2024 European Light Rail Congress

Gerald Clariana

Kruch Railway Innovations

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EFS: Energy Flow Simulation

Your light rail network in your hands

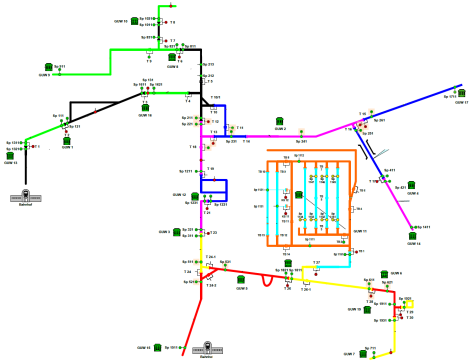
Energy Flow Simulation

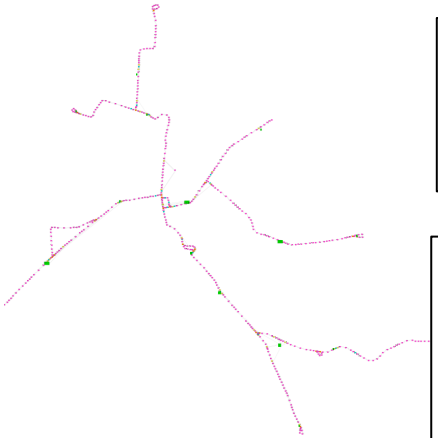
1 Railway network

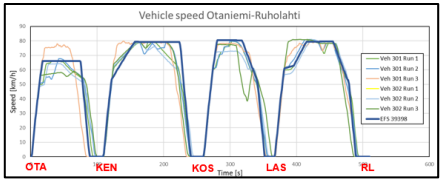
2 Digital model

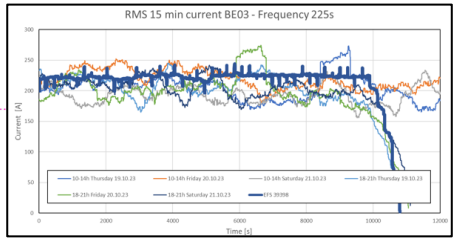
3 Validation

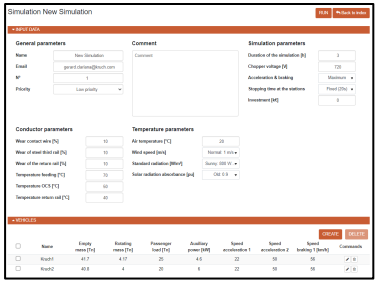
4 Cloud results

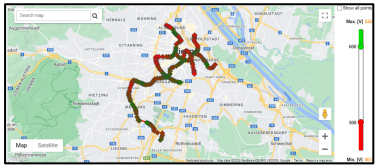






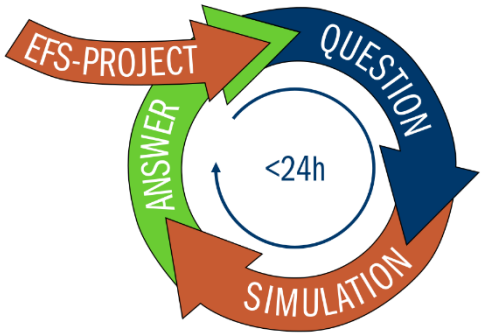




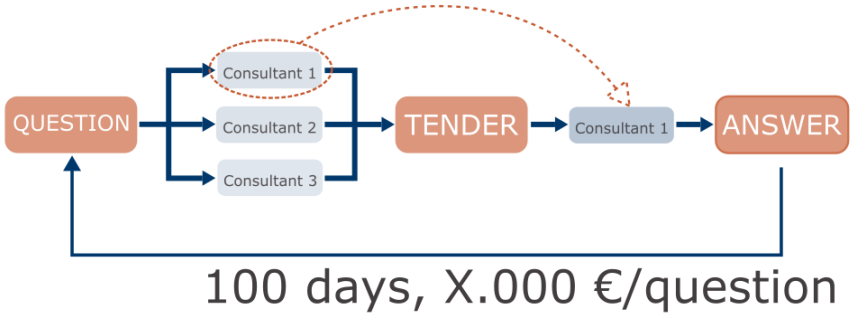


Features of EFS

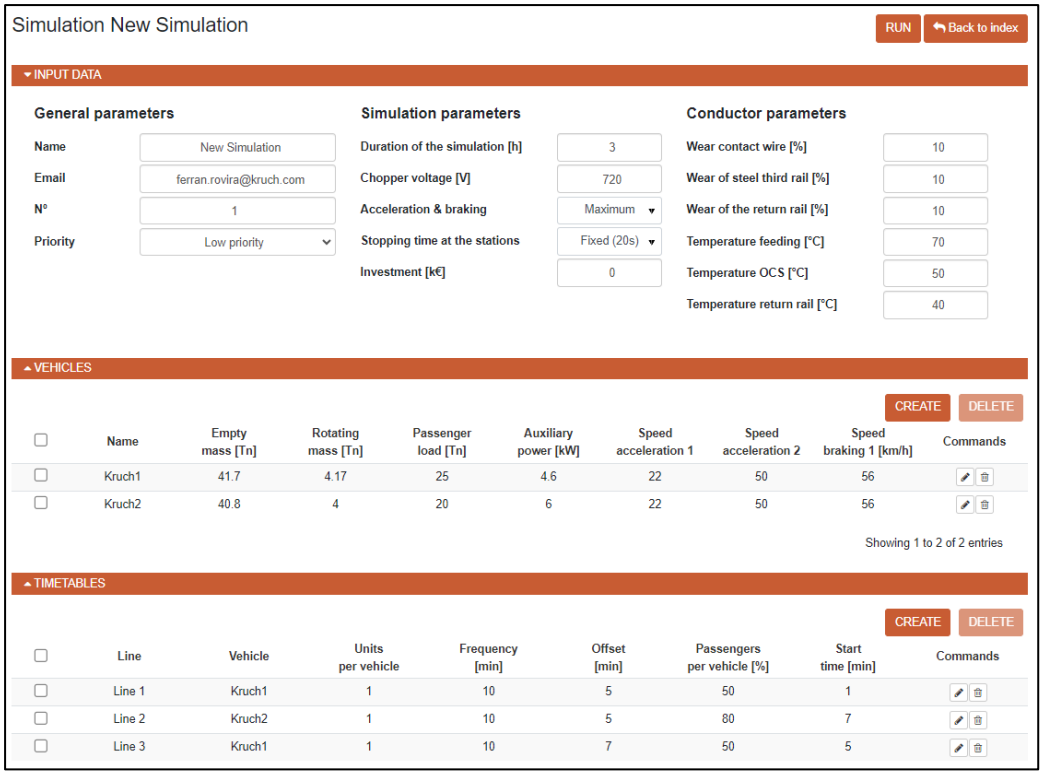
Energy Flow Simulation



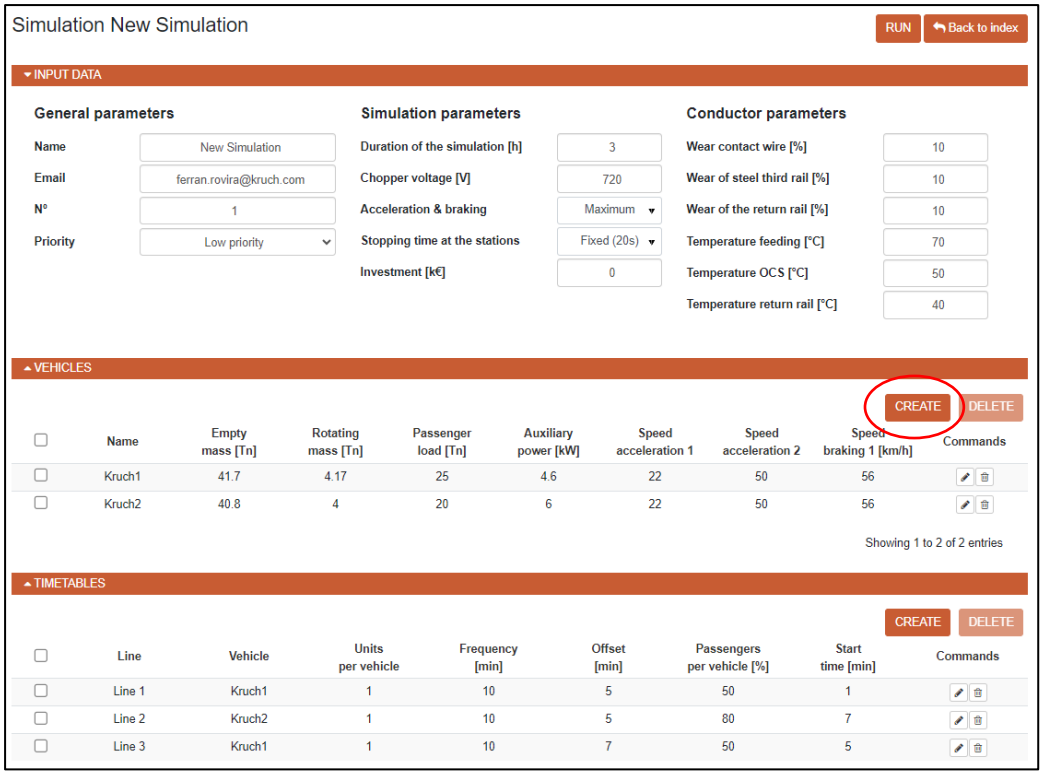
Traditional



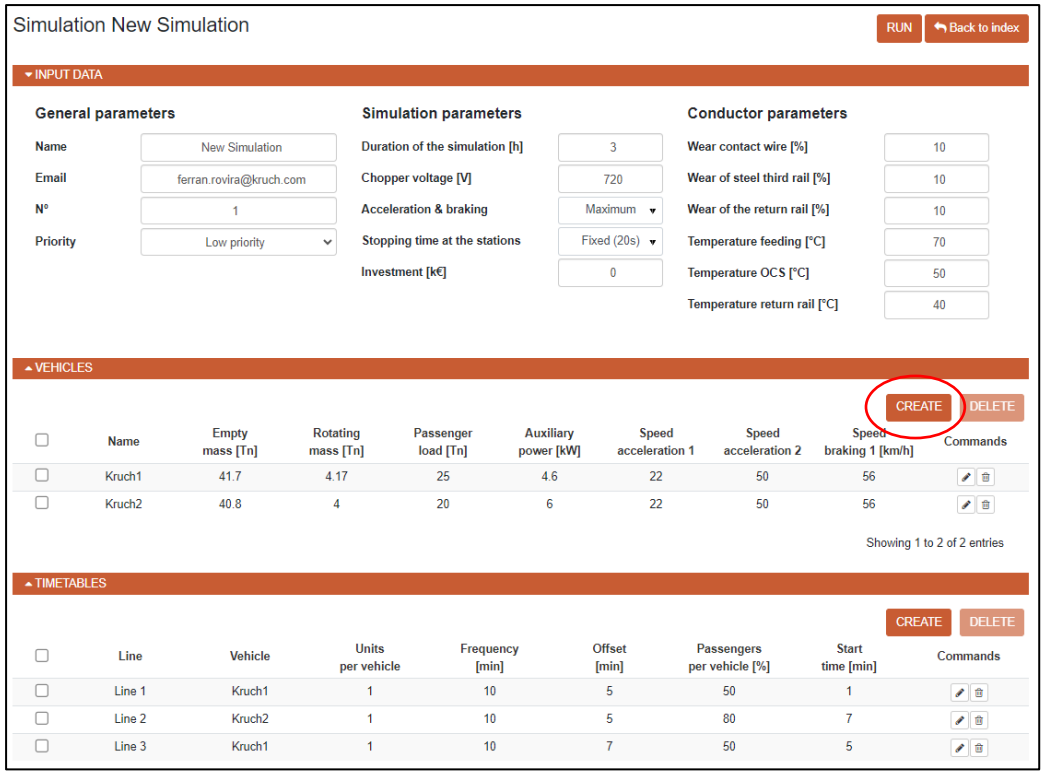
User interface

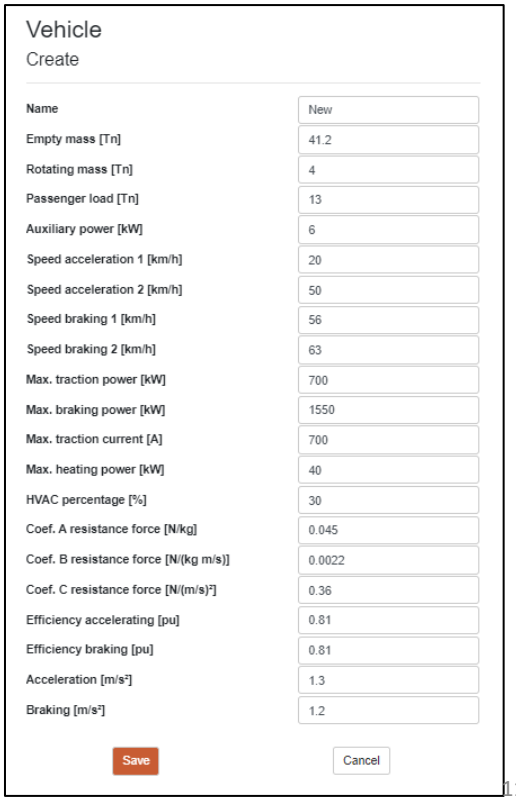


User interface

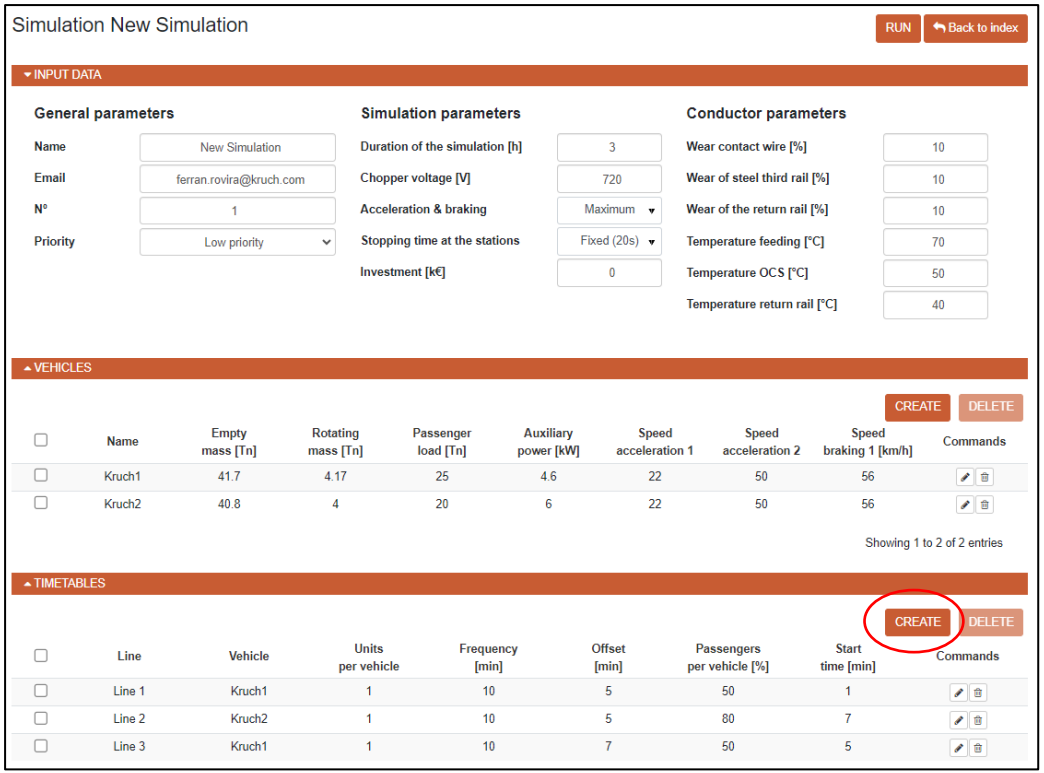


User interface

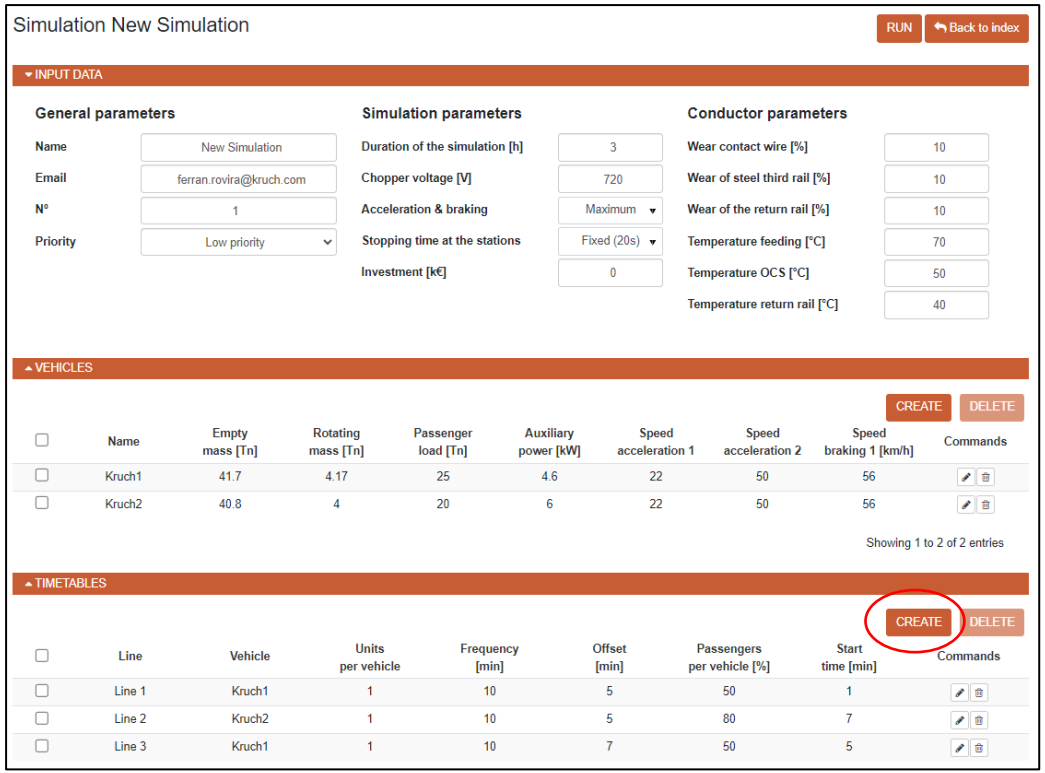


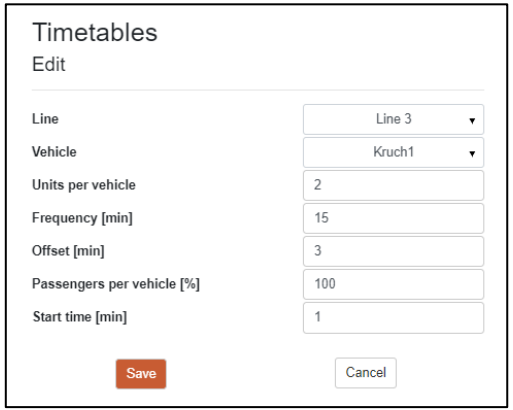


User interface

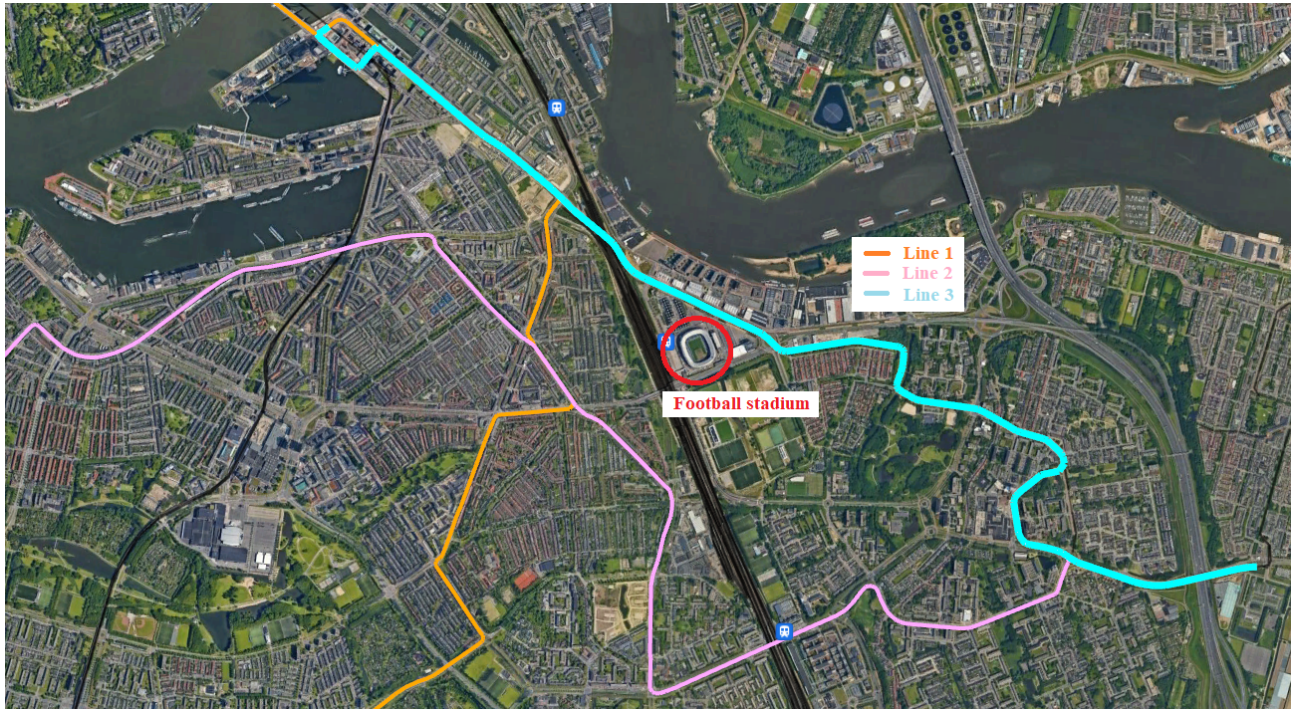


User interface





User case 1: Football game



User case 1: Football game

- Regular schedule: No football game

Name	Transformer loads	Positives feeders	OCS voltage	Rail-earth voltage	CW temperature	kWh/h purchased	Investment [k€]
Regular schedule: 10 min	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	2980	0

User case 1: Football game

- Regular schedule: No football game
- Football game without investment

Name	Transformer loads	Positives feeders	OCS voltage	Rail-earth voltage	CW temperature	kWh/h purchased	Investment [k€]
Regular schedule: 10 min	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	2980	0
Football game: 2.5 min	Not acceptable	Acceptable	Not acceptable	Acceptable	Acceptable	3810	0

User case 1: Football game

- 3 new substation → 3.6 M€

Name	Transformer loads	Positives feeders	OCS voltage	Rail-earth voltage	CW temperature	kWh/h purchased	Investment [k€]
Regular schedule: 10 min	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	2980	0
Football game: 2.5 min	Not acceptable	Acceptable	Not acceptable	Acceptable	Acceptable	3810	0
Football game: 2.5 min + 3 extra subst.	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	3780	3600

User case 1: Football game

- 3 new substation → 3.6 M€
- 3 batteries (700 kWh) → 2.1 M€

Name	Transformer loads	Positives feeders	OCS voltage	Rail-earth voltage	CW temperature	kWh/h purchased	Investment [k€]
Regular schedule: 10 min	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	2980	0
Football game: 2.5 min	Not acceptable	Acceptable	Not acceptable	Acceptable	Acceptable	3810	0
Football game: 2.5 min + 3 extra subst.	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	3780	3600
Football game: 2.5 min + 3 extra ESS	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	3480	2100

User case 1: Football game

- 3 new substation → 3.6 M€
- 3 batteries (700 kWh) → 2.1 M€

Name	Transformer loads	Positives feeders	OCS voltage	Rail-earth voltage	CW temperature	kWh/h purchased	Investment [k€]
Regular schedule: 10 min	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	2980	0
Football game: 2.5 min	Not acceptable	Acceptable	Not acceptable	Acceptable	Acceptable	3810	0
Football game: 2.5 min + 3 extra subst.	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	3780	3600
Football game: 2.5 min + 3 extra ESS	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	3480	2100
Football game: 4 min	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	3644	0

User case 2: New services

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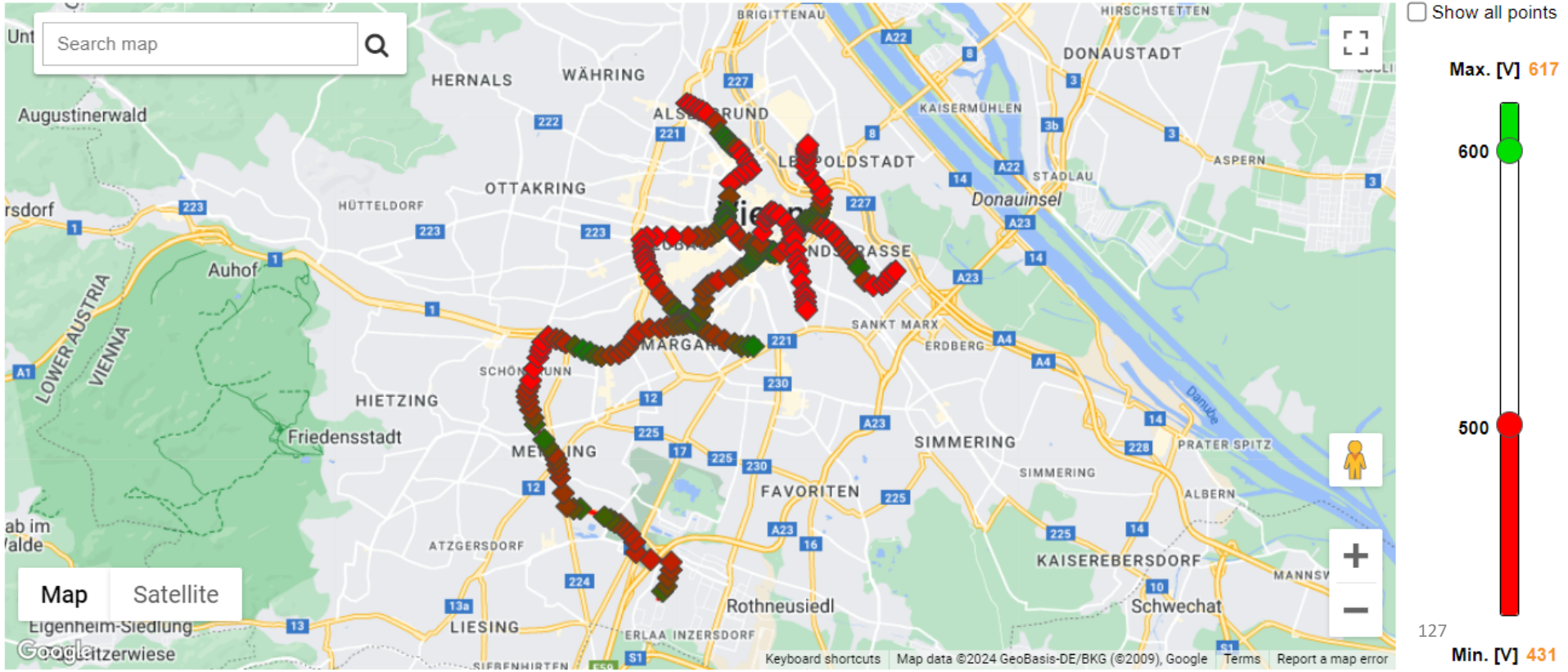
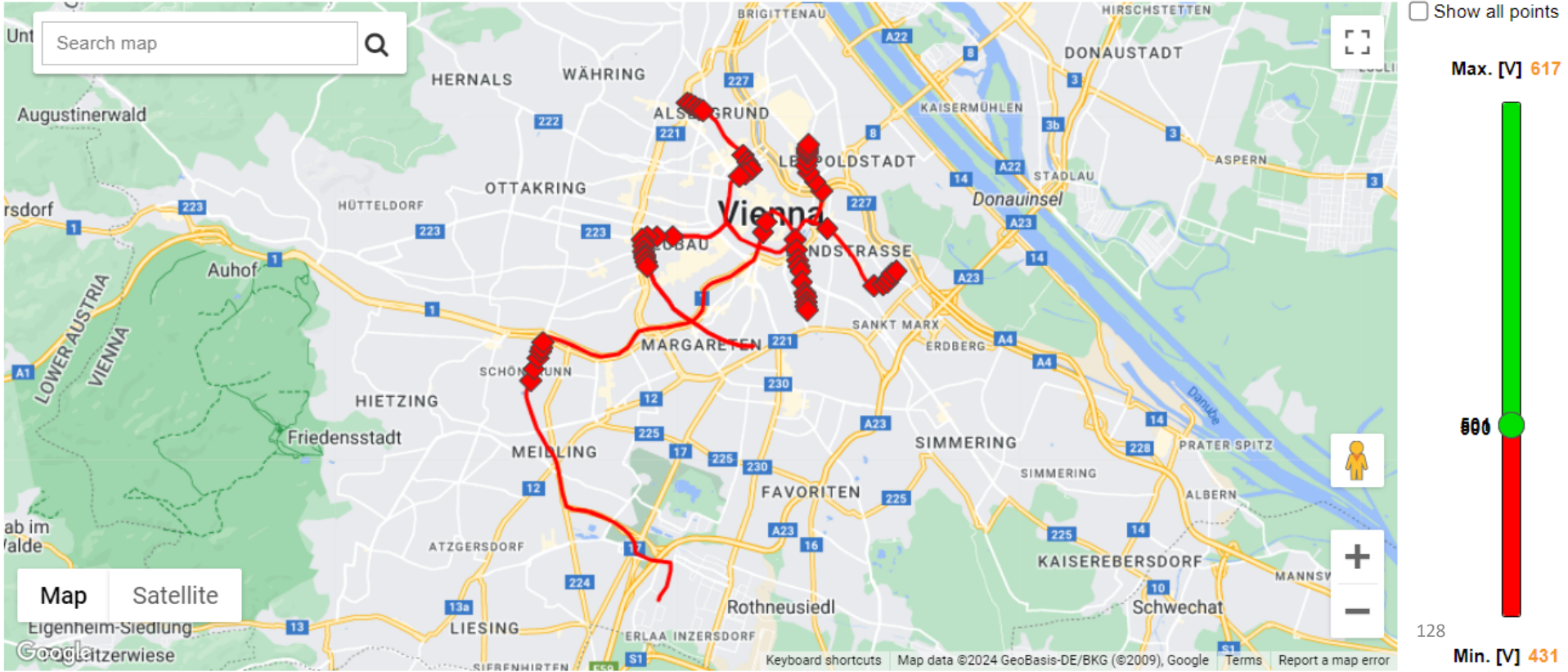


User case 2: New services



User case 2: New services

Id	Name	Transformer loads	OCS & 3rd rail voltage	Rail-earth voltage	Positives feeders	Negative feeders	Investment [k€]
39016	N scenario - 10 min - CW100	Not acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	0

User case 2: New services

Id	Name	Transformer loads	OCS & 3rd rail voltage	Rail-earth voltage	Positives feeders	Negative feeders	Investment [k€]
39016	N scenario - 10 min - CW100	Not acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	0
39024	N scenario - 10 min - CW100+MW150	Not acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	1000

User case 2: New services

Id	Name	Transformer loads	OCS & 3rd rail voltage	Rail-earth voltage	Positives feeders	Negative feeders	Investment [k€]
39016	N scenario - 10 min - CW100	Not acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	0
39024	N scenario - 10 min - CW100+MW150	Not acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	1000
39025	N scenario - 10 min - CW100+MW150 + I&G 2xPnominal	Acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	3000

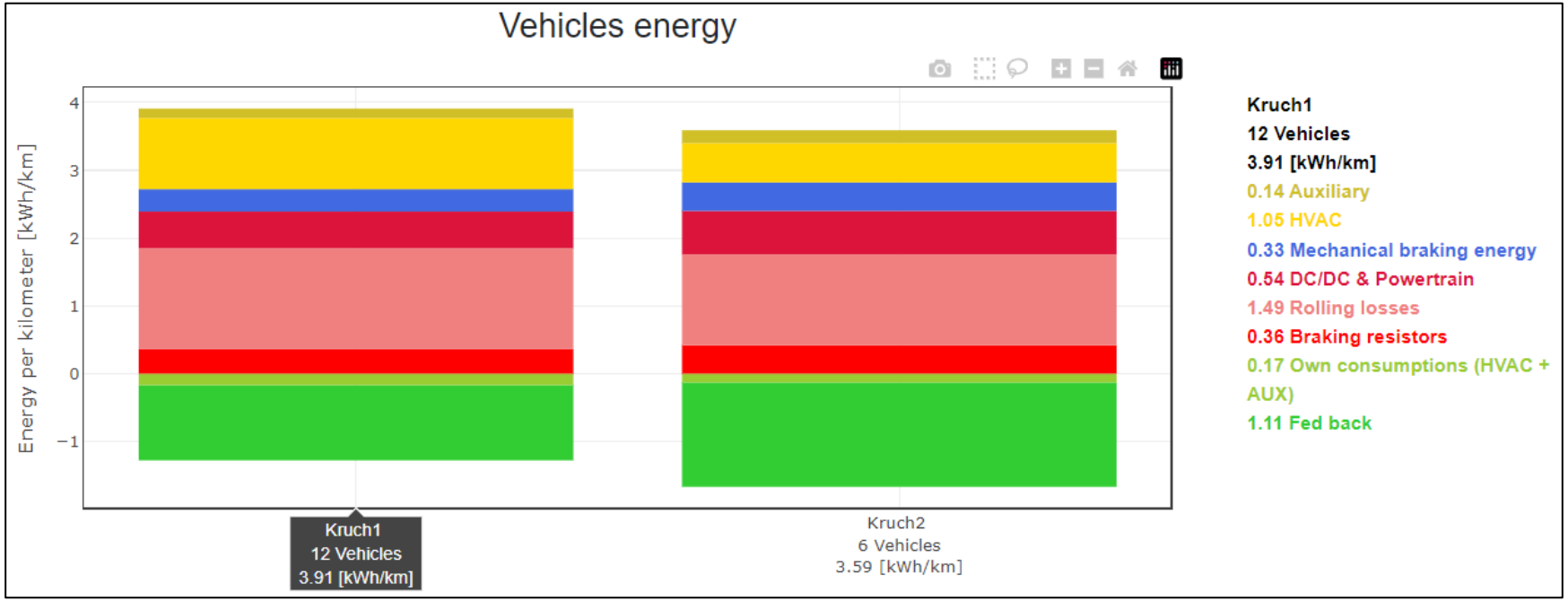
User case 2: New services

Id	Name	Transformer loads	OCS & 3rd rail voltage	Rail-earth voltage	Positives feeders	Negative feeders	Investment [k€]
39016	N scenario - 10 min - CW100	Not acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	0
39024	N scenario - 10 min - CW100+MW150	Not acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	1000
39025	N scenario - 10 min - CW100+MW150 + I&G 2xPnominal	Acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	3000
39030	N scenario - 10 min - CW100+2xMW150 + I&G 2xP nominal	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	5000

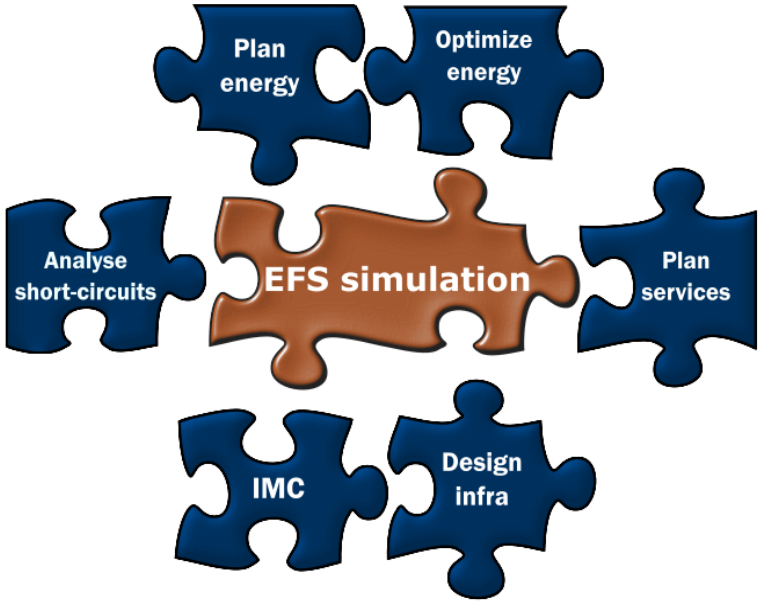
User case 2: New services

Id	Name	Transformer loads	OCS & 3rd rail voltage	Rail-earth voltage	Positives feeders	Negative feeders	Investment [k€]
39016	N scenario - 10 min - CW100	Not acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	0
39024	N scenario - 10 min - CW100+MW150	Not acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	1000
39025	N scenario - 10 min - CW100+MW150 + I&G 2xPnominal	Acceptable	Not acceptable	Acceptable	Acceptable	Acceptable	3000
39030	N scenario - 10 min - CW100+2xMW150 + I&G 2xP nominal	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	5000

User case 3: Energy vehicle comparison



Why a simulation tool?



References

Thank you for your attention

How can EFS help you?

Visit us at our booth in the exhibition hall for an EFS demonstration

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