



Opportunities and Challenges with Standards- Based Communication between DSOs and DER

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Agenda

- Drivers for standardisation of interfaces
- The best candidate for real-time communication standard
- Challenges with implementing IEC 61850 for DER in Denmark
- Perspectives for the future
- Discussion...



Let me introduce myself: Philip J. Douglass

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- B.sc. Computer Science, University of Maryland, 2000
- M.sc. Computer Engineering, Technical Univ. of Denmark, 2002
- Ph.d. Electrical Engineering, Technical Univ. of Denmark ,2014

- Consultant at Dansk Energi 2014 - 2021
 - Work on research and demonstration projects related to digital control of power distribution systems.
 - Contribute to Grid Codes communication requirements

- From August will start as power system engineer at Better Energy



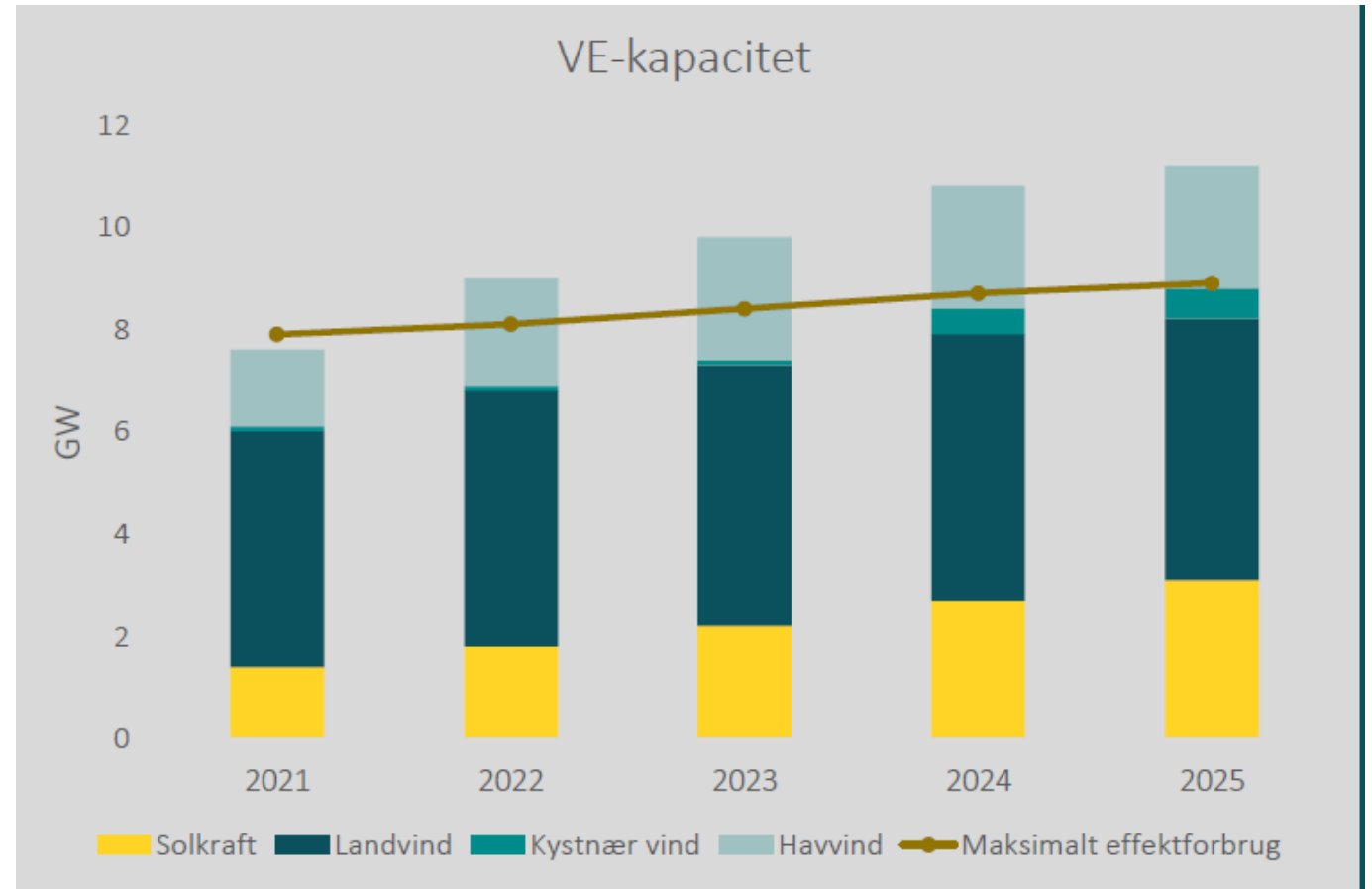
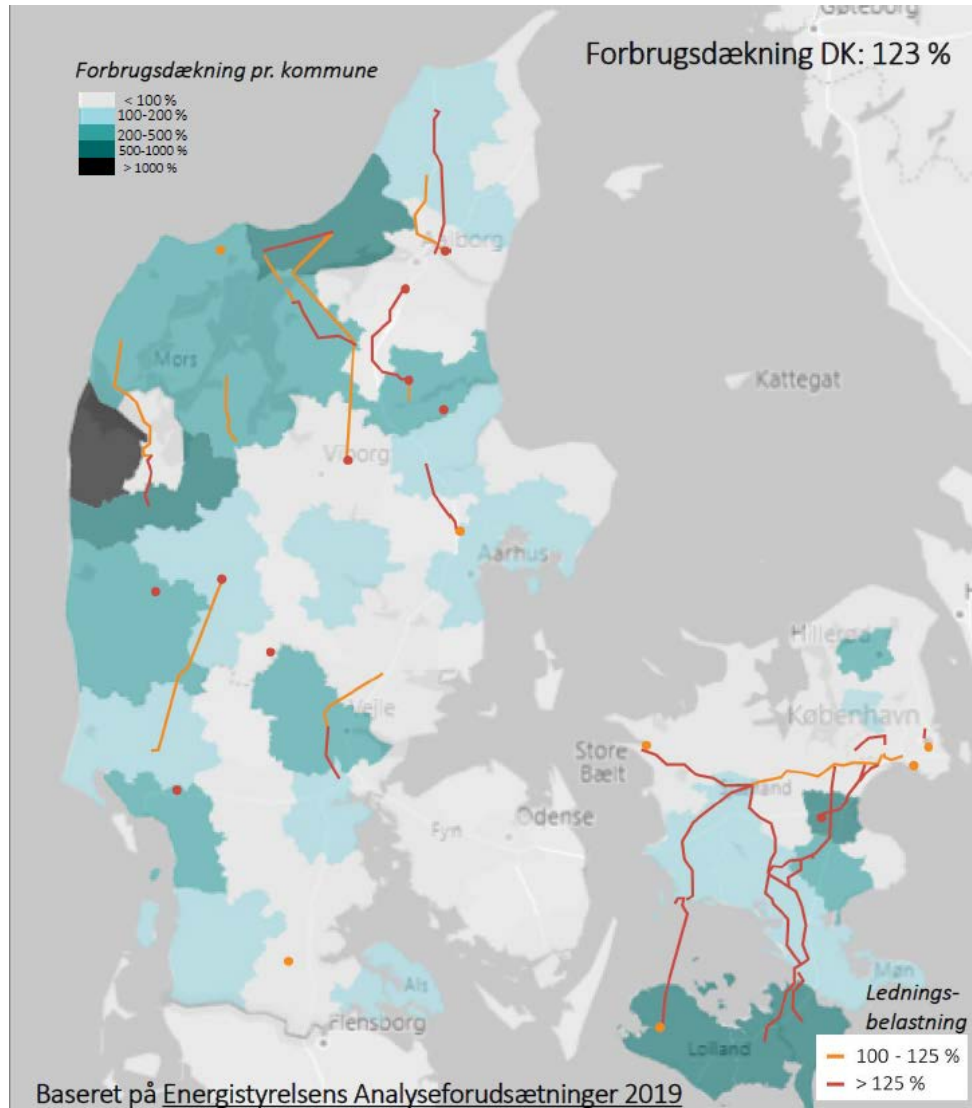
Why is there a need to develop standardized communication interfaces now?

- The RES development will press distribution infrastructure to its limits.
 - Large quantities of new RES require streamlined connection procedures.
 - Mechanisms for congestion management at distribution level are absent.



RES are poised for rapid expansion

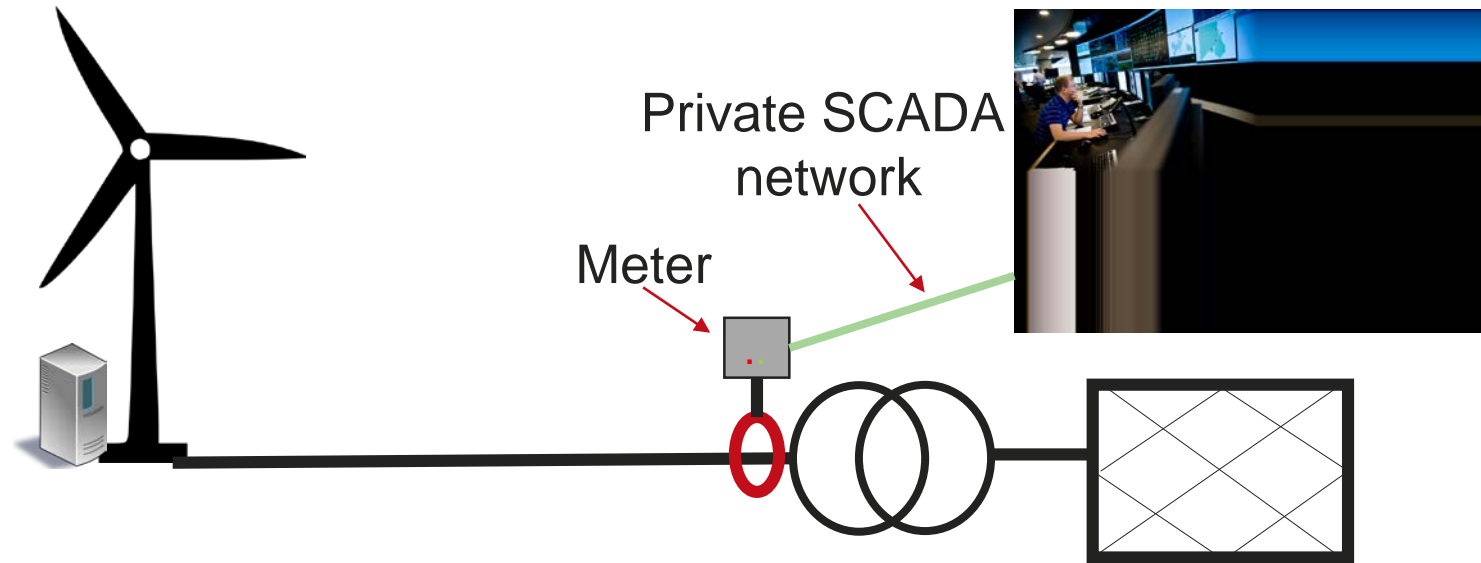
Overloaded lines in 2025



Why is there a need to develop standardized communication interfaces now? (II)

- The EU is pushing to harmonize grid codes.
 - I.e. Requirements For Generators (RFG), System Operation Guidelines (SOGL)
 - Evolution, not revolution
 - Enables scale for international actors
 - See https://www.entsoe.eu/network_codes/
- The RFG says “power-generating facilities shall be capable of exchanging information with the relevant system operator or the relevant TSO in real time or periodically with time stamping, as specified by the relevant system operator or the relevant TSO” (article 14, section 5.d)

DER monitoring in the recent past



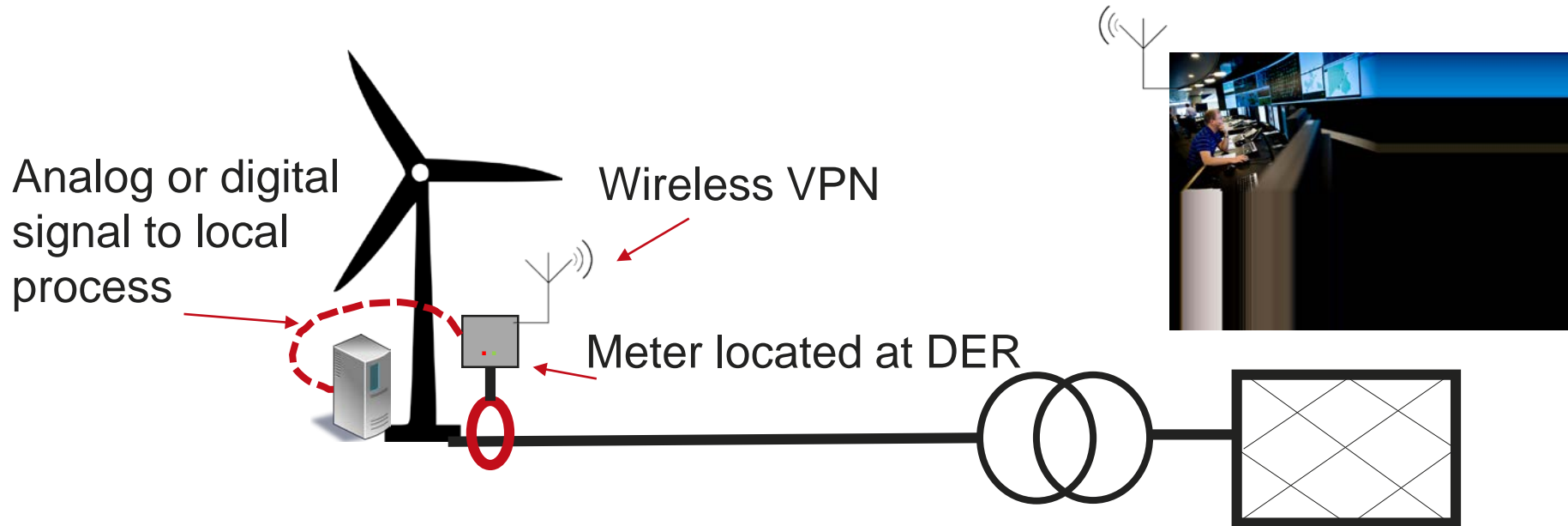
- Adequate for current and voltage measurements
- Can not be used for control of DER

All kinds of advanced controls require rich data exchange between DSO and RES

- Measurements for state estimation
- Controls for security and optimization
- Low latency for closed loop controls
- High reliability – especially in fault situations



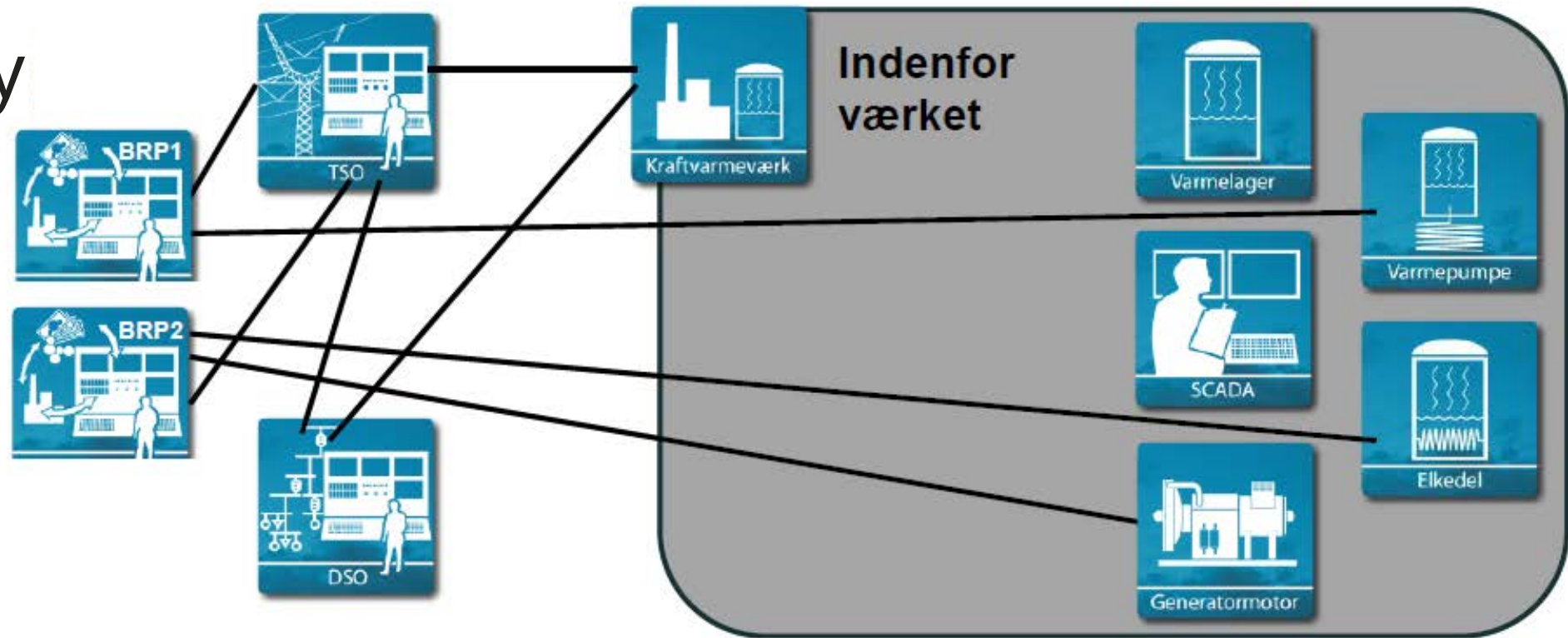
DER monitoring at present



- Parameters from the DER process are transferred with hardwired signals, or serial interface
 - Two-way communication is possible
 - Requires custom made software to map unique process data
- Data collected typically by wireless service, often with VPN

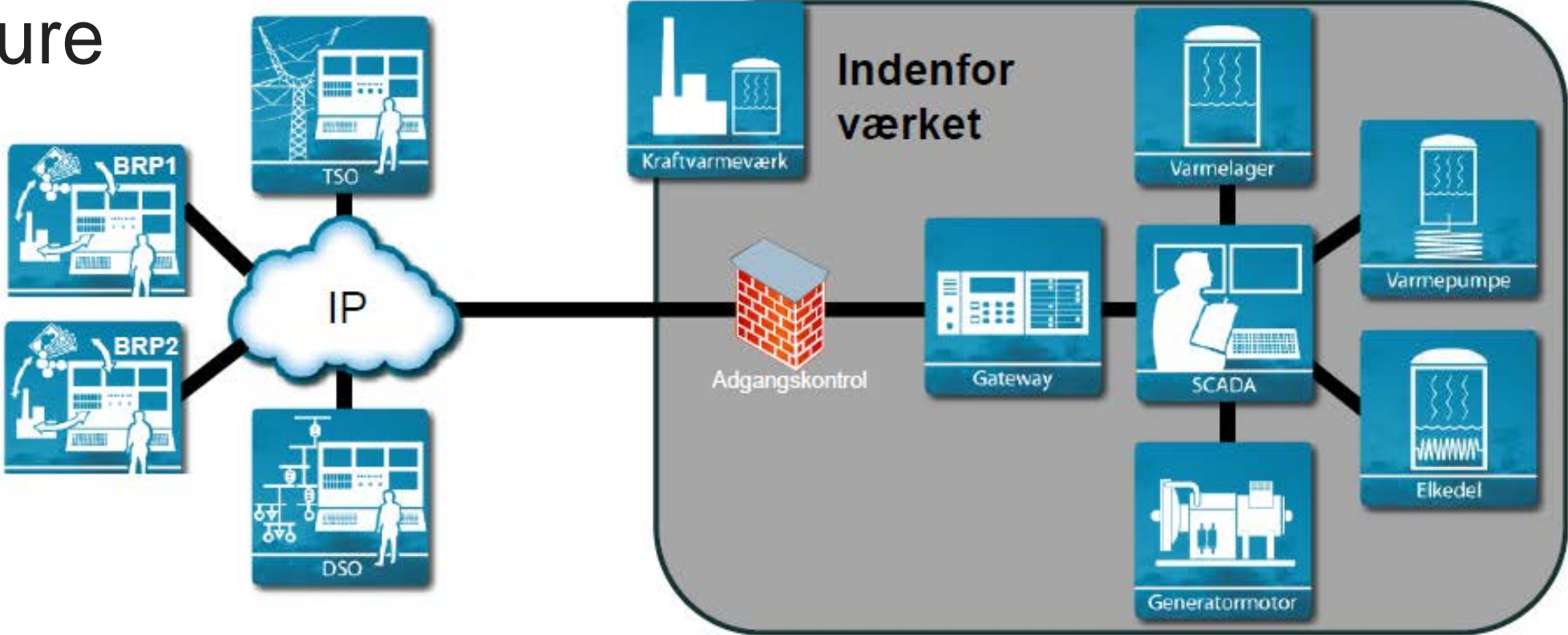
DER communicate with several external partners

Today

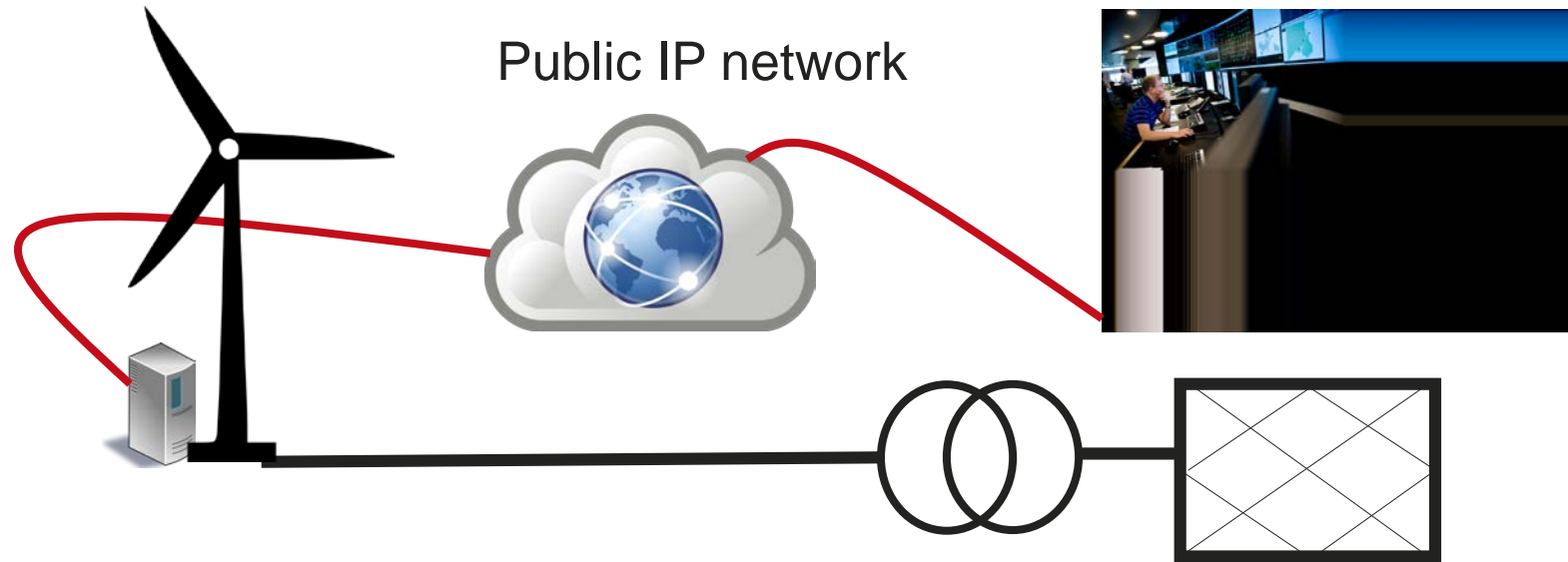


DER need to simplify their interfaces to external partners

Future



Future requirements for DER monitoring



- No extra hardware, shared network resources
- In use today for transmission-connected central power plants
- Not common for smaller DER

Standards-based interfaces are the safe choice

- Don't reinvent the wheel! - Reuse proven solutions
- Avoid vendor lock-in
- Automate processes so that they scale
- Shared interface to DER for all external actors: DSO, TSO, BRP, asset management.

“The great thing about standards is that there are so many to choose from.”

But which standards to use?

- Legacy protocols?
 - Tried and true, not futureproof
 - IEC 60879-5-104
 - No datamodel
 - No security mechanisms
- Industrial Automation Protocols
 - Ie. OPC/UA
 - Not much traction with energy utilities
- DNP3
 - Used in the North American energy industry
 - Uncommon elsewhere – perhaps that could change?



IEC 61850

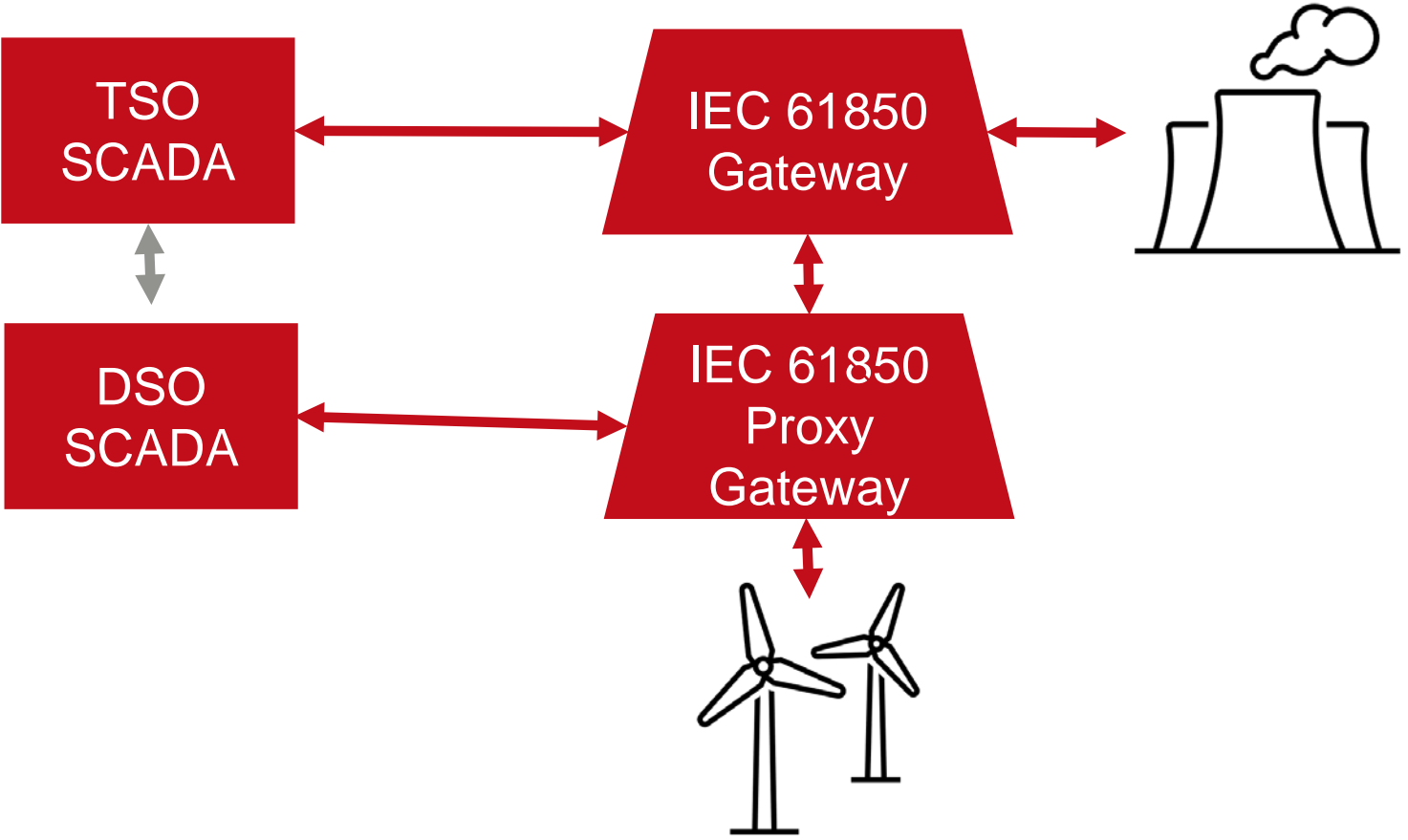
- Widely used by network operators for bidirectional communication to equipment to own stations
 - Defines a complete toolchain for highly automated workflow
 - Not widely used across organizational boundaries – but it could be!
-
- Defined extensions for DER, IEC 61850-7-420
 - Defined security protocols for confidentiality and authentication, IEC 62351



Danish DER Communication Architecture



From 2024!



Challenges in deploying IEC 61850 for DER

- Few vendors are fully implementing the standard today
 - Proxy Gateway with necessary security not available off-the-shelf
 - Lack of proven open-source implementations for client and server
- Security
 - Automated encryption key distribution and renewal still immature
 - Fine-grained differentiated permissions for access to signals
- The standard has recently been revised
- DSOs have very low risk tolerance



Perspective

- It's taking longer than expected to roll out IEC 61850 for DER in Denmark.
 - The first large unit came online this year
 - For DER the deadline moved from 2022 to 2024.
- Denmark seems to be alone in requiring IEC 61850, or perhaps just ahead of other countries.



FLEDGEPOWER – an open-source project from the Linux Foundation

- LF-Energy consortium has numerous TSOs
- General purpose protocol converter
 - Proxy Gateway functionality one of many use cases
- Builds upon existing projects
 - “libiec68150”
- <https://www.lfedge.org/projects/fledge/>



Call to action!

- A validated, secure, open implementation of IEC61850 is needed!
- The need is clear!
- The time is now!
- The route is well-traveled!
- Who will help get there?



Thanks for your attention!

Questions and Comments welcome...

Questions for discussion

- How does this experience compare to the choice of protocol, and their implementation, in your country?
- Are there better alternatives to IEC61850 for DER monitoring and control? I.e. DNP3?
- How do you encourage buy-in for new technologies across organizational boundaries?

