

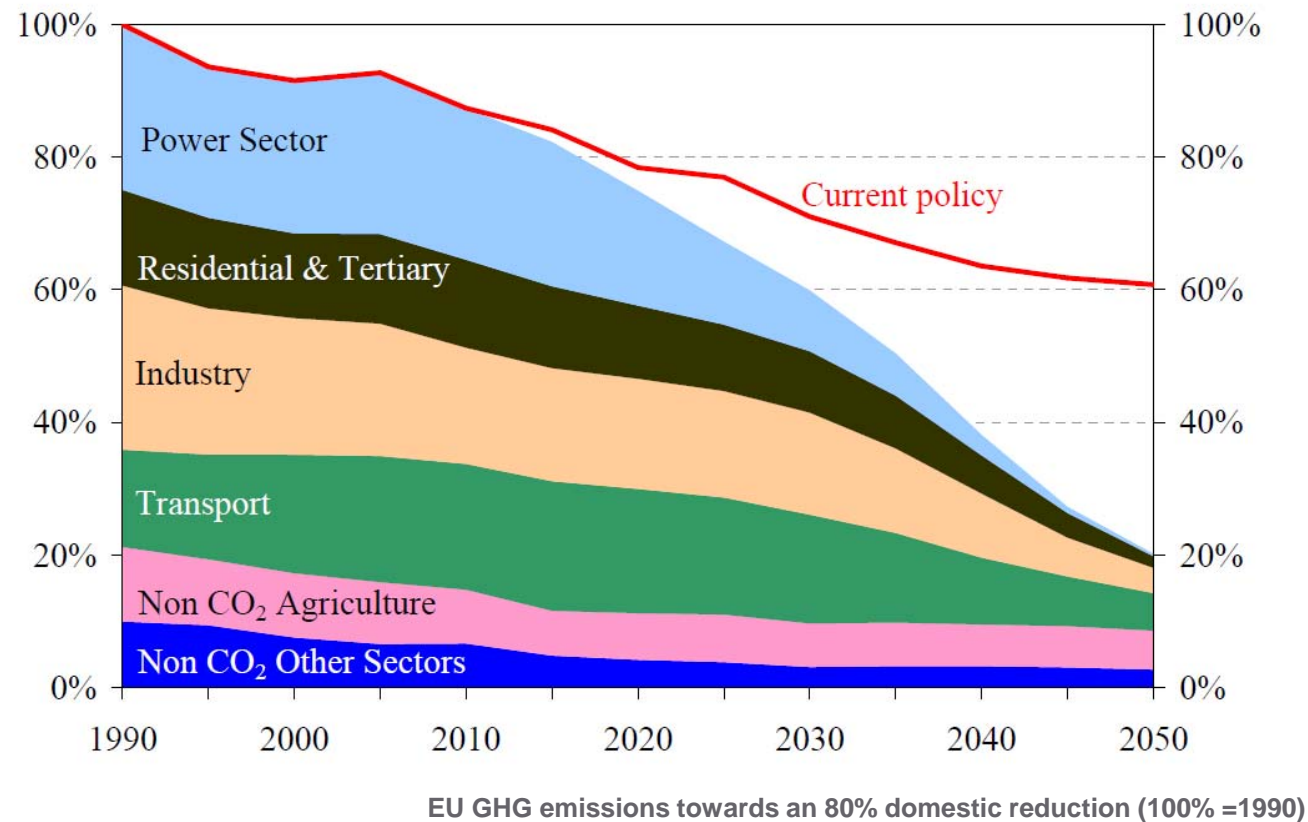
Smart Cities Technology Vision 2050

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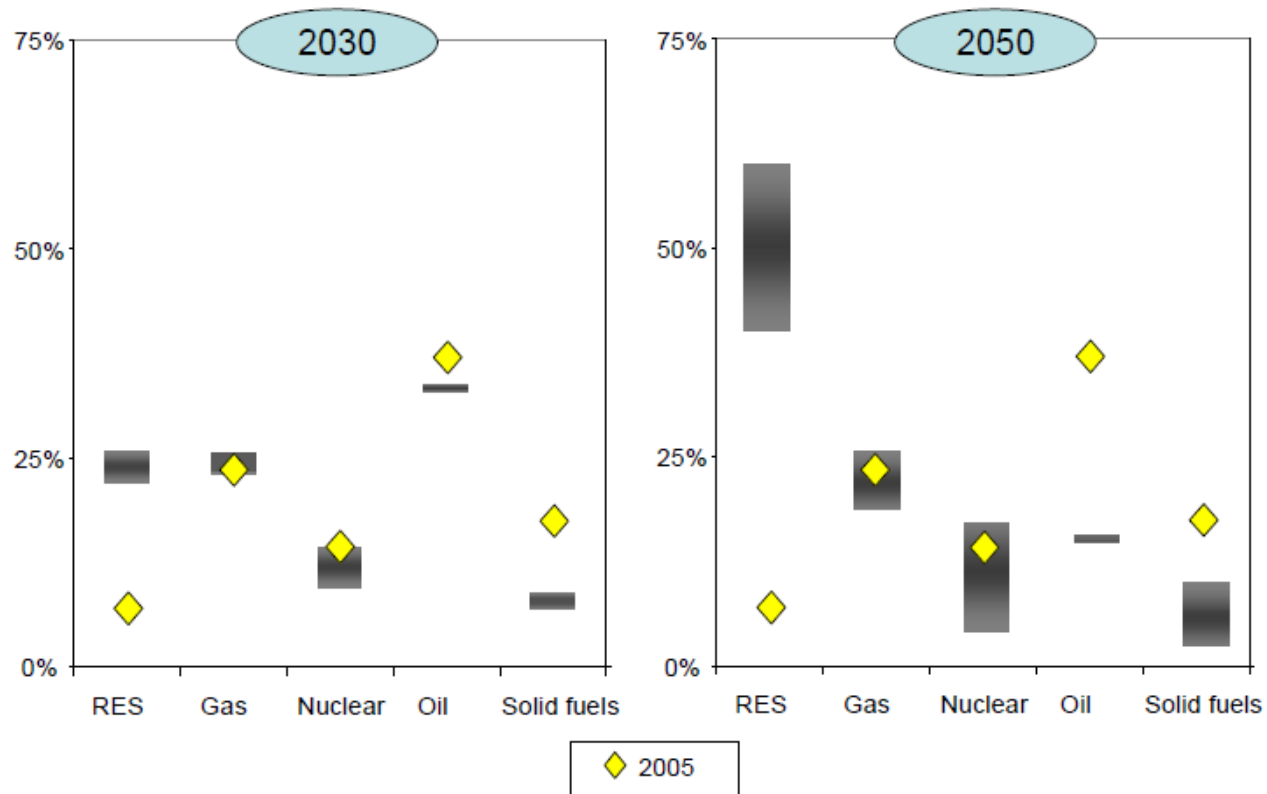
Vision 2050 - Low Carbon Economy Roadmap

Urgent need for actions



Energy Roadmap 2050

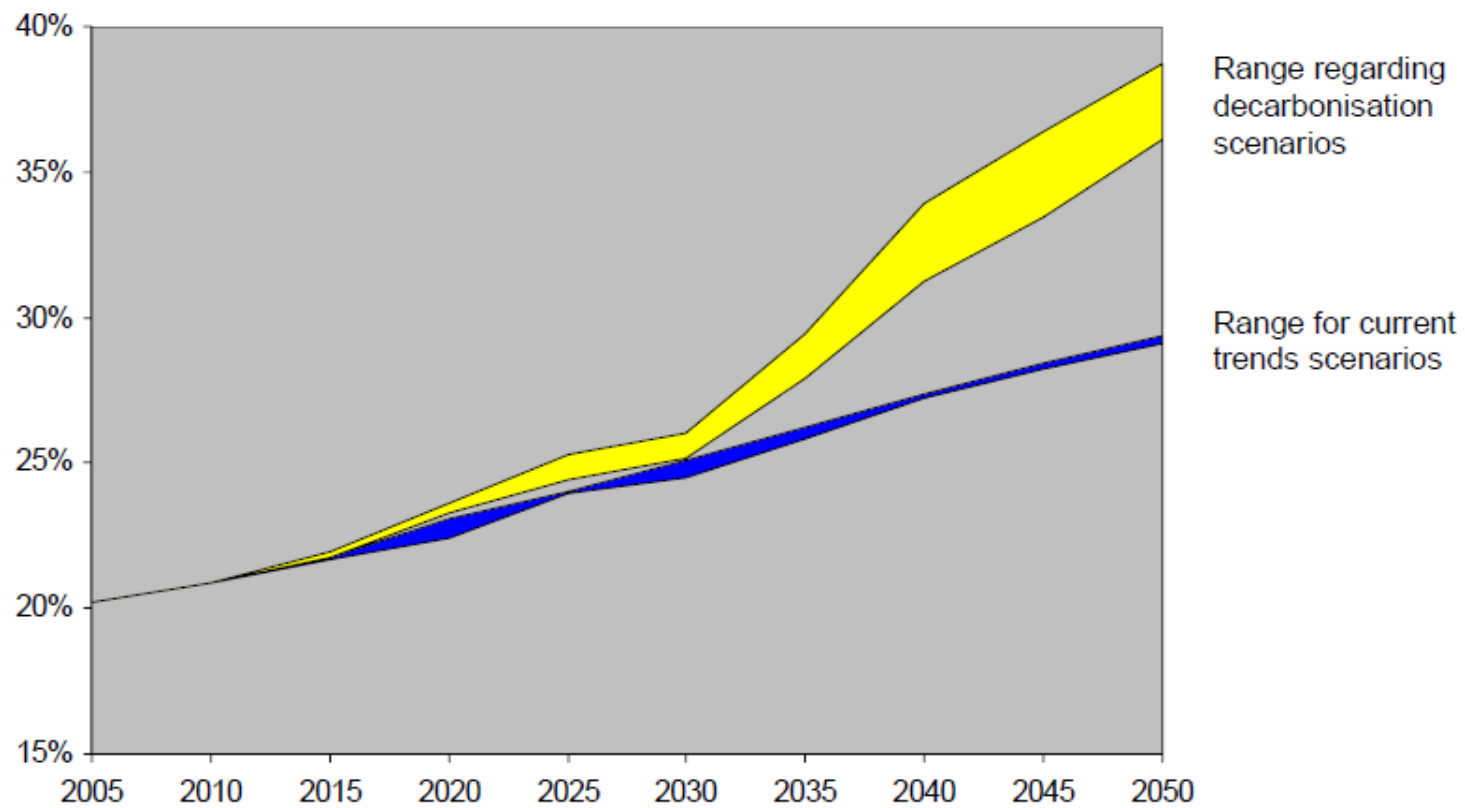
Graph 1: EU Decarbonisation scenarios - 2030 and 2050 range of fuel shares in primary energy consumption compared with 2005 outcome (in %)



Source: European Commission, Brussels – COM (2011) 885/2

Energy Roadmap 2050

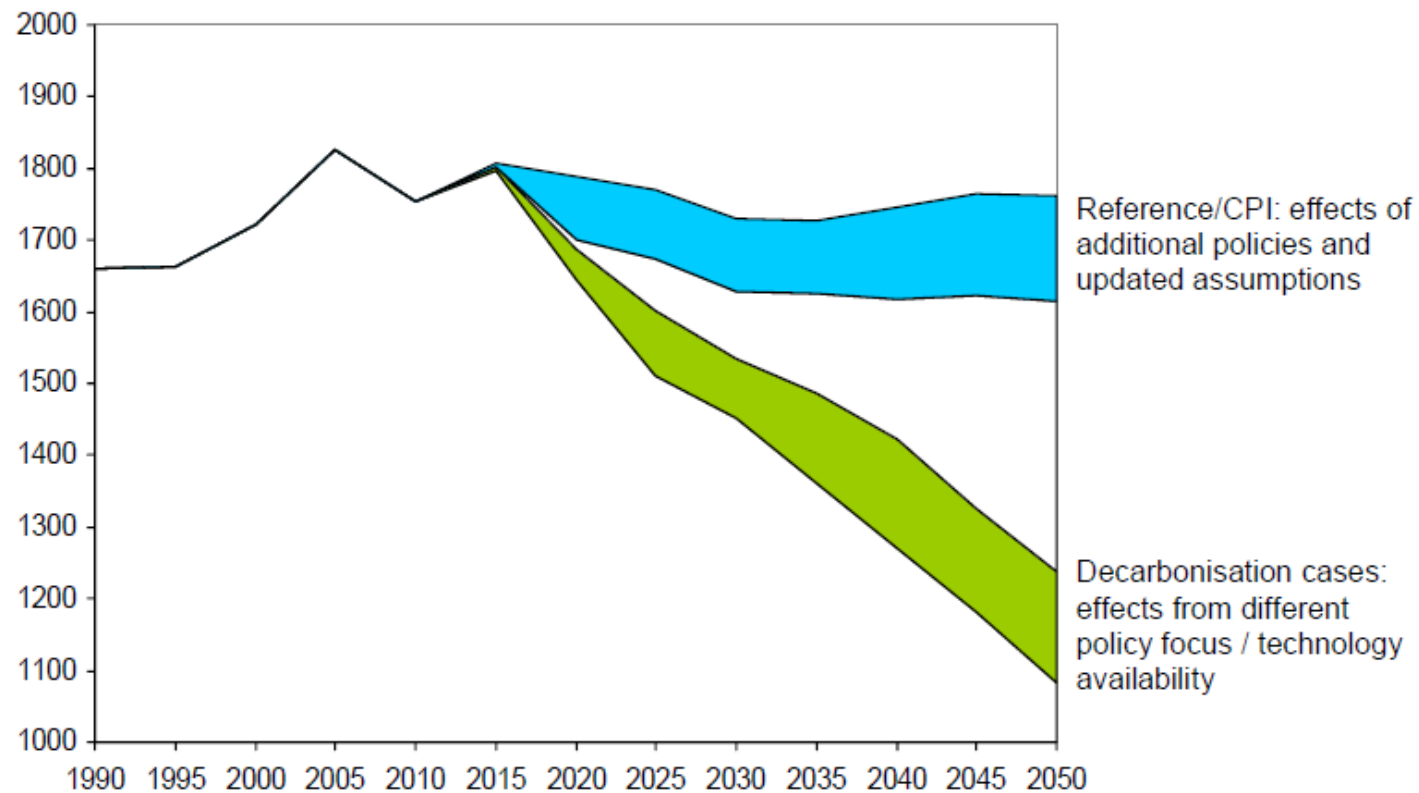
**Graph 2: Share of electricity in current trend and decarbonisation scenarios
(in % of final energy demand)**



Source: European Commission, Brussels – COM (2011) 885/2

Energy Roadmap 2050

Graph 3: Gross energy consumption - range in current trend (REF/CPI) and decarbonisation scenarios (in Mtoe)



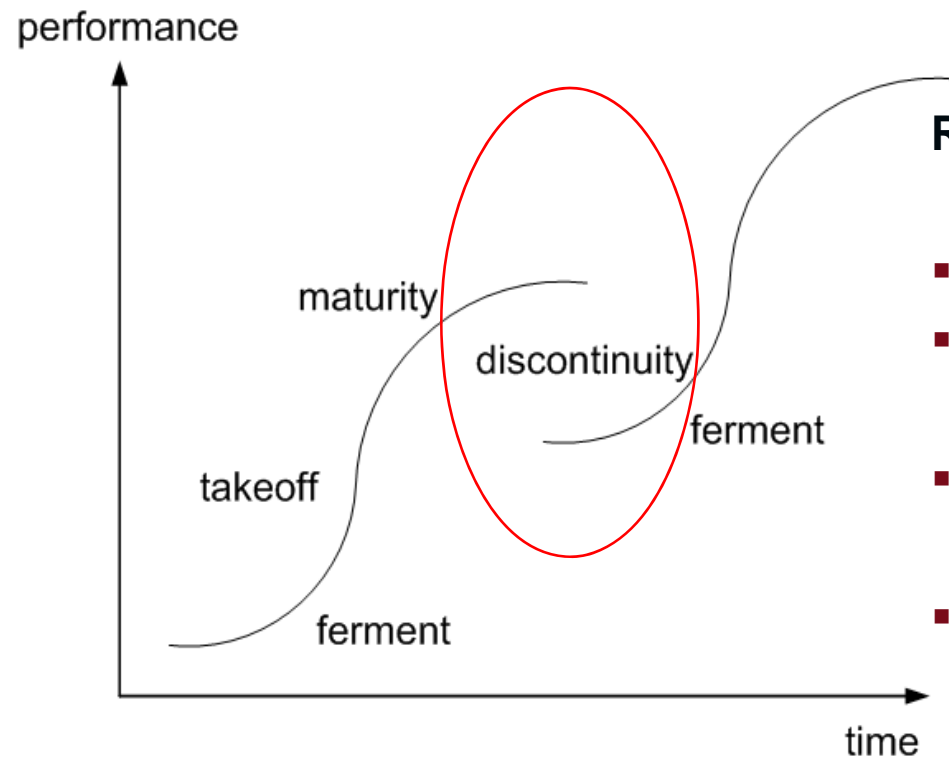
Source: European Commission, Brussels – COM (2011) 885/2

Requirements based on the climate goals...

- Sustainable change of the **energy systems** based on the climate goals
 - Energy efficiency
 - Integration of renewable energy
 - Intelligent [Smart] infrastructure
- **Secure, sustainable and affordable** energy provision worldwide
- **Sustainable Cities**
 - High living standard
 - Dealing with resources efficiently and sustainable
 - Socio-economic measures
- **Economic Sustainability**
 - New business models
 - Incentives and funding

Guiding radical innovation

Position of AIT



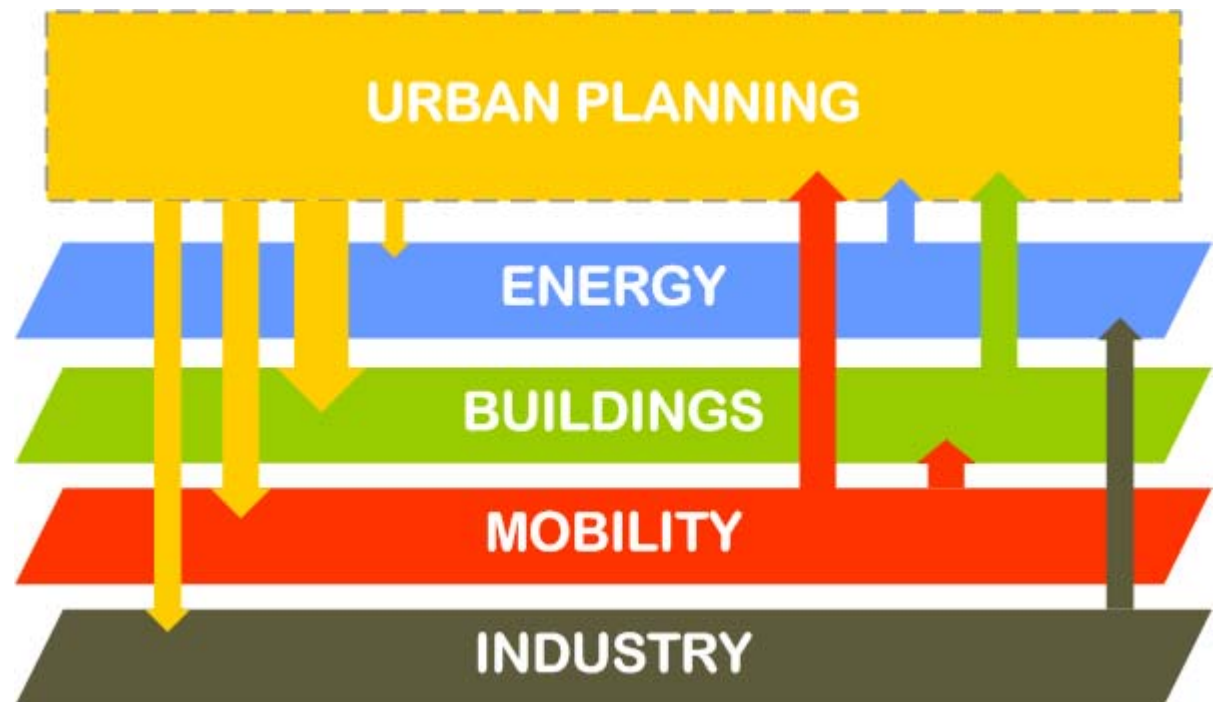
Radical Innovations

- passive → active
- static systems → dynamic systems
- local → urban wide implementation
- single technologies → integrated approach

Processes: The Integrated Planning Approach

Urban Planning Structures: Status Quo

- Diverging planning tasks / goals / time dependencies
- Homogenous Stakeholder Processes
- Optimisation of single technologies



Processes: The Integrated Planning Approach

Urban Planning Structures: Goal

- Integrated planning tasks
- Heterogeneous Stakeholder-Processes
- Common Goals
- Common time dependencies
- Intensive and continuous communication
- Optimisation of the overall 'system' of the city



EU Experience – e.g. Smart City Concept

ICT & Energy Technologies are merging
Intelligent energy management on regional & city level

New integrated planning approach

- Energy Planning
 - Smart Grids
 - Active Buildings
 - Supply Technologies
 - Mobility
-
- New Business Models
 - New innovation processes (testing field, stakeholders etc)



Integrated Urban Planning

Methods	Demonstration
New organisational processes for innovation and city transformation (multiple stakeholder participation)	Fully integrated, designed and intelligently managed energy systems at district and urban scale
City-visioning exercises	New planning tools applied in innovative stakeholder processes
Tools for understanding energy characteristics/performance of cities (morphology, demography, end-use mix)	City-wide progress-monitoring in operation
Decision support tools (GIS based) for scenario analysis, including economic aspects, and strategy development	Establishment of new urban structures supporting sustainable city environment
Detailed dynamic simulation of energy flows in cities	Regular update of city strategies/roadmaps according to the iterative assessment of its performance relative to KPIs
Methods for linking urban energy planning, transport planning and urban planning	Organisational innovation enabling smart energy management
Integration of relevant sustainable city aspects (waste, water, environment, climate, air pollution) into urban energy planning	Innovative business models in practice
Data management structures and methodologies for linking and processing data relative to urban planning, energy, transport as well as waste, water	Development of city roadmaps/strategies and action plans
Development of living lab concepts	
City-wide energy data monitoring concepts	
Development of Smart Cities KPIs	

Urban Energy Networks

Methods	Demonstration
New concepts for network design + planning	Maximised decentralised RES integration at city level
Smart network operation (control structures, stability, ICT, etc.)	Implementation of smart multi-source energy grids at district and city level
Demand-side management (load shifting) and storage capacities	Demand-side management in full operation at district and city level
Multi-source energy management (interface for different energy types - electricity, gas, heat, cold - and from different sources - solar, wind, geothermal, waste heat, etc; decentralised and centralised)	E-Mobility (incl necessary infrastructure) integral part of sustainable mobility concepts
Integration of decentralised RES into urban energy networks	Flexible energy storage systems in practice
Data monitoring/management/analysis	Advanced use of smart metering (for communication with the user, monitoring and active control)
Interaction with E-Mobility	New business models (liberalisation of energy market)
	Legal framework (e.g. removing barriers preventing large-scale production of RES and collaboration between network operator and energy producer)

Energy-efficient Interactive Buildings

Methods	Demonstration
Maximising integration of RES	Large-scale retrofitting of existing building stock to very low energy-levels
High-performance building renovation	New build built to "energy zero" and "energy positive" standards
New concepts for energy-efficient retrofitting of historical districts	New building standards/policies/regulations for the refurbishment of existing buildings and for new build
Concepts for the multifunctional use of buildings	Multifunctional buildings
Building - grid interaction ("B2G")	Optimal integration of RES within urban building stock
Building - user interaction	Buildings fully integrated into smart energy networks (i.e. they serve as energy producers and storage capacity)retrofitted)
Advanced monitoring of buildings and clusters	Continuous energy monitoring of buildings and clusters in full operation
Self-adapting systems for B2G (fault detection, optimization of efficiency, costs etc.)	Innovative building technologies at an affordable price level
Building simulation tools for planning and operation at city level	New business models (e.g. for landlord-tenant issue; private energy producer vs energy utilities for decentralised energy production; contracting; large-scale retrofitting)
Compact high-density heating & cooling storages	Legal framework (e.g. for data security; removing existing barriers preventing refurbishment of buildings and integration of RES)
Innovative building materials	
Smart energy management (advanced automation systems) of buildings and clusters	

Urban Energy Supply Technologies

Methods	Demonstration
New planning and design tools for large scale integration of RES in urban environment	City-wide strategy for the implementation of decentralised RES within the city (regarding e.g. location, energy types, technologies, roll out in time, stakeholders targeted - e.g. individual households, industrial areas, commercial buildings, large areas of RES or scattered production)
Simulation tools for planning and operation of RES at city level	New business models (including funding schemes) for the cost efficient roll-out and exploitation of centralised and decentralised RES production and use of waste heat sources
Development of hybrid systems based on different technologies and their integration with existing HVAC systems	New standards, design codes, regulations and policies for large-scale RES in full practice
Intelligent integration of thermal energy storage devices into buildings and networks	Maximised RES integration at city level (including the integration within buildings, public space, industrial areas, etc)
Management of supply systems at city level	Integration of decentralised RES into buildings from the design of the buildings and their (hybrid) HVAC systems to their operation and connection to energy grids
Methods for large-scale industrial applications	Integration of RES and use of waste heat into smart energy grids (electricity, heat, cold, gas) including need for storage and real-time management for optimal use of RES
Technology component development (materials, systems, etc.)	Waste-heat integrated into urban supply system
Testing/monitoring infrastructure and procedures	Smart energy management of industrial areas and industry plants including the integration of RES and cascade use of thermal energy
Planning and design support for the integration of decentralised RES into buildings (e.g. roofs and facades) and the rest of the urban fabric (e.g. public space, industrial areas, parkings)	