

## Economics 323 (L01) (Economics and the Environment)

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Lecture Location: [SH 268](#)  
Lecture Days/Time: TR 09:30 - 10:45

Office: ZOOM Delivery  
Office Hours: R 16:30 – 17:30

Winter 2022

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### Course Description:

Operation of the natural gas industry in North America. Economics of exploration, development, production, marketing and transportation of natural gas. Impact of government regulations and deregulation.

### 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](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 Envtl. L. & Pol'y Rev. 43 (2018): 137.

Ballam, 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](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 CH<sub>4</sub> and N<sub>2</sub>O mitigation benefits consistent with the US Government's SC-CO<sub>2</sub> estimates](#)" Alex L. Marten, Elizabeth A. Kopits, Charles W. Griffiths, Stephen C. Newbold & Ann Wolverton, *Climate Policy*

#### 5. 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: 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

## 10. 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.

**11. 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

**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:****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 and Final Examination Details:**

MIDTERM EXAM (FEB 17)	30%
ASSIGNMENTS	20%
CLASS PARTICIPATION	5%
FINAL EXAMINATION	<u>45%</u>
	100%

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

A passing grade on minimum of 50% of the course work is required for a student to pass the course as a whole.

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 at the discretion of the instructor. The student must have written the midterm(s) or provided supporting documentation for the absence(s) such as a medical note or statutory declaration.

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>.

Course material dealing with a particular assignment will typically be covered in class at least 5 days before the assignment is due; thus, assignments can be completed at any time up to and including the due date. Given these factors, only situations where someone can document illness or domestic affliction for an extended period (i.e., the entire 5 days prior to the due date) would possibly warrant shifting the assignment weight to the final exam. Furthermore, technical problems can be expected to occur with computer systems (and internet availability) so it may be a good idea to not wait until the last minute to submit your assignment.

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.

The in-class midterm will be held on February 17. This timed assessment will be available via D2L quiz at the beginning of class on February 17 at 9:30AM and will be available for 24 hours. When you access the assessment, you will have the length of the class [i.e., 75 minutes] to complete and submit it. This assessment will consist of written and multiple-choice questions. If you experience an issue that affects your ability to complete the assessment, which can include (but is not limited to) issues with technology, caregiving responsibilities, or distractions within your test-taking environment, you will need to contact your instructor as soon as possible to arrange an alternate or (in the case of technical issues) extended time to write the assessment.

Tests and exams will involve 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.

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.

**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.

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2021-11-30

**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:**

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.

Student committing academic misconduct during the final exam will not receive a passing grade for the course.

For information on the Student Academic Misconduct Policy, Procedure and Academic Integrity, please visit: <https://www.ucalgary.ca/pubs/calendar/current/k-3.html>

**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 policy on Student Accommodations is available at

<https://www.ucalgary.ca/legal-services/university-policies-procedures/accommodation-students-disabilities-procedure>

**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/access-information-privacy>

**Copyright Legislation:**

See the University of Calgary policy on Acceptable Use of Material Protected by Copyright at <https://www.ucalgary.ca/legal-services/university-policies-procedures/acceptable-use-material-protected-copyright-policy> Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy.

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.

**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>.

**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

E-mail: [econrep@fasaucalgary.ca](mailto:econrep@fasaucalgary.ca)

Website: [www.fasaucalgary.ca](http://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 [societyofundergradsineconomics@gmail.com](mailto:societyofundergradsineconomics@gmail.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](mailto: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 Tower.

**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>.

**Winter 2022**