Karlsruher Institut für Technologie

ENERGY LAB 2.0

System Analysis of Energy Valleys- Experiences and Insights from Ongoing Projects

GIZ-IGEF

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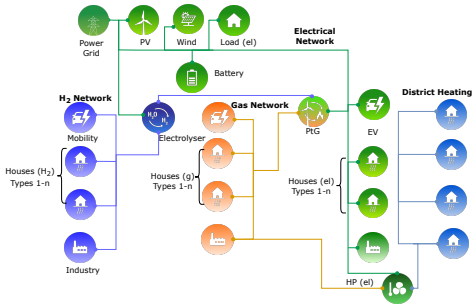
Definition: Energy system

Real time system with energy production and storage, building clusters, Power-, Gas- and H_2 grids.

Energy system representation

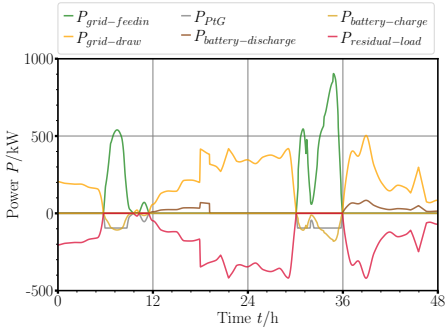


Changeable parameters

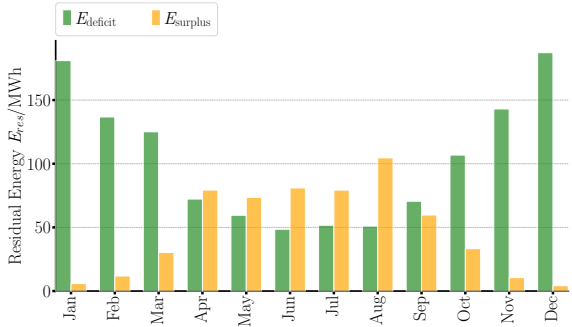
Component	Parameter
Grids	Gases, Power, Heat
Sectors	Buildings, Mobility, Industry
Profiles	Buildings (SLP 1-15), Mobility (eMOB 1,2)
Storage	Battery, Gas, Heat
Sector coupling	PtG, CHP, PtH

Definition: System simulation

Dynamic results (short term)



Seasonal results



- Results specific to the energy valley
- Seasonal results include energy demand/supply, costs and GHG values

Definition: Energy scenarios

Classifications

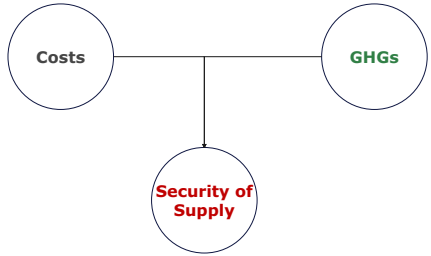
- All electric
- Balanced
- H_2/Gas

Scenario	Trend	Focus: Mobility	Focus: Industry	Focus: Buildings
Fraunhofer:LFS				
TN-El	El	BEVs, H_2	El,H_2	Heatpump
TN-PtG/PtL	SNG, e-Fuel	BEV, e-Fuel	El, SNG	SNG, Heatpump
TN-H_2	H_2	BEV, H_2	El,H_2	Heatpump,H_2
DENA	Balanced	BEV, H_2, e-Fuel	El, SNG, H_2	Heatpump,SNG
Agora KN-2045	El	BEV,H_2,	El,H_2	Heatpump
Ariadne				
Mixed	Balanced	BEV, H_2	El, H_2	Heatpump
El	El	BEV	El H_2	Heatpump
H_2	H_2	H_2	El H_2	Heatpump,H_2
e-Fuel	H_2,SNG	BEV H_2	El,H_2,SNG	Heatpump, SNG
DVGW-RMG	H_2,SNG	BEV,H_2,e-Fuel	SNG, H_2	SNG,H_2

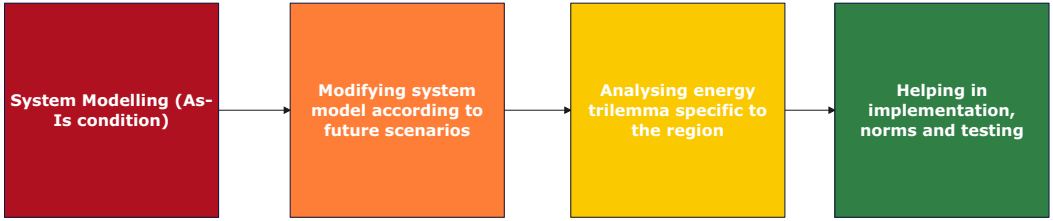
Definition: The Energy Trilemma

Three characteristics

- Security of supply
- Cost effective operation
- GHG minimal operation

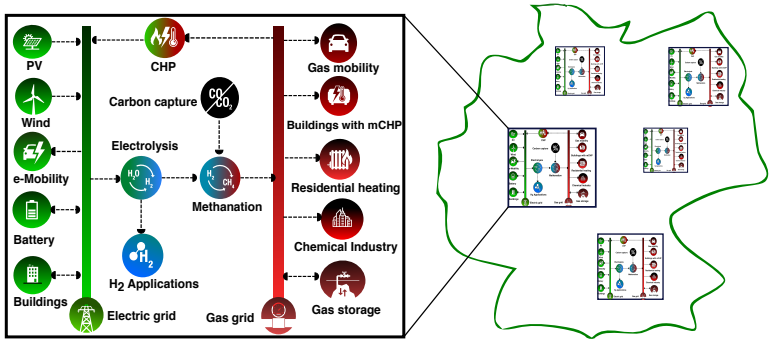


Working methodology



Testing energy valleys: Energy Lab 2.0

Insight 1: Energy valleys are heterogenous



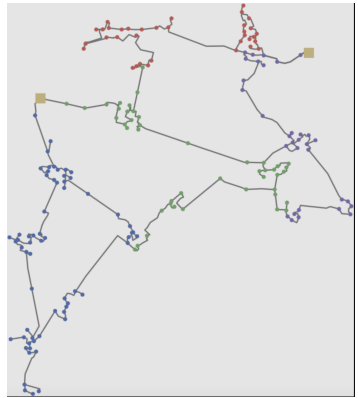
Insights

- Industrial/Building/Mobility transformations will be highly heterogenous
- Adaptations are needed specific to each system

Insight 2: Networks must adapt

Networks must be adapted

- Network instabilities must not occur
- Standards must be developed or modified
- Testing should be a critical part



Electric grid Oberrhein: Source: www.pandapower.net

Insight 3: The Energy Trilemma can only be Pareto optimal

Pareto Optimality

- All three aspects (supply security, costs, GHGs) cannot be minimised simultaneously
- A point will be reached where one aspect cannot be optimised without negatively affecting the others

Quantification is essential

- Costs and GHGs play a major role in decision making
- Must be quantified for each system

Can the methodolgy be adapted in India

Short answer: Yes

- The method can be adapted to any location

But..

- It has to be a multi agency ecosystem
- It will take time

Thank you for your attention. Have a beautiful day.

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