

**Energy Technology and Governance Program**

**BLACK SEA REGIONAL TRANSMISSION PLANNING PROJECT**

**PSS/E NTC CALCULATION WORKSHOP/PREPARATION FOR JOINT BSTP/BSRI WORKSHOP**

**COURTYARD TBILISI**

**4 Freedom Square Tbilisi 0105 Georgia**

**March 20 and 22, 2017**

**TBILISI MARRIOTT HOTEL**

**13 Shota Rustaveli Ave, Tbilisi 0108, Georgia**

**March 23, 2017**

**Schedule:**

A one day NTC Calculation workshop followed by a three day HVDC modeling workshop to continue to build institutional capacities within the Black Sea Regional Transmission Planning Project TSOs will be conducted by Milos Stojkovic and Dragana Orlic of the Electricity Coordination Center (EKC) of Belgrade.  Material will be presented in both morning and afternoon sessions for a total of six hours of daily instruction from 9:00 am to 4:00 pm, with the exception of the second day, March 21 – a Site Visit to the 500/400/220 kV Akhaltsikhe HVDC S/S.

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| **MORNING SESSION** | |  | | **AFTERNOON SESSION** | | |
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| Training session: | 09:00 – 10:30 | |  | | Training session: | 13:00 -14:30 | |
| Coffee break: | 10:30 – 10:45 | |  | | Coffee break: | 14:30 -14:45 | |
| Training session: | 10:45 – 12:00 | |  | | Training session: | 14:45 -16:00 | |
| Lunch break: | 12:00 – 13:00 | |  | |  |  | |

**Objectives:**

* The NTC Calculation Workshop Agenda will cover:
* ENTSO-E Net Transfer Capacity (NTC) Calculation Methodologies;
* BSTP PSS/E NTC Calculation Simulation Model update with explanations and practical calculation examples in the BSTP region, and;
* Preparation for the BSTP/BSRI Workshop, including review of a Balancing Study Questionnaire.
* The HVDC workshop will discuss the most important types of analysis that are necessary for the planning of HVDC based networks. It will focus on steady state and dynamic stability simulation analyses which should be supported by regional BSTP PSS/E planning models for 2020 and 2025 (winter max, summer max and summer min regimes).

**MONDAY, MARCH 20; DAY 1**

**NTC CALCULATION/PREPARATION FOR THE JOINT BSTP/BSRI BALANCING STUDY WORKSHOP**

**Morning Session**

**INTRODUCTIONS AND WELCOMING REMARKS**

* *Sulkhan Zumburidze, Georgian State Electrosystem JSC – to be confirmed*
* *Nicholas Okreshidze, USAID/Caucasus – to be confirmed*
* *Garnik Balyan, Chairman of the Black Sea Regional Transmission System Planning Project*
* *Natalia Fominykh, United States Energy Association*

**ENTSO-E NET TRANSFER CAPACITY (NTC) CALCULATION METHODOLOGIES**

* Total Transfer Capacity (TTC)
* Transmission Reliability Margin (TRM)
* Net Transfer Capacity (NTC)
* Available Transfer Capacity (ATC)

**Afternoon Session**

**PREPARATION FOR JOINT BSTP/BSRI BALANCING STUDY WORKSHOP**

* Preparation of BSTP Simulation Model of NTC Calculations
* Review and Discuss Questionnaire of the Balancing Study
* Homework: Scenarios and Templates for TSO’s Presentations

**TUESDAY, MARCH 21; DAY 2**

**SITE VISIT TO THE 500/400/220 AKHALTSIKHE HVDC SUBSTATION**

**WEDNESDAY, MARCH 22; DAY 3**

**HIGH VOLTAGE DIRECT CURRENT (HVDC) CONVERTER STATIONS MODEING**

Growing interest in the Black Sea region in the use of HVDC converter stations has resulted in the need to model and analyze more accurately the use of HVDC converter stations, which are being proposed in Ukraine, Romania, Moldova and Armenia to connect asynchronous electricity zones. The BSTP will conduct a two day workshop on using PSS/E software to improve the capacity of BSTP network planners to model and analyze HVDC converter stations within the regional context.

**Morning Session**

**THEORY AND METHODOLOGY ASPECTS OF HVDC MODELING WITHIN PSS/E – Part I**

* Introduction
* Line Commutated Converter (LCC) System
* Voltage Source Converter (VSC) System
* Comparison
* Examples and Exercises

**Afternoon Session**

**THEORY AND METHODOLOGY ASPECTS OF HVDC MODELING WITHIN PSS/E– Part II**

* Control of HVDC Systems
* Reactive Power Balance
* Short Circuit Ratio
* Additional Benefits of HVDC Systems
* ENTSO-E HVDC Network Codes
* Examples and Exercises

**THURSDAY, MARCH 23; DAY 4**

**TBILISI MARRIOTT HOTEL: 13 Shota Rustaveli Ave, Tbilisi 0108, Georgia**

**Morning Session**

**PRACTICAL EXAMPLES – Part I**

* Introduction
* PSS/E Load Flow and Short Circuit Basics
* Steady State Modeling of LCC
* Steady State Modeling of VSC
* Steady State Modeling of Multi-Terminal HVDC

**EXERCISES**

* Training network model development in terms of its starting structure and further modification during the workshop
* Steady state analysis input data and setting parameters (work on the developed training network model)
  + PSS/E input data modeling with data manipulation by using internal tables and editors
* Steady state calculation options (work on prepared training network model)
  + Input data checking and necessary settings of calculation options

**Afternoon Session**

**PRACTICAL EXAMPLES – Part II**

* PSS/E Dynamics Basics
* Dynamic Modeling of LCC
* Dynamic Modeling of VSC
* Dynamic Modeling of Multi-Terminal HVDC

**EXERCISES/HOMEWORK**

* Dynamic stability input data and setting parameters (work on the developed training network model)
  + PSS/E input data modeling with data manipulation by using internal tables and editors
* Dynamic calculation options (work on prepared training network model)
  + Input data checking and necessary settings of calculation options

**WORKSHOP ADJOUR**