# Resilience Challenges for System Operators

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Vision 2030 - Stockholm

5/15/2023

### Agenda

- Challenges for DSO
- Vision 2030
- Network Operation Future Capabilities
- Q&A



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Sida 3



# **ELLEVIO**

# Our electricity network is 79,200 kilometers long. This corresponds to almost two turns around the Earth

#### Our network areas

- Dalarna
- Gävleborg (Hälsingland, Gästrikland)
- Skaraborg-Närke
- Stockholm (Stockholm City, Ekerö, Lidingö, Täby, Nynäshamn, Vallentuna)
- Värmland
- The West Coast (Halland, Bohuslän)

Kilometers of network

**79,200** km



# Since Ellevio was founded, network investments have almost tripled, to meet societal developments

Ellevio's investments 2015–2021, SEK





## What do we invest in and why? (2021 c. 3.5 mdr SEK in our network)

### In general

- Increase safety, eliminate unsafe components and assets
- Reduce environmental risk, increase security of supply
- Periodical renewal of network, handle increase maintenance cost and safety issues.
- Increase degree of digitalization

### Regional networks > 24 kV

- Stockholm increase in capacity (*urbanisation*)
- Outside Stockholm capacity demand driven by wind power and industry electrification

### Local networks up to 24 kV

- Stockholm renewal investments and capacity increase (urbanisation). Vision 2030, automation, smart charging
- Outside Stockholm changing overhead lines to underground cable. Charging infrastructure



Sida 7

# Future DSO cornerstones for Ellevio



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# Vision 2030

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### Vision 2030

- A transformation program supported by regulatory changes that focuses on customer value



The role of the DSO is transitioning from being a reactive to an active and pro-active role in order to ease the market development, regulate the grids and support customer need. Clean Energy Package is aiming to clarify roles and boundaries.

# Programme Vision 2030 – Digital DSO

The development of society with a focus on the environment and renewable energy in general and the electrification of vehicles in particular will lead to even higher demands and incentives for better delivery security and unchanged quality. Our work will be characterized by and require significantly more proactivity at every stage to meet our customers in a credible and reliable way.

**Vision 2030:** By the year 2030 we will have reduced SAIDI by half across the board for all of our customers This will be accomplished through: **Operation and Continuously analyse information** Information/ Maintenance predictively to proactively connect and Build the digital network with a Digitalisation Prediction and perform maintenance of the electricity measuring point centred information - Investment Layers Analytics grid model Use functions centrally and locally to **Customize organization and** Organisation Automation make automated analyses and processes to utilize the new - New processes Value creation enabling new connections of the electricity grid knowledge and make more effective functions and value decisions capture Drivers - New Regulation

Page 12

### Vision 2030 Investments layers

	Investment Lay	vers – All these layers are need fo	r vision 2030 of reaching SAIDI, however all at once might not be nece	ssary
1. Executive Summary	Analytics (New Business	<ul> <li>Statistics</li> <li>Trends</li> </ul>		AMO's operational efficiency and profitability are entirely dependent on the Electricity Network
2. Background	Driver)	• Big Data	СІМ	being able to be monitored and maintained continuously.
3. Investment	Systems & Applications	<ul> <li>Network information system</li> <li>SCADA</li> <li>Data management</li> <li>Integration Platforms</li> </ul>		This requires that all parts of the network are connected.
strategy development 4. Grid of the Future	Network & Communication	<ul> <li>Al &amp; Automation</li> <li>Communication technologies</li> <li>Network infrastructure</li> <li>Protocols and standards</li> <li>Security</li> </ul>		Our Road Map for creating a long-term architecture is based on a structure developed by CEN, CENELEC and ETSI, Smart Grid Architure Method (SGAM). Based
5. Vision 2030	Assets & Components	<ul> <li>Redundancy</li> <li>Cable vs OH lines</li> <li>Metering</li> <li>Control equipment</li> </ul>		on this method, we have landed in a warehouse model for Ellevio. We call it Investment Layers

## Improve Reliability and Reduce Maintenance Costs

#### Primary Drivers included in Vision 2030 Reliability **Cost Reduction Automation &** Renewable Communication Integration Avoid outages **Efficient Mainentance** Securely balance Automate fault intermittent localization and Maximize grid Reduce outage generation, supply restoration duration utilization switchable loads, **Closely interact with** Utilize consolidated Minimize grid losses\* and storages\* field IEDs user control across Optimally the entire grid Gain maximum curtail/restore benefit from smart generation acc. meter information\* to grid load ability\*



\*VC not included in BC Electricity to You

### Vision 2030 – Stockholm Purpose and deliverables

### Purpose

- Reduce SAIDI by 50% by enabling remote switching and reduce fault location time
- Establish solutions for the collection of data and a platform for the continuous use of data in our existing and new processes
- Leveraging the data in order to create insight and benefits to our Customers, Ellevio and the Society

### Deliverables

- Introduce equipment and processes for **Remote Control** of Secondary Stations for faster disconnection of faults and switching during normal work.
- Ensure a stable network regarding **protection functions** and RTUs in Primary Substations.
- Create a platform for continuous **collection and storage** of measurement data and operational data for network analysis, network development, operational analysis and predictive maintenance
- Establish basic support tools and applications
   for network analysis, network development, operational analysis and predictive maintenance

5 Establish **processes and business activities** for network, operation and maintenance analysis



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# Vision 2030 – Greater Stockholm area

### - Aiming to improve analytic capabilities and reduce SAIDI by half until 2030

Ellevio aims to invest in communication to network sites and capabilities in central system applications for improved operational and business performance. New strategy for data management and revised working methods, affecting all our main processes is furthermore developed.

#### New Communication Infrastructure

Homogenous platform with digital (package) based communication that supports e.g. increased remote control and information handling.



### ~2100 Secondary Sub-stations

To be equipped with either metering, controls or automation capabilities in order to reduce SAIDI. There will be three levels of investment based on individual stations, Monitoring, Remote Control and Automation.

#### **Primary Sub-stations**

Current stations to be equipped with more sensors and new one will be built with "Central Protection Control" to enable fault location remotely, analytics, machine learning and predictive maintenance.





AMM2G Replacing all smart-meters with new functionality and back-end will allow for customer interaction as well as enable greater analytical capability of grid-performance on a customer level. Critical for system design and growth of solar / charging infrastructure.



Monitoring

**Remote Control** 

Monitoring

Remote Control

## Vision 2030 creates improved cross functional operational efficiency

- To provide strategic direction to the program, a set of focus areas have been defined with clear objectives and implementation targets, allowing the program to build a strong foundation within these pillars which also provide clear implementation responsibilities within the respective project in the program
- These focus areas impact all our core processes and will require an enhanced cross-functional end-to-end process mind set in combination with new organizational abilities



# Vision 2030 – Stockholm -transition towards a Distribution System Operator (DSO)

		Value and maturity		
<ul> <li>Staffing and establishment of program management structures</li> <li>Business and IT Transition plan</li> <li>Governing documents and technical guidelines approved</li> </ul>	<ul> <li>Implementation and consolidation of IT/OT architecture including needed integrations</li> <li>Developed processes for rollout, OT management and metering data management</li> <li>Extended usage and collection of existing information for analysis purposes</li> <li>First steps in rollout completed</li> </ul>	<ul> <li>Contractual agreements, processes, systems and organization prepared for large-scale rollout including OT management and metering data management</li> <li>Rampaged rollout with higher degree of parallelism</li> <li>Manual remote control and management of grid data</li> <li>Improved systems for relay protection</li> </ul>	<ul> <li>Stabilized processes, system support and organization for ramped up rollout, volumes of OT equipment and metering data</li> <li>Planned value creation realization for network analysis, network development, operations analysis and predictive maintenance.</li> <li>Increased degree of operations automation and remote grid control</li> </ul>	<ul> <li>Predictive operations analysis with fact-based forecasts</li> <li>Behavior-based operations and maintenance of the electricity grid</li> <li>Decision support for optimization of maintenance and exchange of faulty components</li> <li>From forecast to proactivity</li> <li>Decision support with built-in automation</li> </ul>
Phase 0: Establishment of organization, architecture and transition plan 1/10 2021 – 31/12 2021	Phase 1: Construction of basic structures. Rollout started 1/1 2022 – 31/12 2022	Phase 2: Organization, processes and systems ready and ramp-up started 1/1 2023 – 31/12 2023	Phase 3: Stabilization with increased analytic capability 1/1 2024 – 31/12 2024	Phase 4: Business performance platform for DSO established 1/1 2025 – 31/12 2026

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# Transferring from a DNO into a DSO



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Sida 20

# DNO to DSO: Where are we today?





Sida 21

A DSO in 2030 is a operator that is proactive and have the possibility to plan, operate and overview the network in every part at all times

To succeed, we will need correct data from our assets in a real time model, systems that support this and well established processes

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# DNO to DSO: Where do we want to be





Sida 23

### DNO to DSO: Market trends

- Clean Energy Package (CEP)
- Disconnecting customers due to insufficient production capacities in Europe
- Batteries, batteries, batteries, ancillary services, flexmarkets etc...
- Large customers without need for backup
- Data model interchange, analytics, big data
- Running network closer to limits, simulation
- Technology from TSO to be used on the medium- and low voltage network

### Vision 2030 – Digital DSO - Vision 2030 Investments layers

	Investment Layers – All these layers are need for vision 2030 of reaching SAIDI, however all at once might not be necessary				
1. Executive Summary			Full-scale rollout of digitization until 2030 includes:		
	Analytics	Statistics	Applications for analytics		
2. Background	(New Business Driver)	Big Data	<ul> <li>ADMS (FLISR), DERMS</li> <li>~100 Primary Substations equipped with more sensors in order to enable predictive maintenance and predictive</li> </ul>		
3. Investment	Systems & Applications	<ul> <li>Network information system</li> <li>SCADA</li> <li>Data management</li> <li>Integration Platforms</li> <li>Al &amp; Automation</li> </ul>	• 12-24 Primary Substations equipped with CPC (central protection control)		
strategy development			• 250 Primary Substations equipped with old RTUs need to		
4. Grid of the Future	Network & Communication	<ul> <li>Communication technologies</li> <li>Network infrastructure</li> <li>Protocols and standards</li> <li>Security</li> </ul>	<ul> <li>New communication infrastructure redesigned as well as setting up communication infrastructure 24/7 operations. New communication solution to all primary substations (~550)</li> </ul>		
5. Vision 2030	Assets & Components	<ul> <li>Redundancy</li> <li>Cable vs OH lines</li> <li>Metering</li> <li>Control equipment</li> </ul>	<ul> <li>~ 8000 Secondary substation equipped with metering, steering and automation. One third of thes equipped with primary equipment such as breakers etc.</li> <li>~ 25 000 charging spot for EVs</li> </ul>		

Smart meters AMM2G

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# Vision 2030 – Stockholm -transition towards a Distribution System Operator (DSO)

		Value and maturity		
<ul> <li>Staffing and establishment of program management structures</li> <li>Business and IT Transition plan</li> <li>Governing documents and technical guidelines approved</li> </ul>	<ul> <li>43 pcs Secondary substation</li> <li>4 pcs Primary substation</li> <li>Analytics plattform</li> <li>FLISR</li> <li>Flexmarket</li> </ul> • Implementation and consolidation of IT/OT architecture including needed integrations <ul> <li>Developed processes for rollout, OT management and metering data management</li> <li>Extended usage and collection of existing information for analysis purposes</li> <li>First steps in rollout completed</li> </ul>	<ul> <li>Note that the second second</li></ul>	<ul> <li>Stabilized processes, system support and organization for ramped up rollout, volumes of OT equipment and metering data</li> <li>Planned value creation realization for network analysis, network development, operations analysis and predictive maintenance.</li> <li>Increased degree of operations automation and remote grid control</li> </ul>	<ul> <li>Predictive operations analysis with fact-based forecasts</li> <li>Behavior-based operations and maintenance of the electricity grid</li> <li>Decision support for optimization of maintenance and exchange of faulty components</li> <li>From forecast to proactivity</li> <li>Decision support with built-in automation</li> </ul>
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### Q&A

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