Ringhals and Forsmark

Digitalization – Wireless and IIoT

Andreas Björklund - Manager Plant strategy and Investment portfolio

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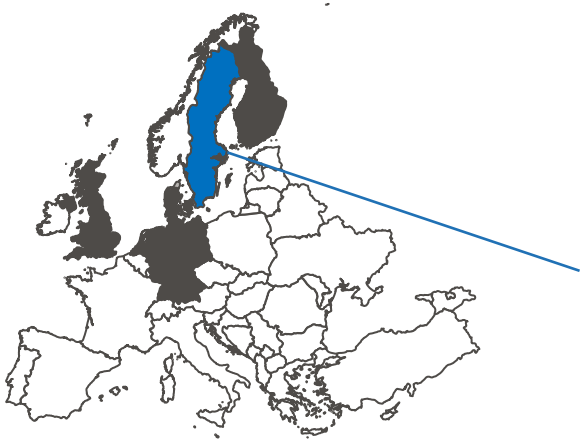
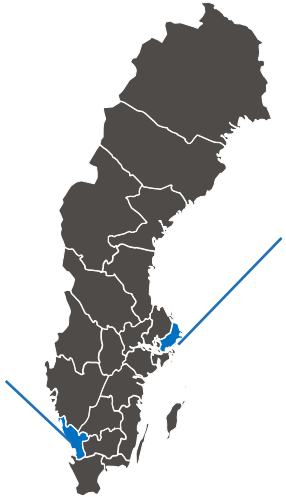
Vattenfall Nuclear Generation



Ringhals 1 BWR - 881 MW
Permanent shut down 2020
Ringhals 2 PWR – 904 MW
Permanent shut down 2019
Ringhals 3 PWR – 1063 MW
Ringhals 4 PWR – 1130 MW



Forsmark 1 BWR - 932 MW
Forsmark 2 BWR – 1087 MW
Forsmark 3 BWR – 1129 MW

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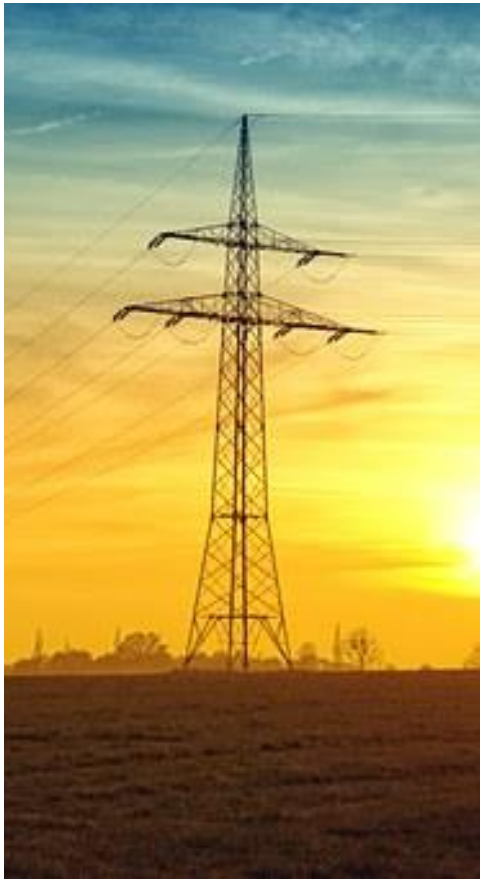
Asset management



Digitalization is in general a part of our Asset Management

Monitoring, Diagnostic and Prognostic is in particular a part of Performance monitoring based on WANO Performance, objectives and criteria

Data and information is to be used for ex. within our Scram reduction program and Reliability Centered Maintenance

The focus areas are our systems and components classified as single point of vulnerability and/or criticality

System engineering and maintennance network is the target group and will be the cross functional main users of the MDP center

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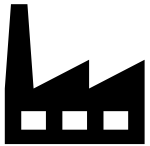
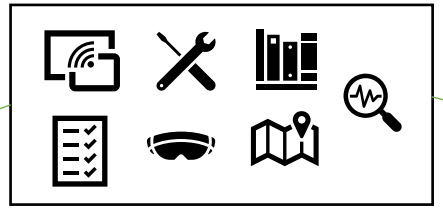
Mapping the Digital Eco-system

Operational personal and our way of working

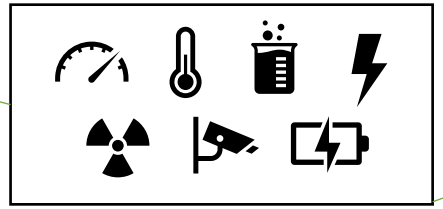


Plants and Assets

IIoT - Tablets, glasses, etc. (Real-time and history information, documentation, work order, error reporting, barcodes, back office support, etc.)



Wired and Wireless



IIoT – Cameras, Sensors, drones, smart meters etc. (Eg pressure, temperature, flow, vibrations, electricity, chemistry, positioning etc.)

Integration plattform
Data Center - Storage, Security, Scalability, Trust, performance

Monitoring, diagnostics, Prognostics
System engineering and maintennance network - system and component health as well as aggregated performance etc.

Monitoring, diagnostics, Prognostics
Overall management and follow-up - Plant status, performance, safety and risks. Staff performance, safety, efficiency, cost monitoring etc.

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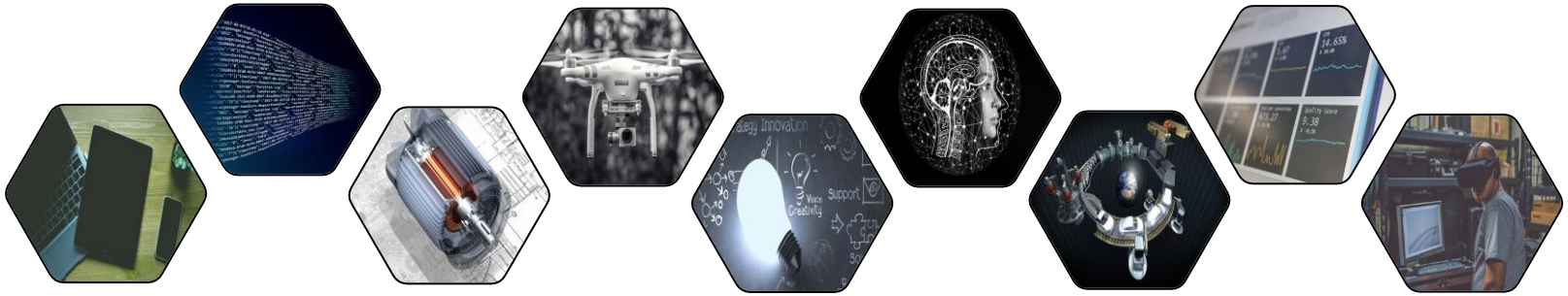

Mapping the prerequisites to achieve a digital Eco-system

- IT – Safety and Security (Plant network and administratively network including categorization of sensitive data)
- IT Infrastructure – Wired and wireless (Safe, secure and available with full coverage within our plants)
- IT Architecture – Storage and servers including data management through data warehousing and data catalouge
- Standards and regulations – Over all alignment to maintain our construction basis
- Partners and stakeholders – Experience coverege and good practices

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Wireless and IIoT

- Ongoing project of installing Wireless at Ringhals
- Cover our Plant facilities
- Wire based cupper and opto fiber for a robust backbone
- Selected technology for wireless – WiFi, with future compatibility for ISA.100, Wireless Hart etc. Classified for industry
- Private on premise network including zone modell to ensure data acces.
- The purpose of the wireless network is only for informative data, not controlling
- Start installation 2022 (successive implementation fascility by fascility)

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Challenges

- Cyber Security
- Separation and shielding to avoid disturbance of existing equipment
- Short equipment lifecycle 7-10 year
- New extensive preventive maintennance of batteries related to IIoT equipment
- Extensive cabling to achieve a backbone
- Technical standardization and rules for IIoT Equipment
- Constantly new, upcomming technologies and protocols such as for example 5G

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Monitoring,Diagnostics and Prognostics

- Start implementation of MDP-center for Ringhals 3 and 4
- User Interface with Dashboards
- Indicators for system and component health assesment including Alarms and notifications
- Leading indicators for equipment reliability index
- Applied analytics for pattern recognition and prediction
- Governing a condition based maintennance and predictive system health

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Purpose & Value MDP center

- Reduced maintenance cost and a better component/system availability/reliability:
  Early indications of possible/potential fault to:
  - Avoid failures and breakdowns
  - Avoid corrective maintenance
  - Avoid unnecessary change of components
- Reduce the amount of manual plant inspections
- Optimize our maintenance in specific areas by steering towards needs rather then periodic service intervals
- Through predictive mantenance focus and steer for the best suited occasion to maintain components due to operational state
- Life time extension of components through stronger real time monitoring of leading health indicators

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Prerequisites MDP center

- Define objects due to single point of vulnerability and/or criticality
- Define target ares as well as standards and best practicies for IIoT, monitoring and prediction (e.g. vibrations, temperature, flow, pressure, position etc.)
- Define data and information sources and gather relevant input
- Define the digital and integration platform including:
  - Tools (Hardware and software)
  - Datamodels and algorithms
  - Visualization och UX
- Define, gather and cooperate close with interests (Internal and external)

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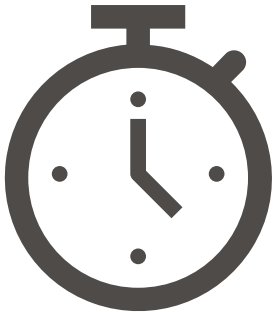
Challenges

- Data/information management and governance
- Understanding and confidense
- Competence skills (e.g. IIoT, Data science and UX)
- Find the best suitable datamodell for the object to fullfill the purpose
- Inclusion of predictive and condition based maintenance in todays working methods and processes
- Priority and business case (workload and effort)



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Thank you!

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