Smart Grid Center Short Courses

IMPROVING THE GRID RESILIENCE

Course Director: Dr. Mladen Kezunovic and Dr. Tom Overbye

Description

The grid resilience is a concept that merges the traditional reliability studies with predictive analytics, when combined leads to a robust power system operation are allowing the continuity of electricity supply. As the major disturbances occur, a resilient system should be able to either ride through or restore its service timely. This course lays out some major resilience criteria, and offers detailed discussion of related solutions at the various levels of the power system design, implementation and exploitation: operations, planning, outage and asset management, microgrids, distributed generation, and markets. The course objective is to provide the attendees with examples of advanced solutions with demonstrations illustrating the resilience improvements. Collectively the three course instructors have decades of experience in doing electric power system and market studies, including engineering education (Hours: CEU 2.1, PDH 21).

Who Should Attend

The course is designed to provide a comprehensive coverage of the fundamentals of the resilience design, planning and implementation, as well as criteria for performance assessment of the power system resilience. It is ideally suited for electrical engineers who have minimal experience in the concepts of resilience, including new graduates and engineers from other areas of the utility industry. The course will also be useful for managers who would like to gain an understanding of the resilience issues, for those working in the policy and regulatory areas, for academics wishing to gain a practical understanding of the resilience concepts, and for graduate students interested in careers in the power industry.

Topics

Day 1

- Overview of the electric grid including its structure and operation
- Differences between resilience and reliability
- Causes of grid failure both small and large
- Impact of relaying on grid resilience
- Metrics for reliability and resiliency
- Planning and design for resiliency

Day 2

- Operational strategies to enhance system resiliency
- Hands-on: Grid planning for resiliency
- Hands-on: Grid operation
- Industry resilience case study: Reducing the grid risk due to geomagnetic disturbances
- Strategies for reducing the harmful consequences from a major blackout
- Grid restoration following a major blackout

Day 3 (morning)

- Regulatory and market considerations for enhancing grid resiliency
- The role of ancillary services in mitigating resilience threats
- Planning studies aimed at resilient designs

Syllabus

Day 1		
Stella Hotel	8:00-8:30am	Transport from hotel to CIR
Instructor	**Time**	**Topic**
Kezunovic	8:30-9:30am	Resilience: Overview, Course objectives
Kezunovic	9:30-10:15am	Intro: Resilience and relaying
Break	10:15-10:30am	
Overbye	10:30-11:15am	Intro: Resilience and Operations
Matevosyan	11:15-12:00am	Intro: Resilience and Markets
Lunch	12:00-1:15pm	Lunch
Kezunovic	1:15-2:00pm	Example#1
Overbye	2:00-2:45pm	Example #2
Break	2:45-3:15pm	
Matevosyan	3:15-4:00pm	Example #3
All	4:00-4:45pm	Demo&Discussion
Adjourn	4:45pm	Transport from CIR to hotel
Reception	5:30pm	Hotel Stella
Day 2		
Stella Hotel	8:00-8:30am	Transport from hotel to CIR
Instructor	**Time**	**Subject**
Kezunovic	8:30-10:15am	Resilience: Impact of Relaying and DER
Break	10:15-10:30am	
Overbye	10:30-12:15am	Resilience: Impact of Operations&Operations Planning
Lunch	12:15-1:15pm	Lunch
Matevosyan	1:15-3:00pm	Resilience: Impact of Long-term Planning and Ancillary services
Break	3:00-3:15pm	
Kezunovic	3:15-3:45pm	Demo&Discussion
Overbye	3:45-4:15pm	Demo&Discussion
Matevosyan	4:15-4:45pm	Demo&Discussion

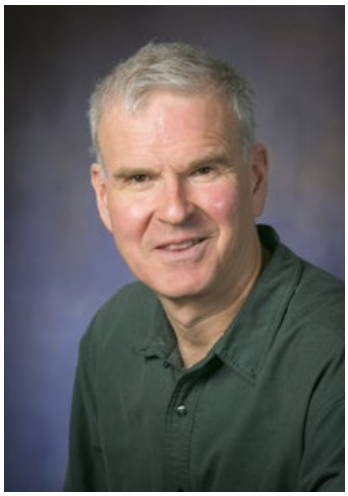
Adjourn	4:45pm	Transport from CIR to hotel
Day 3		
Stella Hotel	8:00-8:30am	Transport from hotel to CIR
Instructor	**Time**	**Subject**
Kezunovic	8:30-9:30am	Closing remarks: Resilience, Relaying and DER
Overbye	9:30-10:30am	Closing remarks: Resilience, Operations&Operations Planning
Break	10:30-10:45	
Matevosyan	10:45-11:45	Closing Remarks: Resilience, Long Term Planning and Ancillary Services
ALL	11:45-12:00	Closing Discussion
Adjourn	12:00pm	Transport from CIR to hotel

Instructors

Mladen Kezunovic, Regent Professor and Eugene E. Webb endowed Professor in the Department of Electrical and Computer Engineering at Texas A&M University

- Before his academic career, employed by Westinghouse Electric and Energoinvest Company in Europe developing digital substations
- Principal Consultant and CEO of XpertPower Associates, a firm specializing in world-wide Smart Grid services
- Author of widely used books on protective Relaying and on Time-Synchronized Measurements in Power Systems
- Recipient of the IEEE Educational Activities Board Standards Education Award, IEEE Life Fellow
- Fellow, Honorary and Distinguished Member of CIGRE

Tom Overbye, TEES Eminent Professor in the Department of Electrical and Computer Engineering at Texas A&M University (TAMU)



- Before starting his academic career, employed by Madison Gas and Electric Company, working in their planning and operations departments
- Original developer of PowerWorld Simulator (a widely used power system planning tool) Co-founder of PowerWorld Corporation
- Author of a widely used Power System Analysis and Design book
- IEEE Power and Energy Society Outstanding Power Engineering Educator Award, IEEE Fellow
- Member of the U.S. National Academy of Engineering

Julia Matevosyan Lead Planning Engineer, Resource Adequacy, System Planning, ERCOT, (https:// www.youtube.com/watch?v=gHsmzuGmNmc)

- PhD and Post-Doctoral research on Coordination of Wind and Hydro Power in Areas with Limited Transmission Capacity, at Royal Institute of Technology, Stockholm Sweden
- Before starting at ERCOT, employed by Parsons Brinkerhoff and Sinclair Knight Merz working primarily on grid interconnection and grid code compliance studies for wind power plants in the UK
- Member of Technical Advisory Committees for a number of projects related to synchronous inertia, frequency performance and flexibility needs with growing share of renewable and distributed generation carried out by Electric Power Research Institute (EPRI), Hawaiian Electric Company (HECO), North American Electric Reliability Corporation (NERC), National Renewable Energy Laboratory (NREL), Lawrence Berkley National Laboratory (LBNL), U.S. Department of Energy (DOE), Xcel Energy, EU SysFlex project