Claus Leth Bak
Professor, Leader
AAU Energy
The Faculty of Engineering and Science
Electric Power Systems and Microgrids
Electric Power Systems and Microgrids
Intelligent Energy Systems and Flexible Markets
Type of address: Visiting address.
Pontoppidanstræde 111
1.002
9220
Aalborg Øst
Denmark
Email: clb@energy.aau.dk
Phone: +4599409281

Claus is 60 years old and holds 30 years of highly specialized experience within power systems and high voltage technology of theoretical, experimental, and practical issues. 5 years of engineering practice in transmission systems as well as 26 years of wide teaching and research experience in academia. His teaching has been acknowledged in evaluation studies from both students and industry. A very deep research experience within electric power transmission systems, especially related to electric power system transient studies, harmonics, power system protection and high voltage studies related to corona discharge, audible noise phenomena for overhead lines and new insulation materials. He is an expert in transmission underground cable electric performance. Besides this, he possesses a very broad knowledge of energy systems in general, and he is able pinpoint the key challenges in complex systems in both the view of theories, science, and practical real-life engineering. Claus has extensive experience and knowledge in PhD education both as a supervisor and manager. Claus has completed an intensive course in teambuilding and management held by Teambusiness.
In private life, Claus is married to Tine, and he has two grown children, Freja and Frida and me and Tine's 3-year-old son Vilhelm. He resides in Hammer Bakker north of Aalborg and owns a summer's cottage on the Island of Læsø. His main interests include nature (especially the wilderness of the Nordic countries), hiking in the mountains and along the Atlantic coastlines, competition clay shooting, analog photography and cooking from high quality raw materials.

He manages the Energy Technology PhD program at the Department of Energy Technology with +140 PhD students http://www.et.aau.dk/phd/ for 12 years (2011-2023).
• He is the Head of the Section of Electric Power Systems and Microgrids at the department of Energy Technology and a member of the management team of the department for 8 years. https://www.energy.aau.dk/about-the-department/research-staff#02c2eb73-a8fc-4d34-bfaa-014c9fdaacab and https://www.energy.aau.dk/about-the-department/management
• He is a member and chairman of the PhD board of the faculty of Engineering and Science at Aalborg University for 12 years.
• He is the founder and now Vice-head (previously head) of research program "Modern Power Transmission Systems https://www.energy.aau.dk/research/research-groups/powergrids
• Chairman of CIGRE Danish National Committee and CIGRE AdCo member and CIGRE Technical Council member
• He has taught, supervised, and researched numerous topics within electrical energy technology +25 years.

CV

• 1989-1992 Bachelor electrical power engineering, Ingeniørhøjskolen Århus Teknikum (stærkstrøm)
• 1992-1994 Master of science in electrical power engineering, Aalborg University (Cand. Polyt.)
• 1994-1999 Nordjyllandsværket power plant and transmission, project manager substations and relays
• 1999-2002 Assistant professor in dept. of Energy Technology
• 2002-2004 Research Associate professor in dept. of Energy Technology
• 2004-2011 Associate professor in dept. of Energy Technology
• 2015 PhD degree "EHV/HV underground cables in the transmission system", Aalborg University.
• 2011-2016 Professor with special responsibilities (MSO, eq. Full Professor) in dept. of Energy Technology
• 2016-present Full Professor in electric power systems and high voltage in dept. of Energy, AAU
PhD supervisor for +40 PhD's within Energy Technology and 14 PhD guests. He has supervised 8 industrial PhD's.
MSc supervisor for +40 master's Theses and 54 MSc (EPSH) projects
BSc supervisor for +11 bachelor's theses and 54 BSc (Energy) projects
External examiner (Denmark and abroad) for + 50 MSc and BSc theses
PhD examiner (Denmark and abroad) for 14 PhD theses

Services

• Member of Industrial Researcher Committee at Innovationsfonden
• Long-term senior member of IEEE PES and DEIS
• Elected member of CIGRE Technical Council 2020-2022.
• Main organizer of Cigré 2019 International Symposium in Aalborg, Denmark
• Co-organizes the CIGRE NRCC Symposium in Trondheim 2025
• Cigré National committee chairman for Denmark

• CIGRE Advisory Council member
• Cigré Study Committee C4 AG1 expert member
• Cigré study committee B5 member (from 2016-2022)
• Cigré study committee D1 member (from 2022-present)
• Nord-Is technical committee member and session chair
• Member of the board of representatives for Energimuseet
• Reviewer for IEEE transactions, Journal of EPSR, IET, CIGRE and conferences (+100 reviews)
• Driftsleder (Stærkstrømsbekendtgørelsen) in the MV laboratory
• Manages the high voltage laboratory and MV laboratory at AAU Energy
• Vice-chair of censorkorpset (external examiners board) for electronics, IT and energy

Research projects (selected)

• Leveraging AI in the Energy Management System to increase Efficiency and lower the Carbon Emissions towards a 100% Renewable Power System the Faroe Islands
• GoGet: Green Offshore Gas-electricity Transmission Pipeline
• HVDC GREEN: HVDC GRid for intErconnEcting Nusantara
• MESH: Large-Scale Energy Storage Systems Based on High Temperature Solid Oxide Electrolysis Cells and Biogas Methanation Technologies
• Development of Stability Screening Methodology for a 100 % Converter Based Power Systems
• DANPAC II The west coast 400 kV combined OHL/cable line with Energinet
• Ensuring grid stability and supply reliability in a 100% renewable electricity sector in the Faroe Islands
• DANPAC power cables for 150 kV and 400 kV transmission) 5 PhD's with Energinet
• Wind Farm Black Start Service Integration to Assure Resiliency in 100% Renewable Power Systems with ØRSTED
• PoPyFu Power Pylons of the Future
• SALS Smart adaptive load shedding
• HARMONY (together with prof. Blaabjerg as PI)
• COBRAcable with Energinet, TenneT and TUDelft
• Ensuring Grid Stability and Supply Reliability in a 100% Renewable Electricity Sector in the Faroe Islands, industrial joint degree PhD project with Faroese University and SEV.
• 4 industrial PhD projects with ØRSTED in the field of harmonics in offshore wind power plants and the transmission

Awards

• IEEE OAJPE Trending Topic Paper March 2021
• Wind Integration Workshop 2020 Best Papers Award
• CIGRE Technical Council award for C4 2020
• CIGRE Distinguished member award 2020
• IEEE PEDG 2016 Best paper Award
• IET DPSP 2014 Best paper Award

Selected publications representing research career

Total number of publications is approximately 475. These are to be found in http://vbn.aau.dk/da/persons/claus-leth-bak(731438f0-7c08-4746-81f6-61a32ebf4fad)/publications.html Five of my PhD students got their PhD thesis published in the Springer Outstanding Theses Series.

1. REVIEW OF AI IN ENERGY MANAGEMENT SYSTEMS IN ISOLATED HYBRID POWER SYSTEMS, Terji Nielsen, Helma Maria Tróndheim, Claus L Bak, Hannes Gislason, Høgni C Kamban, 9th Hybrid Power Plants & Systems Workshop | Åland Islands, Finland | 03 – 04 June 2025.
2. Unravelling High Temperature Induced Glass Transition Effect on Underlying Multi-timescales Dynamic Mechanisms of Epoxy Resin Insulation in Power Electronics Applications, Xize Dai, Rumi Alberto, Andrea Cavallini, Claus Leth Bak, Jian Hao, Ruijin Liao, Huai Wang, IEEE Transactions DEIS, 2024 (in press)
3. Harmonic Propagation Model for Analyses in Meshed Power Systems, Bjarne Søndergaard Bukh, Filipe da Silva, Claus Leth Bak, IEEE transactions on power delivery, 2023.
4. Determining Optimised Harmonic Filter Locations in a Meshed Power System – A Case Study from Denmark, Bjarne Søndergaard Bukh*, Vladislav Akhmatov, Chris Liberty Skovgaard, Filipe Miguel Faria da Silva, Claus Leth Bak, CIGRE Cairns 2023.
5. Fast Coordinated Power Control for Improving Inertial and Voltage Support Capability of Battery Energy Storage Systems, Zhen Gong, Chengxi Liu, Filipe Miguel Faria da Silva, Yonghao Gui, Claus Leth Bak, CSEE Journal of Power and Energy Systems, 2023.
6. Improved Zone 1 Top-line Tilting Scheme for Polygonal Distance Protection in the Outgoing Line of Type-4 Wind Parks, Kaiqi Ma, Hans Kristian Høidalen, Zhe Chen, Claus Leth Bak, CSEE Journal of Power and Energy Systems, 2023.
7. Multiphysics Digital Model of the High Frequency Transformer for Power Electronics Application Considering Electro-thermal Interactions, Zhaoxin Wang, Claus Leth Bak, Huai Wang, Henrik Sørensen, Filipe Miguel Faria da Silva, I E E E Transactions on Power Electronics, 2023.
8. The design and optimization of the down-lead system for a novel 400 kV composite pylon, Kai Yin, Mohammad Ghomi, Hanchi Zhang, Filipe Miguel Faria da Silva, Claus Leth Bak, Qian Wang, Henrik Skouboe, 2023.
9. Wind Turbine and Battery Storage Interoperability to Provide Black Start by Offshore Wind Farms, Daniela Pagnani, Lukasz Kocewiak, Jesper Hjerrild, Frede Blaabjerg, Claus Leth Bak, Ramon Blasco-Gimenez, Jaime Martínez-Turégano, CIGRE CSE journal, 2023.
10. Influence of pressure on the PD and induced aging behavior of polyimide insulation under repetitive pulse voltage, Changjiang. Zheng, Qian Wang, Zhan Shen, Claus Leth Bak, Filipe Faria da Silva, Huai Wang, IEEE Transactions on Dielectrics and Electrical Insulation, 2023.

11. Frequency and Voltage Stability Towards 100% Renewables in Suðuroy, Faroe Islands, H.M. TRÓNDHEIM, L. HOFMANN, P. GARTMANN, E. QUITMANN, C. LETH BAK, F. FARIA DA SILVA, T. NIELSEN, B.A. NICLASEN, CIGRE CSE Journal, 2022.
12. 100% Sustainable Electricity in the Faroe Islands: Expansion Planning through Economic Optimisation, Helma Maria Tróndheim, Bárður Arnsteinsson Niclasen, Terji Nielsen, Filipe Miguel Faria da Silva, Claus Leth Bak, IEEE Open Access Journal of Power and Energy 2021. BEST PAPER AWARD
13. A droop line tracking control for multi-terminal VSC-HVDC transmission system, Electric Power Systems Research Vol. 179, Roni Irnawan, Filipe Faria da Silva, Claus Leth Bak, Anna Margareta Lindefelt, Alex Alefragkis EPSR 2020.
14. Frequency regulation in an isolated Grid with a high penetration of renewables – The Faroe Islands, H.M. Tróndheim, T. Nielsen, B.A. Niclasen, J.R. Pillai, F.F. da Silva and C.L. Bak, CIGRE Paris 2020.
15. Electrical Design of a 400 kV Composite Tower, T. Jahangiri, Q. Wang, F. Faria da Silva and C. Leth Bak, book 249 pages, Springer 2020.
16. A Current-based Differential Technique to Detect Loss of Field in Synchronous Generators, IEEE transactions on power delivery 2019, Hasani, A., Haghjoo, F., Silva, F. M. F. D. & Bak, C. L.
17. Enabling the Existing Point-to-Point VSC-HVDC Control for Multi-Terminal Operation, 2019 IEEE Power Energy Society General Meeting, Roni Irnawan, Filipe Miguel Faria da Silva, Claus Leth Bak, Nan Qin, Anna Margareta Lindefelt, Alex Alefragkis.
18. Electrical Design of a 400 kV Fully Composite Pylon, Tohid Jahangiri, Qian Wang, F. Faria da Silva and Claus Leth Bak, monograph SPRINGER 2019
19. DC Grid Control Concept for Expandable Multi-terminal HVDC Transmission Systems, Roni Irnawan, Filipe Miguel Faria da Silva, Claus Leth Bak, Anna Margareta Lindefelt, Alex Alefragkis, Cigré session 2018, Paris.
20. Vacuum circuit breaker modelling for the assessment of transient recovery voltages: application to various network configurations, Claus Leth Bak, Alberto Borghetti, Jakob Bærholm Glasdam, Jesper Hjerrild, Fabio Napolitano, Carlo Alberto Nucci and M. Paolone, EPSR 2017.
21. Multi-Stage Optimization-Based Automatic Voltage Control Systems Considering Wind Power Forecasting Errors, Nan Qin, Claus Leth Bak, Hans Abildgaard and Zhe Chen, IEEE transactions on power systems, 2017.
22. Distance protection of multiple-circuit shared tower transmission lines with different voltages. Part I: Fault current magnitude, Filipe da Silva and Claus Leth Bak, IET GTD, 2017.
23. Distance protection of multiple-circuit shared tower transmission lines with different voltages. Part II: Fault loop impedance, Filipe da Silva and Claus Leth Bak, IET GTD, 2017.
24. Efficient Approach for Harmonic Resonance Identification of Large Wind Power Plants, E. Ebrahimzadeh, X. Wang, F. Blaabjerg and C. Leth Bak, PEDG 2016, BEST PAPER AWARD
25. Assessment of Lightning Shielding Performance of a 400 kV Double-Circuit Fully Composite Pylon, T. Jahangiri, C. Leth Bak, F. Faria da Silva, B. Endahl, J. Holbøll, Cigré General Session 2016
26. Distance protection impedance measurement for inhomogeneous multi-circuit 400/150 kV transmission lines with shared towers, DPSP 2016.
27. EHV/HV underground cables in the transmission network, PhD thesis, Aalborg University, 2015.
28. High Voltage AC underground cable systems for power transmission - a review of the Danish experience, part 1 and part 2, 26 pages in total, C. Leth Bak and F. Faria da Silva, Journal of Electric power System Research, 2016.
29. Distance protection of cross-bonded transmission cable-systems, C. Leth Bak and C. Flytkjær Jensen, BEST PAPER AWARD, Developments in Power System Protection, IET DPSP 2014
30. Electromagnetic Transients in Power Cables, F. Faria da Silva, C. Leth Bak, book 228 pages, Springer 2013, ISBN 978-1-4471-5235-4
31. Statistical Distribution of Energization Overvoltages of EHV Cables, T. Ohno, A. Ametani, C. Leth Bak et al., IEEE transactions on Power Delivery 2013
32. Study of Harmonics in Cable-based Transmission Networks, F. Faria da Silva, C. Leth Bak, P. Balle Holst, Cigré 2012
33. Derivation of Theoretical Formulas of the Frequency Component Contained in the Overvoltage Related to Long EHV Cables, T. Ohno, C. L. Bak, A. Ametani, W. Wiechowski, T. K. Sørensen, IEEE trans. Power delivery, Vol. 27, no.2, April 2012
34. Back-to-Back Energization of a 60kV Cable Network - Inrush Currents Phenomenon by F. Faria da Silva, Claus L. Bak, M. Lind Hansen, 07-2010 Proceedings of the PES General Meeting 2010. IEEE 6 p.
35. Field test and simulation of a 400 kV crossbonded cable system, U.S. Gudmundsdottir, B. Gustavsen, C.L. Bak, W. Wiechowski, F. Faria da Silva, I E E E Transactions on Power Delivery 2010.
36. Full scale test on a 100 km, 150 kV AC cable, F. Faria da Silva, C.L. Bak, W. Wiechowski, U.S. Gudmundsdottir, Cigré conference Paris 2010.
37. Methods to minimize zero-missing phenomena, F. Faria da Silva, C.L. Bak, W. Wiechowski, U.S. Gudmundsdottir, M.R. Knardrupgård, I E E E Transactions on Power Delivery 2010.
38. Line differential protection scheme modeling for underground 420 kV cable systems – EMTDC/PSCAD relays modeling, M. Sztykiel, C.L. Bak, W. Wiechowski, S. Dollerup, MEPS 2010 symposium.
39. Measurements for validation of high voltage underground cable modeling, U.S. Gudmundsdottir, C.L. Bak, W. Wiechowski, K. Søgaard, M.R. Knardrupgård, IPST 2009.
40. Overvoltage protection of large power transformers – A real life study case, C.L. Bak, K.E. Einarsdottir, E. Andresson, J.M. Rasmussen, J. Lykkegård, W. Wiechowski, I E E E Transactions on Power Delivery 2008.
41. Analysis and simulation of switching surge generation when disconnecting a combined 400 kV cable/overhead line with shunt reactor, C.L. Bak, W. Wiechowski, K. Søgård, S.D. Mikkelsen, IPST 2007.
42. Overhead line measurements and calculation model for snow and frosty mist, C.L. Bak, S.D. Mikkelsen, C. Jensen, ISH 2005.

43. An improved model for the calculation of the electrical onset in gas insulated medium inhomogeneous gaps, C.L. Bak, B. Bak-Jensen, J.T. Sørensen, ISEI conference, DEIS 2002.

Media presence

Media presence in newspapers, webpages, TV and radio clippings (90 i total) is available in https://vbn.aau.dk/da/persons/106799/clippings/