Alaska Wind Diesel Application Center

Katherine Keith

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ACEP RESEARCH MISSION: To meet state and local need for applied energy research by working towards developing, refining, demonstrating, and ultimately helping commercialize marketable technologies that provide practical solutions to real-world problems.

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Role of ACEP

- Verify performance and reliability of equipment
- Assess technical and economic feasibility
- Test emissions
- Integration with existing power systems
- Resource assessment
- Procurement experiments
- Work with manufacturers to improve products for use in Alaska

Role of ACEP

Serve as an impartial agent on behalf of Alaskan communities and agencies to ensure we are investing wisely in energy projects that make sense and that contribute to the long-term benefit of our residents

Help leverage external resources to address Alaska's energy challenges (funding, businesses, national laboratories, other universities, etc)

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The purpose of the

Alaska Wind-Diesel Applications Center (WiDAC)

is to support the broader deployment of cost-effective wind-diesel technologies to reduce and/or stabilize the cost of energy In rural communities.

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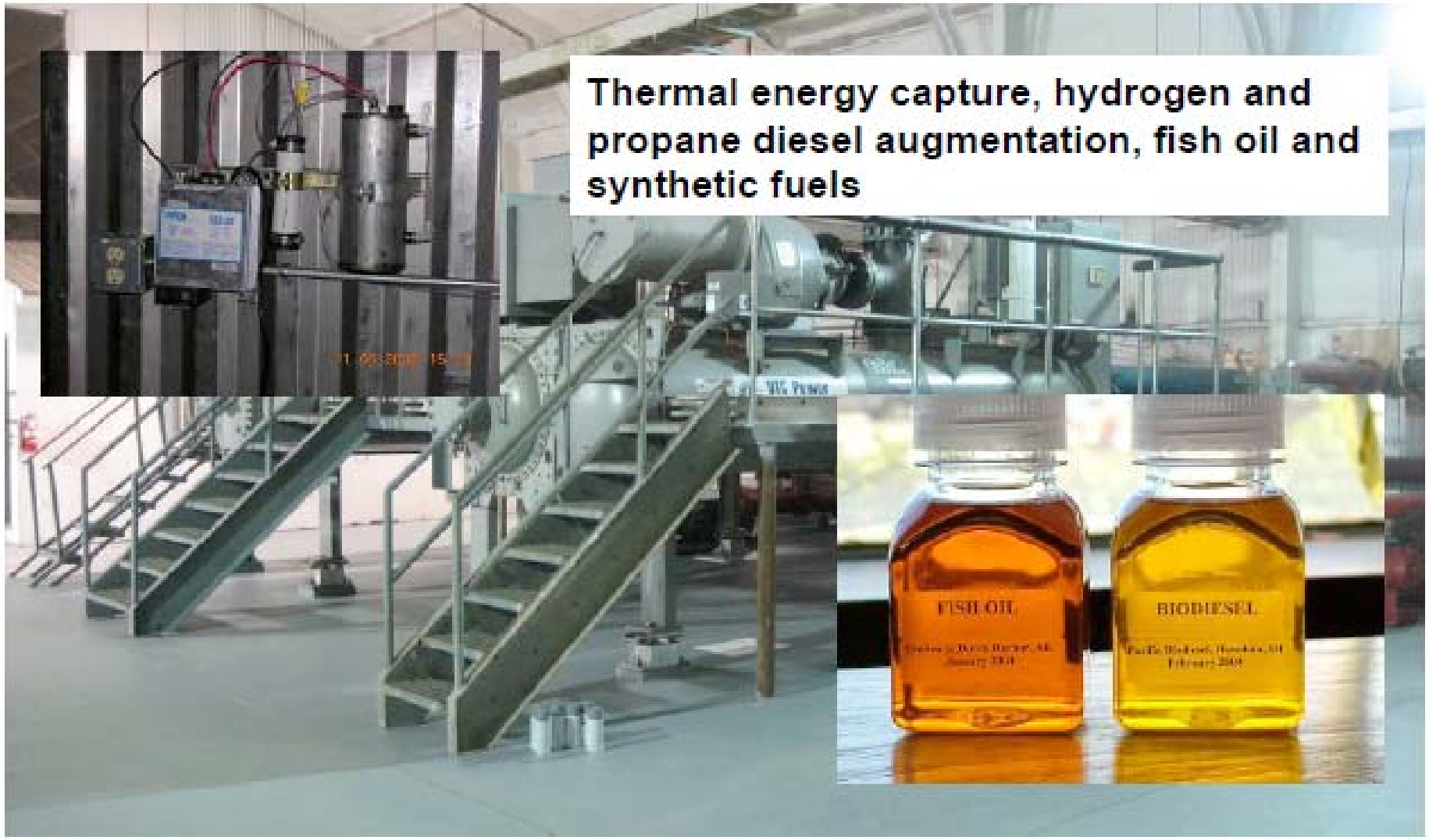
Diesel Engine Efficiency & Fuels Testing



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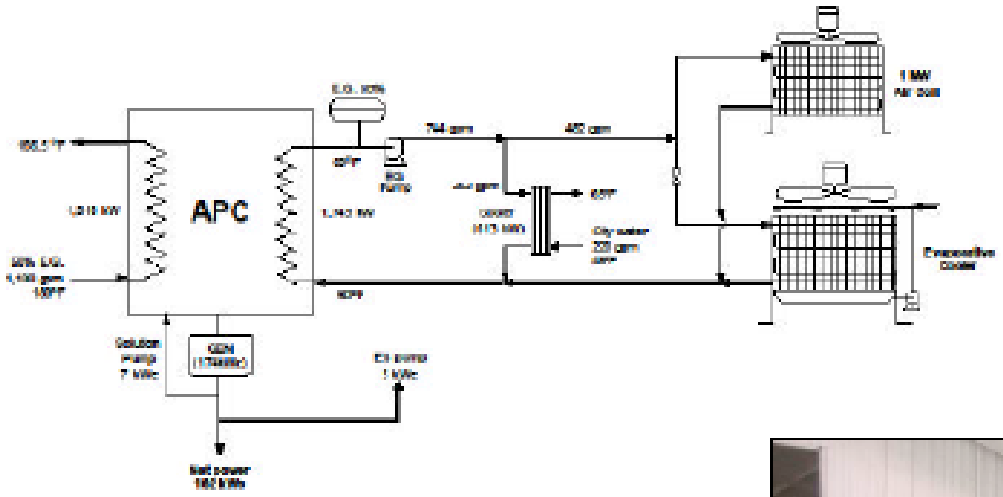
Waste Heat Recovery Systems



Organic Rankine Cycle

Ammonia Cycle Power Plant

Chilling intake air

Stack Heat Recovery

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Alaska Wind-Diesel Test Center

Addressing issues to improve penetration of wind-diesel systems through improvements in control, energy storage, and low-load diesel.

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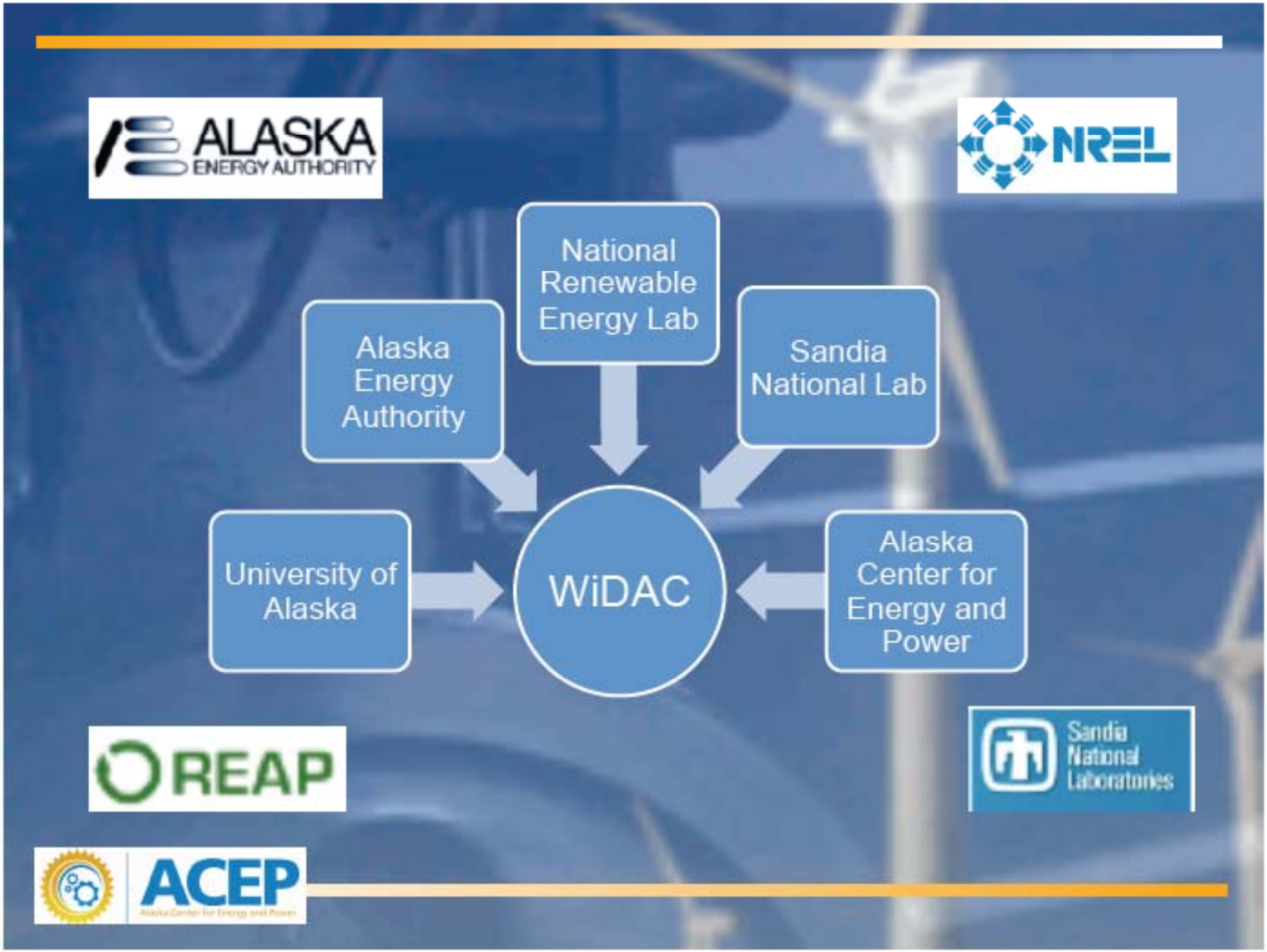
ALASKA ENERGY AUTHORITY
NREL
National Renewable Energy Lab
Alaska Energy Authority
Sandia National Lab
University of Alaska
WiDAC
Alaska Center for Energy and Power
REAP
Sandia National Laboratories
ACEP


Utilities
Developers
WiDAC
Industry
Research
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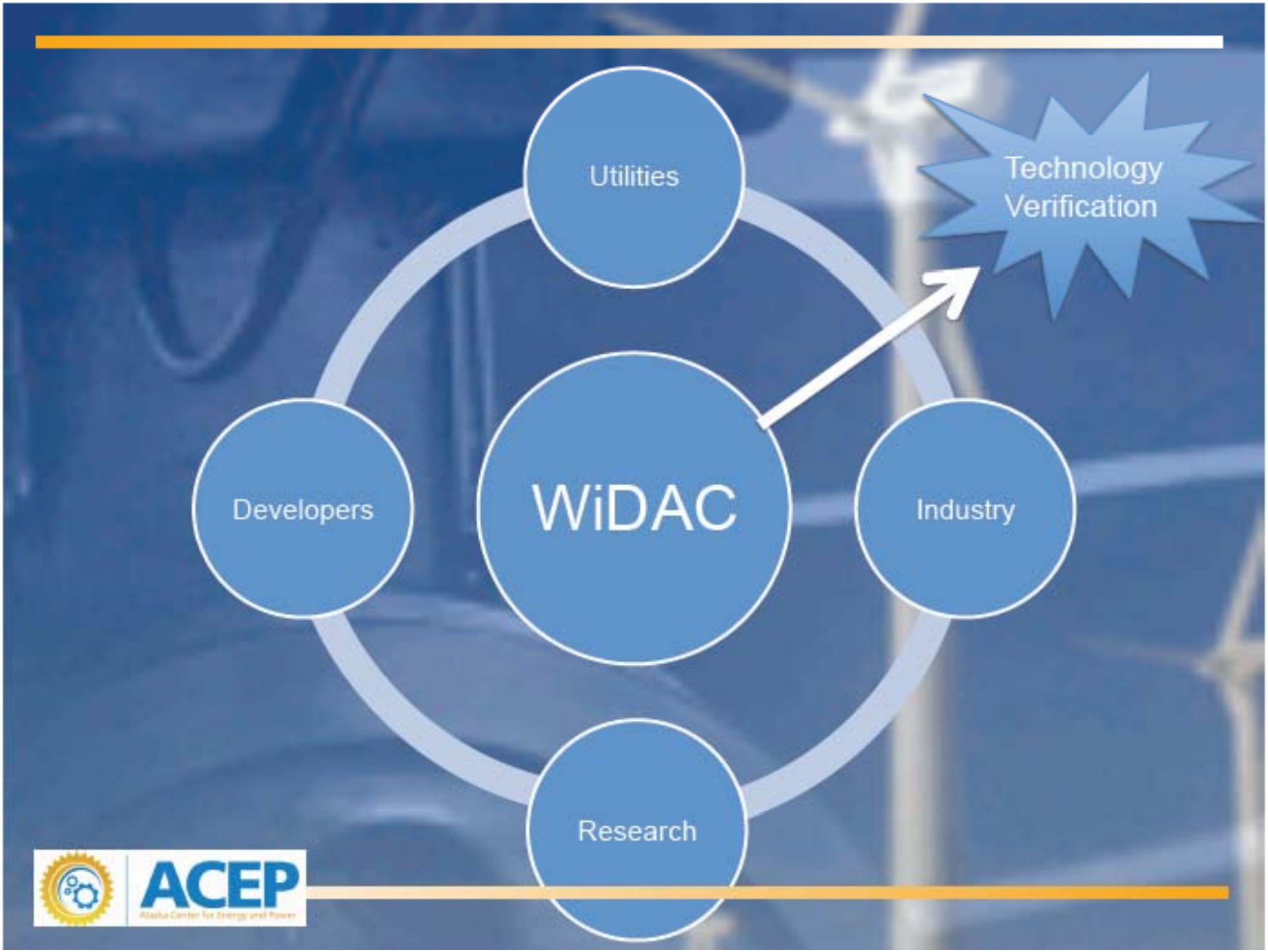
Utilities
Technology
Verification
Developers
WiDAC
Industry
Research
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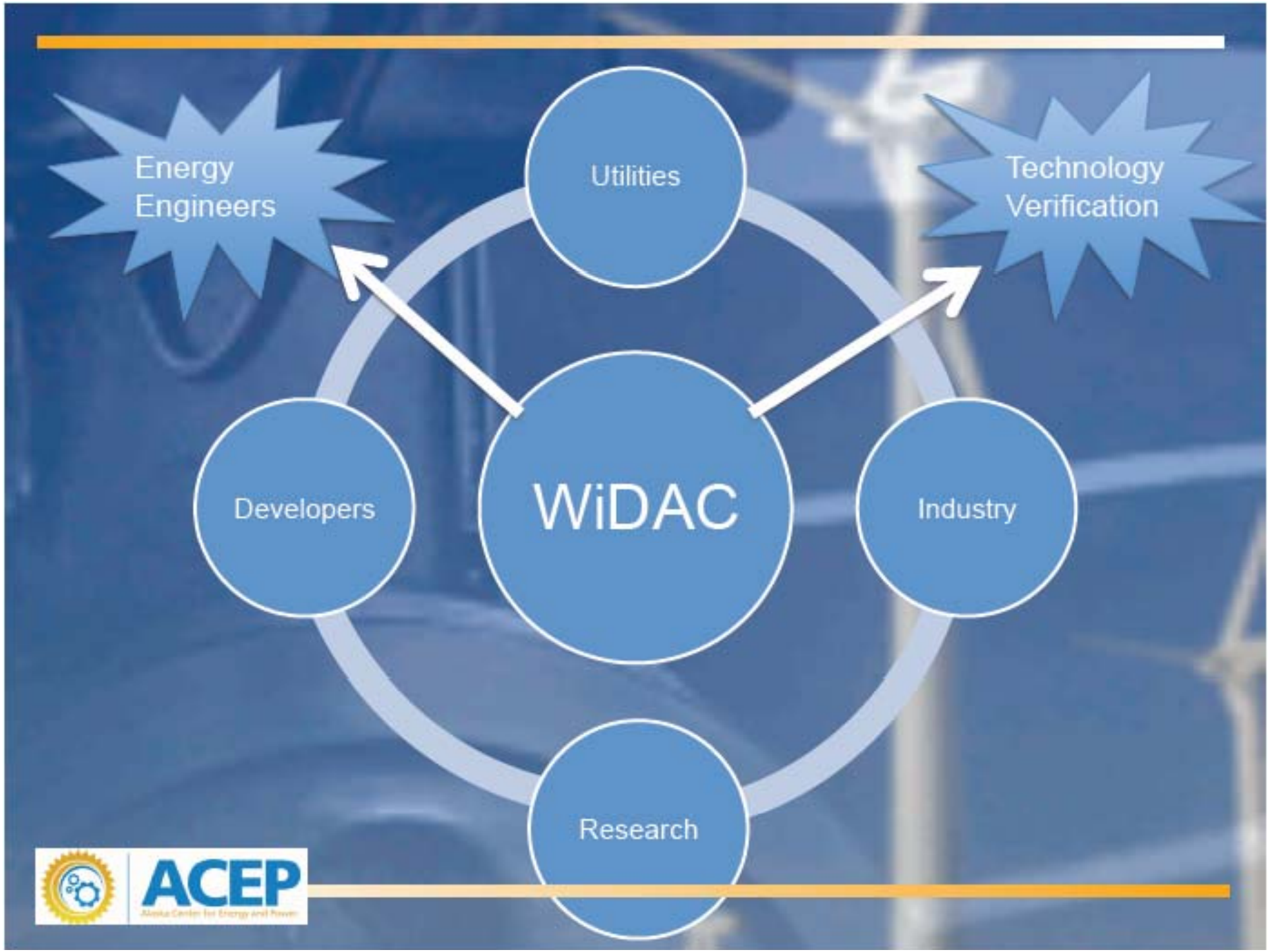
Energy Engineers
Utilities
Technology Verification
Developers
WiDAC
Industry
Research
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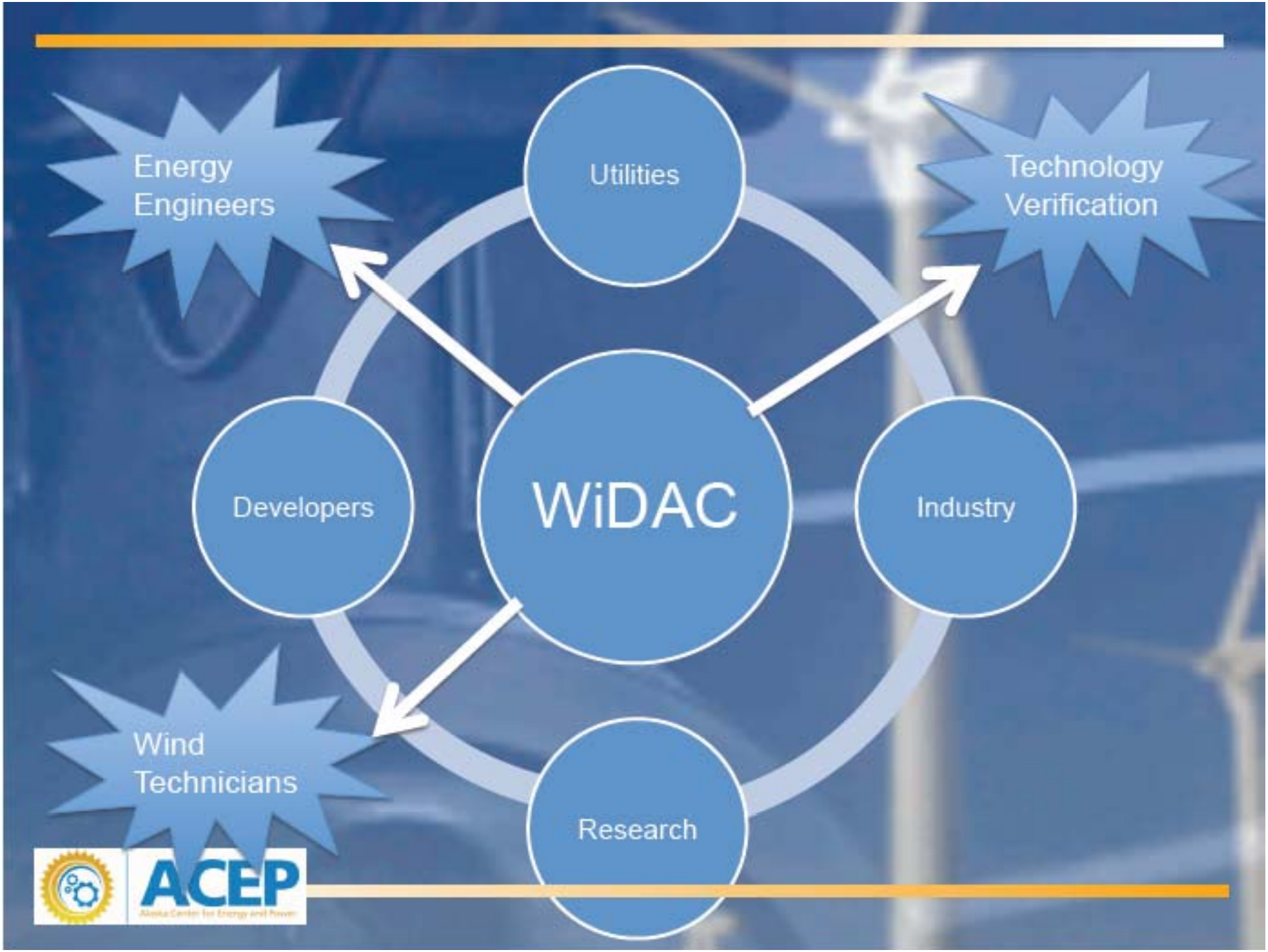
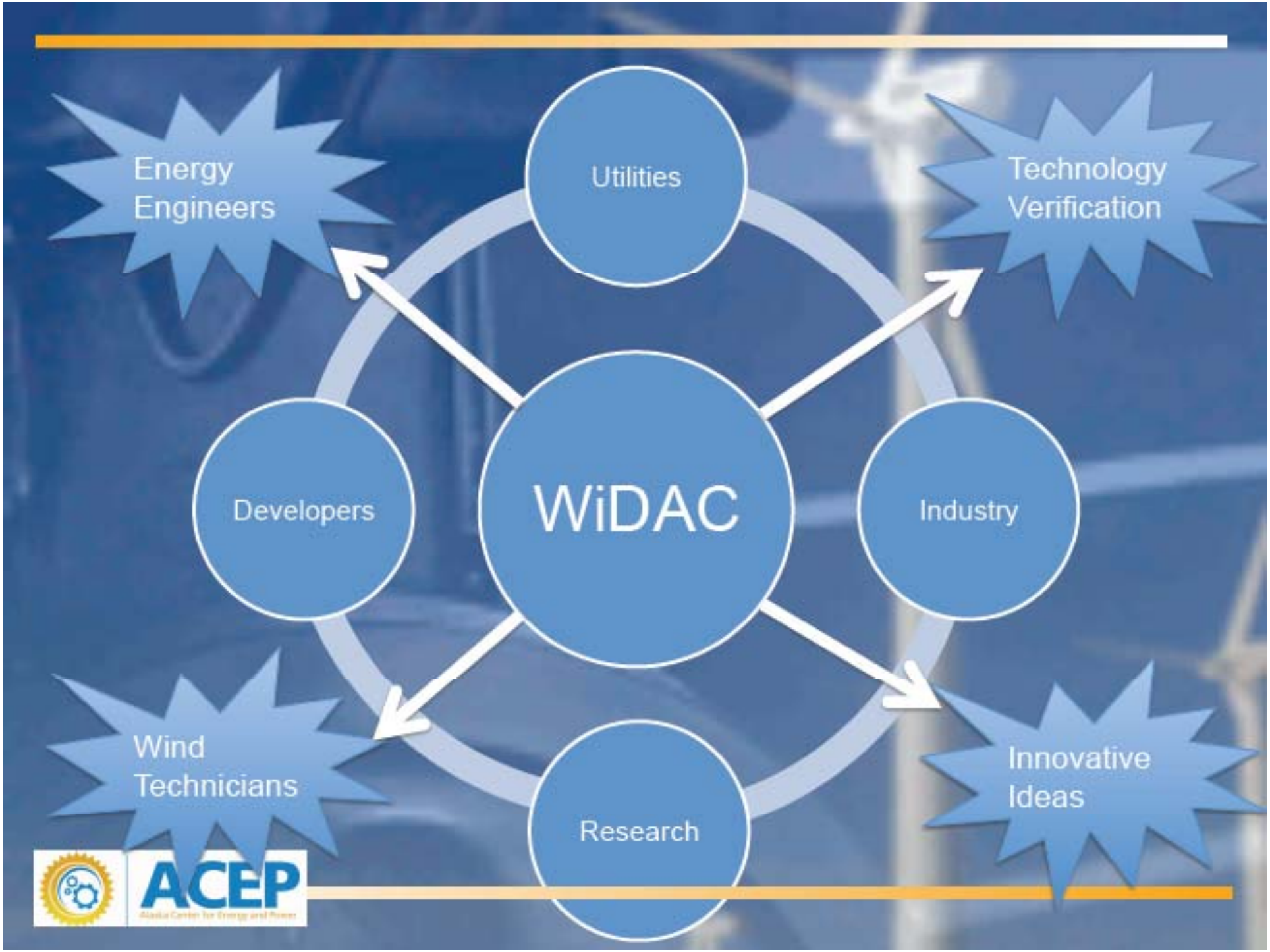

Energy Engineers
Utilities
Technology Verification
Developers
WiDAC
Industry
Wind Technicians
Research
ACEP


Energy Engineers
Utilities
Technology Verification
Developers
WiDAC
Industry
Wind Technicians
Research
Innovative Ideas
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Focus Areas

Research and Development	• Independent analysis & testing • Applied research
Technical Support	• Feasibility studies and • Build human capacity
Workforce Development and Education	• Wind for schools • Technician levels

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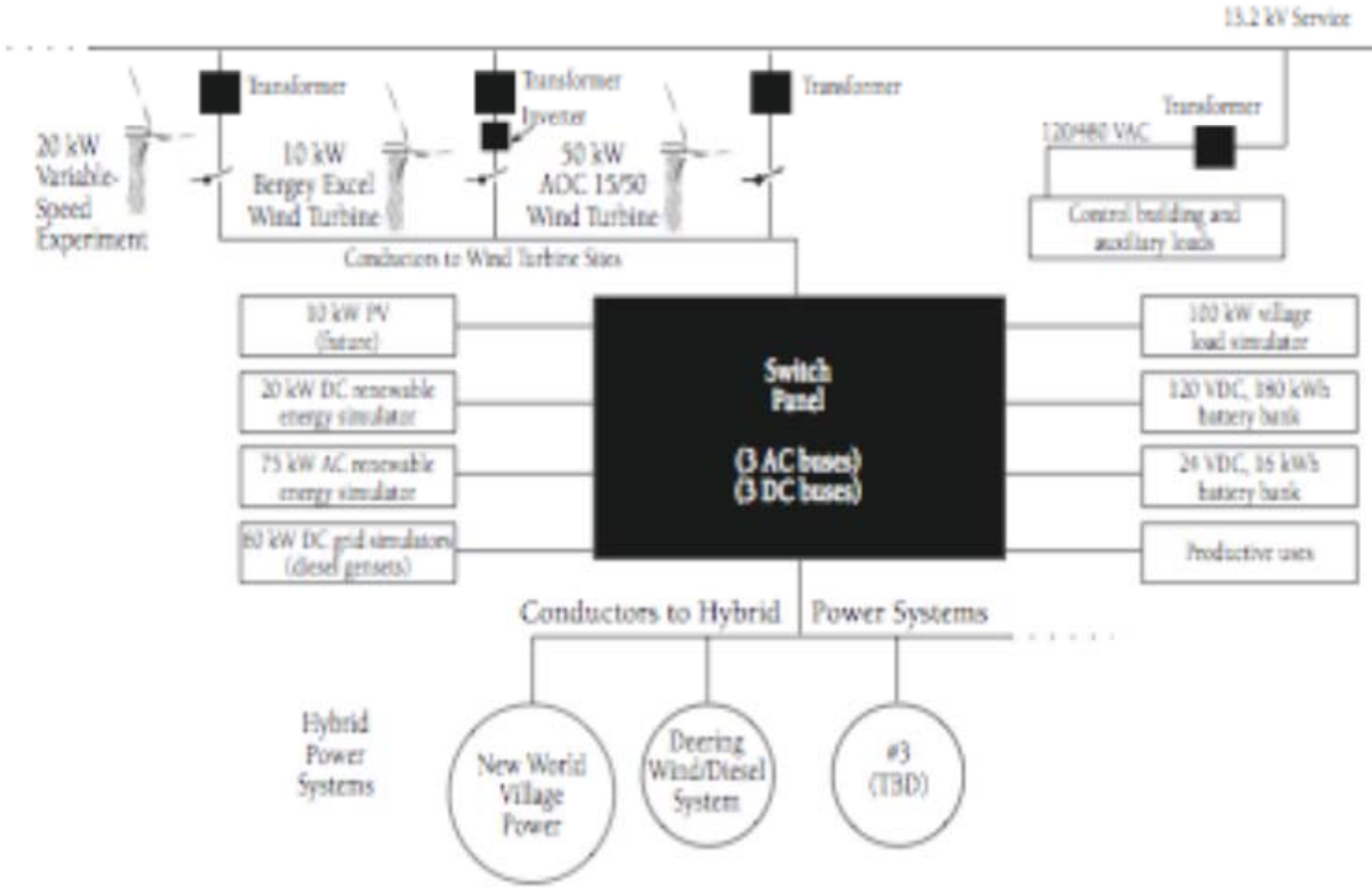
HYBRID POWER TEST BED

NREL



Research and Development

Equipment List	Size
DC Renewable Energy Simulator (solid state device)	20kW
AC Renewable Energy Simulator (induction generator)	75kW
Diesel Gen-Set Grid Simulator	60kW
Village Load Simulator (computer controlled)	2x100kW
DC Battery Bank	
AC Buses	2
DC Buses	2
Secondary Load	Boiler
Diesel Gen-Set	155kW and 75 kW
NW100 Nacelles	2

Research and Development

- Diesel Hybrid Test Bed
  - Simulate village loads to evaluate system and component control logic prior to installation
  - Characterize component performance for more accurate models
- Extend data collection on existing communities and future installations
  - Field performance data acquisition
  - Long Term O&M, Capital Costs, Installation Costs

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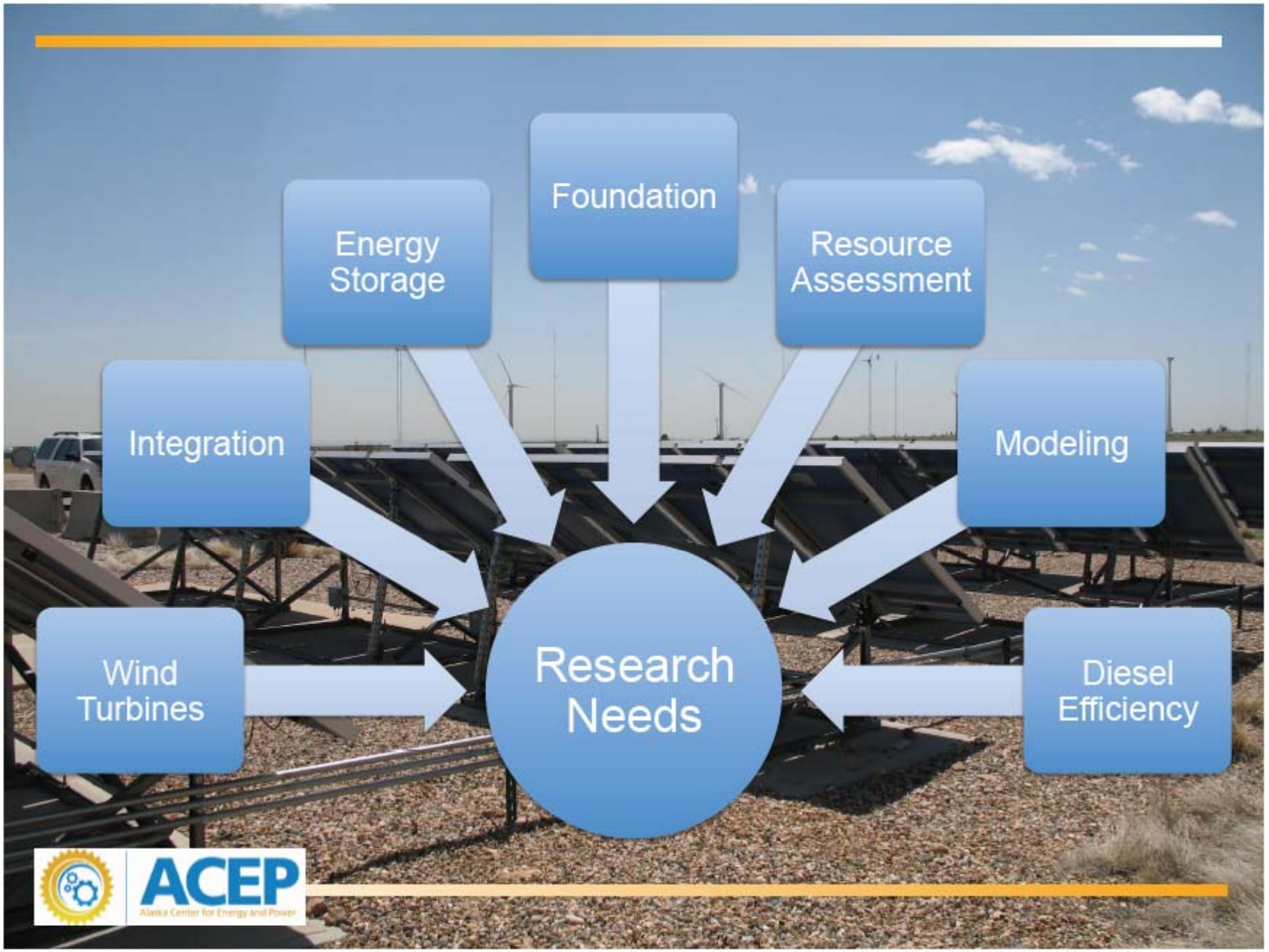
TITAN
SIMPLX


Hydrogen
Storage Tanks


Foundation
Energy Storage
Resource Assessment
Integration
Modeling
Wind Turbines
Research Needs
Diesel Efficiency
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Cold Weather Turbine Certification

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Operations and Maintenance

- Determine cost structure for O&M based on:
  - Region (Function of foundation design and shipping)
  - Penetration level (Low/Medium/High)
  - Turbine type/size (Small/Medium/Large)
- Predict cost of long term equipment failures
- Evaluate workforce needs
- Collect performance data from installed systems and from turbine manufactures to develop a standardized method of calculating O&M.

Technical Support

- Identify needs to ensure project success:
  - Administrative
  - Grant Writing
  - Ownership negotiation
  - Permitting assistance
  - Funding
  - Training
  - MOUs
  - Technical expertise

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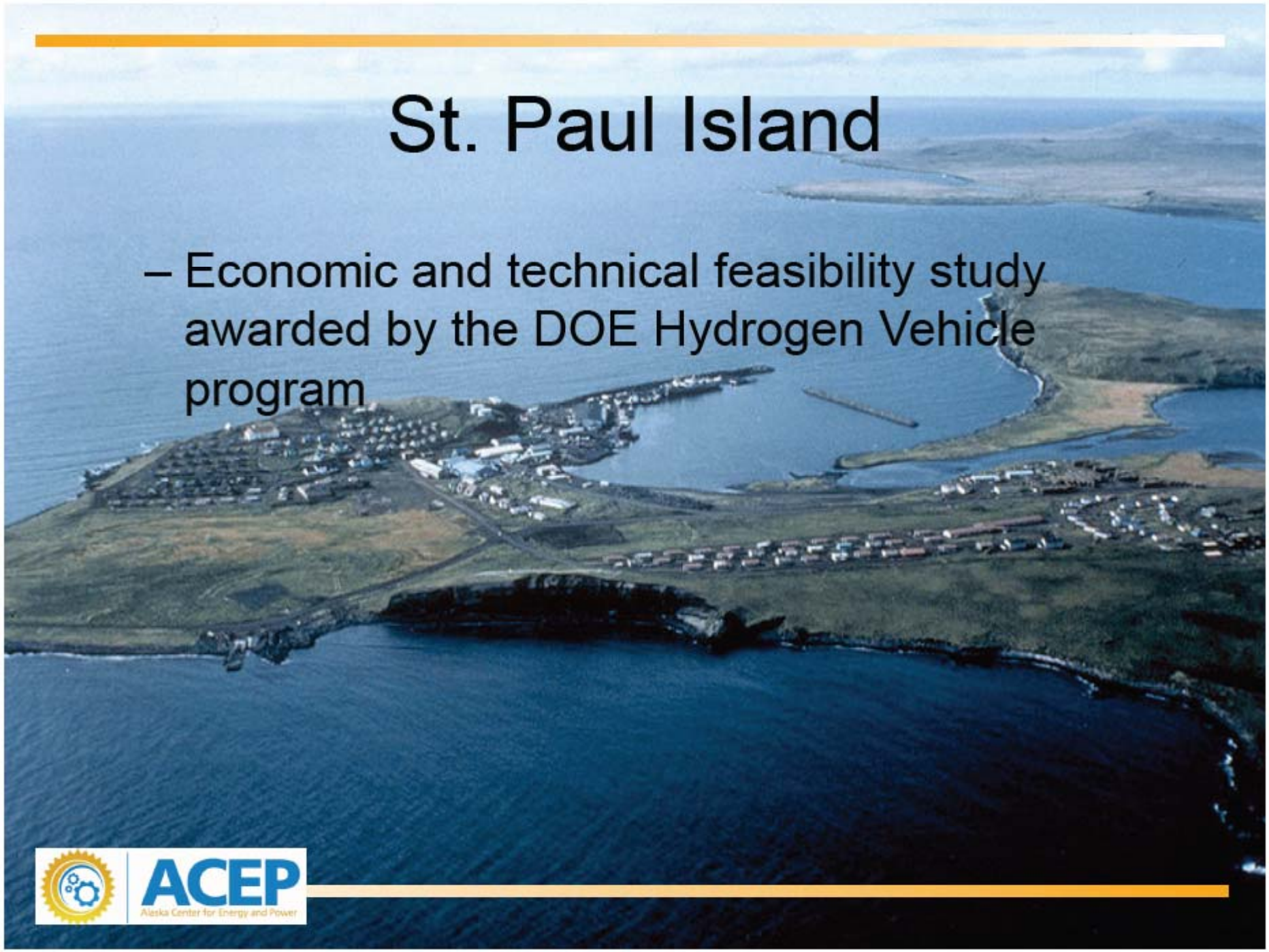
Kodiak Electric Association- Pillar Mountain

- 95% Renewables by the year 2025
- Currently getting power from diesels and hydropower
- Phase One: Three GE 1.5 MW turbines
- Phase Two: Total of 6 GEs with pumped hydro storage at Terror Lake Hydro-electic
- Goal is to develop a model which could benefit other rural communities using PSS/E

St. Paul Island

– Economic and technical feasibility study awarded by the DOE Hydrogen Vehicle program



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Workforce Development

- Address the lack of trained personnel where necessary
- Wind for Schools –Sherrod Elementary
- Mat-Su Campus Renewable Energy Occupational Endorsement

Alaska Wind Diesel Summit

June 22nd - 24th, BP Energy Center
Anchorage Alaska.

The Alaska Center for Energy and Power (ACEP), together with its partners the Alaska Energy Authority, National Renewable Energy Laboratory, and Sandia National Lab proposes to develop a center of excellence in wind-diesel technology that:

- analyses technology options,
- tests state of the art hardware and control software,
- educates engineers, trains operators,
- and provides technical assistance to wind–diesel stakeholders both within and outside the State of Alaska.

The newly formed Wind-Diesel Applications Center (WiDAC) is in its infancy. It is now time to engage wind–diesel pioneers and visionaries to use their knowledge and experience to assist in formulating WiDAC's role in the future of wind-diesel technology. We have organized the invitation only WiDAC Summit to bring selected individuals together with this purpose.

For more information visit:

www.uaf.edu/acep

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Wind Turbines

- Develop Alaska specific verification testing for wind turbines and control strategies
- Expand development of package systems to reduce installation costs and increase parts conformity
- Enhance ice prevention techniques
- Develop lower cost turbine foundations and installation processes
- Develop crane free erection techniques
- Increase availability of mid-size turbines
- Off shore wind

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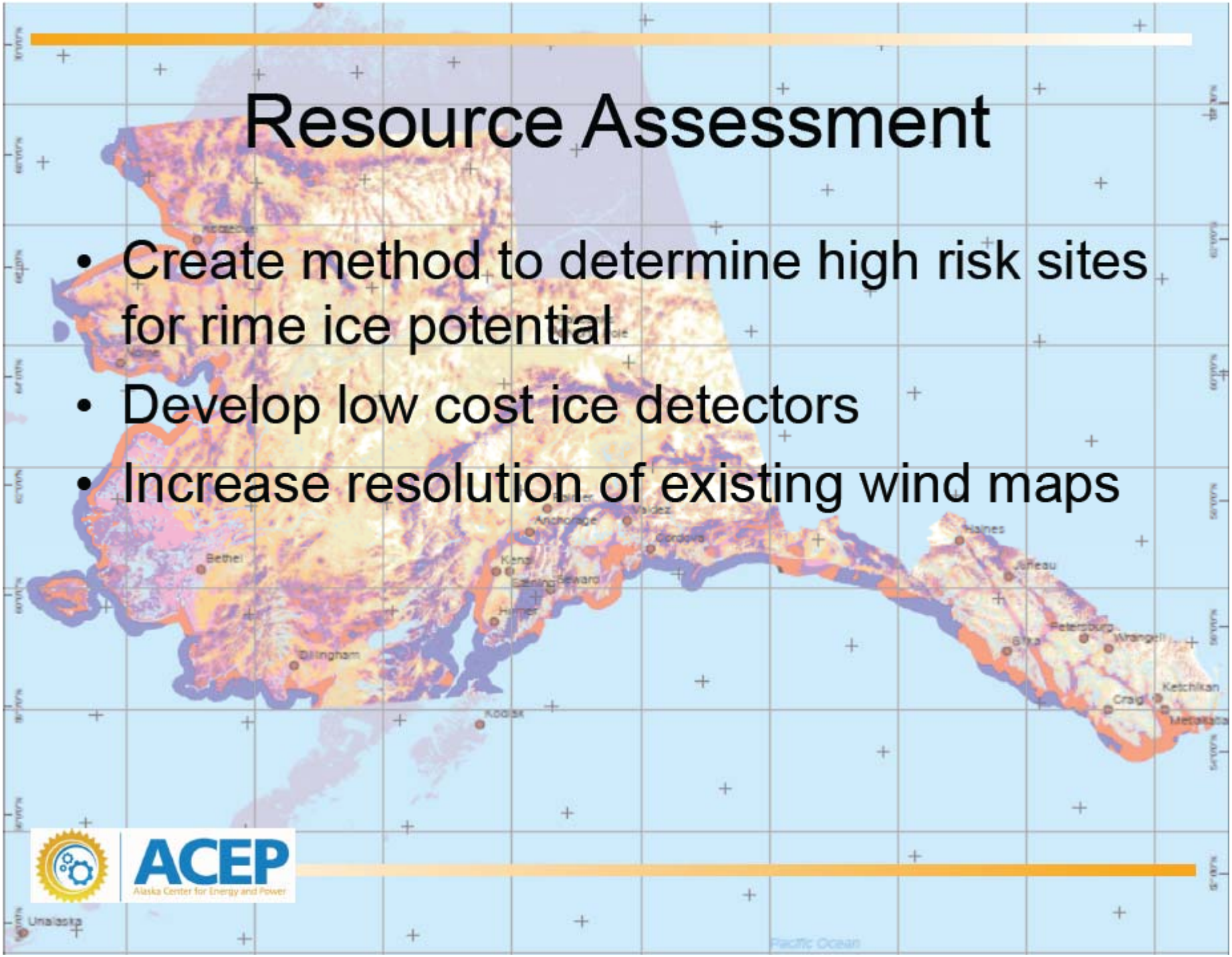
Resource Assessment

- Create method to determine high risk sites for rime ice potential
- Develop low cost ice detectors
- Increase resolution of existing wind maps



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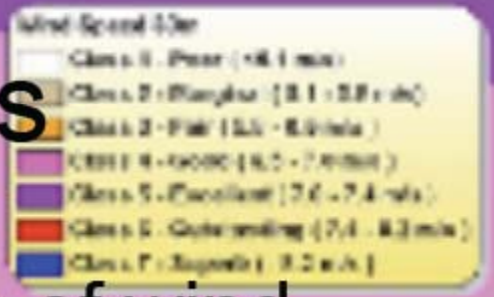
Modeling/Analysis



- Increase collection and analysis of wind-diesel power system performance
- Improve modeling of high penetration systems to understand impacts on rotor angle, frequency, and voltage stability
- Create a method of standardization for modeling

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Modeling

- HOMER (NREL)
- HYBRID2 (Umass,Amherst-RERL and NREL)
- RETScreen
- INSEL (developed at Oldenburg University, Germany)
- SIMENERGY (Creative Analytics-economics)
- PROLOAD
- WINDSYS
- Somes, Vindec, Wdilog, Ralmod, Tkkmod
- PSS/E-Power Simulation for Engineering-(Seimens)
- PSLF-Positive Sequence Load Flow software (GE Energy)

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Controls

- Plug and play controller logic.
- Development and proof testing of dispatch strategies for medium and high penetration systems.
- Smart Grid control and dispatching
- Investigation and testing of decentralized load controllers for dispatchable loads.
- Development or implementation of full system health monitoring.
- Development of standards or guidelines for wind-diesel systems.

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Energy Storage

- Development of lower cost energy storage.
- Procure data and equipment from existing manufacturers.
- Expand understanding of thermal storage solutions such as ceramic heaters.
- Investigate Hydrogen, Compressed Air, Flow Batteries (Zinc Bromide/VRB), NaS, and Flywheels.
- Verify manufacturer's claims

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Diesel Efficiency

- Organic Rankine Cycle (United Technologies/ Electro-Therm)
- Ammonia Power Cycle (Energy Concepts)
- Stack Heat Recovery (CAIN Industries)
- Wet Manifold Heat Recovery (aftermarket device on CAT 3456s-increase heat recovery by 10%
- Advanced controls
- Chilled air intake

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