- For SLCA, quantitative and qualitative social impact indicators are needed which are usually difficult to obtain and most of the times subjective.

4. Prerequisites and context

Students can benefit of a previous familiarity with LCA methodology, though it is not essential.

This module is complementary of the 'Technology Assessment' module developed by UFZ, where SLCA is explained and an exercise proposed for students based on developing a SLCA for geothermal energy application. The Technology Assessment module provides a general overview of LCA which may be useful to undertake before this module if students are not familiar with LCA.

5. Learning outcomes

a) Knowledge

a. students will be able to grab the importance of SLCA and contextualize the methodology;

b. students will learn the steps needed to design and conduct a SLCA;

c. students will be able to explain the characteristics of a suitable sustainability indicator framework;

d. students will be aware of the difficulties in obtaining values for indicators on social themes;

e. students will be able to provide compelling examples of the importance of social issues in real energy projects at different scales.

b) Skills

a. Students will be able to understand the design of a SLCA;

b. students will be able synthetize the findings in a report;

c. students will be able to define a number of sustainability indicators;

d. students will be able to estimate values for social indicators.

c) Social competencies

a. Students will be able work in teams in a collaborative atmosphere;

b. students will be able to discuss/debate ideas with an open mind.

6. Form of classes

This module is divided into two sessions.

1. The first session (1 h 30') is a lecture introducing SLCA, which contains a group work on social indicators

2. In the second session (2 h 15'), the students working in teams will develop a SLCA based on a case study introduced at the end of the first session.

Students will read some aspects of the case study using the provided reading material between the two sessions and will prepare, in teams, a presentation to be shown at the beginning of the second session.

At the end of the second session, students need to compile, as a homework, their analyses in a report.

7. Teaching methods

- Lecture
- Power Point Presentation
- Group work
- Discussion.

8. General classes plan

1. ***Session 1: Introduction – SLCA (2x45 min):*** Sustainability Assessment, Social Assessment Methods, Indicators, Introduction to Life Cycle Assessment, Social LCA methodology, SLCA case studies in the energy field,

i. 10 min introduce of the concept of sustainability assessment by the teacher, stressing its important in the energy field.

ii. 30 min Presentation and group work on indicators.

iii. 30 min Introduction to Life Cycle Assessment, to the Social Assessment Methods, and to the SLCA Methodology.

iv. 15 min SLCA case studies in the energy field, which exemplify the usefulness of the approach.

v. 10 min preparation for session 2.

2. Session 2 Develop a S-LCA analysis (3x45)

i. 20 min presentation of the case study (by a team of students).

ii. 5 min remainder by the teacher of the basic SLCA steps.

iii. 95 min Workshop on SLCA development following the main framework (group work on different aspects, and open discussions).

iv. 15 min final discussion on the quality of the work done and the limitations of the methodology.

Materials needed

Power point presentation + computer + additional files provided with the TM.

Printed Handouts for the activity in the first session (if students don't bring their laptops).

For the second session students should bring at least one laptop per team (in this case, all the handouts can be used in their electronic form).

9. Literature and other materials

Sustainability assessment

1. Bhandari, Ramchandra, Lena Ganda Saptalena, Wolfgang Kusch. Sustainability assessment of a micro hydropower plant in Nepal. "Energy, Sustainability and Society" 2018, Vol. 8, Issue 3. DOI: 10.1186/s13705-018-0147-2

2. Dizarglu, Didem. The role of indicator-based sustainability assessment in policy and the decision-making process: A review and Outlook. "Sustainability" 2017, Vol. 9, Issue 6. DOI: 10.3390/su9061018

3. Freudenburg, R. William. Social impact assessment. "Annual Review of Sociology" 1986, Vol. 12, pp. 451-478. DOI: 10.1146/annurev.so.12.080186.002315

4. Ness, Barry et al. Categorising tools for sustainability assessment. "Ecological Economics" 2007, Vol. 60, Issue 3. DOI: 10.1016/j.ecolecon.2006.07.023

5. Waas, Tom et al. Sustainability assessment and indicators: Tools in a decision-making strategy for sustainable development. "Sustainability" 2014, Vol. 6, Issue 9. DOI: 10.3390/su6095512

Social Life Cycle assessment

1. Ciroth, Andreas, Franziska Eisfeldt. 2016. A Product Social Impact Life Cycle Assessment database. PSILCA Understanding social impacts. https://nexus.openlca.org/ws/files/9062

2. Ekener-Petersen, Elisabeth, Jonas Höglund, Göran Finnveden. Screening potential social impacts of fossil fuels and biofuels for vehicles. "Energy Policy" 2014, Vol. 73, pp. 416–426. DOI : 10.1016/j.enpol.2014.05.034

3. Fan, Yi et al. 2015. A Review of Social Life Cycle Assessment Methodologies. In: Muthu, S. Subramanian (ed.). Social Life Cycle Assessment. Springer, Singapore, pp. 1-24. DOI: 10.1007/978-981-287-296-8_1

4. Kuzeva, Denitsa. 2018. Evaluation of the social impacts of a Smart Grid implementation in the resort city of Albena, Bulgaria using the SLCA methodology. It is unpublished and it can be found in the support material: TM4-S2-RM4

5. Manik, Yosef, Jessica E. Leahy, Anthony Halog. Social life cycle assessment of palm oil biodiesel: a case study in Jambi Province of Indonesia. "The International Journal of Life Cycle Assessment" 2013, Vol. 18, pp. 1386–1392. DOI: 10.1007/s11367-013-0581-5

6. Petti, Luigia, Monica Serreli,Silvia Di Cesare. Systematic literature review in social life cycle assessment. "The International Journal of Life Cycle Assessment" 2018, Vol. 23, Issue 3, pp. 422–431. DOI: 10.1007/s11367-016-1135-4

7. Ren, Jingzheng et al. Prioritization of bioethanol production pathways in China based on life cycle sustainability assessment and multicriteria decision-making. "The International Journal of Life Cycle Assessment" 2015, Vol. 20, Issue 6, pp. 842–853. DOI: 10.1007/s11367-015-0877-8

8. Rugani, Benedetto et al. Towards prospective life cycle sustainability analysis: exploring complementarities between social and environmental life cycle assessments for the case of Luxembourg's energy system. "Matériaux & Techniques" 2014, Vol. 102, Issue 6-7, p.

605. DOI: 10.1051/mattech/2014043

9. Sala, Serenella. 2015. Social Life Cycle Assessment – State of the art and challenges for supporting product policies. JRC Technical Report. DOI: 10.2788/253715.

10. Traverso, Marzia et al. Toward s life cycle sustainability assessment: An implementation to photovoltaic modules. "The International Journal of Life Cycle Assessment" 2012, Vol. 17, Issue 8, pp. 1068–1079. DOI: 10.1007/s11367-012-0433-8

11. UNEP-SETAC. 2009. Guidelines for social life cycle assessment of products. United Nations Environment Programme. http://www.unep.org/pdf/DTIE_PDFS/DTIx1164xPA-guidelines_sLCA.pdf

12. UNEP-SETAC. 2013. The methodological sheets for subcategories in Social Life Cycle Assessment. https://www.lifecycleinitiative.org/wp-content/uploads/2013/11/S-LCA_methodological_sheets_11.11.13.pdf

13. Weldegiorgis, S. Fitsum, Daniel M. Franks. Social dimensions of energy supply alternatives in steelmaking: Comparison of biomass and coal production scenarios in Australia. "Journal of Clean Production" 2014, Vol. 84, Issue 1. DOI: 10.1016/j.jclepro.2013.09.056

14. International Renewable Energy Agency. 2016. Renewable Energy Benefits: Measuring The Economics. IRENA, Abu Dhabi. https://www.irena.org/documentdownloads/publications/irena_measuring-the-economics_2016.pdf

Additional resources

1. Bond, Alan, Angus Morrison-Saunders, Jenny Pope. Sustainability assessment: The state of the art. "Impact Assessment and Project Appraisal" 2012, Vol. 30, Issue 1. DOI: 10.1080/14615517.2012.661974

2. Botelho, Anabela et al. Social sustainability of renewable energy sources in electricity production: An application of the contingent valuation method. "Sustainable Cities and Society" 2016, Vol. 26. DOI: 10.1016/j.scs.2016.05.011

3. Carneiro, Aurora et al. Sustainability, Energy and Development: A Proposal of Indicators. "International Journal for Infonomics" 2012, Vol. 5, Issue 1/2. Online. DOI: 10.20533/iji.1742.4712.2012.0060

4. Colantonio, Andrea. 2009. Social sustainability: a review and critique of traditional versus emerging themes and assessment methods. In: Horner, Malcolm et al. (eds.). Sue-Mot Conference 2009: Second International Conference on Whole Life Urban Sustainability and Its Assessment: Conference Proce. Loughborough University, Loughborough.

5. EPLCA European Platform On Life Cycle Assessment https://eplca.jrc.ec.europa.eu/

6. GRI. 2011. Sustainability Reporting Guidelines. Global Reporting Initiative https://www.globalreporting.org/resourcelibrary/G3.1-Guidelines-Incl-Technical-Protocol.pdf

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11. Mancini, Lucia et al. 2018. Social assessment of raw materials supply chains: A life-cycle-based analysis. JRC Technical reports. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC112626/social_risk_technical_report_third_review_round_final_18_01_19_online.pdf

12. Popovic, Tamara et al. Quantitative indicators for social sustainability assessment of society and product responsibility aspects in supply chains. "Journal of International Studies" 2017, Vol. 10, Issue 4. DOI: 10.14254/2071-8330.2017/10-4/1

13. Santoyo-Castelazo, Edgar, Adisa Azapagic. Sustainability assessment of energy systems: integrating environmental, economic and social aspects. "Journal of Cleaner Production" 2014, Vol. 80, Issue 1. DOI: 10.1016/j.jclepro.2014.05.061

14. Shiau, Tzay-An, Ji-Kai Chuen-Yu. Developing an Indicator System for Measuring the Social Sustainability of Offshore Wind Power Farms. "Sustainability" 2016, Vol. 8, Issue 5. DOI: 10.3390/su8050470

15. Whitton, John et al. Conceptualizing a social sustainability framework for energy infrastructure decisions. "Energy Research & Social Science" 2015, Vol. 8. DOI: 10.1016/j.erss.2015.05.010

16. Wolf, Marc-Andree et al. 2012. The International Reference Life Cycle Data System (ILCD) Handbook. JRC Reference Reports. https://

eplca.jrc.ec.europa.eu/uploads/JRC-Reference-Report-ILCD-Handbook-Towards-more-sustainable-production-and-consumption-for-a-resource-efficient-Europe.pdf

17. Wu, Ruqun, Dan Yang, Jiquan Chen. Social Life Cycle Assessment Revisited. “Sustainability” 2015, Vol. 6, Issue 6. DOI: 10.3390/su6074200