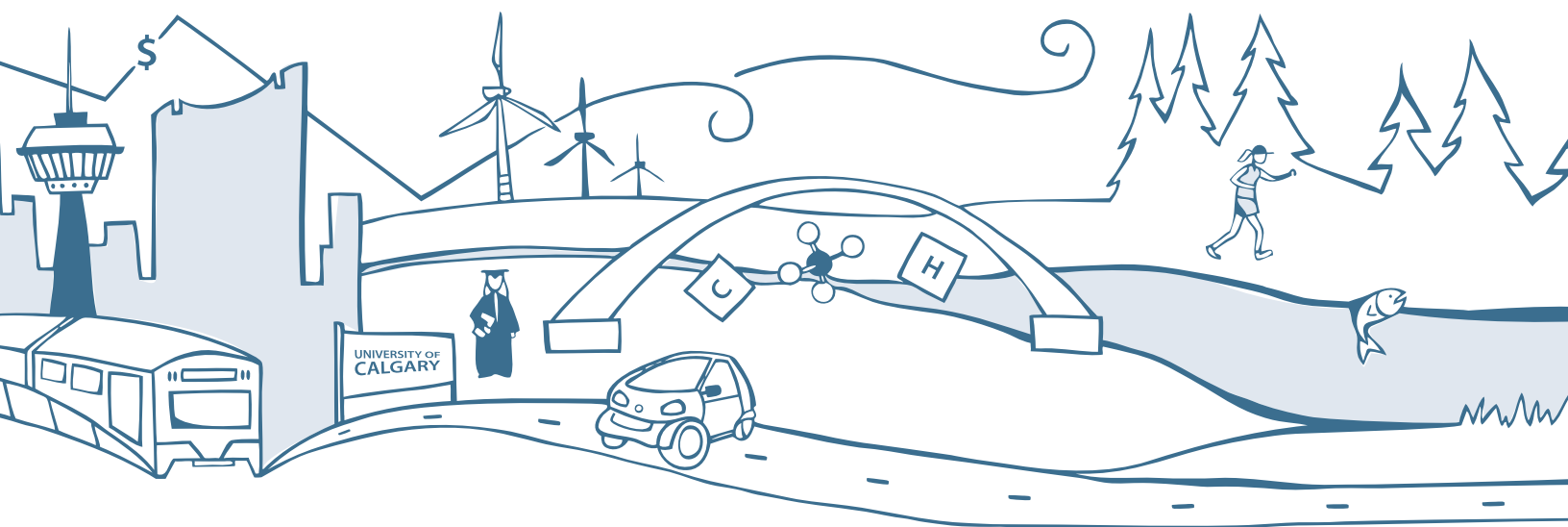


**MANDATE: ISEE DEVELOPS
COST-EFFECTIVE SOLUTIONS
TO THE ENVIRONMENTAL
CHALLENGES OF ENERGY
PRODUCTION AND USE.**

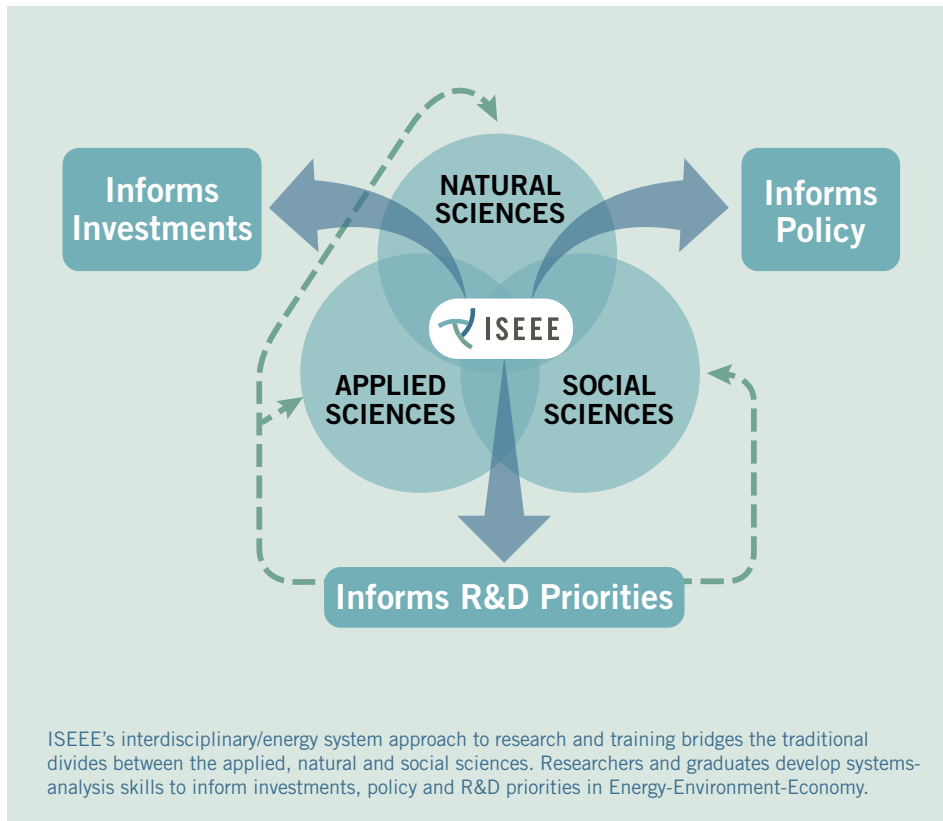
Toward a Sustainable Energy System

The Institute for Sustainable Energy, Environment and Economy (ISEEE) is a collaborative, cross-faculty research and graduate training institute at the University of Calgary.



Institute for Sustainable
**ENERGY, ENVIRONMENT
AND ECONOMY**

ISEEE PROVIDES THE RESEARCH INSIGHTS, SYSTEMS ANALYSIS AND GRADUATES THAT INFORM CRUCIAL INVESTMENT AND POLICY DECISIONS BY INDUSTRY AND GOVERNMENT, IN THE TRANSITION TO A MORE SUSTAINABLE ENERGY SYSTEM IN CANADA.



ISEEE's Strategy

Complex, real-world problems (like Energy-Environment-Economy issues) do not respect disciplinary or sectoral boundaries. Finding solutions that move society toward a sustainable energy system requires integrated, systematic research and interdisciplinary graduate training.

ISEEE uses two strategic approaches:

Multidisciplinary/technology development: brings together researchers from different disciplines – each bringing his or her disciplinary knowledge to the table – to work on common problems. This approach focuses primarily on technology development, particularly in engineering, and on commercialization initiatives.

Interdisciplinary/energy system focus: develops 'systems analysis' skills in researchers and graduate students to work between and across disciplines, especially to bridge the boundaries between the natural/applied sciences and the social sciences.

New technologies and changes to the current policy environment are needed, to drive the transformation to a sustainable energy system. Moving toward a consensus – toward solutions – requires a systematic understanding of the wide range of costs, benefits and tradeoffs associated with technology or policy alternatives.

ISEEE works closely with researchers in partner Faculties and Schools at the University of Calgary, including:

- Haskayne School of Business
- Schulich School of Engineering
- School of Public Policy
- Faculty of Environmental Design
- Faculty of Arts
- Faculty of Law
- Faculty of Science

(includes about 100 faculty working on energy-environment-economy issues)

ISEEE's Partners in the community include industry, government and non-governmental organizations.



Multidisciplinary/ Technology Projects

Since being founded in 2004 to “Lead Innovation in Energy and Environment” at the University of Calgary, ISEEE has led, supported or is currently engaged in several multidisciplinary initiatives, including:

Carbon Management Canada

(<http://www.cmc-nce.ca/>)

ISEEE developed the concept and business plan for and then led the creation of Carbon Management Canada (CMC), a national Network of Centres of Excellence located at the University of Calgary and focused on significantly reducing greenhouse gas emissions in the fossil energy sector.

Carbon Capture and Storage Research Program

(<http://www.iseee.ca/research/carbon-capture-and-storage-research-grant-program/>)

ISEEE received a grant from Natural Resources Canada, to identify and coordinate research aimed at better understanding and addressing outstanding issues that create barriers for industry investment in Carbon Capture and Storage (CCS). ISEEE’s program to date has supported nearly 50 completed or ongoing research projects in four strategic areas: carbon capture; secure carbon storage; technical, socio-economic and policy analysis; and knowledge transfer, communications and outreach.

Alberta Innovates–Energy and Environment Solutions Centre for In Situ Energy

(<http://www.aicise.ca/>)

ISEEE, with the Schulich School of Engineering and the Faculty of Science, led the initiative that created the Alberta Innovates - Energy and Environment Solutions Centre for In Situ Energy. Located on campus, the centre’s researchers are developing technologies to make the recovery and upgrading of in situ oilsands deposits more efficient, cost-effective and environmentally sustainable.

Energy, Environment and Experiential Learning

ISEEE developed the business plan and secured Alberta government funding to add 1,000 new student places in energy-environment-economy at the University of Calgary, and then wrote the business plan and secured provincial funding for the new Energy, Environment and Experiential Learning building on campus.

NSERC-Solid Oxide Fuel Cells Canada Strategic Research Network

(<http://www.sofccanada.com/>)

ISEEE invested in and managed an infrastructure project for University of Calgary fuel cell researchers that led to the formation of the NSERC Solid Oxide Fuel Cells Canada (SOFCC) Strategic Research Network. Hubbed at the university, the network is an association of 21 research groups from universities and government, partnered with Canadian industries developing ‘made-in-Canada’ SOFC technologies.

ISEEE RAISED MORE THAN \$480 MILLION FOR INFRASTRUCTURE, FACULTY APPOINTMENTS AND RESEARCH PROJECTS SUPPORTING SOLUTIONS TO THE ENVIRONMENTAL CHALLENGES OF ENERGY PRODUCTION AND USE.

Wabamun Area CO₂ Sequestration Project

(<http://www.ucalgary.ca/wasp/>)

ISEEE coordinated the University of Calgary-led Wabamun Area CO₂ Sequestration Project (WASP), the most comprehensive study of large-scale carbon dioxide storage to have all its findings made fully available to the public. WASP was funded by the Natural Science and Engineering Research Council and the Alberta Energy Research Institute, with additional support from a dozen industry partners.

ISEEE Special Grants Program

(<http://www.iseee.ca/research/iseee-special-grants-program/>)

ISEEE coordinates and manages both Special Case Grants and Internal Grants that are focused on energy-environment research. A total of 15 projects have received funding through ISEEE since 2008.

UNIVERSITIES HAVE A VITALLY IMPORTANT ROLE TO PRODUCE THE ANALYTICAL TOOLS, BALANCED INSIGHTS AND HIGHLY QUALIFIED PERSONNEL THAT SUPPORT DECISIONS REGARDING ENERGY-ENVIRONMENT-ECONOMY CHOICES.

ISEEE Initiative on Energy System Analysis

The **ISEEE Initiative on Energy System* Analysis (IIESA)** is a coordinated strategy that ISEEE is using to build research capacity, graduate student training and knowledge exchange around the study of Energy Systems – systems that are under tremendous pressures to transform.

Concerns about specific environmental impacts of our existing energy system (e.g. climate change) are often in apparent conflict with other environmental concerns (e.g. water, land use), and with Canada's emerging role as an 'energy superpower' providing the energy needs for the world's growing population and economy.

The diversity of pressures on Canada's energy system means that no consensus exists concerning the goal, path, rate, costs or benefits associated with its transformation. This has tended to paralyze political will and led to policy uncertainty – a reality that is good for neither business nor the environment.

Proponents and opponents of specific energy system technologies and policies tend to argue past each other, resulting in little or no progress towards a coordinated regional or national strategy on the nature of the next energy system transformation.

Elevating the level of the discussion, and moving towards a publicly supported strategy around energy system choices, requires:

- **Analytical Tools** that provide both quantitative and qualitative, system-level insights into the costs, benefits and tradeoffs associated with energy/environment technology and policy options.
- **Engagement and Communication Tools** that draw on the insights from the analytical tools, and synthesize/integrate them into a clear and transparent form that can be used by decision-makers to elevate the national discussion and engage Canadian society.
- **Highly qualified individuals** who have expertise in developing and using these system-level tools to inform policy and investment decisions as well as R&D priorities in government, industry and universities.

As a credible source of balanced research and training, universities have an important role to play in Energy System Analysis. Other leading universities (MIT, Harvard, Stanford, Cambridge) already have dynamic research programs on energy system analysis, but they don't look at the problem from a Canadian perspective. This is the objective of ISEEE's Initiative on Energy System Analysis.

**An 'energy system' is the network of energy flows and technologies that link the various sources of energy, through the carriers (fuels, electricity) to the services that energy provides (heat, transportation, communication). It also includes the costs and benefits of the infrastructure, technologies, policies and personal choices that make the energy system function as it does.*

FOR MORE INFORMATION ABOUT IIESA, CONTACT:

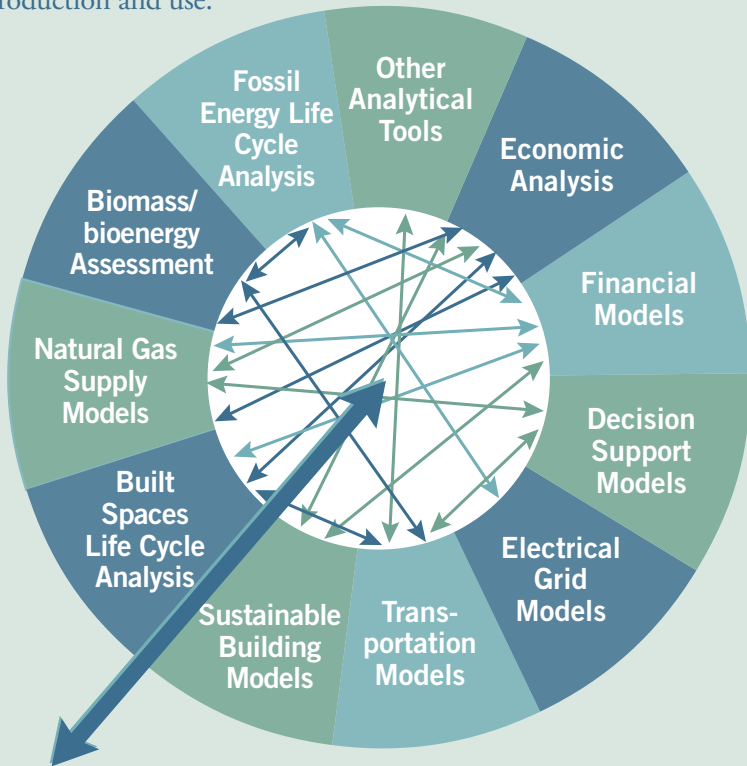
David Layzell, PhD, FRSC, ISEEE
Executive Director

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IIESA is focused in FIVE strategic priority areas:

1. The expanded use of **natural gas** for power and transportation in the North American energy system.
2. Balancing the challenges and opportunities for **oil sands** development in Canada.
3. **Carbon Capture and Storage (CCS)** opportunities and challenges.
4. **Clean power** technologies and policies, which include CCS and integrating renewables into the electrical grid.
5. Transitioning to **low-carbon communities**, encompassing urban design, building efficiency and transportation.

Energy System Analysis Tools – IIESA will facilitate collaboration among researchers who bring their own models and other analytical tools to find solutions to the environmental challenges of energy production and use.



CanESS*

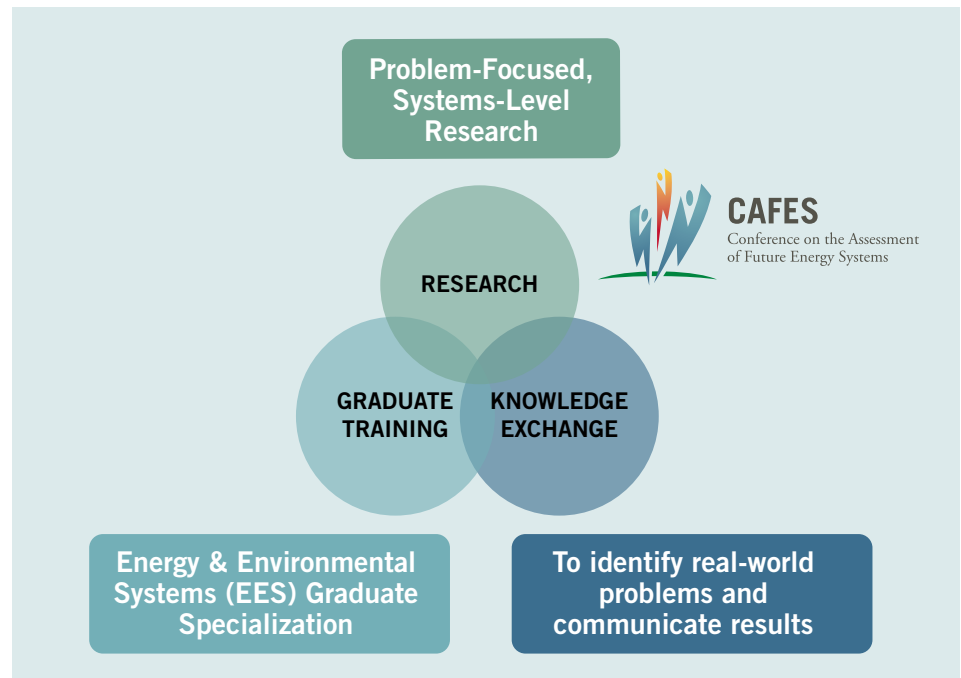
* The Canadian Energy System Simulator is a model that ISEEE is working to enhance, in partnership with whatIf Technologies.

The Value of an Energy System Approach

- Enhanced understanding of energy systems by decision-makers and the public, including the costs, benefits and tradeoffs associated with energy system choices;
- Support the move towards a consensus on a pan-Canadian energy strategy that will benefit both the environment and the economy;
- Better informed policy and investment decisions, including assessments of the risks and opportunities associated with long-term investments in energy and environmental technologies;
- Fresh insights regarding R&D priorities to address the multiple demands on energy systems;
- Training of skilled individuals with the tools and insights that will be valuable for technology or policy assessment, and strategic planning in industry and government.



⤴ Harvard University Professor David Keith, a Visiting ISEEE Fellow, is internationally renowned for his work on energy and environmental systems.





⤴ The new Energy, Environment and Experiential Learning (EEEL) Building is the home for ISEEE's interdisciplinary research and graduate training initiatives, as well as undergraduate teaching, research and graduate training in Science and Engineering.

⤵ Students working in the EEEL Building, where ISEEE is located on the fourth floor.



PHOTOGRAPHY BY MIKE STURJK

Benefits for Graduate Students

- An interdisciplinary advisory committee to support the students during their research
- Access to two core EES graduate courses, EES electives, and special topics courses that contribute to a unique educational experience valued by employers
- A stimulating, collaborative, interdisciplinary work environment in the new Energy, Environment and Experiential Learning Building
- Access to special scholarship funding

“We have lots of technologies that likely could address energy and environmental challenges, but they sit on the shelf and are rarely deployed . . .”

“. . . Effective solutions require an alignment of technological advances with the appropriate socio-economic, regulatory, business and policy environment.”

- D.B. Layzell, PhD, FRSC, *ISEEE Executive Director*

ISEEE’s Students

ISEEE’s **Energy and Environmental Systems (EES)** Specialization graduate program (<http://www.iseee.ca/for-students/>) trains individuals to integrate and apply the knowledge from many disciplines, including those in the applied, natural, and social sciences. For graduate students who aspire to work across and between disciplines, the EES Specialization will equip them with the systematic thinking, research tools and insights that deliver effective solutions for a sustainable energy future.

The EES Specialization provides an interdisciplinary extension to existing graduate research programs at the University of Calgary. Students, working closely with ISEEE faculty and fellows, focus on problem-focused, interdisciplinary research.

The EES Specialization provides students with an academic ‘home,’ in which economists and engineers, physicists and ecologists and climatologists, and mathematicians and policy managers can work together side-by-side every day.

In addition to receiving a Masters or PhD in their chosen discipline, graduates also earn an official “EES Specialization” on their degree. This designation reflects the applied, interdisciplinary nature of their graduate research, carried out in a unique, interdisciplinary learning environment that is valued by employers in industry, government and academia.

Graduates from ISEEE’s EES Specialization are in high demand. The first graduates of the program quickly landed excellent jobs, including with the U.S. National Renewable Energy Laboratory, Carbon Engineering company in Calgary, Harvard University (postdoctoral work), the University of Austin, Texas (faculty appointment), and at a new ‘green’ building institute in Spain.

ISEEE also works closely with the undergraduate **ISEEE Students’ Association** (www.iseesa.com), which delivers enhanced learning opportunities (including seminars, symposia, field trips and an annual networking dinner) in energy-environment-economy for University of Calgary students.

“ISEEESA is all about providing students with unique professional development and learning opportunities in the areas of energy, environment and economy.”

- Lauren Rooney, *President, ISEEESA*



⌘ ISEEE faculty member Joule Bergerson is a highly regarded expert on Life Cycle Analysis of energy systems.

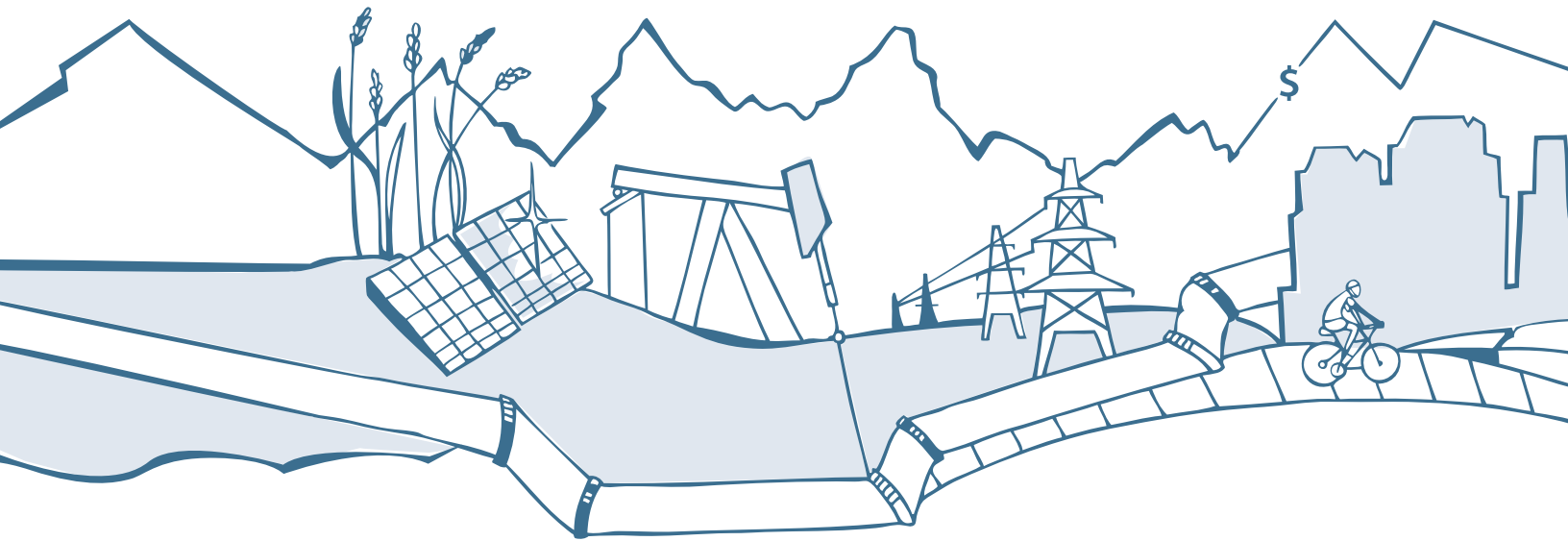
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