Landeshauptstadt
Potsdam

Abbreviated Version
Integrated Climate Protection Concept 2010

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Cover Picture: Panorama of Potsdam (Municipal Administration of Potsdam/Michael Lüder)

Integrated Climate Protection Concept 2010

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Compiled by:

Work Group Integrated Climate Protection Concept for the Federal State Capital of Potsdam

For:

Municipal Administration of Potsdam
Division of Social Affairs, Youth, Health, Order and Environmental Protection
Coordination Office for Climate Protection

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1.1 Definition and Function of Ideals

The notion of an ideal in urban and regional planning is not regulated by law and exists as an informal instrument in various definitions and interpretations. The term is generally used to characterise the targeted state of a planning area. Within the context of urban and regional planning, Lendi describes the term as follows:

> „The term ‚ideal' is used with a certain preference in all places where a particular desired future state is given as a target to be aimed for. The characterising elements of an ideal are, therefore: a desired state that sets itself apart from the current state as well as the trend, and that can and should be achieved by concerted and coordinated behaviour." (Lendi (1995), pg. 624)

Even though a general definition of the term ideal does not exist, some general characteristics can be ascertained. (cf. Scholles et al. (2001); BMVBS / BSR (2009a)):

- universality/abstractness:
  relatively broad, often vivid description of the state that is strived for;
- frame of reference for the purpose of defining more concrete goals:
  no ready-made solutions, instead the possibility of deducing from directives;
  essential feasibility:
  no utopia, instead a state that, in principle, can be achieved;
- political target statement:
  based on a social or functional value system;
- group consensus:
  as a rule there is not just the one ideal for future development, rather there are several ideals, even competing ones;
- summary of different (overall) objectives:
  target systems result from the summing up of existing targets and the derivation of new ones.

Ideals therefore have an orientating, even visionary function that is at the same time anchored in the specific context of the respective town system. This anchorage has two partially opposed faces: on the one hand it describes the historical path dependence of a town system that cannot be changed either overnight or in any arbitrary direction. Some examples are the power plant of a municipality or existing buildings. On the other however, a characteristic of an ideal is that it has to be anchored in the actual potential capacities of a town. Expressed philosophically, this means that it is a possible part of reality. Examples could be the skills and creativity of the local economy or the learning ability of the administration.

An ideal structures the targets in different action areas and should unfold a binding force for decision-makers and sponsors. In view of the political realities in municipalities, this can only mean that ideals have to evolve within a discursive process and are dependent upon the support and synergy effect of other political objectives. From our perspective, this means that the ideal presented here – despite considerable efforts on the part of the assessors to involve municipal decision-makers even in the developmental stages – still has to be tested in the political arena of the state capital. The municipal councillors not only have to still approve a climate protection concept specially tailored to the local political system. Support from economic and social partners in Potsdam still has to be sought so that the ideal can become an orientation to be lived by and not just a piece of paper.

This also means that the ideal has to and will be constantly modified during the process of its realisation. Good reasons for this are not only potentially restrictive conditions such as the development of municipal finances, but also potentially beneficial factors that were not foreseeable or foreseeable in this form at the time of its formulation, e.g. the faster or more cost-effective availability of emission-reducing technologies or organisation forms. Ideals therefore have to be reviewed regularly – not only to measure the status of target achievement, but also to adjust the actual objectives (preferably in terms of accelerating the overall objective). A monitoring and evaluation system is therefore an important component of a municipal climate protection concept.

In summary, this means that the climate change policy ideal of a municipality has to be an integral part of a locally regulated system that reacts in a flexible manner and that is adaptive (in a broader participatory sense), for which the term *Adaptive Management* has become the norm in parts of the professional world. In this case adaptation should not just be understood to mean a decision system that should adapt to changing environmental conditions (for instance adapting to other climate projections than those that had been originally assumed). The ability to adapt in this contest primarily means that a decision system places itself in a position to proactively use its abilities and strengths to create positive new situations or to creatively react to negative new situations. The willingness to give up established routines of political and administrative dealings if necessary and to be open to innovative solutions is, in this regard, part of a key qualification. Due to its modern service economy as well as the high concentration of scientific research activity, Potsdam offers excellent local conditions for such creativity.

1.2 Climate Change Policy Ideal of the Federal State Capital of Potsdam

The city of Potsdam, as the largest municipality and capital of the State of Brandenburg, assumes its part of worldwide responsibility towards climate change policy for itself, its citizens and economy, as well as for the state and the global common interest in climate matters and commits itself to a continuous reduction of its CO_2 footprint. By 2020 there should be an initial saving of 173,334 t CO_2/a, which corresponds to a total emission of, at the most, 693,337 t CO_2/a in the municipal area. This target does not in any way however mean the end of climate protection efforts in Potsdam, but rather just presents one milestone on a continual path of emission reduction. A reduction to 2.5 t per head and year by 2050 is the target.

Potsdam fulfils the ideal of a climate-conscious city through objectives and measures in different areas that target a reduction of the municipal THG emissions as well as an increased adaptability towards unavoidable climate change. In this regard the conditions of the municipality (location, infrastructure, everyday practices) have to be given just as much consideration as the existing potential of the city.

1.3 Policy and Administration: the cooperative and innovation-ready municipality

Ambitious goals in climate protection and climate change mitigation and adaptation can only be achieved if they evolve from niche topics to ‘top-priority items’ with a cross-cutting nature. This will be achieved in the federal state capital mainly through the upgrading of the coordination office for climate protection, review of municipal council resolutions with regard to their climate protection policy, installing a bonus-malus point system in allowances of decision-makers in companies with municipal holdings, instructing administration staff members collectively in climate and resource friendly behaviour and that the public procurement function of the federal capital be aligned with criteria that support energy efficiency and climate protection. The calculation of the profitability of investment measures has to be guided by their life cycle. A climate protection fund to be set up by the federal capital and Energie und Wasser Potsdam GmbH (EWP) *[Energy and Water Potsdam Ltd.]* is also supposed to make sure that citizens take active part in public projects regarding climate protection and that there is a calculable economic benefit to it. Through regular monitoring of the successes (or failings) of climate change mitigation and adaptation policies as well as through a broad involvement of the public in political discussions regarding individual measures, the interest of the urban public should be aroused, the possible acceptance for costly measures increased and the creativity of the urban society in the development of new technical and non-technical solutions (e.g. organisation, life styles) systematically stimulated.

These measures on the whole are aimed at emphasising the role model function of the federal state capital, also in routine administrative practice and to make this visible to the public (cf. chapter 12). Not least, the credibility of administrative behaviour can be solidified in this way. They thus blend in with the best traditions of Potsdam: reliability, solidity, transparency and tolerance – with concurrent recognition of the leadership and coordination responsibility of the local political system. Climate protection can thus be interpreted as a concrete case of application of the overriding principle of sustainable administrative action.

1.4 Energy Supply: sustainable expansion and renovation of the Potsdam energy system

Energy supply plays a key role in urban climate protection concepts and this is also the case for Potsdam. The ideal for energy supply is oriented towards the consistent pursuit of three subordinated goals:

1. Reduction of CO_2 emissions as a contribution towards a municipal council assembly resolution,

2. Reduction of the fossil use of energy for sustainable protection of natural resources and
3. Reduction of the end-use demand for energy for sustainable stabilisation of the production and living costs for the economy as well as residents.

Reduction in demand, increase of efficiency and change in sources of energy are the basic strategies to be combined towards achieving these goals. .

Recent history has brought Potsdam two climate protection policy relevant ‘pounds’, which can definitely be developed till 2020 in order to achieve the municipal council assembly objectives: The GuD power plant in combined heat and power and the district heating grid. Both are also properties of the EWP, a limited liability company in which the federal state capital also holds majority shares. At the same time, the proportion of renewable energy in the Potsdam energy mix can still be improved considerably. The results of this are three main thrusts by 2020:

1. It is clever and useful to continue densifying or expanding the existing district heating grid. Our calculations have revealed that the connection alone of buildings that to date have not been part of the district heating grid in a catchment area of 100 m around the existing grid (ca. 0.76 m. m^2 gross floor area (GFA)) with a 100 % implementation would lead to a CO_2 conservation of 24,000 t/a by 2020. We estimate the costs of this to be about 17 million Euros. An even higher additional savings potential (44,000 t/a) would be realised if the district heating grid would be expanded by 12 areas we have identified and the 3 m. m^2 GFA there equally connected.[1]

2. Parallel to this the percentage of renewable energy in Potsdam has to be considerably enlarged and the expanded potential cleverly integrated into the current system.[2] For this purpose, three key measures are suggested: the set-up of a regenerative fuel contingent in the generation of district heating in combined heat and power (CHP) above the new construction of bio-methane plants as well as the use of sewage gas from the EWP sewage treatment plant; secondly the entry of EWP in the generation of wind energy; thirdly the use of aquifer storage facilities for seasonal thermal energy storage as buffer technology.

3. A decentralised energy supply structure has to be constructed which, with regard to the heating sector, should primarily begin at places where neither district heating conglomeration nor expansion areas are currently to be found, and which connects to electricity sectors everywhere in the urban area. To this end it is suggested first, that about 100 decentralised mini CHP plants (for 116,000 m^2 net floor area (NFA)) be constructed; secondly, for about 150,000 m^2 NFA, heat pumps (air-to-water, brine) should be used; thirdly, photovoltaic (PV) and solar thermal energy (ST) should be used in the entire Potsdam urban area, among other things, through a solar roof website

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[1] A list and cartographical illustration of these areas follows in chapter 7. The same applies to the district heating conglomeration areas.

[2] As is generally known the construction of additional renewable, but mostly volatile energy sources especially in the electricity sector places great demands on grid integration. In this regard, Smart Grids as well as conversion and storage capacity are necessary (cf. ForschungsVerbund Erneuerbare Energien (2010); Sachverständigenrat für Umweltfragen (2010)).

supported by the consortium in form of data in addition to advisory services for home owners and trades people as well as other support measures. If by 2020 even just 15% of the realisable PV as well as 30% of the realisable ST potential are used, there will be a savings potential of well over 8,000 t/a.[1]

The ideal of the Potsdam Energy Concept till 2020 suggested here thus distinguishes itself by the clever expansion of existing potential (CHP, district heating), the successive incorporation of renewable energy in this existing (central) system as well as the gradual construction of decentralised renewable systems. Looked at from a long term perspective (till 2050) the last two aspects will especially gain in importance. It is therefore advisable to already give them a place in the investment activity of the federal state capital today. Incidentally this does not only apply to the objective of climate protection. It is also applicable under the aspects of energy supply security, long-term energy price stability as well as the strengthening of local and regional economic cycles. All suggested measures have, especially in this last respect, considerable positive secondary benefits.

Considering a time frame of up to 2020 and beyond, the boundary conditions in energy supply will have changed drastically: The proportion of regenerative, strongly fluctuating electricity generation is predicted to be 50 – 100% by 2050 with the effect that electricity prices for the end consumer will become very volatile and power generation plants that can react to these dynamic unstable prices and earning structures will have an advantage. Small and agile generation units as well as storage possibility for electricity and heat will tend to be required.

The conscious and transparent handling of electricity consumption, prices and quality (Smart Metering) as well as an increase in efficiency in the home through planned top runner efficiency laws will bring about additional CO_2 savings potential.

The primary energy factor of CHP district heating – for reallocation of CO_2 district heating use emissions within the framework of the electricity credits method – will no longer greatly differ from the primary energy factor in unconstrained heat production with natural gas without stabilising compensatory measures in the long term. In order that the competitiveness of district heating, the high investments in the existing district heating grid and ultimately also the energy standards and thus intrinsic value of the buildings heated with district heating be secured and maintained, the primary energy factor of district heating has to be fused in the long term with an increasing proportion of regenerative heat production at the EWP.

The EWP as well as its stockholder, the federal state capital, naturally plays a key role, especially in view of the district heating grid as well as the power plant system. We find a pivotal point to be that the EWP also modifies in the direction of renewable, partially

[1] These figures have been computed conservatively to the extent that they dispense with the roof surface areas in monument protection statutes (about 25% of the buildings in Potsdam are protected as historic monuments). Citizens in protected buildings should be able to use compensation areas through a solar exchange. Climate and monument protection basically do not however have to exclude each other. The use of surfaces out of direct sight and newer solar modules integrated in building materials, for which we suggest a model building in the city centre, is conceivable. Climate and monument protection are two important public issues which independent administrative agencies have to consider.

decentralised energy systems early, and parallel to the expansion of existing systems. This is because it, as an organisation, can only recognise itself as an 'active climate protector' on the basis of a real proportion of renewable energy and communicate with the public. The advertisement of its own product 'Green Electricity from Potsdam' could play a much more active role than is the case today, where in principle it is a question of keeping clients from changing to 'green' electricity suppliers by buying hydroelectric power.

1.5 Buildings: cost-efficient continuation of renovation success stories and the stimulation of efficient new buildings

Due to the removal of the modernisation backlog since the 1990s the buildings in the federal state capital have, like in many other cities in former East Germany, been refurbished in a more energy-efficient manner than in many municipalities in West Germany. On the whole this drives up the costs per additional unit and forces concentration on the remaining renovation cases. According to our investigations there can be a saving of well over 11,000 t/a CO_2 by 2020 in Potsdam by undertaking thermal renovation in residential and non-residential buildings, in doing so however considering the fact that most (over 7,600 t) would have to be mobilised in private buildings (2 % annually). But even PRO POTSDAM Ltd, in which the municipality holds a majority interest, can still – like many other merged societies of the housing industry in the working group Stadtspuren *[town tracks]* - contribute to a reduction of building fleet consumption in the urban area (about 3,000 t/a) despite renovations already carried out.

The municipal real estate service (KIS) of the federal capital presents a further important climate policy change stakeholder; it does manage the public buildings of the city. The realisation of the KIS potential we identified (370 t/a by 2020) requires reinforcement of responsibility towards energy matters, which would also then be reflected in an amended priority list regarding the due renovation process.

As Potsdam represents, as mentioned earlier, a growing city, new additional buildings to the existing urban ones definitely gain in importance. In this regard the city has to use the opportunities in building law in order to motivate building owners to go lower than the energy conservation regulations standard (EnEV-Standards) (cf. Battis (2009)). As a Europe-wide introduction of the passive house standard in the area of new constructions is to be reckoned with from 2018, introducing this in Potsdam (modelled on other German states) ahead of time would demonstrate a certain mark of quality.

Unlike many shrinking cities in East and West, the federal state capital is not dependent on attracting building owners with 'dumping prices', rather it can tendentially implement more demanding building standards (including those regarding the alignment of the building for the purpose of optimising the solar yield) e.g. also through urban planning contracts. Just as Potsdam today takes care of its historical buildings, so should it in future also pay attention to the quality of climate change mitigation and adaptation orientation of its buildings.

1.6 Transport: establishing climate-friendly mobility

The transport sector represents an emission intensive area in all municipalities. Complementary to the urban planning ideal of the city of short distances, Potsdam should advance the establishment of a climate-friendly urban mobility. The foreseeable urban growth should not translate to an increase of motorised individual transport – not only for reasons of climate protection, but also for reasons to do with environmental and health protection (air pollution control, noise control) as well as transport fluidity in a city that is rapidly approaching the margins of its flow rate capacity. While the ideal of a ‘car-friendly city’ dominated urban and transport planning in the post-war period, cities today have to come up with new concepts of urban mobility in the sense of a modern and harmonised environmental transport mix just as in the sense of substituting physical with virtual mobility. In cities especially – especially also in Potsdam’s ‘older sister’ Berlin – it is becoming clear that young and mobile social milieus do not automatically link their physical need for mobility with the possession of a car any more. Similar needs and capabilities also exist in the city of service and science Potsdam. The ideal of a climate-friendly urban mobility consists of several core components which are based on the savings potential till 2020:

- Motor vehicle transport has to be increasingly replaced by more environmentally friendly means of transport (short-range public transportation, bicycles, pedestrian paths). In this regard the short-range public transportation needs to be improved using a series of expediting and pre-emptive measures, public parking space needs to be managed better in accordance with the Parking Prices Ordinance of 2010, company mobility management set up together with local economy and administrative agencies, bicycle and pedestrian traffic promoted more intensively, conventional car sharing facilitated, and new citizens advised accordingly. With these measures, a total of just less than 8,000 t CO_2 annually would be saved by 2020.
- Urban structures and patterns of use that avoid transport need to be developed and supported. This is in relation to the urban planning ideal of the city of short distances and has to be anchored within the framework of the urban development transport concept as well as the air pollution control plan of Potsdam. The objective is to particularly delink shopping traffic from the car in stages. At best about 650 t/a can be expected.
- Climate-friendly automotive and propulsion technologies. Under otherwise consistent conditions, technical advancement in conventional propulsion technologies will ‘gift’ the town with emission reductions of about 28,700 t/a by 2020. The main duty of the city will be in implementing the Ceteris-Paribus-Clause, i.e. preventing overcompensation of efficiency improvements per vehicle through larger vehicles or higher mileages. In addition, it is already becoming clear today that the combustion engine in automobile manufacture does not any more represent the only technological option, but is rather being progressively replaced by hybrid cars and electric vehicles. Even if these will probably not represent the dominant mode of driving by 2020, cities today already have to address the legal and technical requirements of e-mobility.[1] We argue for the strengthening of the e-mobility car-sharing model test in the concept of the garden town of Drewitz and to take this as a role model for other areas of the city. For this we see a

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[1] The federal capital is already doing this – together with Berlin – within the framework of a pilot project regarding e-mobility of the BMVBS. By 2020 however, the federal capital should also initiate its own activities in this regard.

starting point in younger and better educated milieus, but also in financially weaker young families with a high need for mobility.

- Support of a fuel-efficient way of driving. Particularly due to the fact that the combustion engine will remain the backbone of the vehicle fleet till 2020, the objective must be to orient the motorised road user's way of driving towards higher fuel-efficiency. In this regard transport should be consolidated on the main road network and a speed restriction on the Potsdam federal motorway sections as well as the Nuthestrasse highway worked towards. This would yield about 3,800 t CO_2 by 2020.

1.7 Urban development: the climate-conscious city of short distances

The spatial structure of a city can be interpreted as an expression of its functional modes of operation. The ideal of the compact city, developed as opposed to the city of the Charter of Athens with its separate functions can also be regarded as an orientation framework of urban planning for municipal climate protection in the federal state capital, together with the principles of sustainable urban development (Leipzig Charter 2007). Cities have to make economical use of their architectural density with regard to surfaces and resources. This applies especially to climate protection in Potsdam, whose first energy-related mainstay is the consolidation and expansion of district heating. Moreover, the multifunctional city of short distances also reduces unnecessary passenger and freight traffic and in this way also creates the possibility of the less mobile sections of the population having a greater participation in public life.

At the same time, and this makes the task of planning a special challenge, issues of adaptation to unavoidable climate change in the city structure have to be depicted. On one hand this pertains to the avoidance of overheating due to building density that is too great (*urban heat island effect*), on the other to a more efficient use of the resource of water, which according to most regional climate scenarios, will become scarcer in Potsdam. We suggested the Green Volume Number (GVZ) as a measured value with which both issues can be balanced, even if conflicts cannot always be avoided in individual cases and a solution must be found as part of a participatory implementation of the climate protection concept. Potsdam has to manage its growth sustainably and with regard to climate adaptation issues. And it has to expand its green areas and water surfaces in public as well as private space, design these in an aesthetically appealing manner and look after them carefully. And it has to remain capable of learning so as to be able to take in new insights in climate change research (e.g. with regard to the spectrum of species). Such obligations however also create prospects regarding the quality of living for residents in the city as well as its tourist appeal.

Due to the incorporation of surrounding areas in 2003, agricultural and silvicultural areas as well as near-natural landscapes especially in the northern part of Potsdam have become part of the city, and it has to take care of them. This report has particularly highlighted the role of low moors and forest areas for the urban water and CO_2 balance. The damaging effect to the climate of the release of THG from drained low moors has thus far been underestimated; it can be reversed back, even if not to the same extent, to its opposing form (carbon storage) by rewetting the low moors. The preparation and execution of such measures is complicated and expensive because the management of the affected areas (also affecting neighbouring areas) has to be changed fundamentally. The technical, socio-economical and legal concomitant circumstances require a foundational investigation in the form of a feasibility study or studies. Even in the forest, the carbon storage capacity can be increased and climate protective functions in the sense of an adjustment strategy improved through sustainable cultivation that takes care of reserves. The GVZ suggested as a measured value can be used for the management and control of the situation within the city as regards climate adaptation as well as economic planning for renewable energy, the biomass sector in non-urban areas. These opportunities should be used to advance climate protection in Potsdam.

The urban planning climate ideal can ‘gain considerable momentum’ if it comes within the framework of participatory neighbourhood development. The example of Drewitz shows that climate protection, adaptation and neighbourhood upgrading can go together without a neighbourhood running into the danger of losing its social balance through ‘gentrification’. We therefore argue for a linkage of urban planning issues of climate change mitigation and adaptation with the objectives of sustainable neighbourhood development as well as the principles of its participatory implementation.

1.8 Public Relations Work: the enabled civic society

In contrast to the times of the Prussian Kings or the period of East Germany, city life in Potsdam is characterised today by active citizen involvement and in some cases vigorous public discussion. Moreover, the existence of the Energy Forum Potsdam (EFP) or the Potsdam Citizen Solar Association show that climate protection in this city can have a mobilising effect – which certainly bears a relation to the high concentration of scientific institutions.

A climate protection concept that only banks on political and administrative agencies would not be able to achieve – especially in the long term - the ambitious goals. Economic and social partners in Potsdam have to get actively involved and do so of their own volition. In view of the links between climate change mitigation and adaptation on one hand and issues to do with local/regional economic cycles and the securing or increase of urban quality of living on the other, the odds for this are not bad.

The climate protection concept has to be anchored in the image and public identity of the city, in the fashion of the properties of the ‘UNESCO World Heritage’, ‘family-friendly city’, ‘media city’ or ‘scientific city’. Towards this purpose a concerted public relations strategy is required, which comprises different pillars:

- A municipal climate agency has to actively convey the objectives, but mostly also the financial support possibilities of climate policy concepts and adaptation to individual citizens and local economy. In this regard convincing stationary and mobile propositions as well as an attractive and informative internet presence are indispensable. The establishment of a solar roof website as well as a solar roof exchange also belong to this pillar.

- Climate change mitigation and adaptation require events and continuous visibility in the public space, if possible with the involvement of suitable (e.g. also credible) celebrities from within the city (e.g. from top class sports). Saving energy is done by people on their own – without positive feedback (e.g. informative electricity bills) and competitions, a public mass movement cannot be created. Even symbolic campaigns such as the Tree Planting Campaign (see green volume index), the Green Castle Night or even campaigns with a fun element (e.g. the solar dancing boat) can make a significant contribution to local and regional prominence and towards the positive image of climate protection in Potsdam.
- Climate protection in Potsdam also needs urban planning signs and places. In this regard we suggest that the feasibility of an advanced Potsdam Science Centres be checked.
- Altogether such measures cannot, or are difficult to convert to a prevention effect (and thus no prevention costs). They are however indispensible in making the overall concept visible and tangible for the city – and the world.

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2 Synopsis and Evaluation of Measures

In the preceding chapters measures of the federal state capital Potsdam to reduce CO_2 emission and adapt to unavoidable climate change in the areas

- comprehensive action areas,
- energy and buildings,
- solar roofs,
- transport,
- landscape and environmental planning,
- urban planning and development and
- public relations work

were developed, selected and expounded upon. A total of 99 measures have been suggested to achieve climate protection targets (an overview of all measures can be found in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**).

If the CO_2 reductions of all measures are added up, the total annual savings potential will be almost 284,000 t CO_2 / a by 2020. The internal target of saving 173,334 t CO_2 annually by 2020 can therefore be achieved – and this according to the selection of measures to be taken in various ways. Fig. 2.1 gives an overview of the distribution of savings potential

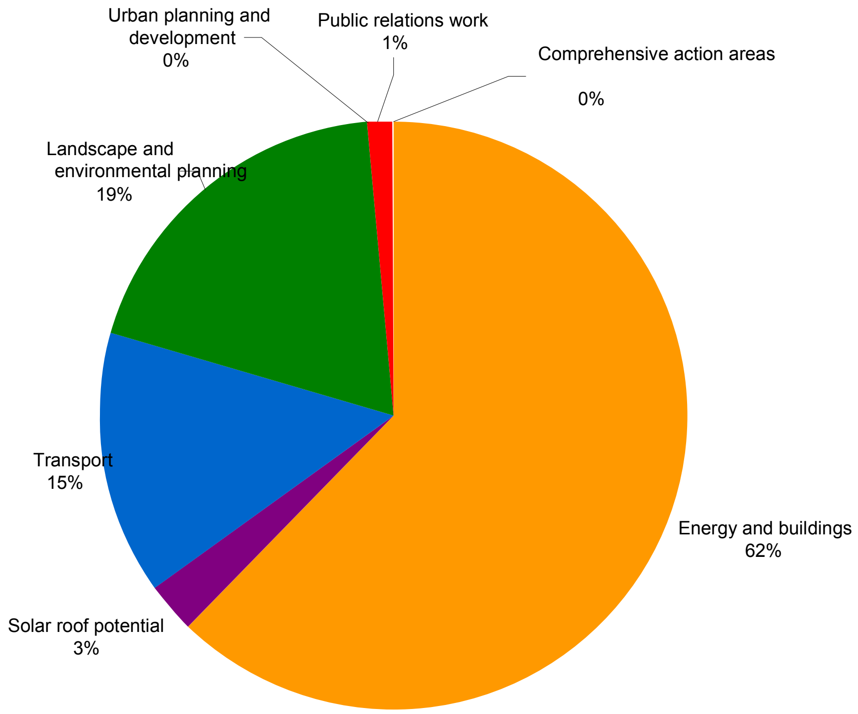

Fig. 2.1: Overview of the distribution of CO2 emission savings

Short overview of the savings potential according to action areas

The quantifiable savings potential of the measures in the comprehensive action areas amounts to just about 120 t CO_2 annually till 2020. An estimation of direct CO_2-emission savings in this action area is however difficult because these are mainly measures that should contribute towards enabling politics, administrative agencies and urban business enterprises deviate from the business-as-usual path and consider climate change mitigation (and adaptation) policy as part of their everyday dealings and thus make an important contribution towards the development of Potsdam into a climate protection city.

It is not surprising that the action area of energy and buildings can and must make the most substantial contribution towards the achievement of the objectives: energy generation (or correctly, the provision of thermal energy and electricity production) in Potsdam is connected in large part to the burning of fossil sources of energy[1] – and carbon dioxide is one of the combustion products. Summing up the total of all saving potential, well over 176,000 t CO_2 annually (or 62 % of the total saving potential) can be reduced by 2020. The saving potential goal can also be reached solely through measures in the action area of energy and buildings. The largest contributions in this action area are made by the measures affecting the district heating grid network: about 70,000 t CO_2 can be saved through expansion and consolidation of the existing district heating grid. The use of bio methane in central electricity and district heating supply also offers a very considerable saving potential of 68,000 t CO_2 annually till 2020. EWP as the owner of the district heating grid network and the central combined heat and power stations will also have to play a substantial role in achieving the climate protection objectives.

As described, the big sinecures in this action area lie in energy supply. In the building sector there is certainly also a considerable savings potential to be had: thermal renovation alone of the hitherto unrenovated private residential and non-residential buildings without monument protection presents a saving potential of 6,400 t CO_2 annually till 2020. A further annual saving potential of almost 5,000 t CO_2 annually can cumulatively be achieved by thermal and energy-related renovation of all other categories of buildings with and without monument protection.

A further amount of almost 8,000 t CO_2 per year (or 3 % of the total saving potential) can be achieved through measures in the action area of solar roof potential, in particular through the installation of photovoltaic and solar thermal energy plants on Potsdam's roofs.

The combustion of fossil sources of energy in the action area of transport is also an important reason for CO_2 emissions. The saving potential accumulates to a total of almost 55,000 t CO_2 annually till 2020. The most effective measure in this area is the accelerated change in vehicle types in Potsdam. Thus new, fuel-efficient technologies with a corresponding smaller amount of CO_2 emissions are used in motorised private transport as well as public transport. Although the change in types of vehicles also presupposes action taken by the municipality (e.g. in the case of public transport carriers), savings are attained by the purchasing and user behaviour of citizens.

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[1] EWP produces electricity and heat from natural gas through the GuD combined heat and power station. Fossil sources of energy are also used to a large extent for further heat supply.

A very high savings potential can be generated in the action area of Landscape and Environmental Planning. In addition to the energy-related recovery of (hitherto unexploited) biomass, land rehabilitation and rehydration as well as the extensification of wetlands and moors play a big role. Measures of this kind had hitherto barely been considered in any climate protection concept (an exception is e.g. the Hanseatic city of Lübeck) and are thus to some extend also unexpected. The rehabilitation and rehydration of land or extensification of low moors are not only important because of reasons to do with climate protection, but are rather also in accordance with the objectives of nature conservation and moreover, indirectly contribute to congestion in the central area of the state capital (cf. chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**). However it must be taken into consideration that emissions that were avoided due to these measures have not been recorded yet, and are not therefore found in the planning of objectives by the state capital. If the theoretical saving potential of these measures amounting to about 43,500 t CO_2-e were simply to be calculated as well, a skewed picture would result. This should not diminish their importance, but rather make clear why it is important to be careful with the numbers here.

Measures from the action area of urban planning and development are an indispensible compliment to measures in the area of energy, buildings and transport: they reveal these more or less in the whole urban municipal area and also ensure that the city pursues a regional course of development that makes it easier for citizens as well as economic partners to behave in a climate-conscious manner (including adapting to climate change). Nevertheless the measures in this action area are just as difficult to quantify as the overall comprehensive measures. The following strategies

- climate-friendly further development of the city,
- support of environmentally-friendly traffic,
- use of natural energy resources,
- strengthening of CO_2-binding structures and
- protecting and expanding heat-regulating structures

with their objectives of CO_2 reduction and climate adaptation will be implemented in municipal development with the help of the suggested measures.

In the action area of public relations work there are some potential savings that can be quantified. In this action area the total saving potential is achieved with an amount of well over 3,800 t CO_2 annually till 2020 und ca. 1 % in total. The importance of this field does not even come close to being reflected even in this case where the contribution to climate protection can be quantified. A climate protection concept can only function when the citizenry and economic partners of the federal state capital of Potsdam also commit to the climate objectives and play an active role in their achievement. Each of the measures mentioned above – also the ‘difficult cases’ – have a communicative aspect, have to be discussed and implemented in political and administrative institutions, have to be communicated in a positive light to the public, require the belief and active participation of the citizenry, have to be defended against all manner of conceivable objections, and as the case may be, further developed. The direct CO_2 saving effect in this case is often either very small or cannot be quantified however has a great indirect effect when it succeeds.

After this introductory overview of the complete picture, the chapter will look at the different scenarios of climate protection in Potsdam. Scenarios are not forecasts but rather possible conditional futures. Their occurrence depends on decisions made – and are moreover also influenced by all manner of marginal conditions. Scenarios of climate protection in the federal state capital of Potsdam therefore become possible because the saving potential of the developed measures calculated by us clearly exceeds the set target of the municipal council assembly. This is essentially good news – our research could also have as well shown that the objective, measured against the capabilities of the federal state capital, was too ambitious. This is fortunately not the case, on the contrary: Potsdam can either implement *all* measures and thus surpass its own set target, or it can make a wise selection which as it were, illustrates the municipal council assembly objective 'in a point by point accurate manner'. As much as we would wish to actually do everything that is theoretically possible, this suggestion is not very realistic. This has various reasons: on one hand most of the measures that we suggest have a 'price tag', and because of scarce municipal financial resources, even in the growing city of Potsdam, budget restrictions alone will steer the selection. In addition to this, not all measures 'fit' together, there are functional and temporal interdependencies and incompatibilities that would also suggest a particular selection.

This raises the question of how – that is according to which criteria – such a selection should be made. We used three such criteria for the scenarios that are going to be presented in the following sections: CO_2 effectiveness, cost efficiency and model consistency. The central question for the efficiency scenario is: which measures achieve the climate protection objectives of the federal state capital – measured in avoided CO_2 emissions – most directly? In other words: where are the most difficulties to be found, which combination of measures achieves the most? Behind this is not just a 'climate rationality' but also a 'social rationality'. Saving X tonnes can also be achieved by using the five most important or thirty 'most unimportant' measures. In the logic of effectiveness one however assumes that five measures are easier to realise in an urban society than thirty. In ignorance of the severity of the individual measures, this is a practical assumption – but only then.

In our analysis we however also assessed the severity of a measure, and thus generally know it. For the sake of simplicity in this regard we take the costs of a measure (provided they are quantifiable) as an indicator of the degree of difficulty of its implementation. A second scenario thereby arises as a result: in this case the question is which set of measures enables the saving target of the federal state capital be achieved with the least cost. Such a scenario makes sense in a world in which (almost) everything has its price. And the treasurer of a city especially, knows it very well.

Not everything that has a price also has a value. However difficult it seems to make this distinction in a given case – or even at the level of economical theorising – it does make intuitive sense. In our case the criteria of significance was somewhat easier to fulfil: it is regarded as necessary to employ a model that, from the purely quantitative saving requirement of the municipal county assembly, can make a coherent account that is in alignment with global climate protection policy as well as the local conditions around Potsdam. We therefore developed a third scenario that implements the climate change policy model of the federal state capital and thus in a sense embodies it. This also implies that the target for 2020 has to be regarded as just one stage on a long road at whose tentative end stands the 'climate-neutral city' – a city which by 2050 will therefore have fulfilled its part of the global task of 'more efficient and just climate protection'.

In the following sections we will therefore briefly present these three scenarios and characterise these with regard to their effectiveness and cost/benefit balance. In order to better class the path Potsdam is taking, we will conclude by comparing the ideal scenario with the climate protection concepts of other selected cities.

Even if in our view as expert advisors a clear preference for the ideal scenario will be seen, it should be emphasised to begin with, that it is of course for the citizenry and their representatives through the municipal council assembly to select a particular set of measures (a scenario). It is ultimately the citizens who have to bear the costs of such a concept and who will enjoy its benefits.

2.1 Ideal and Scenario Suggestions for 2020

In the preceding chapters a number of measures were presented and it was also shown that the climate protection objectives can be achieved without simultaneous implementation of all of them. The question that is posed is which of the measures should be carried out. In this context selected combinations of measures can be understood as scenarios which should be developed and described in this section.

For the development of scenarios it is obvious that measurable criteria for the purpose of evaluation should be used. An approach is to carry out as few measures as possible. In Fig. 2.1 divided into different action areas it can be already be seen that there are some action areas that make a very large contribution towards the attainment of the climate objectives (e.g. action area energy and buildings), other action areas do not make a directly quantifiable (comprehensive action areas, urban planning and development) contribution towards the target achievement of an annual CO_2 reduction of 173,334 t by 2020 or achieve this to a very small degree (public relations work and solar roof potential). A further limitation not only according to action areas but also individual measures ultimately steers towards a scenario in which the climate objectives can be attained with just a few selected measures. Such a scenario will be developed, explained and analysed[1] under the name 'CO_2 effectiveness' in this section.

In addition to the objectives to be achieved, the costs that are expected to arise in this regard also play a not insignificant role. The question that arises is which costs should be expected in order to achieve the climate protection objectives by the year 2020. Following up on this a further scenario was created out of the measures with the least total costs. In the following section this scenario is also named the 'cost efficiency scenario'.

Even if convincing scenarios can be developed on the basis of measurable and ratable criteria, contributions (even towards secondary objectives) that cannot be quantified in this way remain unconsidered. Strategically important measures and measures which pursue other objectives having various side benefits are not taken into account. In order therefore for the state capital Potsdam to undergo transformation a holistic scenario developed through expertise and competence is required, in which the quantitative target achievement represents one of several evaluation criteria. In chapter 1 the components were described which in the view of the appraisers are important for a holistic climate protection concept and an ideal for the federal state capital Potsdam developed. In accordance with the presented ideal, a scenario, the 'ideal scenario', will be developed.

In the following sections various scenarios will be developed from different combinations of measures and evaluated according to costs, benefits, synergy and conflicts.

[1] The title of this scenario is ambiguous to the extent that of course all measures have a greater or smaller effect on the CO_2 footprint of Potsdam – otherwise they would not have been selected. However it is only the first scenario which is named 'CO_2 effectiveness' – and not „reduction-optimised scenario" for instance, which is how it could also have been named –, because only the measures which possess of themselves the most reduction potential would be looked for in it.

2.1.1 Scenario 1: CO2 Effectiveness

As described above, alone the measures from the action area of energy and buildings can achieve the saving potential. There are also other measures in the other action areas which also have a very high saving potential. The scenario CO_2 effectiveness in this section should be developed from as few measures as possible. The selection of measures will take place in such a way that the measures with the highest CO_2 saving potential are selected, until the climate protection objective of the state capital can be attained with the total sum of saving potential. Fig. 2.2 lists the measures with the greatest saving potential. In total, 245,621 t CO_2 can be saved annually till 2020 with these eleven measures.

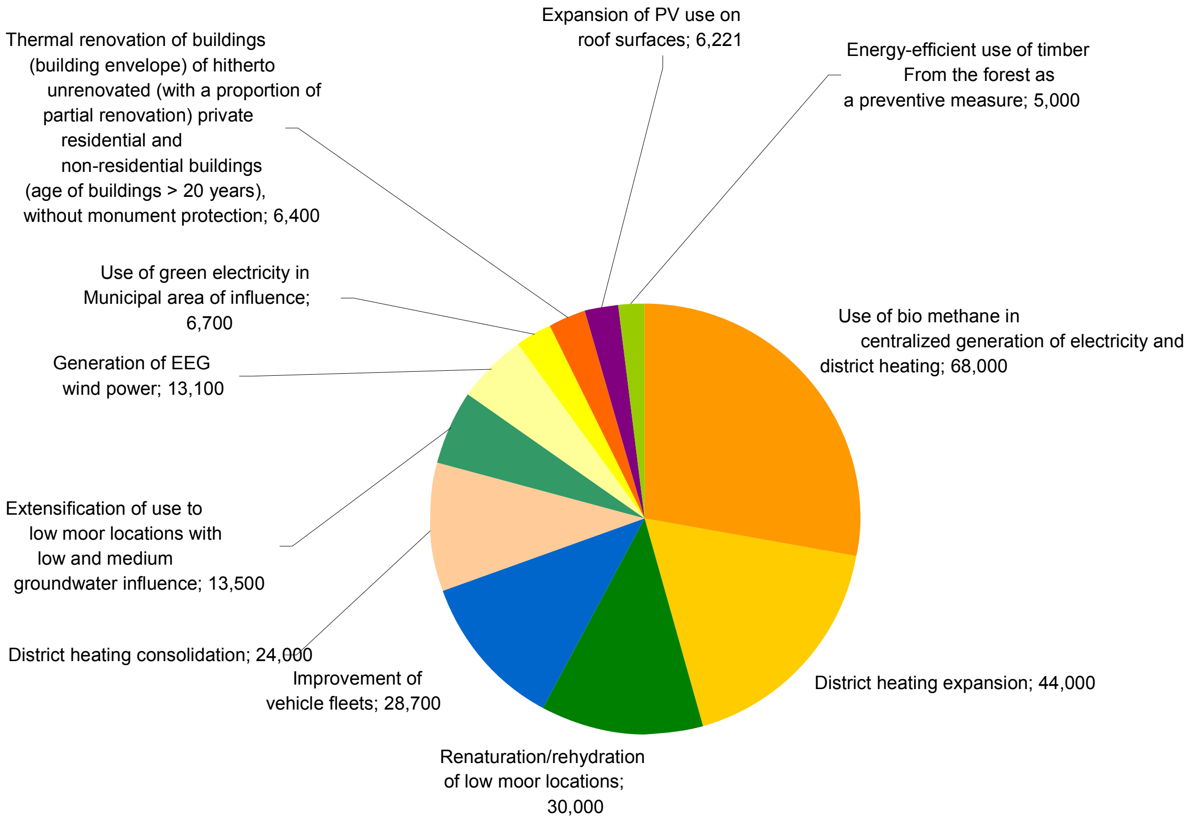

Fig. 2.2: Measures with the highest saving potential

With these 11 measures (altogether 99 were suggested) the state capital climate protection target of emitting 173,334 t CO_2 less annually by 2020 would already be exceeded. In fact the first five measures would already be sufficient for simple target achievement: the measures

4. Use of bio methane in centralised generation of electricity and district heating (68,000 t CO_2 annually),

5. Expansion of the district heating grid network (44,000 t CO_2 annually),

6. Renaturation and rehydration of low moor locations (30,000 t CO_2 annually),
7. Improvement of the vehicle fleets (28,700 t CO_2 annually) and
8. District heating consolidation (24,000 t CO_2 annually)

already achieve a total saving potential of 194,700 t CO_2 annually. It has to however be pointed out that measures to do with low moors in particular cannot be part of target achievement, as emissions which are currently not part of the CO_2 state capital account balancing are avoided. Should a scenario therefore be developed which can actually achieve the saving potential of the city under the specific requirements of the 2007 resolution, these measures have to be filtered out. The measure ‘improvement of vehicle fleets’ should also be taken out of the following contemplation. In this case balancing the emissions is not a problem, but the measure is already being partially carried out due to the improvement of propulsion technology already in the motor vehicle market.[1]

Under consideration of the mentioned restrictions with regard to the selection of measures, a scenario can be developed that fulfils the saving potential by 2020 with only eight measures. Fig. 2.3 illustrates the distribution of the saving potential among the selected measures.

[1] The state capital could only ‘harvest’ the theoretically possible saving potential in accordance with its climate protection objectives if it also ensures through its own measures – e.g. introduction of an environmental zone based on the model of Berlin for instance – that in case a new motor vehicle is purchased, the ‘cleaner’ option will be chosen. In addition to this it has to be ensured that fleet renewal is not accompanied by an increase in engine sizes or driving performance.

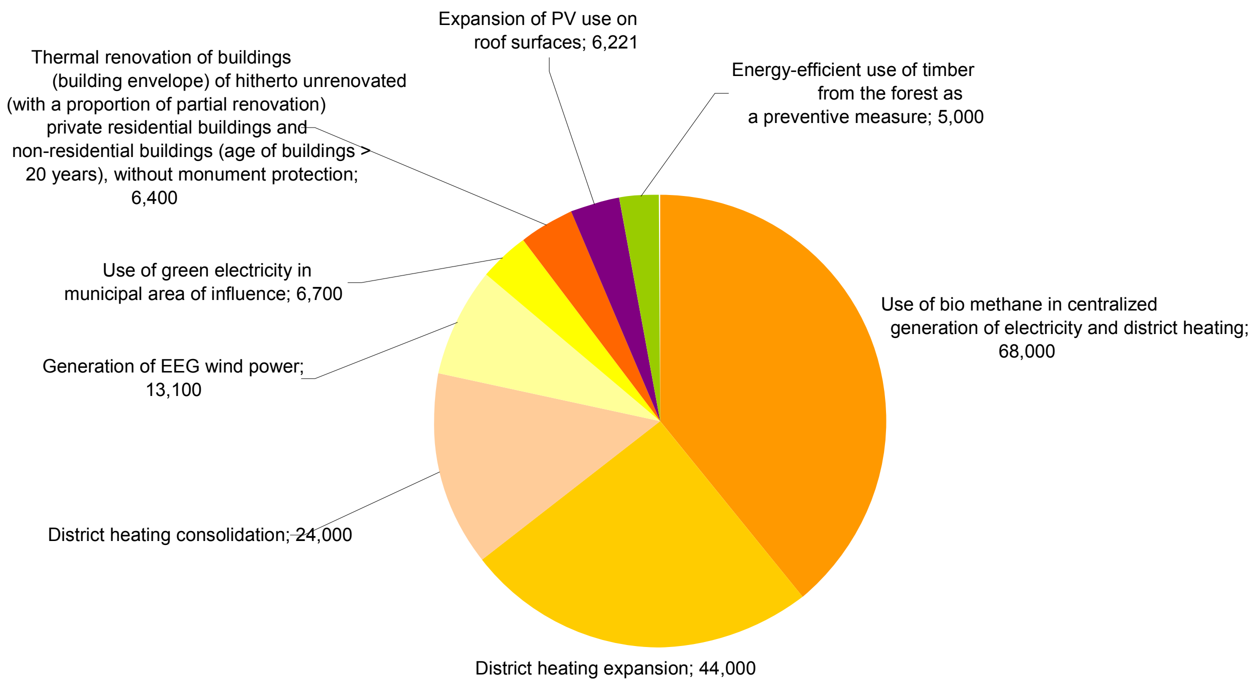

Fig. 2.3: Measures of the Scenario - CO_2 Effectiveness

These eight measures achieve a total saving potential of 173,421 t CO_2 annually with total costs to the tune of 230,539,000 Euros. Table 2.1 presents an overview of the saving potential and costs of the selected measures. The costs are presented as total costs and costs that are the responsibility of the state capital. For some measures, no particulars with regard to the costs can be furnished by the appraisers. In order to however compute a total, a value of zero was assumed in these cases. In considering the totals it should be borne in mind that possible major costs that cannot be quantified at the moment have not been integrated.

Table 2.1: Overview of Measures for Scenario - CO_2 Effectiveness

No.	Measure	CO_2 reduction [t/a]	Total costs [Euros]	State capital share of costs [Euros]
1	Use of bio methane in the generation of centralised electricity and district heating	68,000	6,300,000	0
2	Expansion of district heating	44,000	53,000,000	n/s
3	District heating consolidation	24,000	17,000,000	n/s
4	Generation of EEG wind-generated electricity	13,100	11,700,000	0
5	Use of green electricity in municipal areas	6,700	2,000,000	2,000,000
6	Thermal renovation of buildings (building envelope) of hitherto unrenovated (with a proportion of partial renovation) private residential and non-residential buildings (age of buildings > 20 years), without monument protection	6,400	58,000,000	n/s
7	Expansion of PV use on roof surfaces	6,221	82,539,000	n/s
8	Energy-efficient use of forest timber as a preventive measure	5,000	n/s	n/s
	Summe	**173,421**	**230,539,000**	**2,000,000**

Most of the mentioned measures come from the action area of energy and buildings, as can clearly be seen in Fig. 2.4. Just fewer than 94% of the savings are achieved in the action area of energy and buildings. The remaining figure of about 6 % is then distributed amongst the action areas of solar roof potential and landscape and environmental planning. Comprehensive action areas, urban planning and development and public relations work do not feature at all in this measures portfolio.

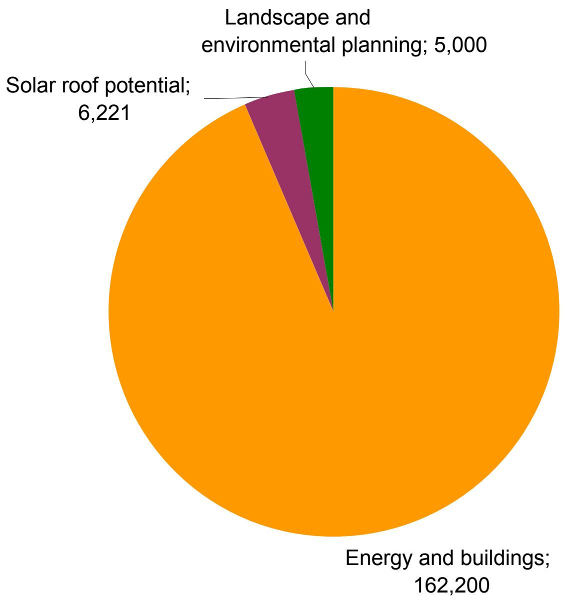

Fig. 2.4: Overview of the saving potential according to action areas

On the whole a scenario can in this way be developed which appears plausible at first glance. An expansion and consolidation of the district heating grids and the integration of renewable energy (use of bio methane and generation of EEG wind power) in the portfolio of the EWP complement each other convincingly. The use of renewable energy for the provision of district heating and in electricity production helps in keeping low the primary energy factor for district heating. District heating as a product can thus also remain competitive in the future, and in this regard an expansion and consolidation of the grids also makes sense in perspective. The key player in this measure is the EWP. If such a scenario were to become effective, the EWP would have to be the trailblazer. It is possible that a strategic alignment of the EWP to an environmentally friendly and climate-friendly energy service provider can also be successful in a commercial sense. This can however not be investigated conclusively within the framework of this report.

Further measures belonging to this bundle fall under the responsibility of the owners of residential and non-residential buildings: the expansion of PV use on roof surfaces and thermal renovation of buildings of hitherto unrenovated buildings that are not under monument protection. Renovation of buildings is particularly effective in terms of CO_2 reduction in areas that are not supplied with district heating. In order to exhaust this potential intensive advisory and consultation services and possibly also support programs at different levels will on the one hand be necessary, on the other legislative guidelines also at different levels are required – which are not part of this scenario. It is therefore doubtful that the measures selected here (without complementary measures such as e.g. the climate agency) would actually attain the forecast reductions.

In the use of photovoltaic, the same applies as with renovation of buildings. At federal level conditions have been created that make the installation of photovoltaic on roofs economically viable at cheap locations, however it cannot be assumed that a far-reaching penetration and comprehensive installation of these structures has been achieved, if these are not accompanied by measures to inform, clarify and guide.[1] Thus this contribution in this scenario will possibly also not achieve full potential with regard to the reduction of emissions, as other synergistic measures are not part of the scenario. A further measure that is related to the active participation of very heterogeneous stakeholders is the energy-efficient use of hitherto unexploited forest timber.

Finally, this scenario also contains a measure that falls within the area of responsibility of political and administrative institutions: the use of green electricity in the municipal area of influence. Specifically, this is a matter of its application in street lighting and consumption points of the KIS. With the help of this measure, the state capital can achieve its role model function in addition to fulfilling the climate protection objectives. Should these be the measures however, the credibility of the city with regard to climate protection issues would clearly be affected.

<u>To sum up, this scenario can be described as follows:</u>

EWP is the main stakeholder in the area of municipal climate protection. Therewith follows a new positioning of the EWP to a climate-friendly energy service provider. At the same

[1] Especially if the compensation for electricity fed into the grid according to EEG declines.

time most of the action areas will not be touched, or will be only be touched to a small degree. The costs for the state capital to the tune of about 195,000 Euros annually are very low – however any further profiling of the city with regard to climate protection should be stopped for reasons of credibility. Savings that are not achieved through EWP and the state capital have to be borne by the owners of residential and non-residential buildings and forest holders, however without availing of informational or advisory services, let alone legislative parameters at municipal level.

All in all, this scenario cannot be considered to be sustainable, as too few stakeholders are involved in the process and side benefits are completely disregarded. Objectives with regard to climate adaptation play as small a role as the stabilisation of regional economic cycles, quality of life and the development of sustainable urban structures. The participation of economic institutions and citizenry in the transformation process of the city is not aided and developed. Such an embodiment of the climate protection objective can in fact have a harmful effect for image, because it deals with climate protection in a non-credible manner. And lastly, a consistent and coherent strategy that is oriented towards longer term goals cannot be found in such an approach.

Although this scenario with just eight measures is supposedly simple to establish, it cannot be recommended that one relies on such few measures with high saving potential.

2.1.2 Scenario 2: Cost Efficiency

A further possibility for scenario development is to select measures on the basis of their costs. The measures portfolio should therefore contain measures that are as cost-effective as possible. Even here selection takes place though a measures ranking order: measures will be selected according to increasing total costs, until the CO_2 savings target of the federal state capital has been reached. Measures which do not contain concrete details regarding costs will not be considered in this scenario. The same also applies to measures which do not contain details regarding their contribution to CO_2 emission reductions (the CO_2 savings potential is also a target criterion with this measures selection method). As opposed to the preceding scenario (CO_2 effectiveness), considerably more measures will be required to achieve the climate protection objective. The total portfolio consists of a total of 23 measures with total costs of 186,052,900 Euros which will be required to achieve the objective of CO_2 reduction. Table 2.2 presents an overview of the measures of this scenario.

Table 2.2: Overview of Measures for Scenario - Cost Efficiency

No.	Measure	CO_2 reduction [t / a]	Total costs [Euros]	State capital share of costs [Euros]
1	Trees along streets, green areas along streets – use of hitherto unexploited biomass for energy extraction	1,500	0	0
2	Reduction of speed limits on BAB sections and Nuthestraße highway	2,900	6,000	n/s
3	Informative electricity billing/Smart Metering	2,060	6,900	0
4	Efficient behaviour in administration	120	25,000	25,000
5	Use of gas from purification plants KWK	617	110,000	0
6	Establishment of short-rotation plantations	1,600	240.000	0
7	Energy-efficient renovation (building envelope) of buildings (apart from schools and day-care facilities) belonging to the Kommunalen Immobilienservice [Municipal Real Estate Service] (KIS), age of buildings > 20 years	77	615,000	615,000
8	Car sharing (conventional)	300	1,250,000	n/s
9	Use of green electricity in the municipal sphere of influence	6,700	2,000,000	2,000,000
10	Thermal renovation of buildings (building envelope) of hitherto unrenovated non-residential buildings of the state of Brandenburg (Brandenburgischer Landesbetrieb für Liegenschaften und Bauen [Brandenburg Federal Institution for Real Estate and Construction]), (age of buildings > 20 years)	330	2,800,000	0
11	Establishment of a climate agency	835	3,200,000	1,600,000
12	Decentralised power generation (thermal heat pumps)	886	5,000,000	0
13	Use of decentralised mini combined power and heating plants	1,700	5,600,000	n/s
14	Energy-efficient renovation (building envelope) of schools and day-care facilities belonging to the Kommunalen Immobilienservice [Municipal Real Estate Service] (KIS), age of buildings > 20 years	293	6,200,000	6,200,000
15	Use of bio methane in the generation of central power and district heating	68,000	6,300,000	0
16	Use of aquifer storage for seasonal heat storage	6,000	8,000,000	0
17	Energy-efficient renovation (building envelope) of unrenovated old residential buildings under monument protection belonging to Pro Potsdam Ltd. (without Drewitz / age of buildings at least 20 years)	680	11,000,000	0
18	Generation of EEG wind-generated electricity	13,100	11,700,000	0
19	Energy-efficient renovation (building envelope) of unrenovated (with a proportion of partial renovation) old residential buildings not under monument protection belonging to Pro Potsdam Ltd. (without Drewitz / age of buildings at least 20 years)	1,800	12,000,000	0
20	District heating consolidation	24,000	17,000,000	n/s
21	Energy-efficient renovation (building envelope) of unrenovated old residential buildings belonging to Pro Potsdam Ltd. in Drewitz / age of buildings at least 20 years	430	17,000,000	0
22	Thermal renovation of buildings (building envelope) of hitherto unrenovated private residential buildings and non-residential buildings under monument protection (age of buildings > 20	1,200	23,000,000	n/s

	years)			
23	District heating expansion	44,000	53,000,000	n/s
	Summe	**179,128**	**186,052,900**	**10,440,000**

Due to these measures total costs accrue to the tune of about 186 m. Euros which is considerably less than in the preceding scenario. The selected measures come from five of the total of 7 action areas. Even if there are more action areas as part of the scenario, a clearer focus on measures from the action area of energy and buildings (see Fig. 2.5) can be identified here: just less than 95 % of the savings potential is generated in this action area. If the objectives require that measures also generate savings, it is not surprising that measures from the area of urban planning and development do not feature in the developed scenarios. (See also Fig. 2.1).

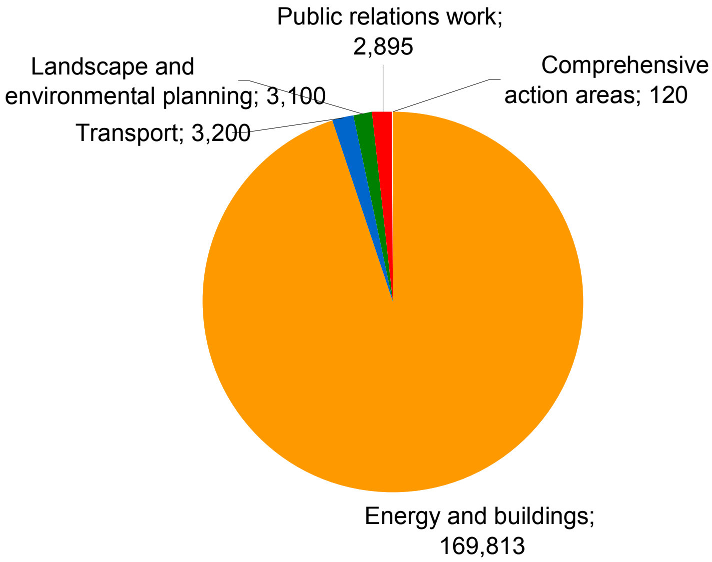

Fig. 2.5: Overview of the Action Area Scenario of Cost Efficiency

Even this scenario is not altogether unrealistic. For the action area of Energy there will be a combination of the measures of district heating expansion and consolidation and the use of bio methane. In this scenario an aquifer reservoir shall also be used to save heat seasonally. The use of renewable energy is particularly meaningful in combination with a seasonal thermal storage system as the central heat and electricity production can be decoupled seasonally. For the production of bio methane, hitherto unexploited biomass obtained from trees and green areas along streets should be used. When this bio methane is used in the GuD combined heat and power station, it should naturally not be doubly recorded as an emission reduction. But it can be as equally well used to substitute natural gas in other processes. It is likewise conceivable that the biomass is used for energy-related purposes other than bio methane production. Apart from bio methane, gas from purification plants is also supposed to be used in power-heat coupling processes. The establishment of short-rotation plantations (KUP) to extract biomass that can be used for energy-related purposes is also recommended. Other renewable energy sources will also be integrated into the portfolio of the EWP through the generation of EEG wind-generated electricity. In this scenario as well, the EWP is the key player in energy supply, at least in the area of district heating grids. In this scenario decentralised (power and) heat generation will be supplied through the expansion of decentralised thermal heat pumps and mini combined heat and power plants (KWK) outside the grids network.

On the demand side, stakeholders in this scenario are requested to reduce power demand through renovation. Unlike in the previous scenario, here it is not only the private owners of residential and non-residential buildings who are actively involved, renovation of buildings (also those under monument protection); even those belonging to PRO POTSDAM, KIS as well as state properties are also requested to do the same. In perspective, building renovation covering the whole region with its corresponding reduction in heating demand, with a simultaneous expansion of the district heating supply can lead to an oversupply of district heating. It is therefore all the more important that electricity production is partially decoupled from heat production (EEG wind-generated electricity). The aquifer storage facility can further contribute towards defusing the conflict.

Due to the comprehensive use of Smart-Metering users should to be motivated to handle electrical energy efficiently and very considerable amounts of reduction are expected. In addition to this green electricity is also supposed to be used within the municipal sphere of influence in this scenario. Efficient behaviour that also applies to administrative institutions should contribute towards reducing emissions.

Reduction in the area of transport in this scenario will on the one hand be achieved through Car Sharing and on the other through the reduction of speed limits on federal highways.

And finally, the establishment of a climate agency will help to ensure that discussions and consultations take place and that information diffuses down to all societal classes. In addition to this the image of the city as well as the EWP (and other shareholders) with regard to climate protection can be profiled quite markedly.

EWP is also one of the main stakeholders in this scenario (district heating grid networks, bio methane, aquifer storage facilities, Smart-Metering etc.), a major role is however also played by the state capital Potsdam itself. This is because the role model function of the state capital is needed here to a greater extent, such that the renovation of buildings within the influence area of the state capital (and municipal companies) should be carried out. The establishment of a climate agency in a sense illustrates the institutionalised commitment of the city and municipal companies towards climate protection. Part of the work of the agency will be to present the climate protection objectives of the city and its companies to the public. A further objective is to generate commitment and involvement on the part of the citizenry and economic partners. Topics such as climate adaptation will also be handled here, even if preferably in an implicit manner. On the whole this scenario is more balanced, however strategic measures that concern the future development and planning of the city are also missing here. Measures that involve political and administrative institutions are also not far-reaching enough: the role model function of the city can only be fulfilled inadequately.

2.1.3 Scenario 3: The Ideal Scenario

The approach towards the development of this scenario is fundamentally different from the other two that have already been presented and described. Here, a selection of measures and their subsequent evaluation should not take place only on the basis of quantifiable criteria. Instead there is a selection and thus also a prioritisation of measures on the basis of a longer term strategic plan of which 2020 is a stage on the path towards the emission target for 2050. The climate change policy ideal that was already mentioned in chapter 1 comes into play. A certain breadth and coherency of the measures is required so that all possible action areas and as many stakeholders as possible are included in the reduction process.

In chapter 1 an ideal was already described that made a breakdown in the areas of

- political and administrative institutions,
- energy supply,
- buildings,
- transport,
- urban development and
- public relations work.

From these descriptions a scenario with several points of focus and corresponding development perspectives can be designed by bundling the measures of the respective action areas.

<u>Measures from the comprehensive action areas (political and administrative institutions):</u>

In these action areas, measures were chosen which should move the topic of climate protection from niche position to a cross-cutting one within political and administrative institutions. By implementing these measures the city undertakes its role model function and emphasises its credibility through sustainable administrative behaviour. Table 2.3 presents an overview of the measures from the comprehensive action areas which should be part of the ideal scenario.

Table 2.3: Measures for Ideal Scenario - Comprehensive Action Areas

No.	Measure	CO_2 reduction [t / a]	Total costs [euros]	State capital share of costs [Euros]
1	Reorganisation of the coordination office for climate protection	n/s	10,000	10,000
2	Climate check for municipal council assembly resolutions	n/s	0	0
3	Climate protection funds	n/s	2,000	0
4	Efficient behaviour in administrative institutions	120	25,000	25,000
5	Climate protection related bonus-malus system	n/s	2,000	2,000
6	Climate protection in tendering, investments and procurement	n/s	2,000	2,000
7	Monitoring und evaluation	n/s	0	0
	Total	**120**	**41,000**	**39,000**

Measures from the action area of energy and buildings

Energy supply plays a key role in municipal climate protection concepts. The ideal in this regard is oriented towards following the strategies of:

9. Reduction of CO_2 emissions as a contribution towards the objectives;

10. Reduction of the use of fossil energy for the sustainable protection of natural resources;

11. Reduction of power demand.

These strategies require, on one hand, the inclusion of existing district heating grids as well as, at the same time, an increased use of renewable energy in the energy mix. And finally, measures are required which tackle consumption and lower power demand through the renovation of buildings. These deliberations give rise to a portfolio of measures as listed in Table 1.4.

Table 2.4: Overview of Measures for Ideal Scenario Action Area of Energy and Buildings

No.	Measure	CO_2 reduction [t / a]	Total costs [Euros]	State capital share of costs [Euros]
1	District heating consolidation	24,000	17,000,000	n/s
2	District heating expansion	44,000	53,000,000	n/s
3	Use of decentralised mini combined heat and power plants	1,700	5,600,000	n/s
4	Thermal renovation of buildings (building envelope) of hitherto unrenovated (with a proportion of partial renovation) private residential and non-residential buildings (age of buildings > 20 years), without monument protection	6,400	58,000,000	n/s
5	Energy-efficient renovation (building envelope) of unrenovated (with a proportion of partial renovation) old residential buildings not under monument protection belonging to Pro Potsdam Ltd. (without Drewitz / age of buildings at least 20 years)	1,800	12,000,000	0
6	Energy-efficient renovation (building envelope) of schools and day-care facilities belonging to the Kommunalen Immobilienservice [Municipal Real Estate Service] (KIS), age of buildings > 20 years	293	6,200,000	6,200,000
7	Energy-efficient renovation (building envelope) of buildings (apart from schools and day-care facilities) belonging to the Kommunalen Immobilienservice [Municipal Real Estate Service] (KIS), age of buildings > 20 years	77	615,000	615,000
8	Decentralised generation of energy (thermal heat pumps)	886	5,000,000	0
9	Use of gas from purification plants-combined heat and power plants	617	110,000	0
10	Use of aquifer storage facilities for seasonal heat storage	6,000	8,000,000	0
11	Use of bio methane in the generation of central power and district heating	68,000	6,300,000	0
12	Generation of EEG wind-generated electricity	13,100	11,700,000	0
	Total	**166,873**	**183,525,000**	**6,815,000**

Measures from the action area of solar roof potential

Just like measures from the action area of energy and buildings, measures of this action area make a contribution towards the increasing use of renewable energy in the whole urban municipal area. The selected measures ‘expansion of PV use on roof surfaces’ and ‘expansion of solar thermal energy use on roof surfaces’ make a direct contribution towards the reduction of emissions. Putting up a solar roof website and the integration of solar exchanges help the objectives, and most of all in actively conveying opportunities for grant programmes to citizens and economic institutions. Tab. 2.5 summarizes the recommended measures in this action area.

Tab. 2.5: Overview of Measures for Ideal Scenario Action Area of Solar Roof Potential

No.	Measure	CO_2 reduction [t / a]	Total costs [Euros]	State capital share of costs [Euros]
1	Expansion of PV use on roof surfaces	6,221	82,539,000	n/s
2	Expansion of solar thermal energy use on roof surfaces of residential buildings	1,711	71,318,100	n/s
3	Setting up a solar roof website	n/s	20,000	20,000
4	Integration of a solar exchange in the solar roof website	n/s	n/s	n/s
	Total	**7,932**	**153,877,100**	**20,000**

<u>Measures from the action area of transport</u>

There are many good reasons regarding climate protection, but also environmental and health protection (through air pollution and noise control), which indicate that the urban growth forecast should not translate into an increase in motorised private transport. In order to prevent this, the environmental transport mix has to be rethought and new coordinated offers developed. A selection of the measures can be found in Table 2.6.

Table 2.6: Overview of Measures for Ideal Scenario Action Area of Transport

No.	Measure	CO_2 reduction [t / a]	Total costs [Euros]	State capital share of costs [Euros]
1	Parking space management	3,700	n/s	n/s
2	Further acceleration of short-range public transportation	50	n/s	n/s
3	Mobility management for new citizens	60	n/s	n/s
4	Mobility management in industry	2,500	n/s	n/s
5	Support of bicycle traffic	1.300	n/s	n/s
6	Car sharing (conventional)	300	1,250,000	n/s
7	'City of short distances' through promotion of local amenities	650	n/s	n/s
8	Car sharing with E-Propulsion (garden town of Drewitz)	320	n/s	n/s
9	Stabilisation of traffic in the main roads network	930	n/s	n/s
10	Reduction of speed limits on BAB sections and Nuthestraße	2,900	6,000	n/s
	Total	**12,710**	**1,256,000**	**n/s**

As mentioned already the establishment of an environmental zone could accelerate the process of modernization of the vehicle fleet and thus also the reduction of fleet emissions.

In this case considerable additional amounts of CO_2 could be saved. However the economic and political costs for this can also not be calculated.

Measures from the area of landscape and environmental planning,

An important primary objective of the measures in this action area concern issues of adaptation to the inevitable climate change and this means that the growth of the city has to be patterned in a sustainable and climate-friendly manner. Green areas and water surfaces in public and private spaces have to be expanded.

However measures which also foster sustainable forestry and agriculture can make a contribution towards adaptation and climate protection. It especially has to be checked whether another approach regarding low moor locations can help in emissions prevention in the future. As there is still need for research in this area, a measure should be a feasibility study on this topic. All measures in this action area are presented in Table 2.7.

Table 2.7: Overview of Measures for Ideal Scenario Action Area of Landscape and Environmental Planning

No.	Measure	CO_2 reduction [t / a]	Total costs [Euros]	State capital share of costs [Euros]
1	Feasibility study on the topic 'Renaturation and extensification of low moor locations'	0	15,000	15,000
2	Conservation measures for forests with rich reserves as carbon storage	1,350	n/s	n/s
3	Retention of water in the landscape	n/s	n/s	n/s
4	Protection of open spaces within the city	n/s	0	0
5	Protection and enhancement of the volume of green areas within the city as well as unsealing in polluted and moderately polluted areas	n/s	0	0
	Total	**1,350**	**15,000**	**15,000**

Measures from the action area of urban planning and development

In this action area as well the objectives of climate adaptation and climate protection are pursued. The model of a compact city with the principles of sustainable urban development is considered to be an orientation framework with regard to urban planning. The economical use of surface area and resources contributes towards avoiding unnecessary roads and thus also unwanted traffic. To prevent overheating through high housing density a measured value has to be introduced which can give information about climatic pollution in the urban area. In this regard the green volume number is recommended as a measure value in land-use plans. Table 2.8 presents an overview of all the measures recommended in this scenario.

Table 2.8: Overview of Measures for Ideal Scenario Action Area of Urban Planning and Development

No.	Measure	CO_2 reduction [t / a]	Total costs [Euros]	State capital share of costs [Euros]
1	Promotion of compact settlement structures	n/s	n/s	n/s
2	Prevention of non-integrated structures with additional traffic generation	n/s	n/s	n/s
3	Stipulation of climate objectives in land-use plans	n/s	n/s	n/s
4	Climate-friendly land-use plans with GVZ specifications	n/s	n/s	n/s
	Total	**n/s**	**n/s**	**n/s**

Measures from the action area of public relations work

A climate protection concept cannot be based on administrative and political institutions alone – an engaged citizenry and active economic institutions are necessary in order to achieve ambitious targets in a sustainably. Climate protection has to be anchored in the self-image of the city, in the fashion of the brand name components ‘city of science’ or ‘UNESCO World Heritage’. A comprehensive range of advisory services regarding the objectives of climate protection and climate adaptation as well as funding opportunities is recommended in order to achieve these secondary goals. There continues to be a need to make climate protection visible to the public, on one hand through campaigns and events and on the other with regard to urban building e.g. through a science centre. All suggested measures of this action area are presented in Table 2.9.

Table 2.9: Overview of Measures for Ideal Scenario Action Area of Public Relations Work

No.	Measure	CO_2 reduction [t / a]	Total costs [Euros]	State capital share of costs [Euros]
1	Establishment of a climate agency	835	3,200,000	1,600,000
2	Internet presence of climate protection in Potsdam	n/s	n/s	n/s
3	Potsdam Climate Prize (award ceremony)	n/s	300,000	150,000
4	Potsdam Green Castles Night	9	n/s	0
5	Climate-friendly tourist products	n/s	n/s	n/s
6	Potsdam Science-Center	n/s	n/s	20,000
7	Campaign ‚Tree planting'	n/s	73,000	40,000
8	Informative electricity billing/Smart Metering	2,060	6,900	0
	Total	**2,904**	**3,579,900**	**1,810,000**

An even more far-reaching justification for the selection of the measures can be found in chapter 1

<u>Summary of the Ideal Scenario</u>

In this scenario a total of 50 measures with a total saving potential of about 191,889 t CO_2 annually till the year 2020 were selected from all action areas. Table 2.10 presents an overview of the amounts of the respective action areas.

Table 2.10: Measures for Ideal Scenario Action Area of Transport

Action area	Number of measures	CO_2 reduction [t / a]	Total costs [Euros]	State capital share of costs [Euros]
Comprehensive action areas	7	120	41,000	39,000
Energy and buildings	12	166,873	183,525,000	6,815,000
Solar roof potential	4	7,932	153,877,100	20,000
Transport	10	12,710	1,256,000	n/s
Landscape and environmental planning	5	1,350	15,000	15,000
Urban planning and development	4	n/s	n/s	n/s
Public relations work	8	2,904	3,579,900	1,810,000
Summe	**50**	**191,889**	**342,294,000**	**8,699,000**

A balanced portfolio of measures was selected here to achieve the objectives for climate protection, climate adaptation and sustainable urban development. A total of just less than 192,000 t CO_2/a in reductions is achieved in this scenario. The reduction target in this case has been thus slightly exceeded. The total costs are about 342 m. Euros; these are however divided between diverse stakeholders and a certain uncertainty regarding costs.

2.1.4 Comparison of Scenarios

Three different scenarios were developed, presented and evaluated. Table 2.11 presents a short overview of the scenarios.

Table 2.11: Comparison of the scenarios

Scenario	Number of measures	CO_2 reduction [t / a]	Total costs [Euros]	State capital share of costs [Euros]
1: CO_2 effectiveness	8	173,421	230,539,000	2,000,000
2: Cost efficiency	23	179,128	186,052,900	10,440,000
2: Model scenario	50	191,889	342,294,000	8,699,000

The table shows that the CO_2 effectiveness scenario consists of the fewest measures, and is at the same time the most cost-effective for the state capital. The small number of measures implies that correspondingly few stakeholders are involved in the climate protection concept. Political and administrative institutions in particular play just a small role in this scenario.

The cost efficiency scenario has the lowest total costs. For that the costs of the state capital are strikingly higher. A good 23 measures are integrated in this scenario and accordingly more stakeholders involved. By far the greatest emissions reduction potential is to be found in this scenario as well in the effectiveness scenario falling under the responsibility of the EWP.

This immediately begs the question of why the state capital should achieve its climate protection objective with 342 million Euros (model scenario) and not with the cost efficiency or CO_2 effectiveness scenario (186 and 230 m. respectively). The effectiveness scenario in particular would actually be very cost-effective for the city of Potsdam itself (with about 2 million Euros) whereas it would actually have to come up with almost 8.7 million Euros for the model scenario.

Common to the CO_2 effectiveness scenario as well as the cost efficiency scenario is that neither climate adaptation objectives nor further secondary ones are taken into consideration. The ideal scenario however pursues the objectives of sustainable urban development and climate change mitigation and adaptation with a holistic approach. Stakeholders from a broad spectrum of citizenry, economy, administration and politics are addressed through all 50 measures. At the same time the costs arising for the state capital are less than those of the cost efficiency scenario. The awareness-raising measures in it however fall short as regards citizenry and economic partners. This endangers the sustainability of this scenario that does have to continue being developed even after 2020, in order to achieve the target of 2.5 t CO_2 per head and year (or less) by 2050. We therefore advocate for the ideal scenario that, due to its coherency and balance of measures, has the greatest chance of steering the whole city towards the ideal of a low carbon city.

2.2 Potsdam in Comparison

The climate protection concept presented here was commissioned by the city of Potsdam and so compiled by an institute acting as consortium leader, which is recognised internationally for its research on climate change. In the development of the overall concept the Potsdam Institute for Climate Impact Research considers, due to its interdisciplinary compilation, the socio-economical, cultural and political implications of climate protection in addition to the focus on CO_2 numbers and technological improvements. This action oriented and integrative climate protection concept anchors the core item of any climate protection concept, the measures package, in an ideal of a climate-conscious city and connects the individual action areas with each other in an integrative manner. Climate protection in Potsdam is supposed to become a 'top priority' issue with cross-sectional character, which is why the suggested measures were not divided into target groups, but rather action areas in which the various stakeholders interact with each other and where they should then also be addressed. With also this in mind an extra chapter was devoted to the comprehensive action areas and measures.

In the states of former East Germany the number of climate protection concepts developed is still low[1]. Within the framework of the BMU *[Federal Ministry for the Environment, Nature Conservation and Nuclear Safety]* support programs, 38 out of a national total of 390 concepts[2] were for instance created there. This may possibly be due in part to the difficult situation (weak structures, demographic development) of many East German cities, or also due to the fact that the subject of climate protection does not yet have a high importance. As one of the few growing and economically dynamic cities in the states of former East Germany Potsdam therefore shows that it takes its responsibilities towards climate change policy quite seriously, when it uses these favourable conditions to advance climate protection in the city and serve as a trailblazer and role model.

The measures package of the Potsdam climate protection concept contains 99 measures. Many of these could also be referred to as 'soft' measures, as they cannot be quantified for any CO_2 savings. Other climate concepts also take up such soft measures in their catalogues. For Mannheim for example, a climate protection agency, a climate protection headquarters, a communication concept, an internet platform and special climate protection programmes such as for sports clubs have been suggested (cf. Institut für Energie- und Umweltforschung Heidelberg GmbH (IFEU) (2009a)).

These soft measures have not been conceived as possible extras, but should rather be an integrated component of the climate strategy. During the development of the ideal scenario for Potsdam they were taken into account very deliberately, as it is assumed that they exponentiate the CO_2 reducing effect of other measures or even make these possible in the first place. Other climate protection concepts also work with scenarios. For Mannheim (cf. Institut für Energie- und Umweltforschung Heidelberg GmbH (IFEU) (2009a)) for instance, two scenarios for areas of energy and transport till 2020 were developed. The trend

1 Examples of active cities in this regard are Erfurt (http://www.erfurt.de/ef/de/leben/oekoumwelt/klimaschutz/) and Dresden (http://dresden.klimastrategie.de/).

2 http://www.kommunaler-klimaschutz.de/bmu-f%C3%B6rderprogramm/zahlen-und-fakten

scenario continues with the dynamic shown till 2005. The climate scenario incorporates the measures suggested in the areas of efficiency and energy supply. For Munich (cf. Öko Institut (2004)) a reference scenario and two target scenarios were developed, one with a reduction target of 50% by 2030 and one with a reduction target of 44% by 2030. In so doing measures to do with technical efficiency and transport structures were taken as a basis. In the development of scenarios for Potsdam, calculations were not done for energy consumption, but rather three possibilities were taken to show how the reduction target of Potsdam can be achieved with the help of some of the suggested measures. 'Soft' measures, those to do with planning, structural policy and communication were also incorporated in addition to technical improvements (such as insulation for buildings).

Potsdam finds itself in a good starting position to become active not only in the area of energy consumption but also energy generation with regard to matters of climate protection. The percentage of mains power supply generated by the public utility companies amounts to 83%, which even makes it possible in the first place to exert influence through suitable measures. Other cities such as Lübeck or Stuttgart could hardly include energy generation in their climate concepts as they obtain most of their electricity from national public utility companies. The percentage of electricity generation in Lübeck, for instance, is about 8% of the mains power supply, which turns the public utility companies in Lübeck into typical energy distributors as compared to the public utility companies in Potsdam. Lübeck however wants to remove this deficit by 2020 and generate 40% of its electricity turnover itself. 20% of this should come from renewable sources by 2020 (cf. URS (2010)). In contrast to this the city of Mannheim generates, just like Potsdam, its own electricity and heat from combined heat and power, however unlike in Potsdam not from a gas-operated thermal power station, but rather a mineral coal power station. Replacing this with a modern station e.g. a GuD combined heat and power station will require high capital costs (cf. Institut für Energie- und Umweltforschung Heidelberg GmbH (IFEU) (2009a)). As it was already possible to achieve a significant CO_2 reduction in the municipal area of Potsdam in the mid-90s due to the switch to an energy-efficient GuD power station, further efforts have to be evaluated taking this into consideration. It is easier for towns that have not yet switched to more efficient supply of electricity and heat energy to achieve additional CO_2 reductions.

The Potsdam climate protection concept goes in some areas beyond that which climate protection concepts normally contain. In the Lübeck concept for example, a heat atlas as well as a solar roof cadastre were recommended as further analyses and partial climate concepts. In the case of Potsdam these are already part of the climate protection concept. Or put another way: the implementation of individual measures, with whose help great potential can be revealed, is already part of the Potsdam climate protection concept. Many climate concepts also concentrate on the areas of energy and residential building matters, transport and public relations work. The areas of landscape and environmental planning, urban planning and urban development are seldom addressed. And yet urban planning especially has an integrative character with regard to other action areas which overlap in this case, such as e.g. energy, residential buildings and transport, but also with regard to social aspects such as 'gentrification' or the access to public goods which are important for the acceptance of climate protection in a city and consequently also play a role in public relations work.

A series of measures is suggested for Potsdam in the area of transport, which prevent the increase of motorised private transport and targets the relocation of the Modal Split to unmotorised transport. Cities such as Münster or Tübingen are mentioned time and again as role models in this regard. In Münster for example, more than 37% of distances are covered by bicycle. The bicycle path network stretches over 300 km; 10 km are special bicycle roads. Radstation [bicycle station] Münster, the largest bicycle parking house in Germany, has 3,500 bicycle parking spaces available. In addition to this, cyclists in Münster are in a better legal position due to special regulations.[1] Münster is not only the bicycle capital city, it was also twice voted, in 1997 and 2006, as the climate capital city. The city has been active in matters of climate protection since the 1990s. Between 1990 and 2006 it was able to lower the CO_2 emission per resident by 10% (cf. Institut für Energie- und Umweltforschung Heidelberg GmbH (IFEU) (2009b)). Münster thus acts as a role model for many other cities in matters of climate protection and also carries out active marketing for itself using this image.

Potsdam is still a young player in matters of climate protection. In contrast to Münster, the self-image of the city is not (yet) shaped by climate protection. Potsdam as the city of scientific institutions however has enough potential that should be used. This is shown by the active citizenry, the citizen solar plant and the energy forum (EFP).

1 http://www.muenster.de/stadt/stadtplanung/radverkehr-konzept2010.html

2.3 Looking to 2050

The main emphasis of this study lies – as commissioned – in a concept that can be implemented in the short- and mid-term. In accordance with the philosophy that the first step is always the most difficult we concentrated on the year 2020. On 01.01.2021 the topic of climate change for Potsdam will on no account have been resolved. It is rather much more important to bring the 'super tanker' city early enough onto a course that will offer sufficient opportunities after 2020 to let the objectives targeted for 2050 not seem utopian any more.

It is in the nature of things that the ideas suggested in this report are much less concrete for the year 2050 than for the year 2020. Neither the technological nor the economical development of the next 40 years can be predicted with any amount of certainty. Trend researchers and researchers of future scenarios try to do so, but the fact that they put away their books every few years because they are completely outdated or revise these afresh indicates that the business of predicting the future is a difficult one. Even those with fewer claims who „only" design scenarios of a possible future have to factor in very different possibility horizons and take into account all manner of 'wildcards' – if these could even be 'calculated'.

On the other hand human history is also full of examples of very linear, unsurprising developments. Such path dependencies restrict – for better or for worse – the potential of a society. With an eye to anthropogenic climate change, such a path dependency only exists due to the inertia of the earth systems: even if CO_2 emissions would be stabilised with immediate effect all over the world, global warming would continue. And according to all that we know about these emissions, a global trend reversal in the next 10 to 20 years is highly desirable and perhaps even not impossible, but rather unlikely.

It is therefore probable that the state capital Potsdam will have to cope with a warmer and on average rather dry climate in the metropolitan region of Berlin-Brandenburg in the year 2050. The adaptation measures recommended here should therefore be implemented wisely and periodically reviewed and further developed while observing the developments. It belongs to the ideal of a resilient city, i.e. one whose (dynamic) balance cannot be easily upset by external disturbances and shocks to adopt a 'culture of adaptation' that has routinely built up exactly this continuous monitoring and implementation process. The state capital with its extensive scientific structure offers very good conditions for this, provided she succeeds in establishing stable industrial relationships with the scientific monitoring system which can be activated quickly, and which on its part should take up a service provision function towards the state capital and the region.

By the year 2050, the inner-city fountain concept suggested here (as part of the municipal water management) could have led to a 'pearl chain' of public and semi-public places with a high residential value as well as a buffering function for the urban climate – complemented by an upgrading of the green areas in the city. By the year 2050 there may be the possibility once again to serve as a location for a federal or state horticultural show, where the city, which by then will be even greener and that will have been made even more attractive by municipal fountains, can serve as a satellite and entrance gate for the actual Buga grounds.

The population of Potsdam has been rising steadily for a few years now; it is therefore not rocket science to assume that it will have grown strongly by 2050. If the space reserves that have been available for municipal purposes do not fall victim to an uncontrolled ‘urban sprawl’, the spatial and urban planning concepts envisaged in this report have to be implemented and developed further. Concentration areas can emerge in the more outlying areas of Potsdam that were hitherto fairly rural – just as in abandoned barrack areas closer to the city. However, just like in core inner-city areas, these should be condensed wisely, which suggests an utilisation mix of residential, business and leisure time activities. These concentrated zones have to be connected by an attractive and low-emission (by 2050 perhaps even: emission-free) local public transport system, without it coming to an excessive increase in the use of motorised private transport between them. This also implies pioneer settlement forms from an urban planning and architectural point of view.

This incidentally also applies to the largely historical inner-city. Potsdam’s architectural heritage – strongly characterised by the Baroque period, the early 19th century and the years of rapid industrial expansion, as well as art nouveau – is a UNESCO World Heritage cultural site for good reason and also represents an economically important asset of the city. It will still exist in the year 2050 and will even be complemented in the coming years by the new buildings constructed with a historical appeal. Not only taking care of its heritage, but also honouring the spirit that once brought it forth are things that belong to the future sustainability of a city. The Baroque period was for instance characterised by a train of self-aggrandisement and demonstrations of power that still impress today – and to which we owe many buildings in Potsdam. For the sake of making this style a structural reality at that time, many older buildings were rebuilt or simply demolished. We do not want to and cannot afford such boastful gestures along with the destructive implications of the respective past – not out of weakness, but rather out of appreciation and responsibility. However a city that is and wants to remain a World Heritage cultural site always has to do more than just tend and manage its cultural heritage. It has to express its own vitality and presence as well as its view of a future worth living in through its buildings. That is the reason why we – with a not inconsiderable expansion of the term ‘comprehensive measures’ – e.g. recommended an architecturally sophisticated new construction of the Plusenergy Potsdam Science Centre. Residential construction in Potsdam in particular has in the last few years permitted the emergence of houses and settlements which epitomise anything but building culture. If one asks the involved parties, what clients desire or are ready to pay for is what is built. If Potsdam continues along this path in 2050 – in view of the looming population growth – it will waste the chance to bring its structural present even just close to eye-level with its structural past. As a weak heir of its powerful past it will put the past to shame through the lack of culture in its new buildings. It is doubtful whether this will attract more tourists to Potsdam.

It seems more promising to use the strategic perspective of a Low Carbon City by 2050 to emphasise the innovative constructional character of its new buildings through an aesthetically demanding building culture. Our discussions with representatives of the housing industry show that this does not necessarily have to mean that Potsdam will only want to have new inhabitants who are rich in the future. It is part of the social responsibility of the decision-makers in a city to visualise the mid- and long-term price development of fossil fuels. Whether the ‘peak oil’ hypothesis will already come to pass in 2011 or not until 2015 – at the moment there is a very controversial discussion going on – is actually not a primary concern for long-term planning. By 2050 fossil fuels – even just because of the over proportional growth of demand in emerging economies alone – will have in all probability become much more expensive. To protect the citizenry from the massive consequences of this development it is necessary to reduce the heat energy demand as well as power consumption in Potsdam’s buildings. The construction of new buildings is predestined to set visible signs of what Potsdam wants with regard to climate change policy.

By the year 2050 the combustion engines to be found on the roads, if at all, and operated by fossil fuels will probably be phase-out models. Even just to recover their not inconsiderable research and development costs (in addition to those of the nation), automobile companies will increase the proportion of electric drives (whether hybrid or clean). Together with an electricity supply based on renewable sources it will lay the foundation for motorised private transport to still play a sustainable role in the transport sector of the state capital even in the year 2050. Businesses in the transport sector will hopefully by then have blossomed into a mobility society to which bicycles, leasable electric cars of various sizes and functionality as well as replacement and compensation offers belong. It will hopefully become everyday practice in Potsdam long before 2050 to compute the inevitable personal residual emissions using one’s mobile phone on the bus, for instance, and to make decisions online about alternative possibilities for compensation using electronic banking. This is already technically possible today. The transport infrastructure of the city will also express this multimodal mix through the fact that cars will be less prestigious with regard to space and the control system. The options of riding bicycles and going on foot will spread, and the upgraded Green and Blue of the city will also make it more attractive. Innovative retail trade concepts will also support this mobility transformation.

Potsdam energy supply will find a concentrated and expanded district heating system as a historical heritage by 2050. Nevertheless the considerably sunken heat requirements of buildings will place the topic ‘Downsizing’ on the agenda. It will then be of help that the percentage of renewable energy in the network will have been considerably expanded in the time leading up to 2050. The isolated applications in the years after 2010 will have also assumed a new character: they will be the nodal points of a decentralised energy supply of the future. All this will however still not lead to the EWP having become history. As a provider of renewable electricity (possibly even nationally) and renewable heat in district heating areas, it will continue to be of considerable importance.

The lifestyles of the people of Potsdam in the year 2050 can perhaps be predicted with even less certainty than, for instance, the technological future. It is hoped that climate change and climate protection develop into a natural and, in a way, unexciting part of lifestyles in the city. And provided that there is success in bringing the urban carbon footprint of the city to the (maximum of) 2.5 t that is being targeted today, one can lean back and relax as regards climate matters and say: Potsdam played its part, did its homework, it can turn to new things. Till then there certainly remains a lot to be done.   .

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