



KNX city

From the smart building to the smart city

www.knx.org



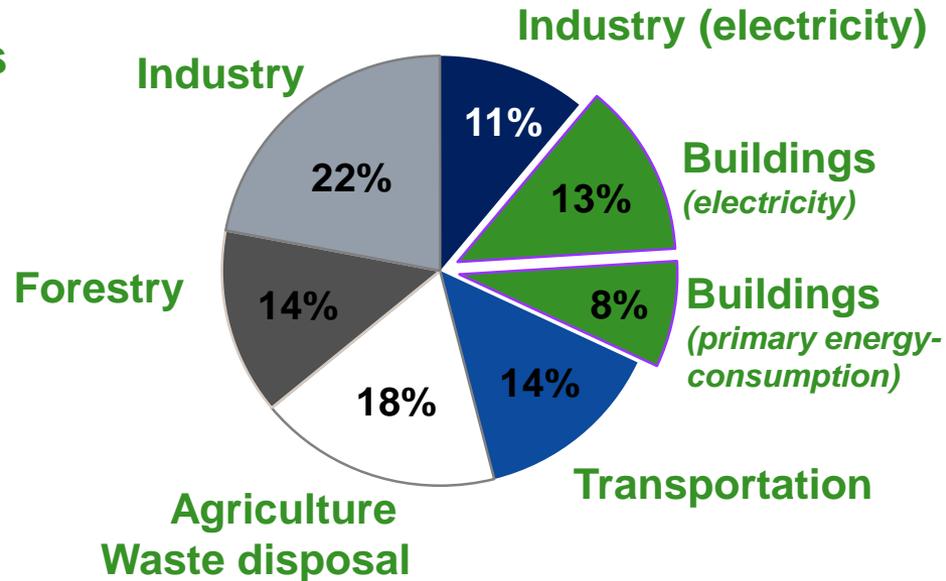
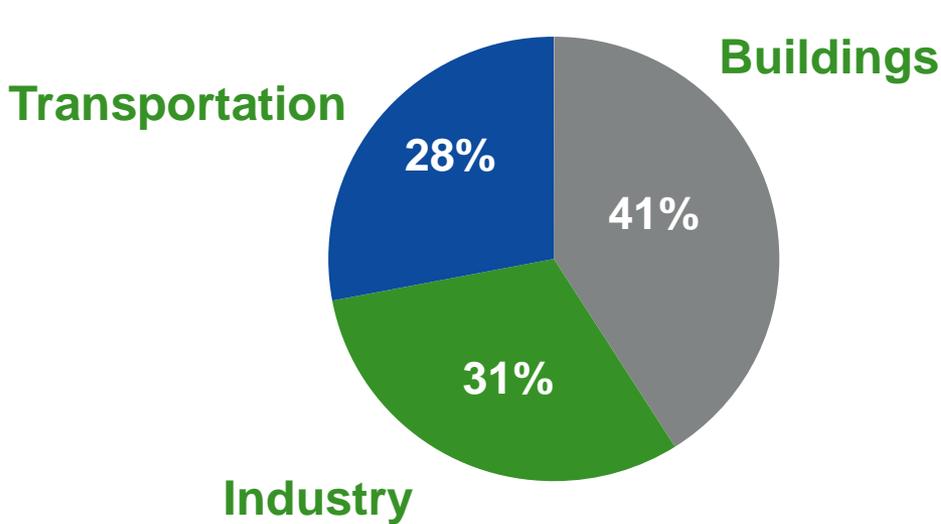
Energy Savings with Building Automation

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Huge Potential for Energy Savings in Buildings

Consumption of 40% of global's energy

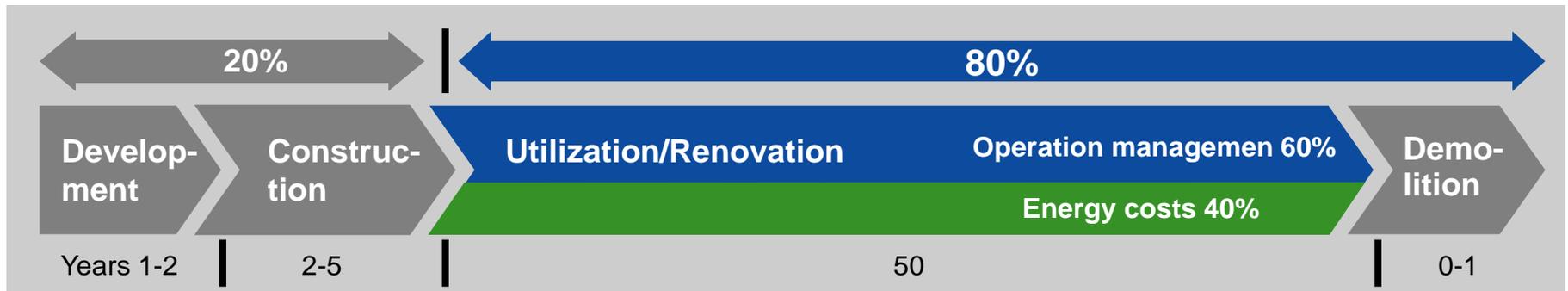
Production of 21% of greenhouse gases



Huge Potential for Energy Savings in Buildings

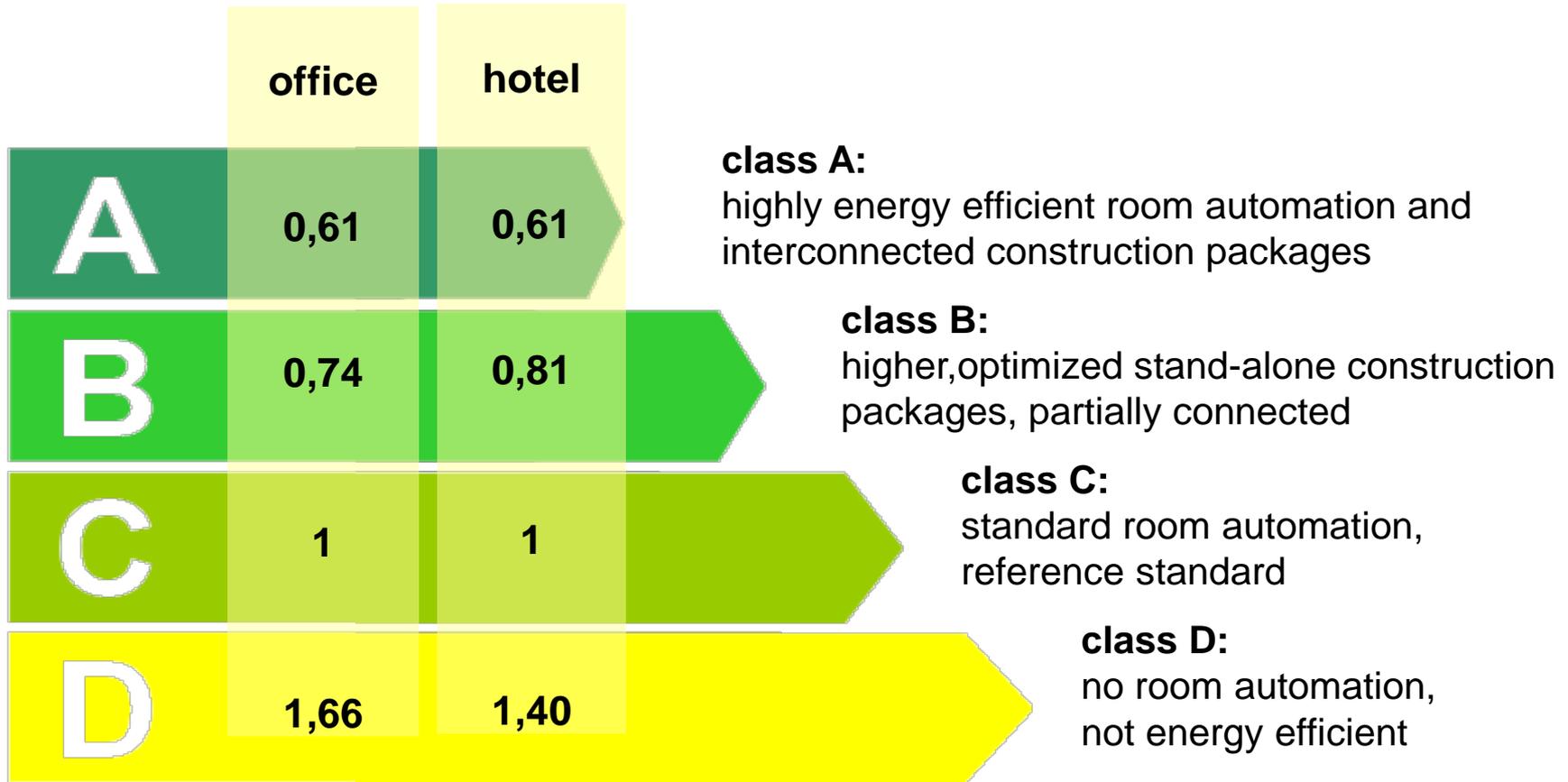


40% of the costs generated during a building's useful life are required for energy



Energy efficiency class according EN 15232

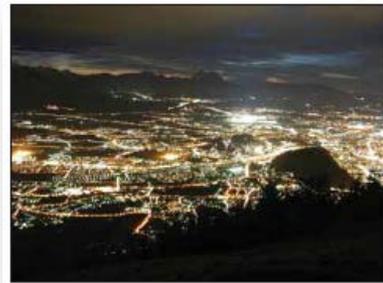
Energy-saving potentials (thermal/electrical)



Energy Efficiency in the KNX Buildings

Energy Savings with KNX in the buildings:

- up to **40 %** with KNX shading control
- up to **50 %** with KNX individual room control
- up to **60 %** with KNX lighting control
- up to **60 %** with KNX ventilation control



Electricity for the City of Salzburg (*Austria*)



A new bioclimatic office building in Huesca (*Spain*)



The largest building in the Middle East



Energy efficiency in Guardia Polytechnic Institute



Nerocubo Hotel in Italy



Oundle School, Peterborough (*Great Britain*)



A family home in low energy standard in Innsbruck (*Austria*)



Improved energy balance in insurance company (*Prague*)



Challenges in cities

- 5 Facts

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Challenges in cities – 5 Facts

■ Fact 1: Cities consume and pollute



- *Consumption of **two third of worldwide energy***
- *Consumption of **60% of worldwide water consumption***
- *Responsible for **70% of worldwide of greenhouse gases***

Challenges in cities – 5 Facts

- **Fact 2: 50% of worldwide population lives in cities**



Forecast for 2050: Expected raise to 70%

Challenges in cities – 5 Facts

- **Fact 3: Raising demand for houses and buildings**



...40% of the consumption of final energy

...21% of the production of greenhouse gases

→ **Continuously increasing demand for energy**

Challenges in cities – 5 Facts

■ Fact 4: The demand for mobility increases



- *Urban traffic accounts for 10% of global greenhouse gases*
- *The number of cars will double by 2030*

Challenges in cities – 5 Facts

- **Fact 5: Power supply can't be secured at this rate**



Cities' demand will exceed current supply



Current Approaches

- *Renewable Energies*
- *Smart Grid*

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Current Approach: Renewable Energies

Benefits of Renewable Energy Use

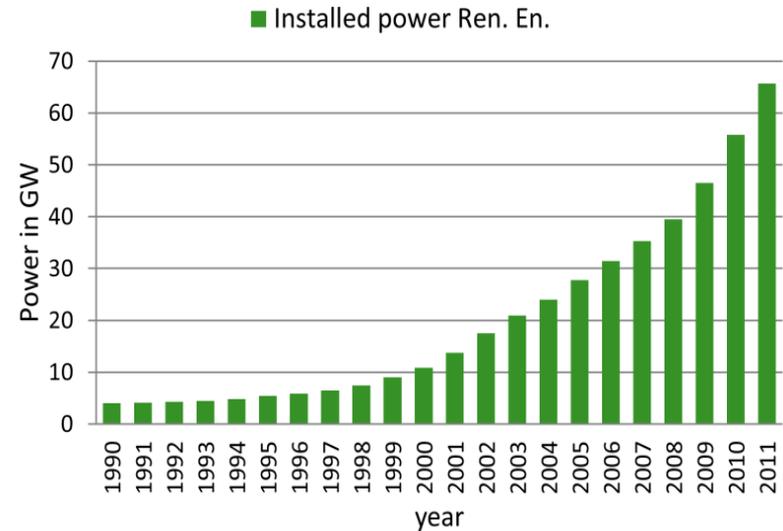
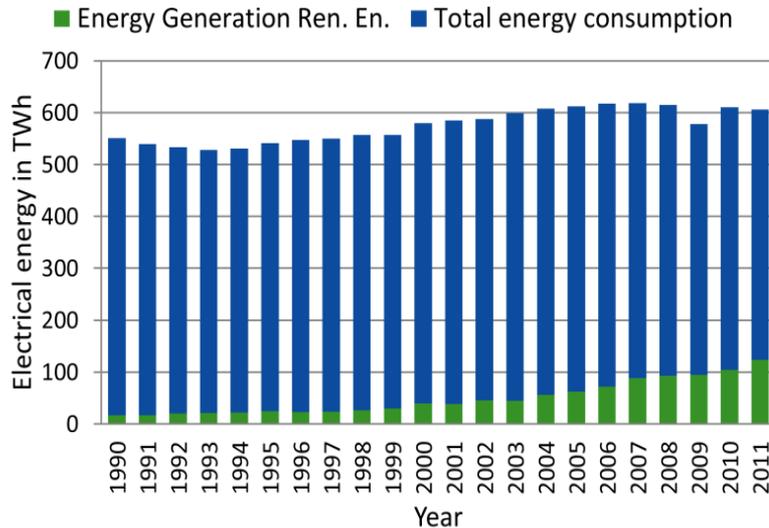
wind, solar, geothermal, hydroelectric, and biomass

- *Little to No Global Warming Emissions*
- *Improved Public Health and Environmental Quality*
- *A Vast and Inexhaustible Energy Supply*
- *Jobs and Other Economic Benefits*
- *Stable Energy Prices*
- *A More Reliable and Resilient Energy System*

Source: Union of Concerned Scientists

Current Approach: Renewable Energies

(Example: Europe)



Only 20% of the total energy generation was covered by renewable energies

→ Why?

Source: Technische Universität Darmstadt

Current Approach: Renewable Energies

(Example: Europe)

**Secured Energy Generation
with fossil fuels**
(producing CO²)

119,4 GW Total power of all power plants

-22,8 GW not usable power

-4,1 GW outages

-2,7 GW revisions

82,7 GW secured power

6 GW buffer

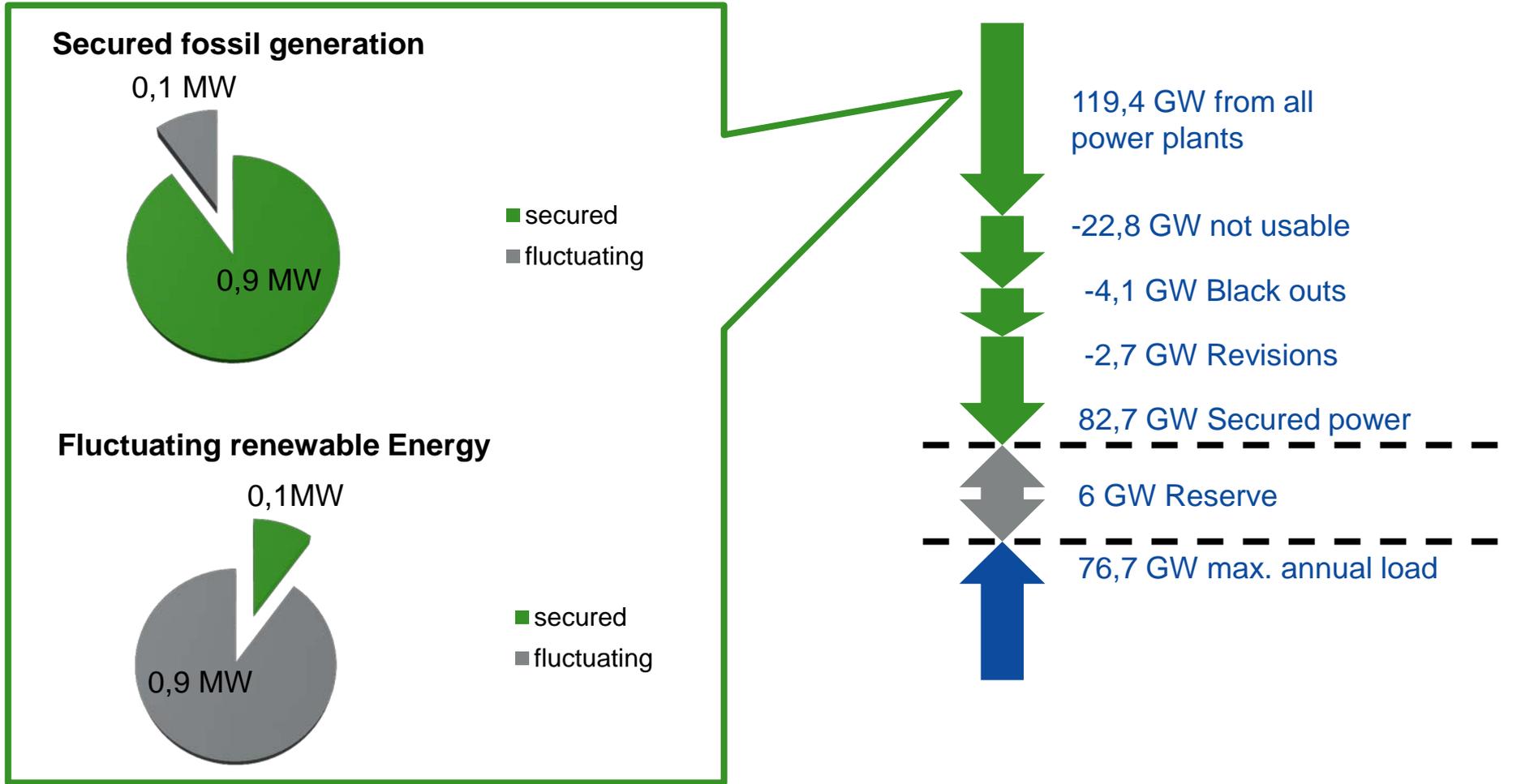
99% Secured Energy

76,7 GW annual maximum load

Source: Technische Universität Darmstadt

Current Approach: Renewable Energies

(Example: Europe)

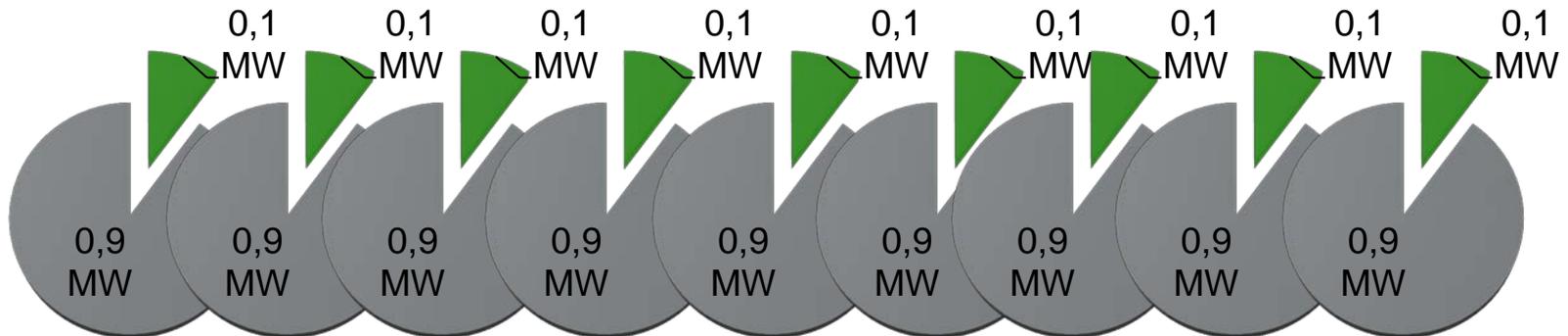


Source: Technische Universität Darmstadt

Current Approach: Renewable Energies

(Example: Europe)

Solution: Securing Energy by increasing renewable energy generation?



Secured Min. Generation

→ **0,9 MW**

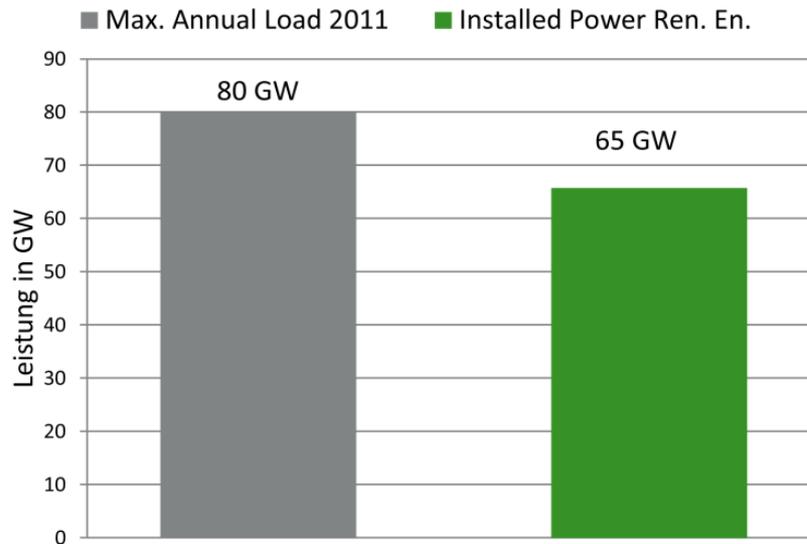
Max. Generation

→ **9 MW**

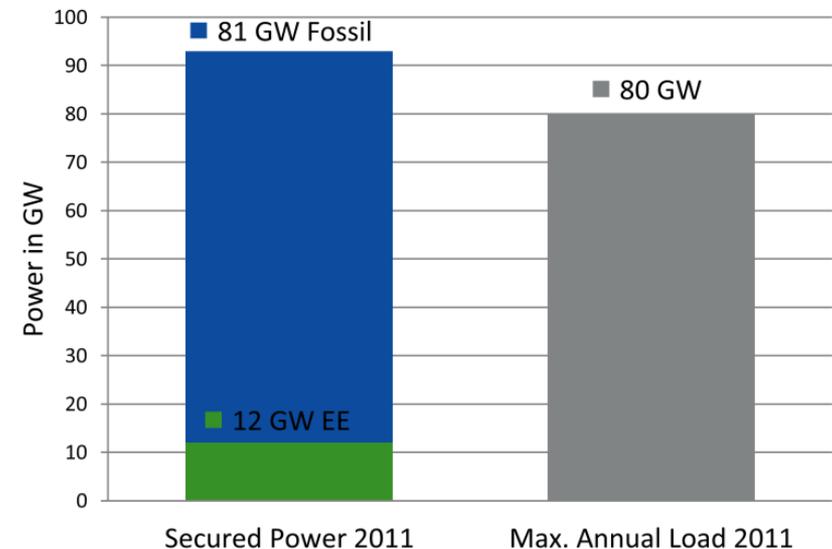
Current Approach: Renewable Energies

(Example: Europe)

Installed Power Ren. En.



Secured Power Ren. En.



→ Renewable energy underlie fluctuations

→ Expansion alone is not a solution

Source: Technische Universität Darmstadt, Dipl.-Ing. Lutz Steiner



Current Approaches

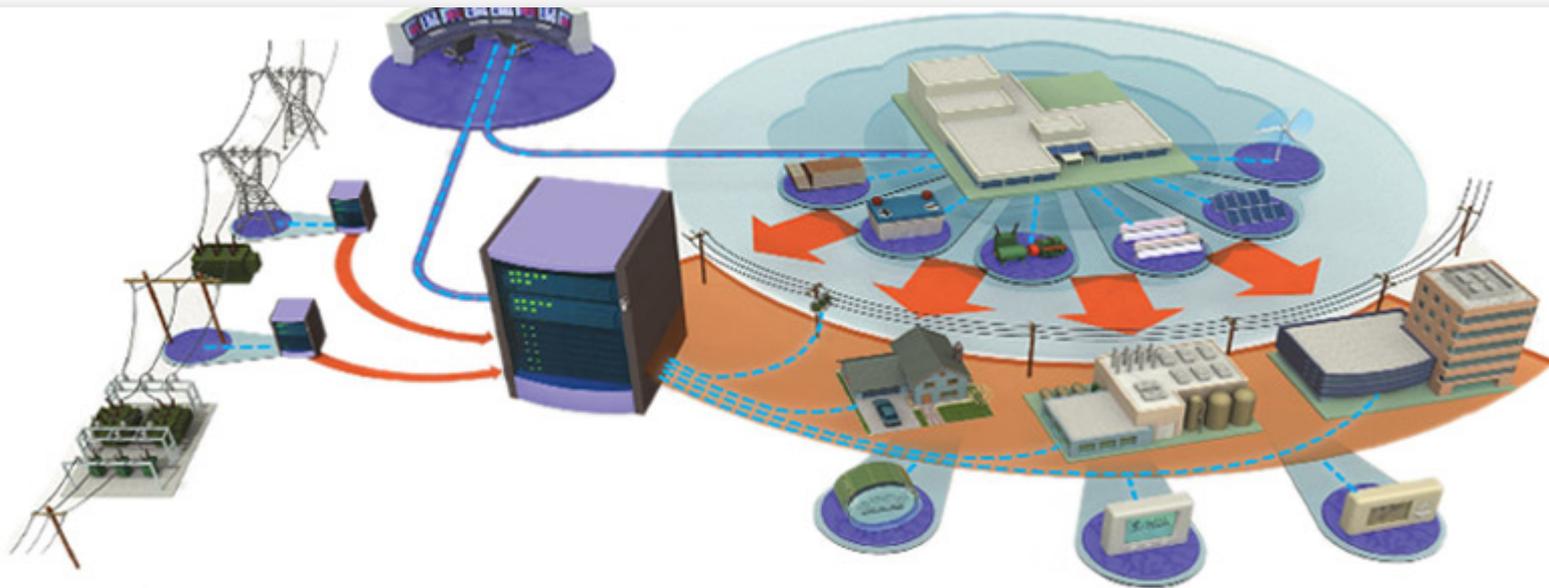
- *Renewable Energies*
- *Smart Grid*

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Current Approach: Smart Grid

What is a Smart Grid

- A Smart grid is defined as electrical power supply combined with Information and Communication technology (ICT)



Smart Grid adapts loads

Current Approach: Smart Grid

Drivers for Smart Grids

- **Generation side**
 - Integration of renewable Energies
 - Reduction of carbon dioxides



Current Approach: Smart Grid

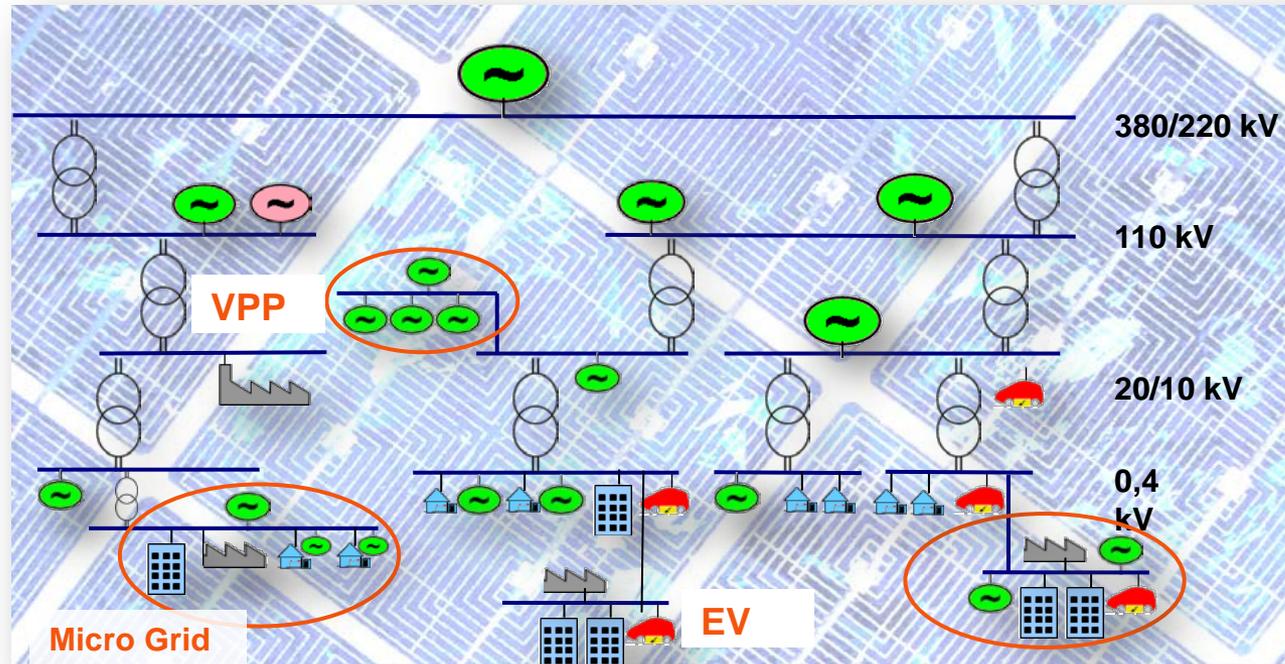
Drivers for Smart Grids

- **Consumption side**
 - Increasing Energy efficiency, especially in Mega cities
 - Control of Energy Demand



Current Approach: Smart Grid

Solution: Installation of Smart Grids



- Current Grid not suitable
- Standards have to be defined
- No solution for overload of grid
- Smart Grid depending on combined solutions



Positive Trends



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Positive Trends: Building

Energy efficiency is on the rise



"Energy management in buildings is the first and easiest way to create an energy efficient city"

Challenges for buildings:

- Energy efficiency in the city is not only to save final energy but to balance the grid.
- The energy management of buildings requires the interaction between the **Building and Infrastructure**

Positive Trends: Mobility

Demand for green mobility increases



"Green Mobility, especially Electromobility, avoids harmful emissions"

Challenges for the mobility:

- Emissions will be only avoided by charging eCars in cities electricity from **renewable energies**
- The charging of eCars in requires the interaction between the **Building and Mobility**.

Positive Trends: Infrastructure

Smart Grids provide intelligent city solutions



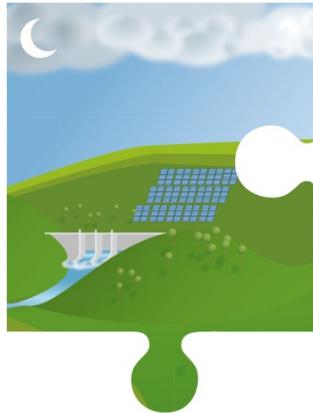
"Smart grids enable a comprehensive interoperable energy management"

Challenges for the infrastructure:

An infrastructure requires the interaction between the Building, Mobility and Energy Generation based on the *smart grid*.

Positive Trends: Energy generation

Renewable Energies are set by the world



"Renewable energy provides benefits for our climate and our health"

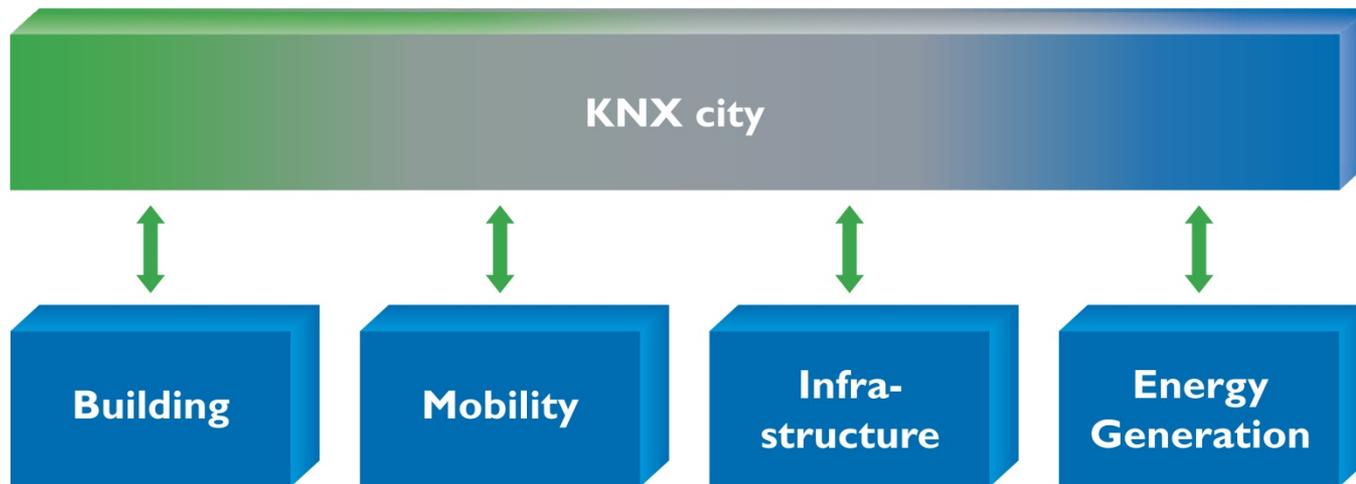
Challenges for Renewable Energies:

- The volatile renewable energy power generation is the major challenge
- The decentralized arrangement of renewable energies requires the interaction between Buildings and Energy Generation

KNX city

... the way to make cities energy efficient

KNX city offers solutions in the interaction of buildings, mobility, infrastructure and energy generation



KNX city

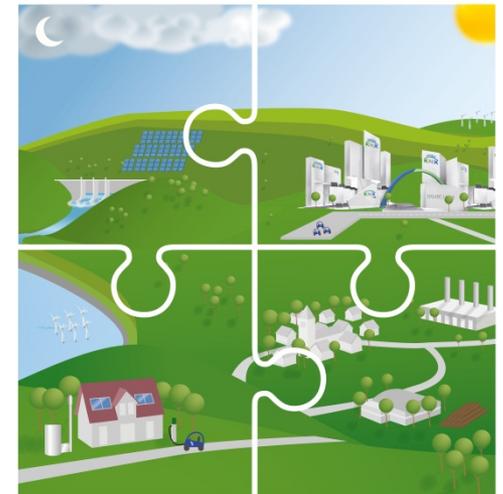
- **KNX city...**

...the overall energy saving solution for buildings

...control of eCar charging through KNX

...uniting distributed facilities to one overall network

...integrating renewables with KNX



Creating Green, Comfortable and Energy Saving Buildings for Modern City Life





KNX city

Put into practice

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KNX Solutions

classic applications

■ KNX offers total building controls

- Lighting
- Blinds & shutters
- Security systems
- Energy management
- HVAC Systems
- Monitoring systems
- Remote control
- Metering
- Audio/Video
- White goods



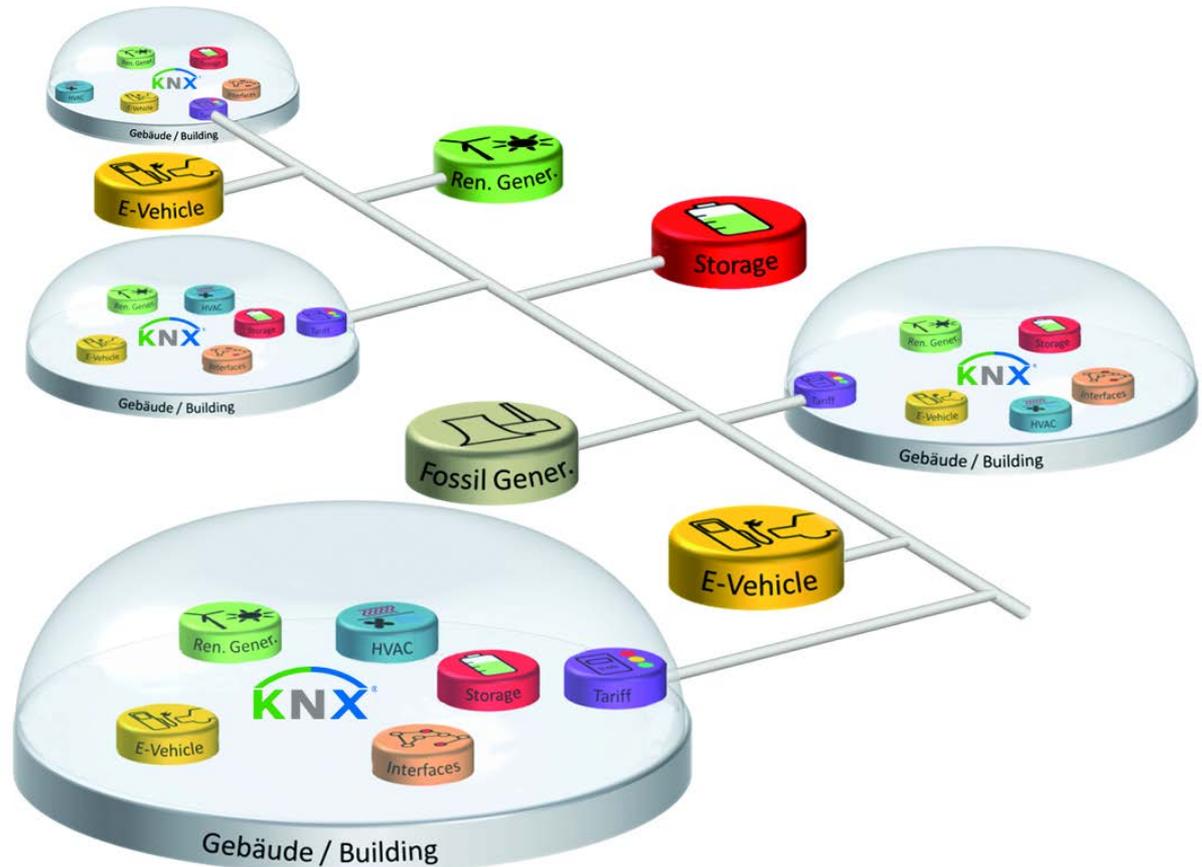
KNX in the building



KNX Smart Grid

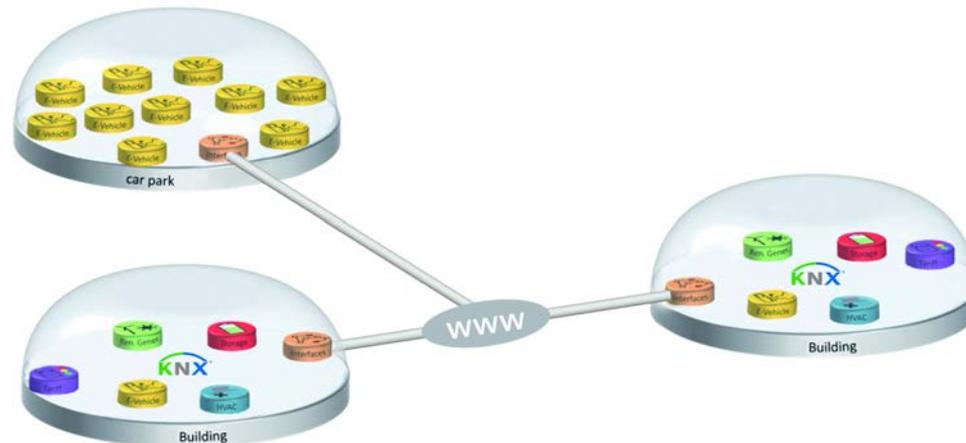
Smart Community

- KNX provides the in-house communication
- KNX provides the communication between distributed facilities
- KNX provides interfaces to the Smart Grid



KNX city distributed facilities

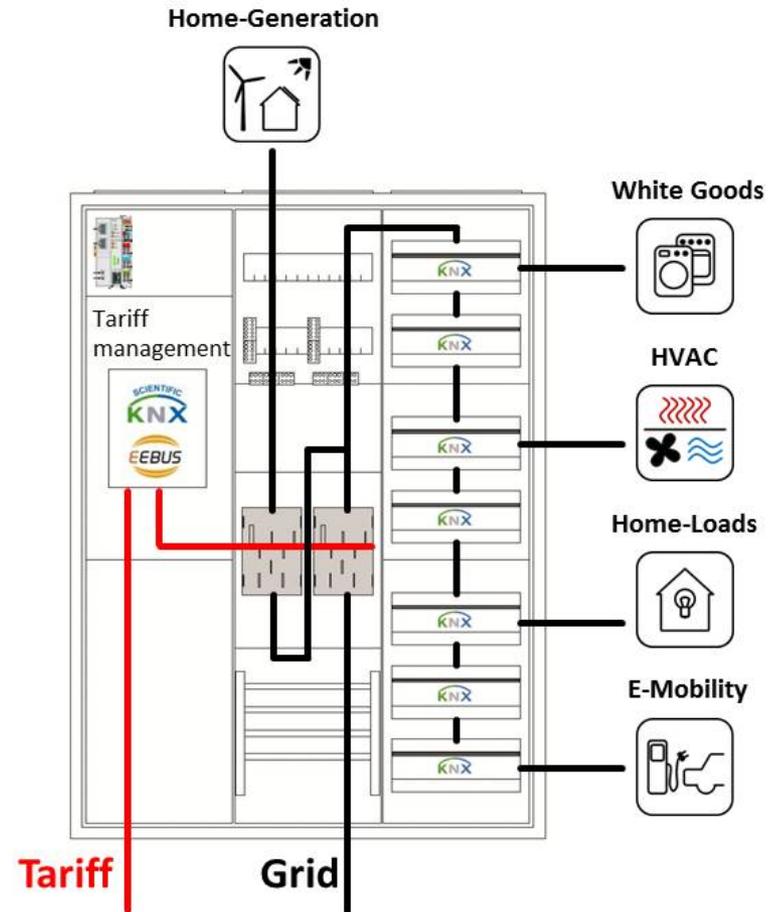
- **Buildings can be connected to each other over distances by IP as if they were one building**
 - *Distributed facilities*
 - *Energy management over distances*
 - *Balancing of generation and consumption of different buildings.*



KNX city application: Building

City load management

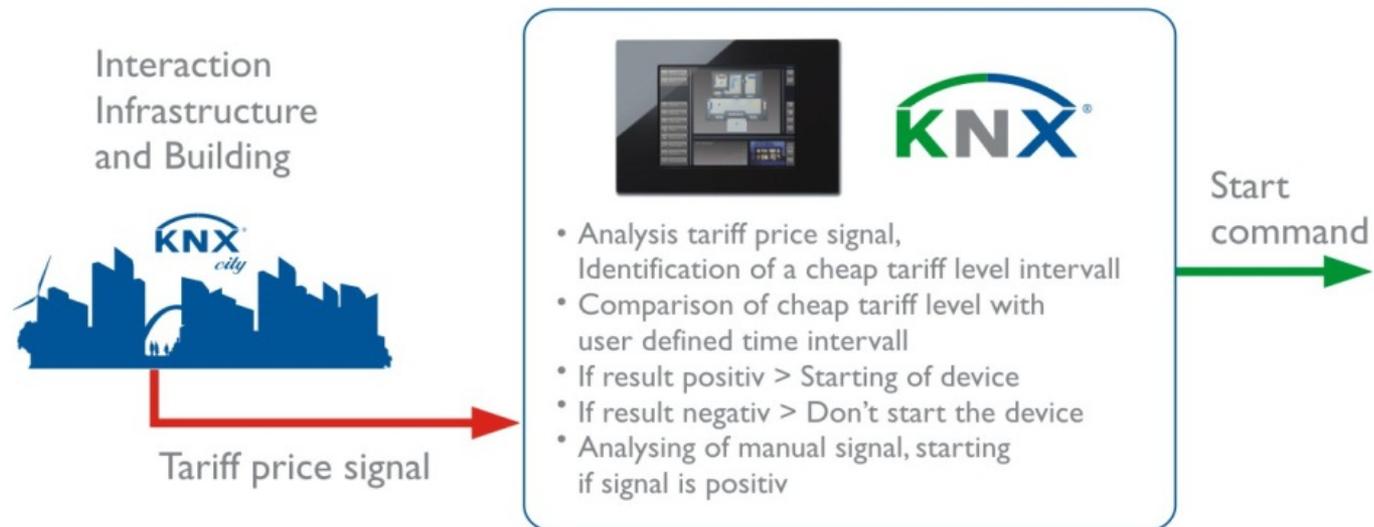
- Tariff or Setpoint Curve is received by a KNX load manager



KNX city application: Building

City load management

- Demand Side Management in dependence of an incoming signal from the city



- The signal depends from...
 - ... the amount of renewable energies which generate currently power
 - ... situation of the power plants
 - ...

KNX city application: Building

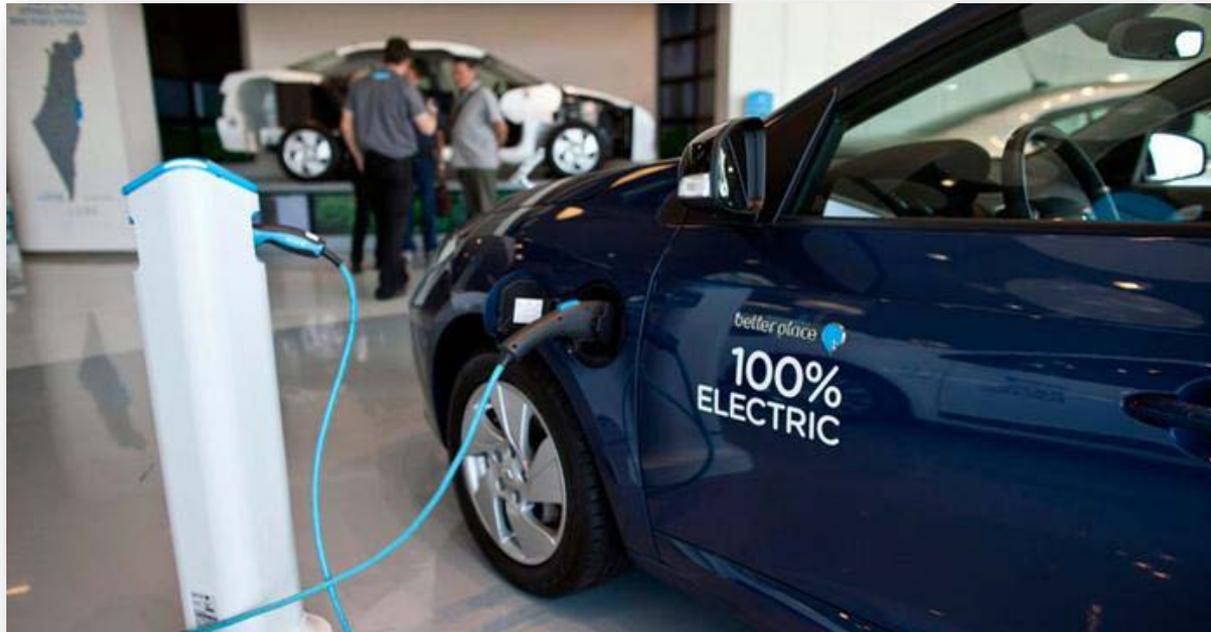
City load management

- *KNX city* helps with **BUILDINGS...**
 - ...to **consume generated surplus** energy from renewable energies
 - ...to **compensate a lack** of renewable generation
 - ...to **reduce peak** loads occurring in the power grid

KNX city application: Mobility

Connectivity of electro-mobility to KNX

- **KNX can charge electric eCars intelligently**
 - Variation of the charging current and thereby the power
 - Predominant charging with renewable energies



KNX city application: Mobility

Connectivity of Electromobility to KNX

Interaction
Infrastructure with Building
and Mobility



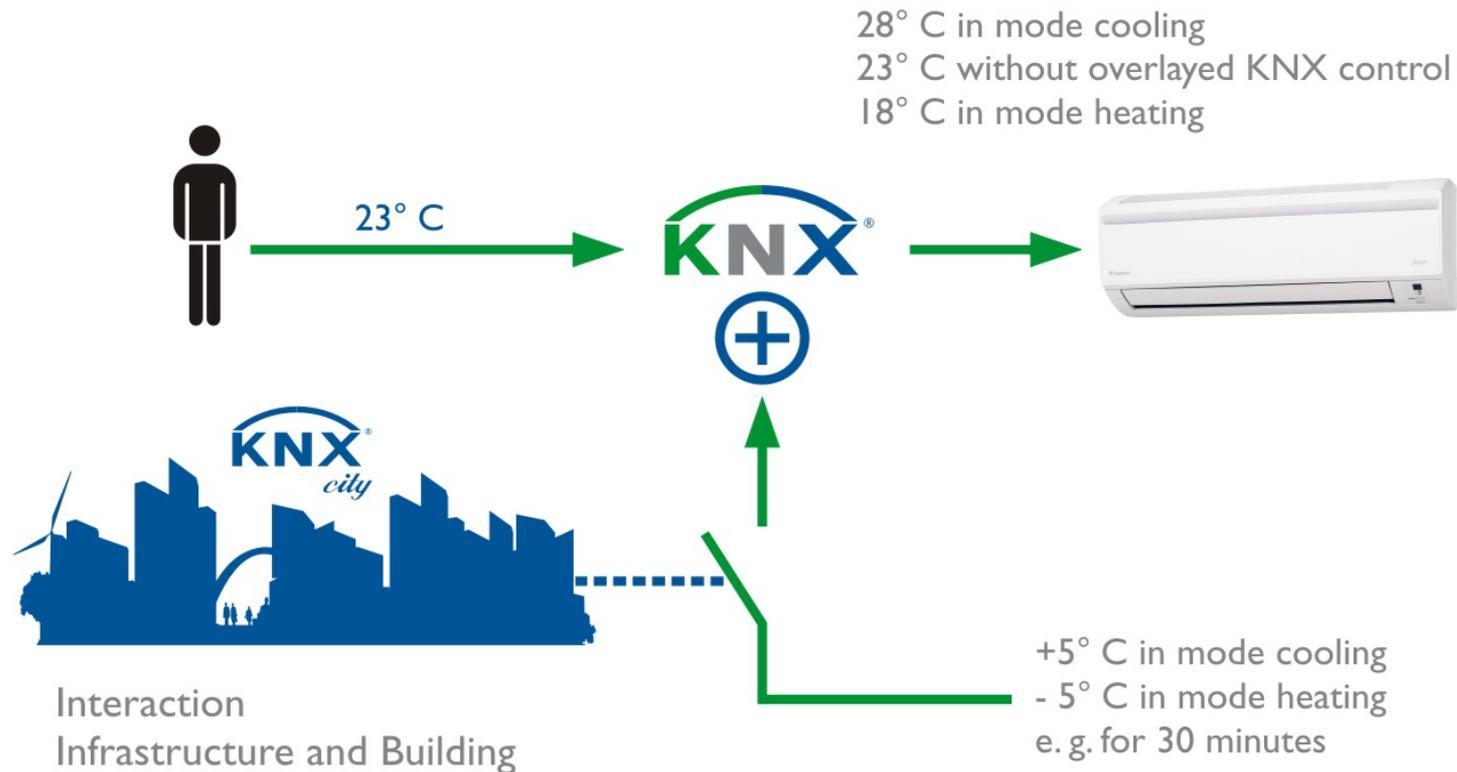
Tariff price signal

Starting
charging power



KNX city application: Infrastructure

City air conditioning control



KNX city application: Infrastructure

City air conditioning control

- **Example 1: Air Conditioning**

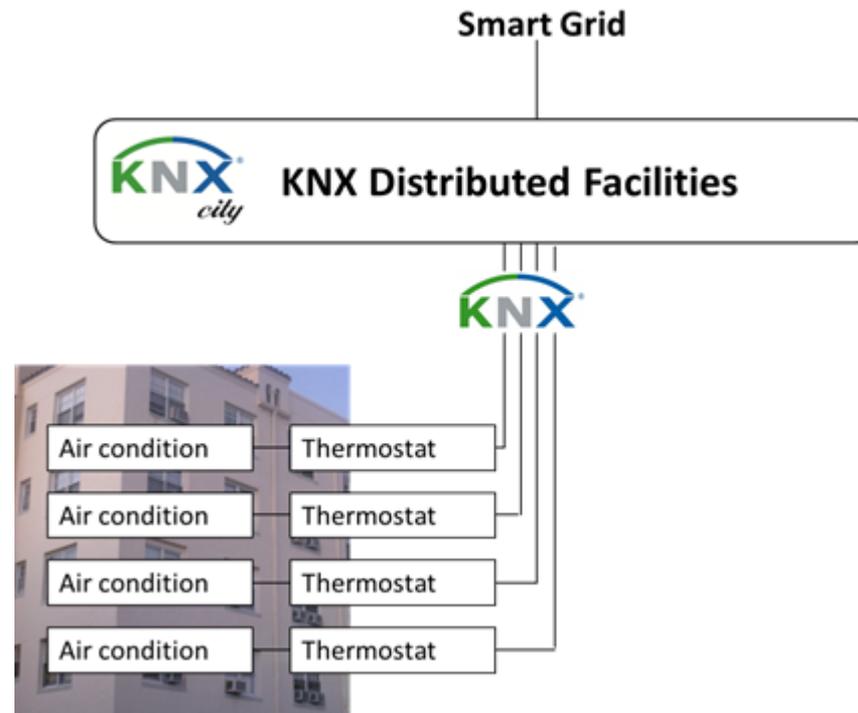
A lot of running air conditioning systems can lead to peak loads in cities



KNX city application: Infrastructure

City air conditioning control

- KNX city Solution: AC – Control via Distributed Facilities



- *Reducing of AC performance for a short period*
- *This has no negative effect on the well-being of the user*
- *Considerable energy savings for the grid*

KNX city application: Infrastructure

City air conditioning control

- **KNX city Solution: AC – Control via Distributed Facilities**

- ***Used Technologies:***

- *KNX Air Conditional Control*
- *KNX Distributed Facilities*

KNX city application: Infrastructure

City air conditioning control

- **Example 2: Illumination of buildings**

Many buildings are fully illuminated during night, causing peak loads



KNX city application: Infrastructure

City air conditioning control

- **KNX city Solution: KNX Dimming via Distributed Facilities**



KNX city application: Infrastructure

City air conditioning control

- **KNX city Solution: KNX Dimming via Smart Grid**

- Helps to reduce peak load
- **On the other hand:** Can compensate Energy Surpluses in the Grid

KNX city application: Infrastructure

City air conditioning control

- **KNX city Solution: KNX Dimming via Smart Grid**

- ***Used Technologies:***

- *KNX Dimming Control*
- *KNX Distributed Facilities*

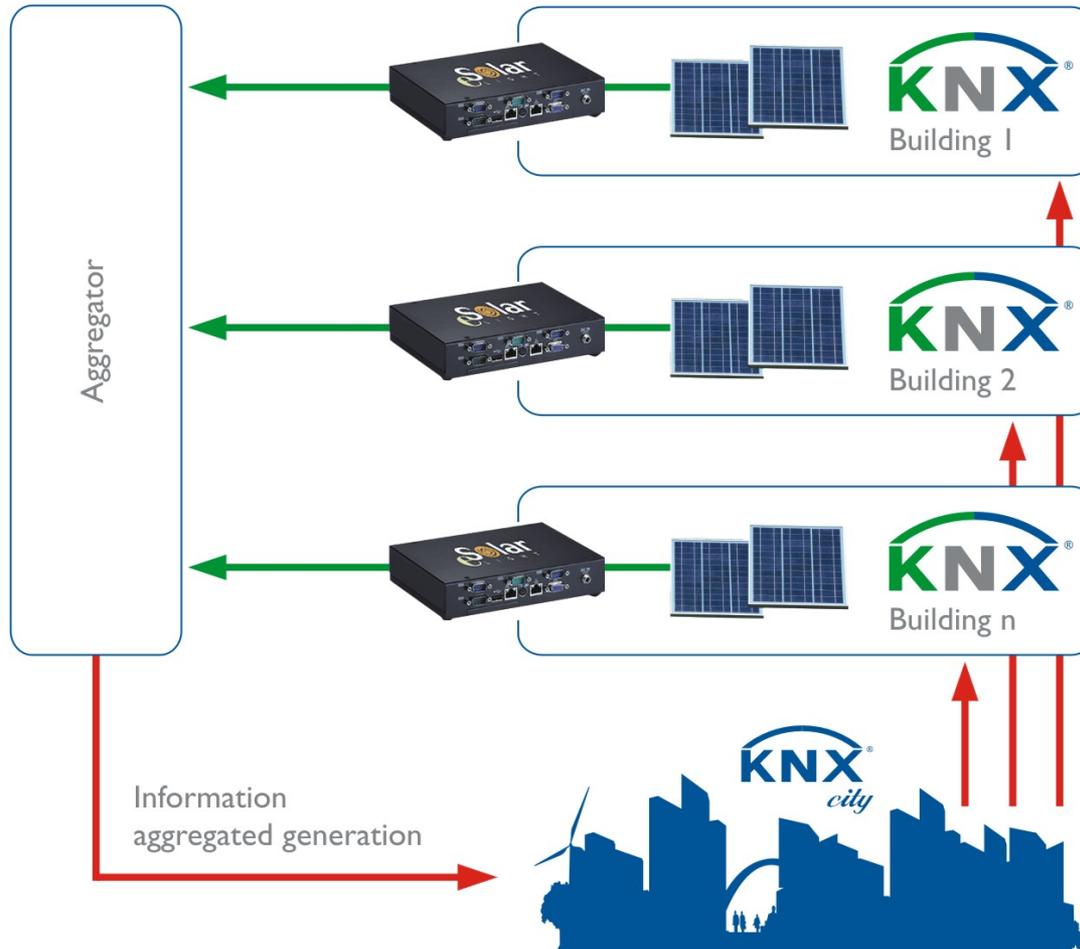
KNX city application: Infrastructure

City air conditioning control

- The KNX city helps with the **INFRASTRUCTURE...**
 - *...to avoid peak loads*
 - *...to save energy*
 - *...to overcome shortly occurring bottlenecks in the power grid*
 - *...to compensate a lack of renewable generation*

KNX city application: Energy Generation

City energy generation management



KNX city application: Energy Generation

City energy generation management

- The KNX city solution helps with **ENERGY GENERATION...**
 - *...to avoid voltage-level violations in low voltage grids*
 - *...to implement demand side management solutions*
 - *...to avoid voltage-level violations in low voltage grids*

Energy generation management helps to
make generation of renewable energies

more transparent



KNX city impressions

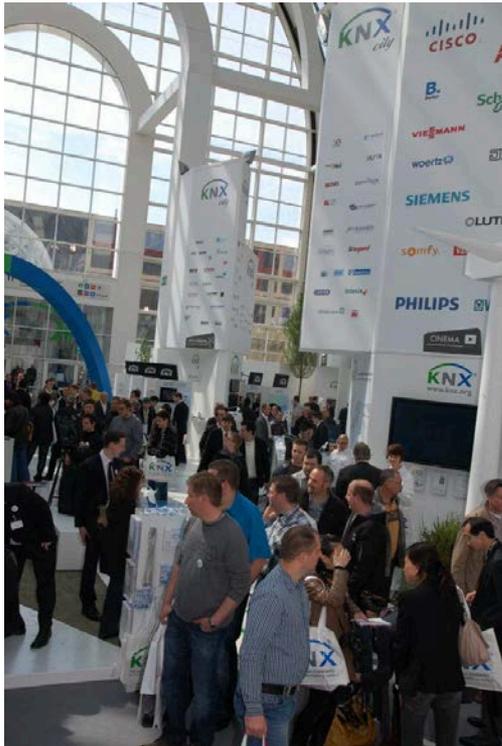
introduced first at I&b 2012 in
Frankfurt, Germany

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KNX city impressions



KNX city impressions



KNX city impressions





**Thank you very much
for your attention**



See you next time in Osaka

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