Jan Röhl
CEO

How to ensure the energy requirements of the future

eBus Conference - Solingen 2018

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European Commission

KRUCH RAILWAY INNOVATIONS

Lorries, buses and coaches produce around

~25%

of CO_2 emissions from road transport in the EU and will increase until 2030 with further 10%

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EU-Targets:

Climate Treaty Paris: <2°C global warming

Until 2021: -40% CO2 reduction for cars

Until 2050: -60% of Transport specific Emissions (to 1990)

electrification offers relatively simple solutions!

Target: less emissions, but…

- More people
- More travels
- More passengers
- More vehicles
- More frequency
- More comfort (HVAC) – 50% energy
- More, more, more…

The good news…

- We are quite inefficient at this moment

  ➔big savings can easily be achieved
- Optimization happens seperately in the different systems

  ➔ holistic optimization is logical
- From ~700 cities in Germany (>20.000 population) only 70 use electric transport

  ➔ big shift to electric transport = big effect
- Huge market for all of us

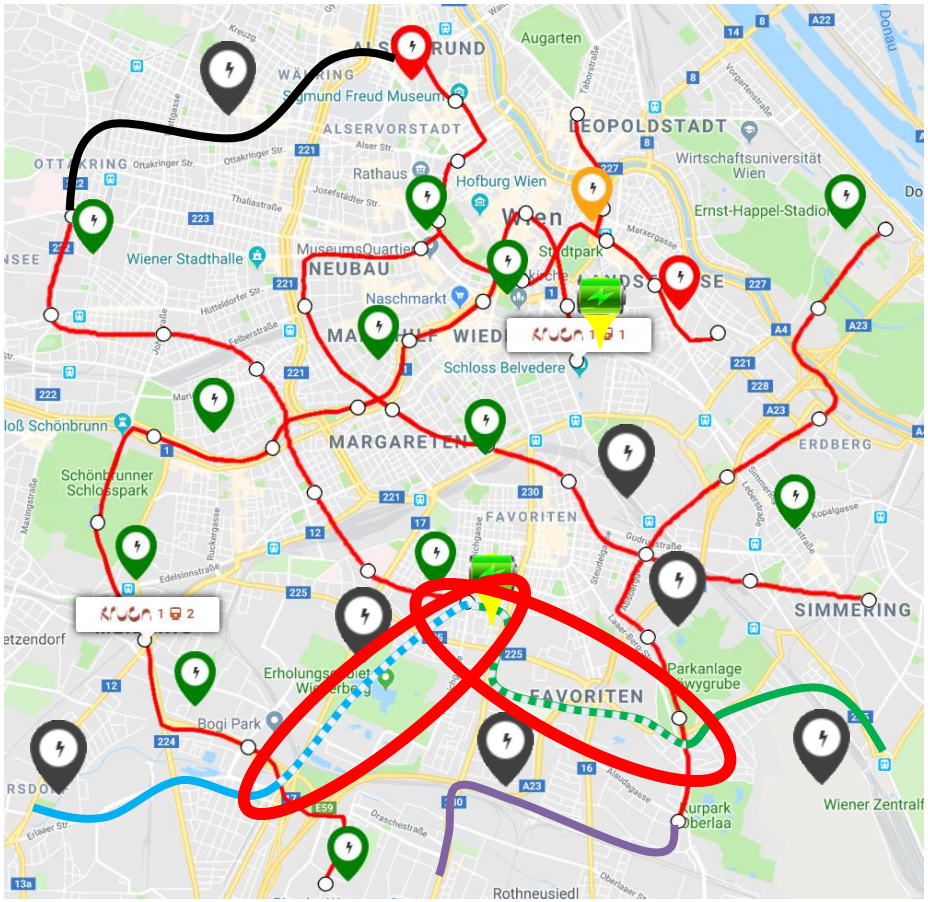
Jack from „Random City“

„Random City“ – 2030 plan

- Reduce individual traffic & CO2 emissions
- Increase public transportation services
  - Extend routes
  - Exchange vehicles
  - New technologies

Network extensions till 2030

- R1: 7km
- R2: 9km
- R3: 4km
- R4: 6km
- 2 Energy Storages
- 7 Substations
- 8km OHL free



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www.kruch.com

A lot has to be considered…

- complexity of networks and vehicle operation
- operation during n-1 situation (substation)
- New substations / energy storages
- Hybrid vehicles / charging scenarios / 1.000 A
- Renewal of old sections / Contact line free sections
- EMC regulations (hospitals)
- middle voltage network stability
- short circuit detection
- Energy savings
- Additional charging points for individual traffic

KRUCH provides EFS

Simulating the energy flow in transportation networks

Simulate the energy flow for x-different scenarios

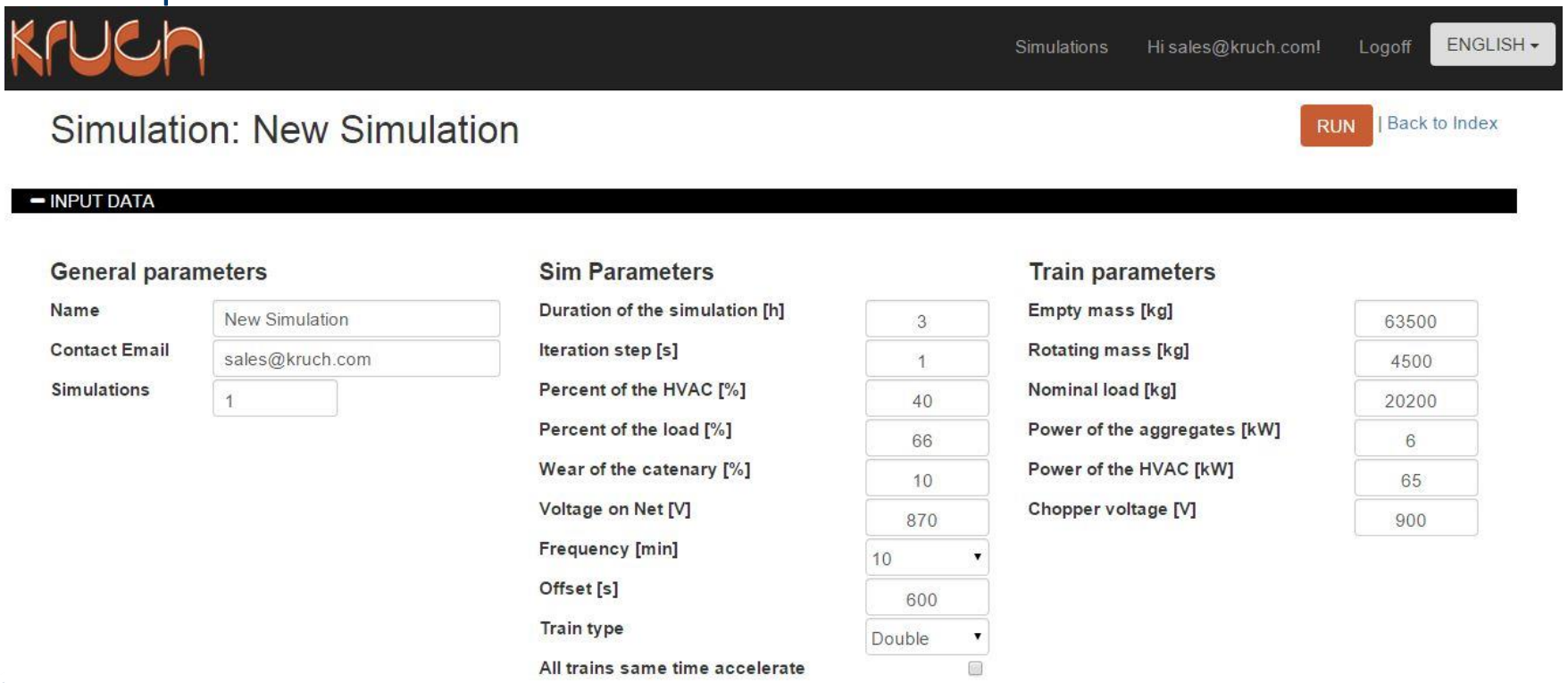
- track extensions
- new vehicles & technologies
- new timetables & routes
- simulate substation failures

Simulate the energy flow for x-different scenarios

- Power consumption of buses
- Effect of energy storage systems
- Effect of charging stations
- Energy availability

User interface

EFS is an online platform, you can use it on any device with web access. No local installations are required. The user interface is clearly arranged and simple to use.

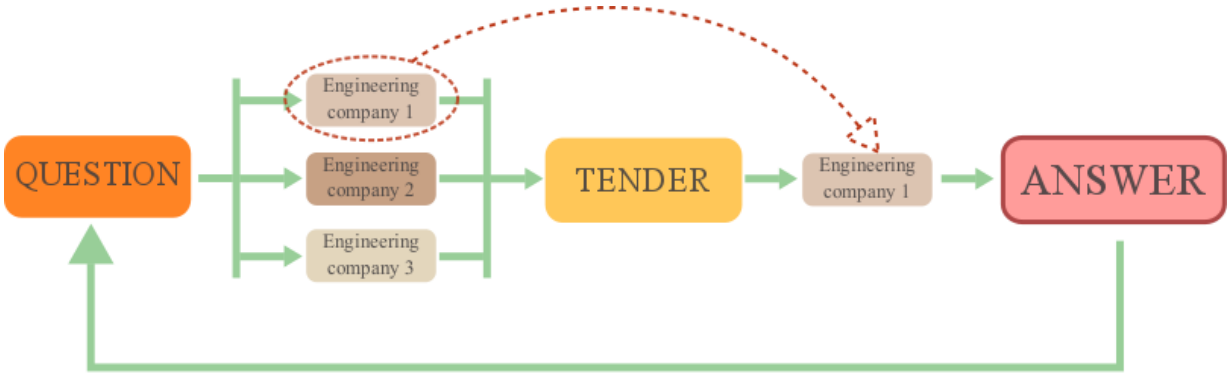


KRUCH EFS Energy Flow Simulation

The ways to find answers:

RAILWAY INNOVATIONS

Currently

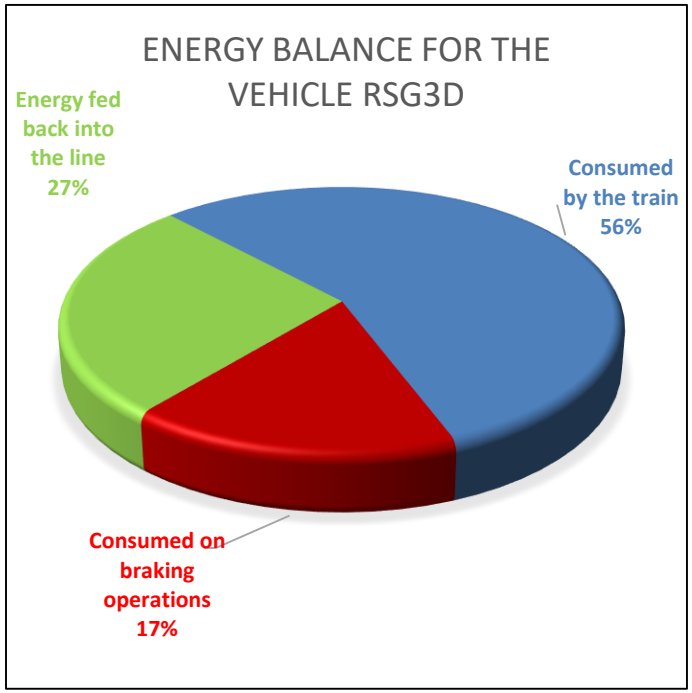


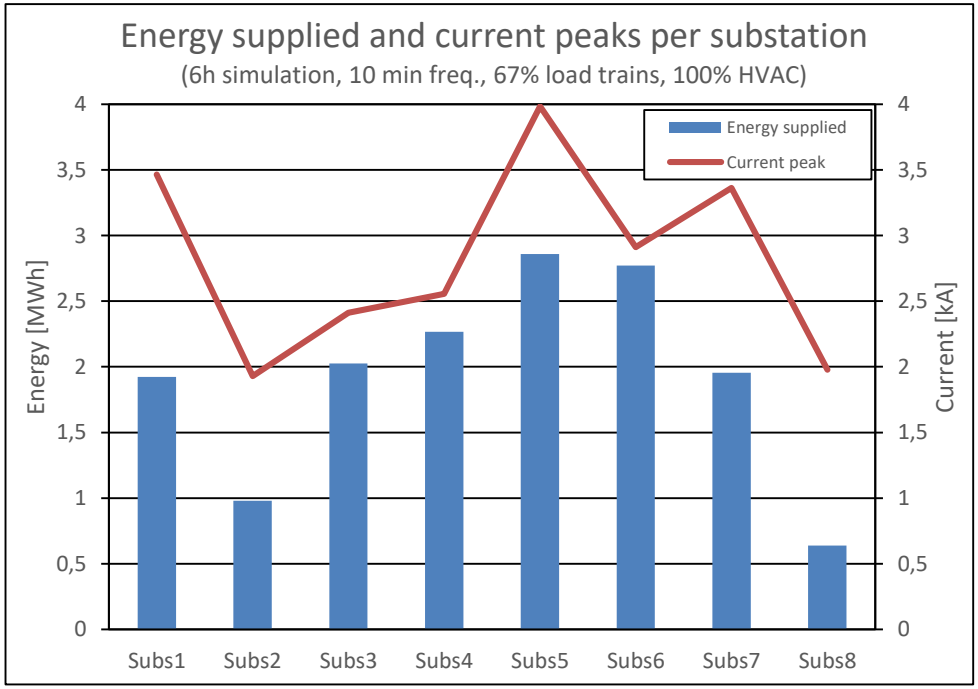
100 days, 20.000 €/question

In future

< 1 day, 250 €/month

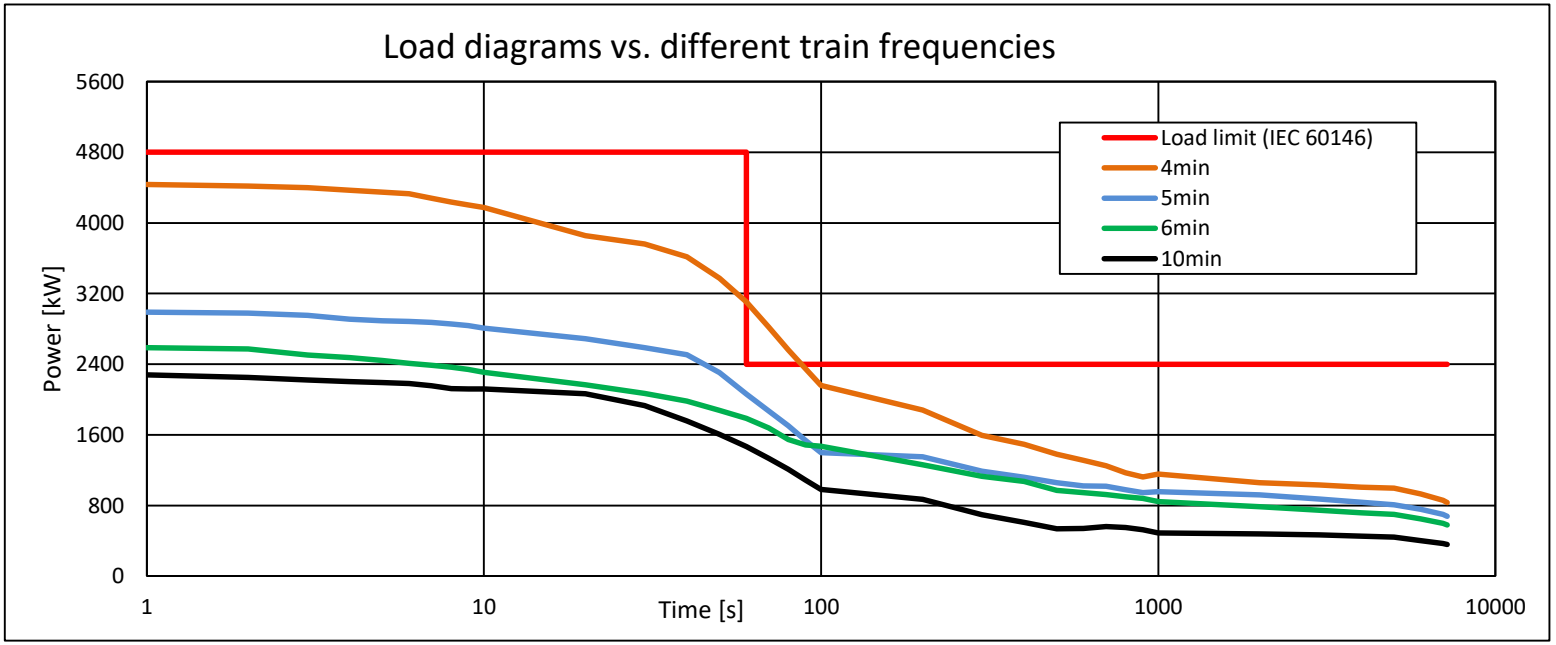
Result of EFS





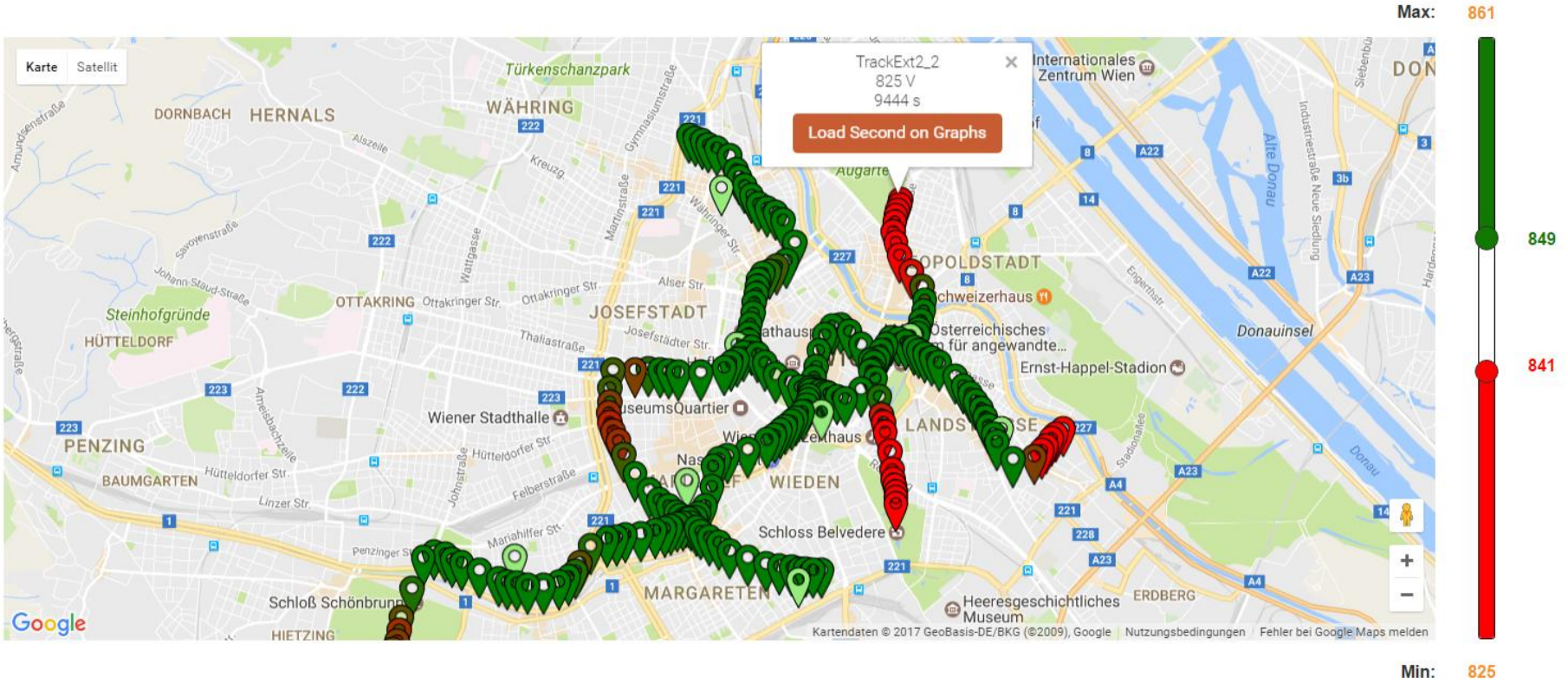
Results of EFS

Example a) Displaying the functionality of a sub-station when adapting the time table:



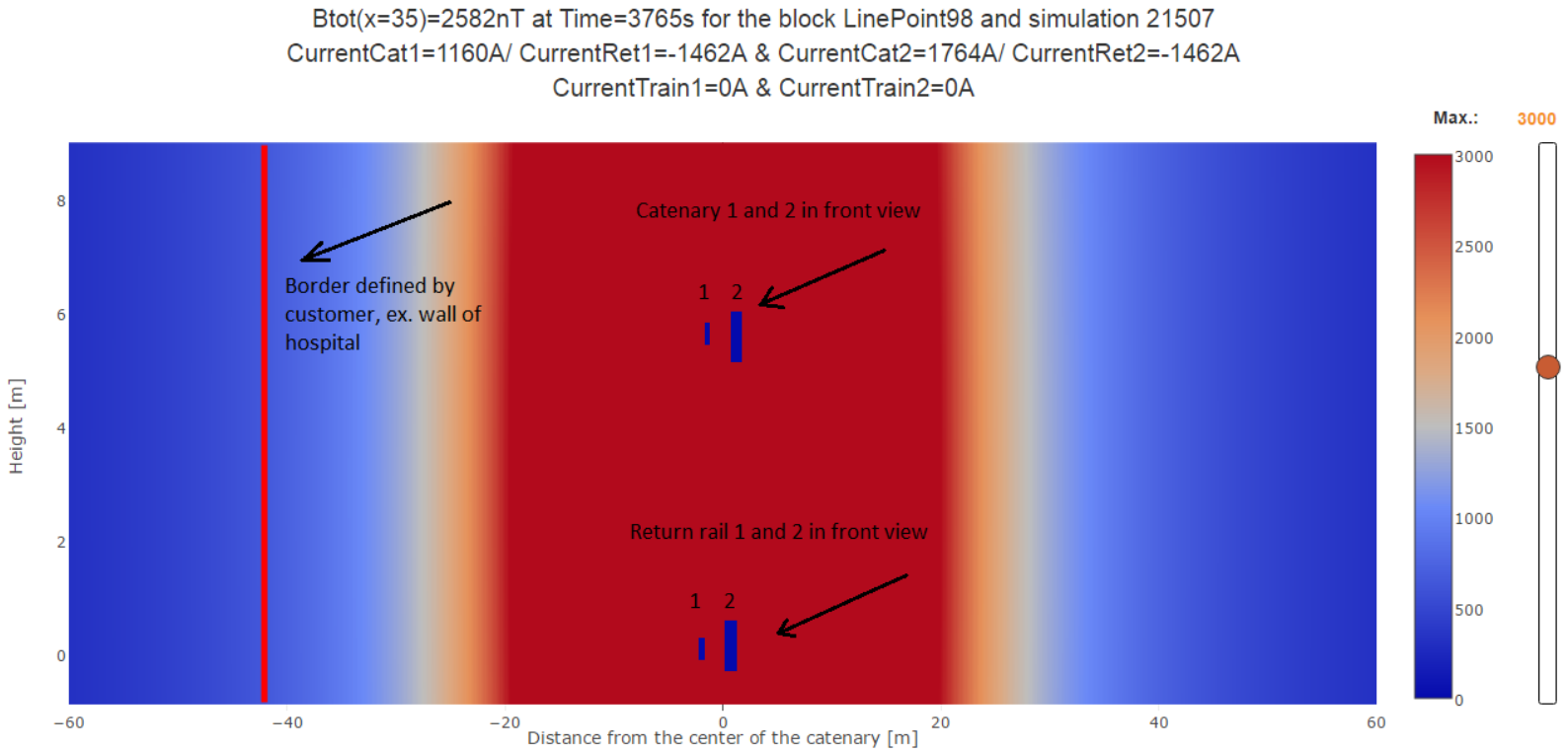
Results of EFS

Example b) Displaying the voltage behaviour along the line



Results of EFS

Example d) Displaying the EMC at a defined point along the r



KRUCH EFS Energy Flow Simulation

Very easy to use:

Training to work on this system takes no more than 1h!

Supplies reliable results

Confirmed results with on-track measurements

Easy to extend

Adaptations to the physical network can easily be transferred to the simulation

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KRUCH EFS Energy Flow Simulation

Jack can simulate every day to find the optimum solution!

„Random City“ – 2030 plan

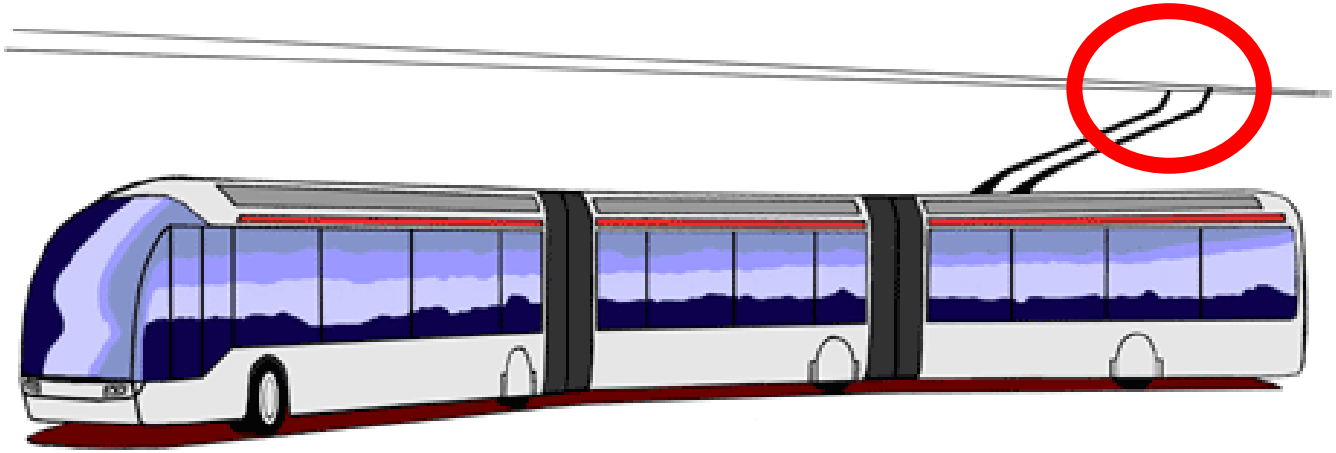
- Reduce individual traffic & CO2 emissions
- Increase public transportation services

- Extend routes
  Minimum 6 scenarios

- Exchange vehicles
  Minimum 2 scenarios

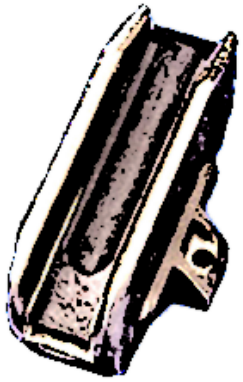
- New technologies
  Minimum 4 scenarios

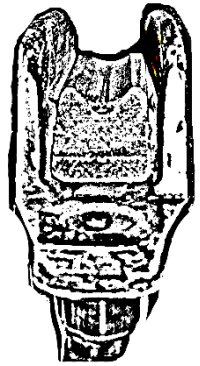
Many tasks – less happiness



Daily check of carbon inserts

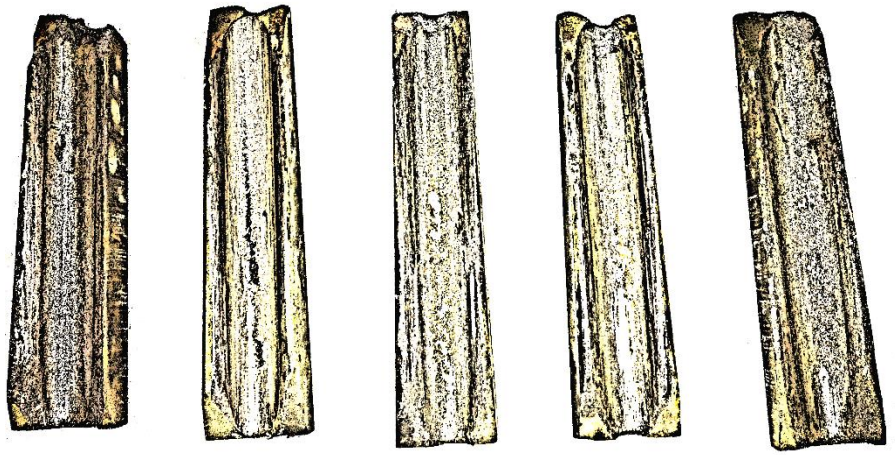
- Look at every pole on every bus
- Daily abrasion & wear
- Cracks, thickness, symn





- Der Bus soll fahren!
- Die aufgenommenen Ströme steigen (>1.000 A)

Jack has to decide when to exchange



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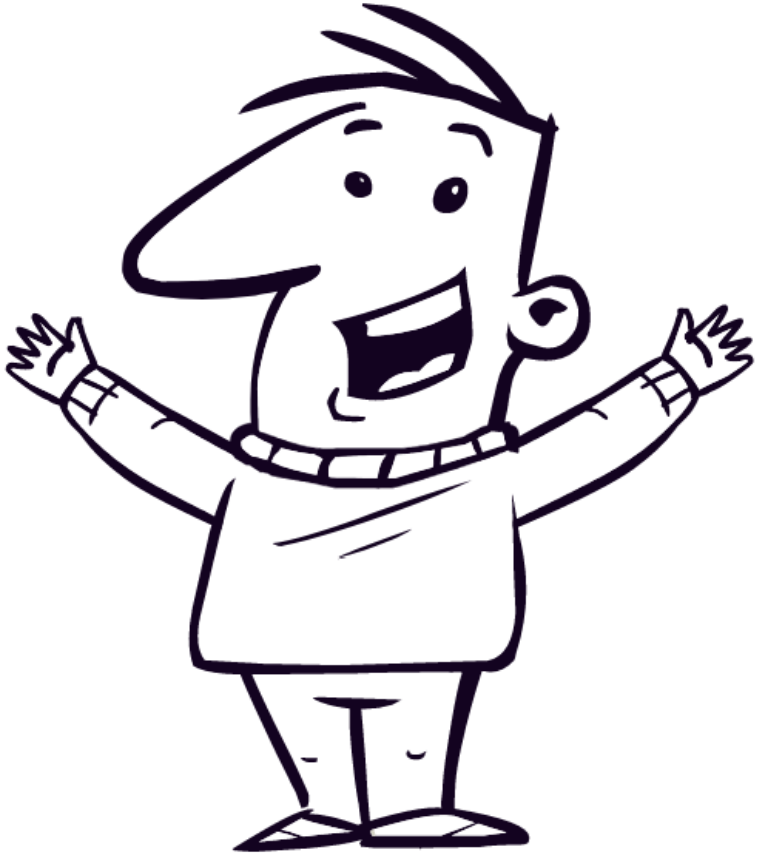
Picture: http://leg.ua/skolzjawie-kontakty.html?locale=en

KRUCH provides for Jack

Checkpoint Trolleybus



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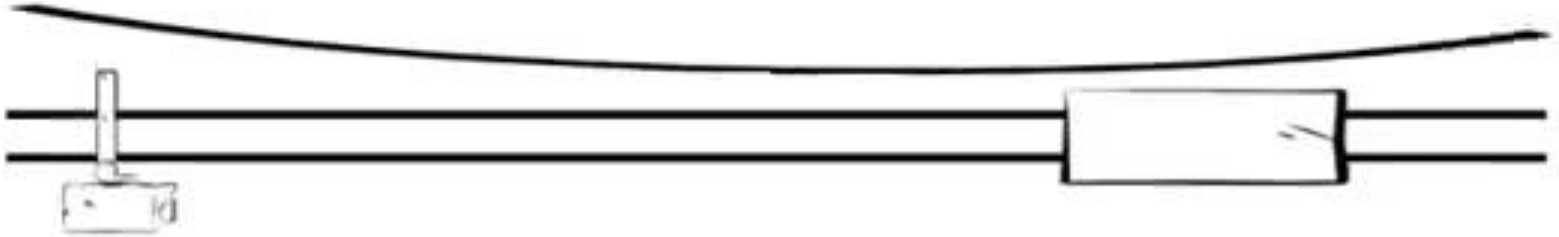
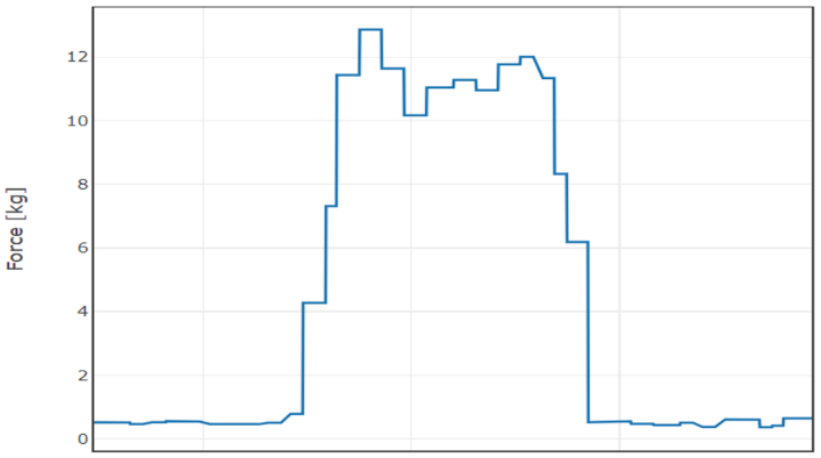
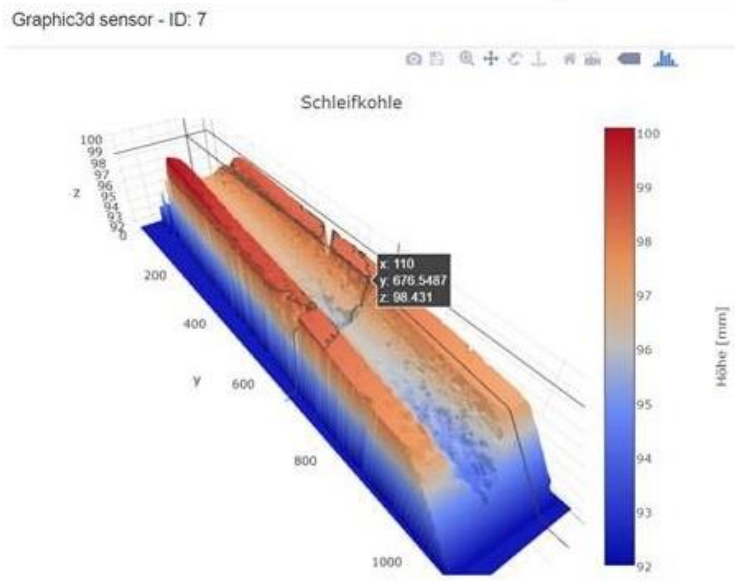



Force [kg]
0
2
4
6
8
10
12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Schleifkohle
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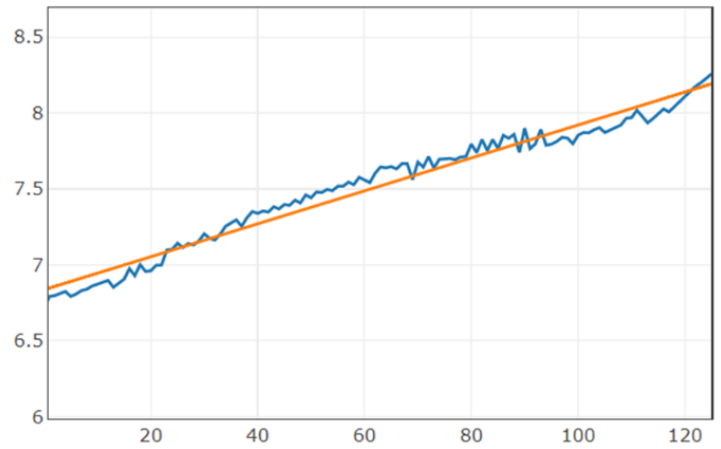
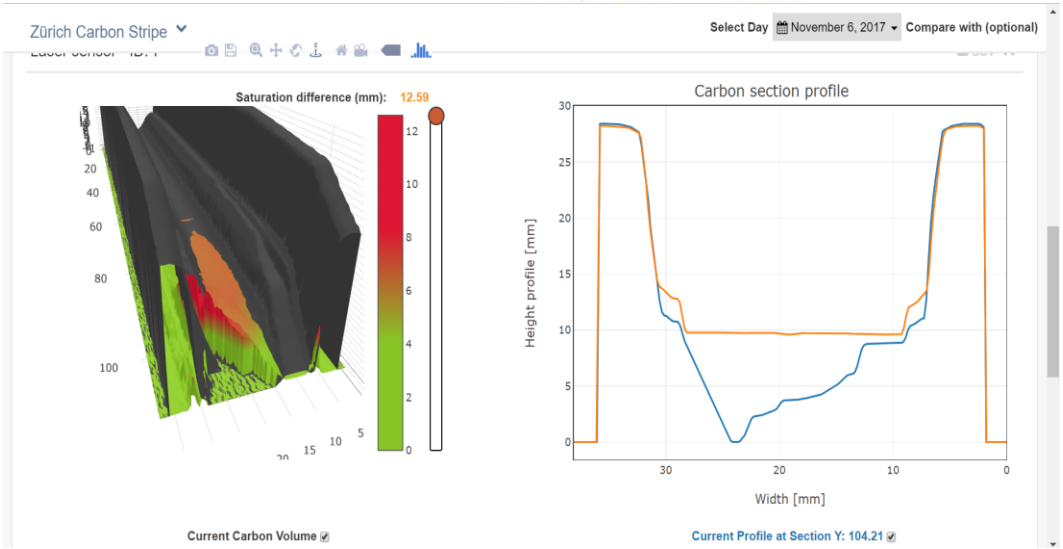
y: 676.5487
z: 98.431
Höhe [mm]


6
6.5
7
7.5
8
8.5
20
40
60
80
100
120


Zürich Carbon Stripe
Select Day
November 6, 2017
Compare with (optional)
Saturation difference (mm): 12.59
Carbon section profile
Height profile [mm]
Width [mm]
Current Carbon Volume
Current Profile at Section Y: 104.21

We will be happy to answer all your questions and show you more details about our solutions

Web: www.kruch.com

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