26.11. klo
13.00-14.55

Webinaari Kantaverkkopalvelun reaaliaikatiedonvaihdosta ja käytöstä vastaavan toimijan ohjauksista

26.11. klo 13.00-14.55

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Ohjelma

13:00 Avaus, Laura Ihamäki

13:05 Miksi ohjattavuus ja näkyvyys ovat tärkeitä muuttuvassa sähköjärjestelmässä kantaverkkokeskuksen silmin, Arto Pahkin

26.11.2025

13:15 Yhteenveto kaikkia laitoksia koskevista Kantaverkkopalveluehtojen ohjattavuuden ja tiedonvaihdon vaatimuksista sekä tulossa olevat muutokset Fingridin Reaaliaikaisen tiedonvaihdon sovellusohjeeseen, Joona Mörsky

13:45 Mitä VJV2024 ja SJV2024 edellyttävät uusilta laitoksilta, Joona Mörsky

14:00 Miten VJV ja SJV2024-laitosten tiedonvaihto otetaan käyttöön, Juha Korpio

14:10 Loissähkön sovellusohjeen muutokset, Onni Härmä

14:15 Käytöstä vastaavien toimijoiden puheenvuorot (á 5 min)

Caverion, Enerva, Rejlers, Smart Energia palvelut

14:35 Aikaa kysymyksille

14:55 Päätös

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Why are Controllability and Visibility Important in a Changing Power System – From the Perspective of the Transmission System Control Center

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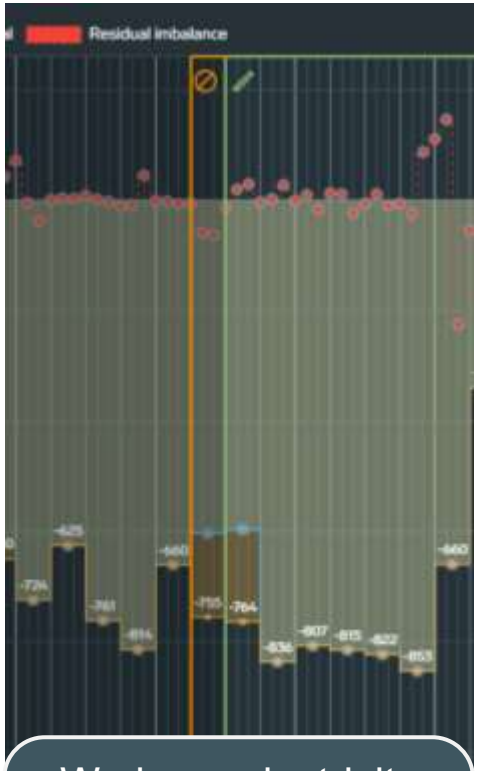
Main Tasks of the Transmission System Control Center

For the power system, the system responsibility lies with Fingrid, which acts as the transmission system operator. Fingrid is responsible for the technical functionality, balance, and disturbance management of the electricity transmission system in accordance with the Electricity Market Act (588/2013)..

We monitor and control the transmission grid 24/7



We keep electricity consumption and production in balance.

We implement transmission outages and anticipate operational situations

We prepare for and resolve disturbances quickly.

We monitor critical ICT systems and communication connections.

Power system in transition

Renewable production

Wind and solar power introduce new situations where real-time visibility becomes increasingly important.

- **Especially during transmission outages and disturbances, two-way information exchange and real-time visibility from connected parties are needed (for example, “wind power output management,” “voltage control settings,” etc.).**
- **Situations develop rapidly, and traditional phone communication is too slow.**
- **The amount of production has increased sharply in recent years; in order to model and verify the behaviour of these resources, real-time data is required.**

Methods for managing rapidly increasing changes in customer load

The change has been rapid, and in certain areas, transmission bottlenecks may occur.

- **In cases of thermal overload, a network protection scheme can be built where the customer reduces or disconnects load quickly upon receiving a signal.**
- **If voltage stability is at risk, the customer is required to maintain a predetermined power limit at the connection point.**
- **Consumption is expected to grow in the coming years; in order to model and verify this behaviour, real-time data is required.**

Forecasts provide reaction time for system management.

Forecast errors are inevitable.

Market participants’ forecast errors can lead to significant balance deviations and market distortions.

In 2024, the largest balance deviations were in the thousands of MW.

Situations caused by forecast errors arise suddenly, and the exact duration is unknown; the maximum duration can be several hours.

Due to changed market and operational conditions, there is a recognized need to create a process for preventing and communicating significant balance errors alongside the electricity shortage process.

More accurate and actively updated forecast data from parties is needed.

26/11/2025

Requirements for real-time signal exchange

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Background

Implementation details of signal exchange

- REAL-TIME INFORMATION EXCHANGE is part of TERMS AND CONDITIONS OF THE MAIN GRID SERVICE KVPE2025
  - Each network, powerplant, consumption or energy storage connected to Fingrid network needs to maintain requirements set by KVPE2025
    - DSO connected powerplant, consumption or energy storage systems: DSO may handle some of the requirements or move the implementation responsibility to them their customers

Grid code specifications are part of KVPE terms but based on European legislation RFG, HVDC and DCC and latest only apply to changes done to assets and new assets

- VJV for Powerplants
- SJV for Energy storage systems
- KVJ for Consumption set
- HVDC for HVDC links

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Sort list of terms used in this presentation

- RO, Relevant operator (= Käytöstä vastaava toimija)
- DSO, Distribution system operator (= Jakeluverkko)
- IBR, Inverter based resources (= Suuntaaja kytketty, esim tuulivoimala, aurinkovoimala, sähkövarasto)
- VJV = Grid code specifications for power generating facilities
- SJV = Grid code specifications for grid energy storage systems
- KJV = Grid code specifications for demand connections
- NC-ER = European Network code for Emergency and Restoration

Types of powerplants and energy storage systems

Table 3.1. The power-generating facility's type classification based on rated capacity and the connection point's voltage level.

Type category	Connection point's voltage level	Term /condition	Power-generating facility's rated capacity P_{max}
Type A	The connection point's voltage level is less than 110 kV[1]	and (*)	The power-generating facility's rated capacity is at least 0.8 kW but less than 1 MW. (0.8 kW ≤ P_{max} <1 MW)
Type B	The connection point's voltage level is less than 110 kV[1]	and (*)	The power-generating facility's rated capacity is at least 1 MW but less than 10 MW. (1 MW ≤ P_{max} < 10 MW)
Type C	The connection point's voltage level is less than 110 kV	and (*)	The power-generating facility's rated capacity is at least 10 MW but less than 30 MW. (10 MW ≤ P_{max} < 30 MW)
Type D	The connection point's voltage level is at least 110 kV	or (+)	The power-generating facility's rated capacity is at least 30 MW (P_{max} ≥ 30 MW)

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Relevant operator (RO, KVT in Finnish)

The entity appointed by and representing the power-generating facility owner. The RO is responsible for the operation of the power generating facility in the electricity network. At all times, the RO must know the operating state of the power-generating facility and have the right and possibility to control the power-generating facility and change its operating point and control mode and authorize or limit any controls issued outside the power-generating facility.

In Finnish, KVT stands for: Käytöstä Vastaava Toimija

Reference: VJV2024: 2.Terms and definitions

Image: Google Gemini 2.5 Flash

Relevant Operator (KVT in Finnish)

- 24/7/365 contact for Fingrid for powerplant or energy storage system
  - Any control needs are requested from relevant operator
    - DSO connected systems, if RO information is not available, contact will be done to DSO control room
    - Remember to maintain contact information to Fingrid
  - Have knowledge of state of powerplant or energy storage system
  - Disturbance records will be requested from relevant operator
    - Will fetch the recordings from the plant systems or forwards the request
  - VJV/SJV2024
    - Can take over external controls, Example market operations

Relevant operator (RO, KVT in Finnish)

Grid code	Type B OR 1… 9.99 MW	Type C & D OR over 10.0 MW or Direct Fingrid Connection
VJV2013	DSO set rules	YES
VJV2018 or SJV2019	DSO set rules	YES
VJV2024 or SJV2024	YES	YES

Image: Google Gemini 2.5 Flash

Controls for powerplants (Inverter based resources)

Grid code	Nominal power (type of plant)	Stopping and starting + Disconnection from grid	Active power control + Fast Power limit (for converters)	U-mode Setpoints up + down	Q-mode Cosp-mode + setpoints up + down, inductive + capacitive	VJV2024 Table 10.1 and 10.2 controls
VJV2013 or older	1.00 MW … 9.99 MW	DSO will set the rules				
VJV2013 or older	Over 10MW	X	Active power control	X	X	
VJV2018	Type B	DSO will set the rules				
VJV2018	Type C & D	X	X	X	X	
VJV2024	Type B	DSO will set the rules				
VJV2024	Type C & D	X	X	X	X	X

References: VJV2024, VJV2018, VJV2013, KVPE2025

Image: Google Gemini 2.5 Flash

Controls for energy storage systems

Grid code	Nominal power (type of plant)	Stopping and starting + Disconnection from grid	Active power control and limiting	U-mode Setpoints up + down	Q-mode Cosp-mode + setpoints up + down, inductive + capacitive	SJV2024 Table 10.1 and 10.2 controls
SJV2019	Type B	DSO will set the rules				
SJV2019	Type C & D	X	X	X	X	
SJV2024	Type B	DSO will set the rules				
SJV2024	Type C & D	X	X	X	X	X

References: SJV2024, SJV2019, KVPE2025

Image: Google Gemini 2.5 Flash

Realtime signal exchange powerplants, Inverter based resources

Generation type	Grid code	Nominal power (type of plant)	Active power + Reactive power + Breaker + Over 10MVAr capasitor bank breaker	U-mode Q-mode Voltage*	Request Fingrid -> KVT (Plim,U,Q) signals **	VJV2024 Table 10.1 and 10.2 signals ***
Converter	Before VJV2018	1.00 MW … 9.99 MW	X			
Converter	Before VJV2018	Over 10MW	X	X	X	
Converter	VJV2018	Type B	X			
Converter	VJV2018	Type C & D	X	X	X	
Converter	VJV2024	Type B	X			
Converter	VJV2024	Type C & D	X	X	X	X

*) Signals indicate (power plant→ Fingrid)
- System at constant reactive power mode
- System at constant voltage control mode
- Voltage used for constant voltage control reference

**) Signals over the ICCP or ELCOM to indicate (Fingrid → RO)
- Request for active power limit
- Request for constant voltage control mode
- Request for constant reactive power mode

***See interface description from document ”VJV2024 and SJV2024 relevant operator real-time signal exchange”

References: VJV2024, VJV2018, KVPE2025, real-time signal exchange 2026

NOTE!
table doesn’t include reserve market signals as they are market specific.

Realtime signal exchange powerplants, synchronous machine

Generation type	Grid code	Nominal power (type of plant)	Active power + Reactive power + Breaker	U-mode Q-mode Voltage*	Request Fingrid -> KVT (Plim,U,Q) signals **	VJV2024 Table 10.1 and 10.2 signals ***
Synchronous machine	Before VJV2018	Over 1 MW	X			
Synchronous machine	VJV2018	Type B, C and D	X			
Synchronous machine	VJV2024	Type B	X			
Synchronous machine	VJV2024	Type C & D	X	X	X	X

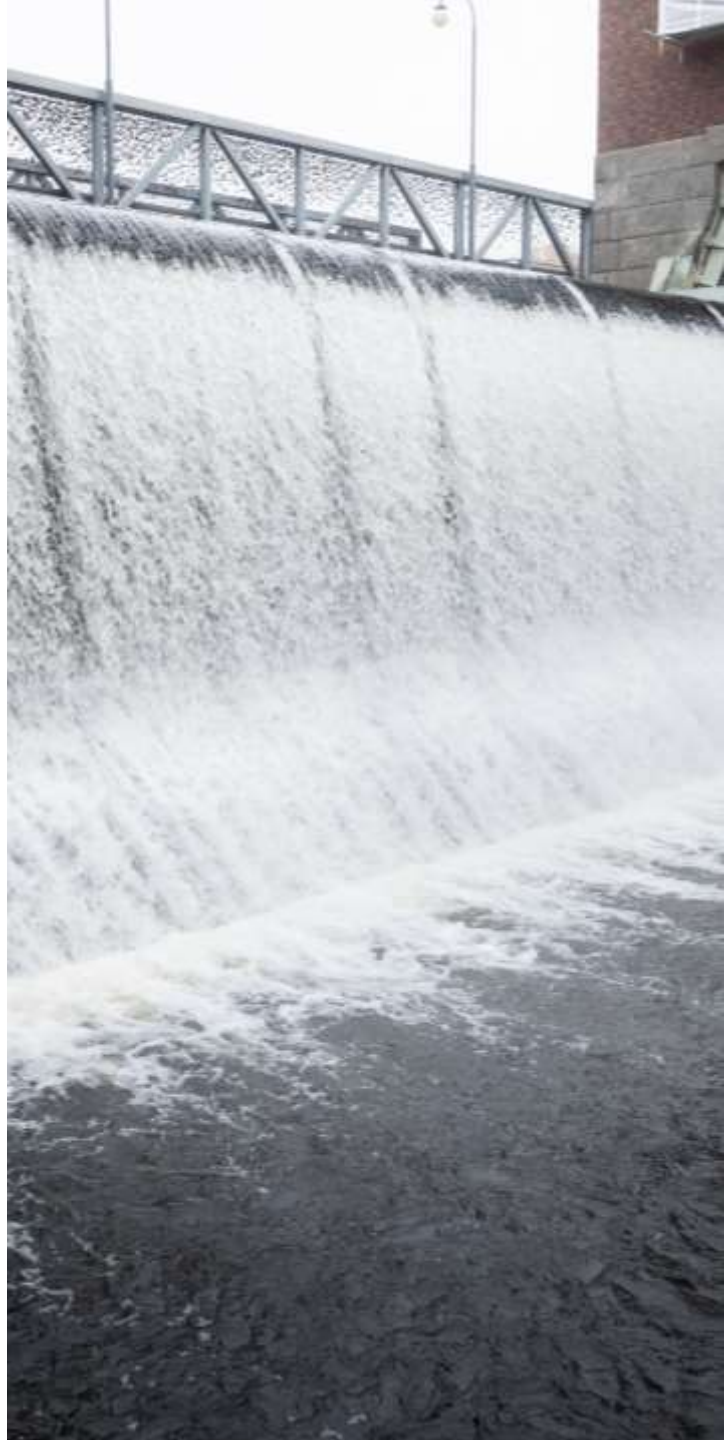
*) Signals indicate (power plant → Fingrid)
- System at constant reactive power mode
- System at constant voltage control mode
- Voltage used for constant voltage control reference

**) Signals over the ICCP or ELCOM to indicate (Fingrid → RO)
- Request for active power limit
- Request for constant voltage control mode
- Request for constant reactive power mode

***See interface description from document ”VJV2024 and SJV2024 relevant operator real-time signal exchange”

References: VJV2024, VJV2018, VJV2013, VJV2007, KVPE2025, real-time signal exchange 2026

NOTE!
table doesn’t include reserve market signals as they are market specific



Realtime signal exchange energy storage systems

Grid code	Nominal power (type of plant)	Active power + Reactive power + Breaker	U-mode* Q-mode Voltage*	Request Fingrid -> KVT (Plim,U, Q) signals**	SJV2024 Table 10.1 and 10.2 signals ***
SJV2019	Type B	X			
SJV2019	Type C & D	X	X	X	
SJV2024	Type B	X			
SJV2024	Type C & D	X	X	X	X

*) Signals indicate (Energy storage system → Fingrid)
- System at constant reactive power mode
- System at constant voltage control mode
- Voltage used for constant voltage control reference

**) Signals over the ICCP or ELCOM to indicate (Fingrid → RO)
- Request for active power limit
- Request for constant voltage control mode
- Request for constant reactive power mode

***See interface description from document ”VJV2024 and SJV2024 relevant operator real-time signal exchange”

References: SJV2024, SJV2019, KVPE2025, real-time signal exchange 2026

NOTE!
table don’t include reserve market signals. They are market specific

Image: Google Gemini 2.5 Flash

Realtime signal exchange, consumption

Grid code	Nominal power (type of plant)	Active power	Reactive power*	Switchgear status	Compensation equipment status*
Datacenter*, Electric boiler, Heatpump	Over 1 MW	X	X		Over 10MVAr or 110kV
Datacenter*, Electric boiler, Heatpump	Over 10 MW	X	X	Aggreed separetly	Over 10MVAr or 110kV
Industrial consumption, charging statation	Under 10 MW	X	X	Aggreed separetly	Over 10MVAr or 110kV
Industrial consumption, charging statation*	Over 10 MW	X	X	Aggreed separetly	Over 10MVAr or 110kV

*) New additions to real-time signal exchange 2026
Compared to real-time signal exchange 2024

References: KVPE2025,
real-time signal exchange 2026

NOTE!
table don't include reserve market signals. They are market specific

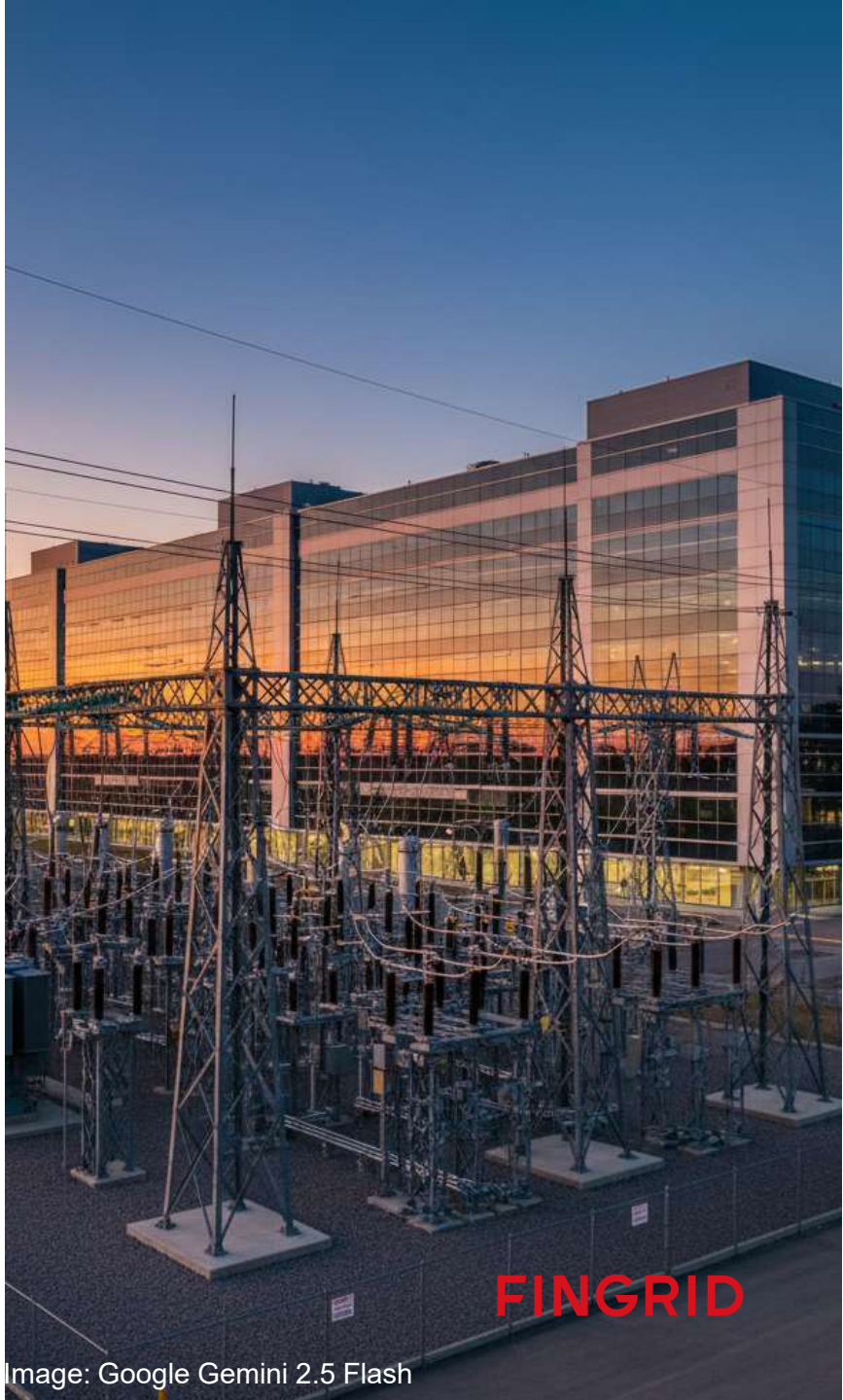


Image: Google Gemini 2.5 Flash

Realtime signal exchange, distribution networks

- Relevant switchgear status and measurements (mainly 110kV)
  - Ask details from reaaliaikatiedonvaihto@fingrid.fi
- Status and control mode of 110kV or over 10MVAr reactive power compensation equipment

Data connections and protocols

Grid code	RTLITE (REST API over internet)	Requirement for 24h operation capability during outages	FEN-network	KOVA FEN
Under 1MW powerplant, energy storage system that participates on market	YES, if connected to DSO network	YES, If connected directly to Fingrid network, Not required from DSO connected assets	YES IEC104 or ICCP	YES IEC104 or ICCP
1MW…9,99MW powerplant, energy storage system	YES, if connected to DSO network	YES, If connected directly to Fingrid network, Not required from DSO connected assets	YES IEC104 or ICCP	YES IEC104 or ICCP
10MW…30MW powerplant, energy storage system	No	No	YES ICCP	YES ICCP
Over 30MW powerplant, energy storage system or consumption unit or any other with direct Fingrid connection	No	YES	No	YES ICCP

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Fault recordings

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Reporting responsibility

- Powerplant or energy storage system owner have a responsibility to report events when system does not fulfil grid code specifications
  - VJV2013 Chapter 5.1.1
  - VJV2018, VJV2024 Chapter 6.1.1
  - SJV2019, SJV2024 Chapter 6.1.1
- Fault and swing recorders should be time synced with 200ms accuracy
- **Example of events to report (C&D type or over 10MW system):**
  - Power plant or energy storage system trips due to grid disturbance
  - Islanding event occurred
  - Fault in reactive or active power control
  - Unstable behaviour
  - Power plant or energy storage system have limited reactive power capacity, for example, broken cap bank
- **Example of events to report (B type or system with 1.0 … 9.99 MW system):**
  - DSO set the rules and reporting routes in general
  - Report to Fingrid voimalaitostiedot@fingrid.fi withing 1 week of event in following conditions:
    - Unstable behaviour
    - Power plant or energy storage system trips due to grid disturbance against fault ride thru requirements

Delivering fault recordings to Fingrid

- Include the email report
  - Power plant or energy storage system name and substation name
  - Sort description of event
  - Fault recording of event, max +/-2min from event
    - Sampling requirements set by VJV/SJV, it not stated, deliverer best data available
    - Preferred formats: COMTRADE, CSV
  - List of events from SCADA or from protection relays
    - CSV, EXCEL,TXT, max +/-2min from event
  - Setpoints before events
    - Active power setpoint
    - Reactive power controller mode and setpoints
      - Constant voltage control (U-mode)
      - Constant reactive power (Q-mode)
      - Constant power factor mode (cosp-mode)

Reports should be sent Fingrid to email address voimalaitostiedot@fingrid.fi withing 1 week of the event

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26/11/2025

VJV2024 and SJV2024 new signal requirements

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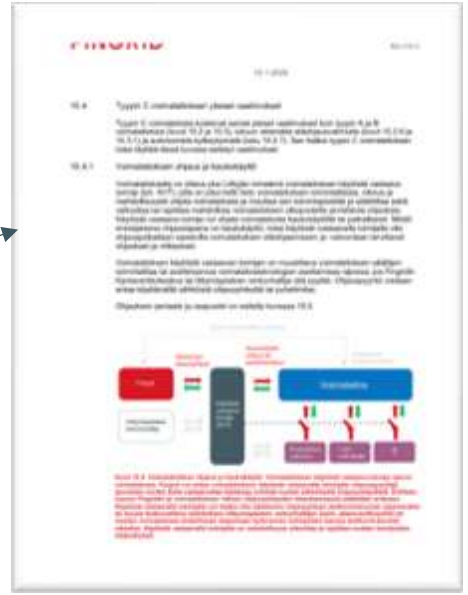
Background

- ONLY APPLY POWERPLANTS AND BESS BUILD WITH SJV2024 or VJV2024
- VJV2024 and SJV2024 chapter 10.4.1 and tables 10.1 and 10.2 set new signal and control requirements for powerplants and energy storage systems of type C&D
- Implementation details of signals between RO and Fingrid can be found from document "VJV2024 ja SJV2024 mukainen käytöstä vastaavan toimijan reaaliaikainen tiedonvaihto"
  - Note that signals between RO and powerplant / energy storage system are part of project design
- Signals doesn't move operation responsibility of powerplant or energy storage system from Relevant operator to Fingrid
- Signals are only used in emergencies



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Signal flows and relevant manuals (C&D type)

Direct connection is not typically used

Powerplant or energy storage system internal design

Direct control connection (reservation)

Electronic control connection

Remote control or local control

(interface port for direct control)

Fingrid

Relevant operator (RO)

Power-generating facility or Energy storage facility

DSO / Relevant network operator

Commercial operator

Equipment manufacturer

CONTROL TAKE OVER
CAN BE LOCATED ALSO IN RELEVANT OPERATOR SYSTEMS

Always remember check DSO requirements if asset is connected to DSO network

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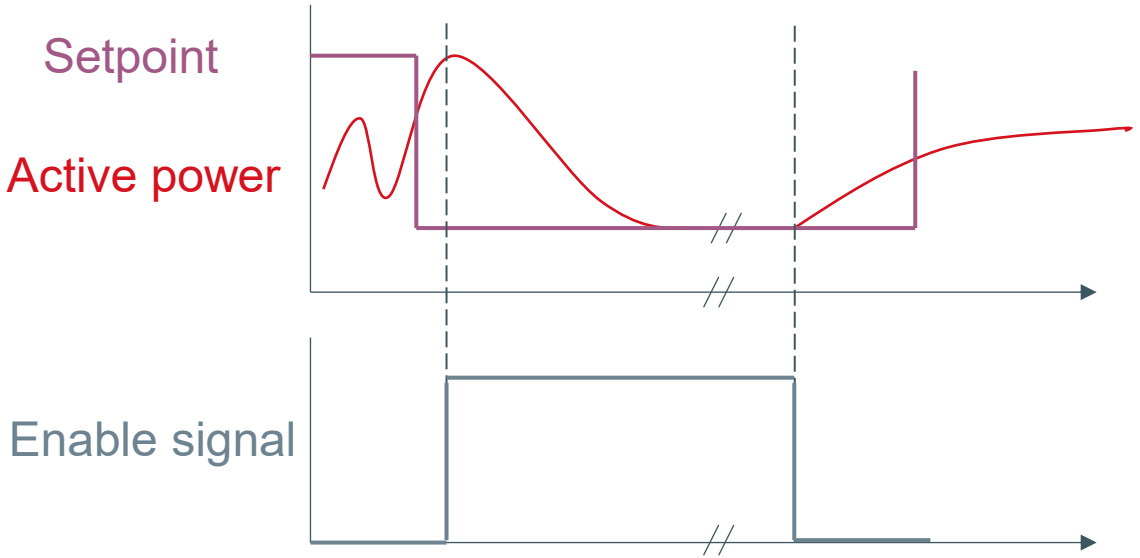
VJV/SJV2024 requires ramps to be used in controls

- SJV2024 and VJV2024 have ramp rates defined
- Important to note that these ramps need to be implemented some point of signal chain, Powerplant controller / SCADA or in RO SCADA systems



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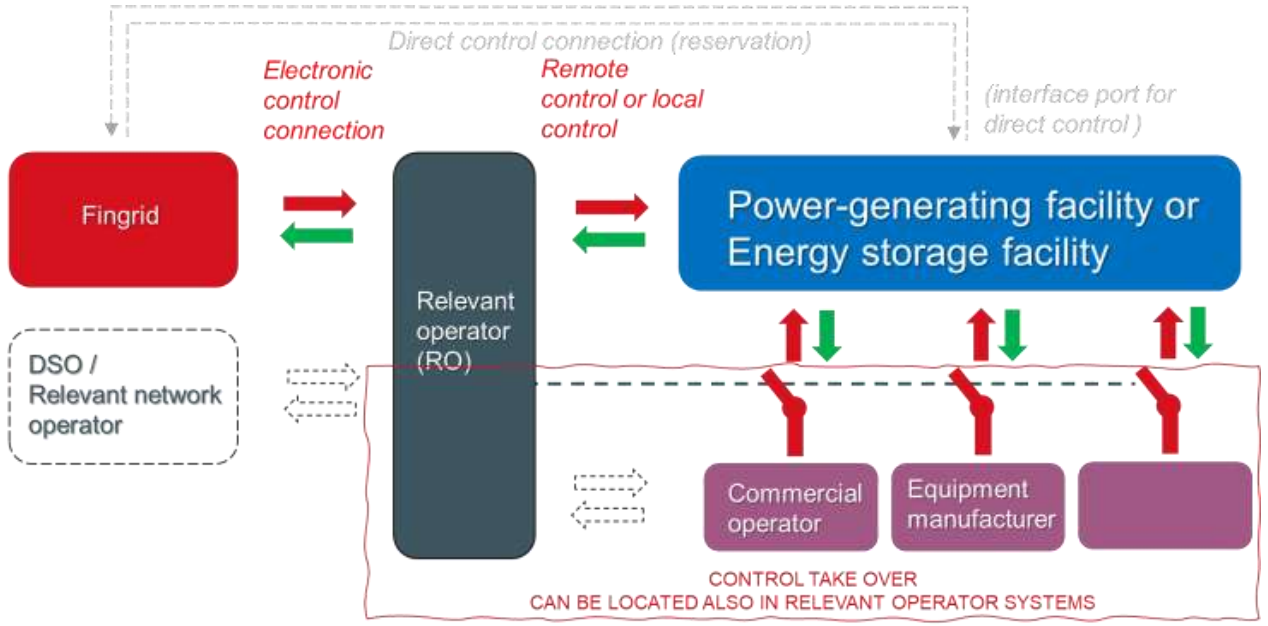
VJV2024 and SJV2024 RO control take over

- **Example 1:** A facility designated as a significant network user loses normal communication connections due to a disturbance in the distribution network or the telecommunications network. Before the disturbance, the facility had been shut down due to market-based controls. The Relevant operator (KVT) is able to take control of the facility using connections with 24-hour operational capability (NC-ER) and restore the facility to production according to the original production plan.

- **Example 2:** A disturbance occurs in the facility's market control system, and the facility begins to behave unstably. The Relevant Operator (KVT) is able to prevent automatic market control during the fault investigation.

- **Example 3:** A fault occurs in the electrical network supplying the facility, and due to backup route used after fault for feeding, the facility must be set to a power limit. Under Relevant operator (KVT) control, it must be possible to restrict market controls or commissioning test runs so that network capacity is not exceeded during backup feed route.



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26.11.2025

VJV/SJV2024 Real-time Signal Commissioning Process

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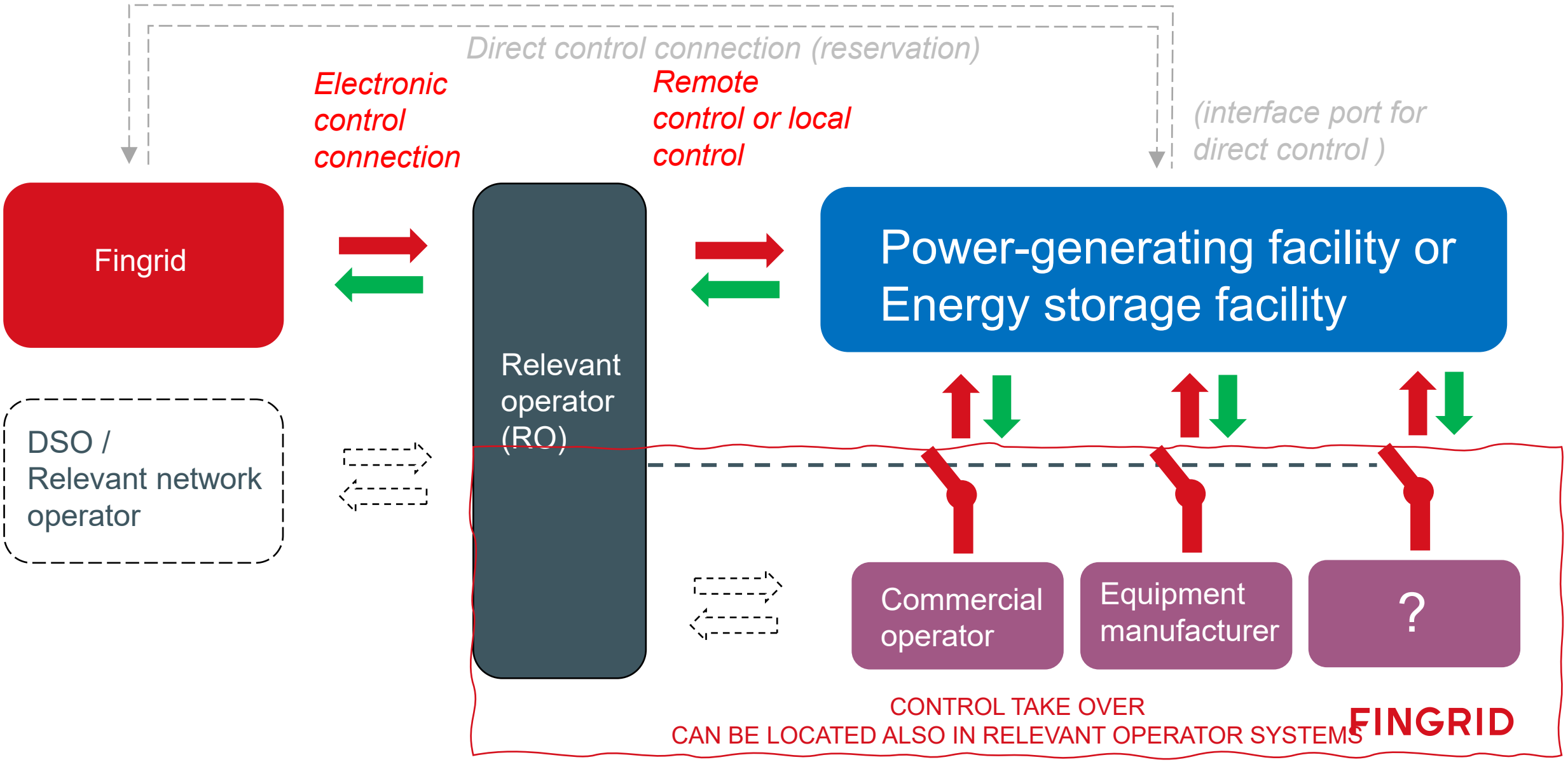
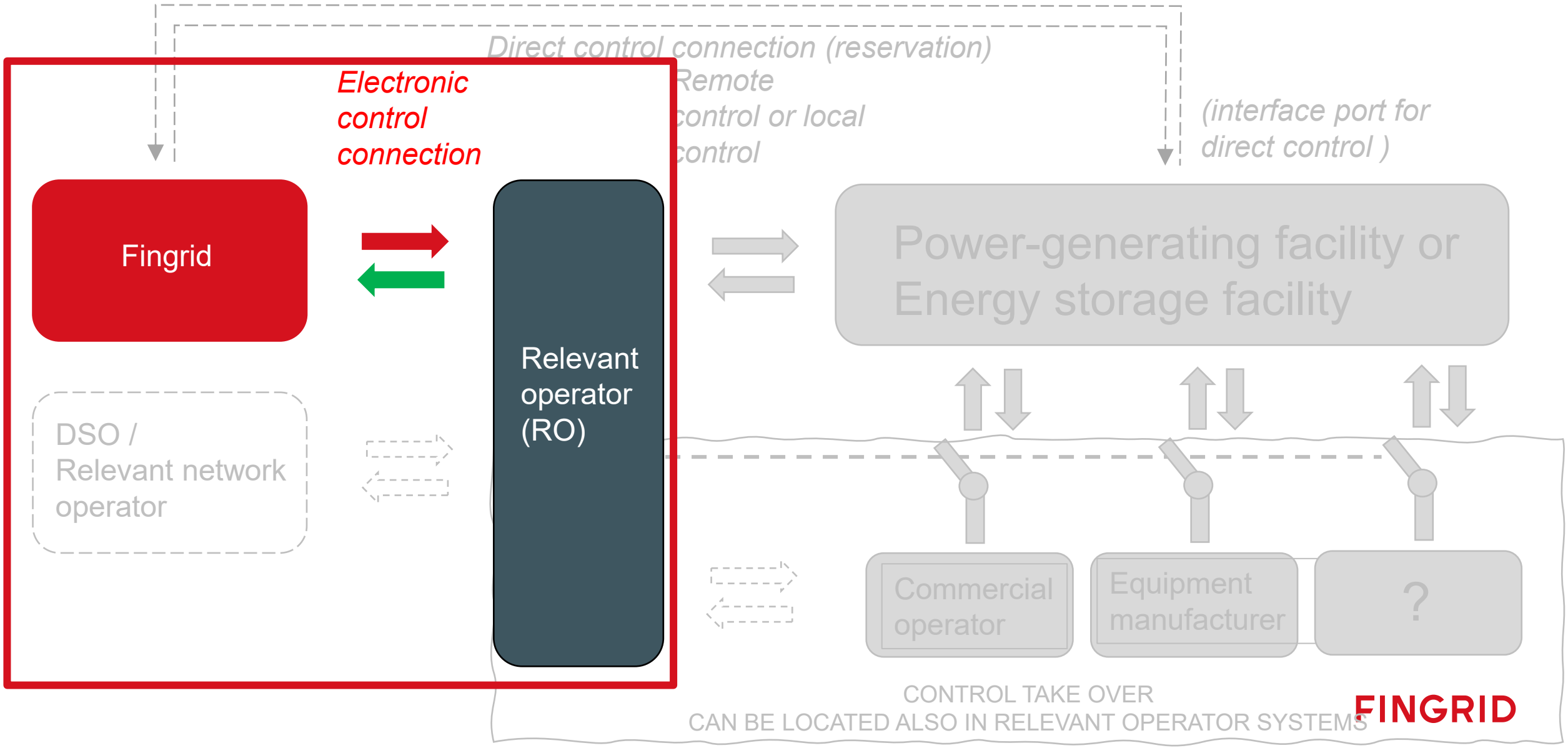
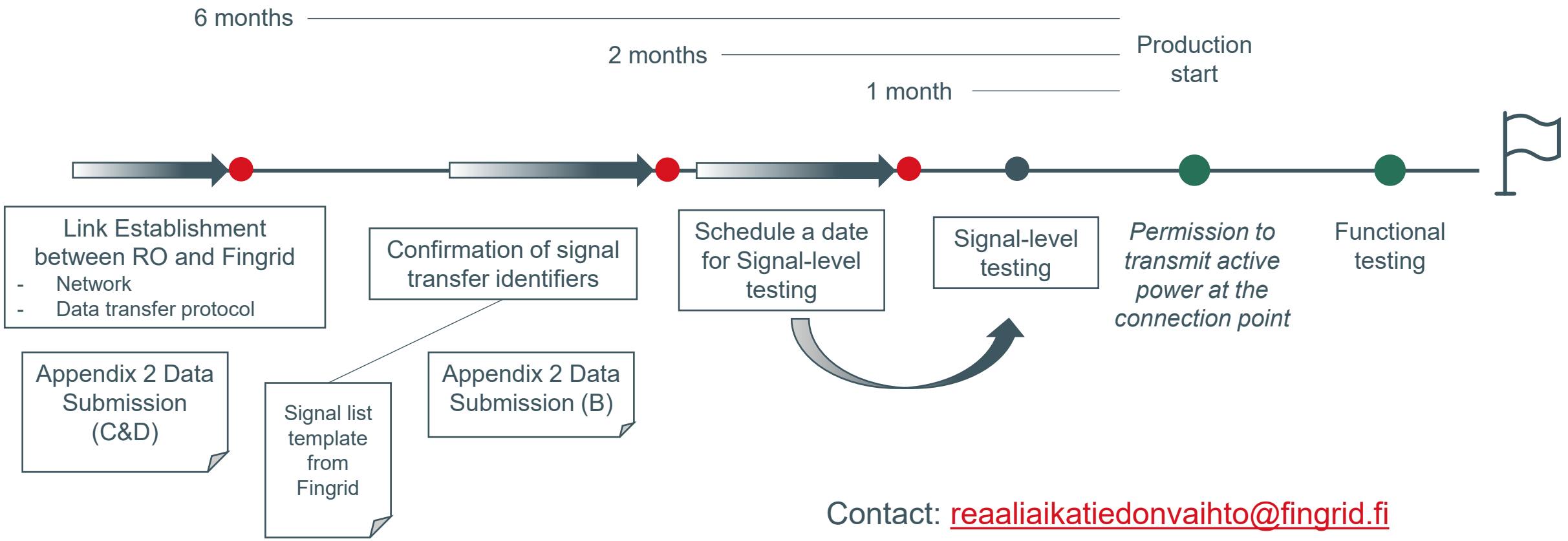
Real-time signal exchange VJV2024 or SJV2024, Type C or D



Real-time signal exchange VJV2024 or SJV2024, Type C or D



Real-time Signal Commissioning Process



Contact: reaaliaikatiedonvaihto@fingrid.fi

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Signal commissioning process for VJV/SJV2024 Type B Plants

1) Link Establishment:

A communication link between the Responsible Operator (RO, KVT) and Fingrid is established in accordance with the real-time data exchange application guideline. Multiple power plants and energy storage units may share the same link based on risk assessments. The RO must contact Fingrid at voimalaitostiedot@fingrid.fi **2 months before signal testing** for the power plant or energy storage unit. The contact must clearly specify all plants connected to the same link.

2) Data Submission:

The connecting party must submit the data table as defined in Appendix 2 to Fingrid at reaaliaikatiedonvaihto@fingrid.fi.

3) Signal Transfer Identifiers:

These are defined and confirmed **2 months before signal testing**.

4) Agreement on Signal Testing:

Must be made **1 month before the start of production**.

5) Signal-Level Testing

Conducted before the start of production.

6) Commissioning Permit, Start of Production Use

Issued for the plant once the above steps are completed.

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Signal commissioning process for VJV/SJV2024 Type C Plants

1) Link Establishment

A communication link between the Responsible Operator (RO, KVT) and Fingrid is established in accordance with the real-time data exchange application guideline. The same link may carry data for multiple power plants and energy storage units based on risk assessments. The RO must contact Fingrid at voimalaitostiedot@fingrid.fi at least **6 months before the planned commissioning date** of the plant or storage unit for risk assessment. The communication must clearly list all units connected via the same link.

2) Data Submission

The connecting party must submit the data specified in Appendix 2 to Fingrid at reaaliaikatiedonvaihto@fingrid.fi at least **6 months before the planned commissioning date**.

3) Signal Transfer Identifiers

Signal transfer identifiers are defined and confirmed **2 months before signal testing**. Signals requiring model verification of the plant or storage unit (e.g., voltage control setting groups) are conditionally set if simulation model testing results are not yet available at the time of signal confirmation.

4) Agreement on Signal Testing

Signal testing must be agreed upon **1 month before the start of production**.

5) Signal-Level Testing

The functionality of the signals is tested. If any changes have occurred in the data, the connecting party must resubmit the Appendix 2 data to reaaliaikatiedonvaihto@fingrid.fi before the signal tests. Testing must be successfully completed before the plant is granted permission to transmit active power.

6) Electrification and Start of Production Use

The plant is electrified and begins production use (permission to transmit active power at the connection point).

7) Functional Testing

Functional testing of the signals must be conducted as soon as possible after the plant or storage unit begins transmitting active power to the grid. This testing ensures that the plant behaves according to the given control points and that feedback values match the operational values.
Testing of active power limitation and reactive power control must be performed once the plant reaches **30% of its rated capacity**, but no later than **3 months after** the start of production.
Remaining functional tests may be conducted during commissioning trials or at another agreed time.

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Signal commissioning process for VJV/SJV2024 Type D Plants

1) Link Establishment

A communication link between the Responsible Operator (RO, KVT) and Fingrid is established in accordance with the real-time data exchange application guide. The same link may carry data for multiple power plants and energy storage units based on risk assessments. The RO must contact Fingrid at voimalaitostiedot@fingrid.fi at least **6 months before the target date for the Interim operational notification (ION)**. The message must clearly list all plants included in the same link.

2) Data Submission

The connecting party must submit the data specified in Appendix 2 to Fingrid at reaaliaikatiedonvaihto@fingrid.fi at least **6 months before the target ION date**.

3) Signal Transfer Identifiers

Signal transfer identifiers are defined and confirmed **2 months before signal testing**. Signals requiring model validation (e.g., voltage control setting groups) are set conditionally if simulation model testing results are not yet available at the time of confirmation.

4) Agreement on Signal Testing

Signal testing must be agreed upon **1 month before the planned test date**.

5) Signal-Level Testing

The connecting party must resubmit the Appendix 2 data to reaaliaikatiedonvaihto@fingrid.fi before signal testing if any changes have occurred. Testing must be successfully completed before the plant can be granted a temporary commissioning license (ION).

6) Interim operational notification (ION) and Start of Production Use

The plant receives the interim operational notification (ION) and begins production use (permission to transfer active power at the connection point).

7) Functional Testing

Functional testing of signals must be performed as soon as possible after the plant or energy storage unit receives the ION. The testing ensures that the plant behaves according to the given control points and that feedback values match operational values. Testing of active power limitation and reactive power control must be performed when the plant reaches **30% of its rated power**, but no later than **3 months after production start**. Remaining functional tests may be conducted during commissioning trials or at another agreed time.

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Loissähkön sovellusohjeen muutokset

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Changes to the guideline: supply of reactive power and maintenance of reactive power reserves

- Sections that are already included in the Terms and conditions for the main grid service will be removed from the guideline where applicable.
- Definitions and concepts will be clarified to align with other terms and conditions.
- For FC power plants, voltage-dependent reactive power limits also apply when drawing electricity from the main grid (cf. energy storage).
- The conditions for reactive power reserves will be clarified regarding when constant voltage control must be active (when connected to the grid).
    - A power plant is considered connected to the grid if the **generator circuit breaker is closed and the plant operates above its minimum output**. This definition also applies to energy storage, except for electrical storage connected to the grid via converters.
    - Electrical storage is considered connected to the grid if the **high-voltage circuit breaker and the circuit breakers of the converter units are closed**.

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26/11/2025

Käytöstä vastaavien toimijoiden puheenvuorot

FINGRID

Caverion
Building Performance

Sustainable Energy Services

Fingrid Webinaari

26.11.2025

Caverion
Building Performance

Assemblin Caverion Group

Together since 2024

Assemblin | Caverion

~21,900
Total employees

EUR 3.8 billion
Combined revenue

10
Countries

Our offering

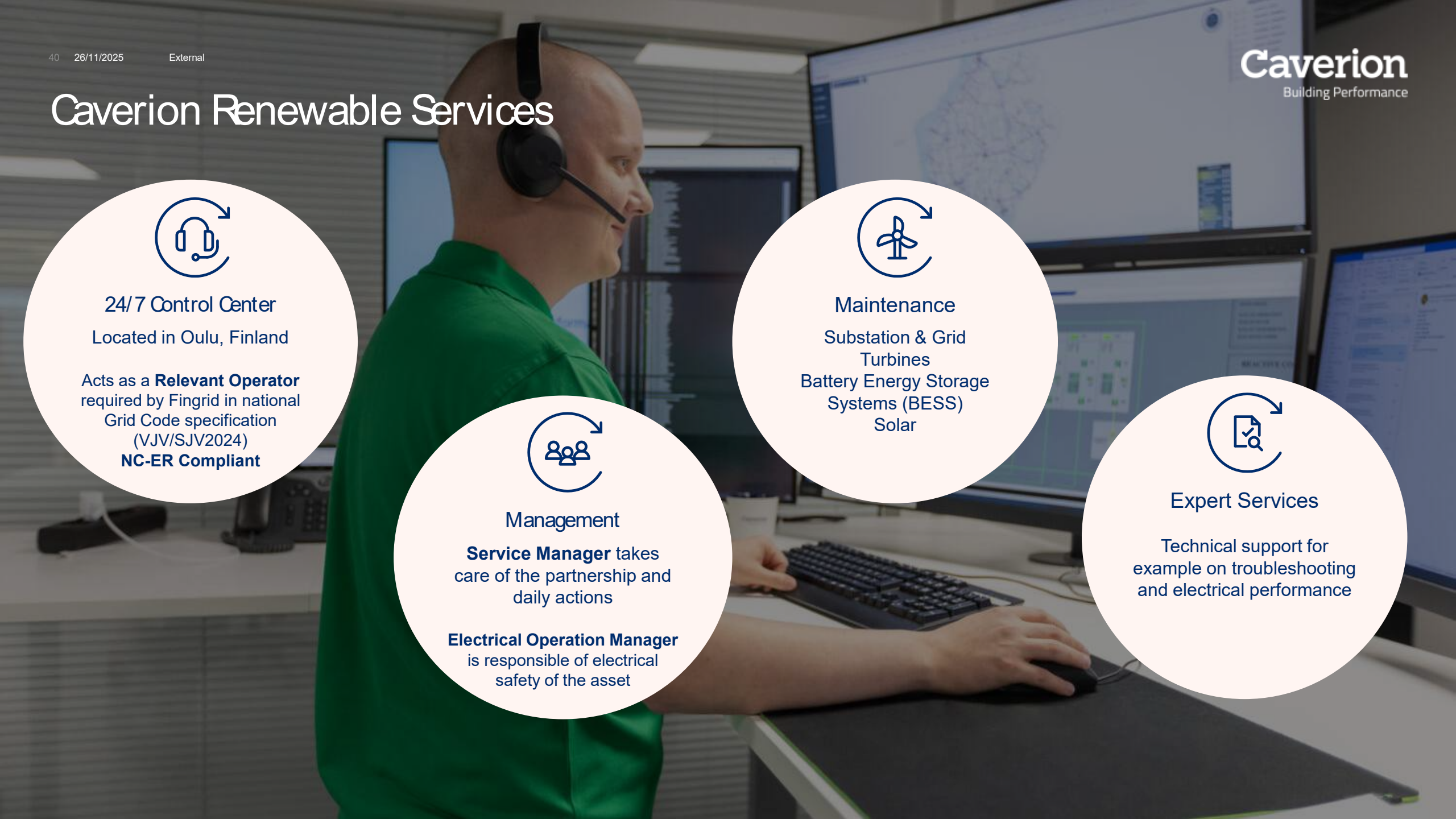
- Installation & Projects
- Service & maintenance
- Manage & Operate
- Advisory & Solutions

We continue to focus on

- Our people and safety
- Excellent customer service
- Technical expertise
- Smart and sustainable solutions for buildings, industry and infrastructure

Caverion
Building Performance

Caverion Renewable Services



24/7 Control Center

Located in Oulu, Finland

Acts as a **Relevant Operator** required by Fingrid in national Grid Code specification (VJV/SJV2024)
NC-ER Compliant

Maintenance

Substation & Grid
Turbines
Battery Energy Storage Systems (BESS)
Solar

Management

Service Manager takes care of the partnership and daily actions

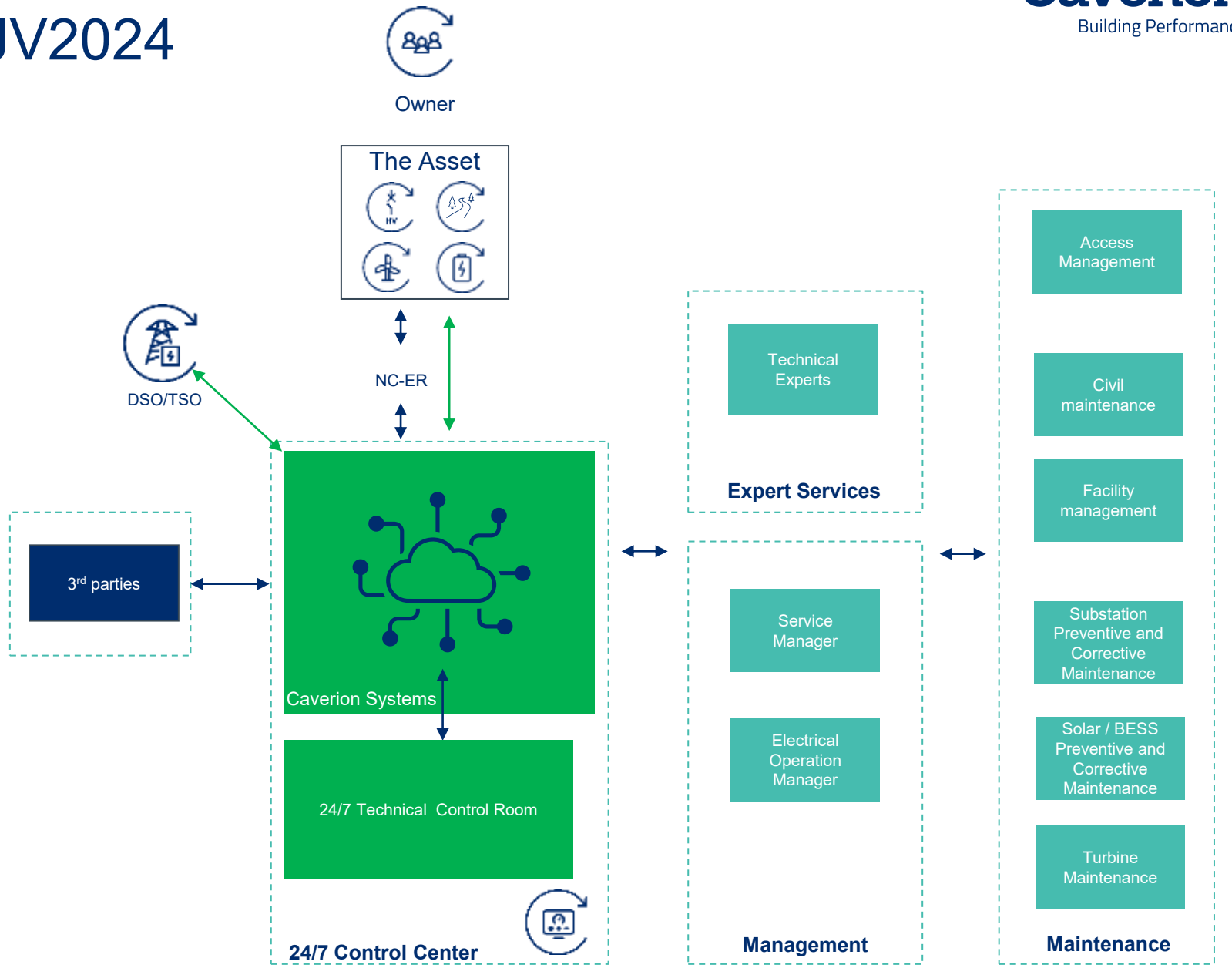
Electrical Operation Manager is responsible of electrical safety of the asset

Expert Services

Technical support for example on troubleshooting and electrical performance

Caverion & new VJV/SJV2024

- Relevant Operator (Käytöstä Vastaava Toimija)
- Operating assets beginning from 1MW onwards
- Connections to TSO and DSOs
- NC-ER compliant, also providing solution for the Asset greater than 30MW
- Disturbance Recorder service
- Enables connections to 3rd Parties, such as Market operators



1. We meet the requirements in the VJV/SJV2024

   Our infrastructure is already built to support new grid code and we will provide communication specs to our Customers accordingly

2. Updated commissioning timeline

   Communication between the systems and the power plant require time and effort. Updated grid code ensures well executed commissioning projects and smooth operational phase

3. Caverion has +3500 MW renewables in operation

   We are able to ensure operation with focus on production and availability enhanced with a technical understanding from grid stability to communication

Thank you!

Kimmo Kaappola, Development Manager
kimmo.kaappola@caverion.com

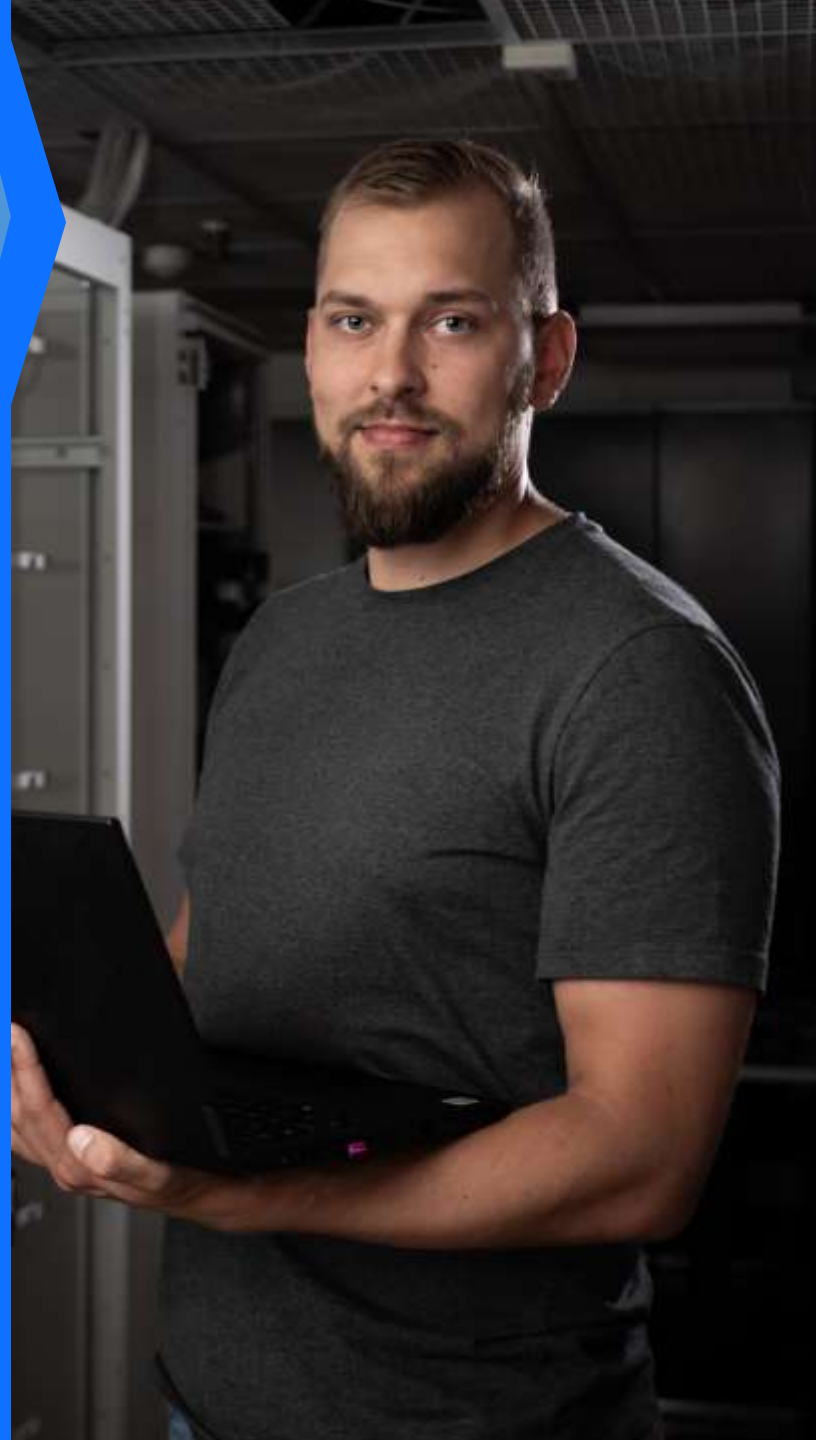
ENERVA

Efficient control and monitoring of infrastructure networks

Henri Heikkinen
Operations Services Manager

26.11.2025

PREAMBLE



Enerva is a new kind of service company

A unique selection of services for the operation of infrastructure networks: a combination of operation, intelligent maintenance, and other expert services

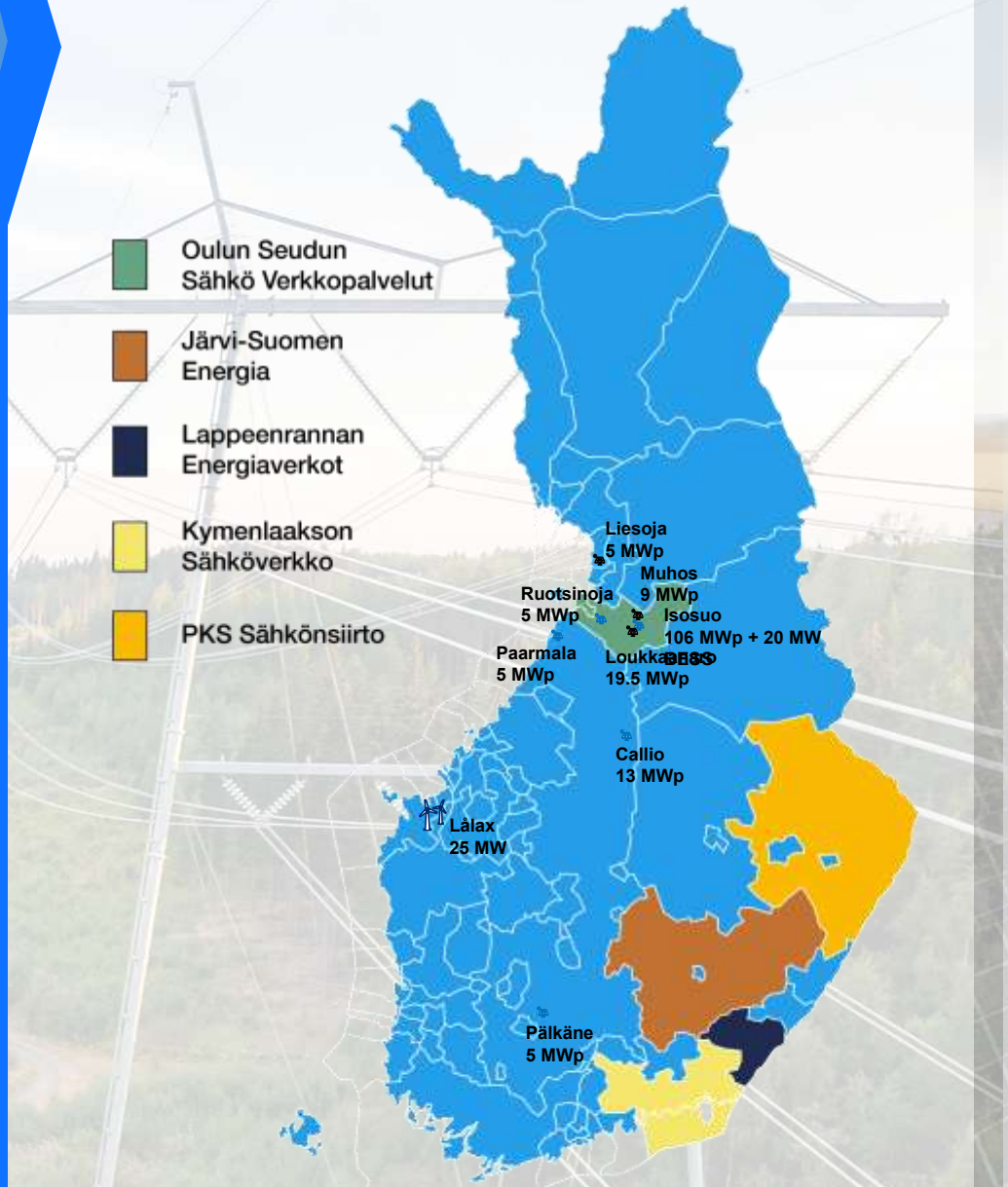
Our slogan: **We handle our customers networks like it's our own.**

Customer collaboration combined with our unique set of services enables many advantages to a single customer through synergy – resulting in excellent and effective operation and monitoring of infrastructure networks.

ENERVA

OUR CUSTOMERS

Assets monitored by Enerva



Only public references shown in the picture.

DSO networks (5)

Wind farms (2)

Solar parks (7 operative, 9 under construction or construction starting soon)

BESS (159 stand alone units operative, 61 under construction)

Demand facilities (1 under construction)

The combined power of the renewable assets under 24/7 monitoring is over 800 MW.

ENERVA

26.11.2025

Key figures of operating services

CONTROL CENTER

Usage points
390 000

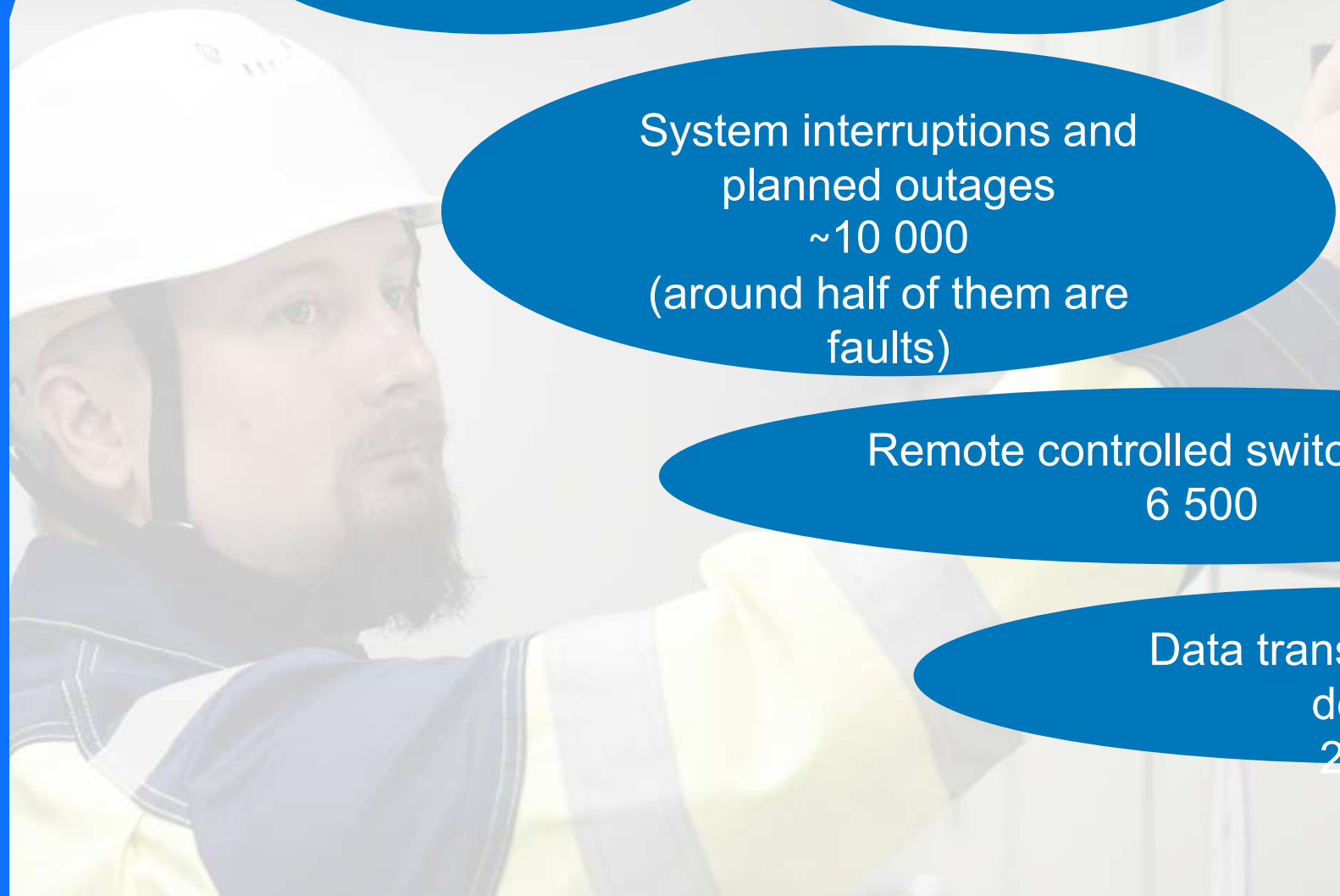
Substations
150

Network length
75 000 km

System interruptions and planned outages
~10 000
(around half of them are faults)

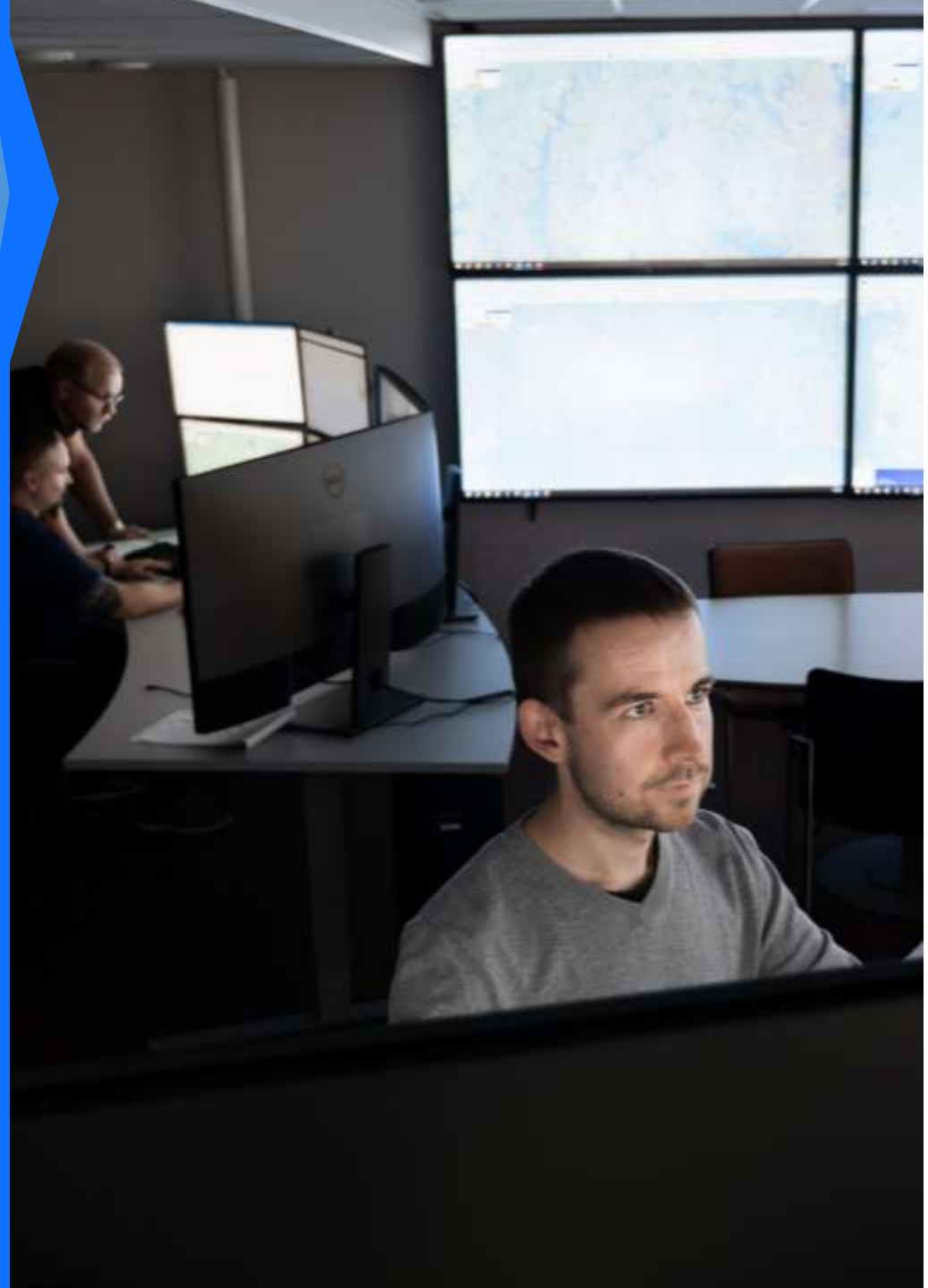
Remote controlled switch devices
6 500

Data transmitting switch devices
20 000



ENERVA

OUR STRENGTHS



Why choose Enerva?

- Control center functioning 24/7/365 and handling different faults and planned outages daily.
- Own highly advanced systems with diverse options of automation and customer notifications, customer owns the data.
- Practically perfected processes with repair personnel enables safe but efficient fault management.
- World class cyber security
  - In accordance with NIS2 and ISO27001
- Critical control center (NC ER) with at least 24h performance in a national black out situation.
  - Geographically four (4) times redundant.
- Our expertise available to our customers beyond control center services: substations, relays, remote control, SCADA etc.

ENERVA

Service options

SERVICES

Core Services

- Highly advanced systems for your network
- Experienced operators 15+
- State of the art cyber security solutions

Control and monitoring center 24/7/365 (NC ER)

Complementary Services

- Electrical operations manager as a service (Required by law)
- 24h fault repairs with a fast response time
- Maintenance

Additional services

- Maintenance planning
- Relay planning
- System solutions
  NC ER as a service
  Camera surveillance ...

ENERVA

26.11.2025

ENERVA

ALWAYS ON

THANK YOU

Who to contact:
Petri Pelli (CEO)
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+358 50 372 4344

26.11.2025

Operation Center Services

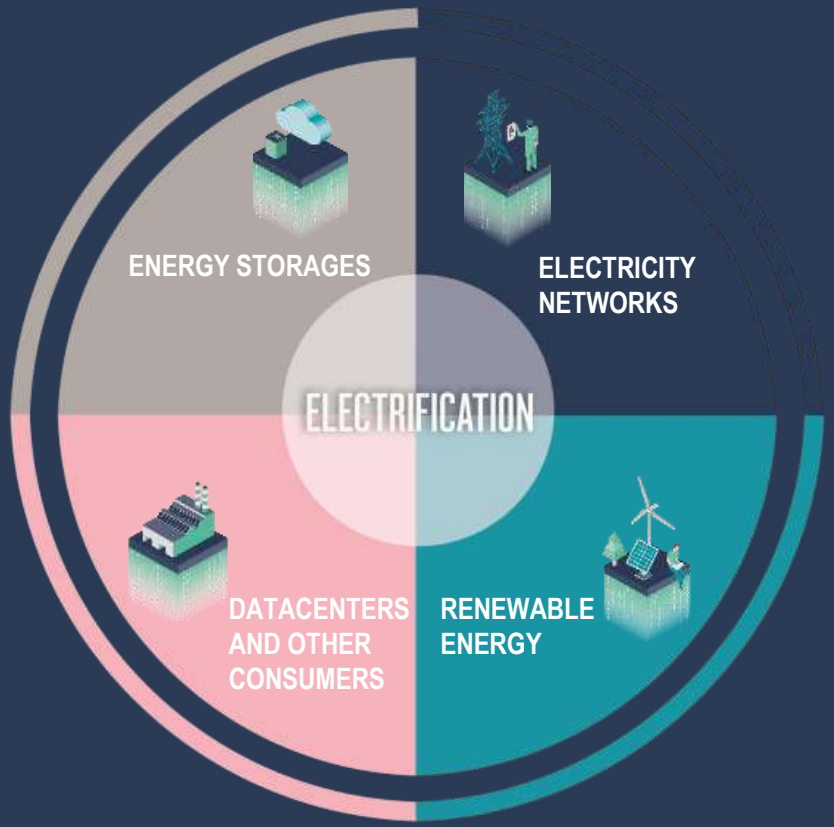
FINGRID WEBINAR 26.11.2025

REJLERS

FINGRID WEBINAR 26.11.2025

24/7 OPERATION CENTER

+ NC ER COMPLIANT OPERATION CENTER – KOVA-FEN CONNECTION AND KOVA-PHONE WITH 24 H POWER SUPPLY.
+ EXTENSIVE AND VERSATILE NETWORK OF RELIABLE PARTNERS – TAILORED SERVICES FOR CUSTOMER'S EXACT NEEDS.
+ AS A LEADING TECHNOLOGY CONSULTANT IN NORDICS, WE HAVE A BROAD IN-HOUSE EXPERTISE AND EXPERT PERSONNEL IN THE ENERGY SECTOR.



OPERATION CENTER SERVICES:

- ✓ 24/7 ASSET OPERATION MANAGEMENT
- ✓ ROLE OF RELEVANT OPERATOR (KVT)
- ✓ REAL-TIME DATA EXCHANGE TO TSO, DSO, 3RD PARTIES
- ✓ ENSURING RESERVE MARKET OPERATIONS (AFRR & MFRR)
- ✓ NC ER RELATED SERVICES
- ✓ ELECTRICAL OPERATIONS MANAGEMENT
- ✓ MAINTENANCE MANAGEMENT
- ✓ GRID COMPLIANCE SUPPORT (VJV, SJV, NC ER)
- ✓ VIDEO SURVEILLANCE (CCTV)
- ✓ SERVICES FOR MGA BALANCE SETTLEMENT, METERING DATA MANAGEMENT AND DATA TRANSFER TO MARKET PARTIES

REJLERS

FINGRID WEBINAR 26.11.2025

24/7 Operation Center

CUSTOMER'S RELIABLE PARTNER IN ASSET OPERATION MANAGEMENT

- Rejlers' Operation Center's main goal is to help our Customers achieve their desired operational targets and profits from investments through quality operation management.

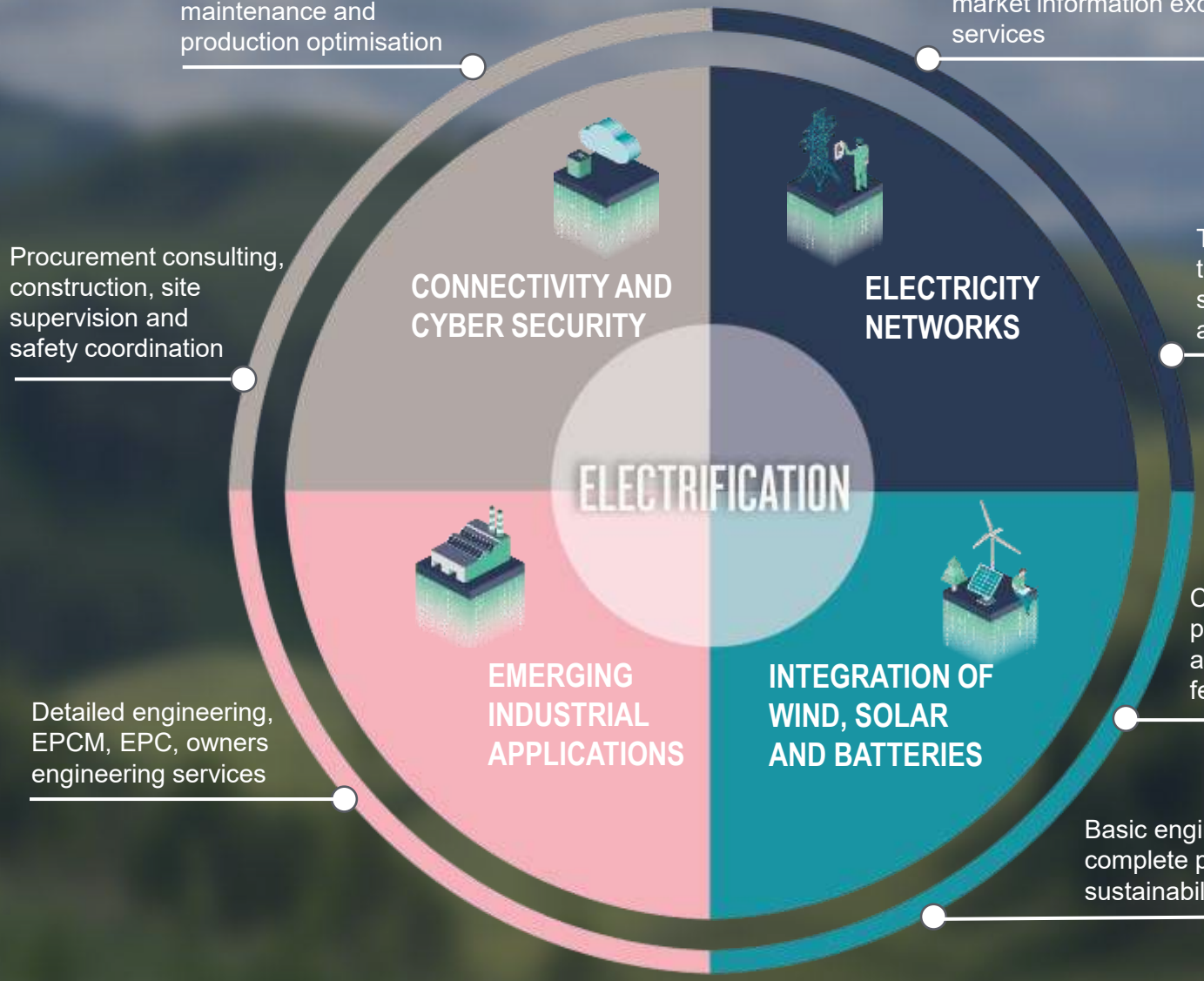
- Rejlers Operation Center provides cyber secured operation & management services 24/7/365 with years expertise.
  - Fast response times in failure situations.
  - Strong experience and expertise from control room operations and electricity distribution process.
  - Up to date and extensive operation center systems.
    - DMS operation support system in use.
  - Strong in-house expertise regarding systems, communications and cyber security.
  - 24/7/365 back-up from system manufacturer on SCADA and it's also redundant (HSBR).
  - Refined and efficient processes shaped through continuous development and years expertise.

- Rejlers' scalable Operation Center services offers cost savings and the tailored fit to Customer's exact needs.
  - Easy upscale of investments and operations through Rejlers' tested and trusted operating models and extensive partner network.

REJLERS

FINGRID WEBINAR 26.11.2025

Broad electrification offering to deliver the green transition from Rejlers.



REJLERS

Certified management systems

ISO 9001:2015
Quality management

ISO 14001:2015
Environmental management system

ISO 27001:2022
Information security management system

ISO 45001:2015
Occupational health and safety

THANKS!

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REJLERS

Smart Energiapalvelut
24h Valvomo

Käyttökeskus valvoo ympäri vuorokauden

SMART
ENERGIAPALVELUT

Käytöstä Vastaava Toimija - KVT

- Pitkä kokemus käytönvalvonnasta (n. 40 vuotta)
- Toimitaan NC ER (Network Code for Emergency and Restoration), VJV2024 ja SJV2024 säädösten mukaisesti (24h valmius, KoVa FEN ja Puhe, jne)
- Asiakasyhtiöinä mm:
  - Sähkövarastot, Voimalaitokset, jne
  - Yhdeksän jakeluverkkoyhtiötä
    - n. 111 000 käyttöpaikkaa
- Toimitaan koko Suomen alueella

SMART ENERGIAPALVELUT

janne.maki@smartenergia.fi
+358 44 738 6169

Järjestelmät

- Hitachi MicroScada X 10.7 **käytönvalvontajärjestelmä** ”Hot-Standby”
  - IEC104 ja ICCP protokollatuki
  - KoVa FEN yhteys
  - Reaaliaikainen tiedonvaihto
- Trimble NIS verkkotieto- ja Trimble DMS käytöntukijärjestelmät, UTG ja webTCC

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Palvelutarjonta

- Smart Energiapalveluiden kautta hoituu KVT toimijan reaaliaikainen tiedonvaihto Fingridille KoVa yhteyksiä pitkin
  - Tarjotaan palveluna NC ER, VJV2024 ja SJV2024 ohjeistuksen mukaiset tiedonvaihtopalvelut
  - Sähkövarastot, voimalaitokset, jakeluverkkoyhtiöt, jne
- Käytöstä Vastaava Toimija, KVT
  - 24h toimintakyky, KoVa yhteydet, sähköpulatilanteiden hallinta, reaaliaikamittaukset alitaajuussuojauksen portailta, jne
- Käytönvalvontajärjestelmä, Scada
- Verkkotieto ja käytöntukijärjestelmä, Trimble NIS, DMS, UTG
- Integrointipalvelut ja muut oheispalvelut

SMART ENERGIAPALVELUT

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Sertifikaatit

- Sertifikaatit
  - ISO 27001 (ISMS, tietoturvallisuuden hallintamalli)
  - ISO 27701 (PIMS, tietosuojan hallintamalli)
  - ISO 9001
- Noudatetaan kaikessa toiminnassa
- Sertifikaattien voimassaolo vahvistetaan vuosittain seuranta-auditointien yhteydessä
- Laadunhallinnan pohjana käytetään ISO 9001 standardia, joka on myös sertifioitu

SMART ENERGIAPALVELUT

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Tietoturva

- Käytössä korkeatasoiset ja kokonaisvaltaiset tietoturvaratkaisut
- Cyber Security Operations Center (CSOC) -palvelu, jonka avulla seuraamme ympäristöä reaaliaikaisesti ja analysoimme siellä mahdollisesti esiintyvää poikkeuksellista liikennettä
- CSOC sisältää mm.
  - 24/7-valvonta
  - Häiriötilanteiden nopea tunnistaminen
  - Hälytys- ja reagointipalvelu
  - SIEM, lokienhallinta sekä haavoittuvuusskannaukset

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Valvomon toimitilat

- Sijainti: Ulvila
- Reittivarmennetut kuituyhteydet
- Sähkönsyöttö varmennettu 24h
  - Varavoimakone + UPS järjestelmä
- KoVa FEN ja puhe palvelut
- Satelliittiyhteydet

- **https://smartenergia.fi/**

SMART ENERGIAPALVELUT

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+358 44 738 6169

26/11/2025

Aikaa kysymyksille

FINGRID

Thank you

Contact details:

real-time signals and data exchange related questions:
reaaliaikatiedonvaihto@fingrid.fi

VJV, SJV or KJV
Contact details from our website
Järjestelmätekniset vaatimukset – Fingrid
Grid code specifications - Fingrid