Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

# Increased efficiency through the use of digital applications

## Input Speech BFH-Conference "Environment & Digitalisation

Prof. Dr. Andrea Vezzini

# About the Speaker


| | |
|---|---|
| Name: | Prof. Dr. Andrea Vezzini |
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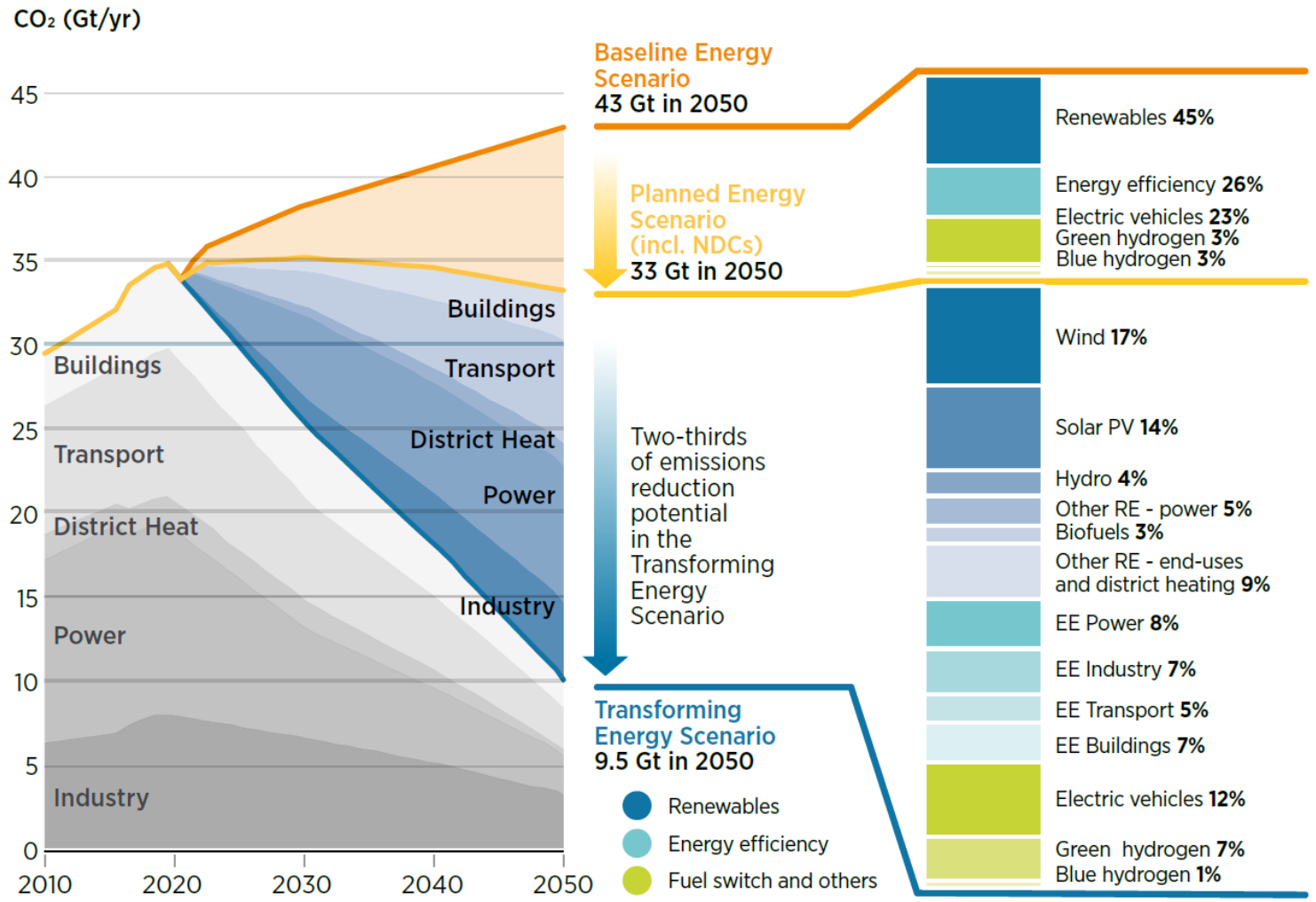
**Vita / Current Activities**

- Professor for Industrial Electronics since 1996 at Bern University of Applied Sciences
- Head of the BFH Energy Storage Research Center
- Deputy Head of the Swiss Competence Center for Energy Research “Mobility”
- Member of the Federal Energy Research Commission (CORE).
- Co-founder and Chairman of the Board of drivetek ag since 2002
- Co-founder and Member of the Board of Integrated Power Systems AG since 2009
- Co-founder and Chairman of the Board of ennos ag since 2016
- Inventor/Co-Inventor of 8/23 patents in the field of electric motor design and lithium-ion battery technology

# Big expectations on energy efficiency…




Annual energy-related $CO_2$ emissions in the Baseline Energy Scenario, the Planned Energy Scenario and the Transforming Energy Scenario, and mitigation contributions by technology in the three scenarios, 2010-2050

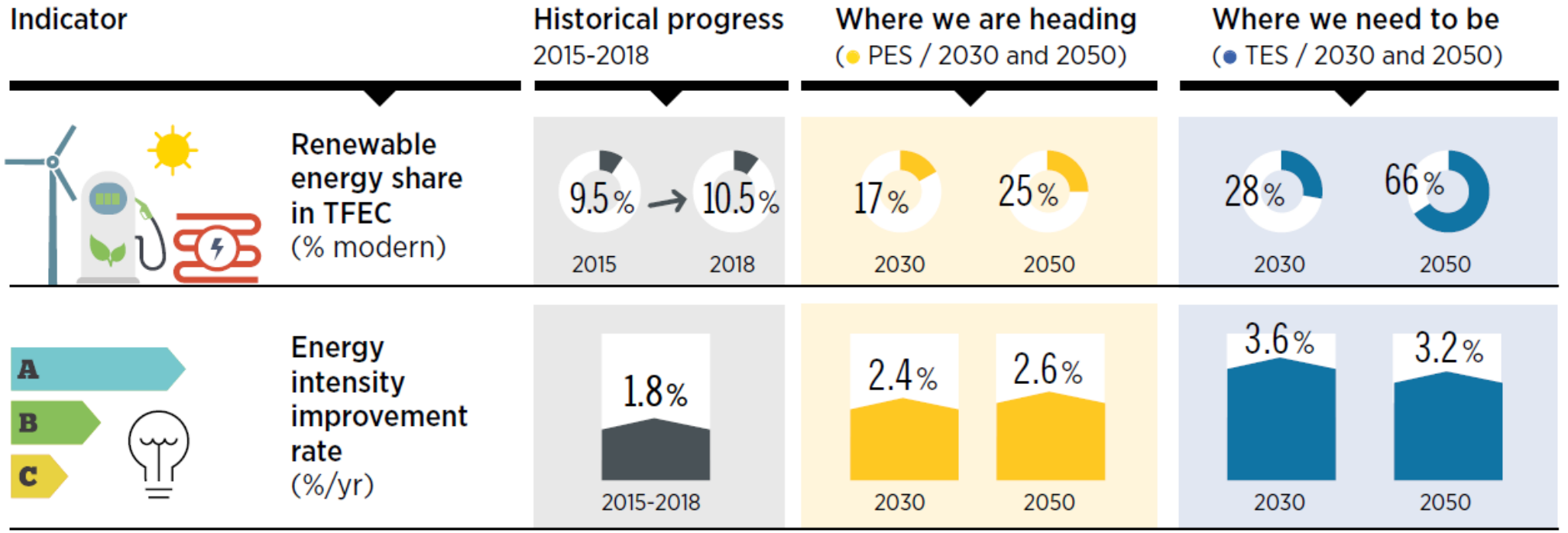
Renewables, energy efficiency, electric vehicles and hydrogen can provide bulk of necessary emissions reductions by 2050



Source: IRENA, 2020

# Energy efficiency improvements must be scaled up rapidly and substantially.

- Energy efficiency and renewable energy are the two key solutions to enable the global Energy Transformation, together they offer over 90% of the mitigation measures needed to reduce energy-related emissions in the Transforming Energy Scenario.






Source: IRENA, 2020

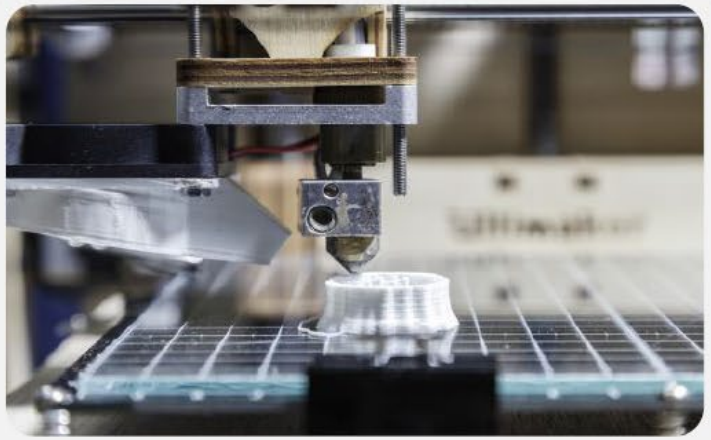
# Digitalization can accelerate and scale up end-use efficiency…

**Transport**

- Key digital trends across all modes: connectivity, sharing, and automation
- Digital solutions for trucks and logistics could reduce energy use for road freight by 20-25%

**Buildings**

- Smart building controls will improve comfort and transform building energy use
- Globally, buildings energy use could be reduced by 10% to 2040



**Industry**

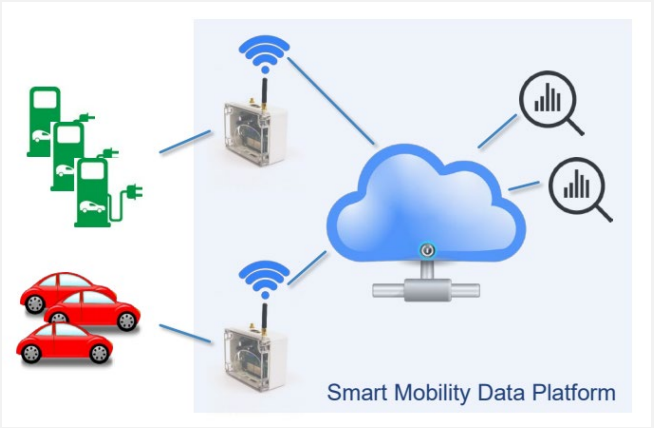
- Digital energy management systems enable real time data and control
- Plant level savings in the region of 10 – 20% of energy use (just through optimization)

- Digitalization has the potential to reshape, modernize, transform demand-side sectors.
- Policies are essential to maximize benefits and reap energy saving opportunities.



Source: IEA

# BFH-Zentrum für Energiespeicherung

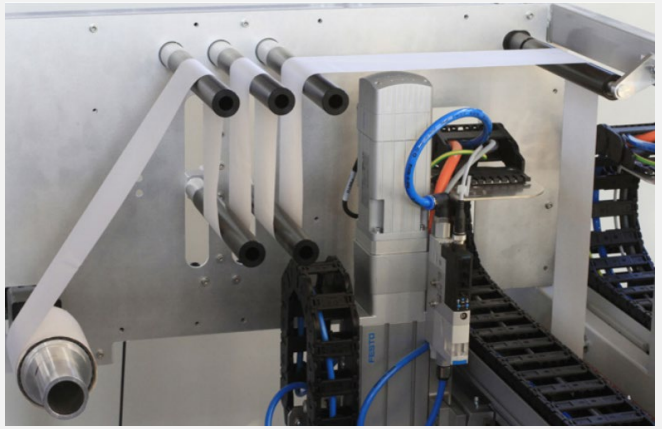



**Smart Mobility Data Platform**

- Field test analyzing the real use of electric vehicles, batteries and charging stations in Braunwald
- This is done by respecting user privacy, under harsh and changing environmental/seasonal conditions
- Prof. Peter Affolter

**Prosumer-Lab**

- The Prosumer-Lab test environment simulates modern prosumer households in the laboratory in order to be able to test system components realistically and reproducibly
- Prof. Michael Höckel



**Battery Production Research**

- Production and optimization of batteries, including material synthesis, electrode production, cell production, battery pack, testing and diagnostics
- Prof. Axel Fürst

▸ www.bfh.ch/energy

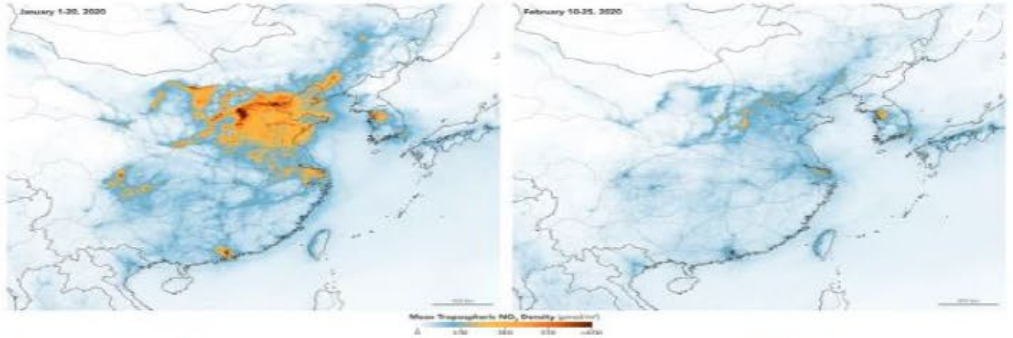
# Challenges

- "Many companies already have complex measurement infrastructure and vast amounts of data, but don't actually know how to generate added value from it."
- "Under a best-case scenario of improved efficiency through automation and ride-sharing, automated driving technologies could halve the energy use  compared with current levels. Conversely, if efficiency improvements do not materialize and rebound effects from automation result in substantially more travel, energy use could more than double."
- "The pace of digitalization in the energy sector may potentially outpace cyber defense and digital management capabilities, resulting in greater exposure to risk."

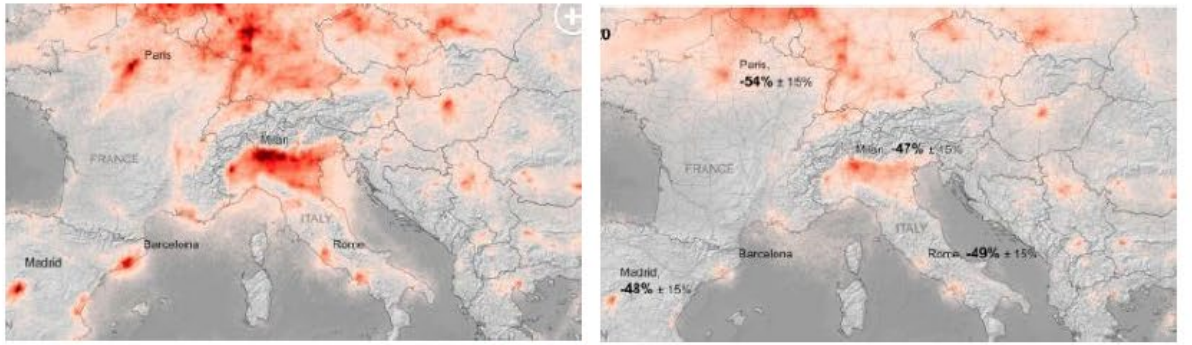
# COVID-19: the unexpected road to decarbonization

A worldwide drastic reduction in air pollution; Nitrogen Dioxide ($NO_2$) in particular, with concentrations across all impacted countries dissipating rapidly

China



Europe




New Delhi

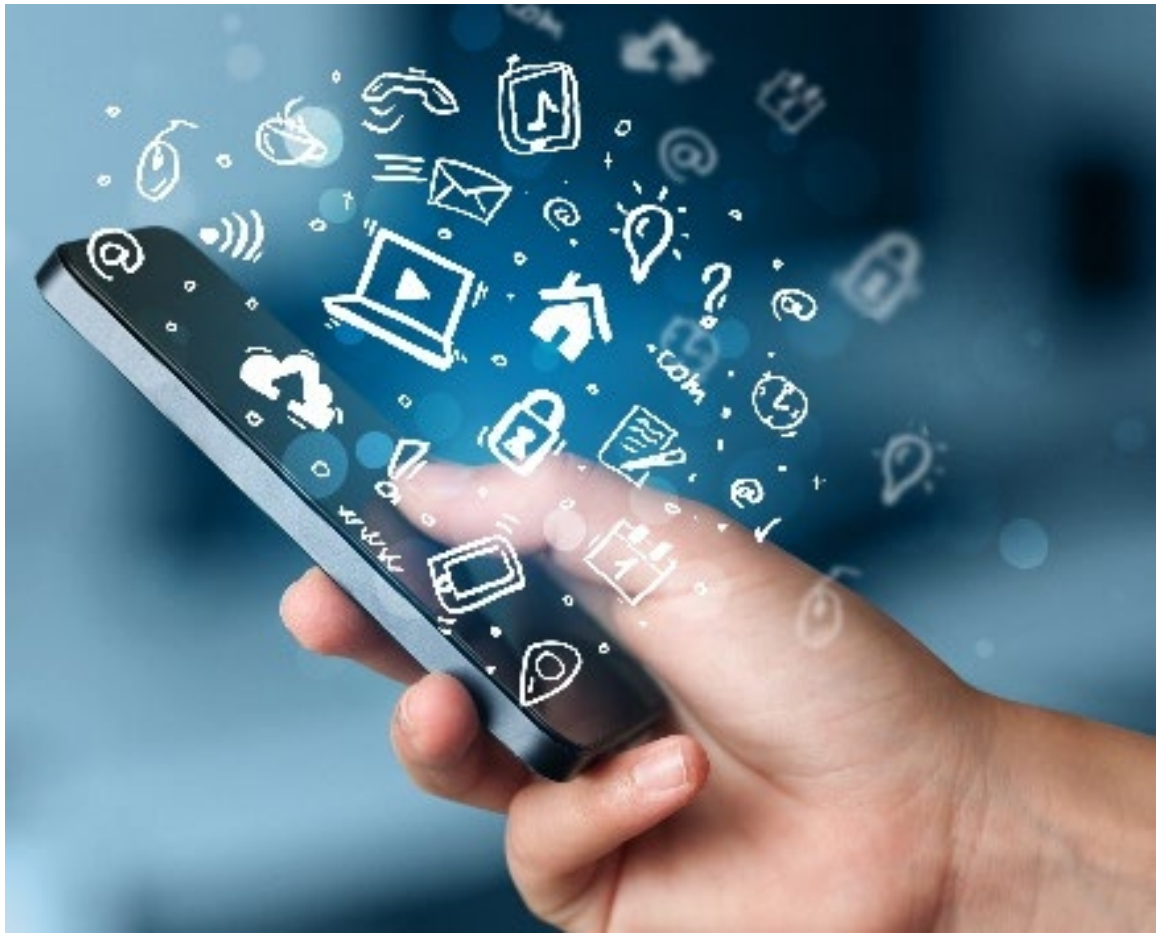
Wuhan

London

Source: Wood Mackenzie

# Corona crisis brings digitalization push

More than two thirds of the IT service providers organized in the edna Bundesverband Energiemarkt & Kommunikation (Federal Association of Energy Market & Communication) expect the corona crisis to ignite the "digitalization turbo" in the energy industry.



Source: www.smarterworld.de

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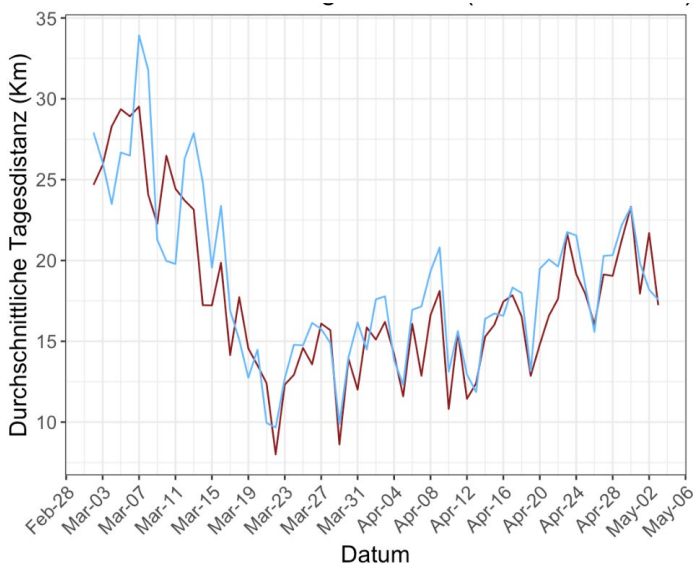
# Questions?

## Input Speech BFH-Conference "Environment & Digitalisation

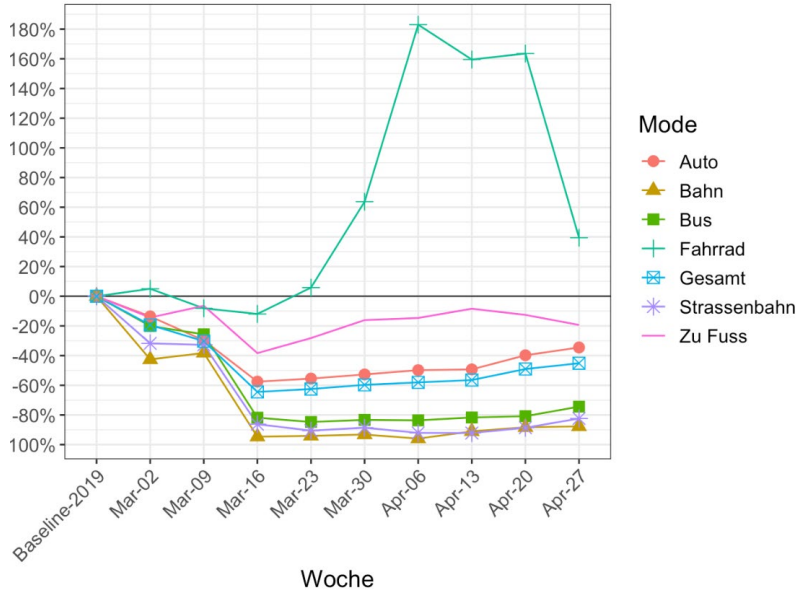
- Bern University of Applied Sciences – Prof. Dr. Andrea Vezzini

# MOBIS-COVID19/04

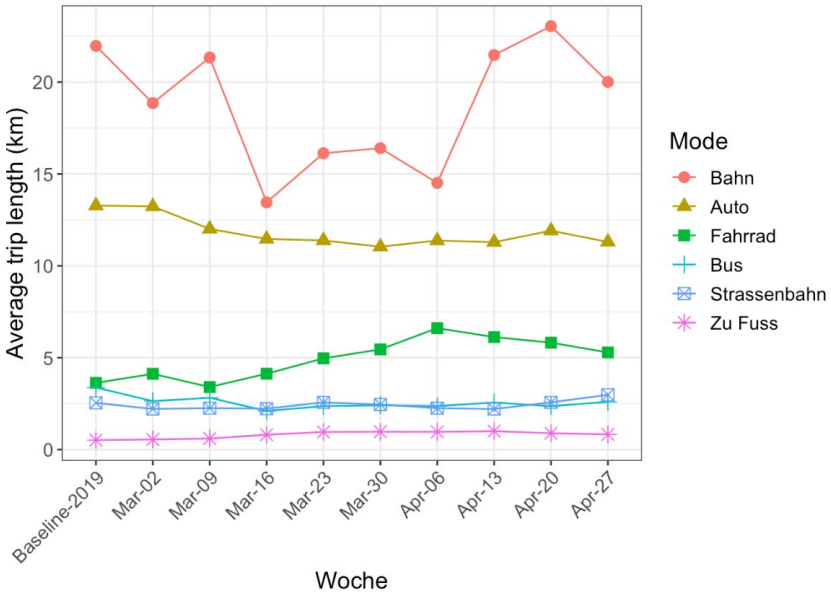
A project of IVT, ETH Zurich and WWZ, University of Basel. Over 1200 active participants during the period of the measures to control the spread of coronavirus




Average daily distance



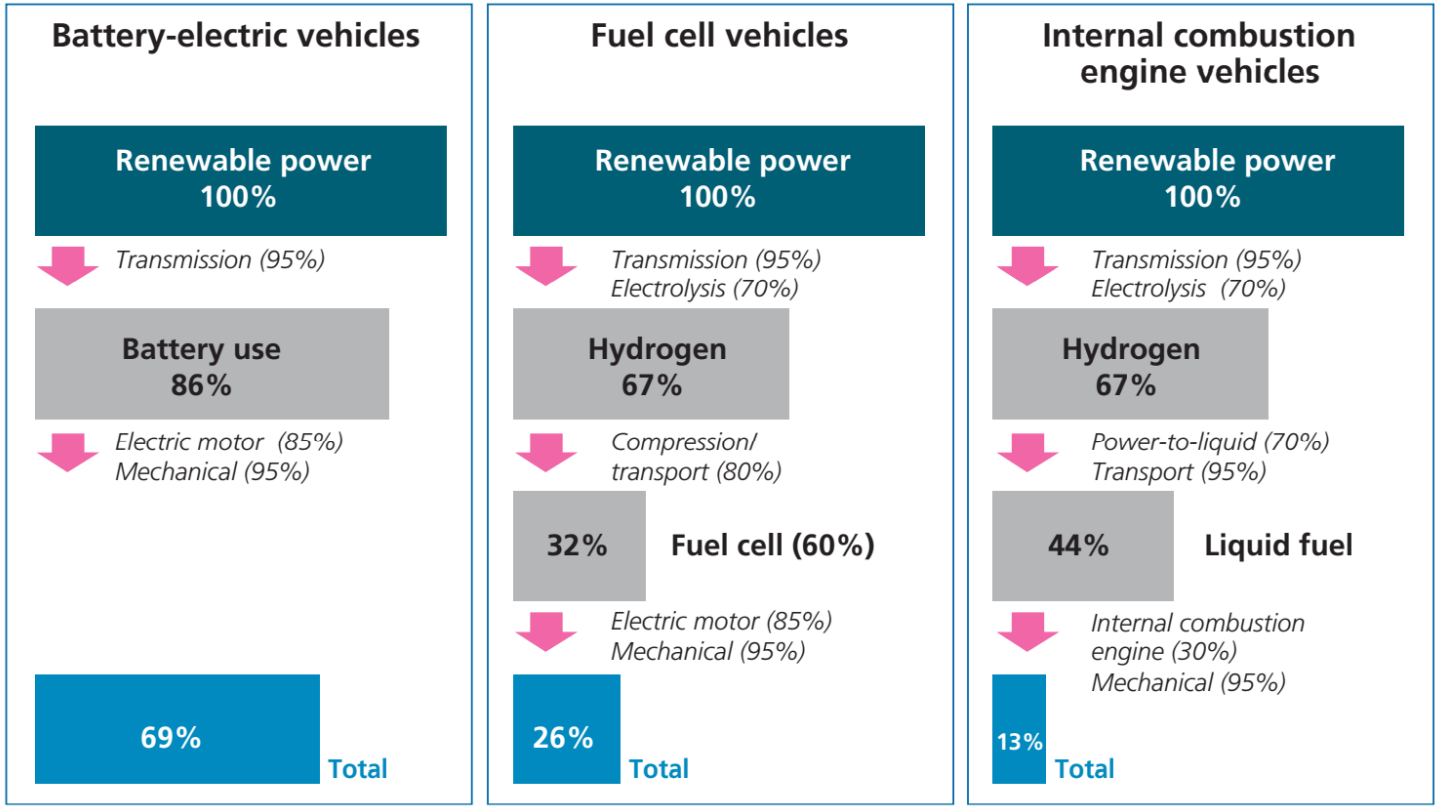

Change in kilometers travelled by means of transport




Average route length by means of transport (km)

# Decarbonisation of transport: options and challenges

## Conversion efficiency comparison for electricity used in BEVs, FCEVs and synthetic fuel ICEs. (Redrawn from figure 5 in Nationale Akademie der Wissenschaften Leopoldina et al. 2017.)



# 2020 is shaping up to be a lost year for all automakers and EVs will take the brunt of the damage

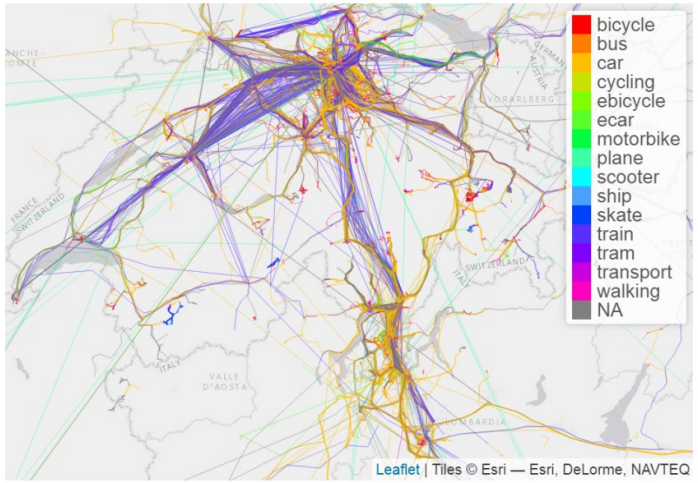
## Wood Mackenzie projects a 43% reduction in EV sales for 2020 compared to 2019 against a prior projection of a 30% increase

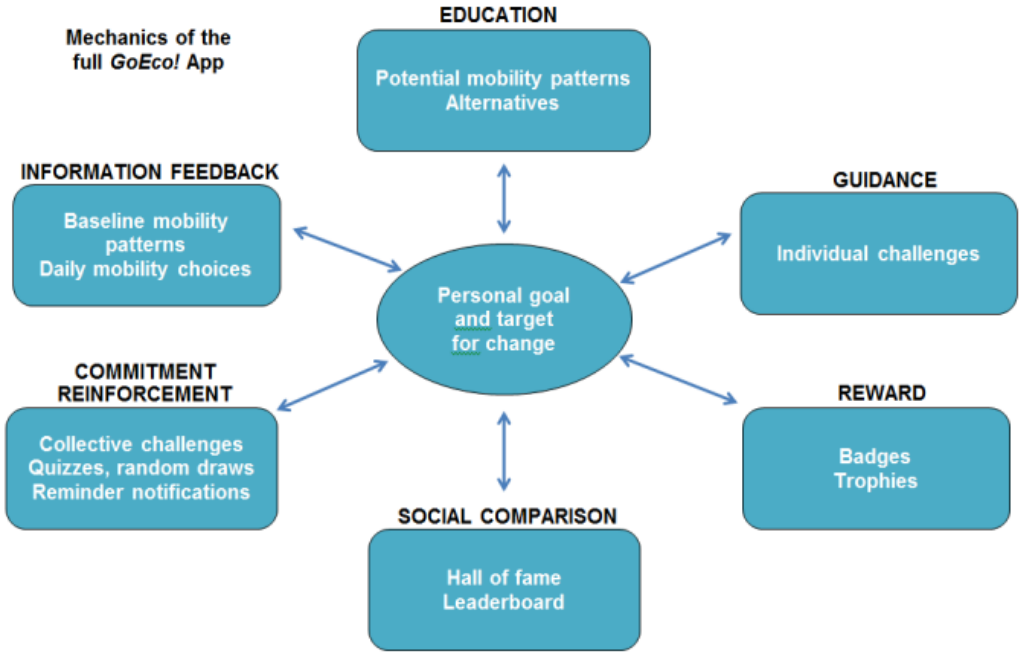
- China projected to reach 2019 YoY numbers by November with EU following by December
- US and rest of the world projected to trail 2019 sales by up to 30% by end of the year
- Oil price collapse will likely not have a direct impact on retail EV adoption, will delay fleet adoptions
- Long-term goals of carbon neutrality stronger, especially in EU, as a direct result of the crisis
- Pandemic has made organizations reevaluate globalized supply chain, it certainly appears more vulnerable than ever before

Source: Wood Mackenzie

# A Set of Smartphone Apps Supporting the Transition Towards Sustainable Mobility Patterns

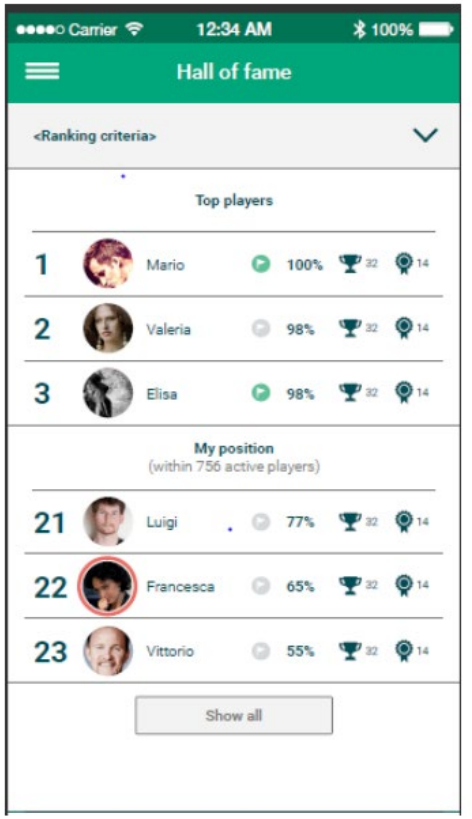
The activities GoEco! tracked from the 359 members of the GoEco! Community during the first study period, from March 7, 2016 to April 4, 2016.




Components of the GoEco! motivation mechanics

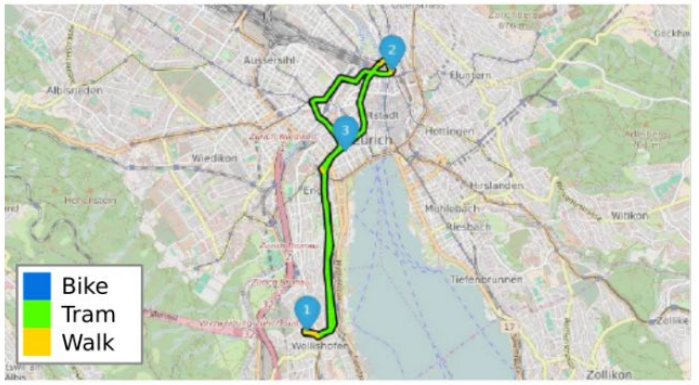
The “Hall of fame” section in the GoEco! App



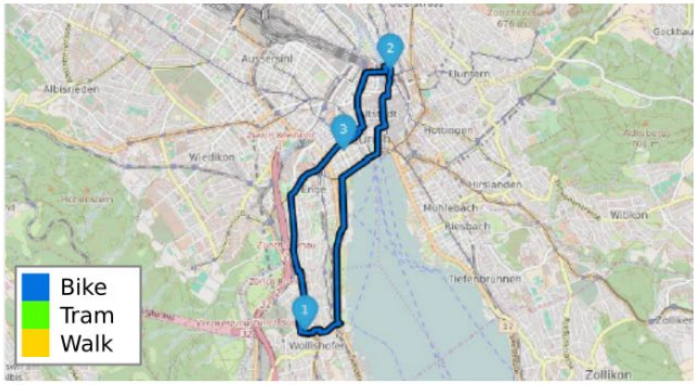

Francesca Cellina, Dominik Bucher, Martin Raubal, Roman Rudel, Vanessa de Luca, and Massimo Botta. GoEco!–A set of smartphone apps supporting the transition towards sustainable mobility patterns. Change-IT Workshop at ICT for Sustainability (ICT4S), 2016.

# Framework for Geographic Information Collection, Processing and Visualization to Promote Sustainable Mobility Behaviors

- View of the alternative for a systematic loop as displayed in the eco-feedback report. On the left is the original loop, on the right the alternative.
- The modal choice of a single user, as identified based on six weeks of monitoring using a tracking app (A), and the modal choice suggested in the provided eco-feedback (B). Next to each figure, the average weekly traveled distances are shown.

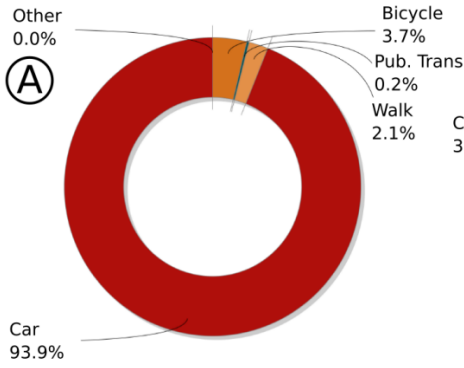


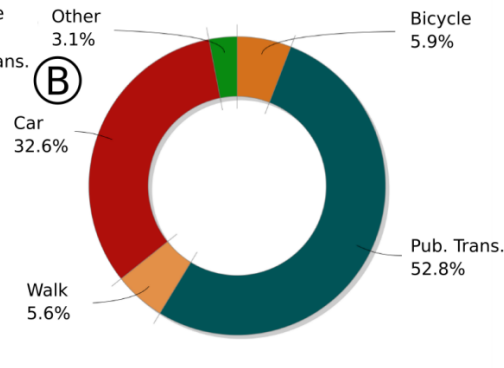

| | |
|---|---|
| Length | 11.35 km |
| Energy Consumption | 3.29 kWh |
| $CO_2$ Emissions | 0.28 kg $CO_2$ |
| Average Traveling Time | 1h 0min |
| Means of Transport | Walk, Tram |




| | |
|---|---|
| Length | 9.55 km |
| Energy Consumption | 1.72 kWh |
| $CO_2$ Emissions | 0.18 kg $CO_2$ |
| Average Traveling Time | 0h 48min |
| Means of Transport | Bike |

| **Distances** [km] | |
|---|---|
| Car | 396.1 |
| Bicycle | 15.6 |
| Pub. Trans. | 0.8 |
| Walk | 8.9 |
| Total | 421.8 |




| **Distances** [km] | |
|---|---|
| Car | 98.4 |
| Bicycle | 17.8 |
| Pub. Trans. | 159.4 |
| Walk | 16.9 |
| Other | 9.4 |
| Total | 301.8 |

Dominik Buchera, Francesca Mangilib, Francesca Cellinac, Claudio Bonesanab, David Jonietzd, MartinRaubal
From location tracking to personalized eco-feedback: A framework for geographic information collection, processing and visualization to promote sustainable mobility behaviors. Preprint submitted to Elsevier, 2019.