THOROUGH

Engineering the future of energy

From environmentally friendly biomass fuels, to power grids that can deliver sustainable energy, USask Engineering is developing energy solutions the world needs.



university of saskatchewan College of Engineering engineering.usask.ca

Hard Hat Ceremony

USask Engineering officially inducted its second- and third-year students into their disciplines at the college's annual Hard Had Ceremony on September 24, 2021 at Prairieland Park. With the cancellation of the 2020 ceremony, our community was delighted to gather and celebrate these students. The ceremony was among the first USask events where attendees were required to provide proof of vaccination. Photos by Dave Stobbe



FUTURE USASK ENGINEER

#ENGINEERSTHEWORLDNEEDS



COLLEGE



In every edition of Thorough, the College of Engineering remembers with respect and fondness distinguished members of our USask Engineering community – college leadership, faculty, longtime alumni volunteers - who have passed away.

Robert Besant, October 31, 2021: Served as Department Head of Mechanical Engineering; his pioneering research continues to have a major impact on energry conservation in building design in Canada and other industrialized countries

Madan M. Gupta, November 8, 2021: Professor Emeritus; recognized worldwide with numerous honours for his research in areas including adaptive control systems, fuzzy computing, neuro-computing, neurovision systems, and neuro-control systems

Clifford Smith, August 12, 2021: Served as Department Head of Civil Engineering; recognized for outstanding contributions to the field of hydro technical engineering in Canada

THOROUGH

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COLLEGE OF ENGINEERING

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Dean's Message, December 2021

W The future of engineering **holds remarkable opportunities**

Warm greetings to all of our Thorough community with my wishes for a safe and meaningful holiday season. Many of us are looking forward to more freedom to be with family and friends this year at the same time as we keep some limits on large gatherings. The college will return to full face-to-face operation in the new year, with a vaccination mandate and masking mandates in place for at least another four months. We are all breathing a sigh of relief as we return to (mostly) in-person exams this December.

This fall has been an exciting time in the college as we launched the RE-ENGINEERED First-Year program, hosted an accreditation visit from the Canadian Engineering Accreditation Board, and built plans for significant renovations to the college. While we can't yet share details, we are excited to see the university's comprehensive campaign nearing the point where we will fully launch plans that will uplift engineering for the next generation.

The future of engineering holds remarkable opportunities – and many challenges. ESG (Environmental, Social and Governance) Value Strategies have become central to our thinking about new projects and a key part of investor relations. The future of energy and energy transitions are top of mind for everyone – and our college is no different. Read about how we are Engineering the Future of Energy, on Page 23.

We also recognize that sustainability has new dimensions – we now look beyond financial sustainability and environmental sustainability to consider community impacts, the importance of meaningful consultation, and the socio-cultural impacts of major changes. Infrastructure projects may be subject to the impacts of major climate events and need to be designed to address these additional challenges – in the face of limited resources and the need for innovation and effective solutions. Our post-COVID-19 working world will be different – and also the same. Our teams now have greater geographic reach with the ability to leverage travel time for other purposes – but also the need to recognize that the travel time was not wasted! Hybrid work will provide all of us with more flexibility – and even the quietest introverts are excited to return to the office.

I had the privilege of engaging with a number of elders and community members this fall as we offered our Indigenous Cultural Contextualizaton course for the first time. You can learn more on Page 19. As I look back on my own first courses in engineering and recall that environmental concerns were not part of our practice, and then remember the dramatic change in workplace safety as we all implemented safety cultures a decade later, I am optimistic about the future. The 92nd Call to Action from Canada's Truth and Reconciliation Commission and Recommendation 34 from UNDRIP (United Nations Declaration on the Rights of Indigenous Peoples) really sound like the ways we would all like our communities to be treated in the face of major project developments.

This path is not simple to map out, but the steps we are taking are meaningful steps toward a wider truth. It is my belief if we can stay the course, we will find that these skills will benefit everyone, and our technical work will be much better as a result of thoughtful listening and response.

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Leadership and Faculty Appointments



General Engineering Lab and Logistics **Coordinator Whitney** Curtis (BE '19 Engineering Physics) is in charge of the labs for the first-year program.

Assistant Professor Joel Frey (PhD '12



college in 2017 as a curriculum developer for **RE-ENGINEERED** and was ultimately one of the core team members that developed the program.

Electrical) joined the



Lecturer Glyn Kennell (PhD '11 Chemical)

has more than 10 years experience teaching in the College of Engineering and also contributed to **RE-ENGINEERED** as a curriculum developer.

Professor Shaobo Huang, who holds a

PhD in engineering education, was one of the core team members who developed **RE-ENGINEERED.**



Associate Professor Sean Maw was among the original group in the college who envisioned developing a brand-new first-year program and has worked on the project since 2016.



Lecturer Randi Strunk (MSc '09 Civil) has been a sessional lecturer in the college and has





HONOURING ALUMNUS

Nyron Stacnyk (BE'85, Mechanical) 45th C.J. Mackenzie Distinguished Lecturer

Engineer, Executive & Philanthropic Leader February 1, 2022 • Prairieland Park, Saskatoon



is serving as Acting Head of the Department of Electrical and Computer Engineering while

Department Head and Professor Robert Johanson is on administrative leave until July

2022. When he returns, Johanson will begin an additional three-year term as department head.

7



ed his successful term as

department head.

Associate Professor

Terry Fonstad (BE

Engineering, PhD

'04 Civil), currently

Dean Research and

USask's new Associate

Vice-President Research (Ethics and

Infrastructure) on Jan. 1, 2022, providing

leadership to the university's animal care

and research support team, human ethics

team, and research infrastructure projects.

the college's Associate

Partnerships, will become

Professor Seok-Bum Ko

'88, MSc '96 Ag

Professor Akindele Odeshi is USask Engineering's new Associate Dean Academic. He will begin his five-year term on Jan. 1, 2022. He assumes the post from Professor

Bruce Sparling (BE '83, MSc '85 Civil), who has overseen the design and implementation of the college's RE-ENGINEERED first-year program and the virtual accreditation visit from the Canadian Engineering Accreditation Board in November 2021.

> **Professor Jafar Soltan** will serve as Acting Associate Dean Graduate Studies and Strategic Projects until July 2022, when Professor **Carey Simonson (BE** '91, MSc '93, PhD '98

Mechanical) returns from a six-month administrative leave.

RE-ENGINEERED

USask Engineering is proud of the sixperson instructional team (see right) assembled for RE-ENGINEERED. Each department in the college holds a joint appointment with the first-year team, who are based in the Ron and Jane Graham School of Professional Development (SOPD)

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FACULTY AND STAFF

We proudly recognize the 2021 achievements of these faculty and staff members of USask Engineering.

Faculty and staff achievements

Professor C.Y. (Tony) Chung (Electrical and Computer) was awarded IEEE Canada's P. Ziogas Electric Power Award, which honours Canadian engineers who have made important contributions to the field of electric power engineering. Chung was cited "for contributions to the theory and practice of power system stability and operation."

Chung, NSERC/SaskPower Senior Industrial Research Chair in Smart Grid Technologies, was also named the Saskatoon Engineering Society's 2021 Educator of the Year, which is based on the educator's innovation, organization, and effective delivery of educational material; mentorship of others; service to the profession in public education; and educational service to the community.

The SIGMA entrepreneurial project for students won the Outstanding Initiative Award at the 2021 Science, Technology, Innovation and Collaboration Awards, hosted by the Saskatoon Regional Economic Development Authority (SREDA). SIGMA – which stands for Saskatchewan Innovation Growth & Market Acceleration - was launched by Assistant Professor and LaBorde Chair in Engineering Entrepreneurship Tate Cao (MSc '11 Biomedical Engineering), who is based

in the Graham School of Professional Development. During summer 2021 the initiative engaged six student teams in the first stages of their start-up concepts.

Distinguished Professor Ajay Dalai (PhD '90 Chemical) (Chemical and Biological) won USask's 2021 J.W. George Ivany Award for Internationalization, which recognizes a USask faculty member's exceptional contributions in enhancing the university's international profile through mentorship, teaching, and training in internationalization activities. Dalai is the Canada Research Chair (CRC) in Bioenergy and Environmentally Friendly Chemical Processing and is USask's longest-serving CRC.

Assistant Professor Joel Frev

(PhD '12 Electrical) (Electrical and Computer / Graham School of Professional Development) was the College of Engineering's winner of the 2021 Provost's Award for Outstanding Teaching. Frey's nominators wrote that his wish is that "each of his students make a 'new connection to their true selves' as a result of engaging in their learning journey in his classes." Frey was one of the lead developers of the college's newly launched RE-ENGINEERED firstyear program.

Distinguished Professor Safa Kasap

Chung

(Electrical and Computer) received the 2021 USask Distinguished Researcher Award. Research by Kasap, a Saskatchewan Centennial Enhancement Chair, to enhance the electrical properties of selenium (Se) for use in medical X-ray imaging has revolutionized the field. His work on direct conversion flat panel X-ray imaging detectors has led to the use of these detectors in mammography and tomosynthesis. About 70 per cent of mammography machines today use Se detectors, whose superior resolution and greater sensitivity are improving cancer detection rates and reducing radiation doses received by patients.

Dean Suzanne Kresta (Chemical and Biological) was named vice-chair of Engineering Deans Canada, Canada's national organization of engineering deans. As vice-chair, Kresta helps lead the pan-Ca-



nadian organization, which represents the 44 deans of faculties of engineering and applied sciences at higher education institutions with accredited undergraduate engineering programs.

A research team led by Professor and **Acting Department Head Seok-Bum Ko** (Electrical and Computer) won the Project Award at the 2021 Science, Technology, Innovation and Collaboration Awards, hosted by the Saskatoon Regional Economic Development Authority (SREDA). The award, also dubbed the "most likely to save the world category," recognized the team's commercialization of deep learning automated diagnostic systems from medical imagery. This involves breast/lung imaging, rib/bone imaging, and COVID-19 work.

Majak Mapiour (BE '07, MSc '10 Chemical and Biological, BSc '07 Chemistry), lab coordinator in the Department of Chemical and Biological Engineering, made significant contributions to improve experiential learning by revamping and restructuring the experiments that all undergraduate chemical engineering students perform. During the COVID-19 pandemic, Mapiour took a leadership role in making sure every senior-level student received the hands-on laboratory experience needed to complete their courses, which included initial development of instructional videos.



Associate Professor Kerry McPhedran

(Civil, Geological and Environmental) was recognized with the USask New Researcher Award in 2021. McPhedran, the Centennial Enhancement Chair in Water Stewardship for Indigenous Communities, provides strong research leadership that not only contributes to improving access to safe drinking water on First Nations, but is community-centred and respectfully done as a true partnership. McPhedran is also recognized as an outstanding mentor and trainer of highly qualified personnel, and is highly regarded in Canada and abroad for numerous papers in high-impact journals.

The K.W. Nasser Plaza, a public space between the four towers at Saskatoon's River Landing Development, pays tribute to Professor Emeritus Karim (Kay) Nasser (PhD '65, DSc '16 Hon.). Nasser, through his company Victory Majors, spearheaded the \$300-million-plus mega project that includes the province's tallest building, Nutrien Tower.

Rob Peace (BE '00, MSc '03 Mechanical)

was awarded the 2021 USask Safety Recognition Award, which recognizes an employee who goes above and beyond to keep USask students, staff and faculty safe. Peace, department assistant in the Department of Mechanical Engineering, is a diligent health and safety leader in the College of Engineering. Through his work on the Local Safety Committee, Peace led



the development of the Engineering Safety Management System, a key framework for helping to keep students, staff and faculty safe

Professor Emeritus Richard (Dick) Strayer (BE '48 Mechanical, BE '50 Ag Engineering) received a Saskatchewan Volunteer Medal, recognizing his volunteer accomplishments. Highlights include collaborating with the city to establish the Beaver Creek Conservation Area near Saskatoon and being instrumental in organizing Meals on Wheels in Saskatoon Strayer is also a former president of the Association of Professional Engineers and Geoscientists of Saskatchewan. He volunteered with the Saskatoon Council on Aging for more than two decades and is credited with developing the first Guide for Caregivers.

Alumni Awards and Achievements



Tom Atkins (BE '82 Mechanical) received the Association of Consulting Engineering Companies – Saskatchewan Lieutenant Governor Meritorious Achievement Award, recognizing his 40 years of engineering guidance in Saskatchewan and beyond. Atkins was project lead on the \$86 million Dr. F.H. Wigmore Hospital in Moose Jaw, the first hospital build project in Canada to use an integrated project delivery model.

USask Huskies football Head Coach Scott Flory (BE '99 Civil) was named the Canada West 2021 Coach of the Year. For the first time in 15 years, the Huskies advanced to the Vanier Cup national championship final, which the Western Mustangs won 27-21.

Alumni Ron (BE '62 Civil, DCL '13) and Jane (BEd '62) Graham made a game-changing \$900,000 donation to USask Engineering. A \$500,000 gift supported development of the college's newly launched RE-ENGINEERED program for



first-year students while the college's Ron and Jane Graham School of Professional Development will use a \$400,000 contribution from the Grahams to support a project co-ordinator who will monitor and evaluate initial outcomes of RE-ENGINEERED and help develop a suite of professional development opportunities for engineering students, alumni and other professionals. The Grahams' cumulative donations are the largest total of any USask alumni donors.

Tony Harras (BE '61 MSc '62 PhD '68,

Electrical) is the first-ever recipient of the USask BUZ Volunteer Leadership Award, recognizing the graduate who best exemplifies dedication and the spirit of volunteerism through community service. After he retired from SaskPower in 1999, Harras' volunteerism increased, with much of his





effort focused on preserving his Ukrainian heritage and heritage languages in Saskatchewan.

Lyle Hosler (BE ' 80 Civil) won the 2021 Environmental Excellence Award from the Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS). Hosler, who worked for Saskatchewan's Water Security Agency, was a key part of a project to improve water flow on the Upper Qu'Appelle River, which collects the flow from Lake Diefenbaker to Buffalo Pound. His design has dramatically improved the fish population in the waters affected and helped ensure the water supply for a large portion of the province's population, and the cities of Regina and Moose Jaw.

A photo of a Peary caribou that **Paul** Loewen (BE '01, MSc '05 Electrical) snapped in 2006 while working in Canada's High Arctic was chosen by Canada Post

to appear on 600,000 stamps, as part of the corporation's 2021 Snow Mammals Collection.

Jocelyn Peltier-Huntley (BE '05 Mechanical, MSc '20) was awarded a prestigious 2021 Vanier Canada Graduate Scholarship. Peltier-Huntley, part of the interdisciplinary studies program, is continuing to explore gender discrimination in mining and how to make workplace culture more inclusive for women and other under-represented groups.

Sheri Praski (BE '97 Civil), principal at EcoStrategies Consulting, was named the Saskatoon Engineering Society's 2021 Engineer of the year. Praski is also a sessional/guest lecturer at USask Engineering. Engineer of the Year is chosen based on: accomplishments in engineering; service to the profession in public education and/ or active participation in engineering associations, societies, or institutes; and service to the community. Previous winners have included the following USask Engineering alumni:

- Ritu Malhotra (PhD '10), president of March Consulting
- Margaret Kuzyk (BE '83 Civil), a 20-year member of the Canadian Commission on Building and Fire Codes and past chair of the Engineering Advancement Trust
- · Jason Mewis (BE '95 Civil), founder and president of structural engineering firm Engcomp







ECOWATER, a team of three USask Engineering graduate students, won third place and the audience choice award at the Western Canada AquaHacking Challenge, a tech competition that drew 21 teams seeking to create solutions to freshwater issues. The ECOWATER project addresses optimization of wastewater treatment plants with its innovative Eco-Model and EcoFilter to remove pollutants, including pharmaceuticals, from wastewater before it's released back into the environment. The ECOWATER team is: Mohsen Asadi, PhD student in civil and environmental engineering; and Khaled Zoroufchi Benis and Shahab Minaei, PhD students in chemical and biological engineering.

Electrical engineering student **Dawson** Bacon and computer engineering student Jay Shah won the Entrepreneurial Powerhouse Award for strong overall performance while navigating the virtual 2021 University of New Brunswick APEX pitch competition with their company, Koble, which connects fans with bands. The event drew 163 participants from a total of 70 teams, representing 45 universities across 15 countries.



Student Awards and Achievements

Chemical and biological engineering PhD student Khaled Zoroufchi Benis won the Three Minute Pitch competition at the 2021 Canadian Chemical Engineering Conference for his presentation "Eco-friendly method for treatment of aqueous arsenic." The event followed the spirit of a Three Minute Thesis (3MT) competition in which participants must present their research to non-specialist judges in just three minutes.



Engineering student Dannielle Brewster received a Resiliency Award at USask's 2021 Indigenous Achievement Awards. Brewster persevered and completed her co-op internship in Ontario, overcoming several barriers, including the pandemic, to stick with her work placement.

Amy Bunyamin (BE '17, MSc '20

Mechanical) won the 2021 Harry Toop Memorial Prize in Scientific Writing for the best written thesis by a domestic USask student in the areas of agriculture, engineering, biology, geology, chemistry, computer science, mathematics, physics, and any other physical science. The title of her master's thesis is "Predicting Off-Axis Bone Strength of the Distal Radius Using High-Resolution Peripheral Quantitative **Computed Tomography Based Finite** Element Modeling."



neering student Allison Grajczyk-Jelinski was named a second-team Canada West all-star for the 2021 cross-country season.

USask Engineering grad students captured top placements at the 2021 USask Graduate Students' Association Three Minute Thesis (3MT) competition, in which thesis-based graduate students

present their research in three minutes, with one PowerPoint slide, in language geared to a general audience. Scan the QR code to find the pre-

sentations on the GSA's YouTube channel.

- First place: Ahmad Karimi (Department of Mechanical Engineering), Topic: Just like popping popcorn in a microwave, oxygen plasma treatment
- Third place: Alivia Mukherjee (Department of Chemical and Biological Engineering), Topic: Spent coffee grounds for carbon dioxide capture, a sustainable approach toward climate change
- Honourable Mention: Ninu Kallingal Mohandas (Department of Chemical and Biological Engineering), Topic: Developing protein products from canola meal and its techno economic analysis

Saman Naghieh (PhD '21 Biomedical Engineering) was awarded the Madan and Saman Gupta Award for the best engineering PhD dissertation in 2021. His thesis





was titled "Extrusion bioprinting of hydrogel scaffolds: printability and mechanical behaviour."

Remington Rohel (BE '21 Engineering Physics), who graduated with degrees in engineering physics and computer science, posted an impressive 94.66 cumulative average in his undergrad engineering studies, earning him one of the two Governor General's Silver Medals awarded at USask's 2021 Spring Convocation to the top undergrads.

Samia Sami (BE'21 Electrical) won a 2021 Saskatoon YWCA Women of Distinction Award in the Research and Technology category. Her areas of undergraduate research included renewable microgrids and the observability of solar integrated distribution systems. She was also named Canada's top Institute of Electrical and Electronics Engineers (IEEE) Power and Energy Society Scholar.

Sami also received a 3M National Student Fellowship from the Society for Teaching and Learning in Higher Education (STLHE), awarded to student leaders who demonstrate outstanding leadership in their lives and at their post-secondary institutions. Sami's dedication to sustainable innovation also saw her recognized with the 2021 Global Citizen Youth Award from the Saskatchewan Council for International Cooperation.



Above: The Big Push: This photo by master's student Ben Fox (BE '19 Civil) was selected as the winner in the From the Field category in USask's 2021 Images of Research Competition. It shows large-scale plate load testing, in which loads as heavy as 108 tonnes (238 000 pounds or 30 elephants) were pushed onto preconstructed testing pads using a large piston assembly and a moveable 19-tonne steel platform.

Arliss Sidloski, a mechanical engineering student now starting her second year at USask Engineering, won the prestigious Marie Carter Engineering Ambassador Award from the Canadian Engineering Memorial Foundation (CEMF). The ambassadors, who serve as role models for other young women, are selected based on their enthusiasm for engineering, involvement in volunteer activities, leadership, communication, and interpersonal skills.

B'yauling Toni, a second-year student in engineering physics, received the 2021 Multicultural Youth Leadership Award from the Multicultural Council of Saskatchewan. In summer 2021, Toni cycled 3000 kilometres over 24 days to visit 20 Saskatchewan residential schools. Toni leveraged social media and his "Moccasins for Remembrance" tour raised over \$10,000 for the Orange Shirt Society, which raises awareness across Canada about the ongoing legacy of Indian residential schools.

Heloisa Westphalen won Best Clinical Science Paper at the 2021 USask Life and Health Sciences Research Expo. Westphalen is seeking to advance membrane technology in biomedical applications, specifically hemodialysis, which is a life-sustaining treatment for kidney failure patients; it

purifies a patient's blood using membrane filters inside the dialysis machine in the hospital. The paper she submitted for the expo is entitled: "Assessment of hemodialysis clinical practices using polyaryl ether sulfone-polyvinylpyrrolidone (PAES:PVP) clinical membrane: Modelling of in vitro fibrinogen adsorption, in situ synchrotron-based imaging, and clinical inflammatory biomarkers investigations."



Above: Colourful Tragedy: This photo taken by Zahara Teimouri, a PhD student in chemical and biological engineering, was runner-up in the Research in Action category in USask's 2021 Images of Research Competition. Her project is exploring the feasibility of using canola hull derived activated carbon to remove toxic dyes released via wastewater into our waterbodies.

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USask Engineering student groups **persevere** through pandemic

We asked student groups how they adapted during the disruption and here's what they told us. Reports were edited for length and flow.

Sled Dogs 1/4 Scale **Tractor Team**

Did you compete during the pandemic?

We competed virtually in May 2021. The usual performance events (tractor pulls, durability, manoeuvreability) were removed. Instead, the points breakdown consisted of the usual written design and cost reports, and a series of panel judging presentations conducted virtually.

How did you do?

With a limited amount of personnel, we decided to opt out of one presentation event. As a result, we finished 12th overall out of 15 teams, though we did take away many positives. For the Written Design reports, we tied for first in Criteria and Objectives, placed third in Design Details, first in Design Log, second in Cost Strategy and third in Cost Analysis to finish in third place overall in the reports category, our second-best performance to date. Other notable results include second in Serviceability and second in Manufacturability, resulting in a record-tying fifth-place overall finish in the Design Judging events.

Are you prepping now for a competition?

We are currently full swing into the design of a new tractor for the 2022 International Quarter Scale Tractor Student Design Competition, which will be held in June 2022, in Peoria, II.

What was missed most during the pandemic?

We missed being in the shop and seeing each other daily. Access to the Hardy Lab was restricted to regular business hours Monday to Friday, and only a few select people were allowed in. Not only did this hamstring our building efforts, it also affected the whole team dynamic and camaraderie.

Biggest lesson learned?

While we proved it is possible to virtually design a functioning tractor, it's not a sustainable replacement for being hands-on in the shop. With the cyclic nature of a student design group, the transfer of knowledge and experience from year to year is incredibly important and is just not possible in a virtual format. Some things you just cannot learn from behind a computer screen.

Huskie Formula Racing FSAE

Did you compete during the pandemic?

We competed virtually in June 2020 and April 2021. These events included a presentation on our designs and analysis, a presentation on our car's bill of materials, and a marketing presentation – either pitching the race car to theoretical shareholders or pitching the overall concept of the team.

For 2020, teams were not ranked overall however we did win our competition group for the marketing event. In 2021, we placed 37th out of 132 teams.

In fall 2020, once we were allowed some shop time, we completed our 2019-20 car, to use for data acquisition purposes. We also built a new car in the 2020-21 year as we thought we may have been able to attend our competition in spring 2021 but were unable to as the pandemic continued.

Are you prepping now for a competition?

We are planning to compete in mid-May in Michigan! We built a new frame last year that we will be using, and are working to optimize our aerodynamics package, cooling system and brake system.

What did your team miss most during the pandemic?

We really missed our normal shop access. Limited after-hours access and capacity limits made it very challenging and stressful to find time to work on the car. Knowledge transfer and keeping new members engaged was also difficult. We also really missed the social aspects of the team and the renewed excitement and purpose we find each year in bringing the race car to competition.

Biggest lesson learned?

There's no replacement for hands-on work. Being in the shop to fabricate or rebuild components not only builds practical skills but also leads to a much more intimate understanding of the system than can be achieved through Zoom calls. Our race car is a unique hybrid of a car and a motorcycle, so even the folks who join the team with previous experience working on one or the other have a learning curve.

Saskatoon Engineering **Students' Society**

How did your group adapt during the pandemic?

We began adapting our engineering student society into an online format, focusing on the crucial things students rely on us for, such as the academic and external aspects of our society. Tutorials, usually hosted in-person, were changed to WebEx meetings and were very successful. We then focused on promoting online conferences held by the Western Engineering Students Societies' Team (WESST) and the Canadian Federation of

Engineering Students (CFES) and were able

Biggest lesson learned?

to send over 40 people.

The willingness of the past executives to help us through our challenges brought together executive members from several years who lent their expertise. The willingness for people to come together and help each other throughout the pandemic showed the true spirit of the college: community.

What event - virtual or otherwise were you really happy with?

Our most successful event was the first annual Honour Pin Ceremony. This ceremony is similar to the second-year Hard Hat Ceremony. The Honour Pin Ceremony was created to introduce first-year engineering students to the college, make sure that they understand the importance of academic honesty and give them crucial knowledge to make their way through their first year. We had around 100 first-year students attend, with APEGS as sponsor.

University of Saskatchewan Steel **Bridge Team**

Did you compete during the pandemic?

Our team successfully competed in the recent virtual Canadian National Steel Bridge Competition. We were able to design, model, and present our bridge,









despite the challenges presented by the pandemic. We finished in the Overall Top Five out of 12 universities, representing nine Canadian universities, two Mexican universities, and one Chinese university.

Are you prepping now for a competition?

The Canadian Society for Civil Engineering (CSCE) is planning an in-person Canadian National Steel Bridge Competition for May 2022 in Sherbrooke, Quebec. We're still waiting for details, but we do know there will be fabrication or assembly components.

What did your team miss most during the pandemic?

In-person collaboration. As a team, we discuss and transfer knowledge on bridge design and analysis. It was hard to bridge through interactive discussions and analysis via online meetings.

Biggest lesson learned?

Always keep on innovating. Although there was limited interaction in the group, each member was given the chance to innovate individually. We were able to gather a handful of potential ideas and solutions to our goals. As a group, we were able to see and decide the feasibility of combining the alternatives.

U of S Space Team

What have you been working on since the pandemic began?

We've been hard at work collaborating with the USask RADSAT-SK student team, which is designing and building a cube satellite for launch in summer 2022.

The USST has also begun its first-ever rocket project. The rocket will fly to 30,000 feet and we are aiming to compete in the 2023 Spaceport America Cup, hosted in Southern New Mexico every year. The rocket engine, carbon fibre aerostructure, flight computer and electronics will be designed entirely by USask students.

What was missed most during the pandemic?

In-person collaboration! A big part of being on the space team is the opportunity to meet like-minded individuals.



Biggest lesson learned?

When people are passionate about something, nothing will stop them - our Fall 2020 recruitment event was just as successful, if not moreso, than years prior. The team is charging ahead and excited to be part of history as the RADSAT-SK team launches Saskatchewan's first CubeSat and our team develops one of Saskatchewan's highest-performance rockets.

Chemical Engineering Student Society

How did your group adapt? Any event that you were really proud of?

We shifted our meetings online and hosted our clothing and perogy sales virtually. We were most proud of our first-ever brew project! Because we hadn't hosted a project like this before it was difficult to plan, but fortunately, we were able to use online streaming platforms and partnered up to use brew kits at home. This way we were all able to work and learn as a group while still maintaining safety protocols. It was a great way for students to learn the concepts behind fermentation and was so successful that we are doing another brew project this year!

Biggest lesson learned?

Learning to adjust to changing circumstances while maintaining group success and safety is a crucial skill for engineers,

and I think the group really learned the importance of this. ChESS has almost all completely new executive members this year, with only one person having participated in ChESS before the pandemic, so we are all learning how to run the group in an in-person setting, which is a whole new challenge in itself! I am proud of the group in the way they have been able to quickly adapt to the changing circumstances thrown at them.

Mechanical Engineering Students' Association

How did your group adapt during the pandemic?

MESA was having an incredibly successful 2019-20 school year before the pandemic and was planning the classic MechChem curling tournament for March 14th, 2020. However, the night before, the university announced the transition to online learning and our event was cancelled. This was challenging but we adapted and distributed grad gifts to the 2020 grads and held online tutorials for our first set of online final exams. During the 2020-21 year, our goal was to engage with students as best we could. We hosted two virtual trivia nights, sold clothing, and hosted exam tutorials.

Biggest lesson learned?

As an executive and as individual students, we learned how much people in mechanical engineering rely on each other academically and socially. Engineering is

truly a team effort, so the elimination of social events where students can have fun and get to know each other outside of the Engineering Building took a toll on many of us. We also learned how to communicate more efficiently with students and faculty in the college, as well as within our own student group.

Geological Engineering Students' Society

UOFS

How did your group adapt during the pandemic?

GESS was able to keep active during the pandemic by EST. 1937 hosting virtual

events and by modifying existing events that our student group normally hosted. Virtual events included game nights, poker

nights and a hockey draft. This fall we were able to modify some of our regular events, such as converting our Pool (billiard) Night With the Profs event to a successful outdoors Disc Golf with the Profs, as well as host an outdoor second- and third-year event. We found that students were looking for a safe way to socialize with others, so by providing virtual events we were able to have great turnout.

Environmental Engineering Students' Society

How did your group adapt during the pandemic?

Our group continued to try to foster the undergraduate community, setting up online platforms to continue communication between students enrolled in Environmental Engineering. This allowed us

New fund enhances student experience

BY USASK ENGINEERING COMMUNICATIONS

These are a few key points to know about the newly established University of Saskatchewan Engineering Students' Fund (USESF).

What is the fund?

The USESF is used to advance the engineering undergraduate student experience by distributing funds to student groups and individuals within the engineering undergraduate community.

When was it created?

In February 2020, USask Engineering students passed a referendum establishing the USESF. The effort to establish the fund was led by Saskatoon Engineering Students' Society (SESS) president Dayne Gawley.

"I'm super proud that our team was able to get it established," Gawley said in a recent interview." I couldn't have imagined being

a large impact on student life." "Establishing USESF was a significant accomplishment for the SESS and our college," said **USask Engineering** Dean Suzanne

Kresta, who was especially grateful for Gawley's efforts.

How is the USESF funded?

The USESF is an endowment fund, which means that it is comprised of two accounts: one that acts as savings and collects interest, and another that will be distributed each year – the spending account. The USESF is funded by a \$20 per term student fee, an annual \$20,000 donation from the College of Engineering, and other donations from alumni and supporters.

to continue to mentor younger students in

the major and help them settle into their new class schedule.

What was your biggest lesson learned?

Virtual events can be successful if they are properly adjusted to an online format. We were able to successfully adjust a few of our yearly events to work online allowing for an inclusive environment for all students.

Did you stage any event - virtual or otherwise - that you were really happy with?

We staged an online version of our industry tour event. Even though we were not able to travel to another city to explore and learn more about careers in environmental engineering, we were able to get lots of engagement from alumni who joined our call and gave short overviews about the different fields and career paths that can be pursued with an environmental engineering degree.

able to have such

Half of each student's \$20 fee is put into the endowment fund to collect interest, and the other half is put into the spending account to distribute to applicants that year. The \$20,000 donation from the college is distributed each year and alumni can choose to either endow their donation or put it towards the year's spending. The interest collected each year from the endowment fund is transferred into the spending account to be distributed along with the other funds.

How are funds distributed?

USESF applications open twice a year and close in October and February of each term. Funding is open to all undergraduate engineering students within the College of Engineering, as well as ratified student groups within the college. Applications are assessed on a variety of factors, including impact on students, collaboration, involvement, and learning outcomes.

USask Engineering believes that learning about Indigenous culture and worldviews and the importance of authentic consultation are engineering practice skills needed for the next century.

Honouring Indigenous context in engineering

📏 BY DONELLA HOFFMAN

Eye-opening. Powerful. Impressed. Grateful.

That's how students from the University of Saskatchewan (USask) College of Engineering described the experience of setting up the college's newly acquired tipi.

They were volunteers from the college's newest crop of first years, the first students in the completely redesigned first-year program, dubbed RE-ENGINEERED.

Along with changes to student assessment and the overall structure of the program, the curriculum was broadened and includes the addition of an Indigenous Cultural Contextualization unit, taught in September as students take their first steps into the world of engineering.

"We want all of our engineering students to understand the unique relationships that exist in Canada, and certainly in Saskatchewan," said Joel Frey, a member of the team that created RE-ENGINEERED, explaining the rationale for the prominent and intentional inclusion of Indigenous con-

continued on page 21



First-year engineering students volunteered to help set up USask Engineering's new tipi. It was first raised behind the college on Sept. 28, in time for the National Day of Truth and Reconciliation on Sept. 30 and stayed up for just over a week.

Photos by Tenille Campbell



19 THOROUGH DECEMBER 2021



USASK COLLEGE OF ENGINEERING 20





Above: (From left) Candace Wasacase-Lafferty, Tim Eashappie, Suzanne Kresta, Alana Bitsuie and Joel Frey after the pipe ceremony.



Scan the OR code to watch the tipi pole assembly

text in first-year. "The U of S, especially on

Treaty 6 Territory and the Homeland of the Métis, has a unique place in the world."

USask Engineering Dean Suzanne Kresta, who taught the unit with Frey, says placing it early in the program will help change how students think about engineering from the very beginning.

"It sets them up with engineering skills that are needed for the next century.

"We can't do engineering projects anymore without due consultation, whether it's a suburban high school or a soccer field, a highway, new real estate development or a more challenging project that runs through Indigenous lands and provides the country with critical infrastructure.

"So, starting from Day One, with consultation skills, with building an appreciation for how others see the world, we hope to change the way that they think about practising our profession."

Key parts of the contextualization unit, devel-

oped with assistance from USask's Gwenna Moss Centre for Teaching and Learning, include Indigenous culture and worldviews, the calls to action of Canada's Truth and Reconciliation Commission, elements of the United Nations Declaration on the Rights of Indigenous People (UNDRIP) and the importance of free, prior and informed consent of Indigenous peoples before proceeding with economic development.

Kresta, an engineering educator for more than 25 years, says having the dean teaching the course is essential when major change is at play. She found that, "Students are ready to come to the table and find a path forward, and that's what we're here to do with them"

The highlight of the unit was the students' first experience with engineering design. Students were assigned one of six Indigenous technologies - snowshoes, basket weaving, tipis, travois, hide tanning, or canoe building - and had video lessons from elders on sourcing materials and making these things in a good way. This provided lessons in sustainability, the continuum of crafts, technology, engineering and functional art forms, and in reverse engineering of built objects.

Kresta was thrilled when the college's

Indigenous Initiatives Coordinator, Alana Bitsuie, launched plans to acquire a tipi and have students learn from elders about its structure and cultural significance as part of this unit. The poles were sourced from Elders Rose and Lester Morin of Big River First Nation, while the canvas was provided by Bruce and Deanna Starlight of the Tsuut'ina Nation in Alberta.

"This type of work is so healing for us as employees," said Bitsuie, a member of Saskatchewan's Red Earth First Nation. "We get to share the beauty of the culture."

It is also a key element of how the college is strategically and thoughtfully taking steps to build respectful relationships with Indigenous communities, she said.

Because of the significance of the community raising the tipi together for the first time, Elder Tim Eashappie conducted a pipe ceremony beforehand with the students, Kresta, Frey, Bitsuie and Candace Wasacase-Lafferty, Senior Director of Indigenous Engagement at USask. The tipi was then taken down so the students could participate in raising it.

Eashappie said he appreciates "the college being gracious enough to understand that we need to work together to acknowledge and understand our First Nations ways. I think that incorporating First Nations worldview in engineering is integral to understanding science, math, technology and engineering. We were taught that everything fits together in a universal dynamic."

Having a tipi in the college is especially significant, he said. "It is the best thing we have to be in touch with our old ancestral ways. And that's why it was so awesome to have the tipi raising, to show that we are working together."

Although COVID-19 concerns prevented the large gathering initially envisioned for the tipi raising, the smaller group of students who participated were clearly engaged as they learned about the cultural significance of the tipi and the Indigenous technology at play.

"I think it's very important to learn about these aspects of this culture," said student Mariam Alkoragaty, as she took a break from lifting and holding poles in place as the tipi was raised. "It was really informative, and I had a lot of fun today."



USask Engineering Indigenous Initiatives

Our vision

It is our vision – Söhkeyimowin – to provide meaningful access to engineering for Indigenous students and to increase representation of First Nations, Métis and Inuit students in our college and the engineering profession.

We celebrate and share Indigenous ways of knowing as an integral part of teaching, learning and research at USask Engineering.

The college appreciates the support provided by our community to advance Indigenous initiatives in the college. We are grateful to all who support our Indigenous Peoples Initiatives Fund in the college, supporting projects, programs and initiatives that support the education and experience of Indigenous students in the college.

The Indigenous Student Ambassador Program is one of the programs advanced by this fund. Ambassador Patrick Nelson says he became a student ambassador to help others. His family was one of many that came to Saskatchewan on Red River Carts and he identifies as being Anishinaabe and Swampy Cree Métis.

"I saw an opportunity to help make a community where we support each other from the ground up and provide the boost that is often needed to keep pushing through school or a hard time."

FEATURE

(From left) Tony Chung, Xiaodong Liang, Ajay Dalai and Bishnu Acharya are engineering the future of energy with their research

Photos by Dave Stobbe

Engineering the future of

USask Engineering researchers are exploring how to bring reliable and clean energy solutions to Saskatchewan and the world

energy 5

BY JOANNE PAULSON

When the federal government asked Natural Resources Canada (NRCan) in 2017 to map out a path for a low-carbon energy future, the department returned a thoughtful and comprehensive report on Canada's Energy Transition, with a recurring theme throughout.

Electrify everything.

If that sounds like a simple fix, just have a chat with Terry Fonstad.

The Associate Dean, Research and Partnerships at the University of Saskatchewan (USask) College of Engineering has a 30,000-foot view of the energy landscape. With experience in largescale research, he is among the leaders of the energy engineering cluster in the college, which is investigating everything from reliable smart grids that can incorporate renewable energy sources, to biomass fuels that are a clean alternative to fossil fuels.

Creating knowledge and providing solutions in these areas for Saskatchewan and

the world is what drives the deep pool of talented researchers in the college. Their work to explore and engineer the future of energy is having a global impact and is delivering on the USask promise to be the university our world needs.

Leading-edge researchers in the college have been seeking solutions to the net zero problem for several decades, and the reasons are legion. Fonstad, who is also an environmental engineer, starts with some perspective on just how many factors come into play when working to achieve a clean energy/net zero future.

When U.S. President Joe Biden was elected, he announced he was going to buy 640,000 electric vehicles. The whole federal fleet was going to be electric.

"The president of Toyota and Elon Musk (of Tesla), two main electric vehicle manufacturers, replied with, 'If you're going to do that, two things have to happen. You need grid modernization . . . and the energy has to come from somewhere else and it takes minerals. It takes copper wires, it takes lithium batteries, it takes all kinds of things



to produce these electric vehicles and this electric grid. You need to increase mining at least by an order of magnitude.

"It's kind of an awakening for people who have this utopian ideal of a clean environment. You need that utopian dream. But then reality sets in; if we're going to get that, you're going to need the resources to do that."

In Fonstad's view, Saskatchewan is not only the perfect place to unearth those resources, but also to execute research on new energy grids and renewable energy sources partly because of our extreme weather.

"In Saskatchewan, we could put everything on wind and solar, except the problem is our peak demand is somewhere around mid-January on a day when there is no wind, potentially overcast skies and the daylight hours are short ... so there has to be some sort of back-up."

The way things stand today, that back-up would have to be a connection to Manitoba Hydro or natural gas. Solar and wind battery storage technology is not sufficient, and geothermal won't cover the need either.

We are earning a high reputation in Canada and internationally.

We work closely with SaskPower to help solve a lot of critical technical challenges that SaskPower is facing in modernizing the power grid.

TONY CHUNG

Plus, the system was originally set up to go only in one direction — from the power producer to the home or business. How do we, for example, connect small solar communities to the grid, while also allowing them to operate independently?

These issues demonstrate the importance of the college's smart grid and microgrid research, much of it being done in partnership with Saskatchewan corporations, municipalities and industry. Saskatchewan's First Nations are also quickly becoming leaders in the renewable energy sector.

Tony Chung: Solving critical technical challenges to modernize power grids

C.Y. (Tony) Chung, has been working on these problems since before 2014. That's when he formed the SMARTGEN Lab to help Canada create a safe, reliable and sustainable power grid while adapting it to the use of renewable energy sources.

Chung is the Natural Sciences and Engineering Research Council (NSERC)/ SaskPower Senior Industrial Research Chair in Smart Grid Technologies and Professor and SaskPower Chair in Power Systems Engineering. He is also the recipient of the 2021 IEEE Canada P.D. Ziogas Electric Power Award and the 2020-2021 Saskatoon Engineering Society Educator of the Year Award.

Chung came to USask from Hong Kong because of the college's reputation in energy engineering and the province's interesting weather.

"The power grid in Saskatchewan faces extreme weather conditions. It can be very hot, and it can be very cold throughout the year. It creates a lot of problems for the power engineer to manage the grid," Chung said.

"Now, many cities are suffering from

extreme weather. Climate change is increasingly coming into the picture. SaskPower has provided an excellent platform to study this problem, which will be very useful for many cities all over the world.

"Not many countries or cities have this facility to test their work on grid modernization under extreme weather conditions."

Traditional power systems are not "smart" enough to handle the fluctuating and intermittent output from renewable energy sources such as wind and solar power, he said.

"If the grid is not smart enough to handle those variations, then the system may collapse, leading to large-scale blackouts."

Chung and his colleagues are using emerging sensing technologies to first gather accurate real-time information. Then they apply artificial intelligence to analyze the data, which cannot be done efficiently or guickly enough by a human brain, and predict possible courses of action to maintain grid reliability.

"The program is very successful. We are earning a high reputation in Canada and internationally. We work closely with SaskPower to help solve a lot of critical technical challenges that SaskPower is facing in modernizing the power grid," Chung said.

SaskPower, too, has for decades been moving toward using more renewable energy and modernizing its grid, often seeking the expertise available at USask Engineering.

"This collaboration goes back a very, very long time. We have had very close contacts with the College of Engineering going back to the time when the Power Systems Research Group was established there," said Elemer Demeter, SaskPower's Manager, Engineering Protection and Control, referring to the internationally recognized engineering research group established at the college in the 1960s.

That collaboration has gathered momentum in recent years.

"Things have improved significantly in the last decade in terms of the number of contacts and the number of projects," Demeter said, noting that this has coincided with SaskPower's gift to the college to establish the research chair.

"This is where Professor Tony Chung comes in," he said.

While the university selected him, "We were allowed to meet the prof and we had the ability to show the prof around in one of our power plants. This was in the middle of a Saskatchewan winter and the prof was from Hong Kong, so it was quite an experience for him. We were in the middle of a cold snap as well. We were laughing that if he would accept the job after this visit, we won't have problems with him leaving.

"We're excited that he was nominated and the college decided to offer him this position."





A significant additional benefit of Chung's program is the training of excellent students, some of whom go on to work with SaskPower, Demeter said. Part of the corporation's funding is allocated to paying grad students for their work.

"With this, they were able to bring in top students from across the world, so the guality of what NSERC calls highly qualified personnel skyrocketed," he said. "The quality of the people was outstanding in terms of technical preparation."

SaskPower also provided paid internships for grads approaching the end of their degrees. "Several of them were hired after the end of their four months and they are still working with us."

Demeter added that some of the work emerging from the college is being tested and proving successful, as SaskPower works toward its goal of reducing greenhouse gas emissions to 50 per cent below 2005 levels by 2030 – and reaching net zero by 2050.

"They have developed a forecasting tool for wind generation that we are testing at the system control centre. Lots of computers, many terminals and applications monitoring our power system, so it's a pretty cool facility," which is also bomb-proof and tornado-proof, he said.

"The software has turned out to be very good and we're working to see how we can make its use permanent."

Other applications are being designed to modernize the distribution system, particularly to accommodate customers who would like to generate their own power.

"This is extremely important for SaskPower because that's where the distributed green generation is coming up," Demeter said. "It needs a tremendous amount of innovation. The system built 50 years ago doesn't have the ability to accept generation at the end of customer loads. Everything is one direction. It goes from our generators to the user.

"The user wants to be a generator and that is a problem the system wasn't designed to solve," Demeter said.

Chung's group also works closely with Saskatoon Light and Power and the International Mineral Innovation Institute, among other partners.

I very much appreciate all this collaboration because it gives my team a lot of advantage compared to just doing research closed-door.

My plan is to expand this collaboration with local industry.

XIAODONG LIANG

Xiaodong Liang: Developing solutions for energy security in remote communities

Xiaodong Liang's energy research is charting a new direction in Canada.

She is the Canada Research Chair in Technology Solutions for Energy Security in Remote, North and Indigenous Communities. It's the first chair of its kind in Canada.

Her program is aimed at developing a new system of isolated microgrids, powered by renewable energy such as wind and solar. About 200,000 Canadians in remote communities, along with others in northern global areas, rely largely on diesel for power generation. It's expensive and creates high emissions.

0 THE OWNER WATCHING DISCOME. 0 Liang

Liang has been engaged in smart grid, microgrid and renewable energy since 2013; the research chair program began in mid-2020. She came to USask after working at Washington State University and Memorial University of Newfoundland.

"Renewable energy-based microgrids provide clean energy, and offer the foundation of future smart grids," Liang said.

"Renewable energy is being developed very fast recently. This kind of technology can be integrated into power grids through power electronics devices, communication networks and advanced control schemes to allow the grid to become smart."

Saskatoon Light and Power, which co-funds Liang's project with the university, provides her team with system data so that she can validate her research with real, on-theground information.

"I very much appreciate all this collaboration because it gives my team a lot of advantage compared to just doing research closed-door. My plan is to expand this collaboration with local industry."

She also hopes to collaborate with the Peter Ballantyne Cree Nation in Northern Saskatchewan and the Gwich'in Tribal Council communities in the Northwest Territories.

Liang's research includes seeking ways to monitor microgrid operations and detect problems; enable system self-healing; and integrate controls that respond to abrupt surges of power or sudden drops in load demand.

Bishnu Acharya: Turning low-value waste into high-value products

The grid research being undertaken by Chung and Liang is just one area where USask Engineering faculty are leading the way to solve energy-related problems. The college is also home to world-class researchers who are exploring how to use agricultural by-products to produce energy and other valuable products.

For example, Bishnu Acharya, the Saskatchewan Ministry of Agriculture Chair in Bioprocess Engineering, is investigating

Coming to the heartland of agriculture, especially with the interest of the Ministry (of Agriculture) on how to use agricultural biomass (for) by-products, I feel that's a very aood fit for me. It was my dream place to be.

BISHNU ACHARYA

how to maximize returns to Saskatchewan's agri-food and bioproducts industries.

"My research incorporates a lot of different applications of agricultural biomass," said the Associate Professor in the Department of Chemical and Biological Engineering. "That includes energy and material applications and chemical applications, which would eventually replace synthetic petroleum-based materials."

The applications include bioplastics for packaging as well as biofuels. For the latter, Acharya is working on a process of gasification to produce more hydrogen for energy applications, using flax, hemp wheat straw and other kinds of waste biomass.

Again, it's an issue of finding baseload energy sources to supplement other renewable energy sources, while aiming for the net zero goal.

"You need some kind of alternative energy to provide that baseload. That alternative energy could be nuclear — they're looking at small nuclear reactors — and I feel the biomass can also fit into that context."

Flax straw, for example, has a very high energy value and can be pelleted for bioenergy production.



"However, there are a lot of challenges as well," he noted. "How far do we go to collect them, and what is the model for handling and transportation? They come with a lot of costs. We have to come up with a unique process that can meet those kinds of challenges."

He is in discussions with the Saskatchewan firm Prairie Clean Energy, a company looking into how to convert flax into energy pellets.

Acharya came to USask after being edu-

cated in Nepal, Thailand, and Dalhousie University in Halifax, before going to the University of PEI. His work has always focused on agricultural biomass, and "coming to the heartland of agriculture, especially with the interest of the ministry on how to use agricultural biomass (for) by-products, I feel that's a very good fit for me as well. That's my interest.

"It was my dream place to be. There are only a few institutions where this kind of research is happening at this scale."

Around 2000, biodiesel was not on the radar.... Petroleum was still driving the economics. We wanted to work on biodiesel and look at the processes to make this product in an environmentally friendly way.

AJAY DALAI

Ajay Dalai: Breaking the trail on biofuels research

Ajay Dalai has been working in this field at USask since 2001, a clear sign that USask Engineering was on the leading edge of energy research many years before the public became aware of its potential benefits.

The Canada Research Chair (CRC) in Bioenergy and Environmentally Friendly Chemical Processing is developing alternatives to diesel from low-grade canola, waste cooking oil, sunflower, rapeseed and microalgae.

Dalai is working on converting vegetable oil to jet fuel as this fuel is environmentally friendly, "because jet engines emit two per cent of the world's carbon dioxide," he noted.

He is also working on creating liquid fuel from organic waste products using hydrothermal liquefaction process and environmentally friendly solids as catalysts to improve gasoline and diesel and to remove nitrogen and sulphur pollutants from petroleum fuels through a process called "hydrotreating."

"When I started here, I was asked to develop a project on biofuels. I had no idea what biofuels were all about," he recalled.

"Around 2000, biodiesel was not on the radar of the province and Canada and also internationally. Petroleum was still driving the economics. We wanted to work on biodiesel and look at the processes to make this product in an environmentally friendly way," said Dalai, who is USask's longest-serving CRC.

Vast amounts of water have historically been required to "wash" impurities from diesel fuel, so Dalai began seeking alternative chemical reactions. Using water for the process is basically "misutilizing the resource," he said.

"We have really come a long way. We have made materials that don't leach into biodiesel, and we can make very high-quality

product without water washing."

His team has worked with Foam Lake, Sask. company Milligan Bio to help optimize its canola-based biofuel creation process.

"What we (have) found is if you add one per cent biodiesel to diesel fuel, it can improve the lubricity in the diesel engine by 60 per cent. So, it is not just a fuel; it is very friendly to the diesel engine."

Other projects included turning glycerol by-product from the biodiesel-making process into propylene glycol, commonly used for de-icing airplane wings during winter months. Dalai and his team are working with Saskatoon firm NULIFE Green Tech to help commercialize its technology in this area.

Dalai is also engaged in biopellet research. He noted that Canada exports roughly \$400 million worth of biopellets to Europe, Japan and USA, where they are used for heat and power. The region has tax benefits for using biopellets, which helps drive their use.

"If we had similar incentives in Canada, I believe that a lot of companies would be producing a lot more biopellets, utilizing them for heat and power in place of natural gas, coal and petroleum and this can benefit the environment quite a bit."

Indeed, 80 per cent of global CO2 emissions come from the use of fossil fuels, so replacing these non-renewable fuels with plant-based substitutes will have a significant environmental impact. His research is focused on the utilization of biomass materials for renewable energy and green chemicals production. It is well known that biomass is created by utilizing carbon dioxide from the atmosphere through photosynthesis and once biofuels are combusted for heat and power, carbon dioxide is emitted to the environment.

"This is basically a more-or-less carbon dioxide neutral process if we use the biofuel in place of fossil fuel."

The Future of Energy

Fonstad said there is huge opportunity for Saskatchewan to capitalize on biofuels.

"We're in the middle of 80 per cent of all the arable land in Canada. That (Cargill) canola crushing plant east of town is the largest soft seed processor in North America, for example."

But we, and the world, must also look at expanding nuclear energy, he added.

"We have to look at the small reactors. We're sitting on 35 or 40 per cent of the world's uranium, something that has magnitudes more energy than any other fuel we have."

What is needed next is energy economics to evaluate and analyze all of these advancements, which will become crucial for the province, the country and the world, he added. The United Nations Sustainable Development Goal number 7 is to "ensure access to affordable, reliable, sustainable and modern energy for all." The provincial growth plan is well-aligned with all of these components and government policies are stimulating growth in these areas, he notes.

"All of a sudden, Saskatoon and USask becomes a big player. We have global institute for water and food; why wouldn't we have a global institute for energy?"

BY BROOKE KLEIBOER

University of Saskatchewan (USask) chemical engineering PhD candidate Alivia Mukherjee is investigating how spent coffee grounds can be used to reduce greenhouse gas emissions - adding value to an abundant Canadian waste product.

The project is supervised by USask Engineering professor Ajay Dalai, the Canada Research Chair in Bioenergy and Environmentally Friendly Chemical Processing since 2001. It is co-supervised by Catherine Niu, also from USask Engineering.

Coffee is one of the most widely consumed drinks and sources of caffeine in the world.

"One day sitting at a local Tim Hortons, I saw the employees were discarding the wastes in huge plastic bags," said Mukherjee. "I began to brainstorm to understand how leftover organic material—spent coffee grounds from one of the biggest coffee chains in Canada—can be valorized to produce value-added products."

When waste products such as coffee grounds go to a landfill, the decomposition process produces methane, which has 21 times more greenhouse gas effects than carbon dioxide.



Spent coffee grounds could help reduce greenhouse gas emissions

Mukherjee and her research team instead want to find sustainable strategies to reuse and recycle organic waste products in Canada.

In the case of coffee ground waste, the leftover substance has the potential to serve as a trap for carbon dioxide.

Using USask's Canadian Light Source (CLS) synchrotron technology, Mukherjee treated coffee ground waste with heat to change the surface characteristics of the grounds, allowing it to become more effective at storing carbon.

"With these findings, we can further tune the surface of the adsorbent to help improve the interaction with carbon dioxide in a post-combustion scenario."

Mukherjee's work can be applied to the concept of carbon capture and storage - trapping the emissions before they are released into the atmosphere, contributing to global warming.

The question of how to be environmentally friendly while still stimulating global economic growth is a long-standing public debate, and Mukherjee's project could serve as an example of a possible solution.

"I believe it will excite the public (to) know that drinking coffee is not only limited to an everyday pleasure that contributes towards the economy, but also the waste generated from consuming it can have a significant impact on the environment."

Class of '68 Mechanical forges 50 years of memories

It's a track record that likely can't be matched by any other USask graduating class.

For more than 50 years, the Class of '68 mechanical engineering grads from the University of Saskatchewan (USask) College of Engineering have gathered for class reunions. While the COVID-19 pandemic unfortunately put an end to their streak, it remains an enviable achievement.

Bob Logan, one of the '68 grads, says he's never heard of another group that has remained as connected. "When we've talked to other classes, no one else has been holding reunions as long. I'd like to challenge the college or even the university to come up with somebody that has," he said in a recent interview from Calgary.

His classmates credit him with getting the reunions off the ground back in the day and then working hard to keep them going.

"From the day we graduated, Bob was taking notes of where we were going to work and where we were, and he always kept in touch with us," recalled Doug Frame from his home in Calgary. "I think anybody you talk to from our class will tell you that it was a wonderful thing he did.

"He's really kept the class together. He is the glue."

They've gathered, usually in June, in a variety of spots throughout the West: Calgary, Kananaskis, Radium Hot Springs, Salmon Arm, Victoria and Great Falls, Montana to name a few. And since 2010, a part of the group has held a "half-year" edition each spring in Arizona.

Along the way, the group has adopted a few kindred spirits, including former assistant dean Buck Staples, who was held in great affection and attended many reunions.

Frame noted that the group has been fairly lucky with good health and though eight or nine members have passed away, about 50 remain.

He also says there's another reason for their success.

"Over the years our wives became good friends. They look forward to the reunions as much as we do, and that's important."

Plus, the reunions are simply a lot of fun.

With golf a key part of the proceedings, a booby prize has been created. "A little statue showed up at one of our reunions and it's a real ugly looking thing," said Logan. "Getting it is not something you look forward to."

And it's well known that a reunion won't be officially complete until Brian Murphy has told his favourite joke, which he recounts with relish.

"I was a fun seeker when I first got to the college," Murphy said in an interview from Calgary. "I had too much wine in my third year – the first time – and failed out and had to stay out a year. I worked at the Allan Potash Mine, got married and went back to school and finished my third and fourth years after that.

"When that happened, a professor had said to me, 'Murphy, just keep going. We mark on a curve and there'll be a dumb class that will come along, and you'll get swept in with it and you'll get pushed through by marking on the curve," recounts Murphy, the smile evident in his voice.

"So, every year when the class gets together, I get up and I thank them for being the dumb class that allowed me to graduate. They know what's coming and they hiss and boo every time I start to thank them. It's all in jest, of course, because they're great guys and they all went on and did well."

Frame knows the story well. "We do a lot of joking and teasing each other about our golf and that kind of stuff. It's a lot of fun when we get together."

Since the spring 2020 reunion was cancelled, the Class of '68 has not gotten together, but it plans to reunite in spring 2022 in Calgary, and they're already looking forward to it.

"We're just a good group of friends," said Logan. "We've all gone different ways in our lives, but we always get back together and enjoy each other's company."









Mechanical engineering student Dustin Archdekin used his experience in manufacturing and machining to help design lab kits for USask Engineering's new first-year program.

Photo by Dave Stobbe

From textbooks to hands-on learning

Machinist turned mechanical engineering student creates lab kits that bring textbook concepts to life

When the team designing the RE-ENGINEERED first-year at USask Engineering was sourcing student lab kits for their new Statics course, they couldn't find what they wanted.

But they knew there was in-house expertise that could help them create what they wanted - they called on third-year mechanical engineering student Dustin Archdekin.

Archdekin, a mature student, had taken an interesting path to engineering. After high school, he went to racing schools and ended up building engines in the States.

"I came back to Canada and I realized that the machining aspect of building race engines was what really drew me into the manufacturing area, so I ended up doing CNC (computer numerical control) machining for about five years."

After working for a small shop on the USask campus and helping university professors and students with their designs, Archdekin realized he wanted to take his career in a new direction.

"Once I figured out that I really like the design portion, I decided to come back to school after 10 years and go into engineering."

In his first-year engineering classes he crossed paths with Associate Professor Sean Maw, the Jerry G. Huff Chair in Innovative Teaching, based in the Graham School of Professional Development in the College of Engineering.

Maw is also a co-lead on the team that redesigned first-year engineering at USask. The new program launched in fall 2021.

Archdekin recalls that in Maw's classes, "I was the guy always asking the questions and then helping other students out in tutorial sessions."

He and the professor chatted, and Maw learned about Archdekin's machining and building background, which he sought out when sourcing lab kits for the new first-year Statics course.

"When we were doing the research to look for what we wanted this kit to do, it has never been done, or we couldn't find one that would do a good job of it," Archdekin said.

"Sean decided to bring me on over the summer to actually create the lab experiments for other students, as a student. I really liked it because I actually got to put in my input on how I learned, and then I figured out how maybe other students could learn, too."

For instance, Archdekin incorporated a tool that tradespeople use into the kit, so that in addition to learning about the concept of a moment of couple – a system of two forces acting in opposite directions – students can feel it as well.

"As well as being able to measure with the torque wrench, we will be able to feel the moment," Archdekin said. "A couple moment is not generally something that an engineer can feel, and with this kit we are able to feel what a couple moment would feel like." (Scan the OR code to watch a video highlighting this part of the lab kit.)

Maw is thrilled with the results of Archdekin's work and the opportunities it brings for student learning.

"Basically, we can bring almost everything in the textbook to life," he said. "And the students are going to get to play with these lab materials when they want, how they want, so they're going to be able to engage in exploratory learning, which we're very excited about."

Maw also notes that it was the college's Engineering Advancement Trust that pro-

> vided the support to create the kits. "Without partners like the Engineering Advancement Trust believing in the RE-ENGINEERED first-year program, opportunities like this just wouldn't exist."



Students at work in the Department of Electrical and Computer Engineering.

Photos by Dave Stobbe

What you leave behind is not what is engraved in stone monuments, but what is woven into the lives of others.

- Pericles

Legacies live here

Estate Gifts

James Lundie

USask Engineering is honoured and humbled to be entrusted with the legacy wishes of our friends and partners, whose generosity helps ensure the future success of our students, college and the engineering profession. The following contributions from alumni will keep their legacies alive while having meaningful, substantial impact within USask Engineering.

Alumnus James Lundie (BE '30 Civil) created

the Lundie Memorial Trust in the memory of the Lundie family: James Lundie

Sr., James Lundie Jr., sister Edith Irene

Lundie (BA '38), and brother William Earle

Lundie (BE '33 Civil). The endowed Lundie

Memorial Trust will be used to continue

and advance research in the College of

for generations to come.

David C. Riley

USask.

Engineering, creating impactful outcomes

A generous estate gift from David C. Riley

(BE '58 Mechanical) will create new bursa-

ries for engineering students who have the

this intention in 2002, working closely with

greatest financial need. Mr. Riley created

the college to ensure his desired impact

would be achieved through the bursa-

ries, supported by an endowed fund in

Thomas and Laura Smith

his memory that will exist in perpetuity at

Thomas (BE '45 Civil) and Laura Smith left

ance to USask, supporting the Engineering

a remarkably generous gift of life insur-

Advancement Trust and the Murray

Library Trust Fund. Tom and Laura met

while skating at the Rutherford Rink and

chose to build a life together. Tom's varied

career included teaching in the College of

Engineering as a materials lab instructor,



and Laura was a teacher who spent time working at the USask Library. Their legacy gift will have lasting impacts in the two areas of personal importance to them.

The Pioneers Elsie and Harold Lambert

An estate gift from Gladys Calland will create the first graduate bursary in electrical engineering. "The Pioneers Elsie and Harold Lambert and Gladys Calland Family Bursary" is in memory of Gladys' late parents, Harold and Elisie Lambert, as well as her late husband, Alfred Francis Calland and sons Richard Calland and Clive Calland.

George (Ron) and Myrtle Gray

A generous gift from George (BE '48 Chemical) and Myrtle Gray will support the Department of Chemical and Biological Engineering, providing strategic upgrades and enhancements in the department. impacting a great number of students for years to come.

Al Demetrick

With a deep appreciation for his education and the impact it had on his life, alumnus Al Demetrick (BE '64 Civil) generously left a legacy gift to the Department of Civil, Geological and Environmental Engineering to purchase a simple shear apparatus. This meaningful gift will provide hundreds of civil, geological and environmental engineering students with hands-on experience

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and Gladys Calland Family Bursary



that enhances their understanding of soil characterization.

Memorial Awards

Meaningful award support is something that students will remember for years to come. It inspires many to do their very best and follow in the footsteps of their alumni role models. Thanks to these new memorial awards, the values, spirit and legacy of our alumni will be recognized, nurtured and carried into the profession by our newest USask Engineers.

Spirit of Charles Gibson Award in Mechanical Engineering

In lieu of holding a 40-year class reunion at the height of a global pandemic, the Class of '81 Mechanical decided to commemorate the occasion with a new award for fourthyear mechanical engineering students, created in memory of classmate Charles Gibson. Current students will nominate peers that they feel share Charles' qualities of generosity, excellence and enthusiasm. Student body reviewers will then recommend a recipient, who will receive final approval by the mechanical engineering department head. The Class of '81 looks forward to meeting the first recipient of the award in person at its next reunion celebration in 2022.

George Werezak Memorial Bursary

George Werezak (BE '61 Chemical) grew up in rural Saskatchewan and was the first of three generations to study engineering. After graduation, George and his wife settled in Sarnia, Ont., where he enjoyed a long career with Dow Canada. After his passing, George's family established a bursary in his honour, to support aspiring chemical engineering students from Saskatchewan who have financial need.

Myron Washchyshyn Entrepreneurship Award in Engineering

After graduating in 1979 from electrical engineering, alumnus Myron Washchyshyn enjoyed a dynamic career in industry, including a 19-year tenure as president of Mulvey & Banani, where he worked on several projects of national importance. After Myron's sudden passing, his family chose to honour his legacy with an award in his name, to make a difference in the USask Engineering community that meant so much to him. This year, entrepreneurialand community-minded students will benefit from this meaningful award support.

The Blair Hockley Memorial Scholarship

Student leaders, volunteers of the student-led Spectrum engineering showcase or those contributing their time to the Engineering Advancement Trust will be recognized and supported by the new Blair Hockley Memorial Scholarship. As a student, Blair Hockley (BE '96 Mechanical) was Saskatoon Engineering Student Society president, lead coordinator of Spectrum and facilitated the alumni-to-student mentorship program. Blair deepened his involvement with the Calgary alumni



chapter and later joined the Engineering Advancement Trust board of volunteer alumni trustees. Following Blair's sudden passing, friends and peers created the Blair Hockley Memorial Scholarship to carry forward and share his legacy with future USask Engineers, a fitting reflection of the deep dedication Blair had to aspiring engineers.



We are grateful to each member of our community who has chosen to support USask Engineering. **THANK YOU FOR YOUR GENEROSITY.**

You make a DIFFERENCE.

You ensure the collective contributions of exceptional USask engineers continue to benefit our communities and world.

Interested in making a 2021 gift to the college? Your support can impact the area most important to you. Please visit our online donation page; scan the QR code for the link.



To explore how you can leave a legacy gift or support the future of the college with a gift in your will, please reach out to us.

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