SE MOLDELECTRICA

RES integration in power system of Republic of Moldova

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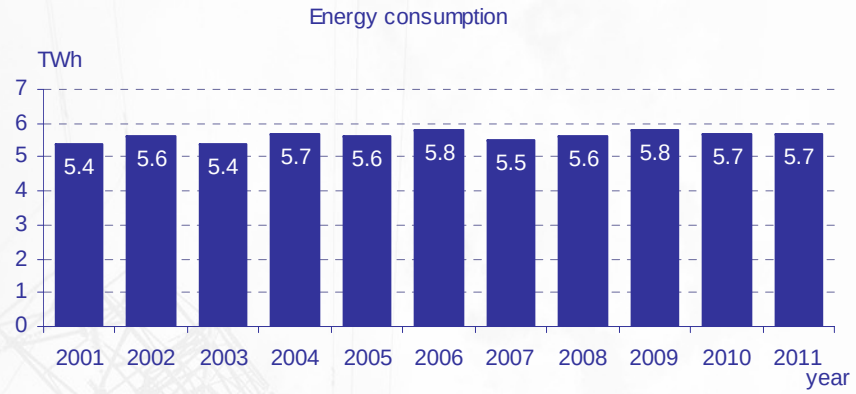
Power system

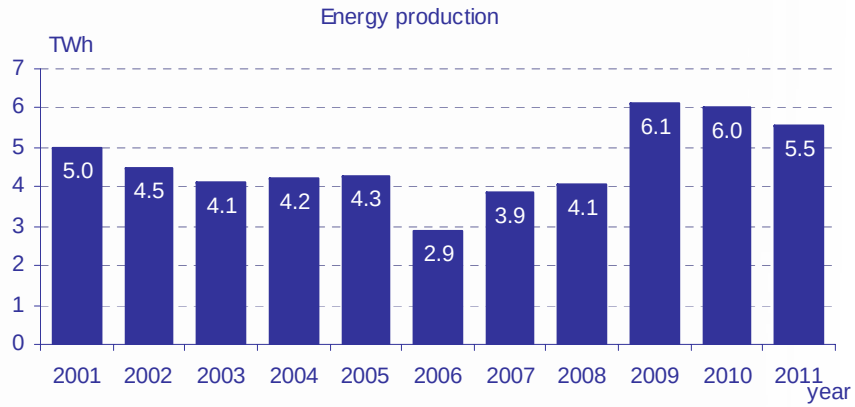
- **Voltage levels: 400 kV, 330 kV, 110 kV**
- **7 x 330 kV and 11x 110 kV interconnection lines with power system of Ukraine**
  (developed interface)
- **1 x 400 kV and 3 x 110 kV interconnection lines with power system of Romania**
  (undeveloped interface)
- **ENTSO-E asynchronous operation**
  (only island mode)
- **IPS/UPS synchronous operation**
- **Installed capacities – total 3014.4 MW**
  (around 2194.4 MW real)

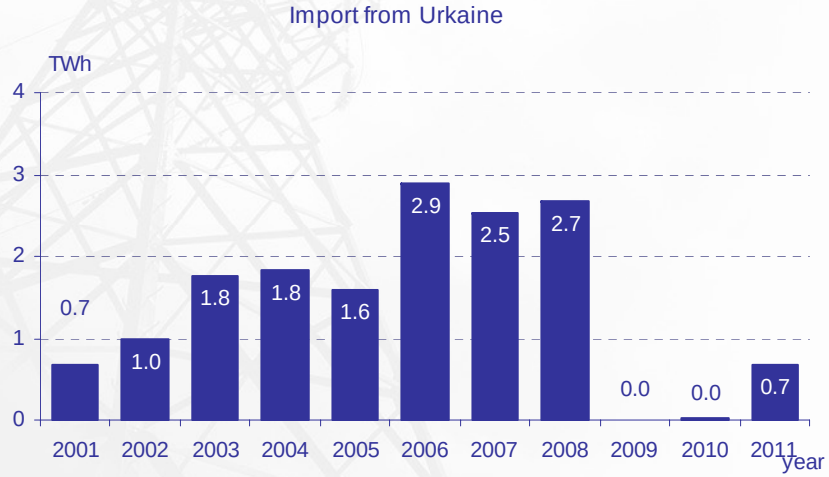
  Right bank – total **408.4 MW** (**CHP 326.4 MW**)
  - Chisinau-2 CHP – 240 MW
  - Chisinau-1 CHP – 66 MW
  - North CHP – 20.4 MW
  - Costesti HPP – 16 MW
  - other small PP – 66 MW

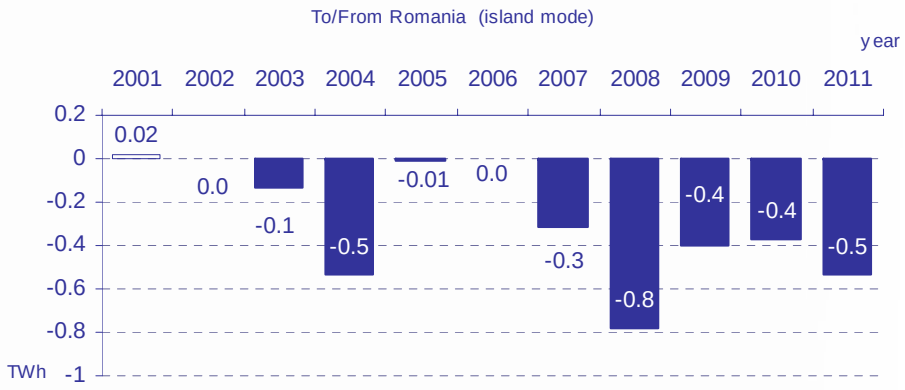
  Left bank – total 2606 MW (around 1786 MW real)
  - Moldavskaia TPP – 2520 MW (around 1700 MW real)
  - Dubasari HPP – 48 MW
  - other small PP – 38 MW

2001-2011 Energy balance









General grid access procedure

Grid connection procedure, established according to “Technical norms for electric energy transmission grid” (ANRE nr.266 from 20.11.2007) and “Law for electric energy” (nr. 124 from 23.12.2009):

- Request for issuing the grid connection permission

  Requesting party shall provide the written request, study with proposed grid access options, technical specification of the equipment to be connected, internal scheme, other relevant data by case;

- Analysis of provided data

- Grid connection permission issuing

  The permission shall include the terms under which the connection and further operation shall be made (requirements for operational capabilities, metering, SCADA integration), delimitation point between requesting party equipment and grid operator equipment, estimated works that are required to be carried out in order to make the connection (the works above delimitation point that are to be supported by the requesting party);

- Grid connection contract signing

- Works according to the grid connection contract

  Works consist of connection site design, equipment acquisition, installation, configuration and testing;

- Grid connection

RES grid access specifics

Issues dues to massive RES grid access request:

- Data unavailability

  Requesting party usually cannot provide the full description of the equipment to be connected to the grid;

  The provided study doesn't have a system or zone wide view and is unaware of other requests and planned system upgrades;

- No filtering mechanism and

  There is no financial commitment from the request party to implement the project;

- Lack of a queue mechanism

  There is no strict mechanism for prioritizing the requests;

- Uncertainty for system planning

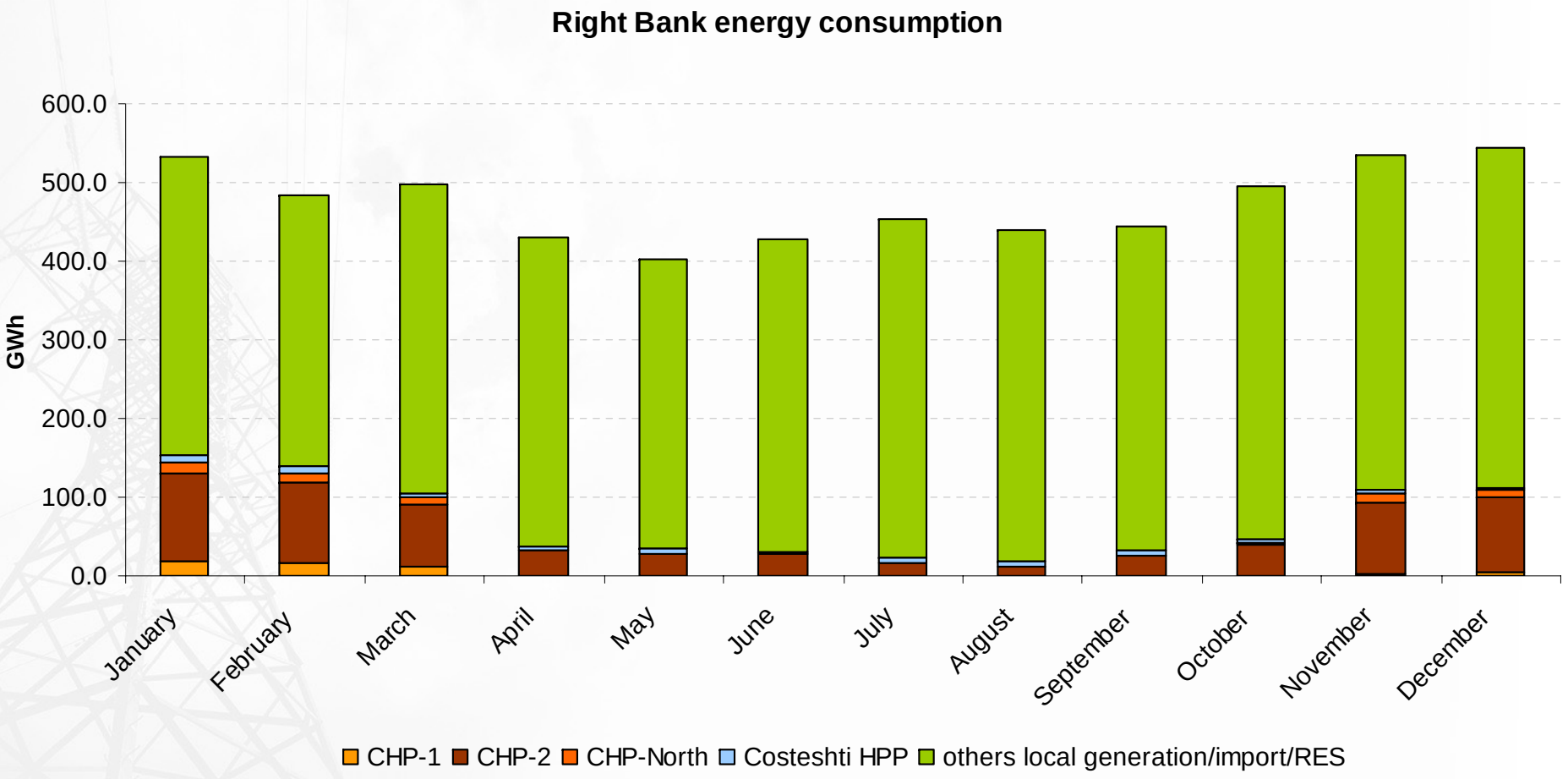
  Due to input uncertainty in implementation of RES projects there is the output uncertainty in system planning for RES integration;

- Cost allocation for transmission system upgrades

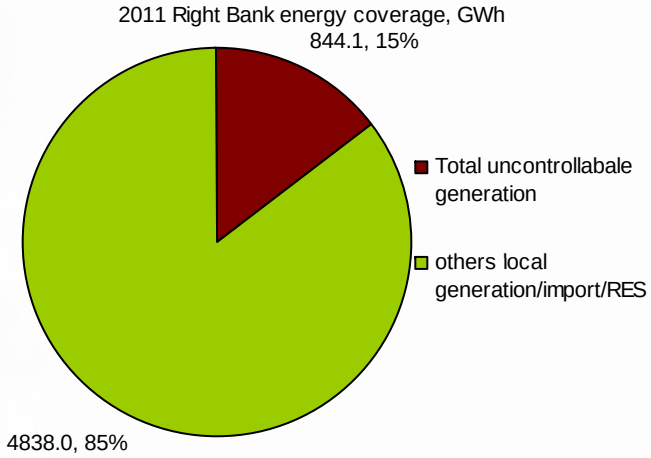
  It is reasonable to share the cost for system upgrades between those who benefit from the system upgrade;

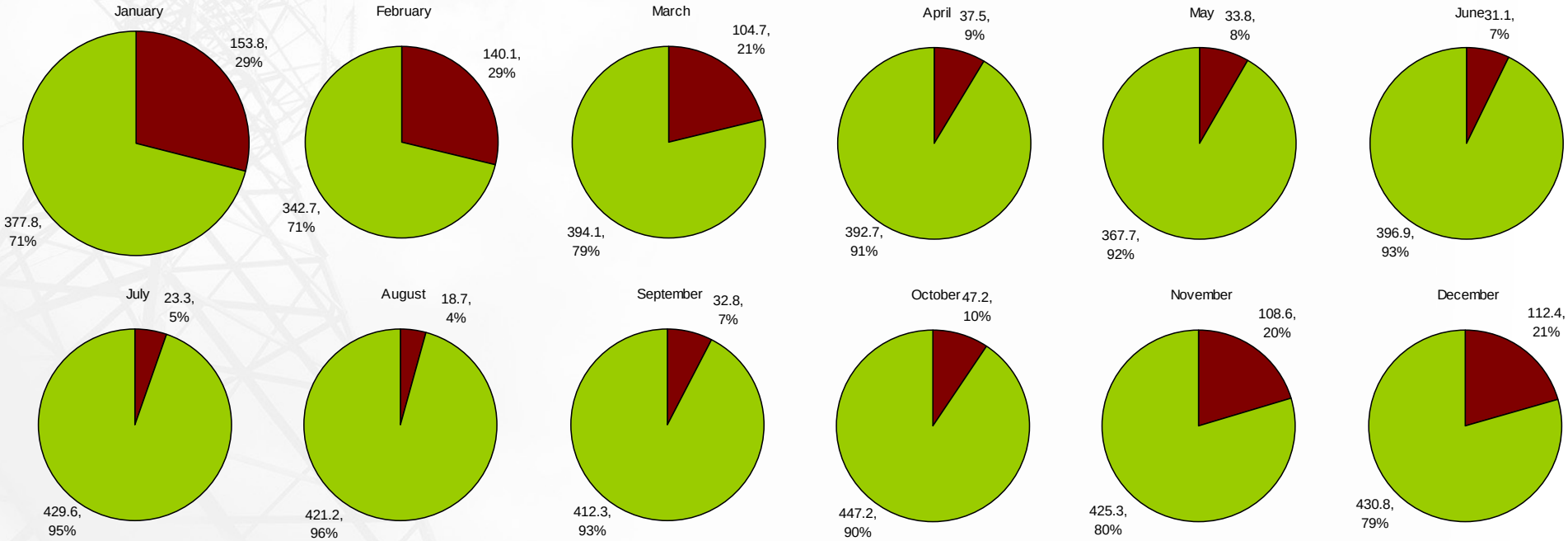
  How to assess the benefits?

RES in RB energy balance (1)



RES in RB energy balance (2)



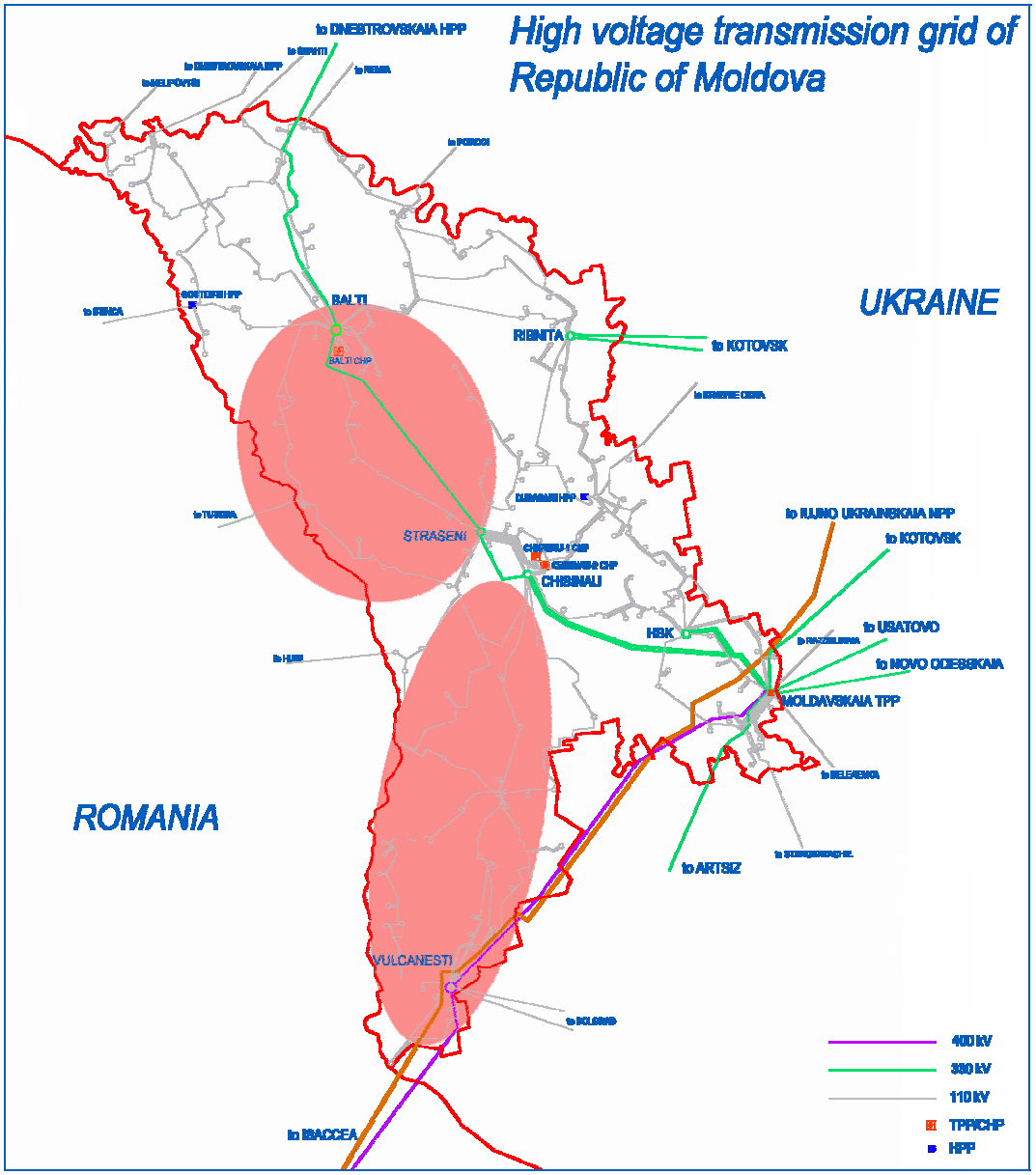


RES integration issues

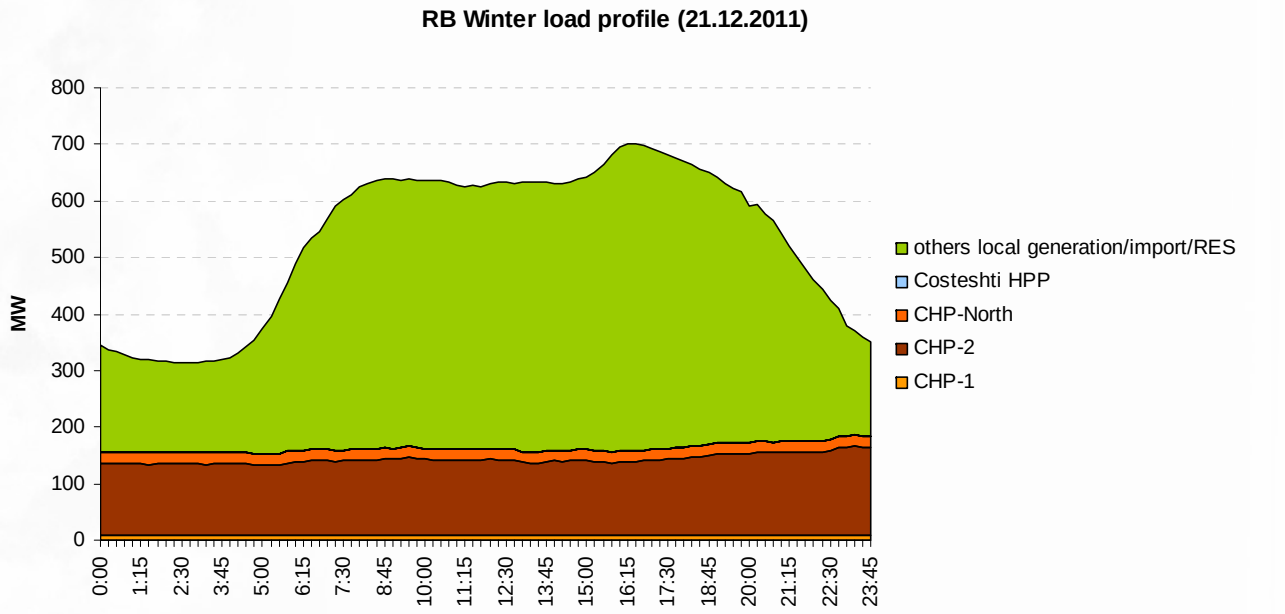
- There is need for grid reinforcement
  - Resources are not were the load is;
  - Large and highly localized RES;
- Lower load factors due to load profile specific
  - Lack of load during off peak hours;
- RES intermittence and balancing
  - No real time balancing capability in the system;
  - Only option is the import from power system of Ukraine;

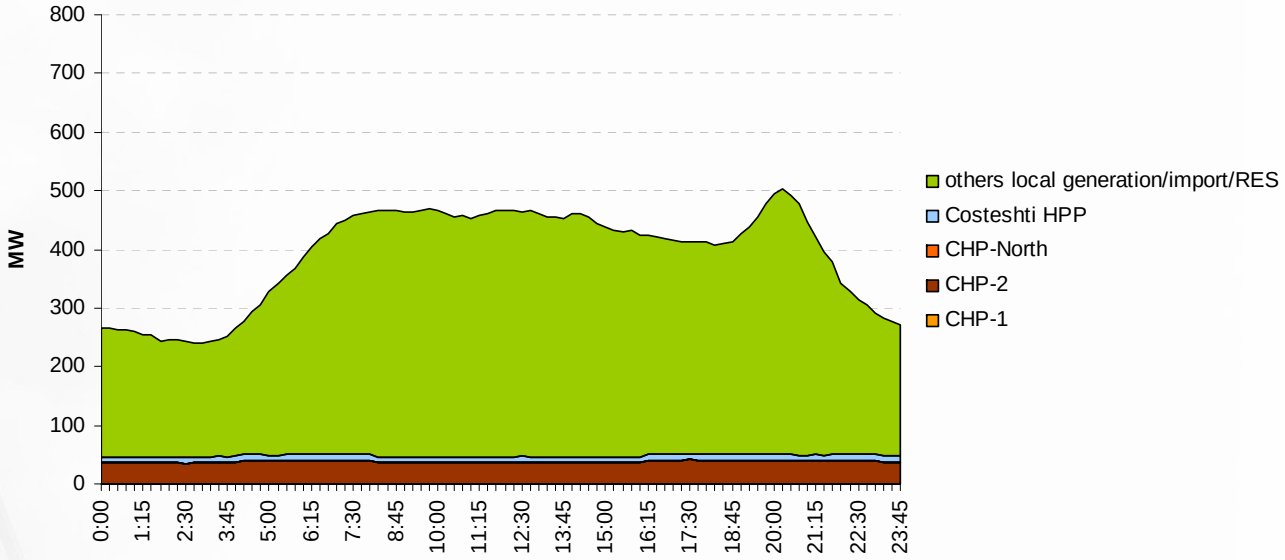
Grid reinforcement

- Reinforcement in the southern part of the grid
- Reinforcement in the central part of the grid
- Maximum usage of existing grid
- System and zone wide protection for N-1 and N-1-1
- Increased loses due to maximum line loading
  (beyond economic current density)
- Current energy strategy doesn't include any projects for grid reinforcement for RES integration



Load profile





RES intermittence and balancing

- No options for hourly balancing capabilities within the system
- RB generation cannot provide balancing service
- Uncertainties related to current market model and RES integration
- Uncertainties related to RES behavior
- Smaller system require more detailed and precise forecast and planning

Current status with RES

- No ongoing projects
- Requests for RES grid connection for about 1000 MW
- Issued grid connection permits require planning for grid reinforcement
- No real experience of RES operation
- Request for grid connection of mostly wind RES
- No RES specific regulation except the “Law for renewable energy”
- Grid permission requires the participation of RES in system frequency and voltage regulation


Thank You