Energy Transition Opportunities for the Fishing Fleet

Kempy Energetics
Alaska Center for Energy & Power
Institute of Social & Economic Research
Department of Energy National Laboratories

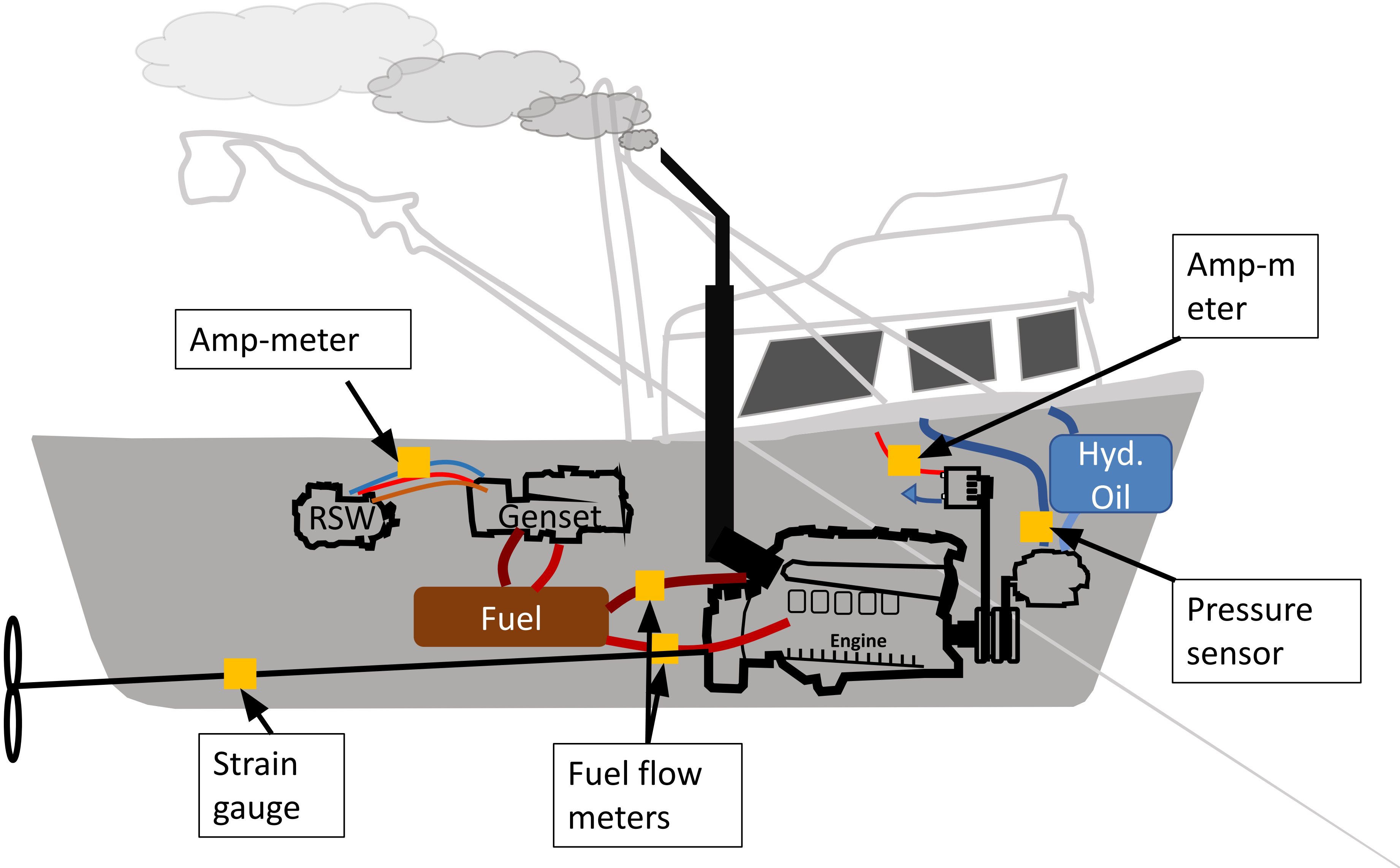
Alaska Longline Fishermen's Association Fish Expo

November 8, 2021

1. Update on Chandler's work
2. What is ETIPP?
   Community + ACEP/ISER + National Labs
3. National Laboratories
4. Other Energy Transition Opportunities in Rural Alaska
5. What are your perceptions?

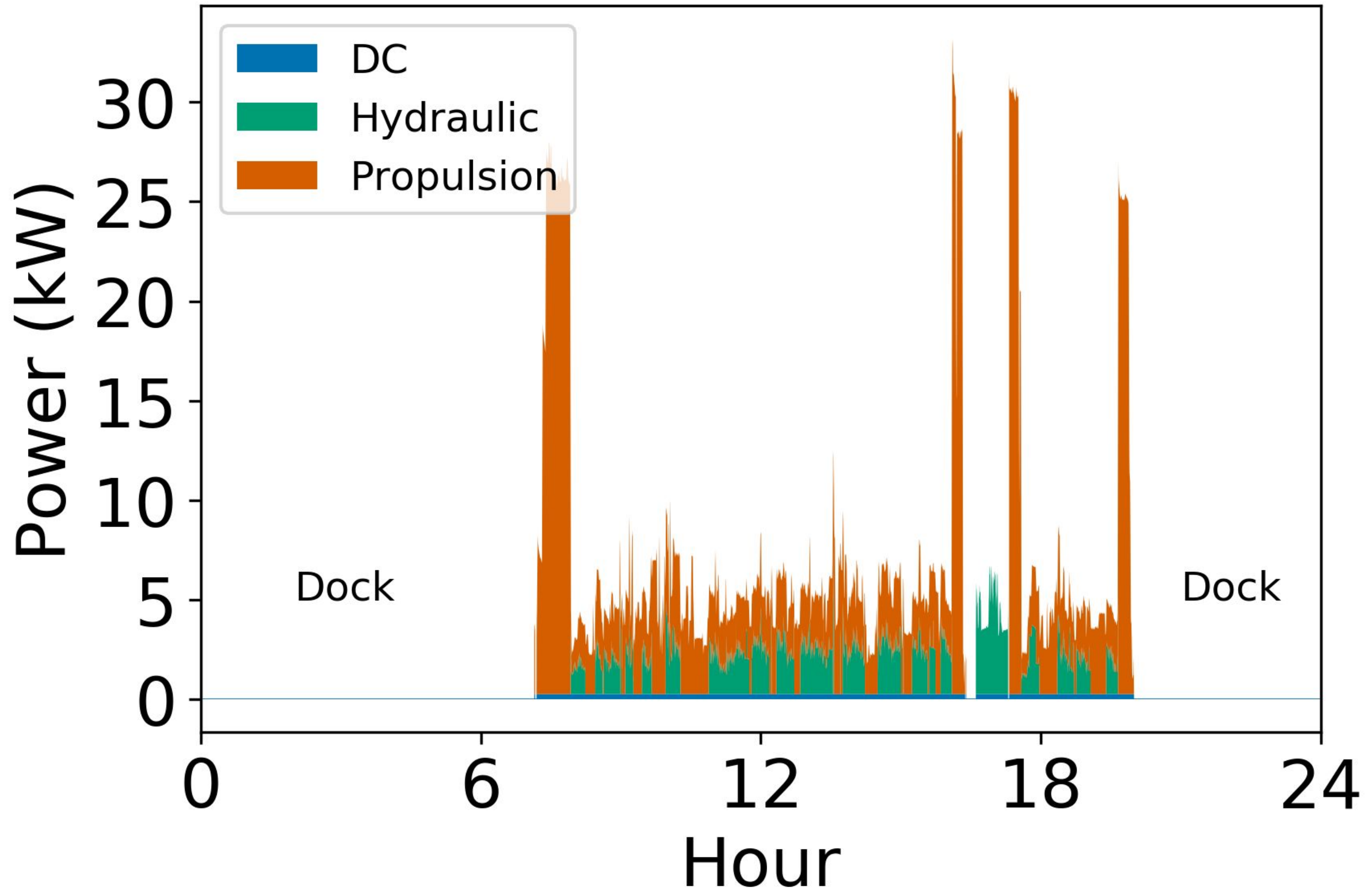
Update on Chandler's work

I’ve been measuring how boats use energy since 2016.

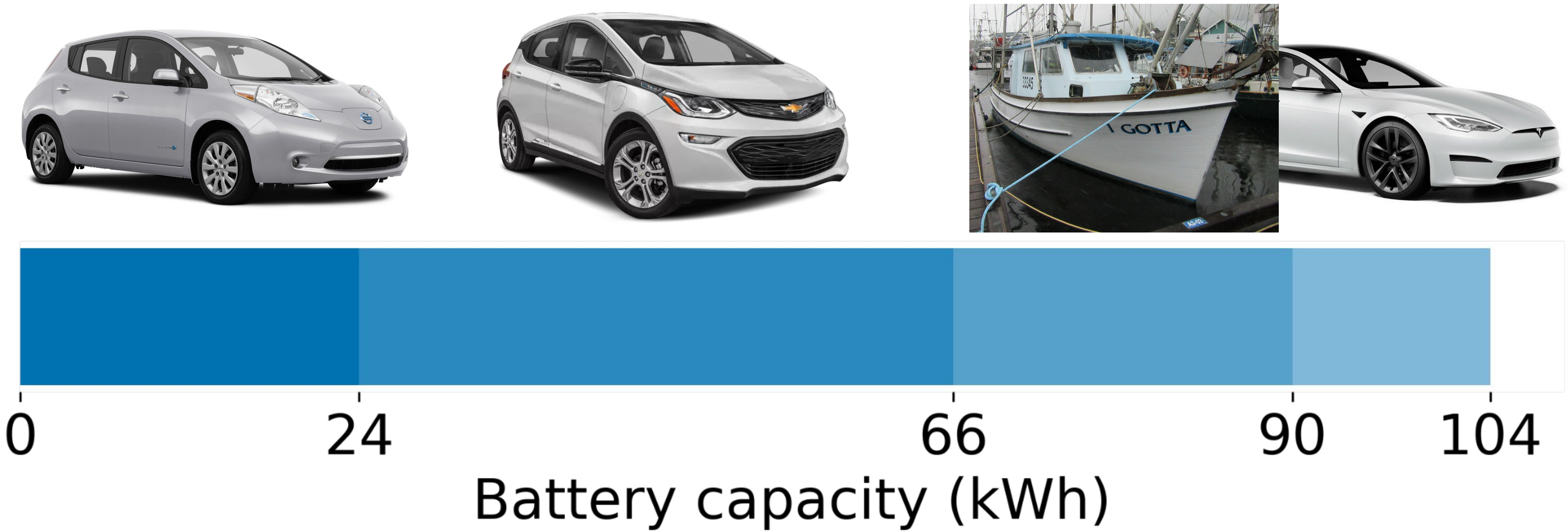


Now we're moving toward alternative energy sources with two trial vessels.

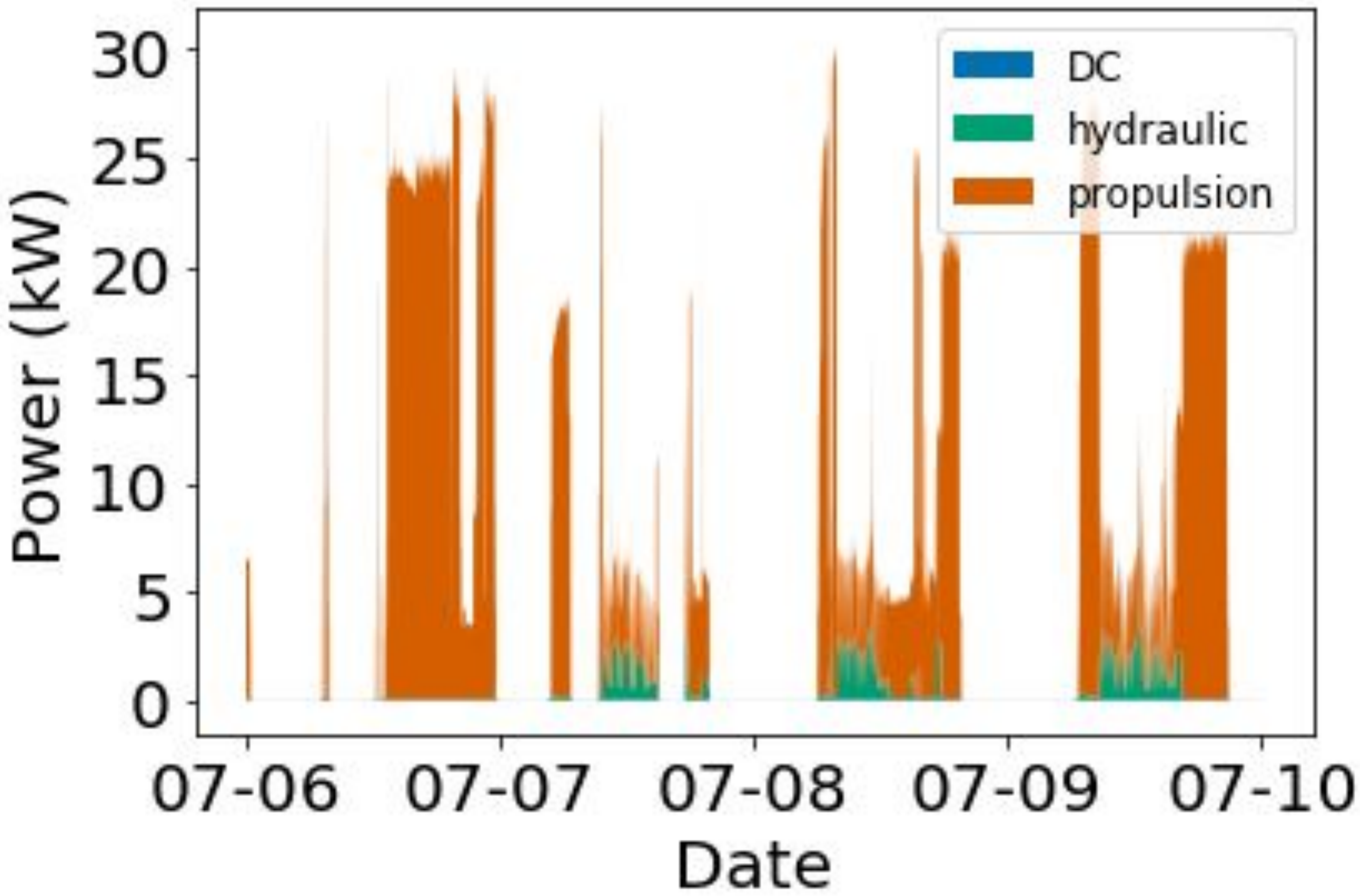
I Gotta uses about 90 kWh of energy in a day of chum trolling. About 55 kWh while fishing.



A day of trolling in Sitka Sound uses a little less energy than a Tesla Model S battery pack.



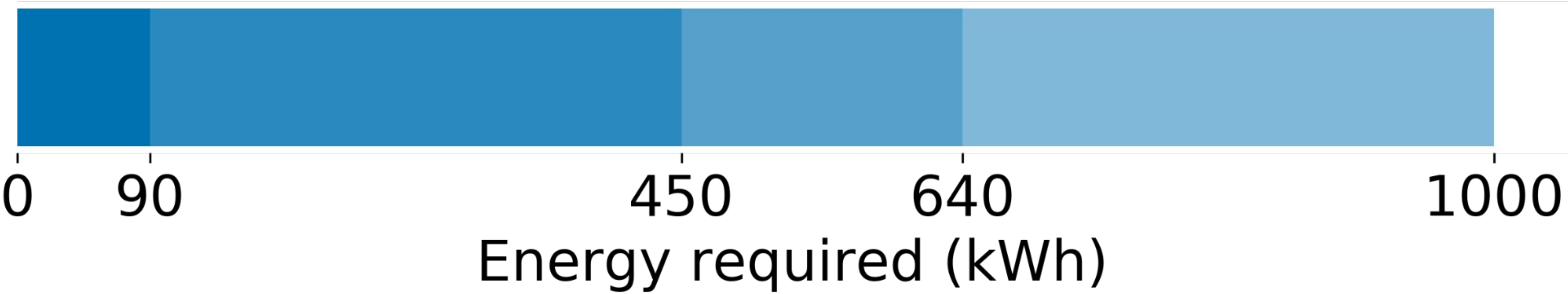
Woodstock required 640 kWh for a 4 day longline trip.



Longer trips require too much energy for practical battery installations.

Image from: City and borough of Juneau

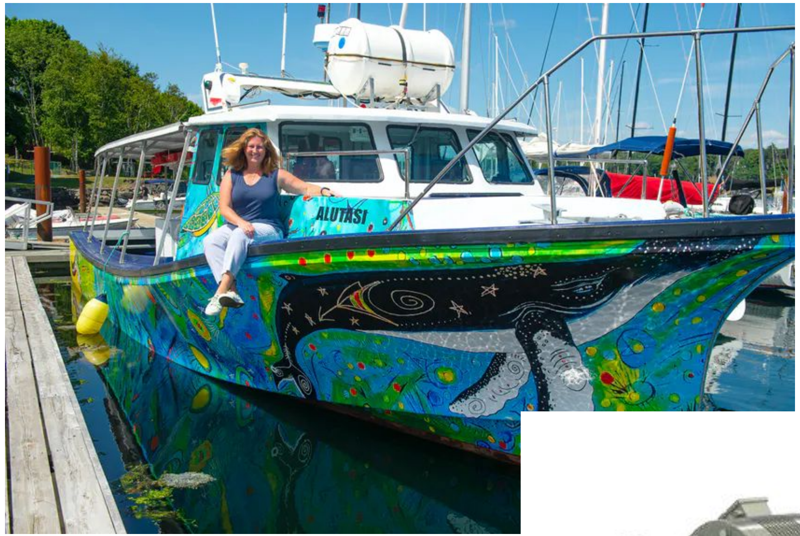
Image from: Corvus Energy



We’re soliciting quotes from several companies that sell hybrid propulsion systems.

BAE Systems

Transfluid



Glas Ocean Electric

What are we doing now?

- Working with National Labs to optimize design through ETIPP
  - 12-18 months of supported National Lab work
- Compiling operation details to support design
- Working with suppliers to define needs
- Applying for funding beyond ETIPP to support equipment purchases
  - We expect a hybrid propulsion retrofit to cost $150-200k

What is ETIPP?

Who is involved?

Energy Transitions Initiative Partnership Project (ETIPP)

ETIPP works alongside remote, island, and islanded communities seeking to transform their energy systems.

Community priorities + **Partnership approach** → **Energy assessment and planning** → **Resilient energy systems**

Communities

Cohort 1

Community Regional Partners

Five regional partners facilitate stakeholder engagement across the national initiative.

The **two Alaska regional partners** have formed the Alaska Rural Energy Partnership.

Alaska Rural Energy Partnership

University of Alaska

ACEP
Alaska Center for Energy and Power

UAA Institute of Social and Economic Research
UNIVERSITY of ALASKA ANCHORAGE

Renewable Energy Alaska Project

REAP








Other Alaska Projects

Dillingham, Alaska – Investigation of Nuyakuk River Hydroelectric Project to reduce community fuel costs.

Sitka, Alaska – Assessment of available community renewable resources while planning for a more modern grid control system.

Wainwright, Alaska -- Transformation of an under-utilized armory building into a comfortable, safe, and resilient building that will stay warm, dry, and have lights during an extended electrical outage.

Ouzinkie, Alaska – Ouzinkie currently relies on diesel generators and an aging hydroelectric system to power their community but is looking to understand how they can optimize their use of renewables and storage.


Photo courtesy of Rob Jordan

National Laboratories

What kind of work do they do?

A Legacy of Innovation

The **17** National Laboratories have served as the leading institutions for scientific innovation in the United States for more than seventy years.

NREL at a Glance

2,307

Employees,

plus more than

460

early-career researchers and visiting scientists

World-class

facilities, renowned technology experts

about 900

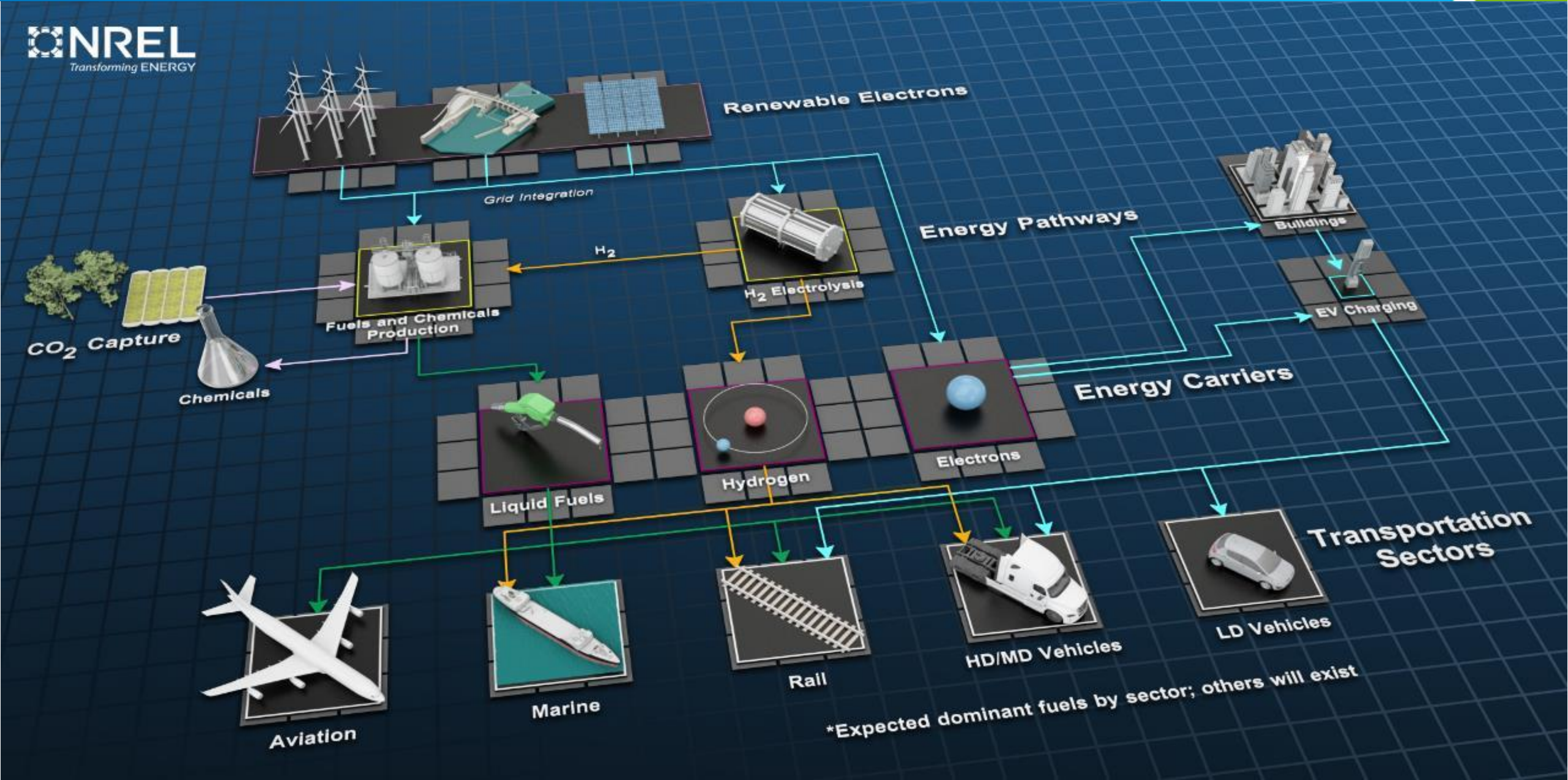
Partnerships

with industry, academia, and government

Campus

operates as a living laboratory

Decarbonizing the Transportation Sector



NREL Center for Integrated Mobility Sciences

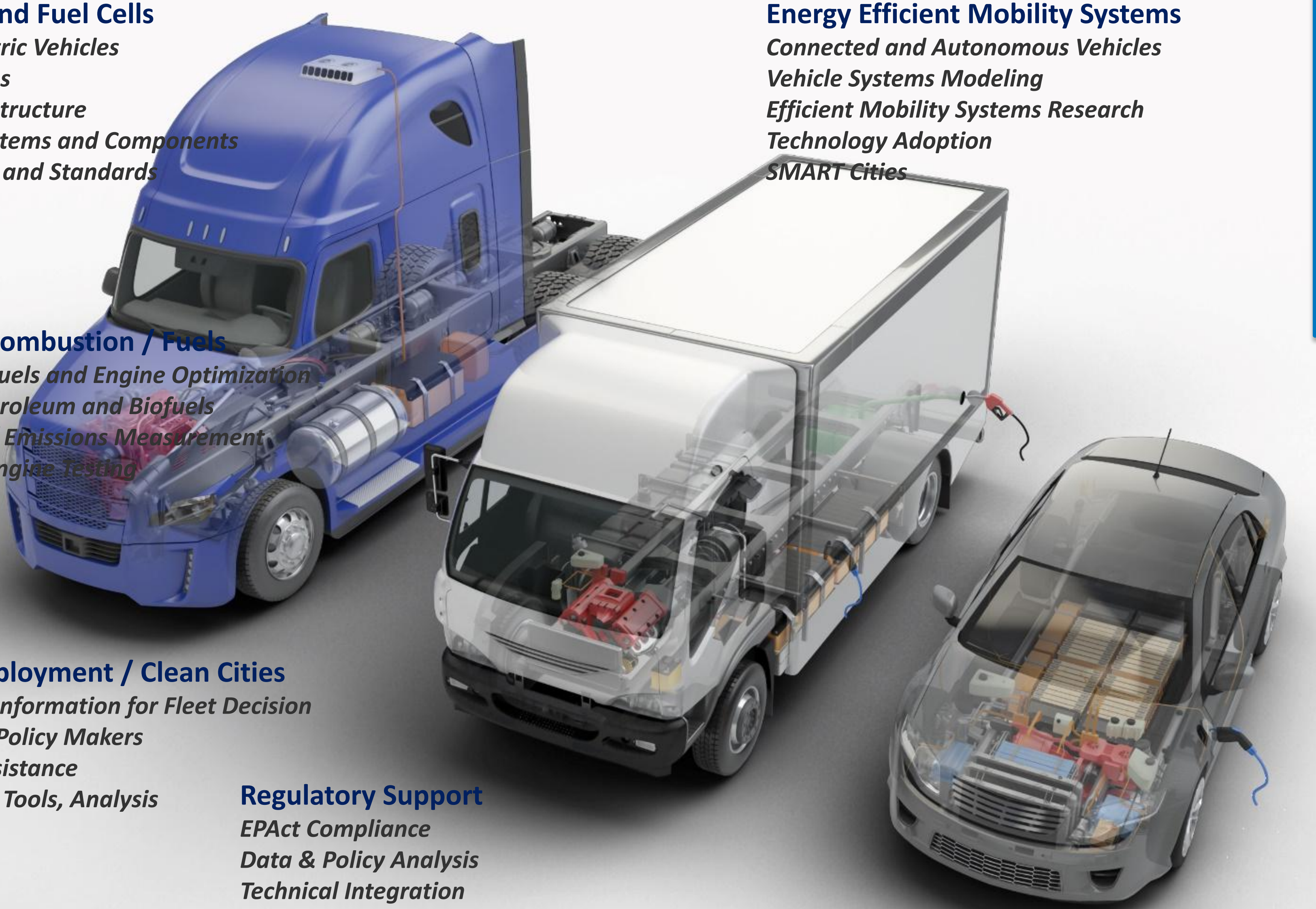
https://www.nrel.gov/transportation/research.html

Hydrogen and Fuel Cells
Fuel Cell Electric Vehicles
Fuel Cell Buses
Fueling Infrastructure
Hydrogen Systems and Components
Safety, Codes and Standards

Energy Efficient Mobility Systems
Connected and Autonomous Vehicles
Vehicle Systems Modeling
Efficient Mobility Systems Research
Technology Adoption
SMART Cities

Commercial Vehicle Technologies
Technology Field Testing & Analysis
Big Data Collection, Storage & Analysis
Vehicle Systems Modeling
Super Truck and 21st Century Truck
Truck Platooning and Automation
Vehicle Thermal Management

EV Grid Integration
Extreme Fast Charging – 1+ MW
Vehicle-to-Grid Integration
Integration with Renewables
Charging Equipment & Controls
Fueling Stations & Equipment



Advanced Combustion / Fuels
CoOptima – Fuels and Engine Optimization
Advanced Petroleum and Biofuels
Combustion / Emissions Measurement
Vehicle and Engine Testing

Mobility Infrastructure & Impacts Analysis
Hydrogen & Energy Storage Analysis
Integrated Transportation & Energy Systems Analysis

Advanced Energy Storage
Thermal Characterization / Management
Life/Abuse Testing and Modeling
Computer Aided Engineering
Electrode Material Development

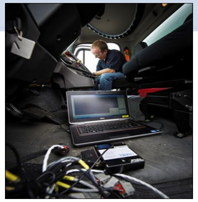
Vehicle Deployment / Clean Cities
Guidance & Information for Fleet Decision Makers and Policy Makers
Technical Assistance
Online Data, Tools, Analysis

Regulatory Support
EPAct Compliance
Data & Policy Analysis
Technical Integration
Fleet Assistance

Advanced Power Electronics and Electric Motors
Thermal Management
Advanced Heat Transfer
Thermal Stress and Reliability

"Adaptable" Fleet Evaluation Process

Step 1 — Vehicle Inventory and Fleet Coordination



Step 2 — In-use Vehicle Data Collection

Fleet DNA

Step 3 — Duty Cycle Analysis

DRIVE

DriveCAT

Step 4 — Assessment of ZEV Technology and Efficient Operations

FASTSim

RouteE

Step 5 — Infrastructure Requirements and Charging Strategies

EVI-Pro

Step 6 — Total Cost of Ownership

T3CO

Step 7 — Detailed Charging Infrastructure Requirements

Step 8 — Results / Reporting

Port EV and Infrastructure Analysis

Objective

Independent engineering analysis of vehicle power demand, infrastructure requirements, and potential grid impacts for the Port of Long Beach and Port Authority of NY/NJ vehicle electrification.

Process:

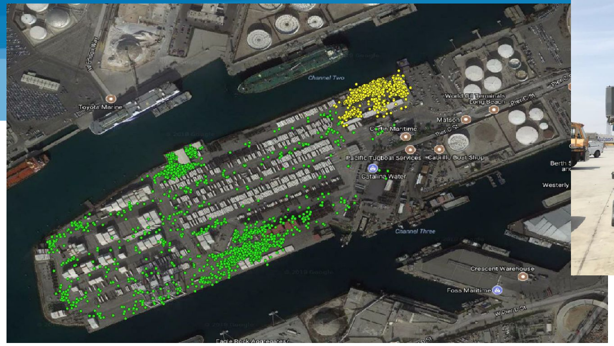
- Vehicle data acquisition
- Geospatial and Energy duty cycle characterization
- Powertrain model to evaluate EV requirements
- Charging requirements – time of day power demands
- Grid impacts and potential charge management strategies

Status and Next Steps:

- Results presented to POLB and PANYNJ and POLB external advisory group including Vehicle Manufacturers, Utility (SCE), and Port Operators
- Refining models and analysis based on feedback with results to be published in peer-reviewed technical report
- PANYNJ follow-on study on EV class 8 drayage trucks

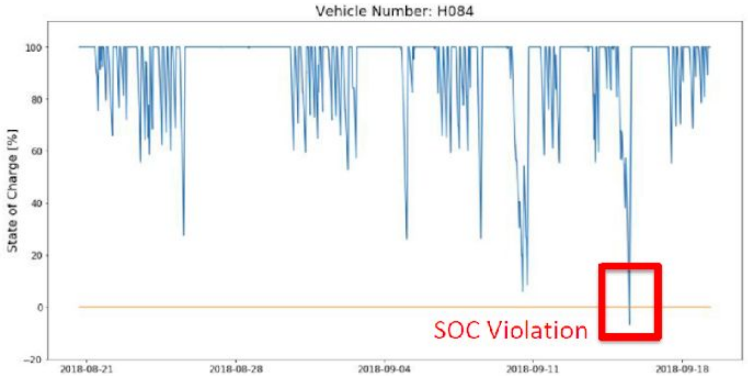
Significance & Impact

- Contributed to development of POLB EV Blueprint to replace *100% of Cargo Handling Equipment by 2030*
- Analysis methodology will be applied to existing projects with: Port Authority of NY/NJ, Dallas-Fort Worth Airport, LAX, National Park Service, and others



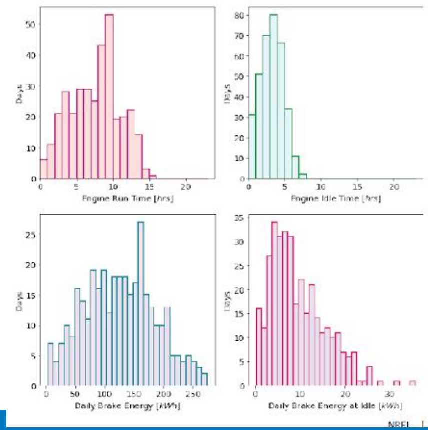
Geospatial terminal equipment dwell locations showing potential charger locations

POLB Yard Tractors

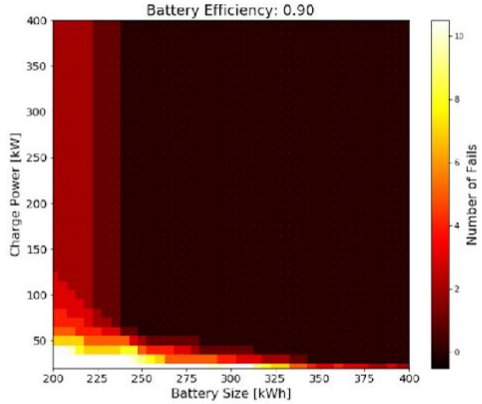


Simulated electric yard tractor SOC – one month of operation

Duty Cycle / Energy Requirements



Vehicle design requirements



Study Objectives

- Gain insights about existing operations.
- Identify opportunities for use of existing technology.
- Identify limitations in existing technology.

Operability

- Identify parameters that must be met for technology adoption with minimal impact to operations.

Technology

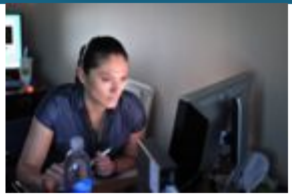
- Data-driven decision making for future adoption.
- Develop higher degree of certainty of cost-savings.
- Discover other associated benefits.

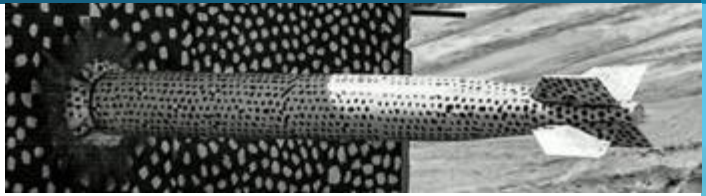
Opportunities

Sandia National Laboratories

Water Power Technologies

Oct. 29, 2021





Presented by

Dominic Forbush (dforbus@sandia.gov) and Jesse Roberts (jdrober@sandia.gov)

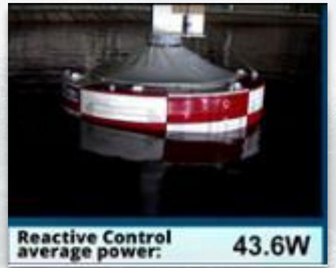
U.S. Department of Energy · NNSA

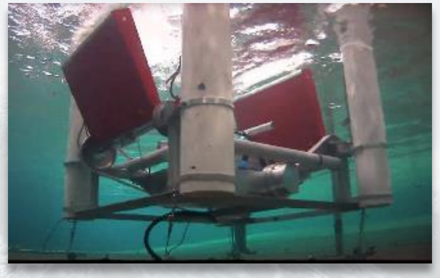
Water Power

Marine and Hydrokinetic technologies harness energy from waves, currents, tides and ocean thermal gradients to generate clean, renewable energy.

Dynamics and Controls

Incorporating reactive control experts from robotics, defense, energy systems, and aerospace.





Experimental Testing, Measurements and Instrumentation

A decade of experience in hydrodynamic and load measurements, and MHK sites and laboratory testing facilities.

Materials and Coatings

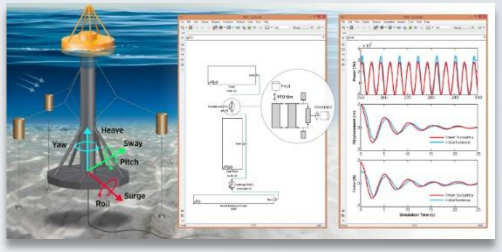
Prevention of corrosion & biofouling, composite performance, composite manufacturing, materials/coatings reliability.

Powering the Blue Economy

Supporting the development, simulation ,and testing of devices for aquaculture, desalination, ocean instrumentation, and with energy storage or for microgrid applications.

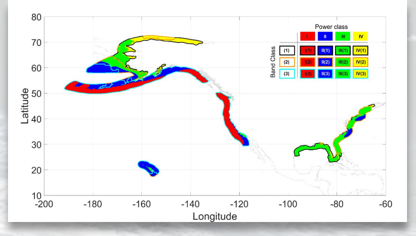
Code Development for Simulation & Analysis

Develop and maintain open source code for marine renewable energy applications, including resource assessment, environmental effects analysis, device performance, hydrodynamic response, extreme conditions, and others.



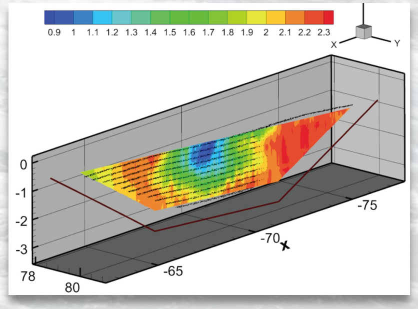
Environmental Analysis & Resource Characterization

Developed codes and provided regulatory and IEC standards input for MHK resource characterization and device interactions.



Hydropower

Water resource engineering, river flow and storage modeling, hydropower plant measurements, plant cyber security and resilience, grid and storage design optimization.



WEC Dynamics and Controls

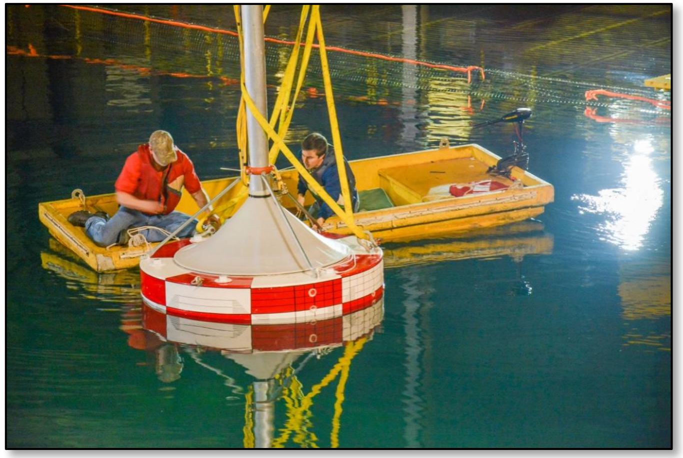
- Top ranked projects in (1st and 3rd) in DOE Water Power portfolio
- High-impact experimental campaigns onsite at Sandia and offsite: focus on dissemination of findings and outreach
- 50+ publications over the last 5 years

Technology Performance Characterization

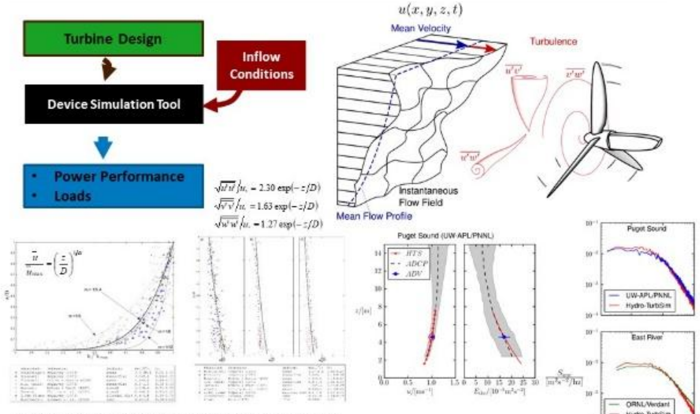
- Assessment methodologies and standards development for current turbines and other devices

Wave-SPARC

- Systematic process and analysis for reaching commercialization with novel technologies
- Expanding to support "Blue Economy" applications
- Equal partnership between NREL and SNL

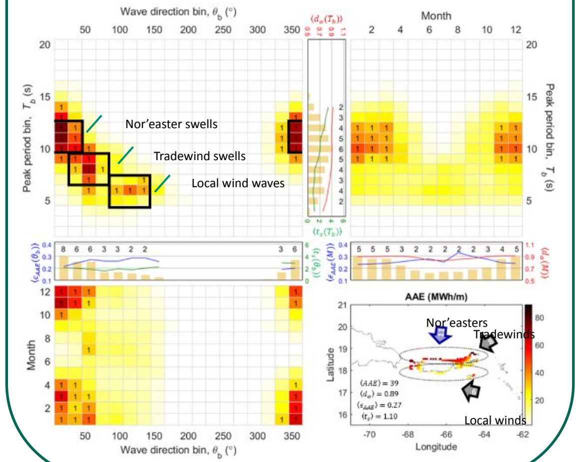


River & tidal currents and turbulence



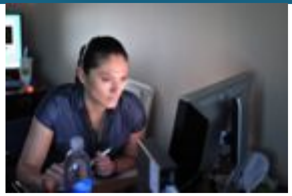
Vertical profiles of mean velocity, normal Reynolds stresses reported for depth-limited turbulent boundary layer flows. Neary, V. S., B. Gunawan, and D.C. Sale. (2013). Turbulent inflow characteristics for hydrokinetic energy conversion in rivers. *Renewable and Sustainable Energy Reviews*, 26, 437-445.

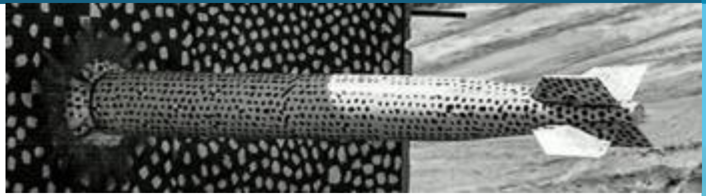
Wave resource characterization



Sandia National Laboratories

Fire Risk for Emerging Technologies Capabilities





U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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SAND2020-7488 PE

Software modeling

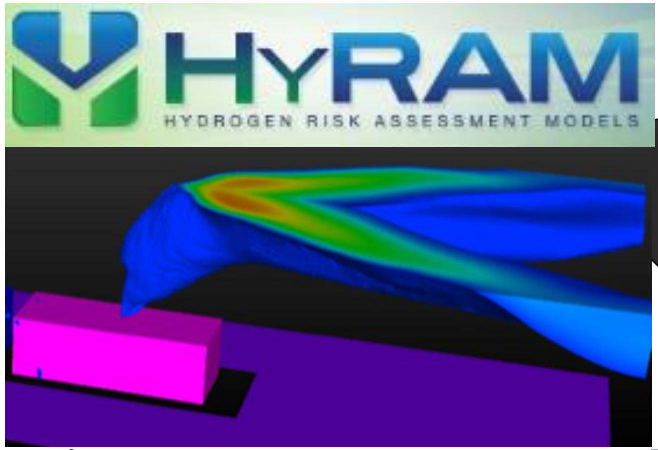
- Quantitative risk assessment (QRA) methodology with frequency & probability data for hydrogen leaks
- Free and open source, fast-running models of hydrogen gas and flame behaviors.

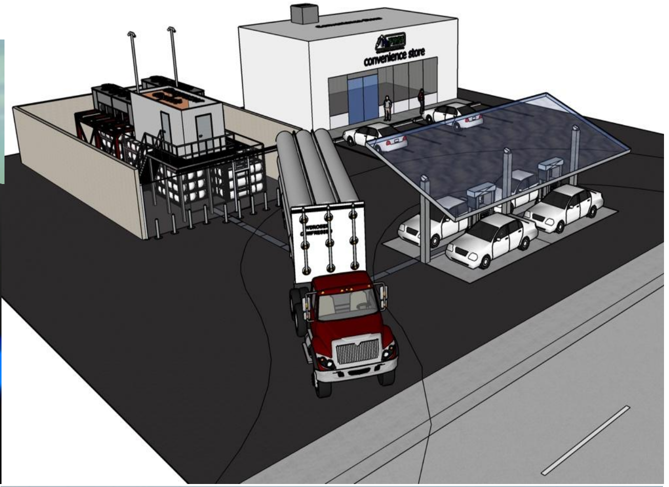
Infrastructure and transportation

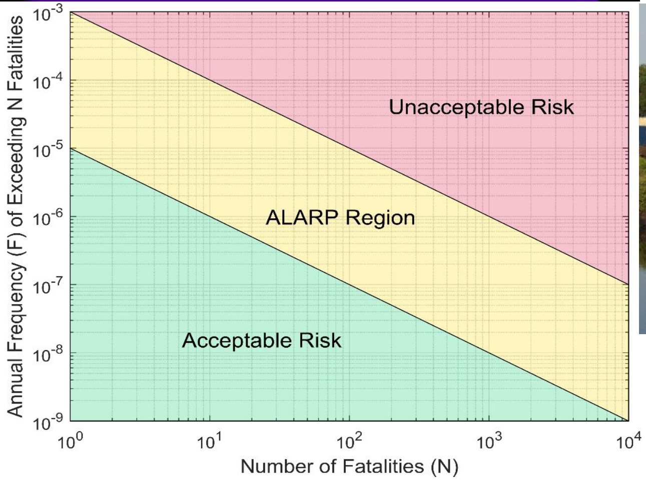
- Develop reference refueling station designs to stakeholders
- Detailed designs, parts lists, cost estimates, and physical footprint for reference station designs

Codes and standards participation

- Committee membership and active participation in NFPA 2 and 55 codes
- Also active in IEC and ICC



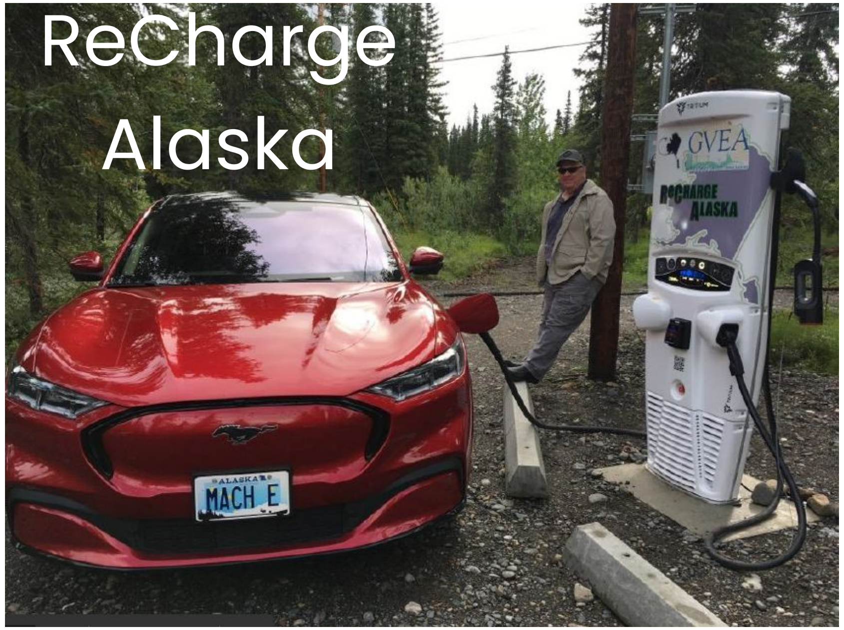




Other Energy Transition Opportunities in Rural Alaska

University of Alaska and Electric Vehicles

Advancing EV use in Alaska



But will they work in rural Alaska?

Do electric vehicles work at 40 below? Alaska owners say 'yes'

By **Dan Bross, KUAC - Fairbanks** - June 11, 2020

Electric Vehicles in the Arctic (EVITA)

Michelle Wilber mmwilber@alaska.edu
Jennifer Schmidt jischmidt@alaska.edu

NSF #2127171

Goals

1. Identify perceived barriers to adoption, mechanisms for facilitating adoption, perceived usefulness, and potential uses of EVs.

2. Examine potential trade-offs between conventional and electric for rural vehicle users across specific use cases such as subsistence activities.

Participating communities:
Galena
Kotzebue
Bethel


Energy Transition Opportunities for the Fishing Fleet
Insights from ALFA
Hybrid Propulsion System

Q1: Which do you see as the main benefits of a hybrid propulsion system?

(Please select your top three)

- Using less fuel
- Better for environment
- Redundant propulsion systems
- Helping lead sustainability efforts
- Less noisy
- Reduced engine hours
- None / Other

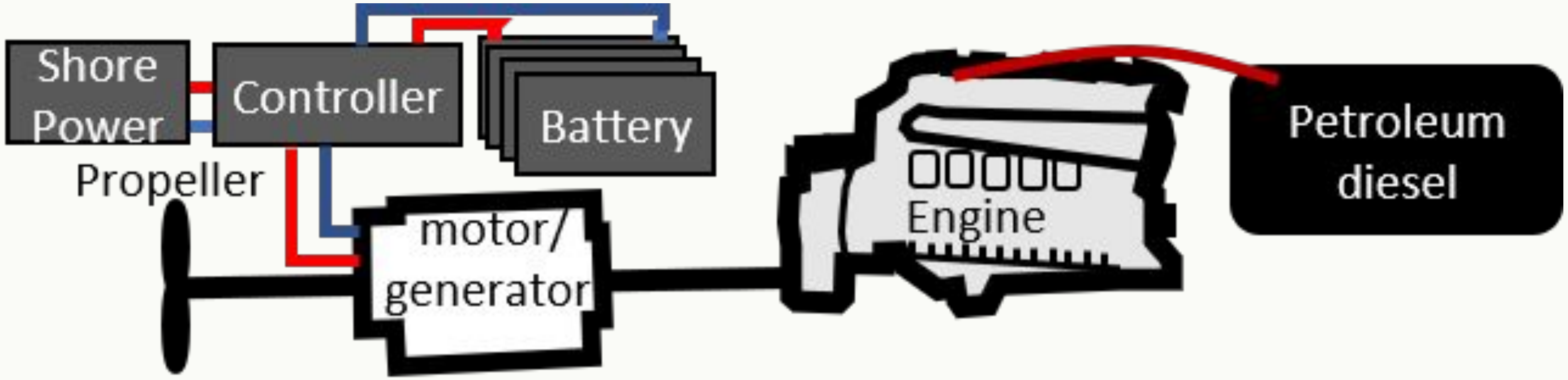
Q2: What do you see as prohibiting your use of this technology? Roadblocks.

(Please select your top three)

- High initial startup cost
- Unfamiliar with maintenance practices
- Unproven reliability
- Risk of battery fire
- Extra weight on boat
- Takes up extra space on boat
- Other

Q3: Are you *interested* in using a hybrid propulsion system on your boat?

- Yes
- No



Discussion

What information do you need to make a decision about investing in a hybrid propulsion system on your boat?

Photo courtesy of Transfluid

Thank you

Questions?

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Alaska Rural Energy Partnership

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