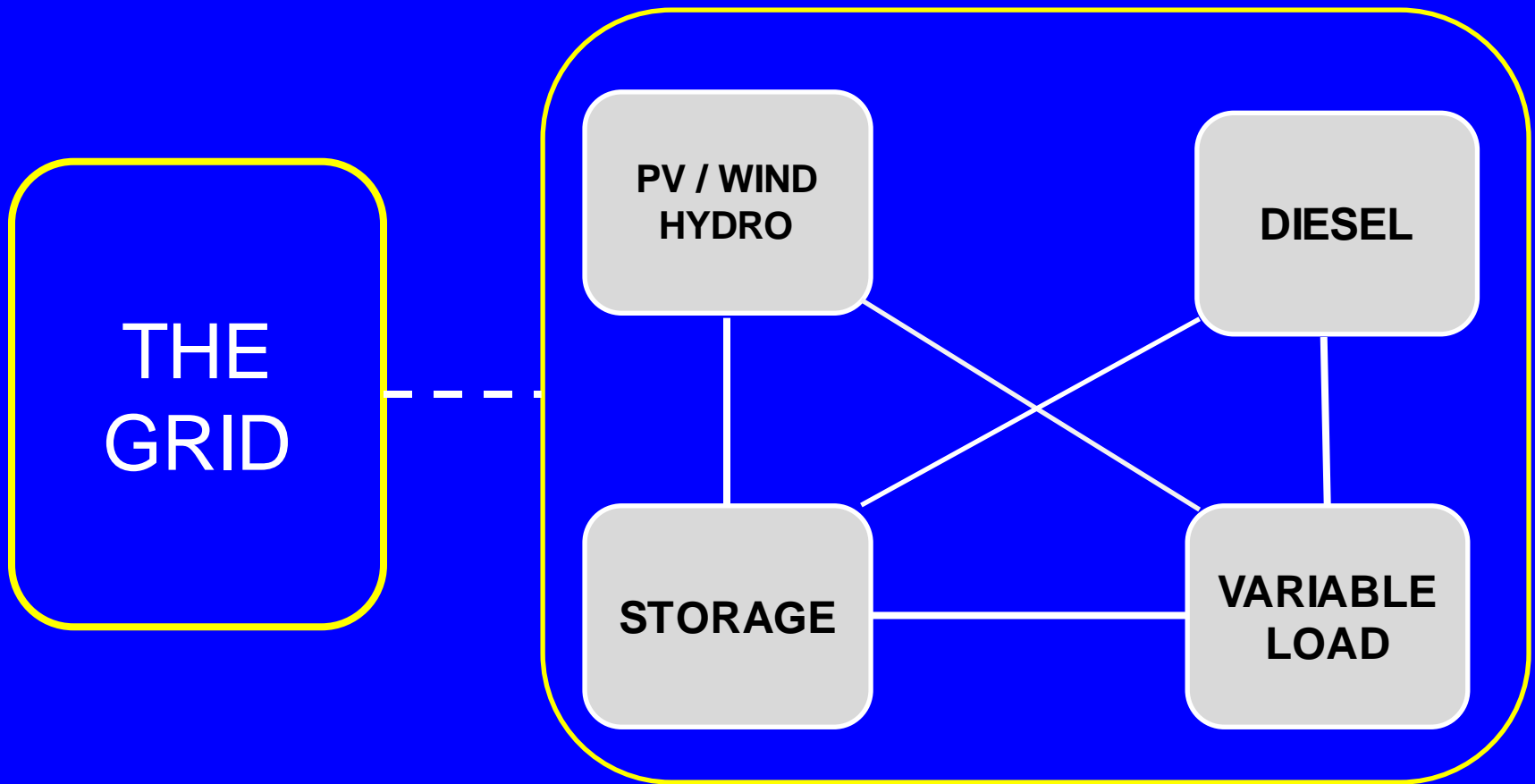


# Energy Storage for Rural Electrification: Case Studies

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

# An Autonomous Micro-Grid



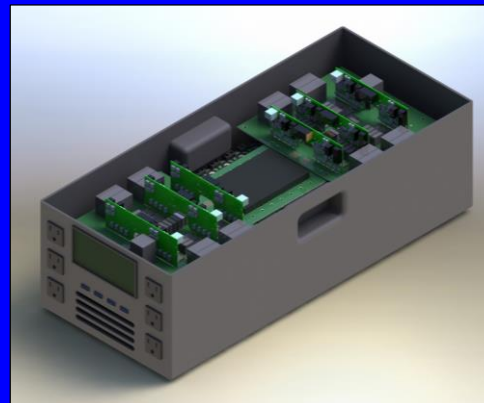
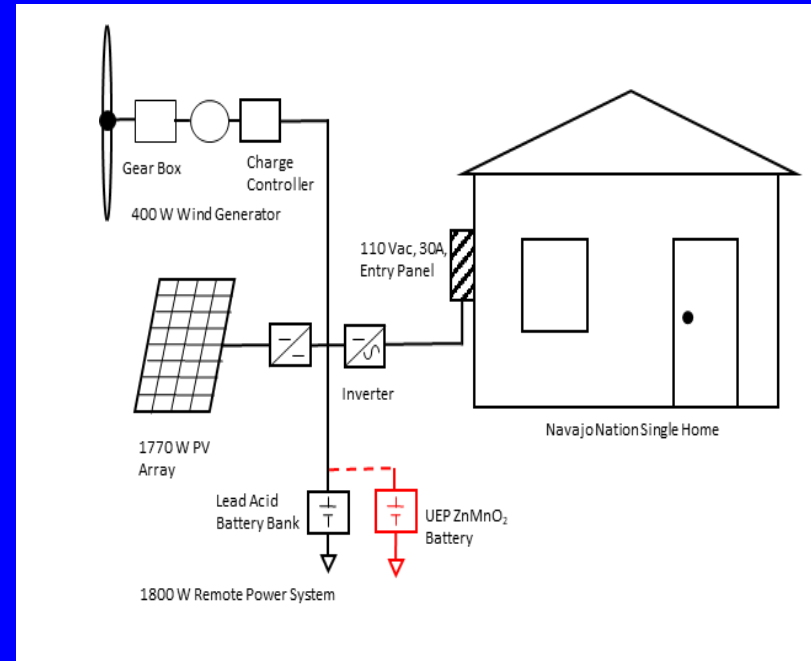
How big is the Box?

What is the Best

Balance Inside it?

# Robust Power Conversion System for Off Grid Renewable/Storage Deployment

(Georgia Inst. of Techn.)



Field Tested  
by  
Navajo Nation

# 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

# Cordova, Alaska, Municipal System



Cordova, Grid Isolated



6MW Run of River Hydro Power

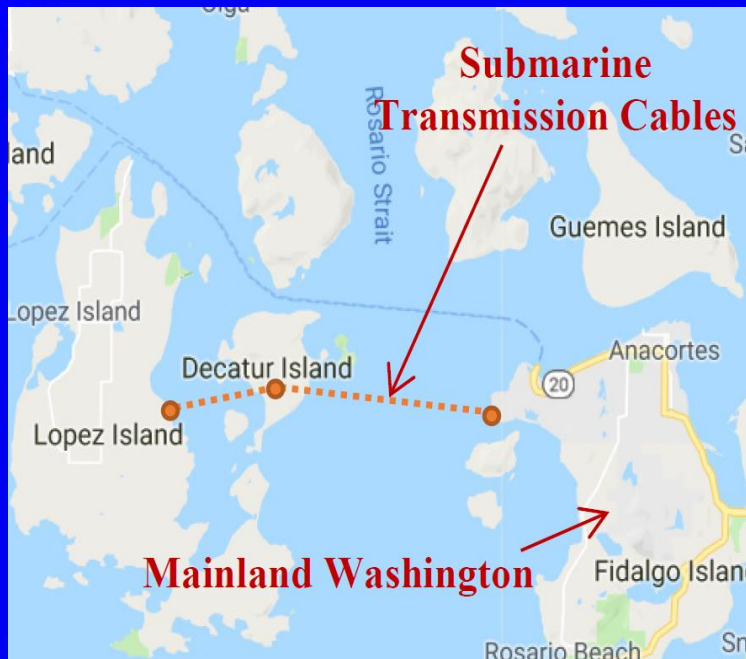
Total Capacity: 7.25MW Hydro; 2x 1MW Diesel

0.5MW Deflected as Spinning Reserve

Hydro: \$0.06/kW; Diesel: \$0.60/kW

1MW/1hour Battery, Commissioned June 7, 2019

# Decatur Island, WA, OPALCO WA CEF, DOE/PNNL Analytics



San Juan Islands

San Juan Archipelago:  
Peak Load exceeded  
Transmission Capacity

Solution:

- Local Demand Shaping with 1 MW, 2.6 MWh
- Storage, Li-ion
- 504 kW DC Solar Array



# Commissioned February 2021



Demand charge reduction  
Cable replacement deferral  
Transmission charge reduction  
Energy cost reduction  
Voltage regulation  
Outage reduction  
**PNNL Report-27696**

- Benefits – \$3.3M, higher than costs – \$2.9M
- Benefit cost ratio 1.13
- Submarine transmission cable deferral ~\$2M
- Demand charge reduction \$0.7M



# Decorah, IA: Peak Shifting, Distribution Upgrade Deferral

Alliant Energy / DOE-OE, Sandia.

\$200K Grant from Iowa Economic Dev. Authority (IEDA),  
and \$250K from DOE-OE, for a Total Cost of \$2,500k

3.3MW installed Renewables already on Circuit  
2.5MW/2.9MWh storage will allow installation of 900kW new PV.



Li-ion batteries by ENEL-X

# North Troy, VT, Wind Curtailment GMP, VEC, Sandia/DOE

N-S Transmission forms bottleneck  
for wind from the North to population in the South.  
3MW / 12 MWh, Expected Completion: Sept. 2022  
\$5,500,000 Storage to be installed at SHEI Interchange:  
100% of all benefits accrue to VT retail customers.



JOIN US FOR THE 6<sup>TH</sup> ANNUAL  
DOE ENERGY STORAGE  
SAFETY AND RELIABILITY  
FORUM. MAY 4 – 5. 2022  
VIRTUAL and FREE

Now and in Future,  
Energy Storage  
should be in  
the Toolbox of every Utility!