

## Masterplan 100 % for Climate Protection | on the Way to a Climate Neutral Hannover Region 2050

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20<sup>th</sup> REFORM Group Meeting, Salzburg, 2. September 2015

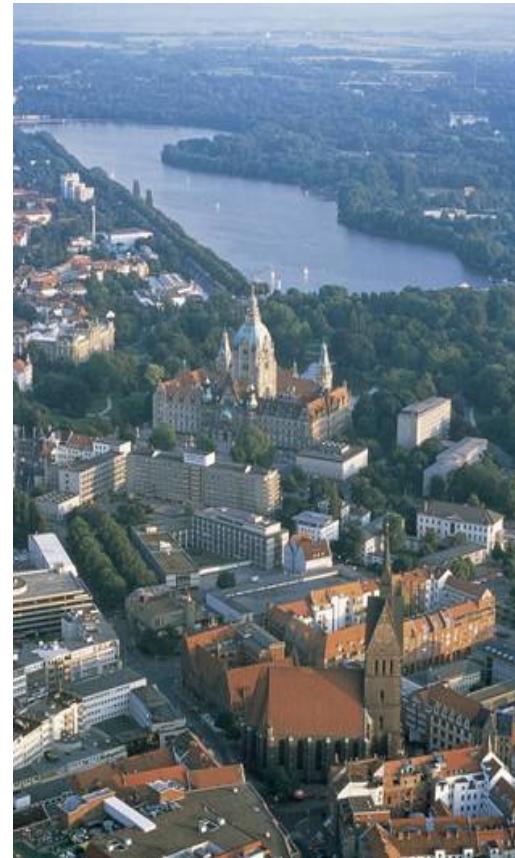


### City of Hannover



## City profile

- 526,000 inhabitants
- Centre of the Hannover Region (pop. 1.1 million)
- Capital and economic centre of Lower Saxony
- City with a good quality of life
- World's largest trade fair location
- 35,000 students at famous universities
- 245,000 jobs in service industries (e.g. insurance) and manufacturing and processing industries (e.g. automobile)



## Hannover Region

City of Hannover and  
and 20 surrounding  
communities

Surface area about  
2,300 square kilometers  
with about 1.1 million  
inhabitants



## Hannover has powerful instruments for Climate Protection

- committed climate protection units in the City and Region administration
- a majority municipal holding in the city energy utility, Stadtwerke Hannover / 'enercity'
- a climate protection fund, awarding grants totalling 5 million Euro a year
- a regional climate protection agency responsible for campaigns and public relations
- about 160 industrial and commercial companies participating in the 'Ecoprofit' scheme
- SEAPs (sustainable energy action plan) for the City and the Region of Hannover, and all surrounding towns
- Existing networks



## Municipal action plan 30 measures: reduction target 40 % CO<sub>2</sub>

- energy efficiency retrofitting of all municipal buildings by 2020
- new buildings in passive house standard
- ongoing conversion to district heating, decentralised cogeneration (CHP) and renewable energy
- ongoing staff training and programmes with schools, kindergartens and administration
- energy efficiency as an important criteria for municipal procurement
- conversion of street lighting and traffic signals to low-energy lamps (up to LED)



## Supply Side: Energy Utility Programme

- expanding own natural gas-fired CHP capacity  
(combined cycle gas and steam power station)
- extending district heating from 800 to 1,000 MWth
- building local CHP plants up to 4 MWel
- expanding renewables: hydroelectric plant, photovoltaic and wind



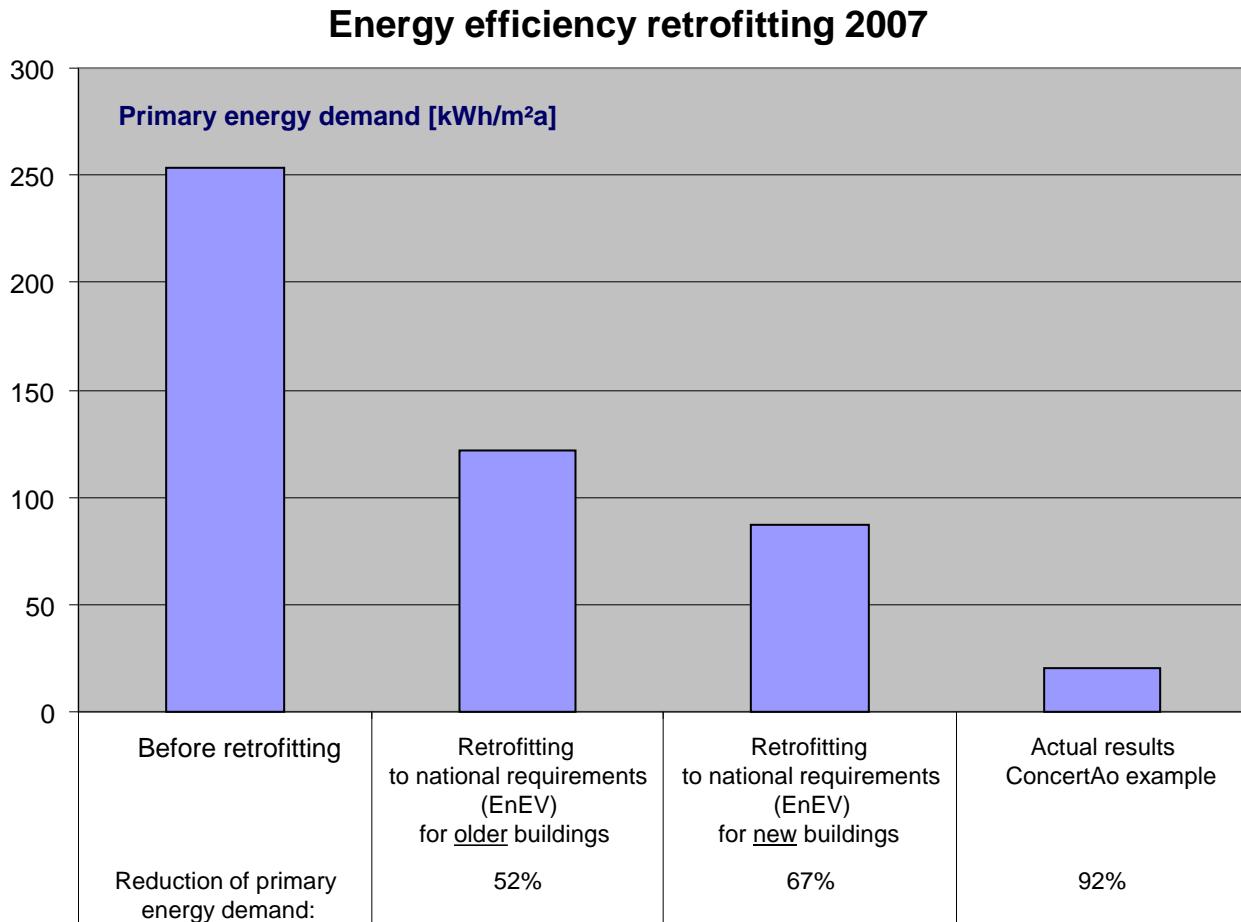
## Renewable Energies: Photovoltaic (PV) and Solar Thermal

- 1,020 PV-plants with 20.556 kW installed power  
(about 200,000 m<sup>2</sup> surface area)
- Duplication of the installed power since end of 2010
- About 1,500 solar thermal plants installed with 15,000 m<sup>2</sup> surface area





## Multiple-family dwellings Primary energy demand



City of Hannover Concerto/act2



## Energy Aspects in Urban Planning

### Kronsberg District

3,000 units built in 1998/1999

low-energy-houses, district heating and renewables

(60-80% less energy demand than normal houses)



### Zero:e park Wettbergen

#### A zero emission estate

320 Passive Houses

(15kWh/sqm for heating)  
with renewable energy



## Demand Side: Campaigns, Advice and Education

### Several advice campaigns for building owners and enterprises

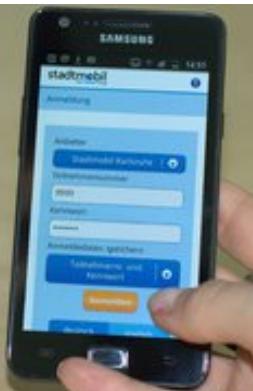
- on energy efficiency retrofitting on buildings
- on saving heat and electricity
- on using high efficient technologies like lightning
- Campaigns for schools, kindergartens and employees
- Education material
- Projects and workshops



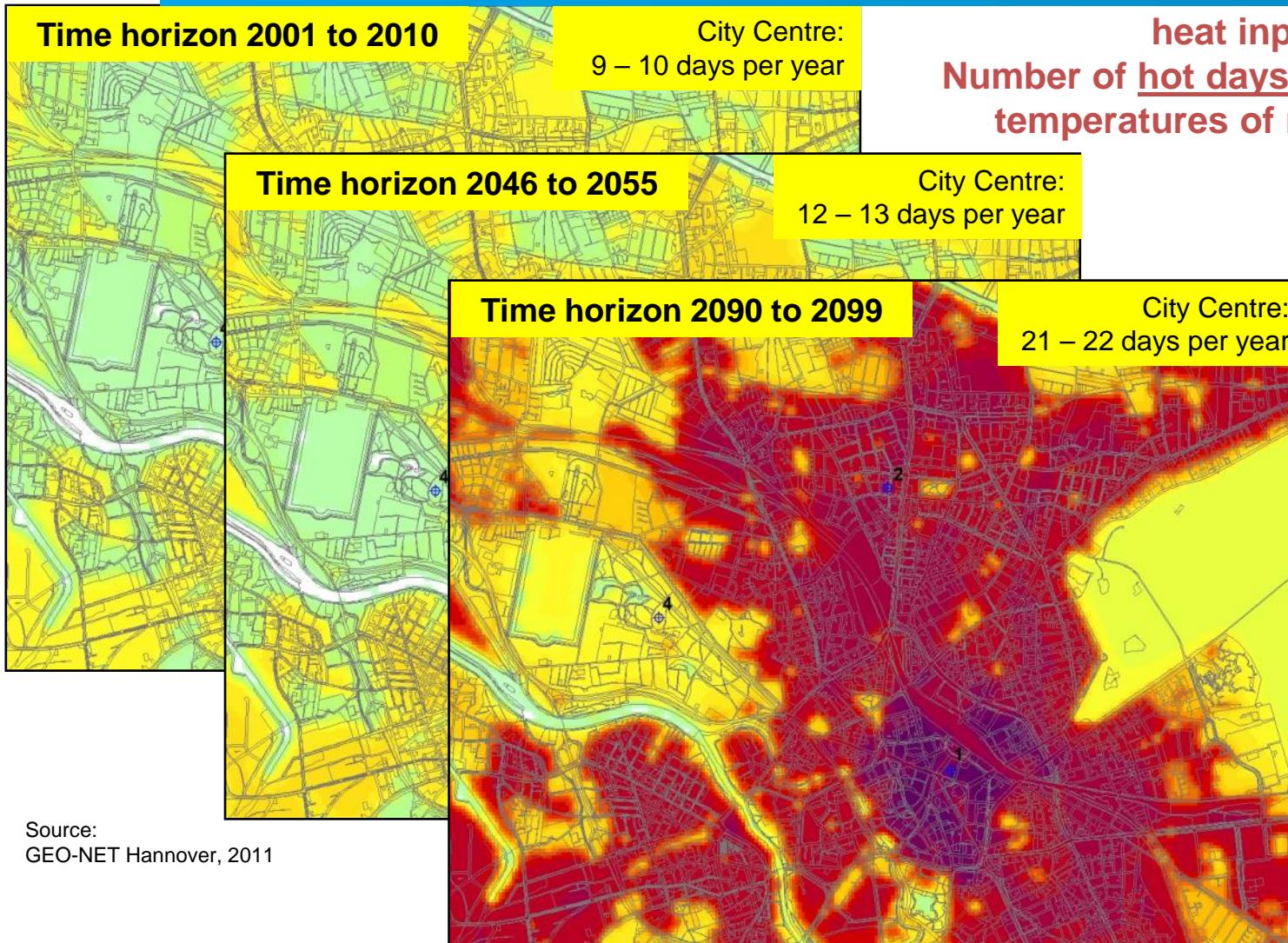
## Sustainable Mobility

Hannover has a successful long-term transport plan with a quite good modal split

- 27% on foot
- 13% by bicycle
- 19% by public transport
- 41% by car : no increase in cars beyond 1995 level



# City of Hannover: Predicted Climate Change



## Background: German Energiewende

(political decision German federal government 28.09.2010)

Year	Reduction greenhouse gas emissions	Power generation with renewable energies
2020	- 40 %	35 %
2030	- 55 %	50 %
2040	- 70 %	65 %
2050	- 80 to - 95 %	80 %



In 2011, Germany's Federal Ministry of the Environment launched its action programme to implement the Energiewende at regional level:

### **Masterplan 100 % for Climate Protection: Targets on climate change by 2050:**

**Greenhouse gas emissions**

**95 % reduction compared with 1990 level**

**Energy consumption**

**50 % reduction compared with 1990 level**

- increasing energy efficiency
- implementing a sustainable life style
- using renewable energy, especially from local sources
- closing material cycles

The strategy paper “Masterplan 100% for Climate Protection” was developed from 2012 to 2013. These goals have already become policy (summer 2014).

Political decision: Hannover City Council and the Regional assembly of Hannover voted with a large majority

## Project structure



## Seven Strategy Groups

**Broadly-designed participation process for creating the masterplan**  
by including 240 experts from the economy, science, NGOs and administration

1. Scenarios (saving and regenerative) potentials
2. Energy supply (including network and accumulator questions)
3. Building energy efficiency  
(focus of concern: existing residential buildings)
4. Mobility and space (land use)
5. Regional economic circulation / waste economy
6. Economy
7. Climate-friendly everyday life (lifestyle change)



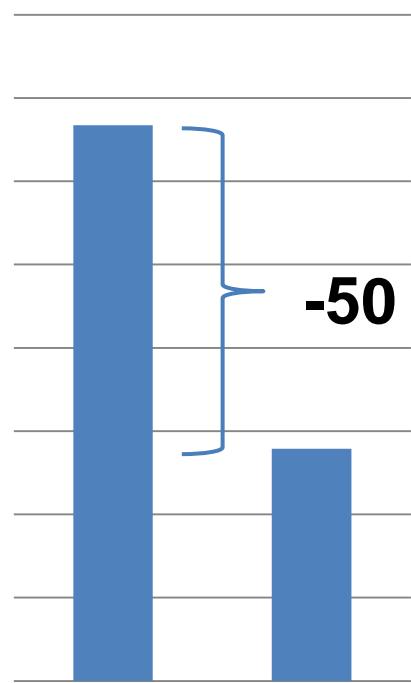
SG Building Energy Efficiency

## Strategy groups - tasks

- Every group met 7 times
- Developed visions for 2050
- Defined measures
- Defined framework conditions on local, national and EU-level
- **Prepared a strategy paper for each group as part of the Masterplan**

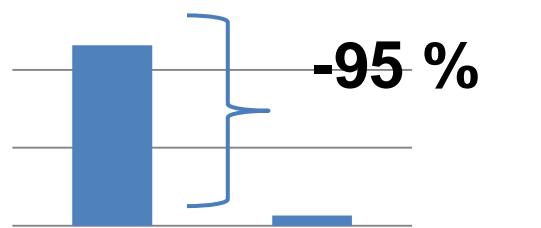


### Efficiency until 2050 [GWh]



### Reduction targets

Greenhouse  
gas emissions  
until 2050 [CO<sub>2</sub>,  
eq]

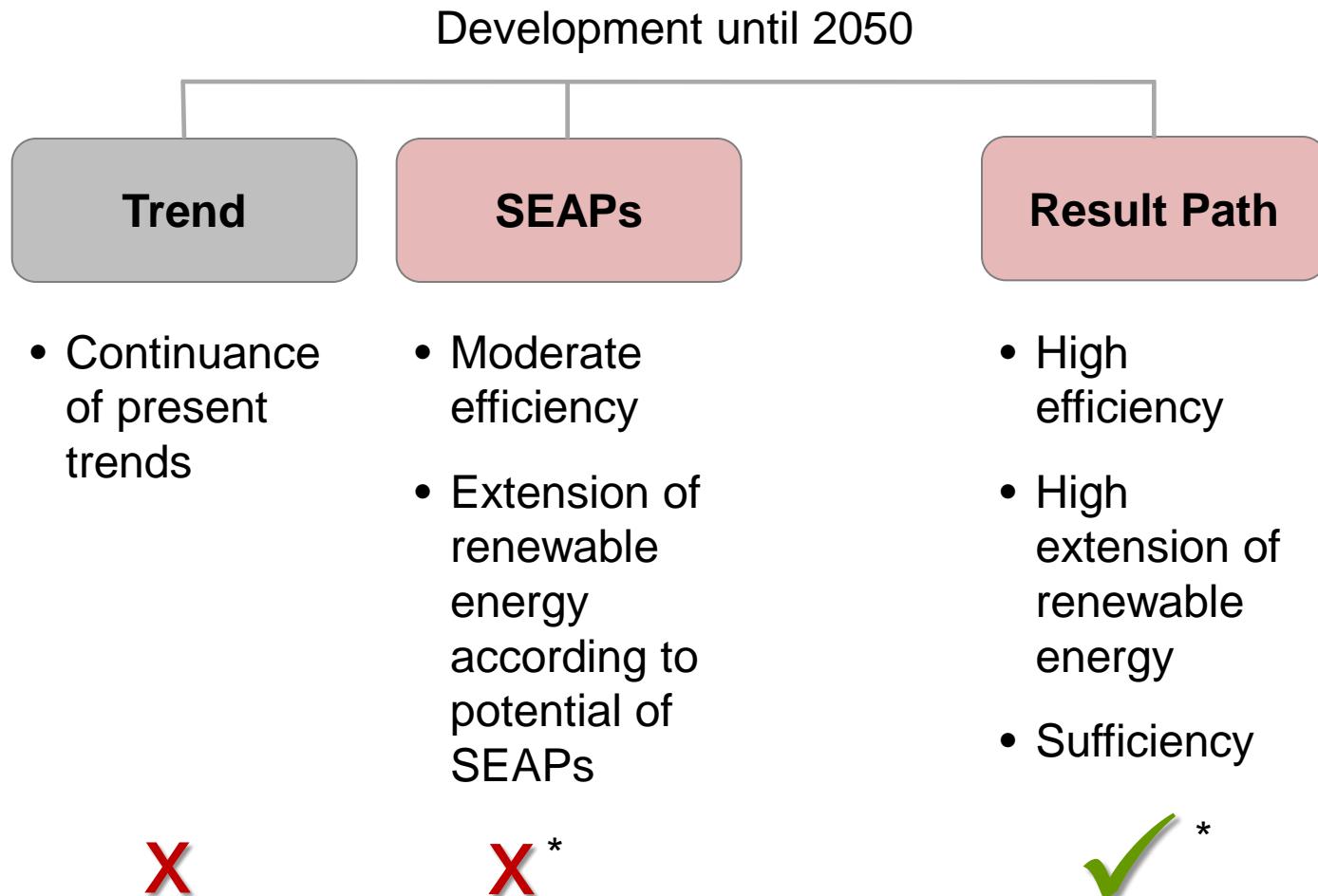


100 % renewables,  
no nuclear power

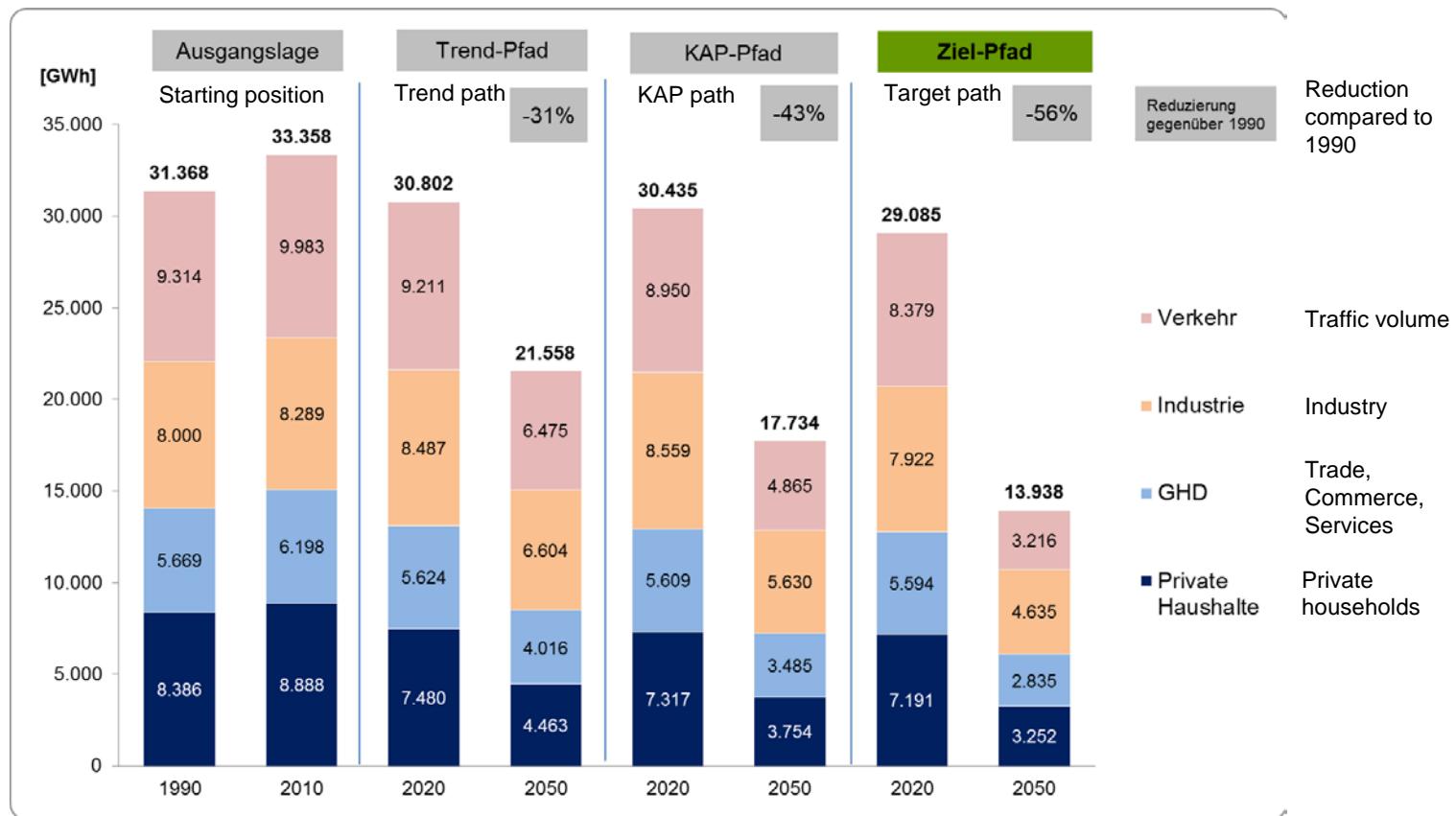


heat, electricity, mobility

## Description of scenario paths



### Scenario results for the Hannover Region: Final energy consumption according to consumption sectors

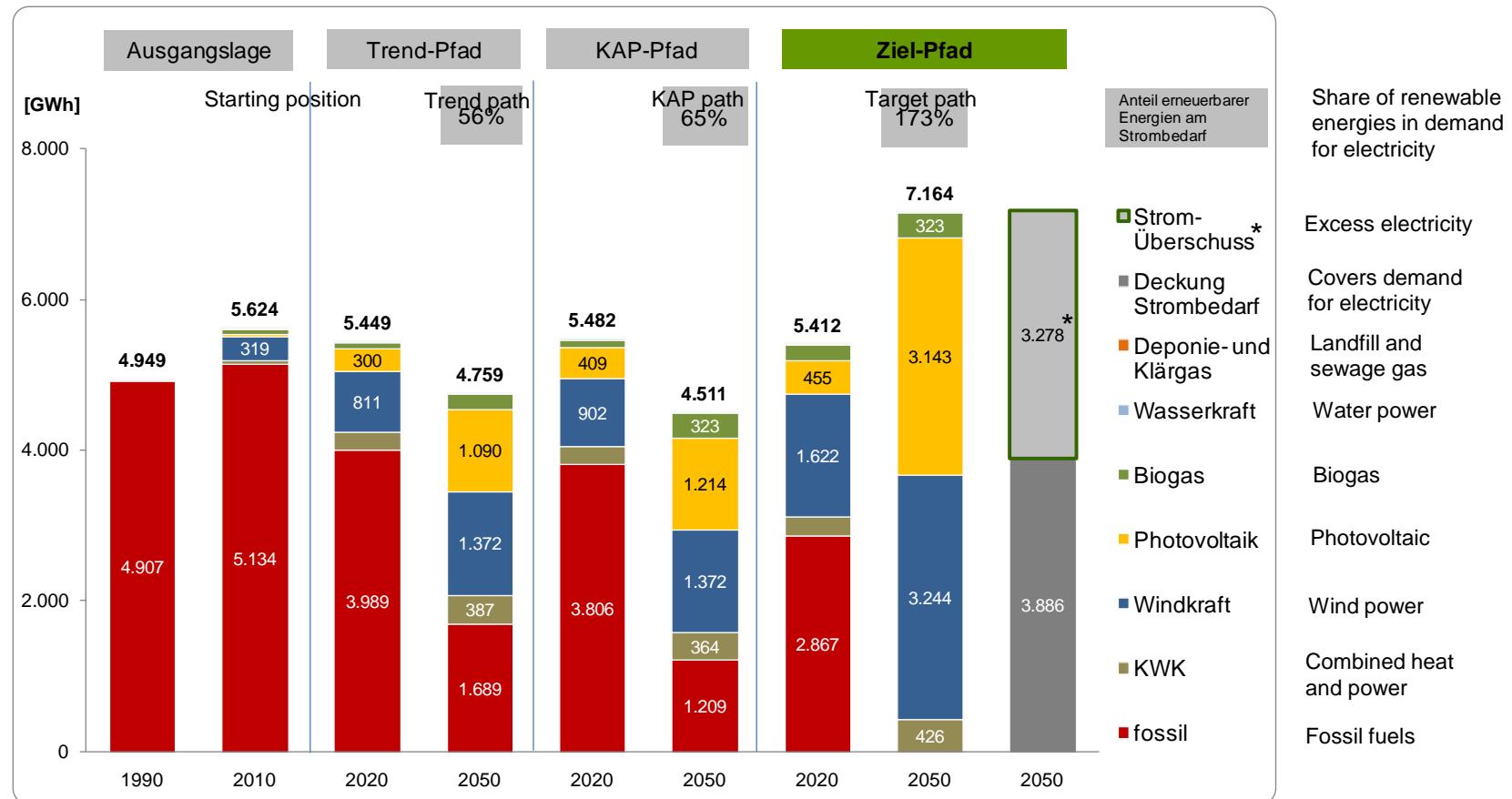


### Scenario results for the Hannover Region: Greenhouse gas emissions according to consumption sectors



This means a reduction of the inhabitant-relevant greenhouse emissions  
from 12.0 t CO<sub>2</sub> eq/EW (in 1990)  
to 0.6 t CO<sub>2</sub> eq/EW (by 2050 in the target path)

### Scenario results for the Hannover Region: Development of power generation according to fuels



\* Electricity surplus can be used for remaining heating requirements

## Core Points of the Strategy Group on Energy Supply

- Zero fossil energy sources and no nuclear power
- Heating and cooling for buildings: only a minimum needed, generated with optimum use of primary-energy sources
- Energy system: strongly fluctuating energy production must be compensated
- Control / Organisation: market design determined by energy system, intelligent management, electricity will become central form of energy
- Extensive storage systems

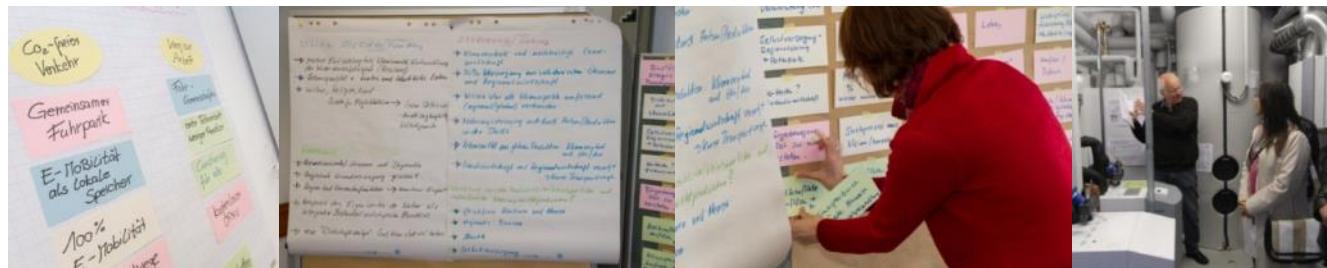


Photos: City of Hannover

## Core Points of the Strategy Group on Economy : Trade and industry consumption sector

Basis: The Hannover Region will also be an industrial site in 2050

- Energy-optimised non-residential buildings / industrial estates
- Deployment of highly efficient “Green IT”
- Optimisation of process heat / process cooling / waste heat utilization
- Climate protection as criterion for acquisition / investments
- Mobility and logistics in the economy
- Energy consultation and energy and environmental management
- Education / motivation



# Climate Neutral Hannover Region 2050

## Initial conclusions from the project

- A regional energy transformation is possible.
- The fundamental technologies are available.
- The basis is a rethinking and transformation process at all levels of society.



## Regional creation of value

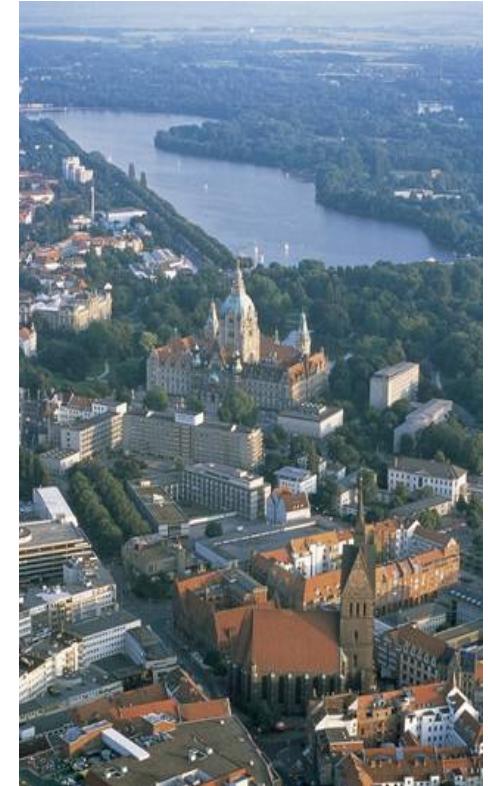
In 2010, in the entire Hannover region, about **2.6 billion euros were spent by the inhabitants, commerce and industry on electricity, heat and fuel**, which corresponds to a value of about € 2,300 per person.

The larger the portion that is generated in the region, the higher also the portion of the budget that is available for investments in the region.

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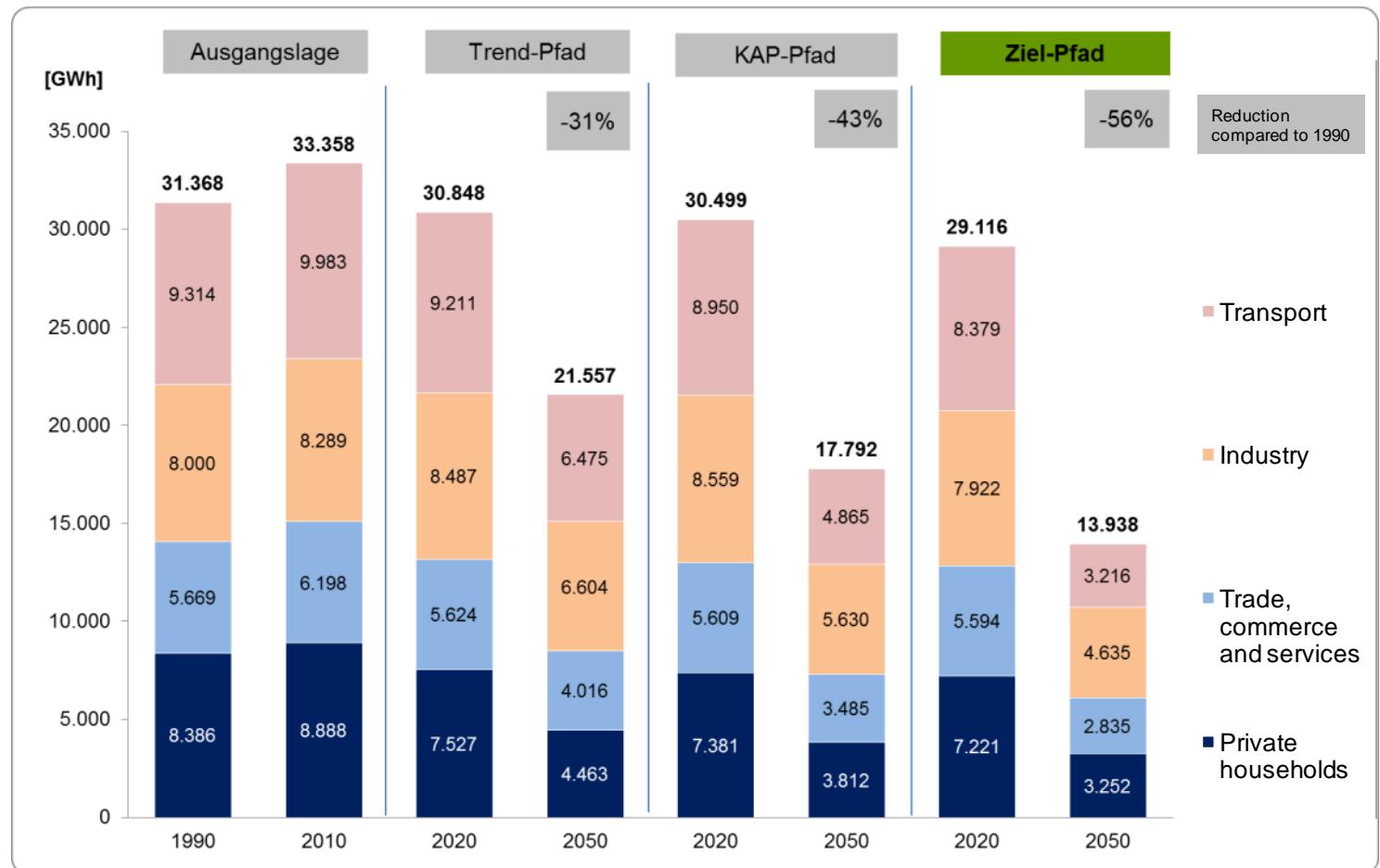
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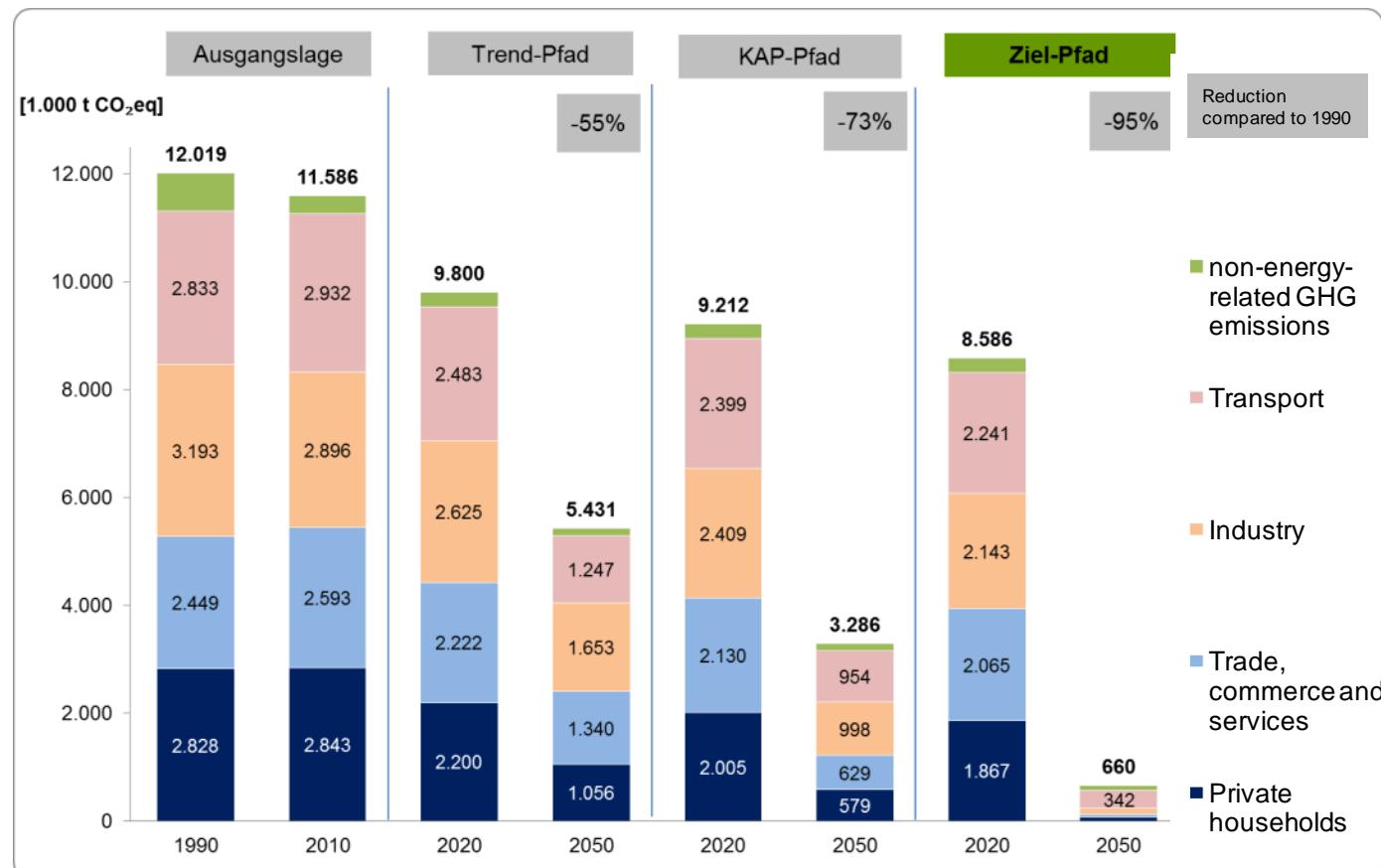


# Zusätzliche Folien für Nachfragen (nur Teil-Übersetzt)

### Szenarienergebnisse für die Region Hannover: Endenergieverbrauch nach Verbrauchssektoren

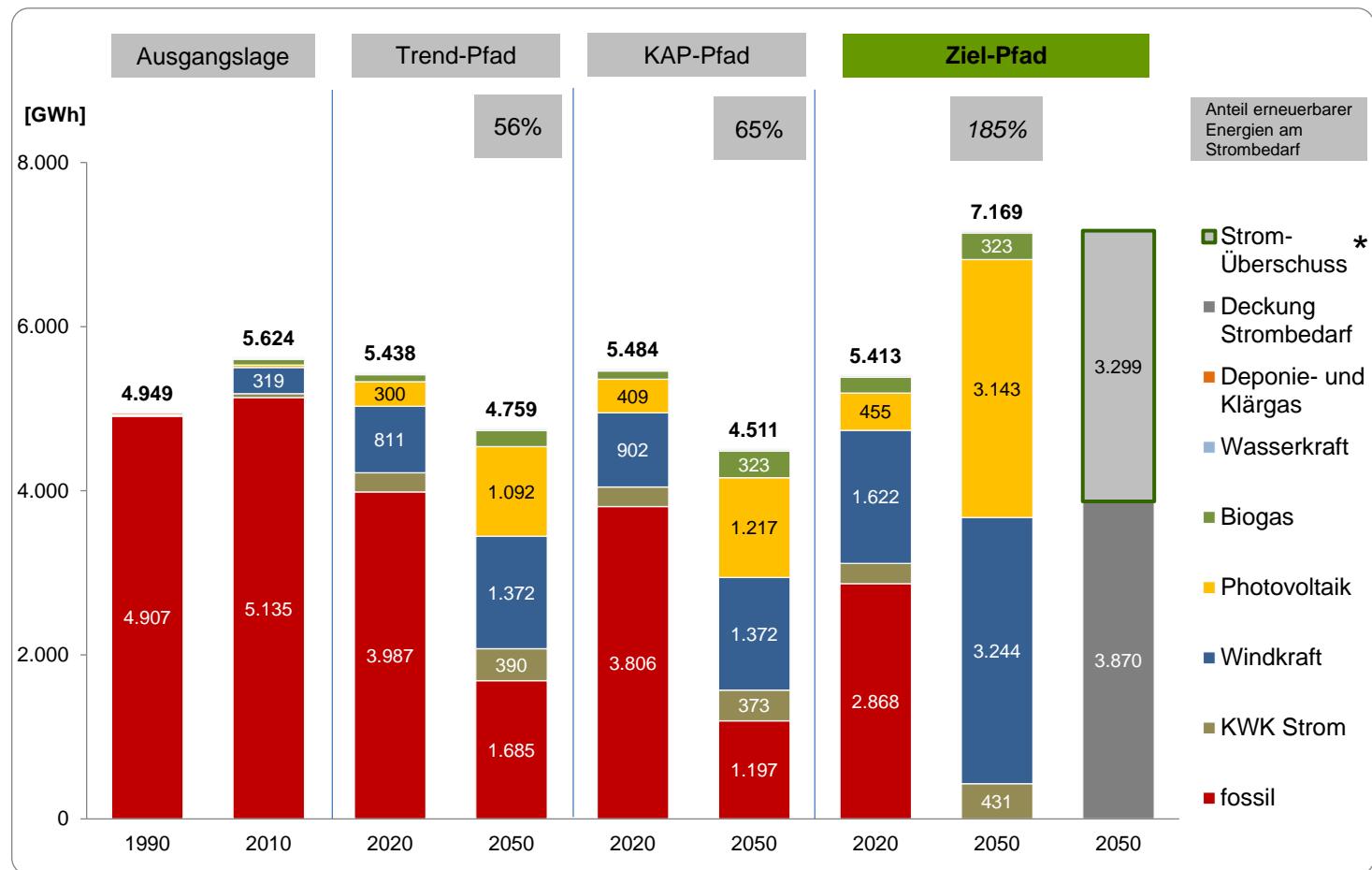


### Szenarienergebnisse für die Region Hannover: Treibhausgasemissionen nach Verbrauchssektoren



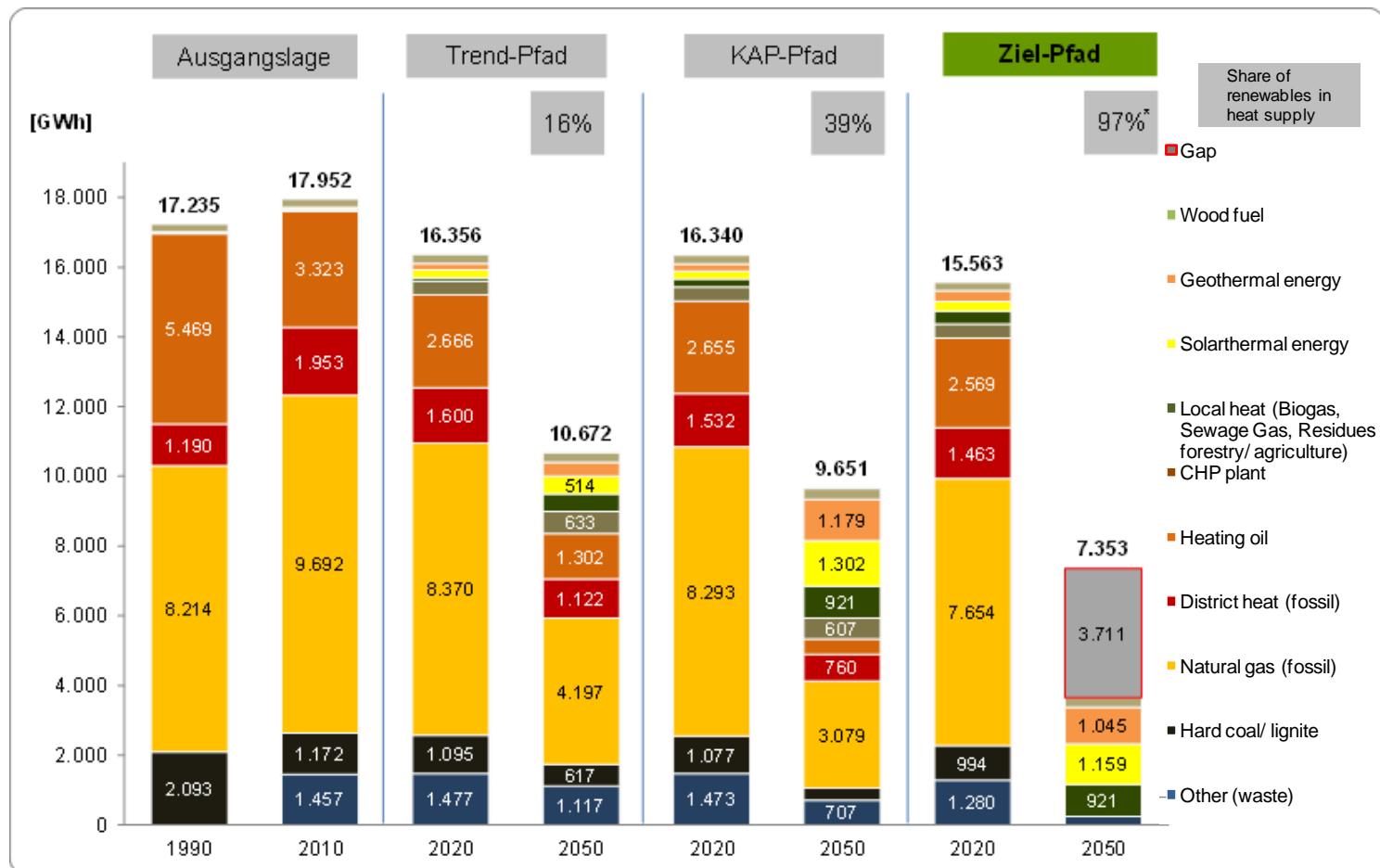
Dies bedeutet eine Reduzierung der Einwohner-bezogenen THG-Emissionen von 12,0 t CO<sub>2</sub>eq/EW (im Jahr 1990) auf 0,6 t CO<sub>2</sub>eq/EW (bis 2050 im Ziel-Pfad)

### Szenarienergebnisse für die Region Hannover: Entwicklung Strombereitstellung nach Energieträgern

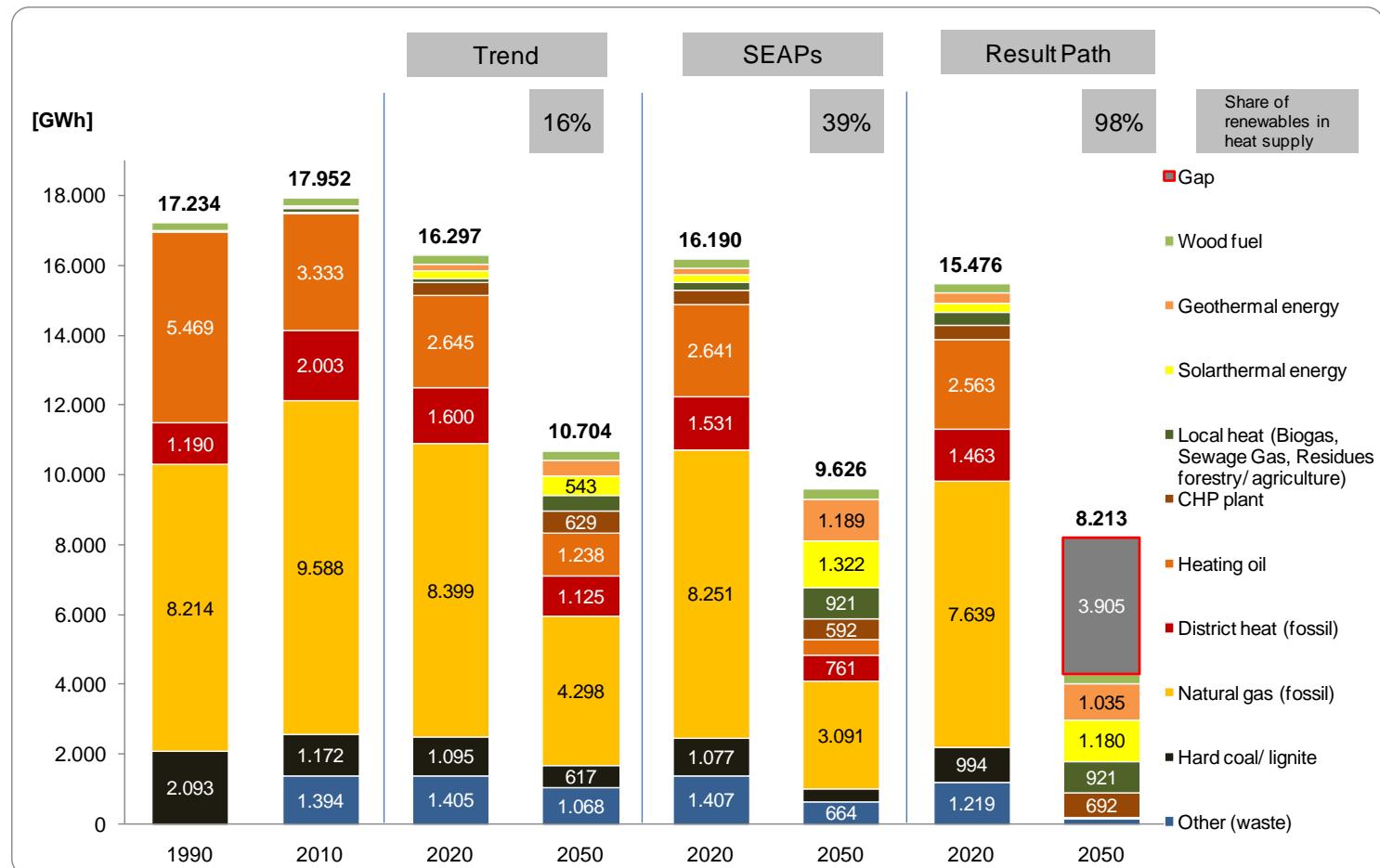


\*nutzbar für den verbleibenden Wärmebedarf

### Szenarienergebnisse für die Region Hannover: Entwicklung Wärmebereitstellung nach Energieträgern



### Energy production Development heat supply



## Energy production

### Extension of wind power, photovoltaics and biogas plants

Power supply until 2050	Trend	SEAPs <sup>1</sup>	Result Path
<b>Extension of Wind power</b>			
Area portion of Hannover Region	0,85 % 1.940 ha	0,85 % 1.940 ha	2,0 % 4.580 ha
Installed capacity	400 MW	485 MW	1.150 MW
<b>Extension of Photovoltaics</b>			
Installed capacity on roofs	1.000 MW	1.140 MW	2.730 MW
Installed capacity on walls	50 MW	50 MW	130 MW
Area for solar parks	23 ha	23 ha	200 ha
Installed capacity solar parks	36 MW	36 MW	310 MW
<b>Extension of Biogas plants</b>			
Use of potential	90 %	100 %	100 %

## Energieerzeugung Ausbau Wind, Photovoltaik und Biogas

Stromerzeugung in GWh	1990	2010	Trend-Pfad 2050	KAP-Pfad <sup>1</sup> 2050	Ziel-Pfad 2050
Windenergie	0,6	319	1.372	1.372	3.244
Photovoltaik	0	31	1.090	1.214	3.143
Biogaserzeugung	0	67	196	323	323

<sup>1</sup> Potenziale aus kommunalen Aktionsprogrammen (KAP)

## Energieerzeugung

### Ausbau Nahwärme, Solarthermie, Wärmepumpen (Umweltwärme)

Wärmeerzeugung in GWh	1990	2010	Trend-Pfad 2050	KAP-Pfad 2050	Ziel-Pfad 2050
erneuerbare Nahwärme (aus Biogas, Klärgas, Restholz, Reststroh)	4	112	462	921 <sup>1</sup>	921
Solarthermie	1	22	513	1.314	1.159
Wärmepumpen	0	34	400	1.221	1.045

<sup>1</sup> Potenziale aus kommunalen Aktionsprogrammen (KAP)

## **Szenarienergebnisse: Energieerzeugung Optionen zur Deckung des verbleibenden Wärmebedarfs (3905 GWh)**

### **Optionen innerhalb der Region Hannover**

- regionaler EE-Strom-Überschuss zur Nutzung für Power to Gas (erneuerbares Erdgas)  
⇒ 42 % des verbleibenden Wärmebedarfs
- Intensivere Nutzung der Abwärme aus Industrie/ GHD
- Abwärme aus Abwasser durch Wärmetauscher im Kanalnetz
- Tiefengeothermie

### **Optionen Regionsgrenzen überschreitend**

- Anrechnung von Offshore-Wind-Potenzialen entsprechend der Einwohnerzahl zur Nutzung für Power to Gas  
⇒ 32 % des verbleibenden Wärmebedarfs
- EE-Strom aus an die Region Hannover angrenzenden ländlichen Regionen zur Nutzung für Power to Gas

## Core Points of the Strategy Group on Lifestyle Change

Society: Need of a broad transformation process in

- Education
- Consumption
- Awareness
- Living
- Diet (Food)
- Transport / getting around

-> Criteria's of sufficiency are counted within the 2050-Scenario

