Alaska House of Representatives
Special Committee on Energy

February 13th, 2013

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Alaska Center for Energy and Power

Presentation Outline

- Introduction to ACEP
- Emerging Opportunities for the State of Alaska
- Example from Iceland
- What can we do now?

Alaska Center for Energy and Power

- Organized under the Institute of Northern Engineering as 'Gateway' to Energy Research for the Univ. of Alaska
- 30+ affiliated faculty and post-docs
- 16 fulltime staff (Fairbanks and Anchorage)
- ~50+ students
- ~$17M in currently funded projects

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Role of ACEP and the University of Alaska

- Technology testing and optimization
- Energy analysis
- Prepare students to work in energy-related disciplines
- Develop IP with Alaska applications

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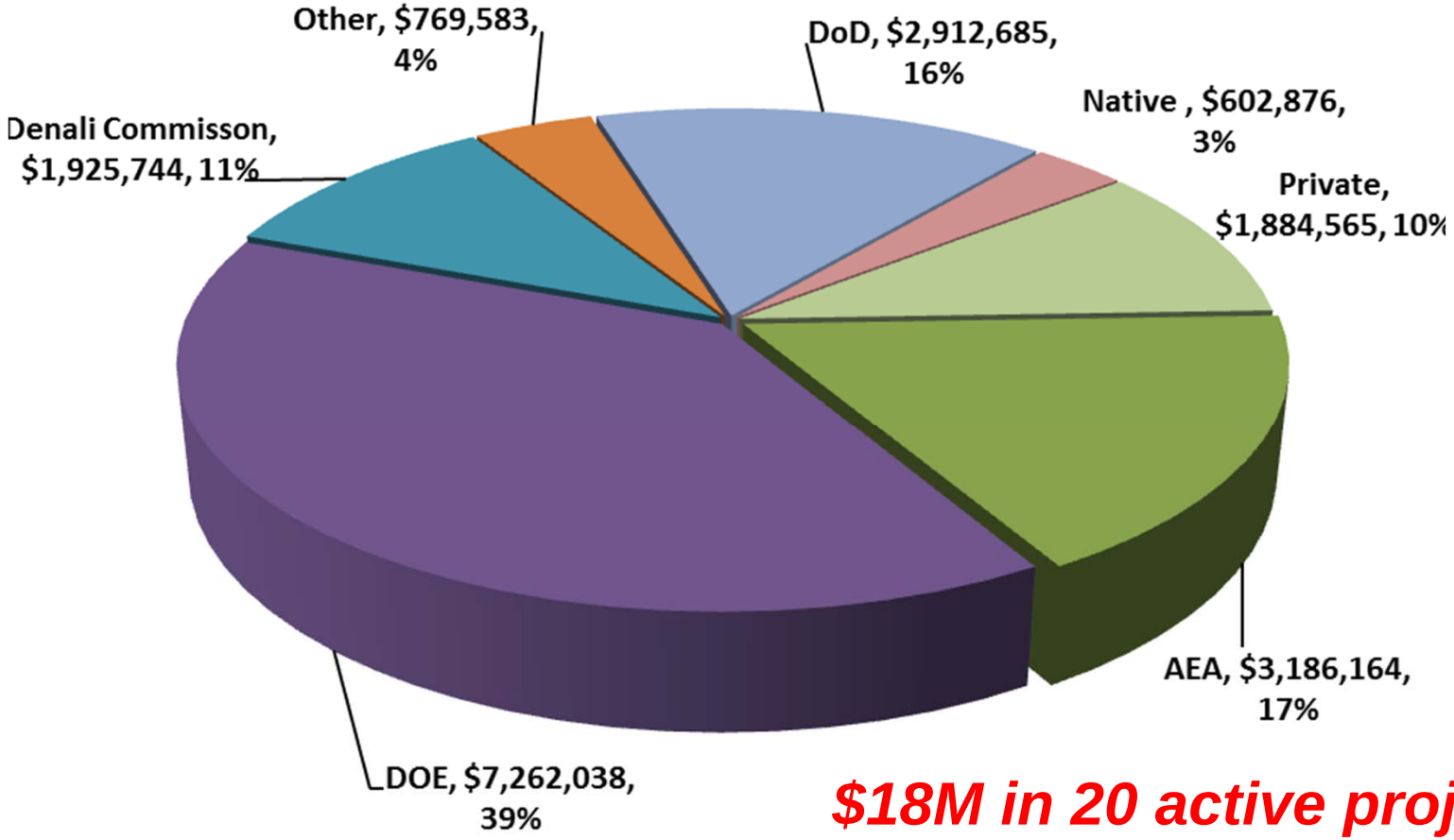
ACEP Funding Distribution by Source



$18M in 20 active projects

$750,000 in program funding
(UAF Operating Budget)

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ACEP Focus Areas

Community Energy Solutions

Powering the Economy

The EnergyField of the Future

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VISION: *Alaska leading the way in innovative production, distribution, and management of energy*

- High energy costs
- Fragmented electric grid
- Harsh climate
- End of supply lines
- Stranded resources
- Dispersed population

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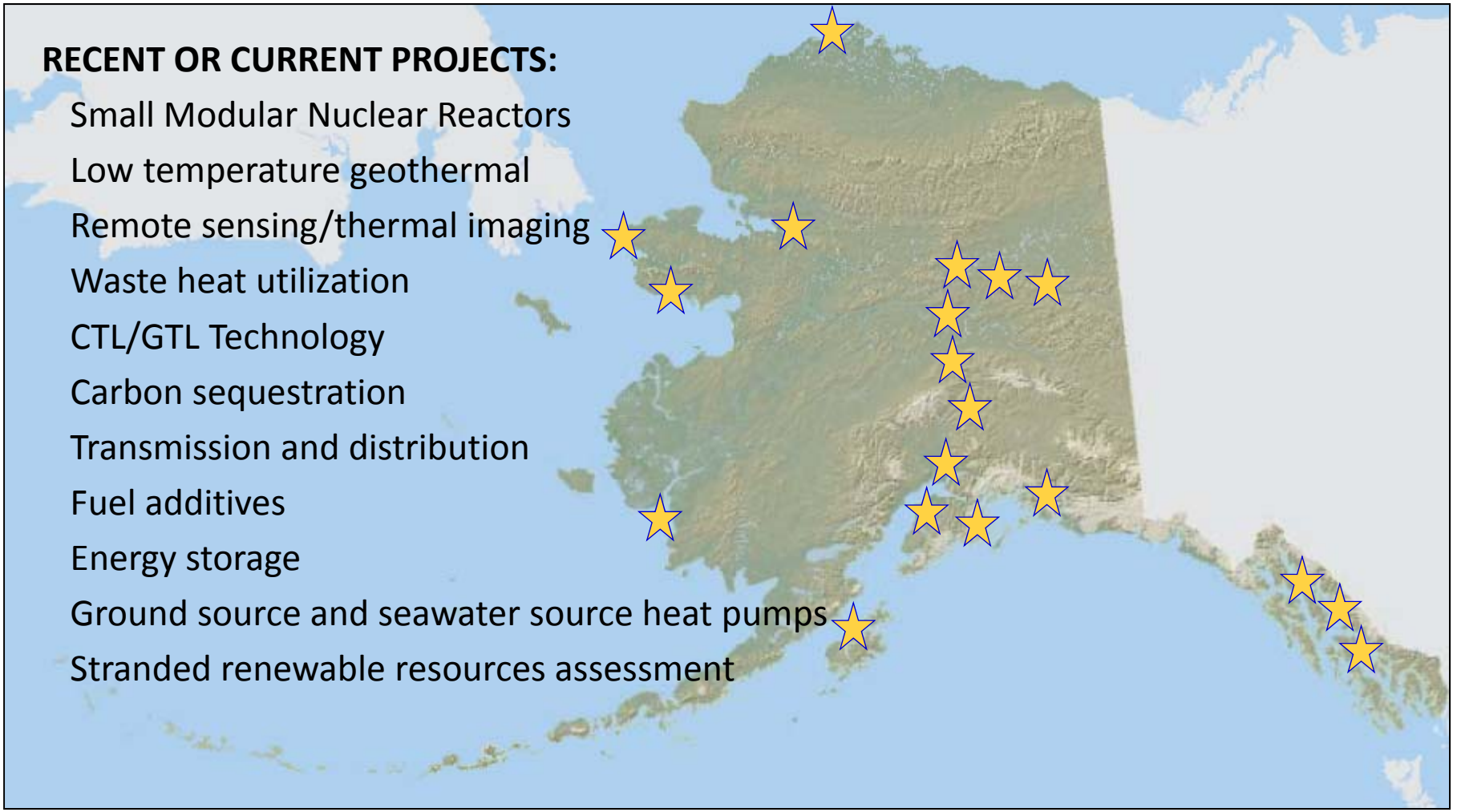
Current ACEP Projects



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Internal Partnerships

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Alaska as a leader in energy technologies

- Coil drilling technique pioneered in Alaska
- Thermosiphons for extracting heat to maintain pipeline and building foundations in permafrost-rich soil
- Largest battery system in the world in Fairbanks
- Low temperature geothermal (niche renewables)
- Leader in diesel hybrid development

Role of research: peering over the horizon

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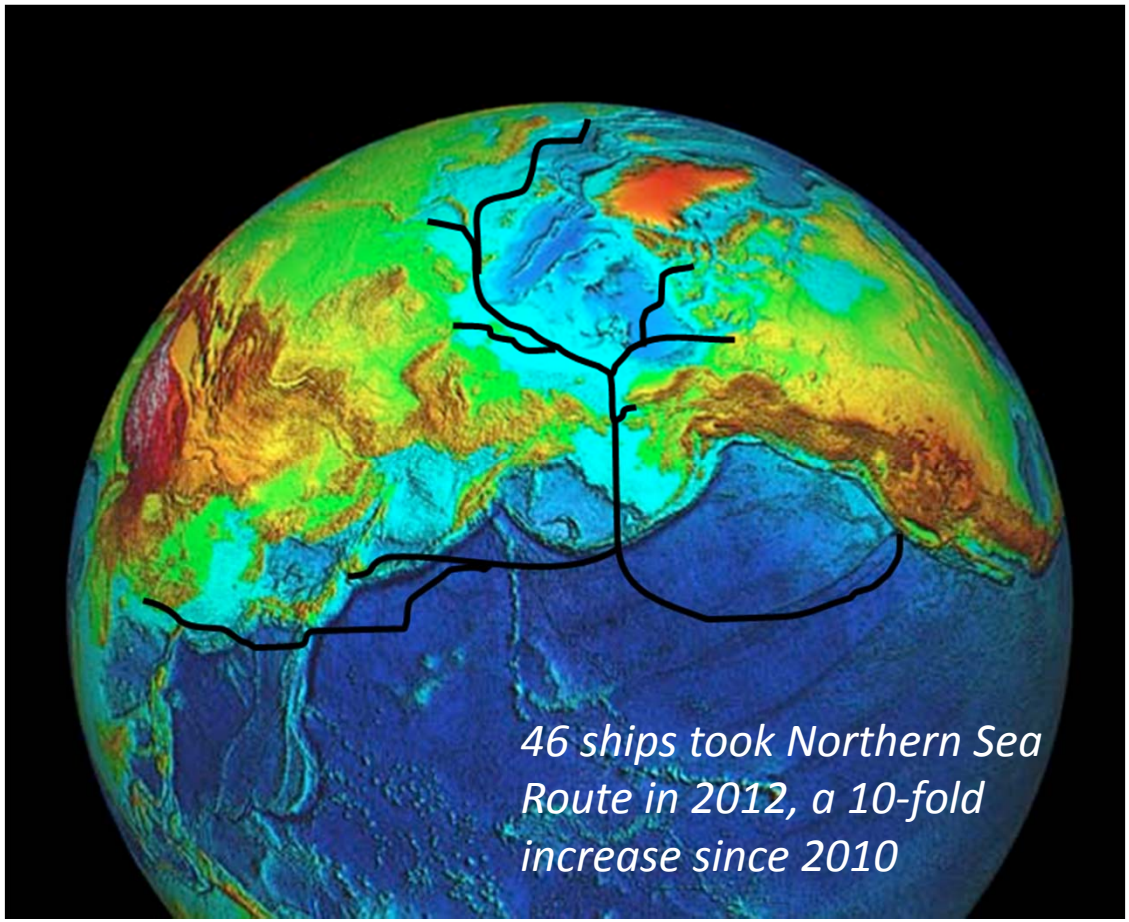
Emerging Energy Opportunities

- Value added processing – exporting energy through means other than pipelines and transmission lines (example - energy intensive industries)
- High penetration renewables
- Niche technologies (low temp geothermal, hydrokinetics)
- Difficult to extract/transport fossil fuels

Energy Intensive Industries



Alaska is already situated in close proximity to Asian markets

New markets and shipping routes may open in a seasonally ice-free arctic

Many new mineral discoveries expected to be made in the Arctic

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World energy demand is increasing

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High penetration renewables

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

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Niche Technologies - hydrokinetics

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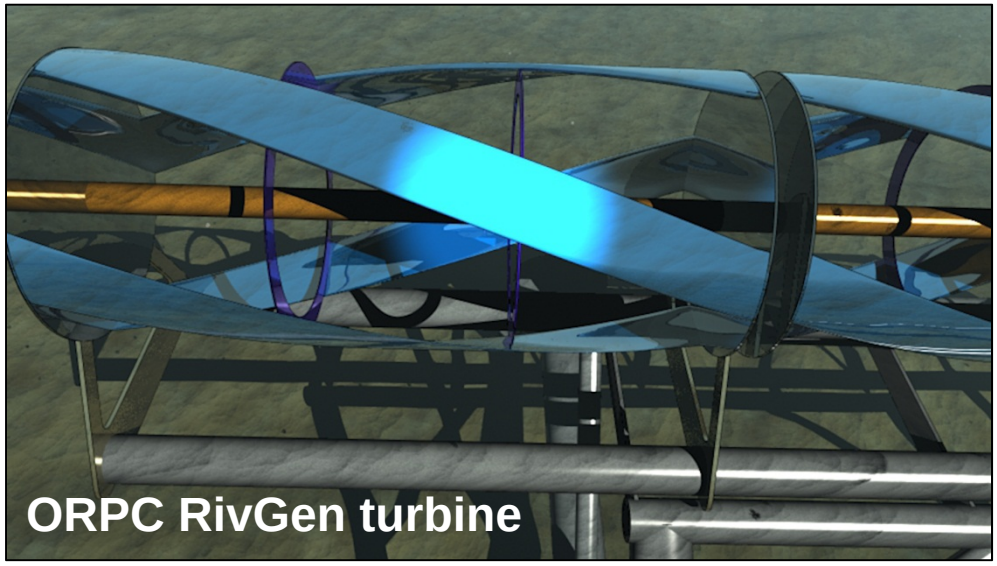
Niche Technologies - hydrokinetics

Of 70 Round 1 EETF Proposals received in 2012, 19% were for hydrokinetic technologies (by far the largest category)


ORPC RivGen turbine


Vortex hydro

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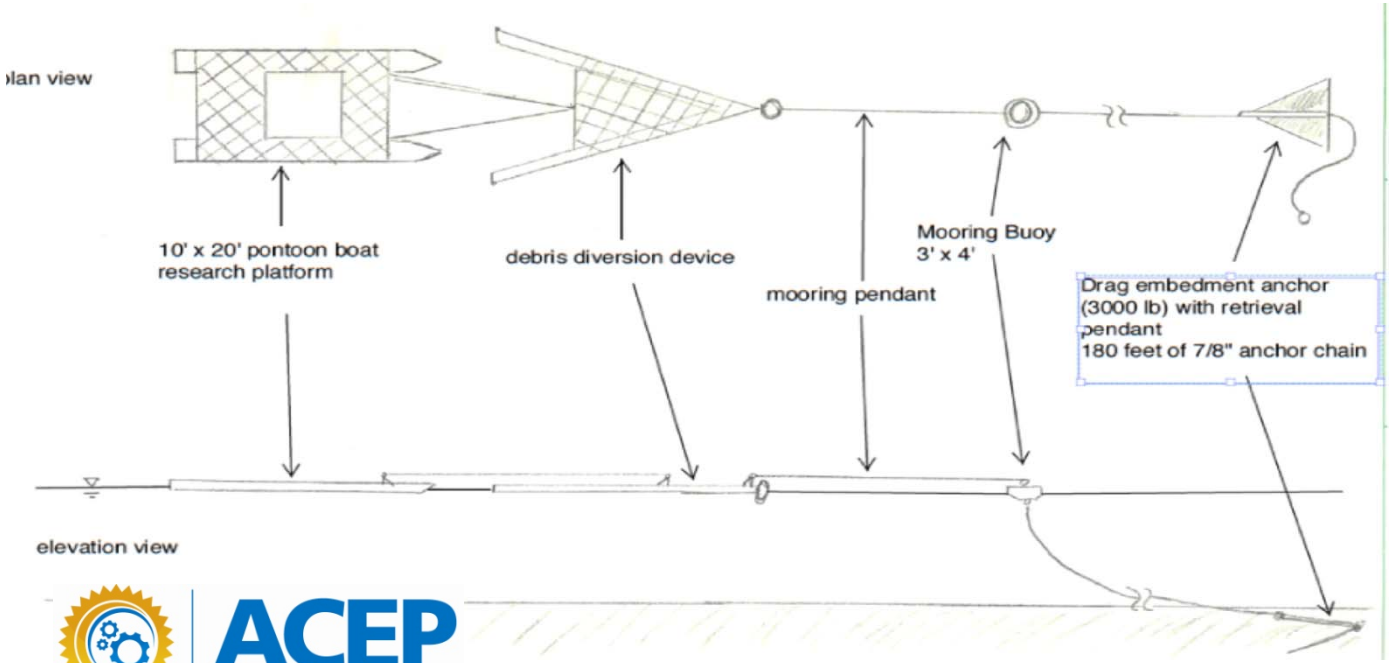
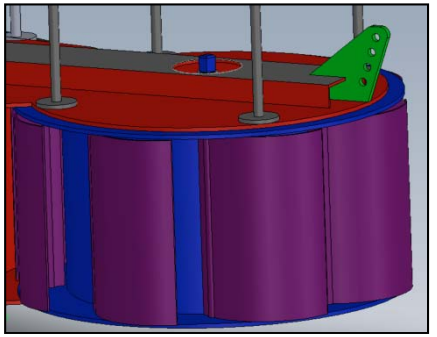
UAF supports emerging industries

ACEP has developed a device to divert surface debris from a surface deployed hydrokinetic device





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Niche technology: Low-temp Geothermal

First Organic Rankine Cycle power plant using geothermal energy ***in the world*** operated at Manley Hot Springs in 1980.

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Niche technology: Chena Geothermal

Niche technology: Moving beyond geothermal

Using Organic Rankine Cycle technology for waste heat recovery

Electratherm testing at UAF

Electratherm 50kW ORC System

Pratt & Whitney 280 kW ORC System

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Testing and System Optimization

- Both in the laboratory and in the field.
  - Recent lab-based examples include: Electratherm, Sustainable Automation grid-forming inverter, Prudent Energy flow battery.
  - Field-based examples include 11 current projects funded under the EETF program.

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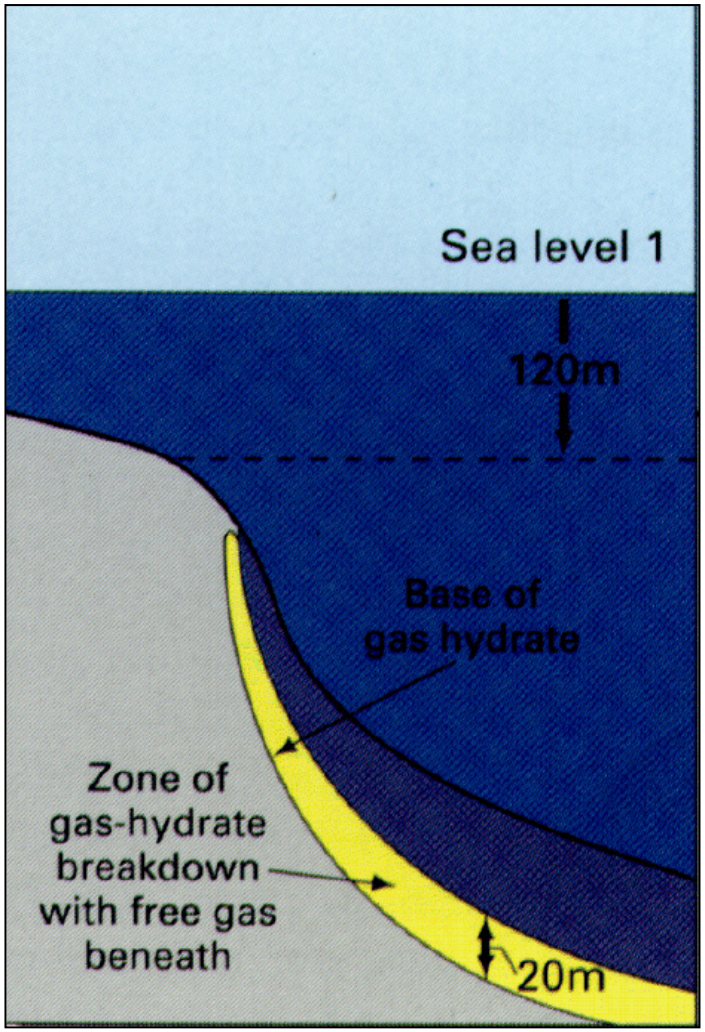
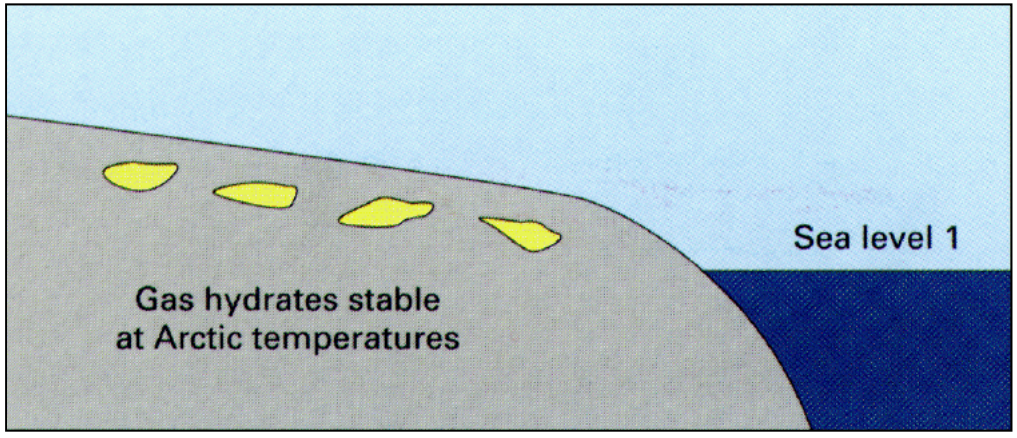
Difficult to extract fossil fuels: On-Shore Methane Hydrates



Energy content in methane hydrate resources worldwide dwarfs conventional oil and gas resources



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Lessons learned from Iceland

World-class geothermal and hydropower

- Located just south of Arctic Circle between Greenland and Scandinavia.
- Total land area of 39,769 sq mi
- Population of 318,000 (about ½ of Alaska population)
- No on-shore fossil-based energy resources (possible off-shore reserves off northeast coast)

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2012 Iceland Policy Tour

Karanhukar Powerhouse

Organized by the Institute of the North – 5 days in November, 2012

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Iceland in 1901

- Per capita national output was the same at today's Ghana ($2500).
- Dependent on one major industry (fishing).
- Imported coal for heating.
- Island environmentally decimated (all trees cut down, significant erosion of soil and stress on native vegetation due to overgrazing).

Reykjavik in 1932

All buildings heated using fossil fuels

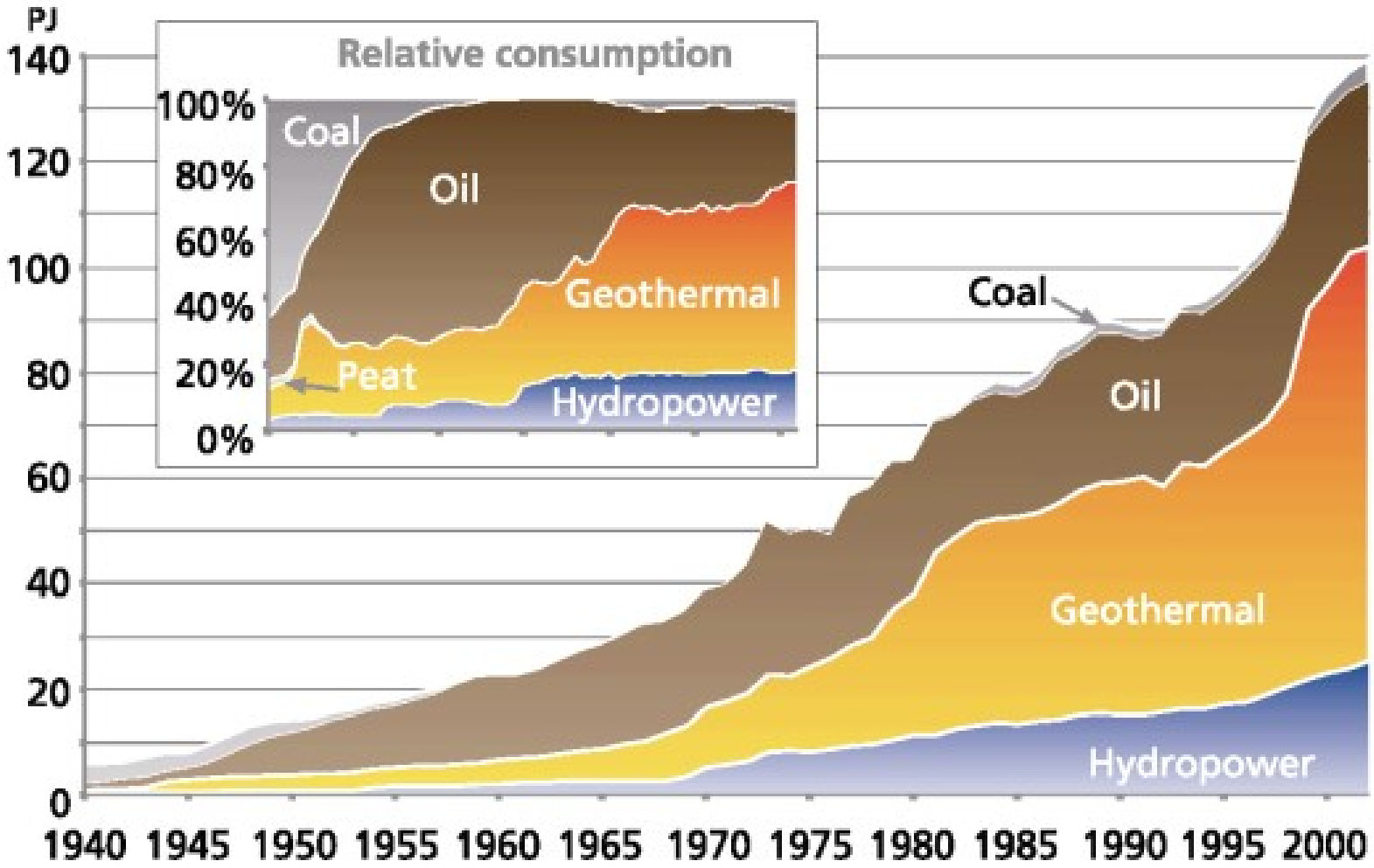
Iceland Today

- Estimated GDP per capita was $58,005 in 2008
- Ranks 3rd in the world in United Nation's Human Development index
- Only 18% of its total energy needs imported.
- It took Iceland just 100 years (3 generations) to become one of the world's most affluent countries.

Reykjavik today

One of the cleanest cities in the world

Iceland's Domestic Energy Portfolio



Creating opportunities at home & abroad

- Over 80 companies involved in geothermal industry (exploration, development)
- Provides free education to students from countries with undeveloped geothermal potential
- Pipeline for business opportunities for Icelandic businesses in emerging markets
- High quality jobs, energy sector significant contributor to GDP

Iceland has become the world leader in geothermal development

Boise, ID is home to the oldest geothermal district heating system in the world

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Alaska Energy Use

Assuming a constant fuel demand, we are on track to spend over $5 billion on diesel fuel in rural Alaska and ~ $60 billion on fossil fuels for Railbelt electric power generation.

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Alaska Energy Investment

Energy-related appropriations have totaled $2.3 billion since 2008 (PCE endowment, RE fund, AHFC programs, etc)

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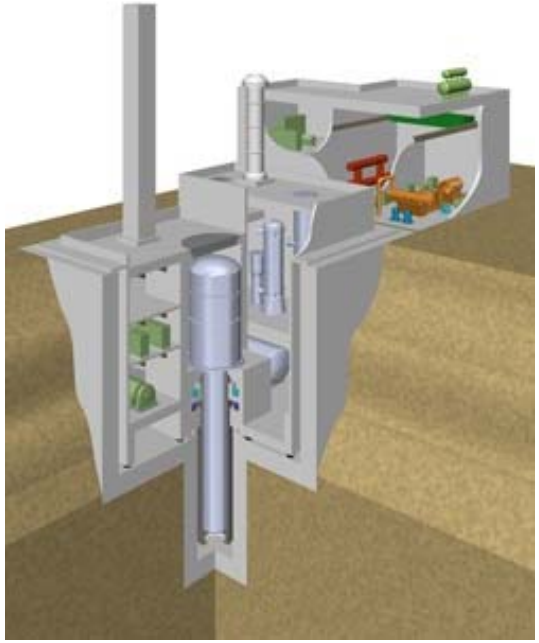
How can the University support the legislative process?

- Energy analysis to support policy decisions and appropriations (Fairbanks market analysis)
- Scenarios planning as a long-term planning tool
- Assessing technology options (small modular reactors)
- Data collection and analysis (how are our investments doing?)



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www.uaf.edu/acep

I skate to where the puck is going to be, not where it has been

- Wayne Gretzky

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