POTSDAM

100%
CLIMATE PROTECTION
MASTER PLAN FOR POTSDAM
2050

Dear reader,

in your hands you now hold our brochure ‘100% Climate Protection until 2050 – the Potsdam Master Plan’. We appreciate your interest!

The year 2050 seems far away—a distant future that we can hardly imagine. But who would have been able 30 years ago to imagine that we would send pictures around the world with a phone? Or to find a nearby restaurant with its help—including a preview of the menu and the possibility to make a reservation?

The Master Plan 100% Climate Protection wants to give you an overview of the steps and milestones that are necessary to reach the goal of climate neutrality by the year 2050.

Potsdam, as a pioneer in climate protection, has set off along an ambitious path.

In 2016 our city has become one of 41 German Master Plan municipalities in total. This brochure summarizes and explains the report that was produced in the course of the Master Plan process. The Master Plan goals—a 95% reduction in our CO_2 emissions and a 50% reduction in final energy use by 2050 as compare to 1990—were agreed by the city assembly in 2017, together with the core strategies.

We from the city’s coordination office for climate protection seek to enter into conversation with you and other players in order to find shared goals and solutions that we then want to reach by small, but steady steps.

Climate protection is not only the task of political decision makers, of the business sector, the public administration or whatever ‘others’ one might name. It is a task for every individual in our city–because every little effort we make does help the global climate.

In our view, this is a worthwhile goal!

Best regards,
your Climate Protection Coordination Office!

CONTENT

Global Climate Change and Climate Protection in Potsdam

The rise of the global mean temperature of about 1° Celsius during the last 100 years as well as the increase in weather extremes make clear: Climate change—caused by humans, as science demonstrates—has already started. According to the ►[1] IPCC we can expect a further rise in mean temperature of about 4° C by 2050, if emissions continue to rise as in the past. The consequences would be disastrous: a dramatic sea-level rise, the death of the coral reefs due to higher water temperatures and ocean acidification, droughts and water shortages in many regions of the world, food crises, biodiversity loss, more weather extremes, and a substantial increase of environmental refugees. Some of these processes are in progress already. Potsdam also would feel the impacts of climate change, mainly in the form of increased summer heat events and more heavy rainfall.

With the conclusion of the ► *United Nations Framework Convention on Climate Change* (UNFCCC) in 1992 the international community decided to mitigate against ► anthropogenic climate change by reducing greenhouse gas emissions—and by safeguarding against the negative impacts of climate change. In December 2015, the member states of the UNFCCC decided to limit further global warming to a maximum of 2° or even 1.5° C. This 2015 Paris Agreement is the international legal basis for national climate policies of the member states that are called upon to bring in a variety of measures. In Paris, the German Federal Government has submitted its Climate Protection Plan 2050. The government is continuously developing its catalogue of measures in order to reach its goal: to minimize German emissions by 80-95% by 2050 (base year: 1990). A 55% reduction is intended by 2030. As well as the Federal Government and the Laender, many local communities have started to engage in local climate protection. Given the fact that more and more people—both in Germany and worldwide—live in cities, this evolution is absolutely essential. The biggest cities worldwide emit more than many developing countries taken together. They carry a global responsibility. Think global, act local—that is the motto.

The state capital of Potsdam, too, can now look back on a success story in climate protection: the substitution of the coal-fired power plant by a natural gas-fired, combined heat and power plant; the joining of the *Climate Alliance* in 1995; the *Integrated Climate Protection Concept* of 2010; the transformation of the Drewitz district into a climate-friendly garden city; the *Climate Adaptation Concept* of 2015; the construction of a huge hot water storage system allowing for Power-to-Heat by the public utility ► EWP; or the current planning process for the new, climate neutral district Krampnitz. These milestones in Potsdam's climate protection policy have been accompanied and supported by many other processes and events: the establishment of the Potsdam *Climate Council* in 2008, the *Potsdam Climate Dialogue* since 2011, or the *Potsdam Climate Award*, institutionalized in 2012.

As a result of all these measures, Potsdam has been able to reduce its greenhouse gas emissions: from 1.3 million tons in 1995 to 0.8 million tons in 2014 (the most recent data available). But even this remarkable reduction of almost a third does not suffice as a locally determined contribution to the Paris goal. Potsdam has to do more—and yes, it can do more. The Master Plan 100% Climate Protection is pointing the way!

[1] *The symbol ► indicates terms that are explained in more detail in the glossary on page 32.*

Potsdam on its way to a Master Plan Community

Potsdam has succeeded in its goal to become a Master Plan community. It is now part of a growing number of cities in Germany and worldwide that are pioneers in climate protection (more on this in he following Chapter 2).

In order to achieve its ambitious goals, Potsdam has commissioned a concept—the *'Master Plan 100% Climate Protection'*—that formulates concrete measures against the background of Potsdam's potential and specific challenges. For the implementation of this concept it is crucial to ensure the participation of civil society and to sensitize the general public, the local economy, and municipal decision makers. Another supportive measure is the fact that the German Environmental Ministry (BMU) has—in addition to funding the *Master Plan Concept*—also provided funding for the position of a climate protection manager, thus supporting the implementation of the concept.

The *Potsdam Master Plan Concept 100% Climate Protection by 2050* was submitted to the municipality in May 2017 and was adopted by the citycouncil in September of the same year. With that, the implementation phase has begun. With its ambitious goals, the *Master Plan* is building upon the recent achievements in climate protection in Potsdam and at the same time giving them new momentum. The goal is clear: ►climate neutrality by 2050.

Urban Growth and Climate Neutrality

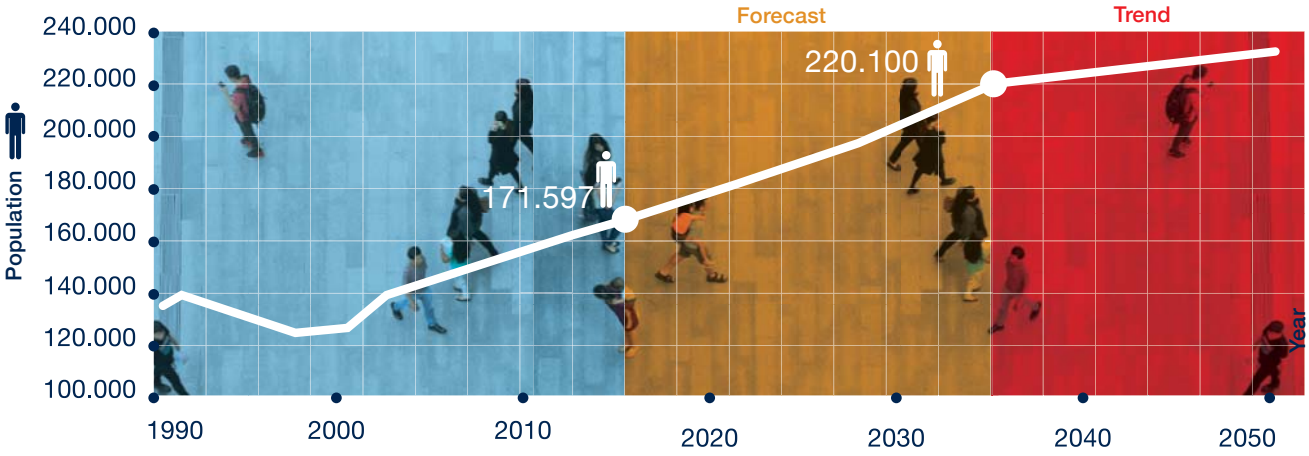


Figure 1: Population development in Potsdam from 1990 to 2050. Sources: Statistics and Election Domain of the City of Potsdam (Date: 01/18) until 2035, later: *Master Plan Climate Protection* scenario.

Potsdam is a growing city. While the *Master Plan Climate Protection* goals are ambitious for any city, they are especially challenging for a growing city. In order to ensure comparability over the 1990-2050 periods, the *Master Plan* concept had for the initial year 1990 to include all the districts that had been administratively incorporated in 2003. From this perspective, the number of inhabitants of Potsdam in 1990 equaled about 140,000. In 2016, 171,597 people lived in Potsdam. The official population projection goes only until 2035 and expects 220,100 people to live in the city (cf. Fig. 1).
More inhabitants mean more economic activity, more traffic, more consumption, more energy use, and thus more emissions. The *Master Plan Climate Protection* goals refer to the city as a whole and in total, not in per capita values. And this means: a growing Potsdam has to do even more than a hypothetical steady-state city. And exactly this defines the challenge for the capital of the state of Brandenburg.

With its Master Plan guidelines the Federal Ministry for the Environment (BMU) is supporting local communities that want to reduce their ► greenhouse gas emissions by 95% and their ► final energy use by 50% by 2050. The first 19 Master Plan communities were selected in 2012. In 2016, an additional 22 communities qualified, including Potsdam. With their ambitious goals these Master Plan communities are forerunners in climate protection and can serve as role models for other cities and counties in Germany.

Potsdam's Targets

The Master Plan consortium had to adapt the general targets to the specific situation in the Brandenburg capital. As the city had been administratively enlarged in 1993 and 2003 by incorporation of rural communities to the north, the initial number of inhabitants had to be corrected upwards in order to ensure comparability with the 2050 situation. As reliable data on energy use and emissions are not available for earlier than for 1995, this year (instead of 1990) was chosen as the base year. Based on this, the master plan Targets for Potsdam until 2050 can be concluded: Reduction of final energy consumption use to a maximum of 1,466.5 ► GWh, and reduction of greenhouse gas emissions to a maximum of 65.5 ►kt (see the two target corridors in Figure 3). In the following section 3 (Potentials and Strategies) these overall goals will be broken down into sector- specific strategies.

Mission Statement and Master Plan – hand in hand together

It is important that climate policy goals are synchronized with other city policies and guidelines. In the case of Potsdam, an official mission statement for the city's policy (*Leitbild*) had been adopted in 2016 after a broad participation process. This key document for informal planning defines six action fields on how Potsdam should develop in the future. The *Leitbild* is explicitly dedicated to the idea of sustainable urban growth, viewing Potsdam as an 'ecological city, actively engaging for sustainability, climate end environmental protection'. Inclusive, innovative, smart, vivid, and productive—these goals defined by the *Leitbild* can in fact be reached, if Potsdam follows the path to become a climate neutral Master Plan community.

Participative Drafting Process of the Master Plan Climate Protection

The *Master Plan Climate Protection* concept was developed by the consortium during a one year project phase (July 2016 to August 2017). In this, the consortium worked closely with Potsdam's coordinating body for climate protection. Early on the consortium focused in concrete policy measures, which have been further discussed in several subsequent versions. Potsdam's Climate Council served as a key discussion partner and steering committee for the project, with regular discussions on interim results of the *Master Plan*. Parallel to these discussions a couple of bilateral talks with decision makers and data holders took place in order to better understand the initial situation of the city, and to improve the strategies and measures originally developed by the consortium.

In two workshops with the extended *Climate Council* it was possible to discuss open questions more thoroughly. The consortium offered information and discussion events on the *Master Plan* to all political factions represented in the city parliament. Finally, the consortium carried out thematic workshops, for example on gender justice as well as on youth and climate policy. At a kick-off event including a panel and audience discussion, the *Master Plan Climate Protection* project was presented to a wider audience in November 2016.

The *City Forum Potsdam* dedicated an own event to the *Master Plan Climate Protection* in March 2017 under the motto "Potsdam – Climate Protection with a Future". As part of the regular Potsdam climate dialogues in the "URANIA Potsdam", the focus has repeatedly been put on the topic of transport, such as in April 2017 with the event "Just get in - Climate-friendly mobility in Potsdam". The *Master Plan* process was also anchored in both local and regional media. An overview of the elaboration process of the *Master Plan* report as well as impressions of the objective for Potsdam is given in Fig. 2).

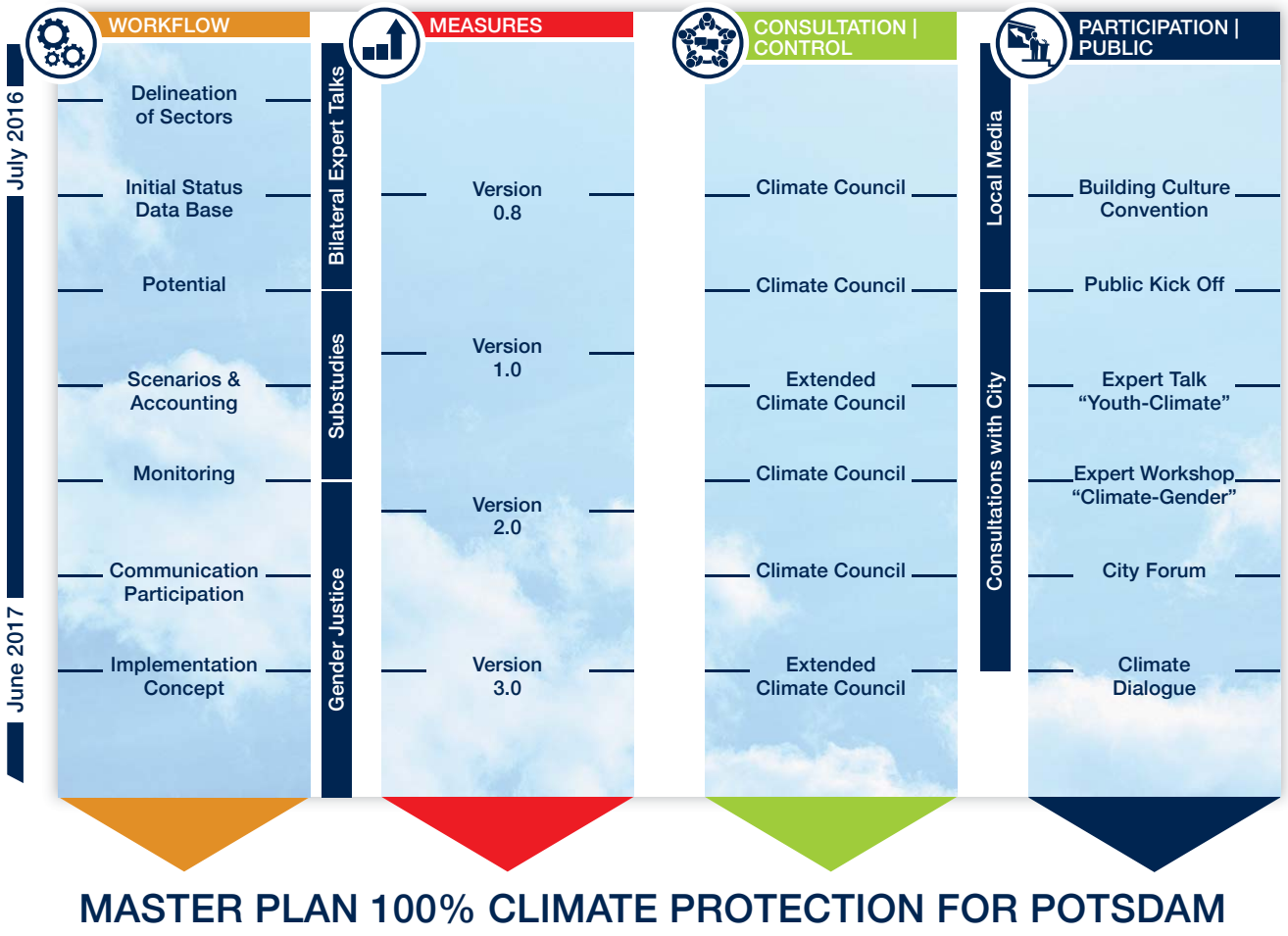


Figure 2: Schematic representation of the procedure for the preparation of the Master Plan report

Action fields and measures

In order to be able to tailor the analyses and strategies of the *Climate Protection Master Plan* for Potsdam, the project team defined eight fields of action that were dealt with separately. In tailoring these fields of action, guiding factors were greenhouse gas emission and energy consumption accounting, as well as assigning players in the city society and consideration of the structure of the city administration. The following fields of action were chosen and are based on the further presentation as shown below:

1 SUSTAINABLE PLANNING

2 ENERGY PROVISION AND INFRASTRUCTURE

3 BUILDINGS

4 ECONOMY

5 PRIVATE HOUSEHOLDS AND CONSUMPTION

6 TRANSPORTATION

7 COMMUNICATION AND PUBLIC RELATIONS

8 CO_2 SINKS AND ADAPTION

As a result, 157 individual measures were developed in eight fields of action. The measures were assessed i.a. according to their contribution to energy and CO_2 reduction, and with regard to their costs. With this package of measures, the state capital would be able to reduce its CO_2 emissions to 110.5 kt by 2050. This is a reduction of approx. 92% compared to 1995 (see Figure 3).

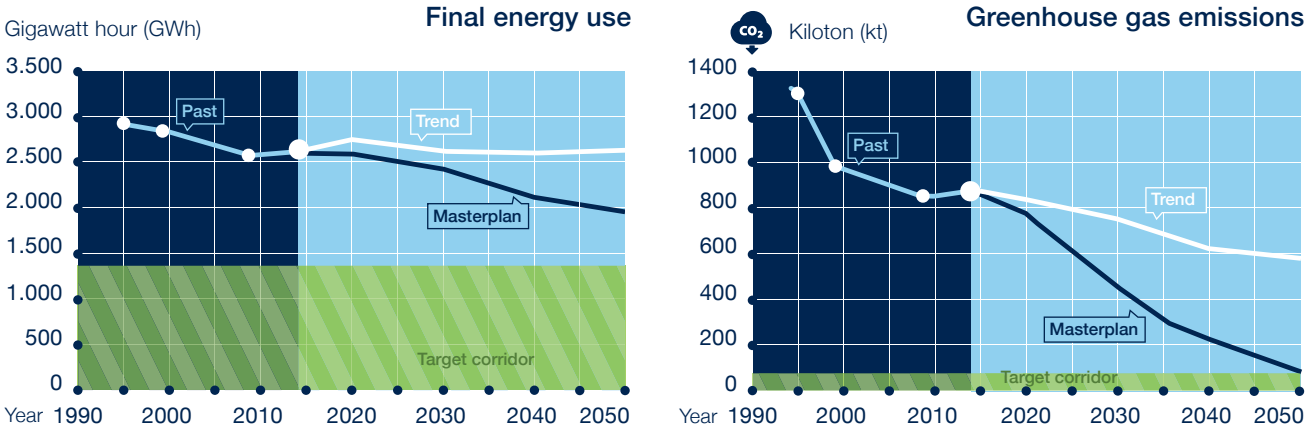


Figure 3: Past and forecast: Final energy use (left) and greenhouse gas emissions (right) in Potsdam from 1995 to 2050

Thus, the *Master Plan* target for greenhouse gas emissions (figure 3, right) has almost been reached. In contrast, the goal to reduce the ► final energy use (figure 3, left) will not be reached in full: Instead of the originally envisaged 50% it will be only possible to reach an approximately 35% reduction by 2050. The reason for this is the massive city growth that corresponds with an increasing final energy demand, which cannot be completely absorbed by energy efficiency measures. So, the ► de-carbonization of Potsdam must be pursued even more intensively.

» The urban green spaces play a big role in climate protection and adaptation to climate change «

Initial Status

The city of Potsdam occupies an area of 190 km². Residential areas accounts for 23% of this area, traffic areas for 8%, green spaces (including forests and agriculture) for 58%, and water bodies for 11%. This exceptionally high share of green space is a main reason for the high quality of living, resulting in top rankings of Potsdam in Germany-wide city comparisons. A more detailed look, however, reveals that different quarters in Potsdam display a rather heterogeneous mix of these land-use forms (cf. Fig. 4). Potsdam's growth not only leads to more inhabitants, it also means that the demand for residential and traffic areas is increasing—often at the expense of green space. The share of sealed areas, not allowing for rainwater infiltration, has grown from 9.2% in 1992 to 11.3% in 2010. This can lead to problems, especially under climate change, where increased heavy rainfall can lead to a higher vulnerability to urban flooding. Another challenge is posed by the heterogeneous building structure, disqualifying a homogeneous strategy for the city as a whole.

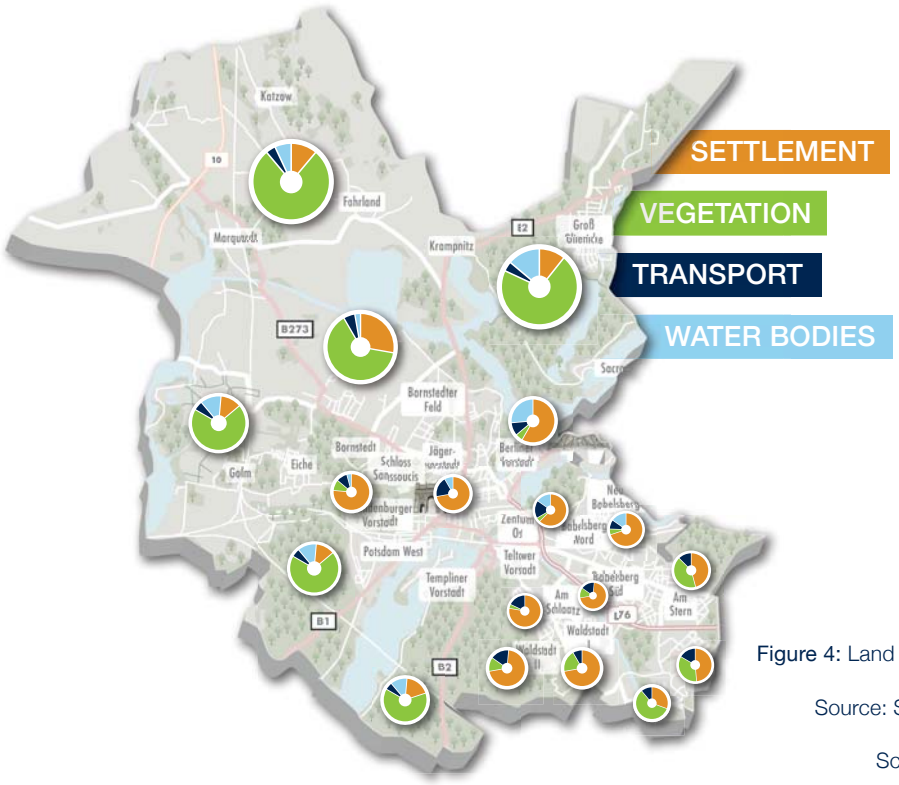


Figure 4: Land Use in Potsdam's Planning Regions (state: 2015).
Source: Statistical Report and Environmental Monitoring of the city of Potsdam; Scientific processing: *Luftbild,Umwelt, Planung* (LUP), Potsdam.

Leverage Points for Climate Protection

Potsdam's zoning plan (*Flächennutzungsplan*) is a preparatory building plan with mandatory character. Already now it includes a number of important and promising starting points for climate protection and adaptation with respect to land use. The instruments of the special urban planning law—redevelopment areas, social city—have played a big role in Potsdam's urban development. In the future, their use for supporting the Master Plan goals should be intensified. Our city has good experience in combining different aspects of a climate-friendly urban planning, e.g. in the case of the Drewitz garden city or the new Krampnitz low-carbon quarter. Constructive ideas for the building stock—including those for historical monuments—complement the climate policy toolbox required for the *Master Plan*.

Climate protection can also be strengthened by Potsdam continuing to follow the guiding principle of a "city of short distances" (**mixed urban development**). This approach comprises two components: on the one hand, compact, and on the other hand, mixed neighborhoods have to be created, which combine different urban functions such as living, working or supply in a small-scale manner.

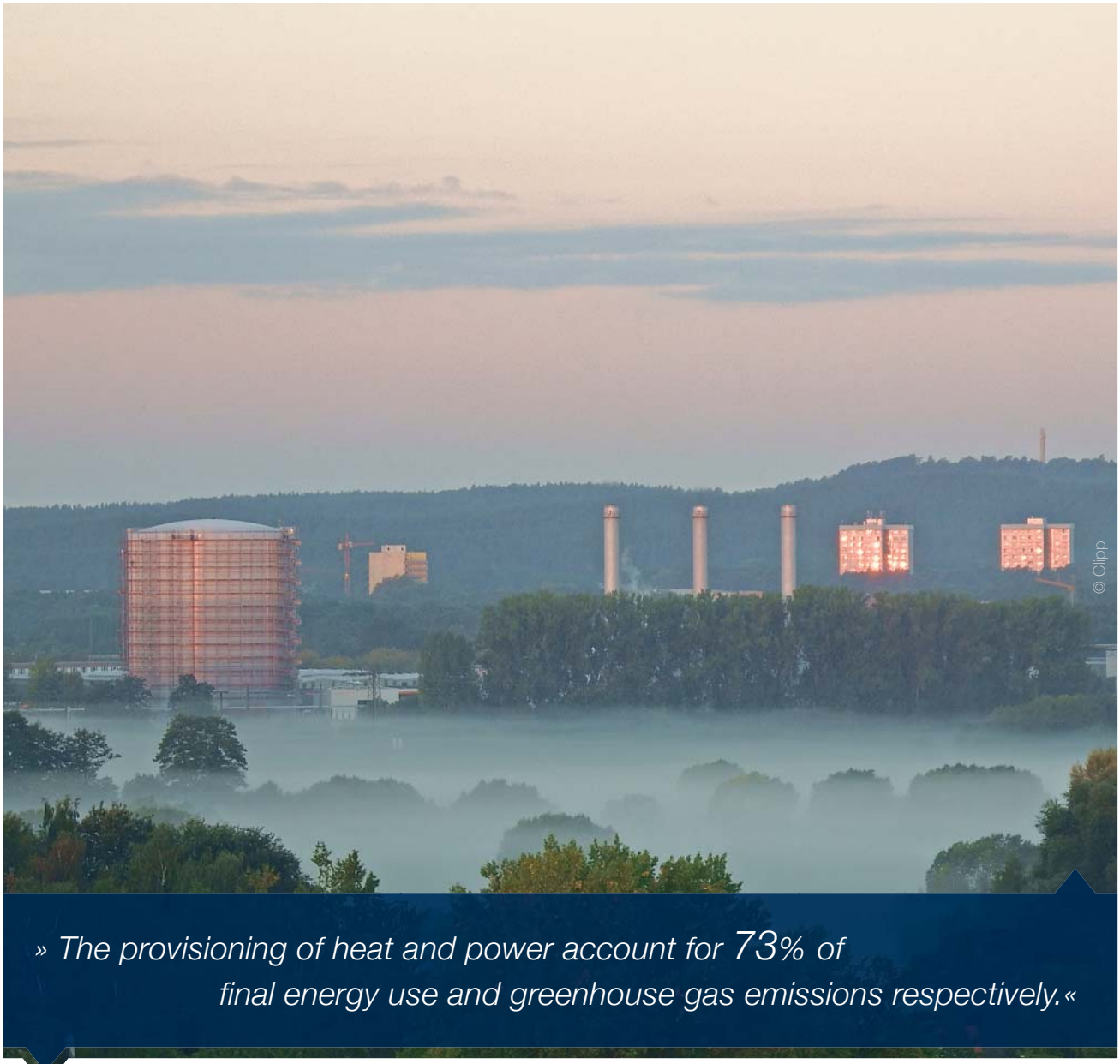
Through prioritizing the development of urban indoor spaces vis-a-vis outdoor spaces, all the negative effects summarized by the term "urban sprawl" could be limited or even prevented. In this way, the city of short distances is characterized by a higher urban density, which is needed, for example, for low-cost local and district heating networks, affordable public transport or the convenience of non-motorized transport. In addition, mixed urban development fosters districts' capacities for a smart future in which the energy, transport and housing sectors will increasingly interlink technologically and digitally (sector coupling/ integrated energy).

With amendments to the Building Code in recent years, federal legislators have laid the foundations for taking climate protection and adaptation into greater account in preparatory and binding land-use planning. The state capital has to use these opportunities more consistently. In particular, it is now possible to establish a "serious deficit in the field of urban planning" that focuses on the energy quality and overall energy efficiency of the existing development and utilities in the area.

A municipality can respond to this deficit by zoning formally designated redevelopment area or an urban development area. This is an approach with win-win potential: The municipality thus also integrates the private owners of these areas, for example with regard to renovation or energy efficiency measures, which in turn can to some extent offset any additional costs for tax liability.

This so-called special city planning law is coupled with special funding instruments. Particularly noteworthy here are the nationwide programs "Social City", "Urban Heritage Listing" or funding programs of the *Kreditanstalt für Wiederaufbau* (KfW). The *Climate Protection Master Plan* can progress in the urban planning area if these funding instruments are combined with the new climate policy options of the special urban planning law and accompanying investment measures. In view of the heterogeneous urban development situation in Potsdam, it makes sense to define area-specific goals for the various quarters.

This makes it possible to combine a strict target in the sense of the *Climate Protection Master Plan* with flexible implementation on the small-scale level. The monitoring proposed in the *Master Plan* (see Chapter 4) is an important control tool for this.
Finally, the state capital Potsdam would have the possibility to conclude target agreements according to the *Master Plan 100% Climate Protection*, with city-owned companies (for example *ProPotsdam, Stadtwerke, Ernst von Bergmann Hospital*). Furthermore, the large landowner *Prussian Palaces and Gardens Foundation Berlin-Brandenburg* should be integrated into the *Master Plan* with its own climate protection efforts.



» The provisioning of heat and power account for 73% of final energy use and greenhouse gas emissions respectively.«

Initial Status

The high importance of the heat and power sector to the Master Plan can be deduced from the fact that it accounts for 73% of the final energy use and the greenhouse gas emissions respectively. This fact also identifies the most relevant players: the public utility *Energy and Water Potsdam* (EWP), and the *Potsdam Grid Corporation* (NGP), operating the power and gas network of EWP, both subsidiary companies of the public utility holding (SWP). A big asset of the city is the district heating network, which covers about 40% of urban heat demand through its extensive system. Since the closing-down of the coal fired power plant in 1995, natural gas is the main energy source. In 2015, the main power plant in the south of Potsdam has been complemented by a large heat storage unit. Two electrode boilers have been built, with which surplus electricity from renewable sources can be used and fed into the heat storage and the district heating network (Power-to-Heat).

With this system, Potsdam has embarked on the use of renewable heat - an important starting point for the *Climate Protection Master Plan*. Natural gas currently plays the main role not only in district heating, but also in smaller, decentralized district heating grids and in the individual supply of buildings. Coal and oil-based heating systems generated 79,300 MWh (or 6.6%) of the heating supply in 2014, but are continuing to decline. In contrast, regenerative heat sources are on the rise, in particular environmental heat (e.g. ground source heat pumps) at 29,800 MWh, solid biomass (pellets / wood chips) at 5,500 MWh and solar thermal systems at 1,000 MWh (2014). The combined heat and power (CHP) plant in the south of Potsdam run by the EWP, produces approx. 400,000 MWh covering three quarters of the city's electricity needs. This central power production is supplemented by 41 decentralized gasfired combined heat and power plants (as of 2014). Renewable electricity is used, for example, in CHP plants based on biogas (2014: 2,900 MWh) and by PV systems (2014: 5,000 MWh). At the end of 2014, there were 323 such EEG-subsidized facilities in the city of Potsdam; in 2009 there were only 53. This dynamic must be further strengthened for the *Climate Protection Master Plan*.

Use potential, recognize opportunities and challenges

The urban energy system of the future faces several challenges that the *Masterplan Climate Protection* must respond to. They arise not only from the imperatives of climate protection, but also from the general technical and economic development:

- The **massive cost reduction in the PV sector** in recent years is likely to continue and makes the increased use of this technology even more economically attractive. Prerequisite for this, however, are appropriate legal framework conditions. The nationwide expansion of renewable energy increases the availability of surplus electricity.

- An increased share of electricity from renewable energy sources and especially the increased use of electrical energy (e.g. in the area of mobility) makes it necessary to **expand the grid as well as storage and conversion systems** (Power-to-Heat, Power-to-Gas).

- The goal of long-term **energy security** together with corresponding cost developments suggest an **expansion of local/regional renewable energies**, which is also associated with regional growth impulses. The increase in urban renewables production also relieves the burden on rural areas and reduces conflicts that may arise there.

- The ongoing **progress in digitisation** is posing new challenges and opportunities to the energy sector, such as the timely linking of generation and consumption.

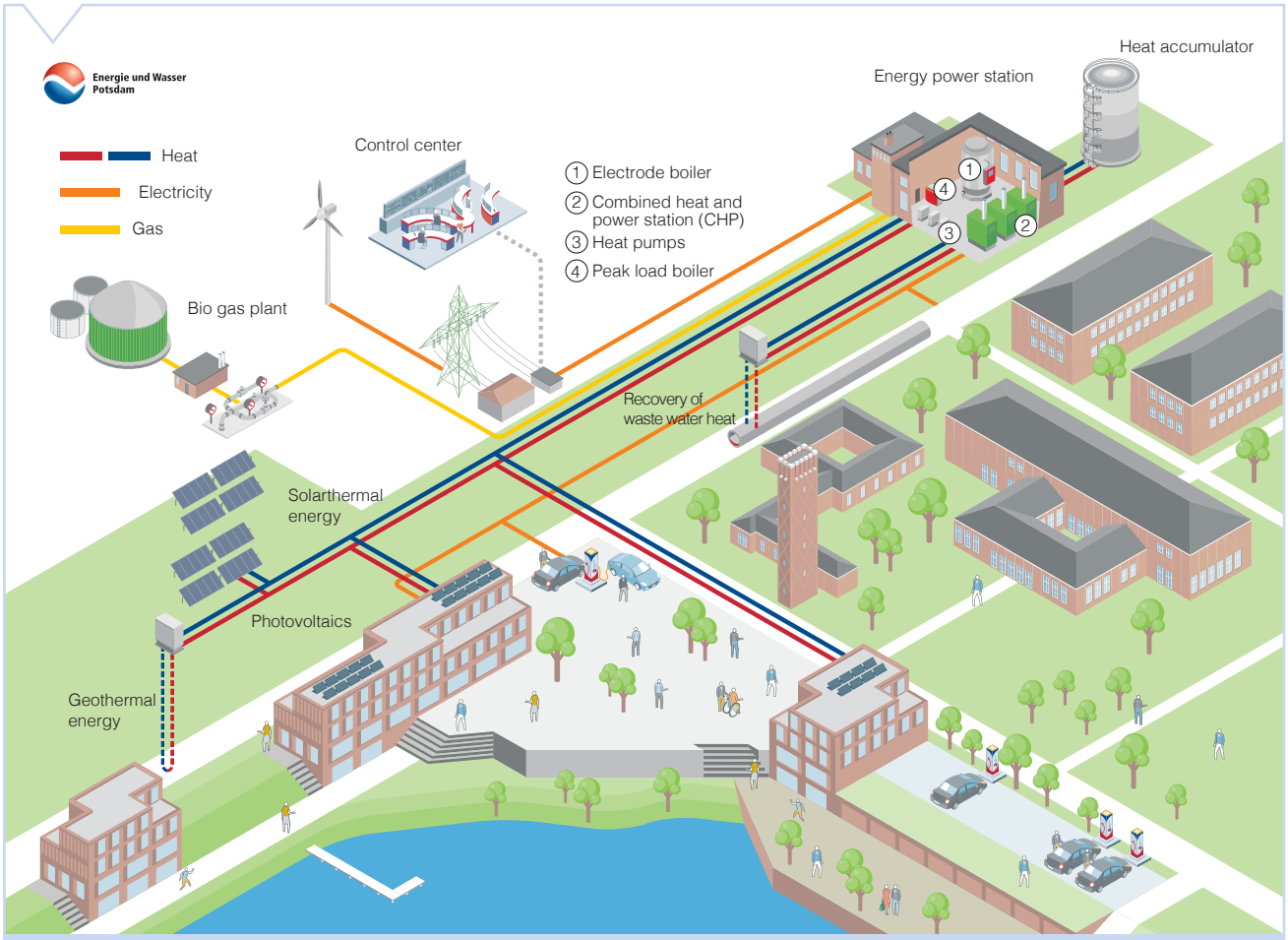
Potsdam has already shown in the past that it can respond to such challenges: e.g. with the fossil-fuel phase-out in 1995 or the construction of the heat storage 2015. With the objectives of the *Master Plan Climate Protection*, efficient municipal utilities and cooperative partners in business and society, the challenges can be mastered.

Leverage Points for Climate Protection

While wind turbines will play a minor role in the city of Potsdam in the future, **photovoltaics (PV)** will become more important in the future. If one excludes all listed buildings and uses only 60% of the remaining roof areas, there is a usable potential of 124,500 MWh of renewable electricity per year. In addition, there are some 400,000 MWh of PV ground-mounted systems - even if only 10% of the theoretically available space were used.

Within the framework of the Master Plan concept further options for a future climate-friendly heat supply were investigated: **near-surface geothermal energy** (ground source heat pumps) can provide 295,000 MWh, the use of the **Havel river water heat** would yield another 550,000 MWh - theoretically this could cover the total demand for district heating (as of 2014). This enormous potential can be tapped if seasonal storage is built to 'shift' the summer heat of river water into the winter time. Increased use of the **biomass** produced in the urban area (for example from the *Foundation of Prussian Castles and Gardens* (SPSG), from bio-waste bins or from residual waste) would add another approx. 10,000 MWh.

Overall, electricity demand and the volatile feed-in of electricity will increase significantly. Accordingly, the **Potsdam power grid must be expanded and upgraded**. To balance energy demand and supply, the opportunities offered by **digitization** should be exploited.



Climate neutral energy supply of Potsdam's newly developed district Krampnitz (schematic representation) by the municipal utility company (Energie und Wasser Potsdam - EWP), Source: EWP 2018

» Approx. 50,000 buildings of Potsdam hold big potential for saving energy and climate protection. «

Initial Status

Currently there are approx. 50,000 buildings, most of them residential buildings, in Potsdam. 44% of all buildings were built before 1949, 29% in GDR times and 27% in the period from the German reunification (1989) to the present day (see Fig. 5). Depending on the city quarter, the composition is different.

The ownership structure is also quite hetero-geneous: the urban construction holding *ProPotsdam* and the private, non-profit housing cooperatives each own about 9% of the gross floor space of the Potsdam building stock, the state capital Potsdam itself 6%, private owners (mostly private homeowners) 28%, and other owners (such as federal, state or commercial owners) 48% of the space (see Fig. 6).

The heat consumption of the buildings differs, and depends, e.g., on the year of construction as well as on the renovation status. Thus, different urban quarters are characterized by different heat consumption rates: In the *Berlin Suburb* of Potsdam or in *Babelsberg Nord* heat consumption rates up to 164 kWh/m^2 are achieved; whereas these rates in the districts *Stern*, *Drewitz* or *Schlaatz* are about 70 kWh/m^2. Therefore, a differentiated analysis by buildings and urban quarters would be promising. In the *Master Plan Climate Protection Report*, as a first step a citywide analysis was carried out.

Historic buildings and monument protection plays an important role in Potsdam: 15% of all buildings are listed monuments, another 13% of Potsdams buildings are situated in protected monument areas. Additionally, there are buildings which are part of the UNESCO *World Cultural Heritage* as well as some particularly attractive buildings, for which there are less stringent requirements than in case of the preservation order.

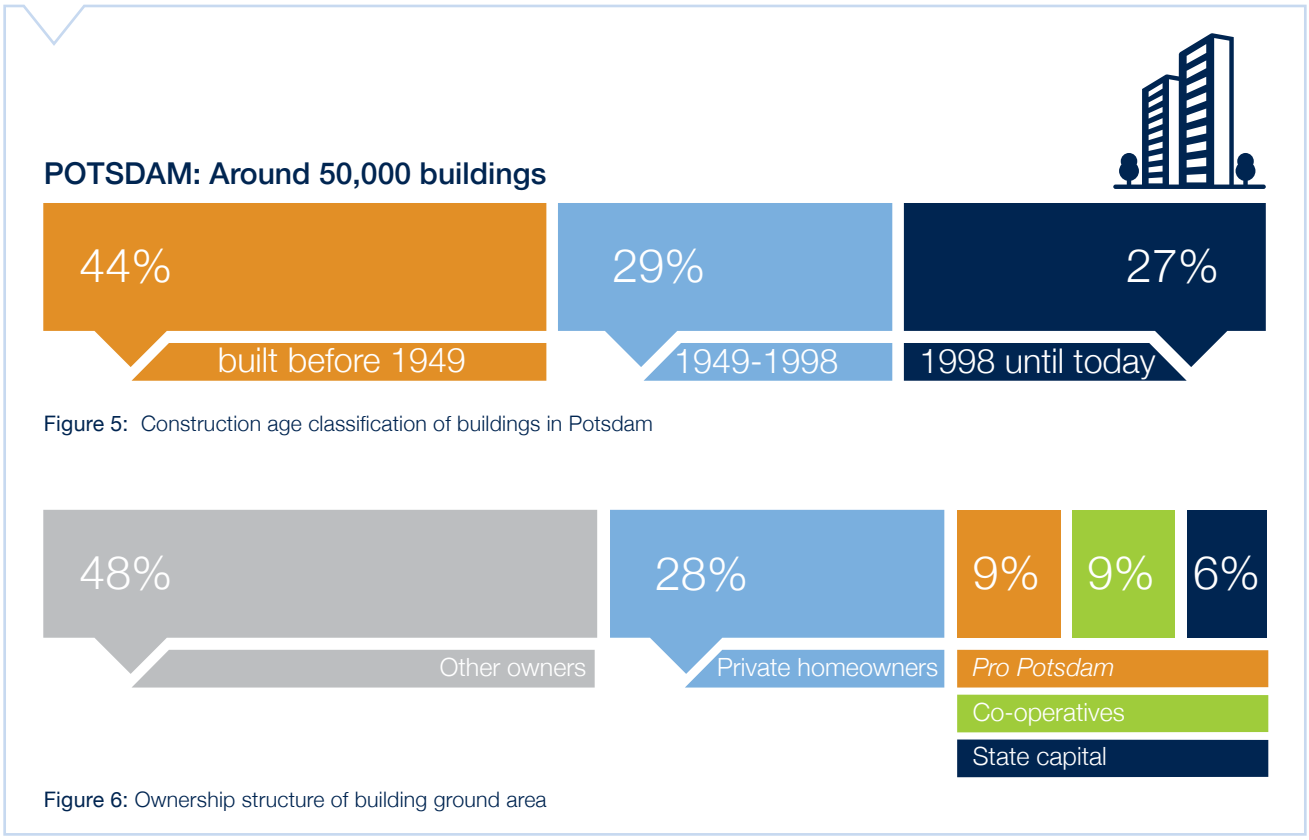


Figure 5: Construction age classification of buildings in Potsdam

Figure 6: Ownership structure of building ground area

Leverage Points for Climate Protection

A general and at the same time very important lever is the **energy refurbishment rate**, which is currently around 0.8% per year for the East German building inventory. In terms of climate policy, a significant increase is required so that the heat requirement of the existing buildings can be reduced. The *Master Plan Climate Change* concept assumes a gradual increase in the refurbishment rate to 1% in 2020, 1.6% in 2030 and 2.5% from 2040 onwards.
With regard to the depth of refurbishment, i.e. the degree of efficiency of all measures (e.g. of windows, roof, façade), a distinction must be made between listed (less renovation depths) and buildings without listed building regulations (higher renovation depths). According to the *Master Plan Climate Change* expert's report, a total of nearly 30% of heat in Potsdam's building stock can be saved between 2014 and 2050. Additionally, the report contains suggestions on how to mitigate the frequently occurring conflict of goals between energetic renovation and affordable housing.

The *Master Plan Climate Protection* report assumes that more than 10,000 buildings in the state capital will be newly constructed by 2050. The **energy standard of these new buildings** also determines how much energy Potsdam's buildings consume overall until 2050.

In view of the large proportion of private owners in Potsdam's existing building stock, it will be important to involve them in the process of implementing the *Master Plan Climate Protection* goals - for example through increased information and consultation services, coupled with references to public funding opportunities. In addition, the state capital itself must be active where it can exert direct influence (municipal buildings) or indirectly (public housing sector, *ProPotsdam*). In case of refurbishment and new construction of municipal buildings, they should serve as role models.

As a shareholder, the state capital would also have the opportunity to enter into **CO_2 target agreements** with the urban housing company *ProPotsdam*; it could also help the company to use its financial resources even more for the goals of the 100% *Climate Protection Master Plan.* The city could also actively work to ensure that the Potsdam housing industry can receive more **public funding** from higher level governments (the federal level, the federal state of *Brandenburg*). This funding could help foster a **socially acceptable refurbishment** primarily from the city's own resources easier (keyword: rent or housing costs). In this area **improvements of federal legislation** (for example with regard to tax deductibility) are also required.

Advancing digitisation (such as smart metering) should be used for **climate-friendly home solutions**, and building monitoring should be improved. At district level, the potential of **decentralized and connected heat and power supply** ("sector coupling") must be better utilized – this is also helped by the **energy utilization plan** (*Energienutzungsplan*) that has already been proposed. Potsdam's new development areas could already be planned today in the direction of **CO_2 neutrality or even "plus energy" standards**. For new public buildings the passive house standard is suitable.

Measures to reduce the heat demand of the tenants by **influencing behavior** as well as by advising and supporting tenants must be intensified (for example in case of tenancy changeover).

Planning for the climate-neutral district *Krampnitz*: Visualization of the entrance area (*Müller Reimann Architects*)

» Consistent focus on sustainability and climate protection offers many opportunities for Potsdam as an attractive business location. «

Initial Status

Potsdam's economy with around 100,000 wage-earners achieves an annual gross value added (GVA) of just over € 6 billion (2016). Most of the approx. 13,000 companies in Potsdam belong to the predominant economic sector commerce, trade and services.

These are primarily small and mediumsized enterprises in the fields of health care and welfare, commerce, tourism, software and IT, science and the media industry.

The Potsdam economy also includes more than 1,800 craft enterprises and—with a downward trend—about 30 farms. About 11% of employees work in the public administration.

The economy sector accounts for around one quarter of final energy consumption (26%) and for as much as one third of greenhouse gas emissions.

Leverage Points for Climate Protection

The **share of energy costs** differs between economic sectors. It ranges from less than 5% (e.g. in the retail, butchery and bakery sectors) to 4-8% in the hotel and restaurant services, up to 10% e.g. in cleaning or industry up to 20% in senior citizens' homes.
Many companies often know neither their exact energy consumption and associated costs nor the potential savings options. These can be significant (Figure 7).

The first step should therefore be to boost exploitation of existing **economically viable potential**. For example, companies could be better activated through **round tables** and **energy efficiency networks** (*peer-to-peer learning*).
At the same time, the already important players such as business promotion, chambers of commerce and associations should play an even more important role. The state capital could conclude **climate protection agreements** on a voluntary basis with larger companies. As workplace use also plays a role, workers should be informed and motivated in cooperation with trade unions (for example, through information campaigns on **"climate protection in the workplace"**).

Potsdam's economic development promotion and industrial property policy could be based on the goal of a **climate-friendly sector structure**. Potsdam is an attractive business location in the metropolitan region of Berlin. Therefore, the objectives of the *Climate Protection Master Plan* can certainly play a role in resettlement policy: Interesting for Potsdam are particularly sustainable companies which fulfil high standards, for example in the fields of energy consumption and efficiency. A **climate-friendly model business park** would be groundbreaking and could provide further impulses.

Positive regional economic effects are to be expected from the implementation of the *Climate Protection Master Plan*. Falling energy demands and a decline in energy imports mean that more money remains in the region and is available for other purposes. The necessary investments (refurbishment of buildings, expansion of renewable energies, etc.) can benefit the domestic economy and have positive effects on productivity, competitiveness, employment, income and public finances.
The envisaged transformation with the key aspects energy saving, energy efficiency and the switch to renewable energy has to be accompanied by specific educational and training measures. It will only succeed if the local business and vocational institutions consistently offer **modern, future-oriented training and qualification measures**. The *Center for Advancement of Trade* (Zentrum für Gewerbeförderung) of the *Skilled Craft Organization* Potsdam in Götz offers positive examples.

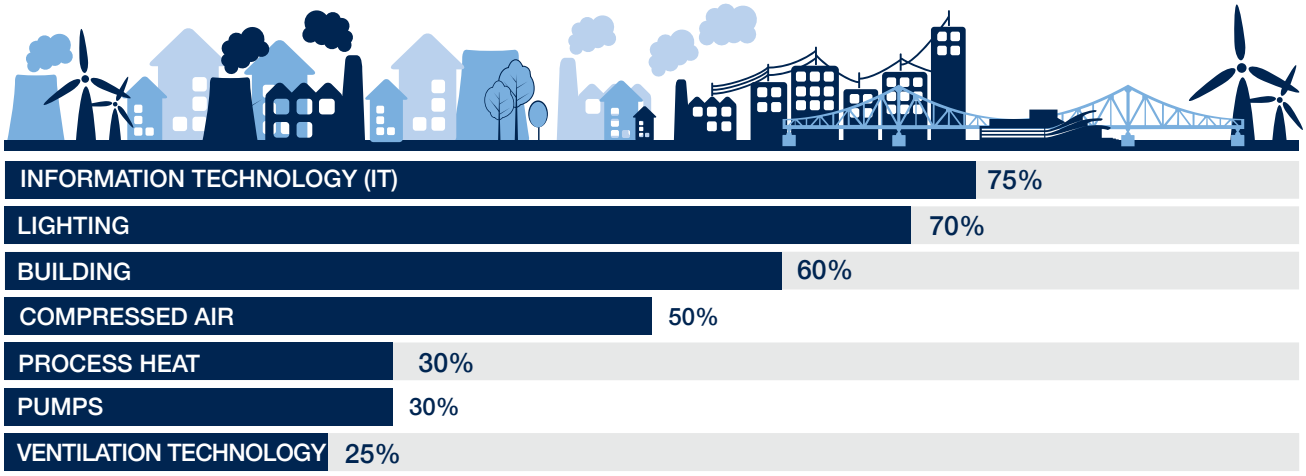


Figure 7: Energy-saving potential with a focus on small and medium-sized enterprises
Source: *German Energy Agency (Deutsche Energie-Agentur* - dena)

The administration of the state capital Potsdam is itself an important economic player, for example in **procurement** or **building refurbishment**. In these fields, the *Master Plan Climate Protection* goals should be given consistent importance and a comprehensive **"climate-friendly administration" strategy** should form the roadmap. This strategy should include the city-owned companies, which could make a difference.

Finally, **sector-specific measures** seem necessary in some cases. For example, a regular **Roundtable with the banking and financial sector** should explore options for action in the area of **climate-friendly financial products** and **funding opportunities**. Also, **sector-specific *Master Plan* strategies** are to be launched that are tailored to important sectors in Potsdam or overarching topics (like science, tourism, commercial food waste, media, biotechnology).
Successful realization of the ambitious energy and climate policy goals has also **institutional implications**. On the administrative side, the climate and business departments should consistently work hand in hand, because in the long run, consistent climate protection is the best economic policy!

» The higher the household income, the more energy it uses and the bigger its CO_2 footprint «

Initial Status

In this field of action, primarily the **power consumption** of Potsdam households is considered (the topic heat consumption is dealt with in Chapter 3.3.). In this context, the **consumption of products and services** is very important, as it allows us, as consumers, to indirectly decide how energy consumption and CO_2 emissions evolve. This is also the reason why **education** is considered an important key factor.

In Potsdam there are approx. 95,000 private households (2016), the majority of which are single-person households (see Figure 8), which together account for 40% of the city's electricity consumption. The smaller the household size, the higher the per capita consumption of energy. From nationwide studies we also know that the higher the income of a household, the greater its energy consumption and the overall carbon footprint. Although the household appliances of higher-income households are usually also more efficient than the poorer ones, the equipment rate is higher. In addition, so-called rebound effects can be observed: while households are buying more efficient appliances, they may at the same time buy more equipment and / or use appliances more frequently, thereby eliminating the energy saving effect.

Leverage Points for Climate Protection

Important factors that determine private power consumption are equipment rate, energy efficiency and user behavior. Many home appliances are more than ten years old, consume significantly more power than new appliances, and thus incur higher costs. In low-income households, this can contribute to disproportionately high energy costs, which can lead to energy poverty. In general, it is important to use even greater **incentives**, **information** and **advice** to move Potsdam citizens to **save energy** and promote **climate-friendly usage behavior.** Here **voluntary agreements** with the **retailing sector** are a feasible instrument, but also the **extension of consulting services** can be helpful. An **energy bill** that is much more **informative** than before can be a useful tool for raising awareness. As it grows, Potsdam should also actively focus on the **opportunities of digitization**, for example through intelligent control technology in the home ('smart home') in conjunction with intelligent tariffs.

Part of a sustainable consumption culture is to strengthen the idea of ► **sufficiency**, e.g. by **extending sharing opportunities** (such as car-sharing, the sharing of home appliances and tools, or food-sharing), incentives and good examples. The improved possibility of exchanging apartments that are too large for smaller ones also belongs here.

In the area of nutrition in particular the factors **seasonality, regionality** and the production of certified **organic food** represent climate policy starting points. A rather simple and at the same time very effective means for the reduction of greenhouse gases is the minimization of **meat consumption**.

Finally, strategies for **waste reduction** are required across all consumption sectors. This primarily concerns packaging waste, in particular if made of plastic, but also the careful handling of food. There is still too much food waste to be found in the residual waste bins. Many of these food leftovers could still be "rescued", and really not usable leftovers should be disposed of in the bio bin. Due to their role-model function and multiplier effects, cafeterias, canteens, bulk consumers (administration, educational institutions, hospitals, restaurants, etc.) should also be specifically targeted on their waste-avoidance policies.

Climate change and climate protection must already be an issue at school. The many good examples of climate protection ideas from schools honored at the annual awarding of *Potsdam Climate Prize* show that children and young people are providing the city with very valuable suggestions. The *Potsdam Climate Council* was to be expanded to include young people. Climate protection and adaptation contribute to the future viability of Potsdam. This is one of the main messages of the *Master Plan Climate Protection*. In order to bundle the various activities and to make them visible, the report proposes the establishment of climate neutrality as an umbrella brand for Potsdam.

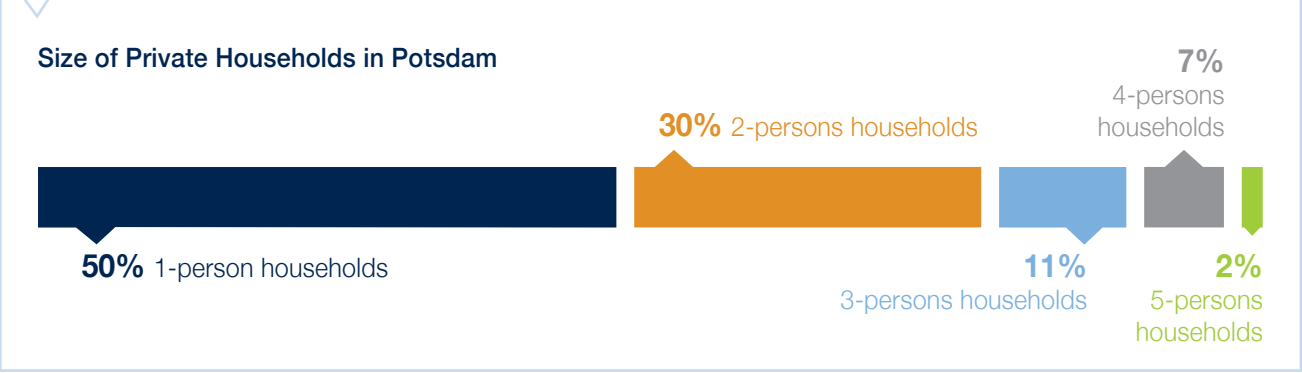


Figure 8: Composition of the private households in Potsdam (as of 2016).

» The traffic sector accounts for 28% of Potsdam's final energy use and 27% of the city's greenhouse gas emissions. «

Initial Status

Potsdam's recent growth is also reflected in the urban traffic. For years, the total traffic performance, i.e. the sum of the kilometers traveled by all modes of transport, has been increasing and reached in 2014 the sum of about 1.2 billion kilometers. Anyone who drives through the city by car can experience this live during the regular traffic jams in the main road network at rush hour times. But also buses and trains time and again reach their capacity limits.

Completely independent of climate protection, it is clear that a growing Potsdam needs new mobility solutions. This also applies with regard to the environmental and health effects of the motorized individual traffic, such as noise, ground-level ozone or particulate matter. The transport sector accounts for 28% of total final energy consumption in Potsdam and 27% of greenhouse gas emissions, mainly driven by the use of diesel (almost half of traffic energy consumption in Potsdam) and gasoline (35%).

Figure 9 shows that 90% of traffic-related CO_2 emissions in Potsdam come from road traffic, mainly from cars, trucks and light commercial vehicles. Rail transport contributes 10% to the traffic emissions.

Above all, the *Climate Protection Master Plan* must therefore significantly reduce emissions from motorized road traffic - a big challenge in the face of future city growth. It turns out that the pedestrian and bicycle traffic is the preferred mode of travel for the shorter distances, car and public transport for the longer routes. However, it is interesting to note that as much as 44.6% of all journeys made in Potsdam by car are less than 3 km long. This could be an intervention point.

Figure 9: CO_2 emissions of the traffic sector according to traffic modes.
By authors (Data from: Deutsches Zentrum für Luft und Raumfahrt-DLR; Frauenhofer Institut für Windenergie und Energiesystemtechnik-IWES; Institut für Energie- und Umweltforschung Heidelberg-ifeu)

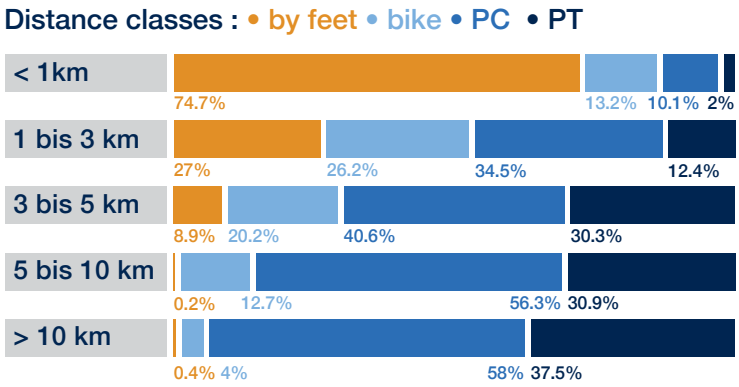


Figure 10: Transport share according to distance classes (PC= Private car, PT = Public transport).
Source: By authors (Data from: System repräsentatver Verkehrsbefragungen-SRV 2013)

Leverage Points for Climate Protection

A **climate-oriented transport policy** must pursue the target priorities of '**avoiding - re-locating – improving**'. The most climate-friendly motorized transport is that which does not even arise - for example, by implementing the concept of a '**city of short distances**' (see Chapter 3.1 Planning). The fact that Potsdam is growing, which will lead to completely new quarters, offers great opportunities here. Already in the course of the refurbishment of the Drewitz quarter the **downsizing of the urban space devoted to individual motorized traffic** and the parallel **development of public spaces** under **strengthening of public transport** played an important role. The new district of Krampnitz is to accommodate up to 10,000 people, and by means of functional mix and a newly-built tram connection to the city center, will significantly reduce the need for private car use. **Car-sharing** opportunities as part of apartment rental agreements could be another building block in reducing traffic demand.

The avoidance of empty runs in the context of intelligent logistics concepts or the promotion of climate-friendly alternatives in the local distribution of goods (for example electric mini-trucks, cargo bikes) can reduce the volume of traffic in the commercial sector. If past trends in the mix of transport modes persist, then the greenhouse gas emissions, but also the pollutant and noise emissions of traffic will continue to increase - and there will be even more traffic jams. City-wide, an expansion of environmentally friendly transport means (public transport, pedestrian and bicycle traffic) is therefore urgently needed in order to achieve the *Master Plan's* climate protection goals.

The *Master Plan* allows for an increase in the total transport performance in Potsdam, but only by 26% in the *Master Plan* instead of by 32% in the trend scenario. Central to the *Master Plan* is the expansion of the environmentally friendly traffic modes and a limitation of the individual motorized traffic - especially with respect to the short distances within the city.

A **dynamic city toll** (reduction of traffic peaks), the **increase in costs of public parking spaces** for internal combustion engines and an **expansion of the parking space for bicycles** as well as **car and bike sharing offers** are important building blocks.

A mobility agency should specifically address commuters and new citizens, and offer advice on individual mobility choices. At the same time, the **attractiveness of public transport** must be significantly **increased**, for example through providing more stops in the **network** and **more frequent services**. That requires an increase in capacity that needs to be funded. The current **financing system** – comprising user charges for passengers plus subsidies from other budget areas - is under scrutiny. **Use-independent systems**, for example in the form of a city-wide levy together with the inclusion of business and tourism, could improve the financial basis of public transport in the medium term. A **citizen ticket** with a simplified booking and payment system would make public transport more attractive. **Cycling** must be further strengthened, for example by building **fast bike paths** between the city and the surrounding area. More **park-and-ride car parks** in Potsdam's urban area and surrounding communities facilitate multimodality. **Call buses** in the rural north of Potsdam complete the 'relocate' package.

Finally, the remaining individual motorized traffic must be made more efficient and emissionfree. In freight transport and in public transport (buses), **fuel cell technology** and **Power-to-Gas** are increasingly being used, and in private passenger transport **battery-electric vehicles**. The **conversion** of the **urban vehicle fleet to electric drive** must be a role model here. *Energy and Water Potsdam* (EWP) could become the urban **competence center for sector coupling of e-mobility and regenerative electricity**. Finally, the Brandenburg state capital could check the potential of information and communication technology (ICT) and autonomous driving early on, e.g. in new housing estates.

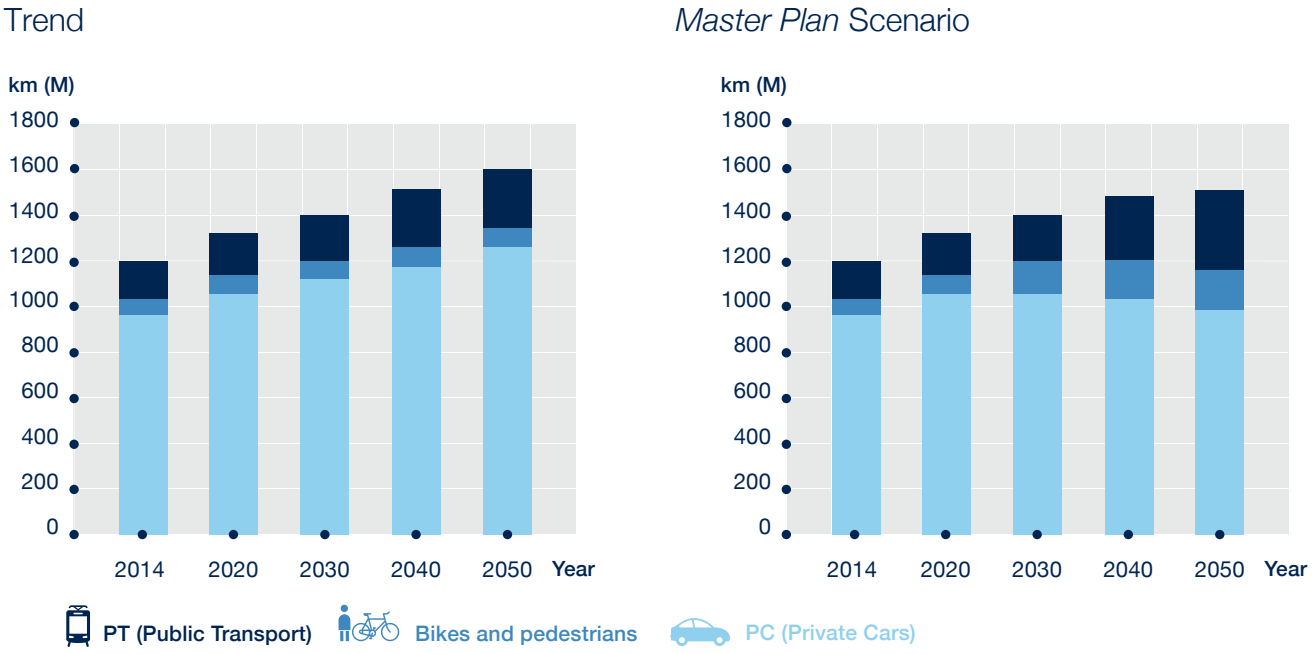


Figure 11: Development of transport performance in private passenger transport until 2050

» *Climate protection is a joint task which must include everyone.* «

Initial Status

The topic of climate protection is already visible in many places in the Potsdam public sphere. Publications, events, internet offers, hands-on activities, the *Potsdam Climate Prize* or consulting offers are just a few examples of successful climate communication. But still many people are hardly or insufficiently informed, especially concerning their own vulnerability to climate change (see Chapter 3.8.). Moreover, people also lack a fully understanding of what they can do individually in order to mitigate against global warming. However, the following applies: **climate protection is a joint task** which must include everyone. From the general public, via players in the economy, education, etc., up to the level of public administration and politics: the *Master Plan 100% Climate Protection 2050* needs visibility, acceptance and support in the entire city public. And the *Master Plan* goals must find their way into Potsdam's core brand values - not just in city marketing, but also in the self-perception of those responsible for and active in promoting its goals.

Leverage Points for Climate Protection

Like other cities, Potsdam has unique urban characteristics which are important for perception and communication. The *Master Plan* will have to link-up to them, and they need to be further developed in the sense of its goals:

- Climate protection in Potsdam needs an **'umbrella brand'**, a narrative brand core which is visually recognizable, under which the various existing and new topics and activities are combined. The anchor point of this "brand" core could be the quality of life in and the beauty of Potsdam, in which climate protection and climate adaptation ultimately 'pay'. A climate-friendly city is at the same time a healthy, livable, and sensually appealing city.

- This also brings **economic opportunities** for all, as the transformation of the energy, building and transport systems in the sense of the *Master Plan's* climate protection goals will stimulate the local and regional economy. Here, urban enterprises and their own communication strategies play a key role.

- Climate communication must make (joint) **success visible** and tell (individual) **success stories** - it must not be written only negatively (climate risks, more modest lifestyles, etc.).

- Climate communication needs to address **broader audiences** than before, such as financially well-off households with a big carbon footprint, but also people in more modest financial and social situations, children and adolescents, women and immigrants. For this purpose, the life-world implications of climate protection, also at peoples' local level, deserve special mention.

- Potsdam is an excellent **location for science and culture**. The communicative potential of the relevant organizations and individuals needs to be used much more intensively.

- The annual **Potsdam Climate Award** should be extended (**climate week**) and serve as a starting point for more visibility of climate projects in the city.

» CO_2 sinks are of great importance in the fight against climate change. «

Initial Status

Potsdam is a green city. In view of the great challenges posed by climate change, Potsdam's **urban greenery** can be regarded as a **valuable asset** in various ways:

- Urban green spaces can absorb and bind dangerous CO_2 from the atmosphere (► CO_2 sink)
- Urban green spaces can contribute in various ways to mitigating the threat of climate change for the city of Potsdam (see Info Box A, B).

While we humans with our ways of living and working are currently emitters of dangerous greenhouse gases, natural areas within cities functions as a sink: forests, green spaces and bogs absorb CO_2, store it and thereby act as a factor counteracting global warming. Although these CO_2 sinks for formal reasons could not be included in the calculation of the climate balance of the *Master Plan*, they are in fact of great importance in the fight against climate change.

Contribution of urban nature to protecting Potsdam from climate change impacts

Urban green spaces in Potsdam acts as an important 'assistant' in the fight against the health, social, ecological and economic consequences of climate change, which Potsdam is expected to have to face (see Info Box B). Urban green spaces play a central role for the city's micro climate: they provide shade and cool and moisten the air, which in a city warms up more than average due to the high share of building infrastructure and sealed surfaces. Green areas help with the management of extreme weather events such as heavy rainfall and heat waves by means of water retention and storage, thus increasing urban ► resilience. The examples show that urban ►'green infrastructure' will increasingly support and relieve the technical ('gray') infrastructure in the future.

Infobox A

Climate Change Impacts for Potsdam

Unmitigated climate change will be a threat to Potsdam. A key message from PIK studies for the city: Potsdam's climate in the year 2100—both with respect to temperature and to precipitation—will resemble the climate we currently see in Toulouse in the south of France. But already on the way to 2100 there will be more heat days (accompanied by 'tropical' nights), which will increase the risk of cardiovascular and respiratory diseases, especially in very young and older people as well as in the group of chronically ill. Heatrelated mortality will also increase. Heavy rainfall events cause urban flooding, damaging private property and urban infrastructure. The climate protection concept 'Adaptation to the consequences of climate change in Potsdam', which was commissioned by the city, analyses the climate change consequences for Potsdam in detail and at the same time contains a catalog of important measures to increase the resilience of Potsdam. The implementation of the *Master Plan* by 2050 and the climate adaptation concept have to work together in a synergistic manner.

Infobox B

The Brandenburg state capital is covered to almost one third with forest (almost 5,000 ha, particularly in the northeast and southwest). Through biomass growth alone, this forest area binds more than 50,000 t of CO_2 every year. Also the approx. 77,500 park and street trees as well as other green areas and allotment gardens contribute to the binding of significant amounts of carbon dioxide. Potsdam's fens – located mostly in the north of the city – account for approximately 10% of the city area and are by their nature almost optimal helpers in the fight against climate change. However, the nature of their management, which is sometimes not suitable for the location, have turned potential CO_2 sinks into CO_2 sources with emissions of around 30,000 t CO_2 per year. The CO_2 sink function of urban greenery and its capacity for protection against the effects of climate change (see Info Box B) are referred to as ► 'ecosystem services'. A major economic benefit of these services is that they are provided almost cost-free.

Leverage Points for Climate Protection

With continued **urban growth**, it is important to protect the strategically important green and open spaces. As these are important for the air exchange and the cooling of the city at night, they should not be built over under any circumstances. The **increase in the sealed area** of Potsdam from about 9% (1992) to 12.6% (2016) is critical as every act of sealing (in sum currently about 10 ha per year) removes ecosystem services for the city.

The ► **green volume** of the city should at least be kept constant, and should at best to increase. A good way to combine climate protection and climate adaptation is to **systematically green the facades and roofs of Potsdam's buildings** - with site-adapted plant species and using natural rainwater irrigation. The **interaction of technical ('gray') and ► natural 'green' infrastructure** should also be systematically analysed, controlled and enforced in Potsdam.
It is also important to **maintain the functions of urban greenery** in the long term, in a **changing climate**. The forward-looking design or conversion of green area with the aim of climate resilience should play an even greater role for public and private owners.

This is also true for the **forest** areas. The preservation and sustainable management of Potsdam's forests ensures their functionality for future generations. In cases when it is not possible to avoid clearing existing forests spaces (for example in the case of construction projects), appropriate compensation should be provided. Currently, the chosen wood is sold as saw-wood or industrial wood - i.a. for pulp production. From a climate protection point of view, a so-called **'cascade use'** of the wood is needed: Wood as a high-quality (building) material must be used more intensively in order to extend its CO_2 binding effect as long as possible.

Potsdam's historical **parks and gardens** are one of its key assets, both as monuments of cultural history, and as tourist attraction. They must be protected and adapted to future climate change (for example with regard to heat and drought stress), a joint task for the *Foundation Prussian Castles and Gardens* and the urban green space administration. **Public green areas** can also significantly increase their ecosystem services for climate protection and climate adaptation. In addition, it makes sense to address individuals with **allotment gardens** or **organizations with green spaces** (such as companies, schools, residential complexes, institute locations, sports facilities, etc.) with the aim of implementing qualification and adaptation measures.

Due to their CO_2 storage function, Potsdam's **areas of moor** not only serve the urban climate, but also climate protection. The state of Brandenburg has launched a new **funding program** that supports site-specific management of (renaturalized) moors. Potsdam's agriculture could be enriched with a new facet: In addition to the energetic use of crops such as reed ('Paludiculture') cattle breeding and grazing with water buffalo would be possible - a high-quality meat with a much better CO_2 balance than that of beef from factory farming.

4. IMPLEMENTATION

Climate Protection as a Joint Task

The *Master Plan 100% Climate Protection* touches many key areas of urban life - from energy supply, to the building sector, to transport and private households. Only if progress is made in all areas the *Master Plan* can be successful. And only when the relevant players get involved and work together can their ambitious goals be achieved. In addition to politics and administration, the Potsdam economy and civil society, i.e. each and every one of us, is required here.
The Brandenburg state capital Potsdam itself is also an important player, for whom there are many leverage points, such as **procurement**, the **construction of new schools and day-care centers**, or the **refurbishment of public buildings** and the creation of climate-friendly framework conditions, for example in **urban or traffic planning. Climate protection agreements with municipal companies** would be another important step. Finally, climate protection should be established as an **umbrella brand**, and the population of Potsdam and their guests should be motivated to participate through **information and motivation campaigns** for climate protection.

Gender

In addition to the technical questions of climate protection, social and gender-related aspects should also be included in the implementation of the *Master Plan*. This is because gender roles, associated tasks, income, participation in climate policy decisions, etc., are very different between women and men and require careful treatment.

On the one hand, this affects questions of **equity** and **participation**: at present, despite several exemplary participatory processes, decisions about the future of the city in important areas (e.g. urban planning, transport, economy, energy, etc.) are still far too often mainly made by men. But in everyday life, it is women who have to cope with the practical consequences of these decisions, i.e. a certain traffic infrastructure, the surrounding building environment, new kindergartens or electricity tariffs.

On the other hand, it is about **effectiveness** and **acceptance**. It is necessary to take the different attitudes, daily routines and needs of men and women, as well as of further sub-groups (such as the elderly, children, handicapped people) into account when it comes to the concrete prioritization and implementation of climate protection measures. As a result, the planned measures will work better, the implementation will be more effective, and will lead to higher acceptance.

The term **'gender plus'** should make clear that all these individual aspects (gender, age, income, education, etc.) cannot be considered independently of each other, but can also in combination with one another aggravate disadvantages or discrimination.

Monitoring

Without continuous observation and evaluation of the implementation of the *Master Plan*, it is difficult for policymakers and the public to understand whether Potsdam is moving in the right direction when it comes to climate protection and where, if necessary, readjustments are needed. That's why the *Master Plan* needs systematic monitoring. This monitoring should include the following modules:

- **Final energy savings** and **greenhouse gas reduction** must be continuously monitored as these are the two key variables in the *Master Plan* concept.
- The measures proposed in the *Master Plan* must be monitored in their **implementation** and their **impact** assessed.
- Measures that have a particular impact on gender equality, interlocking with other social categories (**'gender plus'**) require special attention. For this to happen, gender-disaggregated data on needs and responses to measures must be used or collected.
- In addition to the coarse city-wide level monitoring, finer resolutions or even small-scale spatial observation systems have to be developed.

For cost and effectiveness reasons, it may be useful to build on existing and thematically related monitoring systems. Potsdam's environmental monitoring (carried out every six years) or the three-dimensional energetic city model developed by the *Master Plan* team could be used and extended to a full-fledged monitoring tool. The *Climate report* (every two years) should continue to show the climate balance and energy consumption in the Brandenburg state capital.

FLEXIBLE IMPLEMENTATION

The *Master Plan* goals until 2050 are defined at the citywide level. But Potsdam is structured in diverse ways: Land use, age of construction, energy supply, traffic situation and last but not least the social situation—they all differ from neighborhood to neighborhood. Therefore, the city-wide *Master Plan* goals have to be broken down to the quarter level.

To this end, the *Master Plan* team proposes the introduction of so-called 'CO_2 lids' for city quarters. Based on the specific situation on site, each district should develop its own CO_2 reduction path, for which different implementation foci can be defined. Where listed buildings or social conditions impede upon further refurbishment of the building stock, for example, the focus would be on the de-carbonization of energy provisioning and traffic systems. The introduction of these CO_2 lids is facilitated by recent developments in the Federal Construction Act.

However, in order to ensure that the city-wide goals and concerns are not neglected, some institutional arrangements should be made:

- At district conferences, citizens, together with industry and administration, set their respective climate goals.
- Specialized conferences involving the public administration, local politics and urban enterprises provide the necessary information and data basis and make suggestions.
- The city administration focuses on planning measures and their implementation at the district level and, if necessary, provides financial support for the neighborhoods.

5. CONCLUSION AND OUTLOOK

It is possible to achieve a CO_2 reduction of around 92% by 2050 compared to 1990 even in a growing Potsdam – this is what the *Master Plan* report has shown! In the same period, the final energy consumption can be reduced by approx. 42% – an enormous achievement in view of the predicted significant increase in Potsdam's population.

For this, a lot has to be done in all eight fields of action presented here. The 100% *Climate Protection Master Plan* proposes a total of 157 concrete measures and assesses them according to their capacity, their costs and the required actors. The City Parliament of Potsdam has endorsed this concept in principle. Now it will be important to implement it and to apply the necessary 'long breath'.

The recent past gives us some positive signs of hope that Potsdam can do it. The exit from coal, heavily debated at the federal level, in Brandenburg and Berlin, was accomplished in Potsdam in the mid-1990s. With the construction of the EWP heat storage system in the mid-2010s, the entry into the large-scale use of renewable energy in the urban heat supply was created. With the renovation of Potsdams district called 'the garden city' Drewitz, it was possible to show how energetic refurbishment, comprehensive modernization and climate-friendly energy supply must work together so that socially acceptable climate protection can be achieved. Potsdam's future urban growth not only presents challenges, but also opportunities for climate protection, as the plans for Potsdam's new, climate-neutral district Krampnitz show.

In order for Potsdam to achieve the *Master Plan* goals, all relevant decision-makers from politics, administration, business and civil society should be actively involved in the implementation process. The goals and measures should also be reflected in the business models and investment plans of (urban) companies. And last but not least, the city society must be integrated and taken on board.

Already today, parts of the population are very active in climate protection, as the annual *Potsdam Climate Award* shows. With the concept of flexible CO_2 lids for neighborhoods, the report proposes an innovative implementation and participation idea. Climate protection may (still) not always have the priority it deserves in everyday life. We live in times of dramatic change, and the risks are as tangible as the opportunities. It is therefore all the more important to link the process of implementing the *Master Plan* goals with other urban processes and developments, where it is objectively reasonable and politically appropriate. For example, the Master Plan objectives fit well into the Potsdam mission statement and they show many overlaps with the digitization of the city.

Many cities in Germany and in the world are on the way to climate neutrality. Together with e.g. Copenhagen, Washington, London, Berlin, Hanover, Munich, Rostock, Stuttgart and many more Potsdam can be among the pioneers of a modern future and show: We can do it! We act with responsibility! We are making our city fit for the future!

6. GLOSSARY

Anthropogenic Climate Change
Climate change caused by greenhouse gas emissions from humans (ancient Greek: *anthropos*) in contrast to natural climate change in the Earth's history.

Car Sharing
The organized joint use of motor vehicles either in stationary (lending and return to fixed stations) or more dynamic (borrowing and returning on the roadside in the service area) form. Car sharing reduces downtime and car ownership.

Climate Neutrality
Activities and processes that emit only as much greenhouse gas emissions as are compatible with the 1.5 or 2-degree target of the UNFCCC. They can be termed 'climate-neutral' even if they do not mean zero emissions. With the same global emissi-on rights for all people, in 2050, about 1-2 tons per capita per year of greenhouse gases might be allowed.

CO_2 Sink
Term from climatology, which refers to a reservoir that stores carbon temporarily or permanently. Such sinks, such as forests or bogs, are counteracting climate change by absorbing the greenhouse gas carbon dioxide (CO_2) or other greenhouse gases such as methane (by microorganisms), from the atmosphere during growth and storing it instead of sending it directly to the atmosphere.

De-Carbonization
The transformation of an economy or area (such as a city) to non-fossil energy sources.

Ecosystem Services
Supportive functions of ecosystems (e.g., pollination of flowering plants, purification of water or air) that are vital or useful for humans and society

EEG (Renewable Energy Act)
A federal act that regulates the preferential feed-in of electricity from renewable sources into the power grid and guarantees their producers fixed feed-in tariffs.

Energy Efficiency
Energy efficiency is a measure of the effort (consumption) of energy to achieve a specific use or benefit. The less energy that needs to be used, the more energy efficient a product or service is.

EWP
German abbreviation for *Energie und Wasser Potsdam*. EWP is Potsdam's municipal utility. Main tasks of EWP are the energy supply and the water supply. Many other activities – like local public transport or waste management - complete the broad service range.

Final Energy
Energy delivered (e.g. in the form of electricity) after deduction of conversion losses (e.g. in power plants) and transmission losses (in networks) and used for energy services (e.g. cooking).

Greenhouse Gases
Greenhouse gases are gaseous components of the atmosphere that cause the so-called greenhouse effect by changing the radiative balance. Greenhouse gases come from both natural and human sources. The most important greenhouse gases in the atmosphere are water vapor, carbon dioxide, nitrous oxide, methane and ozone. In their overall effect, they increase the heat content of the atmosphere. As a convention, the warming effect of all greenhouse gases, which have varying volumes, is expressed in CO_2 - Equirvalent (CO_{2eq}).

„Green Infrastructure“
Sometimes also called ‘blue-green infrastructure’. Designates the equipment of areas (for example cities) with green areas and their services for humans and society, e.g. health, well-being, biodiversity conservation, flood protection or climate regulation. For reasons of cost and effectiveness, future city planning increasingly relies on the interplay of traditional, technical (‘gray’) and ‘green’ infrastructure.

Green Volume
Concept from landscape planning, which is calculated as the product of a vegetation-covered area (e.g. the base area of a forest) and the height of vegetation. In the growing city, it is often a question of keeping the green volume index at least constant in order to secure green urban ecosystem services

GWh (Giga Watt hour)
The prefix Giga (G) stands for one billion. One gigawatt-hour equals one billion watt-hours (Wh) - the energy consumed by a system with a power of one watt in one hour.

IPCC (Intergovernmental Panel on Climate Change)
International scientific committee, which regularly summarizes the latest developments in climate and climate impact research for policymakers and the public and outlines climate policy options for action. So far, five such IPCC reports have appeared.

kt (kiloton)
1,000 tons.

Passive House Standard
Energy-efficiency standard of a building that needs very little energy for heating due to good insulation, optimal orientation of the windows and heat recovery/ventilation. Heat energy demand is less than 15 kWh/m^2/year. Depending on the age of the building, values of between 70 and 178 kWh/m^2/year can be currently found in Potsdam’s building stock.

Power-to-X
Technical conversion of (surplus) electricity from regenerative sources into different energy forms and carriers, e.g. directly into heat (Power-to-Heat) or via electrolysis in hydrogen (Power-to-Gas) or other energy sources.

Resilience
The concept is derived from the Latin word ‘resilire’ (rebound) and refers to the ability of a system (e.g. a city) to withstand external disturbances or shocks, such as climate change.

Sufficiency
The absolute reduction of energy consumption through changes in usage, for example reduction, substitution or better adaptation of use to actual needs.

UNFCCC (United Nations Framework Convention on Climate Change)
An environmental agreement adopted by the United Nations in 1992, in which the signatories commit themselves to climate protection and adaptation. The Paris Agreement of December 2015 represents a concrete implementation of this convention.

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