Empowering Rural Electrification

Parallel Break-out Session 3:
Financial engineering of the proposed financial mechanism

Linking financial engineering to energy system planning

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- Founded 2010
- about 25 researcher
- Member of Alliance for Rural Electrification

Research groups:

- Renewable Energy Mobility
- Renewable Energy Technology
- Renewable Energy Systems
- Renewable Off-Grid Systems

Scientific research and support for a transition towards 100 % renewable energies

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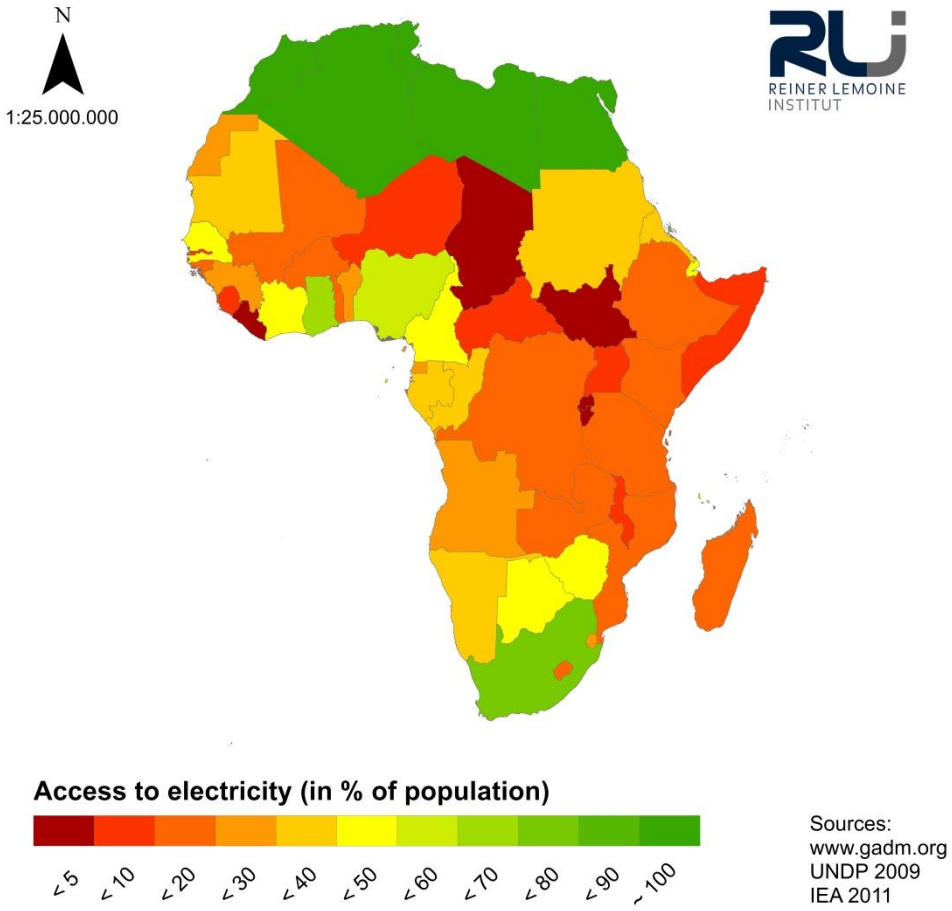
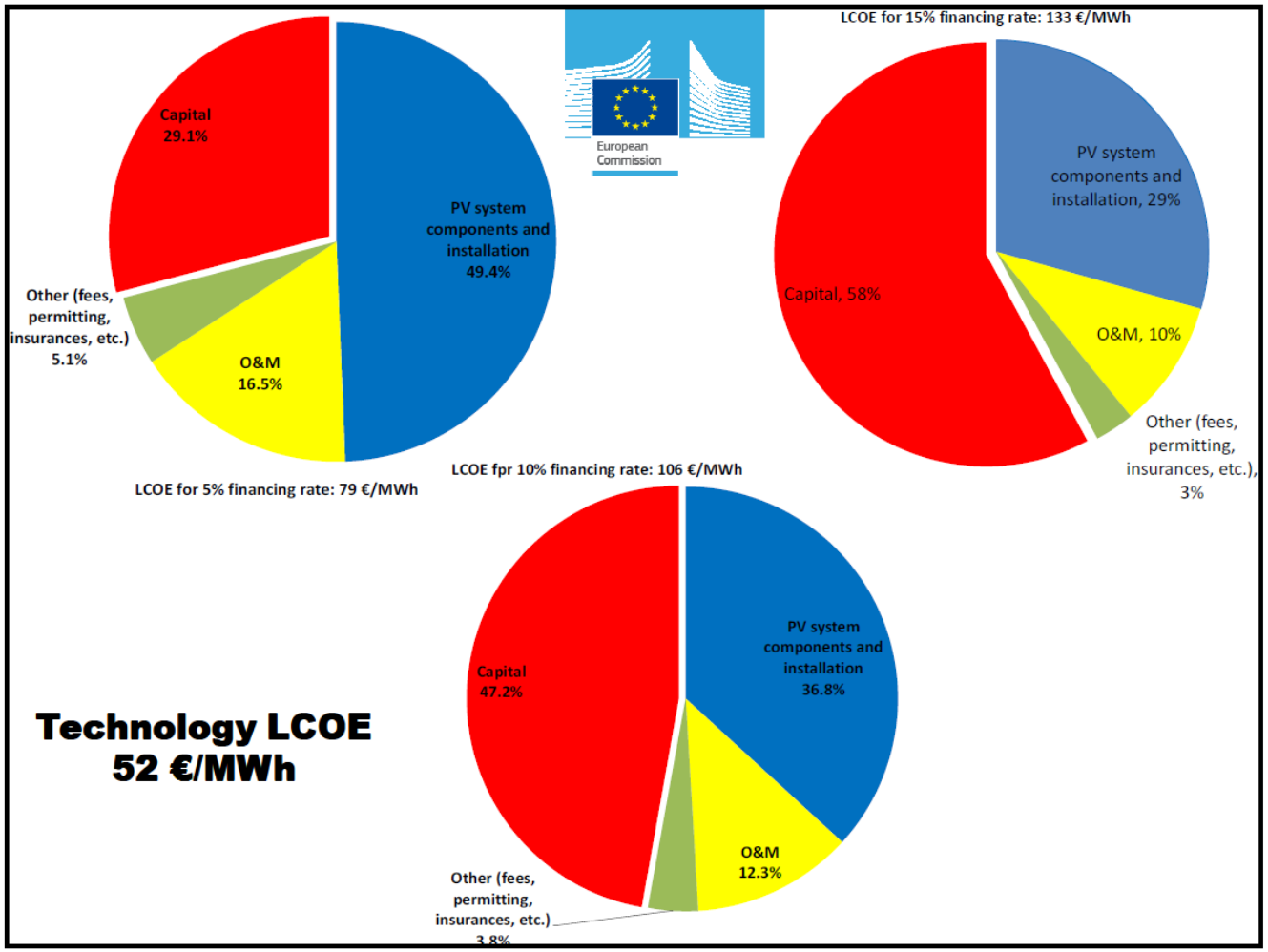
Problem

- Electricity access shares remain low although much effort is undertaken
- Availability of renewable resources and renewable technologies extenisvely demonstrated in scientific literature
- Deployment of renewable resources slow due to low contribution from financing sector
- **Main problem:** Bankability of rural electrification projects



High Financing Costs



Jäger et al. 2014. Proceedings of AfricaPVSEC

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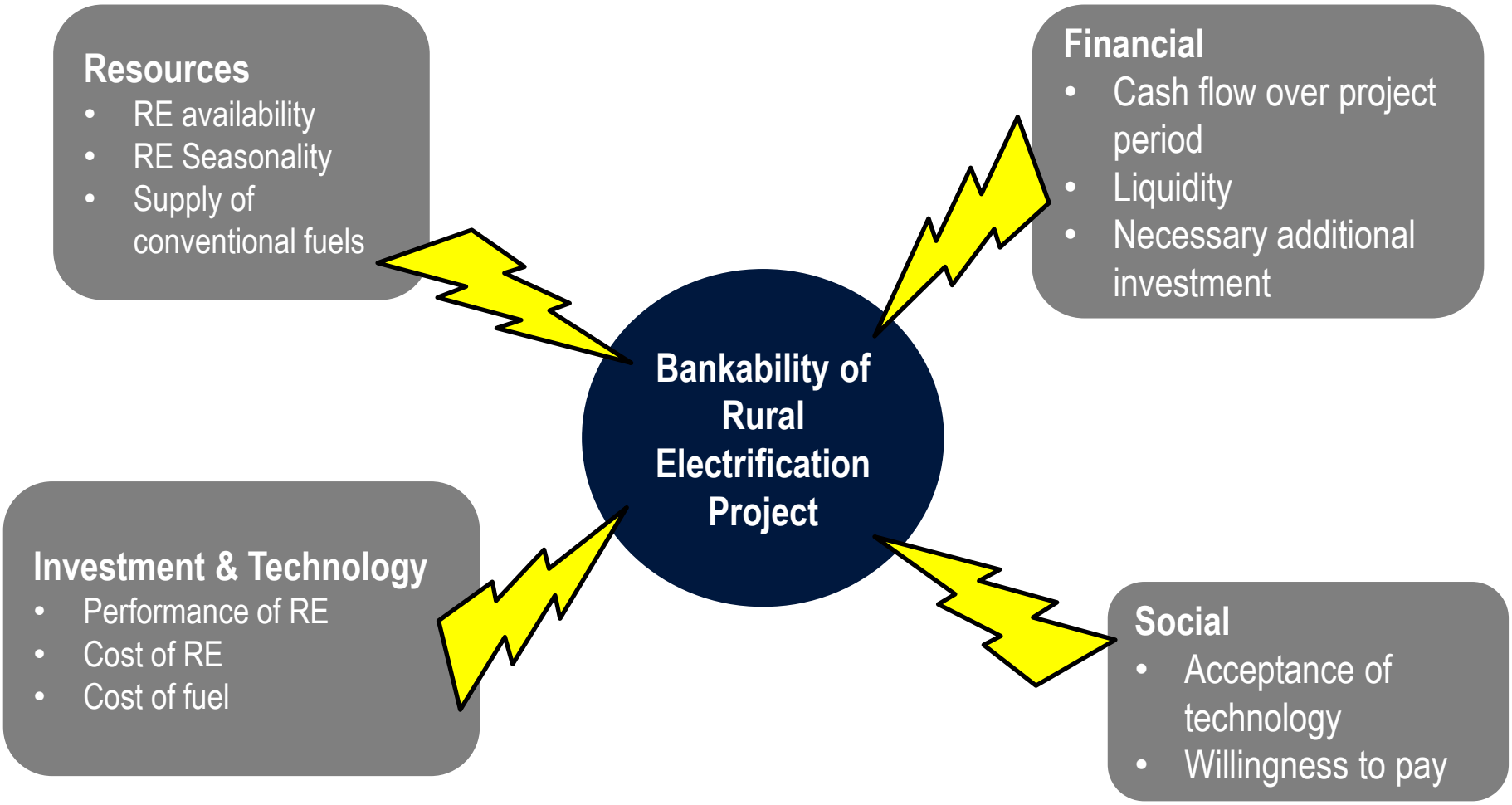
Cosmos of Uncertainties



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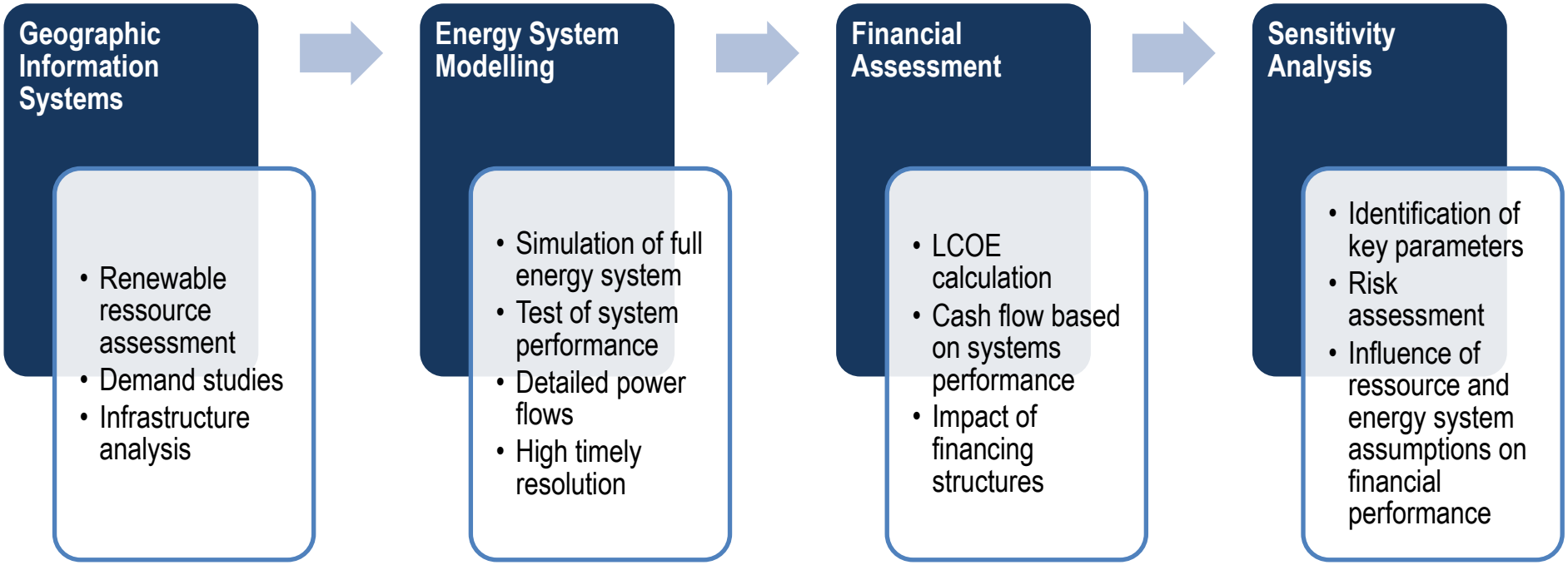
RLI Approach: CAREP

- **Uncertainties and risks will remain in rural electrification, but a comprehensive project assessment helps to understand and minimize them**
- **EC instruments is „risk“ mitigation, RLIs approach minimizes risk of risk mitigation tool via „Comprehensive Assessment of Rural Electrification Projects (CAREP)“**
- **Four single planning phases are combined to one holistic instrument: CAREP**



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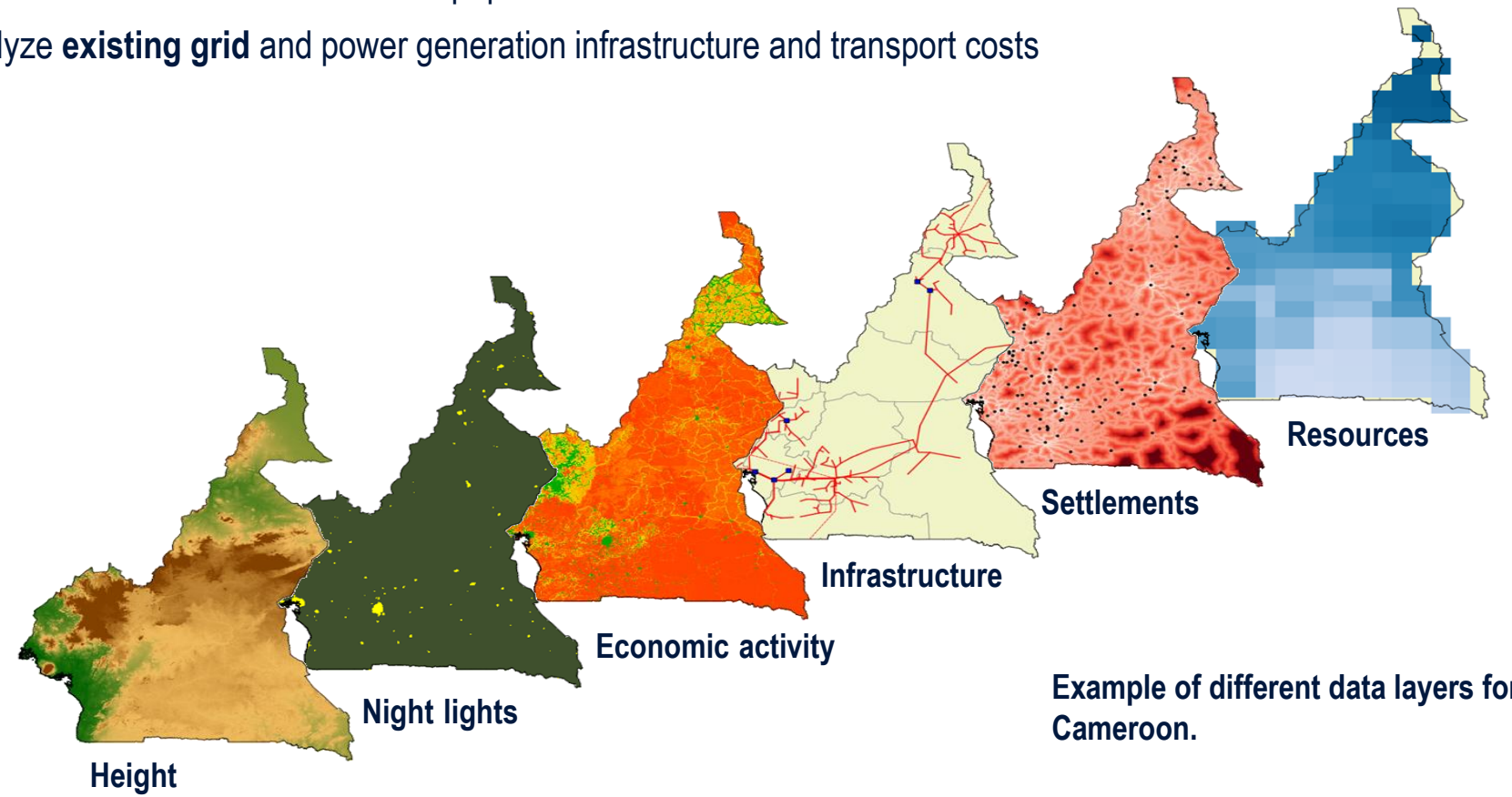
CAREP 1
GIS-based Analyses

Based on satellite and other data geographic analyses can be performed to

- Assess **renewable ressources** in high timely resolution over more than 20 years
- Perform **demand studies** based on population and economic data
- Analyze **existing grid** and power generation infrastructure and transport costs



Example of different data layers for Cameroon.

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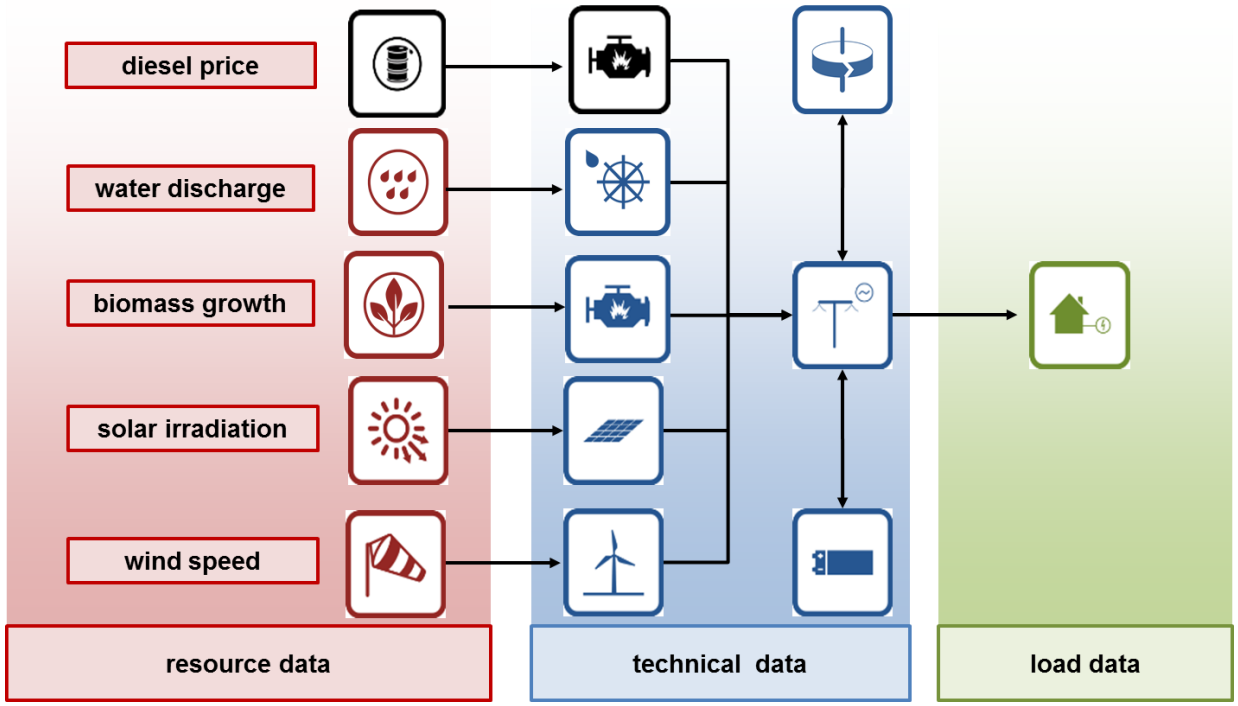
CAREP 2
Energy Systems Modelling

Based on GIS data as input and an inhouse developed simulation tool the energy system can be simulated and optimized

- Ressource and load data can be incorporated in hourly or 1 minute timesteps
- Full system performance is simulated under technical stability constraints
- Diesel consumption and other outputs can be shown for the entire project lifetime



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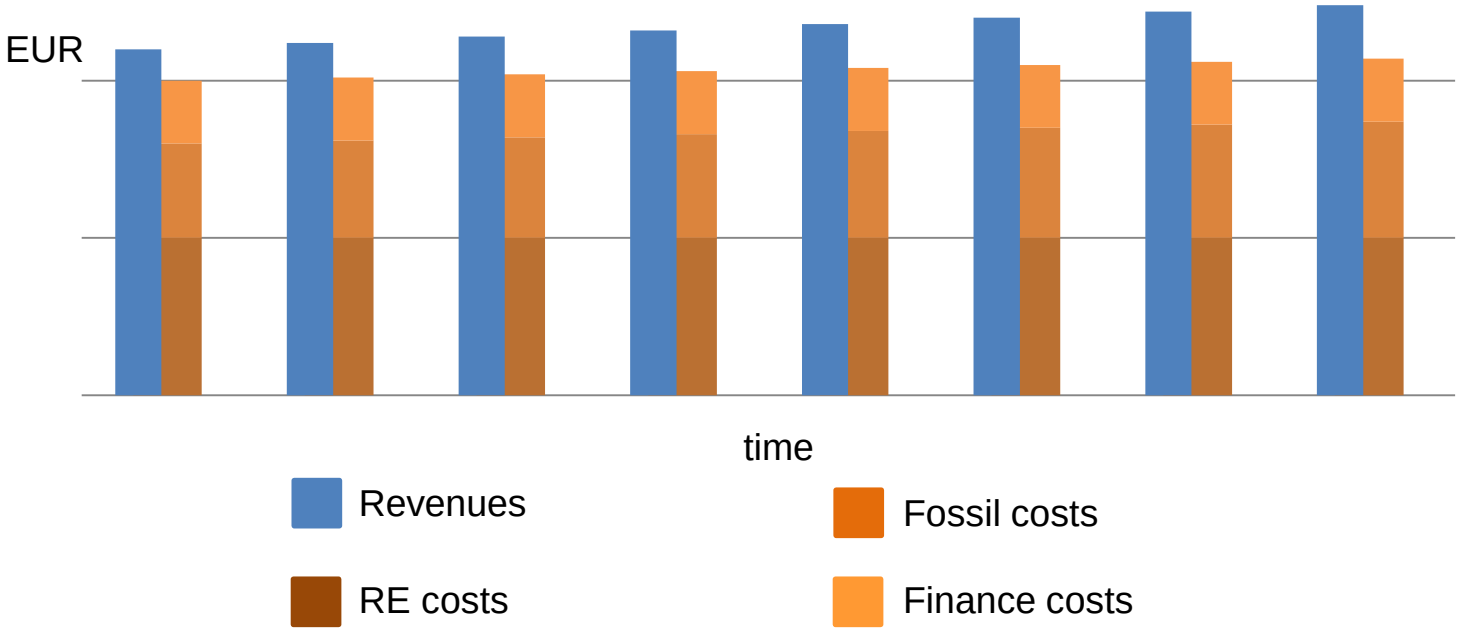
CAREP 3
Financial Assessment of Projects

Based on the energy system modelling the diesel consumption and system configurations are taken to assess the financial performance

- LCOE calculation based on CAPEX, OPEX and fuel costs
- Cash flows for every year are calculated based on the energy system output for the entire project lifetime including changes in resource data or load patterns
- Impact of different finance structures is tested



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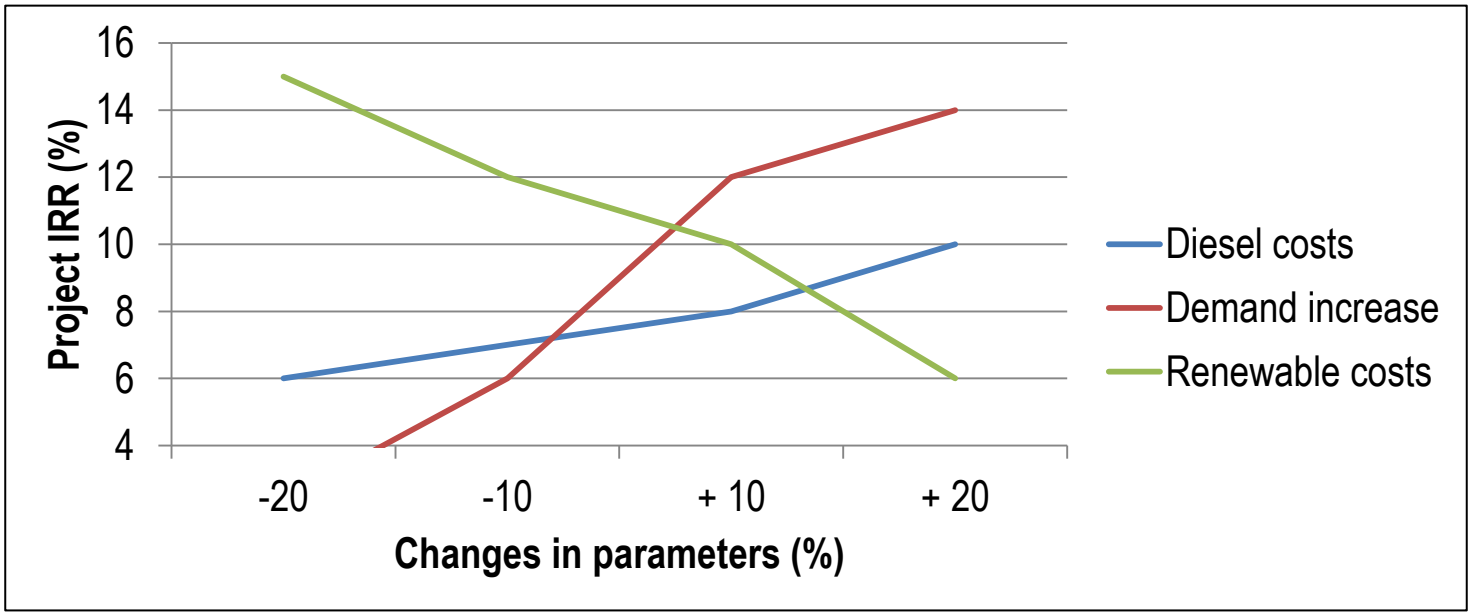
CAREP 4
Sensitivity Analysis

With a sensitivity study the robustness of rural electrification project is studied

- As all previous steps are automatically connected all input parameters can be tested according to their influence on the project performance
- Financial specialists can test the impact of the a change in the assumptions of technical specialists on the system performance and the other way around



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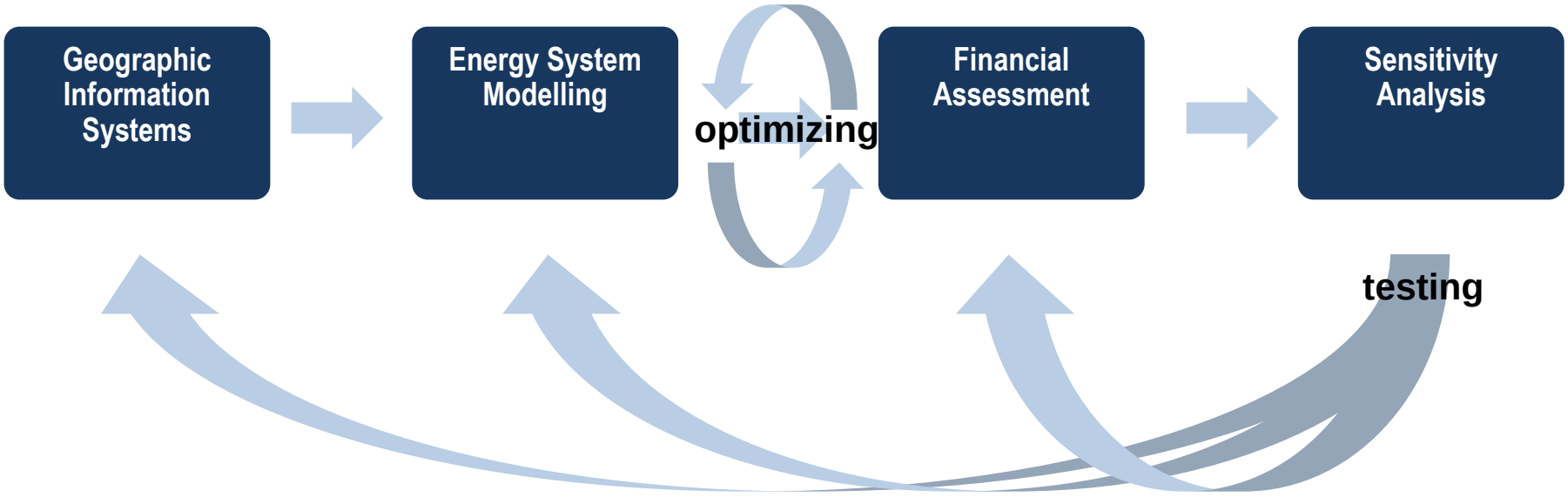
CAREP 5
Summary of Approach

- For project assessments usually experts on the different phases provide results
- Using the CAREP approach all phases are automatically connected
- Sensitivites allow changes in all previous phases to see the impact on the project performance
- Combination of energy system and financial assessment allows a techno-economic optimization of the systems configuration



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Setting it in the frame-work of EC instrument

CAREP allows to examine the feasibility of a project en détails and therefor mitigate the risk for all parties involved:

European Commission

- Feasibility study (grant to subordinated debt)
- Estimation of possible interest rate of subordinated debt without compromising project
- Assessment of liquidity: Necessity of risk capital

- Feasibility study
- Risk evaluation – extraction of detailed cash-flows

- Return on Equity / Dividends
- Optimal system (e.g. min. LCOE, IRR) vs. Optimized system (e.g. available equity)

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- Evaluation of the effect of FIRE on profitableness (NPV, IRR, LCOE)
- Based on our approach a financial strategy is developed how to implement the system

Our Contribution

- Showcase leverage effect of FIRE
- Guidance for project developers in applying FIRE
- Due diligence of project submissions for FIRE

Thank you!

And special thanks to the RLI off-grid team

For further questions please contact us:

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