Living Lab unIT-e^2: Lead project for optimized grid integration of electromobility

Dr.-Ing. Simon Köppl & Michael Hinterstocker (FfE)
General project lead unIT-e^2

Supported by:
Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag

Living Lab for Integrated E-Mobility

E-WORLD, ESSEN 23.05.2023

Research creates knowledge – knowledge creates practice

68 Experts

Support young and talented researchers.

74

Years of Experience

Transformation for society, politics and economy.

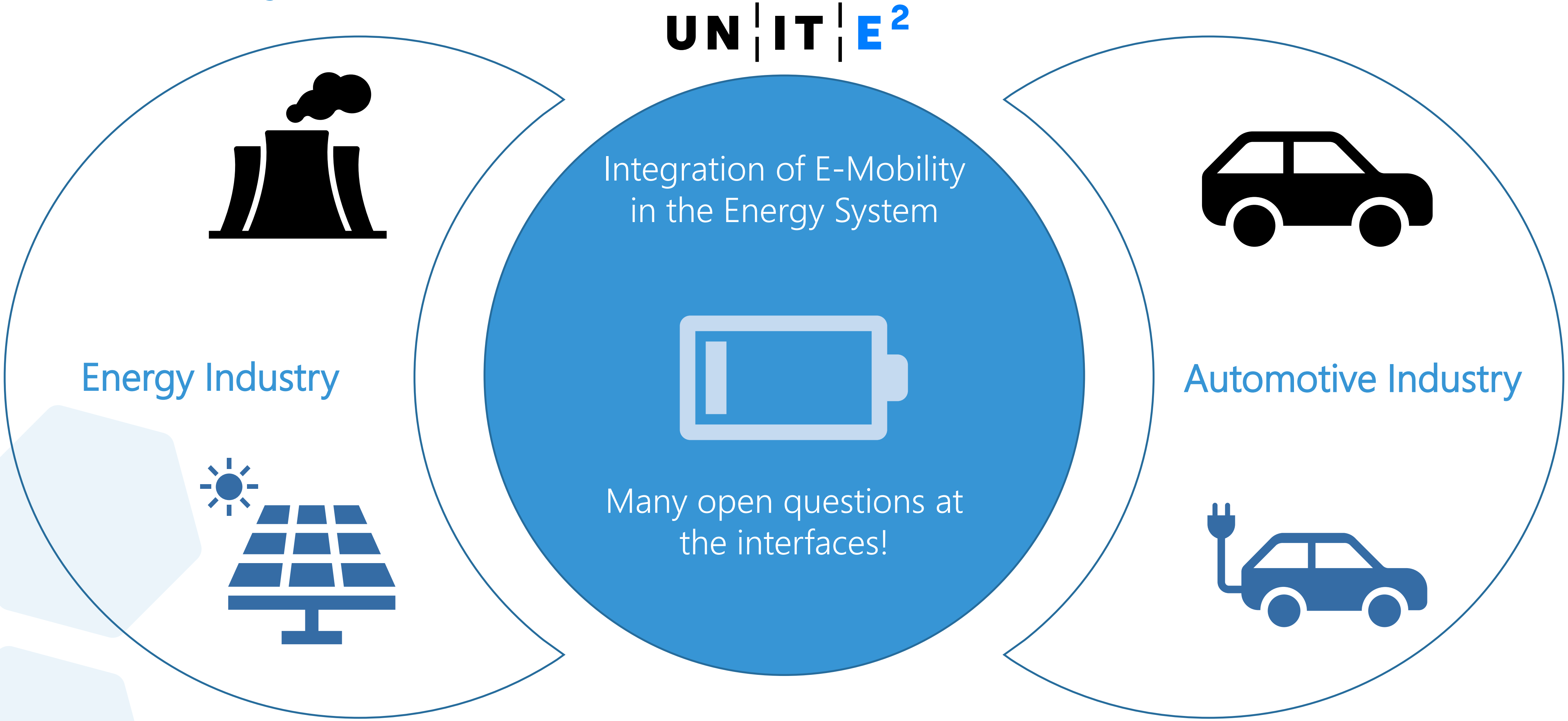
>1400

Projects & References

Independent scientific assessments.

Overlapping Issues of Energy & Automotive Industry

Need for collaboration and innovative concepts for optimized integration of electromobility



unIT-e² - Living Lab for Integrated E-Mobility

Key Data and Project Objective

FUNDED IN:

Elektro-Mobil funding program of the German Federal Ministry for Economics and Climate Action (BMWK)

DURATION:

08.2021 – 07.2024

LEAD:

FfE Munich

CONSORTIUM:

31 partners

Our claim: We mobilize the digital energy transition

- Technological and process-related upgrading of the value chain from electric vehicles to charging infrastructure to customers, energy markets and power grids
- Harmonization of energy industry and grid requirements with the business models of electromobility and the needs of customer

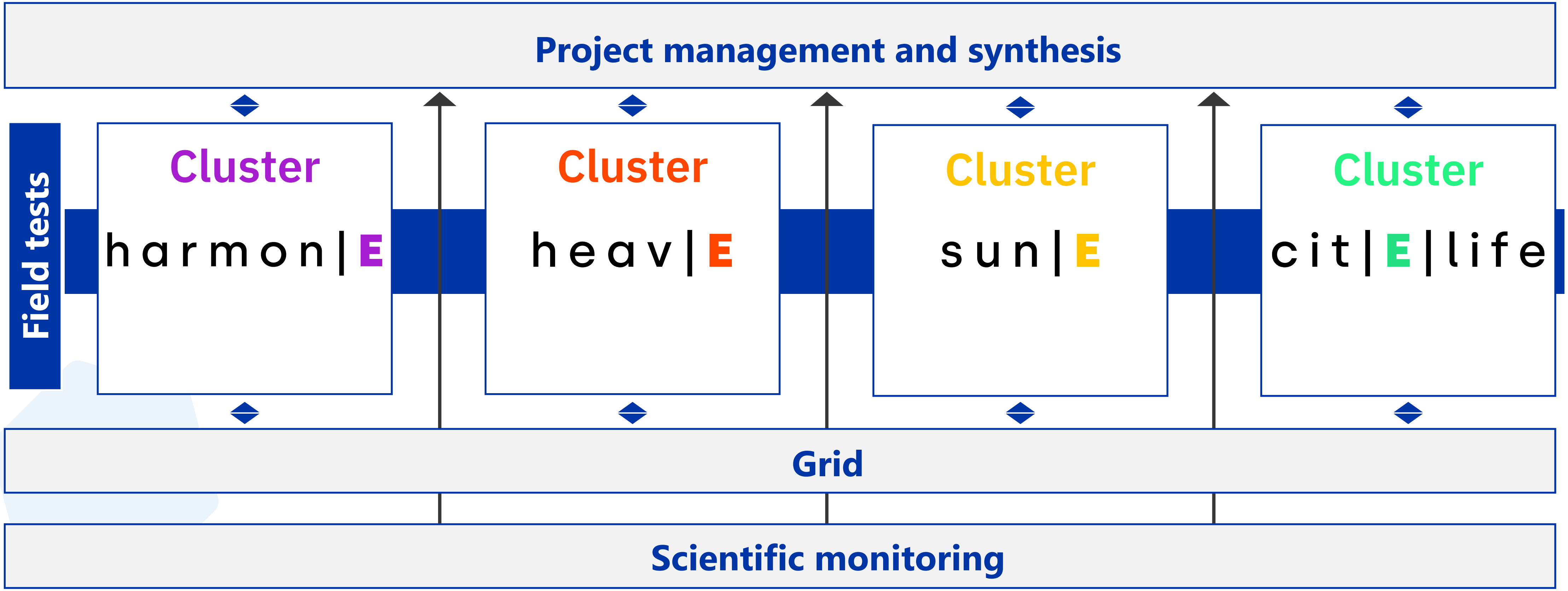
Three focal points: Symbiosis of science-based conceptualization & field demonstration

- Conceptual development of intelligent charging concepts and energy/grid management processes
- User orientation & participation approaches for customer-oriented concepts & products
- Intensification of the living-lab approach for continuous cooperation/transfer between concept and real operation

INFORMATION: UNIT-E2.DE

Cluster structure: Science, concept and demonstration

Solution diversity and competition of concepts inside the project



Selected intermediate results

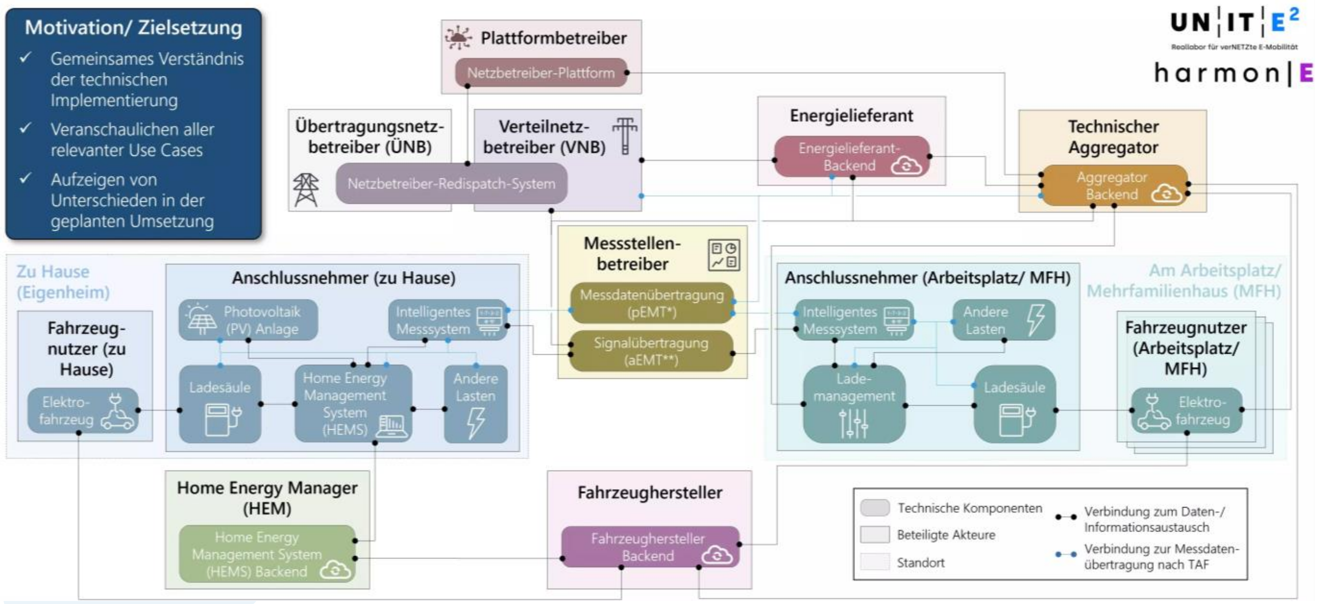
Result Thesis 1: Variety of possible Use Cases

Classification	sun|E	harmon|E	heav|E	cit|E|life	INCENTIVE SIGNAL
Self-optimization	PV self-consumption optimization	PV self-consumption optimization Emergency power supply		Building management with competing constraints from grid side	LOCAL/ ON SITE
Emission optimization	GHG-optimized electricity procurement	Peak-Shaving	CO_2-optimized charging in the neighborhood/ property CO_2-optimized charging of a vehicle fleet		ELECTRICITY MARKET
Market orientation	Market-oriented flexibility via price incentives Market-oriented flexibility via marketing success	Market (& grid) serving flexibility	Adaptation of the charging behavior through price signals	Market optimization (= dynamic tariffs)	ELECTRICITY MARKET
Indirect grid specification	Grid-serving flexibility via price incentives		Adaptation of charging behavior through qualitative incentives		GRID/ SYSTEM
Direct grid specification	Regulatory-defined grid-serving control	Regulatory-defined grid-serving Flexibility	Adaptation of the charging behavior through direct control	P_{LIM} Power specification at the GCP	GRID/ SYSTEM
Efficient network operation			Integration of electromobility into the intelligent local substation	ANB measurements in the grid/ Improved observability of low-voltage grid	GRID/ SYSTEM
System service	Reactive power provision System services (primary control power (FCR))	System services (redispatch)		System services (FRR)	GRID/ SYSTEM

Place of flexibility: Home; Workplace, neighborhood, apartment building; Public

Power Flow EV: unidirectional; bidirectional; uni- und bidirectional

Results Thesis 2: System Architecture as Basis for technical and procedural Implementation



DETAILED VERSION UNDER SYSARC.FFE.DE

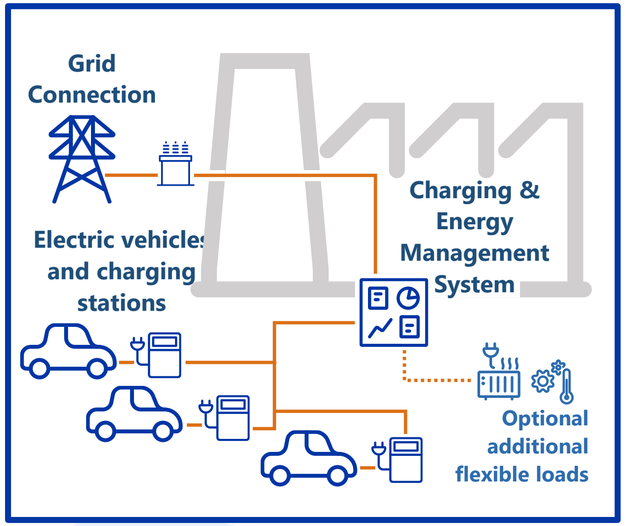
Results

- Digital upgrading of the grid and customer infrastructure (e.g. grid assets, EMS, SMGW) as the basis for use cases for network and market
- Many degrees of freedom in technical and procedural implementation
- Partly open role definition and open technical specifications
- Variety of interfaces requires standards-based solutions to ensure interoperability

Insights in the Cluster Harmon-E

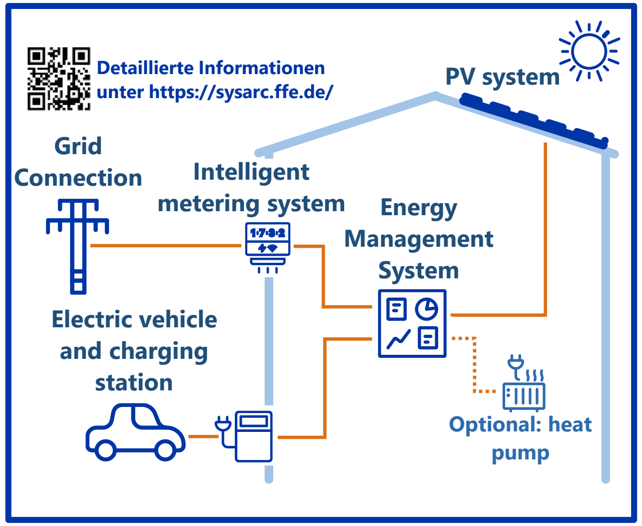
Information on the field trials

At the commercial/workplace



- 10 charging points & Mercedes-BEV at Wernsing in Essen (Oldb)
- Users with frequent presence at the charging point
- Market-optimized charging in compliance with grid restrictions
- Scientific evaluations of measurement data (e.g. improvement of forecast accuracies)

On the private home

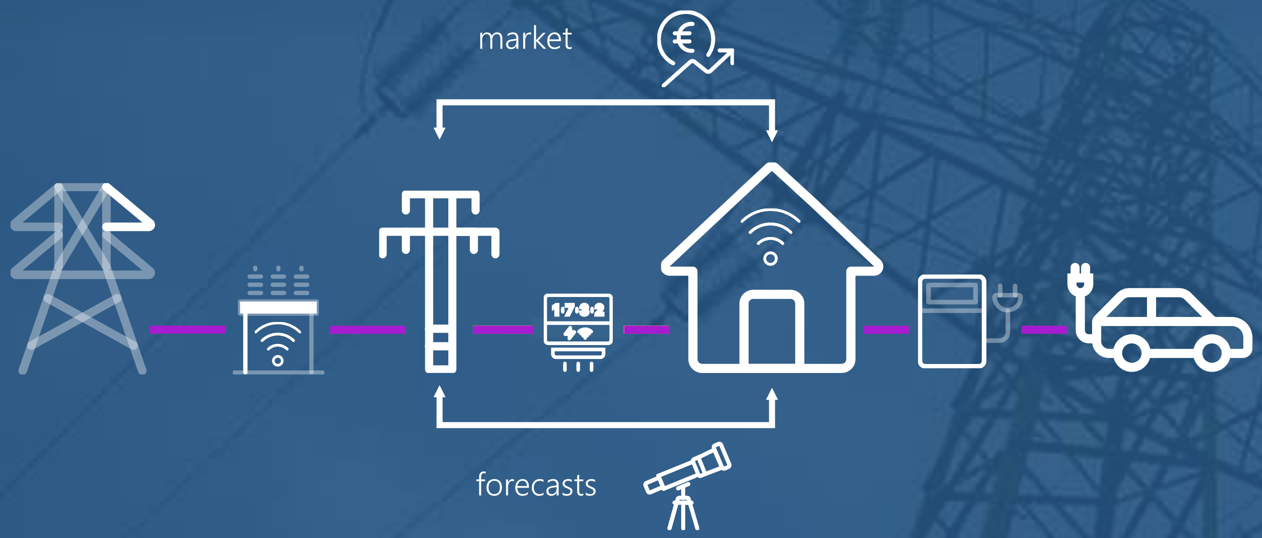


- BEVs & charging stations for intelligent charging control in private homes for 20 private users
- Focus: Performance adjustment in the event of network bottlenecks
- In addition: Test in EFH with further controllable systems (flexibilities)
- Accompanying scientific research, e.g. customer benefits

Result Thesis 3

harmon|E UN|IT|E²
Reallabor für verNETZte E-Mobilität

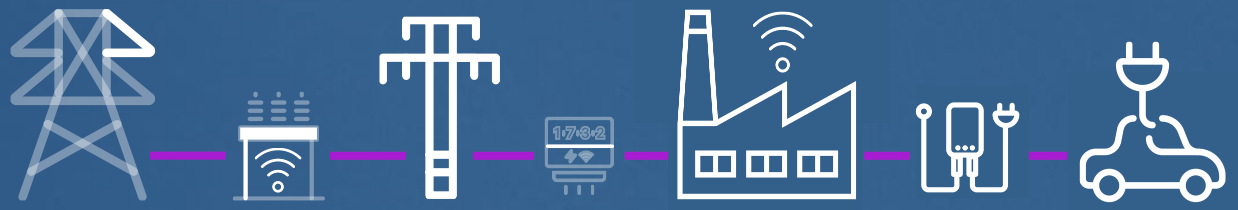
The expansion of the digital infrastructure (network & customer) is the basis for the grid-friendly control of flexible producers and consumers.



The digital infrastructure enables
- to harmonize grid-friendly and market-oriented use cases.
- reduce control interventions by forecasting grid conditions.

Result Thesis 4

We need to test standards along the entire chain of effects in order to integrate components interchangeably and maximize customer convenience.



A first conclusion

Findings after 1.5 years of unIT-e²

System integration of electromobility into the energy system

Many stakeholders with a wide variety of requirements in a complex environment require a structured process for harmonization and concretization

Grid & market as a field of tension with many design possibilities

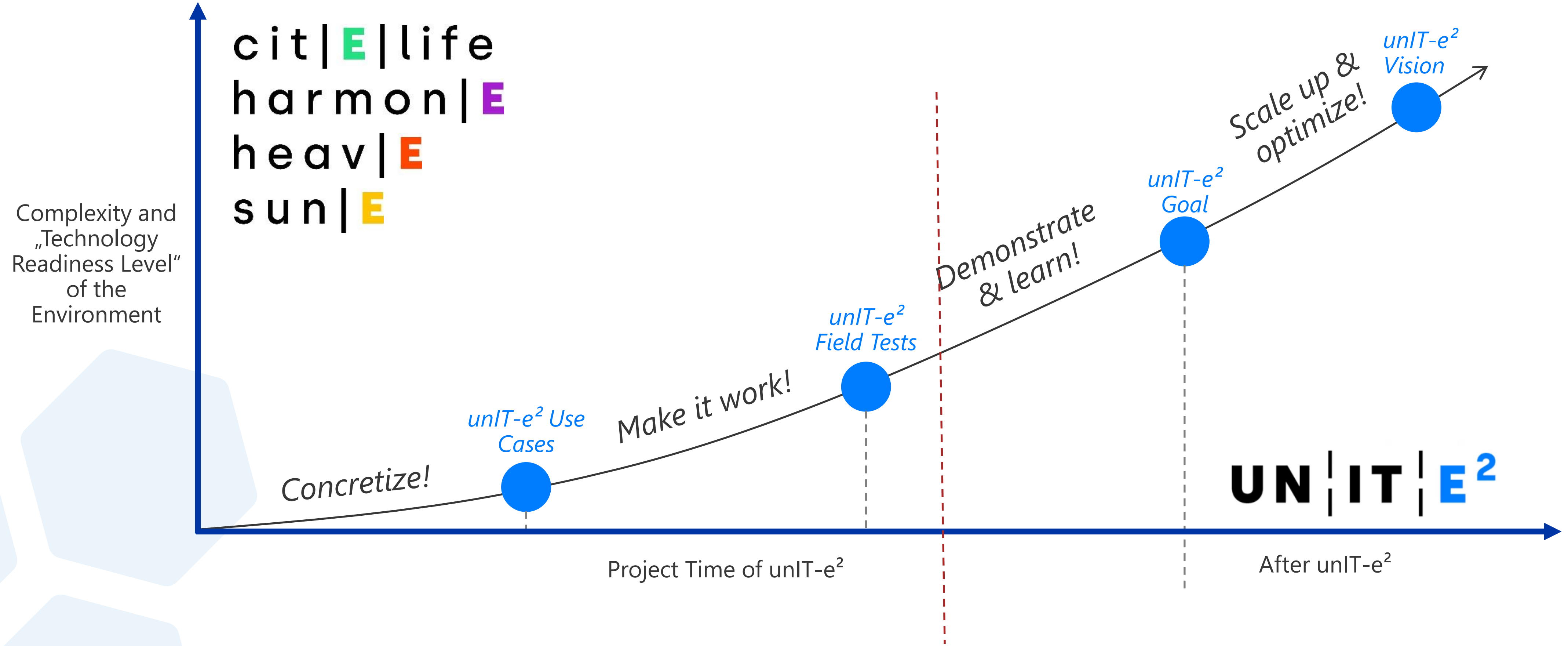
Less "one-fits-all", but more thinking in compatibility and evolutionary possibilities, taking into account practicability, planning security/clarity in the legal and regulatory framework necessary

Cluster structure for solution diversity and competition of concepts

But: Difficult consolidation, synthesis and standardization as large construction sites for the second half of the project + close cooperation with related projects

unIT-e² Evolution Path

More than a Research Project



Kontakt

DR.-ING. SIMON KÖPPL

Head of Living Labs and Electromobility
FfE e.V.

+49 89 158121-78

SKOEPPL@FFE.DE

MICHAEL HINTERSTOCKER

Head of Digitalization and Modeling
FfE GmbH

+49 89 158121-53

MHINTERSTOCKER@FFE.DE

FfE
Am Blütenanger 71
80995 München

Fotos: Enno Kapitza