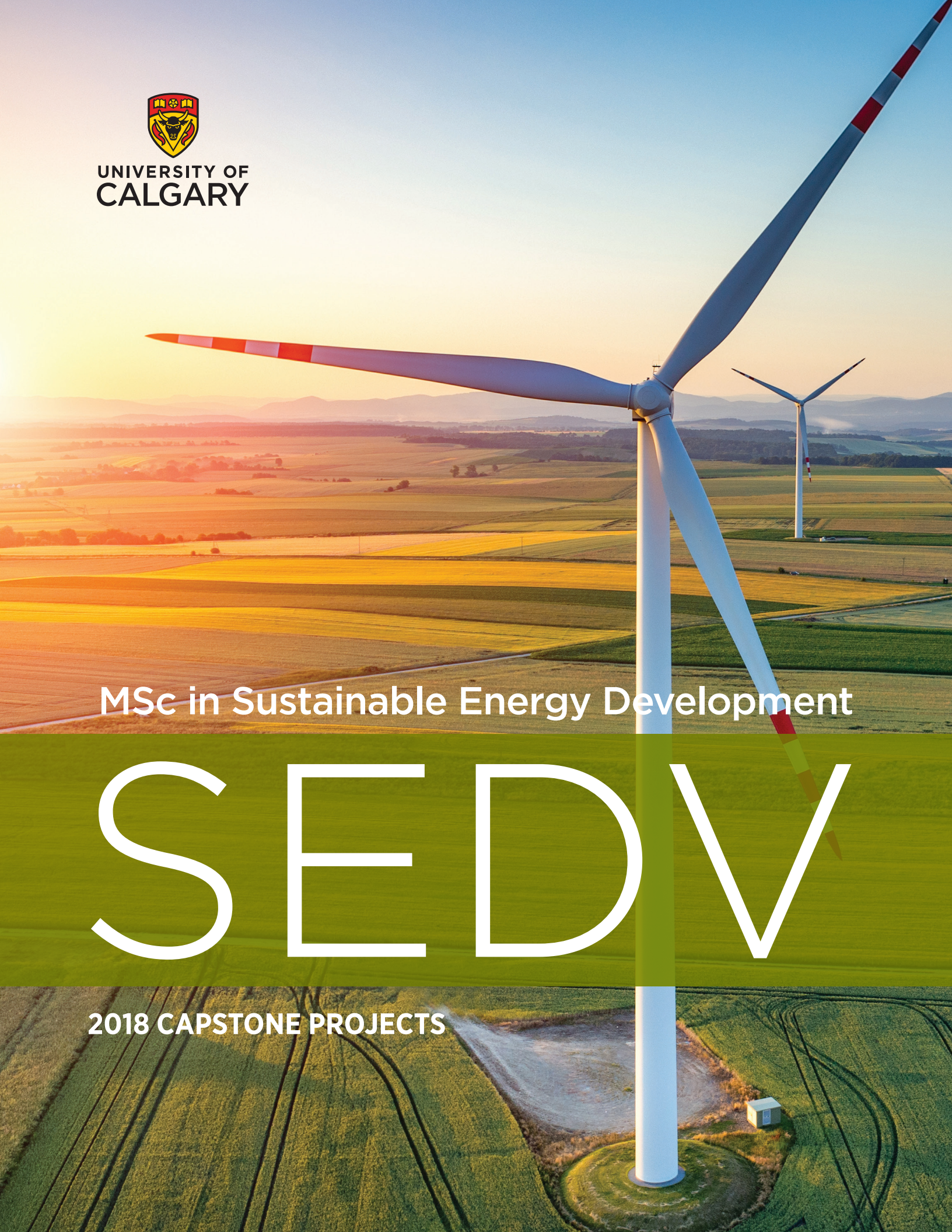

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An Alternate Way of Using Bitumen

Chandan Jain

The oil sands industry contributes immensely to the Alberta economy. Several factors such as climate change, electrification of vehicles and regulations encompassing combustible products can influence this industry. Therefore, it is a wise decision to explore the different products that can be obtained from oil sands apart from combustion products. One of these non-combustion products is graphene, which is a unique material possessing extraordinary mechanical, chemical, thermal and electrical properties. The primary focus of this project is to explore the energy, economic and environmental impact associated with production of graphene from oil sands. After evaluating the interdisciplinary aspects of graphene, its opportunities, limitations and challenges are discussed in this project.

Can Digital solutions improve energy intensities of SAGD Central Processing Facility? An investigation of Opportunities, Challenges, and Barriers associated with digitization of SAGD

Muhammad Faisal Khan

The research project is an effort to identify the potential of industrial internet of things for SAGD processing facilities to improve energy usage and reduce greenhouse gas emissions. Interdisciplinary approach is adapted to connect digital solutions, oil sand production, and GHG emissions. Methodology adopted in this research include basic understanding of “internet of things” with focus on “industrial internet of things.” Inspired from Google’s prediction and optimization of data center energy usage by deploying machine learning algorithm, Energy usage and GHG emissions are estimated to identify critical areas and equipment at SAGD facility. Case studies are reviewed to identify different IIOT applications. Big data analytics can be utilized for Process optimization and Predictive analytics to reduce environmental burdens. Different IIOT solutions are explored with research partner Atheria.io which specializes in providing data handling, analytics, storage and application development for industries to unlock the potential of data to achieve environmental goals.

Carbon Utilization in Building Materials: A Study of Potentials for CO2 Reductions in Canada

Agnieszka Pawlak

Greenhouse gas emissions from anthropogenic sources have been on the rise since the industrial revolution. Scientists now believe that these gases, specifically CO_2, is raising global temperatures and causing the climate to change. Reductions in CO_2 emissions need to be done to mitigate further negative impacts. Following the Paris Agreement in 2015 and the implementation of carbon pricing systems and penalties, reducing emissions has become a necessity. As renewable energy sources mature, other methods for reducing emissions need to be explored. The cement industry is a large emitter, with approximately 5% of anthropogenic emissions coming from process emissions. As a whole, the industry is motivated to reduce its carbon footprint. This study explores the potential for emissions reduction in Canada through the utilization of CO_2 is cement based materials and its economic feasibility.

A Comparative Analysis of Environmental Assessment Regulatory Frameworks for Wind Energy Development in Canada

Ryan Neil Hearn

This research project evaluated the effectiveness of the environmental assessment (EA) regulatory frameworks in place for wind energy developments in four selected Canadian provinces: British Columbia (BC), Nova Scotia (NS), Ontario (ON), and Alberta (AB). Using a semi-quantitative evaluation matrix, the legislation, regulations, and guidance documents that detail the requirements for EA of wind energy projects were used to rank the effectiveness of the province's EA regulatory framework. The results ranked the provinces from best to worst as: BC, NS, ON, AB. Overall the majority of the provinces performed well on the evaluation with the exception of Alberta, which failed to adequately cover all of the evaluated categories on average. It was noted that cumulative effects assessment was lacking in all provinces except BC. It is recommended that each province modify their respective systems as detailed in this research project to ensure that wind energy development proceeds sustainably in Canada.

A Comparison of Grid Power and Solar Power for Electric Vehicle Fast Charging

Nancie Lefebvre

Range anxiety is a common complaint of electric vehicles (EVs). To help address this, a fast charging station was installed in Red Deer. In my study, I compared the scenarios of powering this station with the grid (Case I), solar power (Case II), or solar power paired with a battery bank (Case III) in both 2017 and 2030. This has not yet been studied for Alberta. My research answers the question: is it worth installing solar modules to power this fast charging station? Cases II and III produced less emissions and have higher gross profits than Case I. However, the capital cost and the area that the solar array takes up in Cases II and III are concerning. An issue with EV charging that was considered is demand charging. The installation of a solar array with or without a battery bank and arrangements with utility companies provide potential solutions.

Design and Optimization of Off-grid Solar Photovoltaic Systems for an Indigenous People's Community in the Philippines

Marvin Mayo

Two types of off-grid solar lighting systems are investigated for a remote indigenous community in the Philippines: a Solar Home Lighting System (SHLS) for households; and the Church Complex Solar System (CCSS) serving a micro-grid complex. The research determines the most optimized designs according to energy performance, economics, and environmental benefits. Sensitivity analyses using the PVsyst software are employed to compare the performance of alternatives. The least cost of energy identifies the most optimized system, technically and financially. The carbon offsets and carbon payback time define the environmental performance. For the SHLS, the preferred system has a cost of $0.75/kWh, provides 23% more energy with an initial cost of $165 per unit, total offset of 8.4 tons CO2eq and a payback of four years. For the CCSS the preferred system has a cost of $0.24/kWh, initial cost of $4000, offset of 14 tons CO2eq and a payback of six years.

Designing a Sustainable Development Project in a West African Socio-cultural Environment; Burkina Faso Case Study

Atinuke Chineme

Implementing a sustainable renewable energy development project that generates local wealth is the goal of The Strongest Oak's (TSOs) Solar Village Project. However, understanding the needs of the people in the community—Pau, Burkina Faso in this instance—is vital. This project explores how an energy development project can encourage lasting communal economic development. It attempts to provide answers to the following; What are the pressing needs of the local community? By understanding the needs of the local population, through participant observation, interviews (semi-structured, focus group and questionnaire-type), a suitably sized renewable energy technology that will increase local trade and encourages education can be crafted. The completion and implementation of this project recommendations will be vital to delivering a needed product to the community that supports local trade and innovation.

Development of a Feasibility Framework for Trickle Fill Water Distribution Projects

Samantha Irwin

Lacking economies of scale, most Canadian small water systems do not have the financial capability to maintain sustainable operations, resulting in hundreds of drinking water advisories every year. In Alberta, an alternative to small rural systems has been emerging due to government investment in regionalization. With the "trickle fill" option, treated water is provided from regional supplies via small-diameter piping. This study outlines a feasibility assessment framework for trickle fill regionalization and conducts a case study for an area in Rocky View, Alberta. The case study develops a concept design and calculates the corresponding average end-user cost to be $165.03/month/home with ~80% of the cost due to regional system owner rates. While the study finds that the option is more sustainable than existing systems in the case area, either subsidies or a reduction in connection fees would be required to make it affordable for homeowners.

Development of an Agent Distribution Network for Deployment of Off-grid Solar Home Systems in Rural Peru

Stephanie Duncan

Energy access is essential for human development. The United Nations' inclusion of 'energy access for all by 2030' as a self-standing Sustainable Development Goal emphasizes the importance of this issue. To realize this goal, socially driven organizations are working to provide de-centralized, renewable energy solutions to communities living beyond the reach of the centralized electricity grid. However, several barriers to rural electrification exist, especially for organizations attempting to reach geographically dispersed households with limited financial resources. This project aims to determine how Light Up the World, a Canadian non-profit organization focused on providing solar electricity to off-grid communities, can overcome the logistical challenges associated with rural electrification of the Peruvian Andes through development of an a community-based agent distribution network. A collaborative approach, which capitalizes on the skills, knowledge and relationships of the local entrepreneurs in the community, will allow the organization to develop a flexible operating model and promote local economic development.

Development of an Analytical Tool to Assess a Community's Sustainable Energy Needs

Caroline O'Driscoll & John Coloso

Governments and industry support community energy initiatives with various funding sources. However, we have observed that some proposed renewable energy projects are not properly identified, evaluated or implemented, especially in indigenous communities, resulting in mistrust among the beneficiary communities, project proponents, consultants and funding sources, as well as increasing the risk of project failure. Therefore, our research question is, "What are the factors to be considered in determining the sustainable energy needs and priorities of a community?" A solid project proposal requires proper project identification which in turn requires a properly conducted needs assessment centered on and driven by the community. A solid framework and sound analytical tools are required to determine a community's baseline and effectively identify its needs and priorities, following established project development methodologies, to properly evaluate and identify the most appropriate sustainable energy project for a given community.

Development of Quantification Methodology for Methane Emission through Venting in Alberta Oil and Gas Industry

Shin Roey Tan

Methane emission accounts for a huge proportion of the total GHG as it is 25 times more potent than CO2. New requirements through Directive 60 from AER mandate producers to quantify and report on the methane emissions from the facilities. This research focuses on the quantification methodology on methane emission via venting processes in Alberta oil and gas industry to achieve compliance as there is a limit imposed on the annual venting. This research is conducted through literature review, interviews with industry SMEs, and seminars on related technologies. Two quantification models are identified; measurement and estimation, and these models are analyzed to most appropriately establish their suitability and economics under different conditions. Proper design and implementation of either model will ensure the effectiveness in the quantification and reduction of methane emissions in the oil and gas industry and meeting the target set out by ACLP.

Evolution of an Industry; a Qualitative Analysis of E3 Metals' Petro-Lithium Project

Dennis Andrew Melrose

E3 Metals is an Alberta based company planning to utilize existing oil and gas infrastructure to produce battery grade lithium products. In order to take advantage of government subsidies it is advantageous to quantify expected GHG emissions of their proposed project. This project answers the question: how much Green House gas emissions will this project generate? Analysis of effects on the environment and energy usage were incorporated along with a market analysis for lithium products, to assess the long-term economic viability of a project like this. Analysis was also done on a comparable project in Quebec, to directly compare the results and assess the effects of Alberta's electricity grid. Results showed that through the utilization of geothermal energy, E3 could produce no GHG gases and fully power their operation. The Quebec project required more than five times the power for its operations but contributed only 0.529 t CO2 eq./t LHM.

Exploring Renewable Energy Opportunties for Nunavut

Dixon Byrne

The Canadian territory of Nunavut covers one fifth of Canada's landmass and, without a road network or linked power grid, residents rely exclusively on off-grid diesel generated power stations to supply electricity. Once considered convenient, these systems have now become inefficient and difficult to maintain. Economic, environmental, and social analyses must be conducted in order to recognize the viability of developing clean, renewable, and sustainable energy in the territory. For the community of Rankin Inlet, this involves understanding the benefits of reducing harmful diesel fuel emissions. Simulations of potential wind and solar power plants help to create an understanding of the economics behind such a project. This research focuses on answering the question "should renewable energy be considered as a replacement for the ageing diesel generation stations in parts of Nunavut?" Results suggest that hybrid generation systems are a viable and feasible approach to the future of power generation in Rankin Inlet.

Exploring the energy consumption, environmental impacts and economic consequences of implementing in-house solar cookers in Chitral

Nazish Qureshi

The 'Theory of Himalayan Environmental Degradation', as described by Ali & Benjaminsen (2004), is concerning for many. Chitral is a beautiful remote valley in north-west Pakistan, nestled in Hindu Raj, Hindu Kush and Karakoram-Himalayan mountain ranges. In the absence of other fuel options, about 99% of Chitral's population uses traditional firewood stoves for cooking. To alleviate the consequent burdens of deforestation, pollution and health hazards, my analysis explores the feasibility of implementing solar cookers in Chitral. I make an energy comparison, study the environmental impacts and determine the economic viability of this transition. I collected data for this project through a combination of primary and secondary research methods. With limited research done on solar alternatives for my study area, I provide an insight on whether the environmental and economic expenses of firewood consumption will encourage the people of Chitral to use solar cookers—a technology foreign to their culture.

Feasibility study for installation of solar panels in a school in Zacatecas, Mexico

Zeinab Ghajari

This project investigates the relevance and effectiveness of solar energy as a sustainable and cost-effective solution for providing electricity to the education sector in developing economies. We assess the feasibility of powering a school in Mexico with solar energy and study the economic, social, and environmental costs and benefits. The analysis has been done with RETScreen software and has been checked manually. The internal rate of return (IRR), net present value (NPV), and pay back periods coming from our financial calculations show that the project is economically feasible.

Financial Feasibility of Village-Based Solar Projects: An Example in Burkina Faso

Spencer Illingworth

This research project identifies revenue generating scenarios for a small village-based solar project in Pa Village, Burkina Faso, and the impact they have on overall project economics. Assumptions and input values have been taken from industry experts, Pa Village survey and interview data, and other literature sources. These scenarios are researched and analyzed to calculate the revenue contribution to the project as well as the financial return profile of the entire project. With a project capital budget of $80,000 and annual profit of $5,350, the project realizes a payback period of 13.23 years and an Internal Rate of Return of 6.29%. The implementation of a Wifi sales scenario proves to have the most positive project financial return, while also being the riskiest due to uncertainty in the sales forecast. Further work on the project budget and Wifi sales assumptions will aid in mitigating the financial risks of this project.

Gender Representation in the Caribbean Sustainable Energy Sector

Ryan Bourns

The United Nations Sustainable Development Goals state gender equality and clean energy development as fundamental goals of our world. This paper will address these two goals and how they relate. The following research will aim to answer the question: What are the barriers to achieving more proportional gender representation in the Caribbean sustainable energy sector? In seeking to answer the research question above, there was a literature review of associated topics. Following this, interviews were conducted with individuals directly involved in Caribbean sustainable energy development. Key issues were elucidated through these interviews. Finally, academic theories and research was applied to the common trends and issues identified. The findings and analysis from this research show that some of the barriers to equal gender representation in the sector are; the region's energy needs relative to the supply, institutional theory, and industry misconceptions.

GHG Feasibility Study on a Traditional SAGD Produced Water Treatment Compared to a Pilot Scale Produced Water Treatment Technology

Martha Dias

A feasibility study comparing GHG and landfill disposal impacts of two processes: a traditional warm lime softener in a SAGD produced water treatment plant versus a pilot-scale sorbtion tower technology. The COSIA supported software named CO2Cepts was used to simulate both processes to attain a high level mass, water and energy balance for a 33,000 BPD operation. Data values for the software simulation were taken from literature reviews of journal articles, AER applications and the pilot - scale testing data. Results show that the pilot scale technology was able to reduce landfill costs by 121,827tn/yr equating to 7.5Megatonnes/yr of waste diverted by 2040. Another finding was a small indirect GHG emission reduction of 37 CO2eq tn/yr/33,000 BPD operations, which equates to $1860/yr of carbon levy savings for the lime sludge disposal component. This could equate to a reduction of 2360 tnCO2eq/yr by 2040 with a carbon levy savings of $117,950/yr industry-wide.

Micro Combined Heat and Power Systems (mCHP) for Small Residential and Commercial Sites in Alberta: A Feasibility Study

Kelvin Tan

Alberta has adopted strong measures to decarbonize its electricity sector. This research explores into the feasibility of having Albertans deploy Natural Gas powered micro Combined Heat and Power (NGmCHP) systems under Alberta's Micro-Generation Regulation to support the province's transition towards cleaner and reliable electricity generation. CHP is not new to Alberta where large projects have operated successfully for years. Advancements in miniaturizing the underlining technologies had made smaller scale deployments possible. Europe is actively looking into this too, publishing reports showcasing their most recent and largest mCHP pilot project (ene.field). In this research, numerous NGmCHP systems based on commercially available products were modelled and applied to various scenarios mimicking residential and small commercial sites in Alberta. The research showed that NGmCHP systems should reduce primary energy consumption, will decrease carbon emissions and can be financially viable. Alberta should leverage on this technology further in the decarbonization of its electricity.

MicroGrid Gaza: A Feasibility Assessment on the Utilization of Off-Grid Technologies to Reduce Reliance on Municipal Infrastructure in the Gaza Strip

Feras Salah Abdul Rahman Obeid

The Gaza Strip is in process of rebuilding after years of blockades and war. In 2014, international donors met in Cairo Egypt to pledge nearly 5.4 billion dollars for reconstruction efforts after the last war in the summer of that year. With Gaza facing issues related to energy deficits, improper waste management, and water security, my project assesses the potential of small scale energy, water and waste diversion technologies in a residential dwelling to reduce reliance on the aging and damaged municipal infrastructure. In assessing the technologies in terms of economic feasibility, environmental mitigation, and ability to satisfy SDG requirements, the solar photovoltaic modules and solar water heaters appeared the most feasible. Rainwater harvesting was economically feasible, and performs environmental mitigation, but does not satisfy annual water requirements for a household. Biogas digester and wind turbines appeared the least feasible in terms of economics and ability to satisfy SDG requirements.

Off-Grid Renewable Energy System Design for Implementation in Burkina Faso

Andrea Cosgrove

With less than 3% of the rural population in Burkina Faso having access to electricity, there is a significant need for off-grid renewable energy systems. In partnership with The Strongest Oak Foundation, this research focuses on the technical design of an off-grid solar photovoltaic (PV) system that can provide electricity in the village of Pa, Burkina Faso considering economical and environmental factors. Two design scenarios were analyzed, with 28 250 W PV modules and 897 Ah of battery storage capacity being recommended for the system design. The 600 V charge controller and 3400 W inverter selected for the project are confirmed to be adequate. This project could prevent 6 tonnes CO2eq per year from being emitted compared to a diesel generator. This project can make a positive impact by promoting socio-economic activity through the implementation of clean and affordable energy and can serve as a prototype for similar systems in the future.

Photovoltaics Feasibility in Rural Communities in Colombia

Jorge Enrique Perez Jaramillo

Is it feasible to implement small-scale rural solar photovoltaic (PV) projects in Colombia? The answer to this question is complicated. To answer this question, I have developed a holistic approach with considerations of Colombia´s markets, government policy and accessible technology. Sample houses from the coffee region were selected for my examination of energy consumption, and to set the energy baseline, and develop three PV scenarios. Finally, economic and environmental feasibility suggests the most favourable scenario. Since Colombia does not manufacture PV modules, they are imported, which increases system cost. Hence, there is an economic incentive to minimize the number of modules. To achieve this condition, I suggest the installation of efficient lights and appliances. On average, for the sample houses, the reduction in energy consumption is close to one-third of the original amount, indicating that solar PV should be economically feasible in some remote areas of Colombia.

Preliminary Application Analysis of Supercritical CO_2 Technology for Power Generation in The Energy Industry of Alberta

Junan Rao

sCO_2 power cycle is an emerging technology for power generation and has the potential to help meet Alberta's future energy demand and significantly reduce GHG emissions in power generation. To meet the Alberta Government's 2030 energy projection, the government should not only focus on the development of natural gas-fired power facilities, but also consider adopting sCO_2 technology. My research compares a NGCC w/CC power plant using post-combustion technology with a direct natural gas-fired oxyfuel sCO_2 power plant in terms of energy, environmental and economic performance as the three analytical pillars. Alberta's climatic and industrial conditions are taken into consideration for adopting the technology in Alberta. Potential applications of sCO_2 technology in several energy sectors is also explored. The results show this emerging technology is better and both technologically and economically feasible to be adopted in Alberta as an innovative pathway to achieving the Alberta's goal of a low carbon future.

Renewable Energy Labels

An Exploratory Study on the effects of Renewable Energy Labels on Consumer Purchase Behavior

Humaira Salik Waqar

This research explores renewable energy labels and consumer perception towards them. It aims to answer two questions; are consumer purchase decisions positively impacted by renewable energy labels? and ii) are consumers willing to pay a higher price if a product label stated it was made through renewable energy? The study consisted of a dependent variable (consumer purchase behavior), and various determining factors. Research methodology consisted of survey and focus group. It was found that consumer purchase decisions are positively impacted by renewable energy labels. Enhanced consumer awareness of renewable energy labels are needed. Customers are more willing to trust such a label if backed by the government / regulatory body. Customers are willing to adapt if they will be provided a purchasing incentive. Customers are willing to pay a higher price up to a certain extent for such labels.

Shareholder Activism on Climate Change: Evidence from Shareholder Resolutions Filed Against Canadian Oil, Gas, Utility and Pipeline Companies

Julie Nguyen

Shareholders play an important role in corporate governance and are increasingly concerned about the impacts of climate change. This paper examines shareholder activism – in the form of shareholder resolutions – on climate change and how companies disclose climate change-related information. I compile shareholder resolutions on Canadian oil, gas, utility and pipeline companies from 1987-2018 and how investors voted on those resolutions. I also examine climate change-related corporate disclosure from 2013-2017. Climate change received the greatest number of shareholder resolutions, many of which asked for disclosure and focussed on carbon asset risk. Larger companies were targeted and resolutions were filed by environmental, social and governance funds, faith-based organizations and financial institutions. The response of institutional investors to these resolutions has varied. Standardization of corporate social responsibility reports using the Global Reporting Initiative has fallen over the reporting period, although CDP scores remain consistent. My study provides recommendations for better disclosure practices.

Solar Glare Catalogue Development for Solar Photovoltaic Project Proposals

Jaimie Slana

One of the most common social concerns surrounding the development of solar energy is the potential for glare. Glare is an unintended consequence of solar photovoltaic (PV) installations. With the Alberta government committing to having 30 percent of the provincial electricity provided by renewable energy by 2030, the growth of solar energy and any associated impacts are expected to increase. To help address the issue of glare, this report asks: How do you effectively demonstrate the expected intensity of glare to stakeholders prior to solar power development? A glare catalogue, comprising photos and videos, was developed to better communicate the expected glare hazard from proposed PV projects. Glare is not limited to solar modules and the findings of this research suggest that in Alberta, the existing built environment represents a larger glare source than the solar PV systems.

Sustainable Building Advancements for Alberta: LED and Solar PV Technology

Agasthya Sadasivan Parassery

The Alberta electricity sector comprises electricity generated primarily from non-renewable sources like coal and natural gas which have high GHG emissions. Coal power plants and natural gas power plants account for approximately 85 percent of the electrical energy production, the remainder being supplied via renewable energy sources. My research project covers the energy, environment and economic dimensions of building construction as I investigate the integration of LEED concept and Solar PV technology which will improve building electrical sustainability, while generating energy savings and reducing the carbon footprint of the homes and buildings in Alberta. Hotel Alma on the University of Calgary campus is the reference facility. Results indicate that the incorporation of a LED – Solar PV system significantly reduces building energy consumption by almost 30 percent, with reduced carbon dioxide emissions and economic benefits in the case of the solar PV system.

Sustainable Energy Development of an Off-Grid Village in Burkina Faso, West Africa: Potential Communal Demand for Modern Power.

Lucas Barr

Clean and affordable energy is a key aspect for the sustainable development of many emerging nations around the world. In Burkina Faso, West Africa, only 3% of the population has access to electricity. To support Burkina Faso's energy genesis, our team is developing an off-grid, solar power plant ('Power-Hub') in the village of Pâ. The Power-Hub is being developed by the Calgary based not-for-profit 'The Strongest Oak' and will supply electricity to support a small-scale shea butter processing Woman's Co-operative. My research investigates the realistic energy demand to support select mechanisation processes for shea butter harvesting. The results indicate that decentralized solar power can provide enough tangible power to support mechanization, increase production and lessen the burden of a labor-intensive production process. My project provides integral information for the overall design of the Power-Hub and will support the greater initiative of 'The Strongest Oak' in West Africa.

Technical and economic feasibility of building a small hydro plant in two different sites in Alberta

Cinthya Haybeth Caicedo Ferrer

Hydropower has long been used due to the ease of producing energy via water. However, construction of large dams has negative environmental impacts on wildlife as well as aquatic ecosystems, due to large land requirements to support their development. Small dams present an alternative to limit these known issues, with potential growth of around 77% in Canada alone. This research aims to assess the technical and economic feasibility of building a small hydro facility at two sites, in a pre-determined region of Alberta. Using a simplified Levelized Cost of Energy model for each site, an evaluation will determine which is more ideal to be developed first. Additionally, the environmental benefits of a large hydropower plant compared to a small hydropower plant will be discussed. The results are expected to provide the company currently investigating development at these sites with greater insight on how to proceed with project development plans.

Utilizing Wave Power as Green Energy for Remote BC Communities

Eric Charles Fischer

The west coast of Canada has an abundance of potential wave energy. Currently there are many off-grid communities that do not take advantage of this renewable energy source and instead rely on diesel generators to fulfil their electricity needs. This study examines the viability of integration of wave energy converters into off-grid communities to lessen the reliance on fossil fuels for electricity. Implementation of a singular wave energy converter in the Tlatlasikwala community of Bull Harbour was estimated to yield 31.6 megawatt hours of electricity a year or around 13.3% of the yearly demand. Analysis of the economic viability through calculating payback periods using the average cost of wave energy converters and the fuel savings from renewable energy generation over a 20-year project life noted a requirement of funding by grants to recover costs. Included is a review of the current and proposed environmental concerns regarding wave energy converters.

What are the technical and regulatory limitations for the use of unmanned aerial vehicles (UAVs) in sulfur emissions monitoring on ships in Canada

Alexander Gonzalez

The objective of this research is to determine the technical and regulatory limitations for the use of unmanned aerial vehicles (UAVs) in sulfur emissions monitoring on ships in Canada. This research is based on an attempt to replicate a similar European effort to accomplish the same goal. The need to reduce the impact of ship transportation as a major source of air pollution due to the use of fuel with high sulfur content is what is driving the enforcement effort by regulatory authorities. The use of these UAVs as an emergent technology can help to mitigate that environmental challenge. An exhaustive literature review, as well as regulation analysis was used to answer this question. It was found that even though technology is feasible to monitor those emissions, the current regulatory framework is impeding to reach its full potential as flights in the shared aerospace and beyond visual line of sight is not permitted currently.

Why We Do What We Do: The Factors that Influence Energy Behaviour and How to Effect Change in Alberta Energy Consumption Patterns

Eric Timmins

In order to address the growing issue of climate change, the Alberta Climate Leadership Plan was developed and implemented so the Province can work to minimize GHG emissions attributed to energy production. For this plan to be successful, reduction in energy demand and a change in energy culture in Alberta is required. This policy initiative demonstrates that integration of individual behaviour into energy analysis has become very relevant. Yet, it is not always clear what factors most affect energy behaviour. In this study, I examine the relationship between factors affecting energy behaviour and the implications for energy culture in Alberta. I conduct a qualitative case study on Alberta's climate policy analysing secondary data on energy use patterns and behaviour. Individual behaviour is influenced by internal factors, such as knowledge and attitudes, and external factors, including social norms and material constructs. Using these factors to effect change in Alberta will require intervention strategies that employ an integrated and interdisciplinary approach.

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