DEPsys- & NASPI-Affiliated Distribution System Operators Surveys Results

Nov. 2020 NASPI Work Group Meeting

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Within DisTT updates

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Overview of presentation

• The DEPsyst (GEiMS) and NASPI questionnaires
• Structure of the GEiMS questionnaire to distribution system operators
  • Conclusions from the GEiMS questionnaire
• Structure of the NASPI questionnaires to distribution system operators
  • Conclusions from the NASPI questionnaire
• Path forward
• Appendix
  • Responses to GEiMS questionnaire
  • Responses to NASPI questionnaire
GEiMS & NASPI questionnaires

• Why GEiMS sought for distribution system operators’ input
  • Assess the practical state estimation requirements
  • Opportunity for added insight for DEPsyst

• Why NASPI sought for distribution system operators’ input
  • Little data on distribution operators’ aspirations/applications with phasors
  • Explore extensions of value to NASPI DisTT
Structure of GEiMS questionnaire

Grid Characteristics, Operation & DG

Is there monitoring infrastructure?

Yes

No

Monitoring Situation

Is State Estimation Performed by the Operator?

Yes

No

State Estimation Situation

Monitoring Vision

State Estimation Vision

Personal Information
Remarks on Grid & DG

• Most operators manage at least some extent of urban grid

• No monitoring for reliability or reinforcement; mostly reports/experience

• Huge push for reducing SAIDIs

• Monitoring to accommodate distributed resources

• Grid status is recorded seasonally (limited monitoring of distribution)

• Gap between operators’ vision and practice
Remarks on Monitoring Situation

• Preference on SCADA implies legacy from transmission monitoring

• Monitoring data gathering and GUI important features of monitoring

• Low voltage grid sparsely monitored, customers on AMI

• Voltage quality primary concern for monitoring
Remarks on State Estimation & Monitoring Plans

• Low response rate

• Not consistent response by polled individuals (different few people answered different questions)

• No apparent correlation of responses that could be meaningful
Any 1 major question you would like to ask?

(Q&A time allocated at the end of the presentation)
Structure of NASPI questionnaire

• 7 questions with follow-ups & some write-ins
  o Measurement infrastructure
  o Monitoring Priorities
  o Wildfire mitigation
  o Distributed Generation management
  o State Estimation situation
  o Microrgrids plans
  o PMU concerns
Remarks on NASPI Questionnaire

• Fault detection & asset health primary reasons for monitoring plans
• DER concerns focus on voltage profile, protection and loss of generation
• PMUs underutilized although some deployed (SCADA widely used)
• No ‘actual’ state estimation at distribution systems
• Wildfire mitigation very trending concern wrt monitoring
Any 1 major question you would like to ask?

(Q&A time allocated at the end of the presentation)
Path forward (general remarks)

• The distribution system monitoring landscape is uncharted
  • Legacies from transmission affect it (SCADA, voltage concerns, data w/h)
• Customer-centered concerns for monitoring (faults, asset health)
• DERs push ‘advanced’ monitoring projects (relevant to previous)
• State estimation at distribution systems necessary, but unexplored
• Good timing to affect/standardize developments in all of the above
And a Request...

Can we count on some DSO experts who will volunteer for 30’ anonymous interviews as follow-up to the surveys?

Not necessary to interview the same surveyed experts/scholars
Questions?

Clarifications?

Comments?
Appendix
Responses to GEiMS Qs – Grid & DG (1/4)

Which option describes better the distribution grid of the utility?

- Mostly urban grid: 57%
- Mix of urban and rural grids: 43%

* 6/13: N. A.

Which option characterizes better the utility's grid?

- Mostly overhead lines: 43%
- Mostly underground cables: 43%
- Mix of o/h lines and u/g cables: 14%

* 6/13: N. A.

How has grid reliability been assessed?

- End-customers' report: 37%
- Monitoring devices: 13%
- Maintenance staffs' report: 37%
- Other: 13%

* 8/13: N. A.

How are grid reinforcement decisions taken?

- Grid simulations using power systems software: 36%
- Estimations based on experience: 46%
- Site visit: 18%

* 6/13: N. A.
Responses to GEiMS Qs – Grid & DG (2/4)

How frequently is system reconfiguration employed in average/year) for a...

- **MV feeder**
  - <5 times a year, 50%
  - It is not used, 50%
- **LV feeder**
  - <2 times a year, 25%
  - It is not used, 75%

What percentage of... feeders are remotely controllable?

- **MV feeder**
  - >90%, 13%
  - Not remotely controllable, 12%
  - <10%, 75%
- **LV feeder**
  - <10%, 43%
  - Not remotely controllable, 57%

* 9/13: N. A.
* 6/13: N. A.
Responses to GEiMS Qs – Grid & DG (3/4)

Which might be interesting for the utility in the future?

- Decreasing SAIDI: 24%
- Decreasing grid losses: 29%
- Facilitating EV integration: 19%
- Integrating BSS: 9%
- Facilitating RES penetration: 19%

How is the maximum penetration of DG determined?

- Policy implementations: 72%
- Grid studies based on standards: 14%
- Other: 14%

How many times per year (/y) are grid voltages & loads recorded?

- >5/y: 60%
- <5/y: 20%
- 1-2/y: 20%

Has any monitoring system been used in the grid?

- Yes: 83%
- No: 17%

* 6/14: N. A.
* 7/14: N. A.
* 8/13: N. A.
* 7/13: N. A.
Responses to GEiMS Qs – Grid & DG (4/4)

Last year System Average Interruption Duration Index (SAIDI)?

\[
\text{Average} = 49' \pm 36.6'
\]
\[
\text{Median} = 42.5'
\]

Average last 5 years SAIDI?

\[
\text{Average} = 135' \pm 167'
\]
\[
\text{Median} = 59'
\]

Annual energy consumption?

\[
\text{Average} = 6747 \pm 13464 \text{ GWh}
\]
\[
\text{Median} = 526 \text{ GWh}
\]

Average/peak loading (%)?

\[
\text{Average} = 33.5 \pm 18\%/36 \pm 14\%
\]
\[
\text{Median} = 30\%/31.5\%
\]

Total installed capacity of DG?

\[
\text{Average} = 523 \pm 1215 \text{ MW}
\]
\[
\text{Median} = 26.5 \text{ MW}
\]
Responses to GEiMS Qs – Monitoring Situation (1/3)

Which monitoring systems are used?

- SCADA: 50%
- ADMS: 15%
- AMI: 14%
- Other: 7%
- Smart meter: 14%

* 4/13: N. A.

What percentage of ... are equipped with monitoring or smart meter systems?

- MV feeder:
  - >90%: 33%
  - 60% < % < 90%: 71%
  - 30% < % < 60%: 17%
  - <10%: 30%
  - No monitoring systems: 29%

- LV feeder:
  - >90%: 25%
  - 60% < % < 90%: 13%
  - 30% < % < 60%: 17%
  - <10%: 37%
  - No monitoring systems: 29%

- End Customers:
  - >90%: 25%
  - No monitoring systems: 25%
  - 60% < % < 90%: 13%
  - <10%: 37%

* 7/13: N. A.
* 6/13: N. A.
* 5/13: N. A.
Responses to GEiMS Qs – Monitoring Situation (2/3)

Does the employed monitoring system...

- ...store the measurement data locally?
  - Yes, 33%
  - No, 67%

- ...transmit the measurement data?
  - Yes, 100%

- ...provide visualization interface?
  - Yes, 100%

- ...provide data analysis toolbox?
  - Yes, 33%
  - No, 67%

- ...format data in CIM or IEC61968?
  - Yes, 50%
  - No, 50%

* 10/14: N. A.
What are the functionalities of the monitoring systems?

- Voltage level monitoring: 34%
- Congestion monitoring: 8%
- Outage management: 17%
- DSM/DR: 8%
- Grid control: 17%
- Other: 8%

What control actions does the monitoring system support?

- Feeder reconfiguration: 40%
- Voltage Control Equipment: 20%
- No control action: 20%
- Other: 20%

Has any state estimation been used in MV and/or LV distribution grids?

- Yes, 50%
- No, 50%

*8/13: N. A.*

*9/13: N. A.*

*9/13: N. A.*
The plans of monitoring infrastructure deployment and the expected results are unclear...
Practiced and planned state estimation of distribution grids has unclear results and aims...
Responses to GEiMS Qs – Survey ID

Which of the following best describes your role?
- Other: 62%
- Grid planner: 15%
- Grid operator: 15%
- R&D: 8%
- Other: 61%

What is your seniority level?
- Expert / Specialist: 15%
- Team leader: 8%
- Manager: 8%
- Director: 8%

In which country is your organization active at?

Answer: Switzerland, Spain, Greece, Lithuania, Iran, Nigeria, Ecuador/Argentina, India
Responses to NASPI Qs (1/4)

Which monitoring systems are used?

- SCADA: 37%
- AMI: 21%
- ADMS: 21%
- PMU: 21%

Which types of feeders are valuable to monitor?

- High DER & Industrial load feeders: 14%
- Industrial load feeders: 14%
- High DER penetration: 72%

Is State Estimation performed at the feeder?

- Yes: 22%
- No: 78%

Are microgrid projects* in the utility planning?

- Yes: 57%
- No: 43%

* assuming use of PMUs
Responses to NASPI Qs (2/4)

Rate the priority of concern for monitoring each of the following aspects of distribution systems?

Rate the challenges associated with higher penetration of DER for your utility?
Responses to NASPI Qs (3/4)

Which wildfire risk mitigation strategy does your utility use?

- Underground Cables, 21%
- Preemptive shut-off, 21%
- Down conductor detection, 18%
- High Z arc detection, 14%
- Optical detection, 7%
- Ground fault detection, 14%
- Other, 4%

How important is each of the following wildfire mitigation strategies to your utility?

- Undergrounding cables
- Public safety power shutoffs
- Falling/broken conductor protection
- High impedance arc-fault detection
- Optical recognition of point-source fires
- Sensitive ground fault protection

Legend:
- 1 Top
- 2 High
- 3 Medium
- 4 Low
- 5 Not relevant
Responses to NASPI Qs (4/4)

Based on your estimation, assess the cost effectiveness of each fire mitigation solution?

Which practice for wildfire mitigation do you expect to perform better in the future?
### All comments/remarks in one slide

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