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# SMECS

Smart Energy Communities



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by the German Bundestag

## SMECS project

- consortium with 6 organizations

- CIS Solutions
- CAS Software AG
- Energiearchitekten Chiemgau
- Energieforen
- Fraunhofer Institute for Industrial Engineering IAO
- Social CRM Research Center e. V.



- project duration: 2 years from February 2018 till January 2020

- supported by the German “Federal Ministry for Economic Affairs and Energy” on the basis of a decision by the German Bundestag



## Question

- How can we economically operate (old) renewable energy facilities under new regulatory conditions

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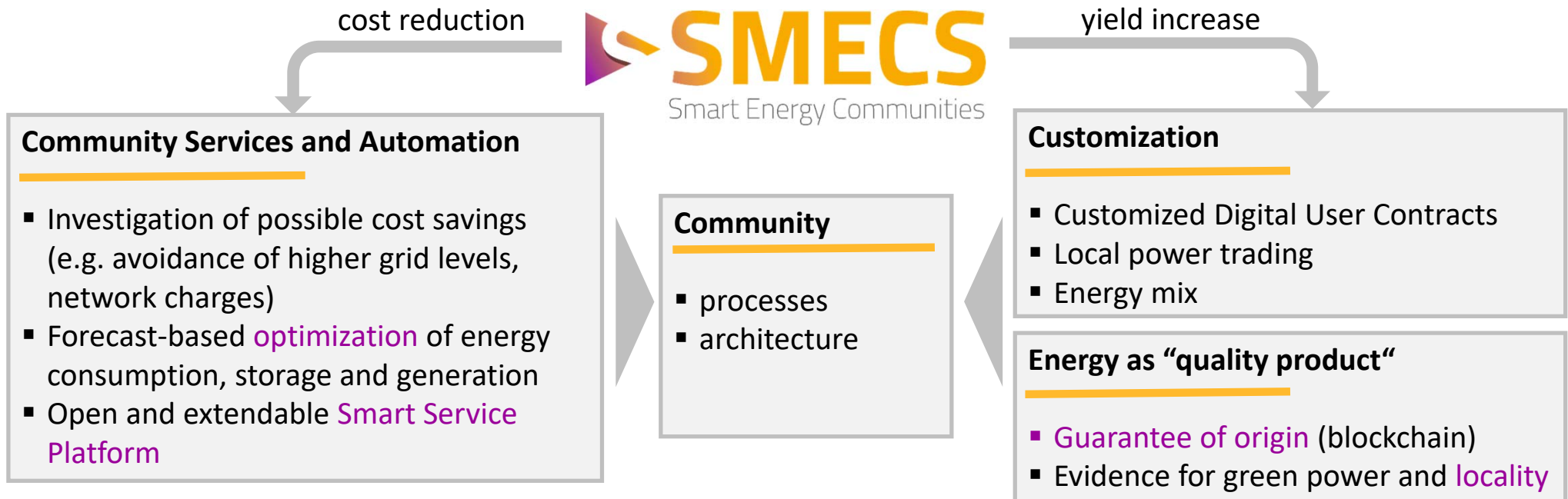
### Situation in Germany

- end of 2020 the promotion/support/sponsorship for old renewable energy plants in Germany expires (Renewable Energy Sources Act – Erneuerbare Energien Gesetz, EEG)
- consequences: instead of up to 18.73 ct/kWh only between 2.9 to 6.3 ct/kWh photovoltaic power plant
- EU Directive 2018-2001 on the promotion of the use of energy from renewable sources as part of the “Clean Energy for All Europeans” package, support of
  - renewables self-consumption
  - guarantee of origin for energy from renewable sources
  - renewable energy communities

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## Primary objective

- Efficiently support **small energy producers** and energy cooperatives through sustainable **community** approaches and **smart services** for cooperation and customer processes.

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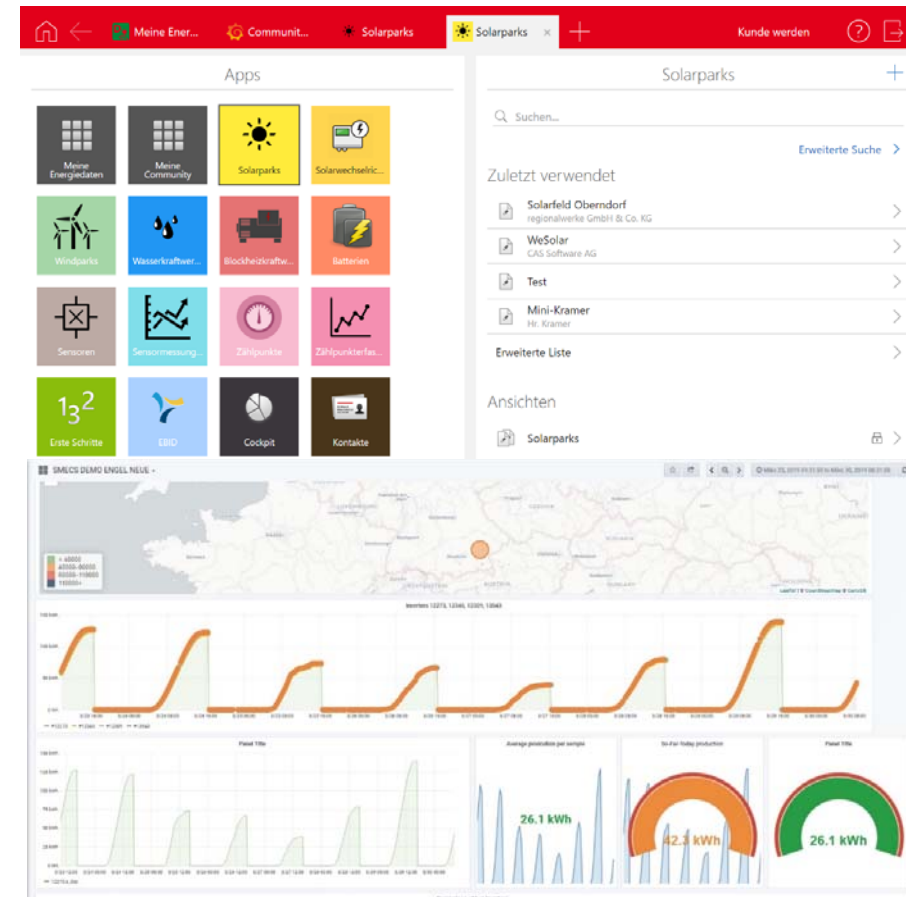


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# SMART SERVICE PLATFORM – SMARTWE



- xRM Cloud platform ecosystem for energy communities
- Connecting small producers and consumers
- Different views for all participants (producers, consumers, community managers, ...)
- Central place for the Smart Services of the community (Apps)
  - power plant master data management
  - energy data analytics
  - energy forecasts
  - optimization
  - guarantee of origin
- Open and extensible – AppDesigner or custom apps
- Visualization of community data
- Backend with all energy time series
  - measurements
  - forecasts
  - optimization results



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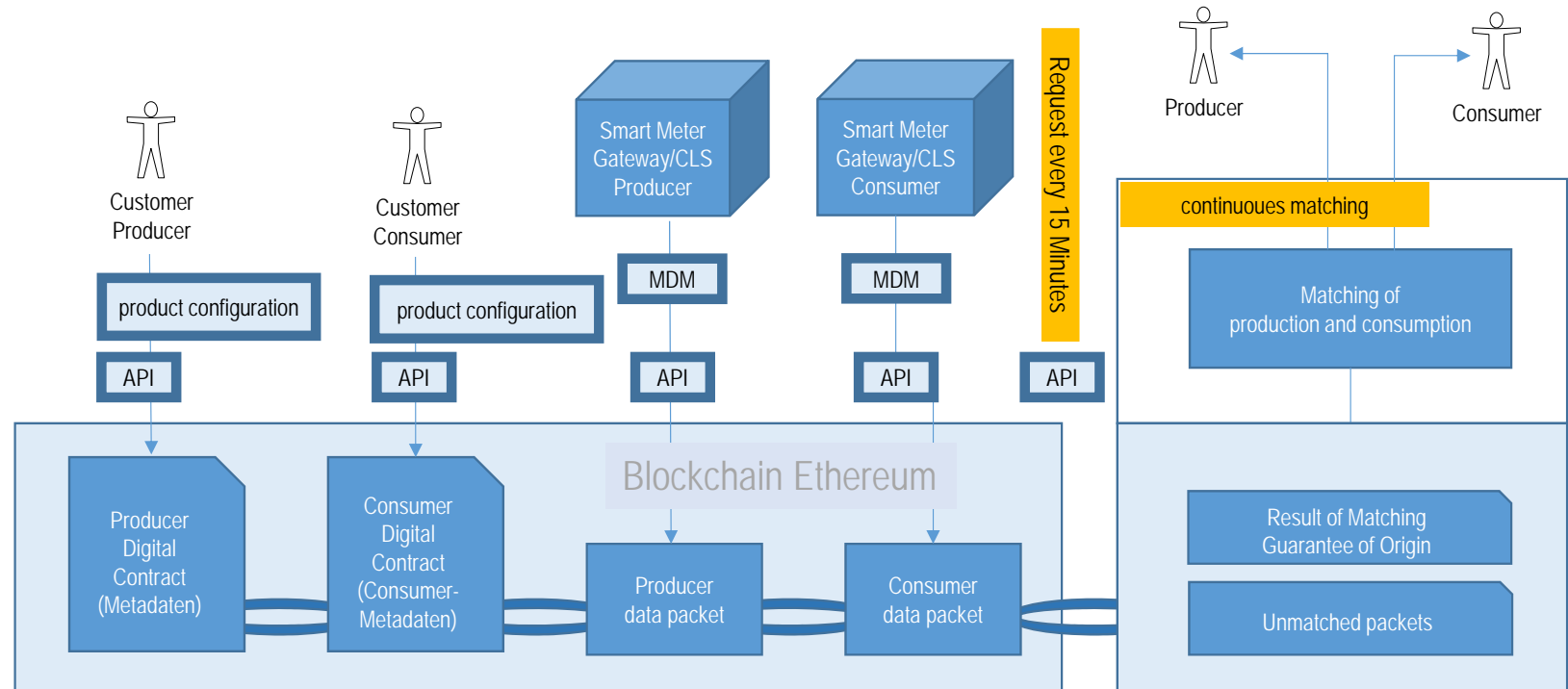


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# GUARANTEE OF ORIGIN USING BLOCKCHAIN TECHNOLOGY



- documentation and evidence for simultaneous energy production and consumption in the same region
- through upcoming regulations and laws: cost savings if renewable energy is used region
- peer-to-community trading (peer2peer on blockchain)







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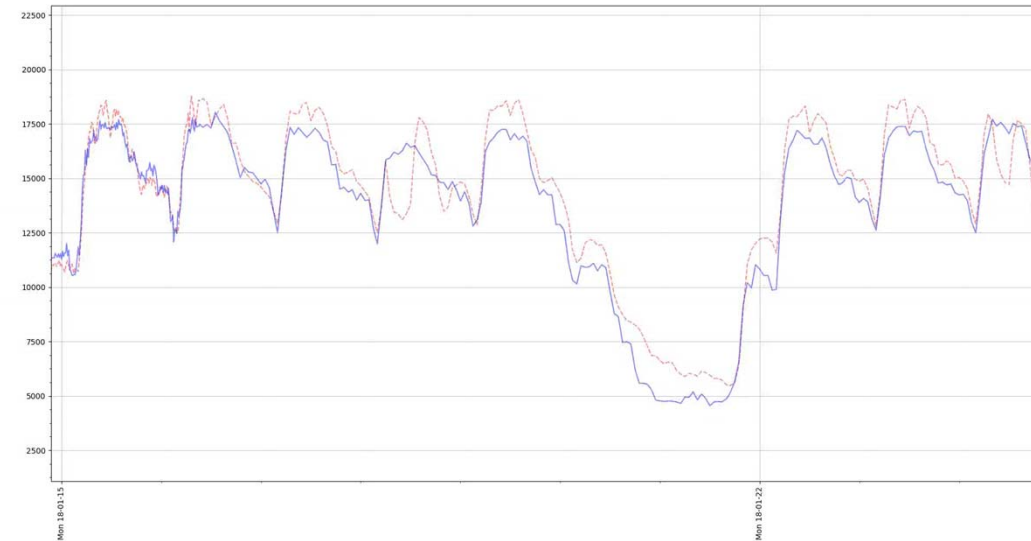


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# ENERGY FORECASTS

- Prerequisite for **optimization** and peak shaving
- Based on AI technology
- Forecasts for
  - **loads** like households or industry  
  - energy **production** by renewable energy plants like PV fields or wind power stations  
- Cloud-based REST Service
  - Requests up to 1 per minute
  - Customizable arbitrary forecast resolution (e.g. 15 min)
  - Adjustable forecast horizon (e.g. 2 days, 1 week)
- Data driven
  - Historic energy values
  - Date/time based data (e.g. weekday, vacations, season)
  - Weather
  - Optional metadata (e.g. # of present/absent employees)

forecast and true load for a manufacturer



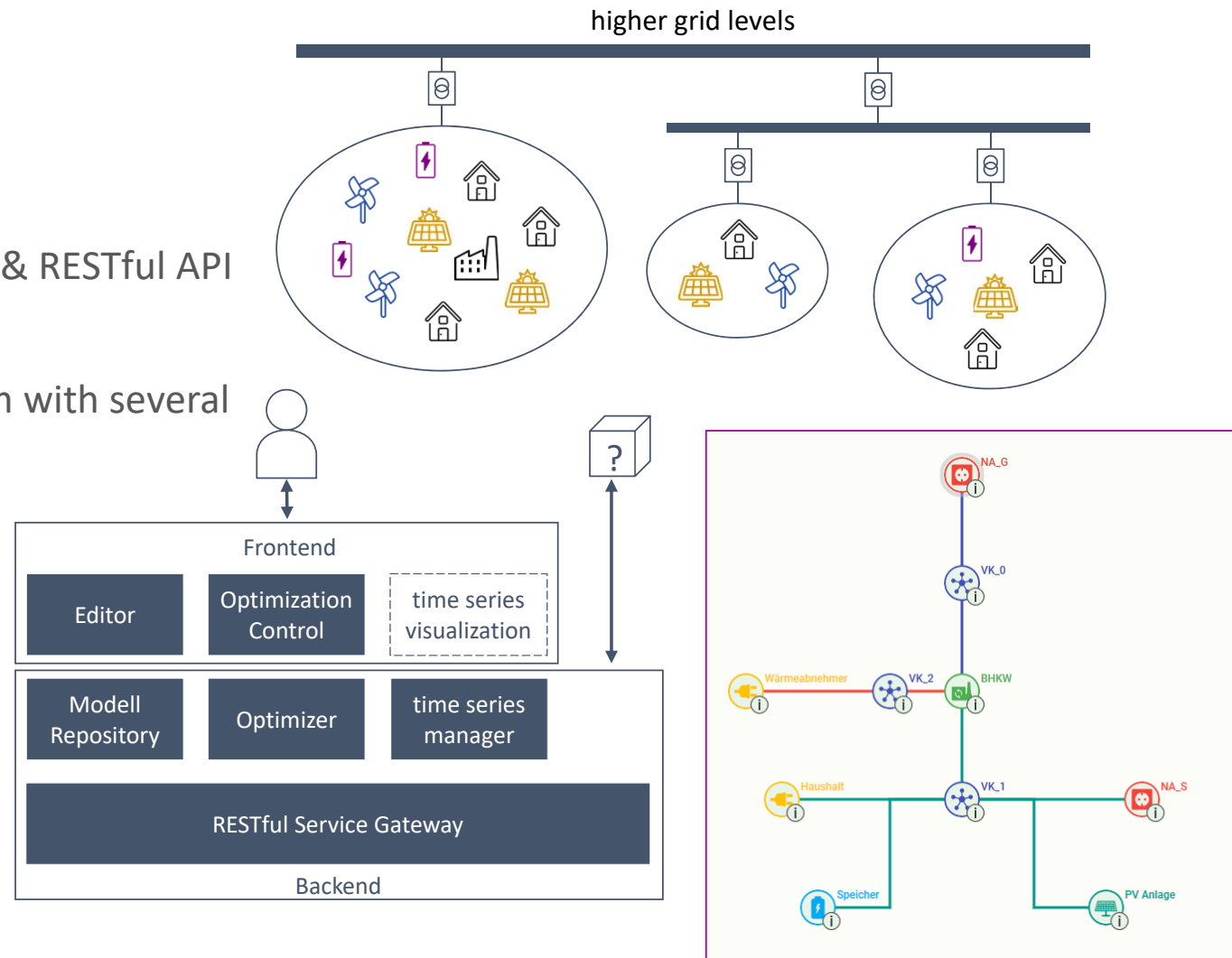
- Machine learning algorithms
  - Linear Regression
  - Support Vector Machines
  - Artificial Neural Networks
  - Gradient Tree Boosting

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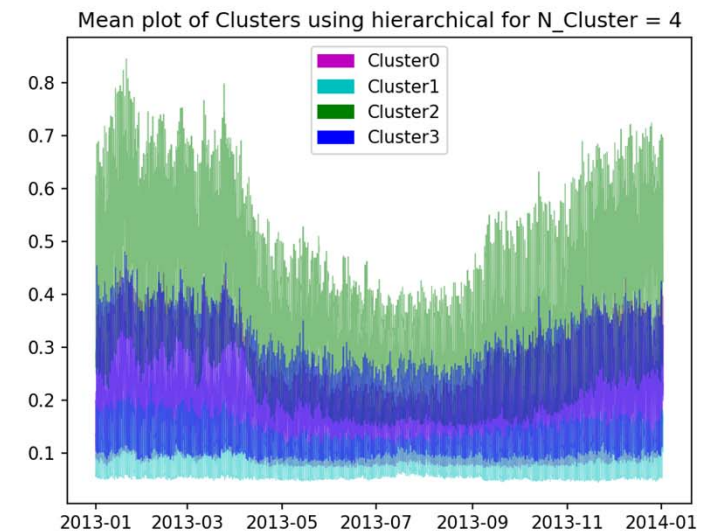
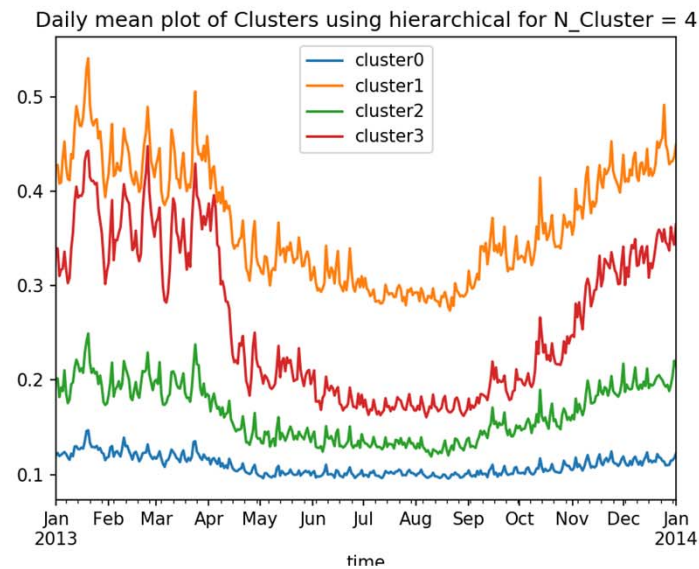
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- Optimization goals
  - cost efficiency
  - avoid higher grid levels
  - utilize energy storage
- (Micro-)Service-oriented architecture & RESTful API
- Angular-based user frontend
- Editor for modelling the energy system with several
  - plant types
  - energy types
  - conditions
- transformation into mathematical representation
- support of AMPL and GAMS
- optimization result: all energy flows





- Goal: find most attractive customers for the community
- Identify households with load profiles matching renewable energy production
- based on household metadata
  - region
  - type of house
  - economic data
- different algorithms and approaches
  - PCA
  - auto encoders (NN)
  - distance metrics



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## CONCLUSION

- SMECS provides benefits for energy producers and consumers
  - AI driven Smart Services
  - customer can see where the electricity comes from
  - Transparent energy consumption and prompt billing
  - Improve regional market presence
  - Increasing the profitability
  - Enabling new and sustainable business potentials
- Concepts and prototypes show the legislation how decentralized energy markets can succeed



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THANK YOU!

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