

# Strategic Plan






# CAES Strategic Plan

September 2011

Approved by:

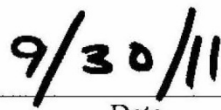
  
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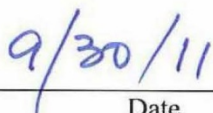
  
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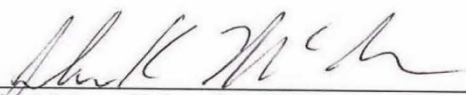
  
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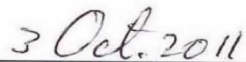
  
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## EXECUTIVE SUMMARY

The Center for Advanced Energy Studies (CAES) leads energy research programs important to the nation; attracts bright undergraduate and graduate students and faculty to the Idaho universities; reaches out across Idaho and the nation to promote an informed energy policy dialogue and research; strategically complements the Idaho National Laboratory (INL) in accomplishing the Department of Energy, Office of Nuclear Energy (DOE NE) mission; and, acts as a catalyst for Technology-Based Economic Development (T-BED) in Idaho. By design a collaboration comprised of Boise State University (BSU), Idaho State University (ISU), University of Idaho (UI), and the INL, CAES employs a *collaborative approach* to attract and empower the best and brightest in an environment that fosters excellence, unbounded by personal or organizational affiliation, while increasing the impact and reducing the timescale of innovative research and continuously renewing the scientific and engineering talent pool.

The goals of this approach include strengthening U.S. scientific and technical leadership by:

- Executing basic and applied research,
- Facilitating the transmission of new ideas, products, and processes,
- Supporting the competitiveness and vibrancy of the U.S. economy,
- Promoting university collaborations and concomitant human capital development as a distinctive competitive advantage for the INL,
- Establishing CAES as the portal to the INL.

The CAES strategy is to systematically select and focus on research initiatives, which include nuclear science and engineering, advanced materials, bioenergy, geofluids energy science, and energy efficiency. Initiatives are complemented and supported by cross-cutting capabilities in advanced modeling and visualization, energy policy, and education programs. A key element of the CAES strategy is its complementary nature: CAES complements rather than competes with the research interests and capabilities of its partners and therefore supports mission accomplishment not only for CAES but also for each of the CAES partners. CAES outcome-oriented and disciplined approach to scientific inquiry and operations underpins this strategy.

Ultimately, CAES success will be measured against its ability to:

- Build value and promote trust amongst its partners,
- Create distinct, unique, and complementary capabilities and programmatic opportunities,
- Renew the scientific and engineering talent pool, upon which the partners' success depends,
- Promote creativity and innovation and diversity across the partnership,
- Earn recognition as a key element of each partner's research, business, and human capital strategy,
- Achieve long-term fiscal health,
- Attract world-class affiliates, for whom CAES affiliation is highly sought after and prestigious,
- Generate regional technology-based economic development.



## CONTENTS

EXECUTIVE SUMMARY .....	v
ACRONYMS* .....	viii
INTRODUCTION .....	1
THE CAES STRATEGY.....	2
Strategy Map .....	3
Distinguishing Capabilities that Enable Mission Accomplishment.....	5
Strategic Objectives .....	5
Stakeholder Value .....	8
Mission Accomplishment .....	8
IMPLEMENTATION STRATEGY TO ACHIEVE OUR GOALS .....	9
General Tasks .....	10
Distinguishing Capabilities and Critical Enablers.....	11
Executing World-Class, Collaborative Research and Education .....	12
Research.....	12
Education .....	12
Stakeholder Value .....	13
Appendix A—Initiative Evaluation Criteria.....	18
Appendix B—Initiative Summary Sheets.....	19
BioEnergy Initiative Summary .....	19
Energy Policy Institute Initiative Summary .....	23
Nuclear Science and Engineering Initiative Summary.....	26
CAES Geofluids Energy Science Initiative Summary .....	29
Advanced Materials Initiative Summary .....	33
CAES Energy Efficiency Research Initiative Summary .....	37

## FIGURES

Figure 1. Depiction of the CAES strategy for pursuing its vision. ....	4
Figure 2. CAES is home to a Local Electrode Atom Probe (LEAP), one of the few in the world.....	6
Figure 3. The CAVE supports a range of CAES research projects and initiatives. ....	7
Figure 4. Leadership team and initiative leads.....	9

## TABLES

Table 1. Implementation summary. ....	14
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## ACRONYMS\*

ACE	Academic Centers of Excellence
AD	Associate Director
ATR NSUF	Advance Test Reactor National Scientific User Facility
BSU	Boise State University
CAES	Center for Advanced Energy Studies
CAMS	Center for Advanced Modeling and Simulation
CRADA	Cooperative Research and Development Agreement
CAVE	Computer Assisted Virtual Environment
CEERI	CAES Energy Efficiency Research Initiative
DOE	Department of Energy
DOE NE	Department of Energy, Office of Nuclear Energy
EPI	Energy Policy Institute
ES&H	environment, safety and health
ESTEC	Energy Systems Technology and Education Center
GIS	geographical information system
HPC	high performance computing
HVAC	heating, ventilation, and air conditioning
INEST	Institute of Nuclear Engineering Science and Technology
INL	Idaho National Laboratory
IP	intellectual property
IT	information technology
iSTEM	Idaho Science, Technology, Engineering and Mathematics
ISU	Idaho State University
JA	joint appointment
LDRD	Laboratory Directed Research and Development
LEAP	Local Electrode Atom Probe
LIDAR	Laser Imaging Detection and Ranging
MaCS	Microscopy and Characterization Suite
MS	Master of Science
NEUP	Nuclear Energy University Programs
PD	Program Development
QA	quality assurance
ROI	return on investment
SPS	Spark Plasma Sintering
T-BED	Technology-Based Economic Development
UI	University of Idaho

\* Acronyms introduced in Appendices are not included in list



# CAES Strategic Plan

## INTRODUCTION

The U.S. Department of Energy (DOE) created the Center for Advanced Energy Studies (CAES) to lead energy research programs important to the nation, attract bright undergraduate and graduate students and faculty to the Idaho state universities, reach out across Idaho and the nation to promote an informed energy policy dialogue, and act as a catalyst for technology-based economic development (T-BED) in Idaho. By design, CAES is a collaboration comprised of Boise State University (BSU), Idaho State University (ISU), University of Idaho (UI), and the Idaho National Laboratory (INL). This *collaborative approach* is critical to CAES' success. The design intent is to attract and empower the best and brightest to collaborate in an environment that fosters excellence, unbounded by personal or organizational affiliation, and increases the impact and reduces the timescale of innovative research while continuously renewing the scientific and engineering talent pool.

**CAES fosters multi-institution collaborative research ...  
CAES is the collaboration model of the future.**

This strategic plan guides the CAES collaborative research agenda by marrying the resources, capabilities and talents of the CAES partners in addressing energy research challenges with cross-cutting integrated approaches, which are difficult if not impossible to execute individually. The goals of this strategy include strengthening U.S. scientific and technical leadership by:

- Executing basic and applied research to discover and develop new energy technologies that address global energy challenges while mitigating the environmental consequences of fossil fuel combustion.
- Facilitating the transmission of new ideas, products, and processes – the outcomes of academic research – into the marketplace to catalyze economic development and societal advancement and promote the competitiveness and vibrancy of the U.S. economy.
- Elevating university collaborations and concomitant human capital development to levels that underpin INL mission success such that CAES is recognized as a distinctive competitive advantage and as a key enabler in sustaining the INL as a world-class nuclear laboratory.
- Establishing CAES as the portal to the INL to include: Mission capabilities; the Advance Test Reactor National Scientific User Facility (ATR NSUF); regional initiatives; and, international research and education opportunities.

## THE CAES STRATEGY

The CAES partnership is a strategic collaboration valued by its partners because CAES is a key enabler to the Idaho research universities in achieving their aspirations of becoming first-tier, nationally-recognized research leaders and likewise to the INL in achieving its transformation into a world-class nuclear laboratory. The CAES strategy is to systematically select and focus on research “initiatives.” These include nuclear science and engineering, advanced materials, bioenergy, geofluids energy science, and energy efficiency. CAES initiatives are led by CAES research affiliates selected from the CAES partners; both initiatives and affiliates are selected by the CAES leadership team which represents the four partners. In addition, initiatives are complemented and supported by cross-cutting capabilities in advanced modeling and visualization, energy policy, and education programs. There are five main advantages to this strategy:

1. The CAES multi-institutional collaborative research approach brings to bear science and engineering alongside social science and policy formulation to focus on energy production, conversion, storage and use in a holistic way that provides a more complete understanding of potential options. This includes minimizing disciplinary, institutional, and other barriers which traditionally limit cross-disciplinary approaches. The CAES approach:
  - Clearly links research initiatives to the solutions of larger issues.
  - Supports energy research initiatives with unique technical capabilities and specialized researchers beyond the resource constraints of individual projects.
  - Leverages INL Laboratory Directed Research and Development (LDRD) funding to bring faculty and students into INL projects and programs; refresh current initiative by creating programmatic off-ramps from this exploratory research.
  - Builds relationships between basic and applied research activities, and government sponsors and industrial customers.
  - Guides researchers in identifying and conserving potential intellectual property (IP).
  - Encourages the development of new initiatives with program development (PD) funds.
  - Complements the research interests and capabilities of its partners.
2. The CAES approach has a multiplicative effect that integrates the capabilities of the partner institutions allowing the CAES initiatives to achieve outcomes that the partners could not accomplish individually. In this regard the CAES approach:
  - Increases the integration of research-based education into the national lab and universities through increased placement and co-advising of graduate student in the national lab environment and the integration of faculty and researchers into national laboratory-led research. This includes the strategic use of joint appointments (JAs) as a recruitment strategy for universities and the INL through which faculty are appointed to INL positions and recognized as contributing staff in INL programs, and in turn, laboratory researchers are appointed to university positions to enhance the quality of academic programs and as an INL retention strategy.
  - Promotes the coordination of selected education programs (such as nuclear engineering/science) that include curriculum and resources shared across the partnership.
  - Expands and maintains shared research laboratories, equipment, and other physical infrastructure for common use by the CAES partners to promote research execution beyond the means of individual partners, including the growing importance of the so-called “virtual CAES” comprised of CAES resources located on the campuses of the CAES university partners.
  - Provides underlying proposal development, fiscal planning, and project management support to facilitate increased awards and successful execution of large and complex grants and contracts.

- Enhances the professional reputations of those associated with CAES by providing access to new and cutting-edge opportunities for scholarly activities.
3. The CAES approach promotes regional and national economic development and job creation by:
    - Enhancing regional economic activity through the grants and contracts awarded to CAES that represent dollars largely reinvested in the Idaho economy.
    - Forming industry-oriented advisory board(s) that inform(s) the direction of CAES activities.
    - Increasing the levels of industry sponsored and funded research including student participation at the CAES partner institutions through deployment of CAES capabilities.
    - Developing cost-sharing relationships with industry to jointly compete for programs requiring cost-share.
    - Teaming with technical schools and programs to promote energy-related workforce training and development.
    - Facilitating technology transfer and IP activities that promote the expansion of existing and/or the development of new energy related companies.
    - Participating in local and regional government and private economic development organizations.
  4. CAES actively promotes the inclusion of underrepresented communities in all CAES-supported activities to enhance the diversity of the partners and to promote creativity and innovation through:
    - Partnerships with institutions serving underrepresented groups.
    - Partnership with tribal and/or disadvantaged communities.
    - Engagement with minority-owned businesses and start-ups.
  5. CAES provides an exemplar of operational excellence by leading in the development and implementation of safe, flexible, regulatory compliant, and effective processes and procedures that facilitate productive research and ensure the safety of all CAES participants, the public, and the environment by:
    - Promoting a common environmental, safety and health (ES&H) culture across the CAES partner institutions.
    - Including student education in ES&H matters as an integral part of the CAES experience.
    - Incorporating both ES&H and quality assurance (QA) in all stages of the work-planning and execution processes.

## Strategy Map

The CAES Strategy Map, Figure 1, depicts the CAES strategy for pursuing its vision: “Develop Secure Sustainable Energy Solutions to 21st Century Challenges.” The map shows how the elements of the *collaborative approach* discussed above align to achieve mission success.

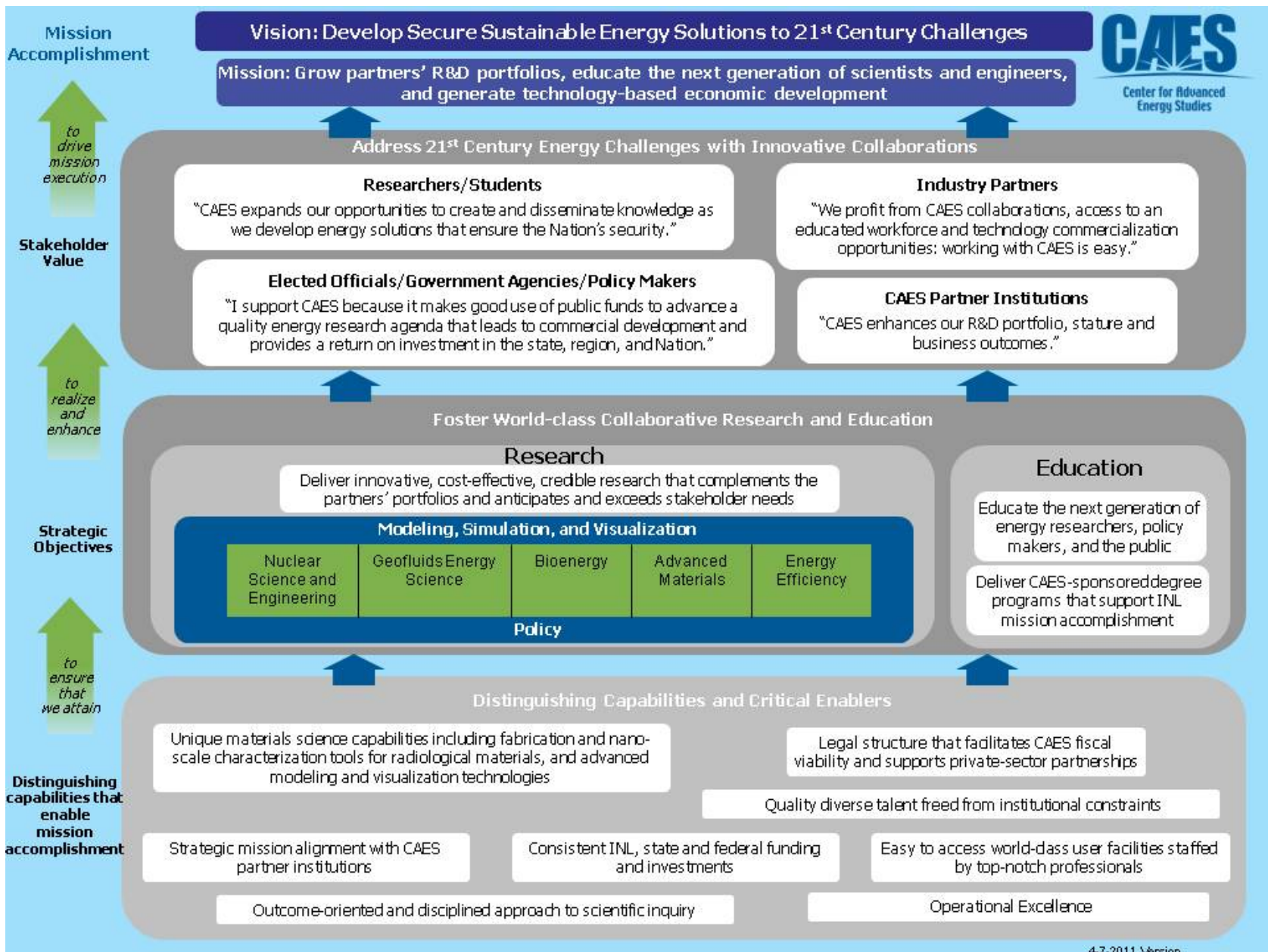


Figure 1. Depiction of the CAES strategy for pursuing its vision.

## ***Distinguishing Capabilities that Enable Mission Accomplishment***

Foundational to its strategy are CAES’ “Distinguishing Capabilities and Critical Enablers.” Collectively, these comprise the elements that sustain CAES and competitively advantage CAES in competing for and successfully executing world-class research and in educating the energy academics and professionals of tomorrow. These include:

- Outcome-oriented and disciplined approach to scientific inquiry
- Operational Excellence
- Strategic mission alignment with CAES partner institutions
- Consistent INL, state and federal funding and investments
- Easy to access world-class user facilities staffed by top-notch professionals
- Quality diverse talent freed from institutional constraints
- Legal structure that facilitates CAES viability and supports private-sector partnerships
- Unique advanced materials capabilities including spark plasma sintering, nano-scale microscopy and tools to characterize radiological materials.
- Advanced modeling and visualization including high performance computing (HPC) and a Computer Assisted Virtual Environment (CAVE).

## ***Strategic Objectives***

CAES’ overarching strategic objective is to foster world-class collaborative research and education. The CAES research agenda is designed to deliver innovative, cost-effective, credible research that complements the partners’ portfolios and anticipates and exceeds stakeholder needs. This agenda includes five research initiatives that were formulated and are guided by a systematic selection and review process to ensure that each initiative contributes to CAES mission accomplishment and adds stakeholder value. This initiative selection and review process is a key element of the *CAES collaborative approach* that encourages calculated risk taking, anticipates both success and failure, and builds links between the partners, industry, and government. By balancing opportunity with historical performance, this process promotes flexibility and responsiveness to new opportunities and the changing needs of the partners across the CAES research agenda. Periodic initiative reviews inform all CAES investment decisions. For the initiative evaluation criteria, see Appendix A.

***This initiative selection and review process is a key element of the CAES collaborative approach that encourages calculated risk taking, anticipates both success and failure, and builds links between the partners, industry, and government.***

Brief descriptions of initiatives and cross-cutting capabilities follow:

- Nuclear Science and Engineering: CAES’ nuclear science and energy research supports the goals and objectives of national and international nuclear energy programs, especially the Department of Energy, Office of Nuclear Energy (DOE NE). CAES researchers are working to solve some of the world’s most pressing nuclear problems, including extending the life of commercial reactors and developing solutions for closing the nuclear fuel cycle.
- Geofluids Energy Science: CAES’ geo-scientists use advanced tools (geographical information systems (GIS), Laser Imaging Detection and Ranging (LIDAR), and a CAVE) to develop strategies to

locate and characterize geothermal resources; study innovative methods of geothermal heat recovery; and, innovative methods of geothermal heat conversion to produce electricity and process heat. They also conduct carbon sequestration research focused on carbon and water management to reduce the environmental effects of anthropogenic CO<sub>2</sub>.

- Bioenergy: CAES' bioenergy researchers focus on converting such regional feed stocks as agricultural and forestry waste products into bio-fuels and high-value materials. Through research targeted at optimizing feedstock conversion processes and the bio-fuels life cycle, researchers expect to produce valuable energy products and co-products that improve production efficiency while reducing environmental degradation.
- Advanced Materials: CAES researchers focus on the fabrication and characterization of materials designed to withstand the harsh conditions associated with energy production, transmission, distribution, and storage including heat, abrasion, radiation, and corrosion, and on materials for all phases of the nuclear fuel cycle including resource recovery, radiation detection, nuclear fuel reprocessing and waste management.

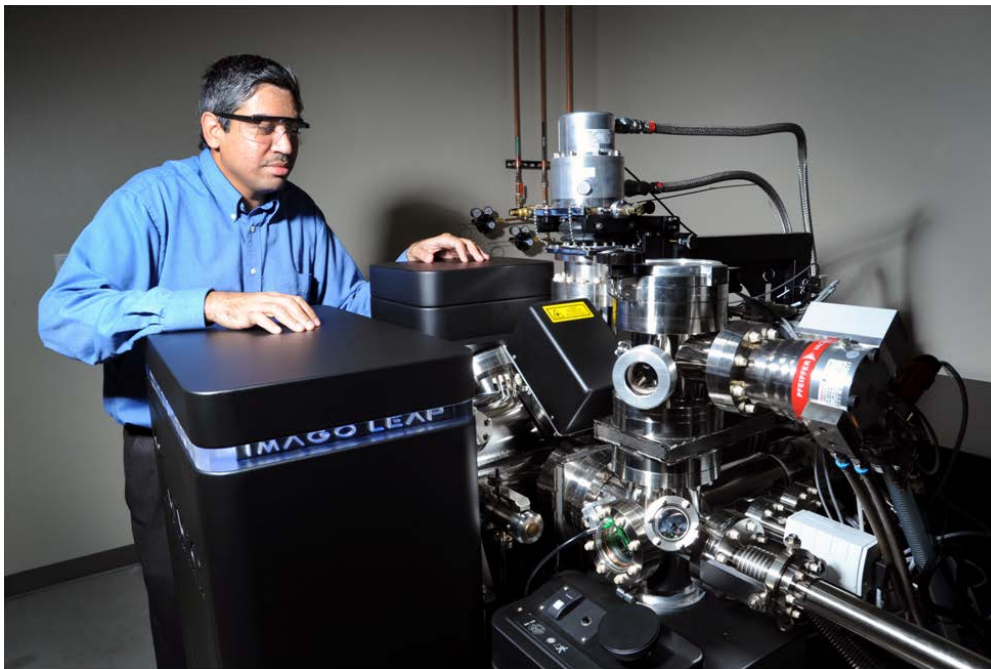


Figure 2. CAES is home to a Local Electrode Atom Probe (LEAP), one of the few in the world.

- Energy Efficiency: CAES researchers include mechanical, electrical, civil, and software engineers who focus on building performance management, heating, ventilation and air conditioning (HVAC) optimization, lighting systems and controls, the maturity and readiness of efficiency technologies, industrial processes, and consumer engagement and public acceptance, including sustainable demand-side management that meets the needs of both residential and commercial energy consumers.

Three programs, the Energy Policy Institute (EPI), Advanced Visualization and Modeling, and Education embody cross-cutting capabilities that enhance the quality of CAES initiative research and products across the portfolio.

- Energy Policy Institute (EPI)

The CAES EPI conducts research on the siting of such energy infrastructure as transmission lines and solar electricity generation facilities, and on integrating renewable energy into the electric transmission system, and analyzes public perceptions to inform and educate the public, policymakers,

and other stakeholders in support of policy decision processes. EPI analyzes the policy implications associated with transforming technically viable solutions into realities accepted by the public and other stakeholders.

- Advanced Visualization and Modeling

CAES visualization and modeling infrastructure includes HPC, a 2M pixel power wall, and a CAVE to support mission accomplishment in CAES initiative areas. This cross-cutting capability is managed and operated by the Center for Advanced Modeling and Simulation (CAMS) for both CAES and the INL.



Figure 3. The CAVE supports a range of CAES research projects and initiatives.

- Education Programs

CAES education programs aim to educate the next generation of energy researchers, policy makers, and the public with the goal of delivering CAES-sponsored educational opportunities that support CAES mission accomplishment. CAES education programs include:

- Joint appointments (JAs)
- Employee development opportunities
- Internships
- Idaho Science, Technology, Engineering and Mathematics (iSTEM)
- Energy Systems Technology and Education Center (ESTEC)
- DOE Nuclear Energy University Programs (NEUP)
- Institute of Nuclear Engineering Science and Technology (INEST)
- Academic Centers of Excellence (ACE)
- CAES scholarships.

## **Stakeholder Value**

CAES builds stakeholder value by addressing 21st century energy challenges with its innovative *collaborative approach* to executing research. For its partner institutions, CAES supports the Idaho research universities in achieving their aspirations of becoming first-tier, nationally-recognized research leaders and supports the INL in becoming the preeminent nuclear energy and multi-program national laboratory envisioned by the DOE. For industry partners, CAES improves access to an educated workforce and technology commercialization opportunities. For researchers and students, CAES expands opportunities to create and disseminate knowledge in research disciplines of regional and national importance. And, for partners from the governmental and policy spheres, CAES is valuable because it provides a return on investment (ROI) by making good use of public funds to advance a quality energy research agenda that leads to commercial development, as well as providing valuable information and data to help policy makers arrive at informed decisions.

For all stakeholders CAES employs a user facility model that allows ready access to a unique suite of equipment capable of supporting innovative state-of-the art research.

**For partners from the governmental and policy spheres, CAES is valuable because it provides a return on investment (ROI) by making good use of public funds to advance a quality energy research agenda that leads to commercial development.**

A key element of CAES *collaborative approach* in terms of building stakeholder value is its complementary nature. CAES research initiatives and capabilities are intentionally designed to complement rather than compete with the research interests and capabilities of its partners and therefore support mission accomplishment not only for CAES but also for each of the CAES partners. For example, one main focus of the CAES nuclear science and engineering initiative is advanced materials fabrication, microscopy and characterization. Researchers fabricate, test and characterize novel metals, ceramics and composites optimized for energy applications including fuels, vessels, piping, cladding, cellular solids and waste forms. To ensure that this research initiative and its capabilities complement the INL mission, CAES is establishing post-irradiation examination capabilities to perform nano-scale and atomic-level characterization such that examinations can be completed using micrograms or nanograms of irradiated specimens. The CAES INL partnership is also exploring an unprecedented separate-effects irradiation capability expected to provide real-time physical data on the early dynamics of fuels, materials, and instrumentation in a controlled irradiation environment similar to but far less complex than a nuclear reactor core. The establishment of such unique capabilities in the CAES research facility will not only support INL mission accomplishment but also encourage university collaborations while underscoring CAES' role as the portal to the INL.

Another example of how CAES complements stakeholders and creates value is CAES' role in filling the human capital pipeline. CAES collaborative approach to education encourages JAs, whereby researchers are jointly employed by two institutions, and internships that provide opportunities for students to work alongside INL researchers. These functional relationships, which CAES further encourages through its initiative process, lead to career-building opportunities that benefit all parties: University students and faculty gain firsthand experience in a national laboratory setting; INL researchers gain insights from exposure to new ideas and diverse talent; and, all gain from the free flow of ideas and talent across the partnership and beyond.

## **Mission Accomplishment**

Mission accomplishment derives from CAES collaborative approach and the elements of the CAES strategy: unique capabilities, a disciplined collaborative strategy, and the creation of stakeholder value.



## IMPLEMENTATION STRATEGY TO ACHIEVE OUR GOALS

Implementation of our strategy is the responsibility of the CAES leadership team and initiative leads (see Figure 4).

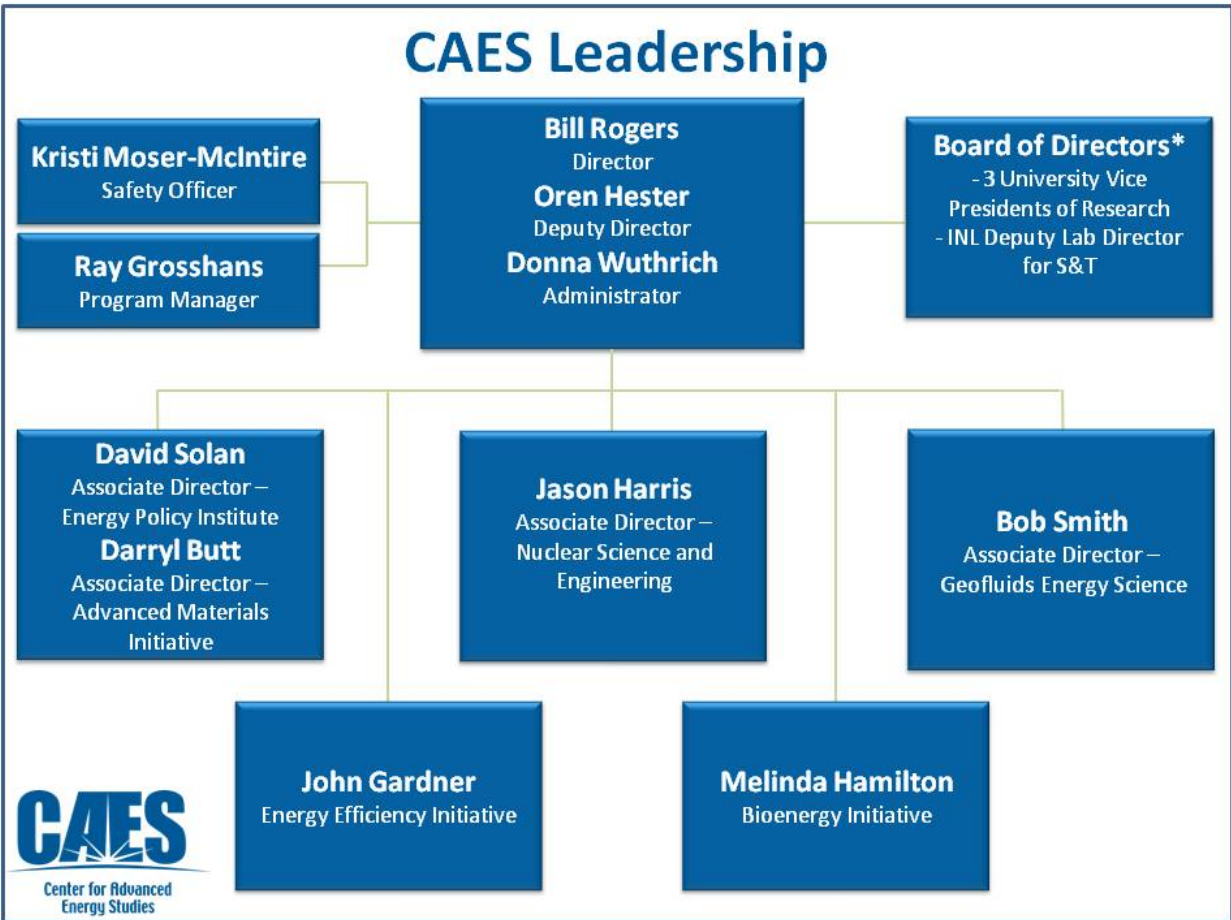


Figure 4. Leadership team and initiative leads.

\*CAES Board Members: Mark Rudin, Boise State University; David Hill, Idaho National Laboratory; Richard Jacobsen, Idaho State University; John McIver, University of Idaho

Below are the tasks CAES will undertake to achieve mission success. General tasks are presented first followed by tasks necessary to implement the CAES strategy. A basic description of the nature and value of each task is provided. Table 1 provides a summary of tasks, owners, completion dates, and metrics.

## General Tasks

**Task:** Create and implement a CAES Communications Plan

**Description:** The Communications Plan serves multiple purposes including: information dissemination, stakeholder education and advocacy, publicity and branding, and provides for technical reports, meetings and a seminar series. The plan will balance the partners' interests and touch all stakeholders such as the public, faculty, researchers, industry, State and Federal legislatures, and government agencies with emphasis placed on DOE NE, and will include a media strategy. The primary objectives are to increase CAES visibility, promote CAES value, and build trust amongst the CAES partners.

**Task:** Develop and execute a CAES Assurance Plan

**Description:** The plan will lay out the methodology by which CAES tracks and trends its progress towards mission outcomes as well as its key tactical and strategic actions to achieve those outcomes. The plan will identify the tools and techniques that will be used to assure performance and explain the relationship between outcomes, measures, strategies, and tactics.

**Task:** Develop human capital

**Description:** CAES has a responsibility to renew the scientific and engineering talent pool upon which the partners' depend to accomplish their respective mission outcomes. Therefore, CAES must expand educational opportunities by promoting highly competitive science and engineering academic programs that are well integrated across the Idaho universities and grow the number of energy technicians and professionals that graduate from the CAES partner universities. In addition, CAES must support the recruitment and retention of nationally and globally recognized professionals across the partnership including at least one preeminent researcher that elevates CAES reputation to the next level.

CAES will also contribute to the retention and recruitment of INL staff by providing a unique collaborative environment and by supporting sabbatical assignments and other opportunities to engage in university activities. Subtasks include:

- Grow CAES Affiliate Base: Cultivate processes, an image, and a reality through which CAES affiliation is a highly sought after and prestigious opportunity for faculty and researchers.
- Establish three endowed faculty chair positions.
- Establish multiple JAs with the INL in each initiative area.
- Establish JAs of INL researchers with universities.

**Task:** Integrate cross-cutting capabilities into initiative strategies

**Description:** Each initiative will explicitly define its strategy to leverage policy and modeling and simulation capabilities to provide a niche for the initiative's success.

**Task:** Cultivate partnerships with underrepresented communities in all CAES-supported activities

**Description:** CAES is committed to enhancing the diversity of the partners and to promote creativity and innovation through: Partnerships with institutions serving underrepresented groups; partnership with tribal and/or disadvantaged communities; and, engagement with minority-owned businesses and start-ups.

## Distinguishing Capabilities and Critical Enablers

**Task:** Incorporate CAES into each home institution's strategic plan

**Description:** CAES is explicitly recognized by each CAES partner institution in their research portfolio and strategic plan as a key element of their research, academic, and human capital strategies.

**Task:** Achieve and sustain operational excellence

**Description:** CAES recognizes that maintaining the appropriate physical infrastructure has far reaching impact on the research capabilities of the organization, staff morale, and the ability to attract new talent. At a minimum, laboratory facilities and offices where research is conducted must remain vital and effective for accomplishing the work scope at hand. The CAES facilities must be maintained as modern and best-in-class, so they serve as a significant selling point in attracting both research projects and those who would execute them.

CAES has developed its first generation of operations and ES&H processes for assuring that research can be planned and performed efficiently and safely and that operational risks are being managed appropriately. These processes help to ensure that CAES executes research and projects in a safe, cost effective, quality, and timely manner. Self-assessments, walk downs, a plan-of-the week process, observations of work, and management of identified issues are the steps taken to ensure the safe and efficient execution of research.

Subtasks include:

- Maintain and grow CAES infrastructure and equipment capabilities.
- Fully implement CAES second generation of operations and safety and health processes.

**Task:** Achieve Fiscal Viability

**Description:** CAES fiscal viability means long-term fiscal health and hinges on a variety of actions, some by CAES and some by its stakeholders. The key subtasks are:

**Key Subtask:** Secure State commitment for recurring funding

**Description:** State recurring funding of \$3M is needed to sustain CAES research and education agendas. The funding will allow CAES universities to hire an adequate base of faculty/researchers to compete for research dollars needed to maintain CAES' viability and conduct requisite courses. The value proposition to the State for educational, human capital, and T-BED must be communicated effectively.

**Key Subtask:** Secure long term INL support

**Description:** CAES is seeking a 5-year \$3M commitment from the INL to support research (LDRD) and CAES management.

**Key Subtask:** Implement a CAES legal structure

**Description:** Becoming a legal entity is necessary for CAES to (1) streamline contractual agreements with customers, (2) enable CAES to generate revenue to pay for its operating costs (i.e., fiscal viability), and (3) manage CAES partners' liabilities.

- Key Subtask:** Implement user facility model for CAVE
- Description:** Enables easy access to this unique capability, facilitates collaborations, and generates revenue to operate and maintain the CAVE.
- Key Subtask:** Implement user facility model for the Microscopy and Characterization Suite (MaCS)
- Description:** Enables easy access to these unique capabilities, facilitates collaborations, and generates revenue to operate and maintain the MaCS.
- Key Subtask:** Implement user facility model for two Spark Plasma Sintering (SPS) systems
- Description:** Enables easy access to these unique capabilities, facilitates collaborations, and generates revenue to maintain the SPS systems.

## Executing World-Class, Collaborative Research and Education

### *Research*

- Task:** Develop and maintain initiative and cross-cutting capability summary sheets
- Description:** These sheets provide a road map for success for each CAES initiative area as well as the cross-cutting capabilities. The initiative summary sheets are provided as Appendix B. Some areas of focus that apply to all initiatives are:
- Refine and cultivate CAES research agenda to increase potential for major funding awards
  - Formalize CAES collaborations with national university consortia and other strategic universities.
  - Develop industry-funded consortia focused on pre-competitive research with consortia; and, support student research and career development.
  - Develop partnerships with industry focused on new product development and QA that match talent with opportunity; increase industrial innovation; and, support student research and career development.
- Task:** LDRD Investments
- Description:** Conduct energy research that results in distinct and unique capabilities and programmatic opportunities in CAES initiative areas.
- Task:** Strategic PD investments
- Description:** Use PD funds for strategic and targeted investments with measurable outcomes identified, when applicable.

### *Education*

- Task:** Develop an integrated CAES human capital strategy
- Description:** CAES human capital goals across its initiative and cross-cutting capabilities are articulated in a concise plan with clear strategies and outcomes identified.

- Task:** INL mission driven degree programs
- Description:** Create CAES-sponsored degree options targeted to INL mission needs such as a Master of Science (MS) in nuclear safety (technical elements of nonproliferation) and a MS in nuclear management, with the goal to provide a sufficiently large pool of skilled workers such that a shortage of skilled workers is never an obstacle to INL mission accomplishment.
- Task:** Provide a forum for academic program collaboration
- Description:** CAES is positioned to support Idaho universities in the execution of their education missions. Fiscal, quality, and demographic constraints have made collaboration a priority for Idaho universities. Education programs with an elevated importance to CAES and the INL include:
- Nuclear engineering undergraduate and graduate programs.
  - Material science undergraduate and graduate programs.
  - Modeling, simulation, and visualization.

## Stakeholder Value

Mission accomplishment is driven by CAES collaborative approach and the elements of the CAES strategy: Unique capabilities, a disciplined collaborative strategy, and the creation of stakeholder value. Measures for stakeholder value are presented in Table 1.

Table 1. Implementation summary.

Task	Owner	Completion Date	Metrics
<b>General</b>			
Create and implement a CAES communications plan	K. Rolston	December 2011	Embedded in communications plan
Develop and execute a CAES assurance plan	O. Hester	November 2011	Embedded in assurance plan
Grow CAES affiliate base	Associate Directors (ADs)	Ongoing	Number of active CAES affiliates; number of new affiliates each year
Establish 3 endowed faculty chair positions	ADs	2014	First endowed chair by September 2013; Number of endowed chairs
Universities establish joint appointments (JAs) with INL	ADs/ Initiative Leads	September 2012	Two JAs established and maintained per initiative area; one JA for each cross-cutting area One INL researcher JA with each CAES university by September 2012
Cultivate partnerships with underrepresented communities	Director	Ongoing	Number of partnerships with institutions serving underrepresented groups. Number of partnerships with tribal and/or disadvantaged communities. Number of engagement with minority-owned businesses and start-ups.
<b>Distinguishing Capabilities and Critical Enablers</b>			
Incorporate CAES into each home institution's strategic plan	Board Members	June 2012	CAES has a well-defined role in research, human capital and education strategy for each University and INL
<b>Achieve and Sustain Operational Excellence</b>			
Maintain and Grow CAES Infrastructure and equipment capabilities	O. Hester	September 2012	Equipment in CAES laboratories provides a competitive advantage that results in increased research in initiative areas; CAES has a strategy to maintain and replace unique equipment and acquire new equipment.

Task	Owner	Completion Date	Metrics
Fully implement CAES second generation of operations and safety and health processes	O. Hester	September 2012	CAES has a strong safety culture that is embraced by all its partners.
		September 2013	CAES is routinely benchmarked for its operational excellence and ability to conduct research efficiently.
		September 2012	Effective operations processes that consistently result in productive and safe work practices.
		September 2012	Best-in-class safety record.
<b>Achieve Fiscal Sustainability</b>			
Secure state commitment for recurring funding:	Board	June 2013	\$3M in line item funding in State budget by 2013.
Secure long term INL Support:	Director	June 2012	5-year commitment to fund LDRD and CAES leadership at \$3M annually.
Implement a CAES legal structure	Director/ADs	September 2012	Legal structure implemented by September 2012.
Implement user facility model for CAVE	E. Whiting	September 2012	CAVE user facility model operational by September 2012
Implement user facility model for MaCS	O. Hester	September 2012	Nationally recognized microscopy and characterization capabilities 80% of MaCS operating cost paid by customers by 2013.
Implement user facility model for two spark plasma sintering systems	D. Butt	December 2012	SPS user facility model operational by September 2012.
<b>Sustaining World-Class, Collaborative Research and Education or Strategic Objectives</b>			
<b>Research</b>			
Develop initiative and cross-cutting capability research agendas and document strategy using initiative summary sheet	Initiative Leads	Ongoing	See Initiative Summary Sheets in Appendix B.
		TBD	Number of major research grants competed for and won by CAES.
	Initiative Leads	December 2012	Recognized as the honest broker for Idaho energy solutions, especially in bio and renewable energy – December 2012.
	Initiative Leads	Ongoing	CAES research is routinely published in well-respected, peer-reviewed journals and conference proceedings (an average of 20 journal articles or conference proceedings each year).

Task	Owner	Completion Date	Metrics
	Initiative Leads	Ongoing	Technical leadership in provided in key energy technology areas critical to the nation.
	Leadership Team	Ongoing	Reduced innovation cycle as a result of collaborations.
	Leadership Team	Ongoing	Increased utilization of CAES universities to support INL mission as a result of past success
	Initiative Leads	Ongoing	Increased number of LDRD projects that lead to programmatic work and Corporative Research and Development Agreements (CRADAs).
	Leadership Team	September 2013	Research demands dictate a need to expand the virtual CAES or build CAES 2.
LDRD Investments	R.Grosshans/ Initiative Leads	Ongoing	Distinct and unique capabilities that result in programmatic funded research.
Strategic PD Investments	Director	Annually	Explicit outcomes identified and measurable ROI for investments
<b>Education</b>			
Develop an integrated CAES human capital strategy	M. Hamilton	March 2012	Number of interns and post-docs that become permanent hires Enhanced ability to recruit world-class faculty Improved retention of key INL staff as a result of JAs.
INL mission driven degree programs	ADs	Ongoing	Degree programs that support INL mission Number of new degree programs that support mission needs Number of graduates from new degree programs that are INL employees or become INL employees.
	E. Whiting	September 2012	Strategy to leverage information technology (IT) to streamline learning and foster collaborative degree programs and sharing of individual courses.
Develop an information technology-based strategy for executing collaborative learning	ADs		



Task	Owner	Completion Date	Metrics
Facilitate academic program collaboration	Director/ADs	Ongoing	CAES leadership serves on academic program advisory boards Workshops held to facilitate academic program collaboration State universities value CAES contributions to undergraduate and graduate programs in: <ul style="list-style-type: none"> <li>• Nuclear engineering undergraduate and graduate programs</li> <li>• Material science undergraduate and graduate programs</li> <li>• Modeling, simulation, and visualization.</li> </ul>
<b>Stakeholder Value</b>			
Effectiveness of tasks above and stakeholder value are also measured by these metrics	Leadership team	Ongoing	<ul style="list-style-type: none"> <li>• Established industrial partnerships in each CAES initiative area with enough membership fees to conduct meaningful and sustainable core research.</li> <li>• A commitment from DOE NE for recurring funding to support CAES initiatives</li> <li>• INL recognizes and uses CAES as its portal for external access</li> <li>• Industrial sponsorship secured for individual laboratories.</li> <li>• A constant backlog for use of CAES laboratories</li> </ul>

# Appendix A

## Initiative Evaluation Criteria

CAES systematically selects its areas of research using a well-defined set of criteria. The same criteria are used to assess initiative performance and to make future investment decisions. The CAES research agenda is flexible allowing it to be responsive to new opportunities and changing needs based on past performance. The criteria that guide CAES research agenda are:

- **People:** Do the CAES institutions have the quality and quantity of people to successfully execute the initiative mission.
- **Academic Programs:** Do the CAES universities have academic programs that support the initiative area; conversely does the initiative provide a logical forum for conducting research by students at the universities.
- **Equipment:** Do the CAES institutions have adequate available equipment to execute the initiative's research.
- **Funding Source:** How well defined are the customers who are currently or who are likely to invest in the initiative at a level that will sustain the initiative.
- **Alignment:** How well the initiative focus is aligned with the missions of the four CAES partner institutions.
- **Collaborative:** Does the initiative have potential for and has it resulted in collaborations among the CAES partners. And, can it leverage or has it resulted in good working relationships between university and INL researchers, such that (1) the capabilities of each institution are well understood and (2) they are leveraged by the "other" institutions.
- **Complementary:** How well does the initiative's focus complement the missions of one or more of the CAES partners or, conversely, whether or not it is perceived as or is actually competing with the CAES partners.
- **Sustainable:** Where is the initiative today as well as what potential has it demonstrated to achieve sustainability. The CAES default timeframe within which it expects an initiative to become sustainable is five years. Note: Sustainable has yet to be defined and may be initiative-specific based on different factors such as expected revenue, whether or not it is more cross-cutting than standalone, commercialization potential, etc.
- **Technology-Based Economic Development:** Is there reasonable potential for the initiative to produce substantial business volume and/or potential for commercialization, with emphasis on the Idaho economy and industry.
- **Industry Synergy:** What is the actual or potential private sector interest in the initiative.

# Appendix B

## Initiative Summary Sheets

### BioEnergy Initiative Summary

#### CAES INITIATIVE SUMMARY

<b>INITIATIVE TITLE:</b>	BioEnergy					<b>Date</b>	2/18/2011
<b>Initiative Leader:</b>	Melinda Hamilton					<b>Signature</b>	<b>Date</b>
<b>Initiative Description:</b>							
Develop a statewide research and education center focused on development of bioenergy, biofuels, and bioproducts from regionally available feedstocks							
<b>Customers:</b>	DOE-EERE, Idaho SBOE, US Department of Agriculture (AFRI), United Dairymen of Idaho, Idaho Dairyman's Association, Cargill, agriculture and industrial waste producers, regional energy and products industry partners.						
<b>Funding Profile:</b>	09	10	11	12	13	14	
<b>Planned:</b> These are the \$s you project/hope to capture in the respective year based on your initiative plan/strategy (i.e., where you hope to be and how you define success)	\$150K indirect	\$340 indirect	\$0.8M (\$460K direct/in kind) (\$340 indirect)	\$1M (\$700K direct/in kind) (\$290 indirect)			
<b>Planned Hard Dollars:</b> This row is new and captures the \$s you have won/commitments for in the respective year		\$340K LDRD \$40K PD	\$340K LDRD \$65K PD	\$190K LDRD \$50K PD			
<b>Actual (YTD):</b> These are the \$s actually expended in the FY	\$150 K LDRD \$20K PD	\$ 280 K LDRD \$45K PD		0			
<b>Strategic Objectives: (list)</b>							
Long Term Objectives							
Stand up a self sustaining Bioenergy Center in Idaho with multiple sources of federal and state funding, industrial partner support and matching funding, and cooperation and support from the agriculture and forestry industry in the region.							
Be recognized as Idaho's BioEnergy Resource by OER and Industry							
<b>Tactics: (list)</b>							
<b>Objective A. Establish Robust Research Program and Establish Credibility</b>							

## CAES INITIATIVE SUMMARY

### **Priority 1: Continue focus on research that will advance anaerobic digestion technology and establish credibility of LCA approach**

- Complete 3 year LDRD in FY11 utilizing LCA approach to evaluate regional feedstocks
- Complete AD LDRD in FY12/early FY13
- Initiate large scale anaerobic digester tests at Meridian Wastewater treatment plant- ABES , anticipated funding \$150K and expected start summer 2011
- Refine and validate anaerobic digestion LCA models- in kind support by Cargill in the form of operating digester analysis/data will be provided
- Continue development of proposals to federal and state agencies and respond to comments as proposals are reviewed.
- Publish and present findings from current LDRD projects and utilize as preliminary data for proposal efforts
- Invest in Capital Equipment: FY12 for Pilot Scale Anerobic Digestor, Lide Chen PI, 100K, System will be located at Twin Falls with the dairy research efforts.

### **Priority 2: Initiate new research projects that establish CAES with forest biomass industry in pacific Northwest.**

- Invest in Capital Equipment: FY12, \$ 200K. Biomass Monitoring Equipment, Monitoring instrumentation to assess (i) biomass feedstock, (ii) bio-oil composition and syngas composition, and (iii) biochar that will be integrated into the pilot plant pyrolysis unit. This will aid in integrating the pyrolysis unit with the INL biomass pretreatment system. System will include instrumentation, data logging, and control system. System will be mounted on the mobile pyrolysis unit at UI. Armando McDonald will be the responsible PI. This equipment will be used in proposals and potential joint LDRD with Richard Hess' organization.
- FY12 Initiate one new LDRD project -\$100K

### **Priority 3: Pursue opportunies for Seed Oil focus as they arise and resources allow.**

### **Objective B. Develop Partnerships with industry that will support through in-kind or research funding continued research**

#### ***Anaerobic Digestion focus***

- ABES and Meridian Waste Water Treatment Plant Project  
UI and BSU involved in technology validation research funded by ABES who will be funded by private investor at around 40-50K.
- Amalgamated Sugar—discuss with them potential use of energy crops and sugar beet waste as substrate material for AD and potential application of their separation technology (chromatography/fractals) in conjunction with digesters
- Innovation Center for US Dairy—Jointly work with them on LCA of anaerobic digestion for reduction of GHG emissions and anaerobic digestion related to substrates (they have interest to construct a prototype digester at the U of I/USDA experiment station at Kimberly to test all kinds of substrates in order to make AD more profitable and to test effluent fibers for by products)
- Cargill—work with them on the LCA model using test data from their large AD operation by Kimberley
- Western State Equipment—acquire test data from their AD operation, that is different from Cargill's (plug flow vs. mixed tank), for use with our LCA model
- Idaho Dairymen's Association—continue work with Bob Naerabout to establish CAES as a center to conduct research to reduce GHG emissions within the national dairy industry

## CAES INITIATIVE SUMMARY

- Simplot—develop a research project to support their efforts to process manure at their 75,000 cows feed lot operation (gasification, pyrolysis etc)
- C-3 Holdings—work with them to establish a technology center here in Idaho to be partly funded by Sinomac of China

**Forest Residues Focus**

- Develop business plan that aligns with the BioEnergy Strategy specific to use of forest residues
- Attending the Forest Engineering Conference, March 1, 2011 to interface with Idaho Forest Group, USDA Forest Service, Idaho Department of Lands, Mahon Logging, Northwest Management, and Forest Stewardship Council.
- Develop relationship with Andrew White, A.T. White Company, Energy Management Engineers, potential investor for Bioenergy programs in Idaho
- Develop path forward for using feedstocks from Richard Hess' program in pilot scale advanced pyrolysis unit

**Objective C: Develop diverse federal funding portfolio**

- Focus on USDA/AFRI and EERE funding sources initially
- Develop comprehensive list of anticipated grant opportunities
- Pre-proposal to U.S. DoE/ USDA (Dev Shrestha, UI- PI): Mobile fast pyrolysis of forest biomass and agricultural residues for biofuel production. Biomass Research and Development Initiative Funding Opportunity Number: DE-FOA-0000341 -submitted 7/9/2010- submit full proposal if invited
- Conduct two policy round tables with EPI. Topic 1: community digesters and policy/regulatory implications, April 21, 2011, Twin Falls. Topic 2: Access to public and private lands for harvesting forest residues, TBD. Reports from the round tables will be utilized to develop a strategy for joint proposal/research opportunities between Bioenergy Initiative and EPI.

**Outcomes: (list)**

- Detailed marketing/business plans for AD and Forest Residues areas of strategic plan
- Secure research funding (direct and indirect) near \$1M by end of FY 11
- Secure financial commitments/in kind contributions or memberships from at least 3 industrial partners by end of FY 11
- Establish recognition with 3 peer reviewed joint publications over FY10 and FY11 based on current LDRD and joint research efforts
- Increase student involvement with at least 1 additional PhD and 1 additional MS student on joint projects in FY11

Outcome Name - Description	Performance Measure	Date
<ul style="list-style-type: none"> <li>• External funding for research</li> </ul>	<p>\$400 K Direct funding including in-kind industrial contributions FY11, \$700 K in FY 12.</p> <p>4-5 proposals submitted/year with 30% success rate</p>	<p>— Sept., 2011</p> <p>Sept., 2011</p> <p>Sept., 2011</p>
<ul style="list-style-type: none"> <li>• Industrial Partnerships</li> </ul>	<p>3 new partners that contribute through membership, matching funds, in-kind contributions, or direct research funding per year</p>	<p>June, 2011</p>
<ul style="list-style-type: none"> <li>• Recognition</li> </ul>	<p>3 Peer reviewed publications submitted and/or accepted</p>	<p>Sept., 2011</p>
<ul style="list-style-type: none"> <li>• Student Involvement</li> </ul>		

## CAES INITIATIVE SUMMARY

	<b>Increase number of B.S., M.S., Ph.D., and post docs engaged in joint R&amp;D by 2 per year</b>	
<p><b>Status Summary: (accomplishments, opportunities, critical success factors, risk management, issues, concerns, weaknesses, challenges, additional tactics)</b></p> <p><b>Strategic Research investments:</b></p> <ul style="list-style-type: none"> <li>• 2 LDRD projects still on-going</li> </ul> <p><b>Proposals pending</b></p> <ul style="list-style-type: none"> <li>• USDA AFRI Foundational Program RFA (Dev Shrestha, UI- PI): Developing Strategies to Increase Prosperity for Small Farms through Sustainable Livestock Production, Processing and Marketing -submitted 6/4/2010</li> <li>• AFRI Education grant: Submitted last summer. In final stages, one of 8 finalists, 4 will be awarded. Focus is on STEM education specifically bioenergy education and will use research projects to train undergraduate and graduate students who in turn will assist in K-12 education. This is part of a larger bioenergy proposal with UI, WSU and industry participants.</li> <li>• DOE EERE proposal submitted Jan. 2011 Principle Investigators: Kevin Feris, Boise State University; Jon Van Gerpen and Dev Shrestha, University of Idaho; Tim Magnuson, Idaho State University; Greg Bala and Melinda Hamilton, Center for Advanced Energy Studies. Project Title (Topic Area 1): Optimization of a Novel Whole Organism Encapsulation Platform for an Integrated Lignocellulose Biochemical Hydrolysis System,</li> <li>• ABES and Meridian Waste Water Treatment Plant</li> <li>• United Dairymen of Idaho (Aurelio Briones, UI – PI; Erik Coats, UI – coPI): Reducing dairy emissions and enhancing phosphorus recovery through 2-stage anaerobic digestion- proposal submitted 9/10/10</li> <li>• Idaho Dairymen’s Association: Treatment of Dairy manure with AD (Lide Chen, UI- PI)- Proposal submitted 9/10/10</li> <li>• USDA AFRI Sustainable Bioenergy (Dev Shrestha, UI- PI): Farm To Fly: Northwest Oilseed Aviation Fuel- submitted 9/15/2010</li> </ul> <p><b>Other business Development efforts:</b></p> <ul style="list-style-type: none"> <li>• Subcontract with Dennis Keiser, UI to develop AD business relationships.</li> <li>• Travel expenses to support Darin Saul, UI to develop contacts in forest residues effort.</li> </ul>		

# Energy Policy Institute Initiative Summary

## CAES INITIATIVE SUMMARY

<b>INITIATIVE TITLE:</b>	Energy Policy Institute					<b>Date</b>	September 15, 2011
<b>Initiative Leader:</b>	David Solan						
	<b>Signature</b>						<b>Date</b>
<b>Initiative Description:</b>							
Through its core staff and affiliate researchers from the CAES partners, CAES' EPI provides robust and timely research that meets the challenges of an increasingly carbon-constrained economy, which include the need for energy and environmental security, as well as sustainable economic development. Its research focuses on both innovation and the more routine but critical mission of improving government performance in the implementation of energy policy. CAES' EPI seeks to inform and educate policymakers and other stakeholders to aid them in making decisions about energy.							
<b>Customers:</b>	Current: National Science Foundation, US Department of Energy, Idaho Office of Energy Resources, Western Governors Association, Systems Analysis Working Group (DOE/INL), non-profits						
<b>Funding Profile:</b>	09	10	11	12	13	14	
<b>Planned:</b>				\$1.5 million	\$1.335 million	\$1.6 million	
<b>Planned Hard Dollars:</b>	\$429,898*	\$654K	\$500K estimate	\$1.4 million (includes CAES approp, DOE Sunshot, LDRD, NSF and CHP)	\$895K (includes Sunshot and CAES approp)	\$911K (includes Sunshot and CAES approp)	
<b>Actual (YTD):</b>	<b>\$fully expended*</b>	<b>\$fully expended*</b>	N/A	N/A	N/A	N/A	
<b>Strategic Objectives: (list)</b>							
Become nationally renowned as the lead research institute in regard to energy infrastructure siting (big tent - electric transmission, renewables, nuclear, etc.). Consolidate small modular reactor and fuel cycle work to cement reputation in nuclear policy.							
<b>Tactics: (list)</b>							
Continue publishing research under CAES EPI banner as well as peer-reviewed articles in journals							
Raise CAES EPI's visibility by presenting and attending conferences;							
Hold research conference and roundtable events at each partner's location and Washington DC; as applicable leverage roundtables into collaborative research and proposals with other initiatives and/or new partners;							
Aim to make the research conference a repeat event;							
Visit and learn from other centers and institutions to develop new business lines for energy infrastructure siting and decision support tools;							
Establish ongoing collaborations with new centers and organizations; ;							
Cultivate and mentor faculty to lead research projects;							
Continue to develop collaborative proposals in response to FOAs;							
Visit each campus to meet with researchers, administrators, and centers/institutes and describe EPI collaborative successes;							
Directly engage industry, regional compacts, and associations/foundations;							
<b>Outcome Name – Description</b>				<b>Performance Measure</b>			<b>Date</b>
Produce reports published under CAES EPI banner				Minimum of 2 reports annually			Underway

## CAES INITIATIVE SUMMARY

<b>Submissions to peer-reviewed journals</b>	<b>Three submissions annually</b>	<b>Beginning 2011</b>
<b>Publish articles in peer-reviewed journals</b>	<b>Two annually</b>	<b>Beginning 2012</b>
<b>Papers and conference presentations</b>	<b>Four annually</b>	<b>Underway</b>
<b>Energy policy research conference in Boise</b>	<b>Significant participation beyond Idaho</b>	<b>2011</b>
<b>Multiple Policy Roundtables held</b>	<b>Roundtable held and Proceedings published</b>	<b>2011/2012</b>
<b>Nuclear-related roundtable held in DC or region</b>	<b>Roundtable held and Proceedings published</b>	<b>2011/2012</b>
<b>Develop "community of practice" for transmission and infrastructure siting in collaboration with government, private sector, and non-profits</b>	<b>Capture funding from grant(s) and other source(s)</b>	<b>2011</b>
<b>Increase number of faculty affiliates and researchers receiving funding through EPI grants and activities</b>	<b>Increase 2x</b>	<b>2014</b>
<b>Increase external funding</b>	<b>Increase 3x from 400K 2009 base</b>	<b>2014</b>
<b>Increase number of projects from 2009 baseline</b>	<b>Increase 2x</b>	<b>2014</b>
<b>Status Summary: (accomplishments, opportunities, critical success factors, risk management, issues, concerns, weaknesses, challenges, additional tactics)</b>		
<p>Measures of Success: First and foremost the success of EPI will be gauged on its research production and the quality of research. CAES EPI's success in securing external funds is another important metric, and external funds must support the research and strategic objectives of CAES EPI. It is important to keep in mind that governmental funding FOAs for applied energy policy are, for the most part, ad hoc and relatively rare. Because of this, it is difficult to predict when specific funds will be available from which agencies—there are little to no annual calls that seek to directly fund applied policy as compared to more technical areas and R&amp;D (e.g. NEUP, EPSCOR, NSF). We must be flexible in terms of competing for funds, and policy has collaborated in more technical areas to bid on and plans to bid on opportunities that are offered annually. Likewise, the educational component needs to be synergistic with policy research objectives. As the federal government constrains funding opportunities in certain areas due to budget issues, policy is moving to support faculty in annual calls such as NSF. EPI continues to work with industry, NGOs, foundations, and others to identify funding opportunities and research that CAES EPI can publicly publish as well as maintain its research integrity. Finally, policy has expanded its work and collaboration with the bioenergy initiative and carbon sequestration through roundtables and the publication of five CCS policy pieces (3 peer-reviewed; 2 CAES EPI reports) by the end of 2011.</p>		



## CAES INITIATIVE SUMMARY

Accomplishments: CAES EPI has laid the foundation for peer-reviewed publishing and bidding on projects in a diversity of areas, and EPI has been aggressive in bidding on projects as research expertise comes online. EPI has been successful in securing funding through competitive proposals.

Publishing highlights for CY 2011 include: 4 CAES EPI Studies (2 CCS, 2 transmission); 2 peer-reviewed journal articles on CCS, 1 peer-reviewed book chapter on CCS to be published later this year; 2 roundtable briefing documents and recommendations to be published this Fall. Another EPI study is slated for this Winter: State of the State for Idaho Energy.

CAES EPI has been active in drafting and submitting proposals for both one-time and annual calls, with 9 proposals submitted in the past year. Secured funding highlights include a \$2.8 million grant from DOE Sunshot on utility scale solar infrastructure siting, a \$70,000 National Science Foundation grant for Northwest Electricity Transmission Planning, and a \$20,000 grant for a Combined Heat & Power policy workshop in collaboration with the State Office of Energy Resources and Simplot.

A new energy and water nexus policy group has been formed in collaboration with the Idaho Water Resources Research Institute. The working group plans to submit an NSF grant this year (100-150K) to be followed by a multimillion dollar proposal among a number of states and regions in a year or two. There are approximately 20 CAES faculty in the group and participants from INL and UNLV.

Policy roundtables aim to connect policy to initiatives that have the potential for a policy component and to leverage off of each other. The first policy/bioenergy roundtable relating to policy and anaerobic digesters and community/cluster/coop concept was held in Twin Falls on April 21. The second policy roundtable on forest biomass and energy policy was held in Coeur d'Alene the first week in August in collaboration with UI's College of Natural Resources Policy Analysis Group.

The Western Energy Policy Research Conference was held on August 25-26 and counted more than 110 participants, with 12 research panels and 37 presenters. 17 universities, 2 national laboratories, and a number of stakeholder groups comprised the research presenters. The conference received excellent press coverage including articles in the Idaho Statesman as well as trade publication SNL Energy. EPI has received many requests from researchers to repeat the conference because of its unique niche in focus on high quality and technical energy policy research.

# Nuclear Science and Engineering Initiative Summary

## CAES INITIATIVE SUMMARY

<b>INITIATIVE TITLE:</b>	Nuclear Science and Engineering (NSE)					<b>Date</b>	September 15, 2011
<b>Initiative Leader:</b>	Jason Harris						September 15, 2011
	<b>Signature</b>						<b>Date</b>
<b>Initiative Description:</b>							
<p>The NSE Initiative is dedicated to providing research and education in the nuclear science and energy fields, both nationally and internationally. This is accomplished via collaborations among the three Idaho universities and the INL, the lead laboratory for nuclear energy in DOE, through successful research proposals to various funding organizations (notably DOE and NRC, but also NSF as appropriate), as well as by seeking industrial collaborations and support (e.g., AREVA, GE-H, etc.).</p>							
<b>Customers:</b>	US Department of Energy (DOE) - Nuclear Engineering University Programs (NEUP), ATR-NSUF - MPact, I-NERI, AFCI, and Minor Reactor Upgrade; Nuclear Regulatory Commission (NRC) - Education Programs and Infrastructure Improvement; AREVA Scholarships; Lovelace Biomedical - Radionuclide Analysis; Stoller - Environmental Assessment Lab; ID-DEQ - Environmental Monitoring Lab and EML DOE CERCLA						
<b>Funding Profile:</b>	<b>09</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	
<b>Planned:</b>	-	-	-	\$4-6M	\$5-7M	\$6-8M	
<b>Planned Hard Dollars:</b>	\$8.0M Total FY09 (\$533K State, \$1.5M NRC, \$6.0M DOE)	\$6.3M Total  (\$533K State, \$529K NRC, \$5.2M DOE, \$15K NASA)	\$3-5M \$4.5M Total  (\$533K State, \$87K NRC, \$2.9M DOE, \$949K Other Sources)	\$4-5M from DOE, NRC, others (\$1M State requested)			
<b>Actual (YTD):</b>			\$4.5M	\$2.1M			
<b>Strategic Objectives: (list)</b>							
Engage all three Idaho state universities in collaborative efforts.							
Initiate three or more major collaborative proposals per year per university, with a success rate of at least two per university.							
Support 60 graduate students continuously (\$3.0M) -- 10 full-time faculty (6 students per faculty member).							
Increase faculty numbers at each university in NSE, including distinguished/endowed chair positions							
Outcomes per university:							
<ul style="list-style-type: none"> <li>- Graduate 15 in two years, 30 in five years</li> <li>- \$4M research funding (faculty and student support)</li> <li>- \$1M fellowship/scholarship funding/year</li> <li>- Initiate at least 1 industry collaboration/year</li> <li>- The three universities broaden their research reputations in Nuclear Science and Engineering - CAES builds world-class reputation in 1 or 2 areas</li> </ul>							
<b>Tactics: (list)</b>							
Respond to repeating RFPs (ATR NSUF, DOE NEUP, NRC).							
Continue collaborations with national laboratories (primarily INL, but also PNNL, LANL, etc.).							
Continue collaborations with other universities (UNLV, NCSU, MIT, RPI, etc.).							
Continue collaborations with commercial partners (especially AREVA)							

## CAES INITIATIVE SUMMARY

Outcome Name – Description	Performance Measure	Date
Reports to sponsors	As required	As required
Submissions to peer-reviewed journals	At least five manuscripts annually	Continuous, Beginning 2011
Publish articles in peer-reviewed journals	At least three annually	Continuous, Beginning 2012
Papers in refereed conference transactions & proceedings	As opportunities and funding allow	
Papers and presentations in conferences (including annual ANS meetings)	At least six annually	
Increase external funding for research	At least three proposals per year	Continuous, Beginning 2010
Seminars and colloquia		Beginning 2009
Participate in national and international professional society meetings and conferences	Three per semester	Beginning 2009
Increase visibility on each university campus (BSU, ISU, UI)	As opportunities and funding allow	Continuously
Increase collaborations with private industry and utilities	As opportunities and funding allow	Continuously
Increase collaborations with other universities and national laboratories		Continuously
Increase faculty size by 50 percent		Continuously by 2015
<p><b>Status Summary: (accomplishments, opportunities, critical success factors, risk management, issues, concerns, weaknesses, challenges, additional tactics)</b></p> <p>The initiative focuses on NSE education and research. Primary target customers are DOE and NRC in the government sector, and AREVA, GEH, and W-Toshiba in the private sector. The three universities together provide a nationally competitive group in a reasonably broad spectrum of research. All three universities have benefited in terms of increased student enrollment, research dollars, and beneficial collaboration with INL, etc. INL benefits by having a research-oriented academic component.</p> <p><b>ACCOMPLISHMENTS:</b></p> <ul style="list-style-type: none"> <li>-- NSE Initiative participants have been successful in NEUP proposals the past three years (\$7,336,662 funded).</li> <li>-- ISU has reorganized to combine Nuclear Engineering and Health Physics in a single department within the new College of Science and Engineering.</li> <li>-- ISU and UI are engaged in discussions about forming a single joint NE program in Idaho Falls. Next steps are on-campus meetings with faculty.</li> </ul> <p><b>STRENGTHS:</b></p> <ul style="list-style-type: none"> <li>-- NE, HP faculty and INL staff are working together to build world-class research in reactor design and fuel cycle area.</li> </ul> <p><b>WEAKNESSES:</b></p> <ul style="list-style-type: none"> <li>-- Relatively low funding contributions by state universities.</li> <li>-- Relatively low industry collaborations from university partners in NSE</li> <li>-- Faculty comment: "Overly INL-like procedures/rules/paperwork (i.e. unnecessarily time intensive processes involving large numbers of people and paper that add no benefit to the research)".</li> </ul> <p><b>ISSUES &amp; CONCERNS:</b></p> <ul style="list-style-type: none"> <li>-- Some NSE faculty feel CAES working environment is not sufficiently open/unstructured.</li> <li>-- The designation of specific research work as CAES/not CAES projects is problematic. The scope and funding of work in CAES is being reviewed to determine if the CAES structure is sustainable.</li> </ul>		


## CAES INITIATIVE SUMMARY

- Faculty concern: "Access to experimental space and capabilities in CAES building".
- Lack of highbay limits capabilities (i.e. for thermalhydraulic experiments)
- Faculty numbers and impending retirements

DETAILS GIVEN IN ATTACHMENTS 1-9

# CAES Geofluids Energy Science Initiative Summary

## CAES INITIATIVE SUMMARY

<b>INITIATIVE TITLE:</b>	<b>Geofluids Energy Science Initiative (GESI)</b>				<b>Date</b>	<b>September 20, 2011</b>
<b>Initiative Leader:</b>	Robert Smith (UI) Leadership Team: Jerry Fairley (UI), Travis McLing (INL), Mike McCurry (ISU), CJ Northrup (BSU), and Robert Podgorney (INL)					September 20, 2011
		<b>Signature</b>				<b>Date</b>
<b>Initiative Description:</b>						
<p>The ability to assess, predict and manipulate the behavior of non-hydrocarbon geofluids (primarily water, dissolved constituents, and carbon dioxide) in subsurface environments underlies the development and implementation of many energy technologies. For example, geologic carbon sequestration (or storage) is an integrated approach for reducing the atmospheric releases of greenhouse gases (such as carbon dioxide) resulting from combustion of fossil fuels and other industrial processes by entombing the gases in deep geologic formations. Another example is the development of geothermal energy resources from hot fluids (primarily mixtures of water and carbon dioxide) that are heated kilometers below the earth's surface and then migrate to shallower depths where their energy can be extracted. Additionally, geologic formations in many locations are anomalously hot; the introduction of fluids from the surface into these formations can potentially be used to harness energy. Finally, the utilization of many energy resources can impact availability and usability of groundwater resources.</p> <p>The Center for Advance Energy Studies (CAES) Geofluids Energy Science Initiative (GESI) is focused on elucidating the physical and chemical behavior of geofluids in the subsurface with relevance to energy production and utilization. The objectives of GESI are focused on preparing the state of Idaho and the CAES partners to take advantage of the research, education, and policy opportunities presented by an emerging carbon constrained economy and along with it the associated increasing demands for alternative low carbon energy sources such as geothermal. These opportunities include significant new federal funding focused on limiting the emission of greenhouse gases and increasing the utilization of less carbon intensive energy. An additional objective is to position CAES to provide support to the State of Idaho's Office of Energy Resources in areas relevant to GESI.</p> <p>Specifically GESI addresses 3 interrelated foci:</p> <p>Carbon Sequestration – Activities are focused on research that leads to greater understanding of the geochemical interactions between carbon dioxide (in supercritical and aqueous phases) and geologic reservoirs — with an emphasis on modeling and monitoring of such systems supported by formation relevant experiments, field studies, and numerical modeling.</p> <p>Geothermal Resources - Activities are focused on research that will lead to greater utilization of geothermal energy resources in Idaho, the nation, and the world. A special emphasis is placed on developing new cost effective tools and approaches for identifying and characterizing potential geothermal resources.</p> <p>Groundwater Resources – Activities are focused on research to understand and mitigate the impact of energy activities on groundwater supplies. This includes water quality and abundance impacts resulting from displaced groundwater and brines; mitigation of groundwater impacts from energy development and production activities, and the injection of geofluids to support energy production.</p>						
<b>Customers:</b>	DOE (FE, EERE & SC); Environmental Protection Agency; US, European and Canadian Energy Companies					
<b>Funding Profile:</b>	<b>09</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>
<b>Planned:</b>		\$498.0	\$877.2	\$1,668.20	\$1,721.20	\$1,971.20
<b>Planned Hard Dollars:</b>			\$877.2	\$1,168.20	\$731.20	\$731.20
<b>Actual (YTD):</b>		\$498.0				
<b>Strategic Objectives: (list)</b>						
Background						
CAES institutions have conducted funded sequestration and other geofluids research for nearly a decade						
Further growth in funding requires						
<ul style="list-style-type: none"> <li>– Transitioning extensive CAES expertise in subsurface contamination to subsurface sequestration of CO<sub>2</sub> and the identification and characterization of geothermal resources                             <ul style="list-style-type: none"> <li>• Assessing and modeling multiphase fluid flow and transport in complex geological settings</li> <li>• Risk assessment and mitigation</li> </ul> </li> </ul>						

## CAES INITIATIVE SUMMARY

- Developing industry relationships
  - Many programs require cost share
  - Industry ultimately responsible for implementation

**Strategic Objectives**

- Expand capabilities through strategic partnerships
- Facilitate DOE's Regional Sequestration Partnership
- Identify unique regional opportunities
- Develop leadership depth

Integrate complementary carbon sequestration and geothermal energy production research and education capabilities within the CAES institutions

**Tactics: (list)**

- Identify industrial partnership opportunities (e.g., Shell, Refined Energy Holdings, US Geothermal)
- Review Federal and State funding profiles (support the continued involvement of INL in the Big Sky Carbon Sequestration Partnership)
- Conduct LDRD research
- Participate in Faculty/Staff Exchange (bring interested university faculty to Idaho Falls)
- Support Idaho Strategic Energy Alliance (Chairmanship of Carbon Issues Task Force and six additional Task Force members)
- Team with Energy Policy Institute (Carbon Policy Roundtable; Geothermal Energy Policy Roundtable) and Center for Advanced Modeling and Simulations (high performance computing and 3-D result visualization)

Outcome Name – Description	Performance Measure	Date
By 2015 CAES will be an internationally recognized R & D center for geologic CO2 sequestration in reactive rocks and a regionally recognized R & D center for carbon management –Minimize impact of carbon constrained economy on regional economic development <ul style="list-style-type: none"> <li>• Opportunities</li> <li>• Regulatory Structure</li> </ul> – Support Idaho's Office of Energy Resources <ul style="list-style-type: none"> <li>• Strategic Energy Alliance</li> <li>• Governor's Carbon Sequestration Advisory Committee</li> </ul>	Funding (annual)	
	– \$1,300 (industry : government – 25:75)	2012
	– \$2,000 (industry : government – 20:80)	2015
	– University : INL split	
	• 20%:80%	2012
	• 50%:50%	2015
	Personnel	
	– 3 FTE INL; 3 faculty; 5 students	2012
	– 3 FTE INL; 10 faculty; 15 students	2015
	Peer Reviewed Publications	
– 6	2012	
– 13	2015	
National/International Presentations		
– 9	2012	
– 20	2015	

**Status Summary: (accomplishments, opportunities, critical success factors, risk management, issues, concerns, weaknesses, challenges, additional tactics)**

- Students
- 2 Undergraduate level
  - 5 Masters level

## CAES INITIATIVE SUMMARY

- 2 Doctoral level
- 1 Post doctoral fellow

### Publications

- 4 peer reviewed articles
- 5 presentation at national/international meetings
- 5 presentation at national/international workshops
- 1 Idaho Strategic Energy Alliance report

### Leadership

- Chair Idaho Strategic Energy Alliance Carbon Issues Task Force
  - 6 Additional Task Force members
- Co-organizer International Energy Agency Green House Gas Working Group Workshop on Natural Releases of CO<sub>2</sub>: Building Knowledge for CO<sub>2</sub> Storage Environmental Impact Assessments, Maria Laach, Germany
- Partisipant Geological Carbon Capture and Storage in Mafic and Ultramafic rock Muscat, Sultanate of Oman workshop

### Collaborations

- Joint United States-New Zealand research workshop on geothermal energy resources (collaboration between researchers at UW, U Canterbury, NZ, UI, Georgia Inst. Tech., and Oregon State University. Proposal to be jointly funded by NSF and Mighty River Power, NZ)
- US EPA Research Group – Natural CCS Analogue Studies
- Impact Technologies –Specialized Drilling Technology
- Bingham Entrepreneurship and Energy Research Center – (Utah State University) promotes economic sustainability, education, business, and technology innovation through energy development and applied research.
- Saskatchewan Organizations
  - Petroleum Technology Research Centre
  - International Test Centre for CO<sub>2</sub> Capture (University of Regina)
  - HTC Pure Energy
  - Saskatchewan Research Council
  - International Performance assessment Centre for Geologic Storage of CO<sub>2</sub>
  - University of Saskatchewan (Saskatoon)

### Challenges

- GESI is largely INL driven
  - Success has largely been in new/expanded INL programs
  - Involvement of universities is very limited
- Geologic sequestration) is not a significant focus of university research or educations (e.g., petroleum engineering) programs
- Lack of GHG legislation limits industry interest
- DOE funding opportunities are focused on demonstrations, require significant cost share, and favor (fossil) energy producing states
- Likely decreases in DOE Science budget limits new opportunities

## CAES INITIATIVE SUMMARY

Project: FRAC-STIM – A fully coupled thermo-hydro-mechanical reservoir simulator; ~\$1,200K; DOE GTP; 9/08-9/11.  
 Project: International Partnership for Geothermal Technology-Reservoir Modeling Working Group Convener; \$90,000 to date; DOE GTP; 2/10-open ended.

Title	Sponsor	PI	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
<b>PLANNED HARD DOLLARS</b>							
Carbon Dioxide mineralization potential of host rocks in deep saline aquifers	Shell International Exploration	INL	\$247.50	\$241.00	\$232.00		
Prediction and monitoring of CO2 behavior in deep, reactive geologic formations	LDRD	INL	\$230.90	\$231.60	\$205.00		
Western Energy Corridor Report, to Western Governors Association	DOE/WGA	INL	\$10.00				
Terrestrial laser scanning of Crystal Cave, Sequoia National Park	INL/CAMS	UI	\$9.60				
Experimental evaluation of least-squares methods for quantifying surface roughness from LiDAR-derived datasets	Sigma XI	UI		\$0.70			
Evaluating the geothermal potential of the Rio Grande Rift using spatial-statistical methods	NREL/DOE	UI		\$5.70			
Big Sky Regional Carbon Sequestration Partnership - Phase III	DOE-FE	INL		\$398.20	\$398.20	\$398.20	\$398.20
Improved Geothermometry Through Multivariate Reaction path Modeling and Evaluation of Geomicrobiological Influences on Geochemical Temperature Indicators	DOE-EERE	INL			\$333.00	\$333.00	\$333.00
<b>Total Hard</b>			<b>\$498.00</b>	<b>\$877.20</b>	<b>\$1,168.20</b>	<b>\$731.20</b>	<b>\$731.20</b>
<b>SOFT DOLLARS</b>							
New Work					\$200.00	\$450.00	\$700.00
Microbial response to CO2 leakage into shallow aquifers	Shell International Exploration	INL				\$240.00	\$240.00
	EPA	INL			\$300.00	\$300.00	\$300.00
<b>Total Soft</b>				<b>\$0.00</b>	<b>\$500.00</b>	<b>\$990.00</b>	<b>\$1,240.00</b>
<b>Total Planned</b>			<b>\$498.00</b>	<b>\$877.20</b>	<b>\$1,668.20</b>	<b>\$1,721.20</b>	<b>\$1,971.20</b>



# Advanced Materials Initiative Summary

## CAES INITIATIVE SUMMARY

<b>INITIATIVE TITLE:</b>	Materials					<b>Date</b>	Sept. 13, 2011
<b>Initiative Leader:</b>	Darryl Butt						
	<b>Signature</b>						<b>Date</b>
<b>Initiative Description:</b>							
<p>The Materials initiative seeks to bring faculty and researchers from the IUC, NUC, INL and other external partners to develop programs and carry out research in areas related to materials development and performance in order to advance energy technologies. Current focus areas include materials modeling, graphite properties, ODS alloy development, advanced welding technologies, complex nuclear fuels development, irradiation effects on materials, and materials characterization. Collaborations and interactions with the Advanced Test Reactor, largely through the Materials Analysis and Characterization Suite, is a critical component to the initiative.</p>							
<b>Customers:</b>	Primarily INL/BEA, DOE NE, DOE Other, NSF, NRC, Industry						
<b>Funding Profile:</b>	09	10	11	12	13	14	
<b>Planned:</b>	\$790k*	\$4300k*	\$9300* \$6000	\$5000k* \$7000k	\$5000k* \$9000k	\$5000k* \$10000k	
<b>Planned Hard Dollars:</b>	\$790k	\$10350k	\$3736	\$3736k	\$300k	0	
<b>Actual (YTD):</b>	<b>\$3436</b>	<b>\$10350k**</b>	>\$10000k				
<b>Strategic Objectives: (list)</b>							
<p>Develop a Idaho Centric team of researchers bridging energy research gaps between fundamental and applied materials science, leveraging and elevating institutional capabilities.</p>							
<b>Tactics: (list)</b>							
<ul style="list-style-type: none"> <li>•Increase the number of faculty participating in the initiative through new hires, collaborations with universities and institutions external to the IUC, and by attracting more existing faculty to CAES projects.</li> <li>All Projects in CAES Must be Collaborative and Communicated             <ul style="list-style-type: none"> <li>–Collegial, inclusive, non-parochial, non-toxic, competent, hard working</li> </ul> </li> <li>•Advocacy for Each Other is Critical</li> <li>•All Equipment Shall be Accessible through Collaborative Arrangements (Recharge Center May Be Necessary)</li> <li>•Establish Baseline Capabilities (SEM, EDS, Sample Prep...)-Capabilities in Place/Tech Hire in Process</li> <li>•Add Unique Capabilities Thoughtfully and Incrementally (SPS, Atom Probe...)-MaCS Up and Running</li> <li>•Focus on Bridging Scales: Electronic to Mesoscale, Picoseconds to Centuries-Modeling Initiatives/Atom Probe/TEM</li> <li>•Strategic Project Selections and Focus: (e.g., Graphite and ODS Alloys)-Multiple Grants in Place</li> <li>•Attract Industry to the Laboratory (e.g., via NSF I/UCRC)--Delayed, Industry Support Elusive</li> <li>•Foster National and International Collaborations with Experts (e.g., UMan, Sussex)-Collaborations Ongoing</li> </ul>							

## CAES INITIATIVE SUMMARY

34

- A Philosophy of Accountability is Critical to Our Reputation
- Produce Students Savvy in Nuclear and Hazardous Materials Handling

Strong Alignment with Other CAES/INL Initiatives, and University Strategic Plans:

- Sequestration
- BioFuels and BioEnergy
- Separations Chemistry
- Modeling
- Policy
- ATR
- NUC
- CSNR
- Community and Industry Engagement
- Internationalization

Talking Points:

- MaCS leveraging will be an issue.
- Need for improved value to INL site researchers
- Almost out of space for new research

Outcome Name - Description	Performance Measure	Date
		O

**Status Summary: (accomplishments, opportunities, critical success factors, risk management, issues, concerns, weaknesses, challenges, additional tactics)**

\* These dollar values are approximately based on the 2010 initiative sheet. The numbers below are revised numbers based on current realities and successes. \*\*Includes ATR capital funds and commitments. All numbers in the table above are based on actuals where available and best estimates in a few cases.

Note: The Outcome Name and Performance Measure boxes above would not allow me to enter text, so this information is included below.

1. Procurement and Installation of Equipment: A combination of funding sources including approximately \$6M in support from the ATR enabled the materials laboratory and visualization suite to see a sudden influx of capabilities that include major materials analytical equipment (SEM/EDS/EBSD/CD, FIB/FEM/EDS, LEAP, and TEM). We are now more than a year ahead of our original projection.
2. Becoming Operational: Several pieces of equipment are operational (e.g., crack growth and SPS). There is now a large number of processes in cue to become operational that creates a bottle neck. Some project leads are showing impatience. We are ahead of schedule in some sense, but not moving fast enough for some customers.
3. Programmatic Support: PIs at all four Idaho Institutions have been successful in obtaining grants to support materials research. Currently there is approximately \$8M in

## CAES INITIATIVE SUMMARY

extramural support.

4.

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- Collaborations

- Some "forced" collaborations have not evolved (accountability)
- Some relationships have grown naturally (foster these)
- Some relationships that should be developing haven't (INL culture, hopeful that NEUP program will help)

- University Weaknesses

- State funding level is insufficient to support three engineering colleges—dilution breeds mediocrity
- BSU has a weak presence at CAES, lack of PhD program
- UI lacks critical mass in materials, heavy teaching load
- ISU has no materials program, Physics and Welding Tech programs could engage
- Materials Scientists are in Moscow and Boise
- Need for administrative support

- Need for BSU faculty and staff in CAES--improving with hire of K. Allahar and J. Burns

- \*Hires of New Faculty Member and Technician in Process

- Need for reliable support for RAs

- Promote international collaborations with program development funds

- Need improved system for distance teaching

- One time funding creates personnel mortgages

- Current mortgages create challenges for hiring staff in Idaho Falls

- Retain CAES Champions (e.g., give Bob Smith a raise and support)

- Budget holdbacks, potential salary cuts could lead to loss of top faculty and will prevent strategic hires

- We must be constantly sensitive to potential for conflicts between CAES and University/Departmental goals

- Challenging to gather data and assess our return on investment

- New faculty are essential to growth and reputation of CAES and IUC—mechanism is problematic

- Housing and travel are necessary

- Equipment matching funds would facilitate NSF MRIs and other pursuits

- Operation of facilities may require recharge center status—can fold into BSU center

## CAES INITIATIVE SUMMARY

### Publications/Presentations:

Too numerous to list but the following are a few recent highlights...

J. Kane, C. Karthik, D. P. Butt, W. E. Windes, and R. Ubig, "Characterization of Nuclear Graphite via Optical and Image Analysis," submitted to J. Nucl. Mater., 2011.

C. Karthik, J. Kane, D. P. Butt, W. E. Windes, and R. Ubig, "Microstructural Characterization of Next Generation Nuclear Grade Graphites," submitted to Microscopy and Microanalysis, 2011.

C. Karthik, J. Kane, D. P. Butt, and R. Ubig, "In Situ Transmission Electron Microscopy of Electron-Beam Damage Processes in Nuclear Grade Graphite," J. Nucl. Mater., 412, 321-326 (2011).

P. Periasamy, M. F. Hurley, B. M. Marx, M. F. Simpson, and D. P. Butt, "Compatibility of ZrN and HfN with Molten LiCl-KCl-NaCl-UCl<sub>3</sub>," J. Nucl. Mater., 405, 286-273 (2010).

K.N. Allahar, D.P. Butt, J. Webb, and I. Charit, "Electrochemical Properties of Spark Plasma Sintered Tungsten," NACE 2011, Houston, TX.

J.A. Webb, I. Charit, C. Sparks, D. P. Butt, M. Frary and M. Carroll, "SPS Fabrication of Tungsten-Rhenium Alloys in Support of NTR Fuels Development," Proceedings of Nuclear and Emerging Technologies for Space 2011, Paper 3274, Albuquerque, New Mexico, February 7-10, 2011.

E. Young, J. Carillo, B. Jaques, J. Burns, L. Zirker, I. Charit, D.P. Butt, M. Frary, "Mechanical Properties and Microstructural Evolution of ODS Alloys Joined by Solid State Welding," Materials for the Nuclear Renaissance II, TMS Annual Meeting, Feb. 28 - Mar. 3, 2011, San Diego, USA.

N. Jerred, L. Zirker, I. Charit, J. Cole, B. Jaques, T. Bradshaw, J. Carillo, E. Young, M. Frary, D.P. Butt, M. Meyer, and K.L. Murty, "Pressure Resistance Welding for Advanced Reactor Applications," Materials for the Nuclear Renaissance II, TMS Annual Meeting, Feb. 28 - Mar. 3, 2011, San Diego, USA.

R. Prabhakaran, D. Burkes, A. Robinson, J.F. Jue, A. Demint, J. Gooch, D. Kesier, D. Wachs, and I. Charit, "Mechanical Properties of Fresh and Neutron Irradiated U-Mo Fuels for the RERTR Applications," Materials for the Nuclear Renaissance II, TMS Annual Meeting, Feb. 28 - Mar. 3, 2011, San Diego, USA.

R. Prabhakaran, J. Wang, I. Charit, J. Cole, K.L. Murty, and R.S. Mishra, "Microstructure and Mechanical Properties of Irradiated Friction Stir Welded ODS Alloys," Materials for the Nuclear Renaissance II, TMS Annual Meeting, Feb. 28 - Mar. 3, 2011, San Diego, USA.

C. Sparks, J. Youngsman, J. Webb, S. Howe, I. Charit, M. Frary, and D. Butt, "Spark Plasma Sintering of Tungsten-Rhenium Alloys for Very High Temperature Nuclear Reactor Applications," Refractory Metals 2011, TMS Annual Meeting, Feb. 28 - Mar. 3, 2011, San Diego, USA.

J. Webb, I. Charit, C. Sparks, D. Butt, M. Frary, and M. Carroll, "Physical and Mechanical Properties of Tungsten-Rhenium Produced via Spark Plasma Sintering," Refractory Metals 2011, TMS Annual Meeting, Feb. 28 - Mar. 3, 2011, San Diego, USA.

S. Pasebani, I. Charit, K. Allahar, B. Jaques, D.P. Butt, J. Cole, "Microstructural Characterization of Mechanically Alloyed Lanthana Bearing Oxide Dispersion Strengthened Steels," Processing and Properties of Powder-Based Materials, TMS Annual Meeting, Feb. 28 - Mar. 3, 2011, San Diego, USA.

K. Allahar, J. Burns, B. Jaques, I. Charit, D. Butt, and J. Cole, "Spark Plasma Sintering of Ferritic Oxide Dispersion Strengthened Alloys," Processing and Properties of Powder-Based Materials, TMS Annual Meeting, Feb. 28 - Mar. 3, 2011, San Diego, USA.

# CAES Energy Efficiency Research Initiative Summary

## CAES INITIATIVE SUMMARY

<b>INITIATIVE TITLE:</b>	CEERI					<b>Date</b>	15 September 2011
<b>Initiative Leader:</b>	John Gardner					<b>Signature</b>	<b>Date</b>
<b>Initiative Description:</b>							
Promote the efficient and effective use of energy through cutting-edge research, effective outreach and timely education.							
<b>Customers:</b>	DOE EERE, DOE Industrial Technology Program, DOE Building America Program, Idaho Power, Northwest Energy Efficiency Alliance, Northwest Food Processors Association, National Energy Leadersip Corps						
<b>Funding Profile:</b>	09	10	11	12	13	14	
<b>Planned:</b>			\$320K	\$1,200	\$2,000	\$3,000	
<b>Planned Hard Dollars:</b>	N/A	\$100K	\$320K	\$640K	\$540K	\$440K	
<b>Actual (YTD):</b>		\$100k	\$320K				
<b>Strategic Objectives: (list)</b>							
Establish a nation-wide reputation for quality, mission-driven research responsive to the needs and barriers to greater energy efficiency							
Establish the reputation as a resource to the region's policy makers and private sector to promote energy efficiency							
Develop a robust, respected and well-funded research program that addresses gaps and barriers to further energy efficiency (Funding Goal: \$2M/year)							
Develop and effective outreach program with elements that seek to lower energy intensity across the sectors (Funding Goal: \$1M/year)							
Coordinate with all three universities to develop a state-wide and shared curriculum utilizing the Internet Course Exchange							
Lead statewide efforts to develop workforce training programs that meet established needs							
<b>Tactics: (list)</b>							
Prepare focused proposals that align well with mission							
Involve more faculty and students at all institutions through active outreach/visits							
Involve more INL scientists through active outreach/visits							
Establish partnerships with private sector including utilities, food processors and others.							
Establish partnerships with regional and national entities such as the Northwest Energy Efficiency Alliance and EPRI							
<b>Outcome Name – Description</b>				<b>Performance Measure</b>			<b>Date</b>
Research capacity by involving more INL and university personnel shows steady growth				Add 2 partners per year			
Reputation with funding agencies and others for quality research and results established				Publish in 2-4 journals or conference proceeding per year			
Funding base for research activities established				Research funding at \$2M/year			FY 14
Funding base for outreach activities established				Outreach funding at \$1M/year			FY13
State wide energy efficiency curriculum implemented				Courses available at all partner institutions			FY 13

## CAES INITIATIVE SUMMARY

Significant partnership with Energy Policy Institute	Joint project funded	FY12
<p><b>Status Summary: (accomplishments, opportunities, critical success factors, risk management, issues, concerns, weaknesses, challenges, additional tactics)</b>                      CEERI is nearing it's first anniversary, having been established by gubernatorial proclamation in late October, 2010. In the first 12 months, CEERI researchers have:</p> <ul style="list-style-type: none"> <li>Established a leadership structure with representatives from all partner institutions</li> <li>Initiated an LDRD with participation by INL, U of I and BSU personnel</li> <li>Won the state-wide Industrial Assessment Center grant (\$1.5M with all three universities)</li> <li>Submitted proposals totalling approx \$3M</li> <li>Submitted two joint proposals with the Energy Policy Institute</li> <li>Supported the Western Energy Policy Conference through presentations and session moderation</li> <li>Continued our work toward developing a funding relationship with the private sector by drafting bylaws for an I/U CRC like structure for CEERI.</li> </ul>		



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**Center for Advanced Energy Studies**

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