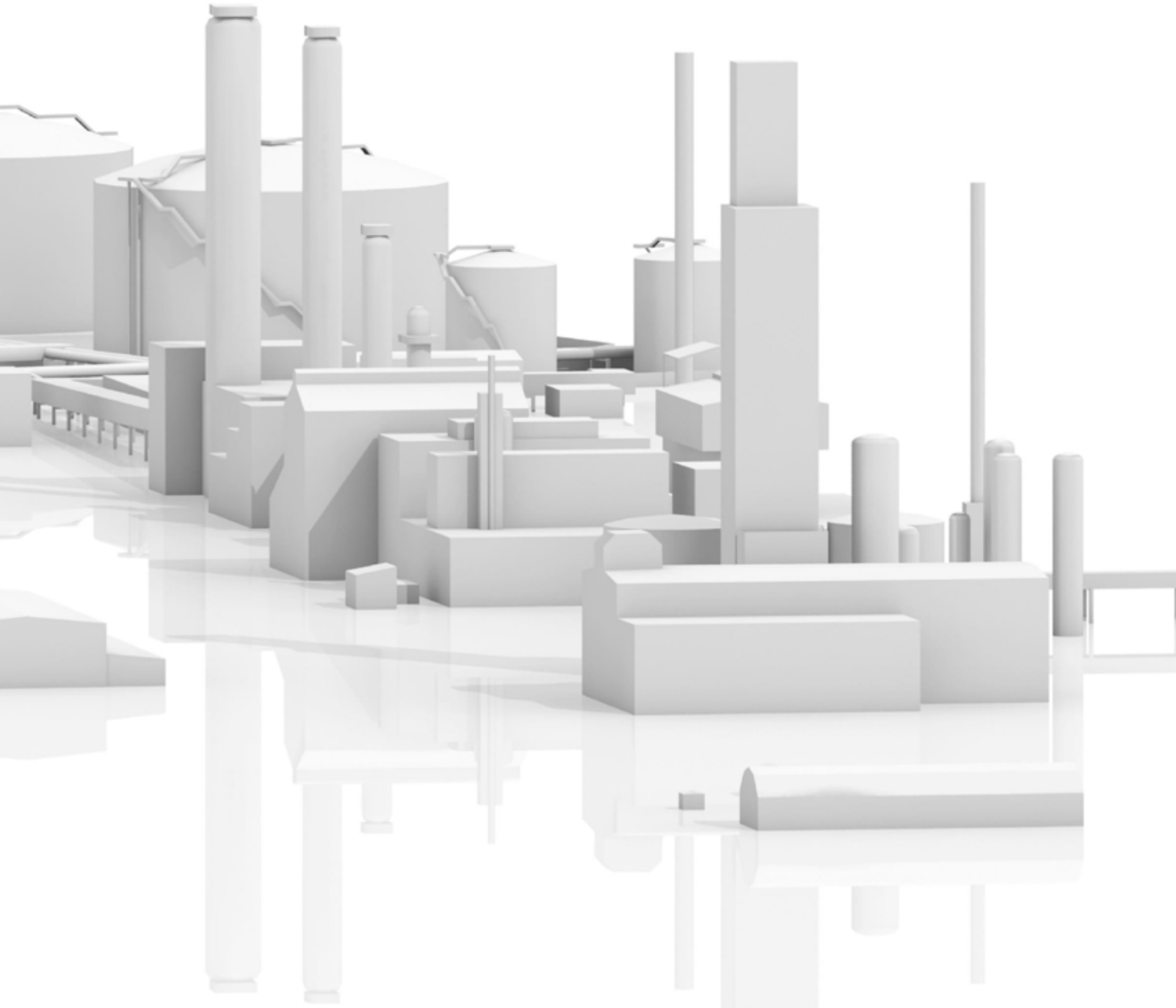
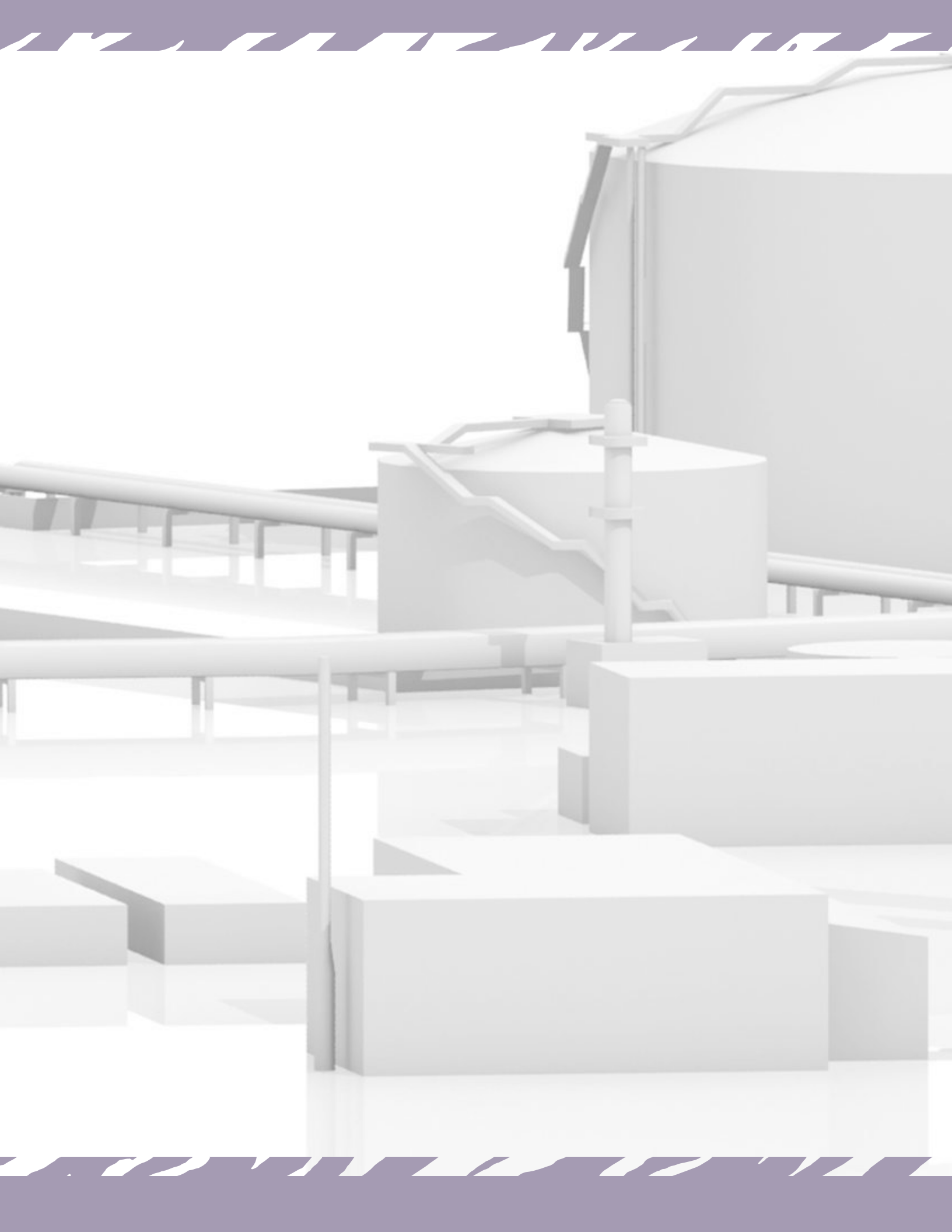
Annual Report 2019



LSU | Center for Energy Studies



Center for Energy Studies Annual Report 2019

Table of Contents

Center for Energy Studies

David E. Dismukes, Executive Director | lsu.edu/ces

This past year has been one of growth for the center, reflected most prominently by the addition of two new faculty members: Brittany Tarufelli and Cody Nehiba. Brittany, who received her Ph.D. from the University of Wyoming, specializes in energy and environmental analyses. Cody, who received his Ph.D. from the University of California, Irvine, specializes in the analysis of energy- and transportation-related topics. Both have hit the ground running, developing publications from their dissertation-related energy research, as well as addressing Louisiana-specific topics on energy efficiency and transportation. CES welcomes them, and we look forward to their continued contribution to our research and outreach efforts.

During this past year, our faculty saw continued research success in several emerging, as well as long-standing, topics. Several years ago, the center led an interdisciplinary team in the analysis of carbon capture, utilization, and storage (CCUS) opportunities for Louisiana. Since that time, not only has CCUS become an increasingly important topic for both the state and industry alike, but CES has been in the middle of linking our important feasibility research with stakeholder interests. CES continues coordinating a significant amount of the University's CCUS-related research activities and has sponsored several events highlighting the university's work and the opportunities this research has for Louisiana.

CES is also continuing its work with the Louisiana Legislature and other stakeholders on important mineral revenue and taxation issues. This past year, under Greg Upton's leadership, the center conducted a comprehensive study as directed by Senate Concurrent Resolution 4. This study was guided by and received input from several industry and state government stakeholders. The mineral revenue study offered several recommendations in which oil and gas taxes could be streamlined, made more efficient, and potentially more stable.

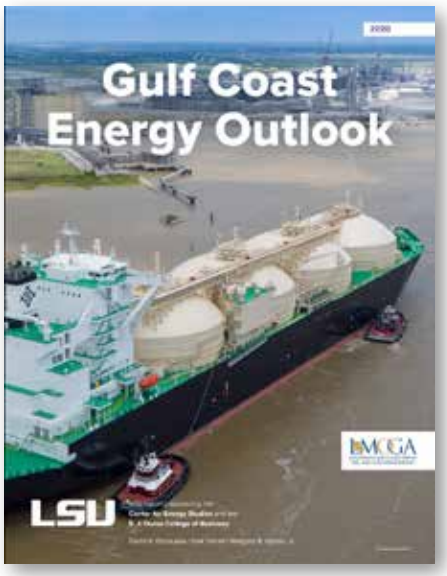
CES' outreach efforts over the past year have been considerable. We hosted foreign delegations from Germany and Australia, as well as a group of journalists, sponsored by the U.S. Department of State, that hailed from all over the world. We continued our annual events such as the Energy Summit and our joint Oil and Gas Symposium with LGS. CES' continued "roll-out" event for the *Gulf Coast Energy Outlook* (*GCEO*) was also well-attended and garnered significant attention as a publication recognized as an authoritative outlook for regional energy. Output from the *GCEO* continues to be cited by several news outlets, both print and video.

Overall, this has been another year of accomplishment and strong community interaction for the center. As this report will attest, CES has worked hard at harnessing the resources of the university on energy-related research for the benefit of Louisiana. CES has worked to organize teams of researchers from other colleges and departments on timely issues impacting the state. CES has worked equally hard at creating high-quality events and venues to disseminate this work and bring stakeholders together to address timely and important Louisiana energy issues. We appreciate the significant support provided by our numerous stakeholders over the past year and look forward to continued success in 2020.

Sincerely,

David E. Dismukes, Ph.D.
Professor & Executive Director

Research Highlights



2020 *GCEO* Reach: *Within one week of its November 6 release, the digital version of the 2020* GCEO *was downloaded more than 100 times. The Twitter thread for the* GCEO *Kickoff earned nearly 14,000 impressions (number of times a tweet appears on an individual's timeline), after LSU re-tweeted.*

The 2020 *GCEO* was made possible with sponsorship from Louisiana Mid-Continent Oil and Gas Association, Phillips 66, Entergy, TJC Group, Enverus, Cameron Parish Port, Harbor & Terminal District, and Louisiana Economic Development.

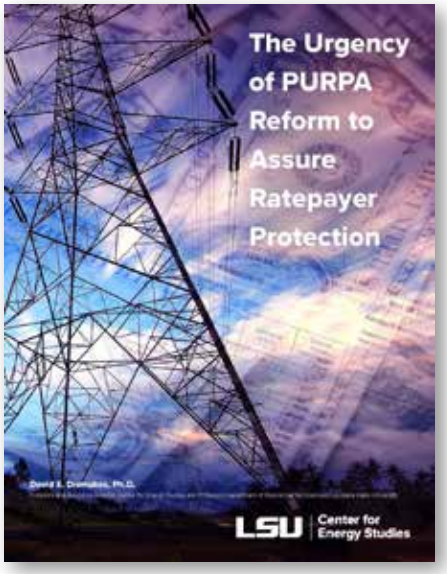
Center, Ourso College Release 2020 *Gulf Coast Economic Outlook*

The LSU Center for Energy Studies and the E. J. Ourso College of Business released the 2020 *Gulf Coast Energy Outlook* with a kickoff event on Wednesday, November 6. The 2020 *GCEO* examines trends in upstream oil and gas activity, transportation infrastructure and bottlenecks, and downstream investments in refining and petrochemicals. Energy sector-specific employment forecasts are also provided. The report is available on the center's website.

Findings include:

- Drilling activity slowed during the previous year, and this slowed pace is expected to continue given low oil and natural gas price forecasts.
- While drilling activity has slowed, production continues to rise due to continued well productivity.
- Increased oil and natural gas production has led to significant and continued pipeline investment opportunities.
- Industrial development and capital expenditures for both Louisiana and Texas slowed in 2019 but are anticipated to rebound in 2020 through 2023.

David E. Dismukes, executive director and professor, LSU Center for Energy Studies; Dek Terrell, professor, LSU E. J. Ourso College of Business; and Gregory B. Upton, Jr., assistant professor, LSU Center for Energy Studies, authored the report.



Dismukes Publishes PURPA Report

In July, David E. Dismukes, CES professor and executive director, published research recommending the immediate reform of the Public Utility Regulatory Policies Act, or PURPA, a piece of federal legislation adopted during the energy crises of the 1970s and early 1980s.

The research finds that PURPA's overly generous and unnecessary "buy-back" provisions have led to the development of around 70,000 megawatts (MW) of excessive renewable generation capacity equivalent to more than $100 billion in new capital investment that is being paid for by retail utility ratepayers.

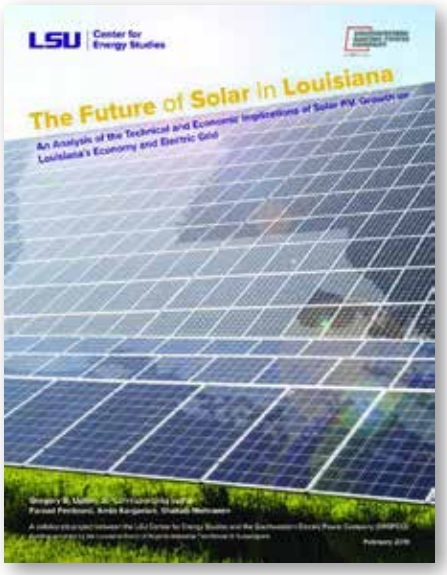
Dismukes notes that, in 1978, the year in which PURPA was passed, electric utilities were vertically integrated and highly regulated monopolies, and non-utility energy represented less than five percent of total U.S. power generation. At the time, PURPA tried to subject wholesale power generation to competition by introducing a host of new players and new capacity.

PURPA forced regulated utilities, who at the time owned all power transmission assets, and were the direct link to end-user customers, to purchase electricity from these new generation developers at a set of fixed prices and contract terms. At that time, PURPA represented "a disruptive piece of federal legislation" that ultimately helped to prove that electric power generation was not a natural monopoly and that competition could be sustained in the electric power industry; however, since then, electricity markets have undergone more than three decades' worth of reform, making them highly competitive with numerous wholesale buyers and sellers.

Dismukes argues that PURPA's mandatory purchase requirements are not needed today, especially given the highly competitive nature of regional electricity markets and the regulatory provisions that require power transmission systems to be operated and governed to support open and non-discriminatory access. The mandatory buy-back provisions included in PURPA simply force utilities to purchase electricity generation capacity that is not needed at prices that do not reflect current market fundamentals. Ultimately, the financial liability of these federally mandated excess electricity purchases will be passed on to ratepayers.

Dismukes says that continuing to allow renewable developers to take advantage of these PURPA buyback provisions will continue to lead to long-term ratepayer financial burdens, incentivize uneconomic renewable energy capacity development, and ultimately increase ratepayer costs. Dismukes notes that PURPA reform "should eliminate a set of regressive and excessive subsidies that benefit large renewable generation developers and their investors, and burden retail ratepayers."

The Institute for Energy Research contributed to Dismukes' research.



Future of Solar in La. Report Released

In February, CES Assistant Professor Greg Upton and coauthors released "The Future of Solar in Louisiana: An Analysis of the Technical and Economic Implications of Solar P.V. Growth on Louisiana's Economy and Electric Grid." Part of the Louisiana Board of Regents Industrial Ties Research Subprogram (ITRS) from June 2016, the study analyzes how solar could be incorporated into the electric grid and whether the incorporation of battery storage could enhance the scalability of the resource in an economical way. Industry partner Southwestern Electric Power Company (SWEPCO) also provided data and support, including technical engineering data on its distribution grid.

This collaborative effort between the center for Energy Studies, the Louisiana Board of Regents, and SWEPCO resulted in a report that assesses both the technical and economic implications of the solar industry in Louisiana. The report is available on the center's website.

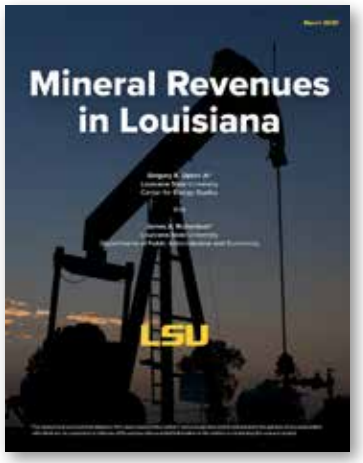
Upton, Richardson Release La. Mineral Revenues Status Report

In the 2018 second extraordinary session of the Louisiana Legislature, Senate Concurrent Resolution (SCR) 4 was passed asking Dr. Jim Richardson and Dr. Greg Upton to make specific recommendations to the legislature regarding mineral taxes in Louisiana. The motivation for this request was based on work conducted by the Task Force on Structural Change in Budget & Tax Policy and a recently published book chapter on the topic.

The economists were asked to explore possible changes to the Louisiana mineral tax structure and consider the following goals:

- Preserve or improve the competitiveness of the oil and gas extraction sector in Louisiana.
- Decrease or remove the difference in tax rates for oil and gas.
- Create an equitable system of severance tax exemptions on all wells, not just horizontal wells.
- Hold constant or increase mineral revenues for the state.
- Explore other reasons why oil and gas production is fluctuating in the state of Louisiana and any changes that need to be made to increase production.

This document, available on the center's website, served as the preliminary status report highlighting the work conducted in the first year of a three-year study process. The final report, released in March of 2020, is also available on the center's website.



Sponsored Research

Description of Helicopter Operations and Utilization in the U.S. Gulf of Mexico. Gregory B. Upton, Principal Investigator. Cody S. Nehiba, Co-Principal Investigator. Bureau of Ocean Energy Management. Project funding: $ 159,247.

Economic Impact Analysis for TransCanada. David E. Dismukes and Greg B. Upton, Principal Investigators. TransCanada. Project funding: $40,798.

Economic Impact Analysis for Enable Midstream Partners, L.P. David Dismukes and Greg B. Upton, Principal Investigators. Enable Pipeline. Project funding: $40,789.

Electricity Market Restructuring in the United States. Greg B. Upton and Brittany L. Tarufelli, Principal Investigators. Public Sector Consultants, Inc. Project funding: $52,000.

Empirical Analysis of the OCS Pipeline Network in the Gulf of Mexico. Mark Kaiser, Principal Investigator. Bureau of Ocean Energy Management. Project funding: $219,678.

Integrating Storage into Rooftop Solar: An Economics and Engineering Approach. Greg Upton, Principal Investigator. Louisiana Board of Regents Support Fund: Industrial Ties Research Subprogram. Project funding: $239,726.

Offshore Oil and Gas Activity Impacts on Ecosystem Services in the Gulf of Mexico. David Dismukes, Principal Investigator. Bureau of Ocean Energy Management, Louisiana Coastal Marine Institute. Project funding: $240,982.

Southeast Regional Carbon Storage Partnership: Offshore Gulf of Mexico. David Dismukes, Co-Principal Investigator. Southern States Energy Board and U.S. Department of Energy. Project funding: $251,803.00.

Update to BOEM GOM Factbook. David E. Dismukes, Greg B. Upton, and Mallory Vachon. U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM). Project funding: $128,431.

Publications

Dismukes, David E. "The 2019 Gulf Coast Energy Outlook." *10/12 Industry Report, Baton Rouge Business Repor*t Q1 2019.

Dismukes, David E. *2020 Gulf Coast Energy Outlook*. Baton Rouge: LSU Center for Energy Studies, Fall 2019, 29 pp.

Dismukes, David E. "Actual Benefits of Distributed Generation in Mississippi." Report prepared on the behalf of the Mississippi Public Service Commission. 2019, 191 pp.

Dismukes, David E. "An Exceptionally Uncertain Time for Energy Markets." *10/12 Industry Report, Baton Rouge Business Report* Q4 2019.

Dismukes, David E. (with Mehdi Zeidouni, Muhammad Zulqarnain, Richard G Hughes, Keith B Hall, Brian F. Snyder, Michael Layne, Juan M Lorenzo, Chacko John, Brian Harder). "Integrated Carbon Capture and Storage in the Louisiana Chemical Corridor." National Energy Technology Laboratories/U.S. Department of Energy. 2019, 151 pp.

Dismukes, David E. "LNG's Changing Fortunes." *10/12 Industry Report, Baton Rouge Business Report* Q3 2019.

Dismukes, David E. "A Tenuous Recovery." (2019). *10/12 Industry Report, Baton Rouge Business Report* Q2 2019.

Dismukes, David E. "The Urgency of PURPA Reform to Assure Ratepayer Protection." Institute of Energy Research, 2019, 24 pp.

Iledare, O.O. (with A.J. Idowu, and B.G. Dada). "Evaluating technical efficiency of firms of different sizes: A case study of Nigerian upstream players." *SPE Reservoir Evaluation & Engineering* 22(2):775-788.

Iledare, O.O. (with J.C. Echendu, A.J. Idowu, A. Adejumo, and A.J. Aklnlawon). "Single-tier or dual-tier tax systems: Implication for petroleum project economics in Nigeria." *SPE Reservoir Evaluation & Engineering* 22(2):789-799.

Kaiser, Mark J. *Decommissioning Forecasting and Operating Cost Estimation: Gulf of Mexico Well Trends, Structure Inventory and Forecast Models*. Cambridge, MA: Gulf Professional Publishing. 560 pp.

Kaiser, Mark J. "Deepwater Subsea Well Spuds on the Decline: Dry Tree versus Wet Tree Trends Examined." *Offshore* 79(2):26-27.

Kaiser, Mark J. "Producing Wells Declining in Shallow-water Gulf of Mexico: New Deepwater Wells Replacing Shut-ins." *Offshore* 79(1):50-52.

Kaiser, Mark J. "The Role of Factor and Activity-based Models in Offshore Operating Cost Estimation." *Journal of Petroleum Science and Engineering* 174 (2019): 1062-1092.

Kaiser, Mark J. (with J.D. Shively and J.B. Shipley). "An Update on the Louisiana and Texas Rigs-to-Reefs Programs in the Gulf of Mexico." *Ocean Development and International Law* July 2019.

Kaiser Mark J., and Siddhartha Narra. "An Empirical Evaluation of Economic Limits in the Deepwater U.S. Gulf of Mexico." *Journal of Natural Gas Science and Engineering* 63 (2019): 1–14.

Kaiser, Mark J., and Siddhartha Narra. "A Retrospective of Oil and Gas Field Development in the U.S. Outer Continental Shelf Gulf of Mexico, 1947-2017." *Natural Resources Research* 28, 3 (2019):685-715.

Kaiser, Mark J., and Siddhartha Narra. "U.S. Gulf of Mexico Pipeline Activity Statistics, Trends and Correlations." *Ships and Offshore Structures* 14(1):1-22.

Nehiba, Cody (with A. Luttmann). "The effects of employee hours-of-service regulations on the U.S. airline industry." SSRN. 69 p.

Pike, R.W. "Essentials of optimization for chemical engineering." Seattle (WA): Kindle Direct Publishing. 525 pp.

Tarufelli, B. (with B. Gilbert). "Leakage in regional climate policy? Implications of electricity market design." Working Papers 2019-07, Colorado School of Mines, Division of Economics and Business. 65 p.

Upton, Greg B. 2020 *Gulf Coast Energy Outlook*. With David E. Dismukes and Dek Terrell. LSU Center for Energy Studies and Economics & Policy Research Group, Fall 2019.

Upton, Greg B. "Decomposing crude price differentials: Domestic shipping constraint or the crude oil export ban?" With Mark Agerton. *The Energy Journal* 40 (3) 155-172.

Upton, Greg B. "The Future of Solar in Louisiana. An Analysis of the Technical and Economic Implications of Solar P.V. Growth on Louisiana's Economy and Electric Grid." With Farzad Ferdowsi, Amin Kargarian, Shahab Mehraeen. LSU Center for Energy Studies White Paper. 2019.

Upton, Greg B. "Integration of Behind-the-Meter Solar into Distribution Feeders: The Importance of Time Resolution on Model Results." With Farzad Ferdowsi and Shahab Mehraeen. 2019 IEEE Green Technologies Conference. April 2019.

Upton, Greg B. "Mineral Revenues in Louisiana: Status Report Submitted to Senate Committee on Revenue and Fiscal Affairs and House Committee on Ways and Means of the Louisiana Legislature." With Dr. James A. Richardson. 2019.

Speaking Engagements

David E. Dismukes

Panelist. Baton Rouge *Advocate* 2019 Economic Outlook Summit. Baton Rouge, January 8.

"A Golden Age: Energy Outlook 2019." Engineering News Record Webinar, February 13.

"Gulf Coast Energy Outlook 2019: Production, Trade and Infrastructure Trends." 66th Annual Mineral Board Institute Meetings. Baton Rouge, March 14.

"Incentives, Risk, and the Changing Nature of Regulation." NASUCA Water Committee monthly meeting/webinar, March 13.

"Ratepayer Benefits of Reforming PURPA." LSU Center for Energy Studies Industry Advisory Council Meeting, March 27.

"MISO Grid Vision 2033." 2019 Spring Regulator and Policymaker Forum. New Orleans, April 15-16.

"Gulf Coast Energy Outlook 2019: Regional Trends and Outlook." Women's Energy Network. Baton Rouge, April 23.

"Overview of Louisiana Energy Issues and Outlook." Australian Media Visit, Greater New Orleans, Inc./Baton Rouge Area Foundation. Baton Rouge, April 29.

Panelist. "Fuel Security, Resource Adequacy & Value of Transmission." 6th Annual Electricity Dialogue at Northwestern University: Energy and Capacity: Transitions? Northwestern University Center of Law, Regulation, and Economic Growth. Chicago, May 6-7.

"Overview of Louisiana LNG Issues and Trends." Berlin LNG, Energy Security, and Diversity Reporting Tour, LSU Center for Energy Studies. Baton Rouge, May 9.

"Natural Gas Outlook: Supply, Demand, and Prices." NASUCA Mid-Year Meeting. Portland, OR, June 20.

"The Economic Impacts and Outlook for LNG Development on the Gulf Coast." 73rd Annual Meeting of the Southern Legislative Conference of the Council of State Governments. New Orleans, July 14 (hurricane cancellation).

"Natural Gas Outlook: Supply, Demand and Prices." National Association of State Utility Consumer Advocates, Natural Gas Committee Monthly Meeting, July 30.

"Reforming PURPA: Implications for Ratepayers." Thomas Jefferson Institute for Public Policy, Annual Energy Summit, State Policy Network Annual Meeting. Colorado Springs, CO, October 28.

"Louisiana's Coast and the Energy Industry." 2019 API Delta Chapter Joint Society Luncheon Meeting. New Orleans, November 12.

"The Urgency of PURPA Reform in Protecting Ratepayers." Americans for Tax Reform, Fall 2019 Coalition Leaders Summit. New Orleans, November 14.

"2020 Louisiana Business Climate Outlook: The View from the Energy Sector." American Council of Engineering Companies Fall Conference. Baton Rouge, November 21.

Cody S. Nehiba

"The Time-of-Day Travel Demand Elasticity Paradox." Colorado University Environmental and Resource Economics Workshop. Vail, CO, September 13.

"Correcting Heterogeneous Externalities: Evidence from Local Fuel Price Controls." 14th Meeting of the Urban Economics Association. Philadelphia, PA, October 12.

"The Time-of-Day Travel Demand Elasticity Paradox." U.S. Association of Energy Economics North America Meeting. Denver, CO, November 5.

"Transportation and Energy Policy in Louisiana." LSU CES Industry Associates Advisory Council Meeting, Baton Rouge, November 20.

Gregory B. Upton, Jr.

"Economic and Fiscal Outlook after Katrina." National Defense University. Foreign Fellow's Program. New Orleans, January 18.

"Gulf Coast Energy Outlook." Feliciana Forestry Association. Clinton, LA. January 24.

"Local Labor Market Shocks and Employment and Earnings Differentials: Evidence from Shale Oil and Gas Booms." LSU Economics Lunch Seminar Series. February 12.

Guest Lecturer. Paul M. Herbert Law Center. Energy Law and Regulation 552. Louisiana State University, Spring Semester.

"Gulf Coast Energy Outlook." American Council of Engineering Companies of Louisiana Critical Issues Summit. Baton Rouge, February 22.

"Gulf Coast Energy Outlook." Shell Norco Community Advisory Panel. Norco, LA. March 20.

"Gulf Coast Energy Outlook." North Baton Rouge Community Advisory Panel. Baton Rouge, March 21.

"Gulf Coast Energy Outlook." Belle Chasse Community Advisory Panel. Belle Chasse, LA., April 16.

"Energy and Economic Update." National Association of Royalty Owners. Louisiana Chapter. Baton Rouge, May 7.

"Gulf Coast Energy Outlook." Gonzales Community Advisory Panel. Gonzales, LA. May 21.

"Firm Dynamics and Local Economic Shocks. Evidence from Shale Oil and Gas Booms." International Association for Energy Economics Meeting. Montreal, Canada, May 30.

"Gulf Coast Energy Outlook." Oil and Gas Industry Organization and Outlook, Oil and Gas Regulation Course, Louisiana Department of Wildlife and Fisheries. Baton Rouge, LA, July 10.

"Energy Statistics." National Association of Business Economists 16th Annual Economic Measurement Seminar. Washington D.C., July 15.

"Gulf Coast Energy Outlook." National Association of Business Economists 16th Annual Economic Measurement Seminar. Washington, D.C., July 15.

"Gulf Coast Energy Outlook." Louisiana Mid-Continent Oil and Gas Association. Baton Rouge, LA, July.

"Gulf Coast Energy Outlook." Baton Rouge Roundtable. Baton Rouge, LA, July.

"Oil and Gas Industry Organization and Outlook." Oil and Gas Regulation Course, Louisiana Department of Wildlife and Fisheries. Baton Rouge, LA, July.

"Gulf Coast Energy Outlook." Plaquemines Association of Business and Industry. Plaquemines Parish, LA, August.

"Econometric Forecasting and Energy Regulation." Institute of Public Utilities, Advanced Regulatory Studies Program. East Lansing, MI, September.

"Louisiana Economic Outlook," with L. Scott. Baton Rouge Business Report. Baton Rouge, September.

"Louisiana Economic Outlook," with L. Scott. Southwest Louisiana Economic Development Alliance. Lake Charles, LA, September.

"Gulf Coast Energy Outlook." International Reporting Tour, Foreign Press Centers. U.S. Department of State. Bureau of Global Public Affairs. Baton Rouge, LA, September.

"Gulf Coast Energy Outlook." Bayou Industrial Group. Thibodaux, LA, October.

"Louisiana Economic Outlook," with L. Scott. Livingston Parish Economic Development Council October.

"Gulf Coast Energy Outlook." Louisiana Gulf Coast Oil Exposition. New Orleans, October.

"Cost Benefit Analysis for Regulated Utilities." Institute of Public Utilities, Advanced Regulatory Studies Program. East Lansing, MI, October.

"Economics of Renewable Energy Resources." Institute of Public Utilities, Advanced Regulatory Studies Program. East Lansing, MI, October.

"Fossil Fuels, Convergence, and Corruption," with M. Oliver. Southern Economic Association 89th Annual Meeting. Ft. Lauderdale, FL, November.

"Assessing Country and Sub-National Regional Renewable Energy Potential," with S. Narra and A. Chanda. U.S. Association for Energy Economics. Denver, November.

"Local Labor Demand Shocks and Earnings Differentials: Evidence from Shale Oil and Gas Booms," with H. Yu. Southern Economic Association 89th Annual Meeting. Ft. Lauderdale, FL, November.

"Gulf Coast Energy Outlook." Society of Louisiana Certified Public Accountants 2019 Oil & Gas Conference. Baton Rouge, November.

"Gulf Coast Energy Outlook." Tulane Energy Institute, Baton Rouge, November.

Brittany Tarufelli

"Energy Policy Analysis for a Sustainable Energy Future. " LSU CES Industry Associates Advisory Council Meeting, Baton Rouge, November 20.

Guest Speaker. Presentation and Q&A on electricity to 100+ fourth grade students. Our Lady of Mercy Catholic School, Baton Rouge, December 13.

CES faculty presented research at more than 50 events in 2019.

Cody S. Nehiba

Brittany L. Tarufelli

Nehiba, Tarufelli Join CES Faculty

In August, the center welcomed two new faculty members, Assistant Professors Cody S. Nehiba and Brittany L. Tarufelli.

Nehiba specializes in the fields of environmental, public, and urban economics. His research examines the regulation of negative externalities with specific focuses on the transportation sector and fossil fuel taxation. He holds a Ph.D. in economics from the University of California, Irvine, and a B.A. in economics from Augsburg University in Minneapolis.

Tarufelli is an applied microeconomist studying relationships between public policy, energy markets, and the environment. Her research evaluates the ongoing transition to clean energy, focusing on interactions between sub-global environmental policies and energy market designs.

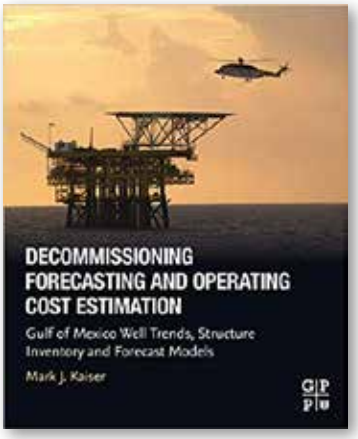
As a Ph.D. candidate, she served in the Office of Energy Policy and Innovation at the Federal Energy Regulatory Commission (FERC).

Tarufelli holds a Ph.D. in economics from the University of Wyoming, an M.S. in business economics from the University of Amsterdam, and a B.S. in financial analysis from Louisiana State University Shreveport. Prior to her doctoral studies, Brittany worked at "Big Four" accounting firms as a strategy and management consultant in four nations.

Faculty Highlights

Kaiser Publishes Decommissioning Text

CES Professor Mark Kaiser recently published *Decommissioning Forecasting and Operating Cost Estimation: Gulf of Mexico Well Trends, Structure Inventory and Forecast Models*. The textbook, the first of its kind to develop models to forecast platform decommissioning in the Gulf of Mexico and to better understand the dynamics of offshore production cost, serves as a guide for operator budgeting and regulatory oversight.



Providing an overview of inventories, types of structures, critical infrastructure issues, operating cost estimation, and future decommissioning trends, the text is designed as a resource for oil and gas professionals, researchers, government regulators, energy and environmental engineers.

Dismukes Facilitates MISO Regulators Meeting in NOLA

In April, CES Executive Director David Dismukes facilitated a second meeting of public service commissioners from several states within the Midcontinent Independent System Operator (MISO) footprint. The senior level, policymaker-only meeting included a robust discussion about the long-term vision for the transmission grid serving the central portion of North America. Some of the detailed topics discussed in the meeting included accommodating future load growth, how to address expansive renewable energy development, and maximizing transmission grid benefits.

The goals of the meeting were to build upon the initial success of the Winter 2018 MISO Grid Vision 2033, or MGV33, meeting and to take a "deeper dive" into a number of subjects and their impacts on MISO, the transmission planning and investment process, and individual MISO state members.

The April meeting promoted the ongoing MGV33 goals of prioritizing regulatory and policy maker concerns about future grid challenges, provided a venue for regulator-to-regulator discussion of actions that need to be taken to respond to those concerns, and helped identify additional priorities that require further detail in future MGV33 meetings.

Platform jointly owned by Kinetica and Contango, set up to receive a pig that was launched from a production platform to remove condensates. Photo credit: Barney Paternostro

Kinetica manned platform where sand blasting and painting, as well as separation and compression processes, took place.
Photo credit: Barney Paternostro

Upton Tours Offshore Facilities

Assistant Professor Greg Upton took two tours of offshore Gulf of Mexico facilities in 2019. In April, he visited three offshore platforms as a guest of Kinetica: a production platform owned by Contango where a pig was launched to move condensates; a jointly owned Kinetica/Contango platform that was set up to receive the pig; and a Kinetica manned platform where Upton viewed sand blasting and painting, as well as separation and compression processes. These platforms were located in the shallow waters of the continental shelf.

In July, Upton again went offshore with LLOG to view deep-water operators. He visited West Capricorn, an ultra-deepwater semi-submersible rig owned by West Capricorn to view a well plug and abandonment. Next, he visited the Delta House production platform in Mississippi Canyon. Delta House was developed by LLOG Exploration with first production in April of 2015.

Delta House production platform in Mississippi Canyon.

West Capricorn's ultra-deepwater semi-submersible rig.

Events & Outreach

2019 Energy Summit

CES hosted its annual fall conference Energy Summit on Wednesday, Oct. 23. Following the theme "Challenging Traditional Paradigms," topics discussed included Austin Chalk developments, utility regulatory policy, trends in methane emissions, and the outlook for industrial construction.

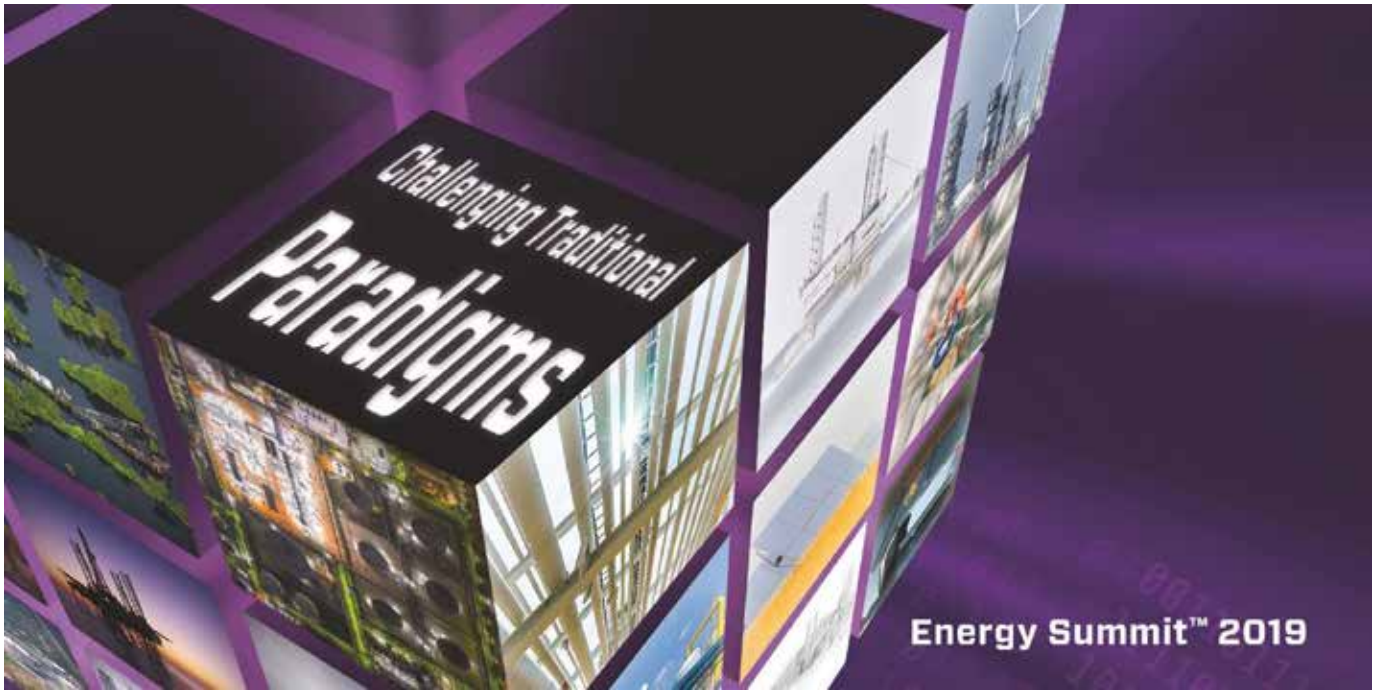
Speaker Travis Kavulla, vice president, regulatory affairs, NRG Energy, Inc., discussed new policy directions in electricity and examined where the utility industry might find opportunities to invest historically low-cost capital into high-return regulated investments.

Robert Kleinberg, senior research scholar at the Columbia University Center on Global Energy Policy, provided an overview of vented and fugitive methane in upstream oil and gas facilities and the challenges of measuring and limiting those emissions.

Kirk Barrell, president of Amelia Resources, gave an overview of the Louisiana Austin Chalk and Tuscaloosa Marine Shale, or TMS, including histories of the plays and trends. He noted that the U.S. has few remaining growth opportunities in unconventional resources but that the Austin Chalk and TMS are proven, but low oil prices could delay the timing of the development.

Kenneth D. Simonson, chief economist for the Associated General Contractors of America, provided an outlook for U.S. and Louisiana construction spending, labor, and materials. He explained that, while contractors remain busy and confident, there was concern regarding the impact of trade policies, an ongoing labor shortage, and the potential for rising interest rates, which would reduce the demand for construction projects.

The more than 80 in attendance included representatives from the upstream oil and gas industry, pipeline companies, storage and mid-stream companies, petrochemical companies, gas and power utilities, state environmental and utility regulators, university students, faculty and staff, and news media.



Energy Summit 2019 was made possible with the generous support of our sponsors:

ExxonMobil · KOCH · Phillips 66 · Southern Strategy Group · Kean Miller · Entergy · LMOGA Louisiana Mid-Continent Oil and Gas Association

Pictured (l-r) Keith Hall, LSU Law, Thomas Douthat, LSU Dept. of Environmental Sciences, and Chris McLindon, Upstream Exploration LLC, participate in a panel discussion on coastal erosion lawsuits at the 2019 Oil & Gas Symposium.

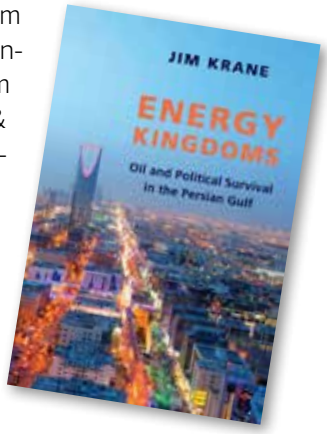
Oil & Gas Symposium Examines State of La. Industry

The 2019 Oil & Gas Symposium, hosted by the Louisiana Geological Survey and LSU Center for Energy Studies on Wednesday, April 17, brought together experts from a range of disciplines to assess the state of the energy sector in Louisiana. Topics included updates on offshore activity, shale and chalk plays, the latest from Haynesville, and an overview of the oilfield services sector. The event attracted more than 90 participants representing industry, academia, state agencies, and media.

Jim Krane, Ph.D., of Rice University's Baker Institute for Public Policy, signs his book Energy Kingdoms: Oil and Political Survival in the Persian Gulf for a student.

Center Hosts Book Presentation, Signing

On Nov. 13, the center hosted Jim Krane, Ph.D., of Rice University's Baker Institute for Public Policy. Krane discussed his book *Energy Kingdoms: Oil and Political Survival in the Persian Gulf* and described how traditional Persian Gulf monarchs have used oil to remain in power. Faculty and students from LSU's departments of Environmental Sciences, Petroleum Engineering, Geography & Anthropology, and Political Science attended. LSU Bookstore (Barnes & Noble) was on hand for the book sale and sold several copies after the event.



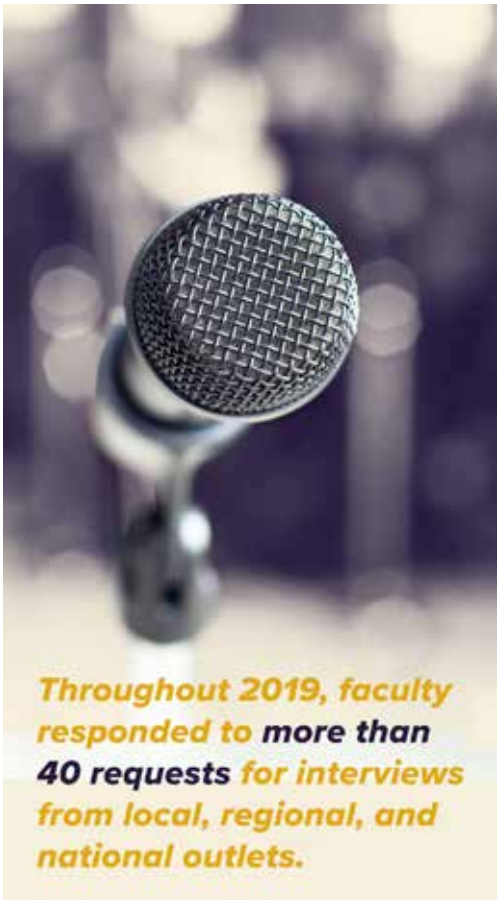
Workshop Provides Current CCUS Research, Outlook

More than 30 attendees took part in a workshop on carbon capture, utilization and storage (or CCUS) in July 2019. Presentations addressed outcomes of the previous legislative session, the then-upcoming Gulf Coast Economic Outlook, and a CCUS research update. Representatives from industry associations, major energy companies, and government agencies attended. The meeting served as a precursor to a larger, two-day stakeholder event in February 2020.

In September, CES Assistant Professor Greg Upton met with international journalists during their energy diversity reporting tour, organized by the U.S. Department of State Foreign Press Centers.

CES Meets World: International Guests Learn about La. Energy

In May, Professor David Dismukes met with representatives from Australia's Northern Territory, which has an abundance of natural gas, to discuss Louisiana's energy industry. The meeting was organized by Greater New Orleans, Inc. Later in the month, both Dismukes and Assistant Professor Greg Upton met with six online and print journalists from Germany to discuss Louisiana's liquefied natural gas developments, carbon capture and storage,



and solar. The Germans' visit, organized by the U.S. Department of State, included a presentation by Dismukes titled, "Overview of Louisiana LNG issues and trends," as well as a tour of a liquefied natural gas facility in Lake Charles with Upton, who answered questions throughout the day. Both Dismukes and Upton were also interviewed for a German radio program.

In September, the U.S. Department of State Foreign Press Centers brought several foreign journalists on an international reporting tour focused on energy diversity. The journalists represented Azerbaijan, Belgium, Bulgaria, Cambodia, Lithuania, Philippines, Papua New Guinea, and Vietnam. Greg Upton provided an overview of the U.S. energy sector and answered their questions. The group also traveled to Austin, Texas.

CES in the News 2019

Throughout 2019, comments by Center for Energy Studies faculty, as well as references to their research, appeared in more than 40 local, regional, and national media outlets. Faculty also provided professional commentary in the form of op-ed columns. As expected, information provided in the 2019 ***Gulf Coast Energy Outlook*** was referenced in several news items.

Executive Director David Dismukes was quoted in news articles including Advocate stories on BP's announced expansion of its Atlantis production field in the Gulf, the $90 billion in investments planned by the region's petrochemical and liquefied natural gas companies, Louisiana's vulnerability to Venezuelan oil sanctions, and Chevron's $33 billion purchase of Anadarko Petroleum, among other topics.

Assistant Professor Greg Upton was interviewed on Louisiana's ability to sustain $32 billion in construction projects planned through 2022, the state's vulnerability regarding tariffs and a trade war with China, the increase in the region's construction jobs, as predicted by the ***Louisiana Economic Outlook*** report, which Upton co-authored with LSU Professor Emeritus Loren Scott, and the strong near-term outlook for our region's energy markets, as reported in the ***Gulf Coast Energy Outlook***.

Both Dismukes and Upton appeared on radio and television outlets, including New Orleans Public Radio, Baton Rouge Public Radio, the Louisiana Radio Network, Talk 107.3, and LPB's ***Louisiana the State We're In***.

The center's "In the News" webpage includes a full list of articles and appearances, by year.

Upton Discusses CES, La. Energy Outlook on Radio Program

On the May 25 broadcast of the Louisiana Business & Industry Show, Tim Johnson interviewed CES Assistant Professor Greg Upton on the role and origins of the LSU Center for Energy Studies, the (then upcoming) 2020 Gulf Coast Energy Outlook, liquefied natural gas investment in the state, and more.

LOUISIANA BUSINESS & INDUSTRY SHOW


Shelby Wainright


Kelly Robertson


Felix Rodrigue


Claire Pearson

2019-2020 Scholarships Awarded

In May, the center awarded scholarships for the 2019-20 academic year to four LSU students pursuing energy-related fields of study and careers.

LMOGA/Brooksher Scholarship: Shelby Wainwright, sophomore majoring in finance, from Hammond, La.

F. Malcolm Hood Scholarship: Kelly Robertson, junior majoring in chemical engineering, from Alexandria, La.

David Olver Memorial Scholarship: Felix Rodrigue, junior majoring in electrical engineering, from Slidell, La.

GCPA emPOWERing Women Scholarship: Claire Kelley Pearson, sophomore majoring in electrical engineering, from Mandeville, La.

Since the early 1990s, the Center has awarded 45 scholarships totaling more than $70,000.

25 LMOGA/Brooksher Scholarships

11 F. Malcolm Hood Scholarships

6 David Olver Memorial Scholarships

3 GCPA emPOWERing Women Scholarships

Websites Revised to Meet ADA Compliance Standards

To comply with the Americans with Disabilities Act of 1990 and the Rehabilitation Act of 1973, Section 504, websites developed by LSU units must ensure that pages are accessible to individuals using a variety of browsing methods. Images, multimedia, and interactive applications must include important information in an alternate text form so that it is accessible to users with hearing or sight impairments. Changes to the center for Energy Studies site include the addition of alternative text to images, changes in heading sizes to conform with ADA standards, removing links to pdf documents that do not comply with ADA standards, and captioning the CES video produced for the 20th anniversary of BOEM.

CES Personnel

Administration

David E. Dismukes, Ph.D., executive director, director of the Policy Analysis Division, and professor

Diana Reynolds, assistant to the executive director

Marybeth Pinsonneault, communications manager

Division of Policy Analysis

Gregory B. Upton, Jr., Ph.D., assistant professor

Mike McDaniel, Ph.D., professional-in-residence (retired) and an adjunct professor of environmental sciences in the School of the Coast and Environment

Don Goddard, Ph.D., associate professor (retired)

Cody S. Nehiba, Ph.D., assistant professor

Andrew Smith, research associate

Brittany L. Tarufelli, Ph.D., assistant professor

Division of Research & Development

Mark J. Kaiser, Ph.D., director of the Research & Development Division and professor

Siddhartha Narra, Ph.D., research associate

Division of Energy Information & Data

Omowumi (Wumi) Iledare, Ph.D., (retired) director of the CES Energy Information and Data Division, professor of petroleum economics and policy research, adjunct professor of petroleum economics at the Craft & Hawkins Department of Petroleum Engineering at LSU, and director of the Emerald Energy Institute, University of Port Harcourt, Nigeria.

Ric Pincomb, research associate

Stacy Retherford, computer analyst

Mike Surman, computer analyst

Minerals Processing

Minerals Processing Research Division

Ralph Pike, Director | F. Carl Knopf, Co-Director | lsu.edu/mpri

The Minerals Processing Research Division (MPRD) was established in 1979 by federal legislation as one of 31 State Mineral Institutes associated with the U.S. Department of the Interior. The mission includes facilitating research and public service programs in process research and technology transfer, sustainable development, energy management, and inherently safer design. The Division's minerals processing research and public service complement and benefit from the energy research and geological research performed by other groups in the Center for Energy Studies and the Louisiana Geological Survey.

Threat analysis begins with understanding who may attack and where attacks are likely to occur, then determining what can be done to mitigate attacks, and finally, if an attack does occur, how best to recover.

MPRD Conducts Research on Threats, Critical Infrastructure

Baton Rouge is in a unique position because it is so critical to the supply chain of the United States, with its major port, transportation corridor, and one of the world's largest chemical complexes located between Baton Rouge and New Orleans. Research began several years ago with initial development of the Chemical Complex Analysis System (CCAS) to demonstrate the integration of new plants for products from carbon dioxide and chemicals from biomass into the existing chemical complex between Baton Rouge and New Orleans.

The CCAS is being expanded to estimate the impact of failure in one of the plants in the complex on the other plants and products in the complex. These sets of scenarios, chosen deterministically and randomly, give static results that represent the resiliency of the complex. The project considered multiple plants in the lower Mississippi River corridor to evaluate the capability of the complex to absorb and recover from adverse events and of the impact of these events on the supply chain of critical chemicals.

A threat analysis layer is being added to CCAS. Threat analysis begins with understanding who may attack and where attacks are likely to occur, then determining what can be done to mitigate attacks, and finally, if an attack does occur, how best to recover. There have been attacks on chemical plants in Algeria, Nigeria, Iraq, and most recently Saudi Arabia. CCAS has the ability to determine how best to recover from an attack. MPRD is working with area experts to quantify risks and develop a probabilistic risk model based on Bayesian networks to address the quantitative assessment of attack likelihood.

Results can be found on the Division's website mpri.lsu.edu, and in the paper by Xu et al., "Development and integration of new processes consuming carbon dioxide in multi-plant chemical production complexes," available on the website.

A Nissan Leaf 30 kWh battery pack has 92 cells and weighs 640 lbs.

Continuous Renewable Energy Generation with Lithium-ion Batteries in the Micro-Grid Examined

Research is being conducted to determine the potential of lithium-ion batteries and renewable energy use in chemical plants and refineries along the Gulf Coast. A disruptive technology is arising from the combination of solar and wind power with lithium-ion battery energy storage in combination with micro-grids. This disruptive technology will advance rapidly as the electricity generation mix continues to experience a rapid rate of change. Using energy storage with lithium-ion battery technology from wind farms and solar arrays, these sites can now provide continuous power to the grid. With battery storage, power generated by renewable resources is stored when it is produced, and then used when demand is high.

A white paper is available on the Division's website giving a detailed review and a summary of future projections for lithium-ion batteries, renewable power, and micro grid technologies.

MPRD Staff Active at National Meetings

The MPRD staff frequently chair technical sessions at annual and national AIChE meetings. They are participating in national committee planning for sessions at the upcoming 2020 meetings.

Energy Sustainability Remote Laboratory Site Revised for ADA Compliance

The Energy Sustainability Remote Laboratory (ESRL), esrl.lsu.edu, is undergoing revisions to comply with Title II of the Americans with Disabilities Act of 1990, required for all LSU websites. Kerry Dooley, professor in the LSU Cain Department of Chemical Engineering, is in the process of performing the remediation of ESRL in collaboration with the OmniUpdate campus program staff.

ESRL allows partner universities to implement authentic experiences by providing data from actual operating energy- or energy-intensive manufacturing systems – a natural gas-based cogeneration unit, a nuclear power plant, a coal-fired plant, a photovoltaic solar facility, bench-scale units for biomass processing to chemicals, and biomass gasification. The ESRL site also provides pre-tested background materials and suggested inquiry-based assignments. Currently ESRL is used by engineering programs at LSU, Auburn University, University of Alabama, University of South Alabama, University of Nevada, Las Vegas, Florida State University, and several other schools.

On-Line Research, Publications, and Programs Available

Essentials of Optimization for Chemical Engineering, 500 pages (2019), now available on Amazon/Kindle, has chapters on analytical methods, LP, SVS, NLP, MILP, MINLP, GO, On-Line (Real-Time) Optimization, GP, DP and CofV. The book is available both in print and e-book, ASIN: 1645700968 print edition, ASIN: B07ZWNFMWC e-book edition for $29.00.

A companion book, *Essentials of Economic Decision Analysis for Chemical Engineering*, 200 pages (2015) is also available on Amazon Kindle in print ($8.95) and e-book ($2.99).

With the MPRD website mpri.lsu.edu now on the LSU web server, its content has been expanded, revised, and extended with new research results, including journal articles, conference proceedings, technical reports, theses, dissertations and computer programs. These programs were developed with industry assistance for Gulf Coast plants, and the process models can be applied to comparable plants. The interactive heat exchanger synthesis program THEN has been rewritten and enhanced with an Excel interface and graphical display.

Two programs that can give immediate and substantial energy savings for chemical plants and refineries are "pinch technology" and "on-line optimization." Large companies have corporate level groups that routinely apply pinch technology and on-line optimization. Small to medium-sized chemical companies in Louisiana do not have the trained personnel needed to apply this technology. The MPRD makes available upon request two short courses.

The MPRD website also includes professional development, self-study courses for professional engineers' PDH requirements. These courses and computer program are part of the website materials that are continually being revised and extended.

MPRD Personnel

Ralph Pike, Ph.D., director,
Horton Professor of Chemical Engineering

F. Carl Knopf, associate director, Professor Emeritus

Kerry Dooley, research collaborator,
BASF Professor of Chemical Engineering

Abby Lafleur, student assistant

Louisiana Geological Survey

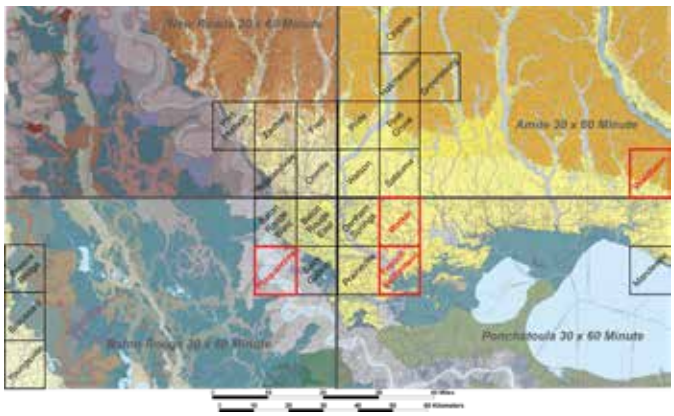
Charles “Chip” Groat, Acting Director | lsu.edu/lgs

The Louisiana Geological Survey (LGS) was created by Act 131 of the Louisiana Legislature in 1934 to investigate the geology and resources of the State. LGS is presently a research unit affiliated with the Louisiana State University and reports through the executive director of the Center for Energy Studies to the vice president for Research and Economic Development.

The goals of the Geological Survey are to perform geological investigations that benefit the state of Louisiana by:

1. encouraging the economic development of the natural resources of the state (energy, mineral, water, and environmental);
2. providing unbiased geologic information on natural and environmental hazards; and
3. ensuring the effective transfer of geological information.

Mapping & Research



Louisiana Geological Survey Conducts Surface-Geologic Mapping for Upper Amite River, Breaux Bridge.

STATEMAP 2018–2019 Deliverables Completed

Since the 1990s, Louisiana Geological Survey research staff have conducted surface-geologic mapping projects, including 1:100,000-scale compilations of 30 × 60 minute geologic quadrangles and 1:24,000-scale fieldmapped 7.5-minute geologic quadrangles. The vast majority of these mapping efforts were funded under the STATEMAP component of the National Cooperative Geologic Mapping Program (NCGMP), begun in 1993 and administered by the U.S. Geological Survey (USGS).

The principal goal of this program was to prepare statewide surface geology coverage at 1:100,000 scale in 30 × 60 minute quadrangle format because it is at the large end of the range of intermediate scales and preserves abundant detail from source mapping done at larger scales, while covering relatively large areas. By the close of FY 2013, LGS had completed 30 × 60 minute geologic quadrangle coverage of the entire state (30 sheets total) with a mix of published lithographs and draft open-file compilations. Since the late 1990s, LGS also has prepared 7.5-minute geologic quadrangles at 1:24,000 scale totaling 66 sheets. Fifty-six were prepared with STATEMAP support, and the other 10 were prepared for the U.S. Army Corps of Engineers within the Fort Polk region, southcentral Louisiana.

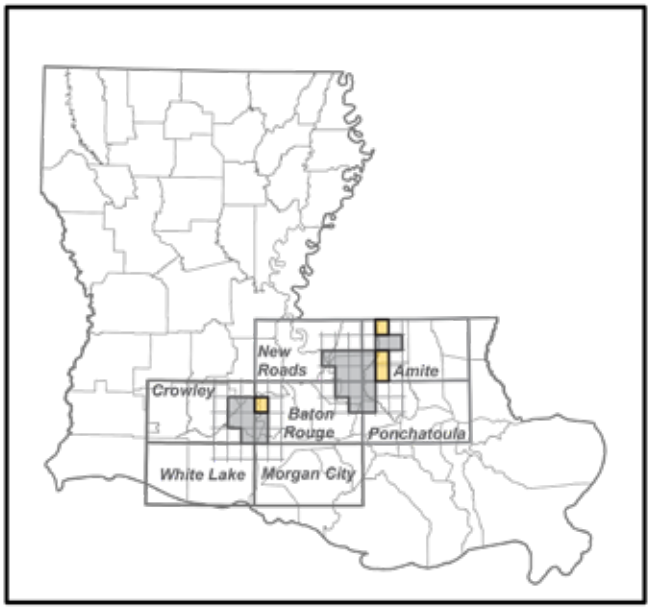
The STATEMAP 2018–2019 deliverables completed and submitted included geological maps and pamphlets covering four 7.5 minute quadrangles in two study areas: the greater Lafayette area in southwestern Louisiana and the upland areas adjoining the upper Amite River valley south from the Mississippi state line in southeastern Louisiana.

LGS Staff Present at LIGO

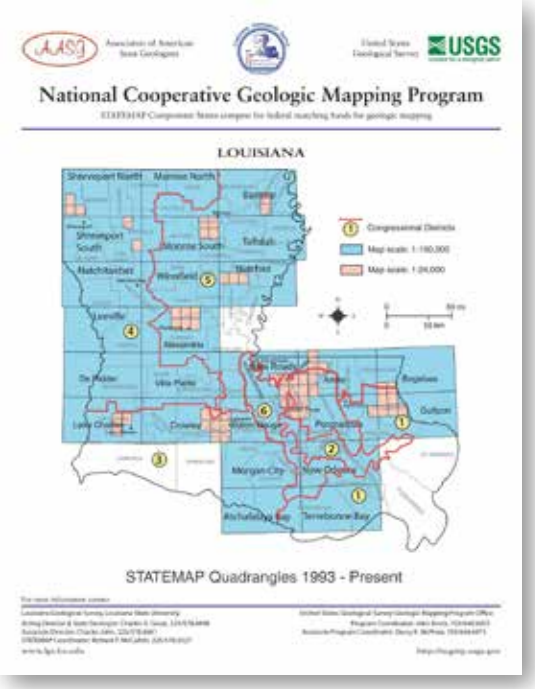
Research Associate Richard McCulloh prepared a presentation with coauthors Paul Heinrich and Robert Paulsell titled “Satsuma 7.5-Minute Quadrangle and LIGO Livingston Observatory: Geologic Context,” and presented it in July to staff at the observatory.

Mapping Publications 2019

- Geologic Mapping of Breaux Bridge 7.5-minute quadrangle at 1:24,000 Scale (Paul V. Heinrich and Richard P. McCulloh).
- Geologic Mapping of Chipola 7.5-minute quadrangle at 1:24,000 Scale (Richard P.McCulloh and Paul V. Heinrich).
- Geologic Mapping of Pine Grove 7.5-minute quadrangle at 1:24,000 Scale (Richard P.McCulloh and Paul V. Heinrich).
- Geologic Mapping of Satsuma 7.5-minute quadrangle at 1:24,000 Scale (Richard P.McCulloh and Paul V. Heinrich).



Status map of 7.5-minute quadrangles completed with support from the National Cooperative Geologic Mapping Program, STATEMAP component in fiscal year 2018. Study areas (yellow) comprised (1) in the west, one 7.5-minute quadrangle in the greater Lafayette area, and (2) in the east, three 7.5-minute quadrangles in the uplands adjoining the upper Amite River valley. Gray-filled areas show previously completed 7.5-minute geologic quadrangles in these areas, and surrounding gray outlines depict overlapping and adjacent 30 × 60 minute quadrangles.



Cover page of current Louisiana fact sheet featuring comprehensive status map of 7.5-minute and 30 × 60 minute quadrangles completed with support from the National Cooperative Geologic Mapping Program, STATEMAP component.

Water Resources

Major unconventional shale gas and oil plays in U.S. Source: Energy Information Administration (2011).

Trends in Hydraulic Fracturing Investigated

LGS researchers investigated trends in hydraulic fracturing in the state of Louisiana and elsewhere in the U.S. Their focus was on the Haynesville shale gas play in Bienville, Bossier, Caddo, DeSoto, Natchitoches, Red River, Sabine, and Webster parishes, compared to many of the major unconventional oil and/or gas plays such as Bakken, Barnett, Eagle Ford, Marcellus, and Permian Basin. The study included examination FracFocus data for the use of water and other fluids for base carrier fluid, usually water, within the hydraulic fracturing process between 2012 and 2018. FracFocus is a voluntary online data base to which contractors report site location, volumes of water used, depth of fracturing, and water chemistry of solution for fracturing. Results have been presented at the 2019 GCAGS annual convention in Houston and the 2019 Louisiana Water Conference in Baton Rouge.

Between 2012 and 2018 the average amount of water used for hydraulic fracturing a well in the Haynesville shale increased by 300%. That is, water used has increased from approximately five million to 20 million gallons per well fractured; however, for many of the 20 units considered in the study, those numbers have increased even more. Two units in the Permian Basin, Wolfbone and Wolfberry, have experienced an average water increase for hydraulic fracturing of over 1000% from approximately one million gallons to approximately 13 million gallons per well fractured. It was observed that Haynesville was similar to other units in that the lateral lengths, horizontal portion of the well, has increased, but not as much as water use. For limited fields, Bakken, Eagle Ford, and Wolfbone in the Permian, like Haynesville, when a well is re-fractured, the volume of water used is double that used for initial fracturing of that well.

The research was originally published as Carlson, D., 2018, An overview of trends within hydraulic fracturing in Louisiana with a focus on Haynesville Gas Play: Gulf Coast Association of Geological Societies Transactions, v. 68, p. 675.

Denham Springs Historical, Spring Study Performed

LGS geologists performed a study near the Amite River, funded by the City of Denham Springs, to determine the location of historical sites and examine spring water chemistry. In 2018, researchers twice sampled five springs within Spring Park and analyzed water for more than 20 different analytes. For comparison, they collected and analyzed water from the city's six water wells. Spring water is generally far richer in many ions than city water. Average concentrations of magnesium and

manganese are more than 50 times larger for spring water than city groundwater. In addition, average concentrations are more than 24 times larger for spring water than city groundwater for chloride and iron, and average concentrations are 6 to 12 times larger for spring water than city groundwater for calcium and sulfate. Most of the difference of ion concentrations are typical for shallow aquifers except for chloride. This could be a hint that the source of spring water is a combination of the usual groundwater flow from nearby areas, plus storm surge water that comes up the Amite River during some of the extreme flood events.

From December of 2018 to February 2019, a series of magnetic surveys was completed to determine the location of an early water well within Spring Park and the location of two 19th century hotels that hosted tourists who came to Denham Springs to receive the believed health benefits from bathing in the spring water. It was determined that the possible location for the older of the two hotels could be within a pair of lots the city owns that lie between Magnolia and Tabernacle Streets.

Results were presented at the annual GCAGS convention in Houston and later to the public at Southeastern Livingston Parish Literacy & Technology Center the evening of October 16, 2019. A final report was submitted to the City of Denham Springs. Researchers are currently working on two LGS open-file reports: The first is focused on a geophysical study locating archeological features; the second on spring water quality and what it may indicate about the natural history of the Spring Park area along the Amite River.

Geologic Studies

During 2019, LGS's Paul V. Heinrich completed the editing of a monograph about the Quaternary stratigraphy and geoarchaeology of the southwest Louisiana continental shelf. It was published in February of 2020. He continued research on geoarchaeology and stratigraphy of the offshore Louisiana continental shelf in association with Michael Miner of The Water Institute of the Gulf and is working on revising and formalizing Quaternary stratigraphic units in Southwest Louisiana. He also reviewed and published on putative Saginaw impact structure, Michigan.

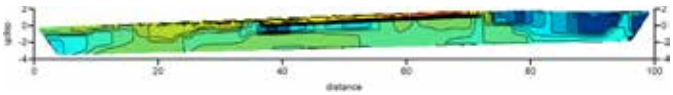
Heinrich continues work with the LSU Department of Geology and Geophysics on a suspected extraterrestrial impact crater in St. Helena Parish. The St. Helena crater is the only known meteor crater in Louisiana.

Heinrich and LGS's Richard P. McCulloh continued the STATEMAP-funded surface mapping of Louisiana. Most recently, the team has been concentrating on mapping the surface geology of the Baton Rouge metropolitan region.

Geophysics Section

In 2019, LGS continued its geological and geophysical study of the flood area of a proposed dam in north Texas. In this study, LGS research faculty have documented river channel exposures, planned and extracted sediment cores from within the river basin, and performed laboratory analyses of samples collected from these field investigations. Electrical resistivity field data collected and computationally modeled by LGS are corroborated by sediment sample analyses, expanding the scope of geo-system interpretation to include basin-wide correlation of stratigraphic and paleo-geomorphic features. The development of a paleogeomorphic model of this Quaternary fluvial system will be crucial to archaeologists and geo-archaeologists from Texas State University and private firms in assessing the potential for sites of Late Pleistocene and Early Holocene human occupation. Study results will be presented at the Society for American Archaeology meeting in Austin, TX.

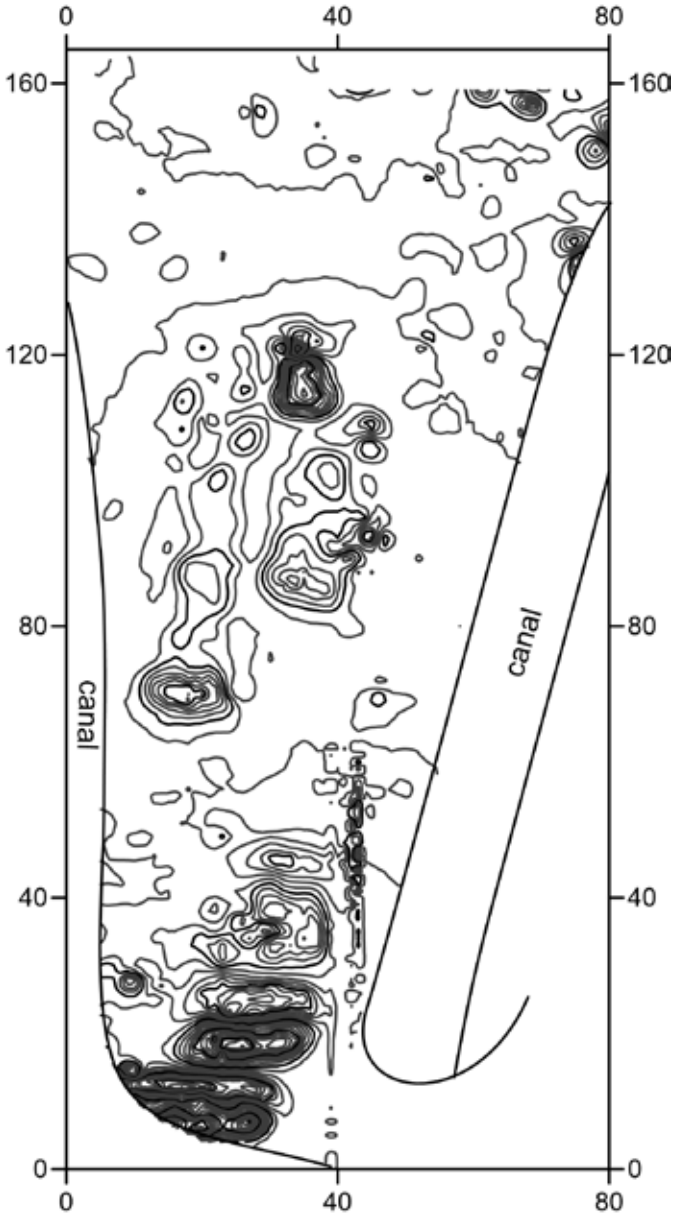
In collaboration with planetary scientists at the LSU Department of Geology & Geophysics, an electrical resistivity study over a suspected crater in St. Helena Parish has resolved subsurface structural and lithostratigraphic elements that are consistent with an impact origin for the feature. Although the findings require additional analysis, these preliminary results will be presented at the annual Lunar and Planetary Science Conference in Houston.



Electrical resistivity tomographic model of the subsurface in a modern river setting. The thin electrically resistive anomaly (red shading) capping a small summit between two abandoned and in-filled river channels (blue, yellow, and green shading) is interpreted as artifact-rich soil. Depth and distance are in meters.

Geophysical field studies by LGS have also successfully resolved anomalies related to subsurface features of interest to local historians, civil planners, law enforcement, and environmental engineers. Geophysical studies of cemeteries and historic sites have located and confirmed antebellum graves in Amite County, Mississippi, and the footprint of an early 19th century health

resort in Livingston Parish. Drawing upon the success of geophysical methods applied to older cemeteries, LGS has assisted law enforcement searches for more recent graves. Environmental engineers in industry and at the Louisiana State Department of Environmental Quality are interested in “graves” of waste vessels and related rubbish unceremoniously buried decades ago under relaxed environmental protection standards. Geophysical field studies have successfully resolved anomalies produced by subterranean man-made objects, helping to prioritize time and resources in mitigation strategies for buried hazardous waste.



Magnetic field contour map of a suspected waste site. Anomaly clusters are interpreted to result from concentrations of buried steel. Map distances are in meters.

Geologic Review

Geologic Review is an ongoing program created by the Louisiana Geological Survey in 1982 that provides regulatory technical assistance to the Office of Coastal Management of the Louisiana Department of Natural Resources. It consists of a thorough review of oil and gas well applications involving impacts to environmentally sensitive areas such as wetlands.

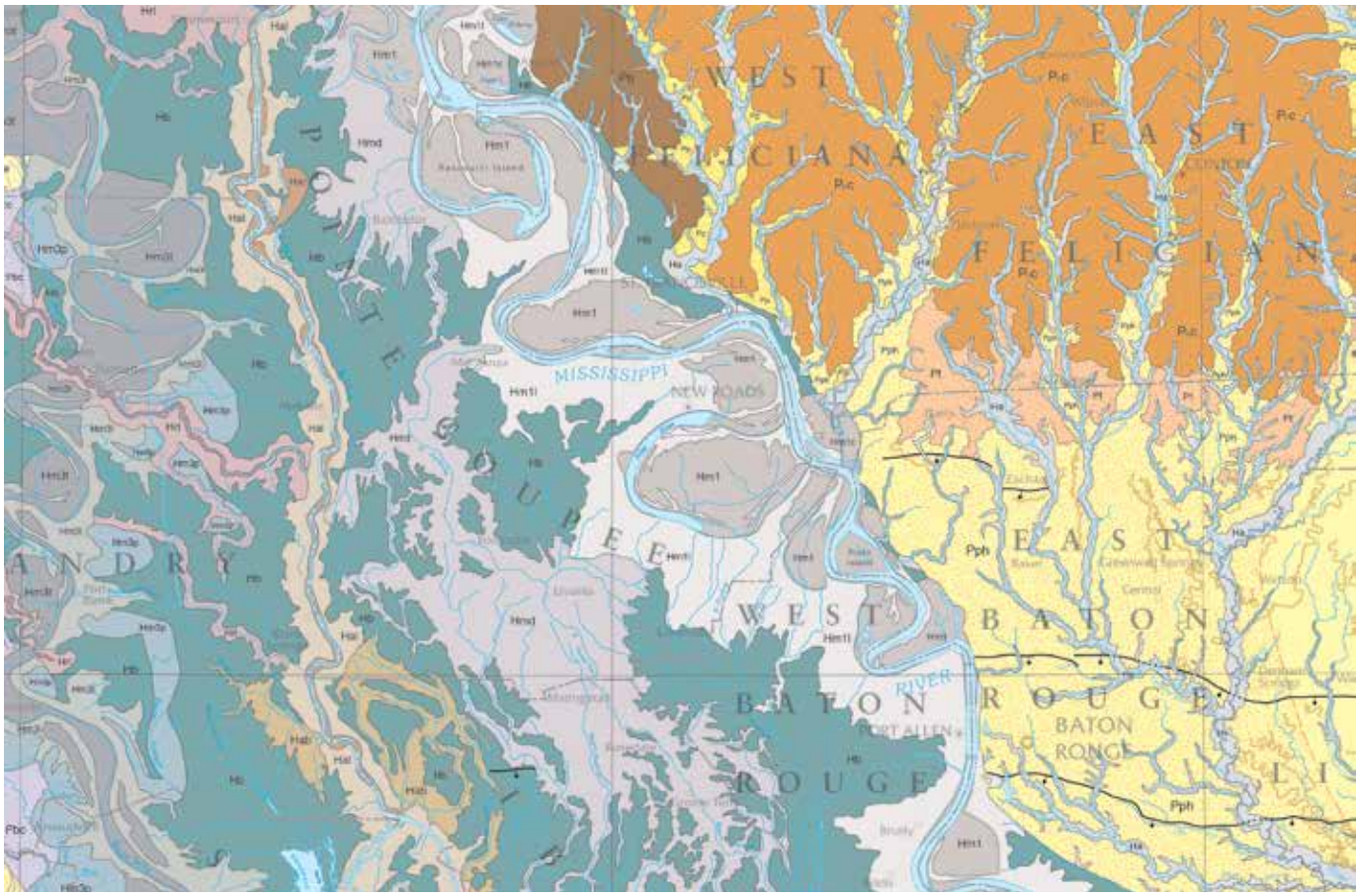
The applicant attends a meeting with an LGS geologist who reviews the relevant geologic, engineering and economic data and makes a recommendation as to the technical and economic feasibility of reducing or avoiding environmental impact by either moving the well to a geologically equivalent location, directionally drilling the well, or accessing the proposed location by a different access route or methodology than that which was proposed.

LGS Publishes Descriptive Landform Book

In 2019, LGS published *Landforms of the Louisiana Coastal Plain, Maps and Atlas Series No. 15*, in an effort to help coastal scientists better understand how geology relates to their areas of interest. The mapped landforms help define Louisiana’s extensive riverine and coastal floodplains, areas that are subject to episodic stream flooding and hurricane storm surges. They also offer insight into the increased flooding potential of very flat upland regions that retain such low gradients that they can still flood during extreme rain events.

Although based on geologic map units of LGS’s series of geologic quadrangles at 1:100,000 scale, the landforms mapped in the publication were extensively refined, extended, and reinterpreted based on high-resolution lidar topographic imagery that was unavailable when many of the geologic maps were developed. One-foot elevation data resolves stunningly detailed features not identifiable on the 5- and 10-foot contours of yesterday’s topographic mapping. Many landforms have a direct relationship with a traditional geologic formation described by deposition, sediment type, and stratigraphy. The landforms described are based upon the shape of their surfaces, their position in the topography, the processes that created and shaped them, and the ecosystems they support.

The publication is available on the LGS website.



Inset image from Landforms of the Louisiana Coastal Plain map.

LGS Publications 2019

Jordan, B.R., T.E. Yancey, P.V. Heinrich, B.V. Miller, and K. McGuire. 2019. "The Age and Geochemistry of Volcanic Ash in the Catahoula Formation of Louisiana, Mississippi, and Texas, USA." *The Journal of Geology* 127 (2): 207-222.

Schaetzl, R.J., W. Sauck, P.V. Heinrich, P.M. Colgan, and V.T. Holliday. "Commentary on Klokočník, J., Kostelecký, and Bezděk, A. 2019. 'The putative Saginaw impact structure, Michigan, Lake Huron, in the light of gravity aspects derived from recent EIGEN 6C4 gravity field model.'" *Journal of Great Lakes Research* 45: 12–20. *Journal of Great Lakes Research* 45: 1003–1006.

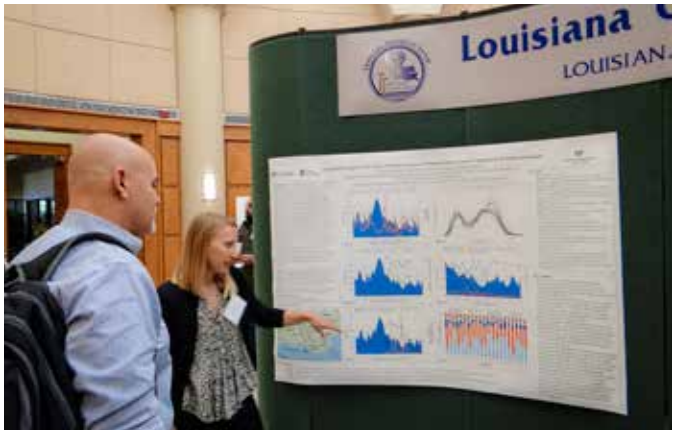
Siverd, C., S. Hagen, M. Bilskie, D. Braud, S. Gao, R.H. Peele, and R. Twilley. 2019. "Assessment of the temporal evolution of storm surge across coastal Louisiana." *Coastal Engineering* 150.

Siverd, C.G., S Hagen, M. Bilskie, D. Braud, R.H. Peele, M.R. Foster-Martinez, and R. Twilley. 2019. "Coastal Louisiana Landscape and Storm Surge Evolution: 1850-2110." *Climate Change* 157: 445-68.

Snead, J., R.P. McCulloh, and P.V. Heinrich. 2019. "Landforms of the Louisiana Coastal Plain." Maps and Atlas Series No. 15. Baton Rouge, LA: Louisiana Geological Survey.

Outreach Activities & Events

LGS Acting Director Chip Groat provides introductory remarks at the 13th Annual Water Conference.



Abigail Eckland, research associate at the Water Institute of the Gulf, discusses her poster on analyzing organic and mineral content of Mississippi River suspended sediment at the 13th Annual Water Conference.

LGS Co-Hosts 13th Annual Water Conference

Louisiana Geological Survey, the LSU Agricultural Center, and Louisiana Water Resources Research Institute co-hosted the 13th Annual Louisiana Water Conference, April 15-16, 2019, in the Dalton J. Woods Auditorium. The annual conference brings together hydrologists, engineers, and other scientists to disseminate the latest water-related research and activities within and around Louisiana. The goal is to promote education and public awareness of Louisiana's valuable freshwater resources, and promote engagement of water-use sectors.

Attendees participate in the poster session of the Third Annual Coastal Symposium, held in October.

The two-day event included presentations on topics ranging from the history of water quality in Denham Springs, La., to safe water for disinfection, to the impacts of fracking on water resources. It also featured poster sessions on levees and rivers and on water modeling, supply and use. The event attracted approximately 120 participants, many of whom earned continuing education credits as required to maintain their status as registered professional geoscientists.

LGS, NOGS Host Third Annual Coastal Symposium

On October 18 & 19, LGS and the New Orleans Geological Society hosted the Third Annual Coastal Symposium, an academic Louisiana coastal conference for engineers, geographers, and policy makers from across the range of geoscience-related disciplines. Topics covered interpretations and insights into Louisiana coastal geology, both onshore and offshore, geophysics, geomorphology, and geography.

LGS Research Associate Riley Milner demonstrates an educational water model at a YMCA camp in Zachary, Louisiana.

Milner Demonstrates Water Model to Campers

La. Geological Survey Research Associate Riley Milner was invited to present LGS's educational water model at the Americana YMCA Summer Camp in Zachary on May 30. The model demonstrates how ground water moves through the subsurface by pumping water injected with different colored dyes through a sand system. Several scenarios are demonstrated, including a confined aquifer, unconfined aquifer, septic tank, underground storage tank, artesian well, river, and lake set ups.

Riley presents the water model, as well as a rock and mineral display, to several camps and Baton Rouge Parks & Recreation events throughout the year.

Staff Highlights

LGS Mourns Loss of Long-time Cartographer Pond

On January 4, 2020, LGS Cartographer and Graphic Designer Lisa Gae Pond passed away at the age of 56. Lisa was born in Baton Rouge and resided out in the countryside, near Arcola, La. She graduated from LSU with a bachelor's in landscape architecture in 1987.

During her 30 years with LGS, Lisa served as a cartographer or co-author on hundreds of maps, publications, and non-cartographic works for not only the Center for Energy Studies and LGS, but also for other LSU departments, state and federal agencies, and private companies, including LSU's Departments of Geology, Geography and Anthropology, the Coastal Studies Institute, College of the Coast and Environment, the Oil Spill Coordinator's Office, and the Barataria-Terrebonne National Estuary Program.

LGS Cartographer Lisa Pond.

Lisa was part of a cartographic team that won a dozen map design awards, including the 2004 Cartography and GIS Society Map Design Competition award for Best Reference Map for the map and image of the Atchafalaya Basin, and the 2000 Avenza Map Publisher Design Competition award for Best Map in Competition for the Official Map of Louisiana.

The Bayou Teche Canoe Trail and Historic Map, for which she secured the contract, compiled, designed, and produced the publication, won the Best Travel Map award in the 2014 Cartography and GIS Society Map Design Competition.

Lisa is survived by her loving husband of 27 years, Kevin Crawford, her mother, Glenda Gae Pond, and aunt, Rae Vorwald, as well as her "girls," her beloved dogs Gumbeaux, Pirogue, and Couchon. She is greatly missed by her colleagues and friends in LGS and CES.

Chacko J. John Retires

Dr. Chacko J. John, former director of the Louisiana Geological Survey, or LGS, retired January 31, 2019. Current and past LGS staff, colleagues, and friends gathered to celebrate and honor John for his 32 years of service.

John joined the LGS in 1987 as a research associate and subsequently held the positions of assistant professor-research, associate professor-research, chief, Energy and Mineral Resources Section, and director of research before being appointed director in 1997.

He also served as director of the Basin Research Institute of LSU, now the Basin Research Energy Section of the LGS. His research interests included petroleum geology, sedimentology, geopressured-geothermal energy resources, and coastal geomorphology.

Chacko J. John (center, in gray vest) with past and present Louisiana Geological Survey staff.

Before coming to LSU, John served as advanced geologist with Marathon Oil Company, senior exploration geologist with Geo Consultants International, and as geologist-in-charge of the Akula Clay mine with English India Clays Ltd.

In 2004, John was elected as a Fellow of the Geological Society of America. Over the course of his career, he received a number of professional society awards, and was the author and/or co-author of numerous technical reports, book chapters, professional presentations and journal publications.

Peele Continues as Editor for National Hydrographic Dataset

LGS mapping scientist R. Hampton Peele continued his work as the editor of the National Hydrographic Dataset (NHD) for Louisiana throughout 2019, under contract with Louisiana Department of Environmental Quality. Louisiana's NHD data is now included in the NHD High Resolution-Plus national dataset. Peele continues to focus his editing of the NHD within the Coastal Louisiana region.

LGS Personnel

Administrative Personnel

Charles "Chip" Groat, acting director and state geologist, professor

Chacko J. John, Ph.D., associate director, professor

Patrick O'Neill, research associate, LGS Publications Sales and Resource Center

Basin Research Energy Section

John Johnston, research associate (retired--part-time)

Brian Harder, research associate (retired--part-time)

Reed Bourgeois, computer analyst

Geological Mapping & Minerals Mapping Section

Richard McCulloh, research associate

Paul Heinrich, research associate

Water & Environmental Section

Douglas Carlson, assistant professor-research

Riley Milner, research associate

Geophysical Section

Marty Horn, assistant professor-research

Cartographic Section

John Snead, cartographic manager (retired--part-time)

Lisa Pond, research associate

Robert Paulsell, research associate

R. Hampton Peele, research associate

Staff

Melissa Esnault, administrative coordinator

Jeanne Johnson, accounting technician

Radiation Safety

Wei-Hsung Wang, Director | lsu.edu/radiation-safety

The LSU Radiation Safety Office (RSO), which reports through the Center for Energy Studies to the Office of Research and Economic Development, is a unique, independent, and critical academic unit. The RSO directly supports and actively engages in research, teaching, and clinical activities involving the use of sources of ionizing and non-ionizing radiation at LSU. Under the direction of the Radiation Safety Committee (RSC), the RSO is responsible for developing and implementing radiological control policies and procedures as well as ensuring sound safe practice to not only comply with federal and state regulations and license/registration conditions but also assure adequate protection of people, the environment, and the integrity of the university. The LSU System's broad-scope Radioactive Material License issued by the Louisiana Department of Environmental Quality (LDEQ) allows the university maximum flexibility to accomplish legitimate and realistic education objectives through the effective and efficient operation of a regulatory-mandated radiation protection program carried out by the RSO. Administrative authorization for the radiation protection program from the University is stipulated in LSU System's Permanent Memorandum-30 (PM-30): *Radiation Protection Program*. Enforcement actions for radiation safety violations are authorized under LSU Policy Statement-99 (PS-99): *Radiation Safety Violations*. In addition, the LSU System's *Safety Procedures for Non-Ionizing Radiation* governs the non-ionizing radiation safety program.

In fiscal year 2018-2019, the RSO reviewed and approved 37 grant proposals involving the use of radioactive materials or radiation producing equipment. Funds requested by these proposals were $103,949,816. Actual funds granted to LSU were $44,047,959. Fifteen out of the 37 grant proposals are still under review by the funding agencies. Currently, there are 1,068 approved radiation workers (including 94 radiation principal investigators) in 192 radiation laboratories with 6,704 annual radiation monitoring devices issued under the LSU's radiation protection program. The program covers the Agricultural Center and its research stations, the Pennington Biomedical Research Center, and associated facilities under LSU, such as the Center for Advanced Microstructures and Devices (CAMD), the National Center for Biomedical Research and Training (NCBRT), and School of Veterinary Medicine (SVM). The RSO provides training and monitoring for radiation workers and performs surveys, inspections, survey meter calibrations (85 meters of different types), leak tests, and radioactive waste management to fully meet regulatory requirements and license/registration specifications. The RSO also evaluates and inspects inventoried Class 3B and Class 4 laser systems for laser intra beam hazards and provides laser safety training. There are 86 active Class 3B and Class 4 laser systems, 49 approved laser users (including 15 laser principal investigators), and 34 laser laboratories.

RSO technical assistant Adam Curet (left) and graduate intern Andrew Hastings examine the contents of a dry radioactive waste bag to ensure full compliance with regulatory requirements for proper storage and disposal.

Louisiana Department of Environmental Quality Conducts Inspections

There were four compliance and enforcement inspections conducted by the LDEQ's Emergency and Radiological Services Division/Radiation Section in 2019. In January, three inspectors visited the RSO and carried out inspections of the broad scope radioactive material license, the physical protection of category 1 and category 2 quantities of radioactive material (PPQRM), and the analytical radiation producing equipment at LSU. The inspectors reviewed the records of designated Trustworthiness and Reliability Officers, individuals granted unescorted access, policy, program, and procedure requirements under PPQRM regulations [e.g., maintenance/service/repair as well as alarm drill/testing of surveillance equipment, review of security and access authorization programs, refresher training, protection of physical and sensitive information, and pre-arranged plan with local law enforcement agency (LLEA)], the National Source Tracking System, membership and meeting minutes of the RSC, preparation, disposal, and shipment of radioactive waste, inventory and leak tests of sealed radioactive sources, personnel and environment radiation monitoring, ordering, receiving, and delivering of sources of radiation, review/approval/renewal/deactivation of authorization to use sources of radiation, and quarterly radiation laboratory contamination surveys. They also inquired about the point of contact at the LLEA, the annual radiological control and ALARA programs review, the administrative limits for occupational radiation exposure, the release of liquid radioactive waste, the current status of approved radiation principal investigators and radiation laboratories, the in-laboratory radiation surveys and action levels as well as the refresher training, the investigation of elevated personal exposure, the quality assurance/quality control and operation of radioanalytical equipment, the

RSO lead technical assistant Emaya Moss (right) worked with RSO technical assistant Margaret Blouin on preparation of swipe samples and operation of a liquid scintillation counter.

functions and applications of the Health Physics Assistant database management software, and the authority of LSU's radiological control program and enforcement (i.e., PM-30 and PS-99). In addition, the inspectors looked over LSU's radioactive material license, the Radiation Safety Manual, the radioactive waste management process, and the emergency procedures for radiation spills.

The inspectors walked through the radioactive package receiving area, three radioanalytical laboratories, the radioactive waste storage facilities, and the PPQRM security zones of the RSO. They also visited 31 radiation laboratories under LSU's radiological control program. During the laboratory visits, they checked the radiation levels, the function and calibration of in-laboratory survey meters, the posting and barrier requirements, the storage of radioactive waste, and the *Radiation Safety Manual*. They also reviewed the source inventory and disbursement logs, the in-laboratory training records, the in-laboratory radiation surveys, and the functions of the fume hoods. In addition, the leading inspector questioned the approved radiation workers (e.g., faculty member, clinical specialist, technician, laboratory manager, and graduate assistant) about the research/clinical protocols involving the use of radiation sources, the designated radiation areas, the patient workload and release limits, the operation and quality assurance/quality control of radioanalytical equipment, the physical operational parameters and safety features of analytical and diagnostic radiation producing equipment, wearing of personnel radiation monitoring devices, the procedures of ordering and receiving radioactive materials, and the practice for radioactive waste labeling/storage/disposal. After the walk-through, an exit interview was held, and no areas of concern were listed on the LDEQ's Field Interview Form.

In May, two inspectors visited the SVM and carried out an inspection of the radiation-producing equipment. The inspectors walked through the SVM to check the posting requirements, documentation for quality assurance/quality control, and operation of the radiation-producing equipment. Specifically, the inspectors visited eight radi-

ation laboratories under LSU's radiological control program that included nine X-ray units. For the radiographic X-ray units, the inspectors checked light field vs. radiation field, timer (i.e., exposure duration) accuracy, exposure reproducibility, accuracy of tube potential (kV), linearity of tube current (mA), postings, and dosimetry on personnel. For the computed tomography unit, the inspectors inquired about the typical peak tube potential (kVp), tube current, workload, use of phantom for daily quality control, use of contrast, scan times, and the annual quality control records. For the linear accelerator, the inspectors asked about the credentials and training of the operators, physicians, and physicists, facility security, typical workload, fractions of treatment dose, typical dose delivered per fraction, how monitor units are backed up during an outage, and how daily quality control is conducted. They also reviewed the records of daily, monthly, and annual quality control. In addition, the inspectors observed the demonstration of interlock testing. After the walk-through, an exit interview was held and no areas of concern were listed on the LDEQ's Field Interview Form.

RSO Hosts Laser Safety Equipment Exhibit

In April, Kentek Corporation visited the RSO in their mobile showroom, a van named Photon1. The vehicle houses a complete spectrum of laser safety equipment, including various types of protective eyewear, beam alignment and characterization products, power meters, beam stop/dump, enclosures, curtains and partitions, window coverings, and interlock systems. Kentek's representatives also demonstrated the capabilities of the laser safety equipment and answered questions. All laser principal investigators had been invited to attend. Numerous faculty, staff, and graduate students participated.

Wang Participates in Research Collaboration with Taipei Hospital

To promote and develop exchanges about the status and knowledge of radiation protection in Taiwan and in the U.S., as well as to enhance the relationship between Taiwan and the U.S. in education and training for radiation applications in medicine, Wei-Hsung Wang, RSO director and Center for Energy Studies professor, visited the Department of Nuclear Medicine at the Tri-Service General Hospital in Taipei, Taiwan. He met with the superintendent and deputy superintendent of the hospital, director of nuclear medicine, and chief of the positron emission tomography center. Their discussion included future research collaboration on radiation exposure to medical staff from nuclear medicine procedures, decommissioning of medical nuclear facilities, and emergency planning and preparedness in response to nuclear incidents.

Pictured (from left to right) Dr. Li-Fan Lin, chief of the positron emission tomography center; Dr. Cheng-Chi Cheng, vice superintendent; Dr. Wei-Hsung Wang, RSO director and Center for Energy Studies professor; major general Dr. Chien-Sung Tsai, superintendent; and Dr. Chuang-Shin Chiu, director of nuclear medicine, at the Tri-Service General Hospital in Taipei, Taiwan.

Professional Contributions and Recognitions

Wang Appointed American Board of Health Physics Board Member


RSO Director Wei-Hsung Wang

Wei-Hsung Wang, RSO director and Center for Energy Studies professor, was appointed as a board member of the American Board of Health Physics (ABHP). Health physics is the application of diverse scientific principles to the protection of people and environment from the hazards of radiation. The ABHP grants professional certification in the field of health physics, and the certification process is accredited by the Council of Engineering and Scientific Specialty Boards.

Established in 1959, the basic purposes of the ABHP are to (1) elevate the standards and advance the profession of health physics by encouraging its study and improving its practice, (2) encourage and insist on the highest standards of professional ethics and integrity in the practice of health physics, (3) determine the competence of professional health physicists and arrange, control, and conduct investigations and examinations to evaluate the qualifications of voluntary candidates for certification by the ABHP, (4) grant and issue certificates in the field of health physics to qualified applicants and maintain a registry of holders of such certificates, and (5) sponsor a certification renewal program, including issuance of "re-certified" seals to qualified ABHP diplomates who have demonstrated their continued professional involvement in health physics. Along with seven other board members from Mayo Clinic, Philips Healthcare, Sandia National Laboratories, Tidewater, Inc., the U.S. Nuclear Regulatory Commission, and Y-12 National Security Complex, Wang is the only board member from academia. His term ends in 2023.

Wang Elected to LSU Faculty Senate

Wei-Hsung Wang was elected to the LSU Faculty Senate, the representative governing body of the Faculty Council. The senate determines and develops the educational policy that is implemented by the LSU Administration. Wang represents the faculty members in the Center for Advanced Microstructure and Devices, Center for Energy Studies, Louisiana Geological Survey, and Louisiana Sea Grant Program. His term ends in August 2022.

Wilson Earns Safety Professional Certification


CAMD Radiation Safety Officer Charles A. Wilson

Charles A. Wilson, IV, CAMD radiation safety officer of the RSO, completed all requirements for certification as a Certified Safety Professional (CSP). Administered by the Board of Certified Safety Professionals (BCSP), this highly respected certification is awarded to individuals who meet academic standards, satisfy professional safety experience requirements, and have passed two rigorous examinations. The examinations cover engineering and management aspects of safety, applied sciences, legal and regulatory matters, professional affairs, and other safety-related topics.

CSPs specialize in protecting workers, the public, property, and the environment by identifying, evaluating, and controlling hazards. The CSP typically directs safety programs at a corporate level to reduce risk and loss.

Hamideh Certified Laser Safety Officer

Amin M. Hamideh, radiation specialist at the RSO, completed all requirements for certification as a Certified Laser Safety Officer (CLSO). Administered by the Board of Laser Safety (BLS), this certification is awarded to individuals who meet educational standards, satisfy professional laser safety experience requirements, and have passed a written examination. This written examination covers nine areas of practice: lasers and optics funda-

mentals, laser/optical radiation biological effects, non-beam hazards associated with lasers, laser control measures, regulations and standards, hazard evaluation and classification, maximum permissible exposures, laser safety program administration, and laser measurements.

RSO Radiation Specialist Amin M. Hamideh

BLS certification is one of the highest credentials a laser safety professional can achieve. It recognizes the individual who has achieved a credible level of knowledge and expertise as well as possesses a higher level of commitment to evaluate laser associated hazards and implement appropriate control measures. This certification demonstrates to the public, colleagues, and employers one's qualifications to manage advanced laser safety issues.

Scholarly Activities

Grant Awarded

- "LSU expanded nuclear science and engineering graduate fellowship program." F. Lu, Y-H Kim, M.R. Gartia, W. Xie, W-H Wang. U.S. Nuclear Regulatory Commission, Award # AWD-002476.

Grants Pending

- Novel module for separation of radionuclides from aqueous solutions. Y-H Kim, W-H Wang, Board of Supervisors of LSU and A&M College.
- Fate of radioactive particles in aqueous environments. Y-H Kim, W-H Wang, Louisiana Board of Regents.

Publications and Presentations

Bastian, F. O., J. Lynch, W-H Wang. Novel Spiroplasma sp. isolated from CWD is an extreme bacterial thermoacidophile that survives autoclaving, boiling, formalin treatment, and significant gamma irradiation. *Journal of Neuropathology & Experimental Neurology* 78: 993-1001.

Davila, A.D., J. F. Fletcher, K. L. Matthews II, W-H Wang. 2019. Evaluating feline release criteria following iodine-131 treatment for hyperthyroidism. The 64th Annual Meeting of the Health Physics Society, July 7-11, Orlando, FL.

DiMarco, D.J., K. L. Matthews II, W-H Wang. 2019. Visualization of radioiodine distribution in silver zeolite cartridges with gamma-ray imaging. The 64th Annual Meeting of the Health Physics Society, July 7-11, Orlando, FL.

Hamideh, A.M., W-H Wang. 2019. Using barium-133 as a surrogate for iodine-131 in a silver zeolite cartridge for air sampling. The 5th International Conference on Environmental Radioactivity, September 8-13, Prague, Czech Republic.

Hastings, A.D., C. A. Wilson IV, A. M. Hamideh, W-H Wang. 2019. Evaluation of skyshine contributions during electron injection at a synchrotron facility using CERN's FLUKA code. The 52nd Midyear Meeting of the Health Physics Society, February 17-20, San Diego, CA.

Robinson J., A. M. Hamideh, W-H Wang. 2019. Response to a spill involving lutetium-177 in a radiation use facility. The 64th Annual Meeting of the Health Physics Society, July 7-11, Orlando, FL.

Wang, W-H, J. Robinson, A.M. Hamideh. 2019. Investigation of elevated radiation exposure from debris of a renovation project. The 5th International Conference on Environmental Radioactivity, September 8-13, Prague, Czech Republic.

Wilson IV, C. A., A.M. Hamideh, K.L. Matthews II, W-H Wang. 2019. Determination of uranium series activity before secular equilibrium is established. *Heal Phys* 117:443-448.

Wilson IV, C. A., A.M. Hamideh, W-H Wang. 2019. Establishment of a NORM baseline for selected seafood in the Gulf of Mexico. *Marine Pollution Bulletin* 145:448-454.

Journal Manuscripts Reviewed

By Wei-Hsung Wang

- Paper HPJ-D-18-00127R2. "Radiation safety considerations in the treatment of canine skeletal conditions using 153Sm, 90Y and 117mSn." Reviewed for *Health Physics*, 2019 (Kent N. Lambert, associate editor).
- Paper HPJ-D-19-00081. "A mixed methods approach for improving radiation safety culture in open-source university laboratories." Reviewed for *Health Physics*, 2019 (Brant Ulsh, editor-in-chief).
- Paper HPJ-D-19-00008. "Use of sigmoid functions in the NTCP models of the radiation oncology therapies." Reviewed for *Health Physics*, 2019 (Wesley E. Bolch, associate editor).

By Charles A. Wilson IV

- Paper TJOM-2019-0118. "Site selection for Croatian low and intermediate level radioactive waste repository." Reviewed *J Maps*, 2019 (Fabio Famoso, associate editor).

Pictured (from left to right) Amin M. Hamideh, radiation specialist of the RSO; Wei-Hsung Wang, director of the RSO, Center for Energy Studies professor, and graduate advisor of Hamideh and Wilson IV; and Charles A. Wilson IV, CAMD radiation safety officer of the RSO, in front of the LSU Nuclear Science Building.

Personnel News

Dr. Erin L. Oberhaus, assistant professor in the School of Animal Sciences, was recommended unanimously by the RSC to become a member of the RSC. Dr. Oberhaus is an authorized radiation principal investigator and possesses proficient working knowledge and experience in the areas of radioisotope applications, radiation biology, and radiation protection. Per PM-30, Dr. Oberhaus' appointment was officially confirmed by LSU President F. King Alexander, with the approval of Dr. Dennis Paul, Chair of the LSU System RSC.

Charles A. Wilson, IV, CAMD radiation safety officer of the RSO, received his doctor of philosophy degree from the LSU Department of Environmental Sciences. His research focused on developing effective analytical methodology for naturally occurring radioactive material (NORM) and evaluating NORM in seafood from the Gulf of Mexico.

Amin M. Hamideh, radiation specialist at the RSO, received his master of science degree with a concentration in health physics from the LSU Department of Physics and Astronomy. His dissertation is titled, "*Determination of conversion factors for various calibration geometries using barium-133 in a silver zeolite cartridge.*"

Anthony R. Davila, Daniel J. DiMarco, and Garrett A. Otis, former graduate interns at the RSO in 2018, received their master of science degrees with a concentration in health physics from the LSU Department of Physics and Astronomy. Currently, Davila is the assistant radiation safety officer at Tulane University. DiMarco is employed by the US Nuclear Regulatory Commission. Otis is a health physicist at the Yale-New Haven Hospital.

Jabari Robinson, manager-operations of the RSO, departed LSU and took over the radiation safety officer position at The University of Tennessee Health Science Center in Memphis. Robinson was employed by the RSO for six years and became a valuable asset for the RSO. Congratulations, Jabari! We wish you the best in your future endeavors.

RSO Personnel

Administration

Wei-Hsung Wang, Ph.D., CHP, CSP, CLSO, director and professor

Jabari Robinson, M.S., CHP, CLSO, manager-operations and laser safety officer

Amin M. Hamideh, M.S., CLSO, radiation specialist and laser safety officer

Charles A. Wilson, IV, Ph.D., CSP, CLSO, CAMD radiation safety officer

Melissa H. Esnault, administrative coordinator

Lorrie Gaschen, D.V.M., Ph.D., LSU School of Veterinary Medicine liaison

Christy White, D.V.M., Pennington Biomedical Research Center liaison

Technical Assistants

Margaret Blouin

Adam Curet

Emaya Moss (lead)

Maia Trailer

Graduate Interns

Anthony Davila

Daniel DiMarco

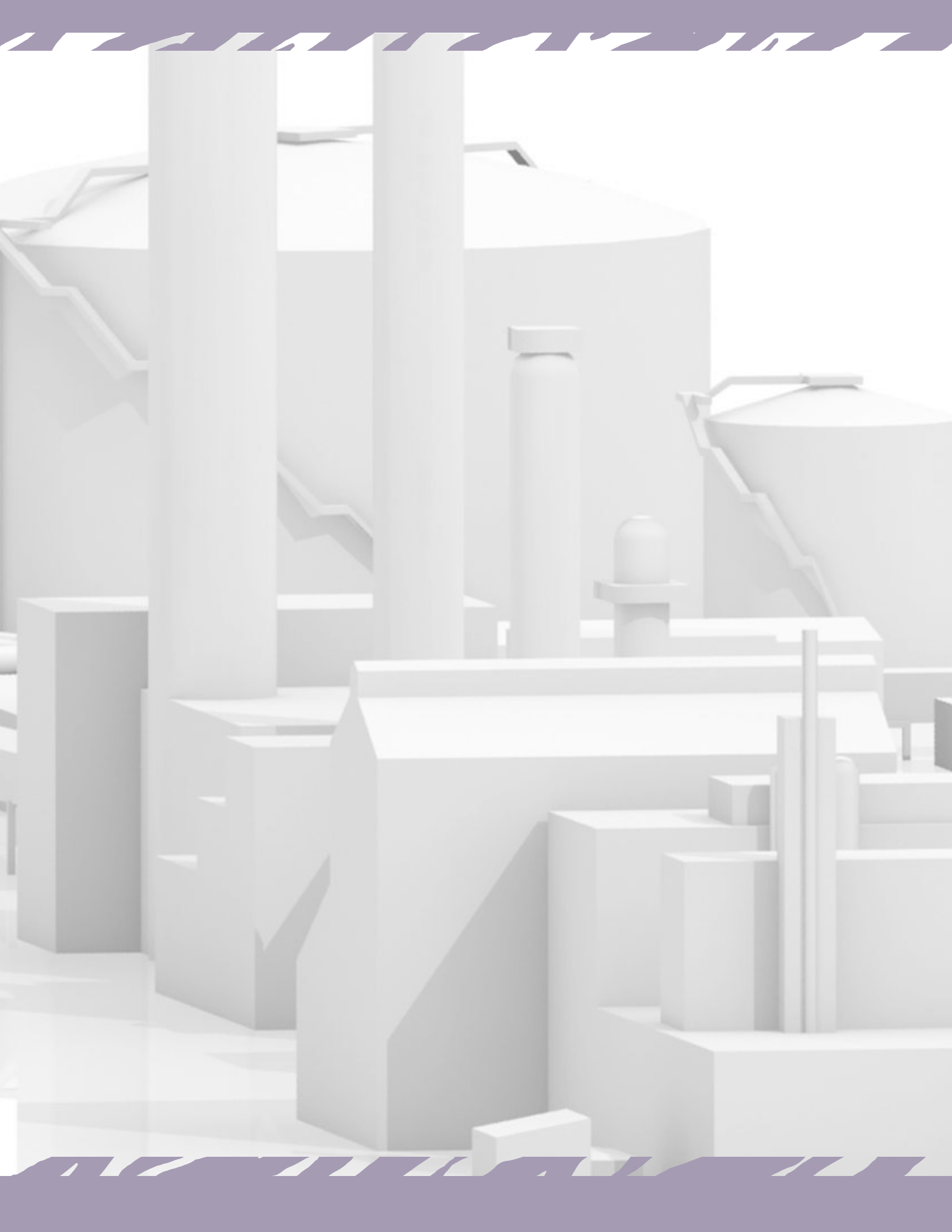
Andrew Hastings

Garrett Otis

We dedicate the 2019 Annual Report to Lisa Pond (1963-2020), award-winning Louisiana Geological Survey cartographer and graphic designer.

Send correspondence to Marybeth Pinsonneault, Communications Manager, at mpinsonn@lsu.edu or 1077 Energy, Coast & Environment Building, Louisiana State University, Baton Rouge, LA 70803

Designed by Stephen W. Radcliffe.



LSU | Center for Energy Studies

CES Scholarships

To donate to the Center's scholarships, in support of LSU students pursuing energy-related fields, fill in the form below and mail to

Center for Energy Studies
1067 Energy, Coast & Environment Building
Louisiana State University
Baton Rouge, LA 70803

Name: _____

Company/Organization: _____

Address: _____

City: _____ State: _____ Zip: _____

Email address: _____

Check which applies:

☐ **Robert R. Brooksher Scholarship Fund**

☐ **F. Malcolm Hood Scholarship Fund**

Amount of donation: $_____

Make check payable to **LSU Foundation-Center for Energy Studies**.

Thank you for your support.