Código/*Code* Nome/*Name*

COX000 Energy and Environmental Input-Ouput Analysis

Carga Horária/*Class hours*: 45 **Período/*Academic term*: 1**

Créditos ECTS estimados/*Corresponding ECTS*: 7.5

Professores / *Professors*

Amaro Pereira

Pre-requisitos e habilidades necessárias / *Course prerequisites and required skills*

Level:
☒ Designed for Ph.D./D.Sc. students
☒ Designed for students with a complete Engineering Diploma (5 years)
☒ Designed for students with a Bachelor Diploma (3 years) and at least one complete year of Master course (M1).

Engineering Program:
This is an Energy Planning Program discipline. The students should be enrolled in one of COPPE's program.

Prerequisites: There is no prerequisites.
Required skills: No special skill required.

Língua e avaliação do curso / *Language and Course Evaluation*

Language: This discipline is taught in English. Is expected English proficiency.

Course Evaluation:
20%: General participation (measured by attendance and commentaries on reading materials in class).
30%: Seminar.
50%: Term paper

Grading Scale: A (maximum), B, C or D (not approved)
Regular attendance is required. Absences affect your final grade.

Objetivos e Motivação / Objectives and Motivation

The course gives an overview of Input-Output (IO) Analysis focused on energy and environmental applications. The initial modules are more theoretical, but the idea of the course is that students learn how to manipulate the tool from the analysis of several case studies and practical examples.

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Ementa / Syllabus

The classes are structured as follows:
Module 1:
(Lecture 1)
1. Foundations of IO Analysis
2. Origins of the Theory
3. Applications of IO Analysis
(Lecture 2)
4. Regional IO Analysis
5. Interregional IO Analysis
6. Multiregional IO Analysis

Module 2:
(Lecture 3)
7. Database of IO Matrix
8. Handling Symmetric and Asymmetric Matrices
(Lecture 4)
9. Brazilian IO Matrix
10. Economic Analysis with Brazilian IO Matrix

Module 3:
(Lecture 5)
11. IO Multipliers
(Lecture 6)
12. Non-Survey Methods
(Lecture 7)

Module 4:
(Lecture 8)
13. Energy Analysis
14. Energy IO Matrix
(Lecture 9)
15. Environmental IO Matrix
(Lecture 10)
16. Social Accounting Matrix
17. Energy Models
18. Computable General Equilibrium Model

Bibliografia / Bibliography

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GUILHOTO, Joaquim J.M. “Análise de Insumo-Produto: Teoria E Fundamentos”. USP, 2004.
MILLER, R.E.; BLAIR, P.D. “Input-output analysis”. Prentice-Hall, 1985.
GUILHOTO, J.J.M.; SESSO FILHO, U.A. “estimação da matriz insumo-produto a partir de dados preliminares das contas nacionais”. TD Nereus 13. São Paulo, 2004.
RAMOS, Roberto L. O. “Matriz Insumo-Produto Brasil”. Série Relatórios Metodológicos – v.18. IBGE, 1997.
GUILHOTO, Joaquim J.M. “Análise de Insumo-Produto: Teoria E Fundamentos”. USP, 2004.
MILLER, R.E.; BLAIR, P.D. “Input-output analysis”. Prentice-Hall, 1985.
PEREIRA JR., A. O.; SOARES, J.S.; ARAÚJO, M.A.; LA ROVERE, E.L.; COSTA, R.C. “Modelos Energéticos: Uma Proposta de Planejamento Integrado”. In: V Congresso Brasileiro de Planejamento Energético, 2006.
THURLOW, James. “A Dynamic Computable General Equilibrium (CGE) Model for South Africa: Extending the Static IFPRI Model”. Trade and Industrial Policy Strategies. Working Paper 1, 2004.
LOFGREN, Hans; HARRIS, Rebecca L.; ROBINSON, Sherman; THOMAS, Marcelle; EL-SAID, Moataz. A Standard Computable General Equilibrium (CGE) Model in GAMS. Microcomputers in Policy Research 5. International Food Policy Research Institute, 2002.
COSTA, Ricardo Cunha da. “Do model structures affect findings? Two energy consumption and CO2 emission scenarios for Brazil in 2010”. Energy Policy (2001), 29, pp.777-785.
MONTOYA, Marco A.; LOPES, Ricardo L.; GUILHOTO, Joaquim J.M. “Desagregação Setorial do Balanço Energético Nacional a partir dos Dados da Matriz Insumo-Produto: Uma Avaliação Metodológica”. TD NEREUS 05-2013. São Paulo, 2013.

Seminars: Students must choose one of the papers below to present its content in 15 minutes.

1. ANDERSON, C. W., SANTOS, J. R., & HAIMES, Y. Y. (2007). “A Risk-based Input–Output Methodology for Measuring the Effects of the August 2003 Northeast Blackout”. Economic Systems Research, 19(785020476), 183–204. doi:10.1080/09535310701330233
2. COHEN, C., LENZEN, M., & SCHAEFFER, R. (2005). “Energy requirements of households in Brazil”. Energy Policy, 33(2005), 555–562. doi:10.1016/j.enpol.2003.08.021
3. DIETZENBACHER, E., LENZEN, M., LOS, B., GUAN, D., LAHR, M. L., SANCHO, F., YANG, C. (2013). “Input–Output Analysis: the Next 25 Years”. Economic Systems Research, 25(December), 369–389. doi:10.1080/09535314.2013.846902
4. HAWKINS, T., HENDRICKSON, C., HIGGINS, C., MATTHEWS, H. S., & SUH, S. (2007). “A mixed-unit input-output model for environmental life-cycle assessment and material flow analysis”. Environmental Science & Technology, 41(3), 1024–1031. doi:10.1021/es060871u
5. SANTOS, J. R. (2006). “Inoperability input-output modeling of disruptions to interdependent economic systems”. Systems Engineering, 9(1), 20–34. doi:10.1002/sys.20040
6. WACHSMANN, U., Wood, R., Lenzen, M., & Schaeffer, R. (2009). “Structural decomposition of energy use in Brazil from 1970 to 1996”. Applied Energy, 86(4), 578–587. doi:10.1016/j.apenergy.2008.08.003
7. WOOD, R., & LENZEN, M. (2009). “Structural path decomposition”. Energy Economics, 31(3), 335–341. doi:10.1016/j.eneco.2008.11.003
8. XU, W., HONG, L., HE, L., WANG, S., & CHEN, X. (2011). “Supply-driven dynamic inoperability input-output price model for interdependent infrastructure systems”, (December), 151–162. doi:10.1061/(ASCE)IS.1943-555X.0000058
9. CHEN, S., & CHEN, B. (2015). Urban energy consumption: Different insights from energy flow analysis, input–output analysis and ecological network analysis. Applied Energy, 138, 99–107. doi:10.1016/j.apenergy.2014.10.055
10. CROWTHER, K. G., & HAIMES, Y. Y. (2005). Application of the inoperability input-output model (IIM) for systemic risk assessment and

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