

# Ancillary Services Market in the South East Europe

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# Contents

- Introduction
- Ancillary services definition
- Types of ancillary services
- Ancillary services prices
- Ancillary services market
- Ancillary services in the South East Europe (review of the market rules, it's behaviour and regulatory framework)
- Conclusion

# Introduction

- Historically, the electric utilities were vertically integrated
- Ancillary services were demanded and provided within the company - it was relatively simple to obtain them
- Liberalization changed that
- Generation, transmission, distribution, supply – have been separated, with special emphasis on unbundling the monopolistic (transmission, distribution) and competitive (generation, supply) segments
- it is no longer desirable to oblige different market players (e.g. generators) to provide certain services without adequate payment

# Definition

- It is not easy to define what ancillary services actually are, and how they should be procured
- some AS are considered mandatory and some others are provided in a competitive basis; some AS are paid, other ones are non-paid;
- They can be provided by generators, transmission and distribution networks, some consumers,
- Many different ancillary services could be defined
- In a theoretically ideal situation all ancillary services should be traded separately
- In a realistically workable situation, not more than three or four ancillary services, or 'ancillary service packages' could be subject to market conditions

- From the market point of view ancillary services usually including regulation and frequency response, operating reserve, energy imbalance and sometimes reactive power and voltage support and black start capabilities.

# Definition

- Ancillary services are Interconnected Operations Services identified as necessary to effect a transfer of electricity between purchasing and selling entities (transmission) and which a provider of transmission services must include in an open access transmission tariff.

(UCTE: Operation Handbook, 2004)

# Definition

- Ancillary services are services necessary to support the transmission of electric power from seller to purchaser given the obligations of control areas and transmitting utilities within those control areas to maintain reliable operations of the interconnected transmission system

(FERC: Order 888-A, 1996)

# Definition

- “... those services provided by generation, transmission and control equipment which are necessary to support the transmission of electric power from producer to purchaser”

(EURELECTRIC: Connection Rules for Generation and Management of Ancillary Services, 2000)

- Ancillary services are all services required by the transmission or distribution system operator to enable them to maintain the integrity and stability of the transmission or distribution system as well as the power quality.

(EURELECTRIC: Ancillary Services, 2004)



# Ancillary services

- Ancillary services represent an important part of the operational costs of networks and are critical to efficient and secure grid operation. Typical examples are active power balancing (frequency control and stability), voltage control and stability, transmission system security and black start capability.
- Ancillary services cost may be about 10% of total generation and transmission cost. Most of it are required for power balancing/frequency regulation, grid loss compensation and voltage/reactive power support.
- A common question is how markets can be organised for their provision, as often the incumbent is the sole supplier within the control area of a Transmission System Operator (TSO).

# Ancillary and system services

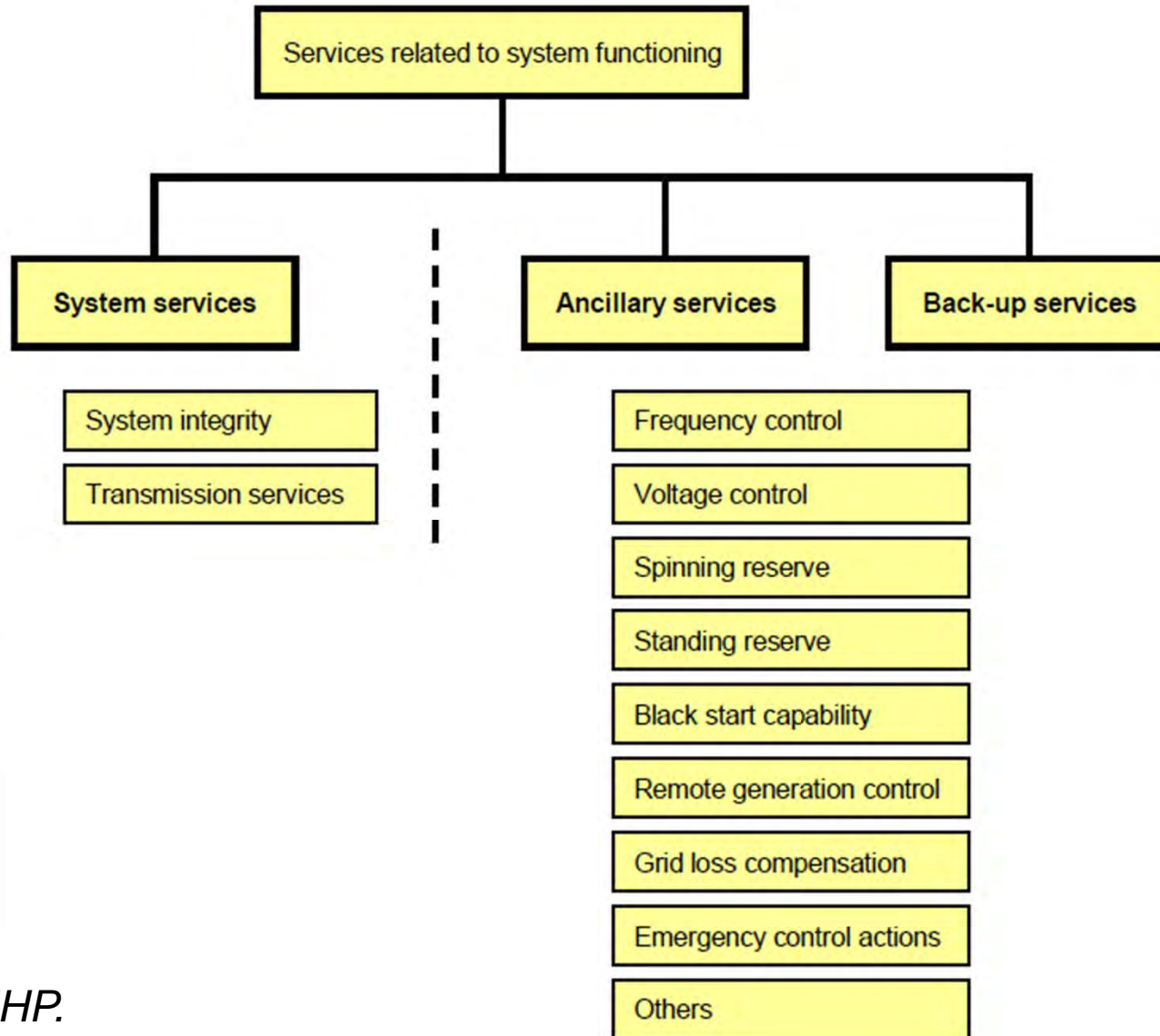
- From a technical point of view it is useful to distinguish between *ancillary services and system services*.
- **System services** are all services provided by some system function (such as a system operator or a grid/network operator) to users connected to the system.
- **Ancillary services** are services procured by a system functionality (system operator or grid/network operator) from system users in order to be able to provide system services.

# FERC



| Provider                 | Generation                          | Distribution            | System operator         | Transmission             |
|--------------------------|-------------------------------------|-------------------------|-------------------------|--------------------------|
| <b>Ancillary service</b> | Automatic Load Shedding Service     | Demand side management  | Administrative Service  | Transmission maintenance |
|                          | Energy imbalance                    | Local reactive support  | Curtailment Management  | Transmission reserve     |
|                          | Frequency regulation                | Power quality services  | Dynamic scheduling      |                          |
|                          | Load following                      | System reactive support | Dynamic voltage support |                          |
|                          | Non-spinning reserve                |                         | Generation dispatch     |                          |
|                          | Operating Reserve - Supplemental    |                         | Generation scheduling   |                          |
|                          | Reactive Supply and Voltage Control |                         | Metering Services       |                          |
|                          | Real power loss compensation        |                         | Static scheduling       |                          |
|                          | Restoration Service                 |                         | Transmission dispatch   |                          |
|                          | Spinning reserve                    |                         |                         |                          |
|                          | Time error correction               |                         |                         |                          |

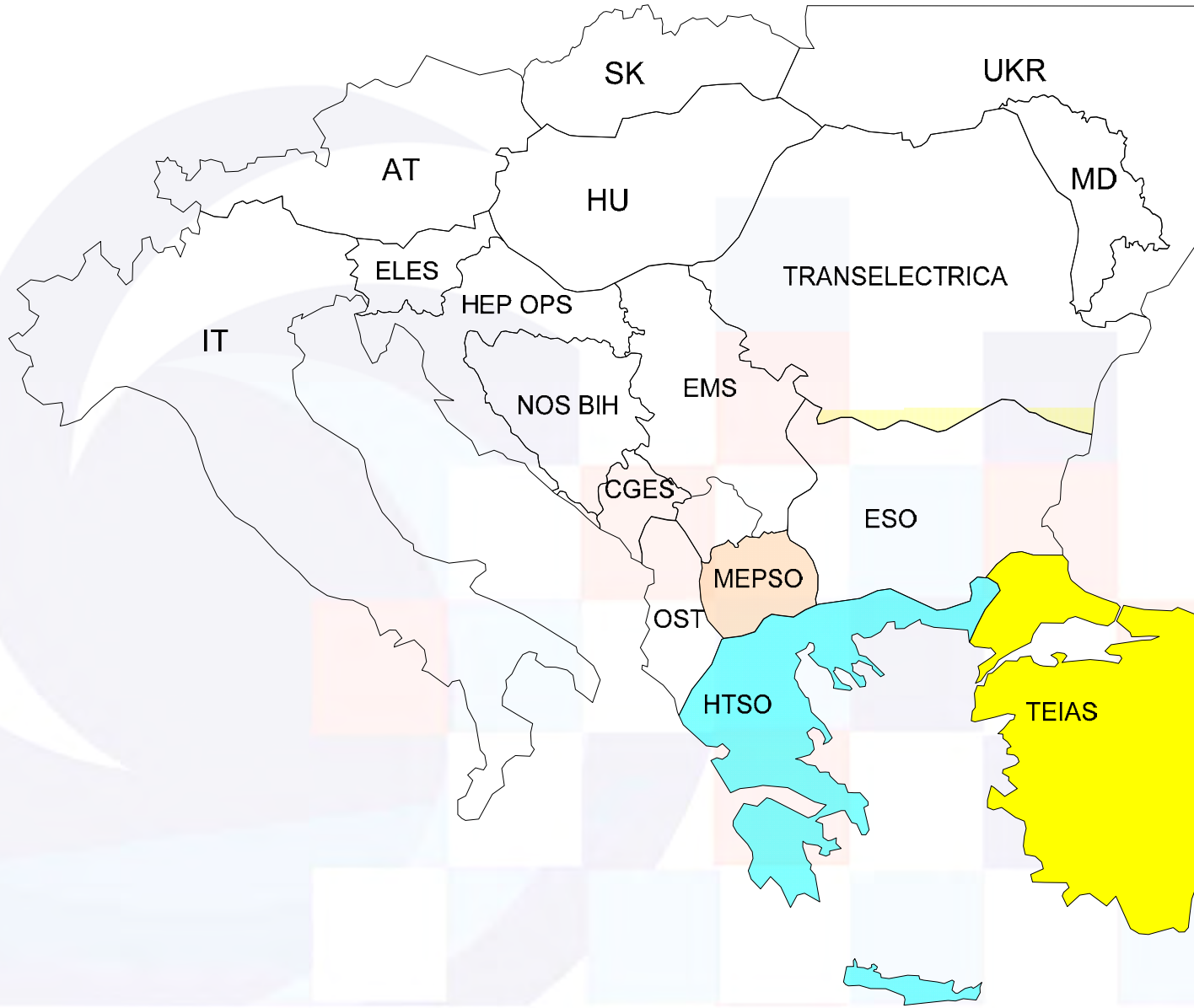
# EUROELECTRIC



Source: EIHP.

- Depending on the rules of electricity energy markets, the market for ancillary services can interact with the main electricity energy market in a significant manner.

# South and East Europe's TSOs



**EXAMPLES OF WHAT THE ANCILLARY  
SERVICES COMPRISE IN  
SEVERAL SEE COUNTRIES:**

# Albania

Ancillary Services in Albania include:

- Compensation of reactive power from the Users to maintain standard levels of voltage and reduce network losses.
- Regulation of active power frequency and related reserves
- Compensation for engagements and allocation of capacities in the interconnection lines.
- Ancillary Services are divided in two categories:
  - Operative - scheduling and operative management services and other activities performed by the Dispatch Center in order to achieve customers' safe electricity supply with least cost
  - Technological - performed by Transmission System Customers are paid by OST sh.a. (Transmission system operator)



# Albania

Technological Ancillary Services are achieved by:

- Providing the frequency Primary Control Reserve,
- Providing the frequency/active power Secondary Control Reserve,
- Providing the active power Control Reserve,
- Providing the reactive power and regulation of voltage levels.

# Bosnia and Herzegovina

- Ancillary Services in Bosnia and Herzegovina include:
  - Primary control of frequency and active power (no payment for this services)
  - Secondary control of frequency and active power (10,579 KM/kW ~ 5,4 EUR/kW) from two lincised HPPs (Jablanica and Rama)
  - Tertiary control of frequency and active power (power 6,00 KM/kW ~ 3,07 EUR/kW, energy 23,28 feninga/kWh ~ 0,119 Eurocent/kWh) from three lincised HPP (Čapljina, Salakovac and ERS)
  - Voltage and reactive power control (no payment for this services)
  - Black start (no payment for this services)
  - Excess eactive energy from transsmission network (0,951 feninga/kvarh ~ 0,486 Eurocent/kvarh)
  
- NOS BiH - Independent System Operator in Bosnia and Herzegovina

# Bulgaria

- Ancillary Services in Bulgaria include:
  - participation of generating units in the primary frequency control;
  - participation of generating units in the secondary load and frequency control;
  - participation in tertiary frequency control;
  - participation in voltage regulation in the point of connection to the transmission system or regulation of the reactive power flow from/to the transmission system.

# Croatia

Ancillary Services in Croatia include:

- Frequency control
- Voltage and reactive power control
- Black start of power plants
- Island operation

# Greece

- Ancillary services are the services required to transfer energy through the System from the injection points to the consumption points and ensure the quality of energy supply through the System.
- Ancillary Services in Greece include:
  - Primary Control and Reserve;
  - Secondary Control and Range;
  - Tertiary Control and Spinning Reserve;
  - Tertiary Non-Spinning Reserve;
  - Standing reserve
  - Voltage Control;
  - Black Start

# Hungary

- Ancillary Services in Hungary include:
  - frequency control (FC);
  - voltage control (VC);
  - spinning reserve (SP);
  - standing reserve (ST);
  - black start capacity (BS); regulated
  - remote automatic generation control (RG);
- Payment is based on negotiated contract in
- The prices are negotiated/tendered in

2010

|                      | OPEX except system-services, losses and ITC | Losses cost | ITC cost/revenue | System-services  |                   |                  |                                |   |                  |                                |                  | CAPEX        |                            |                |
|----------------------|---|-------------|------------------|------------------|-------------------|------------------|--------------------------------|---|------------------|--------------------------------|------------------|--------------|----------------------------|----------------|
|                      |   |             |                  | Primary reserve  | Secondary reserve | Tertiary reserve | Internal Congestion management | Congestion management on interconnections | Black -Start     | Voltage Control Reactive Power | System Balancing | Depreciation | Return on capital invested | Other          |
| Austria              | C   | C           | C/B              | N                | C                 | N                | C                              | C/B                                       | C                | C                              | N                | C            | C                          | N              |
| Belgium              | C   | C           | C/B              | C                | C/B               | C/B              | C                              | C/B                                       | C                | C                              | N                | C            | C                          | Y              |
| Bosnia & Herzegovina | C   | C           | C/B              | C                | C                 | C                | N                              | N   | C                | C                              | N                | C            | C                          | N              |
| Bulgaria             | C   | C           | C                | C (capacity)     | C (capacity)      | C (capacity)     | N                              | N   | C                | C                              | N                | C            | C                          | N              |
| Croatia              | C   | C           | N                | N                | C                 | C                |                                |   | C                | C                              | N                | C            | C                          | C              |
| Czech Rep.           | C   | C           | C/B              | C                | C                 | C                | C                              | N   | C                | C                              | N                | C            | C                          | C              |
| Denmark              | C   | C           | C/B              | C                | C                 | C                | C/B                            | C/B                                       | C                | C                              | C/B              | C            | C                          | C/B            |
| Estonia              | C   | C           | C                | N                | N                 | C                | N                              | N   | C                | C                              | N                | C            | C                          | N              |
| Finland              | C   | C           | C                | N                | N                 | C                | C                              | C   | C                | C                              | N                | C            | C                          | C              |
| France               | C   | C           | C                | C                | C                 | N                | C                              | N   | C                | C                              | N                | C            | C                          | C              |
| Germany              | C   | C           | C/B              | C                | C                 | C                | C                              | C/B                                       | C                | C                              | N                | C            | C                          | C              |
| Great Britain        | C   | N           | N                | C                | C                 | C                | C                              | C   | C                | C                              | C                | C            | C                          | N              |
| Greece               | C   | C           | N                | C                | C                 | N                | N                              | C   | N                | N                              | N                | C            | C                          | C              |
| Hungary              | C   | C           | C/B              | C                | C                 | C                | C                              | C/B                                       | C                | C                              | C/B              | C            | C                          | N              |
| Ireland              | C   | C           | N                | C                | C                 | C                | N                              | N   | C                | C                              | N                | C            | C                          | N              |
| Italy                | C   | C           | C                | C                | C                 | C                | C                              | N   | C                | C                              | C                | C            | C                          | N              |
| Latvia               | C   | C           | C                | C                | C                 | C                | N                              | N   | N                | C                              | N                | C            | C                          | N              |
| Lithuania            | C   | C           | C                | N                | C                 | C                | N                              | N   | C                | C                              | N                | C            | C                          | N              |
| Luxembourg           | C   | C           | C/B              | C                | C                 | C                | C                              | C   | C                | C                              | C                | C            | C                          | N              |
| FYROM                | C   | C/B         | C                | N                | C                 | C                | N                              | C   | C                | N                              | N                | C            | C                          | N              |
| Netherlands          | C   | C           | C/B              | N                | C/B               | C/B              | C/B                            | N   | C                | C                              | C                | C            | C                          | N              |
| Northern Ireland     | C   | C           | N                | C                | C                 | C                | N                              | N   | C                | C                              | N                | CAPEX        | C                          | N              |
| Norway               | C   | C           | C                | C                | N                 | N                | C                              | C   | N                | N                              | N                | C            | C                          | N              |
| Poland               | C   | C           | C                | C                | C                 | C                | C                              | N   | C                | C                              | C                | C            | C                          | C*             |
| Portugal             | C   | C           | C/B              | C/B              | C/B               | C/B              | N                              | N   | C/B              | C/B                            | N                | C            | C                          | C              |
| Romania              | C   | C           | C/B              | N                | C                 | C                | C                              | C/B                                       | C                | C                              | N                | C            | C                          | C              |
| Serbia               | C   | C           | C/B              | C                | C                 | C                | C                              | C/B                                       | C                | C                              | C                | C            | C                          | N              |
| Slovak Rep           | C   | C           | C/B              | C                | C                 | C                | N                              | N   | C                | C                              | N                | C            | C                          | C*             |
| Slovenia             | C/B   | C           | C/B              | N                | C                 | C                | C                              | C/B                                       | C                | C                              | N                | C/B          | C/B                        | C/B            |
| Spain                | C   | C           | C                | C                | C                 | C                | C                              | C   | C                | C                              | C                | C            | C                          | C              |
| Sweden               | C   | C           | C/B              | N                | N                 | C (1/3)          | C                              | C/B                                       | C                | C                              | N                | C            | C                          | N              |
| Switzerland          | C   | C/B         | C                | C/B <sup>1</sup> | C/B <sup>1</sup>  | C/B <sup>1</sup> | C/B <sup>1</sup>               | C/B <sup>1</sup>                          | C/B <sup>1</sup> | C/B                            | N                | C            | C                          | C <sup>2</sup> |

○ C if costs are covered by the transmission invoice

○ C/B if costs less benefits are covered by the transmission invoice (C/B indicates whether certain costs covered by the tariff are also compensated by revenues. Intuitive examples are ITC, congestion costs and balancing. For instance if congestion rents are deducted from congestion costs, then the residual amount to be covered by tariffs is obtained. In this case the corresponding entry in the matrix would be C/B and not only C)

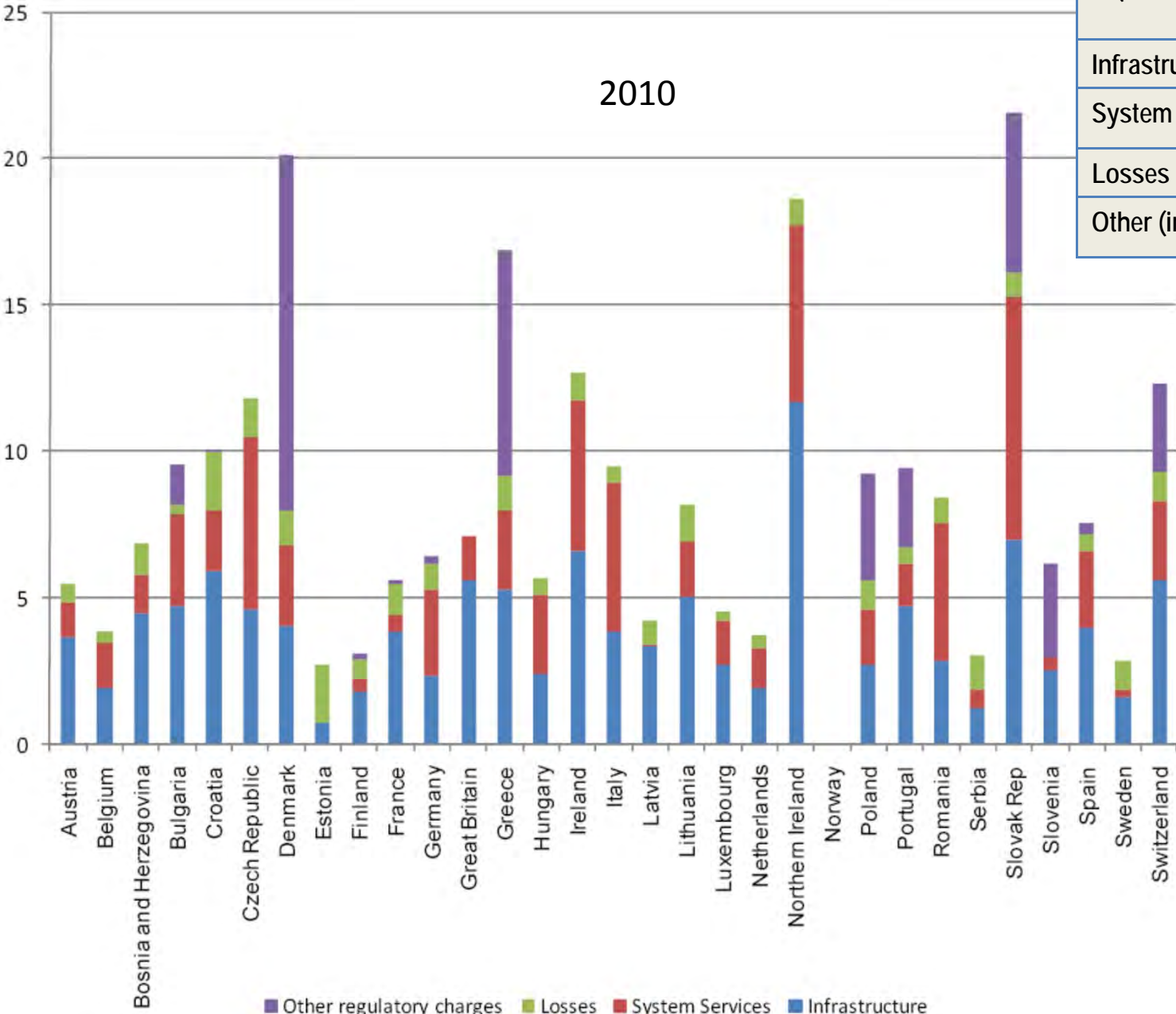
○ N if the costs are not included in the transmission invoice

Source: ENTSO-E

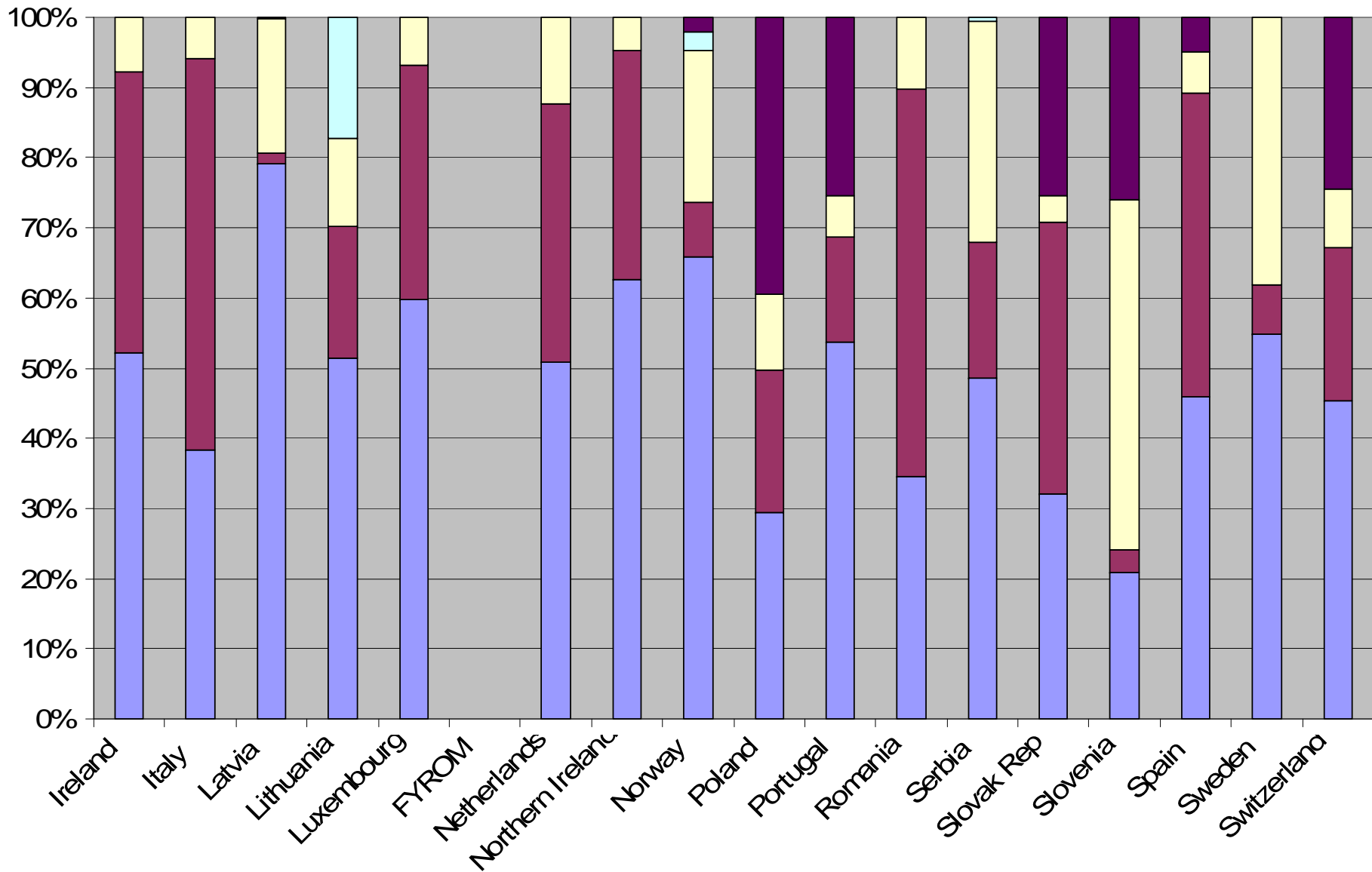
# Transmission tariff brakedown

2010

| % of total tariff<br>(average values) |     |
|---------------------------------------|-----|
| Infrastructure                        | 40% |
| System services                       | 23% |
| Losses                                | 8%  |
| Other (inc levies)                    | 29% |







Blue: Infrastructure; Plum: System services; Yellow: Losses; Magenta: Levies; Pink: Other.

Source: ENTSO-E.

## Relative tariff breakdown

# System service costs

(per MWh finally sold) Data for 2010.



**< 0.5 €/MWh:** Latvia, Slovenia, Sweden, Finland

**0.5 – 1 €/MWh:** France, Serbia

**1 – 3 €/MWh:** Austria, Bosnia and Herzegovina, Netherlands, Portugal, Great Britain, Luxembourg, Croatia, Belgium, Lithuania, Poland, Hungary, Spain, Switzerland, Denmark, Greece, Germany

**> 3 €/MWh:** Bulgaria, Romania, Italy, Ireland, Czech Republic, Northern Ireland, Slovak Republic

*Source: ENTSO-E.*

# Primary control capacity

## SEE market features



- GENERAL LACK OF DATA (FOR ALL TYPES OF A.S.), but there are some data for SLO, CRO, B&H, SR and occasionally some other countries.
- SLO, CRO, B&H: mandatory provision (TSO does not pay for it).
- SR: bilateral contracts.
- Service time horizon: mostly a year or more (non-stop provision).
- Procurement time horizon: a year (SR, CRO, B&H).
- Providers: generators only (no loads, yet).

# Secondary control capacity

## SEE market features



- SLO, CRO, SR: bilateral market.
- B&H: mandatory provision.
- Service time horizon: a year (SLO, CRO), a month (B&H, SR).
- Procurement time horizon: a year (SR, CRO, B&H, SR).
- Providers: generators only.
- Price finding: pay as bid (SLO), regulated (CRO, B&H, SR).
- Secondary energy: the same rules apply.

# Tertiary control capacity

## SEE market features

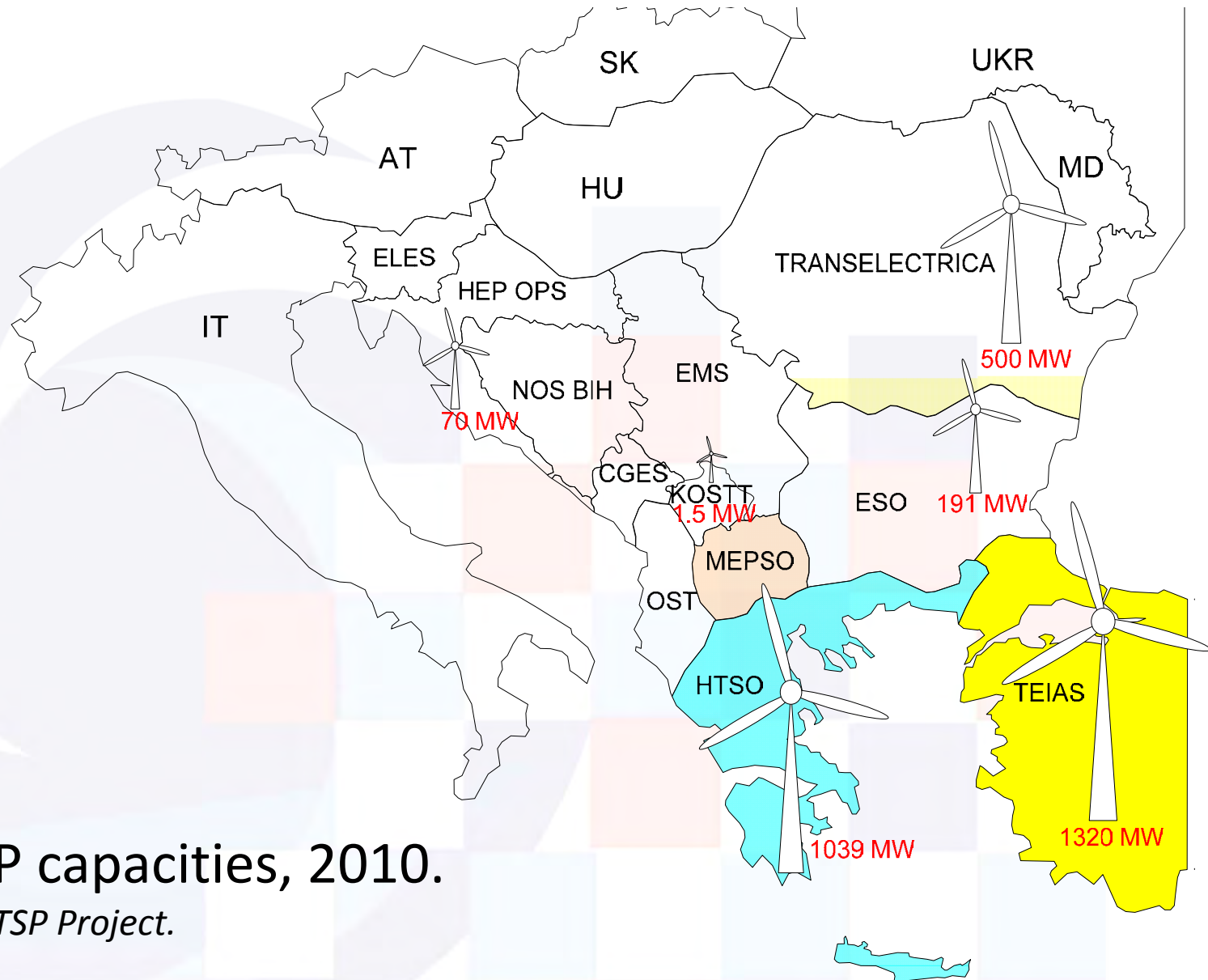


- SLO: organized market.
- CRO, SR: bilateral market.
- B&H: mandatory provision.
- Service time horizon: a year (SLO, CRO, SR), a month (B&H).
- Procurement time frame: a year (SLO, CRO, SR, B&H).
- Providers: generators only in CRO, B&H, SR; In SLO generators+loads, partially from abroad.
- Price finding: SLO: pay as bid; CRO, B&H, SR: regulated.
- Tertiary energy: similar features.

# RES integration and availability of A.S. in the SEE

- As just presented, market features for most SEE countries are not publicly very well known.
- Where they are publicly available, they indicate that:
  - they are oftenly provided on “bilateral” markets, meaning from the incumbent utility;
  - there is very little cross-border exchange of such services.
- The latter is at least partially a consequence of the fact that the EU cross-border rules (which also apply to the SEE via the Energy Community Treaty) actually prevent transmission capacity reservations for non-dispatchable products.
- There is a lack of available system reserves (especially secondary) which will probably limit the RES integration unless more reserves are made available.

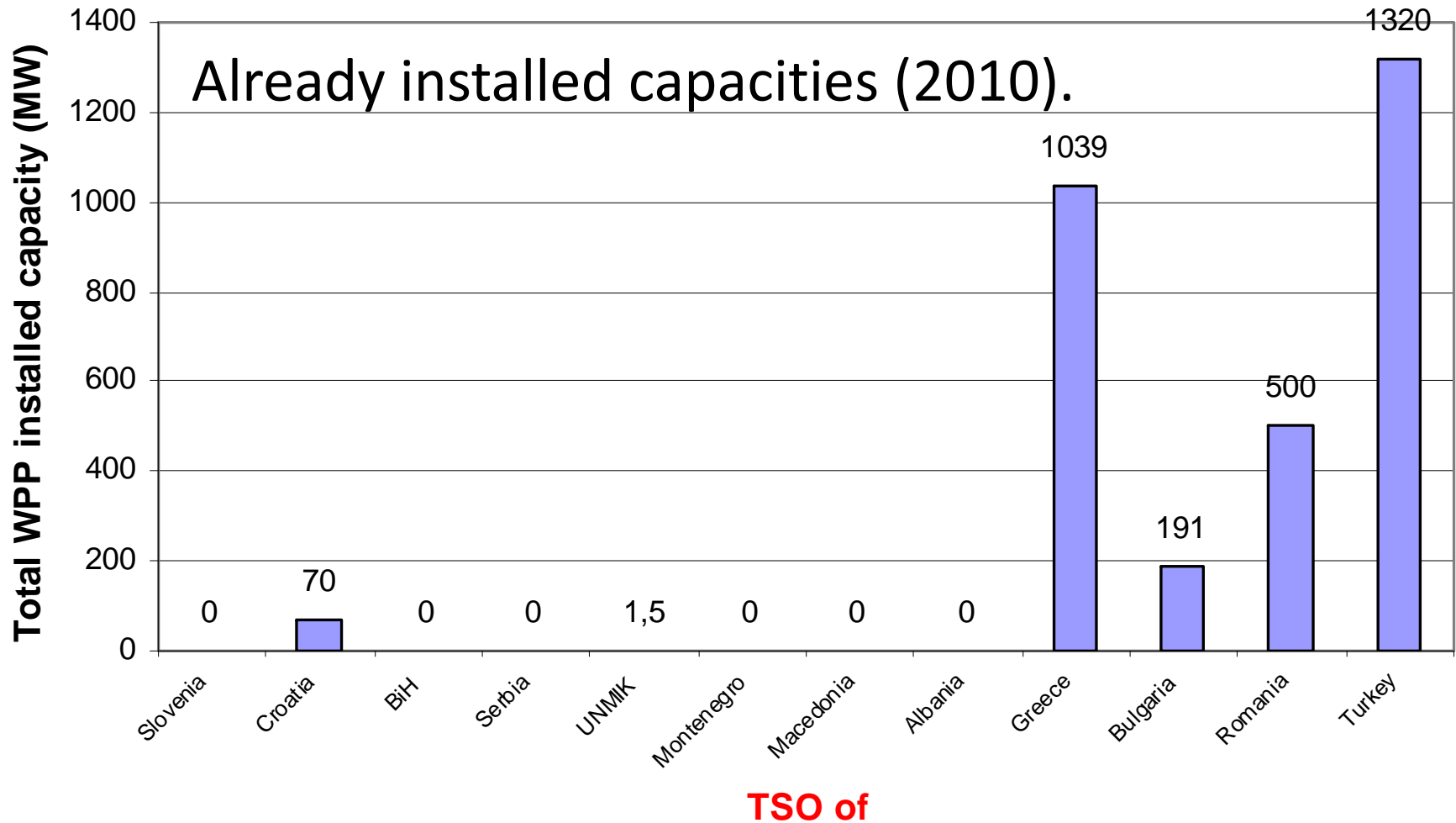
# RES integration and availability of A.S. in the SEE



Existing WPP capacities, 2010.

Source: EIHP/SECI TSP Project.

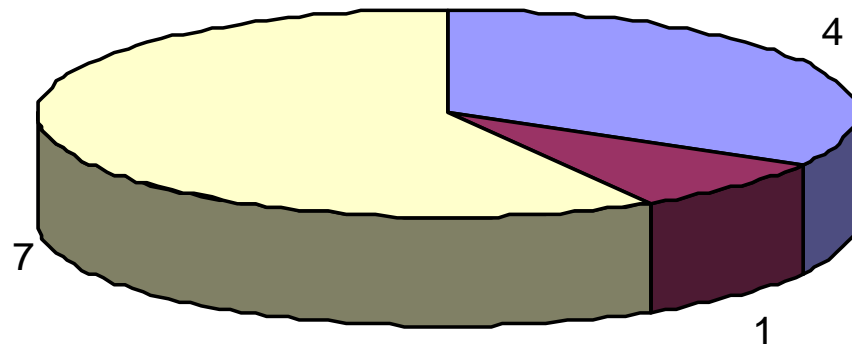
# RES integration and availability of A.S. in the SEE





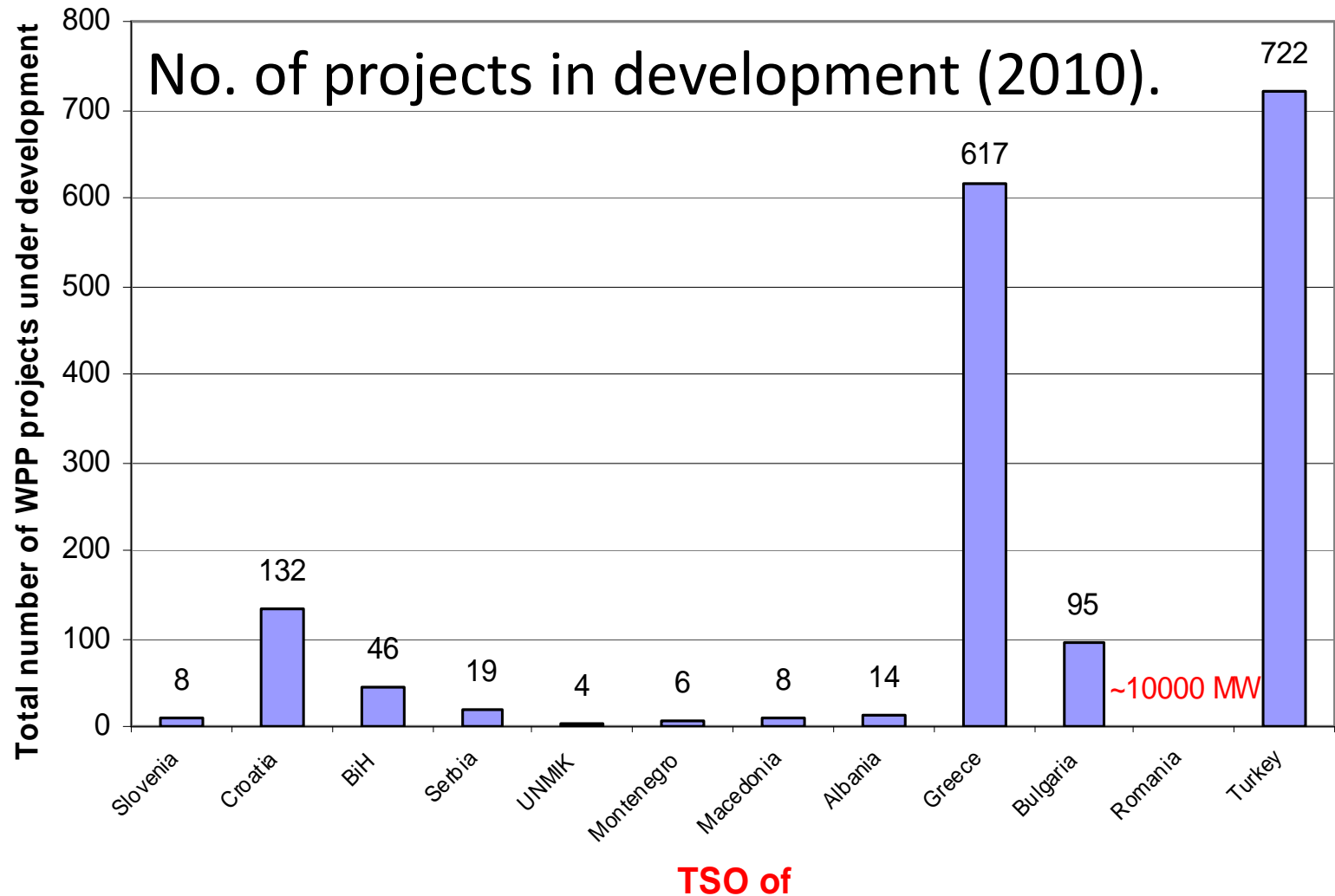
# RES integration and availability of A.S. in the SEE

## RES legislation defined?



- YES: TSO of Greece, Croatia, Turkey, Romania
- NO: TSO of Montenegro
- PARTLY: TSO of Albania, Slovenia, UNMIK, Serbia, Macedonia, Bulgaria, BiH

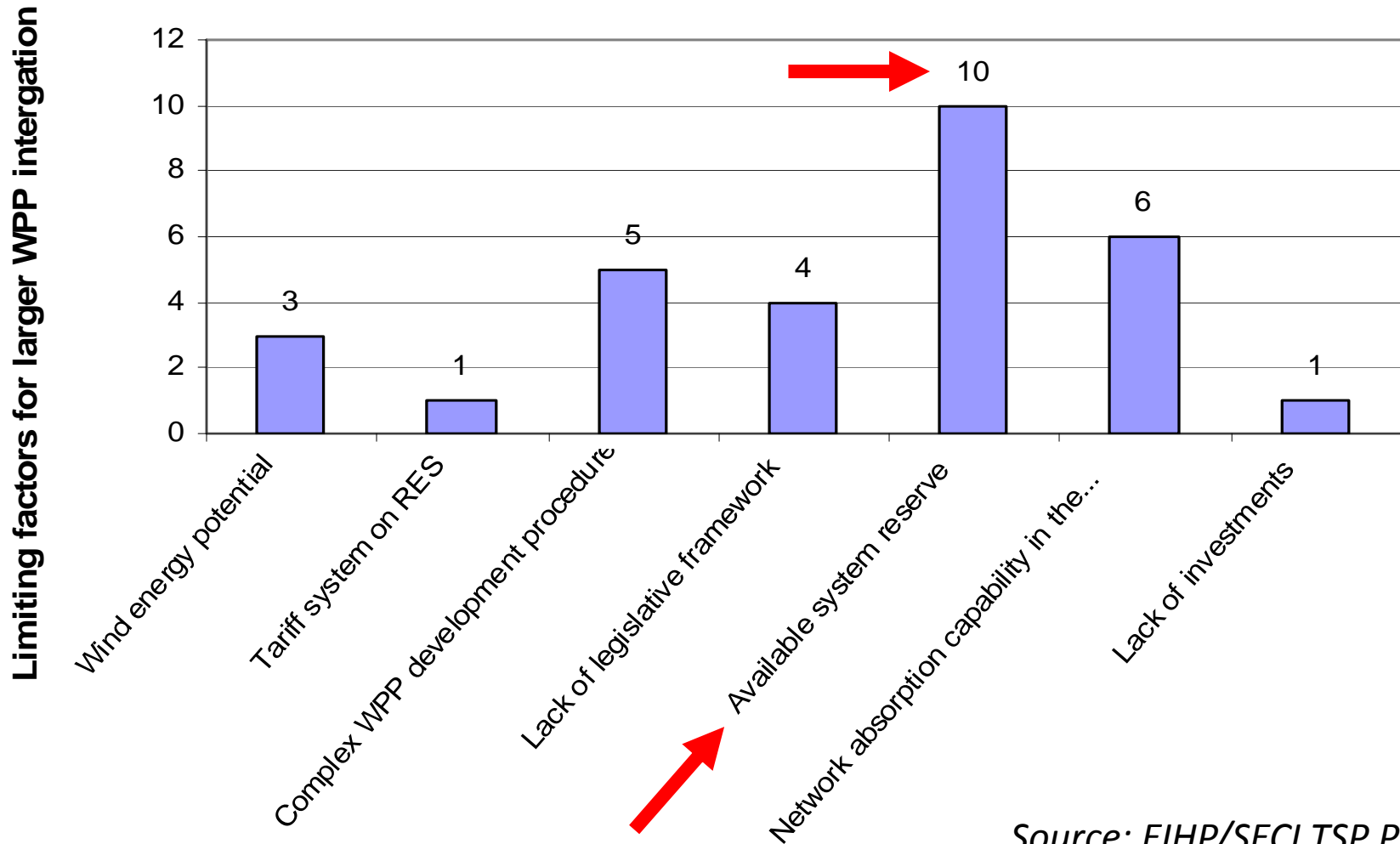
# RES integration and availability of A.S. in the SEE



Source: EIHP/SECI TSP Project.

# RES integration and availability of A.S. in the SEE

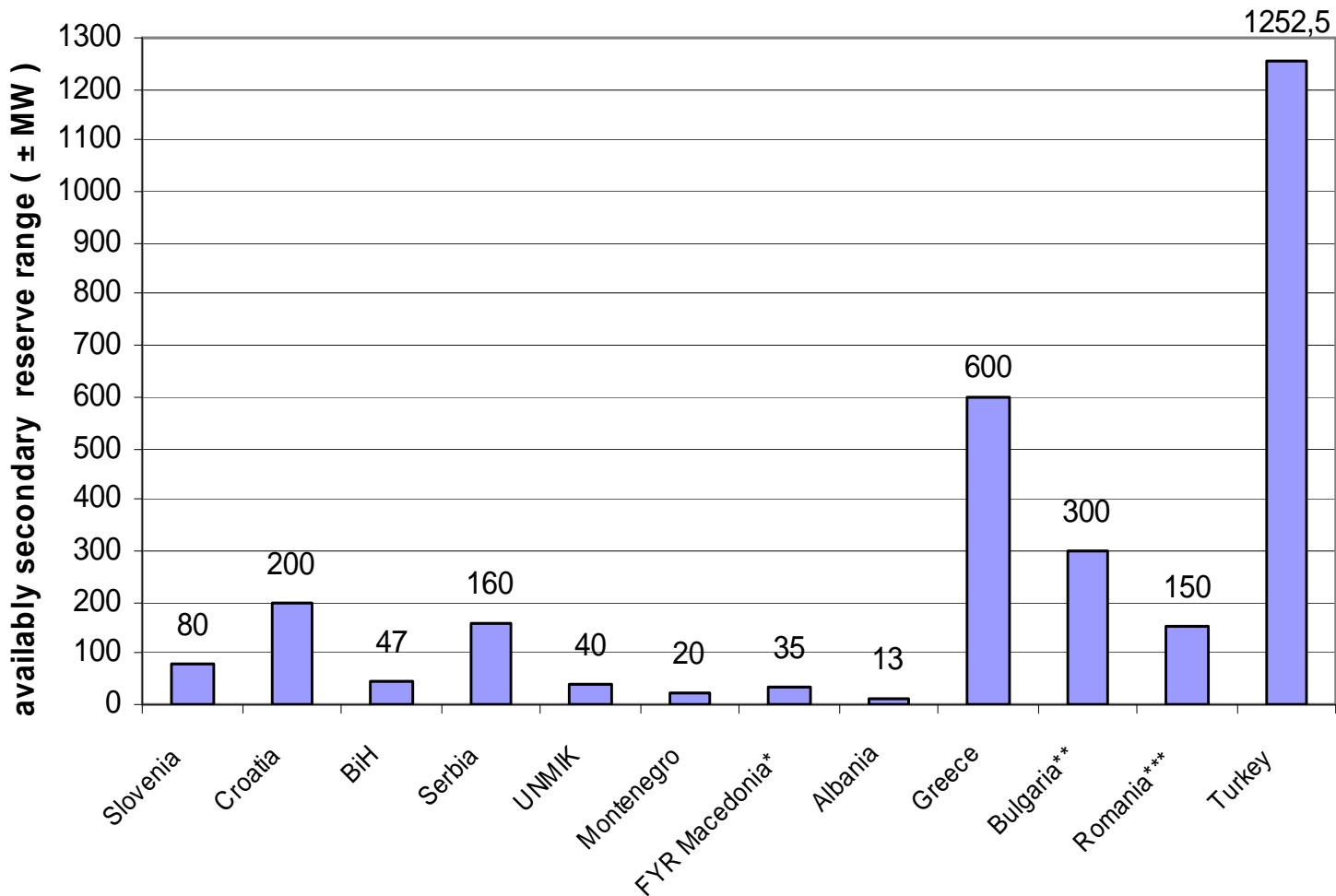
## TSO's opinions on limiting factors.



Source: EIHP/SECI TSP Project.

# RES integration and availability of A.S. in the SEE

## Available secondary reserve capacities.



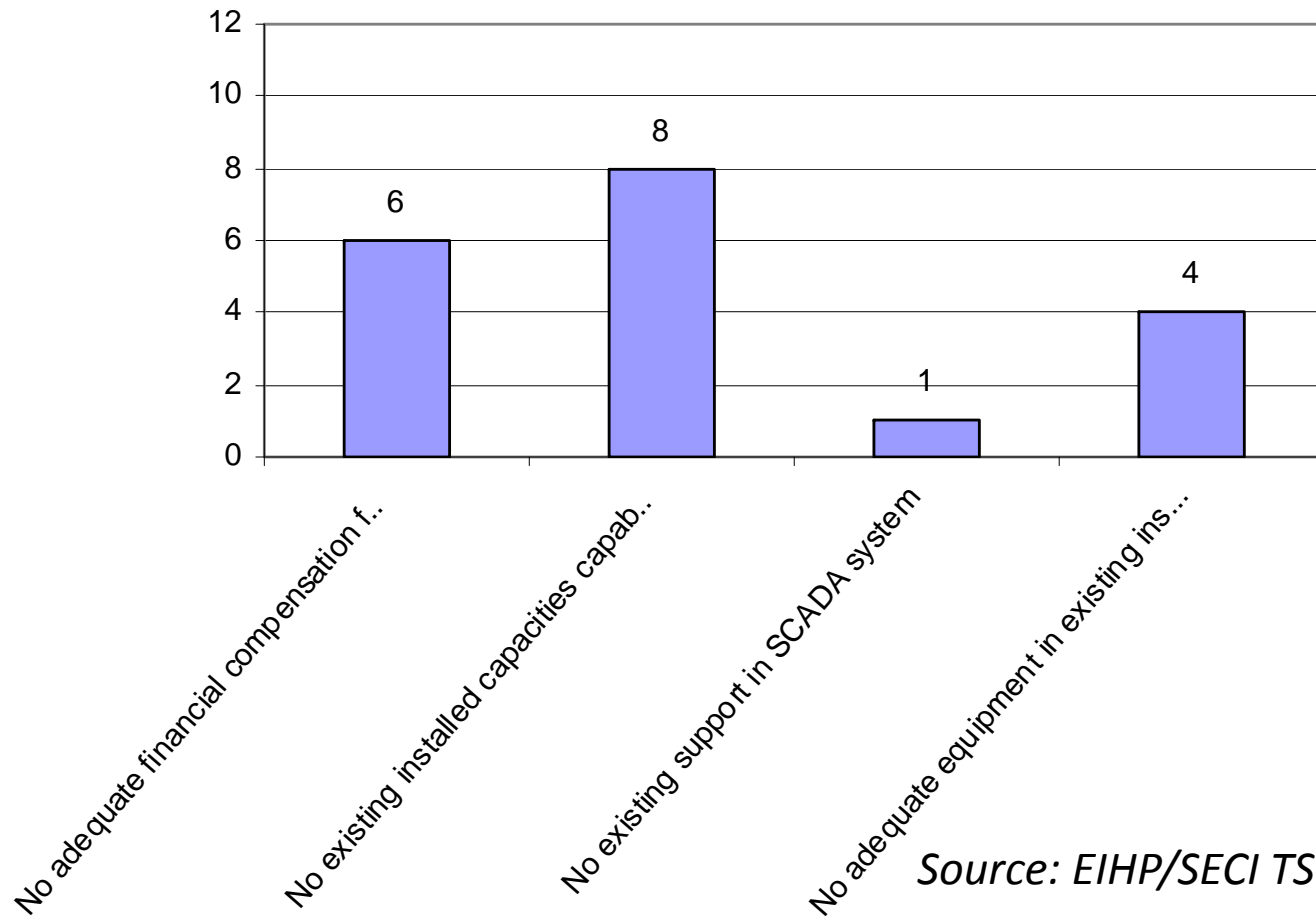
TSO of

Source: EIHP/SECI TSP Project.

# RES integration and availability of A.S. in the SEE

TSO's opinions on limitations preventing sufficient increase in secondary control.

Main limitation for increasing available secondary control



Source: EIHP/SECI TSP Project.

# Conclusion

- The situation with ancillary services around the SEE region is not satisfactory.
- The lack of the reserves is underestimated. It will interfere mostly with plans to integrate large quantities of new RES capacities, especially wind.
- The markets for A.S. are generally not developed, at all. In a great portion of the SEE region they actually do not exist.
- The cross-border exchange of A.S. is virtually non-existent. However, the EU c/b rules contribute to this situation.
- In order to enable a sustainable RES development physical resources for system reserves will have to be increased.

# References

- Albanian Transmission System Code, 2004
- BiH Grid Code, 2006
- Bulgarian Grid Code, 2004
- Croatian Grid Code, 2006
- Greek Grid Control and Power Exchange Code for Electricity, 2005
- Kosovo Grid Code, 2010
- ENTSO-E: *Operation Handbook*, 2010
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