


# SMART ENERGY RESEARCH AND DEVELOPMENT CENTER

## Contact details

Name	Smart Energy Research and Development Center
Acronym	SmartEn
Logo	
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## Areas of expertise

Renewable energy and energy storage:  
wind power plants; hydroelectric power plants; photovoltaic power plants; biomass micro-plants; fuel cells; hydrogen power plants; geothermal power plants; batteries; hydrogen; supercapacitors.

Modeling, simulation and analysis of modern power systems:  
transmission power grid; distribution power grid; microgrids; integration of renewable power plants on a grid; analysis of distributed generation systems; power losses evaluation.

Energy efficiency:  
energy audits for industrial and residential consumers; power quality measurements, analysis and improvement solutions; SCADA implementation.

Artificial intelligence in power systems:  
machine-learning; fuzzy logic; neural networks; genetic algorithms.

Energy management:  
energy forecast; energy market.

Smart metering and demand-side integration:  
Intelligent sensors and data acquisition; analog to digital conversion; communication infrastructure and protocols for smart metering; demand-side integration.

Smart city:  
building management system, building automation system, nZEB concept implementation.

## Team and key skills

Assoc. Prof. Dr. Eng. Phys. Andrei C CZIKER – PhD defended in 2002 at Technical University of Cluj-Napoca (*Unbalance compensation in electrical power systems working in non-sinusoidal condition*). His research activity gathers a number of 140 scientific publications. Research areas: modeling of modern power systems, energy efficiency in building and industry, energy audits, power systems, power quality in networks, digital signal processing, artificial intelligence in power systems, smart grids and renewable energy.

Prof. dr. eng. Silviu Ioan DARIE – PhD supervisor since 1989, His research activity gathers a number of 127 scientific publications. Research areas: power system analysis computer applications; industrial electrical energy distribution design; power quality investigation: site survey, harmonics measurement, harmonics mitigation, harmonics analysis, harmonics filters design, dynamics analysis; transmission pricing in energy deregulated market; embedded generation analysis and design; computer aided power system analysis and design: EDSA / Paladin DesignBase, PSS/E, PSS/U, SKM, ETAP, Easy Power, DigSILENT, NePlan, ASPEN, CYME, PSCAD

/EMTDC software experience;

Prof. dr. Eng. Mircea Dorin CHINDRIȘ – PhD defended in 1986 at Technical University of Cluj-Napoca. PhD supervisor since 1994. He published 24 books and over 250 papers in Romania and abroad. Research areas: end use of electricity, energy efficiency, artificial intelligence in power systems, smart grids, renewable energy

Prof. dr. eng. Sorin Gheorghe PAVEL – PhD since 2000 at Technical University of Cluj-Napoca, His research activity gathers a number of 146 scientific publications (67 in the last 10 years). Research areas: modeling, simulation and analysis of modern power systems; industrial installations design; power quality investigation; computer aided power system analysis and design: EDSA / Paladin DesignBase software experience.

Prof. dr. eng. Radu TÎRNOVAN - PhD supervisor since 2009. His research activity gathers about of 120 scientific publications. Research areas: renewable, fuel cells, modeling of modern power systems, artificial intelligence in power systems, power systems protection and control

Assoc. Prof. Dr. Eng Titus E. CRISAN – Thesis *Theoretical and Experimental Researches on Non-contact 3D Roughness Measurements* – 2004, Technical University of Cluj-Napoca, coauthor/author of 6 books, 50+ scientific publications, teaches courses in Transducers, Applied and Legal Metrology, 3D Measuring Systems; research interests: electrical measurement of non-electrical sizes, daq and measured data transmission, numerical modelling of measuring phenomena, process monitoring

Assoc. Prof. Dr. Eng Bogdan ȚEBREAN – Thesis *Researches on measuring of mechanical shock and vibration using Hall transducers* – 2008, Technical University of Cluj-Napoca, coauthor/author of 4 books, 30+ scientific publications, teaches courses in Transducers, Interfaces and Data Acquisitions, Virtual Instrumentation, Industrial Process Monitoring; research interests: measurements, virtual instrumentation, daq and measured data transmission, numerical modelling of measuring phenomena, process monitoring.

Eng. Daniela NISTE – Degree in Electrical Power Systems in 2021, currently a Master's student in Management of Modern Electrical Power Systems. Research areas: modeling, simulation and analysis of modern power systems, computer aided power system analysis and design: EDSA / Paladin DesignBase.

Eng Mădălin ARDELEAN – Degree in Instrumentation and Data Acquisition, currently a PhD student. Research interest, sensors, and smart sensor structures, data acquisition

Eng. Călin PAȘCALĂU - Degree in Electronics & Telecommunications in 1992, Politechnical Institute of Timisoara, currently PhD student from 2021 at UTCluj , PhD supervisor is Pr Dr Eng Silviu I Darie. Interest area Hardware Computers, Software applications: PCB design, Java& Python applications,UAS, CAE software

## Infrastructure

Power Quality Analyzer SATEC PM 175; Power Systems Analyzer Mavowatt 45; Power Quality Analyser EP 04XX X MEMOBOX 300 Smart, LEM NORMA GmbH, Austria; Power Quality Analyzer: Fluke 43B; Electronic energy meter (ABB, AEM); Data acquisition systems; NI based DAQ boards. ELVIS platform, Ni Motion Control modeling software (EDSA, ETAP, COMSOLL, EVINCE-Prediktera – image analysis, WINCHILL – reliability, etc.)

## Development strategy

The main purpose of the SmartEn center aims to meet the needs of society and to come up with new solutions for a sustainable energy future. This is manifested through prestigious scientific papers, participation in research contracts, involvement of students in research activity and support the society for implementing new technologies to increase energy efficiency, both residential and industrial, both in buildings and production halls.

Development of cooperation and transfer of technology towards the industrial partner.

Participation in national and international competitions for research grants.

Promoting energy-efficient solutions for economical partners.

Developing a training center in partnership with energy and industry key players.

## Representative projects

Adaptive system for energy quality assurance, by correcting the electrical parameters of low voltage networks that can be integrated into SMART GRID - (SAMGRID) networks, Grant PN-II-PT-PCCA-2013-4-1003

Development strategies for photovoltaic power generation systems - PV development - Contract CNCSIS type A

consortium Nr. contract: 167 / 1.08.06, 2006-2007

Continuous voltage microgrids for optimal integration of distributed energy sources, CEEX type project, contract no. 109 / 10.10.2005, 2005-2007

Holistic impact of renewable energy sources on the environment and climate, acronym HORESEC, Contract 31PCCDI / 2018, code PN-III-P1-1.2-PCCDI-2017-0404, period: 2018 – 2021.

IR spectral measurements applied in biometrics and security systems, PN-II 616/2009 2009-2012

## Significant results

### Papers

- Ungureanu, S; Topa, V; Cziker, AC Deep Learning for Short-Term Load Forecasting-Industrial Consumer Case Study. APPLIED SCIENCES-BASEL. Volume 11, Issue 21, Article Number 10126, DOI 10.3390/app112110126, Published NOV 2021
- Ungureanu, S; Topa, V; Cziker, AC. Analysis for Non-Residential Short-Term Load Forecasting Using Machine Learning and Statistical Methods with Financial Impact on the Power Market, ENERGIES, Volume 14, Issue 21, Article Number 6966, DOI 10.3390/en14216966 Published NOV 2021
- Miron, A., Cziker, A.C., Bogariu, H.C., Knowledge-based system for the analysis of voltage fluctuations and flicker. Proceedings of 8th International Conference on Modern Power Systems (MPS), 2019, WOS: 000612401900024
- M. Chindris, A. Cziker, Anca Miron, UPQC - the best solution to improve power quality in low voltage weak distribution networks, Proceedings Paper, 7th International Conference on Modern Power Systems (MPS) 2017, WOS:000428462600002, ISBN:978-1-5090-6565-3
- Darie, S., Dynamics in Distribution Power System. Rev Energetica, Nr. 9, 2020
- Darie, S., Harmonics in Power Systems. Part 1: Overview, Harmonics Indices, IEEE & IEC Standards. Rev Energetica, Nr. 10, 2020
- Darie, S., Harmonics in Power Systems. Part 2: Computer Aided Harmonics Studies. Rev Energetica, Nr. 11, 2020
- Darie, S., Smart Design in Power Systems. Part 1: Low Voltage Circuit Breakers; IEC Standards; Field Data Collection. Rev Energetica, Nr. 1, 2021
- Darie, S., Smart Design in Power Systems. Part 2: How to Build a Digital Twin from a Given Power System Simulation. Rev Energetica, Nr. 2, 2021
- Darie, S., Understanding Arc Flash Hazard - part 1. Rev Energetica, Nr. 6, 2021
- Darie, S., Understanding Arc Flash Hazard - part 2. Rev Energetica, Nr. 7, 2021
- H. G. Beleiu, V. Maier, S. G. Pavel, I. Birou and C. Pică, "Synchronous Motor Behavior in Harmonics," 2019 54th International Universities Power Engineering Conference (UPEC), Bucharest, Romania, 2019, pp. 1-6. doi: 10.1109/UPEC.2019.8893511
- V. Maier, S. G. Pavel, H. G. Beleiu and V. Farcas, "Aspects on Harmonics Analytical Identification of a Periodic Non-Sinusoidal Wave," 2019 8th International Conference on Modern Power Systems (MPS), Cluj Napoca, Romania, 2019, pp. 1-6. doi: 10.1109/MPS.2019.8759685
- Pica, C., Munteanu, R., Pavel S.G. and Beleiu, H.G., Modeling of Photovoltaic Panels, 2018 International Conference and Exposition on Electrical And Power Engineering (EPE), Iasi, 2018, pp. 0769-0773. doi: 10.1109/ICEPE.2018.8559884
- Ioaneş, Andrei; Tîrnovan, Radu, Power Grid Health Assessment Using Machine Learning Algorithms, 2019 11th International Symposium on Advanced Topics in Electrical Engineering (ATEE), Bucharest, Romania, DOI: 10.1109/ATEE.2019.8724920
- C. Cristea, M. Cristea, R. -A. Tîrnovan, I. Birou, C. E. Stoenoiu and F. Mioara Şerban, "Performance analysis of grid-connected rooftop solar photovoltaic systems using different photovoltaic technologies: a case study in Romania," 2021 International Conference on Electromechanical and Energy Systems (SIELMEN), 2021, pp. 310-314, doi: 10.1109/SIELMEN53755.2021.9600338.
- R. Tîrnovan and M. Cristea, "Advanced techniques for fault detection and classification in electrical power transmission systems: An overview," 2019 8th International Conference on Modern Power Systems (MPS), Cluj-Napoca, Cluj, Romania, 2019, pp. 1-10, doi: 10.1109/MPS.2019.8759695.
- A. Ioaneş and R. Tîrnovan, "Energy Price Prediction on the Romanian Market using Long Short-Term Memory Networks," 2019 54th International Universities Power Engineering Conference (UPEC), Bucharest, Romania, 2019, pp. 1-5, doi: 10.1109/UPEC.2019.8893550.
- Septimiu Crisan, Bogdan Ţebrean, Titus E. Crisan - Multimodal Liveness Detection System for Hand Vein Biometrics, 2018 IEEE International Symposium on Medical Measurements and Applications (MeMeA 2018), ISBN 978-1-5386-3393-9
- B. Ţebrean, S. Crisan, C. Muresan, T. E. Crisan - Coplanar capacitive matrix structures used for monitoring the recovery of burn injuries, 22nd IMEKO TC4 International Symposium and 20th International Workshop on ADC Modelling and Testing 2017: Supporting World Development Through Electrical and Electronic Measurements, Vol. 2017-September, 2017, Pag. 385-390, Code 134087
- Crisan, T.E., Ardelean, M.I., Tebrean, B., Munteanu, R.A., Hand Movements Monitoring Device for Post Paresis Recovery Process, IFMBE Proceedings this link is disabled, 2022, 88, pp. 45–54
- Crisan, T.E., Ardelean, M.I., Tebrean, B., Oltean, T. Low Cost Foot Pressure Measuring Device, Proceedings of 2021

9th International Conference on Modern Power Systems, MPS 2021, 2021, 9492694

**Patents**

Sacerdoțianu Dumitru, Nicola Marcel, Ciontu Marian, Ivanov Sergiu, Chindris Mircea Dorin, Cziker Andrei Cristinel, Radu Alexandru, Dumitrescu Camil-Sorin, Sistem adaptiv pentru asigurarea calitatii energiei in retelele de joasa tensiune, Nr. : 132402

**PhD Thesis**

Bogdan Iuga, Studies regarding wireless energy transfer, PhD Supervisor: Prof. Eng. Radu-Adrian TÎRNOVAN, PhD, TCUN 2021

Andrei IOANES, Elements of artificial intelligence in the management of modern power systems, PhD Supervisor: Prof. Eng. Radu-Adrian TÎRNOVAN, PhD, TCUN 2022

Maria FĂGĂRĂȘAN, Contributions to management and design of electrical energy storage systems in distributed generation networks, PhD Supervisor: Prof. Eng. Radu-Adrian TÎRNOVAN, PhD, TCUN 2022

**The offer addressed to the economic environment**

Research & development	Power systems modeling Renewable integration on modern power grids Increase of energy efficiency
Consulting	The SmartEn offers consultancy in all the center fields of expertise.
Applied engineering services	The SmartEn offers applied engineering services to the economic environment through technical expertise in all the fields of our center
Training	Members of the center participate in the organization of postgraduate courses in Romanian like that: Auditori electroenergetici din industrie; Manageri energetici in industrie