



# Document details

< Back to results | 1 of 1

Export Download Print E-mail Save to PDF Add to List More... >

[Full Text](#) View at Publisher

International Journal of Life Cycle Assessment  
Volume 25, Issue 9, 1 September 2020, Pages 1749-1766

## Are large-scale dams environmentally detrimental? Life-cycle environmental consequences of mega-hydropower plants in Myanmar (Article) [\(Open Access\)](#)

Aung, T.S.<sup>a,b</sup> ✉, Fischer, T.B.<sup>c,d</sup> ✉, Azmi, A.S.<sup>b</sup> 👤

<sup>a</sup>Asia Center, Faculty of Arts and Sciences, Harvard University, CGIS South, 1730, Cambridge St, Cambridge, MA 02138, United States

<sup>b</sup>Department of Biotechnology Engineering, Faculty of Engineering, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, 53100, Malaysia

<sup>c</sup>Environmental Assessment and Management Research Centre, School of Environmental Sciences, University of Liverpool, Liverpool, L69 7ZQ, United Kingdom

[View additional affiliations](#) ∨

### Abstract

[View references \(75\)](#)

**Purpose:** Rivers control biophysical processes that underpin essential ecosystem services. Myanmar's rivers provide great opportunities for increasing energy supply at low costs from hydropower plants and make important contributions to the national economy. However, associated environmental impacts, as well as input and output flows of hydropower developments, remain less well understood. In this paper, we report on an investigation of the overall environmental effects of five hydropower plants in Myanmar, using a life-cycle impact assessment (LCIA) approach. The primary objective of the paper is to generate detailed life-cycle inventory data and quantify the environmental impacts of the existing five hydropower plants in Myanmar. **Material and method:** This paper reports on a "cradle to grave" LCIA for five hydropower plants in which environmental impacts associated with construction, operation and maintenance, transportation, and decommissioning of large-scale hydropower plants in Myanmar were systematically assessed. **Results:** Construction, transportation, operation and maintenance phases are most sensitive to global warming, mineral resource depletion, acidification, freshwater aquatic ecotoxicity, human toxicity and photochemical ozone creation. There is heterogeneity in hydropower plants' effects on the environment, based on the size of the power plant. **Conclusion:** Strategic selection of hydropower projects is suggested to enhance resilience in environmentally sensitive areas. It is concluded that more comprehensive and rigorous environmental and social impact assessment (ESIA) is needed, not only for mega-dams but also for the smaller-scale hydropower plants. [Figure not available: see fulltext.]. © 2020, Springer-Verlag GmbH Germany, part of Springer Nature.

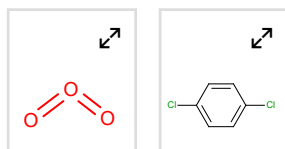
### SciVal Topic Prominence ⓘ

Topic: Life Cycle Assessment | Payback | Solar Collectors

Prominence percentile: 99.070 ⓘ

### Chemistry database information ⓘ

#### Substances



#### Author keywords

Metrics ⓘ [View all metrics](#) >



PlumX Metrics ∨

Usage, Captures, Mentions, Social Media and Citations beyond Scopus.

Cited by 0 documents

Inform me when this document is cited in Scopus:

[Set citation alert](#) >

[Set citation feed](#) >

### Related documents

Life cycle assessment of run-of-river hydropower plants in the Peruvian Andes: a policy support perspective

Verán-Leigh, D. , Vázquez-Rowe, I.  
(2019) *International Journal of Life Cycle Assessment*

Evaluation of the life cycle greenhouse gas emissions from hydroelectricity generation systems

Kadiyala, A. , Kommalapati, R. , Huque, Z.  
(2016) *Sustainability (Switzerland)*

Can hydropower still be considered a clean energy source? Compelling evidence from a middle-sized hydropower station in China

Li, X. , Gui, F. , Li, Q.  
(2019) *Sustainability (Switzerland)*

[View all related documents based on references](#)

Find more related documents in Scopus based on:

[Authors](#) > [Keywords](#) >

## Indexed keywords

### EMTREE drug terms:

carbon dioxide carbon monoxide copper fossil fuel iron methane mineral  
ozone sulfur dioxide

### EMTREE medical terms:

acidification aquatic environment Article carbon footprint construction work  
dam (barrier) ecotoxicity electric power plant energy resource  
environmental decision making environmental impact environmental impact assessment  
environmental parameters environmental policy environmental protection  
environmental resilience freshwater environment greenhouse effect  
human toxicity potential hydropower life cycle assessment Myanmar photochemistry  
priority journal scientist sensitivity analysis traffic and transport uncertainty

## Chemicals and CAS Registry Numbers:

carbon dioxide, 124-38-9, 58561-67-4; carbon monoxide, 630-08-0; copper, 15158-11-9, 7440-50-8; iron, 14093-02-8, 53858-86-9, 7439-89-6; methane, 74-82-8; ozone, 10028-15-6; sulfur dioxide, 7446-09-5

ISSN: 09483349

CODEN: IJLCF

Source Type: Journal

Original language: English

DOI: 10.1007/s11367-020-01795-9

Document Type: Article

Publisher: Springer

## References (75)

[View in search results format >](#)

All  Export  Print  E-mail  Save to PDF  Create bibliography

- 1 Andersson-Skold, Y., Grennfelt, P., Pleijel, K.  
Photochemical ozone creation potentials: A study of different concepts  
(1992) *Journal of the Air and Waste Management Association*, 42 (9), pp. 1152-1158. Cited 53 times.  
doi: 10.1080/10473289.1992.10467060  
[View at Publisher](#)
- 2 Asdrubali, F., Baldinelli, G., D'Alessandro, F., Scrucca, F.  
Life cycle assessment of electricity production from renewable energies: Review and results harmonization  
(2015) *Renewable and Sustainable Energy Reviews*, 42, pp. 1113-1122. Cited 132 times.  
doi: 10.1016/j.rser.2014.10.082  
[View at Publisher](#)
- 3 (2015)  
Myanmar energy master plan The Government of the Republic of the Union of Myanmar National Energy Management Committee (Issue December), Assesed 25 Nov 2019  
[http://www.burmalibrary.org/docs22/2015-12-Myanmar\\_Energy\\_Master\\_Plan.pdf](http://www.burmalibrary.org/docs22/2015-12-Myanmar_Energy_Master_Plan.pdf)
- 4 Aung, T.S., Shengji, L., Condon, S.  
Evaluation of the environmental impact assessment (EIA) of Chinese EIA in Myanmar: Myitsone Dam, the Lappadaung Copper Mine and the Sino-Myanmar oil and gas pipelines  
(2019) *Impact Assessment and Project Appraisal*, 37 (1), pp. 71-85. Cited 2 times.  
<http://www.tandfonline.com/toc/tiap20/current>  
doi: 10.1080/14615517.2018.1529948  
[View at Publisher](#)

- 
- 5 Barros, N., Cole, J.J., Tranvik, L.J., Prairie, Y.T., Bastviken, D., Huszar, V.L.M., Del Giorgio, P., (...), Roland, F.  
Carbon emission from hydroelectric reservoirs linked to reservoir age and latitude  
(2011) *Nature Geoscience*, 4 (9), pp. 593-596. Cited 377 times.  
doi: 10.1038/ngeo1211  
[View at Publisher](#)
- 
- 6 Botelho, A., Ferreira, P., Lima, F., Pinto, L.M.C., Sousa, S.  
Assessment of the environmental impacts associated with hydropower  
(2017) *Renewable and Sustainable Energy Reviews*, 70, pp. 896-904. Cited 36 times.  
doi: 10.1016/j.rser.2016.11.271  
[View at Publisher](#)
- 
- 7 Bragagnolo, C., Geneletti, D., Fischer, T.B.  
Cumulative effects in SEA of spatial plans - evidence from Italy and England ([Open Access](#))  
(2012) *Impact Assessment and Project Appraisal*, 30 (2), pp. 100-110. Cited 29 times.  
doi: 10.1080/14615517.2012.677522  
[View at Publisher](#)
- 
- 8 Briones Hidrovo, A., Uche, J., Martínez-Gracia, A.  
Accounting for GHG net reservoir emissions of hydropower in Ecuador  
(2017) *Renewable Energy*, 112, pp. 209-221. Cited 25 times.  
<http://www.journals.elsevier.com/renewable-and-sustainable-energy-reviews/>  
doi: 10.1016/j.renene.2017.05.047  
[View at Publisher](#)
- 
- 9 Brizmohun, R., Ramjeawon, T., Azapagic, A.  
Life cycle assessment of electricity generation in Mauritius  
(2015) *Journal of Cleaner Production*, 106, pp. 565-575. Cited 44 times.  
doi: 10.1016/j.jclepro.2014.11.033  
[View at Publisher](#)
- 
- 10 Chen, C., Habert, G., Bouzidi, Y., Jullien, A.  
Environmental impact of cement production: detail of the different processes and cement plant variability evaluation  
(2010) *Journal of Cleaner Production*, 18 (5), pp. 478-485. Cited 217 times.  
doi: 10.1016/j.jclepro.2009.12.014  
[View at Publisher](#)
- 
- 11 Dapice, D.  
(2015) *Hydropower in Myanmar: Moving Electricity Contracts from Colonial to Commercial*. Cited 2 times.  
December  
<https://ash.harvard.edu/links/hydropower-myanmar-moving-electricity-contracts-colonial-commercial>
- 
- 12 Dapice, D.  
(2016) *To Build Or Not to Build? Designing Sustainable Hydro for Federalism in Myanmar*  
Issue February, Assesed 25 Nov 2019  
[https://ash.harvard.edu/files/ash/files/20160219\\_to\\_build\\_or\\_not\\_to\\_build\\_designing\\_sustainable\\_hydro\\_projects\\_in\\_myanmar\\_eng.pdf?m=1456347698](https://ash.harvard.edu/files/ash/files/20160219_to_build_or_not_to_build_designing_sustainable_hydro_projects_in_myanmar_eng.pdf?m=1456347698)
-

- 13 Ding, N., Liu, J., Yang, J., Yang, D.  
Comparative life cycle assessment of regional electricity supplies in China  
(2017) *Resources, Conservation and Recycling*, 119, pp. 47-59. Cited 30 times.  
[www.elsevier.com/locate/resconrec](http://www.elsevier.com/locate/resconrec)  
doi: 10.1016/j.resconrec.2016.07.010  
[View at Publisher](#)
- 
- 14 Dorber, M., May, R., Verones, F.  
Modeling Net Land Occupation of Hydropower Reservoirs in Norway for Use in Life Cycle Assessment  
([Open Access](#))  
(2018) *Environmental Science and Technology*, 52 (4), pp. 2375-2384. Cited 8 times.  
<http://pubs.acs.org/journal/esthag>  
doi: 10.1021/acs.est.7b05125  
[View at Publisher](#)
- 
- 15 Edelen, A., Ingwersen, W.  
(2016) *Guidance on Data Quality Assessment for Life Cycle Inventory Data (Issue June)*. Cited 20 times.  
Assesed 25 Nov 2019  
[https://cfpub.epa.gov/si/si\\_public\\_record\\_report.cfm?dirEntryId=321834%0Ahttps://cfpub.epa.gov/si/si\\_public\\_file\\_download.cfm?p\\_download\\_id=528687](https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=321834%0Ahttps://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=528687)
- 
- 16 Erlewein, A.  
Disappearing rivers - The limits of environmental assessment for hydropower in India  
(2013) *Environmental Impact Assessment Review*, 43, pp. 135-143. Cited 52 times.  
doi: 10.1016/j.eiar.2013.07.002  
[View at Publisher](#)
- 
- 17 Fearnside, P.M.  
Greenhouse gas emissions from Brazil's Amazonian hydroelectric dams ([Open Access](#))  
(2016) *Environmental Research Letters*, 11 (1), art. no. 011002. Cited 25 times.  
<http://iopscience.iop.org/article/10.1088/1748-9326/11/1/011002/pdf>  
doi: 10.1088/1748-9326/11/1/011002  
[View at Publisher](#)
- 
- 18 Fearnside, P.M.  
Greenhouse gas emissions from hydroelectric dams in tropical forests  
(2016) *Alternative Energy and Shale Gas Encyclopedia*, pp. 426-436. Cited 8 times.  
<https://doi.org/10.1002/9781119066354.ch42>
- 
- 19 Felix, M., Gheewala, S.H.  
Environmental assessment of electricity production in Tanzania  
(2012) *Energy for Sustainable Development*, 16 (4), pp. 439-447. Cited 25 times.  
<http://www.elsevier.com>  
doi: 10.1016/j.esd.2012.07.006  
[View at Publisher](#)
- 
- 20 Fthenakis, V., Kim, H.C.  
Land use and electricity generation: A life-cycle analysis  
(2009) *Renewable and Sustainable Energy Reviews*, 13 (6-7), pp. 1465-1474. Cited 250 times.  
doi: 10.1016/j.rser.2008.09.017  
[View at Publisher](#)
-

- 21 Gagnon, L., Van De Vate, J.F.  
Greenhouse gas emissions from hydropower: The state of research in 1996  
(1997) *Energy Policy*, 25 (1), pp. 7-13. Cited 112 times.  
doi: 10.1016/s0301-4215(96)00125-5  
[View at Publisher](#)
- 
- 22 Gagnon, L., Bélanger, C., Uchiyama, Y.  
Life-cycle assessment of electricity generation options: The status of research in year 2001  
(2002) *Energy Policy*, 30 (14), pp. 1267-1278. Cited 271 times.  
doi: 10.1016/S0301-4215(02)00088-5  
[View at Publisher](#)
- 
- 23 Garcia, R., Marques, P., Freire, F.  
Life-cycle assessment of electricity in Portugal  
(2014) *Applied Energy*, 134, pp. 563-572. Cited 65 times.  
<http://www.elsevier.com/inca/publications/store/4/0/5/8/9/1/index.htm>  
doi: 10.1016/j.apenergy.2014.08.067  
[View at Publisher](#)
- 
- 24 Geller, M.T.B., Meneses, A.A.D.M.  
Life cycle assessment of a small hydropower plant in the Brazilian amazon ([Open Access](#))  
(2016) *Journal of Sustainable Development of Energy, Water and Environment Systems*, 4 (4), pp. 379-391. Cited 10 times.  
<http://www.sdwes.org/jsdwes/dp811f67c1d37070633255fb58d9d621bcd06e6e9>  
doi: 10.13044/j.sdwes.2016.04.0029  
[View at Publisher](#)
- 
- 25 Goleman, D., Boyatzis, R., Mckee, A.  
Iron and steel  
(2019) *J Chem Inf Model*, 53 (9), pp. 1689-1699. Cited 913 times.
- 
- 26 Gorelick, N., Hancher, M., Dixon, M., Ilyushchenko, S., Thau, D., Moore, R.  
Google Earth Engine: Planetary-scale geospatial analysis for everyone ([Open Access](#))  
(2017) *Remote Sensing of Environment*, 202, pp. 18-27. Cited 1306 times.  
[www.elsevier.com/inca/publications/store/5/0/5/7/3/3](http://www.elsevier.com/inca/publications/store/5/0/5/7/3/3)  
doi: 10.1016/j.rse.2017.06.031  
[View at Publisher](#)
- 
- 27 Günkaya, Z., Özdemir, A., Özkan, A., Banar, M.  
Environmental performance of electricity generation based on resources: A life cycle assessment case study in Turkey ([Open Access](#))  
(2016) *Sustainability (Switzerland)*, 8 (11), art. no. 1097. Cited 25 times.  
<http://www.mdpi.com/2071-1050/8/11/1097/pdf>  
doi: 10.3390/su8111097  
[View at Publisher](#)
- 
- 28 Haberl, H., Erb, K.H., Krausmann, F., Gaube, V., Bondeau, A., Plutzer, C., Gingrich, S., (...), Fischer-Kowalski, M.  
Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems ([Open Access](#))  
(2007) *Proceedings of the National Academy of Sciences of the United States of America*, 104 (31), pp. 12942-12947. Cited 822 times.  
doi: 10.1073/pnas.0704243104  
[View at Publisher](#)
-

29 Han, K.T.  
Possible socio-economic consequences of the hydropower dams on the downstream communities: case study Hatgyi dam  
(2018) *Soc Anthropol*, 6 (2), pp. 237-251. Cited 2 times.

---

30 Hertwich, E.G.  
Addressing biogenic greenhouse gas emissions from hydropower in LCA  
  
(2013) *Environmental Science and Technology*, 47 (17), pp. 9604-9611. Cited 73 times.  
doi: 10.1021/es401820p  
  
View at Publisher

---

31 Hondo, H.  
Life cycle GHG emission analysis of power generation systems: Japanese case  
  
(2005) *Energy*, 30 (11-12 SPEC. ISS.), pp. 2042-2056. Cited 349 times.  
[www.elsevier.com/inca/publications/store/4/8/3/](http://www.elsevier.com/inca/publications/store/4/8/3/)  
doi: 10.1016/j.energy.2004.07.020  
  
View at Publisher

---

32 Strategic environmental assessment of the Myanmar hydropower sector  
(2018) *In the World Bank*, 69 (5).  
<https://doi.org/10.1080/00119253.1968.9940266>

---

33 (2015) *Small scale hydro power Pacific energy projects: impacts on nature and people*  
IUCN, Fiji Island

---

34 Kare, S., Lomite, H.  
(2009) *Impact of Construction Material on Environment-(Steel & Concrete)*. Cited 2 times.  
Dissertation, University College of Boras

---

35 Development or destruction?  
(2018) *The Human Rights Impacts of Hydropower Development on Villagers in Southeast Myanmar*  
Assessed 24 Nov 2019  
[www.khrg.org](http://www.khrg.org)

---

36 Khosravi, F., Jha-Thakur, U., Fischer, T.B.  
The role of environmental assessment (EA) in Iranian water management  
  
(2019) *Impact Assessment and Project Appraisal*, 37 (1), pp. 57-70. Cited 7 times.  
<http://www.tandfonline.com/toc/tiap20/current>  
doi: 10.1080/14615517.2018.1526998  
  
View at Publisher

---

37 Kibler, K.M., Tullos, D.D.  
Cumulative biophysical impact of small and large hydropower development in Nu River, China  
  
(2013) *Water Resources Research*, 49 (6), pp. 3104-3118. Cited 103 times.  
doi: 10.1002/wrcr.20243  
  
View at Publisher

---

- 38 Kirchherr, J., J. Charles, K., Walton, M.J.  
The interplay of activists and dam developers: the case of Myanmar's mega-dams (Open Access)  
(2017) *International Journal of Water Resources Development*, 33 (1), pp. 111-131. Cited 35 times.  
<http://www.tandf.co.uk/journals/titles/07900627.asp>  
doi: 10.1080/07900627.2016.1179176  
View at Publisher
- 
- 39 Koch, F.H.  
Hydropower - The politics of water and energy: Introduction and overview  
(2002) *Energy Policy*, 30 (14), pp. 1207-1213. Cited 39 times.  
doi: 10.1016/S0301-4215(02)00081-2  
View at Publisher
- 
- 40 Labouze, E., Honoré, C., Moulay, L., Couffignal, B., Beekmann, M.  
Photochemical ozone creation potentials: A new set of characterization factors for different gas species on the scale of Western Europe  
(2004) *International Journal of Life Cycle Assessment*, 9 (3), pp. 187-195. Cited 13 times.  
<http://www.springerlink.com/content/0948-3349>  
doi: 10.1007/BF02994193  
View at Publisher
- 
- 41 Liu, K.F.-R., Ko, C.-Y., Fan, C., Chen, C.-W.  
Incorporating the LCIA concept into fuzzy risk assessment as a tool for environmental impact assessment  
(2013) *Stochastic Environmental Research and Risk Assessment*, 27 (4), pp. 849-866. Cited 13 times.  
doi: 10.1007/s00477-012-0621-x  
View at Publisher
- 
- 42 Mahasenan, N., Smith, S., Humphreys, K.  
The cement industry and global climate change: Current and potential future cement industry CO2 emissions  
(2002) *Greenhouse Gas Control Technologies - 6Th International Conference*. Cited 101 times.
- 
- 43 Mallia, E., Lewis, G.  
Life cycle greenhouse gas emissions of electricity generation in the province of Ontario, Canada  
(2013) *International Journal of Life Cycle Assessment*, 18 (2), pp. 377-391. Cited 39 times.  
doi: 10.1007/s11367-012-0501-0  
View at Publisher
- 
- 44 (2010) *Koppen-Geiger Climate Zones of Myanmar (1986-2010) 90°*  
Assessed 25 Feb 2020  
<http://themimuinfo/>
- 
- 45 Naik, T.R.  
Sustainability of cement and concrete industries  
(2005) *Proceedings of the International Conference on Achieving Sustainability in Construction*, pp. 141-150. Cited 21 times.  
ISBN: 0727734040; 978-072773404-4  
doi: 10.1680/asic.34044.0017  
View at Publisher
-

- 46 (2000) *MOD17A3H.006: Terra Net Primary Production Yearly Global 500M*  
Assessed 25 Feb 2020  
[https://developers.google.com/earth-engine/datasets/catalog/MODIS\\_006\\_MOD17A3H](https://developers.google.com/earth-engine/datasets/catalog/MODIS_006_MOD17A3H)
- 
- 47 Opperman, J., Hartmann, J., Raepple, J., Angarita, H., Beames, P., Chapin, E., Geressu, R., (...), Shirley, R.  
(2017) *The Power of Rivers: A Business Case*. Cited 4 times.  
The Nature Conservancy, USA
- 
- 48 Pacca, S.  
Impacts from decommissioning of hydroelectric dams: A life cycle perspective  
(2007) *Climatic Change*, 84 (3-4), pp. 281-294. Cited 36 times.  
doi: 10.1007/s10584-007-9261-4  
[View at Publisher](#)
- 
- 49 Pang, M., Zhang, L., Wang, C., Liu, G.  
Environmental life cycle assessment of a small hydropower plant in China  
(2015) *International Journal of Life Cycle Assessment*, 20 (6), pp. 796-806. Cited 29 times.  
<http://www.springerlink.com/content/0948-3349>  
doi: 10.1007/s11367-015-0878-7  
[View at Publisher](#)
- 
- 50 Pascale, A., Urmee, T., Moore, A.  
Life cycle assessment of a community hydroelectric power system in rural Thailand  
(2011) *Renewable Energy*, 36 (11), pp. 2799-2808. Cited 51 times.  
doi: 10.1016/j.renene.2011.04.023  
[View at Publisher](#)
- 
- 51 Peng, D., Zhang, B., Wu, C., Huete, A.R., Gonsamo, A., Lei, L., Ponce-Campos, G.E., (...), Wu, Y.  
Country-level net primary production distribution and response to drought and land cover change  
(2017) *Science of the Total Environment*, 574, pp. 65-77. Cited 17 times.  
[www.elsevier.com/locate/scitotenv](http://www.elsevier.com/locate/scitotenv)  
doi: 10.1016/j.scitotenv.2016.09.033  
[View at Publisher](#)
- 
- 52 Potter, C., Klooster, S., Genovese, V., Hiatt, C.  
Forest production predicted from satellite image analysis for the Southeast Asia region ([Open Access](#))  
(2013) *Carbon Balance and Management*, 8 (1), art. no. 9. Cited 8 times.  
<http://www.cbmjournal.com/content/8/1/9>  
doi: 10.1186/1750-0680-8-9  
[View at Publisher](#)
- 
- 53 Premakumara, D.G.J., Hengesbaugh, M., Hlaing, O.M.T.  
(2016) *Quick Study on Waste Management in Myanmar*  
First National/City Workshops for Developing National/City Waste Management Strategies in Myanmar, June, 13–17  
<https://pub.iges.or.jp/pub/quick-study-waste-management-myanmar-current>
-



□ 54 Rao, R.V.  
Large and small dams  
(1989) *International Journal of Water Resources Development*, 5 (2), pp. 136-142. Cited 2 times.  
doi: 10.1080/07900628908722425  
View at Publisher

---

□ 55 Ribeiro, F.d.M., da Silva, G.A.  
Life-cycle inventory for hydroelectric generation: a Brazilian case study  
(2010) *Journal of Cleaner Production*, 18 (1), pp. 44-54. Cited 70 times.  
doi: 10.1016/j.jclepro.2009.09.006  
View at Publisher

---

□ 56 Santoyo-Castelazo, E., Gujba, H., Azapagic, A.  
Life cycle assessment of electricity generation in Mexico  
(2011) *Energy*, 36 (3), pp. 1488-1499. Cited 95 times.  
[www.elsevier.com/inca/publications/store/4/8/3/](http://www.elsevier.com/inca/publications/store/4/8/3/)  
doi: 10.1016/j.energy.2011.01.018  
View at Publisher

---

□ 57 Santoyo-Castelazo, E., Azapagic, A.  
Sustainability assessment of energy systems: Integrating environmental, economic and social aspects  
(Open Access)  
(2014) *Journal of Cleaner Production*, 80, pp. 119-138. Cited 244 times.  
doi: 10.1016/j.jclepro.2014.05.061  
View at Publisher

---

□ 58 Siddiqui, O., Dincer, I.  
Comparative assessment of the environmental impacts of nuclear, wind and hydro-electric power plants in Ontario: A life cycle assessment  
(2017) *Journal of Cleaner Production*, 164, pp. 848-860. Cited 21 times.  
doi: 10.1016/j.jclepro.2017.06.237  
View at Publisher

---

□ 59 Simpson, A.  
Challenging hydropower development in Myanmar (Burma): cross-border activism under a regime in transition  
(2013) *Pacific Review*, 26 (2), pp. 129-152. Cited 36 times.  
doi: 10.1080/09512748.2012.759264  
View at Publisher

---

□ 60 Song, C., Gardner, K.H., Klein, S.J.W., Souza, S.P., Mo, W.  
Cradle-to-grave greenhouse gas emissions from dams in the United States of America  
(2018) *Renewable and Sustainable Energy Reviews*, 90, pp. 945-956. Cited 16 times.  
doi: 10.1016/j.rser.2018.04.014  
View at Publisher

---

□ 61 Blanc, E., Strobl, E.  
Is small better? A comparison of the effect of large and small dams on cropland productivity in South Africa  
(2014) *World Bank Economic Review*, 28 (3), art. no. lht026, pp. 545-576. Cited 15 times.  
<http://wber.oxfordjournals.org/>  
doi: 10.1093/wber/lht026  
View at Publisher

---

- 62 Suwanit, W., Gheewala, S.H.  
Life cycle assessment of mini-hydropower plants in Thailand  
(2011) *International Journal of Life Cycle Assessment*, 16 (9), pp. 849-858. Cited 38 times.  
<http://www.springerlink.com/content/0948-3349>  
doi: 10.1007/s11367-011-0311-9  
View at Publisher
- 
- 63 (2016) *Improving hydropower outcomes through system-scale planning: an example from Myanmar*. Cited 4 times.  
The Nature Conservancy, Manchester
- 
- 64 Tremblay, A.  
(2005) *Greenhouse gas emission fluxes and processes*. Cited 119 times.  
Springer, London
- 
- 65 Tremblay, A.  
(2005) *Greenhouse gas emissions—fluxes and processes: hydroelectric reservoirs and natural environments*. Cited 119 times.  
Springer, London
- 
- 66 Tsai, L.S.  
Gender and hydropower in Myanmar today  
(2015) *Australian Aid*  
Assessed 16 Nov 2019  
[https://www.oxfam.org.au/wp-content/uploads/2015/09/2015-30-Myanmar-Country-Report\\_FA\\_WEB.pdf](https://www.oxfam.org.au/wp-content/uploads/2015/09/2015-30-Myanmar-Country-Report_FA_WEB.pdf)
- 
- 67 Turconi, R., Boldrin, A., Astrup, T.  
Life cycle assessment (LCA) of electricity generation technologies: Overview, comparability and limitations  
(2013) *Renewable and Sustainable Energy Reviews*, 28, pp. 555-565. Cited 286 times.  
doi: 10.1016/j.rser.2013.08.013  
View at Publisher
- 
- 68 Turconi, R., Tonini, D., Nielsen, C.F.B., Simonsen, C.G., Astrup, T.  
Environmental impacts of future low-carbon electricity systems: Detailed life cycle assessment of a Danish case study  
(2014) *Applied Energy*, 132, pp. 66-73. Cited 34 times.  
<http://www.elsevier.com/inca/publications/store/4/0/5/8/9/1/index.htm>  
doi: 10.1016/j.apenergy.2014.06.078  
View at Publisher
- 
- 69 Varun, Prakash, R., Bhat, I.K.  
Life cycle greenhouse gas emissions estimation for small hydropower schemes in India  
(2012) *Energy*, 44 (1), pp. 498-508. Cited 43 times.  
[www.elsevier.com/inca/publications/store/4/8/3/](http://www.elsevier.com/inca/publications/store/4/8/3/)  
doi: 10.1016/j.energy.2012.05.052  
View at Publisher
-

70 Verán-Leigh, D., Vázquez-Rowe, I.  
Life cycle assessment of run-of-river hydropower plants in the Peruvian Andes: a policy support perspective  
(2019) *International Journal of Life Cycle Assessment*, 24 (8), pp. 1376-1395. Cited 6 times.  
<http://www.springerlink.com/content/0948-3349>  
doi: 10.1007/s11367-018-01579-2  
[View at Publisher](#)


71 Wang, C., Myint, S.W., Hutchins, M.  
The assessment of deforestation, forest degradation, and carbon release in myanmar 2000-2010  
(2019) *Environmental Change in the Himalayan Region: Twelve Case Studies*, pp. 47-64.  
<http://dx.doi.org/10.1007/978-3-030-03362-0>  
ISBN: 978-303003362-0; 978-303003361-3  
doi: 10.1007/978-3-030-03362-0\_3  
[View at Publisher](#)

72 Weidema, B.P., Wesnæs, M.S.  
Data quality management for life cycle inventories-an example of using data quality indicators  
(1996) *Journal of Cleaner Production*, 4 (3-4), pp. 167-174. Cited 474 times.  
doi: 10.1016/S0959-6526(96)00043-1  
[View at Publisher](#)

73 Zakrzewski, S.F.  
(2002) *Environmental Toxicology*. Cited 18 times.  
Oxford University Press

74 Zhang, Q., Karney, B., MacLean, H.L., Feng, J.  
Life-cycle inventory of energy use and greenhouse gas emissions for two hydropower projects in China  
(2007) *Journal of Infrastructure Systems*, 13 (4), pp. 271-279. Cited 37 times.  
doi: 10.1061/(ASCE)1076-0342(2007)13:4(271)  
[View at Publisher](#)

75 Zhang, J., Xu, L., Li, X.  
Review on the externalities of hydropower: A comparison between large and small hydropower projects in Tibet based on the CO<sub>2</sub> equivalent  
(2015) *Renewable and Sustainable Energy Reviews*, 50, pp. 176-185. Cited 25 times.  
doi: 10.1016/j.rser.2015.04.150  
[View at Publisher](#)

 Aung, T.S.; Asia Center, Faculty of Arts and Sciences, Harvard University, CGIS South, 1730, Cambridge St, Cambridge, MA, United States; email:[thirishwesinaung@fas.harvard.edu](mailto:thirishwesinaung@fas.harvard.edu)  
© Copyright 2020 Elsevier B.V., All rights reserved.

## About Scopus

[What is Scopus](#)  
[Content coverage](#)  
[Scopus blog](#)  
[Scopus API](#)  
[Privacy matters](#)

## Language

[日本語に切り替える](#)  
[切换到简体中文](#)  
[切换到繁體中文](#)  
[Русский язык](#)

## Customer Service

[Help](#)  
[Contact us](#)

