Data science for renewables: forecasting and asset management

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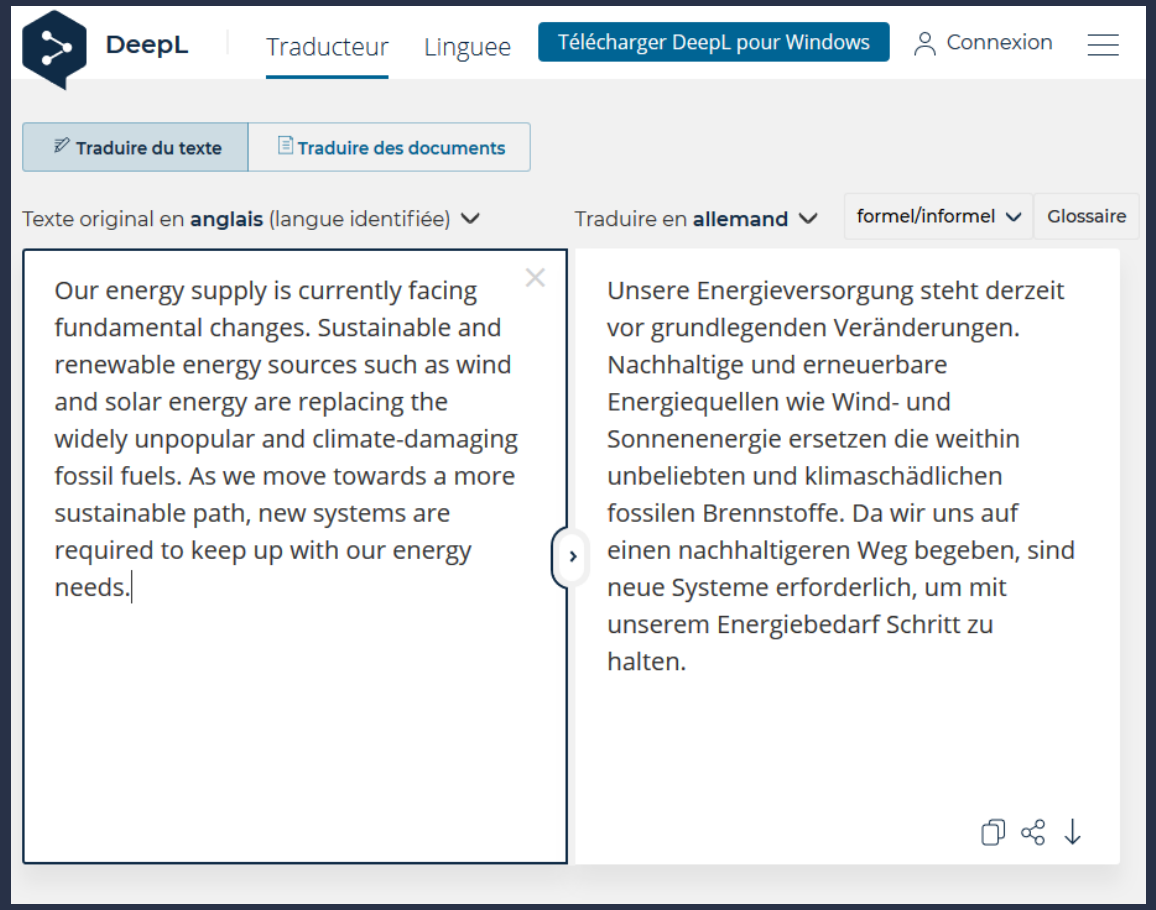
Technology Briefing – Smart Energy Applied Solutions

11 Nov. 2020

Data science…

…for renewables?



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Data from renewables

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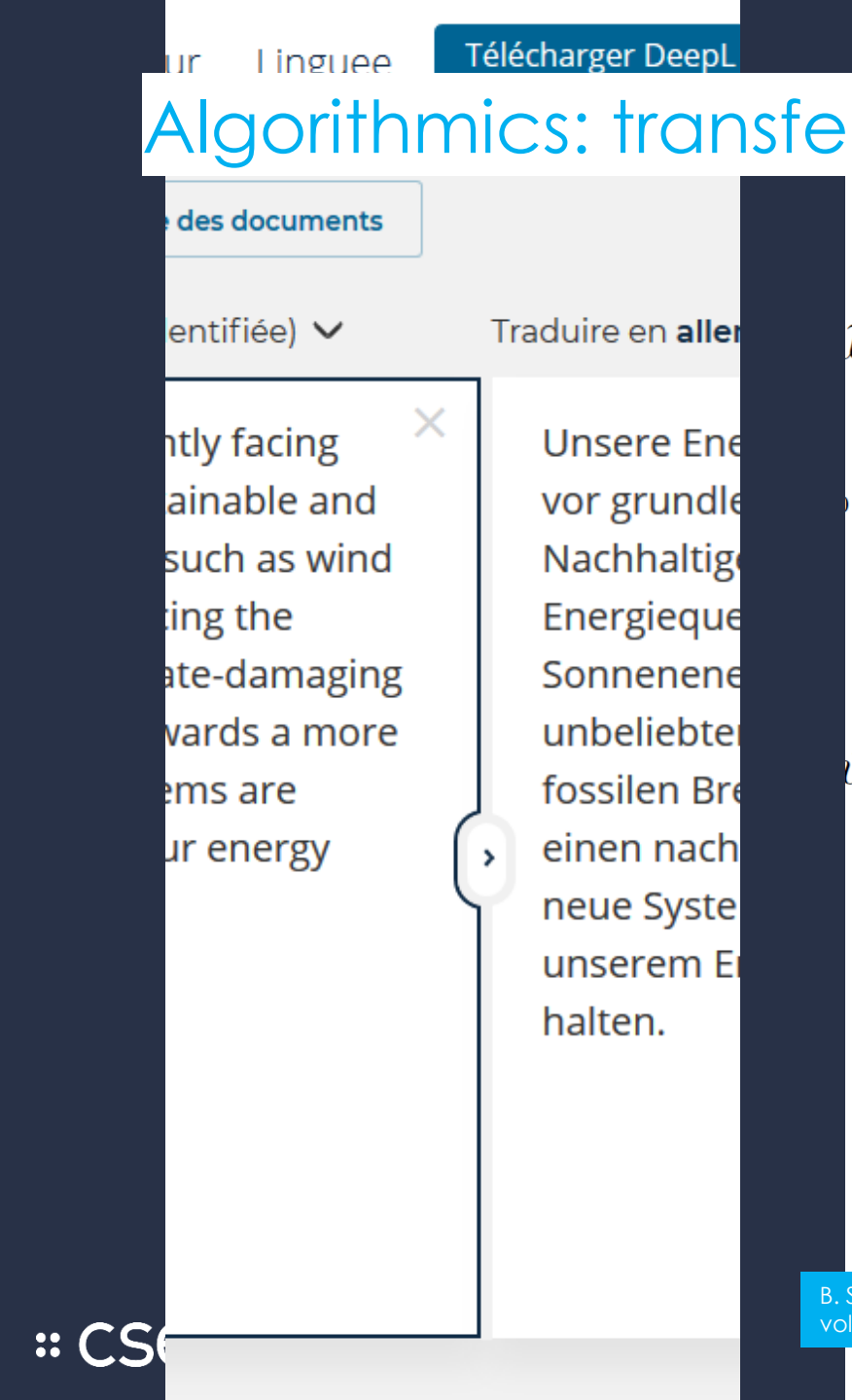
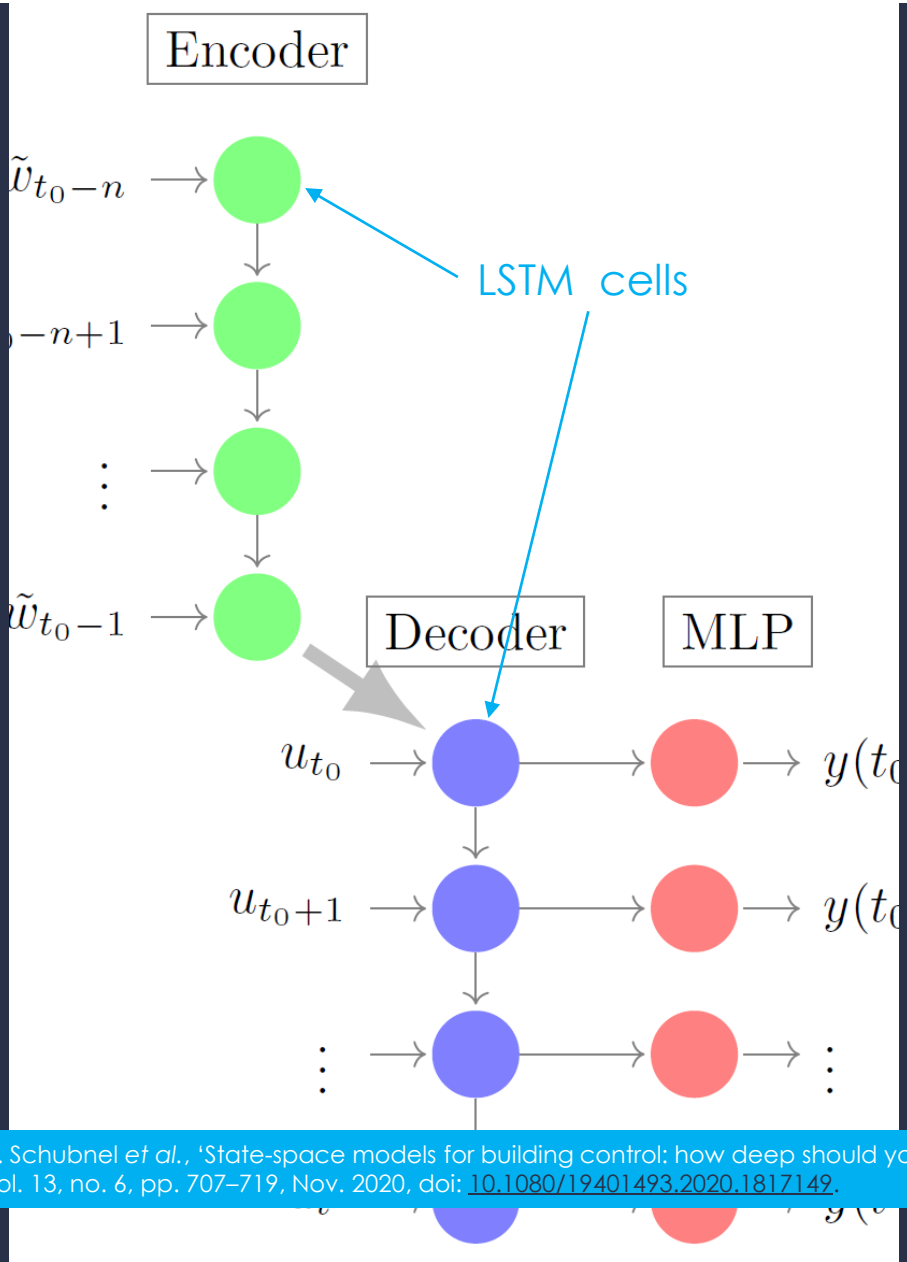
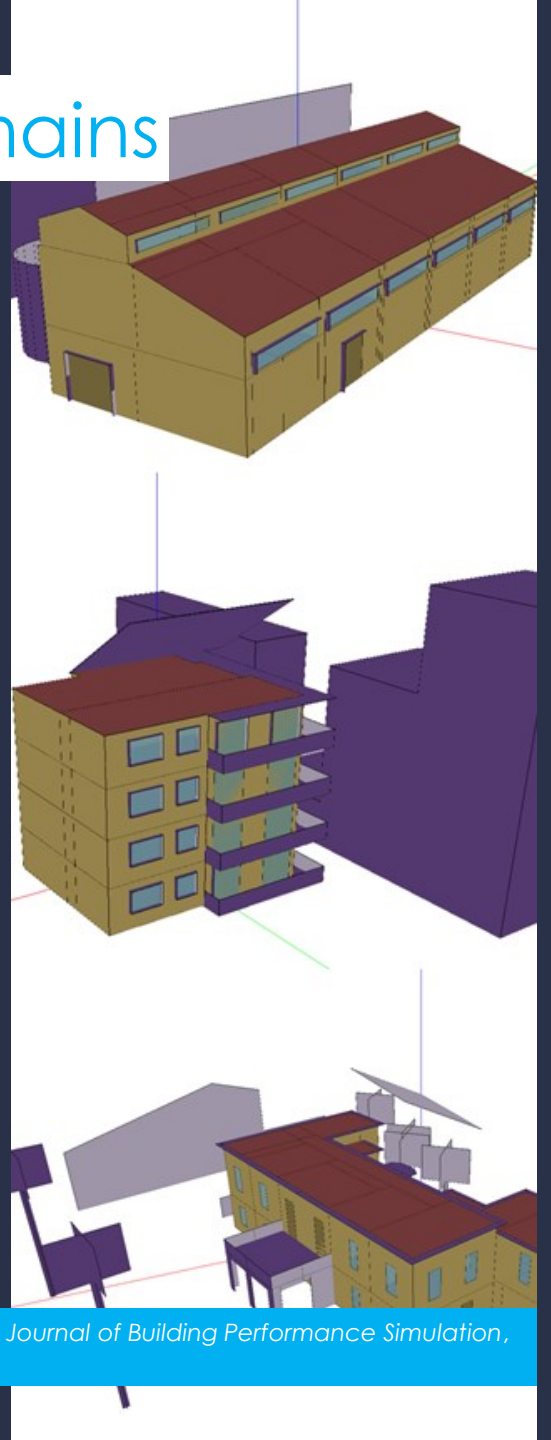
Algorithmics: transfer between application domains







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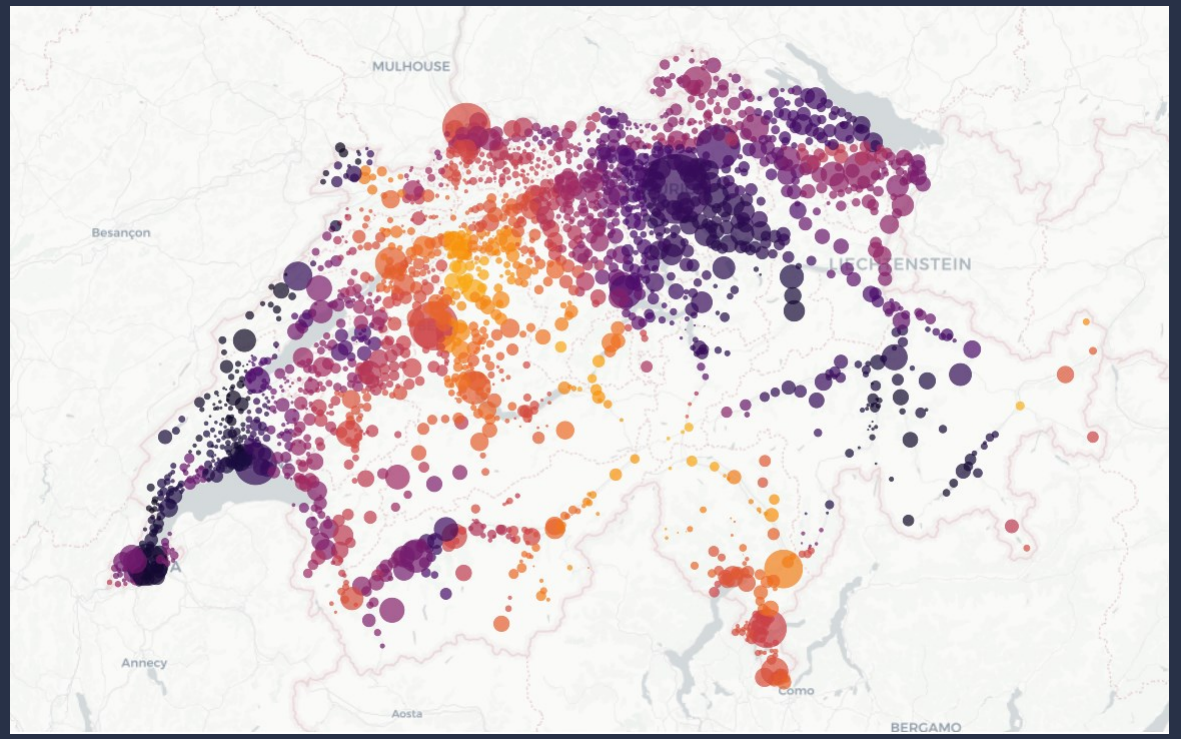
Use cases

- **Reducing** energy consumption
- Accommodating **more renewables** into the **grid**
- Getting more out of renewable generation **assets**

Challenges for integrating renewables in the grid

- Spatial distribution
- Random fluctuations of PV, wind
- Lower capacity factor



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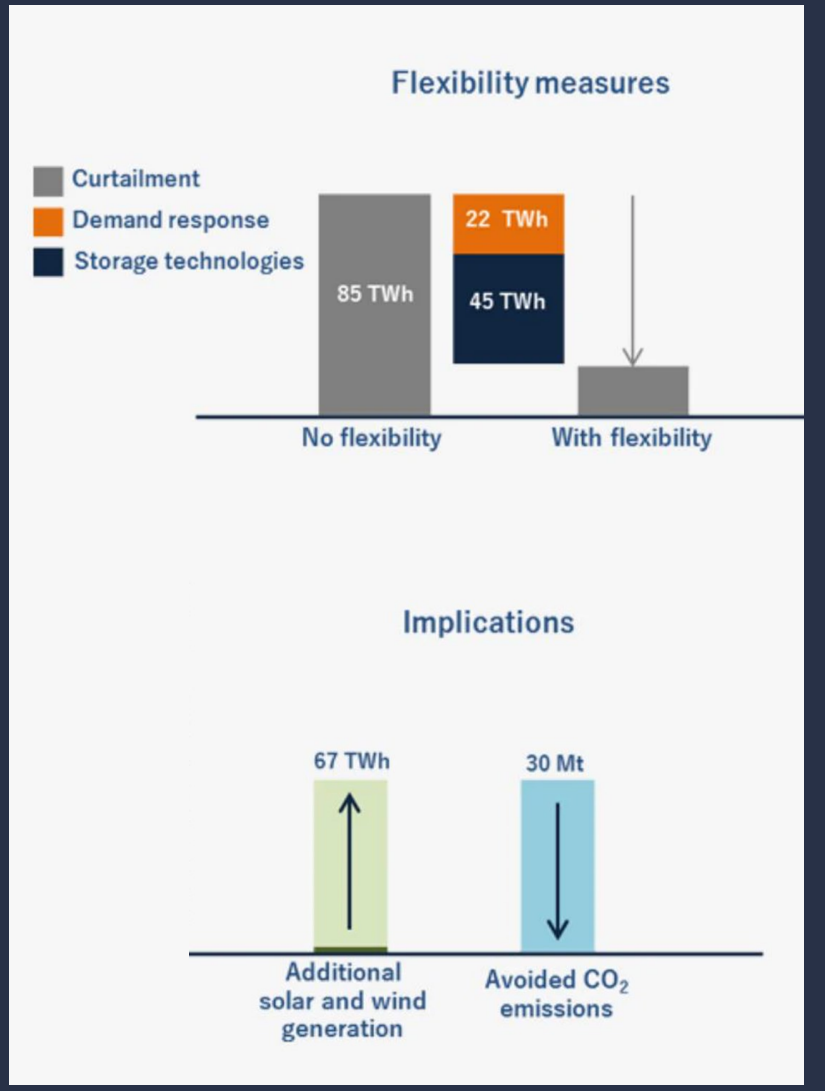
Data-driven solutions to **integrate renewables**

- Data-driven control for
  - Flexibility
  - Power quality
- Prerequisite: forecasting



Flexibility measures and their implications in the European Union in 2040; source: IEA (2017), Digitalisation and Energy, IEA, Paris https://www.iea.org/reports/digitalisation-and-energy

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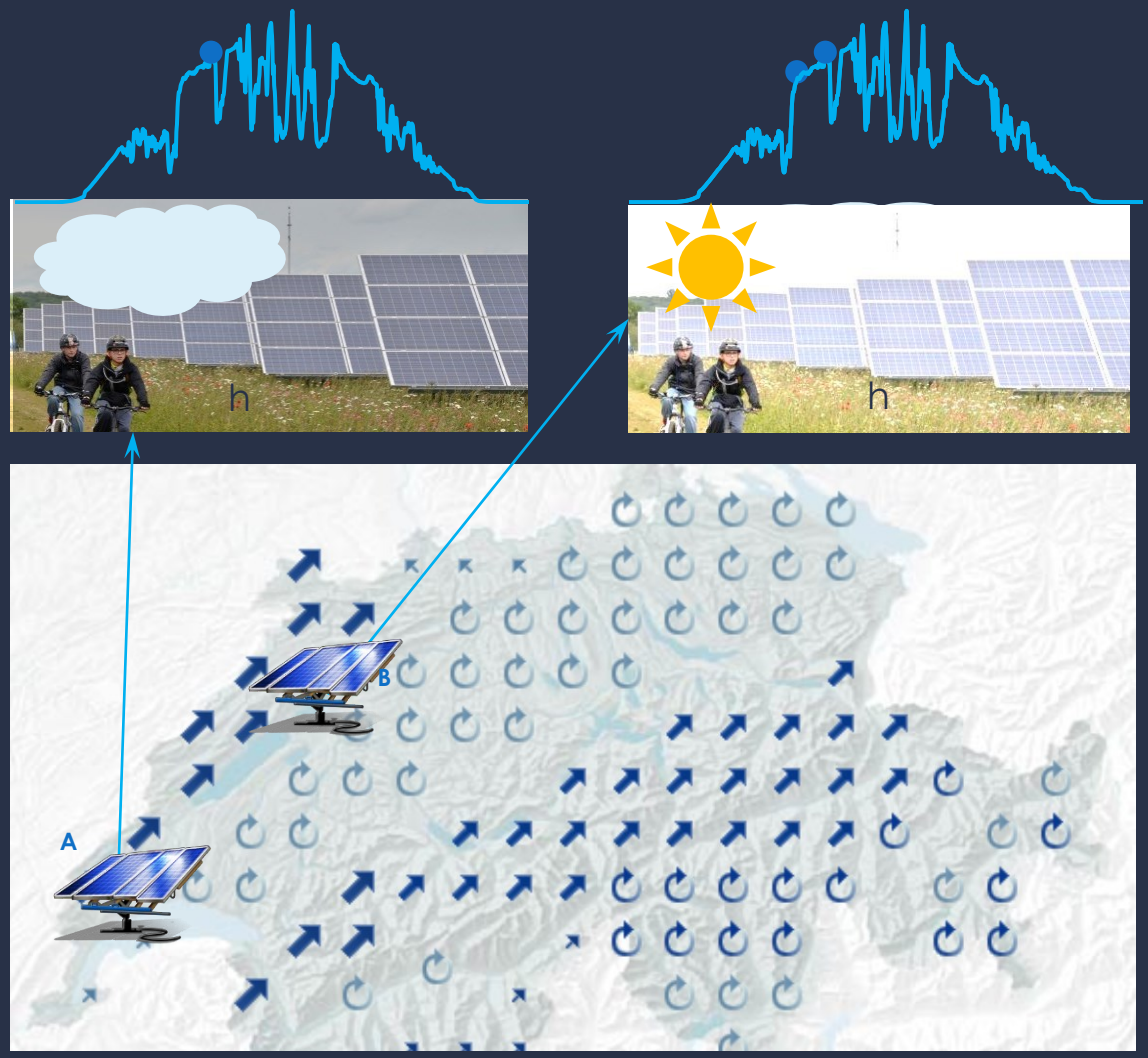
Data-driven **forecasting**: intuition

PV system ≈ weather station

Spatial correlation

↕

Temporal correlation



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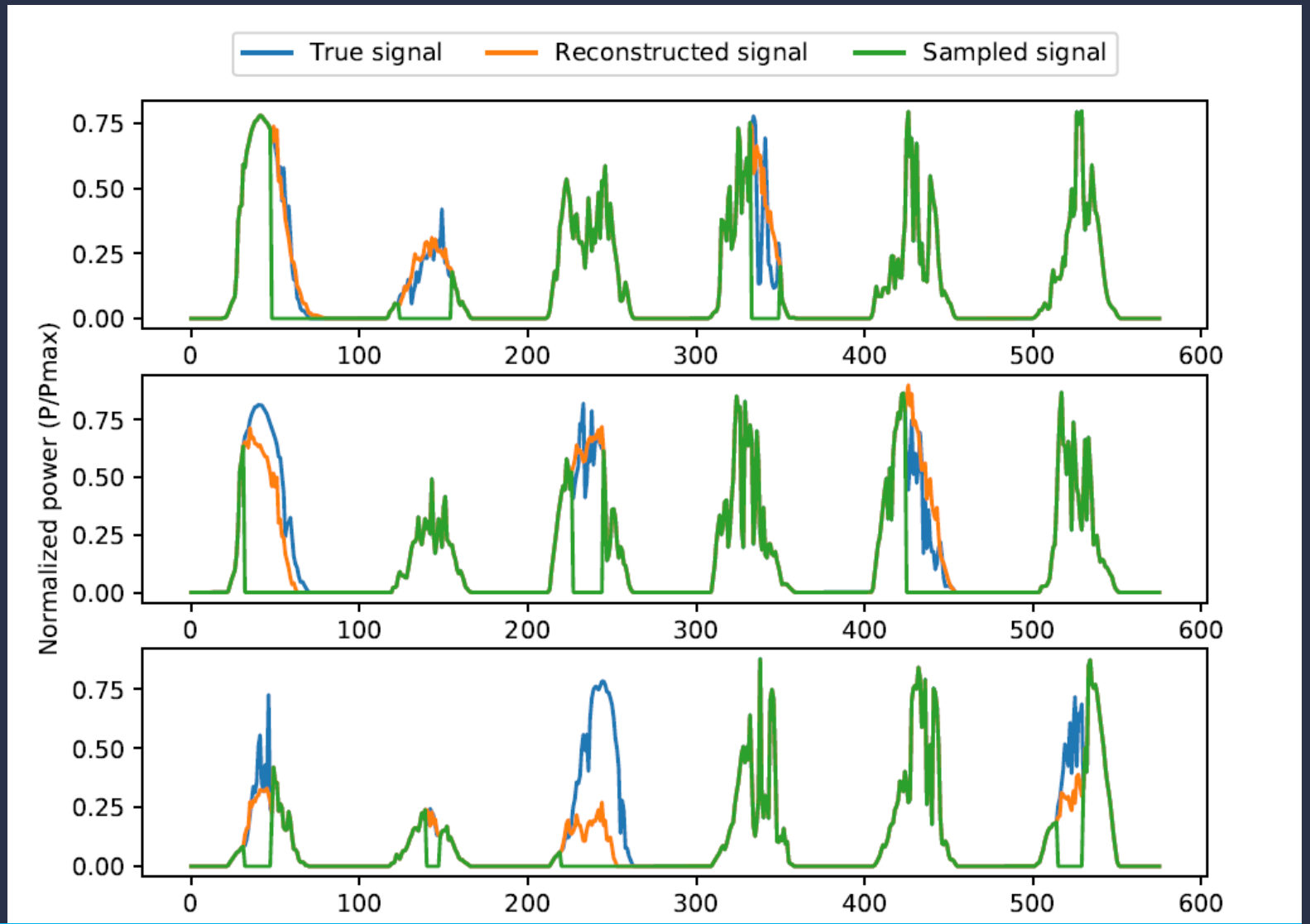
Data quality **challenge**

- Required for machine learning: clean and uninterrupted data
- Real life: incomplete, noisy data
- Solution for reconstruction?



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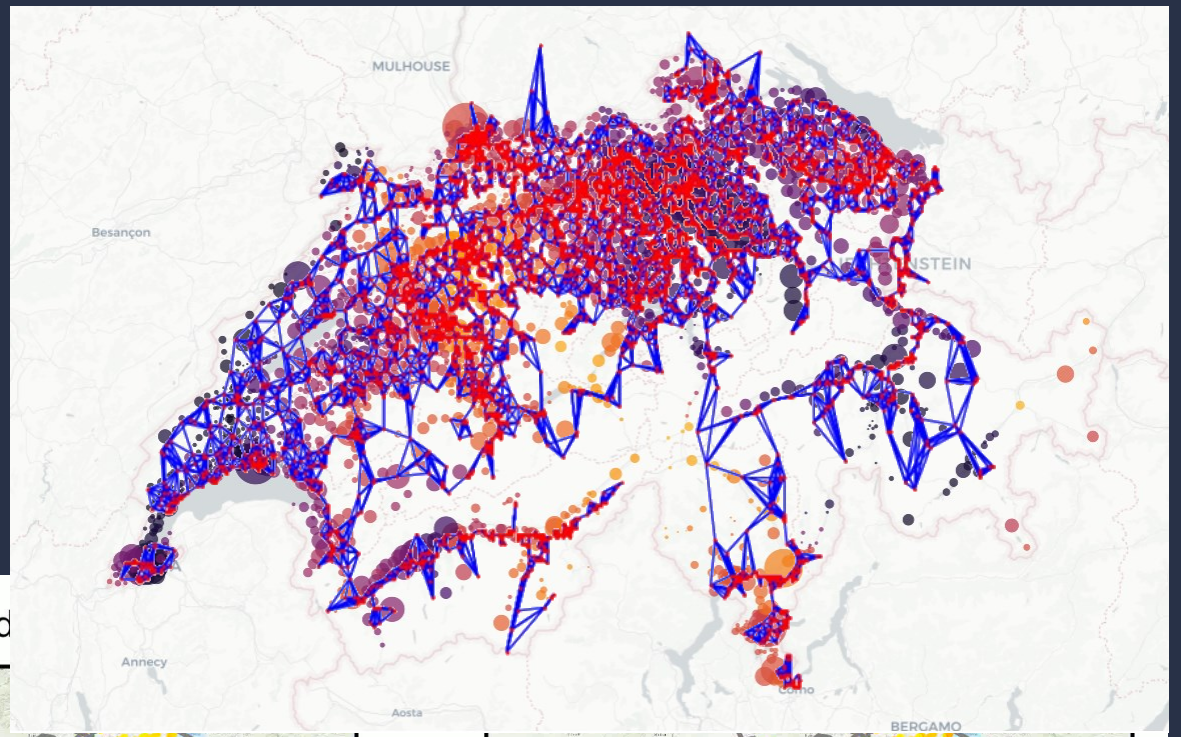
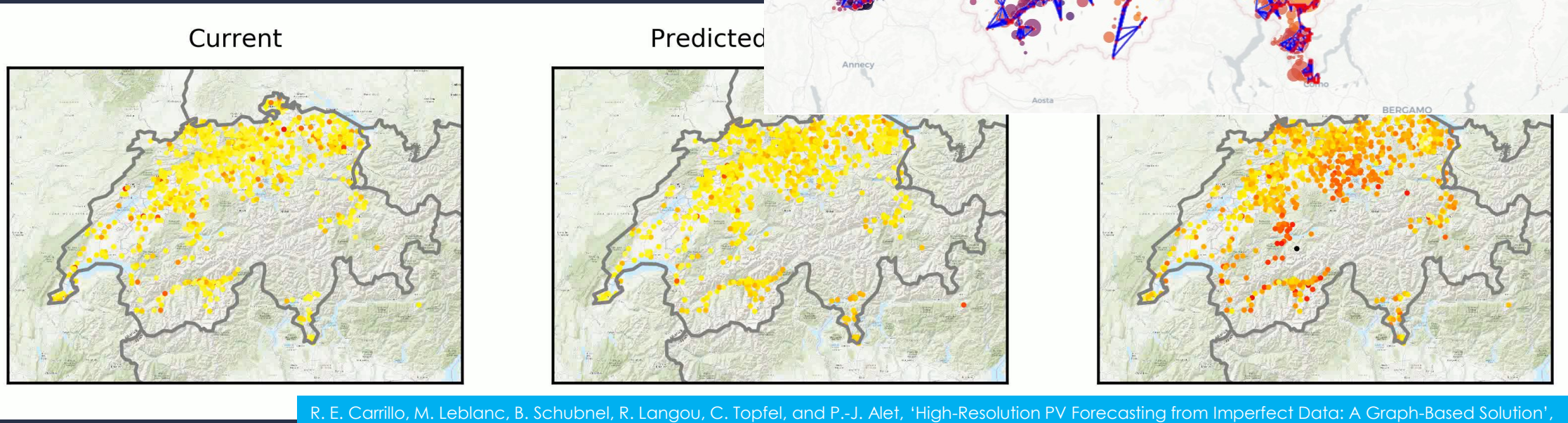
Data-driven **forecasting**: solution

- Graph machine learning (← social networks)
- High spatial and temporal resolution
- Beats numerical weather forecasts up to 5h ahead





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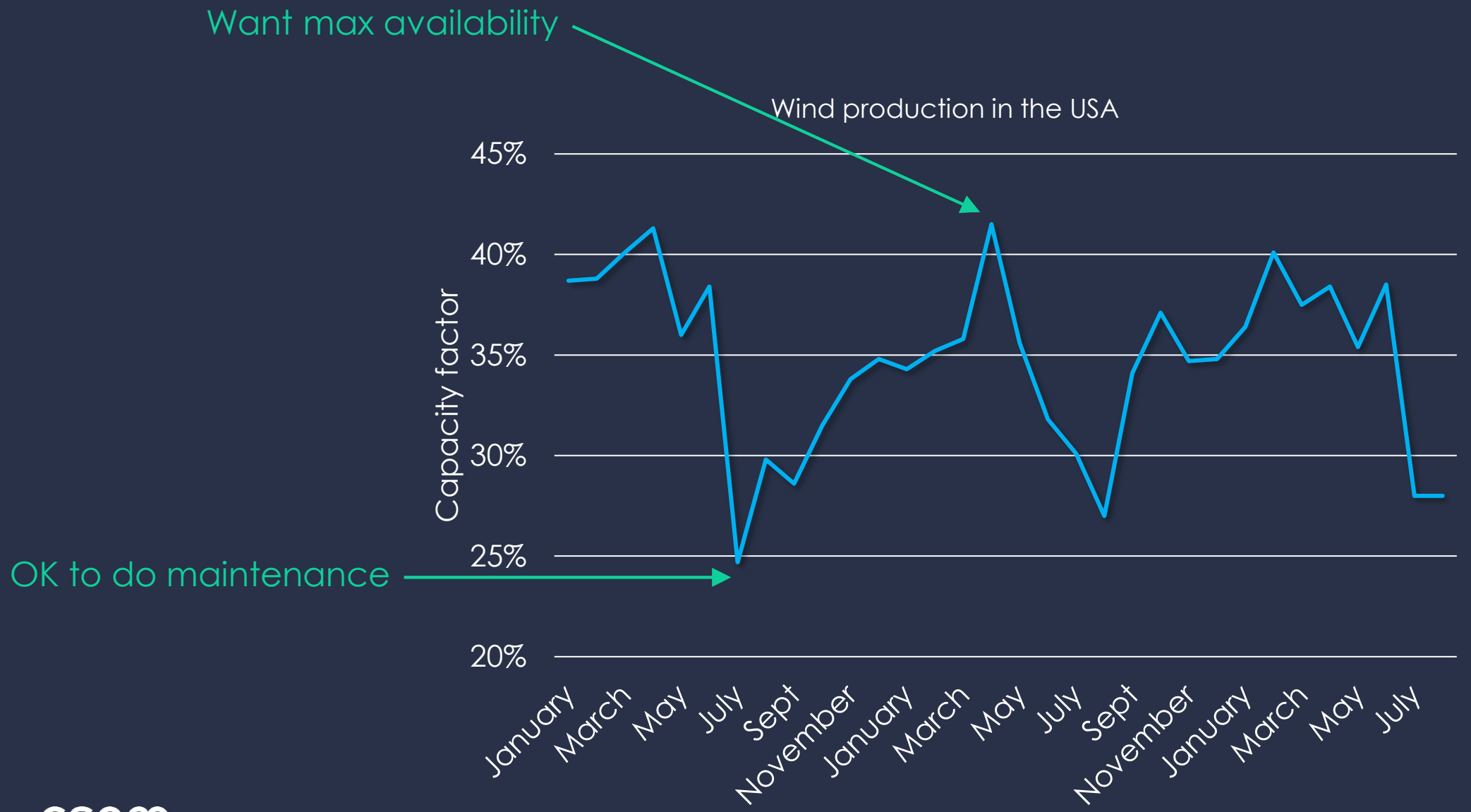
Getting more from renewable generation assets



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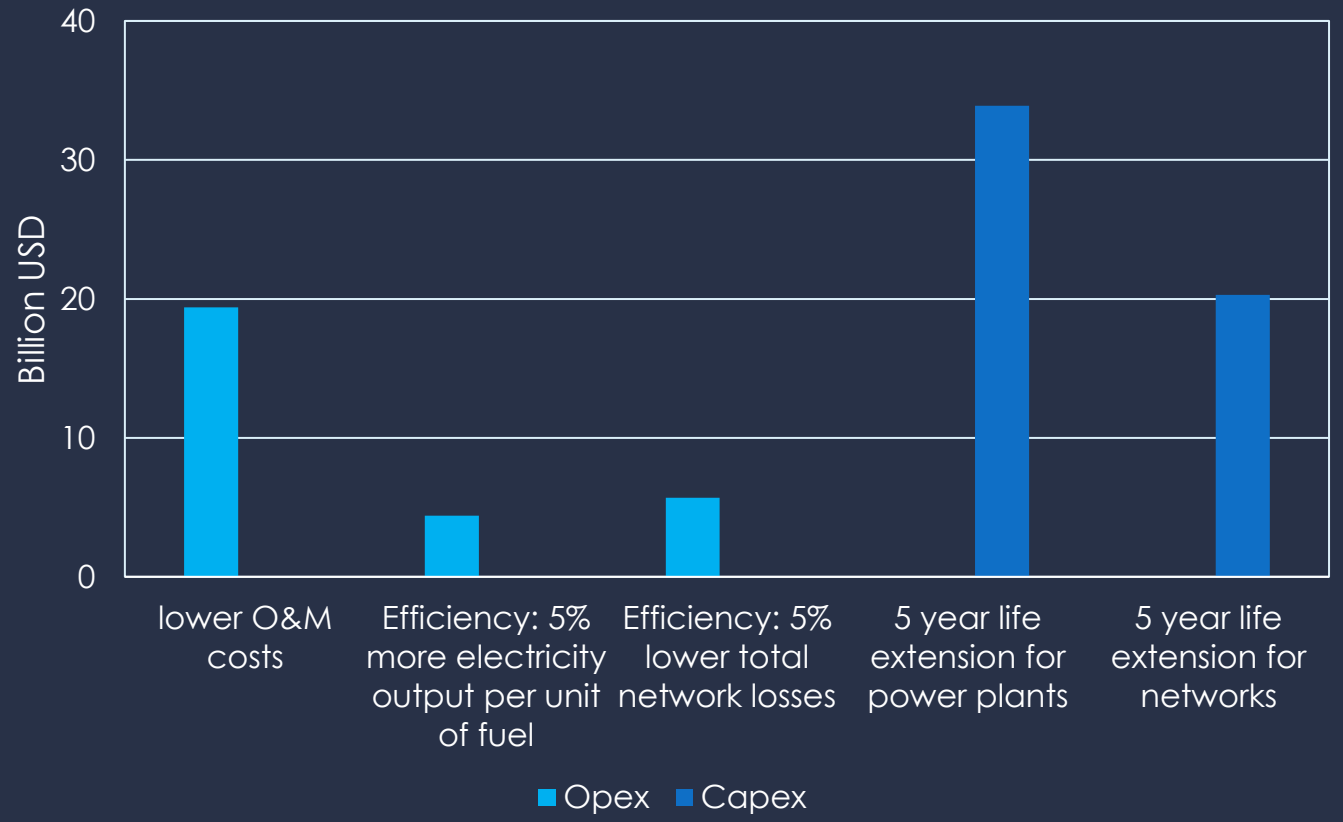
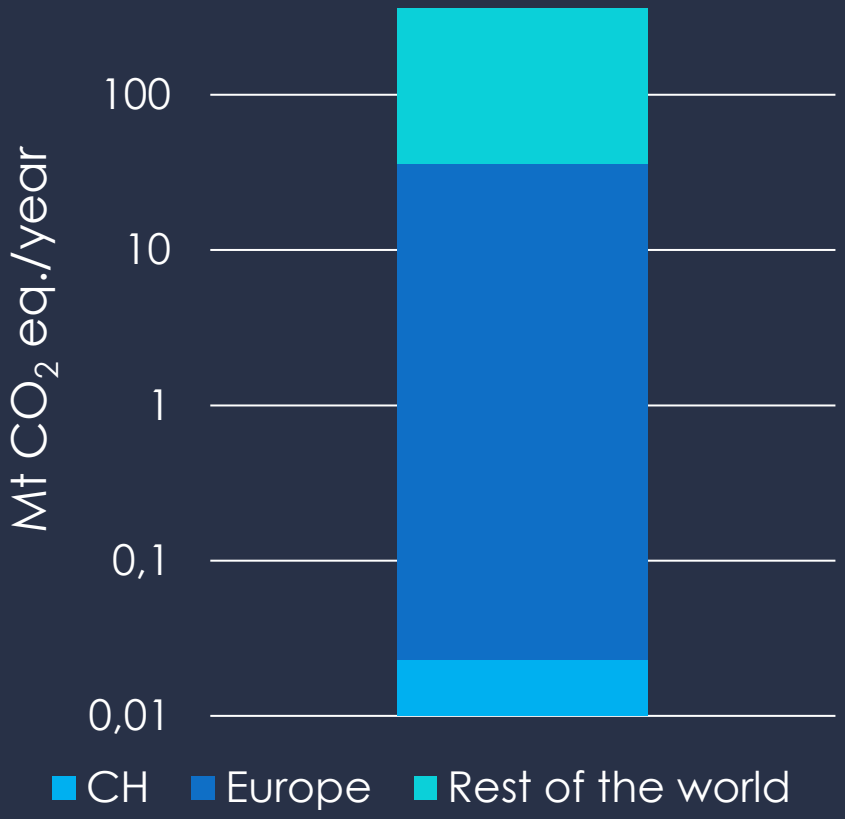
Asset management: impact

Worldwide cost savings from enhanced digitalisation in power plants and electricity networks over 2016-2040



IEA, Worldwide cost savings from enhanced digitalisation in power plants and electricity networks over 2016-2040, IEA, Paris https://www.iea.org/data-and-statistics/charts/worldwide-cost-savings-from-enhanced-digitalisation-in-power-plants-and-electricity-networks-over-2016-2040

Reduction in greenhouse gas emissions by 2040



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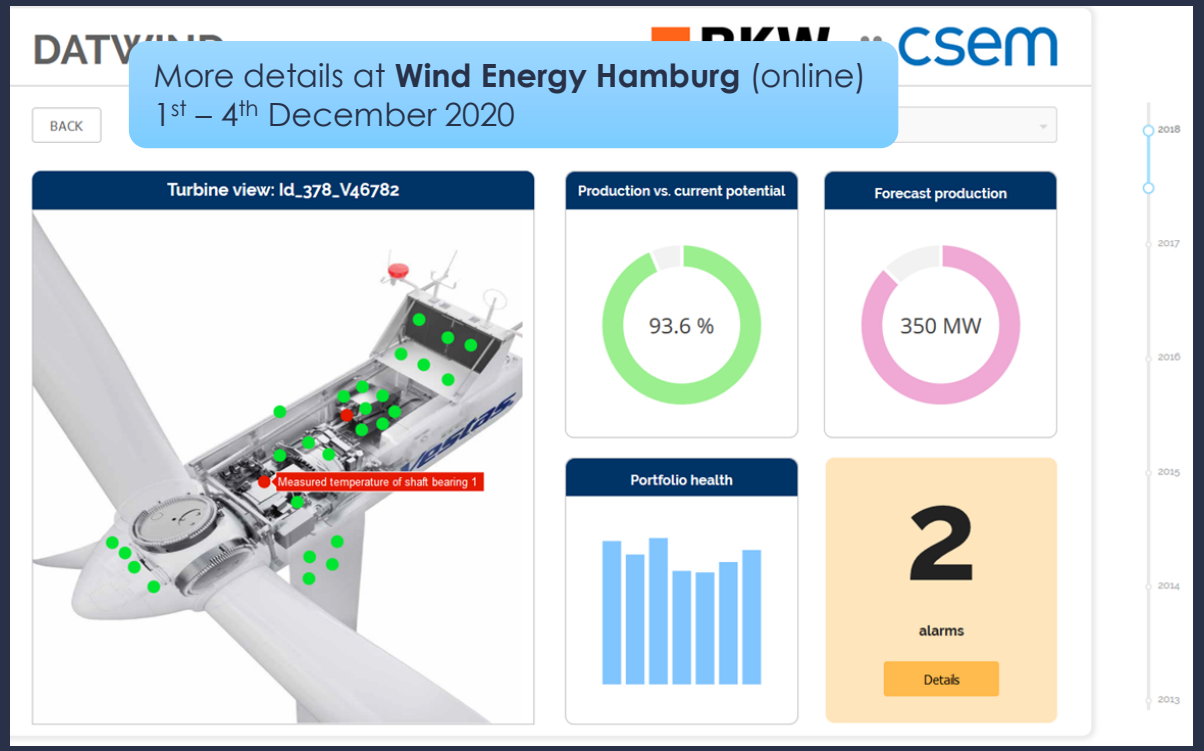
Asset management: solution

- Machine learning on historical data
- Intelligent alarm triggering:
  - Encoding of expert knowledge
  - Latest algorithms from research
- Successful validation on 3 parks
- Solution in productive operations in Switzerland, Italy, France, Spain

Direct collaboration with **BKW** and its subsidiary **Proxima Solutions**



Early software prototype

Conclusions

- Distributed renewables create **need** and **opportunities** for data science
- High economic and environmental potential through:
  - **Energy savings**
  - Improved grid integration (**forecasting**, flexibility, control)
  - **Asset management**
- **Transfer** from pioneer domains + **field expertise** → rapid **value creation**

For your application:

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P. Taddeo *et al.*, 'Management and Activation of Energy Flexibility at Building and Market Level: A Residential Case Study', *Energies*, vol. 13, no. 5, Art. no. 5, Jan. 2020, doi: 10.3390/en13051188.