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# CPC6: Optimal asset management data - Components

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**Project funded by:**

Energimyndigheten e·on

# Changes in the cyber-physical system

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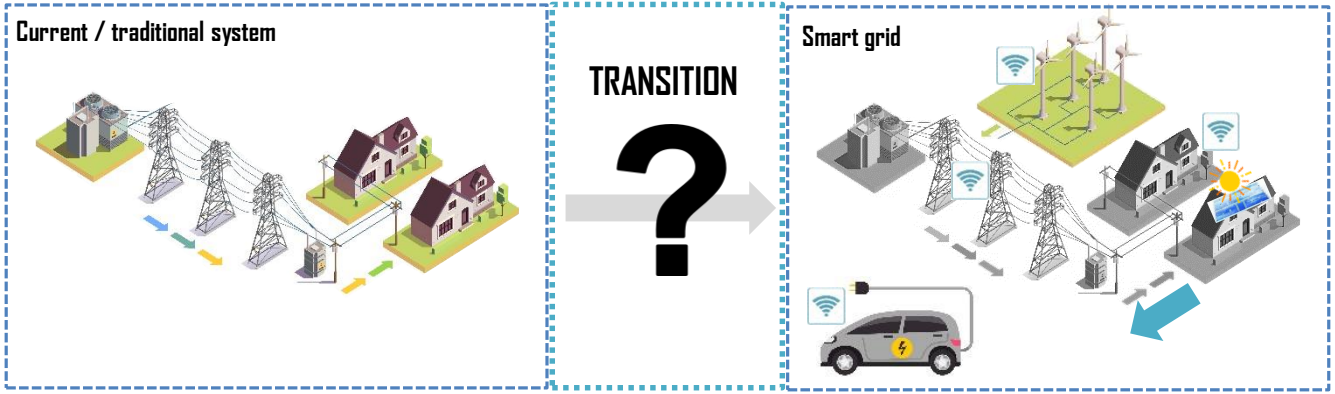


**Physical network**

- Centralized power plants
- Unidirectional flows

→

- Wind and solar farms
- Distributed generation
- Bidirectional flows
- Electric vehicles

**Cyber network**

- SCADA
- Manual entries

→

- Smart meters/Sensors
- Remote control

# The problem of adding sensors

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**Economic issue**: It might be unprofitable to install many sensors, compared to the benefits they provide.

**Environmental issue**: The collection, processing and storage of large amounts of data can be power-intensive.

**Technical issue**: Adding equipment and functionality always carries a risk of new failure modes as well as new uncertainties.

Vectors created by flaticon - www.freepik.com</a>

# Research questions

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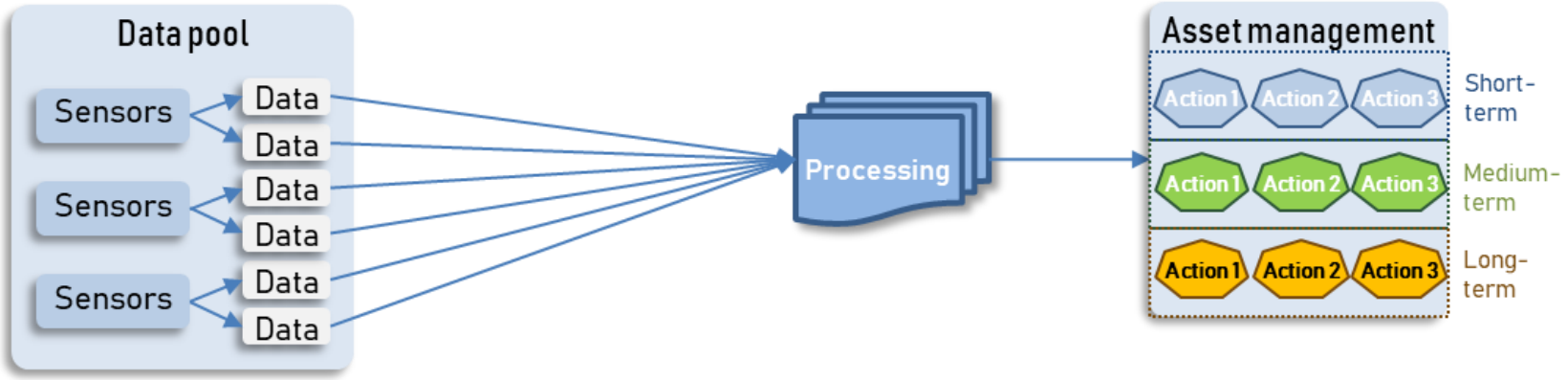


- How to use available data better to improve asset management?
- How much and which kind of new data should be collected?

Electric car and wind turbines: Vectors created by macrovector and flaticon - www.freepik.com</a>

# Approaches taken in the PhD

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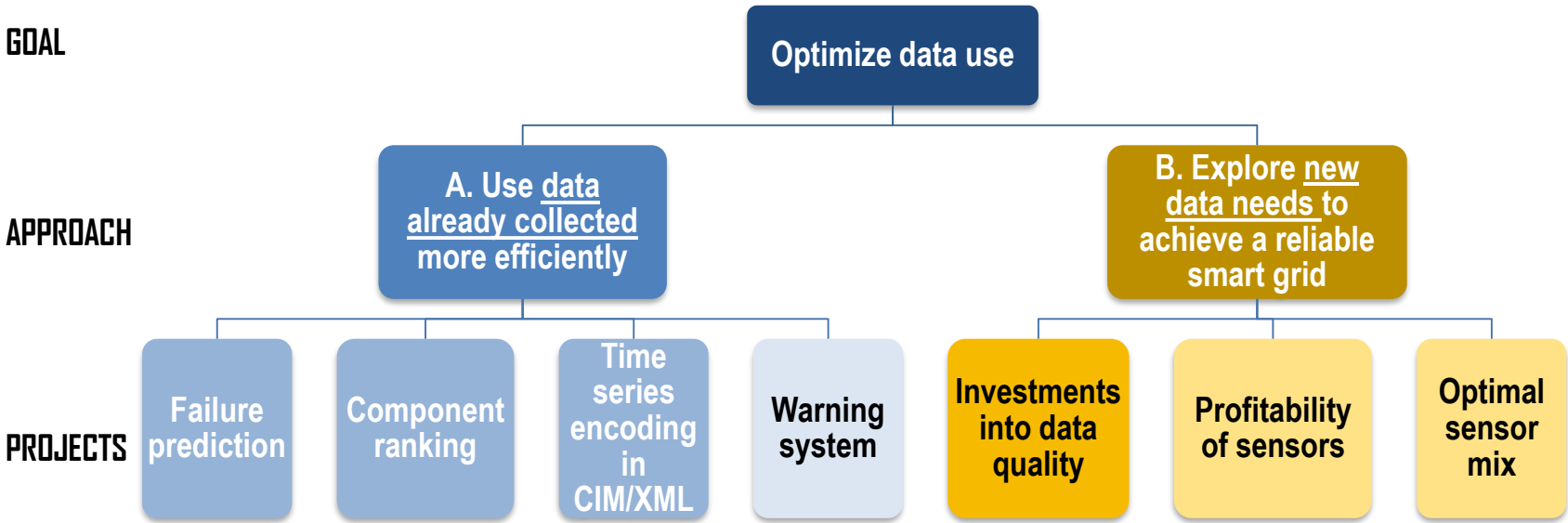

# Approach A

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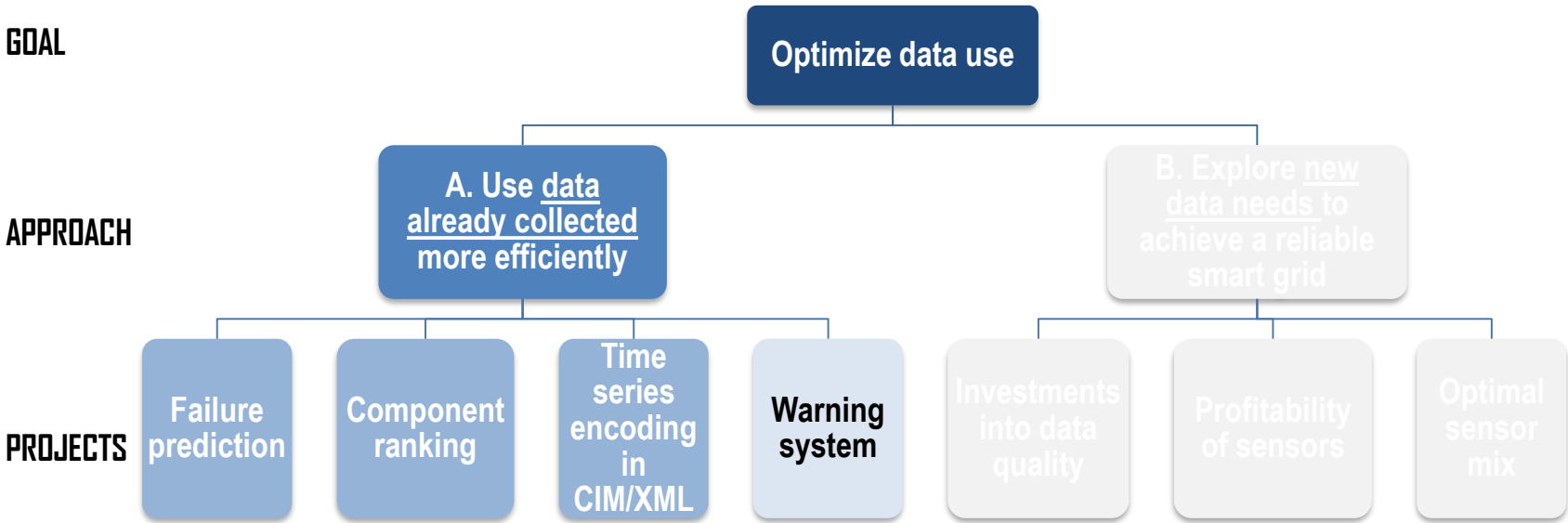
Research question: *What additional information can be extracted if the data **available** were to be mined more efficiently using data analytics?*





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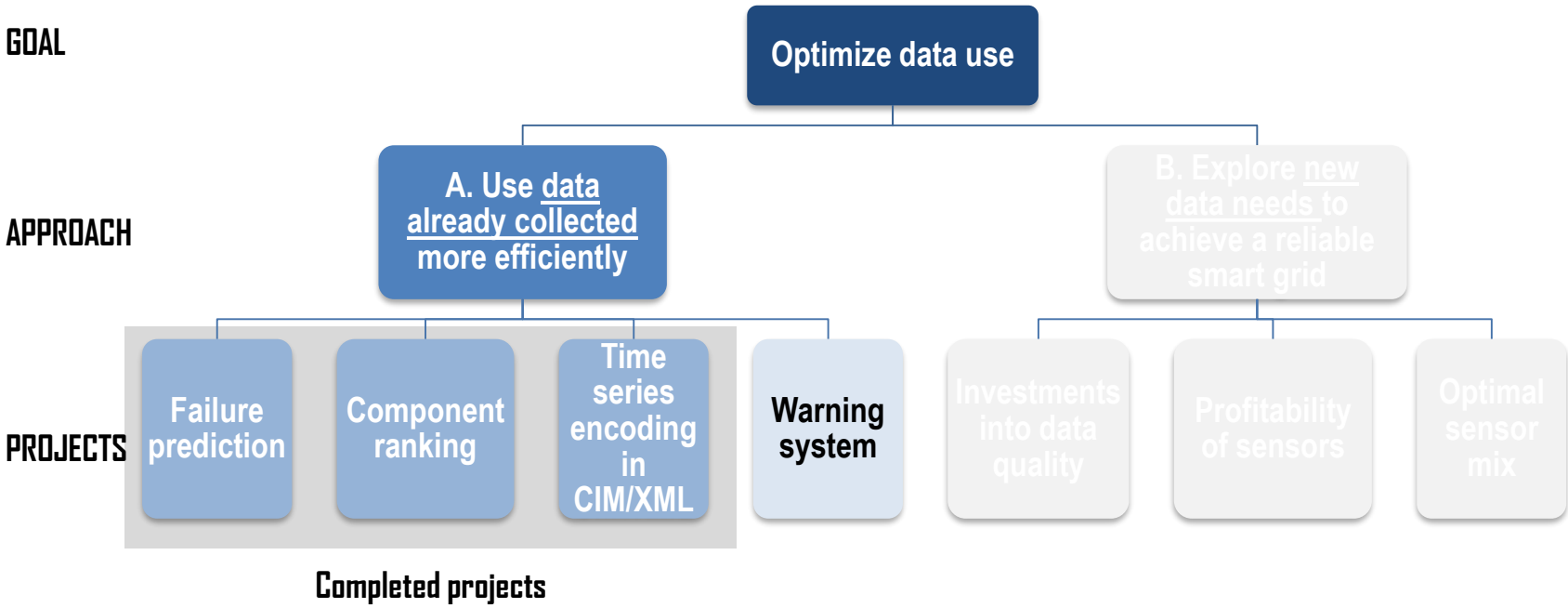

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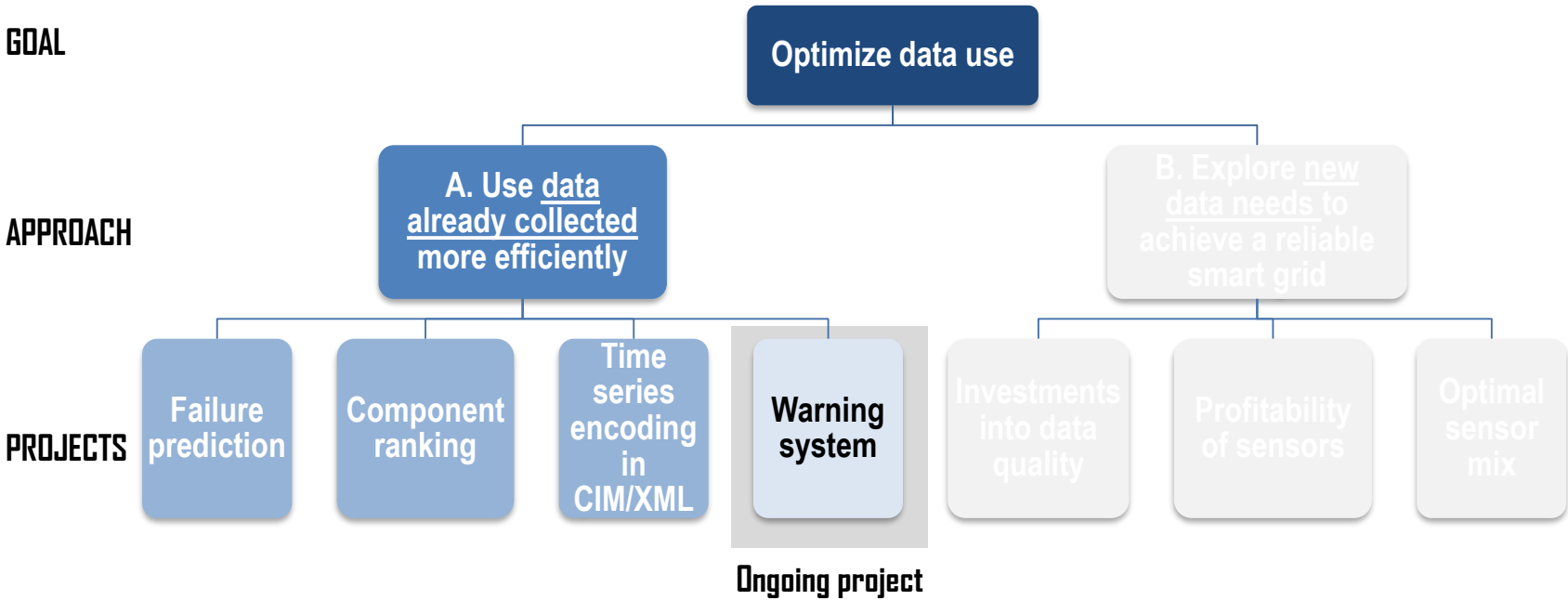

# Approach B

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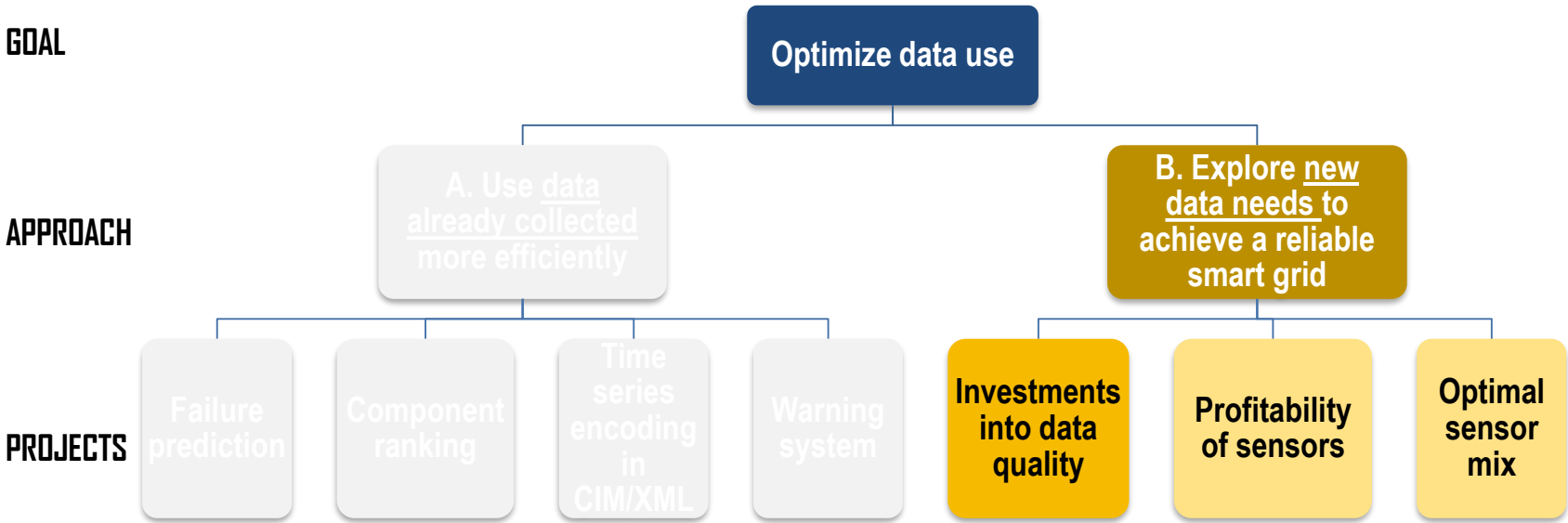
Research question: *When is additional data profitable and useful to the grid manager?*





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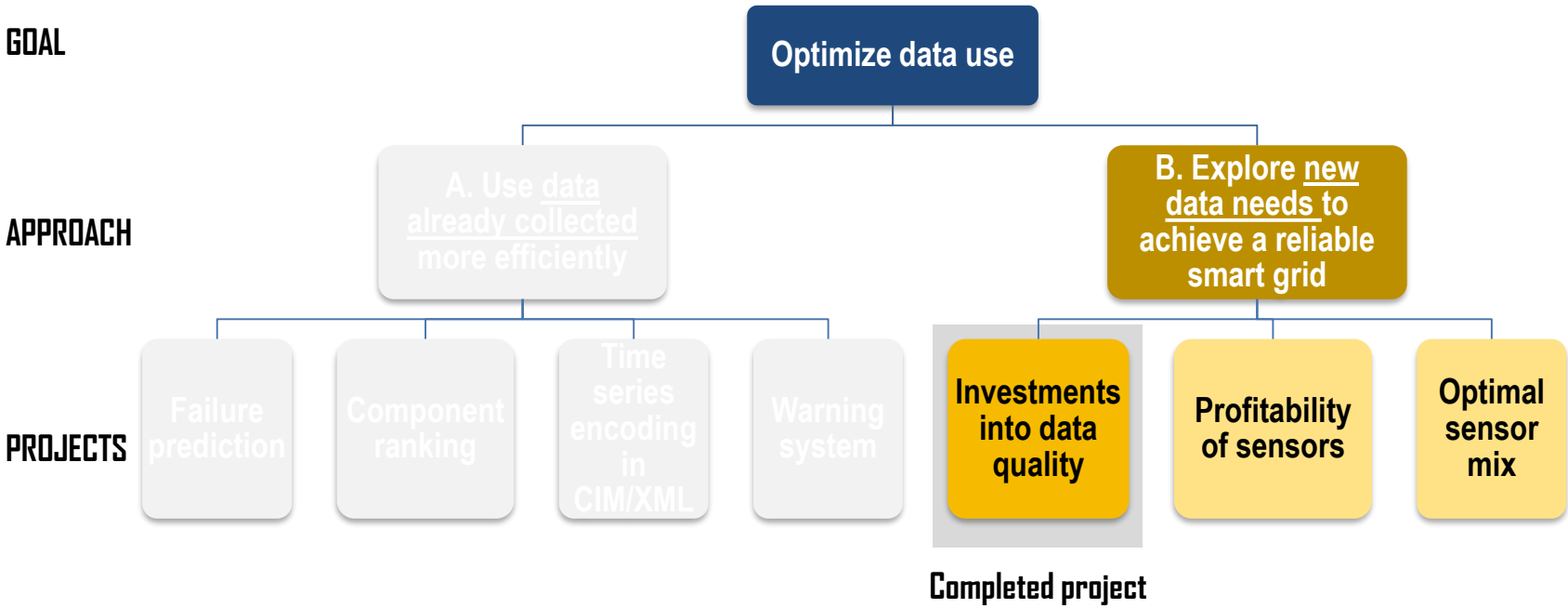

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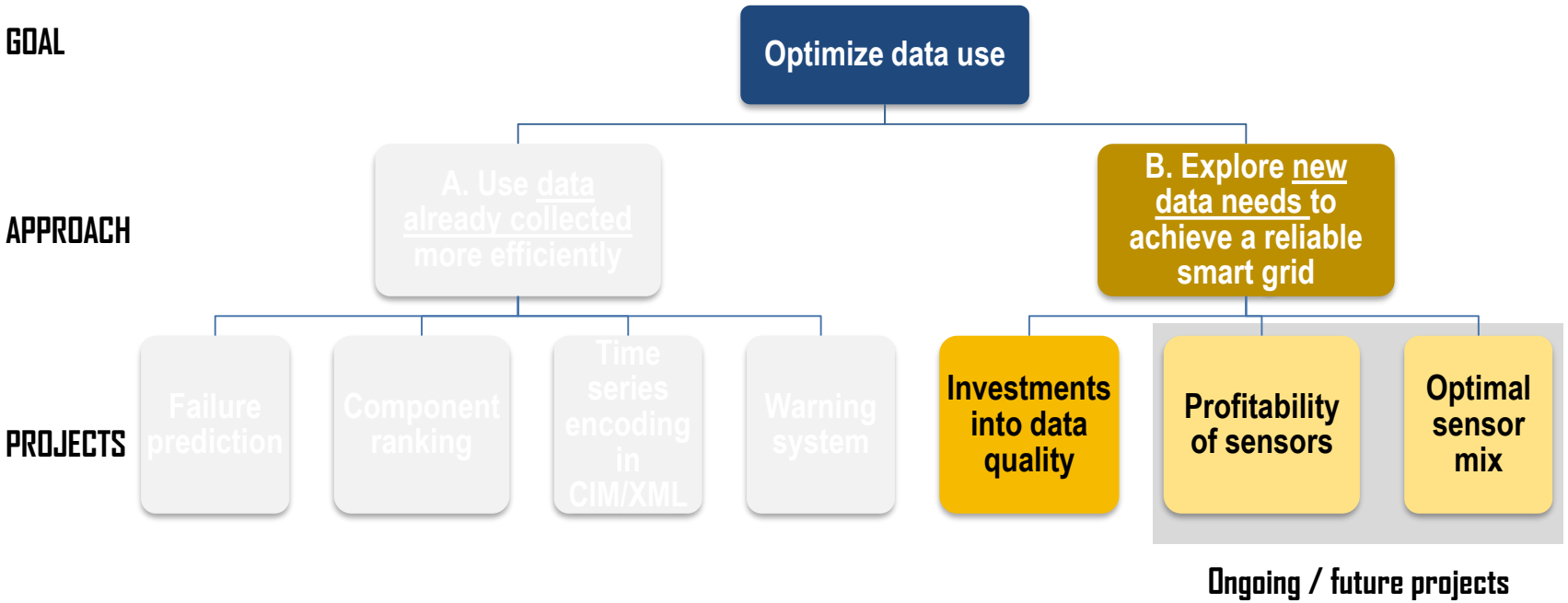

# Completed projects

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I. Background

II. Objectives

III. Approach

IV. Results

| Course credits | Conferences |
| --- | --- |
| 59.5 | ▪ Participation at IEEE Big Data (Los Angeles, USA) – December 2019<br>▪ Participation at PMAPS 2020 (Liege, Belgium) – August 2020<br>▪ Participation at PowerTech 2021 (Madrid, Spain) – July 2021 |

## Research visit

NII (National Institute for Informatics), Tokyo, Japan: 10.09.2019 to 17.01.2020 (130 days)
Work on using machine learning for prediction and detection.

## Publications

**Journal paper 1**: " Investments in data quality: Evaluating impacts of faulty data on asset management in power systems" (*published 2021 - Applied Energy*) https://www.sciencedirect.com/science/article/pii/S0306261920314896

**Conference paper 1**: "Forecasting cross-border power exchanges through an HVDC line using dynamic modelling" (*published 2019 - IEEE Big data conference*) https://ieeexplore.ieee.org/abstract/document/9006536

**Poster + poster-paper:** "Application of big data analytics to support power networks and their transition towards smart grid" (*published 2019 - IEEE Big data conference*) https://ieeexplore.ieee.org/abstract/document/9005479

**Conference paper 2**: "A review of data-driven and probabilistic algorithms for detection purposes in local power systems" (*published 2020 - PMAPS conference*) https://ieeexplore.ieee.org/abstract/document/9183634

**Conference paper 3**: "Component ranking and importance indices in the distribution system" (*published 2021 - Powertech conference*) https://ieeexplore.ieee.org/abstract/document/9494968


THANK
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