

Implementing Condition Based Asset Management @ Elia, the Belgian Electricity Transmission System Operator Diederik Moers







Implementing Condition Based Asset Managment @ Elia, the Belgian Electricity TSO

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**Diederik Moers** 





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- Condition Based Asset Management?
- Asset Management Excellence -TFO
- ACC implementation
- Conclusion & Next Steps





## Elia Group

#### Elia Group, a unique location in the heart of Europe



The Elia Group encompasses two leading TSOs in two European regions: Elia in Belgium and 50Hertz in Germany



#### One group

Two internationally active TSOs





The Elia Group is expanding its international activities through Elia Grid International



#### TSOs at the heart of the electricity system

#### Generation

import

Electricity is generated using conventional and renewable energies.

# Transmission system operators

ensure that generated electricity reaches consumers via distribution system operators (DSOs).

#### Consumers

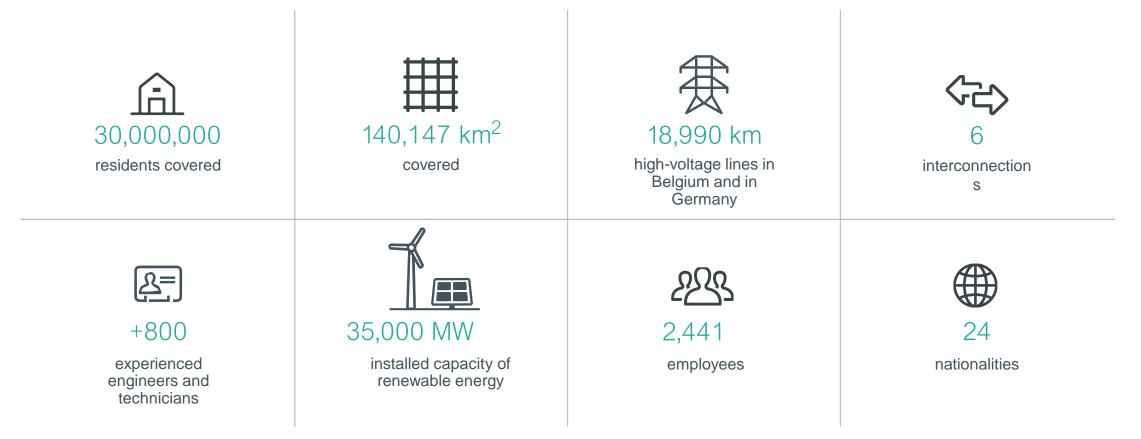
export

use the generated electricity injected into power grids.



#### Facts & Figures 2018: Elia Group

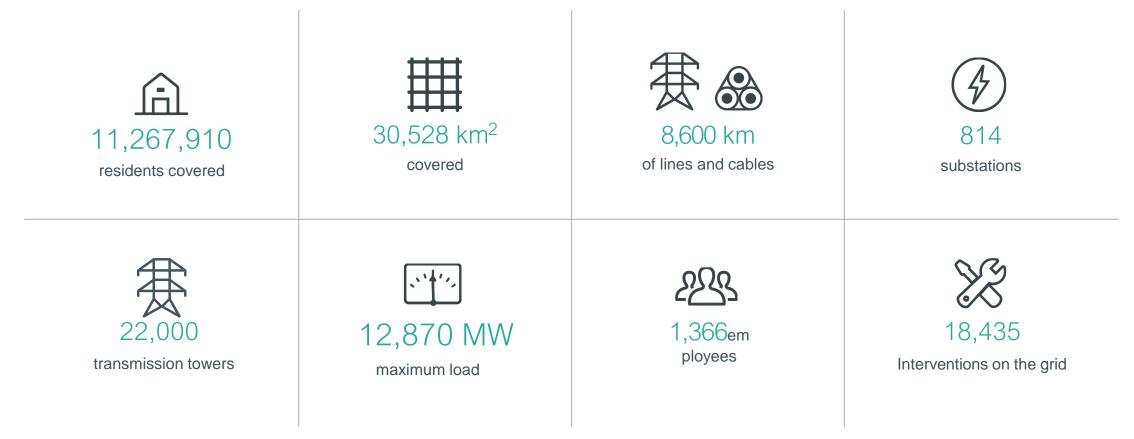
Atop-5 player in the EU TSO Business





#### Facts & Figures 2018: Elia

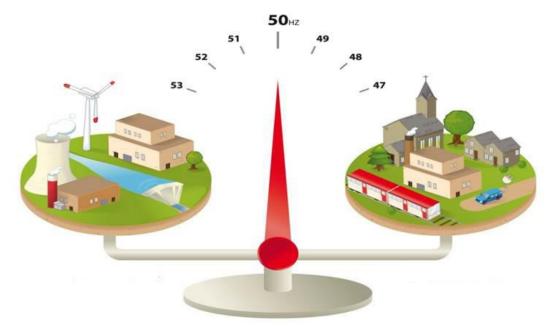
Atop-5 player in the EU TSO Business





# Monitoring the generation/consumption balance in real time, 24 hours a day

The grid needs to be enhanced to respond to changes in the balance between generation and consumption and in the volume and location of generating facilities and centres of consumption





#### Key activities

# Elia Group—

1 Infrastructure management

Operation, maintenance, planning and expansion of onshore and offshore high-voltage infrastructure.

#### 2 Controlling the system

Balancing the entire electricity system and ensuring its safe operation 24/7.

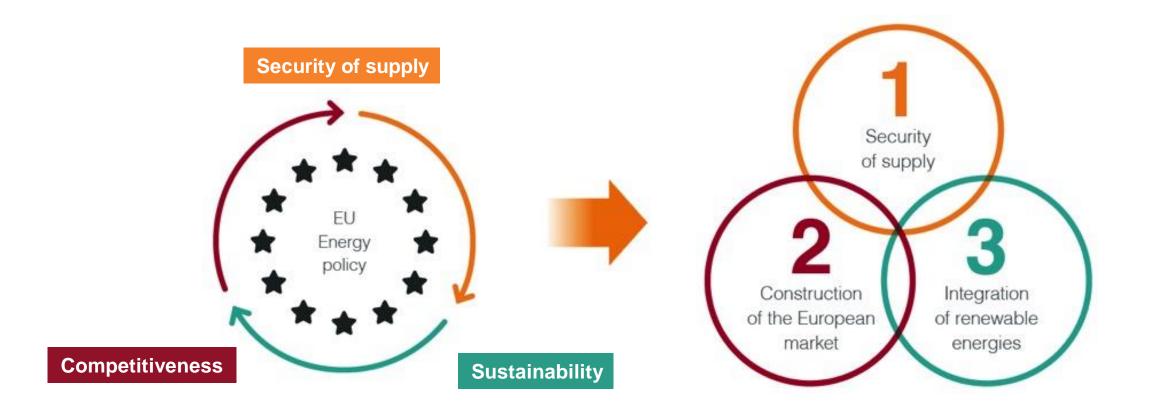


#### 3 Developing the EU market

Being a front runner in the development of the EU electricity market (NWE & CEE regions), to make the EU energy system more competitive, secure and sustainable.



#### Addressing EU objectives







## The Pi System @ Elia

### The Pi System @ Elia



IK: 45 €/MWh

FR-UK 637 MW

> BE-FR 988 MW

FR: 44 €/MWh

#### **Currently 2 implementations of the Pi System at Elia**

#### 1. Visto @ Elia System Operations

The Pi System is used for the visualization of forecasting data at the NCC.



- Imbalance prices
- Winter Dashboard
- Solar/Wind Forecasting
- Spinning Reserve
- Critical Asset Monitoring

Great project, but not the subject of this presentation



....

DE: 30 €/MWh

FR-DE 786 MW

### The Pi System @ Elia



#### **Currently 2 implementations of the Pi System at Elia**

#### 2. ACC @ Elia Assets

The Pi system supports in the asset management decision making process, by calculating and visualizing the condition of our assets.







#### Facts & Figures for ACC's PI System



- 560k tags, 2,2M analytics and 16M attributes
- 180k assets (TFO, AIS, Cables, Diesel Generators, OHL)
- 56 element templates and 72 event frame templates
- Daily automatic generation of 10 different reports and 7 more on a weekly shedule
- 19 different types of PI Vision dashboards + 19 event frame dashboards + 5 Process books
- 16 Interfaces with: 11 UFL, 4 RDBMS, 1 Modbus







#### Condition Based Asset Management @ Elia

Why do we need it for modern Asset Management?

#### Challenges for Asset Management







#### Elia's programs to prepare for the future: House of Assets





#### Some lever examples to reach the AMEX goals

- Finetuning replacement policy of Circuit Breakers
- Adaptation fleet strategy Current Transformers
- Oil sampling frequency based on asset condition
- Retrofit OLTC (On Load Tap Changer for Voltage Regulation)
- Adapted maintenance of OLTC
- Remote Monitoring and Testing of Diesel Generators
- Monitoring and automatic discharging batteries

#### Enabled by

By gathering Dynamic Asset Data, one can calculate the Health Index of an asset in order to support the asset manager in decision making for maintenance and replacement

Through new technology, one can remotely acces and control an asset, which results in less travel, more simple and frequent monitoring

#### New activities governed by

CONDITION

CONTROL







ACC stands for Asset Condition & Control and is as a new department an enabler for smarter Asset Management: ACC will support the development and implementation of Condition Based Asset Management and Remote Maintenance, enabling Elia to use it's resources as efficient as possible on CAPEX and OPEX level.









## History of ACC



- Ideas scope analyses of potential
- Market survey First tests models
- Development of POC based on the Pi System
- Kickoff of POC
- Continuation of POC
- End of POC: Feedback + final bus. case
- Kickoff Final ACC based on the Pi System
- Implementation Amex Wave 1
- Procurement historian DB
- Organisation of ACC within AM
- Implementation Wave 2
- Implementation Phase 3
- ...

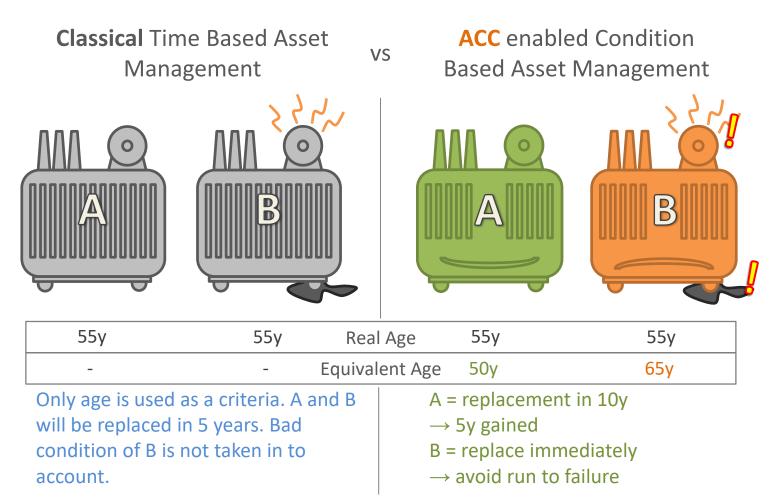




### Asset Management Excellence – TFO case

#### Time Based vs Condition Based AM



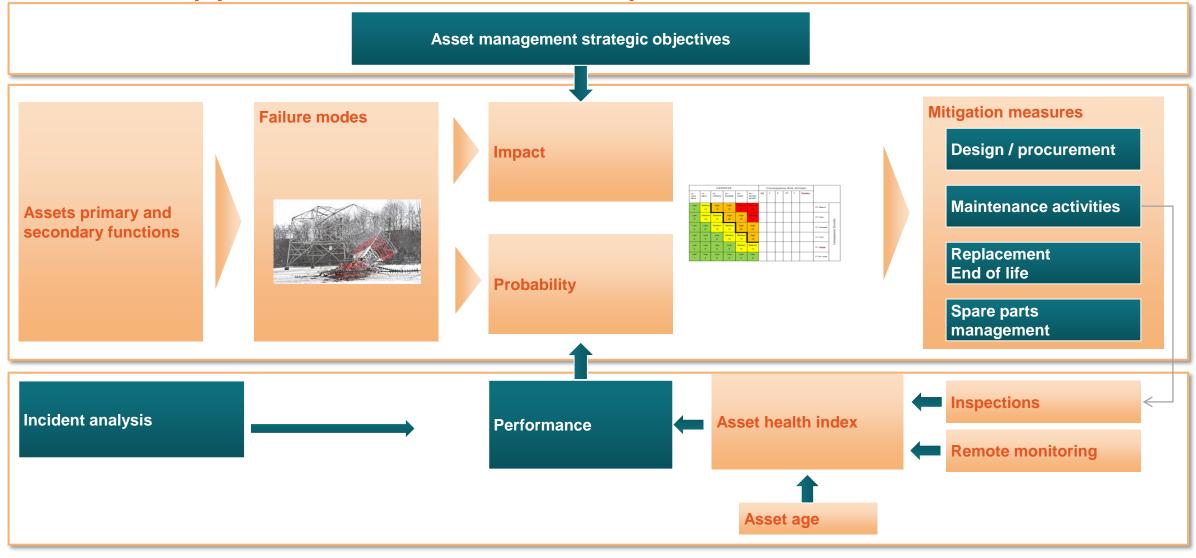


A and B are both 55years old with a lifespan of 60 years. Equivalent age is a calculated age based on real age, life span and the physical health condition of the asset.





#### FMECA approach as driver for improvements





#### Health analysis of specific fleet





#### Results of the Retrofits (1)

After AMEX project need was detected => start-up ACC Asset Condition and Control

Development of ACC : Condition asset translated in Equivalent Age (EA) and Health Index (HI)

- EA Oil analyses : DGA (Internal condition)+ Oil Quality + Paper degradation
- EA **OLTC** : # operations (~type)
- EA Bushing: electrical measurements
- EA Electrical: electrical measurements
- **EA TFO** = Max of worst EA in EA

HI= % of used lifetime ifo expected LT of asset



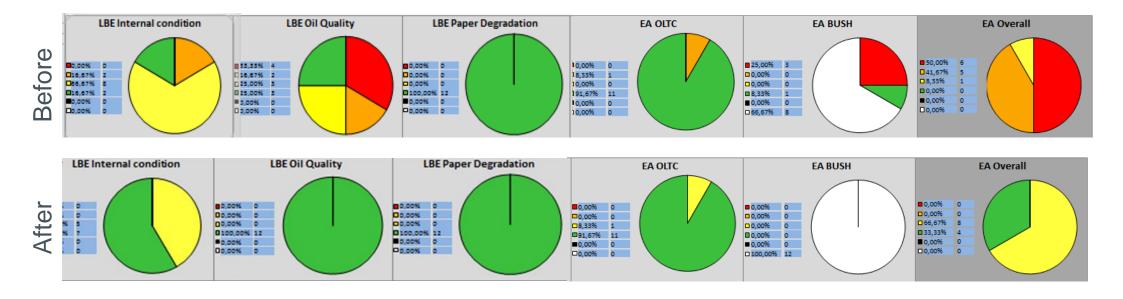
#### ACC centralizes all parameters and delivers a day-day refreshed view of the condition



### Results Retrofits (2)

Not Data =>White (0)
0-50% =>Green (1)
50-70% => Yellow (2)
70-90% => Orange (3)
90-100% => Red (4)
> 100% => Black (5)

#### ACC : Daily updated report of HI (%)



Impact of retrofits => saving a total of 2 assets in years of life-time



#### Retrofits

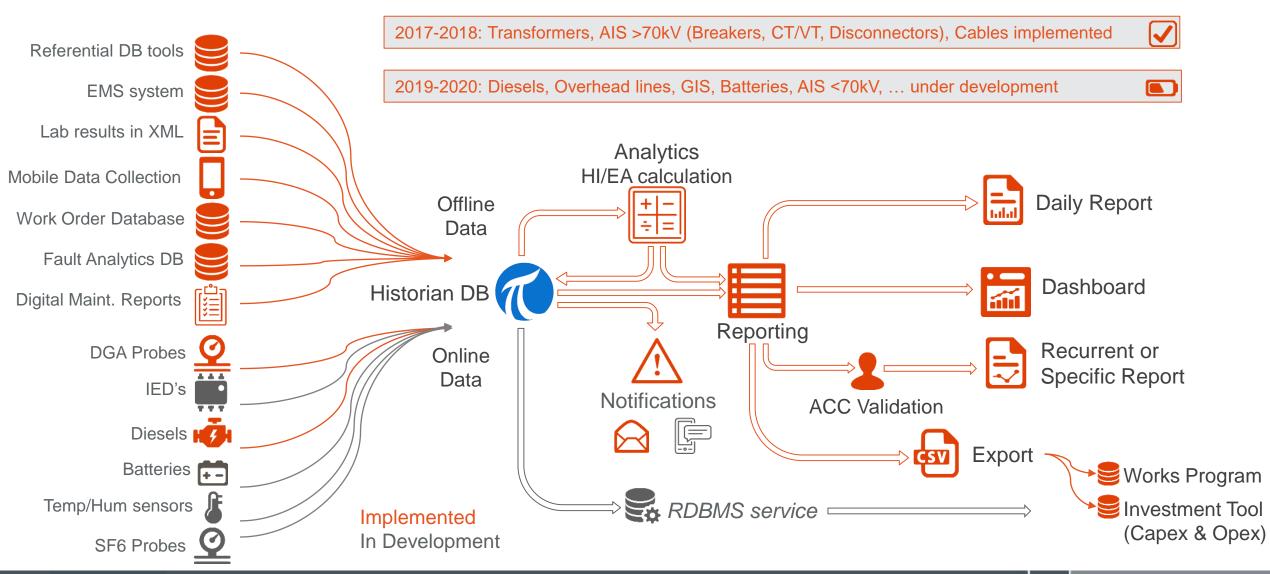






#### How does Health Index calculation work at Elia?

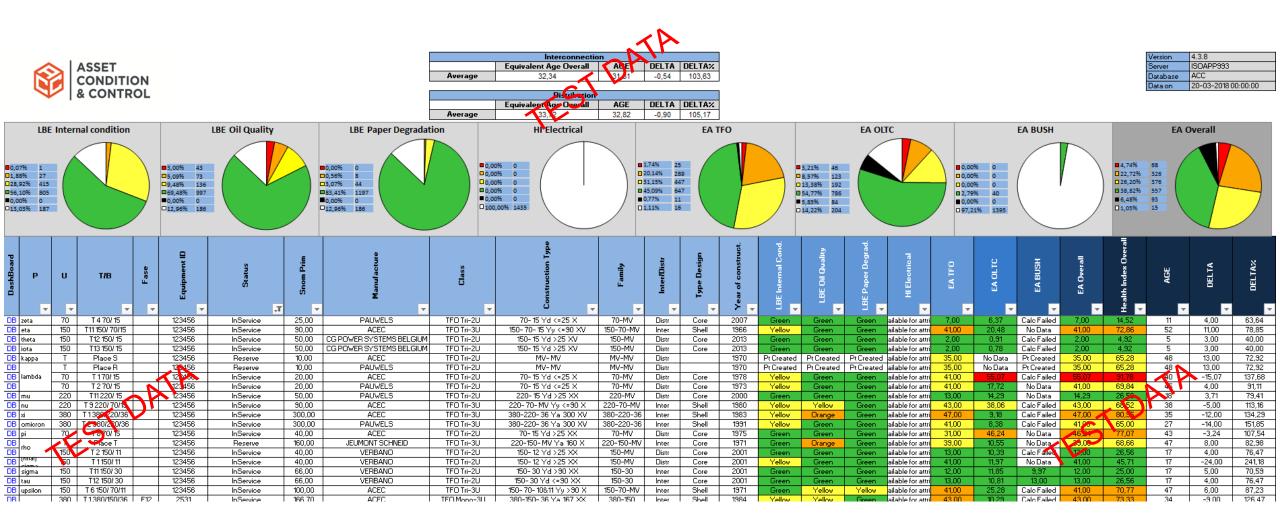






#### **Report Example**

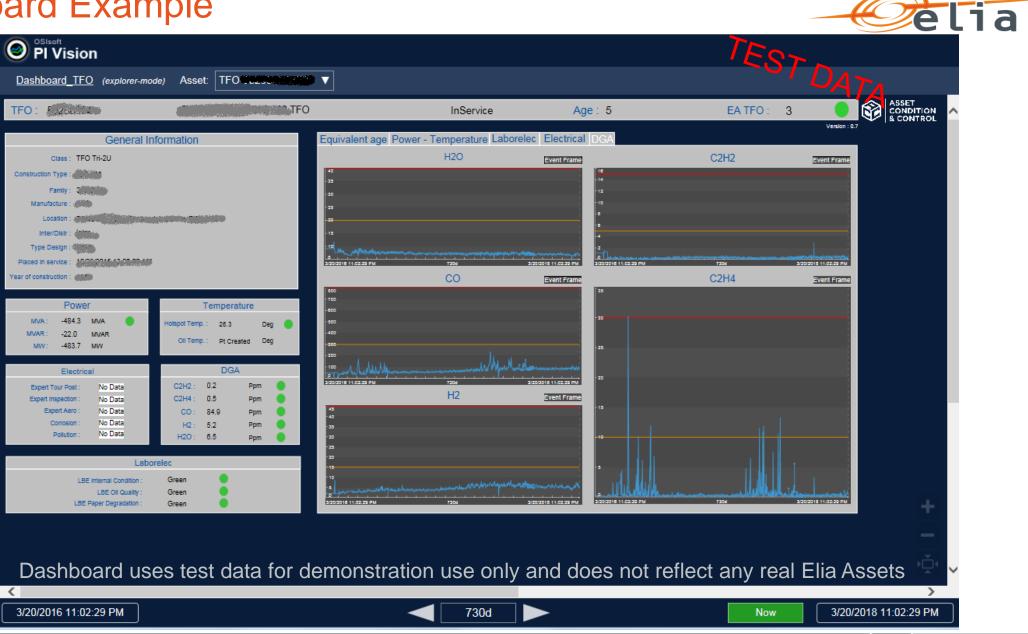




Report uses test data for demonstration use only and does not reflect any real Elia Assets



#### **Dashboard Example**





#### **ACC Operation**

An implemented software solution doesn't run on its own.

#### **Staffing**

4 operational FTE's are required for daily exploitation of the <u>current</u> scope, under the lead of the ACC Manager who reports to the Head of Asset Management.

<u>1x Data Expert ACC</u>: Governs ACC data and database; Defines which and how data is stored within the ACC environment; Develops the basis for dashboards and reports; Collaborates with the Corporate Data Manager

<u>3x Technician ACC :</u> Implements and exploits ACC data and technical tools; Executes first line analysis on data and communication issues; Creates periodic and specific reporting; Executes certain remote maintenance activities







#### **Benefits ACC**

ACC doesn't deliver a direct monetary benefit as a service provider, but delivers services to activities with a positive business case who do:

- o Safety
- o Reliability
- o Availability

ACC will enable Elia to better estimate the health condition of her assets, which means that in certain cases it will be possible to identify a required intervention before a malfunction occurs (avoiding an interruption on the grid and avoiding heavy asset damages and potential safety risks). It is however impossible to quantify this realistically.











First results on health indexes calculated with ACC system are positive and Elia will continue the implementation of other assets.

Some results:

- HI TFO's used in update business plan
- Input for Works Program generator (switches since last maintenance)
- Dashboards have been profoundly used in the analysis of critical assets
- Used by the Asset Manager for project scoping and replacement policies (=CAPEX)
- Notifications are used to identify unregular activities on transformer voltage regulation (switches per day)





## **Biggest Challenges on ACC implementation**



#### <u>Concept</u>

- Why do we need an ACC
- How can an ACC help the Asset Manager in the governance of his fleet? What information does the AM need?

#### **Implementation**

- Building interfaces with the existing environment
- Creating a data model for each asset: what do we truly need to get started?
- Data Cleaning and Data Quality





## **Next Steps on ACC**



By the end of 2019 we will have developed phase 2:

- Implementing High Voltage Overhead Line systems (1000 circuits, totaling 170.000 assets)
- Implementing additional assets like GIS substations, batteries, ...

2020-2021 is reserved for

- Implementing additional assets buildings, cubicles...
- Improving knowledge on CBM (defining actions, alarms and correlating more relevant data)
- Preparing the next step to Predictive Maintenance
- Explore additional opportunities with the Pi System







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- Head Asset Condition & Control
- Elia
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## **Questions?**

# Please wait for the **microphone**

# State your name & company



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