EASY-RES

SUMMER SCHOOL
"ENABLING DRES TO OFFER ANCILLARY SERVICES"
20TH – 24TH SEPTEMBER 2021
COURSE INFORMATION

OVERALL INFORMATION

The Horizon 2020 project EASY-RES (Enable Ancillary Services by Renewable Energy Sources) will be hosting a virtual Summer School from 20th to 24th September 2021. The Summer School titled "Enabling DRES to offer Ancillary Services" is a 5-days PhD-level program and comprises 13 parts which will be taught by the academic partners of EASY-RES with contributions from the project's industrial partners:

- Department of Electrical and Computer Engineering, Aristotle University of Thessaloniki, Greece
- Department of Electrical Engineering, University of Seville, Spain
- TU Delft, The Netherlands
- University of Passau, Germany
- Lancaster University, UK
- FENECON GmbH, Germany

SCOPE OF THE SUMMER SCHOOL

The aim of the Summer School "Enabling DRES to offer Ancillary Services" is to present new methods for controlling the Distributed Renewable Energy Sources (DRES), which are connected in a distribution grid, so that they can offer a number of existing and new ancillary services (AS) following a bottom-up approach: from DRES to distribution systems and from distribution systems to transmission systems. In addition, methods for aggregating frequency related AS in order to be offered to the transmission system are presented. Fundamental as well as advanced concepts are covered.

COURSE DELIVERY

This course is provided free of charge and will be delivered fully online from Monday 20th to Friday 24th September 2021. Live lectures will be recorded, so that they can be accessed by individuals in different time zones. All live and recorded lectures as well as the corresponding material will be accessible via the project website.

The timeslots within the programme correspond to Central European Summer Time (CEST). There will be 2 or 3 lecture parts comprising 4 or 5 hours per day, starting at 8:40am CEST every day. Each academic hour will contain approximately 55 min of lecture time including a Q&A block and a small break.

APPLICATION

To apply for the Summer School, please click here and fill in the form www.eventbrite.de/e/easy-res-summer-school-2021-tickets-165883350567

CERTIFICATE

If you will have attended a minimum of 12 hours of the total 22 hours of the Summer School, you will receive a Certificate.

CONTACT

In case you have any questions about the Summer School, please contact info@easyres-project.eu

SUMMER SCHOOL PROGRAMME

	MON 20th Sep	TUE 21st Sep	WED 22nd Sep	THU 23rd Sep	FRI 24th Sep
08:40 - 09:40	Part 1	Part 4	Part 6	Part 8	Part 11
09:40 - 10:40	Part 2	Part 4	Part 6	Part 9	Part 12
10:40 - 11:00	Break	Break	Break	Break	Break
11:00 - 12:00	Part 3	Part 5	Part 7a	Part 10a	Part 13
12:00 - 13:00	Part 3	Part 5	Part 7b	Part 10a/10b	Part 13
13:00 - 14:00			Part 7c	Part 10b	

MONDAY 20TH SEPTEMBER

PART 1 (8:40-9:40): BASICS OF GRID STABILITY AND DEFINITIONS

- Role of inertia, Frequency Containment Reserve (FCR), Frequency Restoration Reserve (FRR) and Replacement Reserve (RR)
- Frequency limits set by ENTSO-E
- Critical points (ROCOF, nadir, load shedding, etc.)

LECTURERS

Prof. Charis Demoulias, Aristotle University of Thessaloniki

Assoc. Prof. Juan Manuel Mauricio, University of Sevilla

PART 2 (9:40-10:40): GENERAL OVERVIEW OF THE LOCAL CONTROL SYSTEM OF THE DRES CONVERTERS

Description of the control layers of the power electronic converters, so that they can offer the envisioned functionalities in a controllable manner. The concept of Unified Virtual Synchronous Generator (UVSG) model developed in EASY-RES.

LECTURER

Assoc. Prof. Juan Manuel Mauricio, University of Sevilla

20-MINUTE BREAK

PART 3 (11:00-13:00): SYNTHETIC INERTIA BY DRES

The UVSG approach for providing true controllable inertia up to a maximum value and associated sizing of the ESS; Comparison with other approaches for providing inertia which, however, depend on the loading of the DRES and/or require the measurement of ROCOF.

LECTURER

Dr. Georgios C. Kryonidis, Aristotle University of Thessaloniki

TUESDAY 21ST SEPTEMBER

PART 4 (8:40-10:40): THE ROLE OF FRR FOR THE MITIGATION OF POWER IMBALANCES AND THE NEED FOR RRL AS A PREVENTIVE ACTION IN DISTRIBUTION GRIDS

- Use of FRR in interconnected systems is used to mitigate power imbalances and restore the power in the interconnections. RRL can reduce the imbalances, thereby the committed automatic FRR.
- The EASY-RES approach for RRL at DRES and distribution grid level using Ultracapacitors and Battery ESS.

LECTURER
Dr. Kyriaki-Nefeli D. Malamaki,
Aristotle University of Thessaloniki

20-MINUTE BREAK

PART 5 (11:00-13:00): THE PROTECTION CHALLENGES IN DISTRIBUTION GRIDS UNDER HIGH DRES PENETRATION AND REDUCED SHORT-CIRCUIT CAPACITY OF UPSTREAM GRID

- Problems due to high DRES penetration (blinding, sympathetic tripping, etc.)
- The EASY-RES solution in symmetrical and unsymmetrical faults; the control of currents during the fault and after its clearing; the role of extended FRT of DRES.

LECTURERS
Dr. Spyros Gkavanoudis,
Aristotle University of Thessaloniki
Assoc. Prof. José María Maza-Ortega,
University of Sevilla

WEDNESDAY 22ND SEPTEMBER

PART 6 (8:40-10:40): THE SOLUTION FOR VOLTAGE REGULATION IN MV AND LV DISTRIBUTION GRIDS

- The problems with voltage regulation under high DRES penetration (overvoltage, OLTC malfunction or number of operations)
- The reactive power capability required by DRES.
- The hybrid approach of EASY-RES for voltage regulation (bi-optimal solution and minimization of ICT requirements)

LECTURER
Dr. Georgios C. Kryonidis,
Aristotle University of Thessaloniki

20-MINUTE BREAK

PART 7 (11.00-14:00): AGGREGATION AND DISAGGREGATION OF INERTIA AND PFR

BLOCK 7.A (11:00-12:00):
Technical constraints and optimization in distribution grids and converters

BLOCK 7.B (12:00-13:00):
The EASY-RES approach for aggregation and disaggregation of Inertia and PFR

BLOCK 7.C (13:00-14:00):
The extraction of the Dynamic Distribution Grid Model for distribution grids with high DRES penetration

LECTURER
Asist. Prof. Álvaro Rodríguez del Nozal,
University of Sevilla
LECTURER
Dr. Eleftherios O. Kontis,
Aristotle University of Thessaloniki
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THURSDAY 23RD SEPTEMBER

PART 8 (8:40-9:40): NEW SUGGESTIONS FOR THE MEASUREMENT AND QUANTIFICATION OF AS

PART 9 (9:40-10:40): BATTERY ESS IN DISTRIBUTION GRIDS AND THEIR POTENTIAL ROLE IN THE AS PROVISION
- The need for Energy Management System (EMS) of Battery ESS
- EASY-RES vision for Battery ESS
- Battery ESS Market Integration and Economical value for the AS provision

LECTURER
Prof. Charis Demoulias,
Aristotle University of Thessaloniki

LECTURER
Sagar Bandi Venu,
Application Developer at FENECON GmbH

20-MINUTE BREAK

PART 10 (11:00-14:00): THE EASY-RES APPROACH FOR THE REQUIRED ICT
BLOCK 10.A (11:00-12:30)
ICT system modelling
- The role of distributed computing technologies in power systems
- Theories: distributed systems, network virtualization, interoperability in complex systems
- The EASY-RES ICT architecture as layers

LECTURER
Prof. Hermann de Meer,
University of Passau

BLOCK 10.B (12:30-14:00)
ICT Security as a First-Class Entity
- Examples of a proposed system, without/with security provision
- Demonstrate EASY-RES Testbed Security Layering

LECTURERS
Dr. John Vidler, Lancaster University
Dr. Martin Bor, Lancaster University

FRIDAY 24TH SEPTEMBER

PART 11 (8:40-9:40): SOFTWARE TOOLS FOR EVALUATION OF AS

LECTURER
Assist. Prof. Aleksandra Lekić-Vervoort,
TU Delft

PART 12 (9:40-10:40): TESTING PROTOCOLS TO VERIFY THE ABILITY OF DRES TO OFFER AS

LECTURER
Assist. Prof. Milos Cvetkovic,
TU Delft

20-MINUTE BREAK

PART 13 (11:00-13:00): EXPERIMENTAL VALIDATION OF THE EASY-RES CONCEPT: PROTOTYPE UNITARY TESTING AND SYSTEM INTEGRATION TESTING

LECTURER
Assist. Prof. Manuel Barragán-Villarejo,
University of Sevilla

SHORT VITAE OF LECTURERS

PROF. CHARIS DEMOULIAS
Aristotle University of Thessaloniki

Charis Demoulias received the Dipl. and PhD degrees in Electrical Engineering from the AUTH, in 1984 and 1991. Currently he is Professor of the Electrical Machines Laboratory, Department of Electrical and Computer Engineering at AUTH. His research interests include power electronics, harmonics, electric motion systems, and the integration of renewable energy sources in the power grid. He has more than 70 publications in the fields of renewable energy sources, power quality and microgrids. Charis is the Coordinator of the H2020 project EASY-RES.

ASSOC. PROF. JUAN MANUEL MAURICIO
University of Sevilla

Juan Manuel Mauricio received the degree in Electrical Engineering from the National University of Comahue, Argentina in 2003, and the Master's and PhD degrees from the University of Seville, in 2007 and 2009. Since 2004, he has been with the Department of Electrical Engineering of USE, where he is currently an Associate Professor. His primary research interests include power systems and electrical machine control, renewable generation, voltage source converters-based applications, and electrical vehicles.

DR. GEORGIOS C. KRYONIDIS
Aristotle University of Thessaloniki

Georgios C. Kryonidis received his Diploma and PhD degrees in Electrical and Computer Engineering from AUTH in 2013 and 2018. Currently, he is an Adjunct Lecturer at AUTH. He has an 8-year experience as a researcher in EU research projects (FP7, H2020, Interreg-Med). His research interests include distributed generation and storage, renewable energy sources, microgrids, and smart grids operation and control. Finally, he is a member of IEEE and of the Technical Chamber of Greece.

DR. KYRIAKI-NEFELI D. MALAMAKI
Aristotle University of Thessaloniki

Kyriaki-Nefeli Malamaki received the Diploma and PhD degree in Electrical and Computer Engineering from the Department of Electrical and Computer Engineering (DECE) at AUTH, in 2012 and 2020. Currently, she is a Postdoctoral Researcher at the same Department. Her research interests include power quality, interface of renewable energy sources with the grid, power electronic converters control, and energy storage systems integration within the smart grid context.

DR. SPYROS GKAVANOUDIS
Aristotle University of Thessaloniki

Spyros I. Gkavanoudis received the Diploma and PhD degree in Electrical and Computer Engineering from AUTH, in 2008 and 2014. In 2019, he received the M.Eng degree in Electrical and Computer Engineering from University of Thessaly. Currently, he is a Post-doctoral Researcher at the Department of Electrical and Computer Engineering at AUTH. His primary research activities lie in the fields of power electronic converters, wind energy conversion systems, modeling and control of electrical machines, microgrids, and energy storage systems.

**ASSOC. PROF.
JOSÉ MARÍA MAZA-ORTEGA**
University of Sevilla

José María Maza-Ortega received an Industrial Engineering degree with major in Electrical Engineering, in 1996, and a Doctor Enginee-ring and European Doctor degree in 2001, both from the University of Seville. Since 1997, he has been with the Department of Electrical Engineering of the USE as an Associate Professor. His academic ac-tivities have focused on Industrial Engineering, Telecommunications Engineering, Management Engineering and Chemical Engineering.

**ASIST. PROF.
ÁLVARO RODRÍGUEZ DEL NOZAL**
University of Sevilla

Álvaro Rodríguez del Nozal received the B.S. degree in Industrial Engineering with Industrial Automation specialization (2013) and the M.S. degree in Electric Energy Systems (2016) from USE. He received the PhD degree in Control Engineering from the University Loyola Andalucía in 2019. Since 2019, he has been with the Department of Electrical Engineering of USE as an Assistant Professor. His primary research interests include distributed control and estimation and optimal operation and integration of distributed renewable energy sources in the electricity grid.

DR. ELEFTHERIOS O. KONTIS
Aristotle University of Thessaloniki

Eleftherios O. Kontis received his Diploma and PhD degrees in Electri-cal and Computer Engineering from AUTH in 2013 and 2018. Currently, he is Postdoctoral Researcher at AUTH and an Adjunct Lecturer at the University of Western Macedonia. He gained 7 years of experiences as a researcher in EU research projects (FP7, H2020, Interreg-Med, etc.). His research interests include power system dynamics, modeling and analysis of active distribution networks, control and optimal operation of distributed energy resources. Finally, he is a member of IEEE and of the Technical Chamber of Greece.

SAGAR BANDI VENU
Application Developer
at FENECON GmbH

Sagar Bandi Venu holds an M.Sc. in Computer Science from the University of Passau. He finished his master's thesis at FENECON GmbH in 2019, a company that specializes in energy storage technologies, and stayed there after graduation. He works for FENECON as an Application Developer in the Energy Management System department. His main area of expertise is designing and developing energy management controllers, which he implements in OpenEMS, an open-source platform for energy management applications.

PROF. HERMANN DE MEER
University of Passau

Hermann de Meer received his PhD from the University of Erlangen-Nuremberg, in 1992. He was an Assistant Professor at Hamburg University, a Visiting Professor at Columbia University in New York City, and a Reader at University College London. He was appointed as Full Professor at the University of Passau, and as Honorary Professor at University College London, in 2003. His research interests include cloud computing, energy systems, network virtualization, IT security, smart grid, smart city, industry 4.0, digitalization of energy systems, computer networks and communications, and distributed systems.

DR. JOHN VIDLER
Lancaster University

John Vidler is a Senior Research Associate at the School of Computing and Communications. His research focusses on process interaction and communication over areas of computing, energy, and natural language processing. Currently, he develops and administers the EASY-RES multi-site testbed.

DR. MARTIN BOR
Lancaster University

Martin Bor is a Senior Research Associate at the School of Computing and Communications at Lancaster University. His research interests include embedded systems security, low-power long-range wireless communication, and edge compute orchestration.

ASSIST. PROF. MILOS CVETKOVIC
TU Delft

Milos Cvetkovic received the B.Sc. degree in Electrical Engineering from the University of Belgrade, and Mater's and PhD degrees from Carnegie Mellon University in Pittsburgh. Before joining TU Delft, he was a Postdoctoral Researcher at MIT, Cambridge. Milos is working on research challenges of renewable energy integration. He is interested in modeling and control of engineering and economic processes for easier integration of renewable generation and flexible demand. He is fond of combining mathematical methods with numerical simulations. He has strong knowledge of control theory and optimizations.

ASSIST. PROF. ALEKSANDRA LEKIĆ
TU Delft

Aleksandra Lekić received the B.S., M.S., and PhD degrees in Electrical Engineering from the School of Electrical Engineering, University of Belgrade, in 2012, 2013, and 2017. Between 2012 and 2018 she was a Teaching Assistant with the School of Electrical Engineering, University of Belgrade, and an Assistant Professor from 2018 to 2019. In 2019, she worked as a Postdoctoral Researcher at the Department of Electrical Engineering ESAT – ELECTA, KU Leuven and in the Institute EnergyVille, Genk. Since January 2020, Aleksandra has been working as an Assistant Professor at the TU Delft, Faculty of Electrical Engineering, Mathematics and Computer Science.

**ASSIST. PROF.
MANUEL BARRAGÁN-VILLAREJO**
University of Sevilla

Manuel Barragán-Villarejo received the Electrical Engineering and PhD degrees in Electrical Engineering from USE in 2008 and 2014. Since 2008, he has been with the Department of Electrical Engineering of USE where he is currently an Assistant Professor. His primary research interests include exploitation and control of power converters for smart grid management and grid integration of distributed renewable energy sources.