lower income family!

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 mitigate

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

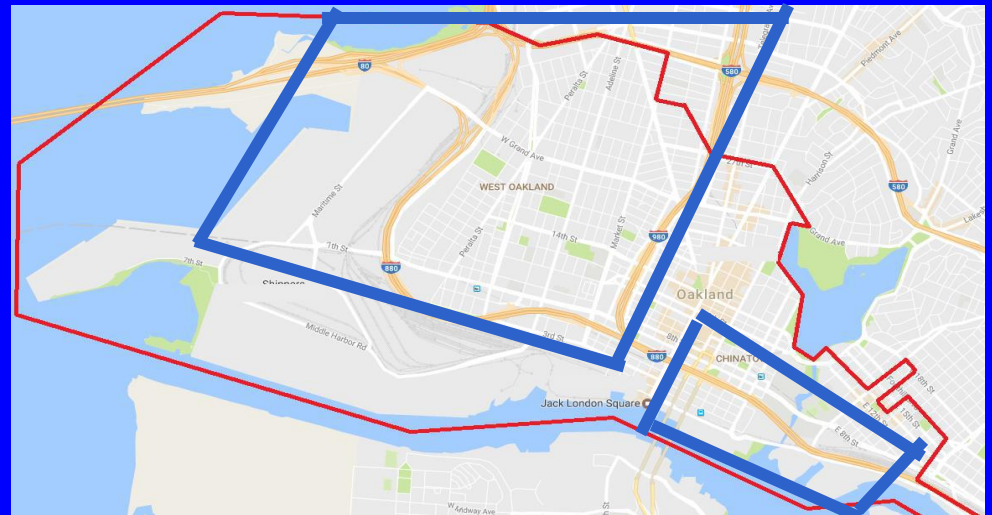
Solar + Storage for  
Tribal communities .....

# 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:

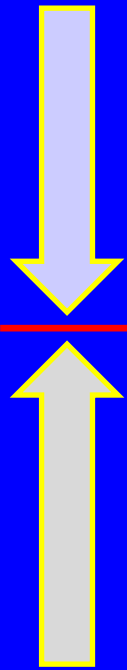
36.25MW / 145MWh

## Distributed Storage:

500 Low Income Homes

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

# 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!

Energy Storage for Social Equity, June 28-29,

<https://www.pnnl.gov/events/energy-storage-social-equity-roundtable>