

Notice from the Senate to the Hamburg parliament

Master Plan for Climate Protection – Objectives, content and implementation

A. Reason

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1.

Reason

In its work program from May, 2011, the Senate has made clear that it will show the achievement of its climate policy objectives in a Master Climate Action Plan. In the fourth updating of the Climate Action Plan 2007-2012, the Ministry of Urban Development and Environment is asked to present the Master Plan and, besides, also to report about the results of the evaluation of the Climate Action Plan, as well as to make a proposal for the content and organizational consolidation of the Master Plan, Climate Action Plan and climate change adaptation. These requests are complied with in the Master Climate Action Plan. Moreover, the still open issues of the Parliamentary request "Hamburg - ready for the energy transition; Benchmarks for a safe, inexpensive, and environmentally and climate-friendly energy supply for Hamburg" (Parliament circular 20/1229 from 10th August, 2011) are thematically treated in the Master Climate Action Plan if this has not already happened with the Parliament circular 20/2392 "Hamburg creates the energy transition - strategic investment of Hamburg in Power companies for electricity, gas and district heating". Appendix 3 gives an overview, together with explanations, where each topic is discussed in greater detail.

2.

The Master Climate Action Plan

I.

2013 – 2020 – 2050:**On the road to a climate friendly city**

Climate change and the responsibility of the cities: ever since the interstate Intergovernmental Panel on Climate Change (IPCC) published new findings in 2007 about continuing climate change, its damage effects and its anthropogenic causes, the topic of climate protection is among the dominating subjects in public debate. With the Master Climate Action Plan, the Free and Hanseatic City of Hamburg contributes its part to the objective that CO₂ emissions of central key fields of action for Hamburg are reduced to a minimum by 2050. The environmental, economic and socio-political challenges resulting from this must be mastered in order to limit global warming as well as to curb dangers and costs on the basis of climatic events.

Because urbane life is the main cause of climate change, there is a big responsibility on cities concerning this. 75% of the greenhouse gas emissions are caused worldwide in metropolises. On

the grounds of their economic strength, of their knowledge and research potential and as sites of multiple exchanges, however, they also offer numerous design possibilities for the reduction of greenhouse gas emissions. As "laboratories of the modern age", they are, therefore, an essential key to climate protection.

The Hamburg climate protection policy - integrated climate protection under the sign of the energy transition and responsible fiscal policy: before this background, Hamburg will continue to make its contributions towards reaching the national climate protection goals: to reduce CO₂ emissions by 40% by 2020 and by at least 80% by 2050, in order to limit global warming to 2° C – as prescribed under international law.

For this, decisive boundary conditions arise from the consistent implementation of energy transition and a responsible fiscal policy.

After the Japanese reactor disaster in March, 2011, the Federal Government has initiated an extensive restructuring of the energy supply. The objective is a supply mainly from renewable resources by 2050. Hamburg is committed to advancing the energy transition. In doing so, supply security, economic efficiency and competitiveness remain guaranteed.

However, this master plan is not limited to the energy sector. Rather, climate protection should be even stronger than it is today and should be part of interdepartmental city policy at all levels, which is integrated into a canon with various objectives. With the master plan, this basic idea of so-called Mainstreaming, that has already formed the basis for the Climate Action Plan 2007-2012, will be further advanced. Then climate protection is not only operated by the Ministry of Urban Development and Environment, but is equally integrated into the sectoral policies of the other Departments of the Free and Hanseatic City of Hamburg. With the Master Climate Action Plan, this process should be continuously improved.

For responsible handling of public funds, inexpensive and efficient CO₂ reduction measures with promising pilot nature and market launch potential are implemented.

Altogether, the economic potential of climate protection (job creation and attractiveness of location, et al.), as well as the other advantages of a climate-friendly city (attractive living environment, et al.), are opened up with the conceptual approach of the Master Climate Action Plan. Climate protection hence becomes a model for success.

The Master Climate Action Plan - approach and assumptions: climate protection policy with the time horizon 2050 must be dynamic to meet the CO₂ reduction objectives. The technical developments will also often progress by leaps and bounds and are currently not foreseeable. Also concerning the political boundary conditions, changes are rather likely by 2050.

Hence, the Master Climate Action Plan limits itself to some fundamental assumptions, and outlines a plausible path and decisions with which Hamburg could master the challenges by 2050 (Part II.). For this, it is not a matter of just putting up planning requirements for the next 40 years. Rather, the knowledge available today and the emerging trends are exploited. Today, the technologies underlying the assumptions are already predominantly available.

The 2020 Action plan, and the qualitative measures that are an action component of the Master plan substantiate the long-term perspective for the next years (Part III.). Here the projects are named that the Senate is getting underway at short notice in order to get a bit closer to the objective in 2050. With these measures, Hamburg can reduce its CO₂ emissions from today until 2020 by just about 2 million tons. The biggest part of the reduction results in Hamburg itself. However, effective climate protection measures will also be implemented when their effects manifest beyond Hamburg. All measures are workable in practice, effective, economical, attributable to the originator and take into account the performance efficiency of those affected.

Hamburg takes over responsibility in the areas in which, as a city, it has special creation possibilities. High climate protection potential and the accessibility of the measures for urban action are crucial for this. The senate puts importance in particular on an improvement of the energy efficiency of buildings, as well as for industry, trade and in the port. However, in many areas, the achievement of the objectives depends on the development of the climate protection policy of the EU and the Federal government. In this, Hamburg will assert its influence even more.

Hamburg today is already a metropolis of climate protection and the energy transition. Building on its present successful climate protection policy, the senate will further develop and consolidate its position here. The experiences and results of the evaluation of the Hamburg Climate Action Plan will be used and one is counting on the strengths of Hamburg as a city. As a service provider hub and knowledge center, location of the wind energy sector, with the agreed cooperation of the grid operators, as well as the

partial acquisition of the grids, with its public enterprises, its own green electricity provider Hamburg Energie, and with the port as a leading logistics hub and the largest contiguous industrial area of Germany, Hamburg has an excellent starting position. Further opportunities arise from the tight integration with the surrounding metropolitan area.

Finally, the Hamburg citizens are a critical and existing success factor. Many already now have a pronounced awareness for climate protection and aim at a climate-friendly lifestyle. For the senate, climate protection is a community achievement that will work only in cooperation. For this, it provides information and forums for exchange.

II.

Vision 2050: Setting the course in major fields of action

In this section, the essential decisions are identified that are required in order to achieve by 2050 a city that is low in CO₂. The areas are addressed that are the most important for climate protection and life in the city.

II.1

Energy / Energy supply (Electricity and heat)

By 2050, the challenges of the energy transition should be mastered. Then the energy requirements of Hamburg will be largely covered in a reliable, demand and competition driven manner through renewable energy sources. This will be achieved by energy conservation, efficient energy generation, distribution and use, as well as the development and integration of renewable energy sources. The following decisions are crucial for this:

No isolated consideration of the energy sector: energy in the form of electricity and heat is required in nearly all urban areas. The requirements for the energy sector are influenced therefore by the developments in other subject fields. For instance, energy conservation and efficiency increases in other spheres of activity lead to the fact that less energy has to be provided. This reduces the pressure on the natural resources exploited for the generation of renewable energy. Savings that are not achieved, or even increased demand, increase this pressure and increase the technical requirements for the distribution and storage of energy. The areas of energy and building are tied to each other especially strongly. Because of its high share in the Hamburg CO₂ emissions and its big reduction potential, the effects of the building sector are even so large that a failure to meet the efficiency targets in this area also calls into question the energy-political objectives.

More renewable energies: The sustainable generation of energy from renewable sources must be clearly increased. This will be necessary in spite of the continuous, ambitious exploitation of the saving potential and efficiency potential, in particular in the areas of buildings and energy grids, for the fulfillment of demand, and it can be provided primarily by the wind energy generated outside of Hamburg. In 2050, the location of Hamburg, which already today is significant for having many company headquarters of the wind energy sector, will have established the North German region, together with the North German states, as one of the worldwide leading industry sites. As a city state, Hamburg can only marginally develop renewable energies within its state borders. However, there are expansions possible in the following areas:

- Wind power generation by further designations of areas, the replacement of existing plants with more powerful plants (Repowering) and by single plants in the port and at industrial and commercial facilities,
- Installation of solar systems on Hamburg roof areas,
- Energetic utilization of biomass that arises in the context of green spaces and landscape management in Hamburg and to a certain extent can be obtained also from sustainable production in the metropolitan area,
- Digestion of biogenic residual materials and organic waste and
- Geothermal heat generation

There might also be potential for power and heat generation with the help of deep geothermics.

The thermal energy need will probably also not be possible to be covered 100% in the long term from renewable energies with the technologies established today for the utilization of the sun, waste, heat and biomass. Hence, future technologies must already now be considered, like the conversion of wind power into heat and if necessary deep geothermics.

System integration of renewable energies: On grounds of the very fluctuating energy generation from wind turbines and solar energy systems, special courses must be set for a predominant supply coming from renewable energy by 2050. The possibility of an energy exchange between electricity, gas and

heating grids appears to be an especially promising basis for this. The starting position for this is good in Hamburg: the city already has a 770km long district heating grid that, together with the local heating grids, forms the biggest heating grid in Germany. The natural gas grid has a length of approx. 7,300 km and supplies about 150,000 household connections. The industrial supply is done via a very dense, high voltage grid system. With the acquisition of equity interests of respectively 25.1% in the grid operators for electricity, gas and district heating, and the energy cooperations with the two largest energy providers of Hamburg - Vattenfall and E.ON -, Hamburg has created the requirements for ensuring that the necessary influence can be exercised. In addition, with Hamburg Energie there exists an innovative energy provider for renewable energies that is 100% under municipal control.

Electricity supply

Through the increased use of renewable energy in the electricity supply, new challenges are also faced by the energy distribution grids. In this, it is a matter of an intelligent networking of fluctuating generation capacities, storage and load management systems in different orders of magnitude. It should ensure that the electricity demand can also be covered in future, if the generation profiles deviate strongly from the consumption profiles. The starting position is favorable in Hamburg, as an industrial metropolis and service provider metropolis with high energy requirements and a well-developed grid infrastructure. The district heating grid and many large electricity-intensive establishments could integrate large amounts of renewable energy into their supply.

In 2050 Hamburg will have regulated its energy flows anew as much as possible, by intelligent control unit systems like virtual power stations. Excessive energy volumes are integrated with reservoirs into the energy system. With Power-To-Heat technology, excessive wind and photovoltaic electricity is converted into heat and is used or stored in the heating grid. Large-volume heat reservoirs can create additional storage capacity for renewable energies. Even large heating and cooling processes that already exist in the port, for example, can serve for the storage of wind power. In this, cooling systems are temperature controlled at a lower temperature than required, for example, when there is an electricity surplus. Then in off-peak supply times, the electric cooling does not need to be operated. With Power-To-Gas technology, wind power is converted into hydrogen or methane. This can be stored in the Hamburg gas grid and in big gas reservoirs.

Heat supply

Basic requirements for a heat supply that is friendly to the climate are significantly lower thermal requirements through a consistent energy modernization of existing buildings.

For the grid-connected heat supply, it is possible to open up further efficiency potential by the use of other fuels and optimizing the grid structure. As energy sources, wind power, waste heat, solar heating, biomass and possibly also geothermal energy are under consideration. The district heating grid will be further expanded and condensed. Especially areas with multi-family homes densely standing together are suitable for this. It has to be checked whether losses in the district heating system can be reduced by complementary heat generation measures. For this, gas remains at least an important bridging energy source.

Ideal for the use of heat from renewable sources, or industrial waste heat, are heating systems on a low temperature basis. For this, heating systems on a lower temperature basis are to be created. This also makes it possible to exhaust the potential of many commercial operations, in particular also in the port, for the supply of waste heat.

The first steps for this were already initiated in the political energy-related cooperation arrangements between the Free and Hanseatic City of Hamburg and the energy supply companies Vattenfall and E.ON. Vattenfall is looking into the utilization of waste heat, as well as the construction of a low temperature district heating grid in the Süderelbe area. The E.ON Hanse group is opening its heating grids for its business partners, with the possibility to feed climate-friendly energy into the grid, to store it there and to withdraw it again (Circular 20/2392).

Large sections of the city are not supplied with the pipeline-bound district heating. These areas are in part less densely populated and characterized by smaller, multi-family, detached and terraced areas. These buildings are heated with heat pumps and solar energy, or KWK plants. Then biogas is used as a fuel if possible.

Priority areas for e.g. pipeline-bound supply, efficiency specifications and efficiency criteria, as well as energy saving rates and offers, would be conceivable.

II.2

Industry, Trade and Port

In the industry, trade and port areas, it is a matter of ensuring that by 2050 the most efficient technologies will be used all over the country. Climate protection must have produced strong environmental

innovations as a part of an active ecological industry policy. In the port, renewable energies will be an indispensable basis of an intelligent and modern port system.

Continuous steps to optimum energy efficiency: Continuous steps to optimum energy efficiency: With many continuous steps within the scope of the established close collaboration between the Free and Hanseatic City of Hamburg and the Hamburg business community, the saving potential must be opened up especially in the cross-sectional applications of production and office buildings. The remaining energy requirements must be covered from renewable energies on the basis of electricity and sustainably produced biofuels. The electricity comes predominantly from renewable sources, and the biofuels from the metropolitan region (see above II.1). Via interfaces, power-consuming facilities are controlled as virtual power plants according to the fluctuating electricity offer in the grid.

In the processing trade, the specific energy requirements for the areas of heat, cold and compressed air generation, illumination, driving mechanisms, ventilation and air conditioning, and computer systems can be economically reduced already today by an average of nearly 30%, with illumination and air cooling even by up to 80%. This is made possible by innovations, as for example LED illumination. The light emission is nearly free from loss through chemical organic substances or bioluminescence and will also soon be ready for the market. Other efficiency-enhancing technology leaps are to be expected.

On the other hand, the efficiency potential is lower in the energy-intensive production methods in the raw material industry. The energy consumption will be reduced here, however, by an improvement of the material and resources efficiency.

Across industries, energy management systems will reduce energy consumption and increase energy efficiency. Long before 2050, Hamburg enterprises will already have set up such systems with which the energy and resource flows in technical facilities are centrally monitored and are controlled. In the technologies of inside air, cooling, compressed air and pumping, only demand-based, controllable systems operate with individual instrumentation & control.

In view of dwindling natural resources worldwide, comprehensive raw material recycling is becoming more and more important. For the establishment of high-tech materials and recycling management in Hamburg, secondary raw materials are obtained from the metropolitan region to a significant degree.

Hamburg as a technology driver: The Senate will act as a technology driver through assuming the

intermediary function between enterprises and universities. A strengthening of applied research excellence will help the Hamburg economy to develop innovative technologies and energy-intensive businesses to optimize their energy efficiency. The energy supply companies and grid operators are also being integrated here.

II.3 Buildings

Privately used buildings

Energy modernizations: in Hamburg, the building area constitutes a key factor for the success of the energy transition (see above II.1). The objective is to exploit its saving potential by 2050. For this, the following can contribute: the insulation of the outer shell with sustainable insulating materials, the replacement of windows and the installation of highly efficient heating systems for the supply of room heating and hot water in the prevailing part of the existing buildings. An ambitious, but not unrealistic, average modernization quality and modernization depth should be achieved, as well as an adequate annual modernization rate. On the basis of 30 to 40 annual modernization cycles, nearly all Hamburg buildings can therefore be rehabilitated by 2050.

The senate is striving to reduce the annual final energy needs (heating and hot water) for existing apartment buildings in stock to an average 40-45 kWh/m² and for single-family dwellings to 45-55 kWh/m². This is equivalent – with the inclusion of a proportionate share of renewable energies - approximately to the primary energy need of today's WK-Efficiency House-70-Standard in the funding (as a middle stage of modernization funding). With non-residential buildings a comparable dynamic development into an existing building level is aimed at that is below today's new building standard with regard to the respective EnEV reference buildings. Here about 50% decrease of the heating requirements should be achieved.

Hamburg couples its climate protection goals to a socially acceptable and economical implementation. The basic condition is that not too much is demanded of the market participants. This applies for investors, whose investments must bring a yield at least in the long term, as well as for the tenants who, with existing income development, still need to find affordable rents for themselves. These principles were agreed in Hamburg in the Association for Housing.

In particular cases and/or dependent on accommodation, an energy optimum between rehabilitation depth and residual supply has to be

defined to adapt the energy quality of the buildings to the individual regions and their heat supply.

For energy modernization, the protection of historic buildings and monuments and the preservation of cityscape formative characteristics of buildings, ensembles and quarters are taken into account.

Also the power consumption necessary for the building operation must be minimized. For instance, there will exist in 2050 a component-based summer insulation against heat, also in the existing buildings all over. Bigger properties will have energy management systems for demand response.

Because of the big saving potential and the significance for the success of the energy transition, it must be intensely monitored how energy modernization in Hamburg makes headway. If it is not possible to bring existing buildings to a satisfactory extent to a modern energy level, a readjustment has to be considered.

Life cycle approach with buildings and components: Life cycle approach with buildings and components: The life cycle approach will be established in 2050. Already today this is ensured for Federal Buildings and for certification by the Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB), by means of the creation of a life cycle assessment for buildings. Building materials and insulating materials will be sustainable, toxin-free and with minimum CO₂ during all product life phases; still existing hazardous materials will have been disposed of in accordance with environmental and climate protection requirements. Buildings will be preserved in the long term, the demolish rates will be low. This will be achieved by a flexibility of the concept of utilization, for example, a reduction or enlargement of flats.

Socially acceptable financing of energy modernizations: In Hamburg, about 2/3 of the living space is rented out. The so-called landlord-tenant dilemma is particularly true here. Hence, the energy objectives can therefore only be achieved if socially acceptable financing of the modernizations is ensured. Hamburg will dedicate itself to promoting suitable models. Already now, mutually satisfactory solutions are compiled within the scope of the Bündnisses für das Wohnen between the Free and Hanseatic City of Hamburg and the housing industry.

Public Buildings

Role model function: The Free and Hanseatic City of Hamburg will meet its role model function by means of the routine implementation of high energy standards. According to the Building Efficiency Directive of the EU, all new public buildings have to be

erected as so-called "Zero-energy building" from 2019 onwards. Hamburg strives for this already at an earlier stage in order to achieve long-term planning, financing and operating costs security for public construction measures. Then new building construction is done within the scope of an integral plan according to ambitious energy efficiency requirements.

The biggest saving potentials also lie here in the energy-efficient modernization of existing buildings. According to the Energy Efficiency Directive of the EU, each year 3% of Government buildings must have an energy upgrade. Hamburg is striving to reduce the heating energy needs of its existing public buildings by 50% by 2050 through energy modernization.

Within the scope of new building and modernizations, sustainable materials and work methods are used. The construction technical information "Environment Guideline for Sustainable Buildings", published by the Ministry of Urban Development, as well as the associated "Evaluation system for Sustainable Buildings" (BNB), form the specialist basis. The central energy management and control for public buildings is strengthened and intensified. To achieve the greatest possible effects, tenants, landlords and users are integrated here. A close interaction with the "Competence center for structural engineering" is aimed for.

II.4

Mobility and Transport

In 2050, the traffic will be sustainably developed in Hamburg. Thus, in addition to climate protection, also noise and pollution control will be advanced. The air traffic will be climate-friendly in design on the basis of progress achieved at international level.

Priority of environment-friendly mobility: Hamburg will use its influence for offers, improvement and funding of non-motorized private transport and in public transport (ÖPNV), as well as for the organization of motorized private transport (MIV). The environmentally-friendly and climate-friendly mobility that will be achieved in 2050 will be reflected in particular in a clear increase of ÖPNV, pedestrian traffic and bicycle traffic in terms of the proportions of the different transport modes relative to each other (Modal-Split). From 2020, only zero-emission vehicles are considered for the procurement of public buses, so that in 2050 the whole bus fleet will be zero-emission.

So that the environmental alliance in 2050 can cover a large part of the transport demand in passenger traffic, continuous funding is required with quality improvements and expansions of the ÖPNV and non-motorized private transport. The principle "Use instead of owning" will have asserted itself in wide parts of the

passenger traffic. In this, already significant behavioral changes can be observed that will further increase. Thus, young adults renounce more and more often their own passenger cars and use car and bike sharing offers. The network of cycle paths is being exhaustively developed with cycling trails, strips, and parking facilities. Pedestrian traffic is enhanced and its share has grown. Footpaths and cycle paths can be used free from obstructions and barriers.

Furthermore, there will be the MIV, in particular for special needs. It will be organized intelligently in relation to other modes of transport, will not discriminate against these and will quite predominantly be operated with renewable energies. The required driving mechanisms will have been established. For eMobility, a public and private loading infrastructure will exist to meet the requirements.

Comprehensive mobility management: The means of transportation are networked together in an optimized manner in order to implement efficient connections and transfer possibilities, both within the city and also to the surrounding areas. The people are on the move "multimodally" and flexibly. Digital offers of information help with the routes and means of transportation selection according to demand and personal mobility wishes. This was achieved by a clear quality improvement of the ÖPNV. All over the city there are attractive offers with high temporal and spatial density. Also the connectivity of the surrounding areas is efficient through good cross-linking of the means of transportation with each other, coordinated transfer connections and the wide range is configured efficiently and environmentally friendly.

The inhabitants of Hamburg understand environmentally friendly mobility and behavior accordingly as being indispensable, and that it is also an economically sensible component of urban life.

Integrated urban development and traffic development: Integrated urban development and traffic development: Climate and environmentally friendly mobility and urban development are considered in an integrated manner and are orientated towards a common objective: among other things compact city / city with short routes, settlement development along the ÖPNV track system, settlements with few cars and neighborhoods, quality, use and transformation of the public sphere, more space and sojourn quality for everybody in the public sphere.

Structural decision on freight transport: The urban and environmentally sound management of the growing freight traffic, caused by the port with its specific requirements,

has top priority in urban infrastructure planning. In coordination with the northern states, the seaport hinterland connectivity via rail could be clearly optimized and so more freight could be brought onto the railway.

Logistics chain: The “last mile” of the logistics chain is organized efficiently and sustainably. Inbound freight and delivery traffic is bundled up in distribution zones. Freight distribution takes place at night and is low-noise. The requirements of sustainable city logistics are considered with urban land use planning and with individual projects.

11.5

Consumption and Disposal

To diminish the CO₂ emissions by 80% means a reduction in per capita emissions from approx. 10 t per year to 2 t per year. The individual refinement of life style will decisively contribute to this. A key area of this is consumerism that has a direct or indirect effect on many areas that cause greenhouse gases. In 2050, climate-friendly consumerism and resource conservation will be a social standard. For production, consumption and disposal the leading objectives of efficiency, sufficiency, consistency and permanence will have become a given.

Consumer motivation: With the citizens, climate protection thought is widespread. They set their own priorities for CO₂ savings. For this, comprehensive information about the CO₂ effects of consumer goods is available. In cooperation with production and trade, transparency is ensured concerning the CO₂ effects during the entire product life cycle, from development via production, the utilization, which is often the crucial phase for resource savings, up to the extension of the useful life span, recyclability and disposal. A special focus is on the area of nutrition, currently responsible for 15% of the Per capita emissions. Here, information is provided about reduction opportunities through the preference for organic food and regional agriculture, as well as a changed level of meat consumption. The senate coordinates consumer advice and communication.

The consumers are motivated into behavioral changes by education, structural changes (infrastructure, product offerings), product transparency and incentive systems. Climate-friendly behavioral manners are recognizable for consumers and implementable in everyday life. Via local measures, direct access to the citizens is sought. For instance, citizens are contacted through their social environment or other groupings, e.g. new citizens, sports associations, educational institutions, etc.

Integrated material flows and material chains: The varied approaches already available in Hamburg for climate-friendly design of material flows and material chains in the areas of production, consumerism, recycling and disposal were integrated and systematized for increased resource productivity, in particular on the supply and demand side with the cooperation of the private and public sectors, as well as with the political and legal framework set.

Resources and recycling management: The present Recycling Offensive was further developed step by step as a building block of recycling management. Recycling management was further developed into an optimized resource management.

Connectivity and inter-departmental contemplation: Changes in a phase of the product life cycle can have effects on the whole life cycle. For example, the product design influences the use and the disposal of a product. Hence, all stakeholders involved in the product life cycle are integrated into all measures within the scope of inter-departmental contemplation and connectivity. Besides the consumer, these are the government agencies, producers and trade, recycling companies et al.

Role model function: In all public institutions (administrative, educational institutions) the 2050 vision is implemented as a role model.

11.6

Integrated consideration of climate protection: Urban development

With the instruments of urban development, in 2050 Hamburg will have developed into a regenerative city in spatial regard, adapted to climate change. Then Hamburg will have integrated climate policy requirements into the organization of spatial planning through the inclusion of climate management. Integrated, spatially referenced, overall concepts will have been implemented, and the example of the compact city with a wide, small-scale usage mix, short routes and decentralized concentrations will have been realized. Settlement development will be orientated along the lines of the ÖPNV track system, there will be numerous car-free neighborhoods and public space, and streets and squares will be of high city-spatial quality. For this, urban development is furthermore used as a platform that includes a wide spectrum of different interests in spatial development and is geared towards climate-friendly development.

Promoting integrated planning: The requirements of climate protection and climate adaptation are increasingly included in spatial planning. Within the scope of integrated management of (part) city development, scenarios are compiled for climate-friendly urban development. The port is included as part of urban development oriented towards climate protection.

Role model function: Hamburg promotes sustainable and climate-friendly development of parts and neighborhoods of the city with its building policy. Active municipal neighborhood management funds, for example, communally-used gardens, solar roofs or rooftop greenhouses, but also projects of social coexistence, such as multi-generational housing and/or neighborhoods. Hamburg coordinates spatial development with the environs despite existing competition. It utilizes its outstanding position as the north German metropolis and is a model of climate-neutral urban development in the national and international context. Hamburg also works on a federal level towards it, so that planning mechanisms and incentive mechanisms are developed that promote climate-friendly, spatial development.

Evaluation and monitoring: The planning is flexible, constantly verifiable and is regularly adapted to developments. For this, the strategies and concepts of urban development are evaluated regularly in terms of their energy-climatic effects, and adverse social, geographical or economic side effects. Systematic monitoring has been developed on the basis of objectives that are also quantified to the greatest extent possible.

II.7

Education

Daycare centers, schools, vocational training, universities, and general and political further education, as well as so-called "informal learning", convey climate protection-related action options for society. In 2050 Hamburg will have developed into an Excellence location for climate-related training and further education. The contributions range from training in education (educators / teachers) to vocational training (crafts, technology, electronics, EDV/GIS, supply and disposal), university degree programs relevant to the climate, and qualifications in further education areas on climate protection and climate adaptation.

All state and many private educational institutions are CO₂ neutral and thus serve as role model learning centers and for demonstration purposes. For this, in particular conversions and the new building of training centers are important according to energy-efficient standards, as is the generation of renewable energy, including its educational use, as

well as climate-friendly mobility and feeding of the users. All public events in Hamburg are carried out CO₂-neutrally.

Trans-disciplinary cooperation is to be strengthened and an educational network between different partners has to be built up, for example between schools, colleges, enterprises relevant for climate, research facilities, community centers and other educational establishments.

Good examples of especially low CO₂ emissions per year are honored annually through awards. To this end, there are competitions and means of funding for the areas of research, testing, education and media.

II.8

Research and Science

Hamburg is already today a leading if not the leading location of climate-related research and science in Germany. In 2050, research and science in the context of climatology will have reached an interdisciplinary and multi-disciplinary orientation. To the classical natural sciences and engineering sciences, will increasingly be added social and economic sciences, urban planning and architecture, however, also communication sciences and media sciences, and these will pursue so-called "integrative research approaches". Thus by 2050, climate-related research and science in Hamburg, in cooperation with industry, will have also made important contributions to the energy transition and will have promoted the expansion of energy generation from renewable energies, the increase of energy efficiency, as well as technologies for energy storage and energy reduction. There will be nationwide and international cooperation for research facilities for climate and climate impact research.

Preserving the competence location Hamburg: The competence location Hamburg in climate research must be preserved in the long term and developed according to the demands of society on research.

Advancing transformation research: Transitions to a CO₂ neutral society throw up absolutely new questions for research and the transfer of research results into practice (research transformation). Here, a special challenge exists in the interlinking of social, natural and engineering sciences in order to understand the interactions between company, nature and technological development.

Communication: Findings from fundamental research and applied research (e.g. the development

and implementation of sustainable solutions) must be communicated efficiently within and beyond the science sector. For this, science must continue to actively pursue a dialog with society and this dialog process itself with all societal groups must become the object of research.

II.9

Integrated consideration of climate protection: Adaptation to climate change

In 2050, Hamburg will be adapted through implementing inter-disciplinary measures at all levels of urban policy towards climate change, in such a manner that damage is avoided as far as possible.

Consideration of city-climatic functions in urban development: Consideration of city-climatic functions in urban development: Also under the umbrella of the city growing inwards through compression, the necessary green areas and open spaces are protected and are developed for sufficient ventilation of the city and for leisure in the city.

Heat protection in buildings: New buildings are established according to the continuously developing standards known today for heat protection (alignment, insulation, materials).

Green roofs: Because of their significance for urban climate and the water household, an innovation strategy was developed for Hamburg green roofs.

Preservation of green areas and open spaces: With the Free Space quality offensive and the biotope group, more green area quality and quality of life was created in the city. With it the requirements of the quality of life were ensured also at high temperatures.

Reinforcing water retention: In water planning and inner city open space development, the retention capacity of areas (e.g. parks, parking places) is considered and strengthened. The open spaces of the city were made in such a manner that, with heavy rainfall, the incurred amounts of precipitation can be temporarily stored, seeping away and/or discharging without damage to the environment.

New building restrictions: Flood affected areas and the flood areas of moraine waters are excluded from redevelopment. In the tidal region of the Elbe river, exceptions can be allowed if flood control is guaranteed in another way, e.g. through an adapted construction method.

III.

Implementation: 2020 Action plan – For this, Hamburg has already done something and is doing even more today

The Action plan sets priorities in the areas in Hamburg in which there is a high potential for decreasing CO₂ and enough scope of action, as well as where especially economical measures can be implemented. The measures are mainly oriented - with the available budgetary means - towards reducing CO₂ emissions effectively and economically. They are oriented on the following principles:

- Large CO₂ decrease at very low costs,
- Economic and social benefits for Hamburg and
- More promising pilot nature and market launch potential.

For this purpose, technologies are subsidized on a large scale that are relatively near the economic efficiency threshold and have good chances to hold their own on the market in the short to medium term without also being subsidized. The selection of the measures in funding programs is also influenced by cost savings at the funding recipients caused by reduced energy consumption as a result of efficiency increases. Many measures also have positive economic-political and structural-political effects like the reinforced establishment of innovative industries (e.g. wind power) and the increases linked with it in jobs and inland revenue. Nevertheless, these cannot be quantified and exactly delimited. Some measures also consider social interests. For instance, placing consideration on not loading up tenants and owners disproportionately plays a central role in the subsidizing of energy modernization of buildings. Depending on the scope of the synergies and the political value of the further objectives, measures can also be advantageous in spite of comparatively lower cost efficiency.

With the large part of the measures, 1 t CO₂ can be curtailed at total costs of at most 30.00 euros. Figure 1 shows how the tons curtailed by the package of measures are distributed among the individual cost categories.

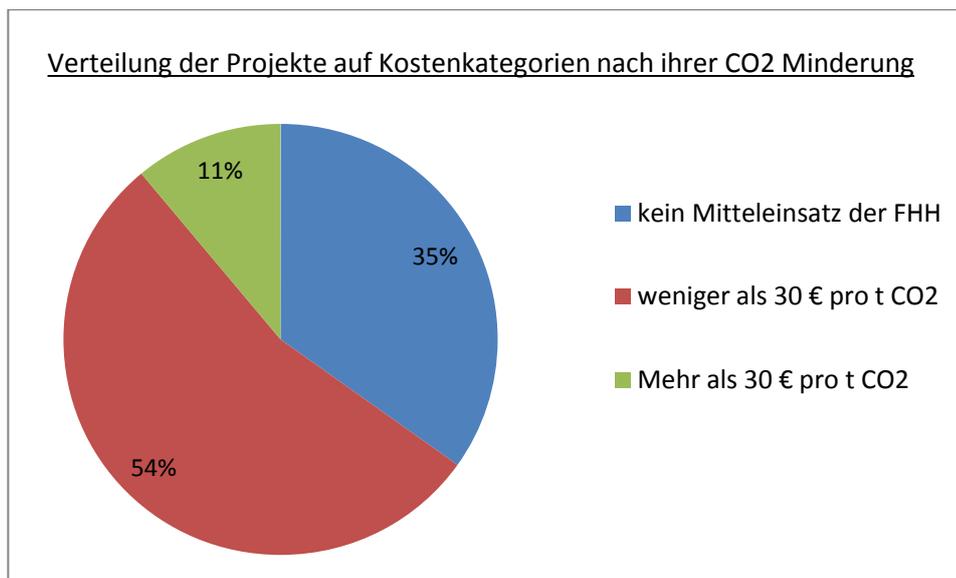
CO₂ reduction according to cost categories

Figure 1

For all measures the achievable CO₂ reductions were estimated (concerning the methodology see Appendix 1). For instance, according to the current state of the calculations, by 2020 a total reduction will be achieved of approx. 2¹⁾ million tons CO₂. Figure 2 shows how the reductions are spread among the individual sectors. Despite tight budgets, the Senate strives for a full implementation of the measures.

For the Hamburg polluter balance a decrease can be achieved according to the present status with the quantifiable measures under the assumption that climate-political boundary conditions remain constant compared with 1990 from what is today approx. 18% to just about 30% in 2020. In addition, emissions can be reduced by qualitative measures, like for example information initiatives or educational initiatives. Moreover, agreed measures at EU and federal level are still to be expected that up to now have not yet been decided on and that are necessary there for the achievement of objectives and

also will contribute to the further reduction of the emission levels in Hamburg.

With the action plan, Hamburg supports the Federal Government in its objective to reduce German climate gas emissions by 40% by 2020 and hence reinforces the German demand to increase the reduction objective of the EU from 20% to 30%. If one continues with the decreases that will probably most likely be achieved by 2020, a reduction of 80% by 2050 in Hamburg results as a goal that appears to be feasible. However, for this Hamburg will depend even more strongly on consistent international and national boundary conditions.

¹⁾ Compared with the original estimate, the self-obligation of the industry and other projects had to be adapted and corrected down by 200 Tsd. t. It will continue working on the optimization of the portfolio towards 2 million tons.

CO₂ Reduction according to fields of action

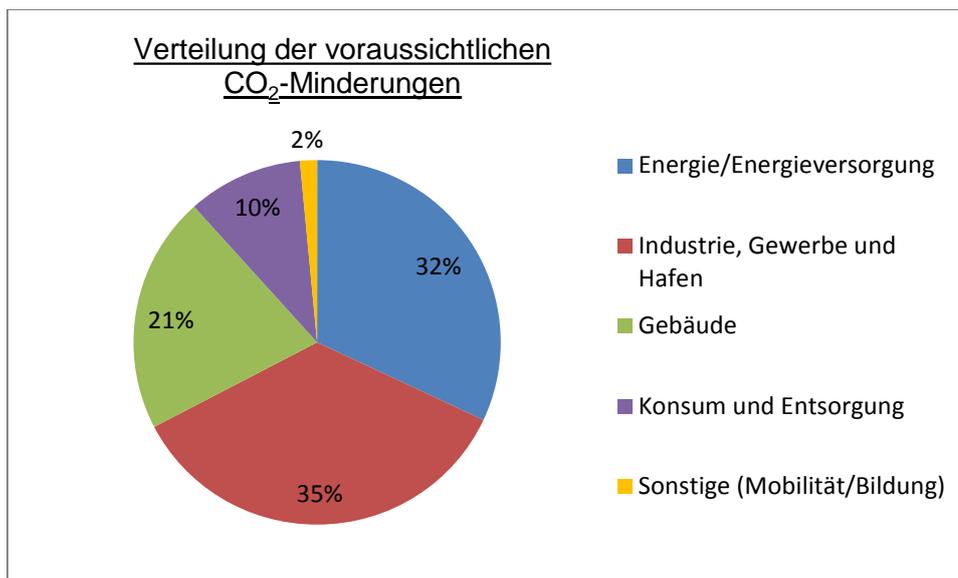


Figure 2

In the following, the measures of the Action plan are shown in 2020 for the spheres of activity of the master plan. The description concentrates on some essential measures with high saving potential. For an extensive listing of the measures, reference is made to Appendix 2. Besides these measures of the Master Climate Action Plan, the climate protection idea is promoted for the purposes of comprehensive Mainstreaming (see I. above) by numerous other initiatives and programs. This, et al., also happens by the measures of the 1st updating of the Hamburg Clean Air Plan that, in high differentiation, contains a measures list that overlaps at its core with the projects of the Master plan, such as for example the measures on local public transport with the objective of strengthening the environmental alliance (e.g. zero-emission coaches) with the improvement of traffic management, as well as measures in the areas of energy for the increase of efficiency, CHP expansion, for the utilization of waste heat, storage expansion, etc. The same applies to the Air Quality Partnership and Hamburg port energy cooperation. In the following representation, it is shown in the example of the areas of Public buildings (III.3) and Mobility and Transport (III.4), how climate protection is included in urban policy at all levels.

III.1

Energy / Energy supply (Electricity and heat)

The measures can mainly be allocated to two areas of action: firstly, the implementation of the energy policy cooperation agreement is an important framework for advancing energy policy objectives. The agreement

between E.ON, Vattenfall and the Free and Hanseatic City of Hamburg is directed to a future-oriented power and heat supply for Hamburg. As a prerequisite, for the 25.1% stake of the city in the power companies, the companies have entered into commitments that advance the energy transition in Hamburg. Via its stake, the Free and Hanseatic City of Hamburg takes a strategic influence.

On the other hand, numerous programs are aimed at saving energy, like improving efficiency and the development and integration of renewable energies. In addition, the systematic integration of renewable energy into the supply structures will advance by first building virtual power plants and measures for load management. Among the most important measures are:

Gas-and-steam power plant for district heating generation: Under the energy political agreement, instead of the previously planned district heating extraction from Moorburg, Vattenfall Wärme Hamburg GmbH intends to replace the Wedel heating plant with an innovation power plant with integrated energy storage. It should be based on combined gas turbine and steam power (CHP) technology, optimized for district heating and operated with high energy efficiency. The reservoirs are supposed to integrate surplus renewable energy through wind-to-heat processes and are also meant to serve for operational optimization of CHP plant and district heating.

Through this, positive effects are achieved in terms of CO₂ saving. The total investment is 430 to 500 million euros. The CHP plant replaces coal as the fuel in district heating production and can be fired without any technical change, with an arbitrary number of proportions of gas generated in a renewable manner (power-to-gas or biogas). The waiver of hard coal as an energy source for district heating production was identified by experts as one of the most important contributions to reducing CO₂ emissions in Hamburg.

Bioenergy funding: The funding of individual systems for the incineration of biomass continues. The focus is on larger systems (> 100 kW) in industry or on the heat injection into local and district heating networks. CHP technology is also meant to be expanded, through which it is possible also to create electricity in parallel to the heat.

Solar Energy funding: Photovoltaic and solar thermal systems on the roofs of Hamburg offer a large, previously underused potential for the generation of renewable energy, in the range of several gigawatts. Both the nationwide support of photovoltaics by EEG, as well as Federal funding and the continuation of solar thermal funding of the Free and Hanseatic City of Hamburg, as well as declining investment costs and rising prices of fossil energy sources, bring forward the necessary expansion of solar energy.

New construction and repowering of wind turbines: Currently, the land use plans will be revised to allow a repowering of most sites. The goal is to reach by 2020 twice the output with about the same number of new plants, and annually about 225 GWh of wind power production. Additionally, locations for individual plants are being sought, particularly in the port and in industrial and commercial areas. , With the current state of technology, a maximum total capacity of 150 MW and a generation of 340 GWh should be possible.

Project ACDC of Vattenfall with companies for resource conservation (UfR): Intelligent load management and consumption in commercial enterprises through external parties, such as the network operators or dealers. By temporarily switching off, and/or selective activation of electricity consumers, it is possible to make a contribution to the management and stabilization of the electricity grid, with an increasing share of renewable energy in the grid and increasing the uptake of renewable energy in the grid. The control technology and the contractual basis are established in the context of pilot projects. The responsible authority operates a pilot project in collaboration with Vattenfall Europe GmbH

and 13 enterprises. In order to achieve the desired effect, a large number of private plants must be integrated.

Fuel switching: In the cooperation agreement, it was agreed to consider whether in the Tiefstack CHP, biomass co-firing could be economically possible. Thus, the CO₂ factor of the district heating supply in Hamburg would be improved. In addition, since September 2012 biomass for district heating is being made available in a cogeneration process in the Borsigstraße waste incineration plant.

Construction and operation of 180 new combined heat and power plants (BHKW): E.ON Hanse has undertaken in the Energy Policy agreement to design the energy supply in Hamburg to be more decentralized and energy-efficient, and to strengthen the overall capacity of decentralized CHP from what is today 9 megawatts to 17 megawatts in 2021. For this, the group will invest around 25 million euros in the next 10 years in the expansion of CHP in Hamburg. The plants are not only significantly more efficient in terms of electricity generation, but are also a fundamental part of a future load management system.

III.2

Industry, Trade and Port

The measures aim at supporting Hamburg enterprises with the minimization of energy consumption and the increase of energy efficiency. Here, emphasis is put on established communication structures and networks with the Hamburg economy and this is extended or aimed in terms contents on the new requirements.

Investment obstacles, that are based, in particular, on long amortization times and lack of money, knowledge about efficiency potentials, specialist staff, time, organization structures and fears of a deterioration of production, should be overcome by investment subsidies and networking of the stakeholders.

In addition, the enterprises should be integrated into the energy transition. Relevant energy systems can contribute to the network control system. Electricity supply and demand are matched so that no supply impairments occur.

The Hamburg programs and actions on entrepreneurial climate protection will be continued and bundled programmatically in the Hamburg Environmental Partnership. It has been continued for the period 2013-2018. Example programs and projects are:

Industry voluntary commitment: The successful voluntary commitment between Hamburg industry and the Senate to implement operational CO₂ reductions will continue for the years 2013-2018. The participating companies will develop additional energy efficiency potential through optimizing systems engineering and production processes, and implementing these largely without funding by the Senate.

CHP initiative for enterprises for resource protection (UfR): The initiative will continue. In Hamburg heat generation plants with more than 1 MW rated thermal output have considerable potential for the economic use of CHP. Even existing potentials in the port can be exploited further. The installation of predominantly gas-CHP leads to greater efficiency in energy production through the use of electricity and the heat thus generated on the same operating location. If the electricity and heat production from CHP plants is temporally decoupled by the combination with heat storage, system balancing energy is generated for the rapid control of the power grid.

Enterprises for resource conservation: With a practice-oriented combination of on-site consultations, inexpensive equipment checks, a communication and know-how network and financial support, investments in resource efficiency initiated at companies that go beyond legal requirements. There is cooperating with 24 partners from industry, science and technology and commerce and trade chamber Professional associations, universities and Engineering associations. For communicating efficiency techniques and to exchange experiences a network with over 2,500 participants is operated. Informative events, technical workshops and seminars are offered on which enterprises can establish contacts with professional consultants, engineers and manufacturers of efficiency technologies. Technical guidelines, brochures, newsletters, information on the website www.hamburg.de/ressourcenschutz round off the cross-linking. The Port will continue to be a major action focus for UfR.

Hamburg Port energy cooperation: Hamburg Port is not only the leading German logistics location, but also one of the largest integrated industrial areas in Germany and Northern Europe. For an innovative, but also economically and ecologically sustainable energy supply as an important location factor and economic driver, the Ministry of Economics, Transport and Innovation, the Ministry of Urban Development and environment as well as the Hamburg Port Authority have initiated the project "Hamburg Port Energy

Cooperation". This is intended to promote the energetic realignment of the port through the implementation of various projects in the areas of Renewable Energy, Energy Efficiency and Smart Energy and Alternative Mobility. In this way, the potential of the port for reductions in energy and resource consumption are opened up and CO₂ emissions are reduced.

III.3

Buildings

The measures are aimed at reducing energy consumption and increasing energy efficiency of buildings, with priority given to the insulation of the building envelope and the use of energy-efficient heating systems. For the achievement of long-term climate change goals, standards are needed here that go far beyond the current law.

Here, historical monument preservation and the preservation of the urban landscape are to be taken into account. In public buildings the measures are also directed to implement the exemplary role of the public sector in the building sector into practice. Among the most important measures include:

Investment and development bank (IFB) - funding thermal insulation in existing buildings:

Energy modernization of owner-occupied housing through thermal insulation to the building envelope should be initiated. Funding is for energy standards above the legal level. Funding is for the modernization of owner-occupied residential buildings with up to 3 residential units and housing owners' associations as well as technical consulting, project supervision, hydraulic balancing and air leaks measurements.

IFB - Funding modernization of rental housing: Energy upgrades in existing buildings are to be advanced through insulation to the building envelope. Energy standards must be achieved above the legally required levels. Funding is for the modernization of rented apartment buildings.

Decommissioning of night storage heaters: There is a one-directed funding and advisory program for decommissioning of night storage heaters and central domestic hot water distribution. Building owners are thus facilitated the extensive procedures required to replace night storage heaters with modern heating systems. A special focus is placed on the creation of low-temperature heating systems. The remaining night storage heaters in Hamburg account for about 9% of the CO₂ emissions of the Hamburg housing sector. Night storage heaters are inefficient. Their storage

does not meet technical requirements, which are required to store excess electricity from renewable energy sources in the energy system so that the energy can be retrieved as needed.

IFB - funding modernization of non-residential buildings: Since 2012, the energy modernization of envelopes of non-residential buildings will be funded if the legal requirements are clearly exceeded. Thus, the funding under the program enterprises for resource conservation will be supplemented, which has as a goal the increase of technical building system efficiency, and in particular provides financial support under certain conditions for the optimization of air conditioning systems.

Alliance for housing: As part of the agreement between the Senate and organizations representing the Hamburg housing industry, the housing associations exert an influence on their member companies, to reduce the average final energy consumption without hot water of their holdings in 2020 to 133 kWh / year per square meter and to reduce the annual CO₂ emissions to 25.0 kg per square meter. Old buildings before 1918 and condominium buildings are considered separately. The associations try to find together with the housing policy and the tenant associations solutions in order to implement the energy objectives in a manner that is socially acceptable. The Free and Hanseatic City of Hamburg and the Housing Associations support among other things the following flanking measures: Consultation of investors tenants, qualification and quality assurance, continuing education common concepts for district-related power supply low in CO₂.

Energy reconstruction of public buildings - modernization of the building services engineering: By measure bundles or a huge number of single measures in public and/or publicly used buildings it is possible for the energy efficiency of the building services engineering in particular electrical installations permanently to improve and to bring them on a technical status that satisfies today's requirements. This also means that a significant contribution to the climate protection of the city is made with a very good funding- cost efficiency that has been proven for investment measures within the scope of the Climate Action Plan in 2007-2012.

Furthermore the Free and Hanseatic City of Hamburg, through the realization of high energy standards in the existing buildings used by it with projects identified in a specific selection procedure, fulfills its exemplary function for climate protection, as other effects, a cost effective operation and lasting cost savings have to be achieved.

Such technical investments go beyond the scope of the measures aimed at ensuring the operations that are to be implemented by the owner of a property. Experiences demonstrate that with appropriate funding of energy efficiency measures after about seven-year period, achievable operating cost savings can exceed the annual investment costs and relieve the household directly from this time.

Building on these experiences it is reviewed to what extent the revolving use of available and refluxing climate protection funds in a so-called Intracting model constitutes an appropriate means for the comprehensive, sustained and long-term further development of financing of climate-effective renovations of a high standard of public buildings, including the associated high level of CO₂-reductions and what budgetary legal and other conditions must be fulfilled or must be created for the establishment of the Fund. This model would also take up the calls of the Court of Auditors for granting financial assistance not only as non-repayable grants.

The most important climate protection measure in this sector is that the Senate is addressing the renovation backlog in public buildings at all.

Mainstreaming²⁾ public buildings

For public buildings that are the property of the Free and Hanseatic City of Hamburg, energy-efficient renovation is a solid component of the building measures in the existing building stock. It takes place in a huge number of the cases in connection with modernisation and repair measures. The Free and Hanseatic City of Hamburg implements varied measures with big investment volumes in order to advance the energy efficiency of its buildings. To be able to optimise this in future even better in the direction of specific CO₂ reductions, a database is created at the Ministry of Urban Development and Environment in which the new building measures and renovation measures of the authorities of the Free and Hanseatic City of Hamburg as well as its public buildings with relevance for the CO₂ emissions as well as their specific CO₂ reductions are recorded. The authorities of the Free and Hanseatic City of Hamburg as well as its public institutions will report to the Ministry of Urban Development and Environment on this in electronic form.

²⁾ See the concept above I. (p. 2) and the introduction to Section III. (p. 12).

New construction of Ministry of Urban Development and Environment: The new construction of the Ministry of Urban Development and Environment building reaches a high ecological standard and, because of its especially low annual energy consumption and its sustainable construction method, was already awarded in the planning phase a gold preliminary certification from the Deutschen Gesellschaft für Nachhaltiges Bauen e.V. (DGNB – German Corporation for Sustainable Construction Inc.) For heating and cooling, geothermal energy is used.

School building Hamburg: The elementary school Kleinflottbeker Weg was established as a CO₂ neutral building. The school Sterntaler Straße was equipped, in addition, with a solar power system.

During the coming years the Senate will also carry out extensive annex building constructions and renovations to the buildings of the general and vocational schools in Hamburg. For the general schools, about 2 billion euros will be used by 2019 for the “School Construction Framework Plan”. In the plan, the building measures are mentioned in detail concerning scope, costs and schedule. The estimated CO₂ reductions that will be achieved amount to about 1,300 t. With the implementation of the measures, the exhaustion of the climate protection potential of the schools is also considered. Hand in hand with this goes another reduction of CO₂. To be able to exhaust this potential even better in future, the cooperation between the stakeholders involved is further strengthened.

Within the scope of the so-called HIBB Tranche for Resolving the Construction and Renovation Requirements of Professional Schools, the ÖPP partner was obliged to follow a special energy standard: The annual energy requirements have to be at least 30% more demanding, the transmission heat loss at least 15% lower than is necessary according to the EnEV.

University building: The new construction of the buildings of the Faculty of Mathematics, Computer Science and Natural Sciences (MIN forum) in Sedanstrasse should reach a primary energy requirement that is 12.5% more demanding than is necessary according to the Energy Saving Ordinance (EnEV). The new building of the Geomatikums is intended to be in the zero energy standard that is supposed to be 60% more demanding than the EnEV.

III.4

Mobility and Transportation

The mobility behavior of people is dependent on a huge number of different factors of influence. These factors can be influenced only partly by Hamburg. Hamburg will continue to advance its efforts for the

strengthening of environmentally-friendly mobility that is based on the measures and instruments of environmentally-oriented, integrated urban and transport planning described with the headwords “Avoiding - relocating - complete with compatibility” and that define the framework of the transport development planning of the city.

Within the scope of environmentally-oriented, integrated urban and transport planning, the mobility needs of inhabitants and enterprises are generally taken into account. Travel distances are reduced as far as possible and/or environment-friendly solutions are searched for. After various measures in the transport sector were funded with the Climate Action Plan in 2007-2012, the focus is shifted within the scope of the Master Plan to the Mainstreaming areas.

Mainstreaming³⁾ Mobility and Traffic

The attraction increase of environmentally-friendly means of transportation and traffic systems promotes an environmentally sound mobility behavior. Therefore, the main attention of real traffic planning in passenger traffic lies on the transfer potential to environmentally-friendly means of transportation, as well as in the improvement and the expansion of the infrastructure. For this, the following play a central role, in particular the expansion of the public transport system (ÖPNV) as a spine of mobility in the metropolis, the market launch and market penetration of low-emission driving mechanisms, the continuous promotion of pedestrian traffic and bicycle traffic, as well as comprehensive mobility and traffic management.

Strengthening the ÖPNV: Central measures in the ÖPNV are the coach acceleration program, the extent of the rapid-transit railway lines U4 and S4, expansion and new building of rapid-transit railway stops, measures for barrier freedom and safety in U-bahn and S-bahn stations, the electrification of the AKN, as well as the conversion to very low emission driving mechanisms, measures for the improvement and expansion of the offers concerning P+R (Park and Ride) and the pilot project mobility service points. Customers of HVV thus receive, within the scope of a comprehensive product (subscription plus), the possibility at select subway stops and city railroad stops to change over directly to a city bike or a motor vehicle of a CarSharing provider.

Implementation of the bicycle traffic strategy: Bicycle traffic is further promoted consistently and through continuous implementation of the bicycle traffic strategy, the aim is to increase its proportion in the Modal Split to 18%.

³⁾ See the concept above I. (p. 2) and the introduction to Section III. (p. 12)

Other important measures of the bicycle traffic strategy are the city bike offer as well as the consideration of the interests of bicycle traffic and foot traffic in other departmental planning.

Advancement of Electric mobility: The projects under the name Electric mobility (or also eMobility) are already underway and/or are currently launched conceptually. The city is integrated into the projects with proportionate financing. The project framework in 2013-2016 has an overall financing volume planned of 49 million euros and an assumed financing portion of the city of 2.9 million euros. These figures are project planning numbers that are not yet finally agreed. They demonstrate a considerable value-creating investment volume and the commitment of the city for the promotion of eMobility.

The eMobility projects are associated with CO₂ reductions of approx. 5,500 t/a (rough estimate). In detail, this concerns the following projects:

Collaborative project "Hamburg – Economy in electricity": in the current plan "Hamburg - Economy in electricity" up to 900 battery-operated passenger cars and light utility vehicles in public and commercial fleets should be used. The objective is the strengthening of eMobility in urban economic traffic with special inclusion of small and medium-sized enterprises.

"e-district Hamburg": For the integration of eMobility in urban development, the starting measure "e district Hamburg" ties together the development and testing of electric mobility offers with urban development policy objectives in new construction as in existing holdings, with in each case different mobility and energy concepts. Furthermore, project objectives are: a district acceptable traffic development, insight about the future eMobility market development for private households, the integration of eMobility in concepts for traffic calming and traffic avoidance, up to the linkage with other transport carriers. Defined target groups are included in the testing of electric vehicles and different "Carsharing" forms are examined. 29 enterprises are taking part in the project. Altogether, a group of up to 120 vehicles with about 2,000 users should be created.

"HAMBURG INTERMODAL" encloses running projects for the integration of hybridized, part-electric driving mechanisms in the ÖPNV, as well as supplementing the public charging infrastructure by including fast charge capability systems. In particular, on the transitions to the ÖPNV, in future it is intended to offer technologically advanced vehicles in the so-called "complementary mobility" and to use them - i.e. with carsharing, short-term rental or in the taxi operation.

"bike and ride" (B+R): The expansion of the offer at the stops of the ÖPNV is an important element of the funding of the environmental alliance. With newly created bicycle stands at widespread locations, the attraction of bicycle traffic has been increased in cooperation with the HOCHBAHN during the past years. With B+R, journeys in individual transport are avoided, additional passengers for the ÖPNV are gained and thus a shifting of the Modal Splits is achieved in favor of climate-neutral means of transportation. The same objective is pursued by the 1,000 bicycle brackets program, with which theft-proof parking possibility for bicycles in selected situations is created.

III.5

Consumerism and Disposal

The measures are oriented towards establishing structures and incentives for climate-protecting behavioral changes. In the interplay with the remaining measures of this Master Plan, it should be achieved that personal emission of CO₂ equivalents, that is necessary for 40% reductions of greenhouse gas emissions, will reduce to approx. 7 t. Because of the narrow linkage to the consumption areas, measures are implemented in this sector for CO₂ savings during the disposal of waste and sewage. The most important measures are:

Communicating personal CO₂ contingent: The CO₂ contingent of every Hamburg citizen of 2 t / head by 2050 and the interim objective of 7 t / head by 2020 are communicated so that it can be compared to the actual CO₂ footprint of every individual. Here, the linkage of the communication between the Free and Hanseatic City of Hamburg and the citizens is crucial.

Transparency during product selection and product use: Within the scope of their communication with the Free and Hanseatic City of Hamburg, enterprises receive consultation and networking for consumer communication concerning climate-friendly consumption. Particularly the retail trade is included since it plays an important role as a direct contact with the consumer with product range creation as well as during clarification (in the utilization phase). In addition, the cooperation between the stakeholders of the individual product life phases should be strengthened.

Public procurement: the public sector as a significant consumer can have a double effect with its procurement behavior. On one hand, substantial amounts of CO₂ can be avoided by life cycle and resource conservation-oriented procurement decisions. In addition, public procurement also sets an example. In the context of the 2007-2012 Climate Action Plan,

there have already been initiatives for CO₂ neutral business trips and package shipments, Green IT and efficient paper use. Within the scope of the Master Climate Action Plan, all product groups (including IT products) are examined once more concerning their potential for climate-friendly consumerism.

Innovative models of utilization: The preferential utilization of efficient products, e.g. electrical appliances, harbors a high saving potential. This must be communicated within the scope of the consumer consultation. In order to extend the phase of utilization of products, concepts like "use instead of own" joint ownership "shop for free" barter rings, lending rings, and Do-it-Yourself workshops must be made accessible to a broad public. Also, social service enterprises and civic idea pools could provide interesting impulses.

Climate-friendly food: The vegetarian action day and/or the Hamburg variation Climate plate with climate friendlier meat consumption that take place once weekly in company restaurants canteens and university canteens contribute to the direct CO₂-decrease on the action day as well as to the informing. Such action days are further established, and here, the canteens of the Free and Hanseatic City of Hamburg lead the way with a good role model.

The regional marketing strategy „from the region for the region“ lays its focus on climate-friendly products among other things ecologically farmed food, open land products and products from extensive cattle farming. Furthermore, a CO₂-footprint for regional products can help consumers in their purchase decision. The better distribution of the regional products decreases shopping journeys out into the country. Regional organic food for company restaurants and schools can promote the consciousness education.

3% of the greenhouse gas emissions of the EU can be traced back to thrown away food. Through providing information on and integration of this subject in other nutrition-related, the attention of consumers can be drawn to the potential for savings. These amount to 10,800 t by 2020 if consumers reduce their food waste by 5%.

Round table: a permanent round table of all relevant stakeholders is established on the subject: How do we want to live in future? The communication should be geared towards representation and motivation of the increase in quality of life. Through the discussion as well as proposals of innovative concepts and ideas (e.g. communal gardens, city farming), new paths can be tread with the climate-friendly consumption.

Recycling-Offensive in waste management: The Recycling Offensive was initiated in 2009. On 1st January 2011, the Hamburg Recyclables Regulation came into force, with which the households are required to separate waste collection of bio-waste and waste paper. In addition, the collection of non-packaging material (metals and plastics) together with the yellow collection was initiated in May 2011. At the end of 2011, a round table has been initiated with the housing industry, in order to improve the separate waste collection in the housing industry. On 24th May 2012, an agreement to implement Recycling Offensive was signed with the housing industry. This optimization of waste management will continue to 2020 and beyond.

Optimization of wastewater treatment: through targeted investment and technological improvements in the wastewater treatment, Hamburg Water will reduce its CO₂ emissions by 2018 to less than 1000 t. In the year 1990, the CO₂ emissions were at 100,000 t in 2009, at 60,000 t.

III.6

Integrated consideration climate protection: Urban Development

The Hamburg urban development supports the CO₂ reduction through improved alignment of its instruments as well as its procedures and plans to combat climate change and adaptation to climate change. The main elements are:

District development and land-use management: There will be territorial concepts and action plans developed for districts and city districts, meant to both minimize the building-related CO₂ emissions (through heating and power supply), as well as to bring together these aspects with urban planning, transport and social aspects. This will take into account the protection of historical monuments and the Cityscape maintenance. The practice of urban development will be increasingly geared towards creating the urban planning requirements for the implementation of measures in other climate-relevant fields of action, within the framework of an integrated approach. In particular, urban development and environment-friendly mobility belong together. Integrated urban and transport development must seek to ensure that pedestrians, bicycle and car traffic share the public space on an equal footing and engage in optimized interaction with ÖPNV (public transport). The port development is part of climate protection-oriented urban development.

The land management of the city further prioritizes the priority of the inner urban development, ensures the protection of climatically important areas and the urban green areas, among others through further development of the visions contained in the spatial model and with the land use plan, as well as the landscape program as citywide planning instruments. These are further developed for the implementation of a climate friendly and energy-efficient urban development and (integrated) city district development.

The experience from the EU projects and projects initiated in the framework of the International Building Exhibition (IBA) Hamburg 2013 will be used in order to advance integrated urban development oriented on climate protection. Among other things, Climate Neutral Urban Districts in Europe (INTERREG CLUE) will supply examples of district/borough-related implementation of climate action (early 2012, Duration: 3 years).

With the Future Concept Renewable Wilhelmsburg, the Wilhelmsburg island on the Elbe is gradually being initiated into having the complete conversion of electricity and heat to be 100% from renewable energy sources. The implementation of projects on the IBA Hamburg 2013 demonstrates in an international framework the implementation of the neighborhood-related Climate Action Plan for Wilhelmsburg. The continuation of the IBA-concepts and projects are carried out in the research projects TRANSFORM and EnEff:Stadt – IBA Hamburg:

- With TRANSFORM (Project within the 7th EU Research Framework Program up to 2015), the climate protection and climate change impact adaptation model district of Wilhelmsburg launched with the IBA 2013 should be further developed. The research approaches and results are to be transferred to other neighborhoods and districts.
- EnEff:Stadt – IBA Hamburg with the energy monitoring of the IBA Project and the Elbe island Wilhelmsburg until the beginning of 2015 is used for operation optimization of the projects and the analysis of strengths and weaknesses. EnEff:Stadt can be used for the readjustment of the standards and specifications for future projects.

For the further development of the Wilhelmsburg role model for climate protection and climate change impact adaptation, further projects in the strategic fields of activity of the IBA will be initiated after 2013, e.g. in the fields of activity of construction and climate-friendly mobility, as well as adaptation to climate change on the basis of the concept "IBA-Deichpark". The objectives and action programs of the integrated urban development are to be implemented in the form of an open dialog and in co-operation with the stakeholders of urban development and climate change. The aim is to achieve a balance between an overall strategy (Top-Down), and the many individual

bottom-up strategies of the stakeholders involved, such as housing associations, energy suppliers, civil society groups and associations. The civic participation in the context of the land use planning is a proven participation instrument to integrate citizens, interest groups, innovation carrier etc. also on the topic of climate protection in the spatial planning process. The "Umwelthauptstadt-Dialoge" in the new format of the "Stadtwerkstätten" is continued.

Support of the districts: the districts are supported in the implementation of climate protection requirements in terms of content and if necessary financially in specifically requested projects. This is important in the support of exemplary projects and planning procedures, such as the provision and processing of special projects, in the further development of the solutions obtained in the so-called Climate model districts and their transfer to other projects or in the implementation of the joint project "Smart Power Hamburg" in the Hamburg area development and district development.

Usage mixtures: in the restructuring of existing urban neighborhoods with predominantly residential and office buildings use creative usage mixtures will be sought with experimental spaces for a sustainable and climate protection oriented district development.

IT-support: In the context of urban development planning, existing and advanced climate tools will be applied to B-plans, to calculate simply and quickly CO₂ emissions depending on specific plan content. Plan areas are subjected to climate protection and adaptation simulations, different scenarios are described, in order to achieve optimizations such as the one concerning innovative and efficient energy supply for neighborhoods and the entire city. A first overview is already provided by the application of the computational tool developed in the context of the Climate Action Plan for the detection of CO₂ savings. Urban Development & Planning visualizes the subject of climate protection and adaptation and makes a contribution to GIS-based spatial analysis on the subject of energy and climate protection. It identifies data, trends, and potential for climate protection and adaptation to climate change.

In the district development plan and other plans, interactions between the structural density, building volumes, greenery portions as well as sealing levels on the one side, and the bio-climatic burden on the other side are recorded. This includes the development of dynamic simulation models for impact assessment and optimization of urban spatial climate measures, for which a first basis is available with the "urban climatic stocktaking and assessment for the Hamburg landscape program".

Urban CO₂ storage: The Hamburg cultural landscapes, forests, marshes, nature conservation areas and the urban biomass (parks, green spaces including other urban green spaces) are also evaluated quantitatively in terms of the bound volumes of CO₂; Measures to safeguard and develop the urban CO₂ storage will be implemented in urban development. The forest with the forest structural plan and other appropriate sector plans is supposed to be developed further in a climate friendly manner with scientific support. Its CO₂-binding capacity contributes to reduce the CO₂ concentration in the atmosphere.

Role model function: the power of good examples is used (model solutions with potential to transfer to other districts/neighborhoods, flagship projects, lighthouses); they are essential for the content control and up to 2020 will remain important as a driver, inter alia also in order to change behavior patterns. Hamburg provides targeted incentives here, for example, with quality competitions, invitations to tender, etc.

III.7

Education

In particular, the following projects on climate change, mitigation and adaptation in the different educational sectors already contribute to a large extent in the context of mainstreaming to meet climate protection goals of the Senate and will be further developed in terms of contents:

- Sector daycare centers: Fifty-fifty junior and Kita 21 of the Save Our Future Foundation – SOF Environmental Foundation.
- School sector: Fifty-fifty and climate protection in schools.
- Vocational school sector: Resource, environmental protection and Climate Protection Officer (RUK officers) in vocational schools.
- University sector: Blue Engineering - engineers with social and ecological responsibility at the Technical University of Hamburg Harburg (TUHH).
- Further education sector: HEINZ – Hamburg developing sustainability indicators of the Future Council
- Informal education sector: “Gut Karlshöhe – Hamburger Umweltzentrum“ – the new learning center for Climate protection and Nature in Hamburg.
- UN Decade “Education for Sustainable Development“ 2005–2014 (BNE).
- Energy advice for low-income households (power saving check) and households with a migrant background.

- Vocational education and training of planners and performers as part of the master plan trade 2020 (joint strategy of the Senate and the Chamber of Hamburg) and of the "brick building advisor" program.

In addition, among others, the following new projects are tested with a focus on CO₂ reduction:

- Establishment of RUK officers in all governmental and educational institutions beyond the scope of vocational schools.
- Model experiment on CO₂ labeling for food at Hamburg school shops.
- Project on measuring CO₂ emissions during activities and events.

III.8

Research and Science

In the science city Hamburg, there is already climate-relevant research, e.g. in the areas of climate and modeling, causes of climate change, technological development, renewable energy, energy efficiency and energy storage. The aim is to provide basic concepts on climate processes, and developments, foresighted findings and solutions in the areas of climate protection and opportunities for adaptation to climate change. This will consistently continue to develop. The main measures are:

The Cluster of Excellence CliSAP and the Climate Campus: The climate research cluster “Integrated Climate System Analysis and Prediction – CliSAP” is an excellence project that is unique in Germany, with an international reputation and visibility. It focuses and interlinks, since 2007, the Hamburg Climate Research. Involved are: the University of Hamburg, the Max Planck Institute for Meteorology, the Helmholtz Zentrum Geesthacht and the German Climate Computing Centre. CliSAP has been funded since 2007 as part of the Excellence Initiative of the German Federal and State Governments as a cluster of excellence and will continue to be funded in the second funding round in 2017. The FHH will also fund the environment cluster with state funds in addition in order to support the sustainable development of climate research and the gradual integration of new cluster structures into the University

Within a few years, the Climate Campus Hamburg has developed from the cluster CliSAP with the involvement of other partners. It brings together all the relevant stakeholders in climate research for the joint work on the social challenges of climate research. In the next two years, the Climate Campus Hamburg is

supposed to be established as an international center of excellence for climate research. Medium term, inter alia the Climate Service Center, the German Weather Service and the Federal Maritime and Hydrographic agency are supposed to be integrated.

Establishment of an Energy Campus: Based on the Competence Center for Renewable Energy and Energy Efficiency (CC4E) of the University of Applied Sciences (HAW) a technology center Energy Campus Hamburg is supposed to be developed. Objective is the networking between companies, universities and institutions for the development of application-oriented solutions / innovations for renewable energy, which will cause a great benefit to the general public. The technological priorities for the Energie Campus are wind energy and the interdisciplinary connected areas of grids / grid integration (smart grids, demand side integration / Energy Efficient City) as well as partial regions of the energy storage.

Hamburg Energy Research Network: An important role in the energy transition is assigned to the Hamburg Renewable Energy cluster. From the science area, the newly established "Hamburg energy research network" gets involved in the cluster activities. The energy research consortium is an association of universities of Hamburg and is meant to coordinate and bundle their research and skills, make them visible, acquire targeted funding to ensure the training of professionals and improve cooperation with industry in research projects.

As one of the planned activities, staff of the Energy Research Association are supposed to develop a common umbrella project, for energy research in Hamburg and jointly work out applications for collaborative projects for submission to federal and other national competitions (e.g. BMBF, BMU, BMWi). This should be done together with the Energy representatives of the universities and in coordination with the R&D-forum of the cluster renewable energies. The cluster management provides the interface to the companies of the cluster, and is working on a common R&D-strategy of business and science for Hamburg within the framework of a coordinated strategy.

In addition, the universities in the context of the fundamental research on renewable energies and energy efficiency make varied contributions to the energy transition. These activities are to be further expanded. The research profile will continue to develop thematically and in scope.

III.9

Integrated view of climate protection: Adaptation to climate change

The presented measures to reduce CO₂ emissions are required, in order to limit a further increase in global warming. Climate changes on the basis of past, present and future anthropogenic greenhouse gas emission will however, inevitably occur, or are already visible. Thus, besides climate protection measures, measures for adaptation to the consequences of climate change are also required. But the different time dimensions of measures to reduce anthropogenic CO₂ emissions and of adaptation measures have to be taken into account. Climate protection measures must be implemented today, but show significant effects not until long after their implementation. Adaptation measures, by contrast, are often effective immediately after its implementation and can therefore be taken partly also at later time-points, namely when the effects of climate change make this necessary. The adaptation to climate change therefore requires both short- and long-term orientation. On the one hand, it acts on the climatic changes already visible today, and in most cases not so serious and takes the necessary action. It tries to describe the further changes to be expected in future and to adapt the activities to them in good time. In many areas, a long leadtime is also needed, for example because the infrastructure facilities, as well as the dam construction are planned for decades in advance. Also, the urban planning is long-term. It is to be borne in mind that the need for adjustment in the coming decades will increase.

For climate change adaptation, the master plan (see II.9) describes first strategic courses. A more specific design, further development and adaptation to the current framework conditions is done within the update of the master plan (see IV.2). For instance, it is intended to integrate the basic strategic decisions for climate adaptation (based on the specialized individual concepts) with the next updates and also the climate Impact Monitoring that is yet to be developed in the strategic part of the master plan.

IV.

The whole of Hamburg is onboard - Integration of stakeholders and further development of the concept

IV.1

Participation

Overall, the objective was: the technical and strategic master plan process is to "map"

the relevant bodies and organizations of the city as a whole - both within and outside the Ministry of Urban Development and Environment and the authorities.

As already begun in the context of the discussion of the "basic expert opinion report" (public events, website, environmental capital city dialogues), the development of the Hamburg Master Climate Action Plan was continued in dialogue with and participation of Hamburg stakeholders. The aim was to include both the scientific community as well as representatives from Hamburg's economy and society. Constructive participation of Hamburg stakeholders in the development of the Master Climate Action Plan is an important prerequisite for the acceptance of the measures and the subsequent successful implementation.

The European Green Capital dialogues in 2011 and 2012 opened up many possibilities for the external (trade) participation in the Master Climate Action Plan.

In the context of the development of the Master plan, there were both contributions from experts from the public authority for urban development and the environment and other authorities, as well as support from external experts such as from science and research.

On the basis of a position paper and a detailed outline, a participation of about 50 external stakeholders and multipliers of the city took place. On one hand, these consisted of associations and companies and, on the other hand, of civil society groups and non-governmental organizations, which were invited to a hearing and were also asked to provide written comments. Suggestions and proposals have been extensively tested and have been partially incorporated into the Master Climate Action Plan. Other suggestions will be taken into account in the implementation of the Master Plan.

In future, new, targeted participation formats will be designed to bring environmental and sustainability issues more close to the width of society. Here, beyond the scope of awareness, the focus in particular should be on the conveying of practical guidance and practical knowledge and incentives to participate and incentives for do-it-yourself. These formats should also be used for the implementation of the Master Plan. The "City workshops" are one way for the mutatis mutandis continuation of the dialogue that was started in 2012, where Environment / Climate Protection issues are also considered. Thus, for example, the topics of the RISA project (rain infrastructure adjustment), which is focused on the development of concepts for the sustainable use of rainwater by HAMBURG WASSER, the Ministry of Urban Development and Environment, and the project partners, were discussed at a city workshop.

IV.2

Implementation, organization and development of the Master Plan

The individual measures within the framework of the master plan will be controlled and further developed in the following manner.

Implementation and operationalization of measures: a part of the measures of the 2020 Action Plan, in particular in the fields of building and energy, is already sufficiently substantiated and can be implemented immediately. The implementation of other measures is a regulating task to be developed even further in the coming years.

The generation of individual measures follows the standards: development of criteria for project funding, control of the use of funds, budgets for individual projects, long-term assignments for multi-year projects/funding programs, award process with the further development of the proven application procedure, support for the implementation of measures. These requirements are derived inter alia from the recommendations of the evaluation of the climate change concept 2007-2012 and ensure its continuity. The established procedures for the granting of climate protection funds are adapted to new circumstances. The necessary steps will be examined in the context of the further Master Plan Implementation (shortening of the procedure etc.).

Monitoring: The measures financed from climate protection funds and the CO₂ reducing measures in Appendix 2 will be subjected to ongoing monitoring, as well as the measures not yet completed that are to be financed by the Climate Action Plan 2007-2012. For the field of climate protection, the existing methodology, the tools and the criteria used for CO₂ monitoring which have been developed in the context of the climate change concept 2007-2012, in cooperation with the Wuppertal Institute and the Institute for Applied Ecology, will continue to be used. The design (type and extent) of the monitoring of further measures (mainstreaming) will be clarified with the agencies involved in the course of the further process. For Climate change impact adaptation, the plan is to establish Climate Impact Monitoring as a medium and long-term controlling instrument by 2015.

Controlling, reporting and further development of the Master Plan: The Master Plan, as a long-term development plan for climate protection and the Climate change impact adaptation in Hamburg, has to be regularly adapted to the current developments and

revised. To this end, the Senate updates it every two years and resorts to the existing structures of the Climate Action Plan 2007-2012. In the update, the monitoring results of individual projects, the achievement of objectives in individual fields of action and projects, project development (completed and newly created measures) as well as changes in the framework conditions are presented in different levels of detail. The criteria for project funding will be developed further. The responsible authority shall involve the other agencies and external partners in the climate protection report.

Assimilation Climate Action Plan, Master Plan, adaptation to climate change: after the basic strategic decisions for adaptation to climate change have been made and are integrated into the Master Plan, the Master Plan will in future be the strategic umbrella for two complementary pillars of the regional climate policy: climate protection and climate change adaptation.

At the same time, the Master Plan, through the 2020 Action Plan, gets its first operative focus. With the measures of the 2020 Action Plan, especially the Climate Action Plan 2007-2012 will continue to be consistently developed. With the inclusion of the climate consequence monitoring and the climate change adaptation (see III.9) that is intended as part of the updating, this pillar is also integrated into the Master Plan.

This update ensures the continuity of the Hamburg Climate Policy, e.g. by supporting the specific individual measures such as the launching or continuation of funding programs and the funding of innovative projects.

Network activity: Hamburg can only achieve its climate protection goals if as many stakeholders in the city as possible get involved. Therefore the competent authority not only promotes the master plan, but also initiates projects with partners in the city. Appropriate measures will be evaluated and can be partly financed from climate protection funds. The appropriate measures carrier will be supported in the project planning. For projects that cannot be funded, the competent authority provides advice of other funding opportunities (e.g. in the area of Federal funding). In the area of industry, commerce and the Environment, the Partnership Hamburg Port plays an important role with almost 1,000 environment partners and contacts to several thousand other businesses. To be highlighted here are the annual Environmental Industry Summit, the intensive networking and the outreach energy and environmental consultancy of chambers, which addresses the small and medium-sized enterprises.

Results from the evaluation of the climate change concept: The recommendations from the evaluation of the climate change concept 2007-2012 were taken into account in the preparation of the Master Plan or will be reviewed when it comes to its implementation.

For instance, the demands for inter-operable and hierarchical goals are met in the Master Plan. Precisely because the focus is on CO₂ reductions, especially in regard to achieving the savings target by 2050, it is necessary to formulate the criteria for non-direct CO₂ saving measures accurately. Also, the recommendations for reducing the project portfolio are met. The measures of the Action Plan are reduced to a level that ensures effective implementation and external representation. Projects that are not financially supported will continue, if they contribute to CO₂ reductions.

The Master Plan was discussed in advance with environmental organizations and chambers, which also corresponds to a recommendation from the evaluation. Furthermore, the established application process has been further developed, as proposed in the evaluation, and adapted to new conditions. The recommendations related to participation in networks and goal-oriented public relations will be fulfilled in the implementation of the plan.

C.

Budgetary impact

The Master Plan includes measures with very different requirements for funds. A considerable part of these requirements will be met in the 2013/2014 budget, from the budgeted funds in the respective departmental budgets, or by external funding.

The usually supplementary funds of the Master Climate Action Plan are made available to the authorities and agencies on application during the year by way of the target transfer.

For this the following funds are budgeted⁴⁾ in the titles 6800.893.19 (investment purposes) and 6800.971.19 (consumptive):

⁴⁾ The Reconciliation of 6 individual plans, planned in 2014, in the wake of "Strategic realignment of the financial system (SNH)" will also change the future budgeting for the funds required, but not change the intended handling. Senate and citizens are informed by separate printed matter on the outcome of the reconciliation of all affected departmental budgets.

Title	Intended purpose	Budget 2013	Budget 2014
		- in k Euro -	- in k Euro -
6800.893.19	Master plan Climate protection (investment)	8,040 KM	8,040 KM
		8,040 VE	4,800 VE
6800.971.19	Master plan Climate protection (consumptive)	5,360 KM	5,360 KM
		5,360 VE	3,200 VE
Total		13,400 KM 13,400 VE	13,400 KM 8,000 VE

In Appendix 2, the proposed distribution of funds is shown.

The financing of other measures will be decided after 2014 with the establishment of the then following budget.

The current application process for the 2007-2012 Climate Action Plan will be continued in a simplified manner and developed further.

D.

Petitum

The Senate requests that the citizens should take note of the submitted communication on the "Master Climate Action Plan."

E.

Appendices

1. Methodology of CO₂ balancing
2. List of measures (including financing from climate protection resources and/or specialist titles)
3. Overview: response to the Official Parliamentary minutes 20/1229

Appendix 1

Methodology of CO₂ balancing

For the 2020 Action Plan, different balancing methods were weighed against each other.

On one hand, top-down approaches that determine the changes in a specific balance sheet framework for the whole of Hamburg between 1990 and 2020. Within this balance sheet framework, a particular goal is established, from which then the measures needed to achieve it are derived. Possible balance sheet frameworks are the Hamburg polluter balance or the modified polluter balance from the baseline report for the 2010 Master Plan. The Hamburg polluter balance cannot fully reflect quantitatively the climate protection measures covered by the Master Plan. It records as a sum total all measures or their impact that have an effect on the CO₂ balance created by the Bureau of Statistics Nord. In addition, important measures that are included in the Master Climate Action Plan are not part of the polluter balance. The polluter balance is also subject to a number of influences that can affect Hamburg only to a very limited extent (e.g. economy, federal policy). For the same reasons, the modified polluter balance from the baseline report for the 2010 Master Climate Action Plan cannot be considered as a balancing basis for the Master Plan: The starting point

is the polluter balance, reduced by emissions trading investments and air traffic. In this framework, all federal and EU measures already decided for Hamburg were credited against a Hamburg reduction target of 40%. From this, a gap of 1.6 million tons was established that has to be bridged by additional measures.

Therefore, the balancing was chosen according to a bottom-up approach for the 2020 Action Plan of the Master Climate Action Plan, as it was already used in the Climate Action Plan 2007-2012. Here, the climate protection measures are added up to an overall goal. Bottom-up balancing: All climate effects (also outside Hamburg) are recognized that are achieved through measures implemented in Hamburg. For each measure, a so-called baseline is defined, showing how the emissions would have changed in this area without the measure. The reduction of a measure is calculated relative to the baseline. An example of this is the construction of new climate-friendly buildings. Here, it is respectively recognized how far they go beyond the legal standard. The legal standards of the ENEV thus form the baseline for new constructions.

An example comparison, what contents are taken into account according to what balancing method

Possible Hamburg measures with CO ₂ reduction effect	Master plan/ total balance	Polluter balance	Baseline report
Sustainable Consumerism	yes	No, effect primarily outside Hamburg	
Additional Wind turbines	yes	No, affects only the federal electricity mix	
Funding program enterprises for resource	yes	yes	No, already adopted measure
Cleaner district heating (innovation power)	yes	yes	yes

Methodology chosen for the Action Plan 2020

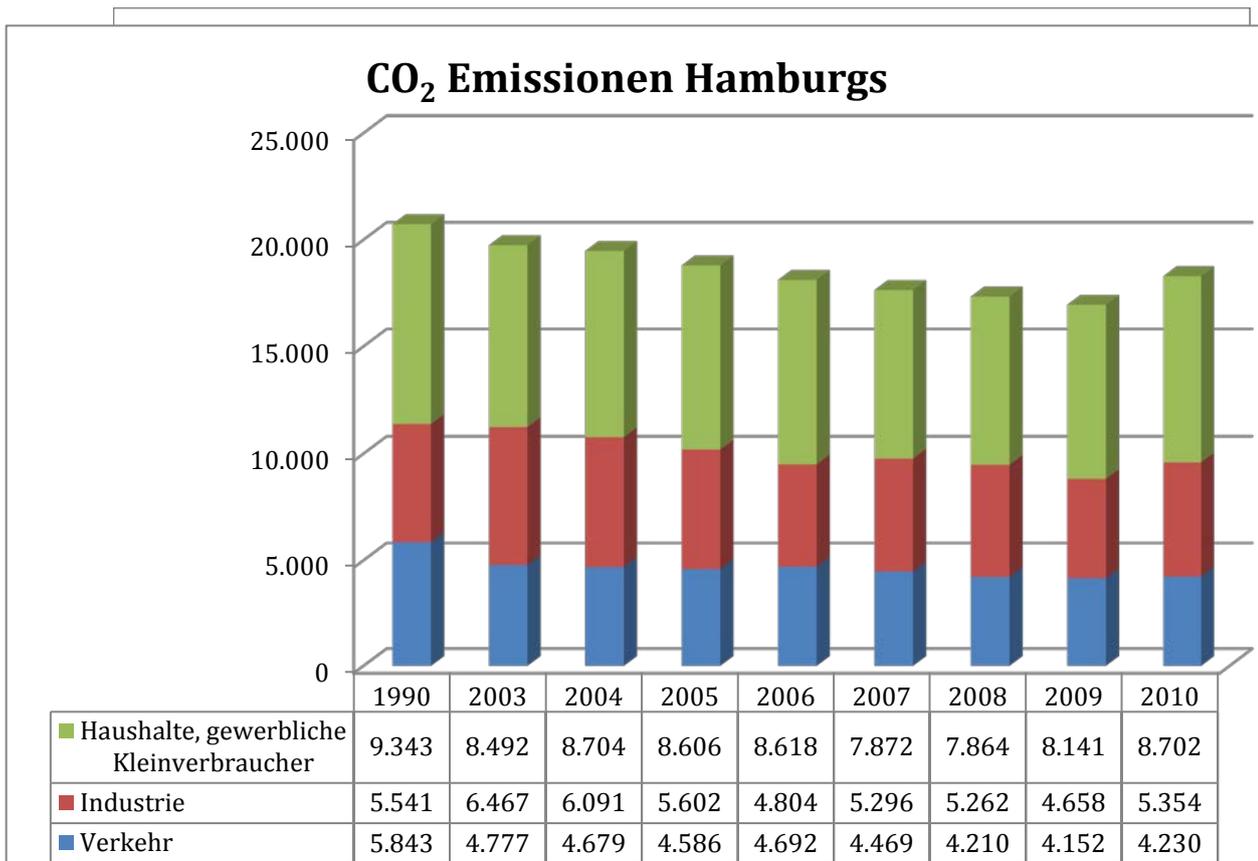
For the action plan, a bottom-up balancing was chosen. Various possibilities for action were weighed and the available climate protection funds planned in such a manner that the highest possible CO₂ reduction is achieved. The cumulative CO₂ reductions from 2013 to 2020 of close to 2 million tons are the target of this concept. The reduction capacity of all plants is accumulated, so that this concerns the annual CO₂ reduction to be achieved in 2020. The Senate takes up the challenge to achieve this goal with the full implementation of the climate protection measures specified in the master plan.

The chosen approach has the following advantages:

- It illustrates, (in contrast for example to the polluter balance), the CO₂ effects of the measures completely. For climate change, this is appropriate, since the factor of where harmful emissions are being avoided is basically negligible.

- The achievement of objectives can be truly influenced by the Senate, as opposed to the top-down approaches.
- Hamburg makes an appropriate contribution to climate protection, taking into account also the fact that Hamburg as a location for industry has high CO₂ emissions that sometimes are not influenceable and that emissions have still risen in the 90s, in Hamburg, in contrast to the federal government.

In the past, a reduction in CO₂ emissions in Hamburg is reported from 1990 to 2010 of 12% based on the polluter balance. A further reduction in CO₂ emissions by 28% by the year 2020, which is based solely on the Hamburg polluter balance, cannot be achieved alone with a realistic Hamburg measures package. This is due last but not least also to the fact that in 2010, emissions have increased significantly in Hamburg because of exceptionally high economic growth.



With this Action Plan, the following target achievement in the context of top-down approaches can be estimated on the basis of the once more updated assumptions from the baseline report for the

Master Plan. The measures were individually analyzed for their effect in the relevant balance context.

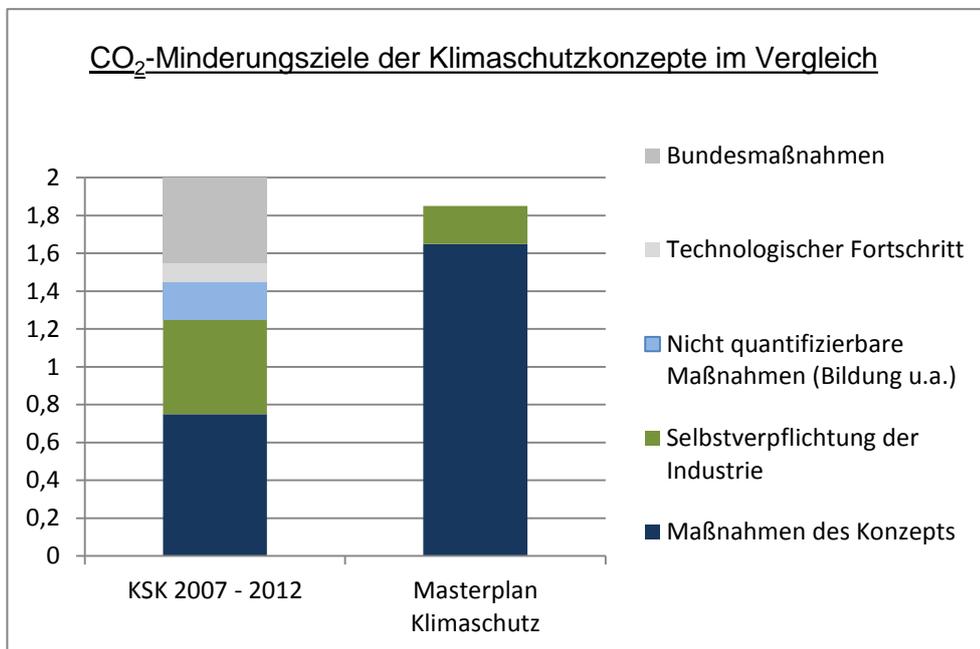
	Balancing framework			
	Baseline report for the Master plan		Polluter balance	
	in million t		in million t	
1990	17.9		20.7	
2006	16.2		18.1	
2008	15.1		17.3	
2009	14.7		17.0	
2010	16.1		18.3	
2020	13	- 27 %	15.2	- 27 %

Notwithstanding the above limitation, the polluter balance remains a further indicator staged alongside this total balance of the course of development of CO₂ emissions in Hamburg.

cannot be ultimately influenced by Hamburg, this approach was not taken over for the Master Plan. Instead, the Master Plan is restricted to predictable reduction potentials that can be influenced.

Comparison of the objectives of the Climate Action Plan with the 2007-2012 Master Plan: The Climate Action Plan aims at a total reduction of CO₂ emissions in Hamburg of nearly 2 million tons. External influences were logically recorded in this concept like the effects from federal actions. But since these

Due to the longer duration of the Master Plan of 8 years compared to 5 years, and a consistent focus on measures with high reduction potential, an overall reduction can still be realized of almost 2 million tons.



*) As things stand, quantifiable measures

Methodology of calculation of reduction costs

The funding cost is calculated by comparing the annualised yearly costs and the annual savings over the lifetime of an individual measure. The running time of an individual measure here refers to the duration of action of the funded measure, e.g. the lifetime of a funded building envelope renovation.

For the calculation, annual costs and savings are expected. It is therefore investigated what costs a funding program causes in a year of funding and what the annual reductions are that result over the lifetime of the funded measures through the funding in one year. This annual observation was chosen for practical reasons.

As costs, the annual funding costs, personnel costs and capital costs are included in the calculation. Capital costs are calculated in the calculation of annuities. Here, an interest rate of 5% is assumed as a basis. These costs are distributed evenly across the years of the term of funded measures. The constant annual costs thus calculated are compared with the annual reductions. The ratio of the annual costs and the annual CO₂ reductions is the indicator of the cost efficiency.

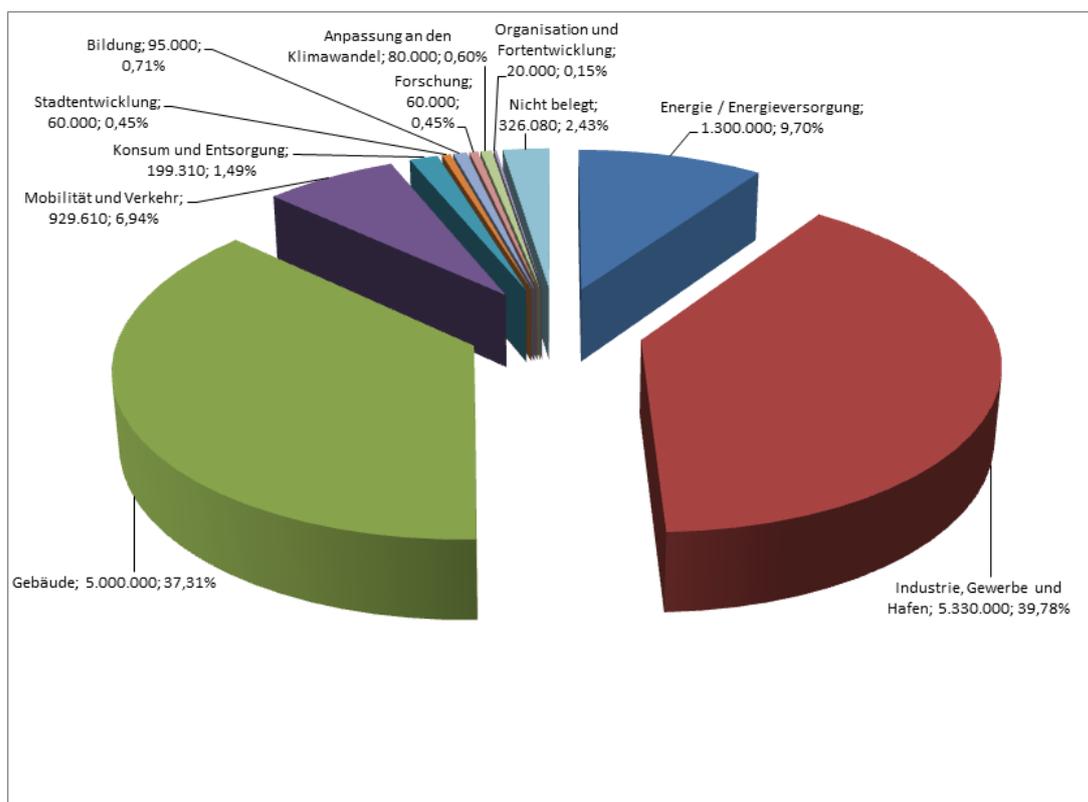
List of measures

Explanation:

The table on the following page contains information contained in the Master Plan. In addition, the reduction of CO₂ emissions sought by the individual measures and the financing from climate protection funds of the budget titles 6800.893.19 and 6800.971.19 and the budget titles 6800.892.11 and 6800.899.10 of the Ministry of Urban Development and Environment are also shown.

The column CO₂ savings gives a breakdown to what extent the individual projects contribute to the goal of reducing CO₂ emissions by 2020 by nearly 2 million tons compared to the current state. The sorting is based on the CO₂ savings, starting with the measure with the highest savings.

The funds distribution of climate protection funds (budget titles 6800.893.19 and 6800.971.19) for the various fields of action of the Master Climate Action Plan are presented below (EUR /% proportion). Approx. 10% of the funds are used for projects to which no CO₂ can be directly attributed:



List of measures (including Reduction of CO₂ emissions and Climate protection financing from funds or specialist titles)

Information about the Project (The projects proposed for funding for 2013/2014 are key projects of the Master Plan and the result of inter-disciplinary Expert Workshops)			CO ₂ reduction by the end of 2020 (in t/a) (k. A. m. = no information possible)	Funding from climate protection funds of the budget titles 6800.971.19 and 6800.893.19 (in Euro)		Funding from the BSU budget titles 6800.892.10 and 6800.892.11 (in Euro)
Field of action	Project number	Project	Period of time 2013-2020	2013	2014	per 2013/14
Energy / Energy supply	2013/001	Cooperation agreements of the FHH with the E.ON and the Vattenfall Group (60 individual measures), such as innovation power plant, additional 180 CHP, district heating expansion, intelligent load and consumption control	330,000			
Industry, trade and port	2008/031	CHP initiative - implementation of a program to enhance coupling of heat and electricity production with companies in Hamburg, from the production, service provider and housing sector (funding program)	230,400	1,200,000	1,200,000	
Industry, trade and port	2007/070	(Enterprises for resource conservation)	178,000	2,000,000	2,000,000	2,000,000
Industry, trade and port	2007/051	Opening up further energy efficiency potential in large industrial and commercial enterprises Implementing voluntary commitment of industrial companies (Letter of Intent - LOI)	150,000			
Consumerism and disposal	2007/117	Optimization of waste management in Hamburg under the aspect of climate protection ("Recycling Offensive")	134,000			
Buildings	2007/142	Energy-efficient modernization of rental housing (Förderprogramm)	111,000			
Energy / Energy supply	2013/002	Development of wind energy in Hamburg: creation of the framework conditions	110,000			
Energy / Energy supply	2013/003	Renewable heat Expansion of bioenergy large-scale systems	100,000			
Buildings	2013/008	Alliance for Housing (agreement FHH Associations)	100,000			
Buildings	2012/009	Replacement of electric night storage by pumped hot water heaters and funding of energy efficient domestic hot water systems (Funding program)	83,000	500,000	500,000	
Consumerism and disposal	2013/013	Implementing climate and energy concept Hamburg Water	50,000			
Buildings	2007/095	Climate protection program "Thermal insulation in existing buildings" (Funding program)	40,000	2,000,000	2,000,000	1,000,000
Industry, trade and port	2011/014	Heating network in the "Enterprises for resource conservation" program (Funding program)	40,000	800,000	800,000	
Buildings	2010/031	Funding of energy-efficient, non-residential buildings (Funding program)	24,000	1,500,000	1,500,000	
Industry, trade and port	2012/008	Energy-efficient optimization of air conditioning systems (Funding program)	22,000	500,000	500,000	

still Appendix 2

List of measures (including Reduction of CO₂ emissions and Climate protection financing from funds or specialist titles)

Information about the Project (The projects proposed for funding for 2013/2014 are key projects of the Master Plan and the result of inter-disciplinary Expert Workshops)			CO ₂ reduction by the end of 2020 (in t/a) (k. A. m. = no information possible)	Funding from climate protection funds of the budget titles 6800.971.19 and 6800.893.19 (in Euro)		Funding from the BSU budget titles 6800.892.10 and 6800.892.11 (in Euro)
Field of action	Project number	Project	Period of time 2013-2020	2013	2014	per 2013/14
Industry, trade and port	2010/019	Creating CO ₂ balances and opening up further energy efficiency potential in public enterprises	20,000			
Buildings	2007/140	New residential construction program (Funding program)	18,000			
Energy / Energy supply	2011/025	Renewable heat Biofuels - Biogas (Funding program)	14,000	200,000	200,000	
Education	2007/025	fifty-fifty	12,500			
Energy / Energy supply	2013/010	Heat supply concept and energy-efficient district planning	10,000			100,000
Energy / Energy supply	2011/025	Renewable heat Solar thermal energy and heating (Funding program)	8,000	500,000	500,000	
Mobility and Transportation	2013/014	Further Projects E-Mobility in the course Model region electromobility "The powered industry," Port-conversion of heavy goods traffic Project per 1,000 electric vehicles and Commercial of Commerce and Chamber of Trade	5,500			
Buildings	2007/159	Energy-efficient refurbishment of public buildings - Modernization of building services engineering	5,125	1,000,000	1,000,000	
Energy / Energy supply	2013/009	Renewable energy: concepts, solar center, monitoring, isolated cases, funding	5,000			650,000
Mobility and Transportation	2008/083	Implementation of the cycling strategy of the Bicycle Forum (from Master plan funds in 2013: individual measure Elbchaussee)	3,200	800,000	0	
Energy / Energy supply	2007/160	Energy savings in buildings with high base load	3,000	600,000	600,000	
Education	2008/082	Implementation of the measures from the climate protection plans of the schools in the context of climate protection in schools	3,000	70,000	70,000	
Education	2009/063	fifty-fifty junior	2,500			
Mobility and Transportation	2011/024	Expansion of the testing of battery-electric vehicles (Funding Master plan approved by VE)	300	50,000	48,500	

List of measures (including Reduction of CO₂ emissions and Climate protection financing from funds or specialist titles)

Information about the Project (The projects proposed for funding for 2013/2014 are key projects of the Master Plan and the result of inter-disciplinary Expert Workshops)			CO ₂ reduction by the end of 2020 (in t/a) (k. A. m. = no information possible)	Funding from climate protection funds of the budget titles 6800.971.19 and 6800.893.19 (in Euro)		Funding from the BSU budget titles 6800.892.10 and 6800.892.11 (in Euro)
Field of action	Project number	Project	Period of time 2013-2020	2013	2014	per 2013/14
Mobility and Transportation	2012/006	Example concepts for the systematic integration of electric mobility in residential neighborhoods	300			
Industry, trade and port	2010/058	Replacement of the lighting system in the Deichtorhallen (Funding Master plan approved by VE)	120	300,000	0	
Mobility and Transportation	2010/065	Pilot project electric mobility launch Smart ED (Funding Master plan approved by VE)	13	79,610	34,387	
Industry, trade and port	2012/001	Funding program for climate protection and resource efficiency in product development and process design	k. A. m.	300,000	600,000	
Consumerism and disposal	2007/080	Energy and Climate hotline in cooperation with the Consumer Advice Center Hamburg (Initial phone consultation) (Funding Master plan approved by VE)	k. A. m.	149,310	149,310	
Industry, trade and port	2007/068	Increase the reach of climate programs through active integration of enterprises not yet involved through economic institutions (HK energy controllers) (Funding Master plan approved by VE)	k. A. m.	135,000	135,000	
Industry, trade and port	2007/068	Increase the reach of climate programs through active integration of enterprises not yet involved through economic institutions (ZEWU mobile plus) (Funding Master plan approved by VE)	k. A. m.	95,000	95,000	
Urban development	2008/025	Climate protection and climate adaptation in Urban development - Climate model districts	k. A. m.	60,000	60,000	
Research and Science	2013/005	Minor measures in Field of Action Research and Science (to be specified)	k. A. m.	50,000	50,000	
Consumerism and disposal	2013/006	Minor measures in Field of Action Consumerism and disposal (to be specified)	k. A. m.	50,000	50,000	
Adaptation to climate change	2008/099	Modeling of urban climate	k. A. m.	50,000	0	
Adaptation to climate change	2008/080	Hamburg strategy for Adaptation to climate change (overall strategy)	k. A. m.	30,000	30,000	
Education	2013/007	Climate checkout Student competition for CO ₂ reduction everyday measures	k. A. m.	25,000	25,000	

List of measures (including Reduction of CO₂ emissions and Climate protection financing from funds or specialist titles)

Information about the Project (The projects proposed for funding for 2013/2014 are key projects of the Master Plan and the result of inter-disciplinary Expert Workshops)			CO ₂ reduction by the end of 2020 (in t/a) (k. A. m. = no information possible)	Funding from climate protection funds of the budget titles 6800.971.19 and 6800.893.19 (in Euro)		Funding from the BSU budget titles 6800.892.10 and 6800.892.11 (in Euro)
Field of action	Project number	Project	Period of time 2013-2020	2013	2014	per 2013/14
Organization and continued development	2010/025	Cost center for Climate protection	k. A. m.	20.000	20.000	
Research and Science	2011/032	Battery-Test-Labor (University of Applied Sciences)	k. A. m.	10.000	0	
Industry, trade and port	2013/015	Eco-profit	k. A. m.			150.000
Buildings	2007/083	ELBCAMPUS / Energy Construction Center	k. A. m.			104.720
Buildings	2007/082	Qualification for architects and tradesmen – IMPULSE Program	k. A. m.			100.000
Industry, trade and port	2013/011	Quality association enterprises with environmental awareness	k. A. m.			60.000
Energy / Energy supply	2007/084	Cluster Renewable Energy Hamburg	k. A. m.			
Industry, trade and port	2008/073	Climate protection in product development and technological innovations in the areas of Energy generation and conversion (Funding program)	k. A. m.			
Education	2008/081	School Construction Agency 2.0	k. A. m.			
Energy / Energy supply	2013/012	Energy cooperation Port of Hamburg (Funding (approximately 1 million Euro) from residual budget 2012)	k. A. m.			
		Totals	1,812,958	13,073,920	12,167,197	4,164,720
			Quantifiable measures as things stand			
		stated in the budget plan		13,400,000	13,400,000	4,235,000

Appendix 3

Overview: response to the Parliamentary Minutes 20/1229 "Hamburg - ready for the energy transition! Key aspects for a safe, inexpensive, and environmentally and climate-friendly energy supply for Hamburg"

Nr.	Parliamentary Circular 20/1229	References	Remarks
1.	Increasing the rational use of energy	Chapt. II.1-4, P.5 pp. Chapt. III.1-4, P.17 pp.	The master plan climate protection is directed towards increasing the rational use of energy in the relevant fields of activity, in particular in the areas energy / power supply, industry, port and commerce, buildings, as well as mobility and transport.
2.	Energy conservation must become a national sport: comprehensive energy consultation of private households through the Hamburger Energieagentur (HAMEA) together with the Verbraucherzentrale Hamburg(VZ) and other players by means of incentive programmes	Chapt. II.5, P.11 Chapt. II.7, P.12 pp. Chapt. III.5, P.23 pp.. Chapt. III.7, P.27	The master plan also relies on communication and education as important instruments of climate protection. However, the scarce resources are more focused on measures with demonstrated high CO2 savings. The following projects in the energy consulting field are sponsored by the Senate: power-saving Check-Plus - Power saving advice in low-income households, energy and climate hotline in the VZ, information for, and addressing of, households with a migrant background in the field of energy conservation through the Turkish community in cooperation with the VZ. The Centre for Climate Issues will be maintained and, among others, has the task to seek contact with private initiatives as multipliers into the population.
3.	Further development and expansion of the power-saving check for households with a low income	Chapt. III.7, P.27	Is a component of the master plan as a measure in the field of activity education
4.	Targeted addressing of Hamburg	Chapt. III.1, P.18	Is a component of the master plan as a measure in the

Nr.	Parliamentary Circular 20/1229	References	Remarks
	enterprise within the scope of environment partnership and enterprises for resource conservation (UfR)	Chapt. III.2, P.18 pp.	field of activity Industry, commerce and port.
5.	Information events as part of work and climate protection	Chapt. III.3, P.20 Chapt. III.1, P.17	The funding under the umbrella "work and climate protection" has been split up, in the meantime, into the areas "Alliance for Living" and "Promoting renewable energies". Information events are held in both areas.
6.	Continuation of fifty-fifty in schools	Chapt. III.7, P.27	Is a component of the master plan as a measure in the field of activity education.
7.	Expansion of the climate-friendly energy generation capacities, also through municipal energy companies such as Hamburg Energie and municipal cleaning	./.	For the expansion climate friendly energy generation capacities, HAMBURG WASSER plans -beside the existing solar and wind power plants of the group - to invest in further renewable energy generation plants in order to become energy-self-sufficient in the long-term. The first milestones were already achieved with the energy-self-sufficient sewage treatment plant Köhlbrandhöft-Dradenau. Currently the establishment of at least two other wind power plants is in the planning. HAMBURG ENERGIE is committed to a decentralized energy supply based on renewable energies and is active across all forms of energy – ranging from green electricity through biogas to environmentally friendly district heating. By 2015, HE will invest about 150 million euros in the expansion of renewable energies in Hamburg (predominantly) and the metropolitan region, with a focus on wind power and biomass projects as well as - where efficiently applicable - solar energy.
8.	Establishment of an energy service		The examination of, and decision for, establishing

Nr.	Parliamentary Circular 20/1229	References	Remarks
	provider and supply company for the public sector (HAMBURG ENERGIE – Kommunal)	./.	HAMBURG ENERGIE has not yet been completed.
9.	Development and implementation of a Hamburg standards for CHP plants	./.	A separate Hamburg standard is not currently considered appropriate, since the development of CHP in Hamburg must be closely linked to federal funding. This, in turn, ties into European standards.
10.	Increase of the energy efficient building renovations in the private, commercial and public existing building stock (using Federal Funds besides additional funding means from the Hamburg climate protection concept for standards that are higher than required according to EnEV) - under consideration of a protection of historic buildings and monuments aspect	Chapt. II.3, P.8 f. Chapt. III.3, P.19 ff.	Is a component of the master plan as a measure in the field of activity buildings.
11.	Proposing a framework for the development of the heating concept in connection with the climate protection provided for in the work program of the Senate MP, including district heating and gas	./.	In 2012/2013, they begun with the development of five exemplary neighbourhood concepts, from forecast to requirements development and the establishment of a data stock for heat supply planning. The heat supply concept is supposed to be available by 2015.
12.	Long-term development of the local and district heating supply	Chapt. II.1, P.6 pp Chapt. III. 1, P.17	Is a component of the master plan as an objective in the field of activity energy / energy supply.
13.	Coupling of heating and cooling concepts where possible		See above 11
14.	Creation of conditions for supporting		HE strives to offer the opportunity to citizens to participate

Nr.	Parliamentary Circular 20/1229	References	Remarks
	additional community bonds for financing investments in wind, PV, solar thermal and bio-energy plants through HAMBURG ENERGIE	./.	in the expansion of renewable energies with a focus on the Hamburg metropolitan region. For each project, appropriate civic participation models are being tested.
15.	Encourage the Hamburg companies to invest in the renewable energy sector in Hamburg within the framework of the competence cluster Renewable Energies	./.	Related publications, trade events, networks and trade shows are among the ongoing tasks of the Cluster.
16.	Review of the results of the area search for wind sites and any corrections to the template and area securing	Chapt. III.1, P.17 pp.	Wind sites addressed in the Master Plan
17.	Reactivation of the expansion of renewable energies in Hamburg by joint ventures with established suppliers	Chapt. III.1, P.17 pp.	With the E.ON Hanse-Group and the Vattenfall-Group, substantial commitments were able to be achieved as part of the energy policy agreement for further expansion and/or promotion of renewable energy generation, in particular the development of the energy infrastructure in Hamburg, and these extend clearly beyond what is currently being practiced.
18.	Further development of near surface and deep geothermal energy, under inclusion of possible Federal funding means and clarification of the efficiency	Chapt. II.1, P.5 pp.	Geothermal energy is a part of the climate protection concept 2007-2012 and of the master plan. The subject area is being constantly developed further. Presently, in the funding programme "renewable heat" , near-surface geothermal energy is being funded in the Hamburg existing buildings, in addition to the Federal funding, if a solar heating plant is installed at the same time . As a support of the planning of bores drilling, data and evaluations of the heat extraction rate are made available on the websites of the BSU free of charge.

Nr.	Parliamentary Circular 20/1229	References	Remarks
			For the investigation of the possibilities for the use of deep geothermal energy in Hamburg, a number of expert opinions and studies were effected in recent years. The plannings for a Deep geothermal drilling in Wilhelmsburg have progressed. Further investigations have not yet been completed, however.
19. 20. 21.	No longer applicable		
22.	Stock taking of the existing plants and current state of planning of the power plants in Hamburg according to operator, location, start of operation	./.	The balancing concerning heating is part of the heat supply concept (Item 11). In the electricity sector, the Federal Network Agency balances the supply capacity nationally and ensures the supply.
23.	Creating the basis and framework for cooperation between the North German federal states in the field of energy supply and its modernization		Metropolitan region is discussed. In addition, the North German federal states cooperate closely under scope of the working structure launched by the BReg for the further development of energy policy framework .