Emerging Energy Technology: A Global Opportunity for Alaska

Alaska has the opportunity to be a world leader in developing, optimizing and exporting renewable energy technology. The state is uniquely situated to capitalize on the growing market for new energy technologies, particularly clean energy technologies for the developing world. Because energy prices are so high in rural Alaska, we can *both* demonstrate technology *and* begin to save money for local residents immediately. Recognizing that Alaska can be a laboratory for testing new energy technology will lead to outside investments in our state and keep Alaska competitive in the increasingly competitive world economy.

More than 150 of Alaska's 350 communities are in remote rural areas without roads or grid-connected power, and suffer from high energy prices that handicap their economies.

Let's connect the dots

Nearly 1.6 billion people, about 25% of the world's population, live without access to electricity, and are looking for ways to energize their communities.

Investment in clean energy worldwide is currently about a $155 billion a year business that is projected to grow exponentially in the coming years. Alaska's high energy costs, abundant renewable energy resources, remote locations and challenging climate make it ideal for researching and developing emerging energy technologies that can help stabilize energy costs for Alaskans *and* be exported to communities in the developing world that lack electricity.

REAP Renewable Energy Alaska Project

Emerging Technology for Alaska's Future

There is currently no state program dedicated to supporting emerging energy technologies. Alaska has the Renewable Energy Grant Fund, but it is directed at mature technologies. Emerging technologies such as tidal power and biomass gasification need more testing and development in order to become commercially available. Strategically investing in an Emerging Energy Technology Fund today will position Alaska to:

- Provide relief for communities in rural Alaska crippled by high energy prices
- Attract innovative technology companies to the state
- Create high-tech jobs
- Develop Alaska's university programs through private partnerships
- Give Alaska an advantage when competing with other states for federal funding programs for green industry and job development
- Capitalize on growing worldwide demand for energy, parcticularly clean energy which in 2008 was estimated at $155 billion/year business
- Become a leader in developing energy technologies, particularly small-scale technologies that can be exported to remote communities around the developing world

Legislation currently pending would establish an Emerging Energy Technology Fund to be administered by the Alaska Energy Authority. The fund would be financed by appropriations from the state legislature, federal appropriations, and contributions from other sources and would be available to utilities, independent power producers, local and tribal governments, Alaskan businesses, and non-profits. In order to receive grants from the fund, the benefiting project would need to be for the research, development, or demonstration of a new energy or conservation technology or for the improvement of an existing technology, with the reasonable expectation the technology would be commercially viable within 5 years.

Examples of Emerging Technology in Alaska

- Tidal power
- Wave power
- Biomass gasification
- High-penetration wind-diesel systems
- In-river hydrokinetics
- Next generation energy storage technology

Alaska Market for Emerging technology

In 2009, the Denali Commission solicited proposals for emerging energy technology projects. Fifty proposals totaling $29 million were submitted, from which nine were selected to receive $4 million in grants. The Commission's goal was to develop emerging energy technology that has the potential of widespread deployment in Alaska and has the long-term goal of reducing energy costs for Alaskans. The robust response to the Commission's request for proposals highlights the need for an emerging energy technology fund. The projects listed below were among those selected by the Commission and are examples of types of technology that could benefit Alaskans.

Alaska Sealife Center: Seawater Heat Pump Demonstration Project

The Alaska SeaLife Center proposes to employ a heat pump system that will "lift" latent heat from raw seawater at temperatures ranging from 35F to 55F, and transfer this heat energy into building heat at a temperature of 120F. Sea water would first be pumped through a heat exchanger containing propylene glycol, an antifreeze commonly used in northern latitude commercial and residential heating systems. The glycol, warmed by the seawater, will boil a refrigerant that would go to an electric-powered compressor. In the compressor, the refrigerant vapor will be heated through pressurization. The refrigerant will then be condensed by giving up this heat to a second glycol loop that circulates to the building's heating system at 120F. While this technology has been successfully deployed in Norway and Sweden, this innovative process of removing latent heat from seawater and using it to heat buildings has not yet been tested in Alaska.

Cordova Electric Cooperative: Psychrophiles for Generating Heating Gas

This research and application project will deploy the use of psychrophiles (cold-loving microbes) to improve efficiency in biogas digestors for generating cooking and heating gas for Alaskan households. Biogas digestor technology is proven and in widespread implementation in India and China, with emerging efforts in Africa, California, and Europe. The technology is based on the biological production of methane by archeal microbes called methanogens, which naturally break down organic feedstock to produce methane. In Alaska, deployment of *cold-region* digestors could be used as a local, renewable energy source for home cooking and heating.

Kotzebue Electric Association (KEA): Flow Battery Energy Storage Systems

KEA's goal for this project is to analyze and demonstrate flow battery systems and their potential for energy storage in rural wind-diesel systems. Efficient storage remains a barrier to the optimal deployment of some renewable energy technology in remote areas. Large-scale batteries for wind-diesel systems that could provide village utility grid stabilization and load shifting are currently being developed by several suppliers. If these batteries become commercial products at the price points currently being anticipated, they would provide even more diesel fuel savings in communities with wind resources.

Ocean Renewable Power Company (ORPC): Nenana Hydrokinetic Turbine

ORPC proposes to build, install and test the RivGenTM Power System, a hydrokinetic energy unit, at the Nenana hydrokinetic test bed and then analyze the resource and technology results. Hydrokinetic devices are placed directly in a river, ocean or tidal current, and generate power from the kinetic energy of moving water. Alaska has significant potential for hydrokinetic development in both rivers and tidal basins. Indeed, most inland communities in Alaska are situated along navigable waterways like the Yukon and Kuskokwim rivers that could host hydrokinetic installations.

Worldwide Market

Examples of Emerging Energy Technology Worldwide

Salt Water Power (Osmotic Power): In November 2009, Norway opened the world's first osmotic power generator prototype. The protoype employs a semi-permeable membrane that uses the same principle of osmosis that governs how leaves absorb moisture. The membrane separates fresh water provided by a nearby river from saltwater from the sea. The saltwater molecules in the sea water pull the fresh water through the membrane, increasing the pressure on the sea water side to a level where it is high enough to drive a turbine to generate power. The Norwegian energy company, Statkraft, estimates global potential for osmotic power at more than 1,600 GWh per year. Alaska's freshwater streams and extensive coastline offer great potential for researching and developing osmotic power.

Storing Renewable Energy with Hydrogen: In 2009, Greenland's national energy company, Nukissiorfiit, announced a plan to establish a demonstration hydrogen and fuel cell plant for storing energy created by hydro and wind turbines. With numerous villages relying on diesel generators not connected to a main utility grid, Greenland is similar to Alaska in that in order to implement high-penetration renewable systems, advancement in energy storage technologies is needed.

Thermoelectric-Chalcogenide Based Chips (Heat to Electricity): As a direct result of Texas' Emerging Technology Fund, Texas State University is partnering with MicroPower Global to develop thermoelectric-chalcogenide based chips. The chips take heat from an engine and convert it directly to electricity. Ultimately, development of this technology will capture heat from jet engines and convert that waste heat into electricity. This technology could have widespread application in Alaska.

Snow Cooling Plant: Sweden's Sundsvall Regional Hospital was built in 2000 and now meets over 90% of its cooling needs by circulating melted snow. Snow is collected during the winter at Sundsvall, then covered and insulated. As the snow melts, the runoff water is filtered and pumped via a heat exchanger through pipes to hospital buildings where it provides cooling. The warmed water is then routed back to the snow bank to be chilled again. Japan is in the process of constructing a similarplant for the New Chitose Airport in Hokkaido and expects it to be operational by 2010.

Demand for Clean Energy

In 2008, about $155 billion was invested in clean energy companies and projects around the world. That money was spent on renewable energy projects that tapped wind, solar, micro-hydro, biomass, and geothermal resources. Countries and international banks around the world are making investments in clean energy industries. Some examples of investments made in clean energy in 2009 include:

•A $9 billion *a month* investment by China on the development of renewable energy.

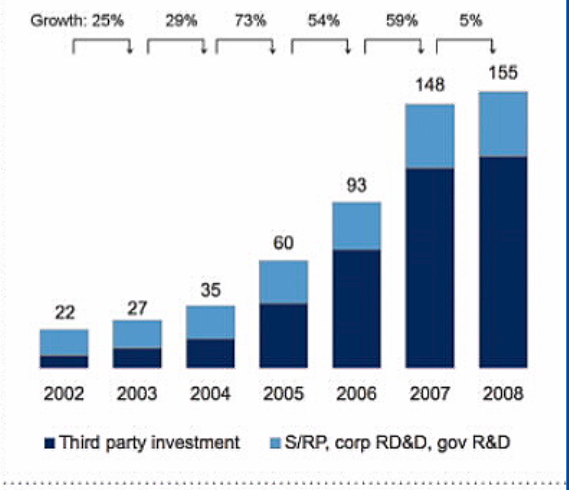
•A $250 million award to the Philippines from the Clean Technology Fund (CTF) to invest in energy efficiency and renewable energy. The CTF is made up of the Asian Development Bank and the World Bank.

•A $72.2 million pledge by South Korea to spur renewable energy production. South Korean manufacturing companies are also expected to spend $3.4 billion in 2010 for clean tech, including research and development, and manufacturing facilities related to solar cells, wind power, and hydrogen fuel cells.

• $16.8 billion allocated to U.S. Department of Energy's office of Energy Efficiency and Renewable Energy.

•$350 million pledged by the United States to developing countries for clean energy.

Figure 1: New Investment in Sustainable Energy, 2002-2008
$ billion



S/RP = small/residential projects. New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals

Existing Emerging Technology Funds

Emerging Technology Funds have helped other states, provinces, and countries attract private investment, create jobs, and develop cutting-edge renewable energy technologies. These funds serve as examples of how government investment in innovative research and development creates jobs, fosters entrepreneurship, and increases the quality of life for the community.

New York State Energy Research and Development Authority

The authority's aim is to help New York meet its energy goals: reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment. A research and development program supports the development and commercialization of innovative energy and environmental products, technologies, and processes that improve the quality of life for New York's citizens and help New York businesses to compete and grow in the global economy.

California Energy Commission's Public Interest Energy Research (PIER) Program

This program supports public interest energy research, development, and demonstration, including in the areas of building efficiency, renewable energy technologies and advance grid technology. The program is funded through surcharges on electricity and natural gas rates and has invested a total of more than $587 million in innovative energy technologies since inception.

Texas Emerging Technology Fund

Created by legislation in 2005, the $200 million Texas Emerging Technology Fund (ETF) is designed to create high-tech jobs, and attract private businesses to Texas. The ETF has funded projects from cancer research to developing energy efficient and renewable energy technologies. In 2009, the Small Business and Entrepreneurial Council ranked Texas in the top three states for small business and entrepreneurship.

Michigan Emerging Technology Fund

The Michigan Emerging Technology Fund is designed to expand funding opportunities for Michigan-based technology companies in the innovation research and development arena.

Massachusetts Emerging Technology Fund

The Massachusetts Emerging Technology Fund offers loans to technology companies in the state to finance manufacturing facilities and equipment.

Sustainable Development Technology Canada's Tech Fund

Established by the government of Canada, this $550 million fund is one of two aimed at the development and demonstration of innovative technological solutions. It supports projects that address climate change, air quality, clean water and clean soil.

Ontario Emerging Technologies Fund

In 2009, the Canadian Province of Ontario committed $250 million to the development of an Emerging Technologies Fund for the development of green technologies.

World Bank Clean Technology Fund

The fund is one of two Climate Investment Funds that promote scaled-up financing for demonstration, deployment and transfer of low-carbon technologies, including renewable energy, with significant potential for long-term greenhouse gas emissions savings. As of January 2009, twelve countries including the United States had pledged $5.7 billion to the fund.

Links

Senate Bill 150 http://www.legis.state.ak.us/basis/get_bill_text.asp?hsid=SB0150A&session=26
Senate Bill 220 http://www.legis.state.ak.us/basis/get_bill.asp?bill=SB%20220&session=26
House Bill 305 http://www.legis.state.ak.us/basis/get_bill.asp?bill=HB%20305&session=26

Existing Emerging Technology Funds
Texas - http://txed.convio.net/site/PageServer?pagename=tetf_homepage
Michigan - http://www.mietf.org/Default.aspx
Massachusetts - www.massdevelopment.com/financing/specialty-loan-programs/emerging-technology-fund/
Ontario - http://www.ocgc.gov.on.ca/site/en
Sustainable Development Technology Canada Tech Fund - http://www.sdtc.ca/en/SOIinfo.htm
Masdar Clean Technology Fund - http://www.masdarctf.com/default.htm
World Bank Clean Technology Fund - http://www.climateinvestmentfunds.org/cif/
Google.org - http://www.google.org/projects.html

Denali Commission Emerging Technology Grants
http://www.denali.gov/index.php?option=com_content&view=category&id=1:energy&layout=blog&Itemid=13

World Market for Renewables
General Trends:
http://sefi.unep.org/english/globaltrends2009.html
http://www1.eere.energy.gov/recovery/
http://energy.gov/news2009/8391.htm

China - http://www.csmonitor.com/Commentary/the-monitors-view/2009/1204/p08s01-comv.html
Philippines - http://businessmirror.com.ph/home/economy/19354-multilateral-lenders-endorse-p250m-for-clean-technology-fund-to-doe.html
South Korea - http://cleantech.com/news/4113/s-korea-plans-72m-renewable-energy

Examples of Emerging Technology Worldwide
Osmotic Power - http://news.bbc.co.uk/2/hi/europe/8377186.stm
Storing RE with Hydrogen - http://www.newenergy.is/newenergy/upload/files/naha/h2kt_info-sheet-eng.pdf
Thermo-Chalcogenide Based Chips - http://crc.mse.txstate.edu/newsrelease.html
Snow Cooling Plant -Sweden - http://advantage-environment.com/byggnader/stored-snow-for-summer-cooling/
Snow Cooling Plant - Japan - http://cleantechnica.com/2008/10/16/airport-will-use-snow-for-30-of-cooling-needs/