IFAB– Institute For Applied Fire Safety Research

New Energy Carriers (NEC) and Related New Risks for Underground Facilities – Possibilities for Water Mist Industry (SUVEREN Research Project)

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Content of presentation

- **Framework:**
  - Vehicle development
  - NECs and Vehicle automation
  - New fire risks
- **SUVEREN Research Project:**
  - Background
  - Status Quo / Future
  - Fire suppression / Water mist
- **Conclusions**

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New Vehicles and Fire engineering

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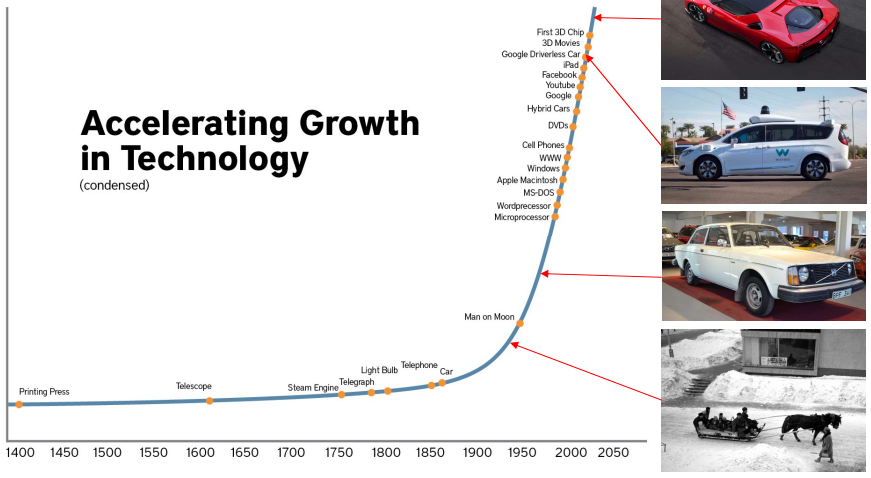
Technology development in transportation (and others)



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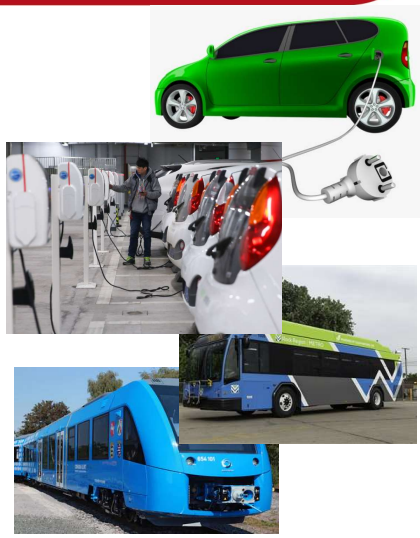
Major trends - NECs

- **NEC**
  - **N**ew **E**nergy **C**arrier
    - Electric
    - Hydrogen / fuel cells
    - CNG
    - LPG
    - Or combination of those even with conventional combustion engine



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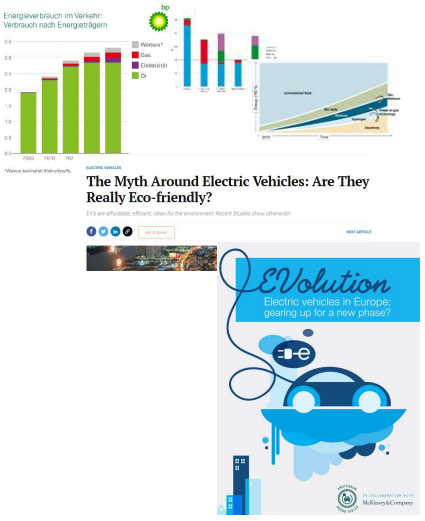
Major trends - NECs

- **NECs:**
  - Sustainable?
  - Environmental friendly?
  - Political?
- **Facts:**
  - Use of NECs increases very rapidly
  - Not harmonised laws between countries or continents



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Major trends – Autonomous Vehicles

- **Automatisation of vehicles has increased and become more reliable:**

2009

2018

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Autonomous vehicles

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New (current) challenges

- **Vehicles are changing to new (alternative) energy sources (NECs)**

Impact to fire engineering

- **Vehicles are becoming autonomous very rapidly (AVs)**

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New Fire Risks?

Batteries

- **HRR**
  - Battery design, capacity and state of charge (SOC)
- **Extinguishing methods**
- **Toxic gases**
  - e.g. hydrogen fluoride, heavy metals
  - Release before fire
- **Additional risks for fire services**
  - High voltage
  - Extinguishing
  - Re-ignition

Pressurized Gas
Liquid Biofuels

- **Jet flame / pool fire**
- **Flammable mixture**
  - deflagration, explosion
- **Oxygen displacement**
- **Equipment**

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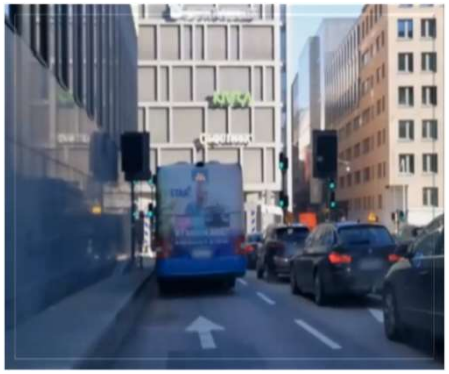
New Fire Risks?

Batteries

Pressurized Gas
Liquid Biofuels



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SUVEREN Research Project

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SUVEREN Research Project

SPONSORED BY THE
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SUVEREN

„Safety of Urban Underground Structures when Using New Energy Carriers“

BAM FOGTEC FIRE PROTECTION STUVA

Associated Partners

INERIS
CETU
DB Station & Service
Feuerwehr München

Sub-Contractors

INERIS Développement
IFAB

Timeframe: 3 years

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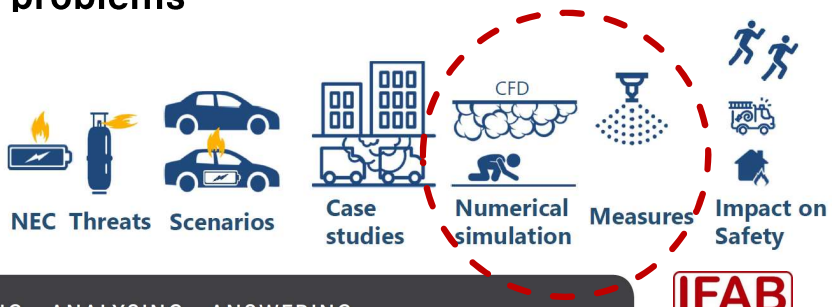
- **Focuses on the fire risks of NECs in underground spaces (confined)**
- **Basic/applied research for developing tools and knowledge to tackele fire risk problems**



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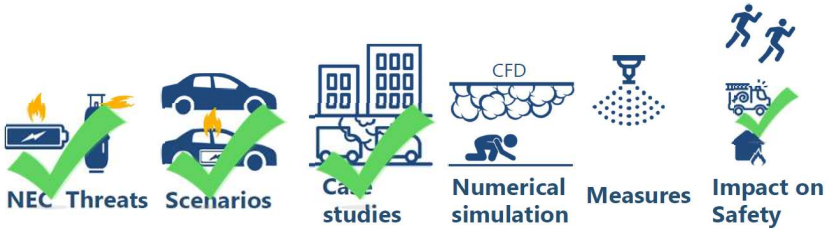
- **STATUS QUO:**
  - Literature works / studies carried out
  - Risk scenarios and case studies carried out
  - Focus on numerical simulations / fire tests
  - Final reporting started



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- **STATUS QUO:**
  - Performance base design considered being most suitable approach
    - Using tools like CFD (emperical based models) in addition
  - The challenge is the development of vehicles (technologies) currently

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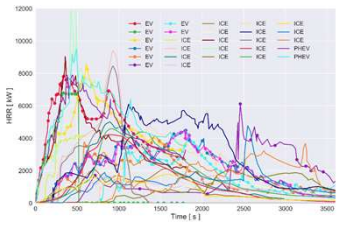
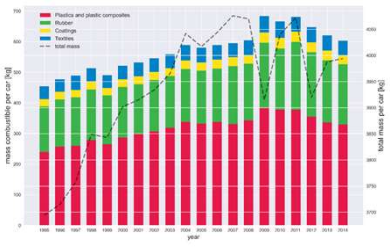
- **First publications:**
  - Alternative representative design fire (HRR) curve for all passenger cars
    - Including NECs / ICEs
    - Including also size of modern car (and material composition)
  - Fire test results (also with water mist systems)





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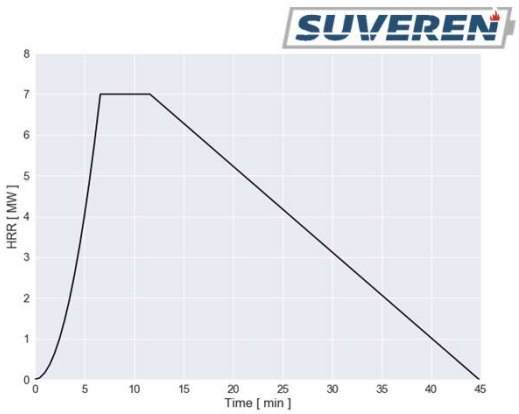

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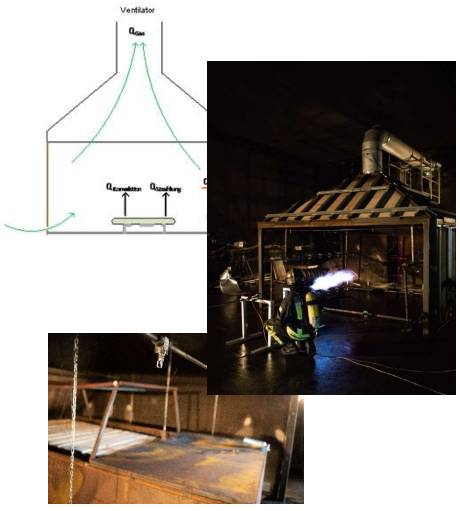
- **First fire tests:**
  - Many batteries burned (LIB)
  - Jet fire (CFD purposes)
  - Refererence (passenger car) mock-up



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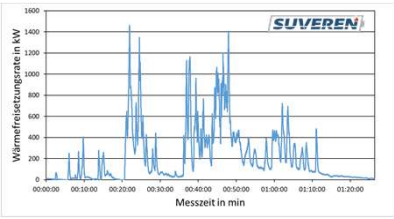
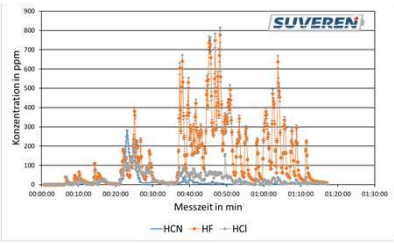
- **Results:**
  - Batteries burn differently depending on the design
    - E.g. 24kWh prismatic cell Li-Ion battery
      - Concentrations raise questions for life safety and safety of fire services
    - HRR measurement in 3 different ways
    - A lot of data with the FTIR
    - Re-ignition possible





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- **Results:**
  - Water based fire fighting systems can fight / extinguish LIB fires (water mist)
  - 2nd test series are to happen 12/2019:
    - Comparison: Deluge, water mist, Novec, F500, Aerosol, CAF, Nitrogen...

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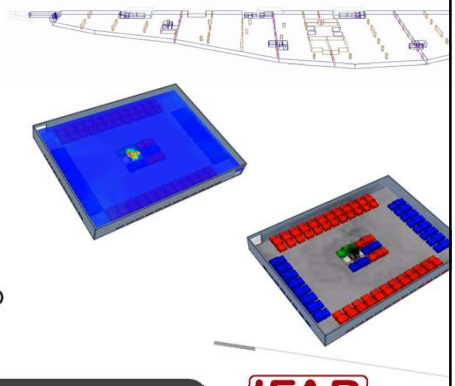
- **CFD:**
  - Vehicle fire in an generic underground car park deck:
    - Design tool to assess life safety & safety of fire services
  - Semi-empirical models:
    - Data from fire tests / vehicle design fire scenario



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SUVEREN – Guidelines

- **SUVEREN-Guideline (Leitfaden)**
  - Providing design methodology and guidance
  - Training programmes for designer and operators
  - Results will be used as input for standards and regulations

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Conclusions

- **Vehichles and their automation level is developing very rapidly.**
- **The development has given new challenges for fire industry.**
- **NECs, in particulas LIB, are considered a special fire risk that needs design quidance. Also NECs based on gaseos fuel are creating new risks compared to conventional ICE vehicles.**
- **SUVEREN Research Project is focusing to NEC related fire risks in underground applications.**

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Conclusions

- SUVEREN has already passed the first parts of project and also large scale fire test progam has been carried out.
- The test results have shown the HRR curves for LIB fires as well as many other data like toxic gas concentrations.
- Water mist system has been tested among many other tehnologies. Water based systems seem to have good results.
- SUVEREN will create unique information that will be published as „Guidelines“ for the industry.

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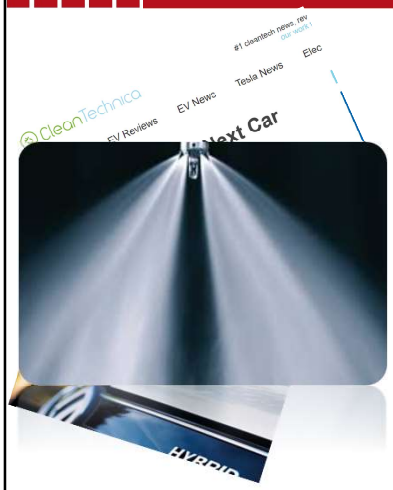
Conclusions



- Sustainable
- Ecological
- Life time
- Innovative
- Political / General opinion

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Future?

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