



SEERC

3rd Technical Advisory Committee Meeting

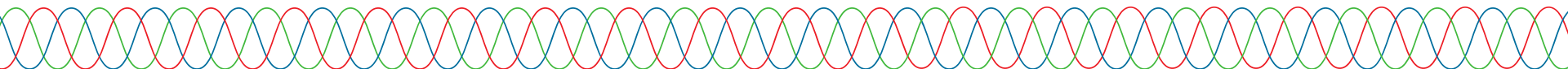
Praque, Czech Republic, 15-16 March 2017

Information about Operation of Croatian Electric Power System in Winter Season 2016/2017



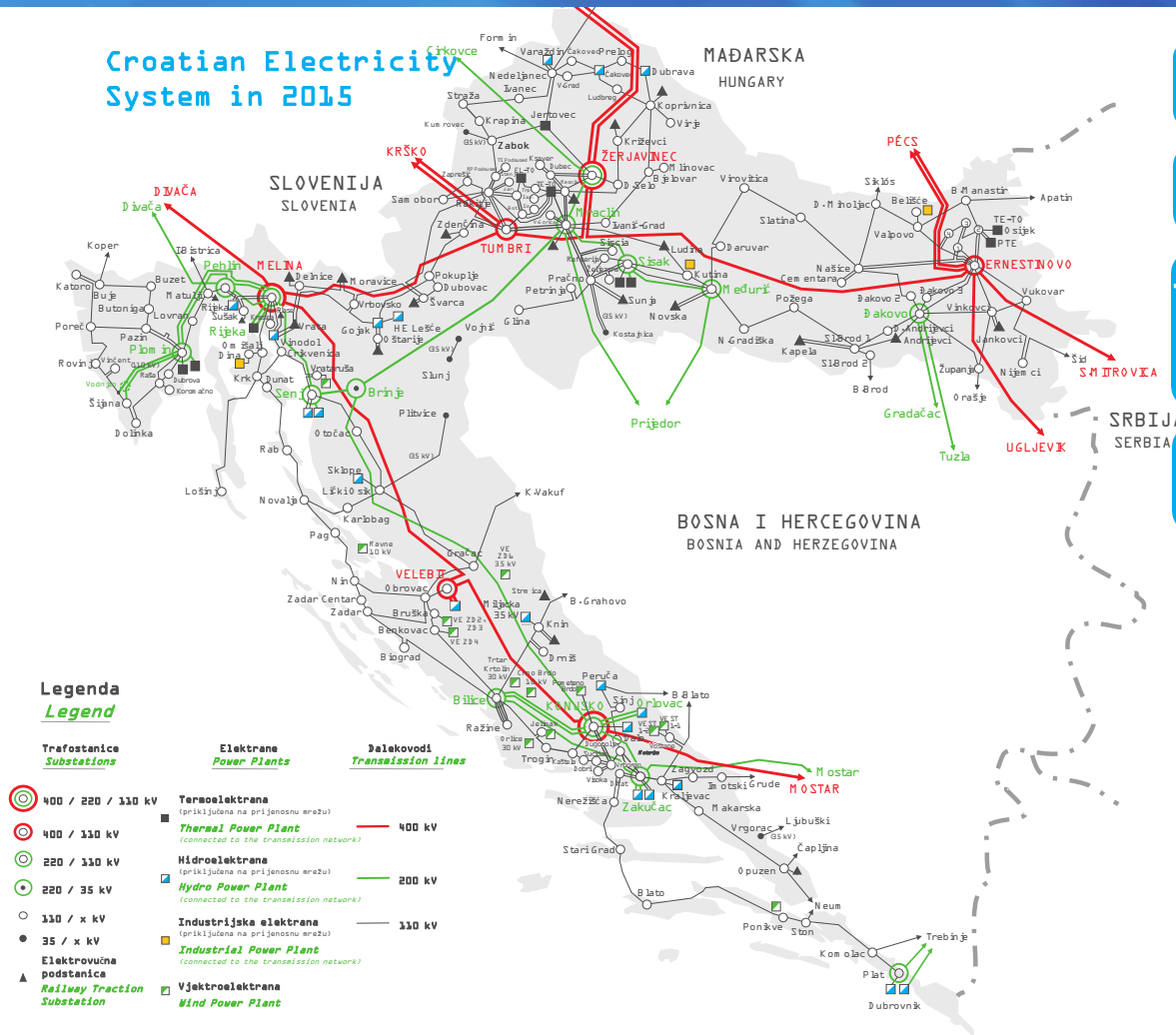
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*President of the Management Board
Croatian Transmission System Operator Ltd.*



Main Features of the Croatian Power System

Croatian Electricity System in 2015



Peak load

3009 MW

Total demand

16.8 TWh

Total net generation delivered to transmission grid

9.2 TWh

Generation mix: 4399 MW

TPPs (gas, coal, oil), other RES (mainly wind)

Voltage level (kV) Line length (km) Substation (number)

400

1247

13

220

1213

24

110

5108

151

MV

11

-

TOTAL

7579

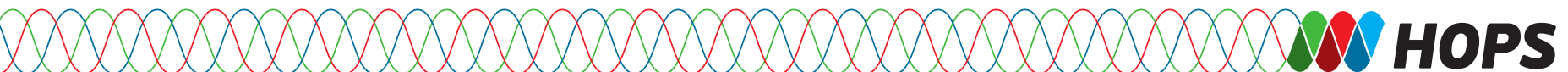
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Main Characteristics of Croatian Electric Power System in Winter Season 2016/2017

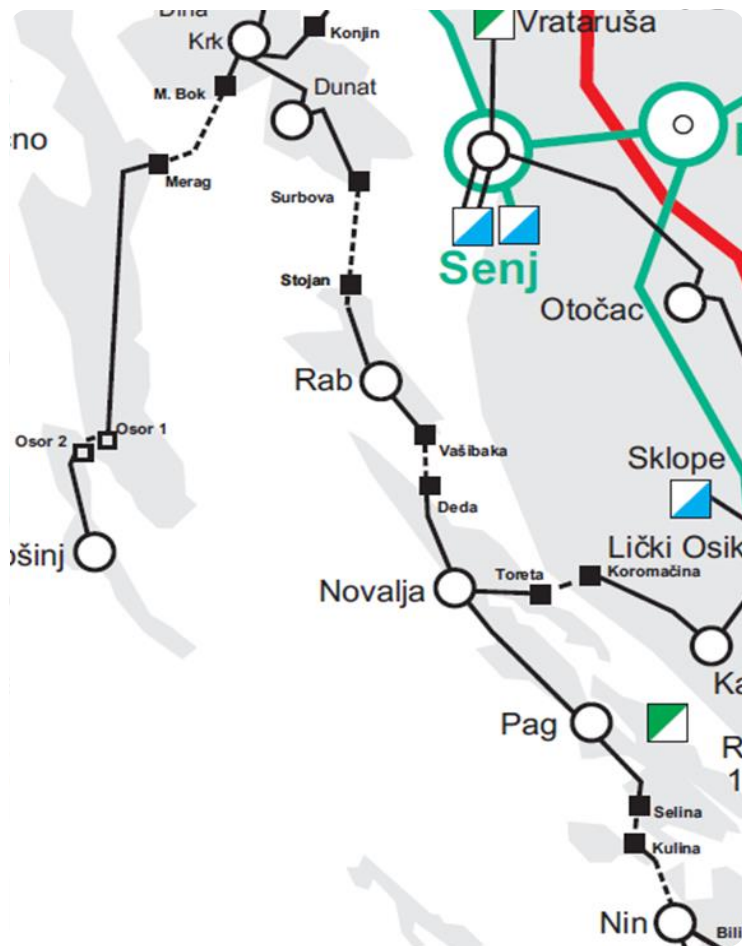
- Extremely low temperatures in January 2017, especially in the southern part of Croatia (islands and coastal area) – the lowest temperatures in the last 50 years
- Extreme wind (bora) in the northern Adriatic area (100-200 km/h) with the most severe salt sediment until now caused long interruptions in electricity supply
- Satisfactory system adequacy
- Increased electricity consumption and maximal system load (3067 MW) – near to the absolute maximum
- Reliable and secure operation of transmission network with the exception in islands in the northern part of the Adriatic
- Enhanced electricity flows in the direction Hungary-Croatia towards BiH and Serbia

Disturbance in the Operation of Croatian Transmission Network in the Northern Part of the Adriatic (1)

- Long and severe bora in the mid and northern part of the Adriatic during winter, causes intensive salt sediment
- Several years before, salt sediment during winter hit external 110/x kV facilities and OHLs in the northern Adriatic, especially in island of Pag
- Salt sediment in combination with humidity caused faults and outages of elements of transmission network in the islands
- Due to aggressive atmosphere, the OHLs were installed with silicone insulators
- The only efficient measure for faults remedy was the insulators' washing (fire department vehicles - facilities, manual washing – OHLs) or **RAIN!**

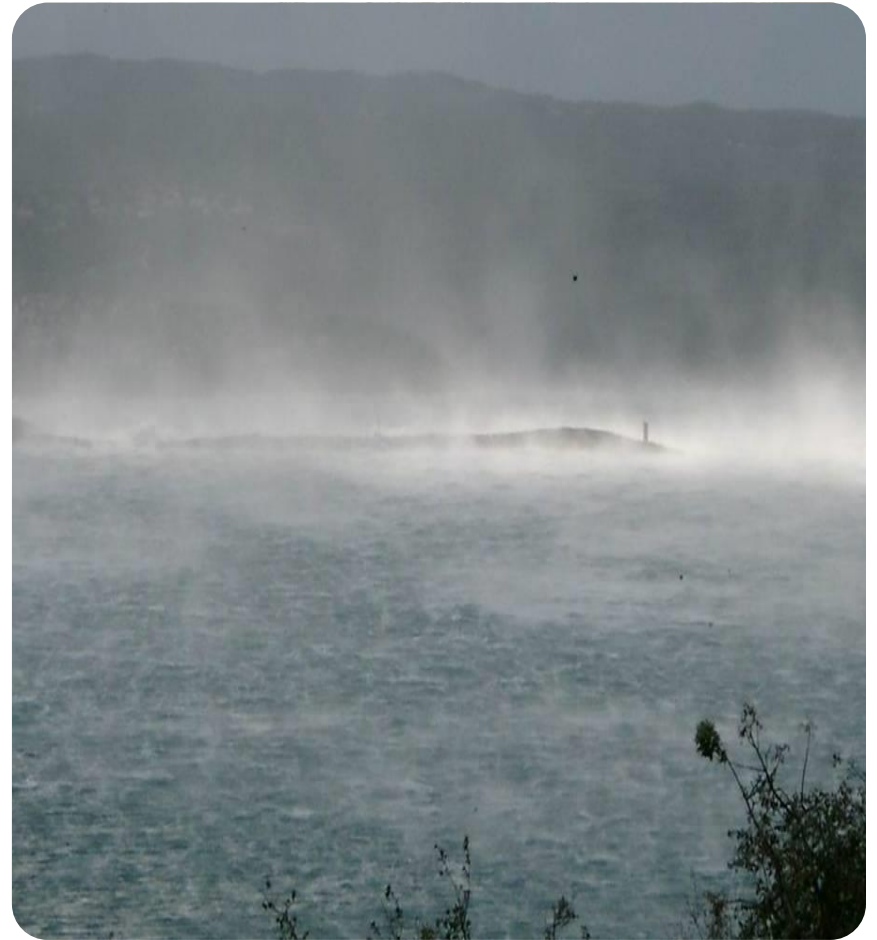


Disturbances in the Operation of Croatian Transmission Network in the Northern Part of Adriatic in January 2017 (2)



Substation	Outages (min)	Washing (min)	Total
Dunat	29	376	405
Rab	2255	376	2631
Novalja	270	309	579
Pag	109	485	594
Nin	29	376	405

Bora in the Northern Part of Adriatic in January 2017



Consequences of salt sediment caused by Bora in January 2017 (1)



Consequences of salt sediment caused by Bora in January 2017 (2)



Insulators' Washing – Removal of Salt sediment After the Bora in January 2017 (1)

The device for salt sediment washing – it is used for washing of insulation on OHL towers accessible by vehicle

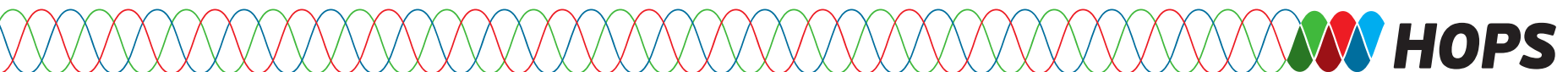


Insulators' Washing in Substation and of OHL after the Bora in January 2017



Experiences in Operation and Maintenance of Croatian Transmission Network in the Northern Part of Adriatic in Extreme Climate Conditions (Bora, Salt Sediment) in January 2017 (1)

- Bora and salt sediment were, until now, a regular phenomena during winter months in the islands of northern Adriatic, and most intensively in the island of Pag
- The consequences of salt sediment were frequent automatics reclose of OHLs and outages in substations due to flashover
- The salt sediment forms a layer on insulators which is removed with washing of insulators (fire department, maintenance teams) after the wind bora
- The maintenance teams are skilled and equipped for insulators' washing on OHLs (vehicle, water tanks)



Experiences in Operation and Maintenance of Croatian Transmission Network in the Northern Part of Adriatic in Extreme Climate Conditions (Bora, Salt Sediment) in January 2017 (2)

- Bora, by its intensity and duration, was in January 2017 evaluated as extreme and the strongest in the last 30 years – natural disaster
- The most severe bora and salt sediment caused by bora occurred in the island of Rab which was without electricity supply for the longest time period
- For the first time on OHLs in the island of Rab, the salt sediment caught also the silicone insulators and caused OHLs' outages
- The interventions of maintenance teams are only possible after the bora stops
- The recovery from the consequences of salt sediment consisted of washing of all insulators within the difficult accessible terrain, and changes of the damaged insulators
- The public was informed of the reasons of interruption in electricity supply by press release (HINA, web page of HOPS)

Lessons learned (1)

- The analysis of operation and outage in the transmission network was made for the area of northern Adriatic caused by long bora and salt sediment in January 2017
- With this analysis were determined short-term and long-term measures for decreasing the number and duration of outages
- **Short-term measures → for decreasing the duration of outages**
 - Targeted monitoring of weather forecast
 - Proclamation of „emergency operation”
 - Mobilisation and reassignment of maintenance teams
 - Extraordinary inspection of OHLs after the bora (teams, drones)
 - Equipping of Regional Transmission Areas with additional equipment for salt sediment washing
 - Informing of the public and local community in time (spokes person)

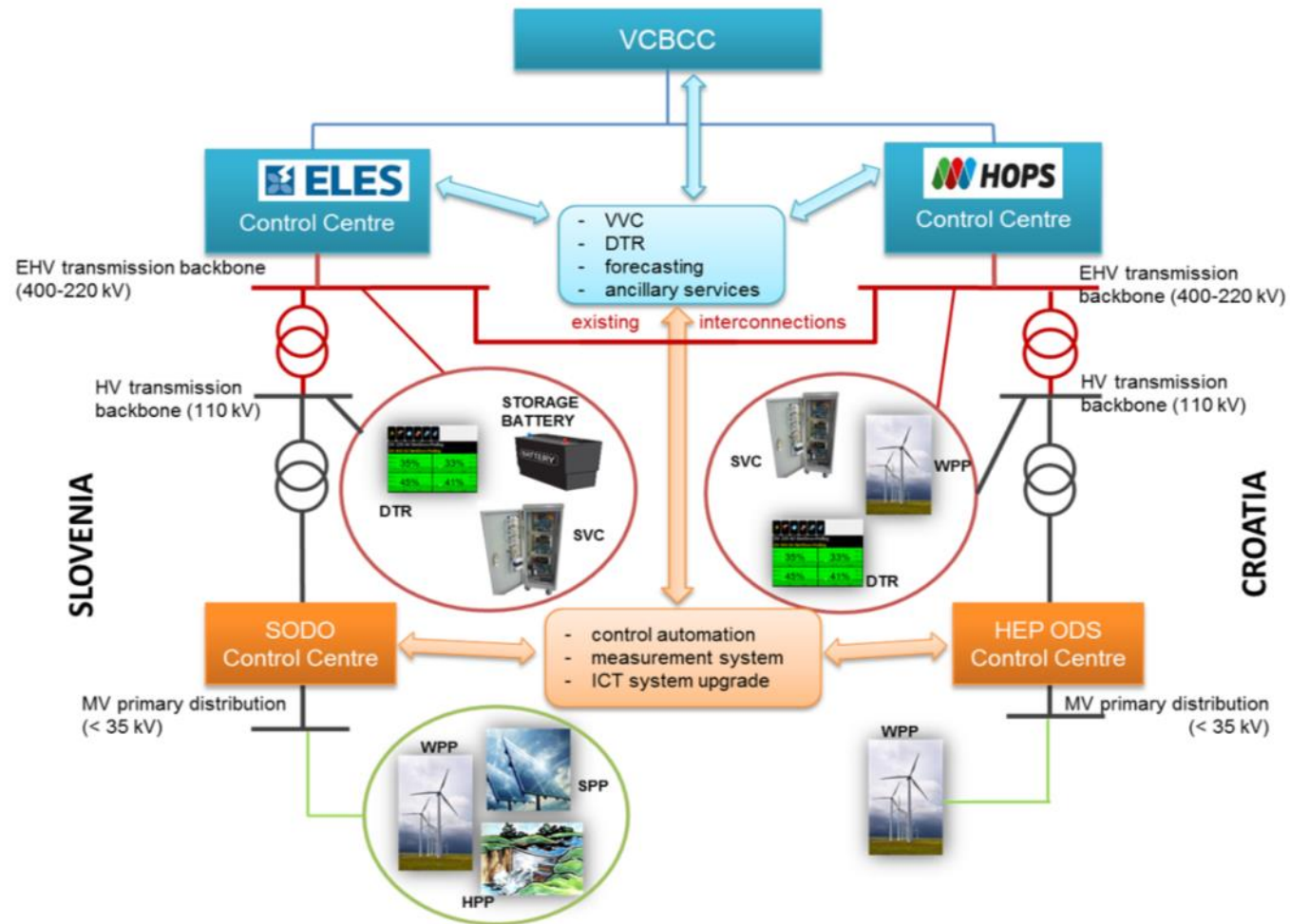
Lessons learned (2)

- **Long-term measures – decrease of number and duration of the outages**
 - Replacement of critical sections of OHLs with cables
 - Equipment of OHLs with sensors for salt sediment
 - Construction of access paths to the towers
 - Equipment of towers with „ladders”
 - Replacement of the outdoor 110 kV cable connection with HV facilities in cables house by the indoor option





SINCRO.GRID Project (1)



Main components of the SINCRO.GRID Project, with indicative timeline and investment costs (HOPS part) (2)

Component	Timeline for implementation	Investment costs
1. The deployment of compensation devices to address overvoltage and voltage instability issues within the transmission grid.	2016 documentation, authorizations	23,7 M€
	2017 tendering	
	2018 to 2019 manufacturing, delivery	
	2019 to 2021 erection, commissioning	
2. The deployment of advanced dynamic thermal rating (DTR) systems	2017 to 2019	0,82 M€
3. The deployment of a virtual cross-border control center (VCBCC) for renewable energy sources (RES).	2017 to 2020	2,06 M€

SINCRO.GRID Project - EC (CEF) Review of Project (3)

CEF Energy Call 2016-2
Internal Evaluation Committee
Overview table

Proposal Code	Proposal Title	PCI Title	Proposal Type	Energy Sector	Applicants	Applicant Country	Priority Corridor	Total costs, €	Request CEF Funding, €	Requested Funding Rate	Maturity	Cross Border Dimension	Positive Externality	Financial Obstacle	Soundness	Stimulating Effect	Priority And Urgency
10.3-0022-SIHR-W-M-16	Implementation of the SINCRO.GRID PCI - Phase 1	SINCRO.GRID (Slovenia/Croatia) aims at solving network voltage, frequency control and congestion issues enabling further deployment of renewables and displacement of conventional generation by integrating new active elements in the transmission and distribution grids into the virtual cross-border control centre based on advanced	Work	Smart grid	ELES, Ltd., Electricity Transmission System Operator / Hrvatski operator prijenosnog sustava d.o.o. / SODO sistemski operater distribucijskega omrežja z elektricno energijo, d.o.o. / HEP Operator	HR,SI	Smart grids deployment	79.390.221	40.489.013	51,00%	4	5	5	5	4	5	4

Recommended Total Cost, €	Recommended CEF Funding, €	Recommended Funding Rate	Recommended for funding	Overall Comment	Total Weighted Score	Rank
79.390.221	40.489.013	51,00%	Yes	The proposed action "Implementation of the SINCRO.GRID PCI - Phase 1" consists of activities which contribute to increased security of operations in the concerned Member States and the wider region. The action aims at better utilisation of existing infrastructure, enabling existing infrastructure to cope with new challenges like the integration of additional renewables (overvoltage and voltage instability), and installation of new infrastructure enabling more renewable uptake. The action contains, among others, innovative elements, e.g. deployment of electricity storage systems, as well as more mature technology, e.g. reactive power compensation devices). Overall the proposal is of very high quality and very well elaborated and detailed. The proposed action is the next logical step and preparatory works have been concluded. The action will increase the reliability of the electric system in the concerned Member States, while providing a positive impact to the region, and significant positive externalities are clearly demonstrated. The action receives strong support from national regulatory authorities and concerned Member States. The proposal contains a convincing description on why public funding is needed as well as an outlook on alternative implementation plans if no co-financing is provided. Soundness of the implementation plan and perceived competences are high; monitoring, quality control procedures, risk register and a risk contingency plan are provided. The proposal as such only has very minor weaknesses. Conclusion: The proposal is recommended for funding.	455	1



Thank you for the attention!

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