

Economics 323 (L01) (Natural Gas Markets)

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Lecture Location: [HNSC 122](#)
Lecture Days/Time: TR 09:30 - 10:45

Office: ZOOM Delivery
<https://ucalgary.zoom.us/j/98708596532?pwd=TDRNdjJZLzA1QlhuSzAvc0puVGVFdz09>
Office Hours: R 16:30 – 17:30
Winter 2023

Course Description:

This course will walk through the natural gas industry, from exploration and development, to transmission, distribution, and end use. Topics covered include regulations of methane emissions, natural gas transportation networks and how they impact natural gas pricing, and the regulation of natural monopolies in the context of natural gas distribution companies.

Course Learning Outcomes:

Students will understand issues in natural gas supply (including exploration, storage, transportation, pricing, and local distribution) and demand (including environmental externalities, and substitutes for natural gas use). Students will gain expertise in conducting literature reviews and use economics to evaluate policies.

- a. Understand natural gas markets, from exploration and development, to transmission, distribution, and end use.
- b. Introduce theory of extraction of exhaustible resources.
- c. Build on economic theory of regulating externalities. Understand the current regulatory system in Canada for methane emissions. Understand positive and negative trade-offs from natural gas-fired electricity generation.
- d. Introduce natural gas transportation networks and how this impacts natural gas pricing and policies.
- e. Develop theory of price ceilings. Introduce allocative costs of price ceilings and the historical context of inefficient regulations. Empirical literature on estimating the size of the inefficiency.
- f. Build on theory of monopoly pricing in the context of local natural gas distribution companies. Examine empirical literature on determining efficiency of natural gas utility rates.
- g. Gain expertise in synthesizing information from the academic literature.

Tentative Course Outline:**1. Overview**

**Alberta's Natural gas overview: <https://www.alberta.ca/natural-gas-overview.aspx>

Natural Resources Canada's Natural Gas Primer: <https://www.nrcan.gc.ca/energy/natural-gas/5641>

["Understanding Natural Gas Markets," American Petroleum Institute, 2014.](#)

(pages 1-34): ["Energy Primer A Handbook of Energy Market Basics"](#)

Natural Resources Canada's Natural Gas Facts (slides 112-124)

https://www.nrcan.gc.ca/sites/nrcan/files/energy/energy_fact/2021-2022/PDF/section6_Energy-factbook_december9_en_accessible.pdf

["Natural Gas Liquids Primer – With a Focus on the Appalachian Region" US Dept of Energy, June 2018](#)
(page 2 has table of uses for natural gas liquids; page 33 describes ethylene crackers).

["Alberta at a Crossroads: Royalty Review Advisory Panel Report"](#)

Black, Katie Jo, Andrew J. Boslett, Elaine L. Hill, Lala Ma, and Shawn J. McCoy. ["Economic, Environmental, and Health Impacts of the Fracking Boom."](#) Annual Review of Resource Economics 13 (2021).

2. Production: upstream exploration and extraction

*** [_ Chapter 2](#) from [Markets and the Environment](#) by Keohane Olmstead

*** [_ Chapter 6](#) from [Markets and the Environment](#) by Keohane Olmstead

*** (pages 391-395) ["Trophy Hunting vs. Manufacturing Energy: The Price-Responsiveness of Shale Gas," Richard G. Newell, Brian C. Prest, and Ashley Vissing, Journal of the Association of Environmental and Resource Economists, 2019.](#)

*** (Introduction 1092-1093, Figure 5, Table 6): [Jacobsen, Grant D. and Dominic P. Parker: "The Economic Aftermath of Resource Booms: Evidence from Boomtowns in the American West" *Economic Journal* \(2014\)](#)

*** (pages 98-99): ["Welfare and Distributional Implications of Shale Gas" Hausman, Catherine; Kellogg, Ryan. Brookings Papers on Economic Activity; Washington](#)

[Muehlenbachs, L., Spiller, E. and Timmins, C., 2015. The housing market impacts of shale gas development. American Economic Review, 105\(12\), pp.3633-59.](#)

Jennifer Winter, "[Buying Anonymity: An Investigation of Petroleum and Natural Gas Lease Auctions](#)" (Pages 1-9)

Kroepsch, Adrienne C., Peter T. Maniloff, John L. Adgate, Lisa M. McKenzie, and Katherine L. Dickinson. "[Environmental justice in unconventional oil and natural gas drilling and production: A critical review and research agenda.](#)" Environmental science & technology 53, no. 12 (2019): 6601-6615.

3. Production: regulations on rule of capture, unitization, and offset wells

**Libecap, Gary D., and James L. Smith. "[The economic evolution of petroleum property rights in the United States.](#)" The Journal of Legal Studies 31, no. S2 (2002): S589-S608. (Section II)

** (Pages 13-16) "[Petroleum and Natural Gas Tenure in Alberta,](#)" Government of Alberta, September 2016.

** (Section 2a-c) Fitzgerald, Timothy. "[Regulatory Obsolescence Through Technological Change in Oil and Gas Extraction.](#)" Wm. & Mary Env'tl. L. & Pol'y Rev. 43 (2018): 137.

Ballem, John, [The Oil & Gas Lease in Canada](#), 2019, (Chapter 9 Drainage and Chapter 10 Unitization)

Libecap, Gary D., and James L. Smith. "[Regulatory remedies to the common pool: The limits to oil field unitization.](#)" The Energy Journal 22, no. 1 (2001).

4. Methane emissions

*** Chapters 8 and 9 of [Markets and the Environment by Keohane Olmstead](#)

*** (pages 1-3, Fig 4, Fig 5, Table 3): Lade, Gabriel, and Ivan Rudik, "[Costs of Inefficient Regulation: Evidence from the Bakken,](#)" Journal of Environmental Economics and Management

Ruiwen Lee, "[Does Self-Reporting Measure Up? Environmental Misreporting in the Bakken,](#)" Job Market Paper 2020

(MAC curves) "[Economic Analysis of Methane Emission Reduction Opportunities in the U.S. Onshore Oil and Natural Gas Industries](#)"

(Section 3): Agerton, Mark, Ben Gilbert, and Gregory B. Upton Jr. [The Economics of Natural Gas Venting, Flaring and Leaking in US Shale: An Agenda for Research and Policy.](#) No. 2021-02. 2021.

"[Upstream Petroleum Industry Flaring and Venting Report Industry Performance,](#)" Alberta Energy Regulator

Manual 15 AER: "[Estimating Methane Emissions,](#)" December 2018

Figure 2, "[A Techno-Economic Analysis of Methane Mitigation Potential from Reported Venting at Oil Production Sites in Alberta](#)"

"Differentiation of Natural Gas Markets by Climate Performance" Alan Krupnick and Clayton Munnings https://media.rff.org/documents/Green_Gas_Report_Final_4hh3kLx.pdf

Carleton, Tamma, and Michael Greenstone. "[Updating the United States government's social cost of carbon](#)." University of Chicago, Becker Friedman Institute for Economics Working Paper 2021-04 (2021).

"[Incremental CH4 and N2O mitigation benefits consistent with the US Government's SC-CO2 estimates](#)"
Alex L. Marten, Elizabeth A. Kopits, Charles W. Griffiths, Stephen C. Newbold & Ann Wolverton, *Climate Policy*

5. Upstream end-of-life issues

***Judson Boomhower, "[Drilling Like There's No Tomorrow: Bankruptcy, Insurance, and Environmental Risk](#)," *American Economic Review*, 2019 (Introduction)

"All's Well that Ends Well: Addressing End-of-Life Liabilities for Oil and Gas Wells" (Page 3, Figure 1)

Muehlenbachs "80,000 Inactive Oil Wells: A Blessing or a Curse?" SPP Briefing Paper, 2017.

6. Natural gas pricing

*** (pages 1-4) "[What Drives Natural Gas Prices?](#)", Stephen P. A. Brown and Mine K. Yücel, *Energy Journal*, 2008

*** (Part II): "[Open Access and the Evolution of U.S. Spot Market for Natural Gas](#)" Doane and Spulber, *Journal of Law and Economics*

*** (section 3.1): McRae.Shaun, "[Crude Oil Price Differentials and Pipeline Infrastructure](#)," NBER Working Paper No. 24170. 2017.

7. Consumption: natural gas in the electricity sector

*** (pages 1-3): "[Vertical Market Power in Interconnected Natural Gas and Electricity Markets](#)," Levi Marks, Charles F. Mason, Kristina Mohlin and Matthew Zaragoza-Watkins

Linn, J. and Muehlenbachs, L., 2018. [The heterogeneous impacts of low natural gas prices on consumers and the environment](#). *Journal of Environmental Economics and Management*, 89, pp.1-28.

Winter, Jennifer, Nick Schumacher, Victoria Goodday and Blake Shaffer, "[Energy and Environmental Policy Trends: Cheap Renewables Have Arrived](#)". 2020. Policy Trends series, The School of Public Policy Publications, November.

8. Natural gas transportation

(Section 2) "[Linking Natural Gas Markets – Is LNG Doing its Job?](#)" Anne Neumann, *Energy Journal*, 2009

(Page 18-20) "[Energy Primer A Handbook of Energy Market Basics](#)"

9. Consumption: Limiting the use of Russian gas

***Heussaff, C., Tagliapietra, S., Zachmann, G. and Zettelmeyer, J., 2022. An assessment of Europe's options for addressing the crisis in energy markets. Bruegel Policy Contribution, 17, p.22.

<https://www.bruegel.org/sites/default/files/2022-09/PC%2017%202022.pdf>

***McWilliams, B., G. Sgaravatti, S. Tagliapietra and G. Zachmann (2022) 'A grand bargain to steer through the European Union's energy crisis', Policy Contribution 14/2022,

Bruegel https://www.bruegel.org/sites/default/files/2022-09/PC%2014%202022_1.pdf

***Di Bella, G., Flanagan, M.J., Foda, K., Maslova, S., Pienkowski, A., Stuermer, M. and Toscani, F.G., 2022. Natural gas in Europe: the potential impact of disruptions to supply. IMF Working Papers, 2022(145). <https://www.elibrary.imf.org/view/journals/001/2022/145/article-A001-en.xml>

Ockenfels, A., Tagliapietra, S. and Wolff, G., 2022. Three ways Europe could limit Russian oil and gas revenues. Nature, 604(7905), pp.246-246. <https://www.guntramwolff.net/wp-content/uploads/2022/04/Three-ways-Europe-could-limit-Russian-oil-and-gas-revenues.pdf>

10. Consumption: demand elasticities and effect of price ceilings

***(Sections 1-3): Davis, Lucas W., and Lutz Kilian. "[The allocative cost of price ceilings in the US residential market for natural gas.](#)" *Journal of Political Economy* 119, no. 2 (2011): 212-241.

*** (pages 1-4): "[Natural Gas Price Elasticities and Optimal Cost Recovery Under Consumer Heterogeneity: Evidence from 300 million natural gas bills,](#)" 2018 NBER Working Paper, by Maximilian Auffhammer and Edward Rubin

11. Consumption: current and future household consumption

Davis, Lucas W. [What Matters for Electrification?](#) Blog post

Davis, L.W. and Hausman, C., 2021. [Who will pay for legacy utility costs?](#) (No. w28955). National Bureau of Economic Research.

Chirakijja, J., Jayachandran, S. and Ong, P., 2019. [Inexpensive heating reduces winter mortality \(No. w25681\).](#) National Bureau of Economic Research.

12. Consumption: natural monopoly regulation

***Chapters 11 and 12 of [Economics of Regulation and Antitrust](#) by W. Kip Viscusi, Joseph E., Jr. Harrington, , and John M. Vernon, (scroll to page 401 in section II ECONOMIC REGULATION)

*** (sections 1 and 4): Muehlegger, Erich; Davis, Lucas W "[Do Americans consume too little natural gas? An empirical test of marginal cost pricing](#)" *The RAND Journal of Economics* 2010

*** (maps) Borenstein, Severin, and James Bushnell. "[Do Two Electricity Pricing Wrongs Make a Right? Cost Recovery, Externalities, and Efficiency.](#)" (2019).

13. Consumption: Hydrogen

*** Bergman, A. and A. Krupnick “Incentives for Clean Hydrogen Production in the Inflation Reduction Act,” Resources for the Future Report

<https://www.rff.org/publications/reports/incentives-for-clean-hydrogen-production-in-the-inflation-reduction-act/>

Hydrogen Hub Explorer:

<https://www.rff.org/publications/data-tools/hydrogen-hub-explorer/>

Hydrogen 101

<https://www.alberta.ca/hydrogen-101.aspx>

Prerequisites/corequisites:

Economics 201.

Required Textbook(s):

None

Recommended Textbook(s):

Keohane and Olmstead, Markets and the Environment (Available at the [library](#))

Books on Reserve:

The list of reserve titles, if any, is posted at the course D2L site.

Desire2Learn:

This course will make use of the Desire2Learn (D2L) platform. Students who are registered in the course can log on at <http://d2l.ucalgary.ca> through their student centre. Please note that D2L features a class e-mail list that may be used to distribute course-related information. These e-mails go to your University of Calgary e-mail addresses only.

Grade Determination:

MIDTERM EXAM (March 7)	30%
ASSIGNMENTS	30%
FINAL EXAMINATION	40%
	<hr/>
	100%

Examination Details:

Tests and exams will involve some multiple choice questions.

Programmable calculators, cellphones, textbooks, course notes, and other electronic devices will not be allowed during the writing of tests or final examinations. Students are reminded that simply being able to access their cellphone during an exam is academic misconduct.

The midterm will be held in class on March 7.

Grading Policies:

The official grading system will be used. See <http://www.ucalgary.ca/pubs/calendar/current/f-1-1.html>.

Students must receive a passing grade on the final exam to pass the course. Students committing academic misconduct during the final exam will not receive a passing grade for the course.

If a student's letter grade on the final exam exceeds their midterm(s) letter grade, the weight of the midterm(s) is (are) transferred to the final exam. The student must have written the midterm(s) or provided supporting documentation for the absence(s). For Winter 2023 the University has suspended the requirement for supporting documentation. Instructors cannot currently ask students for documentation to support absences.

As per the Writing Across the Curriculum Statement in the Calendar, writing and grading thereof will be a factor in the evaluation of student work. See <https://www.ucalgary.ca/pubs/calendar/current/e-2.html>.

Any student work which remains undistributed after the last day of classes will be available to students through the instructor's office during the instructor's office hours.

The final examination will be comprehensive, scheduled by the Registrar, held in a classroom, and last 2 hours. If a student cannot write their final exam on the date assigned by the Registrar's Office, they need to apply for a deferred exam <https://www.ucalgary.ca/pubs/calendar/current/g-6.html>. Under no circumstance will this be accommodated by the Department.

THERE WILL BE NO MAKEUP OR DEFERRED QUIZZES/TESTS/EXAMS under any circumstances, nor may the quizzes/tests/exams be written early. Students unable to write the quizzes/tests/exams because of documented illness, family emergency, religious observance, or university-sanctioned event will have the weight shifted to the final examination; otherwise a grade of zero will be assigned.

Reappraisal of Grades:

For Reappraisal of Graded Term Work, see Calendar I.2

<http://www.ucalgary.ca/pubs/calendar/current/i-2.html>

For Reappraisal of Final Grade, see Calendar I.3

<http://www.ucalgary.ca/pubs/calendar/current/i-3.html>

Academic Misconduct and Intellectual Honesty:

Academic Misconduct refers to student behavior that compromises proper assessment of students' academic activities and includes: cheating; fabrication; falsification; plagiarism; unauthorized assistance; failure to comply with an instructor's expectations regarding conduct required of students completing academic assessments in their courses; and failure to comply with exam regulations applied by the Registrar.

Statement of Intellectual Honesty, see Calendar K.4

<https://www.ucalgary.ca/pubs/calendar/current/k-3.html>

Plagiarism and Other Academic Misconduct

<https://ucalgary.ca/student-services/student-success/learning/academic-integrity>

Academic Accommodations:

Students seeking an accommodation based on disability or medical concerns should contact Student Accessibility Services. SAS will process the request and issue letters of accommodation to instructors. Students who require an accommodation in relation to their coursework based on a protected ground other than disability should communicate this need in writing to their Instructor. The full policies on Student Accommodations are available at <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf> and <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf>.

Freedom of Information and Protection of Privacy (FOIP) Act:

Personal information is collected in accordance with FOIP. Assignments can only be returned to the student and will be accessible only to authorized faculty and staff. For more information, see <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/faq-privacy-faculty-members.pdf> and <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/faq-privacy-students.pdf>

Internet and Electronic Communication Device information:

The use of cell phones for any purpose in class is prohibited. Computers and tablets may be used for note taking only unless otherwise authorized by the instructor.

Copyright Legislation:

See the University of Calgary policy on Acceptable Use of Material Protected by Copyright at <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Acceptable-Use-of-Material-Protected-by-Copyright-Policy.pdf>. Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy.

Recording of Lectures:

Recording of lectures is prohibited, except for audio recordings authorized as an accommodation by SAS or an audio recording for individual private study and only with the written permission of the instructor. Any unauthorized electronic or mechanical recording of lectures, their transcription, copying, or distribution, constitutes academic misconduct. See <https://www.ucalgary.ca/pubs/calendar/current/e-6.html>.

Instructor Intellectual Property:

Course materials created by instructors (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the instructor. These materials may NOT be reproduced, redistributed, or copied without the explicit consent of the instructor. The posting of course materials to third party websites such as note-sharing sites without permission is prohibited. Sharing of extracts of these course materials with other students enrolled in the course at the same time may be allowed under fair dealing.

Important Dates:

Please check: <http://www.ucalgary.ca/pubs/calendar/current/academic-schedule.html>.

Student Organizations:

Faculty of Arts Students' Association (F.A.S.A.):

Economics Department Representative

Office: SS 803, E-mail: econrep@fasaucalgary.ca and Web: www.fasaucalgary.ca.

Society of Undergraduates in Economics:

<https://www.ucalgarysue.com/>.

Society of Undergraduates in Economics is a student run organization whose main purpose is to assist undergraduate economics students to succeed both academically and socially at the University of Calgary. Services include access to the exam bank, career events such as Industry Night and information sessions, mentorship programs, and social events for members. They invite you to join by contacting SUE at sue@ucalgarysue.com.

Faculty of Arts Program Advising and Student Information Resources:

- Have a question, but not sure where to start? The Arts Students' Centre is your information resource for everything in Arts! Drop in at SS102, call them at 403-220-3580, or email them at artsads@ucalgary.ca. You can also visit the Faculty of Arts website at <http://arts.ucalgary.ca/undergraduate> which has detailed information on common academic concerns, including program planning and advice.
- For registration (add/drop/swap), paying fees and assistance with your Student Centre, contact Enrolment Services at 403-210-ROCK [7625] or visit them in the MacKimmie Library Block.

Student Support and Resources:

- See <https://www.ucalgary.ca/registrar/registration/course-outlines> for information on campus mental health resources, the Student Ombuds' Office, Student Success Centre, Safewalk, and Emergency Evacuation and Assembly.
- Online writing resources are available at <https://ucalgary.ca/student-services/student-success/writing-support>.

Notes:

1. Students are responsible for all assigned material, e.g., supplementary material posted on D2L, regardless of whether or not the material was covered in class.

LM

2022-12-08