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MORGENSTADT: CITY INSIGHTS

Joint research project on today's cities as future markets for systems innovations towards smart and sustainable cities

Project description



Eine Initiative des Bundesministeriums
für Bildung und Forschung

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Executive Summary

Cities provide the markets of tomorrow. Already today cities are the biggest entities of industrial and economic activity and the growth of urban populations is steadily increasing. By 2030 the number of people living in cities will rise to five billion, facing great challenges to infrastructure, economic development and life-quality induced by scarce resources, climate change and the mere number of people. Addressing the city of tomorrow and its markets therefore requires a new way of thinking for almost every industry sector. Conventional single-consumer-related products have to be replaced by integrated approaches forming whole urban systems: A new relationship of information, resources, products and users will lie at the heart of the innovation loop that cities will have to master within the next decades.

Fraunhofer develops solutions for future cities. Several institutes of the Fraunhofer-Gesellschaft as Europe's largest application-oriented research organization have been working on a wide range of urban solutions and products for many years. Now their expertise and profound competence will be brought together in a visionary collaborative research initiative *Morgenstadt*. The foundation for this multidisciplinary long term research initiative will be the joint research project *Morgenstadt: City Insights*. Here different Fraunhofer competences will join forces combining technology management for the most important technology- and organization-based urban systems with practical knowhow of industrial, political and further planning partners. The connected research on the most important sectors for the cities of tomorrow – mobility, energy, communications, security, buildings, resources and governance – will lay the foundation for creating smart and sustainable system innovations for future urban structures.

Establishing a starting point for urban systems innovations. Cities worldwide are already delivering early solutions for the pressing future challenges and by this create leading examples for best practices. In contrast to many other current research initiatives on cities, we do not focus on single products or single urban systems from the supply side; we take one step further by detecting the needs of the urban populations living in cities as aggregate of mutually intertwined urban systems. We invite industries, interested cities and NGO's, and enterprises with an international or multinational focus, that aim at shaping urban markets of today and tomorrow, to join the project *Morgenstadt: City Insights* in order to learn from the best available approaches today and form a sound starting point for future R&D.

Applied research and industry joining forces. In close collaboration with industry partners Fraunhofer will use its expertise to identify the most advanced concepts for integrated and sustainable urban systems on a global scale. In-depth analyses and on-site assessments in leading cities worldwide will reveal existing and hidden requirements for future urban innovations. A well-founded knowledge base will be created with comparable data and various inputs from the network representing the starting point for the systematic identification of requirements for innovative concepts, products and technologies. With applied research and industry joining forces in this initiative, for the first time a holistic approach will get off the ground for the fruition of *Morgenstadt* as visionary prototype for smart and sustainable cities of the future.

Partners in the network can benefit from this knowledge for the further development of future solutions and experience a clear winning margin through the multidisciplinary and collaborative approach. The first project stage is scheduled for a runtime of eighteen months with a kick-off in April 2012.

1 Initial Situation

1.1 Cities as living labs for innovation and future markets

The enormous challenges of an increasingly urbanized global society drive companies, city administrations and research institutes around the world to develop strategies and solutions that address problems like climate change, resource depletion, population growth, increasing consumption, individual mobility etc. Since 2007 more than half of the world's population lives in cities - and its share is increasing. Only investments in urban infrastructures will amount to US\$350 trillion within the next 30 years.¹ It is therefore undisputed that cities represent the omnipresent markets of tomorrow. But with their complex network-structures conventional paradigms of consumer-related production- and distribution strategies have to be replaced to create a lasting effect on a global scale.

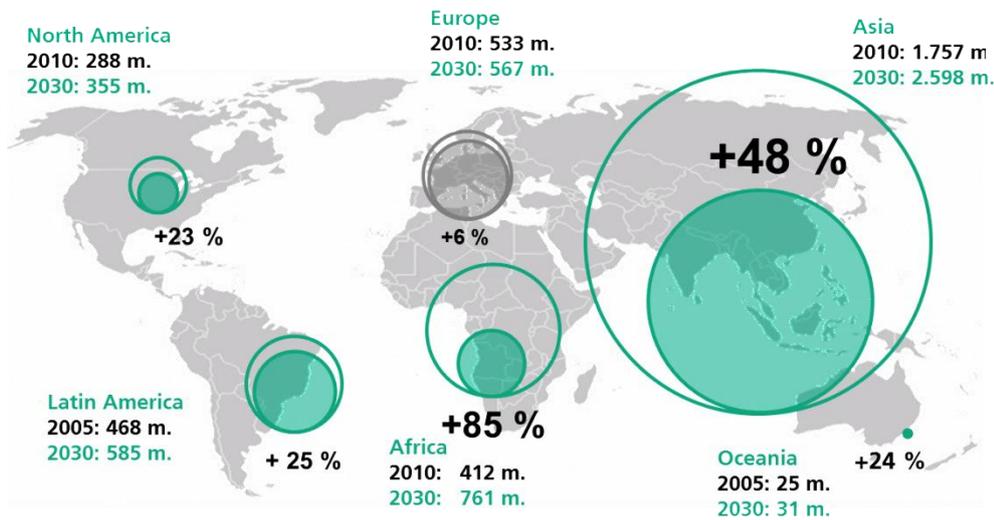


Figure 1:
Growth of urban population
until 2030 (UN World
Urbanization Prospects, 2010)

Ecological sustainability and the pursuit of economic prosperity are the two key issues for cities in the future. Both goals can be achieved by recognizing cities as future markets for sustainable concepts of mobility, housing, communication, energy generation, production and consumption. But these concepts will inevitably link different technology sectors and products with each other in a much stronger way than today. Solutions will increasingly have to overleap sectorial boundaries and combine multiple technologies.

A new relationship of information, resources, products and people therefore lies at the heart of the innovation loop that cities will undergo within the next decades.

In many urban contexts – especially in Europe – solutions have been developed that boost energy efficiency, reduce carbon emissions, strengthen participatory governance and care for high quality of life. Products like zero energy houses, renewable

¹ Booz&Company, WWF, 2010. "Reinventing the City"

photovoltaic energy, electric cars and participatory budgets mark a first step within the transition to sustainable and smart cities. They act as catalysts for green cities and as promoters of sustainable transition within other cities around the world. However, they fail to represent a real quantum leap in terms of urban systems innovation. This will occur when actors from different business sectors, research institutes and governance officials join together for inventing urban systems.

1.2 Challenges for new partnerships

A sustainable future city system combines economic and ecologic efficiency and provides the basis for a high-quality working and living environment. Making smart use of information and communication technologies within all areas of urban life and connecting buildings, devices and people with each other is the essential starting point for systems of urban innovation. It will allow for the development of closed loops of production, consumption and recycling for resources, materials and energy within all relevant areas of urban material flows and at the same time provide for transparent and participatory governance.

Cities as future markets thus open up a great variety of new product segments and business strategies, but also pose a big challenge for companies and business-related ventures. Not only do they have to develop innovative products and concepts, they also have to invent new ways of sales and distribution and they have to succeed within complex networks of governance and stakeholder-management. The traditional way of looking upon individual users and consumers increasingly fails to provide the necessary solutions for complex problems of emerging megacities. The new point of departure for product development has to be the needs of a city as systemic entity that comprises several networked individual systems (energy, mobility, security etc.). In this system the product itself does not represent the most important component anymore. It is the way of organizing processes and structures with respect to the users and urban structures that makes the difference.

The big challenge is to develop unique game changers as enabler for future markets. Innovative Solutions for public participation, cloud intelligence and open innovation concepts will thereby shape the pathways of transition:

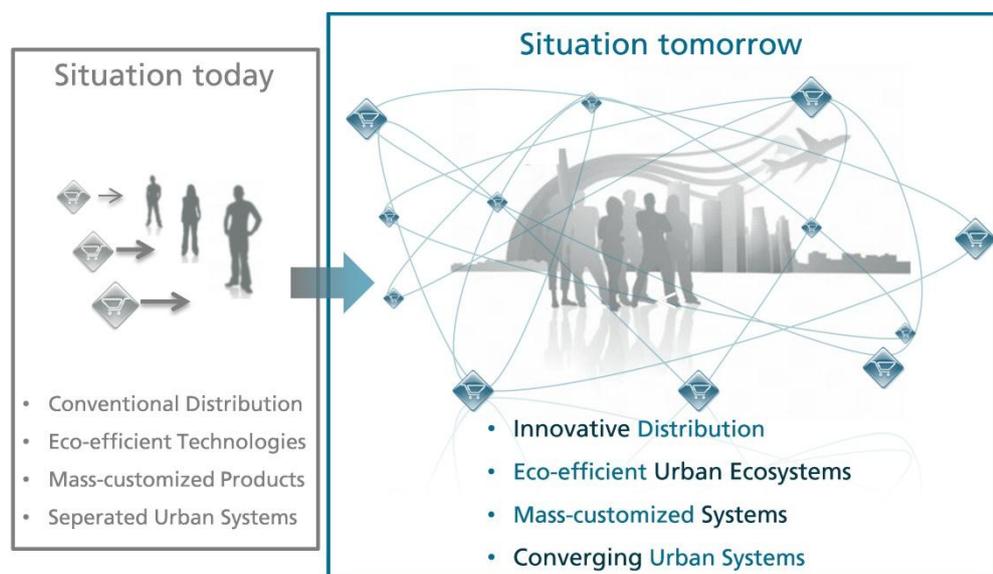


Figure 2:
Developing the urban market
of the future: from singular to
interconnected solutions

Making business in the city of tomorrow will have to increasingly rely on the lasting cooperation of economic, political and social players, for risks of investments and high upfront costs need governmental support and sound governance structures. Market failures like price distortions and perverse incentives have to be tackled between companies and city administrations – or even higher governmental bodies – for ensuring the cost-effectiveness of sustainable innovations. At the same time institutional failures like short-term oriented policies and backward oriented administrations have to be addressed with fresh and innovative collaborative approaches for the invigoration of sustainable urban innovation systems.

1.3 Introducing the Morgenstadt

»Cities are responsible for up to eighty percent of global greenhouse gas emissions. Whoever is the first to find the key to Morgenstadt, in other words a system approach to redesigning existing and newly emerging cities that is sustainable and enhances the quality of life, will chart the way for what may be the largest future market of the next few decades.«

Prof. Hans-Jörg Bullinger, President of the Fraunhofer-Gesellschaft

On behalf of the German federal research minister Annette Schavan and Fraunhofer-President Hans-Jörg Bullinger, a group of experts has initiated a project entitled *Morgenstadt – an answer to climate change*², describing the vision of a typical built city of the future in Europe. Its inhabitants use energy in environmentally friendly ways, transforming our cities into CO₂-free place (reduction of carbon emissions by at least ninety percent compared with today).

Morgenstadt is one of the high priority forward-looking projects of the high-tech strategy 2020 for the federal government of Germany being under development.³ Forward-looking projects will pursue specific objectives related to scientific, technological and social development over a period of ten to fifteen years. Innovation strategies for the realization of these objectives will be formulated and will form the basis of road maps for achieving interim milestones.

Therefore the Fraunhofer-Gesellschaft, Europe's largest applied research organization, has developed a concept for a systems research *Morgenstadt* highlighting the demand for a systemic and holistic approach for joint research on urban production/logistics, mobility/ transportation, planning/building, information/communication, security and safety, decentralized production and distribution of energy and long-term technology management between these technology sectors.

Fraunhofer is already today developing concepts, products and solutions for all of these areas and will consequently play a key role in bringing about future cities that are sustainable and deliver high quality of life.

² <http://www.bmbf.de/pubRD/morgenstadt.pdf>

³ For more information on the German high-tech strategy please see: http://www.bmbf.de/pub/hts_2020.pdf

2.1 Objective

To address the challenges of future cities, together with industrial partners, Fraunhofer is launching a joint research initiative for understanding the systemic needs of global cities and for developing the solutions that combine urban ecological sustainability and economic prosperity to new systems of city development. The goal of the first project stage is to synchronize emerging urban demands and global best-practice approaches in a strategic research project and to thereby develop the basis for innovation of new strategies, products and urban solutions.

The joint research project *Morgenstadt: City Insights* systematically creates insights into key factors and conditions for a successful transition of cities to highly efficient sustainable systems of urban life. It identifies the requirements for the urban markets of the future and enables new collaborations of industry, research and administrations. By this it will create the fundament for the development of innovative concepts and products that help to tackle technical and organizational challenges in the smart cities of tomorrow.

In close collaboration with industry partners, Fraunhofer will carve out the best concepts for sustainable city development worldwide. It assesses the technologies and analyzes the management- and governance structures and the actor-network constellations that render responsible for the individual success of the system. By highlighting the challenges that still exist, it will provide the requirements and potentials for innovative concepts in a variety of technological ecosystems in urban environments.

2.1.1 Fields of research – Urban systems

For achieving this, the project analyzes the five most important technology sectors of the city of tomorrow with respect to best practices, groundbreaking pathways and existing challenges and innovation barriers that have to be overcome. As facilitator to the organization of city-systems, governance represents a key-scope of the analysis. In addition, the field of security, representing a genuinely cross-sectional system of importance for all other sectors, will be analyzed in detail.

- **Mobility**
How can the masses of people in tomorrow's cities be moved most effectively by at the same time assuring quality of life and zero impact on the environment? Highly efficient mass transit systems like in Hong Kong or emission free mobility-on-demand solutions represent some of the groundbreaking solutions to be analyzed and developed further.
- **Energy**
The future city will not depend on fossil energy. Renewable energies, energy efficient technologies and communicating energy grids will become the drive-train of tomorrow's cities. But where will the energy be produced? Already today energy-plus-houses produce more green energy than they need. Integrated community energy solutions that link houses, wind- and solar parks, biomass sites and electric vehicles can be a starting point for an integrated

urban energy system of the future.

- **Communications**

Already today technologies exist that enable communication between devices, buildings, vehicles and people. Geographic information processing, wireless internet and smart-phone technology possess almost infinite potential for the development of smart solutions for urban systems. Some cities like Qatar or Mannheim already try to make use of this potential and thereby provide the framework for innovative business- logistic- and transportation processes

- **Buildings**

There are several groundbreaking technologies that allow buildings to communicate with their environment, to produce more energy than they consume and to work with light, biomass and air from the local environment. In a future city these technologies will be integrated into systems that allow groups of buildings to create closed cycles of energy- and material flows and to shape the micro climate of a city.

- **Resources**

The big challenge of future urban systems is the smart and sustainable use of resources. Full integration of advanced recycling techniques into urban material flows and the holistic use of cradle-to-cradle systems for production and consumption will be imperative for the sustainable megacity of tomorrow. This also implies innovations in product design with a highest possible share of biodegradable materials or recyclable product concepts. Learning from inspiring cities will provide for the basis of future urban resource cycles.

- **Governance**

A new urban paradigm needs efficient governance concepts that enable participation and acknowledge the complexity of systems innovation. Frontrunners like Zurich, Copenhagen, Amsterdam or Sydney are already working with systems that integrate citizens into decision structures and create smart collaborations between city administrations, innovative companies and research institutes.

- **Security**

The resilient city of the future will already integrate security concepts and systems at the design stage of urban planning and policy implementation, therefore ensuring the capability to identify and dominate emerging risks as well as to effectively manage catastrophic situations and quickly return to normal status. New smart and multifunctional protection technologies and materials complemented by sophisticated planning tools will ensure the security of the future urban system whilst not affecting the civil liberties of its citizens.

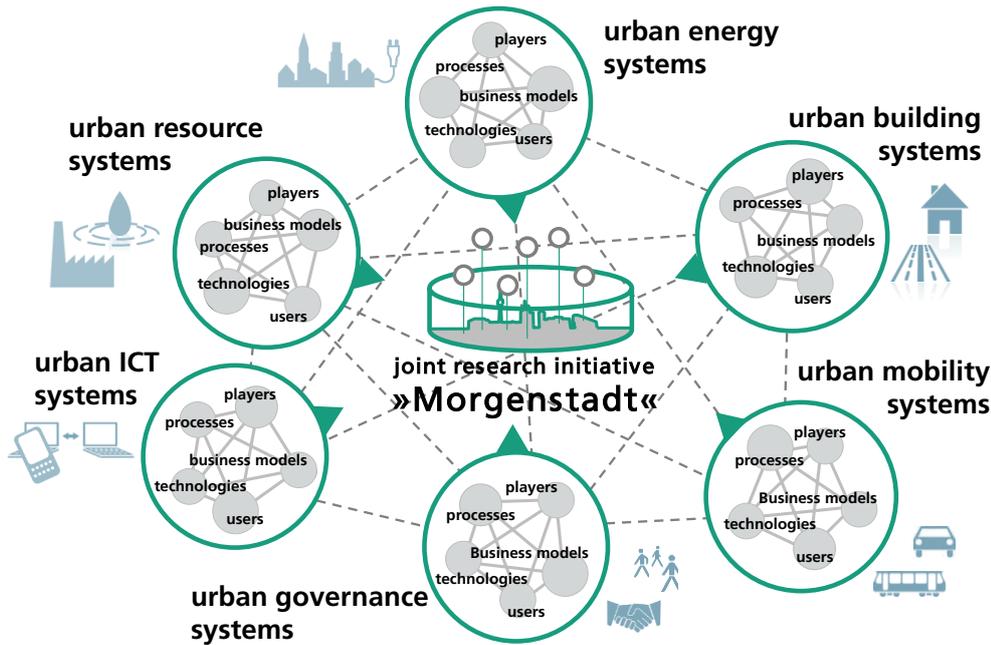


Figure 3:
 Determination of the main urban systems as relevant drivers for sustainable cities.

2.1.2 Fields of research – Best-practice processes

The strategic focus lies on discovering systemic approaches that successfully respond to the increasing problems of the selected technology fields in leading cities. By detecting and analyzing innovative but already field-tested approaches, we evaluate their feasibility to new and complex environments and demands of urban future. Thus verified, we pool expertise to develop smart and individually customized strategies together with our network partners, aiming at the future requirements for further concepts' efficient implementations.

Adapted to distinct functions and consumers, unique but holistic and trans-sectoral solutions shall be anticipated to meet future urban challenges and shape tomorrow's sustainable cities:

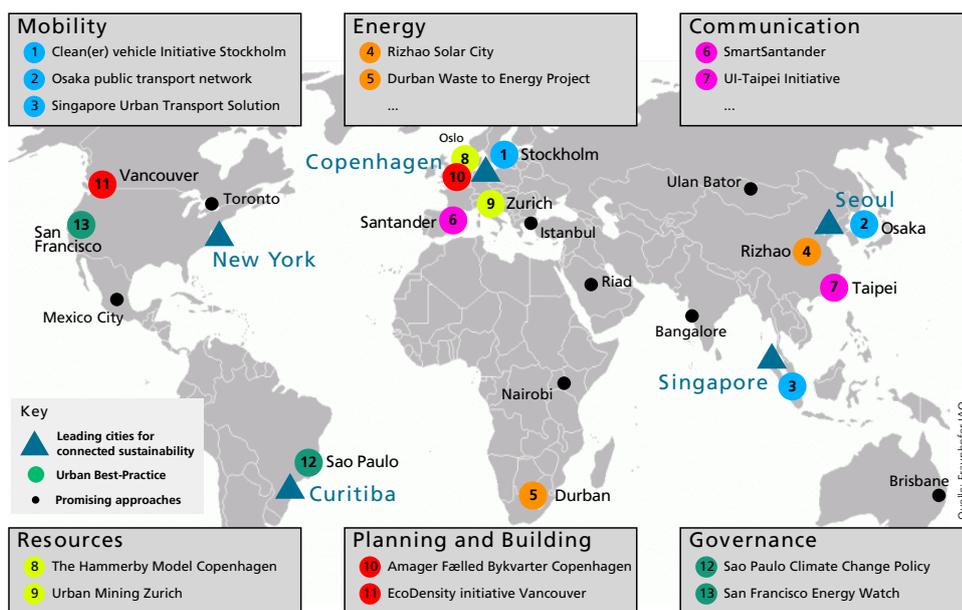


Figure 4:
 Exemplary overview on existing global best-practices for sustainable city solutions

2.2 Project framework

The joint research initiative *Morgenstadt: City Insights* addresses enterprises that see part of their future business within smart and sustainable urban solutions. Starting from the sectors above, Fraunhofer and industry partners will work for strategic improvement of city concepts by identifying the requirements and needs for interdependent innovation systems and cross-sectoral solutions. We invite industry partners and city administrations to join forces for developing strategies for further progress that secure innovative enterprises to be part of the future city.

The global research initiative is designed as a cooperative project of the Fraunhofer-Gesellschaft in which the Fraunhofer IAO together with other Fraunhofer Institutes operates as project initiator and carrier of research authority. These work in close cooperation with the industrial project partners. The research is guided by questions of industrial relevance and is carried out on-site within the common identified leading cities.

The methodical competence and its professional expertise in a multidisciplinary field allows Fraunhofer to work out a well-founded knowledge base on best practices, important technological fields and areas of application for the innovation loop of the urban solutions of tomorrow:

- An on-site research approach ensures the direct assessment of cutting-edge urban solutions across different sectors and systems.
- By testing and witnessing best-practices in-situ and interacting with local experts, Fraunhofer will gain deep insights on working concepts and existing challenges for sustainable solutions of urban systems.
- Partners in the network will benefit from these insights for the future development of innovative concepts and products, but also for establishing contacts with relevant stakeholders in the global cities.
- The special analysis of governance structures and actor-networks gives partners strategic insights that are necessary for taking the right management decisions.
- An additional benefit is created through the cooperative approach that incentivizes smart business models, joint projects and development of technologies.

2.2.1 Target groups

Private Sector

The joint research project provides valuable information for different kinds of target groups. Relating to the previously identified research sectors as Mobility, Energy, Communications, Buildings, Resources, Governance and Security the initiative seeks to address the following industry stakeholders with an international or multinational focus:

- **Mobility Solution Providers**
Automotive Companies and Suppliers, Car-Sharing Providers, Manufacturers of Mobility Products, Developers of Public Transport Systems, Transportation Companies, Logistic and Freight Enterprises, Providers of Mobility-services, Car-rental Companies etc.

- **Energy providers**
Power Companies, Energy Infrastructure and Services Companies, Technology Providers for Renewable Energy Solutions, Product Manufacturers, Cleantech Enterprises, Manufacturers of Grid Solutions, Cable Producers etc.
- **Information and Communication Providers**
Telecommunications Service Providers, Telephone Companies, Information Technology Manufacturers, Cloud Computing Services, Urban Data Suppliers, Security System Integrators etc.
- **Building and Construction Companies**
House Construction Companies, Manufacturers of Construction Components, Technology Companies etc.
- **Infrastructure provider for resource management**
Water Management Enterprises, Recycle Companies, Urban Mining Industries, Bio-Technology Companies, Ecosystem Management Consultants, Purification Industries, etc.
- **Suppliers in the field of governance, financing and project development**
Development Corporations, Facilitators of International Cooperation, Consultancies for Public Administration and Project Management etc.
- **Security System Providers**
Urban Planners, Architects, Construction Companies, Security Service Providers, Security System Integrators etc.

The role of enterprises within this constellation is to identify the needs of urban systems, to provide innovative solutions and creative ideas that work and to partner with city administrations and applied research institutions for establishing the framework for smart and sustainable cities. By this they will lay the foundations for shaping urban markets of the future.

Non-private Sector

The joint research initiative does not only address enterprises, it is also a valuable source of information for city administrations and NGOs that want to learn from best practices and functioning sustainable city systems. How did other cities tackle their challenges of high emissions, inefficient buildings, public participation and fossil fuel dependence? Which are solutions that work and how could they be implemented in alternative urban environments? We invite city officials to join the research project and get insights into the global approaches for city systems of tomorrow. Furthermore we ask NGOs that work towards sustainable urban development to participate in the network and use the insights provided for refining their strategies. For actors from the non-private sector the joint research initiative represents the opportunity to network with each other and establish working ties with important industrial partners.

3 Approach and work streams

3.1 Project Approach

The project *Morgenstadt: City Insights* aims at preparing a status quo and establishing a starting point for the research and development of innovations for urban systems. Therefore the project structure is defined by three work packages with a first preliminary research module for preparation of a global survey on existing urban solutions and detailed studies on future cities, followed by a second in-field research module covering in-depth studies in the jointly identified leading cities worldwide and completed by a third research module compiling the results in an exclusive summary for the project partners.

The outcome will be an aligned and synchronized requirements catalogue together with a broad overview on global existing best-practice and connections to the dominant players and stakeholders in the surveyed cities.

This approach will be continued in a consecutive project stage (2013 – 2015) together with an intensification of joint research and development for the implementation of prototypic concepts and project plans.

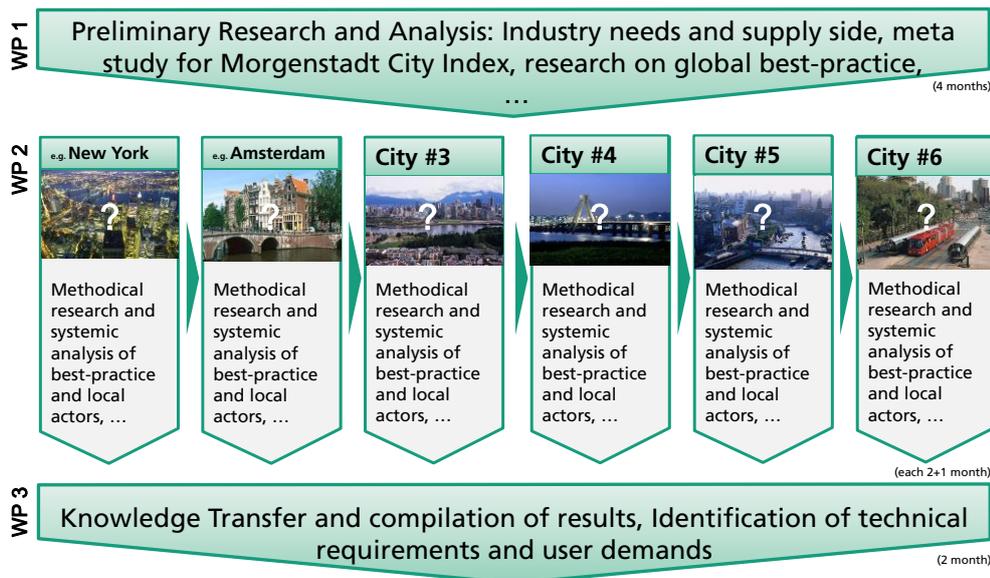


Figure 5:
Project framework

3.1.1 WP1: ANALYZE urban systems and studies worldwide (4 months)

Which best practices, challenges and collaboration approaches do already exist?
What studies and knowledge about today's cities have been carried out?

Goals:

- To identify questions and visions of industry partners that relate to future markets within systems of sustainable cities.
- To identify the most advanced cities worldwide that combine solutions from the six relevant sectors in a smart and systemic way.

- To identify outstanding best practices und existing studies like (city indices, future reports etc.) for each of the six identified sectors of tomorrow's urban innovations.

Tasks:

- Identification of existing questions, concepts and visions on the partner level.
- Assessment of a wide range of leading cities with respect to concepts and solutions on the above named fields of future development. The methodology will be based on expert interviews and meta-studies.

Results:

- A comprehensive overview over the existing state-of-the art technologies, strategies and concepts within urban systems that help solve the challenges of future cities.
- Descriptions of six global *leading cities* that effectively manage to combine approaches from the six sectors, and by this have become global trendsetters on systemic urban solutions.
- In addition: description of outstanding best practices (15-20) from *pioneer cities* for each of the relevant sectors.

3.1.2 WP2: EXPLORE leading cities in on-site field research (12 months)

What is the local situation for world's leading cities on the way to a smart and sustainable future? Which stakeholders are working on solutions in each case?

Goals:

- To identify and describe the existing products and concepts and state-of-the-art technologies that exist within the *leading cities* (e.g. New York, Shanghai, Amsterdam, Mumbai etc.) and that mark the best practice within each of the six sectors.
- To assess the impacts of factors like local environments, socio-economic structures, governance processes, legislative regulations and existing actor constellations (and their mutual influence) on the emergence of trendsetting systemic urban solutions.
- To understand the limiting factors, the existing challenges and the unsolved problems of the '*leading cities*' and of best practice examples for sectoral solutions.

Tasks:

- On-site assessment of cutting-edge products, technologies and concepts within the '*leading cities*.' Each of the six cities will undergo a 2+1 months-assessment by experts of Fraunhofer, including on-site visits, product- and technology tests, expert-interviews and document studies.
- In addition, the single best practices of the six sectors will be analyzed and evaluated.

Results:

- An extensive knowledge base consisting of at least six in-depth-studies on existing state-of-the-art concepts and strategies of global cities to tackle

systemic urban problems of tomorrow, including actor constellations, existing challenges and unsolved problems.

- Furthermore the knowledge base will contain specific detail information about the most outstanding solutions and existing challenges for each of the sectors.

3.1.3 WP3: TRANSFER requirements for innovative concepts (2 months)

What are the technical requirements, economic drivers and user needs for today's and tomorrow's urban systems in cities worldwide for a long-term transition?

Goals:

- To give a comprehensive and well-structured insight into the leading concepts, technologies and strategies of the global 'leading cities'.
- To provide a basis for systemic innovation and development of products and concepts that tackle the problems of tomorrow's cities.

Tasks:

- Processing of knowledge and information into a comprehensive and well-structured analysis.
- Comparing best practices and existing challenges, and evaluating framework conditions that hold responsible for the success or failure of concepts and strategies.
- Identification of requirements and potentials for development of future products and services.

Results:

- An overall report on potentials and chances for future urban markets. It will adhere to a comprehensive and profound study describing the systemic approaches and best practices towards sustainable and smart urban ecosystems, complemented by a systematic analysis and description of the challenges and problems that occur throughout the development and implementation of best practices and promising future concepts for sustainable urban systems
- Starting point for further development of innovative concepts in the different urban sectors together with industry partner and local stakeholders in project stage 2 (2013 - 2015)

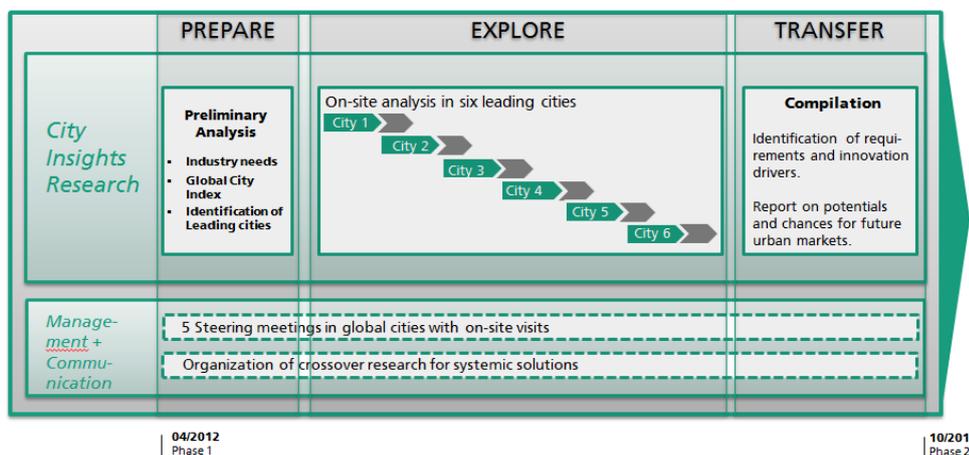


Figure 6: Project structure and overview over the consecutive work packages

3.2 Project Management

Newsletter, analysis reports, surveys

Partners of the joint research project will receive periodical newsletters with information about current research projects, conferences and events, and with information on important actors and initiatives on the fields that are important for the city of tomorrow. After completion of the work packages the corresponding analysis reports and surveys will be distributed to the project partners.

Online platform

In addition to the personal meetings a project-extranet will secure the information flow and enable interaction between project partners. Through the online-platform members will obtain the opportunity to constantly exchange ideas and information and to extend their contact network. Fraunhofer will provide up-to-date information and documents exclusively for the project members in the extranet. In addition, the newsletters and results of the work packages will be provided for download exclusively for the project members.

International meetings

Regular meetings for project steering are the key structure for the organizational success of the joint research project. The progress on the individual fields of investigation will be presented in the plenum to be discussed and evaluated by the project members. On this basis the strategic direction and the focal points for project continuance will be defined. The project meetings will be complemented by expert lectures and visits to thematically interesting locations (e.g. model regions, sites, research institutes etc.) with best-practice tours on ground-breaking projects.

3.3 Project timeline

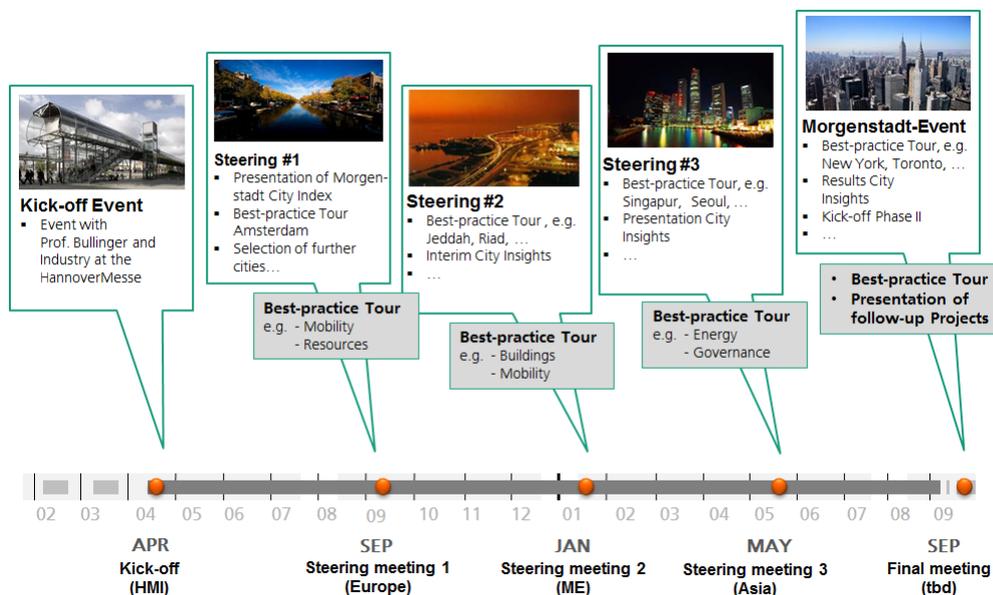


Figure 7: Project timeline and overview over steering meetings

The first project stage of *Morgenstadt: City Insights* is scheduled for a runtime of eighteen months with a kick-off in April 2012.

At every important milestone a project steering meeting will be hold combined with a best-practice tour in the destination city giving insight in innovative urban solutions.

The project kick-off will take place at the international trade fair »Hannover Messe« symbolizing the starting point for the global innovation network of research and industry.

Approach and work streams

The scheduled dates for meetings are:

- **23rd April 2012:** kick-off meeting, Hannover Messe
- **~September 2012:** steering meeting #1, tbd (Europe)
- **~January 2012:** steering meeting #2, tbd (USA)
- **~May 2013:** steering meeting #3, tbd (Asia)
- **~September 2013:** final meeting (kick-off stage 2), tbd

4

Vision: Initiating a transformation process for cities

Vision: Initiating a transformation process for cities

The joint research project aims to bridge the innovation chasm between future demands of cities and existing business ventures. Representing the greatest market of the future, cities are about to alter the understanding of conventional producer-consumer-relations towards a new innovation paradigm. Therefore a profound knowledge and planning reliability is necessary to come up with new and innovative solutions for future energy, mobility, communications and other services in the cities of tomorrow.

The research team, consisting of researchers of several Institutes of the Fraunhofer-Gesellschaft, envisions new business concepts and solutions for the future demands of cities. It thereby pursues the vision of the *Morgenstadt* as of cities as sustainable, livable, highly efficient, intelligent, dynamic and positive habitats for tomorrow's urban societies. The key to an efficient innovation strategy of existing cities and future-proof prototypes for emerging cities, lies in the matching of the technological and organizational demands of cities and the solutions and technologies companies can provide.

In future cities businesses and companies will be fully integrated into the urban processes and value chains, whereas they have to discover new markets and innovation strategies for their products and services.

The joint research initiative Morgenstadt is set to be continued on a closer collaboration together with industry and research partner in stage 2 (2013 – 2015). In the first stage the scientific knowledge base on urban innovations will be established, interviews and meetings with local stakeholders in the addressed cities will be held and concepts for further projects will be developed together with the partners.

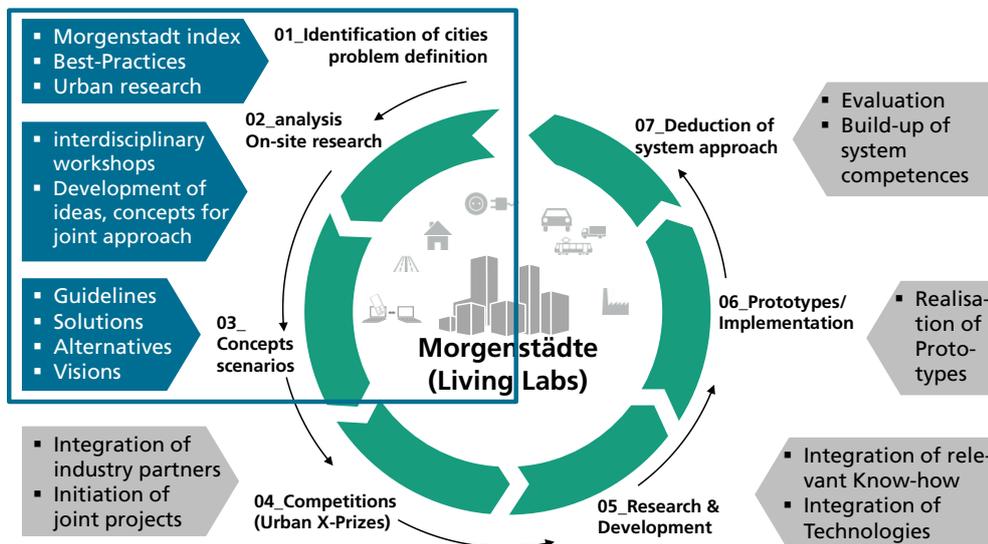


Figure 8:
Overview on long-term transformation process (current stage *Morgenstadt*: *City Insights* highlighted)

5 Research partners

5.1 Fraunhofer-Gesellschaft

Fraunhofer is Europe’s largest application-oriented research organization. Our research efforts are geared entirely to people’s needs: health, security, communication, energy and the environment. As a result, the work undertaken by our researchers and developers has a significant impact on people’s lives. We are creative. We shape technology. We design products. We improve methods and techniques. We open up new vistas. In short, we forge the future.

The Fraunhofer-Gesellschaft undertakes applied research of direct utility to private and public enterprise and of wide benefit to society: Industry, Service sector and Public administration:

- More than 80 research units, including 60 Fraunhofer Institutes, at different locations in Germany
- The majority of more than 18, 000 staff are qualified scientists and engineers
- €1.65 billion annual research budget totaling
- Of this sum, €1.40 billion is generated through contract research. Two thirds of the research revenue is derived from contracts with industry and from publicly financed research projects. Only one third is contributed by the German federal and Länder governments in the form of institutional funding
- Research centers and representative offices in Europe, USA, Asia and in the Middle East



Figure 9:
Overview on global Fraunhofer research centers and representative offices

The Fraunhofer initiative *Morgenstadt* has been formed by a consortium of several Fraunhofer institutes covering all technological and organizational aspects of the different technology sectors for urban systems. Depending on the necessary research expertise within the project different researchers of the institutes will contribute and complement to the project tasks.

5.1.1 Associated Fraunhofer Institutes

To cover all scientific research, that is needed to detect mutual dependencies and influences of urban systems for the cities of the future, different Fraunhofer Institutes from Germany and other countries are available to work together in multidisciplinary project teams for »Morgenstadt: City Insights« (in alphabetical order):

- Fraunhofer Portugal Research Center for Assistive Information and Communication Solutions AICOS
- Fraunhofer Application Center System Technology AST
- Fraunhofer USA Research Center for Sustainable Energy Systems CSE
- Fraunhofer Institute for High-Speed Dynamics – Ernst-Mach-Institute EMI
- Fraunhofer-Institute for Open Communication Systems FOKUS
- Fraunhofer Institute for Industrial Engineering IAO (project coordination)
- Fraunhofer Institute for Building Physics IBP
- Fraunhofer Italia Research Innovation Engineering Center IEC
- Fraunhofer Institute for Integrated Systems and Device Technology IISB
- Fraunhofer Institute for Material Flow and Logistics IML
- Fraunhofer Institute for Manufacturing Engineering and Automation IPA
- Fraunhofer Institute for Solar Energy Systems ISE
- Fraunhofer Institute for Wind Energy and Energy System Technology IWES
- Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT
- Fraunhofer Institute for for Factory Operation and Automation IFF
- Further Fraunhofer International Groups

5.2 International Cooperation

In the course of the project further research partners in addressed cities will be integrated. With them more detailed approaches and solutions for the identified challenges in the different technology sectors and cities shall be researched and developed in the following research stages. The goal is not only to anticipate, but to initiate innovative and future-proof prototypes as parts of real-life living labs for the vision of smart and sustainable cities in future.

Therefore Fraunhofer holds solid connections to renowned institutes and laboratories like:

- Massachusetts Institute of Technology MIT, Boston, USA
- King Abdul-Aziz University for Science and Technology KAUST, Jeddah, Saudi-Arabia
- Tongji University Shanghai, China
- Nanyang University, Singapore
- Tokyo Institute of Technology, Japan
- ...

Research partners

6 Project duration, funding and contact

Project duration, funding and
contact

6.1.1 Project duration

The first project stage of the joint research initiative starts on May 1st 2012 and ends on October 31st 2013. The contract terms contain a project runtime of 18 months.

6.1.2 Project financing

The joint research project will be financed by the partners. Participation fee for the joint research project is hierarchized by character of participants:

Enterprises	Participation fee: 50.000 € p.a. (VAT included)
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Cities & NGO	Participation fee: 25.000 € p.a. (VAT included)
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The overall costs for the 18 months in project phase I (2012 – 2013) will be 75.000,- EUR (VAT included) for enterprises and 37.500,- EUR (VAT included) for cities and NGO.

The budget covers the efforts for researchers of the Fraunhofer-Gesellschaft, travel expenses for on-field research of scientists in charge, workshop expenses and expenditures on literature and material which will be used and generated within the project.

6.1.3 Project language

The project language for research activities and resulting documents is English. Single documents in German can also be available upon request.

6.1.4 Contact

For further information please contact:

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