FROM PLANNING TO IMPLEMENTATION

Comisión Nacional de Energía

CNE
October 2022
Installed Capacity of National Energy System at June 2022 is approximately 32.429 MW, and peak demand around 10.500 – 11.000 MW.

In Chile, the generation segment can participate in three markets:

- **Energy**: Long term contracts. Short term market based on audited and declared costs.
- **Ancillary services**: based in bidding process if the service is competitive (pay as bid).
- **Capacity**: based on administrative payments.

Total capacity: 32.5 GW

Total generation: 75.1 TWh
Hydroelectric, PV and Wind Power present variability and uncertainty. Also we are in a decarbonization process.
With less hydro power, we have an important dispatch of oil power. In a context of lower supply availability, flexible regulation is required to increase supply available.

- We can activate special rules through a rationing decree:
  - Water reserve
  - Additional oil capacity
  - Others.

- Oil dispatch in morning-afternoon (PV time) around 800 MW. In the night, the dispatch of this technology is around 1300 MW.

- Demand of 18-22 hours (peak period) is similar that 10-13 hours.
Storage systems are important in Energy transition and can participate in different markets

Storage systems are important infrastructure in the path of Transition Energy

Can participate, for example, in generation segment with renewables behind the meter

<table>
<thead>
<tr>
<th>Generator</th>
<th>Technology</th>
<th>Year</th>
<th>Capacity MW</th>
<th>Storage MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfal</td>
<td>Hydro+BESS</td>
<td>2020</td>
<td>178</td>
<td>10(5hr)</td>
</tr>
<tr>
<td>Andes IIB</td>
<td>PV+BESS</td>
<td>2022</td>
<td>180</td>
<td>112(5hr)</td>
</tr>
<tr>
<td>Andes IV</td>
<td>PV+BESS</td>
<td>2023</td>
<td>211</td>
<td>130(5hr)</td>
</tr>
<tr>
<td>Alfalfal expansión</td>
<td>BESS</td>
<td>2023</td>
<td>-</td>
<td>49.3(5hr)</td>
</tr>
</tbody>
</table>

Participation in centralized transmission planning process (public service infrastructure). Differences between trunk and subtransmission system.
ISGAN WG 6: Focus on network planning and decision-making under uncertainty

Joni Rossi – RISE/ISGAN WG6
Network Planning and Decision-Making under Uncertainty

How can we best develop adequate power grids that contribute to reaching global the sustainable development goals?

International knowledge sharing project in the current ISGAN program of work.

Rationale:

• Grid planning processes are complex and involve interaction between a large number of stakeholders at different levels.

• Decision making is guided both by high level policies aiming for socio-economic goals, as well as more technical performance indicators.

• In light of the urgency of the energy transition it is critical that these processes are efficient, transparent, legitimate, and based on sound principles and steering mechanisms.
Focus question and project objectives

How can we best develop adequate power grids that contribute to reaching the global sustainable development goals?

Network Planning and Decision-Making under Uncertainty

Stakeholders

Regulations and other steering mechanisms

Socio-economic goals
Technical requirements and regulations
Climate and environmental perspectives
Proactive or reactive approach
Time
Democracy

Assumptions

Network planning

Goal conflicts

Triggers (input)

Connection application
Expected long term need

Tools

Communication

- Increasing transparency, understanding and acceptance
  - Enabling a holistic dialogue
- Efficient and constructive stakeholder interaction
- Steering mechanisms, that lead to intended outcomes

Aim for results with relevance for policy makers and where they have mandate to improve the situation
**Network Planning and Decision-Making under Uncertainty**

*Survey on the planning processes and challenges in different countries worldwide → first outcomes*

**Planning processes**

- Planning processes can include different aspects: network studies, future scenarios, market studies which define the **needs for network-based** solutions.

- The role of **non asset (market-based) solutions** needs to be further highlighted and its potential clarified.

- Sets of **aims and constraints** steer the development of cost-effective, reliable and environmentally sound systems, but they can also be competing and it is hard to define priorities a priori when their importance is contextual and changing.
  
  - For example shift from traditional TSO responsibilities → decarbonization → energy security and customer affordability.
Network Planning and Decision-Making under Uncertainty

Survey on the planning processes and challenges in different countries worldwide → first outcomes

Assessment and decision-making

• This process needs updating in order to make multi-stage decisions to quantify the impact of uncertainties, and strike a balance between risks and benefits.
  ❖ upgrading of parameters: changing system conditions, assumptions of load and production, price evolutions …
  ❖ using more advanced methodologies: modelling of uncertainties, considering more heterogeneous connection requests, improving analytical capacity, probabilistic approaches…
  ❖ expanding granularity in time and space

• Also on the medium and low voltage levels the lack of data and a clearly defined processes can cause delays.

• Only in a few cases the planning decisions are also evaluated ex-post to ensure process improvements.
Stakeholder involvement

- It is a matter of ongoing engagement with **all stakeholders** to balance the competing objectives at all levels of decision-making.
- Need for a better dialogue between political level / regulators and grid operators
  - If the cost recovery mechanism is regulated, **innovation** can be included in the income framework
  - Need to set realistic goals and find feasible solutions in order to reach these goals.
- Tighter **DSO/TSO interactions** and **Integrated planning** with other systems and collaboration with cities/municipalities.
Network Planning and Decision-Making under Uncertainty

Survey on the planning processes and challenges in different countries worldwide → first outcomes

Comments and recommendations

• In the current rapidly evolving technological, carbon abatement policy and geopolitical environment, a reactive approach with utilities establishing network expansion plans every couple of years needs to become more proactive planning based on scenario analysis. Time should be reduced between planning and realization.

  ❖ This new approach has still several barriers.

  ❖ While low-hanging fruits can still be picked in the planning process, the risk of interconnection backlog is increasing.

  ❖ Some see a need for stronger political or regulatory leadership to create a future-looking process.

  ❖ Evergreening can help ensure that they remain relevant and do not become stale.

• Several contributors mention the availability of equipment but also skilled workforce for placement and operation as critical barriers.
Next steps: ISGAN Knowledge Sharing Process

<table>
<thead>
<tr>
<th>Process Step</th>
<th>Involved</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>SURVEY</td>
<td>Survey: Country representatives + Summary: Organising Team</td>
<td>(Internal only) REPORT informing detailed planning of workshops</td>
</tr>
<tr>
<td>WORKSHOP 1 Problems: their root causes and consequences</td>
<td>Country representatives + Organising Team</td>
<td>Interactive knowledge exchange Selection of 1-2 areas for in-depth investigation</td>
</tr>
<tr>
<td>ANALYSIS of results in prioritised focus areas</td>
<td>Organising Team + Country representatives (optional)</td>
<td>Analysis to share with participants in preparation of Workshop 2</td>
</tr>
<tr>
<td>WORKSHOP 2 Problems: Deepen understanding, involving Key National Stakeholders</td>
<td>Country Representatives + Key national stakeholders</td>
<td>Interactive knowledge exchange</td>
</tr>
<tr>
<td>ANALYSIS of workshop results</td>
<td>Organising Team + Country representatives (optional)</td>
<td>Analysis to share with participants in preparation of Workshop 3</td>
</tr>
<tr>
<td>WORKSHOP 3 How can problems be mitigated or solved?</td>
<td>Country Representatives + Key national stakeholders</td>
<td>Summary of Insights and draft Recommendations</td>
</tr>
<tr>
<td>ANALYSIS of workshop results + SUMMARY of insights from project</td>
<td>Organising Team (lead) + All workshop contributors (review)</td>
<td>Full Project Report + Policy Messages to CEM</td>
</tr>
<tr>
<td>DISSEMINATION of Results</td>
<td>Organising Team + ISGAN Communications Working Group</td>
<td>ISGAN Academy Webinar + Presentation at CEM (TBC) + Web material</td>
</tr>
</tbody>
</table>

9 September 6 October 24 November March 2023, TBC (@ ISGAN ExCo?)

Digital

National activities in participating countries (if relevant)
Flexibility as system services – the needs from Statnett perspective

Bjørn H. Bakken
Head of section: Reserves and flexibility

Kjetil O. Uhlen
Special Adviser
The need for flexibility is increasing

• Supporting the green transition of the European power system:
  • Large and rapid changes in power flows and power balance
  • Implementation of the common European rules for markets and system operation
  • More automation of system operation

• Specifically for Norway:
  • Today, balancing, stability and flexibility are mainly provided by dispatchable hydropower plants. May not be sufficient in future!
  • Thus, demand side flexibility is getting increasingly important!
Flexibility is fundamental to the power system of tomorrow

Sufficient flexibility in the power system is important to handle balancing, contingencies and congestion management, to allow further grid connections and to reduce or postpone grid investments.

- What KIND of flexibility do we need?
- HOW are we going to use it?
- How can we implement the necessary FUNCTIONALITY?
Statnett's own balancing products

- **Fast Frequency Reserves** (FFR): 0.7-1.3 sec. response time; 5-30 sec. duration
- **Frequency Containment Reserves** (FCR-N og FCR-D): 30 sec. response time; minimum 15 min duration
- **Automatic Frequency Restoration Reserves** (aFRR): Full response within 2 min; duration according to bid period
- **Manual Frequency Restoration Reserves** (mFRR): Full response within 15 minutes; duration according to bid period
Flexibility categories – the general picture

Explicit flexibility
(procurement of products/services)

- Reserve markets (FFR, FCR, FRR etc)
- "Connection on terms" Bilateral agreements

Implicit flexibility
(reduced energy cost)

- Manual & automatic price response (spot price, tariffs)
- Energy saving investments
  - Building modifications, heat pumps,
  - Alternative energy sources etc

Short term/
Low energy

Enduring/
High energy
Flexibility categories – the general picture

**Explicit flexibility**
- **(procurement of products/services)**
  - "Connection on terms" Bilateral agreements
  - Energy saving investments
    - Building modifications, heat pumps, Alternative energy sources etc

**Implicit flexibility**
- (reduced energy cost)
  - Manual & automatic price response
    - (spot price, tariffs)
  - Reserve markets
    - (FFR, FCR, FRR etc)
  - System Protection (SIPS)

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- Short term/ Low energy
- Enduring/ High energy

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*Statnett*
System Protection Schemes (SPS)
- Event-based or response-based automatic protection solutions
System Protection Schemes (SPS)
Event-based protection solutions
Dissconection of production (PFK)
System Protection Schemes (SPS)

Event-based protection solutions

Dissconnection of load (BFK)
System Protection Schemes (SPS)

Capacity increase on transfer corridor due to SPS

Bid Zone 1

Without SPS 800 MW

With SPS 1000 MW

Bid Zone 2

Factory

System Protection Schemes (SPS)

Capacity increase on transfer corridor due to SPS
Flexibility categories – the way forward

Explicit flexibility
(procurement of products/services)

Reserve markets
(FFR, FCR, FRR etc)

"Connection on terms"
Bilateral agreements

Implicit flexibility
(reduced energy cost)

Manual & automatic price response
(spot price, tariffs)

Energy saving investments
Building modifications, heat pumps,
Alternative energy sources etc

System Protection
(SIPS)

Enduring/
High energy

Short term/
Low energy

Statnett
Det grønne takskiftet
Most customers are connected in the distribution grid
Coordinated activation of flexibility between DSO and TSO is necessary.

<table>
<thead>
<tr>
<th></th>
<th>Needs activation</th>
<th>No impact</th>
<th>Negative impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needs activation</td>
<td>OK</td>
<td>OK</td>
<td>NO</td>
</tr>
<tr>
<td>No impact</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Negative impact</td>
<td>NO</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
High level concept for flex value chain

- National markets
- Local markets
- Aggregator
- Bid filtering

Flex market(s)

TSO

DSO

Smaller customers
Coordinated engagement on three arenas

- National markets
- Local markets
- Aggregator

- R&D and/or pilots
- Bid filtering
- DSO-TSO collaboration
- Smaller customers
- Local trading
- Commercial pilots
Key messages

- Regulations that enables and motivates (incentivises) local markets and sharing (e.g. trading surplus energy locally)
- R&D on development of modularised flex markets
- TSO-DSO coordination to maximize utilization and resilience (avoiding negative impacts)
  - System protection schemes being a part of this.
Thank you for your attention!