

# What happens when there is darkness in the DS?

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# Not dark as darkness ...

- 1. Planned dark**
- 2. Unplanned dark**
- 3. Black-out**



# Not dark as darkness...

## 1. **Planned dark**

Electricity supply interruption in the performance of the **planned works**  
Customers are informed about the planned restrictions of the electricity supply

## 2. **Unplanned dark**

- Electricity supply interruption due to **LV failure**
  - Most often with the least impact on electricity customers
- Electricity supply interruption due to **MV failure**
  - Common with a significant impact on electricity customers
- Electricity supply interruption due to **HV failure**
  - Rare with potentially significant impact on electricity customers

## 3. **Black-out**

- Total darkness has a major impact on people, the economy, the functioning of the state as such - emergency



# Solution electricity supply interruption due to MV failure



app 5 min.

app 60 min.

app 30 min.

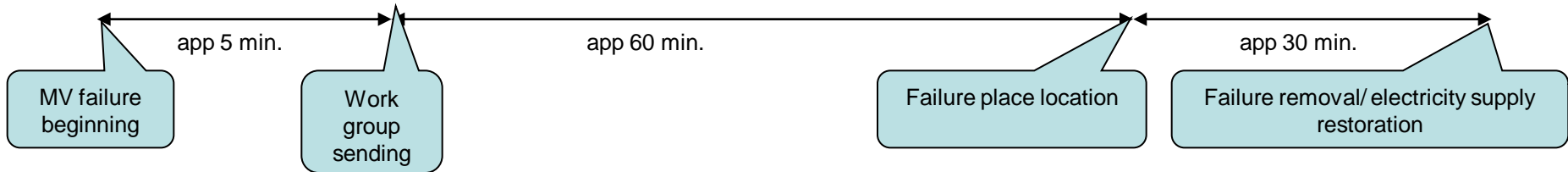
MV failure beginning

Work group sending

Failure place location

Failure removal/ electricity supply restoration

# Failure beginning





# Failure location



app 5 min.

app 60 min.

app 30 min.

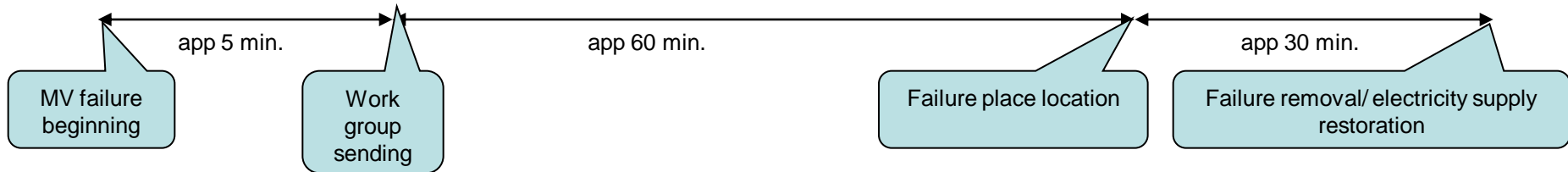
MV failure  
beginning

Work  
group  
sending

Failure place location

Failure removal/ electricity supply  
restoration

# Failure removal





# Other types of DS devices damages





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# Other types of DS devices damages

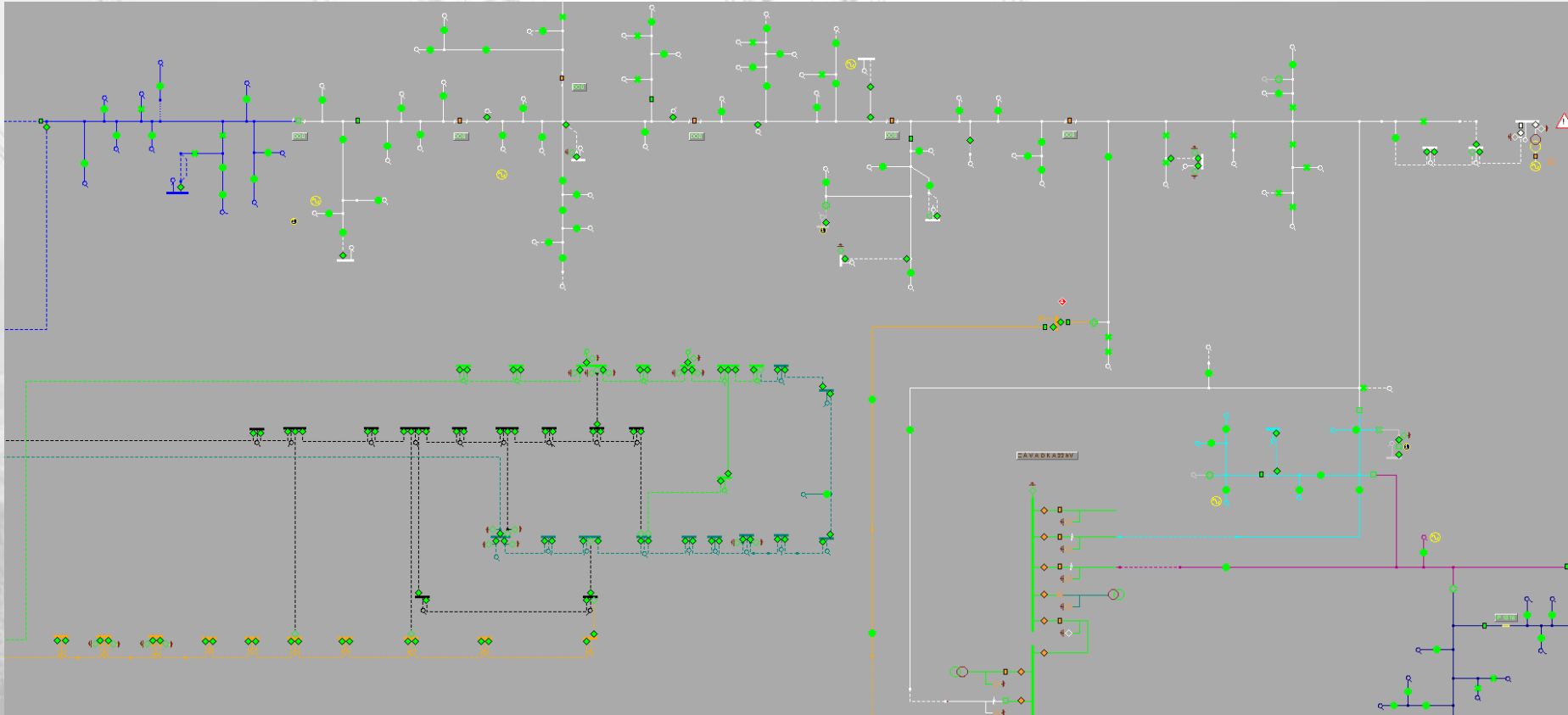


# Electricity supply interruption due to MV failure

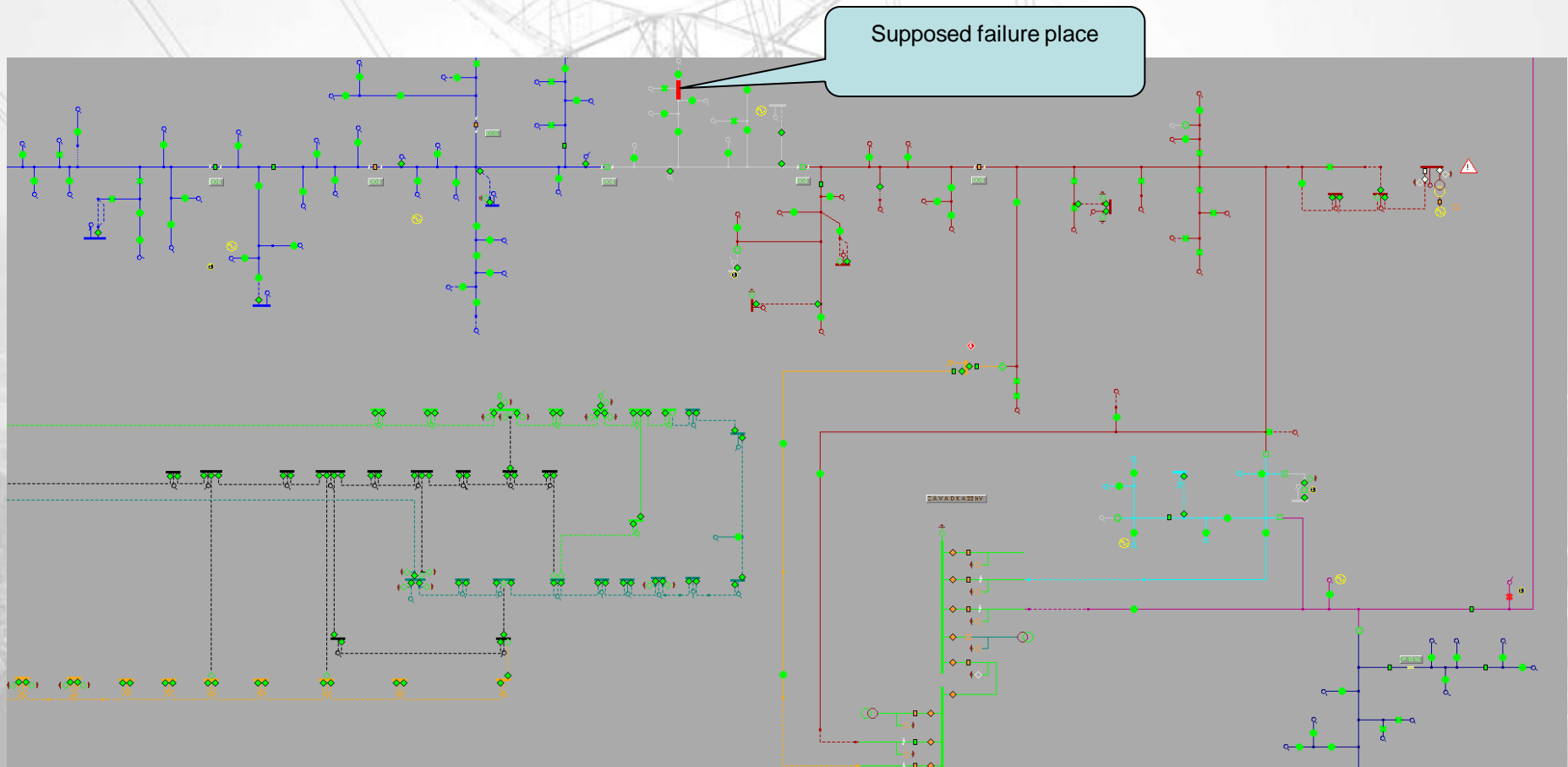
- The objective of DSO is fast electricity supply restoration while protecting the health of workers
  - Safety working processes
  - Training of field staff
  - Training of dispatchers
  - Using Remote Controlled elements in MV system
    - RC section switch
    - RC recloser
    - RC MV/ LV transformer station
    - Indicator of short-circuit currents
  - Using backup electricity resources
  - Study *Automatic MV failures searching*



# Automatic detection MV failures - outage of MV line

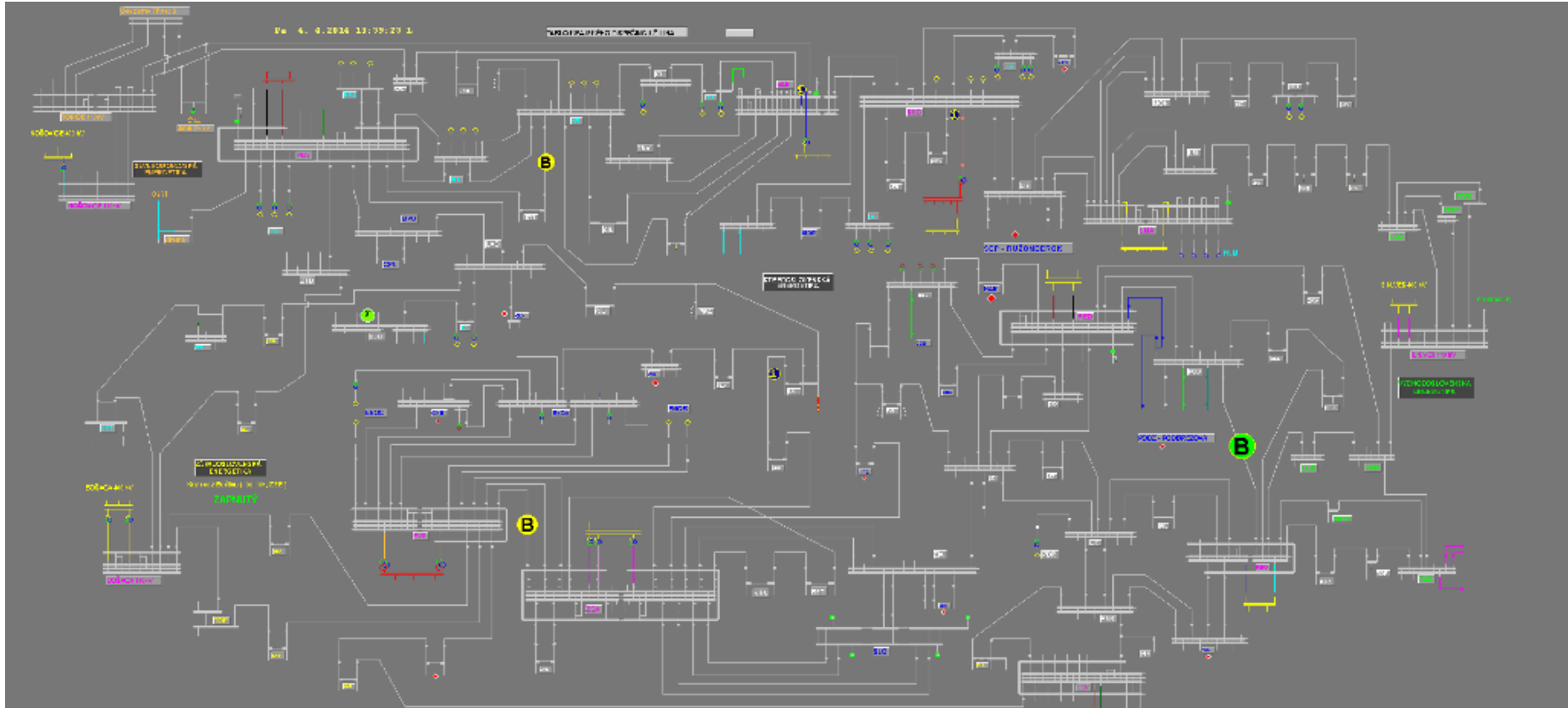


# Automatic detection MV failures – failure place location





# Black-out by DSO dispatcher's eyes



None of us wants to see such a screen, what to do for it?

# Black-out – global dark

- **Prevention B-O:** systematically solved in defences plans
- **Occurrence :** rare but can not be ruled out
- **Range:** all SP are in dark
- **Causes:** global imbalances between production and consumption resulting decay ES
- **Consequence:** interruptions p / e for the ES countries, large units of electricity systems
- **Solution:** crisis management – operatively from center, remote, power supply from another area, mutual assistance with neighboring areas

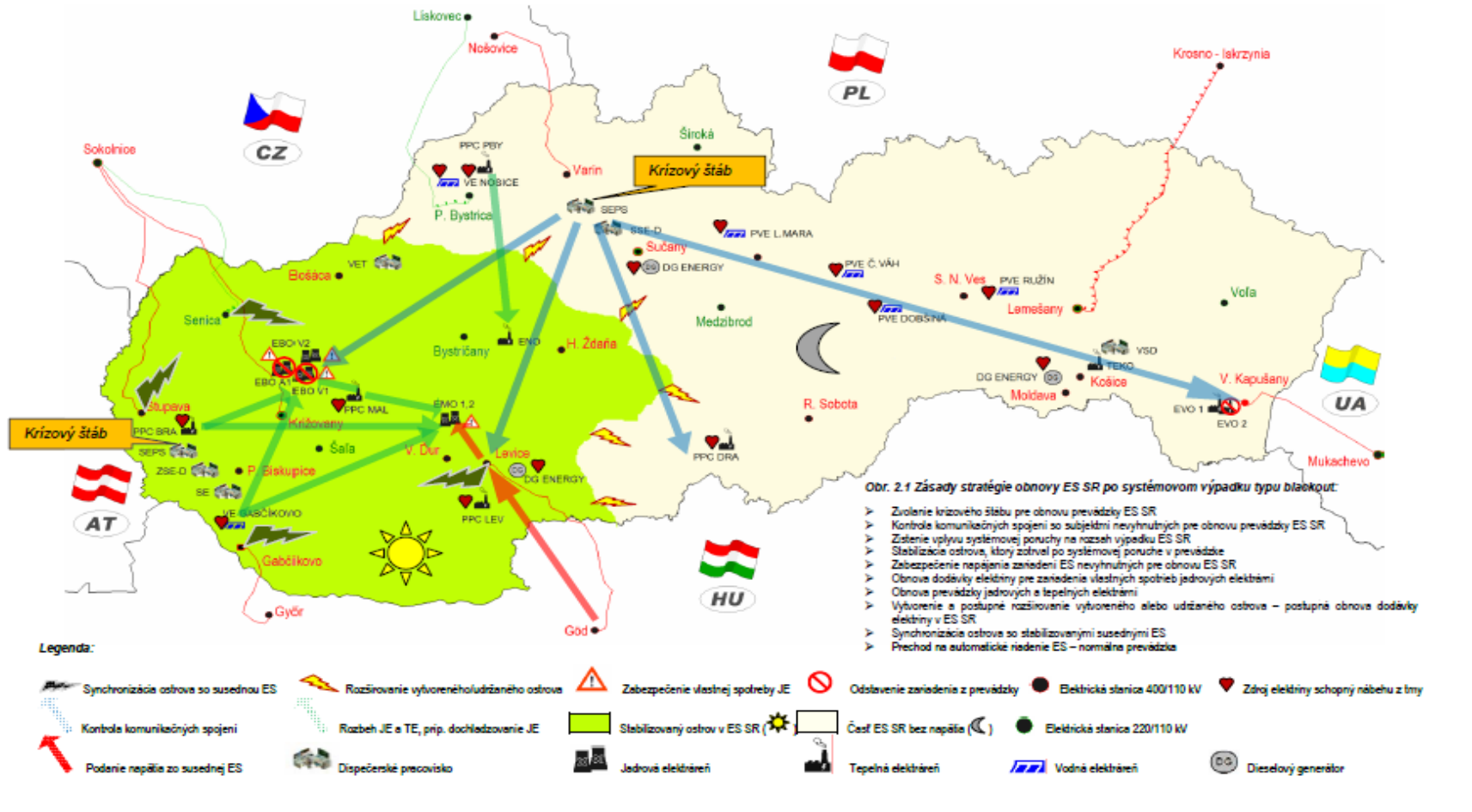


# Cause of the failure of Black-out type



- Sudden changes in balance areas TSO
- The imbalance between production and consumption
- Failures / outages of large-scale
- Multiple outages of critical elements of TS
- Mistake of stuff
- Weather extremes
- Deliberate attacks on infrastructure ES, on their HW / SW

# The 1st phase of Black-out solution in ES SR



# Black-out ... **Who** will light Slovakia...and **how?**

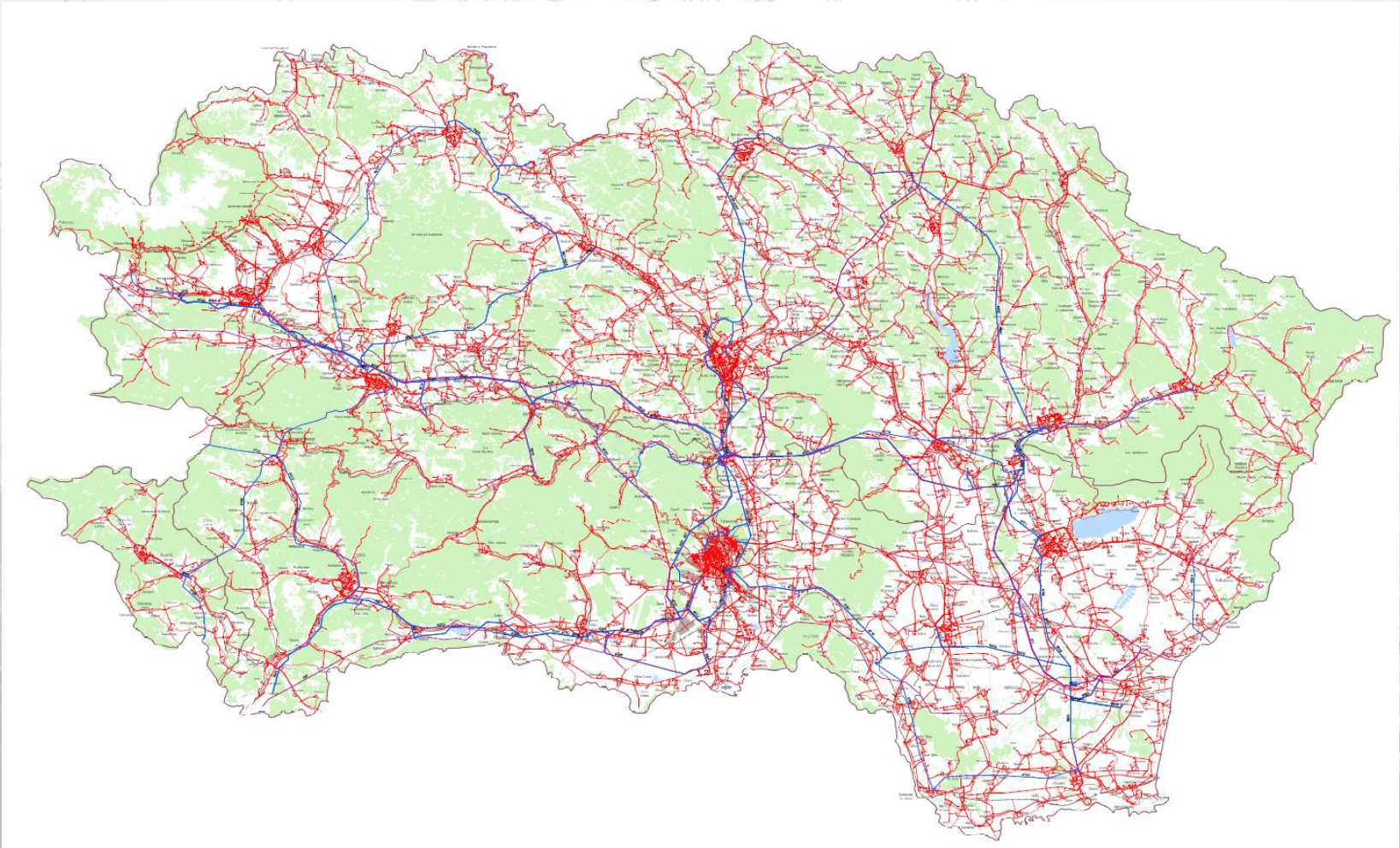
- **Abroad**
- **Own resources - bringing voltage by providers of the service "Start from the dark"**
  - VE Gabčíkovo, PVE Čierny Váh
  - PVE: Ružín, L. Mara,
  - VE: Nosice, Nové Mesto,
  - PPC: Malženice, Levice, Bratislava
  - DG: Sučany, Levice, Moldava
- **Start-up of systems power station**
  - EGA, EBO, EMO, MALŽENICE
  - ENO-B, TEK0, EVO
- **Continuous loading systems power stations**
  - creation the islands of life (HV+MV)
- **Joining systems power stations, the islands into a single unit** renewal of ES



# Black-out and its solutions

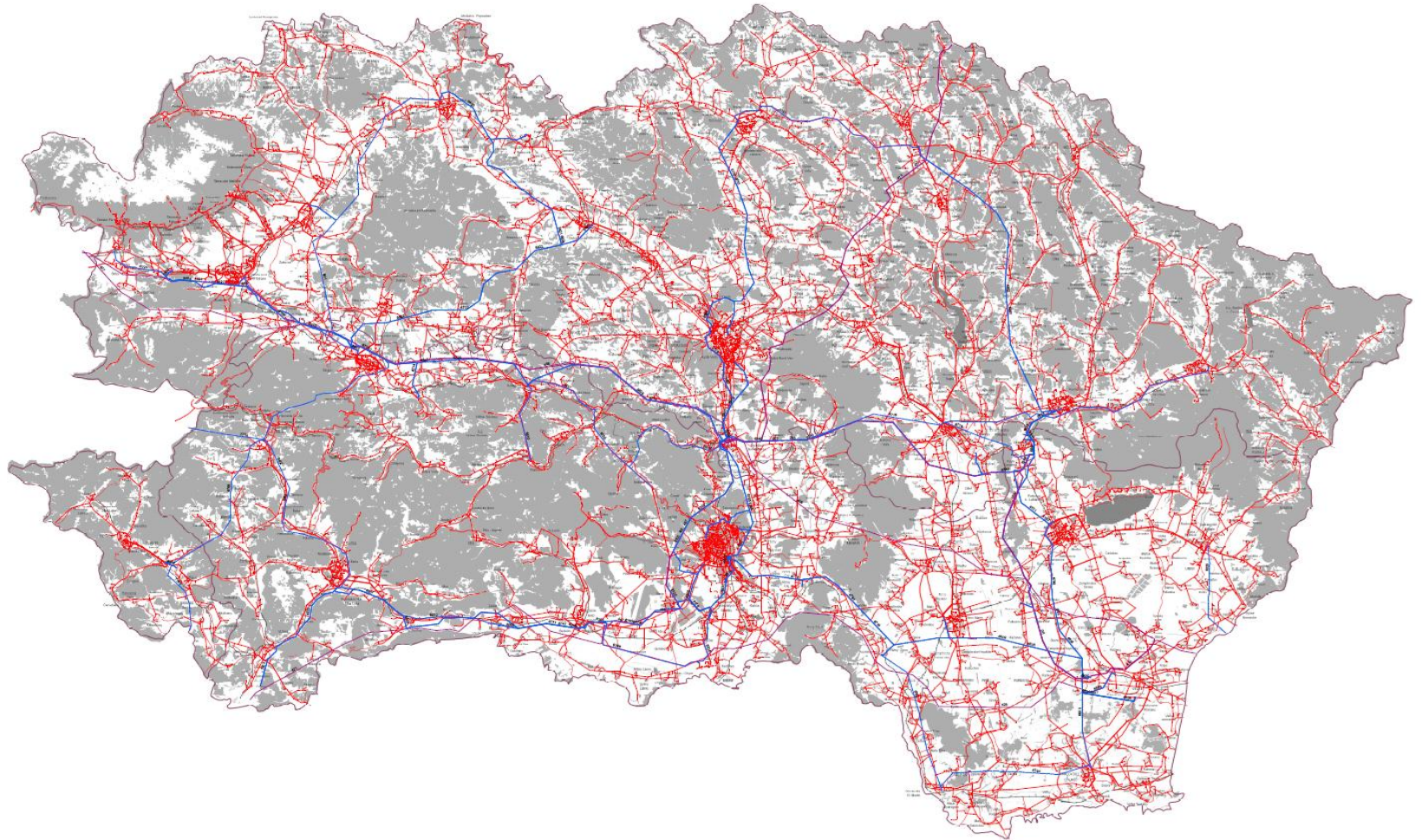
- Establishment of the working group SEPS, ZSD, SSE-D, VSD
- Preparation routes of bringing voltages for the creation of DSO islands of life
- Proposals for legislation modification
- Last tests B-O: 1992 SSE, 1996 ZSE, 1997 VSE
- Preparation and testing new routes of bringing voltage
- In 06/2014 will be realized live test of Start from dark in VSD and later on in SSE-D and ZSD

# East before failure of Black-out type



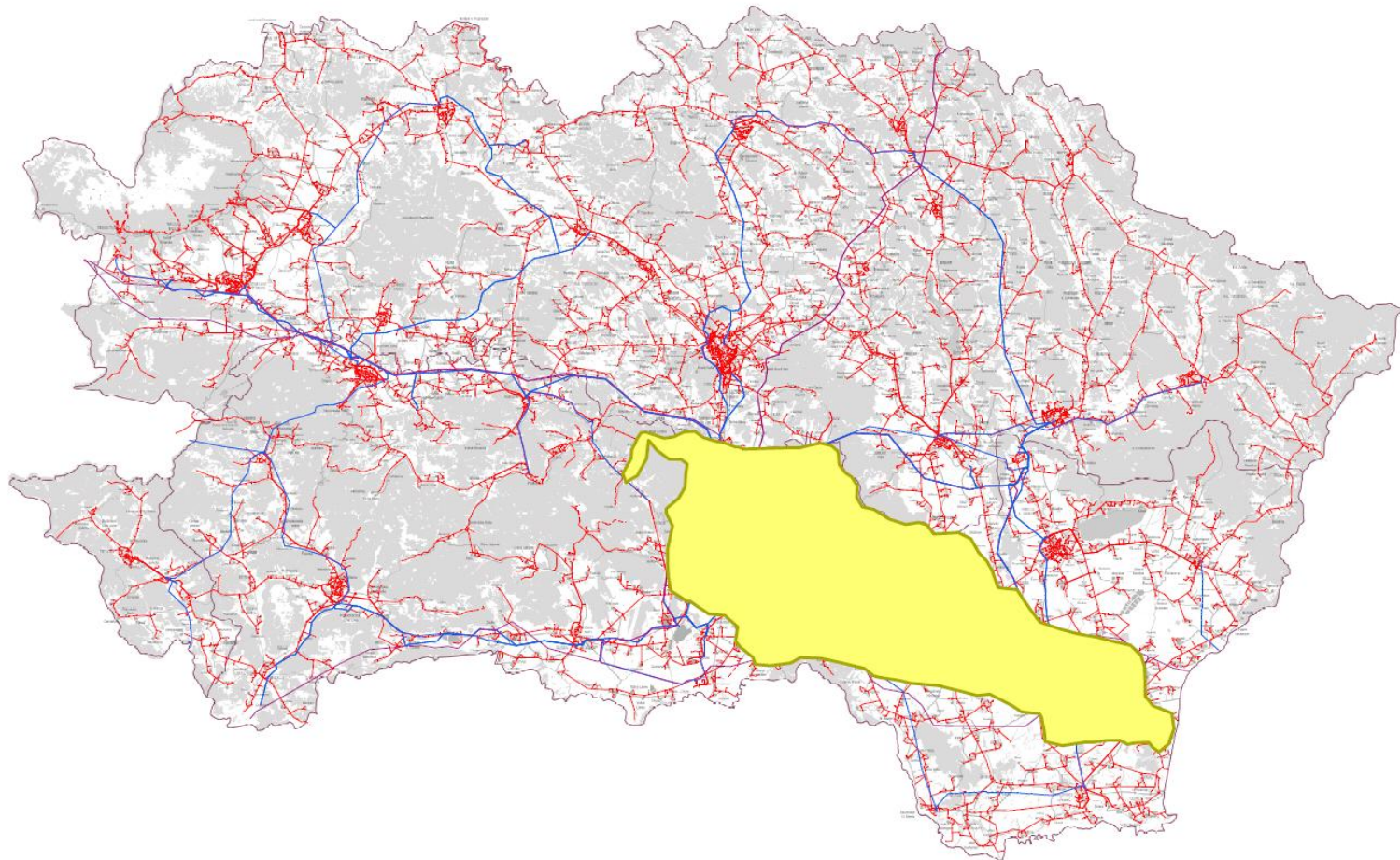


# East during failure of Black-out type



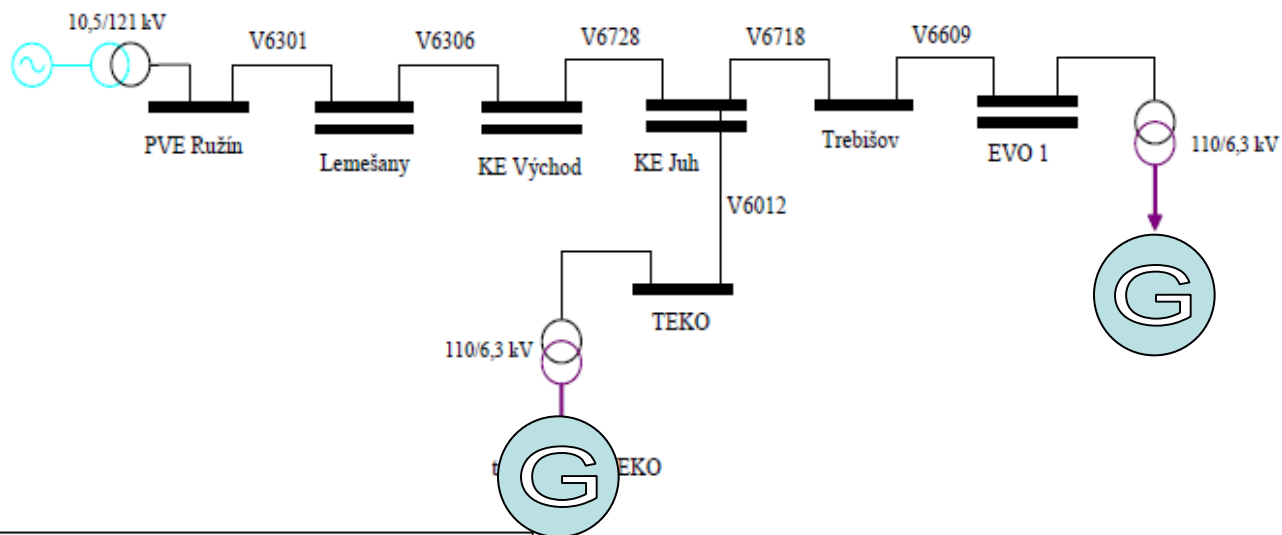


East during failure of Black- out type:  
1. island of life PVE Ružín – TEKO (Košice) – Trebišov -  
Vojany



# Possibility from Black-out for east - route 1

VARIANT 2:



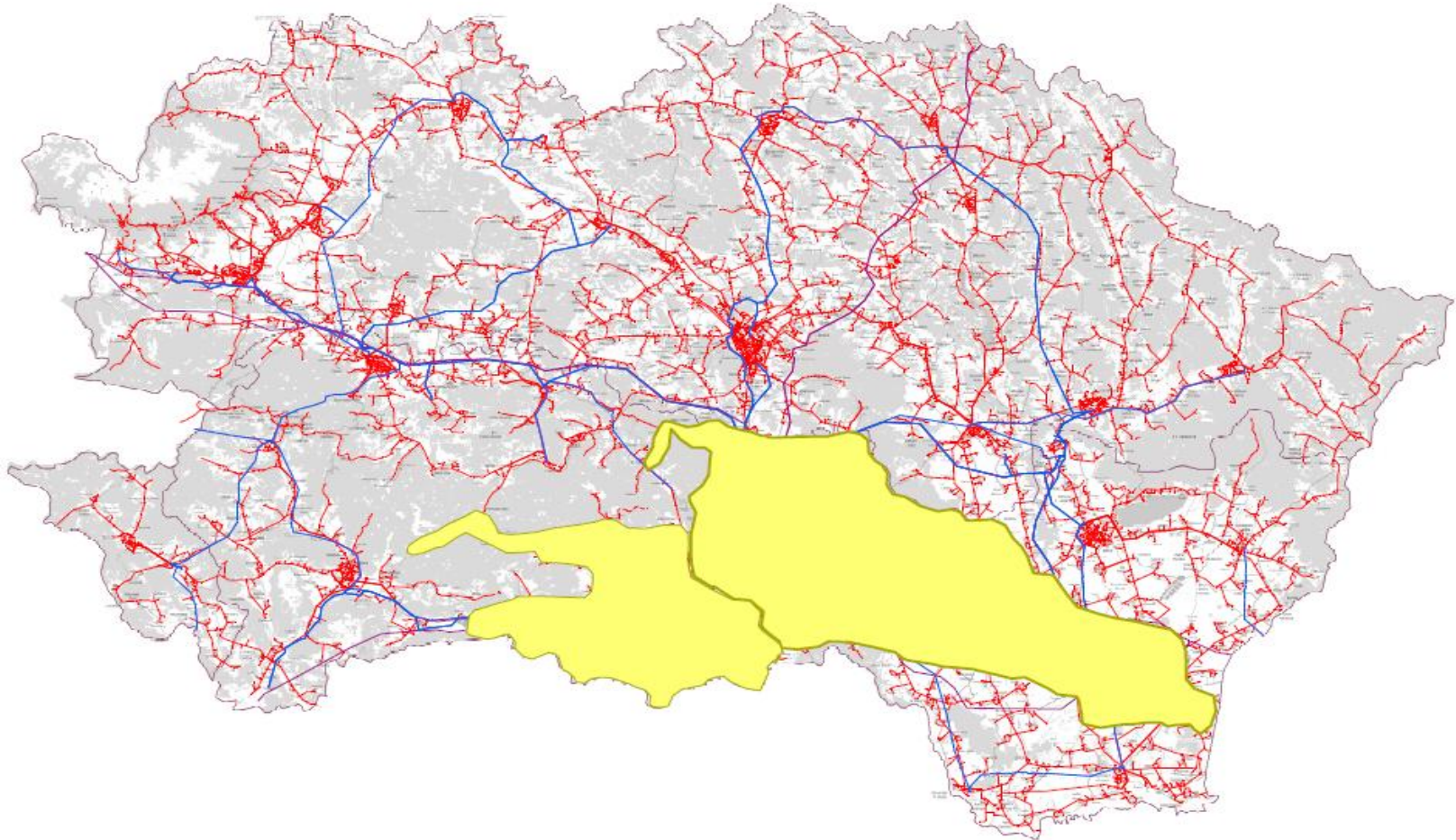
| Nastavenie regulátora otáčok vo PVE Ružín |      |     |      |
|---|------|-----|------|
| Parametre RO                              | Kp   | Ki  | Td   |
| SG1                                       | 2,01 | 24  | 6,25 |
| úprava *                                  | 1    | 0.1 | 2    |

\* Úprava parametrov regulátora otáčok bola nevyhnutná pre zabezpečenie stability.

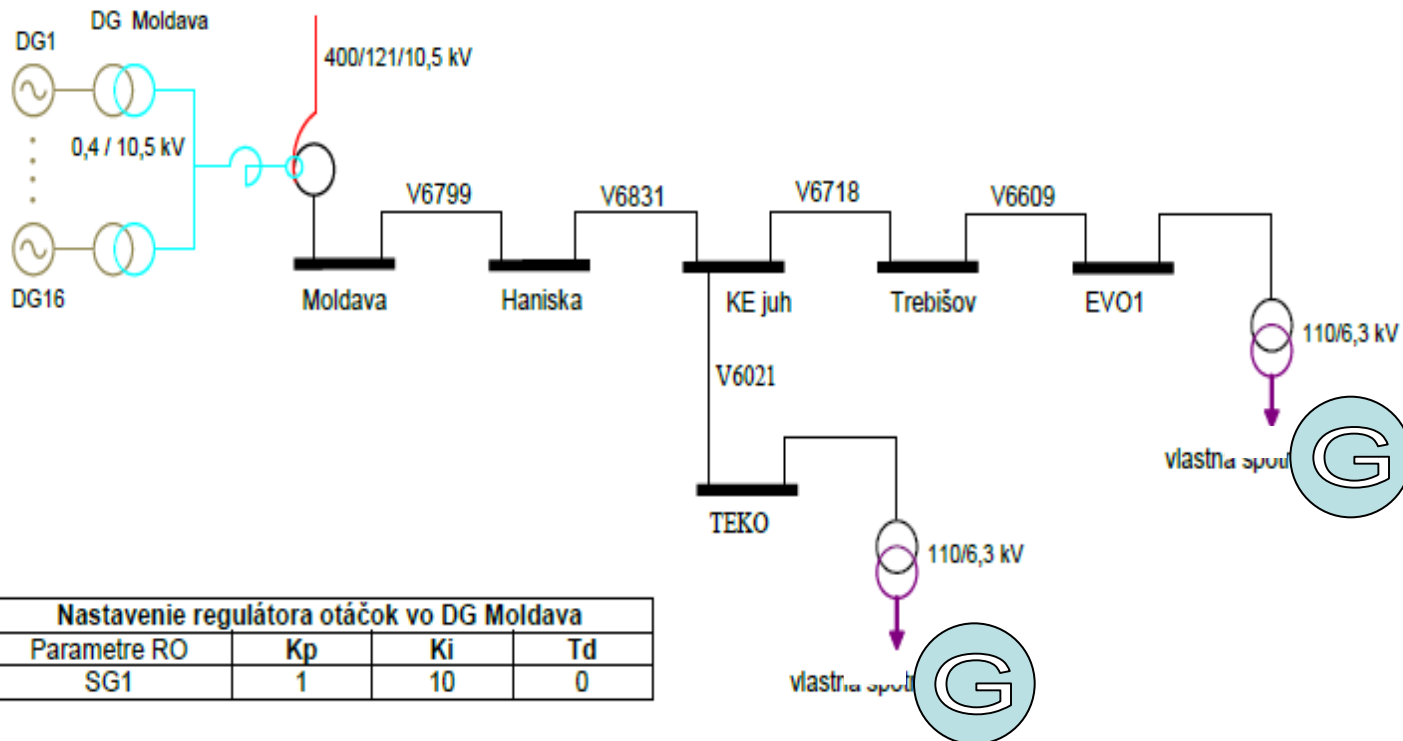
Vstupné hodnoty: napätie generátora SGRUZI1 v PVE Ružín 10,78 kV, napätie v rozvodni 110 kV PVE Ružín 119,1 kV, napätie v rozvodni 110 kV EVO1 119,98 kV, napätie na vlastnej spotrebe EVO1 6,24 kV, napätie v rozvodni 110 kV TEKO 119,68 kV, napätie na vlastnej spotrebe TEKO 6,23 kV, blokový TR Ružín na odbočke -2, TR VS 110/6,3 kV v EVO1 na odbočke +5, TR VS 110/6,3 kV v TEKO na odbočke +5.



East during failure of Black- out type:  
2. island of life DG ENERGY – Haniska – TEKO (Košice)



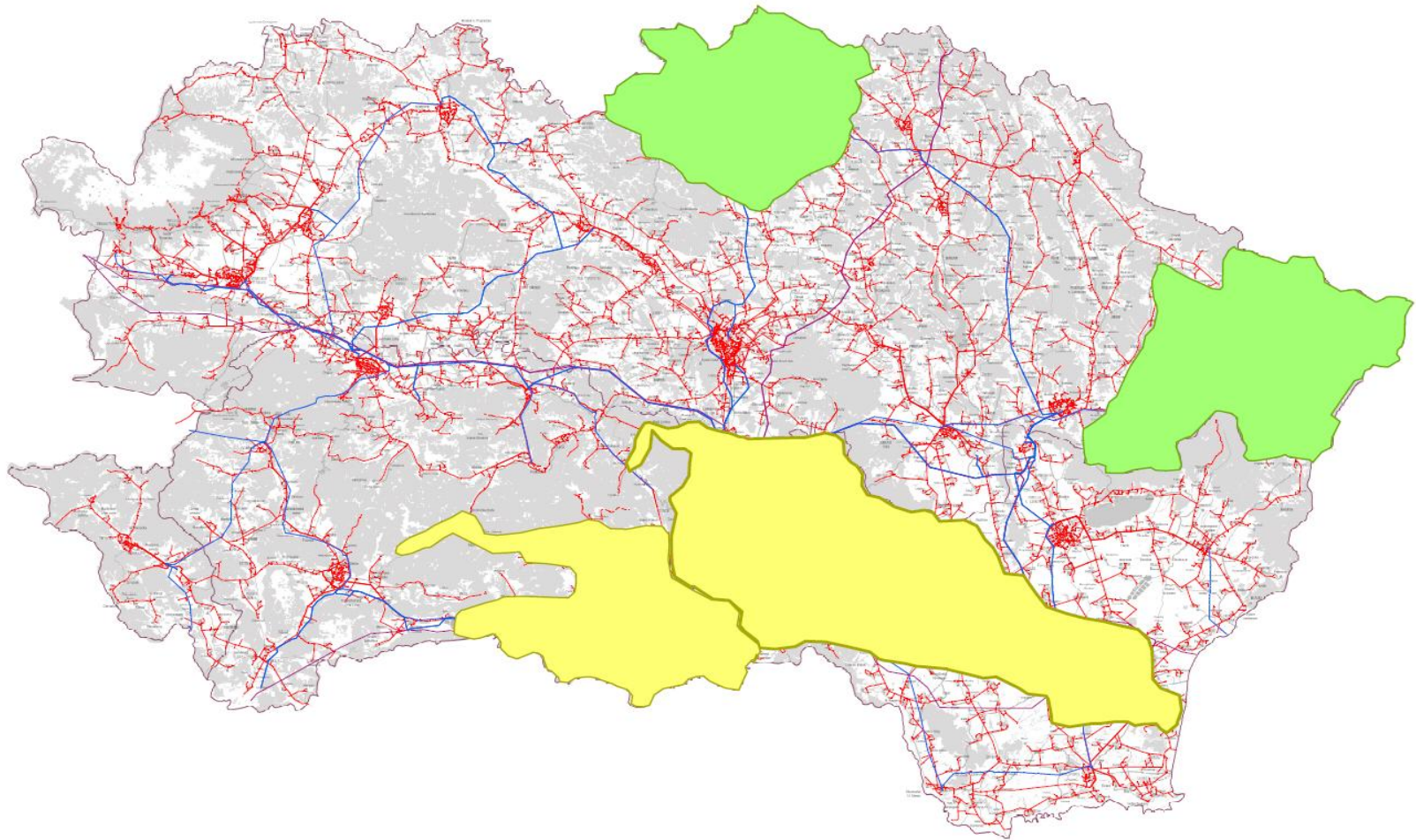
# Possibility from Black-out for east – route 2



Vstupné hodnoty: napätie generátora DG MOLDAVA 0,4 kV, napätie v rozvodni 110 kV Moldava 120,02 kV, napätie v rozvodni 110 kV KE Juh 120,32 kV, napätie v rozvodni 110 kV TEKO 120,32 kV, napätie na vlastnej spotrebe TEKO je 6,26 kV, napätie v rozvodni 110 kV EVO1 120,63 kV, napätie na vlastnej spotrebe EVO1 je 6,28 kV, blokový TR DG na odbočke -2, T401 Moldava na odbočke +5, TR VS 110/6,3 kV v TEKO na odbočke +5, TR VS 110/6,3 kV v EVO1 na odbočke +5.



East during Black-out:  
potential islands of life, hope for area Bardejova + Sniny?







# ZSD: islands of life

- U restoration for EBO and EMO from PPC and VE Gabčíkovo  
The force of the island by BA consumption and by the whole area of the western Slovakia

# Conclusions and open questions with Black-out solutions

- **The absence of a legislative framework to test preparedness to deal with B-O!!!**
- **Preparation of new routes to other islands of life**
- **Power of consumption limiting of customers at B-O (future use of smart metering for the regulation of consumption during B-O)**



An aerial photograph of a high-voltage power line tower, likely a transmission tower, situated in a valley. The tower is a complex lattice structure with multiple cross-arms supporting several high-voltage power lines. The background shows a valley with a town, fields, and distant hills under a clear sky. The image is overlaid with a semi-transparent white filter.

**Thank you for your attention!**