

2-26-09

Work

Session:

**Comprehen-
sive**

Energy

Plan

<target><bill></bill><subject>2-26-09 Work Session
Comprehensive Energy Plan</subject><comm>HENE26</comm></target>

Alaska State Legislature Senate Special Committee on Energy

Cambridge Energy Research Associates Qualifications

February 26, 2009 • Juneau, Alaska

David Hobbs, Managing Director

Michael Marinovic, Vice President, Consulting

James R. Meitl, Senior Director, Business Development



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The CERA Mission

To provide insight into the energy future...

- Provide comprehensive, **integrated** research and thought leadership on market fundamentals, industry dynamics, and strategy in the energy sector
- Offer unique **insights**, often well ahead of conventional wisdom, into the most pressing challenges—economic, geopolitical, financial, technological, regulatory, environmental, and managerial
- Help clients **anticipate** the energy future and make informed strategic, investment, and market decisions
- Foster a **community** of senior-level decision makers



Source: Cambridge Energy Research Associates.

CERA Strategic Consulting and Advisory Services

- **Our Perspective.** Concerns over climate change, energy security and economic development are reshaping the competitive landscape of the global energy business. Through our unique integrated global energy scenarios and outlooks, we analyze markets in a global context while bringing quantitative results at the local level.
- **Our Approach.** Few consulting firms can match CERA's unique blend of profound energy industry knowledge, leading research, and hands-on experience. In working with our clients on strategy engagements, we leverage our deep knowledge and market leading research from all parts of the energy industry.
- **Our Experience.** CERA has provided the energy industry with advice and critical insight for more than 20 years. We have a diverse clientele of more than 400 leading governments, energy firms, and non-governmental organizations worldwide providing CERA with unparalleled breadth and depth of experience.

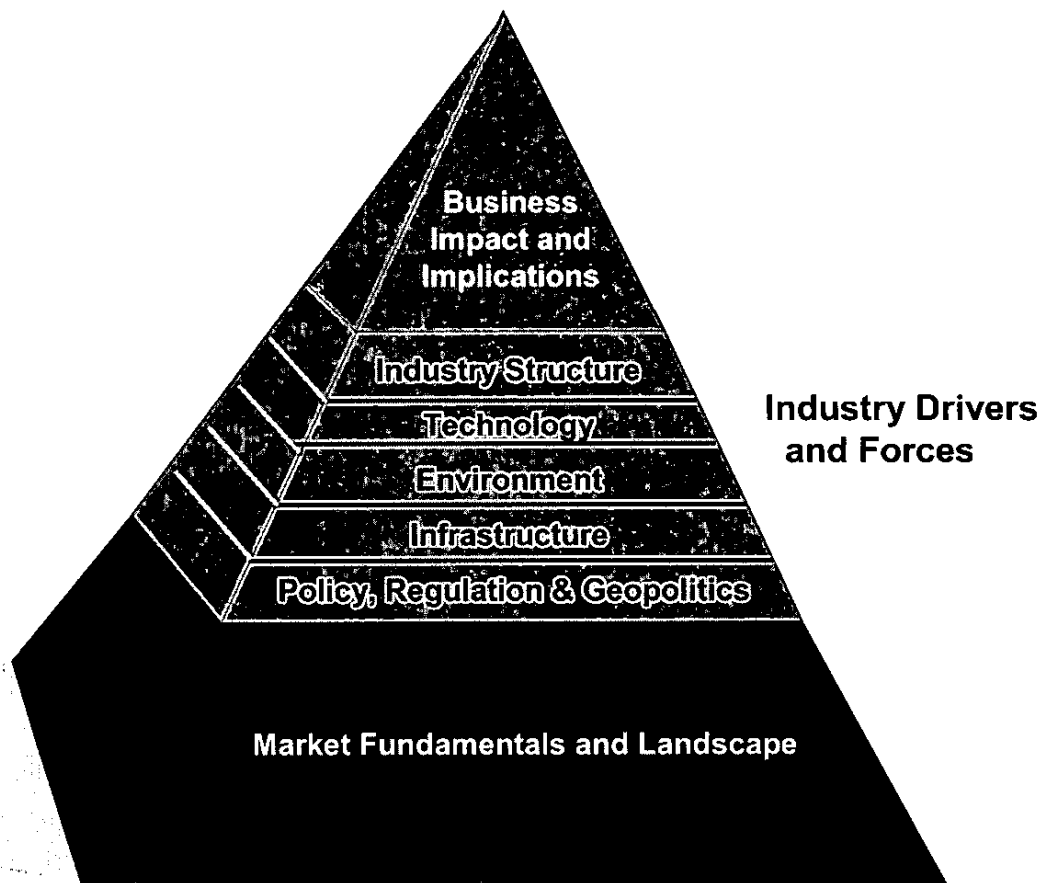


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CERA Advisory and Consulting Services

Insight delivered through analysis of fundamentals, industry drivers, and strategy

Thought Leadership

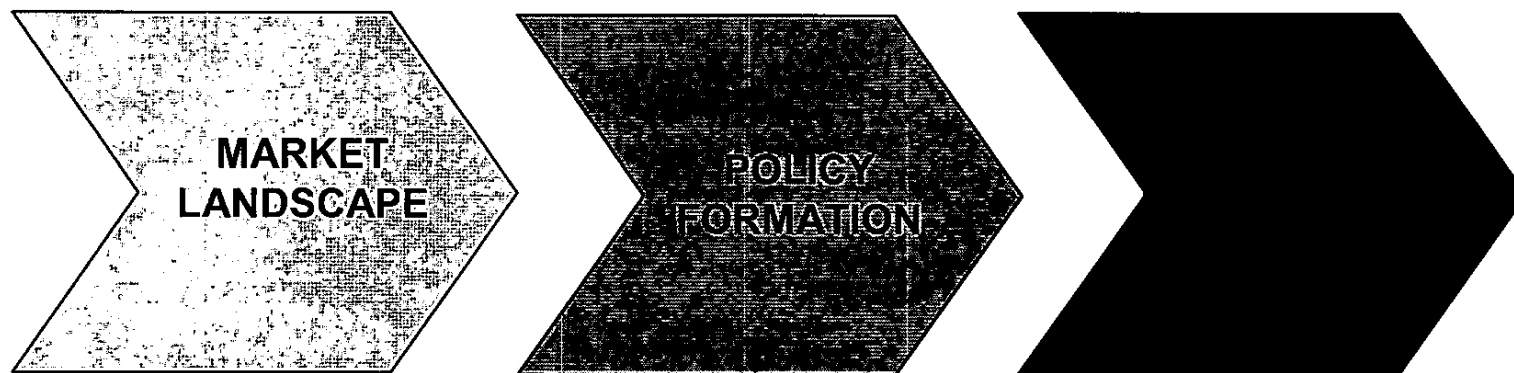


Source: Cambridge Energy Research Associates.

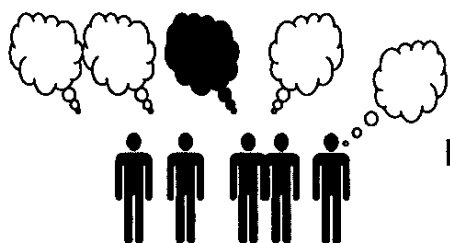
***Policy Methodology and
Selected Previous Engagements***



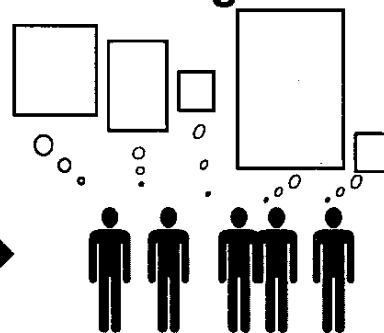
Energy Policy Roadmap Components



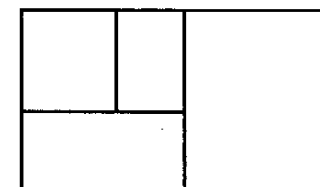
Diverse Views



Structured Dialogue



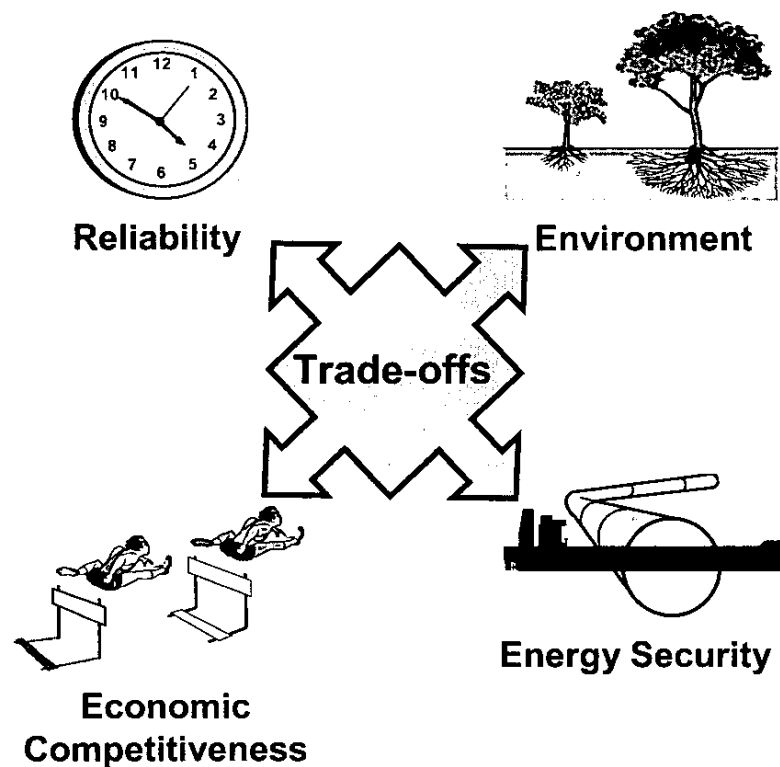
Common Framework



Role of the Market Landscape in Developing an Energy Roadmap

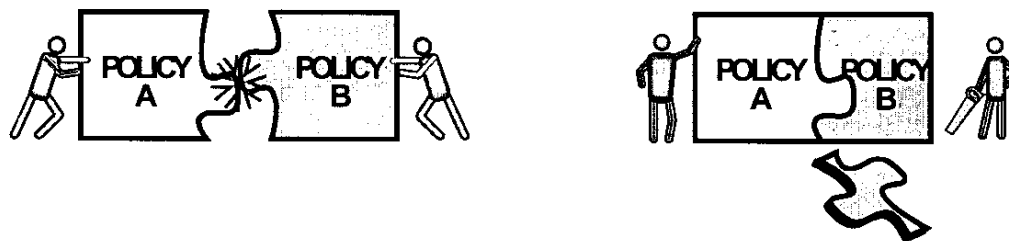
Defining the Landscape → *Defining the Policy Choices*

- Growth objectives
- Social, environmental and planning constraints & commitments
- Outside Linkages
- Geopolitical, economic, fuel and technology outlooks
- Supply and demand projections regionally and Globally
- Current Institutional Structures

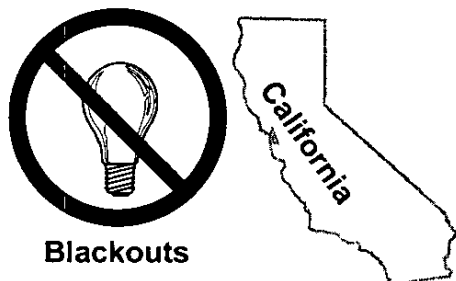


Source: Cambridge Energy Research Associates.

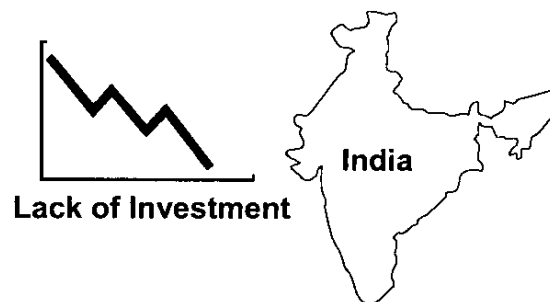
Policy trade-offs Must be Recognized and Resolved Early on



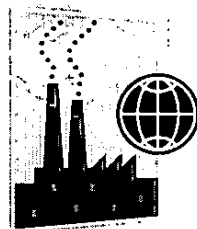
Or Face the Consequences...



Blackouts



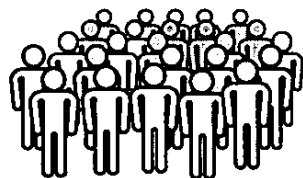
Lack of Investment



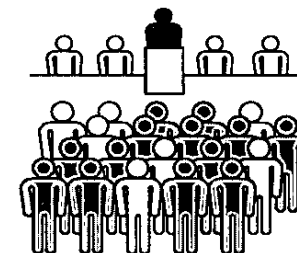
Environmental Consequences

China

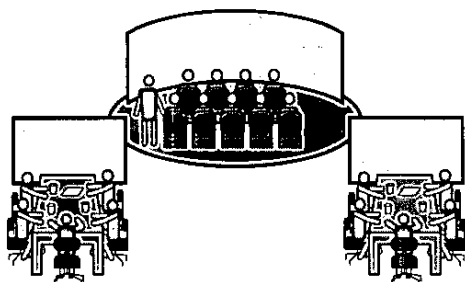
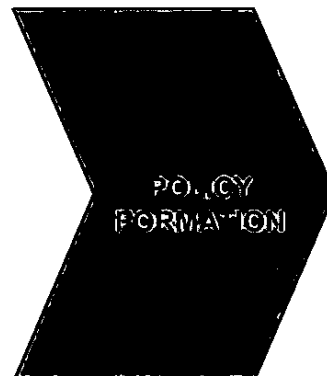
Four Key Policy Formulation Questions



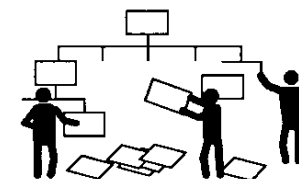
Who Decides?



Who is consulted?



What Institutions?



Which Topics?



We have assisted oil and gas clients in developing a broad range of strategies across the world.

Corporate

- IOC's strategy for high-oil price environment
- Independent's corporate portfolio strategy
- Supermajor's CO2 strategy

National Energy and Resource Development

- National resource plan based on fundamental gas demand supply forecast
- Create national resource planning and dev't

Business Unit & Regional

- SE Asia regional upstream gas strategies
- North Sea regional and country strategies
- West Africa business unit strategies

Exploration & Country Entry

- Middle East country gas entry strategy
- Atlantic Margin exploration strategy
- Various other country entry strategies

Major Resource Development

- Caspian region mega investments
- GOM and West Africa DW developments
- Major new Siberian resource development

Operating Asset Strategies

- Arctic mega asset renewal strategy
- Mature offshore asset cluster strategies
- Steam and CO2 flooding investments

Unconventional Resources

- In-situ and mined oil sands
- Tight gas, CBM and shale gas developments
- New unconventional resource technologies

LNG and GtL

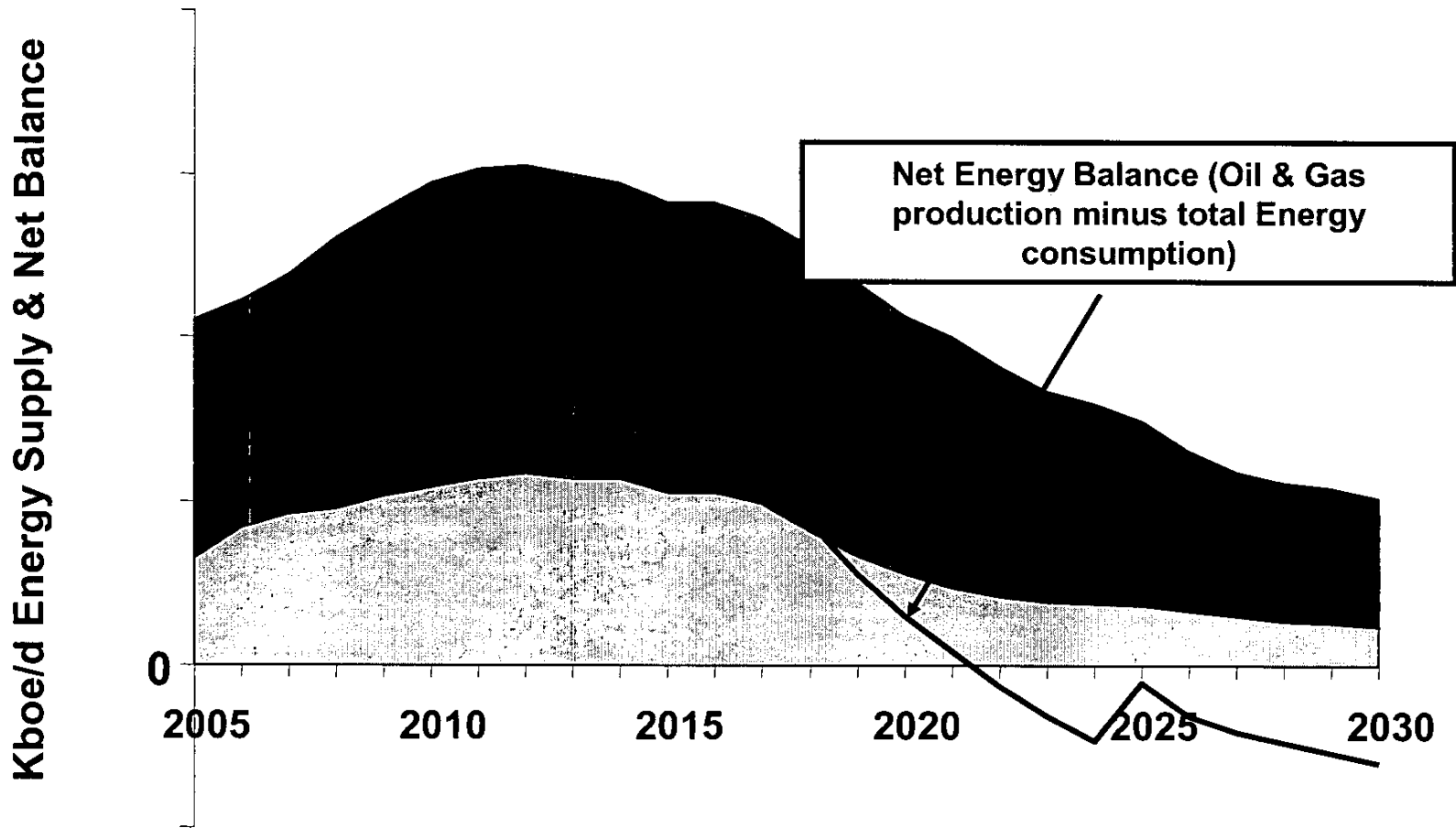
- LNG liquefaction investments
- Portfolio assessment of GtL opportunities
- IOC's LNG portfolio strategy



Case Example

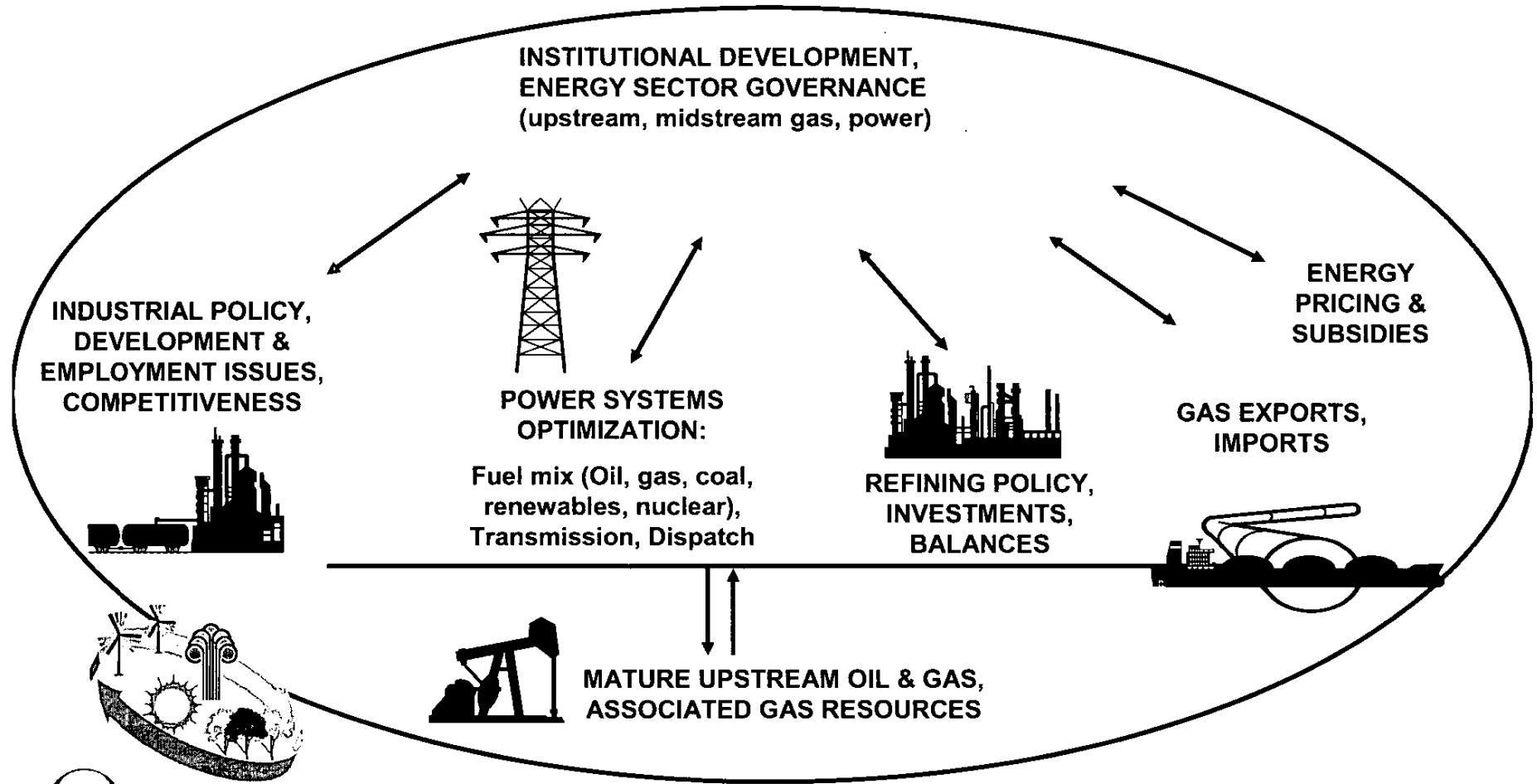
Oil & Gas Producing Country (2007)

Emerging Energy Balance Shift Drove the Need for Policy Review



Source: CERA analysis, study data

Study Embraced the Entire Energy Spectrum



**ENVIRONMENT POLICY ; ENERGY EFFICIENCY
EMISSIONS, CDM, INTERNATIONAL REPUTATION**

Stakeholders were Engaged Throughout

■ Joint contribution from stakeholders



Steering Committee



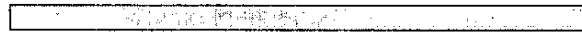
Working Group



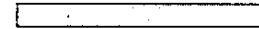
Data gathering (ministry support)



Model Building /analysis



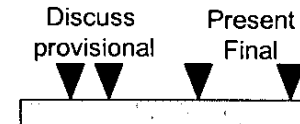
Reporting – Energy Balance



Stakeholder interviews & institutional review



Reporting final conclusions & recommendations to Ministers



Notional Country Energy Strategies were Developed to Test Stakeholder views

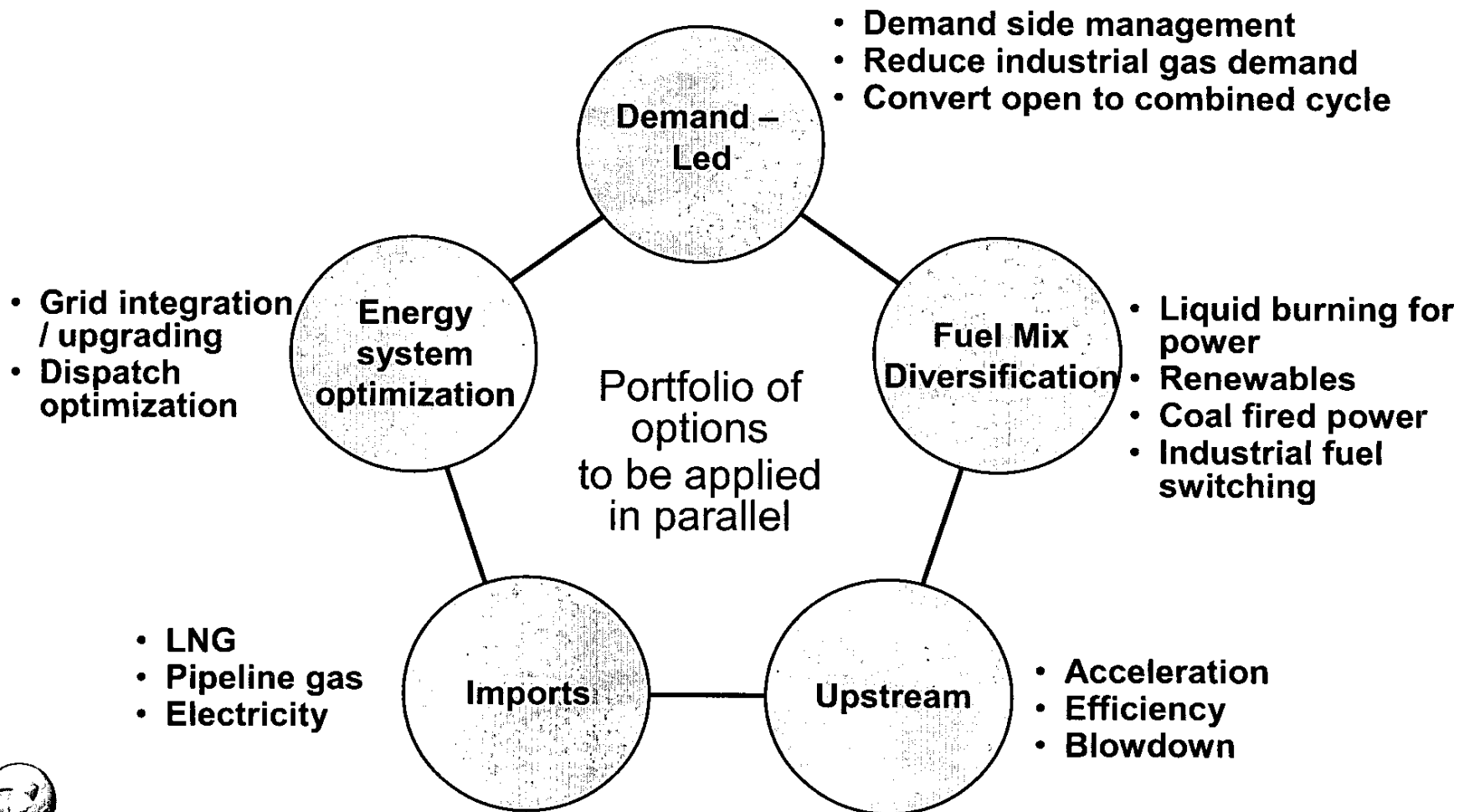
Notional Country Strategy

1. Policy Focus	Restrict / control demand across all sectors	Depend on neighbours for supplies	Give preference to upstream oil energy needs
2. Energy Supply Policies.			
3. Energy Demand Policies			
4. Energy Export Policy			
5. Fuel Mix Policy			
6. Industrialization / development policy			
7. Energy User contracts			
8. Employment			
9. Environm. Policy			
10. International Diplomacy			
11. Govt Regulatory Approach			
12. Foreign companies			

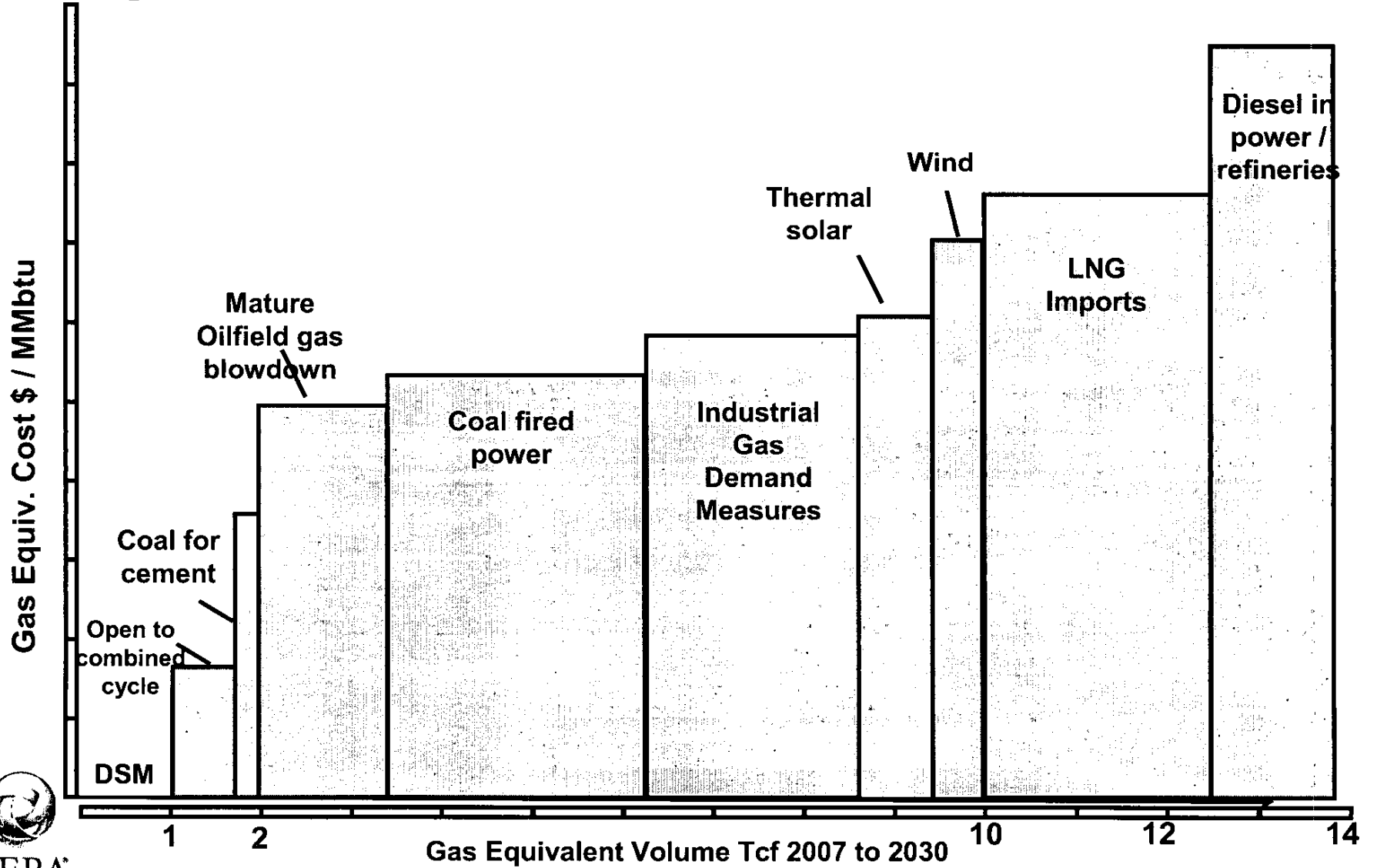
As part of the Stakeholder engagement process, CERA conducted a workshop to surface constraints / agendas affecting policy choices



The Study Analysed a Portfolio of Options to Optimize Future Energy Balance



Costs of Energy Balance Options were Compared



Qualitative Considerations were Critical in Developing Final Energy Policy Recommendations

Qualitative Factors to Consider

Key Questions

Strategic Fit

- Willingness to depend on neighbours ?
- Attitude toward existing gas user contracts ?
- What value does diversification have (gas or fuel sources) ?
- Is there a strategic upside for certain options

Risks and Vulnerabilities

- What risks or uncertainties impact implementation ?
- How robust is an approach to different global energy scenarios ?
- How might institutional capability influence do-ability ?

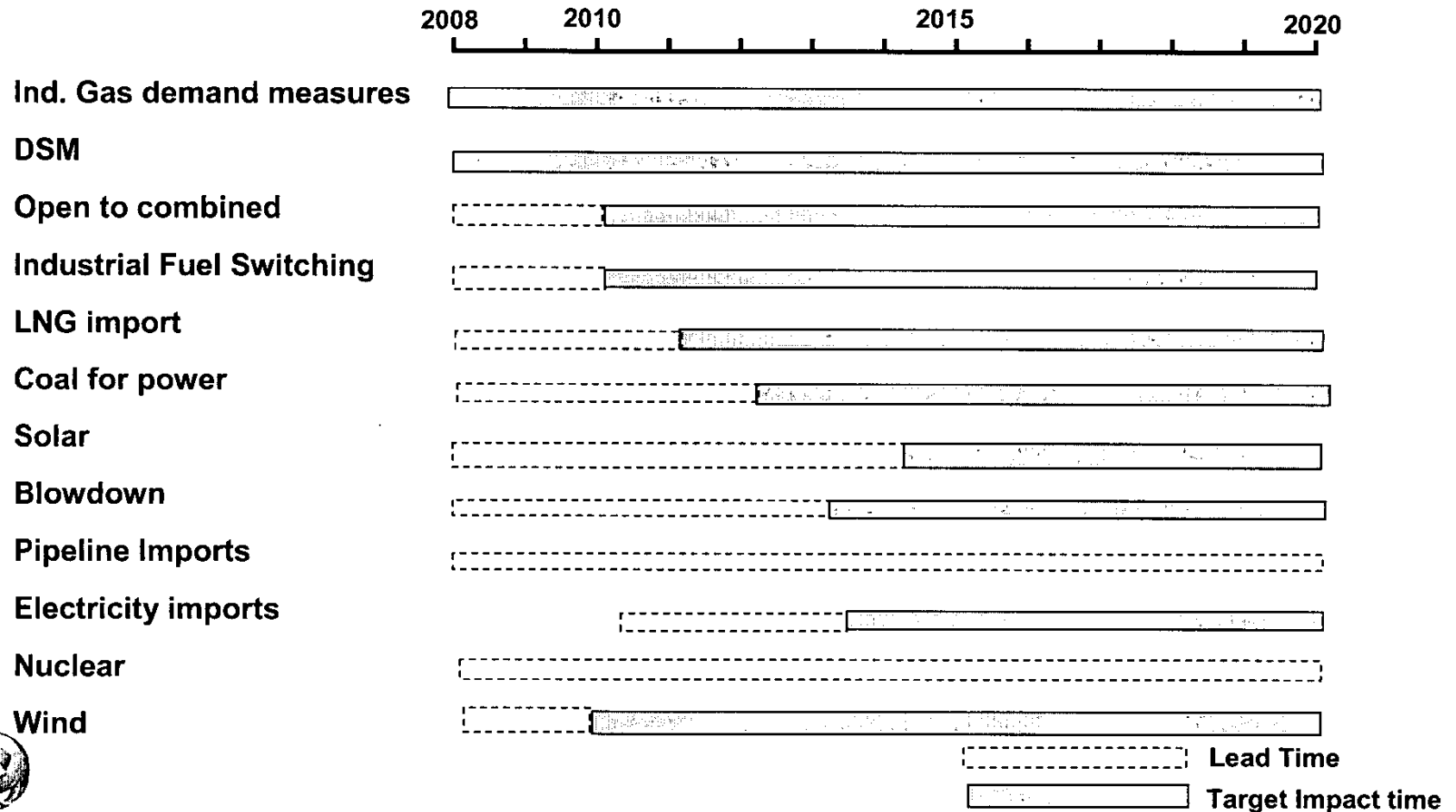
Alternatives & Trade-offs

- Do more radical options exist ?
- What- if certain options excluded ?



Early Planning for Implementation was Recommended

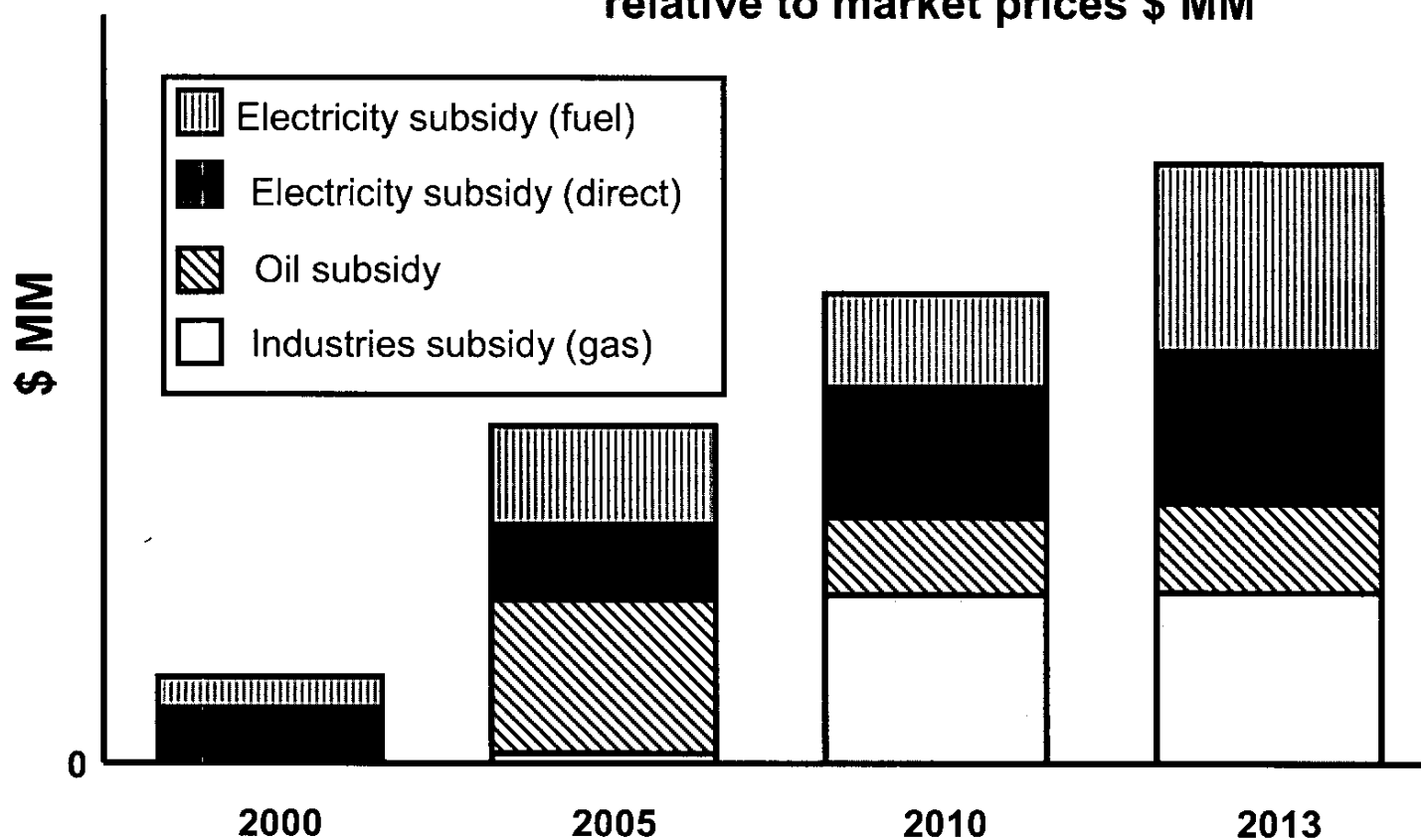
Conservative / prudent planning assuming firm supply and no pipeline imports



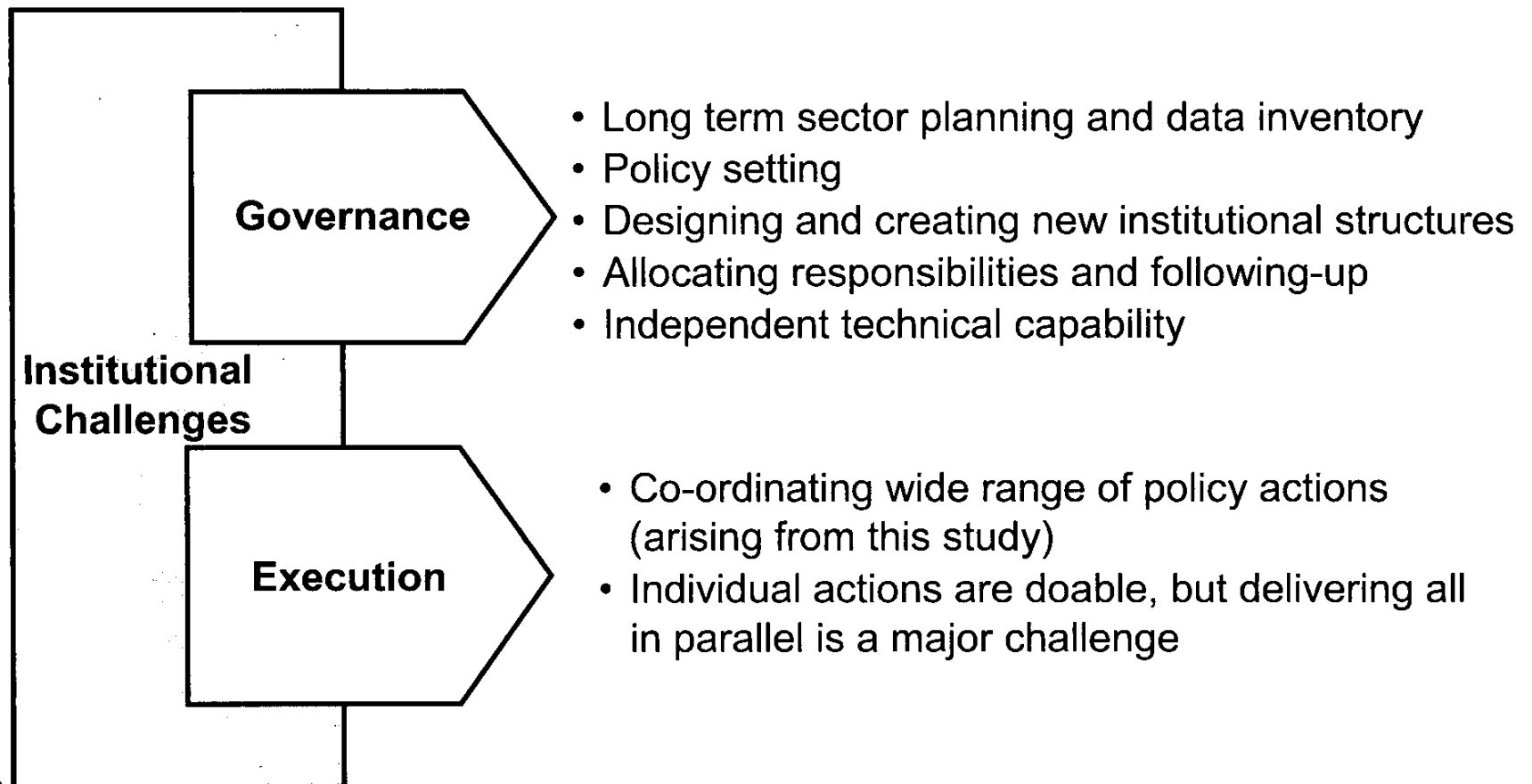
Identifying the Cost of Energy Subsidies

Assisted Pricing Policy Thinking

Approximate Energy subsidies
relative to market prices \$ MM



Identification of Institutional Challenges and Solutions were Important When Recommending a Policy Roadmap



Learnings : Key Success Factors for Energy Policy Related Projects

- **Tailored, issue driven analysis**
 - Identify critical issues to address early on
 - Tailor model / analysis to focus on those issues
 - Broad remit for recommendations : technical, economic, institutional, etc.
- **Build on existing knowledge**
 - Review existing reports, work with local experts
- **Seek and build senior Stakeholder consensus**
 - Early engagement with full range of stakeholders
 - Continue to seek their views as project progresses
- **CERA's independence and objectivity**
 - Flexibility to explore and deliver sometimes sensitive messages

Selected Additional Energy Policy Experience

- **World Bank – Yemen**
- **Ministry of Finance Economic Affairs – Barbados**
- **ExxonMobil – US**
- **Brazilian Petroleum Institute –Brazil**
- **Government Authority –Pakistan**
- **Ministry of Petroleum / Sonangol – Angola**
- **Bureau Of Minerals and Petroleum – Greenland**
- **Ministry of Energy – Kuwait**
- **Nigerian National Petroleum Corporation – Nigeria**
- **General Planning Council – Libya**
- **Confidential – Middle Eastern Country**
- **Directorate General of Hydrocarbons – Gabon**
- **Agencia Nacional de Hidrocarburos – Colombia**
- **JNOC / JOGMEC – Japan**
- **SOCAR – Azerbaijan**
- **Chinese NOC – China**
- **Government of Kazakhstan – Kazakhstan**
- **PetroEcuador – Ecuador**
- **ONAREP - Morocco**

Recent Strategic Consulting Experience Related to Climate Change and Clean Energy

- **Assessment of Voluntary Carbon Markets.** CERA developed a framework to assess the current and potential future demand for energy efficiency services, green power procurement and carbon offsets by businesses to achieve voluntary GHG emissions reductions.
- **GHG Policy Analysis.** CERA developed carbon abatement cost curves to inform the development of policy and business strategies related to the implementation of GHG policies.
- **GHG Policy and Market Strategies.** CERA has advised a variety of clients on the business risks and opportunities related to emerging GHG policies and markets.
- **Investment Strategies.** CERA has advised on investment and business strategies for technology providers and power generators by using a scenario framework to assess the potential risks and opportunities for various strategy options.

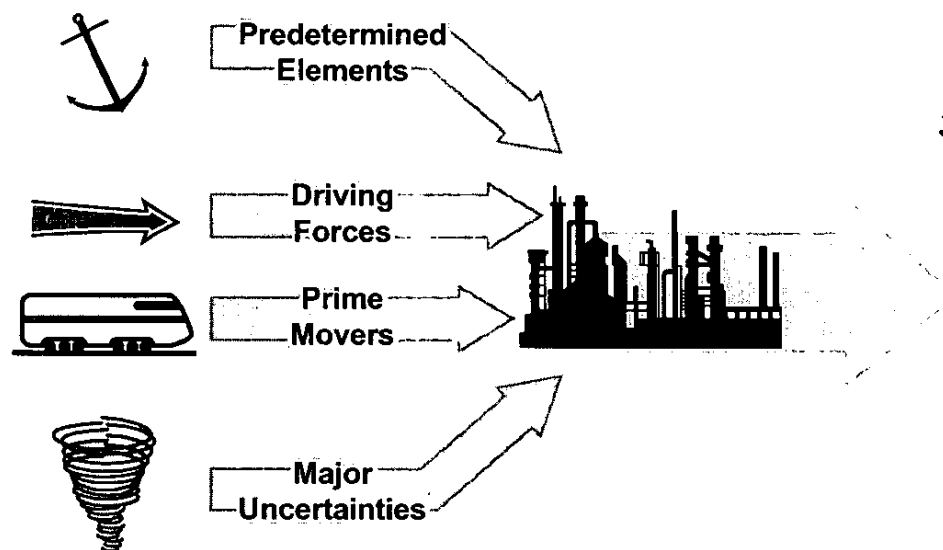
***CERA Scenarios – Testing Strategies against
a Range of Different Futures***



CERA's Scenario Process

INPUTS

Factors that will shape the future



SCENARIOS

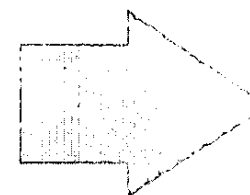
Combine inputs into alternative views of the energy future with signposts for each

3 Alternative Futures



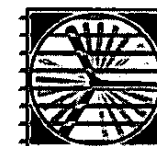
Scenarios

Strategy Links

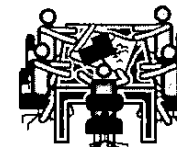


STRATEGY

Apply scenarios to develop and test strategies



Wind-tunneling



Strategy Development



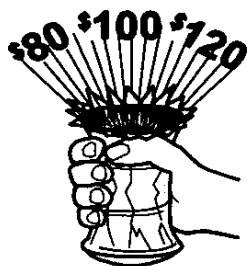
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Source: Cambridge Energy Research Associates.
50714-1

CERA's Global Energy Scenarios are the Backbone of Our Vision of the Future



ASIAN PHOENIX The center of global economic and political gravity shifts to Asia. Strong growth in China and India puts them on a path to eventually challenge the United States for global economic pre-eminence. Piecemeal international efforts to manage carbon emissions.



BREAK POINT Oil supply difficulties limit production growth. Average annual oil prices surpass \$150 per barrel (nominal). Fear of peak oil encourages moves to enhance energy efficiency and accelerate growth of alternative fuels. Oil loses its monopoly on transportation. Strong, coordinated international focus on limiting CO₂ emissions drives carbon prices and research and investment in clean energy

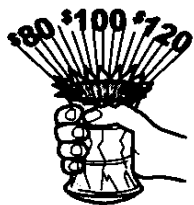


GLOBAL FISSURES Widespread political backlash against free trade and globalization, combined with global trade and political disputes and growing security concerns over ongoing terrorist threats results in lower economic growth and weaker energy demand. Little to no effort to limit carbon emissions.



Source: Cambridge Energy Research Associates.

2008 US Scenarios Policy Drivers



RPS	Tax Incentives	Cap-and-Trade
<input type="checkbox"/> The 29 existing state standards remain in effect but increased compliance flexibility temper demand.	<input type="checkbox"/> Federal ITC and PTC peter out during the lead-up to federal cap-and-trade policy.	<input type="checkbox"/> RGGI continues, followed by WCI and a program in the Midwest. <input type="checkbox"/> A federal program takes effect in 2015. <input type="checkbox"/> Prices stay at \$20-\$35/ton.
<input type="checkbox"/> All existing, proposed and non-binding state goals are met.	<input type="checkbox"/> The PTC and ITC are extended through the start-up of federal cap-and-trade policy and are slowly phased out.	<input type="checkbox"/> A federal program starts up in 2012, requiring a 30% reduction below 2007 levels by 2030 leading to \$100/ton prices by 2020. <input type="checkbox"/> RGGI gets integrated into the federal program.
<input type="checkbox"/> A difficult economic environment saps the momentum behind state programs.	<input type="checkbox"/> The PTC fails to get extended past 2009 and the ITC reverts back to 10%.	<input type="checkbox"/> RGGI continues operating up until 2018 but prices remain at \$2/ton. <input type="checkbox"/> A federal program, as well as additional regional programs stall.



2008 US Scenarios Overview



ASIAN PHOENIX



BREAK POINT



GLOBAL FISSURES

International Outlook	<ul style="list-style-type: none"> <input type="checkbox"/> Trend economic growth. <input type="checkbox"/> Continued growth in world trade. <input type="checkbox"/> India, China, FSU, and Middle East continue development of home markets. 	<ul style="list-style-type: none"> <input type="checkbox"/> Productivity suffers from high commodity prices, reducing long run growth potential. <input type="checkbox"/> Increased reliance on multilateral trading agreements and international solutions to regional conflicts. 	<ul style="list-style-type: none"> <input type="checkbox"/> Economic growth slows as international trade declines. <input type="checkbox"/> NA and European backlash against globalization. <input type="checkbox"/> Focus shifts to national adjustment issues. <input type="checkbox"/> Emergence of resource nationalism.
Technology Outlook	<ul style="list-style-type: none"> <input type="checkbox"/> Technology development dependent on government subsidies and demonstration projects. 	<ul style="list-style-type: none"> <input type="checkbox"/> Rapid pace of technology development requires more public/private initiative and risk sharing. <input type="checkbox"/> Domestic/foreign joint ventures develop. 	<ul style="list-style-type: none"> <input type="checkbox"/> Technology development directed toward promoting energy security within North America.
Regulatory Environment	<ul style="list-style-type: none"> <input type="checkbox"/> Continuing experimentation with alternative regulatory solutions. <input type="checkbox"/> State challenge federal initiatives. 	<ul style="list-style-type: none"> <input type="checkbox"/> Enhanced commitment to competitive solutions at the federal and state levels. <input type="checkbox"/> Move toward multi-state regional compacts. 	<ul style="list-style-type: none"> <input type="checkbox"/> States successfully assert regulatory authority over resource adequacy planning and infrastructure siting issues.
Industry Structure	<ul style="list-style-type: none"> <input type="checkbox"/> Continuation of current hybrid environment with mix of competitive and regulated entities. 	<ul style="list-style-type: none"> <input type="checkbox"/> Increasing reliance on private capital and market-determined returns on gas and power investments. 	<ul style="list-style-type: none"> <input type="checkbox"/> Increasing reliance on traditional vertically-integrated utilities and command and control regulation and policies.



Source: Cambridge Energy Research Associates.

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2008 US Scenarios Overview (continued)



ASIAN PHOENIX



BREAK POINT

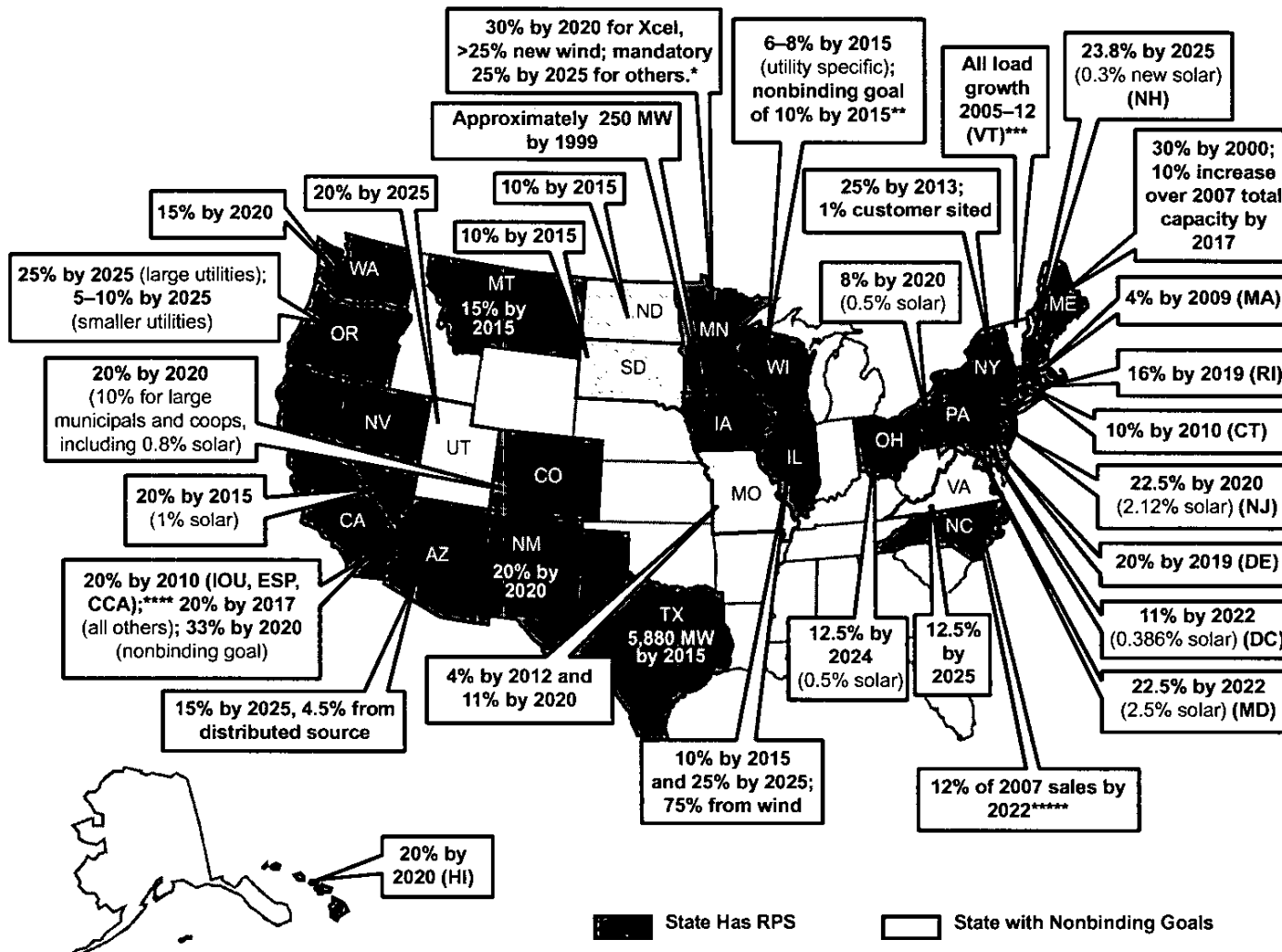


GLOBAL FISSURES

	ASIAN PHOENIX	BREAK POINT	GLOBAL FISSURES
Economic Growth	<ul style="list-style-type: none"> <input type="checkbox"/> Recession of 2008-09 is not severe. <input type="checkbox"/> 2011: return to long-term trend growth. <input type="checkbox"/> Slowing population/labor force growth after 2020 reduces trend growth. 	<ul style="list-style-type: none"> <input type="checkbox"/> High energy prices make recession of 2008-09 worse. <input type="checkbox"/> Productivity growth slows as capital is substituted for energy in production process. 	<ul style="list-style-type: none"> <input type="checkbox"/> Recession delayed to 2009-10 but is severe as world trade shrinks. <input type="checkbox"/> Productivity growth well below historic norms.
Growth in Power Demand	<ul style="list-style-type: none"> <input type="checkbox"/> 1.6% CAGR to 2020. <input type="checkbox"/> Recession slows growth until 2013. <input type="checkbox"/> 1.6% CAGR after 2020 even as population growth slows. 	<ul style="list-style-type: none"> <input type="checkbox"/> 1.1% CAGR to 2020 due to rising real power prices and sharper recession. <input type="checkbox"/> 1.0% CAGR after 2020 as real prices escalate and population growth slows. 	<ul style="list-style-type: none"> <input type="checkbox"/> 1.1% CAGR to 2020. <input type="checkbox"/> 1.4% CAGR after 2020 despite declining population growth rate.
Investment	<ul style="list-style-type: none"> <input type="checkbox"/> Near term drivers: demand growth and tighter reserve margins. <input type="checkbox"/> Long term drivers: continued demand growth, aging plants and environmental programs. 	<ul style="list-style-type: none"> <input type="checkbox"/> Aggressive push for renewables and GHG legislation. <input type="checkbox"/> Early retirement of fossil fuel units and accelerated investment in transmission. <input type="checkbox"/> Investment requirements similar to AP. 	<ul style="list-style-type: none"> <input type="checkbox"/> Need for transmission and generation reduced. <input type="checkbox"/> Lower demand growth and greater reliance on domestic coal and natural gas.
Policy and Regulation	<ul style="list-style-type: none"> <input type="checkbox"/> Rising nominal retail rates. <input type="checkbox"/> Some states end retail choice and reduce renewables targets. <input type="checkbox"/> Federal GHG legislation by 2015. <input type="checkbox"/> Many states move to reassert control over resource adequacy. 	<ul style="list-style-type: none"> <input type="checkbox"/> 2012: Federal GHG legislation begins. <input type="checkbox"/> Aggressive state RPSs. <input type="checkbox"/> Regional transmission planning initiatives. <input type="checkbox"/> FERC asserts federal authority over transmission siting. 	<ul style="list-style-type: none"> <input type="checkbox"/> Increasing emphasis on energy security and independence. <input type="checkbox"/> Emphasis on local reliability. <input type="checkbox"/> Regional climate change initiatives abandoned.
Technology	<ul style="list-style-type: none"> <input type="checkbox"/> Focused in generation, transmission, and distribution (metering). <input type="checkbox"/> Reliance on government subsidies for commercial scale development. 	<ul style="list-style-type: none"> <input type="checkbox"/> Strong push for renewables, GHG abatement, and efficiency accelerate smart grid development. <input type="checkbox"/> Commercialization of CC&S, PHEV, and storage technologies accelerated. 	<ul style="list-style-type: none"> <input type="checkbox"/> Low economic growth pressures government budgets to support new technologies. <input type="checkbox"/> Funding for new initiatives delayed a decade.



State Renewable Portfolio Standards Driving Renewable Investments



Source: Cambridge Energy Research Associates, Database of State Incentives for Renewable Energy (DSIRE).

*Previous Minnesota RPS was a nonbinding goal except for Xcel Energy.

**Vermont's voluntary standard becomes mandatory in 2013 if it is not met by 2012.

***California: IOU = investor-owned utility; ESP = energy service provider; CCA = community-choice aggregator).

****Wisconsin requires all utilities to increase renewables contributions by 6 percent over the 2001-03 average level by 2015 and has a nonbinding goal of 10 percent by 2015.

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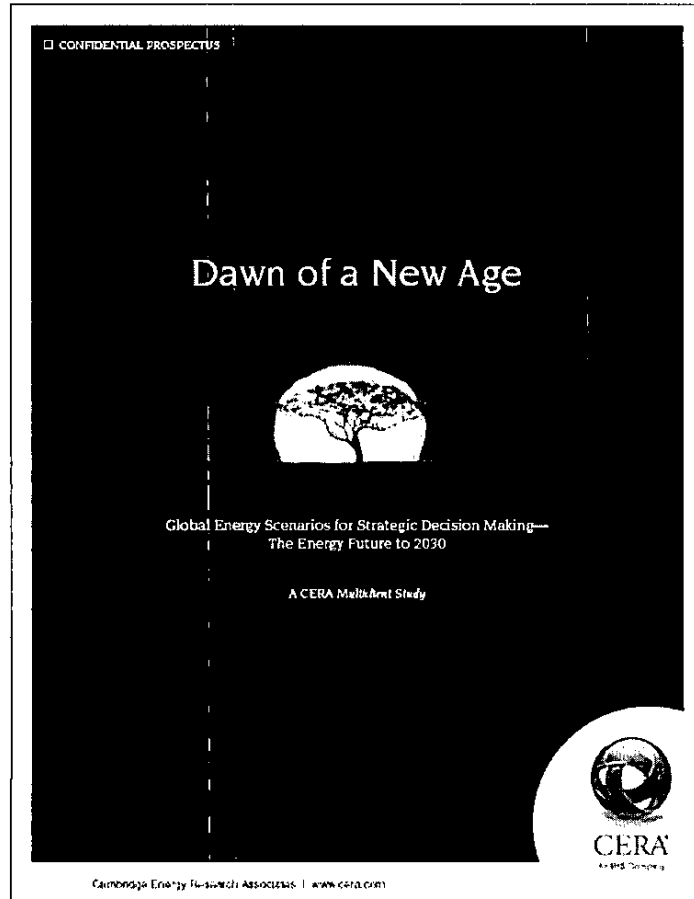


Selected CERA Studies



Global Energy Scenarios

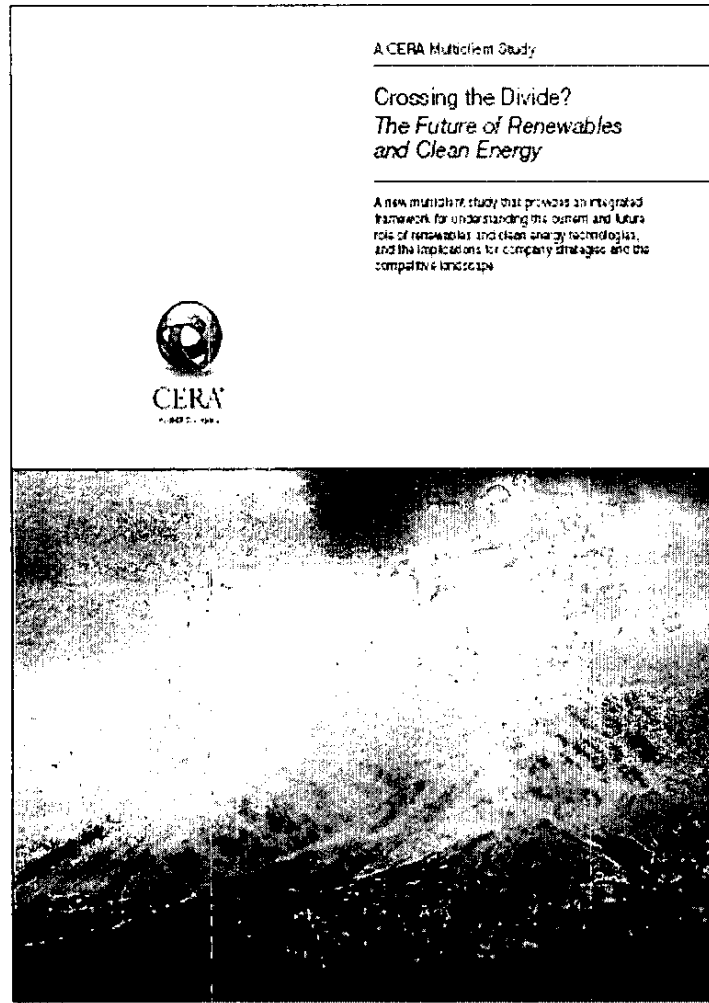
Dawn of a New Age Multiclient Study



CERA's *Dawn of a New Age* study presents three long-term global energy scenarios to assess different paths for global energy supply and demand and to help define key risks and opportunities for a range of energy segments and geographic regions.

Clean Energy Technologies

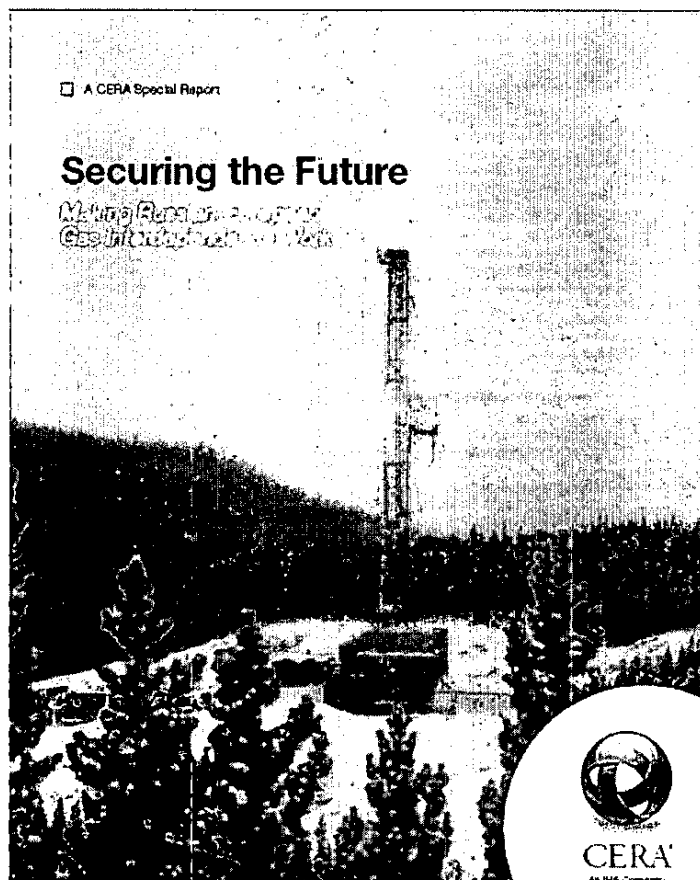
Crossing the Divide Multiclient Study



CERA's *Crossing the Divide* study presents three long-term global energy scenarios to assess the winners and losers among various clean energy technologies and help define key risks and opportunities for a range of energy segments and geographic regions.

Multi Stakeholder Dialogue

Securing the Future Multiclient Study



Cambridge Energy Research Associates | CERA.com

CERA's *Securing the Future* study resulted from an extensive dialogue between multiple stakeholders to understand what was (and was not) achievable in securing the benefits of the gas trade between Europe and Russia. It identified the requirements to ensure mutual benefits and identified the risks to all parties from failing to nurture a trade that has benefited all parties for several decades.

***CERA is part of the IHS Group
The leading provider of insight and critical
information in four key domains***



About CERA

- Leading international energy research and advisory firm
- Founded in 1983
- An IHS Company
- Global presence with offices in 14 countries.
- Staff of over 200 professionals including leading energy market, industry, and geopolitical experts covering all major sectors on a regional and global basis
- Extensive network of distinguished Senior Associates
- Diverse clientele of senior executives at leading energy industry corporations—an exceptional community of strategy and planning executives—and leading policymakers globally.



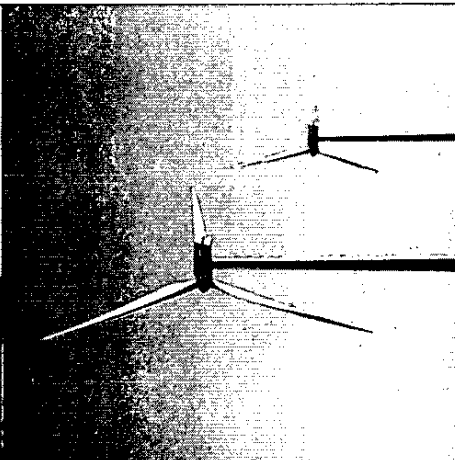
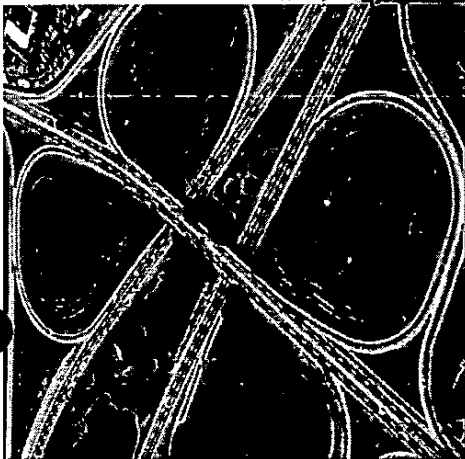
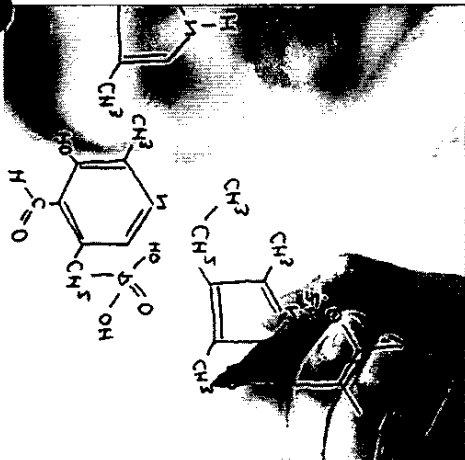
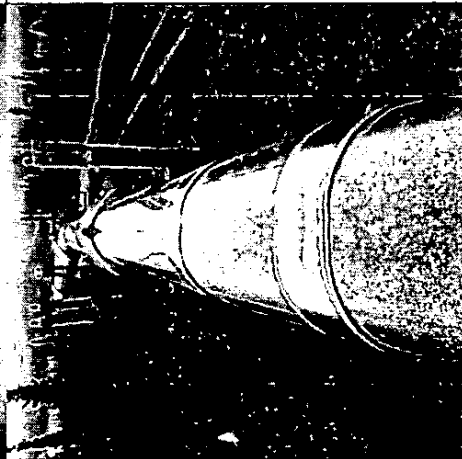
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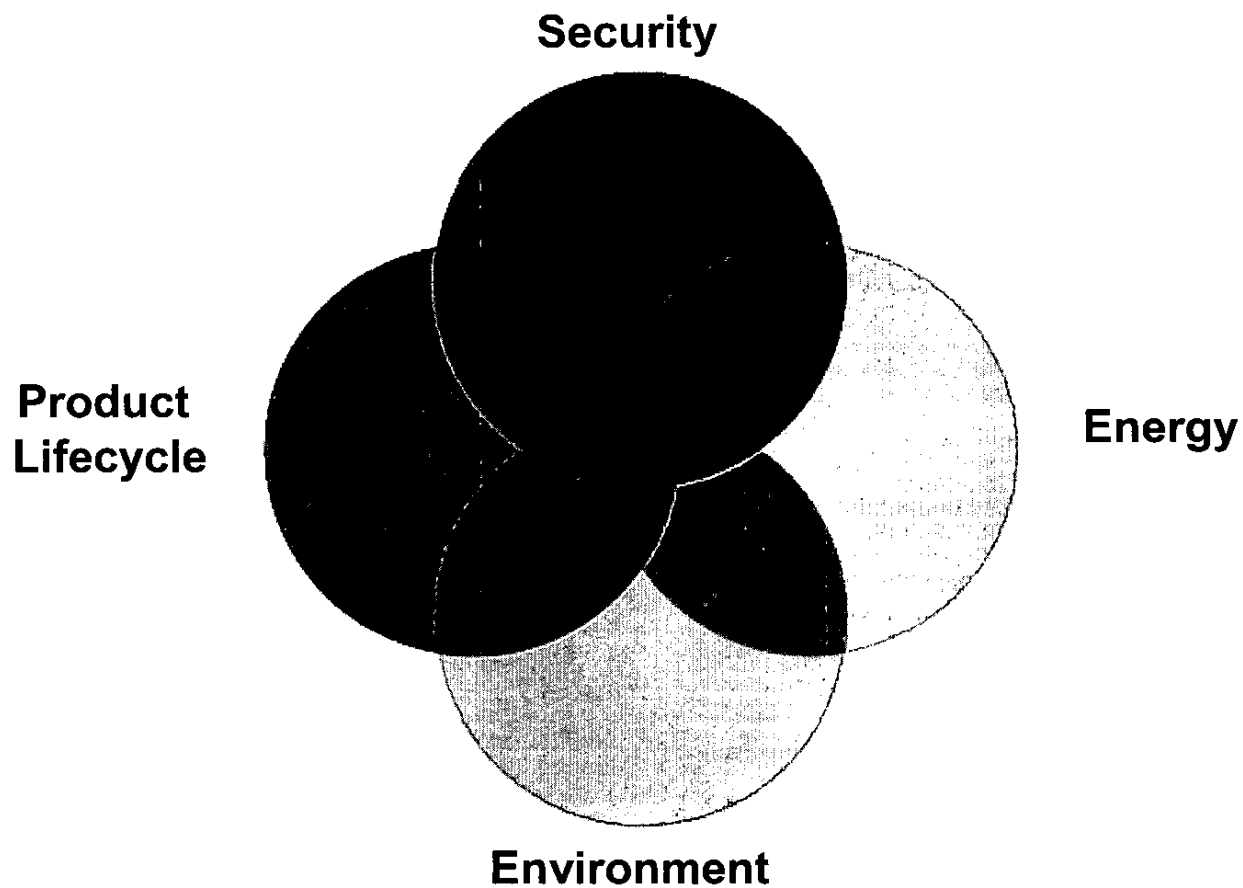
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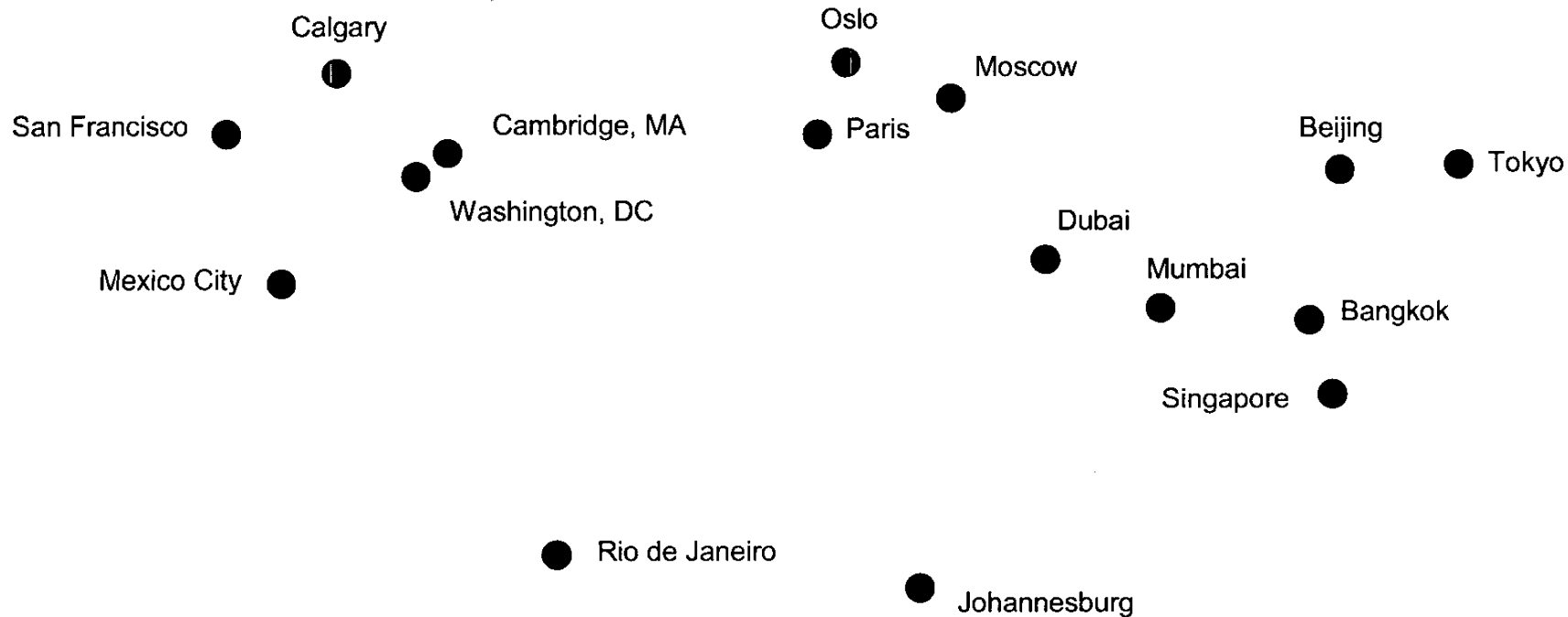


**If you have any questions about this presentation or
CERA in general, please feel free to contact**

Jim Meitl

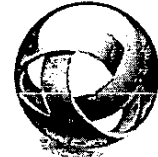
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Daniel Yergin

Chairman

Daniel Yergin is a highly respected authority on international politics and economics and on energy. Dr. Yergin is a Pulitzer Prize winner and recipient of the United States Energy Award for "lifelong achievements in energy and the promotion of international understanding." He is both a world-recognized author and a business leader, as Chairman of Cambridge Energy Research Associates (CERA), one of the world's leading consulting and research firms in its field.

Dr. Yergin received the Pulitzer Prize for his work *The Prize: The Epic Quest for Oil, Money and Power*, which became a number one best seller and was made into an eight-hour PBS/BBC series seen by 20 million people in the United States. The book has been translated into 12 languages.

Dr. Yergin plays a leadership role in the global energy industry. He chaired the US Department of Energy's Task Force on Strategic Energy Research and Development. He is a member of the Board of the United States Energy Association, and a member of the National Petroleum Council, and this year became the only foreign member of the Russian Academy of Oil and Gas.

He also serves as CNBC's Global Energy Expert.

Of his most recent book, *Commanding Heights: The Battle for the World Economy*, the Wall Street Journal said, "No one could ask for a better account of the world's political and economic destiny since World War II." It has been translated into 13 languages. (Dr. Yergin led the team that turned it into a six-hour PBS/BBC documentary—the major PBS television series on globalization. The series received three Emmy nominations, a CINE Golden Eagle award, and the New York Festival's Gold World Medal for best documentary.)

Dr. Yergin has been named one of the 500 most influential people in the United States in the field of foreign policy by the World Affairs Councils of America. He is a Trustee of the Brookings Institution, a Director of the US-Russia Business Council, and on the Advisory Board of the International Institute for Economics.

Dr. Yergin received his BA from Yale University and his PhD from Cambridge University, where he was a Marshall Scholar.

In November 2005 he was awarded the Medal of the President of the Republic of Italy for combining "an understanding of the dynamics of the market with a broad view of the forces of geopolitics as he seeks to point the way to the positive outcomes for the world community."



David Hobbs

Head of Research

David Hobbs, CERA Head of Research, is an expert in energy industry structure and strategies. He previously led CERA's research activities in oil markets and strategies, liquefied natural gas, technology, and environmental strategies. Mr. Hobbs is an author of the major CERA studies *In Search of Reasonable Certainty: Oil and Gas Reserves Disclosures*, a comprehensive analysis of the problem of assessing reserves, and *Modernizing Oil and Gas Disclosures*. He is also a principal author of a major CERA assessment of the world economic crisis, "*Recession Shock: The Impact of the Economic and Financial Crisis on the Oil Market*", and of the CERA Multiclient Study *Harnessing the Storm—Investment Challenges and the Future of the Oil Value Chain*, the author of the CERA Private Report *Daring to Be Disciplined: Continuous Portfolio Improvement*, and a project advisor to the CERA Multiclient Study *Crossing the Divide: The Future of Clean Energy*. Prior to joining CERA Mr. Hobbs had two decades of experience in the international exploration and production business. He has directed projects in Asia, South America, North America, and the North Sea. He has led major international investment and asset commercialization operations Based in Cambridge, Massachusetts, Mr. Hobbs holds a degree from Imperial College.



Michael Stoppard

Managing Director

Michael Stoppard, CERA Managing Director, Global Gas, is a member of CERA's Senior Leadership Team. He is a specialist in the international gas business and is responsible for the development and coordination of CERA's global and interregional analysis of LNG and its communication to clients. Mr. Stoppard led CERA's entry into LNG as Project Manager for the pioneering study *The New Wave: Global LNG in the 21st Century*. Earlier he was a core team member of CERA's European Gas group, developing CERA's European natural gas and power scenarios. Mr. Stoppard has also worked on numerous tailored consulting assignments for clients, including major gas producers, European utilities, power developers, and financial investors. He has extensive experience in providing strategic analysis and recommendations at the board and senior executive level. Before joining CERA Mr. Stoppard was a research fellow at the Oxford Institute for Energy Studies, where he published a variety of studies of the gas industry including his book *A New Order for Gas in Europe?* He also worked on a study for the World Bank on the environmental benefits of natural gas for developing countries. In addition, Mr. Stoppard served as a Parliamentary Special Advisor on energy regulation for the House of Commons Trade and Industry Committee in the United Kingdom. He is the author of numerous CERA reports, including analyses of business models, gas and power

convergence in Europe, LNG shipping and trading, and gas distribution. He was coauthor with Daniel Yergin of "The Next Prize" published in *Foreign Affairs*. Mr. Stoppard holds an honors degree from the University of York.



James Burkhard

Managing Director

James Burkhard, Managing Director of CERA's Global Oil Group, leads the team of CERA experts that analyze and assess upstream and downstream business conditions and strategies. His team also develops and maintains detailed short- and long-term outlooks for global crude oil and refined products markets. Mr. Burkhard's expertise covers geopolitics, world economic conditions, and global oil demand and supply trends. He works closely with CERA clients in assessing how market, economic, and political risks could change the competitive environment. He also works with companies to assess business opportunities in both the upstream and downstream sectors.

Mr. Burkhard was the project director of *Dawn of a New Age: Global Energy Scenarios for Strategic Decision Making—The Energy Future to 2030*, the most comprehensive study that CERA has ever undertaken, encompassing the oil, gas, and electricity sectors. He was also the director of the CERA Multiclient Study *Potential versus Reality: West African Oil & Gas to 2020*. He is also the coauthor of CERA's respected *World Oil Watch*, which analyzes short- to medium-term developments in the oil market. In addition to leading CERA's oil research, Mr. Burkhard served on the US National Petroleum Council (NPC) committee that provided recommendations on US oil and gas policy to the US Secretary of Energy. He led the team that developed demand-oriented recommendations that were published in the 2007 NPC report *Facing the Hard Truths About Energy*. Before joining CERA, Mr. Burkhard directed infrastructure projects in West Africa, supported research on the interaction between government policy and capital investment, and was a field operator for Rod Electric. Mr. Burkhard holds a BA from Hamline University and an MS from the School of Foreign Service at Georgetown University.



Lawrence J. Makovich

Vice President and Senior Advisor

Lawrence J. Makovich, CERA Vice President and Senior Advisor for Global Power, is a highly respected expert on the electric power industry. He directs CERA research efforts in the power sector as part of CERA's Office of the Chairman. He is an authority on electricity markets, regulation, economics, and strategy. His current research focuses

on electric power market structures, demand and supply fundamentals, wholesale and retail power markets, emerging technologies, and asset valuations and strategies.

Dr. Makovich is currently advising or has recently advised several large utilities in major strategic engagements. He has testified numerous times before the US Congress on electric power policy. He has advised the government of China on electric power deregulation and transmission in competitive markets, and the Brazilian Congress invited him to testify on power liberalization. He examined the impact of deregulation on residential power prices and the development of resource adequacy mechanisms in the CERA Multiclient Study *Beyond the Crossroads: The Future Direction of Power Industry Restructuring*. He was also a project director for the CERA Multiclient Study *Crossing the Divide: The Future of Clean Energy*. Among Dr. Makovich's other significant CERA studies are examinations of the California power crisis in *Crisis by Design: California's Electric Power Crunch* and *Beyond California's Power Crisis: Impact, Solutions, and Lessons*.

Dr. Makovich has been a lecturer on managerial economics at Northeastern University's Graduate School of Business. He holds a BA from Boston College, an MA from the University of Chicago, and a PhD from the University of Massachusetts.

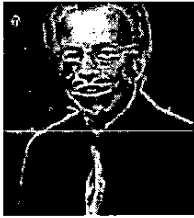


Robert LaCount

Senior Director

Robert LaCount, CERA Senior Director and Head of CERA's Climate Change and Clean Energy Group, is an authority on environmental policy and strategy, climate change legislation and regulations, and emissions trading. Mr. LaCount recently managed the environmental analysis for the CERA Multiclient Studies *Crossing the Divide: The Future of Clean Energy* and *Dawn of a New Age: Global Energy Scenarios for Strategic Decision Making—The Energy Future to 2030*. He was also the project director for the CERA Special Report *Design Issues for Market-based Greenhouse Gas Reduction Strategies* and the CERA Special Study *Clearing the Air: Scenarios for the Future of US Emissions Markets*. Mr. LaCount joined CERA from PG&E National Energy Group where he was Director of Environmental Policy and Strategy. He has managed the design and implementation of numerous environmental regulations and emissions trading programs in previous positions with the US Environmental Protection Agency and the Maryland Department of the Environment.

Mr. LaCount holds a BA from Wittenberg University, an MS from the University of Pennsylvania and the French Petroleum Institute, and an MBA from the University of Maryland.



Paul Markwell

Senior Director

Paul Markwell, CERA Senior Director, is an expert in upstream oil and gas and strategy development, and leads the application of CERA's Global Oil team research to client-specific studies. He works closely with a range of clients and CERA's research leaders to identify clients' strategic needs and directs the delivery of client engagements. He focuses in particular on upstream oil and gas-related strategy advice for international oil companies and service companies, and integrated energy policy development work for governments. He has worked with senior energy policymakers in the Middle East and North Africa, and managed CERA's contribution to a National Economic Strategy project for the Libyan government in 2005.

Prior to joining CERA Mr. Markwell worked for over two decades in the upstream oil and gas industry and subsequent consulting related roles. He held posts at McKinsey and Company as an upstream expert consultant and latterly as European Petroleum Practice Manager, supporting the delivery of firm-wide knowledge and providing expert advice to oil and gas consulting teams. Previously Mr. Markwell spent 18 years in international exploration and production companies, most recently as General Manager for British-Borneo's business in Pakistan, responsible for overseeing the commercialization and development of the company's gas assets. He also worked in Business Development roles in Hardy Oil and Gas, and Shell UK, and led numerous oil and gas acquisition and divestment projects. Mr. Markwell first joined the industry as a Petroleum Engineer with Shell International and worked in a number of operational and team leader positions in the Netherlands, Thailand, and the United Kingdom.

Mr. Markwell holds a BSc with honors from Imperial College, London, and an MBA from Henley Management College. He is based in London.



Gerard McCloskey

Vice President and Global Advisor, Coal

Gerard McCloskey, CERA Vice President and Global Advisor, Coal, is the Chairman and Founder of The McCloskey Group, which specializes in news, data and analysis on the international coal markets. The McCloskey Group is now part of CERA, an IHS company. Mr. McCloskey is considered a world authority on coal and has advised numerous banks, power, steel, and coal companies globally as well as addressing European and British parliamentary assemblies and specialist committees. The group has

extensive publication and consultancy divisions and organizes 14 conferences throughout the world. The McCloskey Group publishes five regular coal newsletters, including the industry leader *McCloskey Coal Report*. McCloskey Coal Information Services Ltd., established in 1987, produced the flagship *International Coal Report*, working with the Financial Times until December 2000. Previously Mr. McCloskey was selected by the Financial Times to run its series of newsletters. Mr. McCloskey was also press advisor in the UK Department of Energy to a series of ministers in the Callaghan and Thatcher governments. He also worked as a journalist. Mr. McCloskey studied economics at the London School of Economics.

Michael N. Marinovic

CERA Vice President

Michael N. Marinovic, CERA Vice President, specializes in strategy development and portfolio optimization in the oil and gas industry. He has advised companies at all stages of growth and in a wide variety of economic and asset environments. His expertise includes regional and asset strategy development, including growth investments and asset divestments. He has led strategy efforts for business units and assets around the North Sea, the deepwater Gulf of Mexico, the Rocky Mountains, South America's Southern Cone, West Africa and Southeast Asia. He has worked extensively with portfolios of mature oil and gas assets, and has lead portfolio strategy efforts in the transportation and banking industries. Mr. Marinovic joined CERA, an IHS company, when IHS acquired Strategic Decisions Group's (SDG's) Oil and Gas Practice. Before joining SDG, he held both technical and operating positions with Exxon Chemical Company. Mr. Marinovic holds a BS and an ME from Cornell University and an MBA from the Stanford University Graduate School of Business.

Alaska State Energy Policy

Introduction

Alaskans utilize energy to light and heat their homes and businesses and power their cars, trucks, trains, four wheelers, skiffs, fishing boats, and snow machines. Industry develops, refines and transports oil and gas, mining, fishing and other natural resources products. Alaska's energy policies need to be as broad as our use and production of energy.

The average Alaska household energy budget is divided with roughly 40 % spent on space heating, 35 % for electricity, and 25 % for transportation; this varies significantly depending on the location. Historically, Alaska's energy policy and investments have been disproportionately focused on electricity generation and oil and gas development, transportation and refining. It is important that Alaska's energy policy be directed at the full range of energy uses and sources.

Alaska state agencies who carry out policy related to energy would greatly benefit from a clear and sensible energy policy. Alaska's energy policy should recognize the difference between energy costs and energy prices. Alaska's energy policy should also recognize that trade-offs exist between a policy's efficiency and its fairness (i.e. a policy that maximizes savings may not be fair and a fair policy may not maximize savings).

Current Energy Policy in Alaska

The following three goals appear to be Alaska's de facto energy policy since the discovery and development of oil and gas in Prudhoe Bay in the 1970s. This energy policy is separated into three parts reflecting three distinct energy policy goals:

- 1) Alaska's primary energy goal is to reduce the total cost of energy by decreasing the cost of energy supply and increasing end use efficiency without sacrificing the quality of life of any Alaskans. The cost of energy supply could be decreased by supplying needed capital, through grants and loans and management to renewable projects.
- 2) Alaska's secondary energy goal is to redistribute resources, in the form of price subsidies and payments to consumers, to equalize the burden of energy costs for all Alaskans in a manner that preserves the effect of natural price signals.
- 3) Alaska's tertiary energy goal is to ensure that energy prices are low enough in some communities to ensure that high energy prices do not cause the destruction or irreversibly damage of rural lifestyles and Alaska Native cultures. The state is willing to artificially (and possibly unsustainably) manipulate energy prices to achieve this end.

Recommendations for Future Energy Policy in Alaska

General Recommendations:

Recognize that oil prices are volatile; establish a long-term oil price forecast on which to evaluate long-term capital investments in energy project to displace fossil fuels.

Tie crude oil and natural gas price assumptions to Alaska Department of Revenue or the U.S. Energy Information Administration long-term oil price forecasts to evaluation projects. The state should determine a reasonable price for carbon emissions to incorporate within the price forecast until a federal price is established

Recognize the importance of discount rates in the evaluation of energy policies.

The discount rate has a significant impact on the net present value and the benefit cost ratio of energy projects. The discount rate reflects not only the opportunity cost of an investment but also how much the investor values the future. The discount rate should not be considered just a value used in comparing competing projects, but instead it should be considered a primary part of state energy policy.

Support establishing national and global policies for capping and reducing carbon emissions.

This will provide a more efficient outcome than a defensive posture toward greenhouse gas legislation.

Develop a carbon emissions reduction plan.

Developing a plan and state goals will provide investment certainty and stimulate markets for renewable energy projects.

Retain a share of the renewable energy grant funding at the Alaska Energy Authority for development of viable energy projects.

The Alaska Energy Authority has experience in managing and developing renewable energy projects. The agency is able to identify renewable energy projects with high rates of return for which there are no grant applications. Retaining a portion of the state's renewable energy funding would allow AEA to identify, develop and manage good projects.

Provide a mechanism for funding applied energy research within the state.

At this time, there is no state funding allocated to energy research and development (R&D). If Alaska hopes to successfully develop a suite of alternative and renewable projects in the future, it will be necessary to address some specific research questions that are directly relevant to ensuring the success of those projects. By reducing failures, prudent investment in R&D can have an excellent return on investment.

Provide a mechanism for developing and maintaining baseline data needed for conducting applied energy research.

Currently there is insufficient data on community energy and fuel use to accurately evaluate the renewable energy and other capital projects.

Recommendations related to electric energy sector:

Development of an Alaska Renewable Energy Goal

Governor Palin recently announced a goal to meet 50 % of Alaska electric energy needs with renewable energy technologies by 2025. This is currently the most aggressive goal in the country; however, Alaska currently meets 25 % of electrical energy needs with renewable energy technologies. Given Alaska's abundant resources, reaching 50 % is well within reach. Additional components of this goal could include:

- 1) Meet the goal of 50 % renewable energy technologies while investing in technologies and projects at the lowest cost to ratepayers and the Alaska state budget energy.
- 2) Give priority to integrated renewable energy projects that displace both electric generation and space heating and have the lowest cost in relation to the cost of the non-renewable energy that they displace.
- 3) In urban Alaska, providing low interest loans rather than grants for energy projects may provide a "market test" for energy supply alternatives while grants may be necessary in rural communities.

Recommended adjustments to the Alaska Renewable Energy Fund

The Alaska Energy Authority should retain a share of the allocated Renewable Energy Grant funding. AEA has experience in managing and developing of renewable energy projects, and the agency is capable of identifying renewable energy projects with high rates of return that may fail to submit application for grant funding.

Develop policy that positions Alaska as the world's leading exporter of small-scale, off-grid integrated energy systems and the know-how needed to adapt them to local conditions.

About two billion people live off the grid or have no electricity at all. Alaska is currently importing the equipment and some of the technical know-how for renewable energy projects under development. Alaska can be a de facto world leader and test bed for small-scale, off-the-grid energy systems while solving our energy issues one village at a time. This will require establishing some funding mechanism for research and development and demonstration projects.

Set a conservation target for communities to offset 30 % of incremental resource needs through conservation by 2020.

This goal would reduce the growth in electricity demand so that by 2020 500 GWh per year of currently forecast Railbelt needs will be met through demand reduction measures. This may include energy efficiency, conservation, and other demand side solutions.

Encourage utilities to pursue cost effective and competitive demand side management opportunities.

Energy efficiency is a critical piece of utility resource plans. Through demand side management (DSM) technologies, combined with price incentives, energy utilities play a

vital role in promoting energy conservation with investments in energy efficient technologies and building designs. Reducing electric utility peak loads energy costs can be reduced energy by avoiding the construction of new capacity or operation of inefficient peaking plants.

Explore new utility rate structures that encourage energy efficiency and conservation.

A key demand side management tool is pricing structures to either discourage consumption overall, or shift demand to less costly periods. Smart meters and peak load pricing for electricity and natural gas have been shown to reduce consumption and shift demand to lower cost periods. In addition to electricity and space heat, establish solid waste utility rate structures that reward recycling and reduction of garbage to landfills.

Establish a competitive request for proposals for the use of sawmill residues, logging debris and beetle-killed timber for space heating and electricity generation to help mitigate impacts from bark beetle infestation.

The spruce bark beetle (*Dendroctonus rufipennis*) outbreak in Southcentral Alaska has affected 2 to 3 million acres in the past 10 years. In heavily affected stands, often all spruce trees greater than 10 cm are killed.¹ The area affected by tree death is one of the largest ever documented from an insect outbreak in North America.² Using this biomass for energy will reduce fire danger while restoring damaged forests and lowering energy costs.

Recommendations related to space heating:

Expand Energy Efficiency Standards for residential housing by 2010.

Expand the Alaska Housing Finance Corporation (AHFC) Building Energy Efficiency Standard (BEES) to all Alaska residential housing.

Implement Energy Efficiency Standards for commercial buildings by 2012.

Expand the Alaska Housing Finance Corporation (AHFC) Building Energy Efficiency Standard (BEES) to include commercial buildings by developing appropriate measures.

Implement an Energy Efficiency Labeling Program for buildings.

Energy performance labeling supports increased energy efficiency by making the efficiency of buildings observable, in much the same way that the Energy Star labels provide information for consumers on appliance energy use. Labeling also supports other policies and programs, such as energy-efficient mortgages, promotion of energy efficiency by realtors and property inspectors, and incentives to promote energy efficiency upgrades of houses and buildings. This program could use the AHFC AKWarm Energy Star rating system for new construction as well as the Weatherization program to rate retrofits.

¹ Juday, Glenn P., Spruce Beetles, Budworms, and Climate Warming, Department of Forest Sciences, University of Alaska Fairbanks, no date. http://www.cgc.uaf.edu/Newsletter/gg6_1/beetles.html

² Werner, R.A., and Holsten, E.H. 1983. Mortality of white spruce during a spruce beetle outbreak on the Kenai Peninsula in Alaska. *Canadian Journal of Forest Research* 13(1):96-101.

Require new state public sector buildings to integrate environmental design to achieve the highest standards for greenhouse gas emission reductions, water conservation and other building performance measures.

Buildings have many environmental impacts, including energy demand, water consumption, waste water production, the embodied energy of building materials, solid waste production, and in some cases, disposal of toxic materials.

Continue to fund the home weatherization programs through the Alaska Housing Finance Corporation.

These programs are well structured to address the needs of homeowners throughout Alaska. Research indicates that the programs reduce energy use by 25 %. The program also attempts to train energy raters and weatherization crews living in the communities and regions where the work is occurring thus fostering local work skills and employment.

Fully fund the Low Income Energy Assistance Program (LIHEAP).

This program assists households with high energy costs when oil prices increase while maintaining market prices signals to encourage efficient use of energy. State revenues also increase when oil prices increase so the funding is more readily available to fund this “counter cyclical” program. The program has an administrative structure in place to readily respond to pressures on household budgets of rising energy prices and is available for all regions of Alaska.

Policy recommendations related to industrial energy use

Develop an Industrial Energy Efficiency Program for Alaska to address specific challenges faced by Alaska’s industrial sector.

Establish an Industrial Energy Efficiency Program for Alaska to address challenges and issues faced by the industrial sector. The program will encourage industry driven investments in energy efficient technologies and processes; reduce emissions and greenhouse gases; promote self generation of power; and reduce funding barriers that prohibit energy efficiency in the industrial sector. Some specific strategies include developing a results-based pilot program with industry to improve energy efficiency and reduce overall power consumption and promote the generation of renewable energy within the industrial sector.

Eliminate routine flaring at oil and gas producing wells and production facilities by 2019 with an interim goal to reduce flaring by 50 percent by 2014.

Reducing flaring is an issue for many jurisdictions and the World Bank is leading a Global Gas Flaring Reduction Partnership. Routine associated gas flaring is considered gas that meets an economic threshold for conservation. Operators will be required to perform an economic analysis of all sources of continuous solution gas flaring and subsequently tie in any gas that shows a net present value greater than zero.

Explore opportunities and new technologies to develop underground disposal of carbon dioxide (sequestration or carbon capture and storage).

Geological carbon sequestration involves disposing of carbon dioxide safely and permanently in carefully selected underground locations. There are opportunities to

dispose of carbon dioxide into depleted gas reservoirs or specific formations with saline water, or to use the carbon dioxide to enhance oil recovery.

Establish policies and measures to reduce industrial greenhouse gas emissions.

Alaska industries with the highest greenhouse gas emission estimates are those engaged in the energy production and energy delivery business accounting for approximately 36 % of greenhouse gas air emissions.

Policy recommendations related to transportation

Support the development of community transit systems and plans to provide alternatives to private passenger vehicles for transportation.

On-road vehicles account for approximately 18 % of Alaska transportation greenhouse gas emissions and a similar proportion of household energy budgets. Community transportation systems provide accessibility to underserved members of the public including senior citizens, low income workers, the physically handicapped and students and facilitate their ability to get to jobs, school, medical facilities, and purchasing food, clothing and other essentials. In Anchorage in 2008, the People Mover transported over 4.2 million riders an average of 4.52 miles per rider displacing approximately 1 million gallons of gasoline and 20 million pounds of CO₂ (one gallon of gasoline creates 20 pounds of CO₂).³

Enhance transportation planning and decision-making criteria by adding CO₂ emissions as criteria in transportation decisions.

By adopting criteria that estimates a project's CO₂ emissions for regional and statewide transportation plans and state transportation improvement program projects (STIP), the public and decision makers can be informed on what projects' CO₂ emissions will be and can make decisions accordingly.

Make transportation investments where existing or planned development will encourage public transportation use, walking, and bicycling.

Use the statewide transportation and STIP criteria to support greenhouse gas (GHG) reducing programs and projects. Give greater emphasis to Plan and TIP criteria and projects that support sustainable land use and transit-oriented development; that promote transit, ridesharing, and travel demand management coordination; and that include bicycle and pedestrian improvements that will generate significant use of these modes.

Remove from law the limits on the percentage of Alaska Department of Transportation's State Transportation Improvement Program (STIP) that can be spent on enhancements.

Also remove any limits on the ability of communities to improve pedestrian, bicycle and trail projects and safety programs.

³ Anchorage People Mover rider ship statistics provided by Alton R. Staff, Planning Manager, Anchorage Public Transportation Department, February 24, 2009.

Encourage more compact communities and land use policies to reduce energy use from the dependence on single occupancy vehicles and reduce the cost of transportation to Alaska families by giving priority to projects in areas identified in local and regional plans as being suitable for concentrated development and/or redevelopment, support initiatives that increase sustainability.

According to John Horsley, Executive Director, American Association of State Highway Transportation Officials (AASHTO), one third of transportation's contribution to emission reductions will be shaped by transportation reauthorization investments, policies and improved fuel efficiency standards. The other two thirds will come from federal, state, and local energy policies, local land use policies, the effect of higher fuel prices, and new technologies.⁴

Support the acquisition of clean and fuel-efficient vehicles for public fleets.

State and regional agencies and urban municipalities should buy more efficient cars and trucks and increase the use of lower-carbon fuels. By doing this, agencies and municipalities will assemble a cleaner fleet and save money on energy.

Support legislation that encourages the expanded use of electric cars.

Electric cars have the potential to reduce energy costs in Alaska communities with excess electricity from renewable sources. These include small, Southeast Alaska communities off the highway system and remote communities developing wind generation facilities. Electric cars, and potentially electric four wheelers, are well suited for off-highway use and are a natural fit for these communities.

Support initiatives to eliminate unnecessary idling.

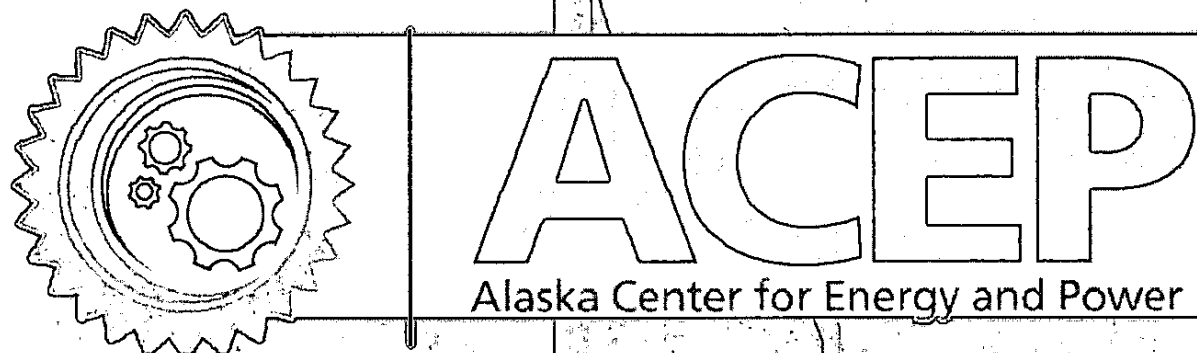
Consider developing an anti-idling regulation that prohibits idling the engine of any motor vehicle while the vehicle is stopped in excess of five minutes (with exceptions for activities such as maintenance and operating equipment such as delivery lifts). With technology that is now available, buses can be automatically switched off if left idling for over five minutes.

Consider environmental issues during transportation project selection.

In particular, air quality and the reduction of pollutants (CO, NO_x, VOCs, particulates, and CO₂), the protection of water resources (soil and water contamination, stormwater management, and wetlands impacts), open space, and fish, wildlife and ecosystem preservation; and value those projects that reduce negative impacts.

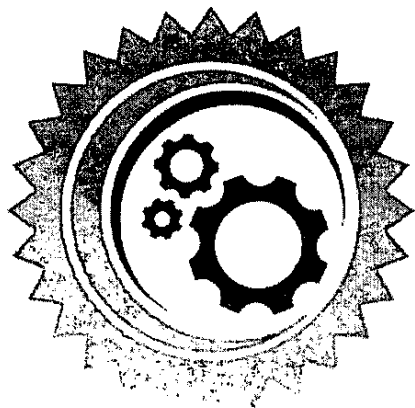
⁴ Horsley, John, Executive Director, American Association of State Highway Transportation Officials (AASHTO), Reauthorization and Climate Change, presentation at the Transportation Research Board Annual Meeting, January 2008.

Developing Energy Policy: A Balanced Approach



Gwen Holdmann, Director
Alaska Center for Energy and Power

Joint Senate-House Energy Committee Meeting
Juneau, Alaska
February 26th, 2009



ACEP

Alaska Center for Energy and Power

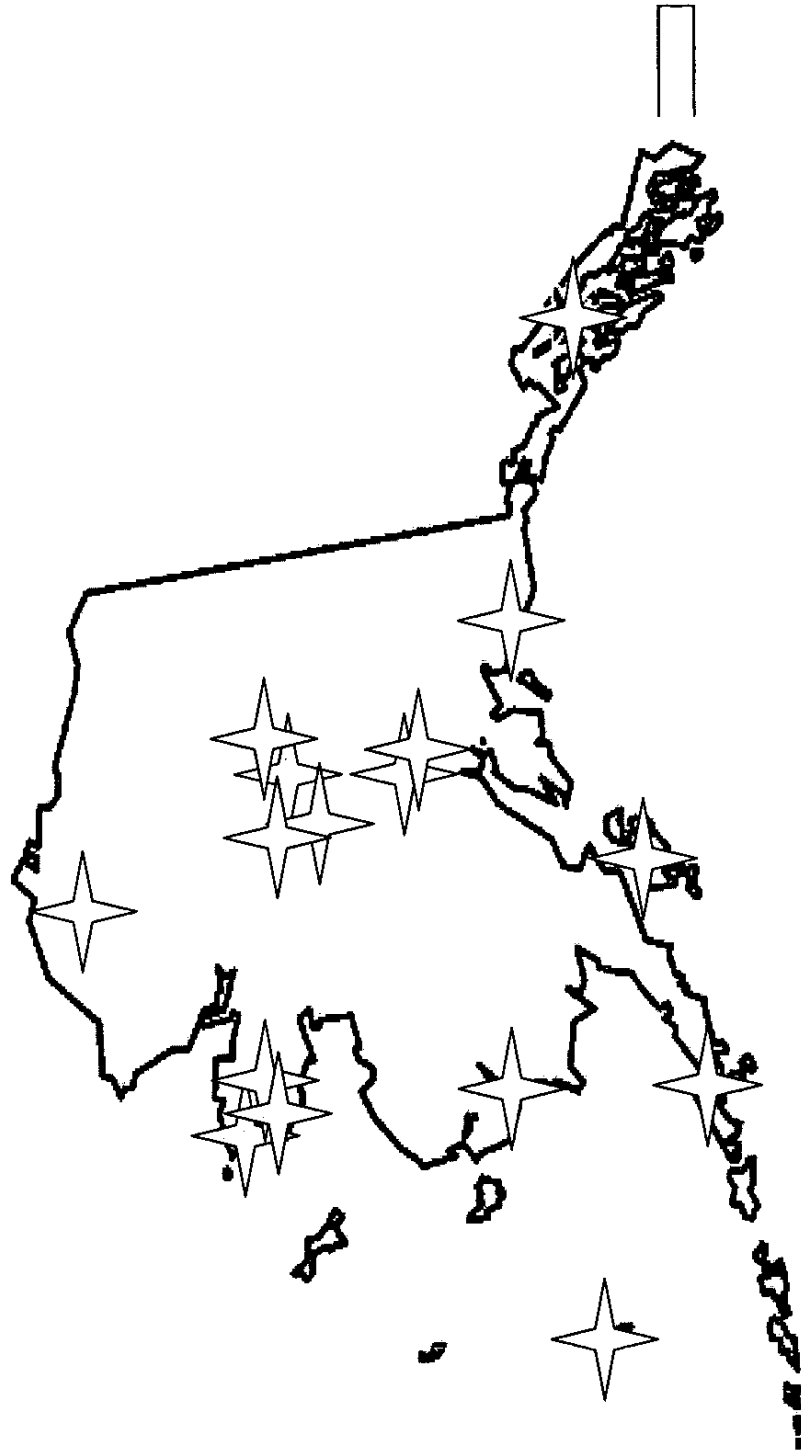
ACEP RESEARCH MISSION: To meet state and local need for applied energy research by working towards developing, refining, demonstrating, and ultimately helping commercialize marketable technologies that provide practical solutions to real-world problems.



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ACEP Current Projects



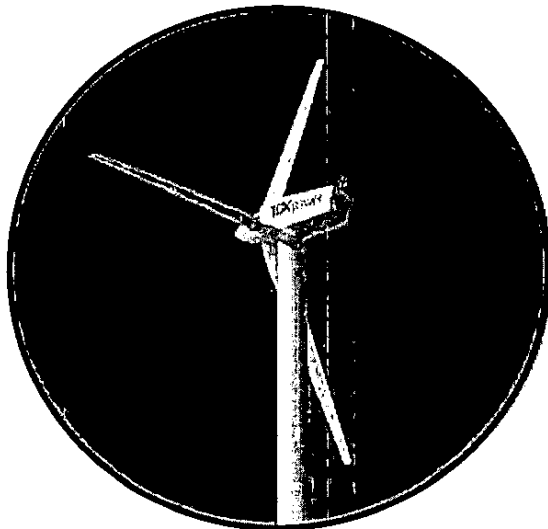
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ACEP Projects

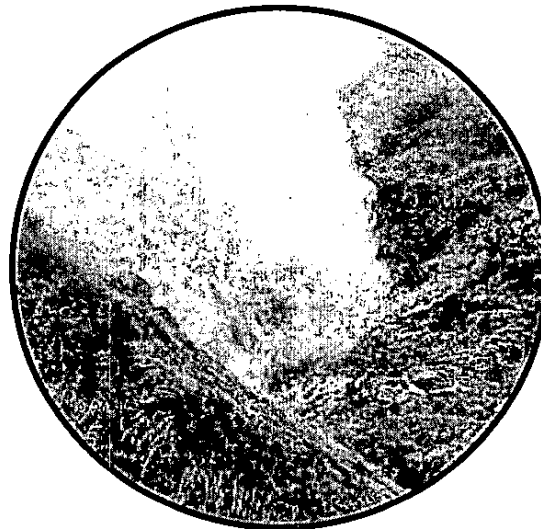
- Waste heat capture (INE)
- Energy storage (INE, working with SNL)
- Geothermal (GI, INE, ISER)
- Tidal and In-stream hydro (SFOS, INE, UAA)
- Wind/diesel (working with NREL and AEA)
- Climate change impacts on hydro projects (GI, IARC, INE)
- Hydrogen Fuels (INE, ISER)
- Biogenic methane as an energy source (IARC, INE)
- Short-rotation woody biomass crops (AFES)
- Education and outreach (Coop. Ext)



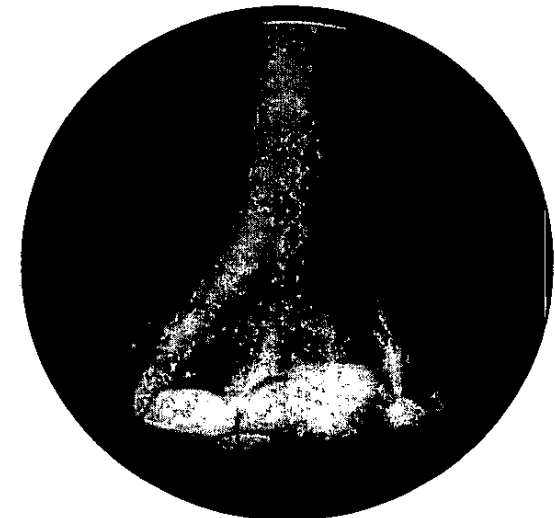
ACEP Focus Areas



**Community
Energy Solutions**



**Powering the
Economy**



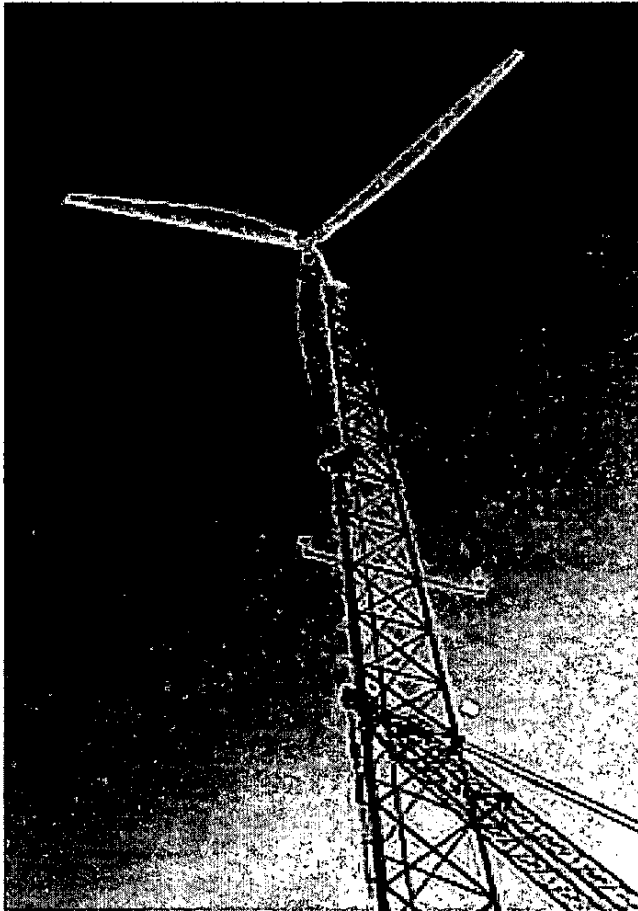
**The EnergyField
of the Future**



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Alaska Center for Energy and Power



Community Energy Solutions



Diesel Efficiency
Energy Economics
Energy Storage
Geothermal
Biomass
Coal Bed Methane
Fuels
In-River Hydro
Tidal Energy
Wind Power



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Powering the Economy



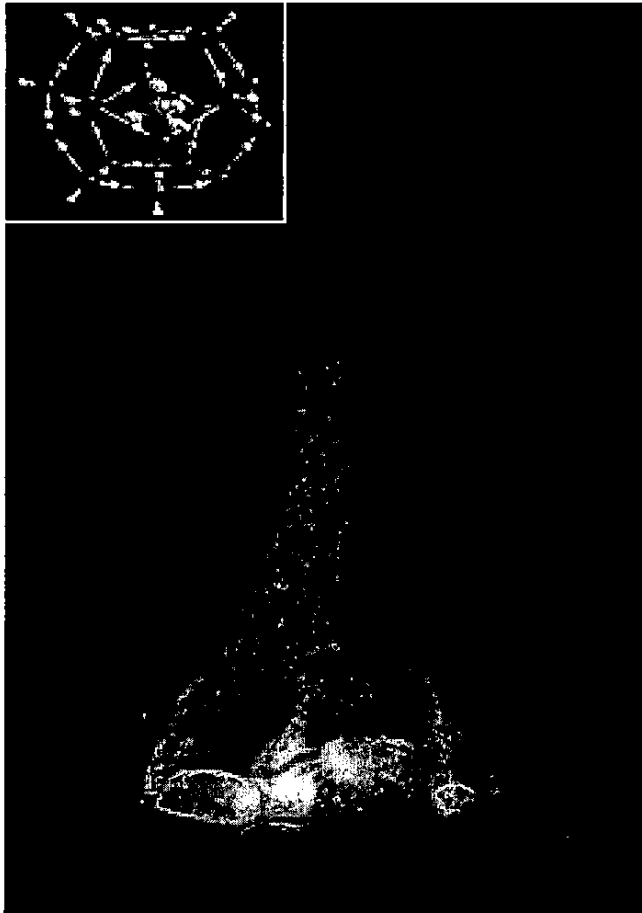
Geothermal in the Aleutians
Susitna/Chakachamna
Mt Spurr
Power for Remote Mines
Etc.



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The 'Energyfield' of the Future



Methane hydrates
Gas pipeline
Heavy oil
Carbon Sequestration
Advanced Coal Technologies
Infrastructure
Etc.



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What are our Goals?

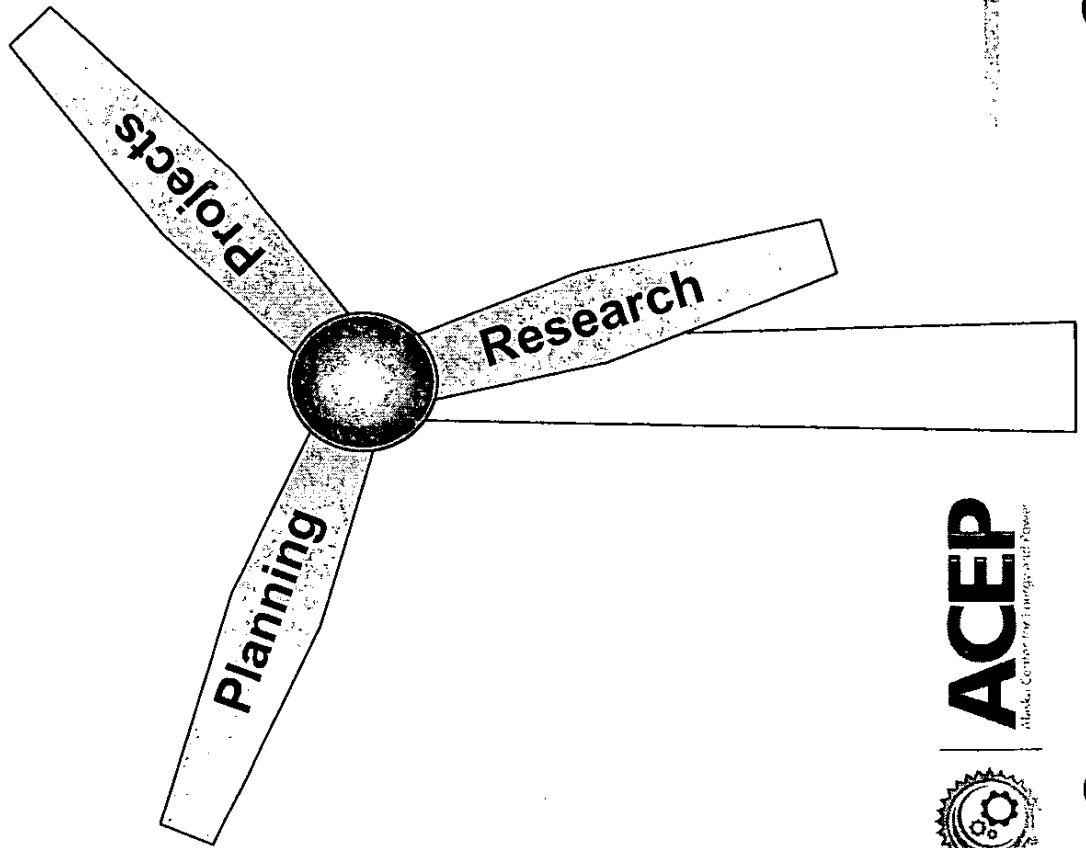
- Lower the cost of energy? For whom?
- Stabilize the cost of energy?
- Community self-sufficiency?
- Build/boost local economies?
- Create jobs?
- Develop wealth?
- Reduce greenhouse gas emissions?



How do we get there?

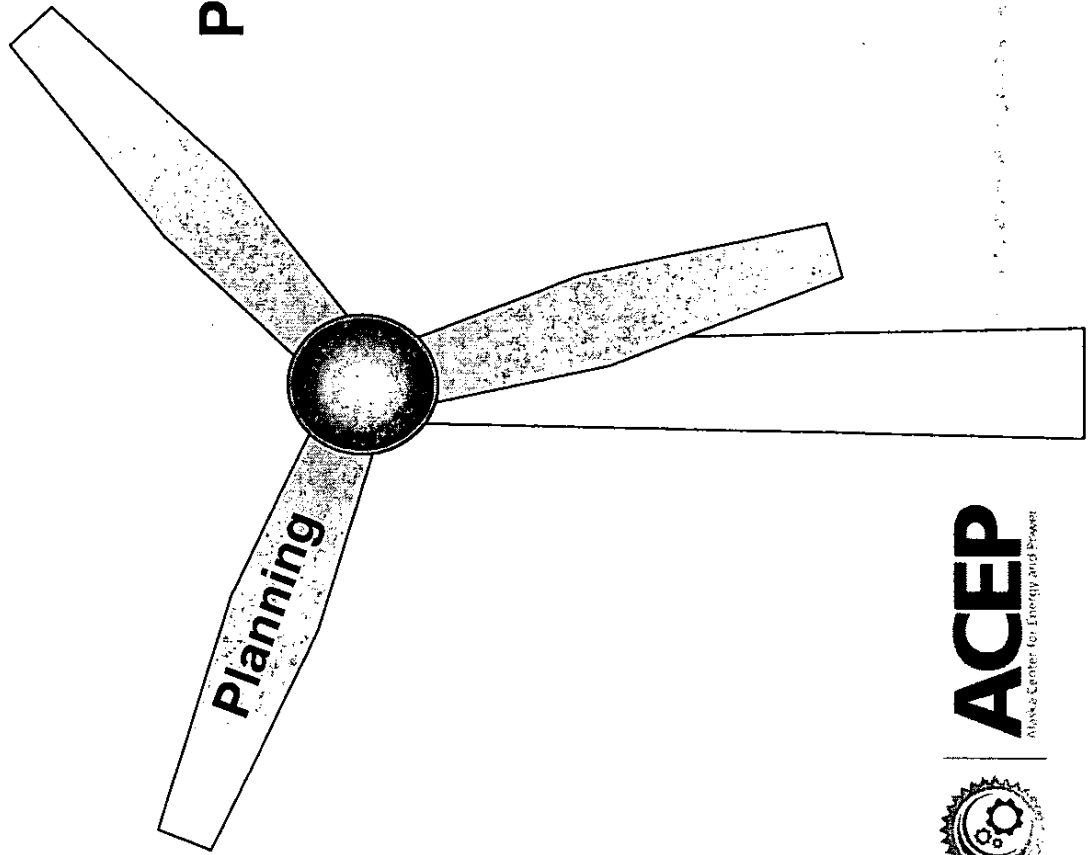
- Make smart investments
- Take calculated risks
- Start with low-hanging fruit

How do we get there?



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How do we get there?



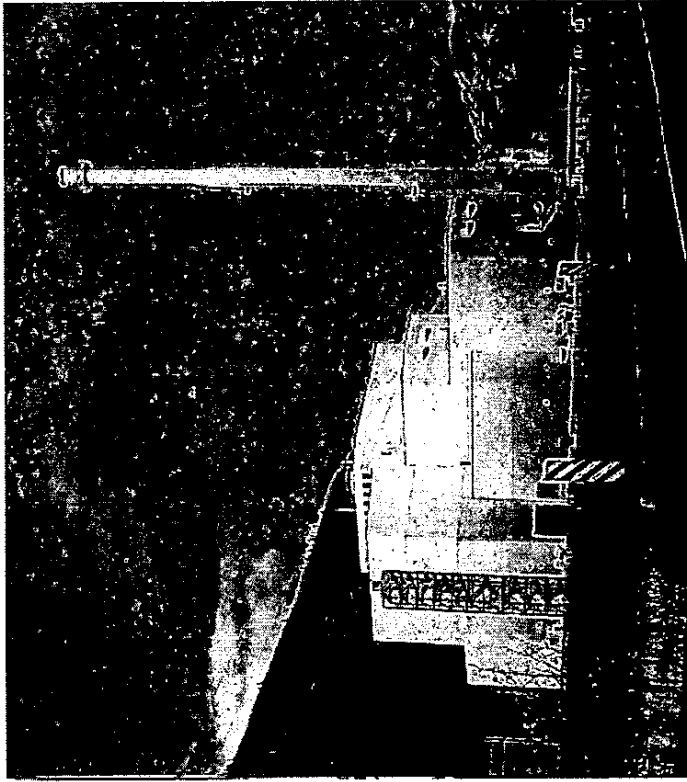
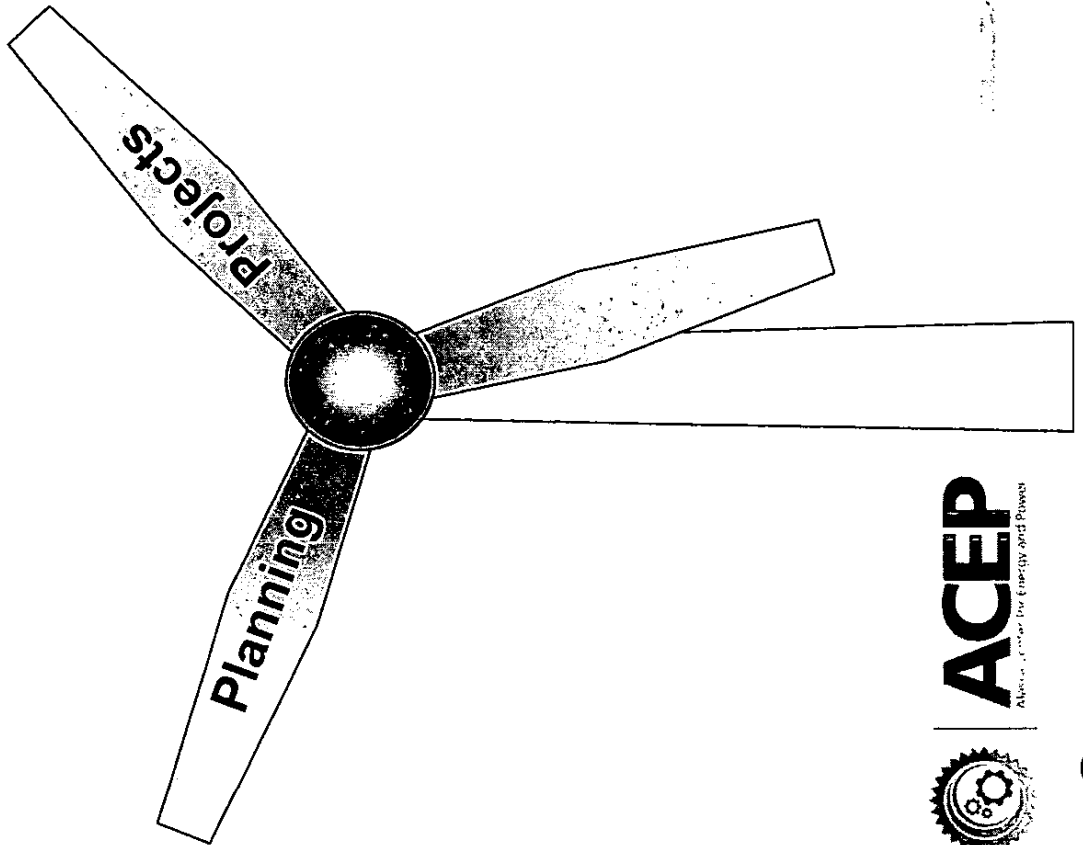
Planning:

- Community level
- Regional
- Statewide



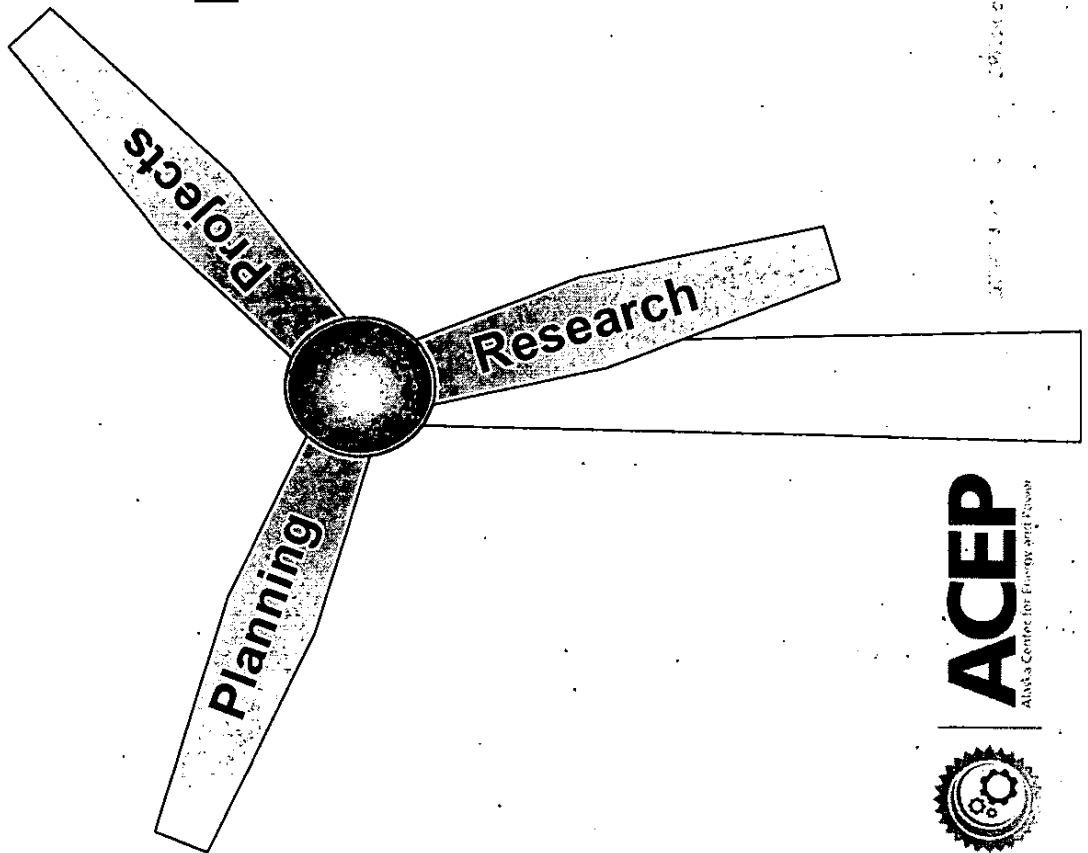
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Make Center for Energy and Power

How do we get there: Projects



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American Council on Energy and Power

How do we get there: Research

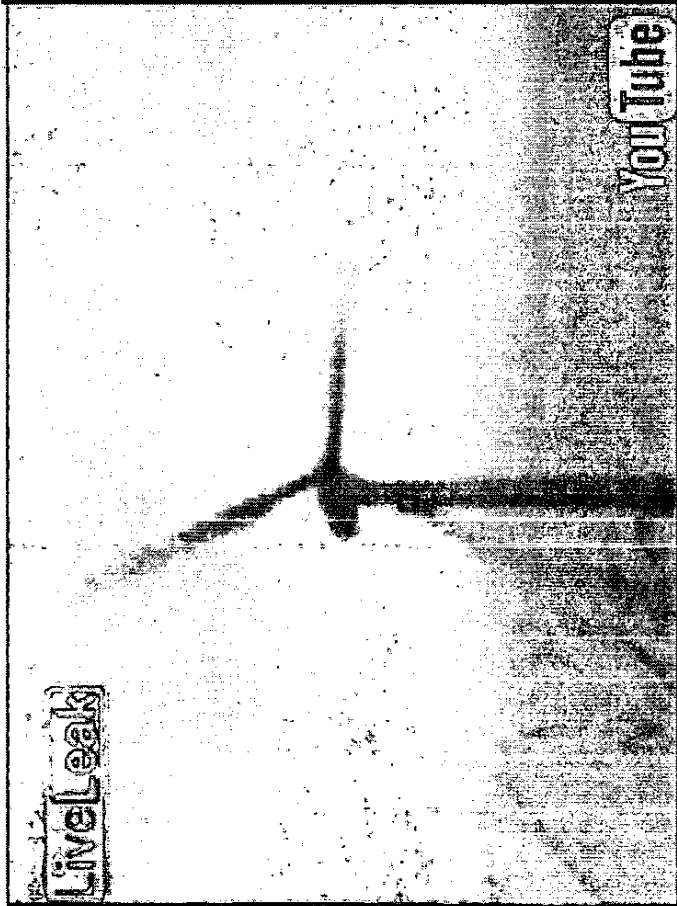
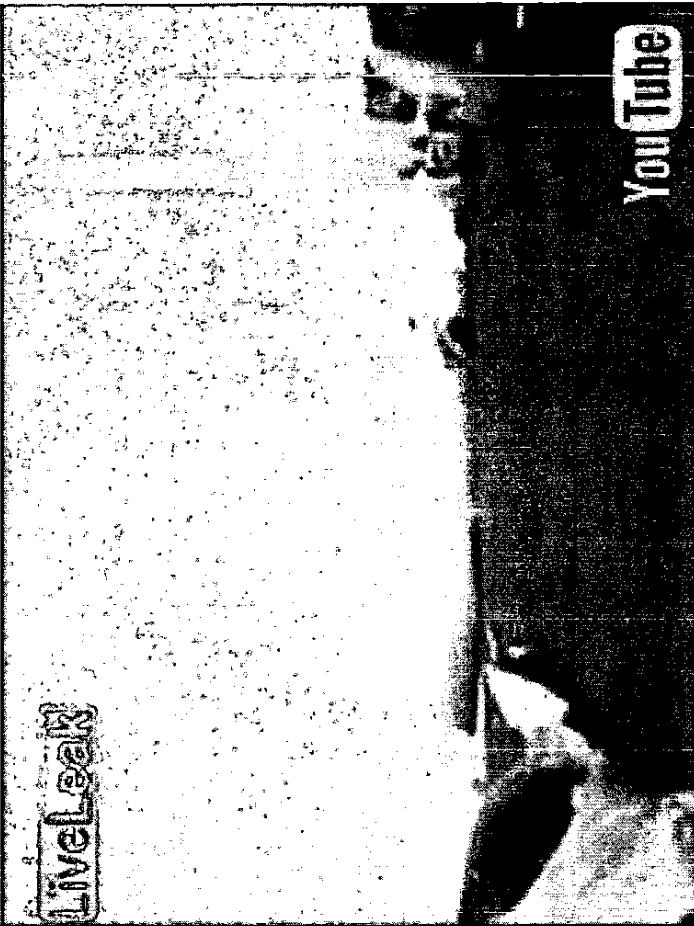
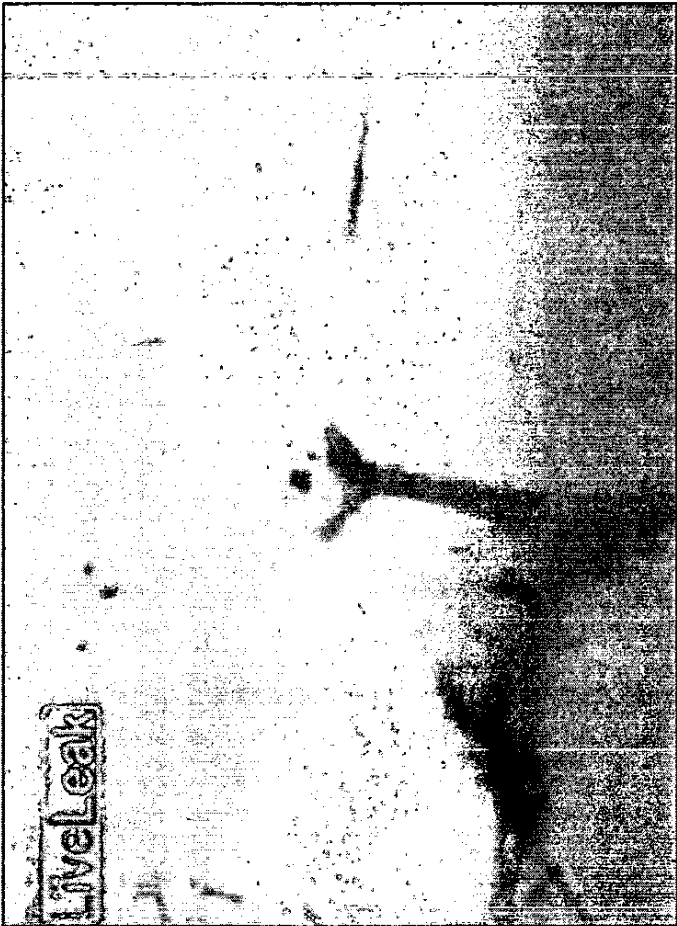


Research:

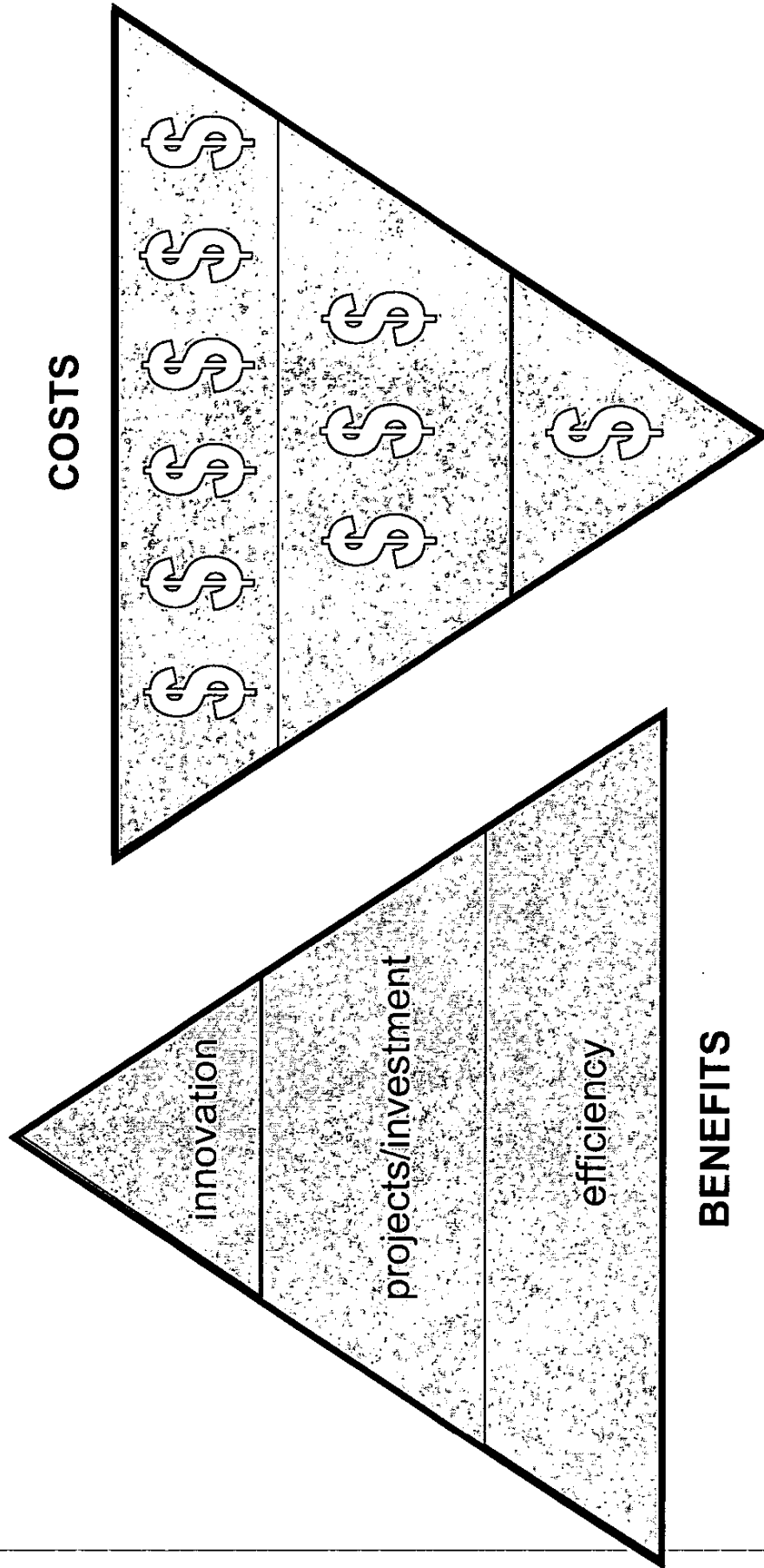
- 'Peering over the horizon'
- Needed for long-term success
- A good investment



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How do we get there?



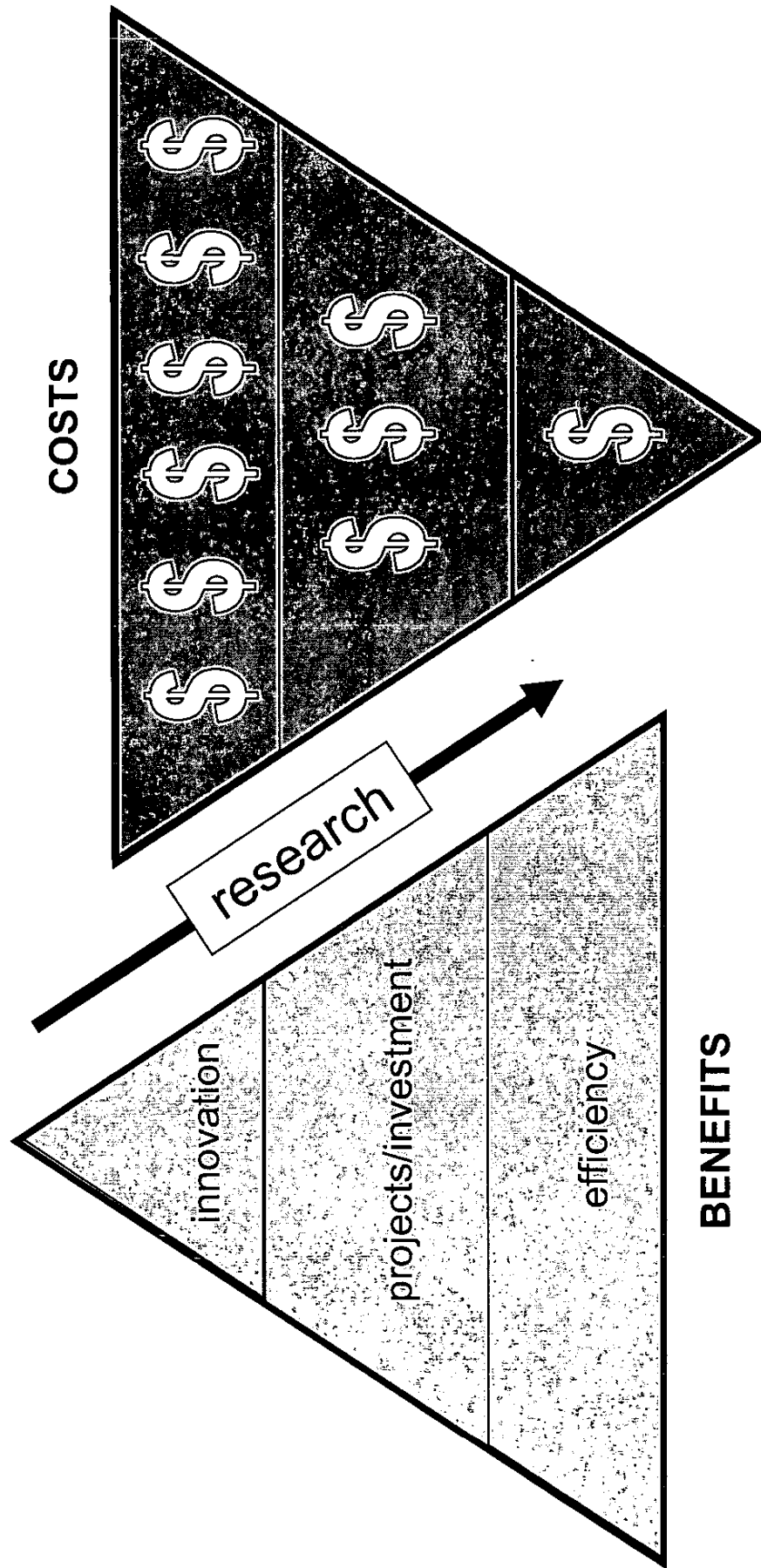
BENEFITS

COSTS



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How do we get there?



BENEFITS



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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

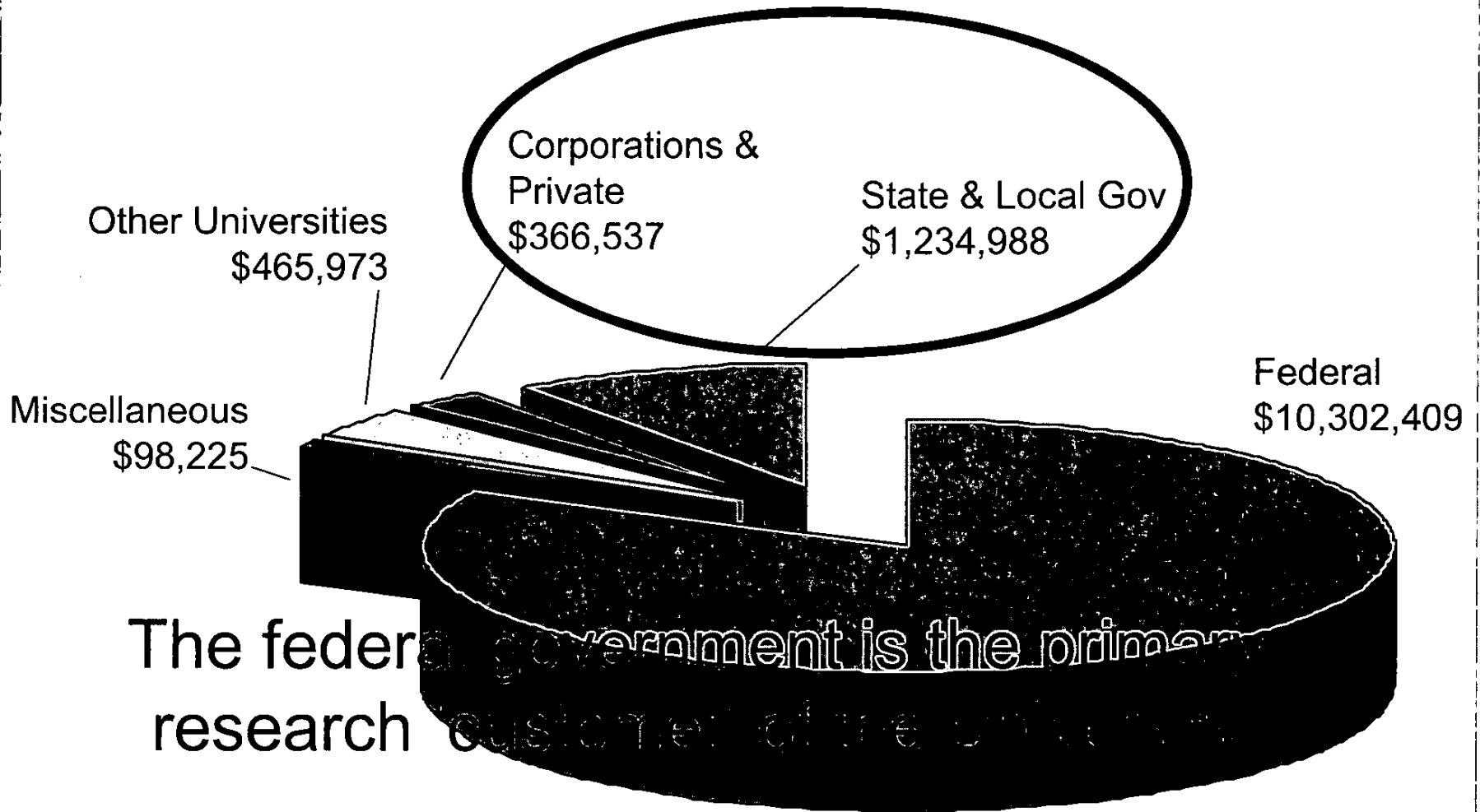
Help leverage external resources to address Alaska's energy challenges (funding, businesses, national laboratories, other universities, etc)



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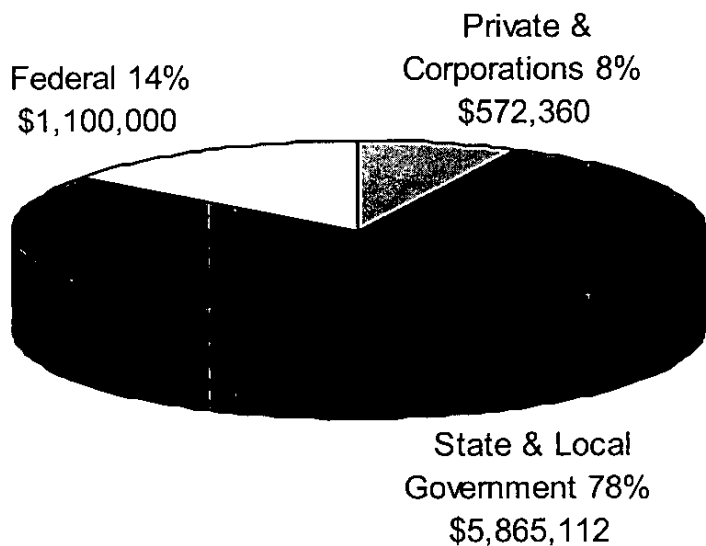
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Funding Energy Research

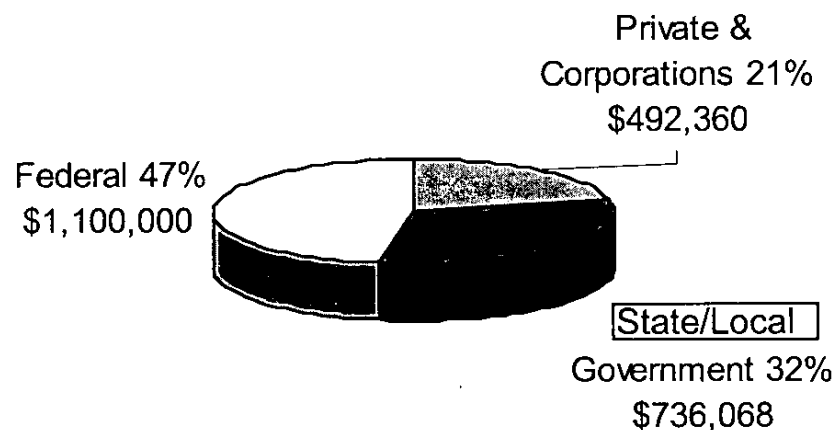


ACEP Funding to Date

Funding Requested (via competitive proposals submitted)



Funding Awarded to Date



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Example from North Dakota Energy and Environmental Research Center

'The EERC is a high-tech, nonprofit branch of the University of North Dakota. The EERC operates like a business; conducts research, development, demonstration, and commercialization activities; and is dedicated to moving promising technologies out of the laboratory and into the commercial marketplace.' (from the EERC website)



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Example from North Dakota Energy and Environmental Research Center

- ▶ 84% of contracts are with private sector
- ▶ Has generated 14 spin off companies
- ▶ 290 scientists, engineers and support personnel
- ▶ Total expenditures in FY07: \$27 million
- ▶ Regional impact: \$94.5 million
- ▶ Receives no base state funding today – instead serves as a funding SOURCE for UND
- ▶ Substantial investment at state and federal level to develop the program initially



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FY10 University capital budget request to fund ACEP and other energy research:

- AEA-ACEP Partnership (\$2M per year for 5 years)
- Rural Power Projects (\$350k per year for 5 years)
- Data Information Network (ISER) (\$200k per year for 5 years)
- Transportation Fuels (\$250k per year for 5 years)
- Coal Technologies (\$200k per year for 5 years)
- Carbon Sequestration (\$250k per year for 5 years)
- Sustainable Infrastructure (\$200k per year for 5 years)
- Biomass Energy (\$700k per year for 5 years)



Emerging Energy Technology Development Fund

- ★ Would create an Alaska Energy Trust to administer grants and loans for R & D and demonstration projects for renewable energy and energy efficiency
- ★ Would coordinate workforce training and development
- ★ Alaska could get “first mover” advantage in several technologies including:
 - Biomass gasification
 - Tidal and Wave power
 - Energy Storage



ACEP

● ● ●

What a good state R&D program can do:

- Attract investment to the state
- Reduce Failures
- Improve existing projects
- Provide focus to energy initiatives
- Assist with developing prudent policy and planning
- Create jobs and develop new/expanded industries



For more information visit:

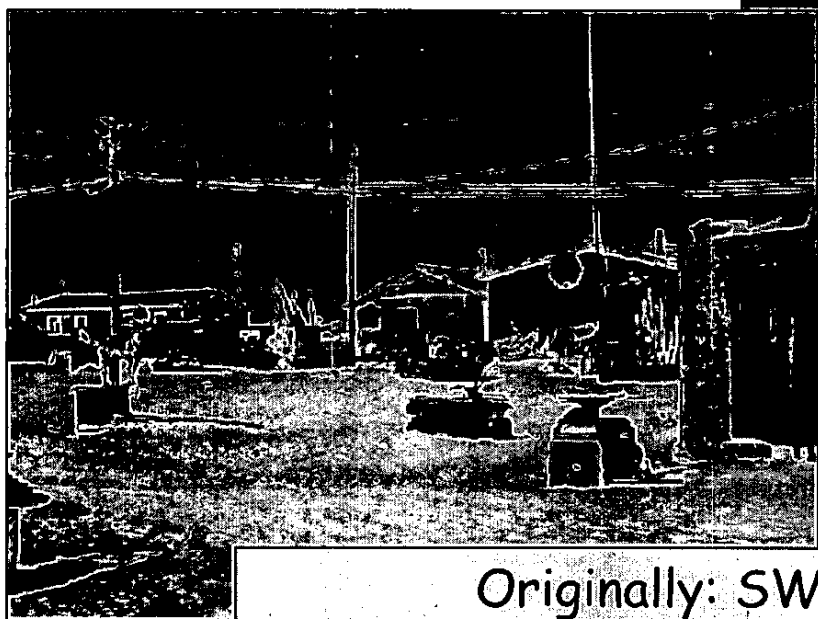
www.uaf.edu/acep



ACEP



Five Almost-Practical Policies to address High Energy Costs in Remote Alaska



Originally: SWAMC Conference, Feb 2006

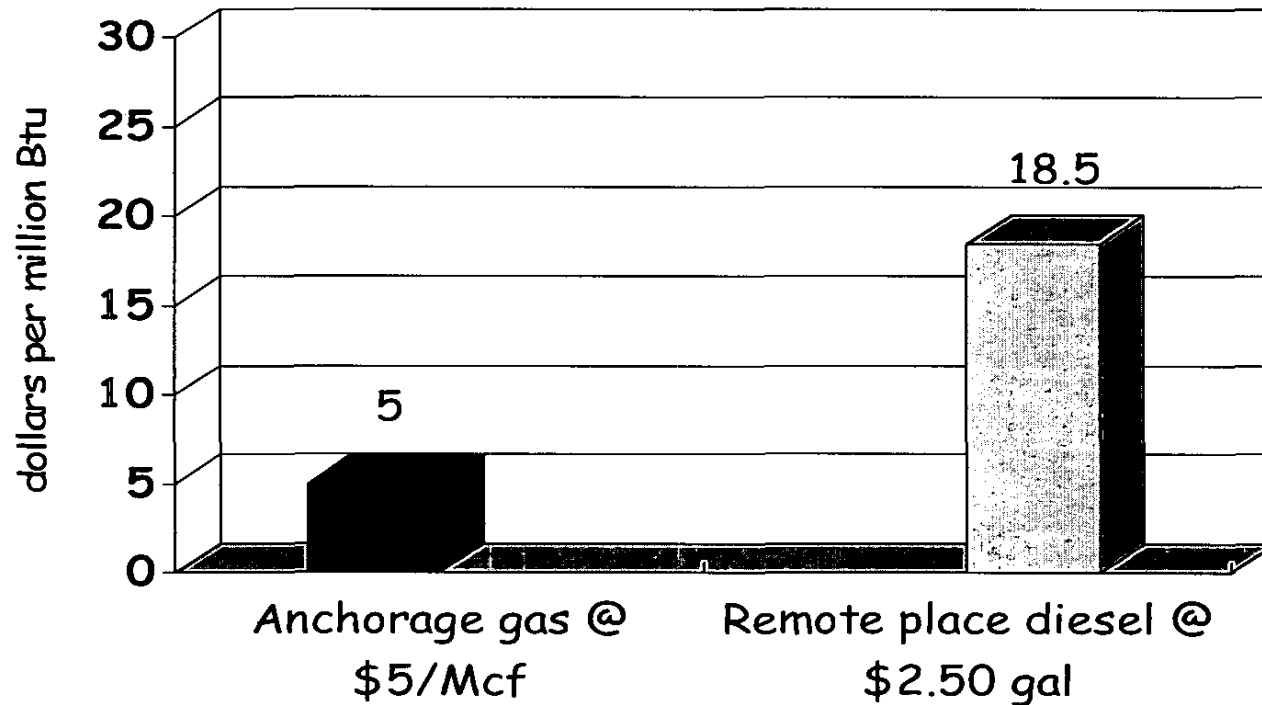
Revised Sep 2006

Steve Colt

UAA Institute of Social and Economic Research

steve_colt@uaa.alaska.edu

The Problem: High energy COST = High energy PRICE



However,
Price is Not Cost

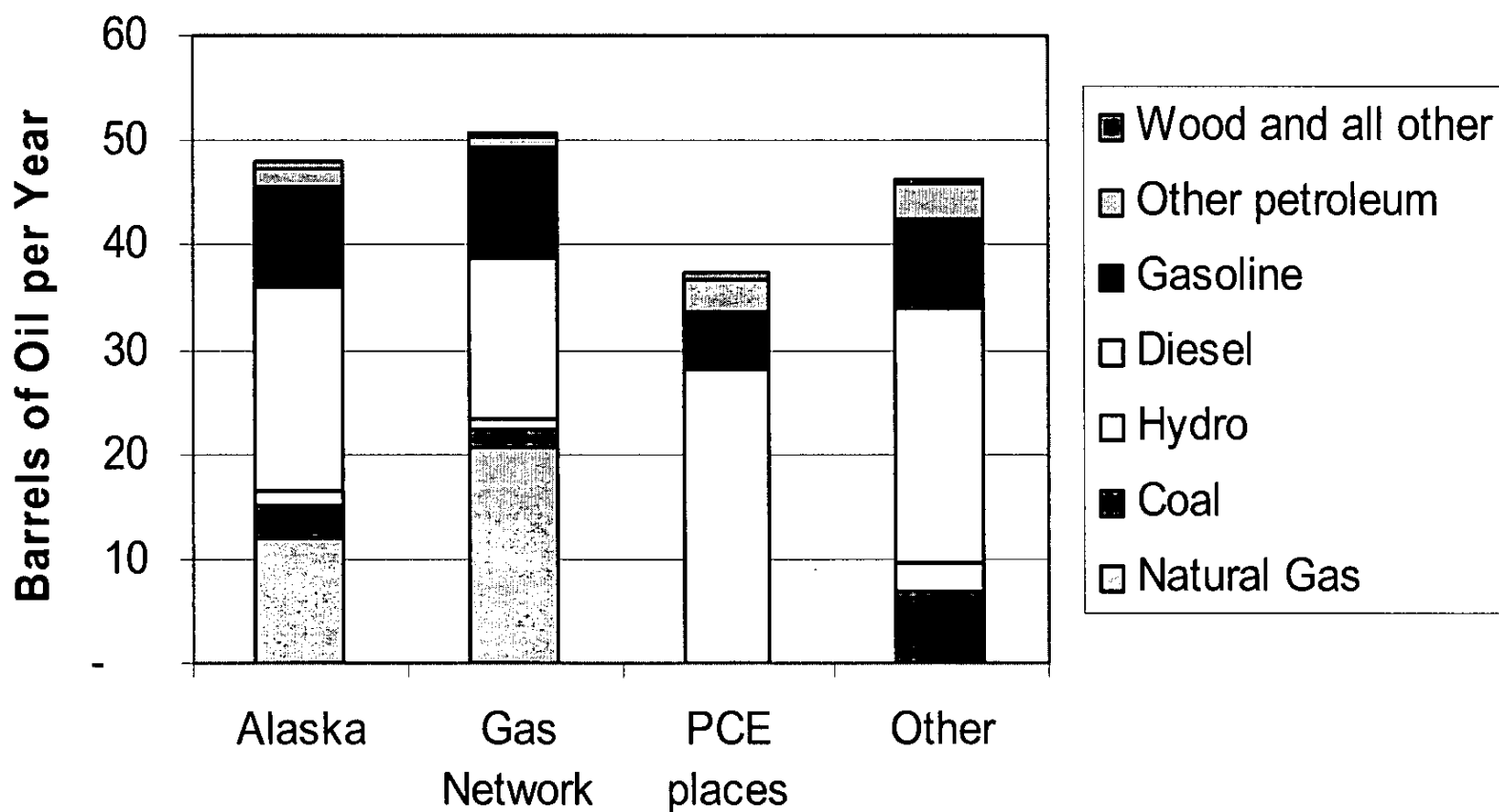
- Very easy to reduce the price of things in remote Alaska
 - rolled-in pricing (First-class mail)
 - subsidized services (bypass mail)
 - cost-shifting (Bill the School District!)
- Much harder to reduce the cost - the overall resources used to provide energy when, where, how people need it

Physics Reminder: Energy is converted from one form to another

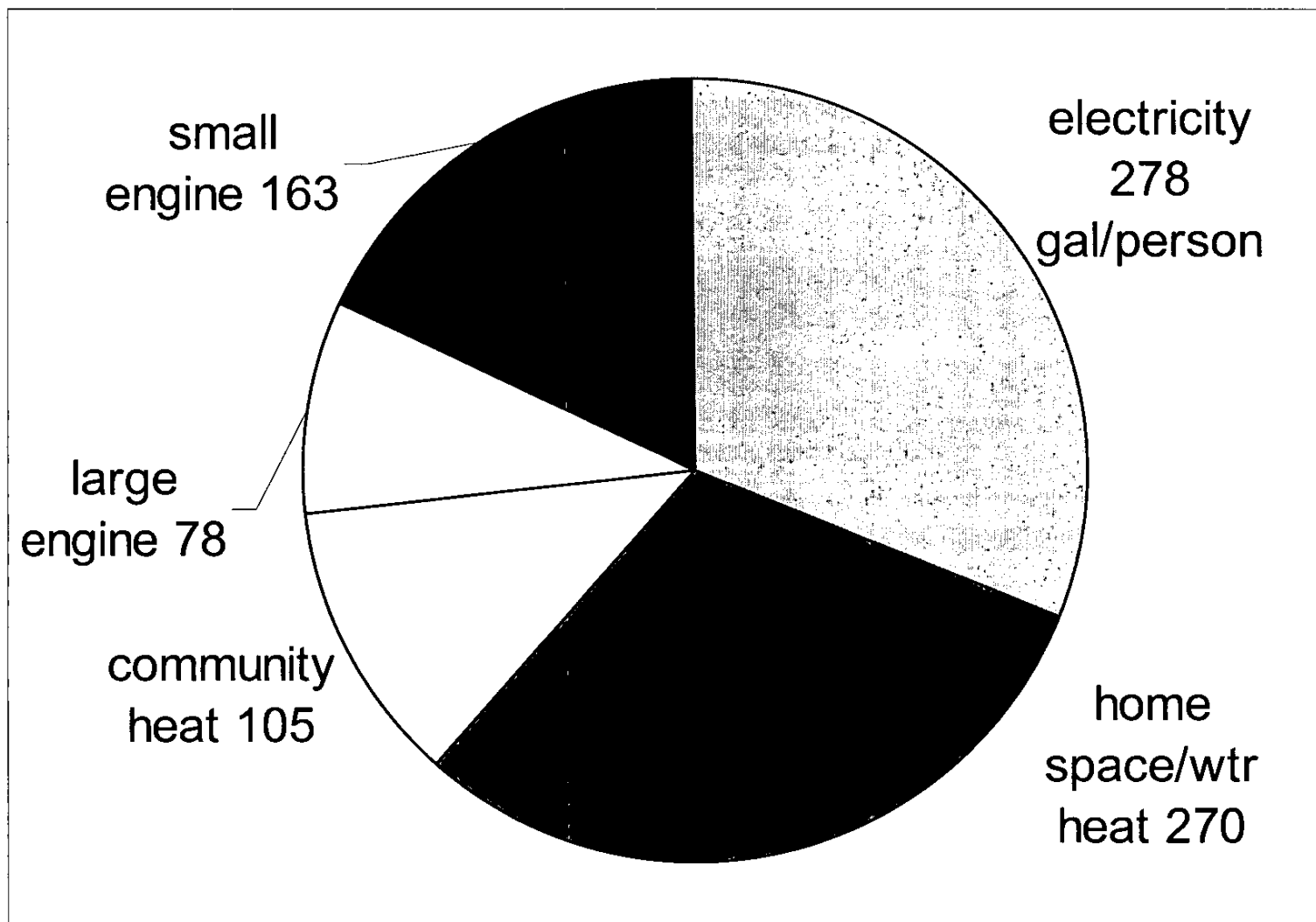
- Electricity is an energy "currency," not a primary energy source
- Hydrogen is an energy currency too!
- Example: Your Toaster
Solar energy → plants → Natural Gas → Electricity → Heat →
(toast + low-grade heat)

Primary energy consumption per Alaskan

barrels oil per person per year



How we use it: about 900 gallons diesel/person/year in remote places



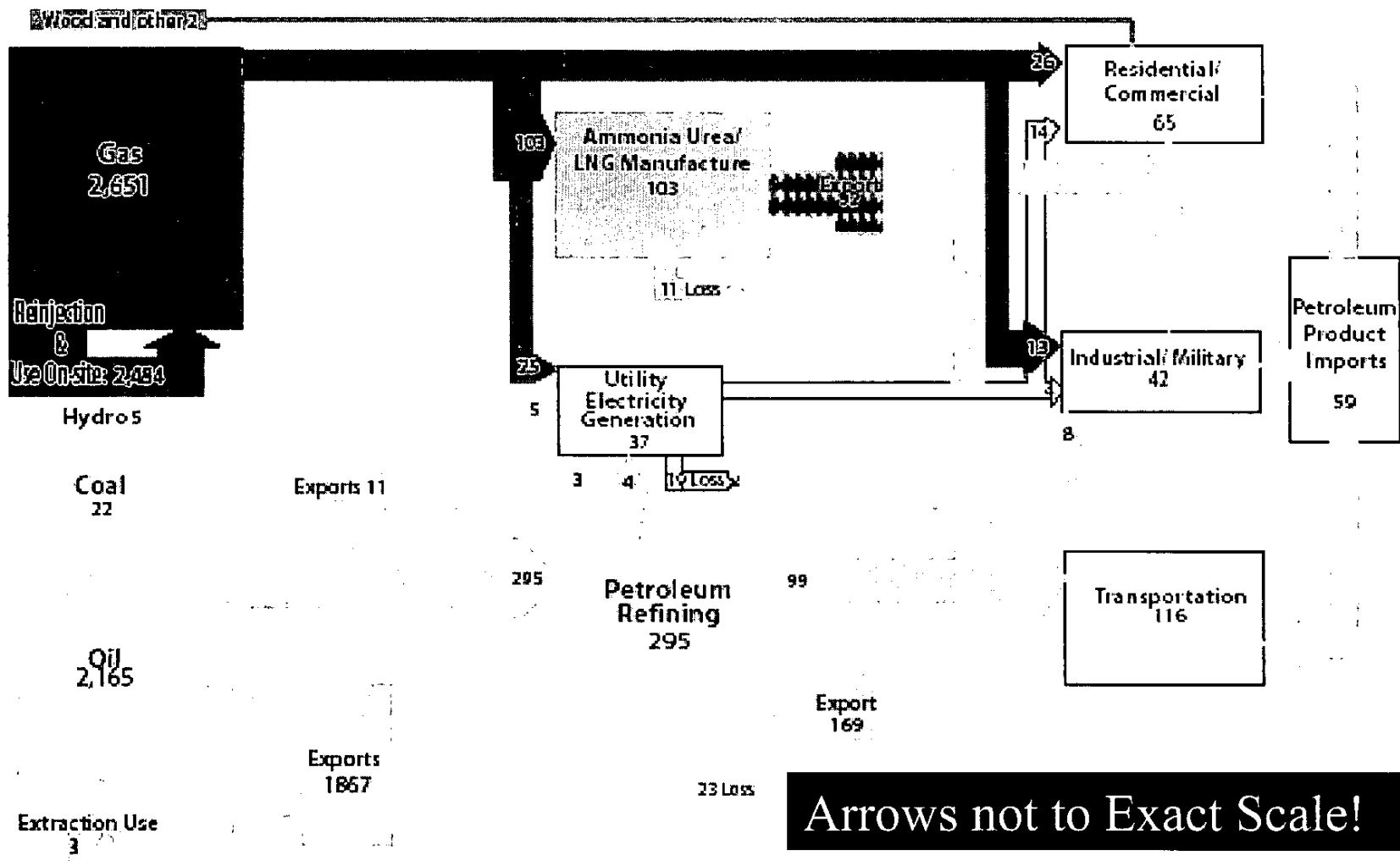
almost practical Policy #1:
Share the wealth from high oil prices

Practical because:

- Alaska is overwhelmingly a Seller of Energy.
- Therefore, we are in GREAT FISCAL SHAPE, overall, when oil prices rise.
- Short-term, do this with cash (revenue sharing) rather than fancy energy projects

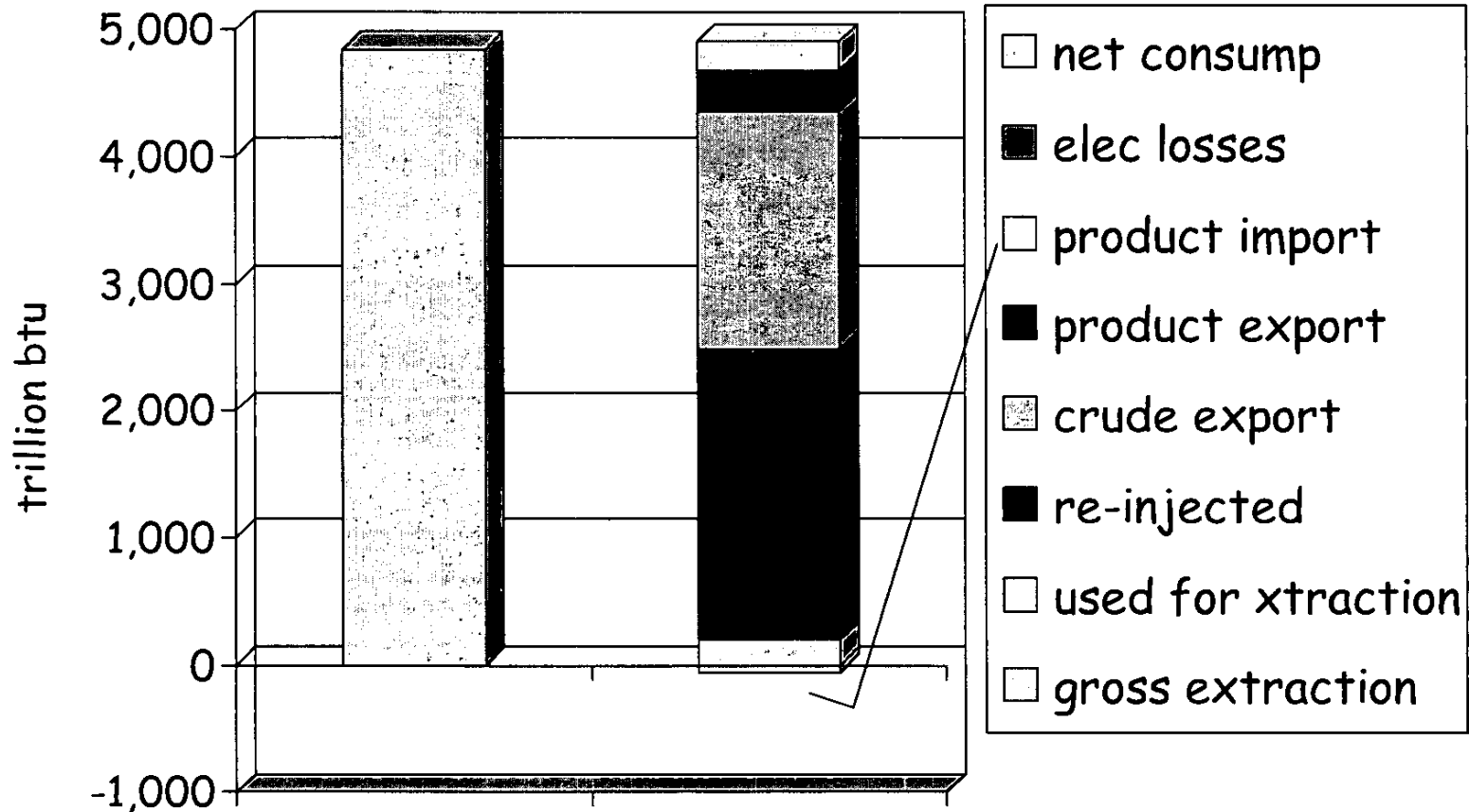
2001 Alaska Energy Flow (Trillion BTUs)

Gross Extraction	Raw Exports	Gross Production	Product Exports	Net Alaska Consumption	Product Imports
4,844	1,878	436	261	223	59



Arrows not to Exact Scale!

Overall Disposition of Energy



Reduce the Energy Bill: Details

- Fully fund PCE, with sliding funding when diesel prices are high
- Community energy assistance tied to rising and falling oil prices

almost practical policy #2: Make PCE a Lump-Sum Payment

Practical because:

- Relatively easy to create a fair formula using existing data and program delivery channels
- Might also REDUCE program admin costs

Make PCE Lump-sum: Details

- Reward utilities for efficiency improvements
- Reward entrepreneurs for new technologies
- Reward consumers for being frugal
 - Preserve the Price Signal!

almost practical policy #3:
Pre-fund energy costs (with an
endowment) as part of a capital project

Practical because:

- We spend a lot of money on the "capital" budget
- It provides powerful signals for efficient design
- It's a proven, prudent way to build sustainable infrastructure
 - Most private universities require this

Pre-Fund Energy Costs as Part of a Capital Project: Details

- Include an energy (and maintenance?) endowment in all appropriations
- Maintain endowments in escrow;
- Make payments partly as lump-sum amounts to further encourage efficient facility design

almost practical Policy #3A:
Include Life-Cycle Energy Costs in
Evaluation of the "Low Bid"

Practical because:

- Communities could do this on their own
- Rewards designers for efficient design rather than penalizing them for higher up-front costs

almost practical Policy #4:
Focus State capital \$\$ on Energy-
Saving infrastructure, Away from
Energy-Using Infrastructure

Practical because:

- You save the most \$\$ with up-front efficient design

almost practical policy #5:
Focus State R&D dollars on Adaptation
of Emerging but existing Technologies

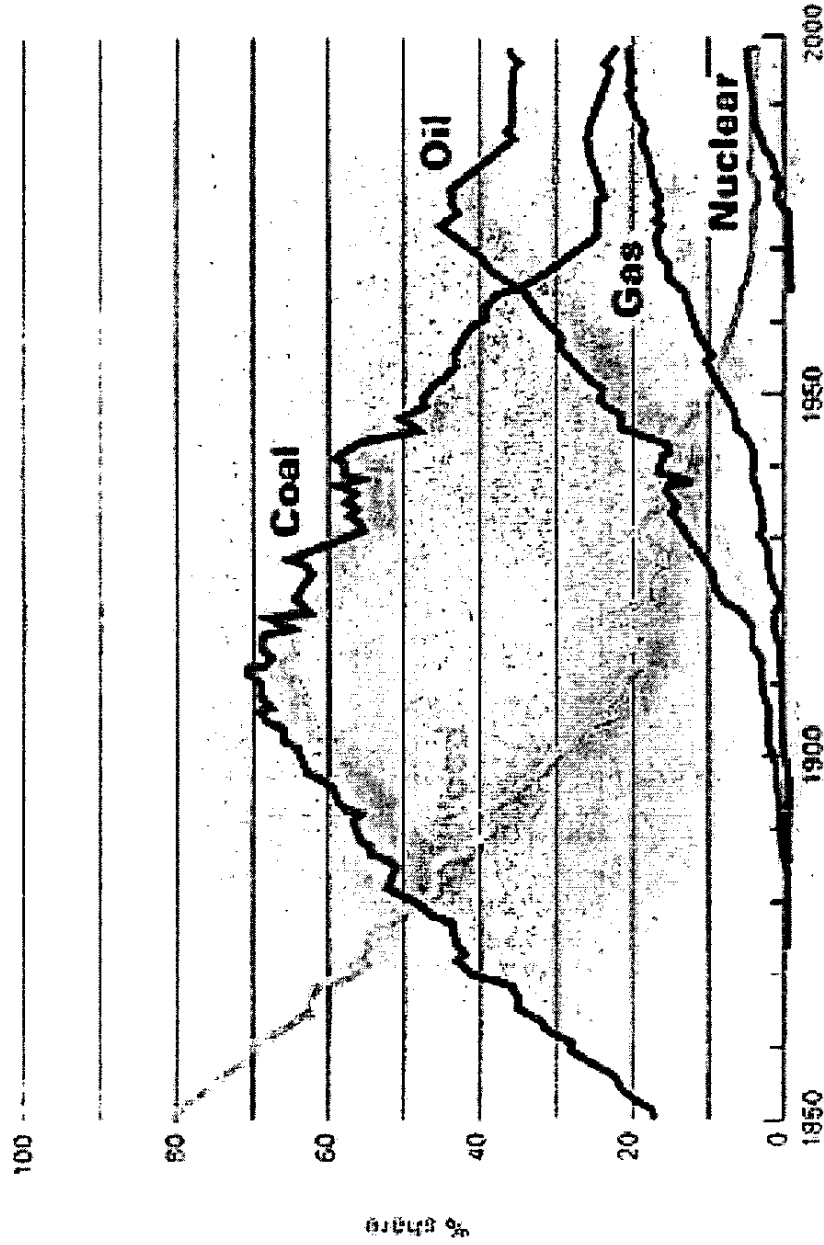
Practical because:

- Feds and private sector are conducting major efforts on "new" stuff
- Alaska is a unique market niche with harsh conditions, most technologies require adaptation

Focus on Adaptation: Details

- Continue support for wind technology, focus on shared O&M from regional nodes
- Pilot projects:
 - Direct Hydrogen combustion in vehicles
 - Small-scale coal gasification
 - Coal-bed methane
 - Biodiesel utilization

Changing Mix of U.S. Primary Energy Sources

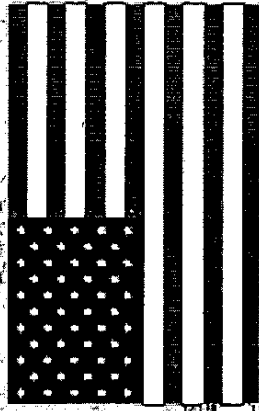


Source: Dr. Neelkanth Narasimhan, International Institute for Applied Systems Analysis, Laxenburg, Austria.
Private communication, Aug. 28, 2000.

www.iser.uaa.alaska.edu

- **Other references:**
- Alaska Electric Power Statistics (with Alaska Energy Balance) 1960-2001 by Scott Goldsmith, November 2003.
<http://www.iser.uaa.alaska.edu/Publications/akelectricpowerfinal.pdf>

Algae



Low cost energy solution

Produced by
CORPUSCULE TECHNOLOGIES, LLC
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Endless Supply of ENERGAE

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“... **ALGAE** is the holy grail, if
we crack it we can probably
give up on everything else...”

Dr. Jerry Murphy, Environmental Research Institute, University
College Cork, Ireland

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ALASKA HAS A PROBLEM

Alaska is the energy capital of the U.S. and yet delivery of a low cost energy solution to remote villages has been elusive

Lack of a solution tempers growth to these areas and threatens to undermine long term expansion of capital & growth to Alaska

Alaska's wealth is inextricably tied to its remote regions where raw materials for capital creation lies

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ALASKA HAS A PROBLEM

Alaska is perceived a big oil's big brother, yet fuel costs in remote villages are among the highest in the world - higher than Central America or other developing countries who have no access to oil finds

the long term financial health of Alaska's Native Corporations and remote regions lies with delivery of a cost effective energy solution to its own: you can have all the wealth in the world, but if you can't provide for your own, you have a problem

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energy alternatives

diesel fuel – \$.24 to \$.25 per kwh

- efficient energy source – yet, even with Alaska's abundant oil resources, they can't supply remote areas inexpensively
- costly transportation
- environmentally challenged

solar – \$.35 to \$.45 per kwh

- too much land required for 1 megawatt of power
- heat value non-existent/limited in winter months

wind – \$.25 to \$.29 per kwh

- average efficiency rating on wind generators is 35%
- costly to install and maintain relative to energy return
- lack of energy grid to maximize return

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natural gas – **\$.09 per kwh**

- perfect source; too costly to install relative to total population
- costly conversion from current diesel energy platforms

geothermal – **\$.29 per kwh**

- excellent source, but, few areas have access
- costly conversion of current diesel energy platforms

coal **\$.06 to \$.08 per kwh**

- lowest cost energy source, but infrastructure non-existent
- unwanted discharge – “true clean coal” solution elusive
- costly conversion of current diesel energy platforms

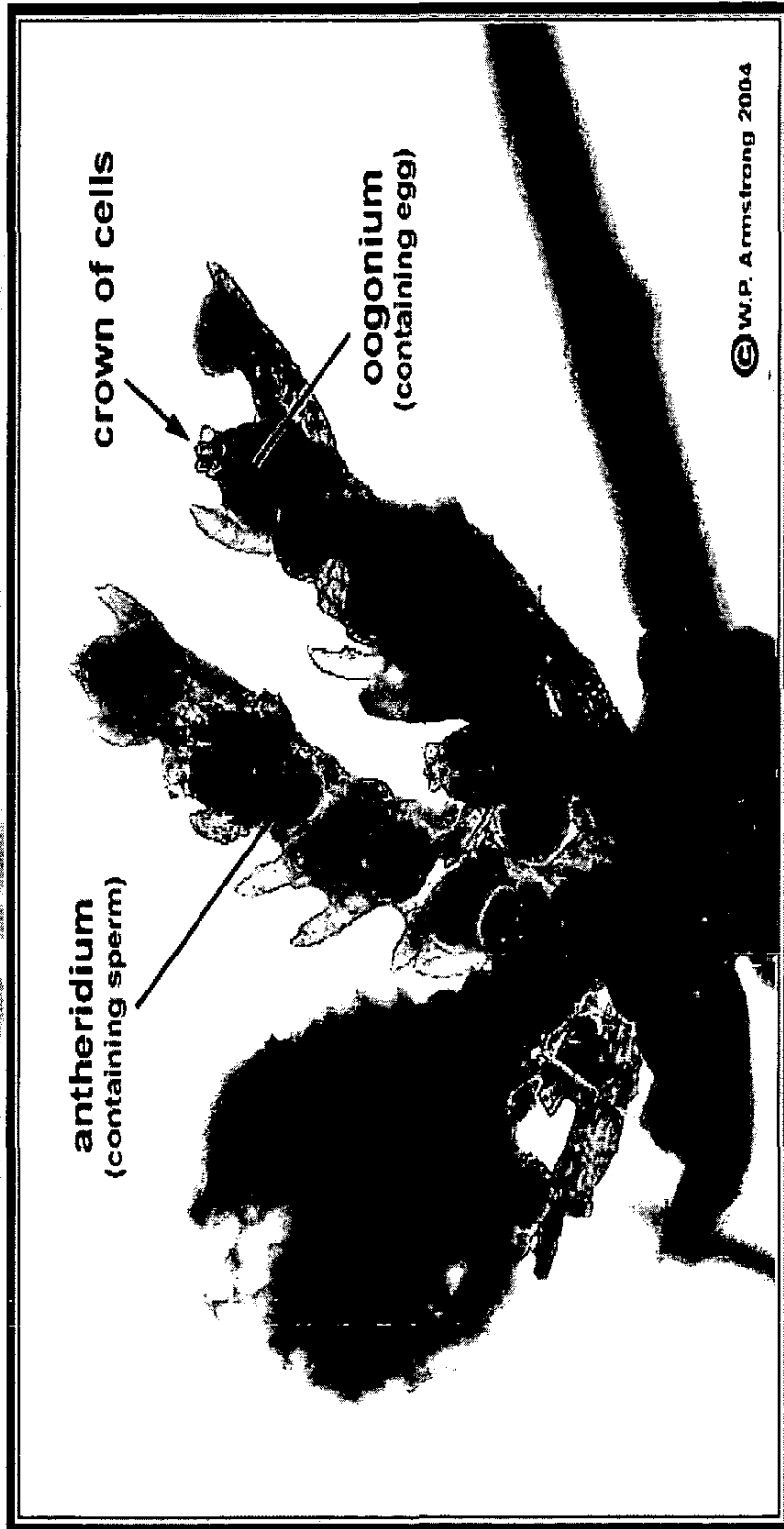
Alaska needs an energy platform solution that provides the following:

- kwh
- environment
- diesel platform
- transportation
- scalable
- set-up time
- infrastructure
- maintenance/upkeep
- renewable
- operation
- low cost
- safe
- combined with no interruption
- current infrastructure
- energy platform expanded as need dictates
- months, not years
- reasonable costs
- low
- "green"
- ease of use

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Alaska needs Algae



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ALGAE**\$.15 per kwh**


- current diesel system
- manufactured oil
- self-sustaining energy
- weather
- BTU quantity/quality
- maintenance
- turn-key systems
- ongoing operation
- retained, enhanced
- on site, at will
- does not require outside source to function
- operates in sub-zero under low cost greenhouse
- manipulate relative to need
- low cost
- RWE builds, maintains
- locals without Phds

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ALGAE history

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National Research Energy Lab (NREL) spent \$450 million studying alternative biofuels from 1977 through 1995, \$25 million of which went to Algae research

- qualified Algae strains relative to oil *quantity*
- qualified Algae strains relative to oil *quality*
- published Algae white paper in 1998 detailing findings

– \$12 oil - Clinton administration cut funding

– Algae research – shifted overseas due to Algae growth problems

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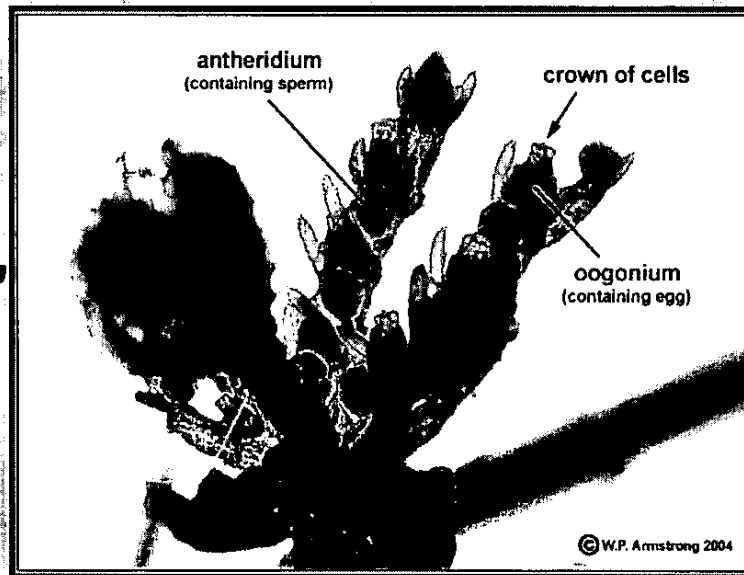
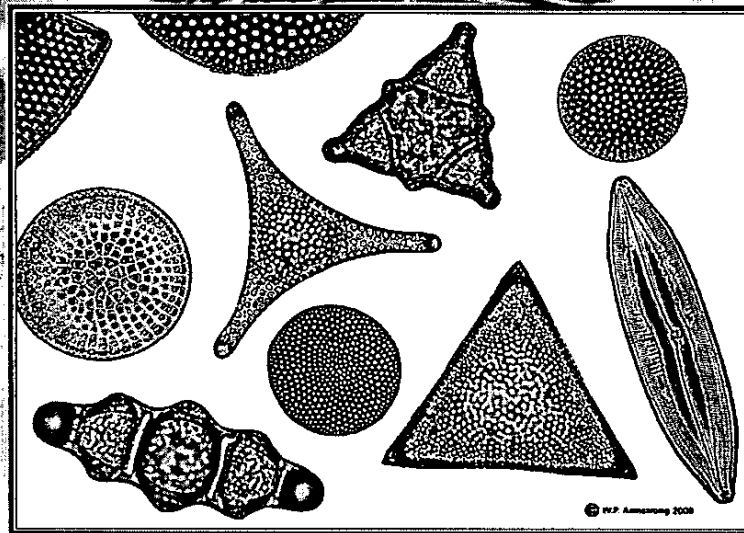
**bad ALGAE - massive growth,
limited energy value**

- dunaliella tertiolecta
- dunilelia salina
- butryococcus braunii
- cymbella
- nitzschia
- amphora
- bacillariophytes

**good ALGAE - massive growth,
much energy value**

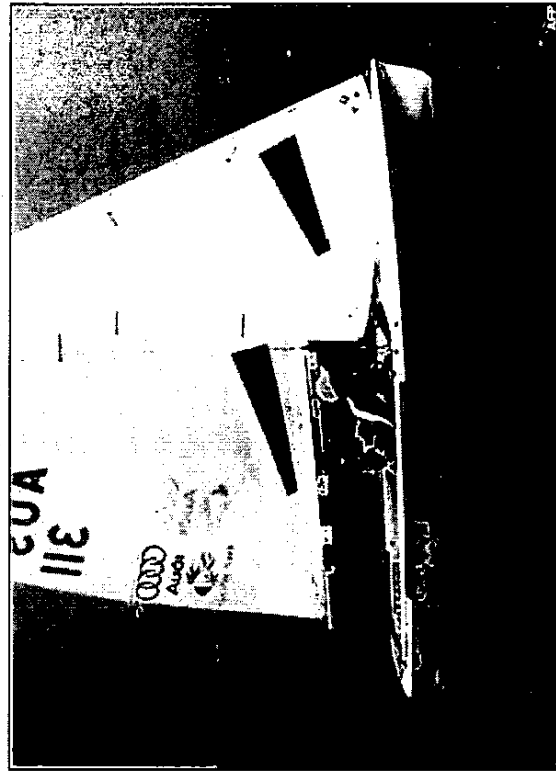
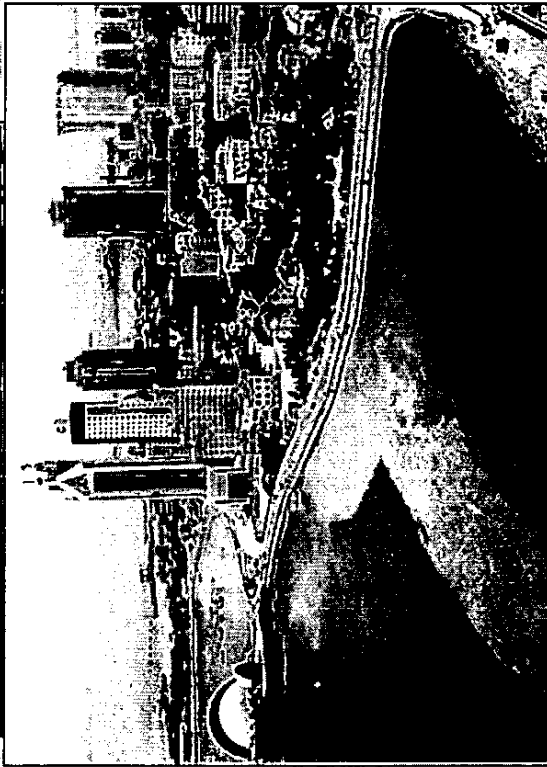
- green algae
- dunilelia salina

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ALGAE growth worldwide - exploding



Indian Ocean, 2008

Shanghai, China - the world's most populous city, Pacific Ocean, 2008

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**The Carolinas were hard
hit with ALGAE
problems**

**They turned to two men to
find a solution: Richard
Armstrong & Tim
Tompkins**



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Armstrong – physicist, electrical engineer, bio-systems & process systems specialist

Tompkins – chemical engineer, bio-engineer

together Armstrong & Tompkins built \$7 billion in pulp, paper, & energy in the southern states – BF Goodrich, Duke Power, Bowater, Rhone Poulec, GE & others

Armstrong & Tompkins had worked to solve “bad” ALGAE growth problems for these companies. Armstrong & Tompkins never had to put out a resume to bid a job, word of mouth & reputation was enough

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Carolinas - "...get rid of it, or find a use for it..."

Armstrong & Tompkins visited
ALGAE research centers worldwide

what they found... ALGAE was
loaded with oil; firms were
growing it

but, two major problems associated
with ALGAE oil eluded solutions

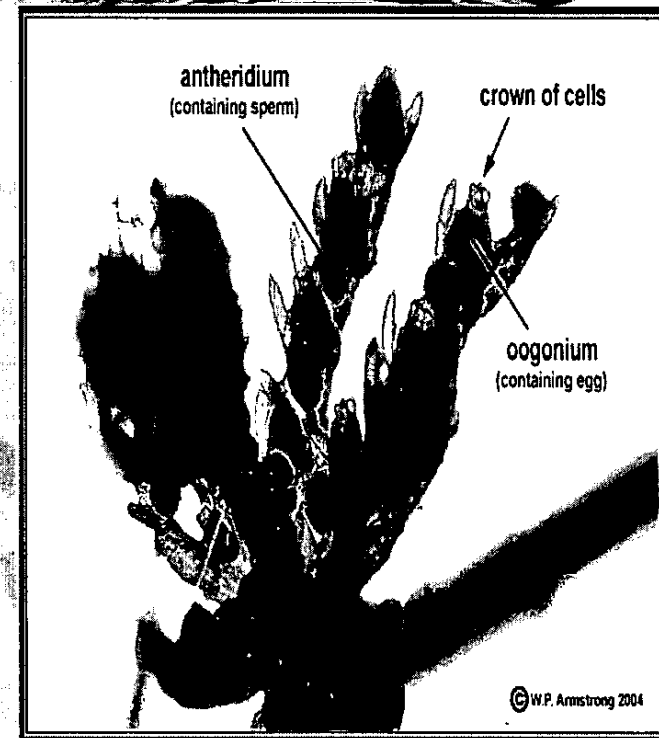
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Problem 1 – Growth: starving the ALGAE increased the oil value, but it slowed the growth


Problem 2 – Oil Extraction: extracting energy from ALGAE's 'tight' cell walls was costly



After much research, personal capital & trial & error Armstrong & Tompkins invented solutions

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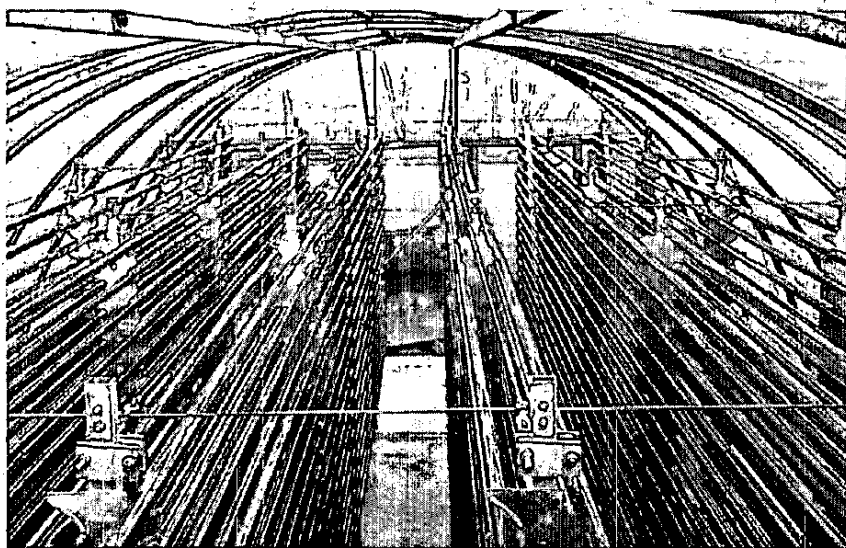
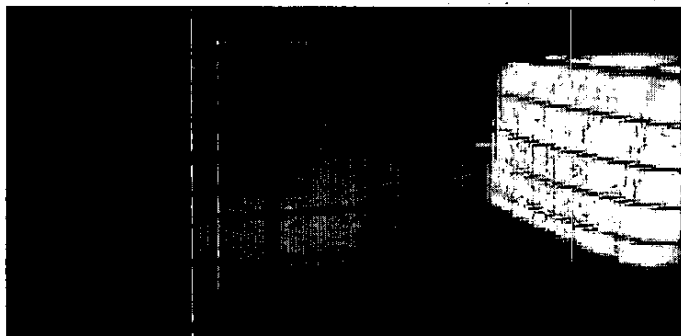
In developing their solutions, Armstrong & Tompkins' visited all known ALGAE bioreactors...

ALGAE bioreactor - a man-made incubation unit in which ALGAE is grown in order to produce oil & other ALGAE bi-products

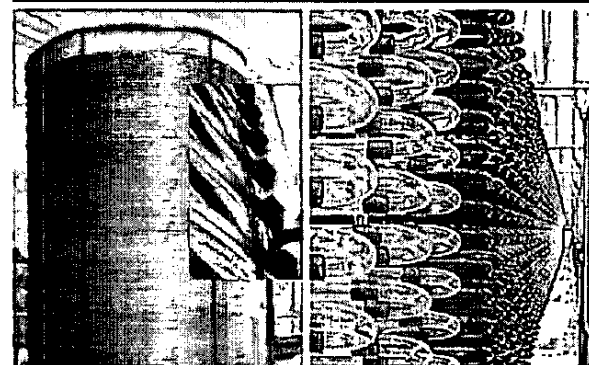
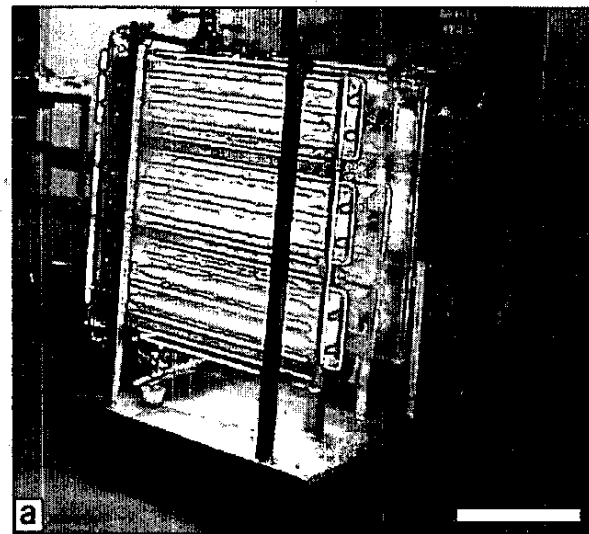
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many good ideas.....but most fell short...either too costly to build or they couldn't efficiently extract oil



Endless Supply of ENERGAE



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**Armstrong & Tompkins A.T. Bioreactor
design principles**

- **Produce large quantities of high energy value Algae and bi-product**
- **Cost effectively produce the oil & bi-product**
- **Complete automation to manage input/output**

Endless Supply of ENERGAE

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if you could build a customizable, fully automatic, computer controlled engine to grow massive amounts of oil, *what would it look like?*

the engine would need to be high tech, ultra durable, made of thermo-isolated materials to prevent energy loss. it would need to achieve optimal nutrient monitoring, optimal light exposure, optimal water flow, optimal CO2 & NOx intake & exchange, and optimal oil extraction.

Endless Supply of ENERGAE

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it would look like this...

It would have

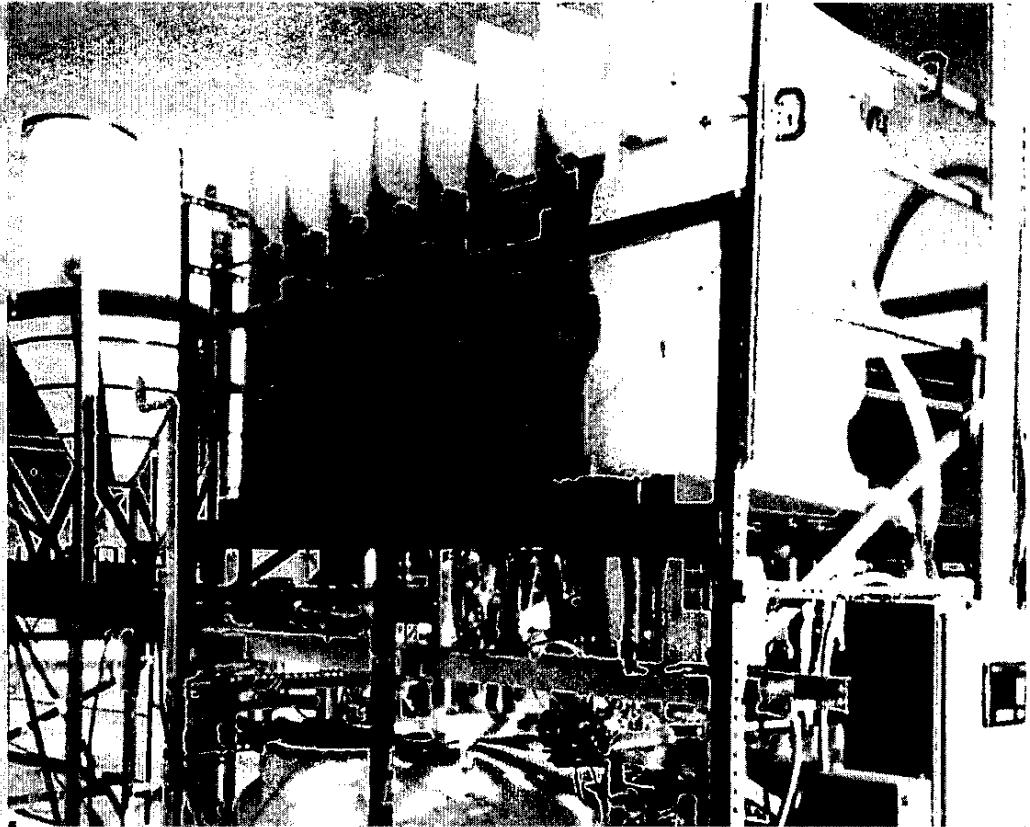
full automation

constant monitoring of

- nutrients
- light
- gas exchange/intake
- water flow
- PH level
- temperature controlled

continuous harvesting

self- sustaining - low
quality oil burned to provide
electricity for the entire unit



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ALGAE optimization & automation produce the following:

low cloud point

cleaner oil

low sulfur

fuel for vehicles – direct use

high quality oil & BTU value

sucks up nasty gases while growing



Endless Supply of ENERGAE

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ALGAE traits

35% to 80% of body weight in oil

fastest growing organism known to man

**ALGAE oil combined with diesel fuel produces
superior burn ratios & cleaner fuel**

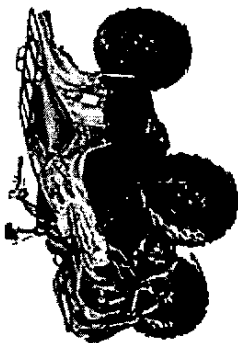
**ALGAE can eat noxious gases produced by burning
fuel – turns them into harmless organic carbons**

Endless Supply of ENERGAE

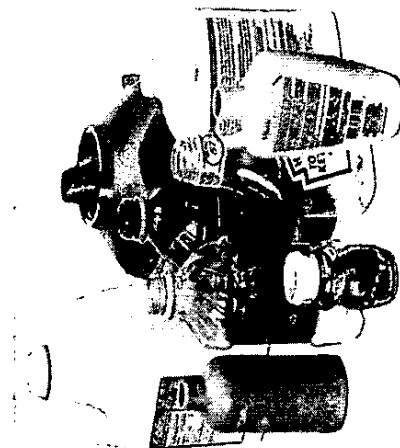
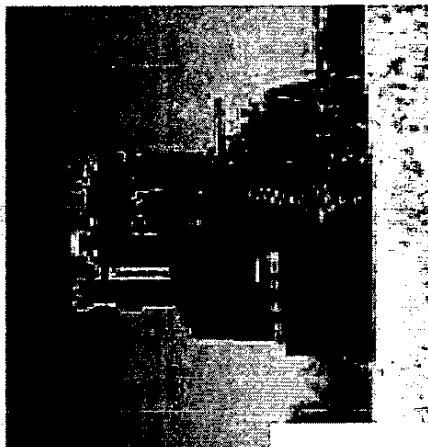
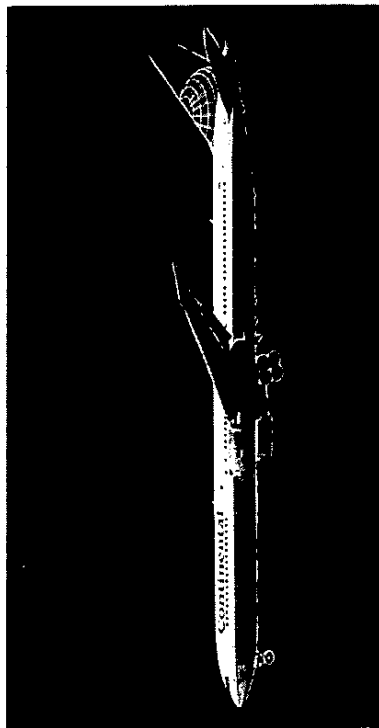
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products derived from ALGAE oil



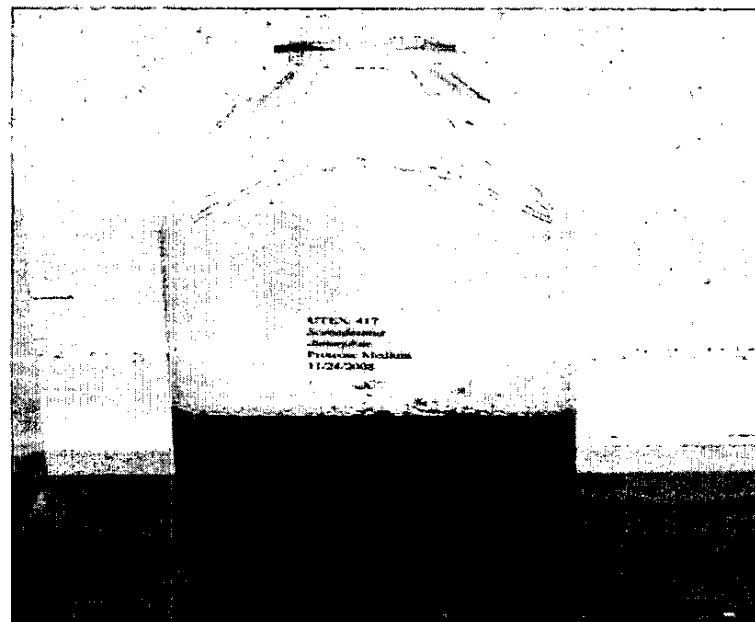
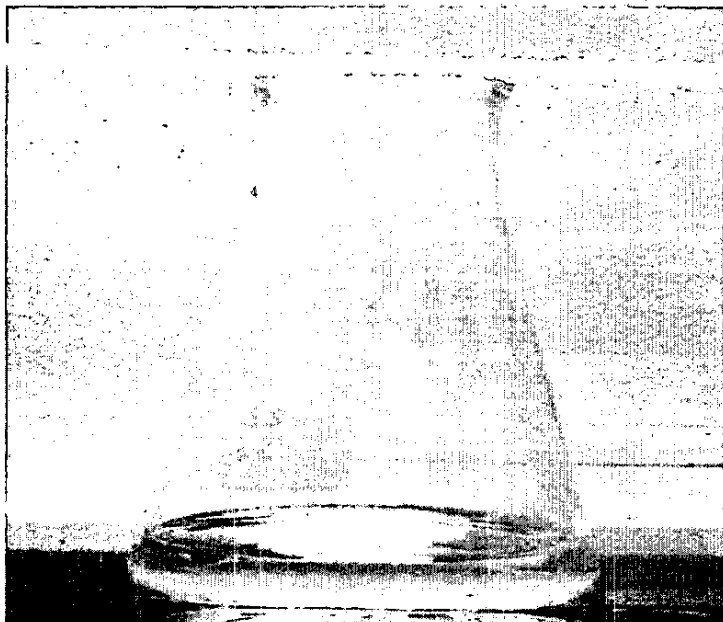
- jet fuel
- gasoline
- plastics
- hydrogen
- Ethanol



Endless Supply of **ENERGAE**

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sample Algae growth rate



It took 30 hours for ALGAE to grow 20 fold in Armstrong & Tompkins bioreactor using their proprietary nutrient solution & automation

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Armstrong & Tompkins Bioreactor

closed System
full Automation
super strains
98% of oil extracted using
proprietary harvesting
methods

cleaner oil extraction
low cost to produce
low cost to build
optimal CO2 intake

Endless Supply of ENERGAE

Others

- open pond system
- partial automation
- local wild strains
- **45% of oil extracted**
using “pressing”
- less quality oil
- high cost to produce
- high cost to build
- poor CO2 management

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some of RWE current agreements

1. Universities – super Algae strains
2. South Carolina Power & South Carolina Gas & Electric, the largest power production companies in the Carolinas
 - free CO2 and NOx
3. State of South Carolina –
 - \$13 million in tax credits,
 - pays for all worker training,
 - 250,000 acres for \$25 an acre
4. largest coal-fired power production company in the nation

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typical processing network serving ALGAE growing systems

ALGAE producing oil in enclosed structure: for village



ALGAE production system beside wastewater utility site



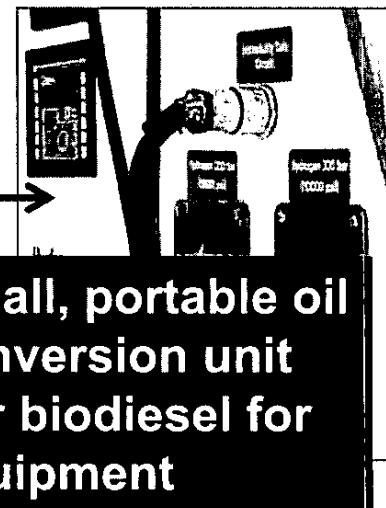
ALGAE processing plant



Syn-gas conversion unit to produce energy/BTUs, or...



Small, portable oil conversion unit For biodiesel for equipment



Distant mining operation in need to clean discharge & energy



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BTU & system production

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our vision – U.S. native groups

Native owned lands in Alaska and the Southwest hold the keys to energy production in the U.S.

Southwest U.S. – perfect for growing Algae low cost, but they lack the capital

Alaska – can provide the capital

Together, the native groups can help provide the energy needs for the U.S., and in the process return an investment for their shareholders

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ALGAE BTU value groups

oil

- bio-lubricants
- gasoline, ethanol additives, plastics

cake - natural drying, no drying agents

- synthetic gas
- omega 3s & other vitamins
- feed

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oil & cake production & profit

1540 bioreactors ~ 38,500 gallons of oil
 per acre per annum
 + 285 tons of cake

Biodiesel spot price = \$73,150
 \$1.90 per gallon

Cake \$120 a ton = \$34,200

cost to produce
 \$.85 per gallon = \$32,725
 =====

Net profit (~acre) = \$74,625

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Net profit = \$74,625

shipping = \$11,550

conversion @ modular = \$13,475

**biodiesel plant in Alaska
distribution from southwest = \$4,620**

=====

EBITDA \$44,980

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cost per gallon of ALGAE oil to Alaska

production	=	\$0.85
shipping to port	=	\$0.30
shipping to villages	=	\$0.35
conversion at villages	=	\$0.45
Misc.	=	\$0.10
Middleware markup	=	\$0.25
		=====
Total		\$2.30
offsetting cake revenue reduction	=	\$0.90
Net cost per gallon	=	\$1.40

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optional revenue source – CO₂ & NO_x

ALGAE eats CO₂ & NO_x

ALGAE chemically changes CO₂ & NO_x gases into organic carbons

organic carbons are harmless to the environment and can be consumed by animals as feed when dried

Endless Supply of ENERGAE

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EBITDA = **\$44,980**

Optional revenue = **\$20,000**

**38,500 gallons of ALGAE consumes
10,000 tons of CO2 while growing;
CO2 producers will pay up to
\$2 per ton to rid CO2**

38,500 gallons of ALGAE consumes = **\$17,500**
50 tons of NOx & other gases while
Growing; =====

**NOx producers will pay \$350
a ton to rid NOx**

EBITDA per 38,500 oil gallons with Optional = **\$119,980**

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industries that need CO₂/NO_x gas management discharge solutions

Coal	Mining	Steel	Cement
CO ₂	CO ₂	CO ₂	CO ₂
NO _x	NO _x	NO _x	NO _x
SO _x	SO _x		

average 3 million ton Coal plant will spend

gas management = \$60 million per year
 installation of = \$200 million
 scrubbing equipment

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ALGAE solution

800 acres of ALGAE beside a 3 million ton coal plant:

gas discharge reduction	=	\$35 million
oil/cake net revenue	=	\$39.58 million
		=====
combined annual savings	=	\$74.58 million or \$24.86 per ton
scrubbing cost installation reduction	=	\$120 million or \$4.50 per ton (amor. 15 yrs)

\$24.86 + \$4.50 = \$29.36 per ton

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ALGAE systems allow for an environmentally safe expansion of the coal, petroleum and mining industries in Alaska and beyond

ALGAE sucks up the nasty discharges, turning them into organic carbons which are harmless

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Proposal: State of Alaska sponsored

**ALGAE pilot project in Alaska,
expected costs & installation**

2.25 megawatt power system

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first step: perform low cost feasibility study to determine costs associated with creating 2.25 megawatts of power

second step: if viable cost-wise, install

- **ALGAE bioreactors**
- **newest, small scale Florida Hydro wind design to provide electrical generation for dark winter months, growing ALGAE under artificial lighting**
- **covered enclosure**
- **optional oil processing & diesel production units**

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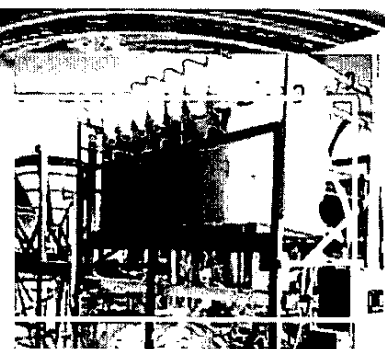
expected system cost for first/single 5 megawatts of power

feasibility study	=	\$0.250 million
3000 Algae bioreactors & set-up costs	=	\$1.50
syn-gas processing station	=	\$1.25
<u>optional</u> oil processing station	=	\$1.75
enclosures	=	\$2.00
wind	=	\$2.00
		=====
Total		\$8.75 million

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expected ALGAE BTU value



3000 units (system)	~	75,000 gallons of oil per system per year +
	+	540 tons of biomass
BTU value oil (syngas)	=	12,242 megawatts per annum
BTU value biomass	=	5,975 megawatts
wind	=	1,000 megawatt
		====
	=	19,217
combined syngas BTU value	~	2.25 megawatts per hour

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monitoring/maintenance, pilot project year 1

testing/monitoring costs = \$150,000

- 1 fulltime employee to

manage system & maintenance

- RWE manager for communication/ = \$75,000

electrical distribution

RWE phase study = \$100,000

=====

Total = **\$325,000**

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expected revenue from energy production

2.25 megawatts & \$.20kwh = \$3.94 million


10,000 gallons of oil not
converted to BTU value for study
and distribution @ \$3.00 a gallon = \$0.03

=====

total = \$3.97 million

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**village prototype system can be
profitable in first year of
operation**

**produces 2.25 megawatts of
energy**

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additionally: ALGAE consumes gas & wastewater

CO2, Nox & other Gases

Algae eats CO2 and NOx gas groups - ALGAE chemically changes CO2 & NOx gases into organic carbons which are harmless to the environment and can be consumed by animals as feed when dried

Wastewater

ALGAE will populate when fed wastewater from human or animal waste; converts waste into organic carbons

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RWE offers

turn key ALGAE systems

on-site plant management

product management

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CO2 and NOx consumption Models as it relates to mining & coal

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In January 2009 the EPA fined Kentucky Utilities' largest coal-fired power plant \$140 million in fines and equipment upgrades to clean-up NOx & Sulfur Oxide emissions. The plant had already spent \$270 million

Both the EPA & the E.U. have a ZERO tolerance for NOx emissions

But, what of CO2?

– World currently operating under TWO CO2 models

E.U./Kyoto model: Each country/industry is allotted "x" CO2 emissions

All CO2 emissions are monitored

If you exceed CO2 emissions you must

1. purchase carbon "credits" or
2. be heavily fined

U.S. Model:

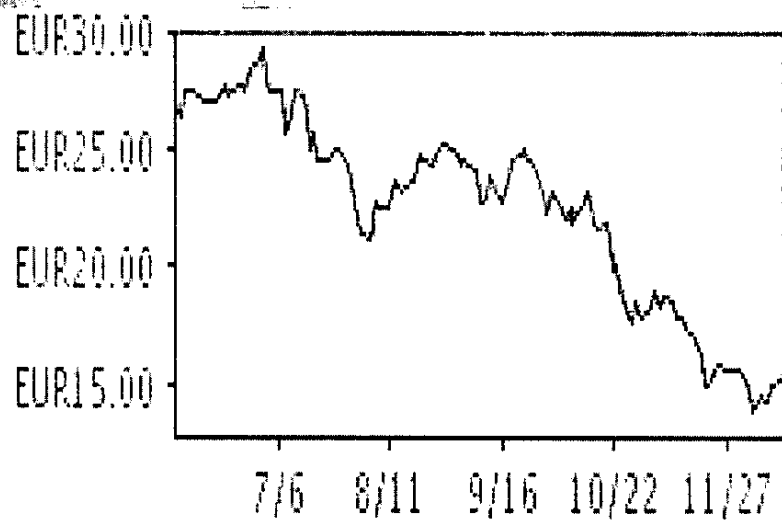
...voluntary...but...

ALL CO2 emissions are NOW recorded by the EPA

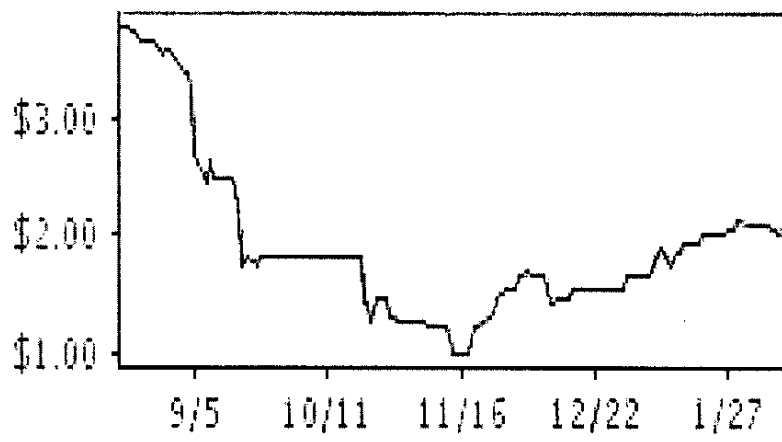
California is mandating a CO2 trading market

Mandatory Carbon Trading Market in Europe

(\$15 E.U. converts to \$19 U.S.)



Voluntary Carbon Trading Market in the U.S.



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E.U. Problem: there are not enough carbon credits relative to demand – \$30 billion traded in 2008

U.S Problem: The US Supreme Court gave the EPA the “right” to mandate all CO2 emissions

Coal Problem: coal plants must spend addtl \$50 million per ton of coal produced per annum to clean-up CO2 emissions, not including NOx upgrades

Mining Problem: water and gas discharge from mining operations run into multiple millions of clean-up

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minimal cost to clean CO₂/NO_x gases in Alaska

CO₂ per coal ton **\$3 to scrub/sequester**
\$6 for equipment to scrub

NO_x per coal ton **\$5 to scrub**
(bound & thermal) **\$8 for equipment to scrub**

====

\$22 per ton

small sized coal plant
1.5 million tons of **1.5 X \$22 = \$33 million per**
coal per annum

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TVA TWO POWER “Lines” ~ 1 000 Megawatt each – are SHUT DOWN, due to

- **being “over limit” on CO2 & NOx**
- **annual revenue loss = \$500 million per annum**
- **cost to correct: \$200 million + \$50 million per year operating costs**

Increased EPA mandates on coal, mining, steel & cement now being set-up for mandates

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RWE Solution: ALGAE system

- consumes all CO₂
- consumes all Nox & other nasty gases
- reduces need for costly scrubbing equipment
- puts people back to work
- produces additional revenue streams
- cleans up mining, cleans up coal

RWE's solution - half the corrective cost of using scrubbing - RWE's solution produces revenue

EPA's solution for TVA - \$250 million COST not including ongoing \$50 million per annum!

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other revenue sources from algae cake & oil

- **Plastics**
- **Fertilizers**
- **Cosmetics**
- **Enzymes**
- **amino-acids**
- **Antioxidants**
- **superoxide dismutase**
- **Phycocyanin**
- **carotenoids, etc.**

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mining

**Algae can be programmed to suck up
mining's "other" output, turns output into
harmless organic carbons for fertilizer
and animal feed**

**produces badly needed low-cost energy for
remote mining locations**

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potential combined NET revenue if oil & cake
separated and sold individually

oil	-	\$1.05 per gallon
cake	-	\$0.90 per gallon
CO2/Nox	-	\$1.94 per gallon
Royalties	-	\$0.12 per gallon
		=====
subtotal	-	\$4.01 per gallon

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foreign petroleum oil

**how does Algae
compare?**

Endless Supply of ENERGAE

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D.O.E . Figures*No. 2 Diesel Fuel****Algae Oil****Cost per gallon****At \$40 per barrel oil*****(\$0.86)****N/A****At \$10 Barrel oil = (\$.22)****Cost to Grow Oil or****Convert Diesel Fuel****(\$0.93)****(\$0.85)****Convert Algae Oil to****No. 2 Diesel Fuel****N/A****(\$0.45)****SG&A & Marketing****(\$0.25)****(\$0.25)****Shipping/Handling****(\$0.25)****(\$0.30)****Subtotal****(\$2.04)****(\$1.85)****Bi-Product Revenue Cake****NA****\$0.90****Bi-Product Revenue Carbon Credits****N/A****\$1.94****Bio-Diesel \$1.00 per gallon credit****N/A****\$1.00****Total****(\$2.04)****\$1.99****Endless Supply of ENERGAE****BLACK LION ENERGAE, LP**

**In January 2009, \$17 billion left American pockets to
purchase foreign oil - \$381,000 per minute**

the U.S. imports 67% of the oil it consumes

we have a solution

Canada - 2.028 million barrels per day

Saudi Arabia - 1.487 million barrels per day

Mexico - 1.296 million barrels per day

Venezuela - 1.071 million barrels per day

Nigeria - 0.775 million barrels per day

Iraq - 0.467 million barrels per day

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other oils vs. ALGAE oil

350 gallons - Palm Oil per acre per year

Fatty acid - HIGH

Conversion to Diesel - LOW

303 gallons Canola/Rapeseed

Fatty acid - LOW

Conversion to Diesel - HIGH

150 Soy Oil

Fatty acid - LOWER

Conversion to Diesel - VERY HIGH

38,500 gallons & more Algae Oil

Fatty acid - Extremely Low

Conversion to Diesel - 1 to 1

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competitors

Valcent Products - No revenues, demonstration model, produces product called Vertigro - website claims similar gallons per acre but system is costly

Solazyme - The company utilizes proprietary genetic engineering methods to develop and optimize commercially relevant biochemical pathways for production of hydrocarbons

LiveFuels - A national alliance of labs and scientists dedicated to transforming algae into biocrude by the year 2010. Working on breeding various strains of algae, driving down the costs of harvesting algae and extracting fats and oils

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Infinifuel Biodiesel - Nevada - home to a unique biodiesel project under development and is being touted as the world's first geothermal powered and heated biodiesel plant. Geothermal "wells" will be used as energy to grow ALGAE on 300 acres; still under development.

PetroAlgae - commercializing environmentally friendly ALGAE developed by a research team at Arizona State University that generates over two hundred times more oil per acre than crops like soybeans. Using a cost-effective, modular cultivation process that can be scaled. Working on converting ALGAE oil to plastics.

Sapphire - a developer scalable photo-bioreactors for the production of alternative oil products from algae oil. Sapphire's closed photo-bioreactors are expensive, but designed for high-end oil market products. Bill Gates dumped over \$50 million into this project and they make oil for \$2.50 a gallon and more

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production/value goals

	2009	2010	2011	2012	2013
RWE oil in MGPY	3	15	30	60	100
RWE Partner MGPY	0	15	40	60	100
	====	====	====	====	====
	3	30	70	120	200
Projected Value Per Unit	\$1665	\$2368	\$3780	\$6890	\$11,450
Based on Profit per Unit	<u>current unit price \$1000</u>				

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Richard Armstrong Resume

Richard Armstrong, President, Chairman

SUNY- Binghamton, Electrical and Chemical

Brome CC, Math and Physics Major

Senior member ISA, Instrumentation Society of America

Extensive experience in building large chemical plants. *Project design/manager on over 5 billion dollars in projects on pulp & paper & chemical processes including transesterification processes.* Experience includes project design, start-up and commissioning of pulp dryers, bleach plants, paper machines, scrubber systems, electrical distribution, emergency generators, plant automation, system networks, electronic primary and final control elements and programming/configuration of PLC's and distributive control systems for boiler houses, chemical batch reactors, conveyor systems, Pharmaceuticals, pulp and paper plants as well as petrochemical.

- **Has extensive experience in negotiating large equipment purchases. *Every project over the last 35 years has been on budget and on time.***
- **Partial list of clients: Bowater Pulp & Paper, Rhone Poulenc Chem., BF Goodrich, Duke Power, Phillip-Morris, AMEX, GE**

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TIM TOMPKINS RESUME

Tim Tompkins, CTO

Technical Association for the Pulp and Paper Industry (TAPPI) – member since 1989

Carolinan Air Pollution Control Association (CAPCA) – member since 1996

B.S., Pulp and Paper Technology

N. C. State University

Engineer on over 2 billion dollars in projects on boilers, Pulp & Paper & chemical processes and often managed these facilities. Pulping and bleaching projects include a new 50 ton-per-day chlorine dioxide plant and storage tank system, bleach plant modifications, recycle and de-ink pulp facilities, pulp dryer system modifications, pulp mill studies, chilled water system modernization, and design of several cooling tower systems. Papermaking projects include white water system modifications, vacuum pump installations, cleaner modifications and additions, post consumer waste recycle system, and ground calcium carbonate system. Environmental projects include scrubber additions and modifications, storm water collection and treatment, and several Cluster Rule related jobs that included: studies, capital cost, design, and construction.

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BLACK LION PARTICIPATION

- ✓ **Discount to Offering Price Up to First \$5 Million Raised**
- ✓ **Partnership With Iowa Biodiesel Producers**
- ✓ **Dividend Rolling**

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ALGAE ENERGAE

Don't save any more
money on food additives

ACT
NOW

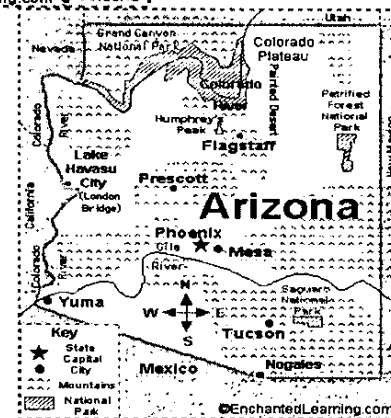
HOW MANY U.S. ACRES?

How many acres of algae planted would it take to replace U.S. imported oil?

15 million acres = 2% of US. Farmland

How many acres of desert are available in Nevada and Arizona?

48 million acres



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