Research for
»Morgenstadt – City of the Future«

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Fraunhofer is the largest organization for applied research in Europe

- 66 institutes and independent research units
- The majority of the more than 22,000 staff are qualified scientists and engineers
- An annual research volume of €1.9 billion, of which €1.6 billion is generated through contract research.
Cities are important pillars by transforming the energy system - Fraunhofer research concept »Morgenstadt – City of the Future«
Morgenstadt: City Insights
Research for carbon-neutral, energy-efficient and livable cities of the future

- **Main challenges for cities:** energy and resource scarcity, climate change, ageing society, traffic congestion

- »Morgenstadt« is part of the **action plan of the hightech strategy 2020** of the German Federal Government

- Twelve Fraunhofer Institutes support the **future mission »Morgenstadt«** with the first pioneering project »**Morgenstadt: City Insights«**

- **Objective:** sustainable solutions for future cities based on smart technologies which increase the quality of life for the citizens
Fraunhofer initiative »Morgenstadt«
Challenges and fields of research

**Decentral and central energy**
- Generating and saving emission-free energy

**Mobility Transportation**
- Multimodal mobility systems

**Planning Building**
- Buildings as climate-neutral power plants

**Production Logistics**
- Urban production and supply systems

**Information Communication**
- ICT platforms for Smart Cities

**Urban processes Organisation**
- Collaborative decision-making processes

**Security Protection**
- Resilient buildings and infrastructures

**Governance Business models**
- Steering the transition and developing business
Joint research project »Morgenstadt: City Insights«

- In depth analysis of six inspiring global cities.
- On-site research by interdisciplinary teams of Fraunhofer Experts
- Analysis of the interfaces between technology systems, socio-economic factors and governance systems

Energy • Mobility • ICT • Governance • Buildings • Security • Resources
**Fraunhofer-Project**  
»Morgenstadt: City Insights«  
**Duration: May 2012 – October 2013**

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- **Management + Communication**
  - Steering meetings, partly in global cities with on-site visits
  - Organization of crossover research for systemic solutions

- **Compilation**
  - Identification of requirements and innovation drivers.
  - Report on potentials and chances for future urban markets.
  - Preparation for Phase II (2013-15)
Analysed Practice Examples
Innovative urban development concepts
/ Governance bottom-up

**Benefit:** Including neighborhoods, creating context, create ´real clouds´, jobs

**Applied technology:** People, Ideas, intellectual & emphatic Ownership, new processes, new models of financing

**Goals:** ´We build our world´, quasi - self-empowerment in public interest

ExRotaPrint  Moritzplatz  Holzmarkt

**Great Challenges of Berlin**

- **Creating a general strategy for sustainability in Berlin**
- **Growth of the City**
  (currently ca. 20,000 per year
  Gentrification and social Displacement
- **Economy**
  structural transformation in 1990s, stable growth especially in Cultural and Creative Industries (media, communication, software, design)
Analysed Practice Examples

**Great Challenges of NYC**
- Population growth
- Security sensitive events
  - crime rate, 9/11, ...
- Aging infrastructure
  - Subway, water supply system, ...
- Coastal position and landfilling
Analysed Practice Examples

- Electronic road pricing
- Green mark scheme
  Energy efficiency of buildings
- Sustainable blueprint
  National strategies for sustainable growth

- Intelligent Energy System (IES)

Great Challenges of Singapore

- Securing sustainable growth
- Changing from public education to public engagement
- Combining low-risk & business oriented mentality with innovation
Analysed Practice Examples

- **Cap and Trade System**
  Emission cap for large buildings, trading of emission rights possible
- **Tokyo Vision 2020**
- **Railway and Subway system**
- **Yokohama Smart City project**
- **International Air Cargo Terminal**
- **Electronic ticketing**
- **Green building programme**

Great Challenges of Tokyo

- **Disaster prevention**
  Earth quakes,...
- **Increase the lifetime of buildings**
  Average lifetime today: 25 years
- **Overcome the traditional way of developing the city by private companies**
  Capacity building in the administration
»Smart Energy Cities« at Fraunhofer ISE

- Development of technologies, concepts, systems for Smart Energy Cities
  - Solar thermal energy, photovoltaics
  - Energy efficient buildings and districts
  - Heating and cooling concepts for districts
  - Concepts and technologies for smart grids, optimization of operation
  - Electricity, heat and gas storage technologies
  - Electric and hydrogen mobility components and concepts
- Modeling urban / regional energy systems
- Development of methods for driving and monitoring of the transformation
- Consultancy for cities and companies
Conclusions

- **Cities are key players** by developing a the concepts for a sustainable way of living

- **»Morgenstadt – City of the Future«** is the vision of Fraunhofer for sustainable and livable cities

- **The systemic research approach of Fraunhofer** fits very much with the complexity of developing city systems

- **»Morgenstadt: City Insights«** is the first systemic research project in the field of Smart Cities – Cities and industry worldwide are invited to join
Thank you for your attention!

Fraunhofer Society

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Die folgenden Folien für den Fall, dass Sie mögliche Projekte im Smart City Bereich vorstellen möchten
Solutions for Efficient urban ENERGY grids of tomorrow

Innovative power electronics as Enabler

Local Energy production

Inductive charging infrastructure

Static energy storage

Micro-Grid

HVDC

24...48 V=

energy-efficient local DC-Networks

1) e.g. city district, community, industrial area

Source: Fraunhofer IISB
Solutions for hybrid urban ENERGY storage – The city as battery
Fraunhofer »markets beyond tomorrow«

Technologic improvement and integration of all measures for urban power management:

► Real storage
► Load management
► Production management

Combination of the most economic technologies to develop a hybrid regional urban storage
to store the energy »within the city«...
Solutions for sustainable and innovative **BUILDINGS** in the cities of the future

- Buildings will have the greatest impact on the future of cities. Therefore the whole lifecycle from planning to retrofitting has to be re-thought.
- Fraunhofer is developing solutions for:
  - innovative planning und building processes
  - Sustainable and energy-surplus buildings
  - Modernization concepts for housing stock (75% of building in Germany older than 30y.)
  - Indoor environments

Energy-plus-house with e-mobility, Berlin

Passive-house tower, Freiburg

Centre for Virtual Engineering, Stuttgart

SIPCHEM Laboratories, Riyadh

inHaus², Duisburg
Solutions for jointly used electric urban **MOBILITY** resources
Fraunhofer »markets beyond tomorrow«

- Combining all urban mobility resources into **one future urban mobility system**!

- Fraunhofer is developing solutions for:
  - Innovative inductive charging
  - Electric city vehicles
  - Automated parking e-garages
  - Mobility data clouds
  - solar e-mobility solutions

Source: Fraunhofer IAO
Solutions for Urban **ICT**-Operating Systems for Smart Cities

Information/Communication

- City as **service provider** for citizens, enterprises, institutions, and tourists
- City as **self-sustaining** and sustainable ecological urban environment
- For an increased urban quality of life and city attractiveness
- By **networked** and integrated urban resources
- Providing **intelligent control** for urban infrastructures

→ **ICT as backbone for a smart city!**

**Always Best Informed Urban Actors**
Information at any need, at any place, at any device, at any time, at any preference
Solutions for Sustainable **SECURITY** for resilient cities

**Security and Safety for more quality of life**

Our society faces new risks and threats which bring up insecurity and fears. People need the assurance of being protected and of being able to protect themselves.

**Fraunhofer works on**

- protecting critical infrastructure like energy providers, banks, airports
- early detection of hazardous substances
- enabling secure communications
- equipping rescue teams
- saving lifes through catastrophe and crisis management
- developing novel material, which provide protection
Solutions for Virtual Cityscapes as urban PLANNING tools for Simulation and Communication

Urban development  Noise  Hazardous pollutants  Traffic flows

Simulation/Visualisation

Information/Communication

3D-Infocenters  3D-Infopoints  Web 2.0 Platforms  Mobile

Source: Fraunhofer IAO
Urban development projects supported by Fraunhofer

Current research projects for the cities of the future

- Airfield Böblingen/Sind. (IAO)
- Berlin Open Data Portal (FOKUS)
- Airport Region Guangzhou (IAO / IML)
- Boston Innovation District (CSE)
- King Abdul-Aziz City for Science and Technology (KACST) (IAO)
- Masdar City (ISE / IBP / IAO)

...Fraunhofer supports future-oriented Urban Development Projects in ~50 Cities worldwide

Development of a strategic research approach for the Morgenstadt