



Smart Grids Plus

ERA-Net

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**Managing power, heat and comfort in
Smart Buildings**

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THE DAI-LABOR – AN APPLIED ICT RESEARCH INSTITUTE AT THE TECHNICAL UNIVERSITY OF BERLIN

- Lead by Prof. Dr. Dr. h.c. Sahin Albayrak
- 50+ full-time PhD student researchers
- 50+ part-time student researchers
- 10+ post-docs
- Research is structured in *Application Centers*



CONNECTED LIVING E.V. – AN INNOVATION CENTER FOR SHAPING THE INTERNET OF THINGS

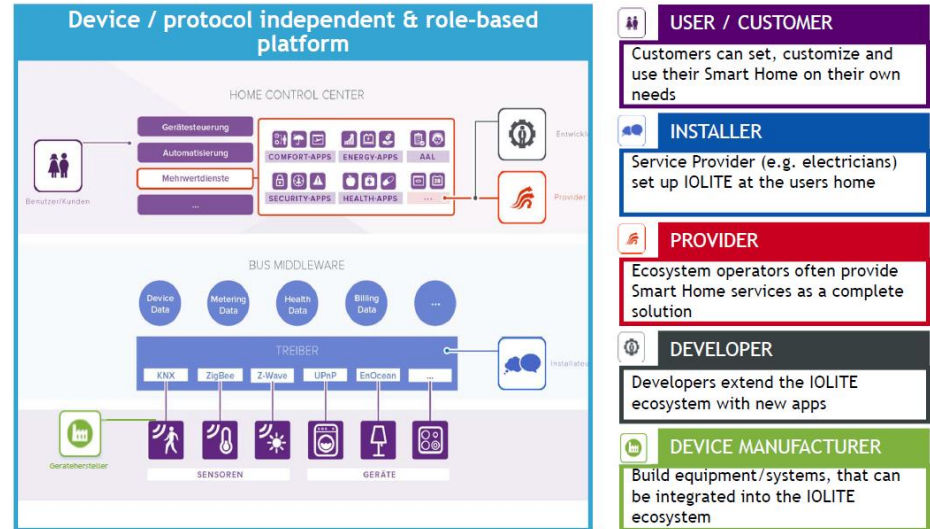
- Innovation Center consisting of more than 50 member companies and organizations from different industries
- Aims to develop and establish forward-looking, intuitive and intelligent solutions and interoperability standards
- Aims at designing new markets in the field of Connected Lives



www.connected-living.org

THE DAI LABOR FOUNDED A SPIN-OFF THIS YEAR TO MARKET RESEARCH PROJECT RESULTS

- The product is a Smart Home Platform and Ecosystem to provide a integration platform for the Internet of Things
- The platform is extensible through drivers and apps and IOLITE offers Software Developer APIs and Tools as an ecosystem.



IOLITE

www.iolite.de

WITHIN PROJECT SHAPE WE COULD SHOW SAVINGS OF 30% THROUGH INTELLIGENT HEATING CONTROL

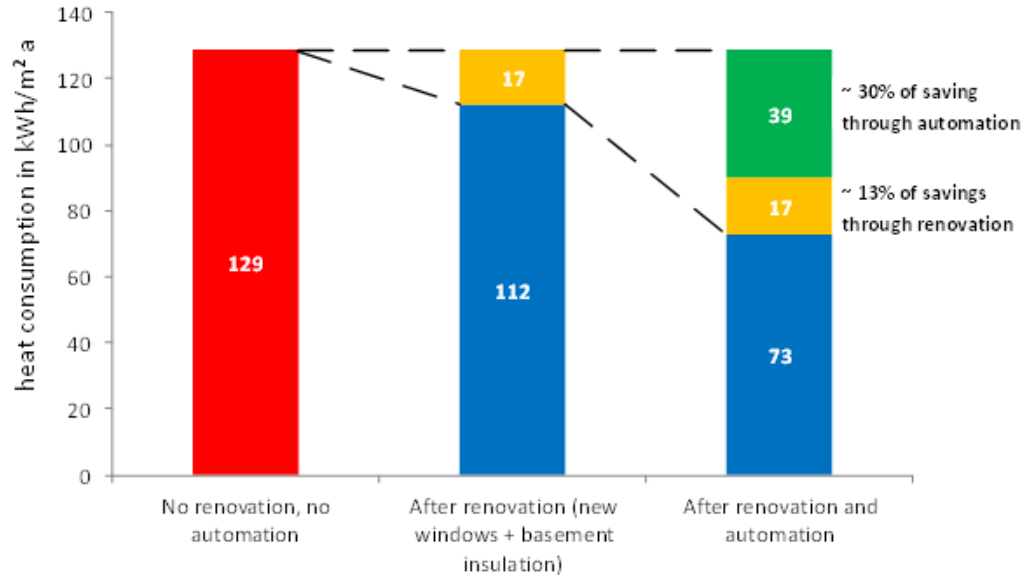
- Goal: Optimization of energy consumption in private households through automation
- Time: June 2010 – June 2012
- Project budget: € 2,8 Mio.



Home Manager



Heater Controller



WITHIN PROJECT PROSHAPE WE AIM AT EXTENDING THESE CONCEPTS TO THE COMPLETE BUILDING

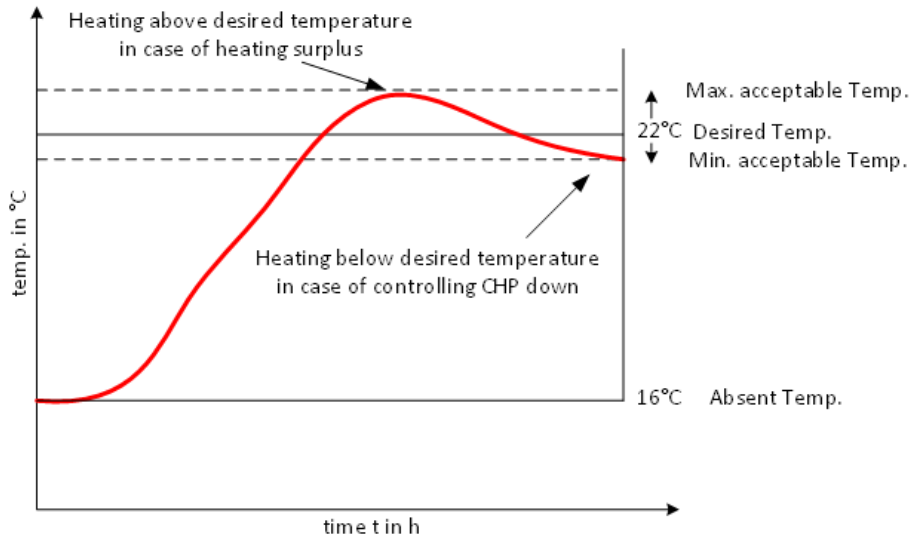
- Extending the ideas of SHAPE to the whole building and district.
- Goal is to demonstrate an optimal control of the building heating supply through intelligent automation and power oriented control of a combined heat and power plant (CHP)
- Time: Jan. 2014 – June 2016
- Project budget: € 2,5 Mio.



THE PROSHAPE RESEARCH AREAS

- Proof-of-concept of **optimized electricity oriented control of a CHP** through intelligent energy management system (EMS), including heat and electricity consumption metering for a small district of 6 buildings (224 apartments).
- Demonstration of **integrated, interoperable building EMS** that is extensible through services (e.g. load forecasts, tariff information) and integrates with the smart home.
- Examination of **operator and business models** for building owners, building administrators, contractors and tenants.

USING THE BUILDING MASS AS FLEXIBILITY FOR SHORT-TERM ANCILLARY GRID SERVICES



- How much flexibility can be provided by using the building mass as additional energy storage?
- How does that compare to other alternatives (thermal and electric storage)?
- We simulate that in a work package in ProSHAPE and aim to validate the calculations with field test data

TOWARDS A FLEXIBILIZED BUILDING ENERGY SUPPLY TO PROVIDE ANCILLARY SERVICES FOR THE ELECTRICITY GRID

Step 1: State-of-art

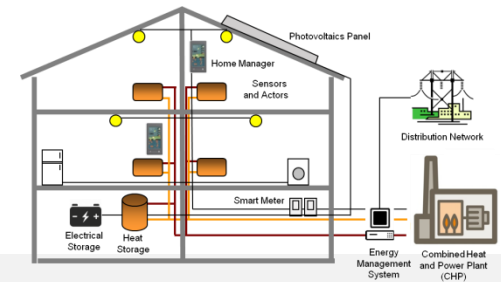
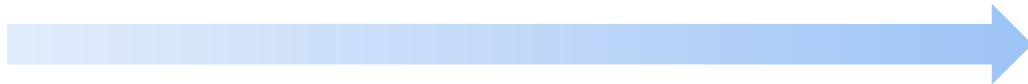
Optimization of energy consumption within the building with a heat-oriented control of a CHP.

Step 2: ProSHAPE

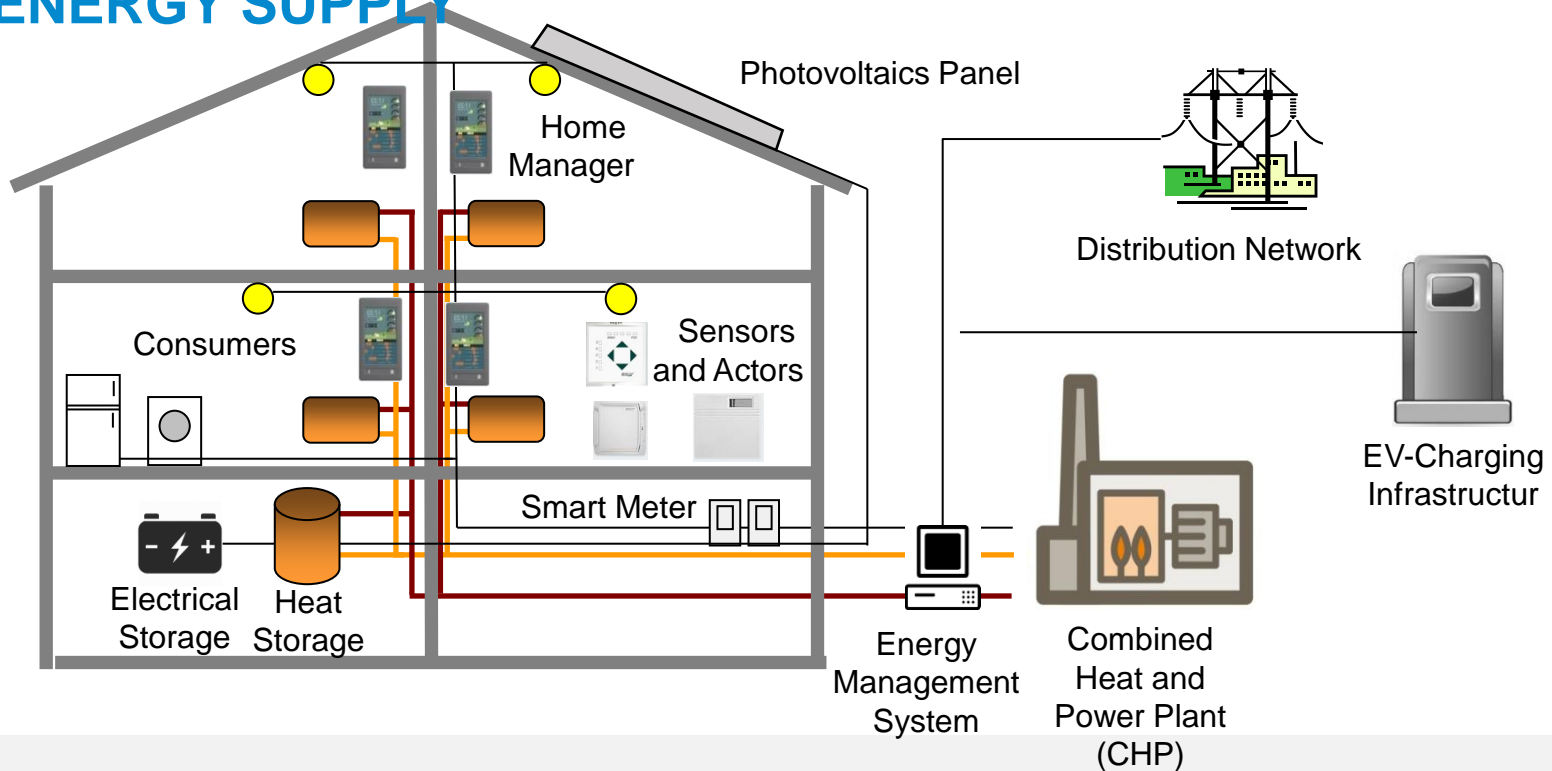
Flexibilized control of a CHP through power-oriented control of a CHP while preserving residents heating requirements.

Step 3: Future Research Needs

Flexibilized energy supply of buildings through flexible CHP, other decentralized production and storage, to provide ancillary services for the electricity grid.



POSSIBLE COMPONENTS OF A FLEXIBILIZED BUILDING ENERGY SUPPLY



RESEARCH AREAS AND TOPICS – FLEXIBILITY

	Technology	Marketplace	Adoption
Flexibility of buildings for ancillary services	How much flexibility do buildings add to the energy system at the lowest level? How does the flexibility differ for different building energy supplies?	What are possible incentives for each of the actors (building owners, administrators, contractors, tenants) to provide flexibility?	
		What are incentives to install larger storage (to increase flexibility)?	
	How much flexibility can the building mass provide under which conditions (e.g., insulation)?		Will end-users accept if temperatures deviate slightly from their set-points and how much?

RESEARCH AREAS AND TOPICS – ENERGY SUPPLY PLANNING

	Technology	Marketplace	Adoption
Planning of optimal energy supply and components sizing	<p>Develop tools to support planning of optimal mix and size of building energy supply and storage components.</p> <p>Survey more typical consumption data beyond standard profiles are needed to improve such tools.</p>	<p>What are business cases and operator models for building energy supply systems?</p>	
	<p>How does the planning differ between (European) countries with different electricity consumption pattern, different heating supply systems, ...)?</p>	<p>How do business cases differ between European countries (different incentives, regulations, ...)?</p>	

RESEARCH AREAS AND TOPICS – SAVING THROUGH AUTOMATION

	Technology	Marketplace	Adoption
Saving potentials through smart automation	What data is needed where in the building/district to optimize the building energy supply?	What are the saving potentials through intelligent automation? What are break even points for automation technology?	Will people accept and sensors and actors in their apartments? Will they use EMS user interfaces appropriately?
	What is the benefit of forecasts and improving forecasting accuracy in building energy management? How do they improve commitment to ancillary services		How can the tenant's privacy be respected and preserved as much as possible?

RESEARCH AREAS AND TOPICS – BUILDING EMS PLATFORMS

	Technology	Marketplace	Adoption
Interoperability of smart home and smart building platforms	How can EMS platform architectures be extended through value-adding services (e.g., for forecasts, AAL functionality, integration of building administration, etc.)?	Can value-added services be used to make better business-cases for building EMS?	Do users accept value-adding services connected to/provided by the building administration?
	How can embedded EMS architectures cope with different actors in the system and ensure priorities in controlling components and ensure data access control?		

RESEARCH AREAS AND TOPICS – EV IN BUILDING EMS

	Technology	Marketplace	Adoption
Integration of EV in building EMS		What are business cases for integration EV charging stations in building EMS?	Would tenants accept if their EV is used for EMS flexibility through intelligent charging or even V2G?



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