QUESTIONNAIRE

on the grids operated by DSOs

This Questionnaire was prepared as part of the activities of the Working Group "Operation flexibility of grids with large distribution generation share." It aims to gather information on the current and foreseen installed amount of Distributed Energy Resources (DERs) in different countries, on what kind of challenges the Distribution System Operators (DSOs), Distribution Network Service Providers (DNSPs) and so on are experiencing due to their increasing amount, and on what kind of countermeasures are utilised or planned to be utilised to overcome these challenges.

The following definitions for voltage levels are used according to IEC 50160 and 60038 standards:

- Low voltage (LV): up to 1 kV
- Medium voltage (MV): above 1 up to 35* kV
- High voltage (HV): above 35* kV

All data will be kept confidential, and only the anonymised (country-specific, not DSO-specific) evaluated data will be included in the report.

Abbreviations & Definitions

CAM	**Control Area Manager**	**LV**	**Low Voltage**
CP	**Customer Plants**	**MV**	**Medium Voltage**
DER	**Distributed Energy Resources:** includes generation and storage units connected in medium and low voltage levels	**OLTC**	**Onload Tap Changer**
DG	**Distributed Generation:** includes generation units connected in medium and low voltage levels	**PV**	**Photo Voltaic**
DR	**Demand Response:** Influence electricity demand in the short term by direct emergency- or price-driven request. Synonym: DSF	**SO**	**System operator: TSO, DSO**
DSF	**Demand Side Flexibility:** Influence electricity demand in the short term by direct emergency- or price-driven request. Synonym: DR	**St.**	**Storage**
DSM	**Demand Side Management:** Influence electricity demand by incentivising customers in the long term to modify their energy consumption patterns.	**T&D**	**Transmission and Distribution**
HV	**High Voltage**	**VR**	**Voltage Regulator**

* In the standards of some countries, 50 and 66 kV are considered Medium Voltage levels.

DSO Name (non-mandatory) HEP ODS

DSO Country Croatia

1. Base data

1.1 Which voltage levels does your utility operate?

132 kV	☐Yes	☐ No
110 kV	☐Yes	☐ No
66 kV	☐Yes	☐ No
35 kV	☑Yes	☐ No
33 kV	☐Yes	☐ No
22 kV	☐Yes	☐ No
20 kV	☑Yes	☐ No
15 kV	☐Yes	☐ No
11 kV	☐Yes	☐ No
10 kV	☑Yes	☐ No
6 kV	☐Yes	☐ No
0.4 kV	☑Yes	☐ No
0.11kV	☐Yes	☐ No

Other: 30 [kV]; _____ [kV]; _____ [kV]; _____ [kV]; _____ [kV].

1.2 Which DG types do you operate in low, medium and high voltage levels?

High Voltage Level (sub-transmission)

Rooftop PV plants ☐Yes ☐ No

Ground-mounted PV plants ☐Yes ☐ No

Hydropower plants ☐Yes ☐ No

Wind power plants ☐Yes ☐ No

Thermal power plants ☐Yes ☐ No

Cogeneration power plants ☐Yes ☐ No

Other:_____

Medium Voltage Level

Rooftop PV plants ☑Yes ☐ No

Ground-mounted PV plants ☑Yes ☐ No

Hydropower plants ☑Yes ☐ No

Wind power plants ☑Yes ☐ No

Thermal power plants ☑Yes ☐ No

Cogeneration power plants ☑Yes ☐ No

Other:_____

Low Voltage Level

Rooftop PV plants ☑Yes ☐ No

Ground-mounted PV plants ☑Yes ☐ No

Hydropower plants ☑Yes ☐ No

Wind power plants ☐Yes ☑ No

Thermal power plants ☐Yes ☑ No

Cogeneration power plants ☐Yes ☑ No

Other:_____

2. Current DER penetration

2.1 Electricity production units connected to HV grid:

Units number _____ or Parks number _____

Total installed power _____ [kVA]

Comments _____

2.2 Storage units connected to HV grid:

Units number owned by SO _____

Units number not owned by SO _____

Total installed power _____ [kVA] Total energy storage capacity _____ [kWh]

Comments HEP ODS does not operate HV grid

2.3 How many distributed electricity producers and storage facilities are directly connected to the MV grid?

How many **Sub-Sys_MV**, see Figure 1, does your utility operate? 144

How long is the longest MV-feeder you are operating? cca. 40 [km] with cca. 40 [km] overhead and - [km] cable structure.

Provide the aggregated installed apparent power of all distributed generation units connected in the MV grid: 390.362 [kVA].

The largest electricity-producing unit (or park) is 20.000 [kVA] (or _____ [kVA]).

The number of electricity-producing units (or parks) is 136 (or _____).

Provide the aggregated installed apparent power and the total storage capacity of all storage units (DSO owned or not) connected in the MV grid: - [kVA] and _____ [kWh].

The largest storage unit is - [kVA].

Comments power data refers to connection power at PCC

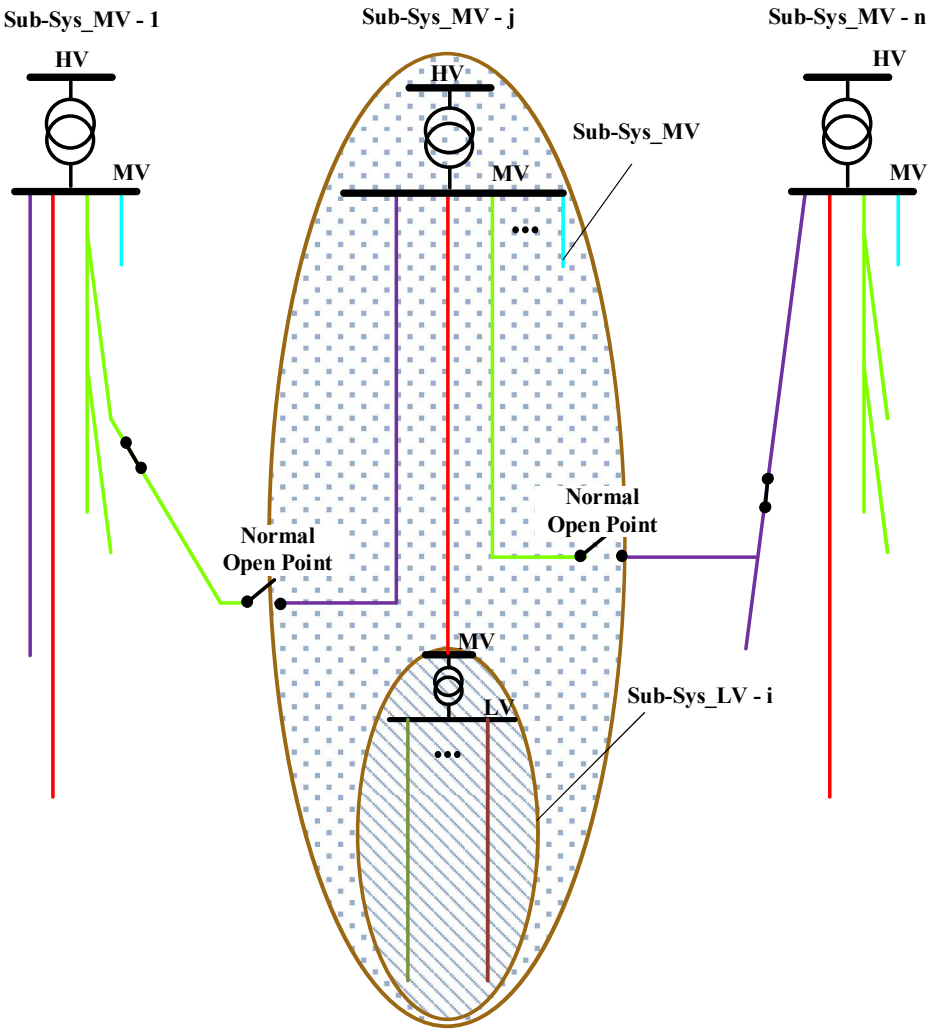

Figure 1. Overview of the Sub-System structure in the radial configurations of distribution grids.

2.4. How many distributed electricity producers and storage facilities are directly connected to the LV grid?

How many **Sub-Sys_LV**, see Figure 1, does your utility operate? 29.510

How long is the longest LV feeder you are operating? cca. 2 [km] with cca. 2 [km] overhead and _____ [km] cable structure.

Please provide the aggregated installed apparent power of all distributed generation units connected in the LV grid: 109.148 [kVA].

The largest electricity-producing unit (or park) is 500 [kVA] (or _____ [kVA]).

The number of electricity-producing units (or parks) is 2007 (or _____).

Please provide the aggregated installed apparent power and the total storage capacity of all storage units (DSO owned or not) connected in the LV grid: - [kVA] and _____ [kWh].

The largest storage unit is - [kVA].

Comments power data refers to connection power at PCC

2.5. Do you have information about rooftop PV and storage installations behind the meter (at the customer plant level)?

■ Yes ☐ No

If Yes :
Please provide the aggregated installed power of all rooftop PVs: 320.704 [kWp].
The largest PV unit is 10.000 [kWp].
The number of rooftop PVs is 12.573.
Provide the aggregated installed power and the total storage capacity of all storage units connected behind the meter: - [kVA] and _____ [kWh].
The largest storage unit is - [kVA].

Comments power data refers to connection power at PCC

3. Future development of DER penetration

3.1 To what extent do you expect DG to penetrate the grid in the next few years?

Additional to the current situation	In 2 Years		In 5 Years		In 10 Years	
	Units	**Total kVA**	**Units**	**Total kVA**	**Units**	**Total kVA**
HV						

Additional to the current situation	In 2 Years		In 5 Years		In 10 Years	
	[%] increase to the current DG installed power	**Total forecasted DG kVA**	**[%] increase to the current DG installed power**	**Total forecasted DG kVA**	**[%] increase to the current DG installed power**	**Total forecasted DG kVA**
MV (directly connected)			385	1.500.000		
LV (directly connected)			150	280000		
CP			220	700.000		

3.2 To what extent do you expect the distributed storage to penetrate the grid in the next few years?

In addition to the current situation	In 2 Years		In 5 Years		In 10 Years	
	UnitNr.	Total kVA	UnitNr.	Total kVA	UnitNr.	Total kVA
HV						

In addition to the current situation	In 2 Years		In 5 Years		In 10 Years	
	[%] increase to the current storage installed power	Total forecasted storage kVA	[%] increase to the current storage installed power	Total forecasted storage kVA	[%] increase to the current storage installed power	Total forecasted storage kVA
MV						
LV						
CP						

3.3 To what extent do you expect the total current load to increase because of heat pumps, e-mobility and other consumption in the next few years?

$$Inst.Power.^{Heat.Pumps}\,[\%] = \frac{Inst.Power.^{Heat.Pumps}\,[kVA]}{Current\ total\ load\ [kVA]} * 100 \quad [1]$$

$$Inst.Power.^{E-mobility}\,[\%] = \frac{Inst.Power.^{E-mobility}\,[kVA]}{Current\ total\ load\ [kVA]} * 100 \quad [2]$$

Load increase	In 2 Years			In 5 Years			In 10 Years		
	Heat pumps [%]	E-mobility [%]	SUM [%]	Heat pumps [%]	E-mobility [%]	SUM [%]	Heat pumps [%]	E-mobility [%]	SUM [%]
MV level									
LV level									
CP level									

4. Challenges provoked by DER penetration

4.1. Reverse power flows in different parts of the network

Do you experience reverse active power flows from the customer plants (when it is a prosumer)?

☐ Never

☐ Yes, but only in a few locations and only rarely (less than ~50 hours a year)

■ Yes, commonly

If "Yes", please give the percentage of time and transformers (if no precise rates, please provide an approximation)

_____

Do you experience reverse power flows through the MV/LV transformers?

☐ Never

☐ Yes, but only in a few locations and only rarely (less than ~50 hours a year)

■ Yes, commonly

If "Yes", please give the percentage of time and transformers (if no precise rates, please provide an approximation)

_____

Do you experience reverse power flows through the HV/MV transformers?

☐ Never

■ Yes, but only in a few locations and only rarely (less than ~50 hours a year)

☐ Yes, commonly

If "Yes", please give the percentage of time and transformers (if no precise rates, please provide an approximation)

_____

Do you experience reverse active power flows towards the transmission grid?

☐ Never

■ Yes, but only in a few locations and only rarely (less than ~50 hours a year)

☐ Yes, commonly

If "Yes", please give the percentage of time and transformers (if no precise rates, please provide an approximation).

_____

Do you experience a direction change in the reactive power flows in the TSO/DSO intersection points?

☐ Never

■ Yes, but only in a few locations and only rarely (less than ~50 hours a year)

☐ Yes, commonly

If "Yes", please give the percentage of time and transformers (if no precise rates, please provide an approximation)

_____

4.2. Have there been violations of the upper voltage limits due to DERs?

Please select all the relevant boxes.

☐ No

■ Yes, in LV networks

☐ Yes, in MV networks

☐ Yes, in HV networks

4.3. Voltage limits

Do you define the voltage limits based on

■ IEC? ☐ IEEE?

Other _____

In your grid, do you respect fixed ranges for the high, medium and low voltage grid (e.g., ± 5 % for HV, ± 2 % for MV and ± 3 % for LV) to ensure the overall permitted range of ± 10 % at low voltage level?

☐ Yes, fixed ranges are respected. They are ±____% for HV, ±____% for MV and ±____% for LV

■ No, there are no general individual ranges for HV/MV/LV;

Comments: _____

4.4. Are you monitoring harmonics on the grid?

☐ No, ■ Yes

If "Yes"

- **Which standards are you using for the limits?**
  IEC 61000-3-6

At what voltage level are the violations identified?

HV level ■ No, ☐ Yes

If "Yes"

- **Have you identified an increase in the Total Harmonic Distortion (THD) in the last years?**
  ☐ No, ☐ Yes the maximal value reached _____ [%]

Comments_____

- **Have you identified violations of current harmonics limits?**

■ No

☐ Yes, the following harmonics are violated

3d harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
5th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
7th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
9th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
11th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
13th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
15th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
17th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
19th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
21th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]

Others: _____

- **Have you identified violations of voltage harmonics limits?**

■ No

☐ Yes, the following harmonics are violated

3d harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
5th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
7th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
9th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
11th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
13th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
15th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
17th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
19th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
21th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]

Others: _____

MV level ■ No, ☐ Yes

If "Yes"

- **Have you identified an increase in the Total Harmonic Distortion (THD) in the last years?**

☐ No, ☐ Yes the maximal value reached _____ [%]

Comments_____

- **Have you identified violations of current harmonics limits?**

■ No

☐ Yes, the following harmonics are violated

3d harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
5th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
7th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
9th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
11th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
13th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
15th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
17th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
19th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
21th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]

Others: _____

- **Have you identified violations of voltage harmonics limits?**

■ No

☐ Yes, the following harmonics are violated

3d harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
5th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
7th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
9th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
11th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
13th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
15th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
17th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
19th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
21th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]

Others: _____

LV level ■ No, ☐ Yes
If "Yes"

- **Have you identified an increase in the Total Harmonic Distortion (THD) in the last years?**
  ☐ No, ☐ Yes the maximal value reached _____ [%]

Comments_____

- **Have you identified violations of current harmonics limits?**

■ No

☐ Yes, the following harmonics are violated

3d harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
5th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]

7th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
9th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
11th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
13th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
15th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
17th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
19th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
21th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]

Others: _____

- **Have you identified violations of voltage harmonics limits?**

■ No

☐ Yes, the following harmonics are violated

3d harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
5th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
7th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
9th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
11th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
13th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
15th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
17th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
19th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]
21th harmonic ☐ No, ☐ Yes → with a maximal value of _____[%]

Others: _____

4.5. Have there been identified violations of current limits of network components, i.e. overloading problems due to the DERs?

Please select all the relevant boxes.

■ No

☐ Yes, in LV networks

☐ Yes, in MV/LV transformers

☐ Yes, in MV networks

☐ Yes, in HV/MV transformers

☐ Yes, in HV networks, changes in short-circuit currents

Have there been identified situations in which the DERs have risen the short-circuit levels above the limits of network equipment (e.g. switchgear)?

☐ No

■ Yes. Equipment Type: circuit breaker

4.6. Have you experienced protection-related problems due to DERs?

☐ No

■ Yes

Please elaborate on which type of problems: anti islandnig protection

4.7. Are some On-Load Tap Changers (OLTC) unable to maintain their voltage setup because they are in the lowest tap position?

☐ Never

■ Yes, in HV/MV substations, but only in a few locations and only rarely (less than ~50 hours a year)

☐ Yes, in HV/MV substations, commonly

☐ Yes, in MV/LV substations, but only in a few locations and only rarely (less than ~50 hours a year)

☐ Yes, in MV/LV substations, commonly

5. Countermeasures to maintain network voltages within statutory/legal limits

5.1. Which local control strategy is used to eliminate voltage violations?

	Fixed cos□□by DER	**cos□□P) by DER**	***Q*(*U*) by DER**	***P*(*U*) by DER**	***Q*(*U*) - coil**	***Q*(*U*) by capacitors**	**OLTC equipped transformer**	**In-line voltage regulators**
HV	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No
MV	■Yes ☐ No	☐Yes ■ No	■Yes ☐ No	☐Yes ■ No	☐Yes ■ No	☐Yes ■ No	■Yes ☐ No	☐Yes ■ No
LV	■Yes ☐ No	☐Yes ■ No	■Yes ☐ No	☐Yes ■ No	☐Yes ■ No	☐Yes ■ No	☐Yes ■ No	■Yes ☐ No
CP (inv.)	■Yes ☐ No	☐Yes ■ No	■Yes ☐ No	☐Yes ■ No	☐Yes ■ No	☐Yes ■ No	☐Yes ■ No	☐Yes ■ No

Other _____

5.2. Are you using central control strategies to eliminate voltage violations?

What part of the grid is covered in a SCADA system?

HV grid ☐Yes ☐ No

MV grid ■Yes ☐ No

LV grid ☐Yes ■ No

	Volt/var control without state estimator	Volt/var control with a state estimator
HV	☐Yes ■ No	☐Yes ■ No
MV	☐Yes ■ No	☐Yes ■ No
LV	☐Yes ■ No	☐Yes ■ No

Other _____

5.3. If you use central control strategies, which levers (control variables) are used to eliminate voltage violations?

Voltage violation location	P by DER	Q by DER	*P* by consumers	*Q* by consumers	*Q* by capacitors	Q by coils	HV/MV OLTC voltage reference	MV/LV OLTC voltage reference
HV	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No	☐Yes ☐ No
MV	■Yes ☐ No	■Yes ☐ No	☐Yes ■ No	☐Yes ■ No	■Yes ☐ No	■Yes ☐ No	■Yes ☐ No	☐Yes ■ No
LV	☐Yes ■ No	■Yes ☐ No	☐Yes ■ No	☐Yes ■ No	■Yes ☐ No	■Yes ☐ No	■Yes ☐ No	☐Yes ■ No

6. Practical countermeasures to minimise thermal and other constraints at the TSO-DSO interface.

Is there any load problem at the TSO-DSO interface that causes the TSO to restrict DER from connecting to the distribution network? ■Yes ☐ No

If "Yes", **what kind of countermeasures are used?**

- Connection restriction; ■Yes ☐ No
- Curtailment (Rule-based approach); ☐Yes ☐ No
- Alternative/non-firm connection agreements? ■Yes ☐ No
- Option of (non-market-based) redispatch in distribution grids
- Other_____

Is there any voltage violation problem at the TSO-DSO interface that causes TSO to restrict the DSO regarding network operation (e.g., reverse Q flow, etc.)? ☐Yes ■ No

If "Yes", **what kind of countermeasures are used**?

- Connection restriction; ☐Yes ☐ No
- Curtailment (Rule-based approach); ☐Yes ☐ No
- Non-firm connection? ☐Yes ☐ No
- Use of the reactive power capacity of DER? ☐Yes ☐ No
- Installation of coils? ☐Yes ☐ No

Other: _____

7. Grid Codes and Distribution Codes of Practice

Please list the Grid Codes and Distribution Codes relevant to DER connection conditions. If they are available online, please add the link.

Grid code: https://www.hep.hr/ods/mrezna-pravila-distribucijskog-sustava/662

7.1. Connection conditions on LV network

What is the power limit for a household-sized power plant? _____kVA

Are there any restrictions on the power plant to be connected due to network limitations? ■Yes ☐ No

If "Yes", what is the content of restrictions (e.g., size limit due to voltage increase, etc.)?

voltage increase, thermal limits

What network calculations are done for connectivity, or is there a rule of thumb?

☐Thumb rule ☐ Calculations: load flow and voltage changes

7.2. Connection conditions on MV network

Are there power limits for a power plant connecting to the MV network?

■ Yes ☐ No general limits (connection point is decided on an individual basis)

If "Yes": Lower limit:_____ kVA; Upper limit: 10.000 kVA;

Where/how are these limits defined?

■ National legislation/grid connection code/NRA defines uniform limits

☐ DSO is entitled to set these limits

Are there any restrictions on the power plant to be connected due to network limitations? ■Yes ☐ No

If "Yes", **what is the content of restrictions (e.g., size limit due to voltage increase, thermal limits)?**

voltage increase, thermal limits, n-1 criteria

What network calculations are done for connectivity, or is there a rule of thumb?

☐Thumb rule ■ Calculations: load flow, voltage changes, short circuit

7.3. Connection conditions on HV/MV substation

What is the power limit for a power plant? 20.000 kVA

- Are there any restrictions on the power plant to be connected due to network limitations?:
  ■Yes ☐ No

If "Yes", **what is the content of restrictions (e.g., size limit due to voltage increase, thermal limits)?**

voltage increase, thermal limits, n-1 criteria

What network calculations are done for connectivity, or is there a rule of thumb?

☐Thumb rule ■ Calculations: load flow, voltage changes, short circuit

7.4. Connection conditions on the HV network

What is the power limit for a power plant? _____kVA

Are there any restrictions on the power plant to be connected due to network limitations?

☐Yes ☐ No

If "Yes", **what is the content of restrictions (e.g., size limit due to voltage increase, thermal limits)?**

_____

What network calculations are done for connectivity, or is there a rule of thumb?

☐Thumb rule ☐ Calculations: _____

8. Effectiveness of energy market/trading rules to promote the DER flexibility

In your opinion, does the actual market structure operated by the TSO (CAM):

- **Promote the installation and DERs operation?** ■Yes ☐ No
- **Or restrict the DER installation?** ☐Yes ☐ No

Have you experienced contingency cases provoked by market decisions? ☐Yes ■ No

If "Yes", **do you reschedule DGs?** ☐Yes ☐ No

If "No", please specify the countermeasures_____

Is a local flexibility market established in your operation area where all grid users (small up to big) can bid and offer directly? ☐Yes ■ No

If "Yes", please describe or give the link or the reference where the information can be found.

_____

Is there any mechanism for the DSO to limit DER participation in these markets if that would cause problems to the distribution network?

☐Yes ■ No

If "Yes", please describe or give the link or the reference where the information can be found.

_____

Is the flexibility procurement used as an alternative to infrastructure reinforcement? ☐Yes■ No

If "Yes", **how is this implemented in your company?** Please give the document link or explain in a separate document.

_____

How have you identified the added value of flexibility solutions compared with the traditional T&D network investment plan (defer traditional network investment)? ☐Yes■ No

If "Yes", please give the document link or explain in a separate document.

_____

What is the time horizon for the asset planning considered in praxis?

- Monthly plan ☐Yes ☐ No
- 6 months plan ☐Yes ☐ No
- One-year plan ☑Yes ☐ No
- Five years plan ☐Yes ☐ No
- Ten years plan ☑Yes ☐ No
- Other Three-year plan _____

For what situations do you already procure flexibility services, and for what situations do you think flexibility procurement could provide benefits?

☐ Regularly occurring congestion situations

■ Ad hoc (rarely occurring) congestion situations

■ Voltage violations

■ Planned maintenance work

☐ Unplanned (repair) work

Other: _____

Comments _____

What kind of flexibility is realised and is in use in your utility?

☐ Demande Side Management ☐ Demand Response

If Demand Response:

- Demand Response (Demand Side Flexibility) of significant users for

Load shaving ☐Yes ☐ No
Load reduction ☐Yes ☐ No
Load increase ☐Yes ☐ No

- Demand Response (Demand Side Flexibility) of small users for

Load shaving ☐Yes ☐ No
Load reduction ☐Yes ☐ No
Load increase ☐Yes ☐ No

If at least one of the answers is "yes", **is this flexibility considered in the planning process?**

☐Yes ☐ No

If "Yes", please describe the methodology or give the link or the reference where this information can be found.

_____

Are there procedures to harmonise and coordinate asset planning between the DSO and the relevant TSO(s)?

■Yes ☐ No

If yes, **in what time period?**

1, 3 and 10 years

Which procedure is used?

Please deliver the link or the reference where the information can be found.

https://www.hep.hr/ods/razvoj-mreze/planovi-razvoja-mreze/536

9. Additional information: Grid Characteristics

The number of customers served by the DSO network: 2.484.575 pcs

Total length of HV overhead lines: - km

Total length of HV underground cables: - km

Total length of MV overhead lines: 23.315 km

Total length of MV underground cables: 19.149 km

Total length of LV overhead lines: 43.999 km

Total length of LV underground cables: 18.670 km

Total number of HV/MV substations: 144 pcs

The voltage ratios of HV/MV substations in kV: 110/35 110/30 110/20 110/10

Total installed capacity of HV/MV transformers: 4.622,5 MVA

Total number of MV/LV secondary substations: 29.510 pcs

The voltage ratios of MV/LV substations in kV: 20/04 10/0,4

Peak demand of the network: 3100 MW