

Sylvain Leduc



Research Scholar
Ecosystems Services and Management Program
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Current Position

Research Scholar

Responsible for the development of the techno-economic model BeWhere (www.iiasa.ac.at/bewhere), International Institute for Applied System Analysis (IIASA), Laxenburg, Austria

Education

Doctoral Thesis

June 2009, Luleå University of Technology, Luleå, Sweden

Subject: Development of an Optimization Model for the Location of Biofuel Production Plants

Licentiate Degree

December 2004, Luleå University of Technology, Luleå, Sweden

Subject: Study of the Reduction of Particle Emissions and Borate Black Liquor Gasification in Bioenergy Systems

Bachelor of Science

October 2000, École Supérieure de l'Énergie et des Matériaux, ESEM (High engineering school of energy and material), Orléans, France

Languages

French	Mother tongue
English	Fluent
Swedish	Fluent
German	Advanced

Computer Skills

Operative System	Windows, MAC, LINUX, UNIX
Programming	Python, Matlab, GAMS, Pascal, Fortran, C, HTML
Software	Computational Fluid Dynamics (CFD): FLUENT, CFX GIS: ArcMap Mechanical: I-deas Process Engineering: ASPENplus

Professional Experience

Aug 2007-on going

Research scholar, International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria

Mar 2002-Jul 2007

PhD student, Division of Energy Engineering, Luleå University of Technology, Luleå, Sweden

Oct 2000-Feb 2002

Military service (Coopération pour le service militaire français)

Division of Energy Engineering, Luleå University of Technology, Luleå, Sweden

Apr-Sep 2000

Engineer internship, Nuclear power plant at Sydkraft, Oskarshamn, Sweden

Luleå University of Technology, Luleå, Sweden

Supervision

Co-supervisor of 8 PhD students

Supervisor of 25 summer students at IIASA

Advisory board

Advisory board member of the European Project Clim2Power - Translating Climate Data into Power Plant Operational Guidance

Follow-up committee member for the doctoral thesis of Ms Hoang Anh Tran on “Clean energy, green growth and equity in Vietnam”.

Articles in Peer Reviewed Journals

1. García-Velásquez, C., **Leduc, S.**, van der Meer, Y. (2022). Design of biobased supply chains on a life cycle basis: A bi-objective optimization model and a case study of biobased polyethylene terephthalate (PET). *Sustainable Production and Consumption*, 30 706–719.
2. Mohd Idris, M.N., **Leduc, S.**, Yowargana, P., Hashim, H., Kraxner, F. (2021). Spatio-temporal assessment of the impact of intensive palm oil-based bioenergy deployment on cross-sectoral energy decarbonization. *Applied Energy*, 285 116460.
3. Harahap, F., **Leduc, S.**, Mesfun, S., Khatiwada, K., Kraxner, F., Silveira, S. (2020). Meeting the bioenergy targets from palm oil based biorefineries: An optimal configuration in Indonesia. *Applied Energy*, 278 115749.
4. Meng, Y., Liu, J., **Leduc, S.**, Mesfun, S., Kraxner, F., Mao, G., Qi, W., & Wang, Z. (2020). Hydropower production benefits more from 1.5°C than 2°C climate scenario. *Water Resources Research* 56 (5): e2019WR025519.
5. Mandová, H., Patrizio, P., **Leduc, S.**, Kjærstad, J., Wang, C., Wetterlund, E., Kraxner, F., Gale, W. (2019). Achieving carbon-neutral iron and steelmaking in Europe through the deployment of bioenergy with carbon capture and storage. *Journal of Cleaner Production*, 218:118–129.
6. Harahap, F., **Leduc, S.**, Mesfun, S., Khatiwada, K., Kraxner, F., Silveira, S. (2019). Opportunities to Optimize the Palm Oil Supply Chain in Sumatra, Indonesia. *Energies*, 12(3):420.

7. Truong, A.H, Patrizio, P., **Leduc, S.**, Kraxner, F., Ha-Duong, M. (2019). Reducing emissions of the fast growing Vietnamese coal sector: the chances offered by biomass co-firing. *Journal of Cleaner Production*, 215:1301–1311.
8. Patrizio, P., **Leduc, S.**, Kraxner, F., Fuss, S., Kindermann, G., Mesfun, S., Spokas, K., Mendoza, A., Mac Dowell, N., Wetterlund, E., Lundgren, J., Dotzauer, E., Yowargana, P., Obersteiner, M. (2018). Reducing US coal emissions can boost employment. *Joule*, 2:1–16.
9. Xylia, M., **Leduc, S.**, Laurent, A-B., Patrizio, P., van der Meer, Y., Kraxner, F., Silveira, S. (2018). Impact of bus electrification on carbon emissions: the case of Stockholm. *Journal of Cleaner Production*, 209:74–87.
10. Mesfun, S., **Leduc, S.**, Patrizio, P., Wetterlund, E., Mendoza-Ponce, A., Lammens, T., Staritsky, I., Elbersen, B., Lundgren, J., Kraxner, F. (2018). Spatio-temporal assessment of integrating intermittent electricity in the EU and Western Balkans power sector under ambitious CO₂ emission policies. *Energy*, 164:676–693.
11. Mendoza-Ponce, A., Corona-Núñez, R., Kraxner, F., **Leduc, S.**, Patrizio, P. (2018). Identifying effects of land use cover changes and climate change on terrestrial ecosystems and carbon stocks in Mexico. *Global Environmental Change*, 53:12–23.
12. Zetterholm, J., Pettersson, K., **Leduc, S.**, Mesfun, S., Lundgren, J., Wetterlund, E. (2018). Resource efficiency or economy of scale: Biorefinery supply chain configurations for co-gasification of black liquor and pyrolysis liquids. *Applied Energy*, 230:912–924.
13. Mandova, H., **Leduc, S.**, Wang, C., Wetterlund, E., Patrizio, P., Gale, W., Kraxner, F. (2018). Possibilities for CO₂ emission reduction using biomass in European integrated steel plants. *Biomass and Bioenergy*, 115:231–243.
14. Xylia, M., **Leduc, S.**, Patrizio, P., Kraxner, F., Silveira, S. (2017). Developing a dynamic optimization model for electric bus charging infrastructure. *Transportation Research Procedia*, 27:776–783.
15. Silveira, S., Khatiwada, D., **Leduc, S.**, Kraxner, F., Venkata, BK., Tilvikine, V., Gaubye, V., Romagnoli, F., et al. (2017). Opportunities for bioenergy in the Baltic Sea Region. *Energy Procedia* 128:157–164.
16. Ghafghazi, S., Lochhead, K., Mathey, AH., Forsell, N., **Leduc, S.**, Mabee, W., Bull, G. (2017) Estimating Mill Residue Surplus in Canada: A Spatial Forest Fiber Cascade Modeling Approach. *Forest Products Journal*, 67:205–218.
17. Xylia, M., **Leduc, S.**, Patrizio, P., Kraxner, F., Silveira, S. (2017). Locating charging infrastructure for electric buses in Stockholm. *Transportation Research Part C*, 78:183–200.
18. Mesfun, S., Sanchez, D.L., **Leduc, S.**, Wetterlund, E., Lundgren, J., Biberacher, M., Kraxner, F. (2017). Power-to-gas and power-to-liquid for managing renewable electricity intermittency in the Alpine Region. *Renewable Energy*, 107:361–372.
19. Patrizio, P., **Leduc, S.**, Chinese, D., Kraxner, F. Internalizing the external costs of biogas supply chains in the Italian energy sector. *Energy*, 125:85–96.
20. Schipfer, F., Kranzl, L., Leclere, D., **Leduc, S.**, Forsell, N., Valin, H. (2017). Advanced biomaterials scenarios for the EU28 up to 2050 and their respective biomass demand. *Biomass and Bioenergy*, 96:19–27.
21. Hetland, J. Yowargana, P., **Leduc, S.**, Kraxner, F. (2016). Carbon-negative emissions: Systemic impacts of biomass conversion. A case study on CO₂ capture and storage options. *International Journal of Greenhouse Gas Control*, 49:330–342.
22. Campana, P.E., **Leduc, S.**, Lim, M., Olsson, A., Zhang, J., Liu, J., Kraxner, F., McCallum, I., Li, H., Yan, J. (2017). Suitable and optimal locations for implementing photovoltaic water pumping systems for grassland irrigation in China. *Applied Energy*, 185(2):1879–1889.

23. van Vliet, M.T.H., Wiberg, D., **Leduc, S.**, Riahi, K. (2016). Power-generation system vulnerability and adaptation to changes in climate and water resources. *Nature climate change*, 6:375–380.
24. Kraxner, F., Aoki, K., Kindermann, G., **Leduc, S.**, Albrecht, F., Liu, J., Yamagata, Y. (2016). Bioenergy and the city - What can urban forests contribute? *Applied Energy*, 165:990–1003.
25. Khatiwada, D., **Leduc, S.**, Silveira, S., McCallum, I. (2016). Optimizing ethanol and bioelectricity production in sugarcane biorefineries in Brazil. *Renewable Energy*, 85:371–386.
26. Slegers, P.M., **Leduc, S.**, Wijffels, R.H., van Straten, G., van Boxtel, A.J.B. (2015). Logistic analysis of algae cultivation. *Bioresource Technology*, 179:314–322.
27. Campana, P.E., **Leduc, S.**, Kim, M., Liu, J., Kraxner, F., McCallum, I., Li, H., Yan, J. (2015). Optimal grassland locations for sustainable photovoltaic water pumping systems in China. *Energy Procedia*, 75:301–307.
28. Patrizio, P., **Leduc, S.**, Chinese, D., Dotzauer, E., Kraxner, F. (2015). Biomethane as transport fuel - A comparison with other biogas utilization pathways in northern Italy. *Applied Energy*, 157:25–34.
29. Kraxner, F., **Leduc, S.**, Fuss, S., Aoki, K., Kindermann, G., Yamagata, Y. (2014). Energy Resilient Solutions for Japan - a BECCS Case Study. *Energy Procedia*, 61:2791–2796.
30. Wang, S., Wang, S., Lovett, A., Zhong, J., Taylor, G., **Leduc, S.**, Firth, S., Smith, P. (2014). Significant contribution of energy crops to heat and electricity needs in Great Britain to 2050. *BioEnergy Research*. 7(3):919–926.
31. Kraxner, F., Aoki, K., **Leduc, S.**, Kindermann, G., Fuss, S., Yang, J., Yamagata, Y., Tak, K., Obersteiner, M. (2014). BECCS in South Korea - Analyzing the negative emissions potential of bioenergy as a mitigation tool. *Renewable Energy*. 61:102–108.
32. Mosnier, A., Havlík, P., Obersteiner, M., Aoki, K., Schmid, E., Fritz, S., McCallum, I., **Leduc, S.** (2014). Modeling impact of development trajectories and a global agreement on reducing emissions from deforestation on Congo Basin forests by 2030. *Environmental and Resource Economics*. 57:505–525.
33. Natarajan, K., **Leduc, S.**, Pelkonen, P., Tomppo, E., Dotzauer, E. (2014). Optimal locations for second generation Fischer Tropsch biodiesel production in Finland. *Renewable Energy*, 62:319–330.
34. Wetterlund, E., **Leduc, S.**, Dotzauer, E., Kindermann, G. (2013). Optimal use of forest residues in Europe under different policies - second generation biofuels versus combined heat and power. *Biomass Conversion and Biorefinery*, 3 (1):3–16.
35. Schmidt, J., Schönhart, M., Biberacher, M., Guggenberger, T., Hausl, S., Kalt, G., **Leduc, S.**, Schardinger, I., Schmid, E. (2012). Regional energy autarky: potentials, costs and consequences for an Austrian region. *Energy Policy*, 47:211–221.
36. Seebach, L., McCallum, I., Fritz, S., Kindermann, G., **Leduc, S.**, Böttcher, H., Fuss, S. (2012). Choice of forest map has implications for policy analysis: a case study on the EU biofuel target. *Environmental science & policy*, 22:13–24.
37. **Leduc, S.**, Wetterlund, E., Dotzauer, E., Kindermann, G. (2012). CHP or biofuel production in Europe? *Energy Procedia*, 20:40–49.
38. Natarajan, K., **Leduc, S.**, Pelkonen, P., Tomppo, E., Dotzauer, E. (2011). Optimal locations for methanol and CHP production in Eastern Finland. *Bioenergy Research*, 5 (2):412–423.
39. Wetterlund, E., **Leduc, S.**, Dotzauer, E., Kindermann, G. Optimal localisation of biofuel production on a European scale. *Energy*, 41(1):462–472.

40. Havlík, P., Schneider, U. A., Schmid, E., Bottcher, H., Fritz, S., Skalský, R., Aoki, K., DeCara, S., Kindermann, G., Kraxner, F., **Leduc, S.**, McCallum, I., Mosnier, A., Sauer, T., Obersteiner, M. (2011). Global land-use implications of first and second generation biofuel targets. *Energy Policy*, 39(10):5690–5702.
41. Schmidt, J., **Leduc, S.**, Dotzauer, E., Schmid, E. (2011). Cost-effective policy instruments for greenhouse gas emission reduction and fossil fuel substitution through bioenergy production in Austria. *Energy Policy*, 39(6):3261–3280.
42. Schmidt, J., **Leduc, S.**, Dotzauer, E., Kindermann, G., Schmid, E. (2010). Potential of biomass-fired combined heat and power plants considering the spatial distribution of biomass supply and heat demand. *International Journal of Energy Research*, 34(11):970–985.
43. Schmidt, J., **Leduc, S.**, Dotzauer, E., Kindermann, G., Schmid, E. (2010). Cost-effective CO2 emission reduction through heat, power and biofuel production from woody biomass: A spatially explicit comparison of conversion technologies. *Applied Energy*, 87(7):2128–2141.
44. **Leduc, S.**, Starfelt, F., Dotzauer, E., Kindermann, G., McCallum, I., Obersteiner, M., Lundgren, J. (2010). Optimal location of lignocellulosic ethanol refineries with polygeneration in Sweden. *Energy*, 35(6):2709–2716.
45. **Leduc, S.**, Lundgren, J., Franklin, O., Dotzauer, E. (2010). Location of a biomass based methanol production plant: A dynamic problem in northern Sweden. *Applied Energy*, 87(1):68–75.
46. **Leduc, S.**, Natarajan, K., Dotzauer, E., McCallum, I., Obersteiner, M. (2009). Optimizing Biodiesel Production in India. *Applied Energy*, 86(1):125–131.
47. Schmidt, J., **Leduc, S.**, Dotzauer, E., Kindermann, G., Schmid, E. (2009). Biofuel Production in Austria Considering the Use of Waste Heat: a Study on Costs and Potentials of Greenhouse Gas Reduction. *Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie*, 18(3):107–116.
48. **Leduc, S.**, Schmid, E., Obersteiner, M., Riahi, K. (2009). Methanol Production by Gasification Using a Geographically Explicit Model. *Biomass and Bioenergy*, 33(5):745–751.
49. **Leduc, S.**, Schwab, D., Dotzauer, E., Schmid, E., Obersteiner, M. (2008). Optimal Location of Wood Gasification Plants for Methanol Production with Heat Recovery. *International Journal of Energy Research*, 32(12):1080–1091.
50. **Leduc, S.**, Fredriksson, C., Hermansson, R. (2006). Particle-tracking Option in Fluent Validated by Simulation of a Low-pressure Impactor. *Advanced Powder Technology*, 17(1):99–111.

Books & Book Chapters

1. Patrizio, P., **Leduc, S.**, Kraxner, F., Fuss, S., Kindermann, G., Spokas, K., Wetterlund, E., Lundgren, J., Yowargana, P., Obersteiner, M. (2019). Chapter 11 - Killing two birds with one stone: a negative emissions strategy for a soft landing of the US coal sector. In: *Bioenergy with Carbon Capture and Storage - Using Natural Resources for Sustainable Development*. London, pp 219-236. ISBN: 978-0-12-816229-3.
2. Elbersen, B., Forsell, N., **Leduc, S.**, Staritsky, I., Witzke, P., Ramirez-Almeyda, J. (2017). Existing modelling platforms for biomass supply in Europe. In: *Modeling and optimization of supply chains, top down and bottom-up assessment for agricultural, forest and waste feedstock*. London, pp 25-54. ISBN: 978-0-12-812303-4.
3. Annevelink, B., Anttila, P., Väättäinen, K., Gabrielle, B., Garcia-Galindo, D., **Leduc, S.**, Staritsky, I. (2017). Modeling biomass logistics. In: *Modeling and optimization of supply chains, top down and bottom-up assessment for agricultural, forest and waste feedstock*. London, pp 79-104. ISBN: 978-0-12-812303-4.
4. Kraxner, F., **Leduc, S.**, Serrano León, H., Fuss, S., Patrizio, P., Yowargana, P. (2016). Expanding renewable energy within the Alpine ecological network. In: *Alpine Nature 2030 Creating*

- [ecological] connectivity for generations to come. Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), Berlin, pp. 93-97. ISBN 978-3-00-053702-8.
5. **Leduc, S.**, Kraxner, F., Serrano León, H., Vettorato, D., Garegnani, G., Poljanec, A., Hastik, R., Geitner, C., Berchtolddomig, M., Cilloi, M., Geri, F., Grilli, G., Gros, J., Kralj, T., Sacchelli, S., Vrščaj, B., Zambelli, P. Decision support systems. p29-59, in Sustainable Renewable Energy Planning in the Alps - A handbook for experts & decision makers, 2015, ISBN: 978-3-200-04346-6.
 6. Balest, J., Bertin, S., Curetti, G., D'Alonzo, V., Berchtolddomig, M., Garegnani, G., Grilli, G., Haimerl, G., Kraxner, F., Kuenzer, N., **Leduc, S.**, Miotello, F., Petrinjak, A., Piske, R., Poljanec, A., Portaccio, A., Serrano León, H., Simončič, T., Zambelli, P., Zangrando, E. Renewable energy exploitation and ecosystem services: Alpine region and pilot area analysis. p70-120, in Sustainable Renewable Energy Planning in the Alps - A handbook for experts & decision makers, ISBN: 978-3-200-04346-6.
 7. **Leduc, S.**, Wetterlund, E., Dotzauer, E., Schmidt, J., Natarajan, K., Khatiwada, D. Policies and modeling of energy systems for reaching European bioenergy targets. V. 6. p3165-3182, in J. Yan, Handbook of Clean Energy Systems, 2015, Chennai, ISBN: 978-1-118-38858-7.
 8. See, L., Kraxner, F., Fuss, S., Perger, C., Schill, C., Aoki, K., **Leduc, S.**, McCallum, I., Forsell, N., Fritz, S. The potential of crowdsourcing for the renewable energy sector. V.1. p721-735, in J. Yan, Handbook of Clean Energy Systems, 2015, Chennai, ISBN: 978-1-118-38858-7.
 9. Kraxner, F., Fuss, S., Krey, V., Best, D., **Leduc, S.**, Kindermann, G., Yamagata, Y., Schepaschenko, D., Shvidenko, A., Aoki, K., Yan, J. The role of bioenergy with carbon capture and storage (BECCS) for climate policy. V. 3. p1466-1483, in J. Yan, Handbook of Clean Energy Systems, 2015, Chennai, ISBN: 978-1-118-38858-7.
 10. **Leduc, S.**, Kindermann, G., Forsell, N., Kraxner, F. Bioenergy potential from forest biomass. Vol. 6. P. 35-48, in J. Yan, Handbook of Clean Energy Systems, 2015, Chennai, ISBN: 978-1-118-38858-7.
 11. Pelkonen, P., Mustonen, M., Asikainen, A., Egnell, G., Promode, K., **Leduc, S.**, Pettenella, D. (ed.). What Science Can Tell Us: Forest Bioenergy for Europe. European Forestry Institute, Joensuu, Finland. 2014, ISBN: 978-952-5980-11-0.
 12. Lindner, M., Gunia, K., Pekkanen, J.M, Goltsev, V., Anttila, M.P., Lehtonen, A.H.S., Mustonen, J., **Leduc, S.**, Böttcher, H., Dees, M., Boch, J., Van Brusselen, J., Verkerk, P.J. Forest Biomass, p29-87, in Vis, M., Dees, M., Biomass resource Assessment handbook. Saarbrücken, 2011, ISBN: 978-3-639-29018-9.

Other Publications

1. Wetterlund, E., Pettersson, K., Mossberg, J., Torén, J., Hoffstedt, C., von Schenck, A., Berglin, N., Lundmark, R., Lundgren, J., **Leduc, S.**, Kindermann, G. Optimal localisation of next generation biofuel production in Sweden. Rapport f3 2013:8, f3 Svenskt kunskapscentrum för förnybara drivmedel.
 2. Rametsteiner E., Nilsson S., Böttcher H., Havlik P., Kraxner F., **Leduc S.**, Obersteiner M., Rydzak F., Schneider U., Schwab D. and Willmore L. (2007) Study of the Effects of Globalization on the Economic Viability of EU Forestry. Final Report of the AGRI Tender Project: AGRI-G4-2006-06, EC Contract Number 30-CE-0097579/00-89, 291 pp. Available at: http://ec.europa.eu/agriculture/analysis/external/viability_forestry/index_en.htm.
- Fredriksson, C., Hermansson, R., **Leduc, S.** Förbättrad Utformning av Sekundär Förbränningszon i Vedpanna. Technical Report 2002, TPS-02-46.