

Challenges on the way to energy optimized communities



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Challenges on the way to energy optimized communities



Background

**Case Studies,
Stadtwerk Lehen,
Salzburg**

Challenges

From Buildings to Communities

Buildings ...

- High standards: from low energy buildings to passive house standard to zero / plus energy buildings
- Technologies are mostly well known
- Players are well known and skilled
- Implementation supported by policy instruments: building directives, law, subsidies

... but ...



From Buildings to Communities

Communities ...

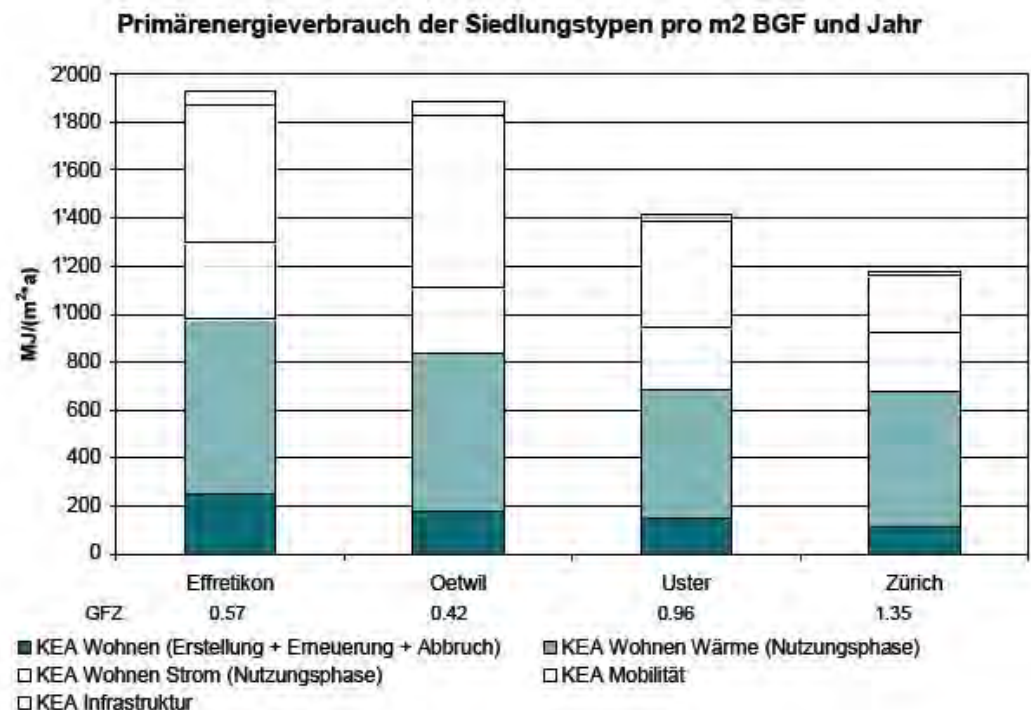
- ? Is sum of optimized single buildings always optimized solution for whole community?
- ? Different understanding of buildings: energy user, energy producer, energy storage
- ? How to define boundaries for communities?
- ? Which optimization criteria are relevant to address the different needs of involved actors?
- ? Which mix of technologies – which technological strategies can be recommended?
- ? Which instruments can be used to implement optimized solutions?
- ? ...



From Cities to Communities

Smart cities, Covenant of Mayors, European Energy Award® ...

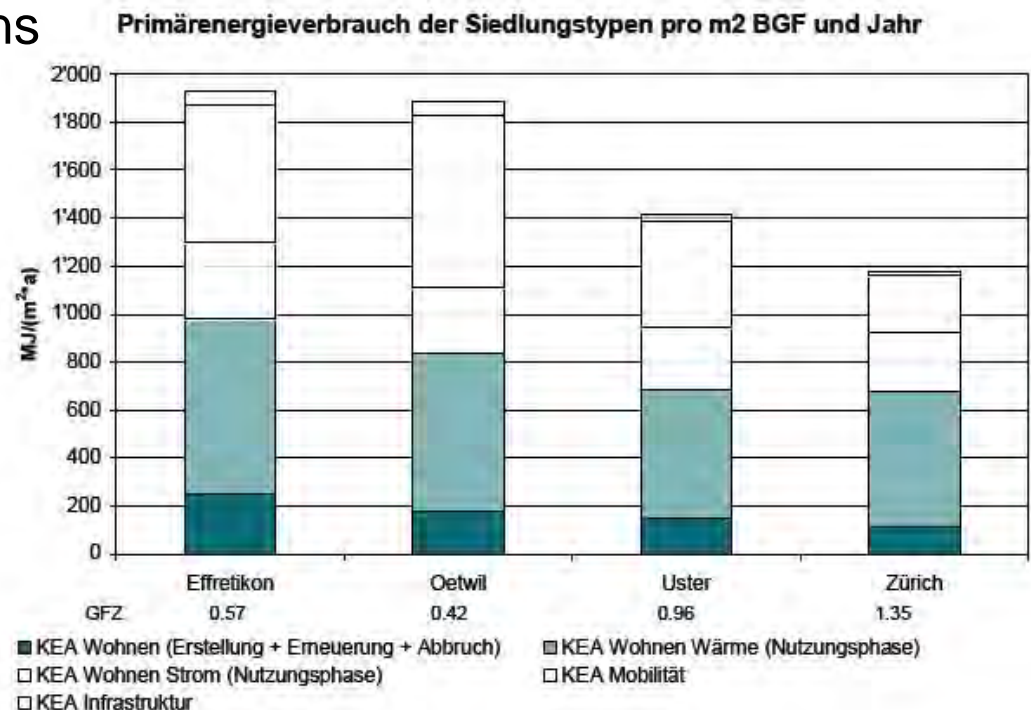
- Holistic approach: energy efficiency, energy supply and grids, mobility, ICT, stakeholder-involvement, monitoring,
- Methodologies for integration of energy planning and optimization in urban planning
- Characteristics of communities determines primary energy consumption / CO₂-emissions
- Implementation of smart cities, energy efficient cities, ... needs transformation to communities level



From Cities to Communities

Communities ...

- Which technological strategies and policy instruments for communities lead to smart cities
- How can the focus be put on strategies for existing building stock, which has rather higher relevance than solutions for new built communities?
- What are the expectations and possible contributions of stakeholders: housing associations, investors, energy suppliers, ...?
- How to create a win:win- Situation for all involved parties?



Case Studies

Several Case Studies within IEA-Annex 51

- ☺ Passive house strategy for communities
- ☺ Solar strategy for communities
- ☺ Economic optimized renovation strategy for communities
- ☺ Energy supply strategy for communities
- ☺ Optimization by Cluster-building,- different buildings with different use
- ☺ ...



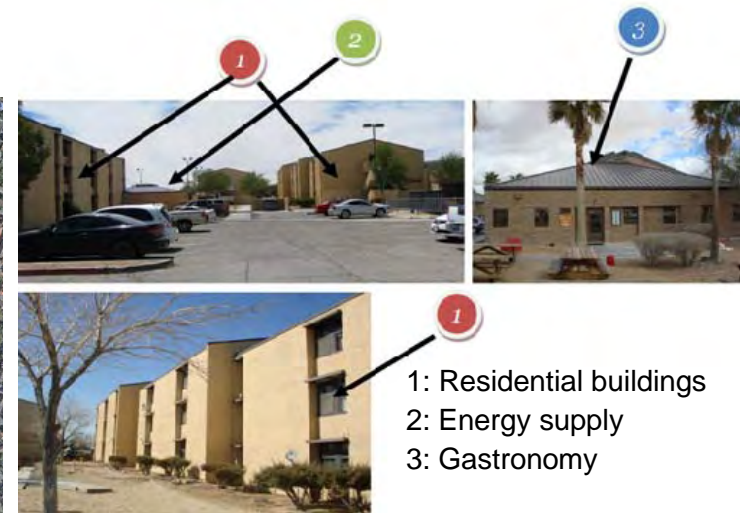
Brogarden, S



Peltosaari, F



Karlsruhe-Rintheim, D



- 1: Residential buildings
- 2: Energy supply
- 3: Gastronomy

Fort Irwin, USA

Case Studies

Optimization Criteria

- ☺ Maximum of Renewable Energy / Minimum of CO2-Emissions
- ☺ Maximum of solar gains
- ☺ Minimum of energy demand
- ☺ Cost effectiveness: Maximum of savings with minimum of costs
- ☺ Considering spin-off effects: upgrading of an area, ...
- ☺ ...



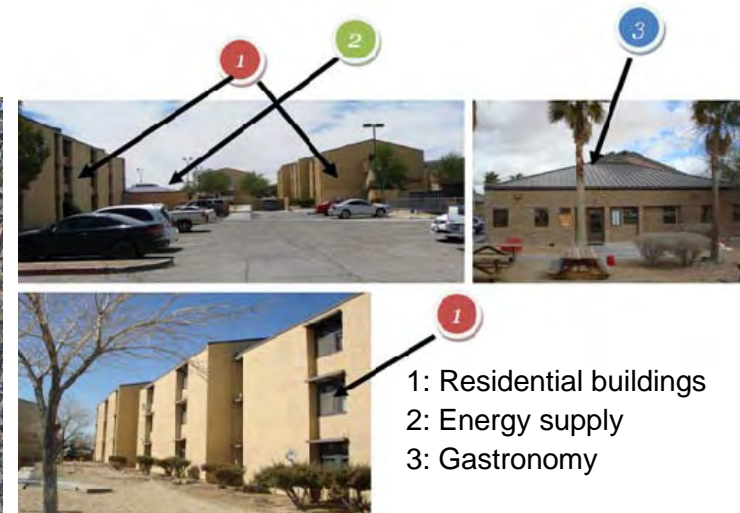
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Fort Irwin, USA

Stadtwerk Lehen, Salzburg

Masterplan for re-development of a community with structural problems

Definition of community-boundaries: new buildings AND existing building stock around



Pilot project funded by EU (Concerto), Building of Tomorrow-Programm (BMVIT), Land Salzburg

Targets

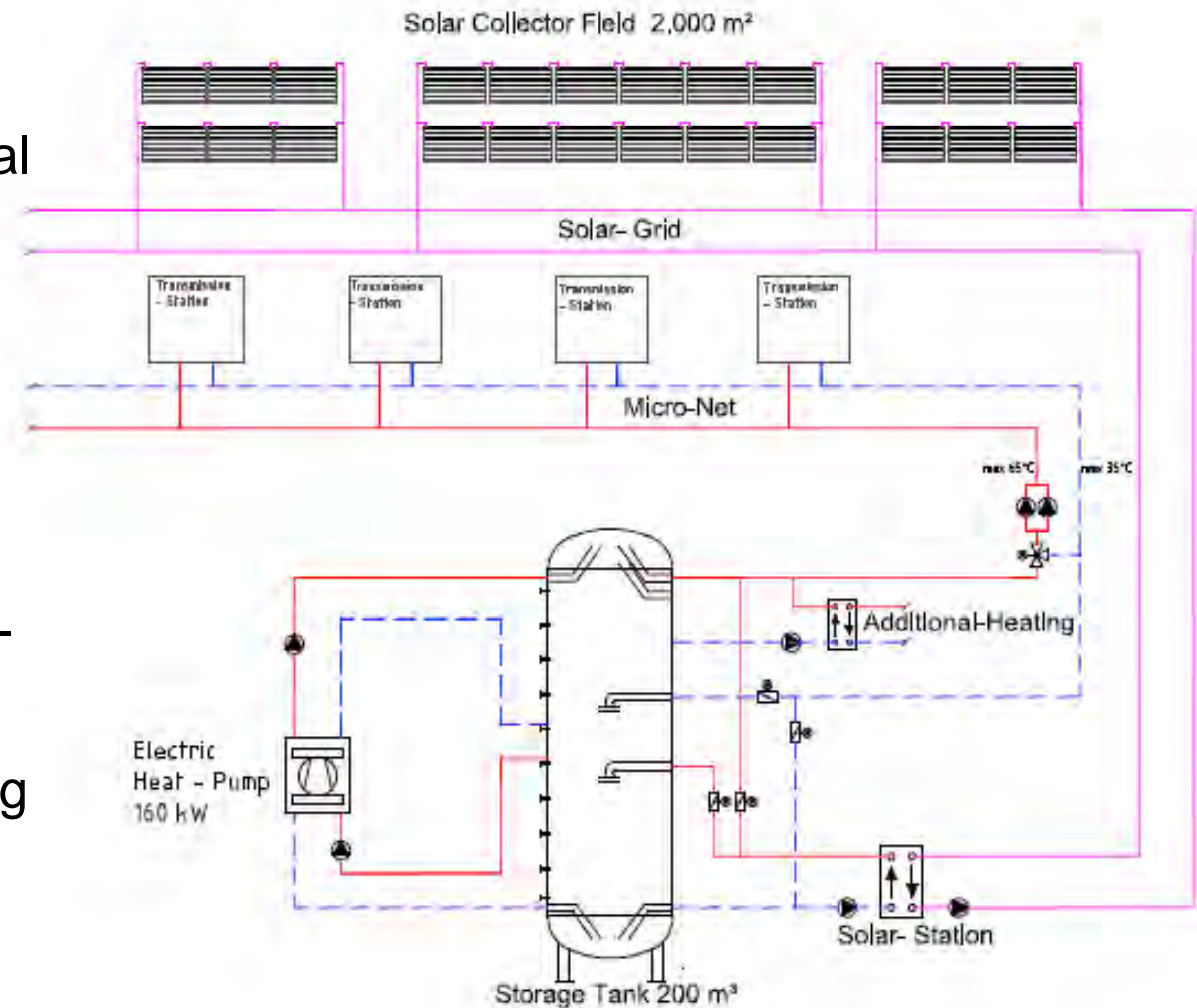
- Low energy standard for buildings

	Specific heat demand (kWh/m ² .a)
New buildings	< 20
Renovation	< 30

- Energy efficient pumps and lightning of public areas
- High share of renewable energy
 - Minimum requirement > 30%
 - Consideration of available district heating

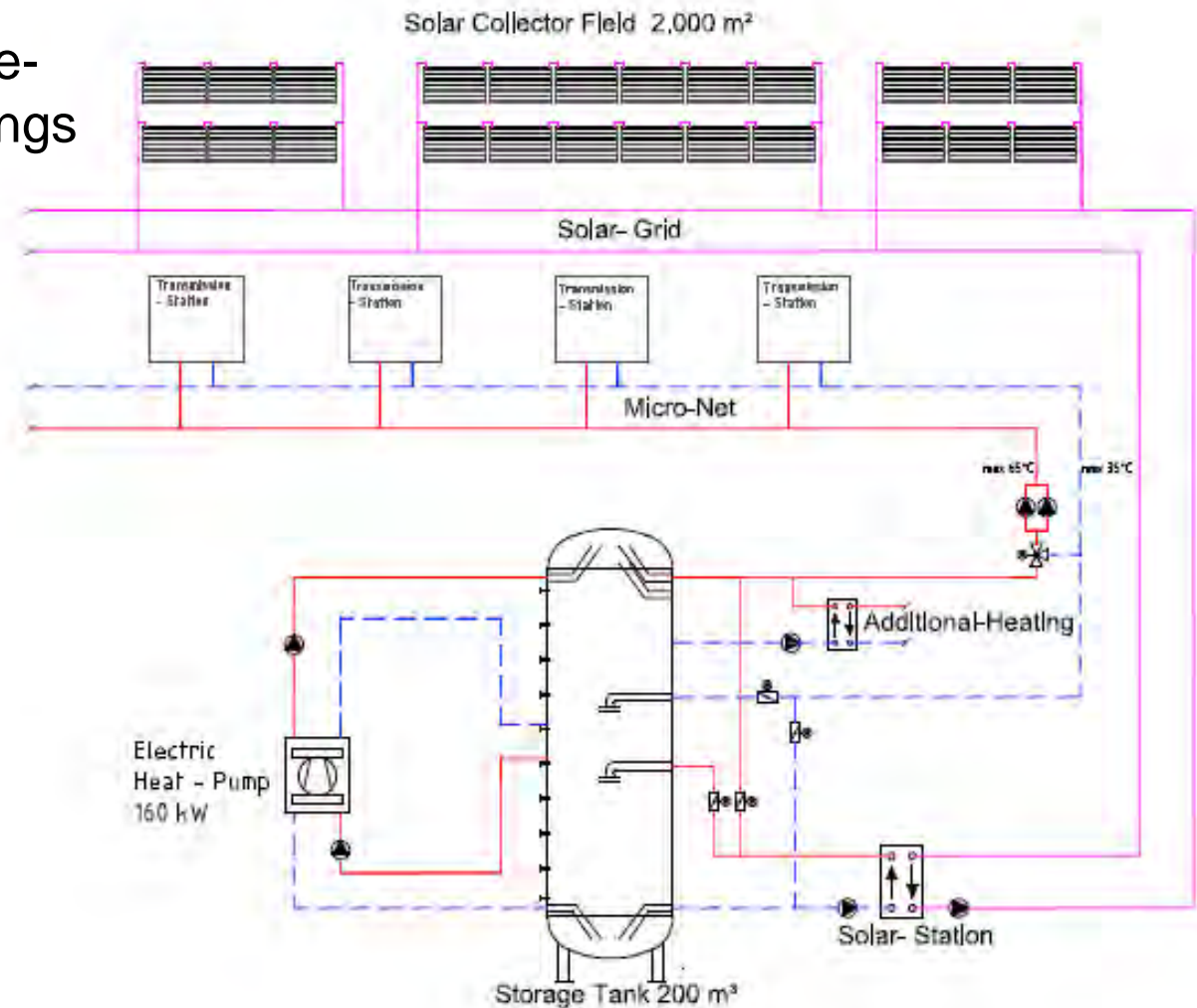
Energy Concept / Heat supply

- Main system: district heating
- Solar collector fields on several buildings
- Central storage tank
- Central heat pump for increasing the efficiency of solar system?
- Heat distribution with own low-temperature- micro-net?
- Possibility for including existing buildings in the surroundings



Optimization

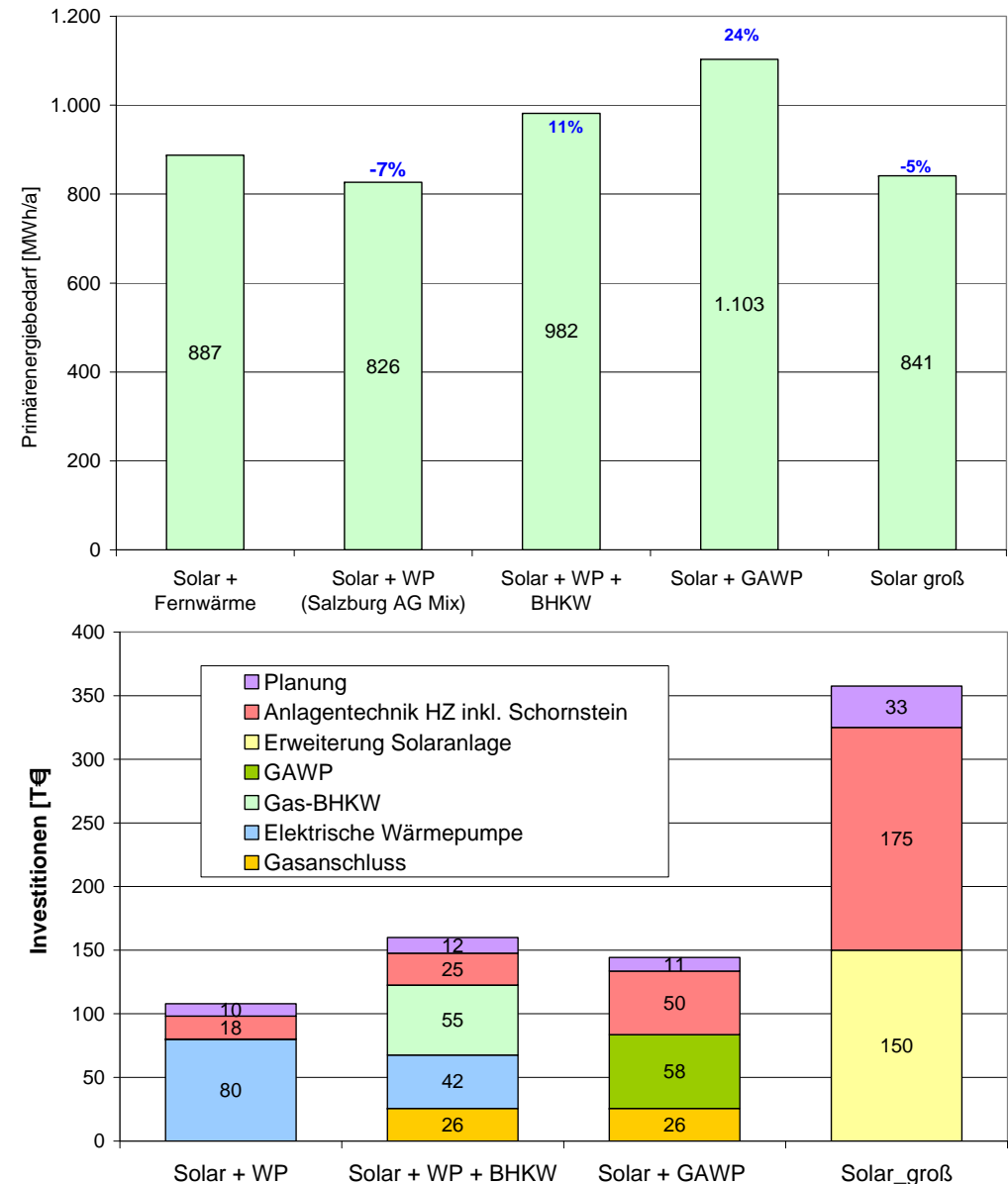
- Variation of heat demand (time-table of realization; new buildings / existing buildings)
 - With / without heat pump
 - Collector area and pitch
 - Size of storage tank
 - Temperatures of micro net
 - Different types of heat pump
- **Specific solar yield**
- **Solar fraction**
- **Investment costs**
- **Primary energy demand / CO₂- emissions**



Optimization: Costs and Primary Energy Demand

- Only solution with electric heat pump and solution with double sized solar system can reduce primary energy demand compared to standard solution (but strongly depends on PEI of electricity)
- Solution with electric heat pump means lowest additional investment costs

CO₂- Emissions: -89% compared to supply with natural gas



Process design

Challenge: Process design with mandatory, ambitious targets and a lot of players

- Signed quality agreement (performance criteria, minimum requirements), mandatory for all partners
- Steering group with all signing partners (monthly meetings)
- Working groups (energy supply, renovation)
- Information Centre, Information activities



Monitoring

- Energy balance of “Stadtwerk Lehen”
- Individual energy balances of selected apartments
- Test of different ways for visualization and feed-back to tenants – which is the most effective and successful way for increasing tenants behaviour



Stadtwerk Lehen: Conclusions

- ✓ Realization of community with new buildings and renovation of existing building stock at low-energy standard
- ✓ Use of solar energy within urban area with district heating system
- ✓ Heat distribution with low-temperature micro-net to increase solar fraction
- ✓ Determined process design based on quality agreement and steering group
- ✓ Monitoring system for community and selected apartments
- ✓ Involvement of tenants



Optimization of Communities: Challenges

Driving forces, Process design

- How to strengthen the driving forces?
- Is there a win:win situation and how can this initiate projects?
- Who is responsible for process steering (city, housing associations, ...)?
- Who is addressed, who is the overall energy planner?
- Which interfaces have to be defined (to architects, individual planners, ...)?
- On which basis (quality agreement, contract, ...)?
- Who is paying for overall energy planning?
- Who decides what? Which tools for decision makers are helpful?
- How can quality standards become binding for all?

Optimization of Communities: Challenges

Policy instruments

- How can task of energy optimization be implemented in urban planning?
- How can results of optimization be binding for all involved partners?
- Which instruments on which scale and level of progress development (availability of data)?
- How efficient are the available policy instruments?

Technological strategies

- How to define boundaries: urban planning – technological needs?
- Which criteria for optimization (with holistic approach)?
- Which technological strategies for minimum costs and highest effect?
- Which optimized technological strategies for different purposes (incl. renovation)?

Optimization of Communities: Challenges

Evaluation, Monitoring

- How to define and evaluate intermediate targets to consider long project duration?
- How to monitor community-projects – data availability?
- Who is responsible for monitoring, who is reacting on results?

Necessary changes in cities need

- **merging of urban planning and energy planning**
- **new cooperations between stakeholders**
- **optimized technological strategies**
- **effective instruments for implementation**

Thank you for your attention!

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