

Civil and Environmental Engineering 6625

Transportation and Energy

Fall 2016

Professors: Michael Rodgers, 226 SEB Building (attached to Mason)
michael.rodgers@ce.gatech.edu;
(404) 385-0569 (Office)
Office Hours: Open door policy and by appointment (schedule by e-mail)

Randall Guensler, 222 SEB Building (attached to Mason)
randall.guensler@ce.gatech.edu
(404) 894-0405 (Office); (404) 894-2278 (Fax)
Office Hours: Open door policy and by appointment (schedule by e-mail)

Teaching Asst. Haobing Liu
Haobing.liu@gatech.edu

Class: T, Th: 9:30-11:00am
L1105, Ford Environmental Science and Technology

This course explores the relationships between the transportation infrastructure, technology, and energy consumption, with a focus on the potential impacts of alternative futures for transportation and energy systems. We will couple lectures, literature review, and class discussions with scenario and data analysis. Students will explore the potential changes in well-to-wheel energy consumption and greenhouse gas emissions associated with alternative energy scenarios applied to specific transportation subsectors.

Course Readings:

Various readings and video lectures are assigned each week. The course syllabus contains the schedule of additional assigned readings. The Resources Section of the class T-Square site will host PDFs of the readings and associated reference manuals (technical guidance documents). T-Square will also contain links to the prerecorded lectures for most of the topics. Students need to complete items listed as “Readings” and “Video” prior to the lecture. Items listed as “References” are useful for assignments.

Course Assignments:

The course grade will be based on:

- Class Participation (10%)
- Transportation Subsystem Presentation (10%)
- Transportation and Energy Systems Report (35%)
- Final Comparative Case Study Presentation (10%)
- Final Comparative Case Study Report (35%)

The class is organized around two group projects. In the first project, teams will develop an overview of a randomly assigned transportation subsystem (e.g., inter-coastal marine transportation, or farm equipment in Georgia) and a fuel subsector (e.g., electricity produced from coal, ethanol from corn, or CNG from fracking operations). Each team will prepare a PowerPoint presentation that provides an overview of the current state of the transportation subsystem. Each team will develop a process flow diagram of the fuel chain for their fuel subsector and an accompanying report explaining the flow diagram. The second course project then tasks the teams with comparing the energy impacts of using two different energy subsectors to fuel their assigned future transportation subsystem (e.g. 60% penetration of electric vehicles in the 2030 fleet, fueled by either electricity from nuclear power or electricity from coal). This scenario analysis requires that teams extend their base knowledge and forecast future fleet composition, energy demand, infrastructure requirements for energy production, and the energy impacts from well to wheel of the two alternatives (using the GREET model).

Assignment grading is standardized. Students must submit a hard copy and an electronic copy of all assignments for grading. Electronic copies are to be e-mailed (never, ever, submitted through the T-Square system). Spell-check, grammar-check, and make sure your name is on every file before sending. All assignments require proper citations using a consistent system (e.g. MLA, Chicago Style, etc.). Proper citation is required by the Georgia Tech Honor Code (avoid as plagiarism). The instructors will distribute supplemental announcements and documents related to the course by e-mail (check e-mail regularly).

Transportation and Energy Fall 2016 Course Schedule

Course Introduction

Tuesday, August 23	Course Overview and Background Discussion (MOR) <i>Reading:</i> None
Thursday, August 25	Energy and Transport as Complex Systems (MOR) <i>Reading:</i> Kirkwood (2013) Systems Dynamic Methods: A Quick Introduction; Chapter 1 and Chapter 2

Traditional Energy Resources and Transportation Systems

Tuesday, August 30	Energy Resources and Energy Consumption (MOR) <i>Reading:</i> USDOE, Annual Energy Outlook 2015 http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf
Thursday, September 1	The Transportation System (RLG) <i>Reading:</i> Meyer and Miller, Urban Transportation Planning, Chapter 3, Urban Travel and Transportation System Characteristics: A Systems Perspective
Tuesday, September 6	Transportation Sectors (MOR, HL) Personal transportation, transit systems, heavy rail freight, intermodal, ports, inland marine, aviation, etc. <i>Reading:</i> Grava, S., Urban Transportation Systems, Choices for Communities, Chapter 8, Buses, Chapter 11, Streetcars and Light Rail Transit, Chapter 13, Heavy Rail Transit. Other sectors on your own

Fuels and Energy Conversion

Tuesday, September 13	Petroleum Refining (MOR) <i>Reading:</i> International Council on Clean Transportation (ICCT 2011) Introduction to Petroleum Refining and the Production of Ultra Low Sulfur Gasoline and Diesel Fuel
Thursday, September 15	IC Engine Operations (RLG) <i>Reading:</i> Guensler (2012), Transportation and Air Quality Planning, Chapter 6 (Manuscript) Engine Operations
Tuesday, September 20	Electric and Hybrid Vehicles (RLG) <i>Reading:</i> TBD
Thursday, September 22	Electric Utilities (RLG) <i>Reading:</i> Santini, Danilo. "Plug-in Hybrid Electric Vehicles." IA-HEV 2014 Task 15 Report. (2014). Joshua S. Graff Zivin, Matthew J. Kotchen, Erin T. Mansur, Spatial and Temporal Heterogeneity of Marginal Emissions: Implications for Electric Cars and Other Electricity-Shifting Policies, Journal of Economic Behavior & Organization, Available online 24 March 2014, ISSN0167-2681, http://dx.doi.org/10.1016/j.jebo.2014.03.010 .
Tuesday, September 27	Electricity Distribution (MOR) <i>Reading:</i> TBD

Midterm Student Presentations (Week 7)

Thursday, September 29	Transportation System Component and Alternative Energy Subsystem Presentations (all) Personal transportation, transit, heavy rail freight, intermodal, ports, marine, aviation, etc. Electricity, CNG/LNG, biofuels, etc. (by feedstock source) <i>Reading:</i> None
Tuesday, October 4	Transportation System Component and Alternative Energy Subsystem Presentations (all) Personal transportation, transit, heavy rail freight, intermodal, ports, marine, aviation, etc. Electricity, CNG/LNG, biofuels, etc. (by feedstock source) <i>Reading:</i> None
Thursday, October 6	Transportation System Component and Alternative Energy Subsystem Presentations (all) Personal transportation, transit, heavy rail freight, intermodal, ports, marine, aviation, etc. Electricity, CNG/LNG, biofuels, etc. (by feedstock source) <i>Reading:</i> None
Tuesday, October 11	NO CLASS, Fall Break

GREET Modeling

Thursday, October 13	GREET (MOR) <i>Reading:</i> Argonne National Labs GREET Website: greet.es.anl.gov
Tuesday, October 18	GREET Hands-On (HL) <i>Reading:</i> Plevin, Richard J., Mark A. Delucchi, and Felix Creutzig. "Using Attributional Life Cycle Assessment to Estimate Climate-Change Mitigation Benefits Misleads Policy Makers." <i>Journal of Industrial Ecology</i> 18.1 (2014): 73-83.
Thursday, October 20	The Transit Fuel and Emission Calculator (RLG) <i>Reading:</i> Gbologah, F., Y. Xu, M. Rodgers, and R. Guensler (2014). "Demonstrating a Bottom-up Framework for Evaluating Energy and Emission Performance of Various Electric Rail Transit Options." <i>Transportation Research Record</i> . Number 2428. pp. 10-17. National Academy of Sciences. Washington, DC. 2014. Xu, Y., D. Lee, F. Gbologah, G. Cernjul, V. Elango, M. Rodgers, R. Guensler (2013). "Load-Based Life-Cycle Greenhouse Gas Emissions Calculator for Transit Buses; An Atlanta, GA Case Study." <i>Proceedings of the 2nd T&DI Green Streets, Highways and Development Conference</i> , pp. 284-294. Austin, TX. November 3-6, 2013
Tuesday, October 25	Ultra-lighting and Other Efficiency Improvements (MOR) <i>Reading:</i> Lotus Engineering, Inc. (2010). <i>An Assessment of Mass Reduction Opportunities for a 2017-2020 Model Year Vehicle Program</i> . The International Council on Clean Transportation. March 2010.

Alternative Fuels

Thursday, October 27	Solar and Wind (MOR) <i>Reading:</i> How to Lose Half a Trillion Euros.” The Economist, October 12th, 2013. pp 27-29. Delucchi, M.A., and M.Z. Jacobson (2013). "Meeting the World’s Energy Needs Entirely with Wind, Water and Solar Power." Bulletin of the Atomic Scientists 69.4 (2013): 30-40.
Tuesday, November 1	Biofuels (MOR) or guest <i>Reading:</i> U.S. Department of Energy, <i>Biofuels Primer</i> ; Institute for Paper Science and Technology, <i>Biomass to Biofuels Primer</i>
Thursday, November 5	CNG as a Transportation Fuel - Production and Distribution (MOR) <i>Reading:</i> TBD
Tuesday, November 8	Shale Oil Production and Distribution (MOR) <i>Reading:</i> TBD
Thursday, November 10	Nuclear Power (RLG or guest) <i>Reading:</i> TBD

Special Presentations (all tentative)

Tuesday, November 15	MARTA Operations Tour (CNG facility) <i>Reading:</i> None
Thursday, November 17	Energy Policy (GHG with MB) <i>Reading:</i>
Tuesday, November 22	Managing Transportation Demand (RLG) <i>Reading:</i> Guensler, R. (2015). Transportation Demand Management Strategies. Work in Progress & Alternative Vehicle Demonstration
Thursday, November 24	NO CLASS, Thanksgiving <i>Reading:</i> None

Prepare for Presentations and Thanksgiving

Tuesday, November 29	Final Presentations <i>Reading:</i> None
Thursday, December 1	Final Presentations <i>Reading:</i> None

Conclusions

Tuesday, December 6	Final Presentations <i>Reading:</i> None
Thursday, December 8	Class End