Energy storage in Islanded Microgrids

Increasing Renewable Energy Contribution
and
Developing New Business Models for Remote Regions

Gwen Holdmann,
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DOE OE Peer Review

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Alaska Center for Energy & Power

Fostering innovative energy solutions for Alaska and beyond by:

- Developing Information for Decision Makers
  - ✓ Technology testing and optimization (industry)
  - ✓ Energy analysis (policy makers, communities)
- Education and training
- Commercializing energy innovation

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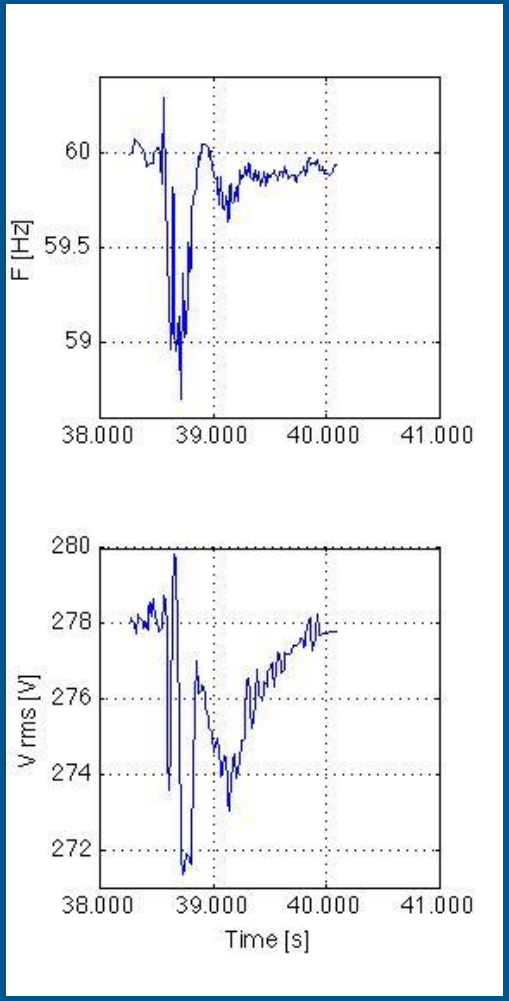
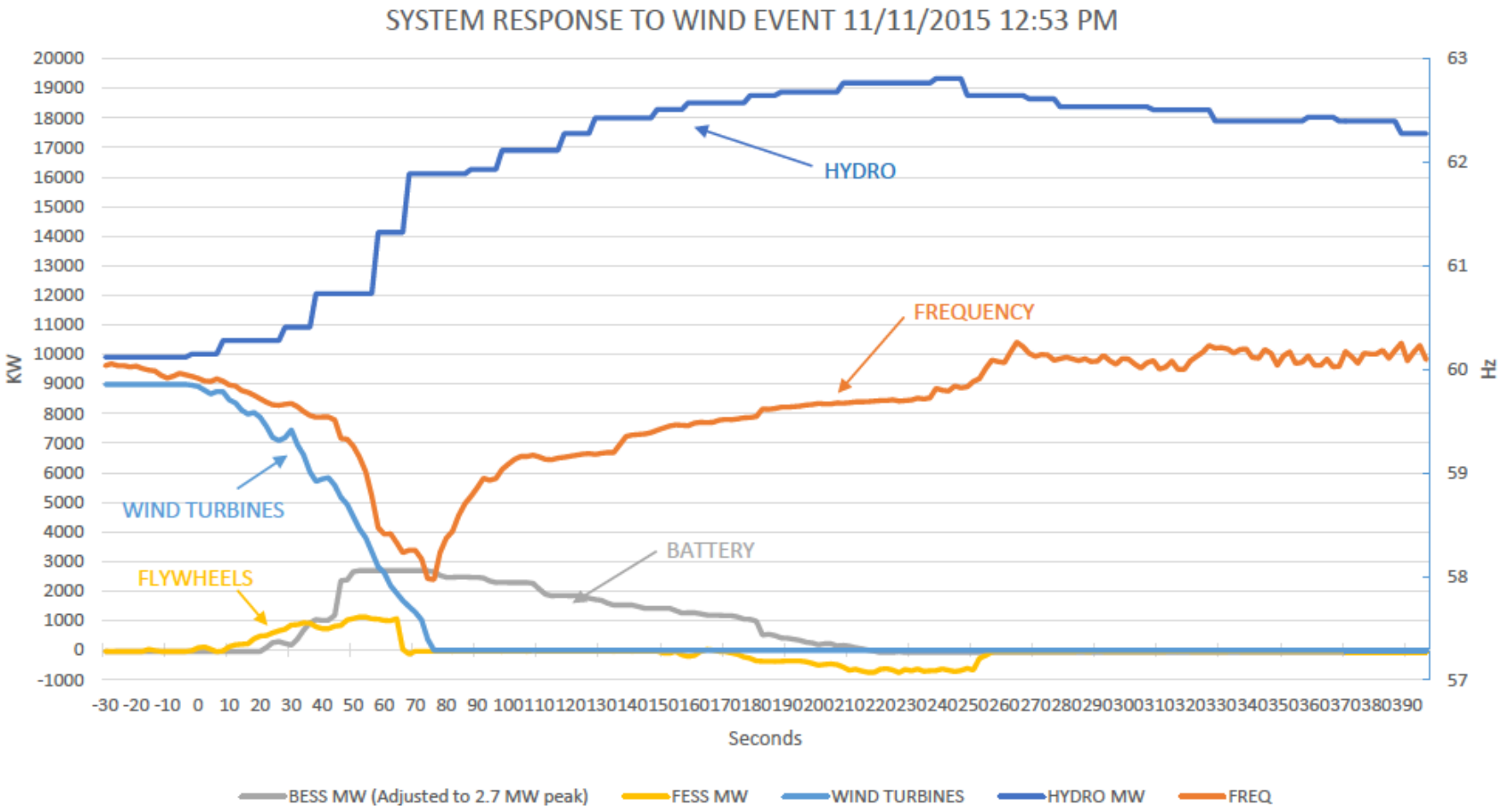
Energy Storage Services

- Power quality - seconds
  - Rapid variability of intermittent renewable energy
  - 'Sluggishness' of diesel generators
- Renewable energy smoothing - minutes
  - Spinning reserve
  - Fast acting diversion load
- Renewable energy shifting – hours (to days)
  - Diversion load
  - Meeting peak demand, when peak production occurs at other times
- Advanced inverters may provide added benefits – var support, diesel-off capabilities, etc.



Kodiak Island: 99.8% renewable generation

Hydropower + Wind + ESS (Battery and Flywheel)



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Case study

CORDOVA, AK
RECOVERY OF SPILLED RENEWABLE POWER

Collaborators: ACEP, Sandia, Cordova Electric Coop

Funding: DOE Energy Storage Program, Dr. Imre Gyuk

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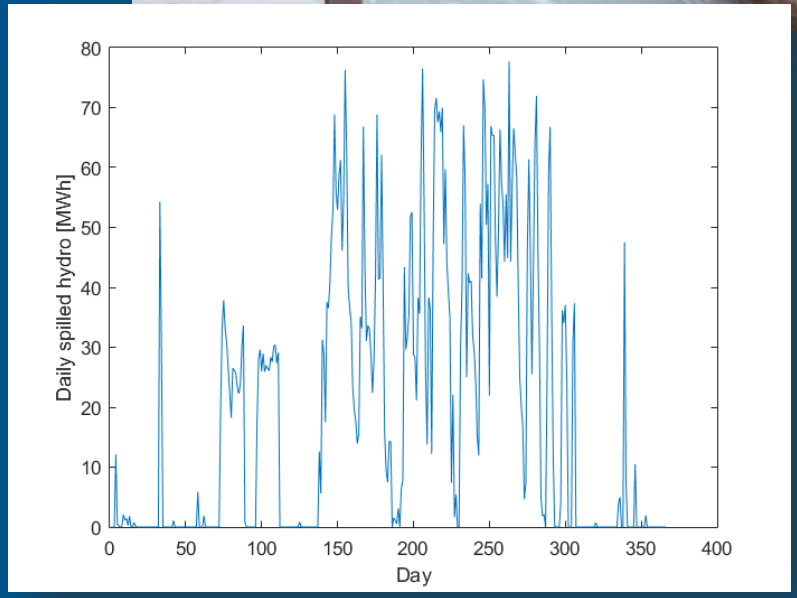
Current Situation

- Pop: 2,400
- 60.5 N (South Coast)
- Large fish processing plants
- Highly seasonal demand
- Run-of-river hydro
  - Diesel supplemented during peak demand and periods of little water
  - Potential for higher production at other times
    - Spilled hydropower



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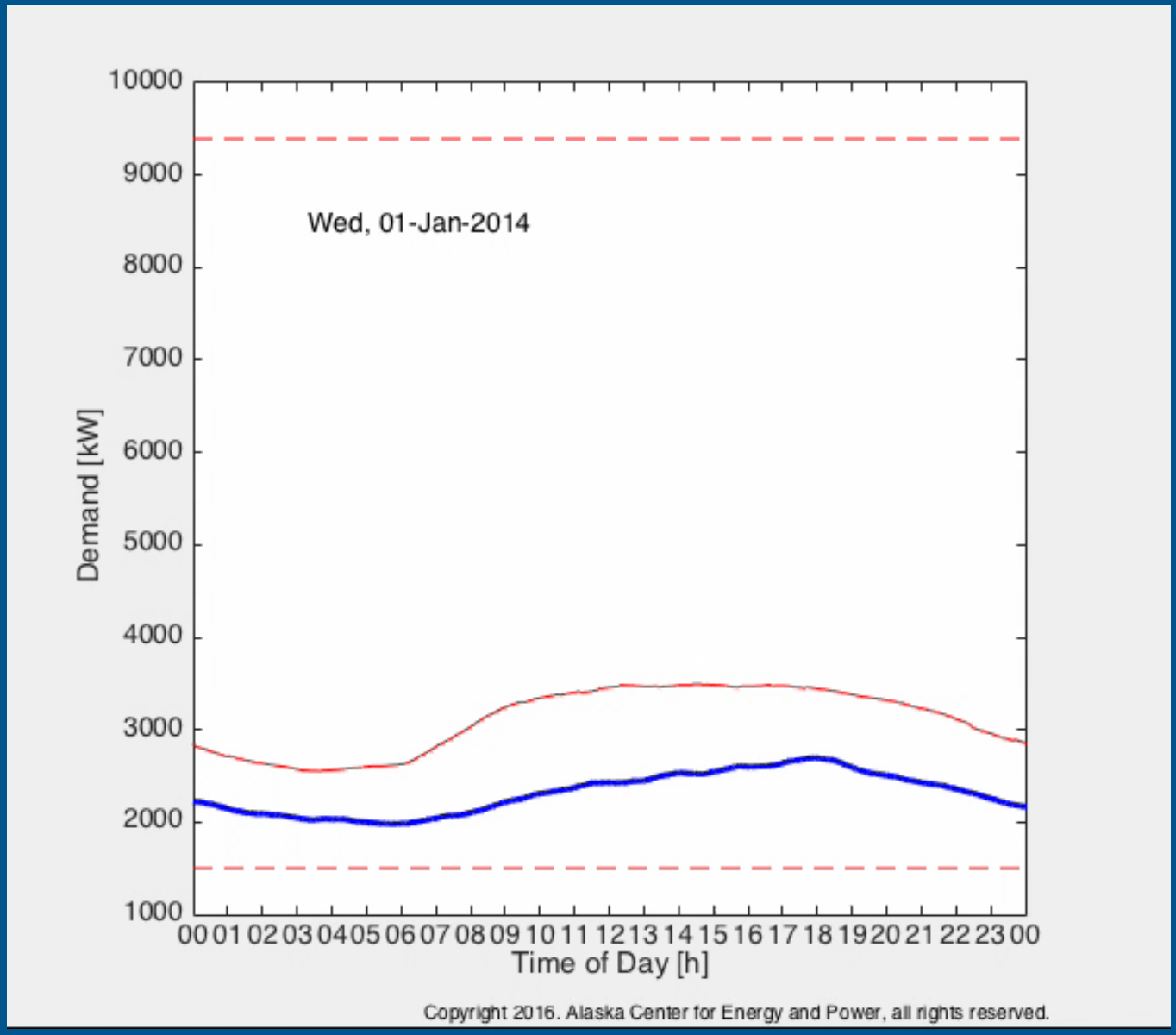


Objective and Approach

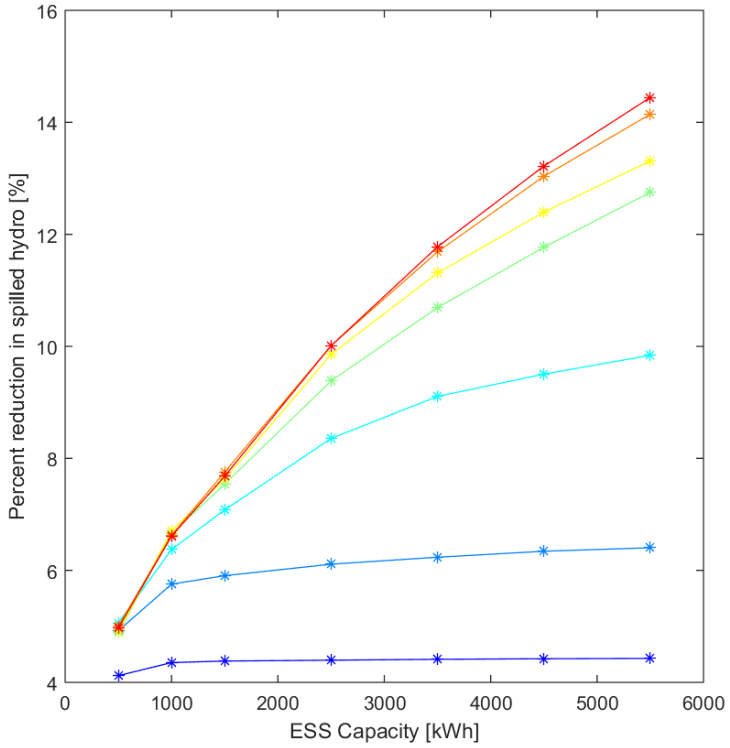
- *Energy Storage analysis and optimization modeling to:*
  - Recover spilled power
  - Reduce diesel consumption
  - Reduce diesel O&M
  - Support grid stability
- *Deliverables*
  - Technical specification for RFP by CEC
  - Project blue print for other AK utilities

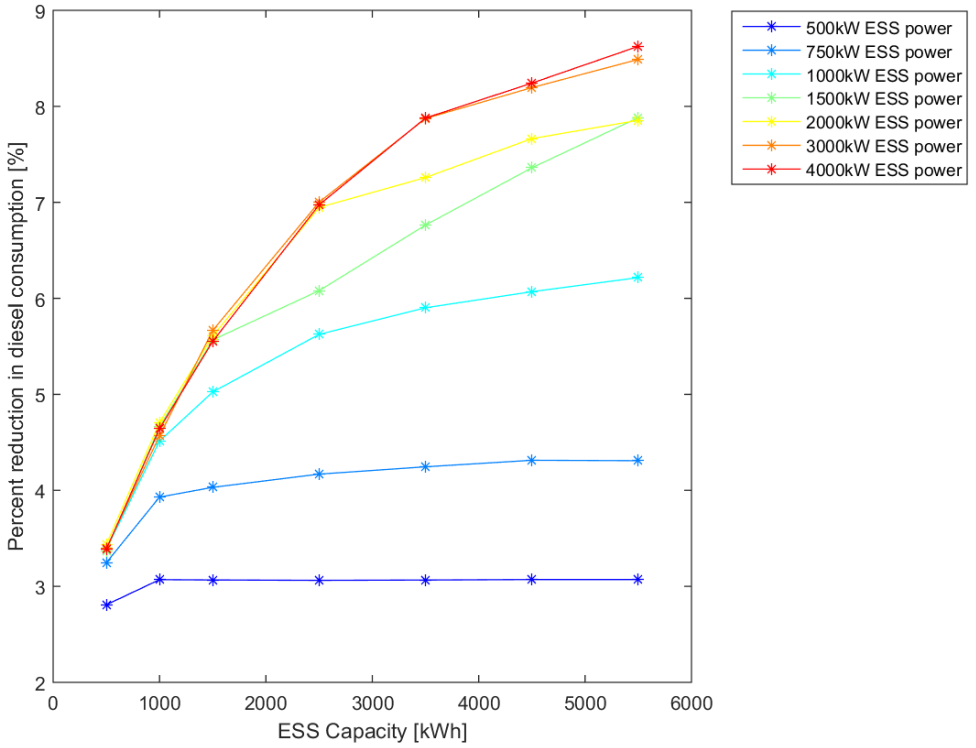
Cordova Energy Mix in 2011

- 18 GWh Hydropower
- 10 GWh Diesel
- 781,000 Gal Diesel @ $3.55/gal
  - $2.77M Fuel bill
- Cost of generation:
  - Hydro: ~$0.06/kWh
  - Diesel: ~$0.35/kWh
- Estimate: 3.8 GWh spilled hydro

Can some of the spilled hydro be recovered to displace diesel fuel?

ESS Potential in 2011





Diminishing returns of reduction of diesel fuel. Low power ESS (<1MW) of limited value.

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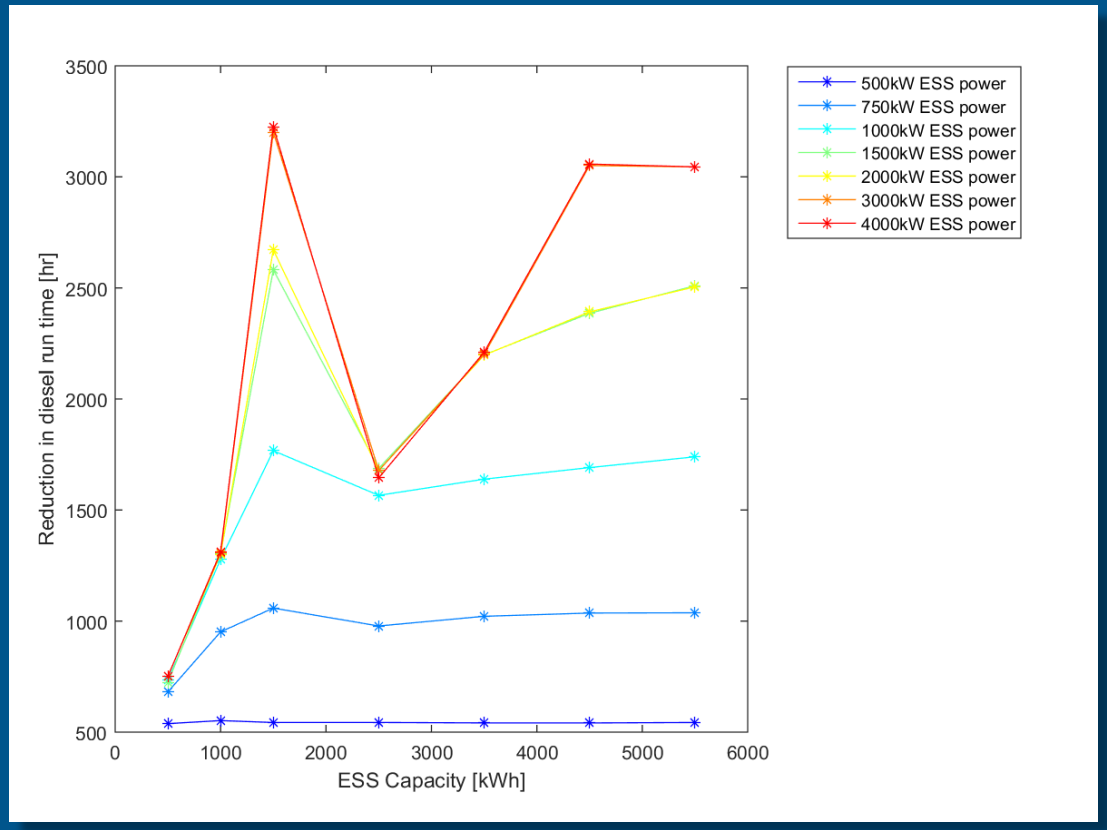
Other value streams?

- ESS as spinning reserve capacity
  - Optimal diesel fleet combination
  - Smaller diesels run
  - Run hours overall reduced
- Ancillary services
  - Var-support (rarely needed in Cordova)
  - Frequency and voltage support



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Next steps

- Analyze data for
  - Cycling of ESS
  - Ramping of ESS
- Merge with dynamic model results
  - Determine optimal location
- Develop technical specification
- CEC: Issue RFP with option to own/operate or bidirectional PPA.

Thank you!

ACEP Project team:
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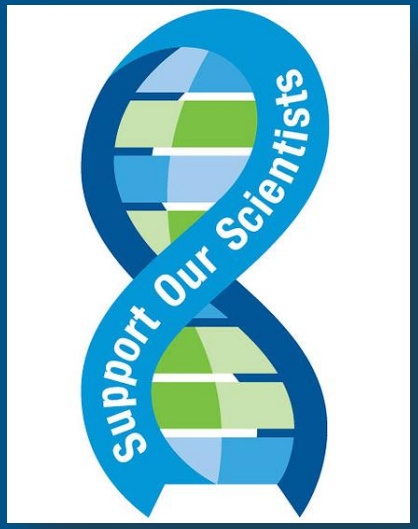
http://acep.uaf.edu



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