

**Abgeordnetenhaus BERLIN**  
Berlin House of Representatives

**Conclusions and recommendations  
from the final report of the Study Commission on**

**New Energy for Berlin – The Future of Energy-Sector Structures**

**Publisher:**

Verwaltung des Abgeordnetenhauses von Berlin  
(Berlin House of Representatives – Administration)

**The final report of the Study Commission on  
New Energy for Berlin – The Future of Energy-Sector Structures**  
was published as printed paper 17/2500.

**English Translation:**

English Express  
(General Manager: Taissir Tillo)

## Foreword

Dear Readers,

Fossil fuels are running out, the global climate is changing in ways that are becoming obvious to all of us, and nuclear disasters like Fukushima have shown any remaining doubters that nuclear energy is not a viable alternative for our future energy supply. More and more people are calling for a sustainable energy supply. What we need now is a consistent energy transition, a permanent departure from conventional energy sources such as nuclear energy, crude oil and coal, and a comprehensive energy supply from renewable energies so that we can secure our highly developed industrial society for the future and ensure wellbeing and economic prosperity for the coming generations.



We urgently need to make significant reductions to our carbon emissions. To achieve this, we must first and foremost cut our electricity consumption – a task that requires new technologies that allow us to use energy efficiently and intelligently. The goal is a climate-friendly, sustainable energy supply for electricity, heat and transportation throughout Berlin and the surrounding region. The energy transition poses an enormous challenge for all of us. Policymakers must craft the right frameworks, science and research must work with industry to find solutions that are fit for the future, and the public must constantly ask themselves whether they can use less energy in their daily lives. Electricity and heat supplies, which currently rely largely on fossil fuels and therefore generate greenhouse gases that harm the climate, must be gradually and continuously replaced by renewable energies.

The Study Commission on New Energy for Berlin – The Future of Energy-Sector Structures, which was established by a decision of the Berlin House of Representatives on 8 May 2014, recommends a comprehensive structural change for Berlin, and the phasing out of lignite by 2020 and of hard coal by 2030.

Shifting our energy systems to reliance on renewable energy sources presents us with economic, technological and political challenges. In addition to expanding renewable energy systems, we must also adapt the grids to the specific requirements of fluctuating energy generation and find suitable solutions for ensuring flexibility. To achieve this, sufficient funds must be made available, investments must be made, and public acceptance must be sought. For the energy transition also presents an enormous opportunity for Berlin. We can turn our city into a beacon for innovative and sustainable energy supplies in urban spaces. Many people are already looking to our city. Metropolises are becoming increasingly international in the way they communicate and share ideas on how to adequately meet residents' needs. Berlin can become an exemplary region for Germany and for other metropolises. There is scope for a boost in innovation that will have a positive impact on Berlin as a business location.

Furthermore, Berlin can act as a sink for energy generated in surrounding German states and thereby make a contribution to the energy transition that goes far beyond our own region. Given their dense population structure and their share of greenhouse gas emissions, it is clear

that large cities such as Berlin have a special role to play in protecting the climate and helping achieve the energy transition.

I am pleased that the Study Commission concluded that the newly founded Berliner Stadtwerke municipal utility (currently a subsidiary of the water utility Berliner Wasserbetriebe) is expected to achieve the abovementioned goals by performing its tasks on the basis of the Berlin model and beyond, and that this expansion of its remit will require some amendments to its legal foundations.

We need close and cooperative collaboration between Berlin politicians, businesspeople and society so that the various processes can be agreed on and placed on a common path. The Study Commission has made a start on this and, with this report, is presenting far-reaching recommendations for future Berlin state governments and parliaments, and for Berlin society.

After extensive hearings with experts and thorough consideration, the Study Commission has also decided to make a clear statement on ownership structure.

It recommends that the state of Berlin return the electricity and gas grids to municipal ownership. Within this context, we also recommend improving the enforcement of the right of municipalities to govern themselves and advocating clear legal rules that include the possibility of awarding contracts in-house (amending the Energy Industry Act).

The Study Commission was made up of 16 members: eleven members of parliament and five external experts. All commission members were full members and had their own voting right and the right to submit motions. Over the past 18 months, we have intensively discussed solutions for climate-friendly structures for Berlin's energy sector, and have made the necessary energy-policy recommendations with cross-party consensus. The first results of the Commission's work were published in an interim report in February 2015. This final report now documents all of the Study Commission's work, and makes specific recommendations for Berlin's energy policy. Thanks to their specialist knowledge, the experts on the Commission played a particularly important role in producing these results. I would like to extend my special thanks to them, and to their deputies, who regularly attended the meetings even when not required to do so.

Within the Study Commission, we extensively examined and discussed the topics, specified in the decision on establishing the Commission, of Berlin's heating and electricity supplies, including questions about the interdependencies of these sectors and about the respective infrastructures. Another topic specified in the decision was institutions, including the future role and duties of the individual actors in Berlin. We also posed questions linked to founding a unified grid company and organising the Berliner Stadtwerke. Within this topic, we also addressed issues of public participation, i.e. involving Berlin residents. The decision on establishing the Commission did not, however, include the topic of transport and mobility, which meant that the Commission only dealt with these matters marginally. However, the Commission feels that the transport sector should be considered a major factor in the energy transition. According to the feasibility study *Climate-Neutral Berlin 2050*, transport accounts for the second-largest share (25 percent) of Berlin's total final energy consumption. Therefore, consumption will have to decline significantly in this sector, too, if the energy transition is to succeed in Berlin. Innovative and sustainable solutions will have to be developed and implemented to address consumption in Berlin's transport sector. Those

responsible for parliamentary energy and environmental policy and the Berlin Senate should tackle this task as soon as possible.

The recommendations that the Commission has set out in this report go far beyond the current legislative term. The Study Commission therefore aimed to produce joint recommendations for Berlin's energy policy from all its members. We have largely achieved this. The customary confrontations between governing and opposition parliamentary groups rarely occurred in our meetings, which allowed us to reach a cross-party consensus. Much of this was thanks to the experts on the Commission, whose observations and proposals often helped us reach compromises.

I am grateful to all the participants whose dedication and hard work helped to make this final report a reality. In addition to the expert members of the Commission, I would also like to thank the Commission members from all the parliamentary groups in the Berlin House of Representatives for their constructive collaboration in the Study Commission and their involvement in the working groups. I would also like to thank the parliamentary-group staff for supporting the groups. My thanks are also due to the experts who, by participating in the public hearings and submitting written statements, provided us with additional specialist information and valuable stimuli for our work. Last but not least, I would like to thank the staff at the Senate Departments for their reliable support, and the staff of the administration's commission office at the Berlin House of Representatives for providing the Study Commission with organisational and specialist support and for helping to produce the final report. I am delighted that an English translation of this report will also be available, as this will facilitate international exchange on key issues of energy policy targeted towards securing the future of modern industrial societies.

As chair of the Commission, I knew from the outset that I wanted our work to have the highest-possible level of public participation and support. We held the meetings that involved hearings with experts publicly, posted the minutes of the meetings, the experts' presentations, and other materials online, and held two well-attended public events. In addition, two exceptionally well-attended press conferences showed that the media were very interested in the Commission's work.

To expand the opportunities for participation in the activities of future study commissions, I propose allowing future commissions to hold more public meetings than is currently the case.

Jörg Stroedter, Member of the Berlin House of Representatives



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## **A. The Commission's conclusions and recommendations**

### **I. Berlin's role in the energy transition**

Energy systems in Berlin, in Germany, and around the world are facing radical change. At the moment, our electricity and heating supplies are still largely derived from fossil fuels. But producing energy in this way is incompatible with the goal agreed by the international community in the United Nations to limit global warming to a maximum of two degrees Celsius this century. We must therefore convert our energy systems to run on climate-friendly energy sources by 2050 at the latest. Given that Germany has decided by cross-party consensus to phase out nuclear energy by 2022, and given that carbon capture and storage (CCS) is not available as a mainstream technology – partially due to a lack of social acceptance – the energy supply in Berlin and throughout Germany will have to be secured almost entirely by renewable energies. The only way to achieve this goal is by conserving energy and continually increasing energy efficiency. The less energy we consume, the lower the costs will be for generating and transporting it, and the sooner we can reduce consumption-related greenhouse gas emissions.

Cities, metropolises in particular, have an enormous responsibility in this regard. Over half of the world's population live in cities, which already account for almost 80 percent of global carbon emissions. Developing a sustainable global energy system will only succeed if cities actively shape the upcoming restructuring of energy systems and create the urban conditions that this requires. The task for cities is to set an example by reducing energy consumption and increasing energy efficiency. Cities must also optimally integrate renewable energies into the municipal energy supply. To achieve this, they will have to expand and build up intelligent infrastructures that make efficient use of energy delivered by climate-friendly sources from both inside and outside the city.

As a large, growing community at the heart of Europe and the capital of Germany, Berlin has a special duty to help set the pace in the energy transition that the world so desperately needs. By implementing a pioneering transformation process, Berlin could function as a showcase for the upcoming global energy transition. In so doing, it can draw on the advantages of its location in north-eastern Germany. The supply of renewable energies here has already outperformed every other region in Europe by advancing far beyond the applicable expansion targets.

Since Berlin uses roughly 70 percent of its fossil-fuel consumption for generating heat, Germany's capital is ideally suited to developing solutions for a climate-friendly energy system that combines urban electricity and heat supplies in an efficient – i.e. cost-effective and consumer-friendly – way. Even though reducing greenhouse gases in Berlin will have little direct effect on climate change, it could have positive indirect effects. In particular, this would be the case if Berlin were to become a role model for other cities and metropolises, and if its climate-protection measures were emulated elsewhere (i.e. the showcase function). Berlin is also a European transport hub that is especially well suited to applying and expanding energy-saving, climate-friendly forms of transportation (e.g. electric vehicles) throughout its territory.

By setting up the Study Commission on New Energy for Berlin, the parliamentary groups in the Berlin House of Representatives have further paved the way for optimising Berlin's transition to a climate-neutral metropolis. The Study Commission aligns its work with the

Energy Concept<sup>1</sup> that the German Bundestag passed on 28 October 2010. The goal stating that Berlin should be a climate-neutral city by 2050 at the latest has the support of all parliamentary groups in the Berlin House of Representatives and can therefore serve as a cross-party foundation for Berlin's future energy policies.

In order to achieve this ambitious goal, Berlin needs the full commitment of political decision-makers and of all those working on the transformation process at the operational level. Together, we must ensure that Berlin – as has already been set out in the Energy Concept 2020<sup>2</sup> and in the 2009 Energy Policy Model<sup>3</sup> – reduces its greenhouse gas emissions by at least 85 percent over 1990 levels by 2050.

Reducing greenhouse gas emissions by roughly 85 percent by 2050 corresponds to cutting Berlin's emissions from around 25 million tonnes per year at present to roughly four million tonnes per year in 2050 (given population numbers remaining the same). Since Berlin's greenhouse gas emissions have stagnated at an increased level in recent years, the Study Commission recommends setting out binding reduction targets in an energy transition law for Berlin.<sup>4</sup>

Decarbonising Berlin to such a large extent requires city-wide, cross-sector strategic considerations, precise and binding savings goals, carefully targeted investments, effective structures, and a high level of management expertise at all levels of implementation.

For energy generation and consumption, this goal means that the use of fossil fuels in all areas of consumption must be systematically reduced to almost zero by 2050. In particular, this means putting an orderly end to coal use. Berlin's existing lignite and hard-coal electricity generation will come to an end at the Reuter C and Klingenberg power plants by 2020 at the latest, in line with the climate agreement reached with the operator. The Study Commission expects that the commitments energy company Vattenfall has made in the climate agreement with Berlin will now lead to binding investment decisions and action plans. At the moment there are no prospects for phasing out the Moabit and Reuter West power plants. However, a phase-out is necessary for achieving the energy transition and the climate goals, so this must be agreed by the Senate and the operator soon, as part of a viable overall concept.<sup>5</sup>

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<sup>1</sup> See Bundestag printed papers 17/3049 and 17/3050.

<sup>2</sup> The *Energiekonzept 2020 – Energie für Berlin* (Energy Concept 2020 – Energy for Berlin) was drawn up between 2009 and 2011 on behalf of the Berlin Senate Department for Economics, Technology and Women by Berliner Energieagentur GmbH (BEA) in collaboration with the Institute for Ecological Economy Research gGmbH (IÖW); available (in German) at: <http://www.berliner-e-agentur.de/sites/default/files/uploads/pdf/energiekonzept2020.pdf> (last accessed on 30 Oct. 2015).

<sup>3</sup> The full title is *Energie für Berlin – Effizient, Erneuerbar, Zukunftsfähig. Leitbild für ein Energiekonzept des Landes Berlin* (Energy for Berlin – Efficient, Renewable, Fit for the Future. A Model for an Energy Concept for the State of Berlin); available (in German) at: <https://www.berlin.de/imperia/md/content/sen-wirtschaft/energie/leitbild.pdf?start&ts=1403174927&file=leitbild.pdf> (last accessed on 30 Oct. 2015).

<sup>4</sup> Cf. Section 3(1) of *Entwurf eines Gesetzes zur Umsetzung der Energiewende und zur Förderung des Klimaschutzes in Berlin* (Bill on Implementing the Energy Transition and on Promoting Climate Protection in Berlin – Berlin Energy Transition Act) of 14 April 2015. The submission for adoption of the Bill on Implementing the Energy Transition and on Promoting Climate Protection in Berlin (Berlin Energy Transition Act) – Berlin House of Representatives printed paper 17/2339 – was debated at the first reading on 25 June 2015 during the 67th session of the Berlin House of Representatives, and referred to the Committee for Urban Development and the Environment.

<sup>5</sup> See also sections A. II. 1. 1.2 Fossil-based electricity generation and CHP, p. 17, and A. III. 3. District heating / Combined heat and power, p. 38 ff. (41/42) of this report.

In parallel, Berlin's entire energy supply must be consistently and irreversibly converted to energy from renewable and climate-neutral sources by 2050. At the same time, efficiency and energy-conservation measures must consistently reduce consumption in order to keep new energy supplies on a manageable scale, even in the face of growth and rebound effects.

Energy provided from renewable, primarily unstable energy sources (particularly from Berlin and the surrounding region) must, via intelligent control systems and optimal storage technology, be managed in such a way that demand can always be covered – i.e. so that there is a high level of supply security. Given that photovoltaics alone can currently generate a considerable amount of Berlin's alternative electricity, this technology should be a focal point of the city's policymaking.

Over the next two decades, an intelligent energy infrastructure must be provided throughout the city for all areas of urban consumption (homes, transport, the economy, administration, leisure, etc.). The infrastructure must allow consumers to see and control their energy use so that they can organise their consumption efficiently. In the transport sector, Berlin must put an end to petrol and diesel use, and develop new, climate-neutral transportation.

These transformation processes can build on the city's existing power distribution system, which must be upgraded for the following tasks in particular:

- Connection to regional, national and international (climate-neutral) sources of supply,
- Ongoing integration of alternative, mostly decentralised feeders such as small-scale combined-heat-and-power (CHP) units, solar energy systems, wind turbines, geothermal systems, heat pumps, etc., and the associated combined-heat-and-power and network systems,
- Use of optimised information and communications technology (ICT) for the efficient, voltage-stable provision of the energy required at any given time from the available range of alternative feeders (security of supply),
- Use of optimised ICT systems to record and adapt consumption as the basis for maximally efficient use of renewable energy sources via direct procurement or from storage capacities (rationality of supply).

As well as in electricity generation, changes also lie ahead in the immediate demand for electricity. For instance, industry, craft trades, retail and services have a particularly large amount of potential for reducing electricity use (20 to 50 percent). The business community can leverage this potential by, among other things, setting up city-wide entrepreneurial energy efficiency initiatives. In private households, lighting and domestic appliances have the most potential for energy savings, and this should be exploited across the board. As electricity networks are upgraded to create smart grids, businesses and private households will increasingly be in a position to make full use of their opportunities for saving energy and to optimally adapt to the instability of renewable energies.

Alongside the electricity sector, the heating sector is also very important for Berlin. In order to cover its future heating needs, Berlin must go beyond its role as "the capital of combined

heat and power” to become “the capital of thermal energy from renewable energy sources”. Sensible steps towards achieving this are as follows:

- Heat must increasingly be generated by renewable energy sources. Technologies such as solar thermal conversion, geothermal energy, high-capacity heat pumps, and power-to-heat (PtH) processes can supply Berlin’s district heating system<sup>6</sup> with heat. However, the concept for an optimal climate-neutral heat supply for Berlin has yet to be drawn up.
- Thanks to its large storage capacity, Berlin’s district heating network can serve as a flexible and extensive PtH reservoir that brings flexibility to the electricity system and can turn excess renewable electricity into heat. This will lead to considerable overlap in the electricity and heating sectors.
- Berlin’s natural gas infrastructure offers a good basis for implementing a power-to-gas storage system throughout the city and in the overall system. The share of Berlin’s future gas that is covered by the hydrogen produced via electrolysis can thereby be increased to highest safe level possible. Within this context, the city’s biomethane capacities (in particular those of BSR, the city’s waste management utility) should also be increased.
- Berlin’s CHP system must conform to the highest technological standards possible. It should use existing centralised structures until it has advanced to become a flexibly controlled, networked supply system with low consumption volumes and an alternative energy supply.

However, generation is not the only key to decarbonising Berlin’s heat supply – the consumption side is also crucial. The following points should be emphasised:

- The feasibility study *Climate-Neutral Berlin 2050*<sup>7</sup> ascribes around 47 percent of greenhouse gas emissions to the building sector, where energy-efficient refurbishment can reduce heat consumption in particular. The majority of Berlin’s building stock must therefore undergo these refurbishments by 2050. The public sector should lead by example here in every respect.

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<sup>6</sup> In the feasibility study *Climate-Neutral Berlin 2050*, the term “district heating” covers both local and district heating networks, in which multiple buildings are supplied by a single heating plant or a combined heat and power plant. In the present report, the term “local heating” will be used to describe situations where heat is transmitted between buildings for heating purposes but travels only relatively short distances compared to district heating.

<sup>7</sup> Potsdam Institute for Climate Impact Research, *Machbarkeitsstudie Klimaneutrales Berlin 2050*, Potsdam and Berlin, March 2014; available (in German) at: [http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/studie\\_klimaneutrales\\_berlin/download/Machbarkeitsstudie\\_Berlin2050\\_Hauptbericht.pdf](http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/studie_klimaneutrales_berlin/download/Machbarkeitsstudie_Berlin2050_Hauptbericht.pdf) (last accessed on 30 Oct. 2015). In the following, the study will also be referred to as simply the “feasibility study”. An English summary is available at: [http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/studie\\_klimaneutrales\\_berlin/download/Machbarkeitssstudie\\_Berlin2050\\_EN.pdf](http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/studie_klimaneutrales_berlin/download/Machbarkeitssstudie_Berlin2050_EN.pdf) (last accessed on 30 Oct. 2015).

- For public buildings, energy-efficient refurbishment must be partially decoupled from the general refurbishment rate (currently around one percent). Otherwise, only around a third of the buildings will have undergone energy-efficient refurbishment by 2050. The goal must be for nearly 90 percent of public building stock to have been energy-efficiently refurbished by 2050.
- Berlin is a growing city. It is expected to have 250,000 more residents by 2050.<sup>8</sup> Via sustainably oriented urban planning and the implementation of the new-build standards that will apply from 2020 anyway, Berlin must ensure that all new buildings without exception play their part in making the city climate-neutral.
- Since Berlin is a city of tenants – 86 percent of the some 1.9 million residential units in Berlin are rented – social concerns must be a core component of the energy-policy implementation strategy. Efforts must be made to include as many tenants as possible in the strategic plans and in their consistent implementation, and to thereby find the best possible synthesis of social acceptability and climate friendliness.

The energy transition harbours enormous economic opportunities for Berlin. In 2012, Berlin's public sector, businesses and households spent around €3.2 billion on their energy supply from fossil fuels. In the course of the energy transition, a large share of this money can be diverted and made to work for more qualitative growth and jobs. Local energy services – electricity and heat generation, the provision of expertise on efficiency and flexibility, energy-efficient building refurbishments – can thus become an important economic sector and a source of employment in Berlin over the long term. The Berlin technology clusters based in Adlershof, and at some stage in the future perhaps Tegel, have the potential to attract to the city companies and investors from along the entire energy value chain. “New energy” also means added value and a qualitative structural change with jobs that are fit for the future.

Remodelling Berlin's energy supply in this way is an intergenerational project that will extend over multiple legislative terms and eludes conventional approaches to policymaking. These days, measures must often be taken that will only develop their full, lasting effect in the coming years or decades. This can only work via cross-party collaboration and in dialogue with the people of Berlin. The Berlin Energy Conservation Act (BEnSpG),<sup>9</sup> a groundbreaking law when passed in 1990, stipulated that state energy programmes were to be drawn up every four years with the public's involvement, and that energy reports based on the state energy programmes were to be prepared annually. Provided that the legally prescribed provisions are implemented consistently, Berlin will be in a good position to build on this preliminary work.

The Study Commission therefore expressly welcomes the fact that, with the planned Energy Transition Act (*Energiewendegesetz* Berlin, EWG Bln), the Senate is tackling an important institutional measure for a policy approach that is dialogue-oriented and will span multiple legislative terms. The energy and climate-protection programme envisaged in the law is the right way to evaluate the necessary adaptation measures and to help secure the measures

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<sup>8</sup> Potsdam Institute for Climate Impact Research, *Machbarkeitsstudie Klimaneutrales Berlin 2050*, p. 29; see also footnote 7.

<sup>9</sup> *Gesetz zur Förderung der sparsamen sowie umwelt- und sozialverträglichen Energieversorgung und Energienutzung im Land Berlin* (Act promoting an economical, environmentally friendly and socially acceptable energy supply and use in the state of Berlin; Berlin Energy Conservation Act – BEnSpG) of 2 October 1990 (GVBl. 1990, 2144)

necessary for implementing the energy transition in Berlin. The Study Commission supports the Berlin Senate and the House of Representatives in their efforts to pass a comprehensive energy transition act during the current legislative term.<sup>10</sup> The central aim must be for all parties, all parliamentary groups, and all citizens to work together to implement, over the coming legislative terms, a vision of a city that is fit for the future environmentally, economically and socially – in other words, to make a climate-neutral Berlin a reality.

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<sup>10</sup> The submission for adoption of the Bill on Implementing the Energy Transition and on Promoting Climate Protection in Berlin (Berlin Energy Transition Act) – Berlin House of Representatives printed paper 17/2339 – was debated at the first reading on 25 June 2015 during the 67th session of the Berlin House of Representatives, and referred to the Committee for Urban Development and the Environment.

## II. Electricity and infrastructures

### 1. Electricity generation

#### 1.1 Berlin's power plants

As already mentioned in the first section of this final report, the state of Berlin will have to radically decarbonise the city's energy supply if it is to achieve the climate goals that it has set for itself. However, most of the city's large power plants are currently combined heat and power (CHP) plants that run on fossil fuels. Vattenfall Europe AG operates them all. The plants which require the most action are the lignite-fuelled CHP plant Klingenberg and the hard-coal-fired CHP plants Moabit, Reuter and Reuter West. As a first step towards reducing greenhouse gases from energy generation, it is necessary to switch to using a different fuel in these plants in the foreseeable future.

#### 1.2 Fossil-based electricity generation and CHP

In terms of energy generation and consumption, the decarbonisation goal means that the use of fossil fuels must be systematically and extensively reduced in all areas of consumption by 2050. In particular, this means putting an orderly end to coal use. Berlin's existing lignite and hard-coal power generation will come to an end at the Reuter C and Klingenberg power plants by 2020 at the latest and in line with the climate agreement reached with the operator. Originally, there were plans to replace the Klingenberg lignite plant with a biomass power plant by 2016. These considerations were incorporated into, among other things, the 2020 Berlin Energy Concept.<sup>11</sup> Vattenfall is now planning to build a gas-and-steam-turbine CHP plant.<sup>12</sup> The corporation also reiterated its promise to the Study Commission that it would complete new gas-and-steam-turbine systems to replace the Klingenberg lignite plant by 2020. The Study Commission now expects binding investment decisions and action plans to follow the commitments that Vattenfall made in the climate agreement. **At the moment there are no prospects for phasing out the Moabit and Reuter West power plants. However, a phase-out is necessary for achieving the energy transition and the climate goals, so the Senate must reach an agreement on this matter with the operators soon and as part of a viable overall concept. Electricity and heat generated from coal can and should be phased out in Berlin by 2030 at the latest.** For the remaining operational life of the existing plants, the limits for harmful emissions must be strictly adhered to and regularly monitored.<sup>13</sup>

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<sup>11</sup> See also Berliner Energiekonzept 2020, footnote 2.

<sup>12</sup> Cf. the 2014 interim report on the climate agreement between the state of Berlin and Vattenfall (published in spring 2015); available (in German) at:

[http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/aktiv/vereinbarung/download/klimschv\\_zwischenbericht\\_vattenfall2014.pdf](http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/aktiv/vereinbarung/download/klimschv_zwischenbericht_vattenfall2014.pdf) (last accessed on 30 Oct. 2015).

<sup>13</sup> See also section A. I. Berlin's role in the energy transition, p. 11 ff. (12) and section A. III. 3. District heating / Combined heat and power, p. 38 ff. (41/42) of this report.

### 1.2.1 Switching to gas as a fuel

Since we must assume that thermal power plants will be needed to cover residual load in the medium term, the climate is not the only reason why we must rapidly transition to gas. Because gas power plants (gas turbines and engines, as well as gas-and-steam-turbine CHP plants) are more effective than any other thermal power plant at balancing out peaks and troughs in generation by wind energy and photovoltaics (PV), **the Study Commission recommends switching to gas as a fuel as soon as possible**. In the long-term and depending on how the technology develops, power-to-gas can be used to produce gas for power plants from excess renewable energy. Furthermore it is already possible to feed biomethane (produced in an environmentally friendly way) into the system, which reduces the carbon footprint of gas.

In order to secure the economic viability of gas-driven CHP during the transition period, the state of Berlin should **campaign at the federal level for all instruments that will support this change in energy sources**. Examples of such instruments include Sweden's carbon tax and the UK's carbon floor price. Also, an efficient solution must be found to the problem that we need to significantly reduce the operating hours of gas power plants in the future.

In addition, the state of Berlin must **campaign at the federal level for a stop to the construction and planning of any new base-load coal-fired power plants**. Every new coal-fired power plant that goes into operation today will probably still be operating in 2050. With their non-adjustable share of the base load, they will counteract efforts to achieve a minimum 80 percent share for renewables, and will also crowd out greener and more flexible gas-fired power plants. On the basis of current technical drafts and simulations, we can assume that the energy system can ensure security of supply even when operated with this amount of renewable energies. If coal-fired power plants still remain in operation in 2050, Berlin will not be able to achieve its climate goals. **Moreover, the state of Berlin should work to ensure that, rather than selling its lignite business in the Lausitz region, Vattenfall fulfils its corporate responsibility by supporting the structural change in the region and making a safe exit by 2030**. This would make it possible to achieve Vattenfall's carbon reduction goals, as well as those of the state of Brandenburg and of Germany as a whole.

### 1.2.2 Promoting the flexibility of (electricity-led) CHP

The situation on the electricity market means that climate-friendly gas-fired CHP plants are experiencing particularly acute economic difficulties at the moment. This is currently leading the actors involved to say that the urgently needed modernisation programme for Berlin's CHP plants is generally not economically feasible and that environmental optimisations will not be implemented. **Berlin should therefore press the federal government for an appropriate adaptation of the Combined Heat and Power Act (KWKG) so that adequate funding is only provided for maintaining and building modern, climate-compatible and efficient CHP plants**. Applicable proposals can be sourced from the monitoring report on CHP expansion that the federal government presented in October 2014.<sup>14</sup>

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<sup>14</sup> The report is available (in German) at:  
<http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/Studien/potenzial-und-kosten-nutzen-analyse-zu-den-einsatzmoeglichkeiten-von-kraft-waerme-kopplung.property=pdf,bereich=bmwi,2012,sprache=de,rwb=true.pdf>  
 (last accessed on 30 Oct. 2015).

The use of volatile renewable energies and of CHP means that heat and electricity production will be closely intertwined. CHP plants make a major contribution to Berlin's electricity supply. During the energy transition, the operation of these plants will have to be aligned with the fluctuating demand for electricity in such a way as to accommodate the increasing amount of electricity that wind energy (from the surrounding Brandenburg region) and PV (including from urban sources) will be feeding into the grid in coming years. In other words, Berlin's CHP plants must increasingly function as control and balancing power plants. This increasingly electricity-led operation of the CHP plants will require Berlin to step up its heat storage solutions in the city and introduce smart grids to maintain a reliable and demand-appropriate heat supply.<sup>15</sup>

In the long-term, it will also be desirable to switch to electricity-led operation in decentralised plants so as to improve system integration. However, profitability will depend on the overall design of the electricity market and on the controllability of the plants. **Therefore, the Study Commission recommends funding and building high-capacity virtual power plants in and for Berlin, and that the city should campaign at the federal level for the creation of favourable conditions for virtual power plants.** This type of intelligent power plant can, for instance, be operated under the aegis of the municipal utility and should use control technology to coordinate renewable energy systems and small-scale CHP plants in public buildings in such a way that load differences can be balanced out within the system and peak loads can be reduced in line with the aim of achieving grid stability. A virtual power plant can also help with the flexible intake of wind-generated electricity. The physical energy for a virtual power plant should come from the connected small-scale CHP plants, heat pumps, solar power systems, heat storage facilities, etc., and from a wide variety of actors or businesses, and thus be as market-oriented as possible.

The components for virtual power plants are all technically available today. **The Study Commission therefore recommends incorporating Berlin's some 1,000 small-scale CHP plants into a remote-controlled system as a first step.** Since low electricity and balancing-energy prices mean that this is not currently economically feasible, **the state of Berlin should investigate to what extent it should quickly set up an incentive structure (e.g. via the Berliner Stadtwerke municipal utility) that is time-limited and will be reduced sharply so as to favour rapid entry to the market.**

### 1.2.3 Central and decentralised CHP

This topic is dealt with in section A. III. "Heat and interdependencies" in the "District heating / Combined heat and power" section of this report.<sup>16</sup>

## 1.3 Renewable energies

In contrast to Germany's non-city states, Berlin has very different, specifically urban potential for renewable energies. While the scope for large-scale wind power is obviously small, the many available building surfaces mean that Berlin has high solar potential (PV and solar thermal power). The city has far fewer spaces for growing biomass, but significant volumes of

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<sup>15</sup> The link between electricity and heat supplies is discussed in section A. III. 10. Interdependencies, p. 72 ff. of this report.

<sup>16</sup> See A. III. 3. District heating / Combined heat and power, p. 38 ff. of this report.

residual and waste materials. Berlin also has geothermal potential and can use a considerable amount of ambient heat.

Berlin already has a number of decentralised systems. They include roughly 1,000 small-scale CHP plants and, excluding stand-alone systems, around 5,000 PV systems with an installed capacity of 64,984.70 kilowatt-peak (kWp) (as of the end of 2013, source: Solaranlagenkataster Berlin).<sup>17</sup> Berlin is also home to a wind turbine, which is located in the north of the Pankow district. The turbine, which has a capacity of 2 megawatts (MW) and a planned annual production of 4,000 megawatt-hours (MWh), went into operation in 2008. A second turbine is currently under construction.

### 1.3.1 Photovoltaics

Based on the current state of the art, PV is the most promising technology for generating electricity in metropolises such as Berlin. Estimates suggest that PV systems could cover roughly 25 percent of electricity generation (assuming 21 percent of Berlin's roof space and four percent of its facades are put to use).<sup>18</sup> Solar electricity currently accounts for just roughly 0.6 percent of the Berlin mix. Measures therefore need to be taken that will significantly increase this figure. For this to happen, Berlin needs better information and communication, pioneering and pilot projects, and regulatory changes (see, for instance, funding for green electricity in Vienna<sup>19</sup>). While Berlin can take action itself at the state level, exerting influence at the federal level is largely only possible via the Bundesrat (Federal Council). Nevertheless, Berlin should consistently use these opportunities for making its voice heard.

Even though opinions about the solar electricity potential that could ultimately be realised differed in the Commission's hearings, there is no doubt that this potential is currently far from being fully exploited. One of the reasons that is causing this sluggish progress and hindering targeted action is the fact that Berlin is a city of tenants and apartment buildings.

A few solar *Mieterstrommodelle* (where the systems are installed on an apartment block and the electricity is sold directly to the tenants) have been successfully completed and placed on the market (e.g. the *Gelbes Viertel* project by LichtBlick, a green electricity and gas provider). In view of the declining feed-in tariffs from Germany's Renewable Energy Sources Act (EEG), on-site consumption of solar electricity (by tenants, owners, or businesses) generated on individual buildings is currently one of the few ways of implementing profitable PV projects. Following the amendment of the EEG, however, *Mieterstrommodelle* had to be revised or in some cases discarded under the worsened economic conditions.

**The state of Berlin should campaign at the federal level to ensure that life is breathed into the authorisation to issue ordinances (Section 95(6) EEG 2014) on compensation for the discontinued green-electricity privilege and on introducing direct selling of green electricity for this and other business models within so-called supply communities.** Today's sales channels (fixed payments, the market premium model, other forms of direct

<sup>17</sup> Cf. [http://www.solarkataster.de/index.php?page=ergebnisse&mode=stat\\_gesamt\\_gesamt](http://www.solarkataster.de/index.php?page=ergebnisse&mode=stat_gesamt_gesamt) (last accessed on 30 Oct. 2015).

<sup>18</sup> Cf. the statements by Prof. Hirschl (IÖW/BTU C-S), EnKoEnergie transcript 17/5, p. 57.

<sup>19</sup> Cf. <https://www.wien.gv.at/stadtentwicklung/energieplanung/foerderungen/oekostromfoerderung.html> (last accessed on 30 Oct. 2015)

selling) stand in the way of a direct link between the generation of electricity from renewable energy systems and its consumption. **Sales to third parties of EEG electricity that is not fed through a grid system (Section 20(3)(2) EEG 2014), which includes *Mieterstrom*, should be made partially exempt from the EEG surcharge so that the projects can operate profitably. Furthermore, independent projects, for example by municipal housing companies and the Stadtwerke municipal utility, should be developed or funded so that they can assume a pioneering role and serve as examples.**

However, Berlin also has about 200,000 detached and semi-detached houses, as well as a large number of suitable commercial and public buildings, which offer a considerable amount of potential surface space. Exploiting all of this potential will, on the one hand, be facilitated in the long term by economies of scale in PV (currently 9 to 14 eurocents per kilowatt hour, ct/kWh; studies talk of future prices below 4 ct/kWh for solar parks in the megawatt range), and on the other will need active market development to advance business models (e.g. lease models for small PV systems) and the stakeholder landscape. With the price of modules – and, currently, of the storage solutions – constantly falling, self-consumption is becoming increasingly attractive. **The state of Berlin should campaign at the federal level to ensure that self-consumption that helps stabilise the grid receives more support and is no longer hampered.** Self-consumption can be a key driver for tapping into solar potential. It also reduces the amount of EEG electricity being fed into the grid, which cuts the EEG surcharge that end consumers have to pay, and creates storage capacities via private capital. However, this reduction in the redistributed cost of the feed-in tariffs is offset by the fact that network charges and surcharges (e.g. the EEG surcharge, concession fee, CHP surcharge) are shared across fewer shoulders. The participation in the EEG surcharge introduced by the legislature is not appropriate because self-consumption reduces the differential costs of the EEG. In the long term, however, it should be considered appropriate for PV systems to contribute to grid charges. Within this context, the European Commission’s new position on self-consumption is to be welcomed, as it plans to introduce special measures to provide greater support and protection for self-consumption of electricity from renewable energy systems.<sup>20</sup>

PV systems will pose no problem to Berlin’s grid for a long time to come, and the grid can be specifically modernised and strengthened over the years so that it will be able to accommodate even high levels of PV output in the coming decades.

**The Study Commission expressly supports the implementation of a “Solar Capital Berlin” master plan** of the kind outlined in the feasibility study *Climate-Neutral Berlin 2050* and in previous drafts of the Berlin Energy and Climate-Protection Programme (BEK). One of the measures that a masterplan should include is establishing a research cluster on (urban) solar energy use in collaboration with Berlin’s universities and relevant non-university research institutes. The information structures and the links between them must also be improved, for instance via a solar register like the *Solardachatlant Großraum Braunschweig* (solar roof atlas for the Braunschweig metropolitan area),<sup>21</sup> via a special online solar platform or via professional advisory services for all individuals and businesses practising in the sector. In collaboration with relevant guilds and the chambers of crafts and trades, the Senate and Berlin’s districts must ensure that, during every advisory session, the owners are informed, e.g. by roofers, of the potential for a PV installation. The Study Commission also recommends accelerating the implementation of innovative flagship projects and pilot schemes, for

<sup>20</sup> Cf. [http://ec.europa.eu/energy/sites/ener/files/documents/1\\_EN\\_autre\\_document\\_travail\\_service\\_part1\\_v6.pdf](http://ec.europa.eu/energy/sites/ener/files/documents/1_EN_autre_document_travail_service_part1_v6.pdf) (last accessed on 30 Oct. 2015).

<sup>21</sup> <https://www.zgb.de/energie-und-klima/solardachatlant/> (last accessed on 30 Oct. 2015).

instance by involving Berlin's universities, non-university research institutes and private companies. The extent to which federal funding can be used for this should be looked into, as should the question of whether there is a need for specific Berlin funding programmes. In addition, citizen-run solar power systems and other forms of financial participation by citizens should be supported. Furthermore, Berlin should launch an initial and further training campaign for planning, installing and maintaining the relevant systems. Technically realising the existing potential and successfully fostering the corresponding effects on the regional economy depend heavily on whether or not the tradespeople have the necessary qualifications and skills. **The Study Commission therefore recommends that the state of Berlin should work with the guilds and the chambers of crafts and trades to create the necessary conditions for this.**

**The Study Commission also recommends that the Senate should begin by prioritising efforts to make use of particularly large public roof spaces – including those on U-Bahn and S-Bahn (underground and suburban train) stations.** Appropriate renewable energy systems should be compulsory on new buildings constructed on state land. Furthermore, 80 percent of the suitable roof space belonging to the state of Berlin should be generating energy (particularly via PV) by 2020. That figure should rise to 100 percent by 2025.

### 1.3.2 Wind energy

The potential for generating electricity via wind power is obviously limited in cities – but it does exist. A study by the Institute for Ecological Economy Research (IÖW) found that large and small wind turbines had a total potential of around 1,125 terajoules (or 312.5 terawatt-hours, TWh) in Berlin.<sup>22</sup> In most cases, the open spaces needed for large wind turbines are lacking. However, opportunities exist on the outskirts of the city in particular. Efforts should be made to achieve double-digit wind turbine installations in these areas. One expert heard as part of the Study Commission's work said that Berlin has potential for roughly 100 MW, which corresponds to between 20 and 30 turbines.<sup>23</sup> In addition, Berlin-owned land in Brandenburg offers much greater potential for the state of Berlin and the Berliner Stadtwerke municipal utilities to become involved in generating electricity from wind. **The Study Commission recommends checking state-owned land to establish the extent to which innovative forms of wind energy generation, such as harnessing high-altitude wind using the type of kites being developed by start-ups in Berlin, could be implemented.**

Given the current state of the art, small wind turbines have a number of issues. Air turbulence in densely built-up areas is particularly problematic. **Nevertheless, the state of Berlin should establish whether suitable locations are available on the outskirts of suburbs or on trading and industrial estates.** The state of Berlin should take the same approach as the city state of Hamburg and promptly check whether and which sites within the state are suitable for installing wind turbines, and then designate appropriate areas. As is the case with PV, efforts must be made to introduce the necessary regulatory changes at the state and federal level.

Micro wind turbines on ventilation pipes could, for instance, largely replace the use of electrical systems for cooling mobile phone base stations and thus achieve significant energy

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<sup>22</sup> Hirschl, B. et al., *Potenziale erneuerbarer Energien in Berlin 2020 und langfristig – Quantifizierung und Maßnahmengenerierung zur Erreichung ambitionierter Ausbauziele*, Berlin, 2011.

<sup>23</sup> Cf. the statements by Mr Diwald (German Hydrogen and Fuel Cell Association e. V.), EnKoEnergie transcript 17/15, p. 40.

savings. **The Study Commission recommends that the Senate should aim to reach a voluntary agreement with mobile communications providers on reducing the energy used for cooling systems, and that it should review the legal options that the state would have in this matter.**

### 1.3.3 Energy generation from biomass and municipal waste

Making efficient, climate-friendly use of biomass from residual materials can help the state of Berlin cut its carbon emissions. Unlike solar and wind energy, biomass is a very limited raw material. In addition, producing it competes with space for food production. Using biomass for energy can serve as a transitional solution that gives us the chance to become independent from coal and oil sooner. In time, it should be replaced by energy efficiency and energy savings measures, and by the use of renewables such as wind, solar and geothermal energy. This kind of transition, however, only makes sense and can only be justified if the biomass in question definitely has a positive impact on the climate and if importing it benefits rather than compromises development-policy goals. Therefore, using biomass to produce energy can only happen if strict sustainability and social standards are adhered to. In the long term, cultivated biomass will be used in a climate-neutral Berlin for higher quality purposes, such as for materials recycling or for fuels, and will only be available for generating electricity and heat to a very limited extent.

Biogenic waste, by contrast, can make a long-term contribution to Berlin's energy production. Berlin must urgently optimise the generation of energy from organic waste produced in the city. Although Berlin's hard-coal power plants are increasingly co-firing biomass, and although the Moabit CHP plant was retrofitted for biomass use in 2013,<sup>24</sup> none of them are making use of biogenic waste. The Ruhleben waste-to-energy plant supplies the Reuter power plant with process steam. This generates 640 gigawatt-hours per year (GWh/a) of district heating (roughly six percent of Vattenfall's district heating) and 180 GWh/a of electrical energy. The energy efficiency value according to the Closed Substance Cycle and Waste Management Act (KrWG) is 0.82. The Ruhleben waste-to-energy plant is therefore already helping to generate electricity (and heat) in a climate-friendly way.

Since 2013, the Berliner Stadtreinigungsbetriebe (BSR, the city's waste management utility) has been operating an ultra-modern biogas plant that ferments the organic waste that BSR collects separately from Berlin households. The plant, which is located in Ruhleben and cost €30 million to build, handled around 60,000 tonnes of organic waste every year before approval was given to increase the capacity to 75,000.<sup>25</sup> The technology allows BSR to replace around 2.5 million litres of diesel every year, which means it avoids roughly 12,000 tonnes of carbon emissions. If organic waste collections were increased across the entire city, an additional 100,000 tonnes could be collected and, providing it is put to the same climate-

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<sup>24</sup> It can now co-fire up to 40 percent – 300,000 tonnes – of air-dried, untreated wood. See (in German) <http://www.euwid-energie.de/news/neue-energien/einzelansicht/Artikel/vattenfall-steigert-holzanteil-im-hkw-moabit-auf-40-prozent.html> (last accessed on 30 Oct. 2015).

<sup>25</sup> The biogas, which is produced using dry fermentation, is 98 percent methane and chemically identical to natural gas. Once it has been suitably processed, the biogas is fed into the city's gas network. Half of BSR's collection vehicles (around 150 bin lorries) run on gas. BSR composts any non-fermentable organic waste. At the moment, therefore, the biogas plant is not used to generate electricity. However, seeing as the biomethane it produces can easily be turned into electricity in a small-scale CHP plant, the BSR plant is a potential building block for Berlin's electricity generation system. Depending on what decision is reached regarding the city's future supply concept, the biogas produced by the BSR plant can be used in a needs-based way.

friendly use, could save a further 11,000 tonnes of carbon emissions. **The Study Commission recommends that the Senate should increase organic waste collection in this way and put the biomass to climate-friendly use.** If these residual materials are used to produce energy in a highly efficient way, Berlin can appreciably reduce its environmental impact and the emission of harmful greenhouse gases.

Berlin regularly produces around 1,200,000 Mg/a of biogenic waste. In addition to organic residual waste (approx. 400,000 Mg/a), this includes relevant quantities of wood waste (approx. 140,000 Mg/a), grass clippings and leaves (approx. 110,000 Mg/a), and sewage sludge (approx. 90,000 Mg/a). These resources must all be used in a sustainable and climate-friendly way as energy sources for the state of Berlin. Relevant studies carried out by the Senate show that, in particular, the use of substitute fuels produced from municipal waste and sewage sludge, and leaves, organic waste and grass clippings (around 500,000 Mg/a) can be sustainably improved.<sup>26</sup> The state of Berlin's 2011 waste management plan also set out the goal of exploiting, from 2016 and in a sustainable and energy-efficient way, the potential of the biogenic waste produced in the city. To achieve this, Berlin must, among other things, reduce emissions, recycle more efficiently, and increase waste separation.

As well as being burned in the Ruhleben sewage-sludge incinerator, sewage sludge is also co-fired (up to approx. 40 percent) in lignite power plants. This co-firing releases enormous amounts of harmful emissions and is inefficient. **The Study Commission is in favour of increasing the share of energy generated from renewables in Berlin and the local generation of electricity by building a new, highly efficient incinerator or comparable facility and using it to turn sewage sludge into energy.** Organic waste, for which collections must be optimised, and the grass clippings and leaves produced every year in the state of Berlin should also be used as renewable biogas for generating electricity in small-scale CHP systems.

In order to guarantee the optimal and environmentally friendly use of endogenic biomass potential and, where applicable, the sustainability of imported biomass, **Berlin must arrange for centralised, public monitoring of the relevant biomass flows (material flow management).** Biomass imports are not currently managed in an efficient way. The Study Commission therefore feels that, for the current mechanisms in the biomass electricity sustainability ordinance,<sup>27</sup> **there needs to be an expansion of the accountability requirements under federal law, and of the sustainability agreements under state law.** Furthermore, efforts must be made to **work towards a common understanding of sustainable biomass**, particularly among larger consumers and retailers, and towards voluntary commitments by operators.

As far as possible, organic waste should be used for materials recycling and to produce energy, rather than just being burned. The carbon and environmental footprint are always the main criteria for the various types of use. This means that the biomass should either be fermented and thus used to help Berlin increase the share of renewable energies in its gas, or returned to the earth as trapped carbon. Part of the solution could be to expand the cultivation of wood energy crops in short-rotation plantations – a practice that is currently just in its

<sup>26</sup> Cf., e.g. (in German) *Stoffstrom-, Klimagas- und Umweltbilanz 2012 für die Nutzung von Berliner Abfällen als Ressource*, [http://www.stadtentwicklung.berlin.de/umwelt/abfall/entsorgung/download/studie\\_langfassung\\_2012.pdf](http://www.stadtentwicklung.berlin.de/umwelt/abfall/entsorgung/download/studie_langfassung_2012.pdf) (last accessed on 30 Oct. 2015).

<sup>27</sup> Ordinance on requirements pertaining to sustainable production of bioliquids for electricity production (Biomass electricity sustainability ordinance, BioSt-NachV) of 23 July 2009 (Federal Law Gazette I p. 2174).

infancy. This would reduce the pressure to use existing forests. Short-rotation plantations should primarily be planted on degraded or polluted land that cannot be used to produce food. Model trials are already being carried out on sewage farms owned by Berliner Stadtgüter, a local property company. Given the multi-year and extensive cultivation methods involved, short-rotation plantations are less problematic from a conservation perspective than conventional intensive agriculture. Grove structures adapted to the specific site could even achieve synergies with the aims of nature and environmental conservation on agricultural land.<sup>28</sup> This would be the case with, for instance, plantations that are planted hedge-like on the edges of arable land. The German Federal Agency for Nature Conservation proposes developing a special standard for short-rotation plantations. **The Study Commission recommends that the Senate should support short-rotation plantations on environmentally beneficial sites, should link these plantations to the abovementioned type of standard, and, via the Joint Spatial Planning Department, should advocate the establishment of a suitable funding programme.**

Efficient materials recycling and energy generation using biogenic residues would greatly reduce air pollution levels in Berlin. The necessary measures and tasks should be implemented via the state of Berlin's existing municipal businesses or, for instance, under the integrative roof of a public utility.

#### **1.4 Harmonising renewable energy production in Berlin and Brandenburg, and coordinating planning for renewable energies in both states**

Overall, the Berlin-Brandenburg region is in a very good position to achieve a fully renewable energy supply in the future. In particular, if the two states work closely together, they will be able to make very good use of their respective potentials. This can, however, only be achieved with a harmonised energy policy. Yet with Berlin's Energy and Climate-Protection Programme, and Brandenburg's Energy Strategy 2030, the two states are developing separate energy plans that aim to create different framework conditions. There is room for improvement here, particularly in terms of strategic considerations. Berlin and Brandenburg should therefore increase the extent of their collaboration in the energy sector.

In 2011, renewable energies accounted for 17.6 percent of Brandenburg's primary energy consumption. Brandenburg's Energy Strategy 2030 aims to increase this share to 32 percent by 2030. At the same time, energy consumption should fall by 23 percent compared to 2007 levels, and carbon emissions should be cut by 72 percent compared to 1990 levels.

According to a study by Deutsche WindGuard GmbH,<sup>29</sup> Brandenburg has the second highest total installed capacity for wind energy among Germany's states. However, problems with acceptance are increasingly hampering efforts to install more wind turbines. Conflicts of interest are also an issue when it comes to designating additional sites for turbines.

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<sup>28</sup> Cf. German Federal Agency for Nature Conservation: *Bioenergie und Naturschutz – Synergien fördern, Risiken vermeiden*, Bonn, February 2010.

<sup>29</sup> Deutsche WindGuard GmbH, *Status des Windenergieausbaus an Land in Deutschlands, 1. Halbjahr 2015*, as of 30 June 2015, p. 5; available (in German) at: [http://www.windguard.de/\\_Resources/Persistent/b6ff13ecabb86fbbdd45851e498d686432a81a2c/Factsheet-Status-Windenergieausbau-an-Land-1.-Halbj.-2015.pdf](http://www.windguard.de/_Resources/Persistent/b6ff13ecabb86fbbdd45851e498d686432a81a2c/Factsheet-Status-Windenergieausbau-an-Land-1.-Halbj.-2015.pdf) (last accessed on 30 Oct. 2015).

The importance of exploiting Berlin's renewable energy potential therefore extends beyond state boundaries. If Berlin increased its renewable energy production, it would have less need to import energy. Berlin could strengthen this effect if it also consistently exploited its potential for saving energy. This would also take pressure off Brandenburg in terms of achieving a joint, fully renewable energy supply, and – given the differing power curves – would sensibly complement wind energy in Brandenburg. **Efforts must therefore be made to harmonise renewable energy production in Berlin and Brandenburg.** In doing so, consistent use should be made of opportunities for coordinated planning in both states. A basis for this should be provided by the Joint Spatial Planning Department, through which Berlin can exert influence by encouraging discussion on an integrated energy and climate-protection plan so as to develop a shared vision. Points of contention, such as conflicts of interest between the two states, could also be resolved in the department. **The prerequisite for this, however, is that the joint state development plan<sup>30</sup> is revised in such a way that, in the energy sector in particular, it gives priority to achieving the climate targets in the future.** In spite of this, the roles of both states are clearly divided. While Brandenburg is an energy-exporting state, Berlin will continue having to import energy in the future – albeit in much smaller quantities. This does not, therefore, free Berlin from the obligation to exploit its own potential – including the immense opportunities for saving energy and improving efficiency that exist in this concentrated metropolitan area – in order to reduce the amount of energy it needs to import in future.

## 1.5 Obtaining energy from the surrounding area

Generating electricity and heat from lignite has been proven to produce the most carbon emissions. In contrast, Berlin and Brandenburg have a great deal of potential for generating electricity from climate-friendly renewable energies, which could cover 100 percent of supply by 2030. For periods in which the renewable energies are naturally unavailable, power plants that can be quickly adjusted are needed. Current lignite-fired power plants only fulfil this requirement to a limited extent because adjusting them is a cumbersome process. In the long term, therefore, a consistent renewable energy strategy for Berlin and Brandenburg that also aims to protect the climate will no longer feature electricity generated from lignite. An orderly phase-out with simultaneous funding for alternatives (e.g. gas-based power plants) is therefore required. Developing the lignite opencast mining areas of Welzow-Süd-II and Jänschwalde-Nord goes against the climate goals and the interests of Berlin and is also not compatible with the climate goals of the federal government and Brandenburg. From Berlin's perspective, therefore, extracting and using lignite resources must be removed as a matter of principle from the joint state development plan. In 2008, the state of Brandenburg also acknowledged in its Energy Strategy 2020 that lignite could be no more than a bridging technology. As far as Berlin is concerned, this bridge will end by 2030 at the latest. The state of Berlin must campaign at the federal level for regulatory change – accompanied by funding measures that incorporate new CHP plants, storage technologies, demand-side management and other flexibility options into the energy system, and exclude coal-fired power plants.

The production of renewable energies and of many energy-efficiency technologies and services is more job-intensive than generating energy from fossil fuels. Nevertheless, phasing

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<sup>30</sup> *Editor's note:* The Berlin-Brandenburg state development plan (LEP B-B) of 31 March 2009 entered into force on 15 May 2009 in Berlin and Brandenburg as statutory instruments of the respective state governments (Berlin Law and Ordinance Gazette (GVBl.), p. 182; Brandenburg Law and Ordinance Gazette (GVBl.) II No. 24).

out coal production and coal-fired electricity generation must be accompanied by measures designed to instigate a structural change that can create alternatives for the jobs lost in lignite production and lignite electricity generation. The state of Berlin should campaign for this to the greatest extent possible.

In keeping with the knowledge that producing energy from lignite must come to an end by 2030 at the latest, the state of Berlin should ensure that the energy it sources from the surrounding area for its public sector comes exclusively from renewable sources. With the requirement to procure non-nuclear electricity, which was introduced back in 2003, and the longstanding practice of purchasing 100 percent green electricity for all public buildings, Berlin already has a history of setting standards in public procurement. **The Study Commission recommends that the state of Berlin should follow the recommendations of the Federal Environmental Office (Umweltbundesamt) in the upcoming calls for tender, and should organise these in such a way that the electricity tender makes an even greater contribution to the energy transition.** This would allow the state of Berlin to act as a role model.

Tendering for public sector electricity procurement can thereby also take the age of plants that generate renewable energy into account when calculating the carbon reduction. For instance, the carbon reduction achieved by new plants can be fully incorporated, while that from old plants cannot be incorporated at all.

## **2. Energy efficiency in the electricity sector**

Saving electricity is one of the easiest ways to reduce costs and, above all, carbon emissions. As has recently been the case in other large cities, electricity consumption in Berlin has declined slightly over the past few years. However, this trend needs to be consolidated and significantly accelerated.

### **2.1 The public sector**

A systematic review of the energy characteristics of public sector buildings must be carried out. **The Study Commission expressly recommends introducing – in line with the announcement by the Senate – an energy management system for all public buildings.** The German Energy Agency GmbH (dena) says that, with low-investment measures, “green IT” has the potential to cut electricity use by 20 percent in the short term. With strategic measures, that figure could rise to 75 percent in the long term. This should be incorporated into the energy management system.

The public sector should also start gradually transitioning to LED lighting in the near term. LED lighting can achieve energy and cost savings of 50 to 80 percent, and thus pays for itself within a short space of time. The Study Commission also advises the state of Berlin to stop installing halogen technology when modernising lighting systems. The EU will, after all, be removing this type of lighting from the market because of its poor efficiency. When it comes to purchasing new lights and lamps for public buildings, only LED lights or equally efficient systems that fit the local requirements should be considered. **The Study Commission recommends amending the administrative regulation on procurement and the**

**environment (VwVBU)<sup>31</sup> and the implementing provision on public lighting in the Berlin Roads Act (*Straßengesetz*) so that LED technology becomes the rule.**

**Switching the state's vehicle fleet to energy-efficient electric cars makes economic and environmental sense in many cases.** It is also financially feasible if, for instance, the fleets belonging to the state and its companies are pooled to create a shared fleet, as this would reduce the number of vehicles required. The vehicles in the fleet should run on green electricity.<sup>32</sup> In addition, efforts should be made to implement intelligent charging management so that, when not being used, the vehicles are charged at times when large volumes of renewable energies are being generated.

Studies by, among others, dena show that public authorities can achieve significant energy savings by procuring efficient electrical devices. In light of this, ambitious environmental-protection requirements for the public procurement of such devices must be laid down in the VwVBU.

## **2.2 Households and businesses**

Households and businesses have a great deal of untapped potential for increasing their energy efficiency. In many cases, they even fail to make power-saving investments that quickly pay for themselves. This is largely due to a lack of information.

Informing citizens about the ways in which they can save electricity, carbon emissions and money is an important task for the state. **The Study Commission recommends that the state should run a widescale energy-saving campaign under the slogan *Berlin spart sich ein Kraftwerk* (Berlin saves itself a power plant)** that runs over several years and alternates between targeting consumers and businesses. The campaign should aim to save enough energy to equal the electricity and heat production of one of Berlin's coal-fired power plants. For the campaign to be as effective as possible, it should incorporate Berlin's environmental organisations, business associations, and unions. A campaign of this type could involve ordering especially efficient devices in bulk and then selling them under names such as the "the Berlin Fridge" or similar, or enabling traders in Berlin to offer "scrapping bonuses" for particularly inefficient household devices when customers purchase new, highly efficient alternatives. Although the design of such campaigns lies in the hands of the actors involved, the Study Commission advises Berlin to upgrade its energy consulting before launching any campaign of this kind.

Numerous actors in Berlin provide energy consultancy services with different areas of focus. **Berlin needs a platform that guides consumers and businesses to the right consultancy service, and that links the various energy consultancy providers with each other and other relevant actors.** For instance, it would be helpful if people who have to use a debt counselling service were also given access to energy consulting that would help them reduce their energy costs. Low-income households should receive support that helps them afford energy-saving devices. To make this a reality, energy suppliers or the state should launch or

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<sup>31</sup> *Verwaltungsvorschrift des Berliner Senats für die Anwendung von Umweltschutzanforderungen bei der Beschaffung von Liefer-, Bau- und Dienstleistungen* (Berlin Senate administrative regulation on applying environmental-protection requirements to the procurement of deliveries, construction works, and services – VwVBU) of 23 October 2012.

<sup>32</sup> See the statements on electricity tenders in A. II. 1. 1.5 Obtaining energy from the surrounding area, p. 26 f.

lend support to microcredit schemes. The important electricity-saving consultancy service for households receiving transfer payments – *Stromspar-Check Plus* (financed by the federal government and implemented by Caritas in Berlin) – must be maintained and expanded.

### **2.3 Investment and financing model for implementing energy-efficiency and resource-efficiency measures**

The Study Commission recommends checking whether, by founding regional energy-efficiency cooperatives (REEGs) that are oriented towards the common good and take their cue from the B.A.U.M. future fund, it is possible to mobilise private capital in the region to realise measures that will save energy and carbon emissions. The REEG model is currently being trialled and refined in three municipalities of different sizes (the city of Aachen, the rural district of Berchtesgadener Land, and the city of Norderstedt).<sup>33</sup>

## **3. Infrastructures**

### **3.1 Promoting the flexibility of electricity demand and generation**

The electricity distribution network should be organised and improved in such a way as to optimise the incorporation of decentralised renewable energy systems while maintaining network stability and security of supply, and reducing the need for expanding the network. The optimisation measures for developing the energy transition in Berlin should be used to help achieve this. Promoting the flexibility of demand and of power generation that is not subject to fluctuations in the natural supply (e.g. highly flexible CHP plants) are the two most important optimisation measures. So-called producer-consumer communities (e.g. *Mieterstrommodelle* – where power is generated on/in a building and sold directly to its tenants – and energy cooperatives), and the state-wide expansion of electricity charging stations for electric vehicles can also help to exploit the potential for increasing flexibility.<sup>34</sup> Storage facilities are a third option – but with the exception of home-based storage units,<sup>34</sup> they will be less cost-effective than the other options in the short to medium term. In the long term, however, they will be indispensable. Therefore, priority should be given to bringing flexibility to the supply and demand side. Furthermore, measures that reduce the need to expand the network should always rank above network-expansion measures.

Overall, a suitable price system should be used to promote flexibility in demand and production. Producers should benefit if they orient their energy production towards demand, and consumers should be rewarded if they orient their energy demands towards production (variable tariffs). This mechanism could be implemented fiscally or by introducing a dynamic EEG surcharge,<sup>35</sup> i.e. without introducing special tariffs (e.g. social tariffs). This type of

<sup>33</sup> See (in German): <https://www.klimaschutz.de/de/projekt/baum-zukunftsfonds-pilotprojekt-drei-kommunen> (last accessed on 30 Oct. 2015).

<sup>34</sup> See the following section (A. II. 3. 3.2 Storage, p. 30 ff.)

<sup>35</sup> Cf. Agora Energiewende, *Der Spotmarktpreis als Index für eine dynamische EEG-Umlage. Vorschlag für eine verbesserte Integration Erneuerbarer Energien durch Flexibilisierung der Nachfrage*. (The spot market price as an index for a dynamic EEG surcharge: Proposal for improving the integration of renewable energies by bringing flexibility to demand), short study, 2014; available (in German) at: [http://www.agora-energiewende.de/fileadmin/downloads/publikationen/Studien/Dynamische-EEG\\_Umlage/Agora\\_RAP\\_Spotmarktpreis\\_als\\_Index\\_fuer\\_dyn\\_EEG-Umlage\\_web.pdf](http://www.agora-energiewende.de/fileadmin/downloads/publikationen/Studien/Dynamische-EEG_Umlage/Agora_RAP_Spotmarktpreis_als_Index_fuer_dyn_EEG-Umlage_web.pdf) (last accessed on 30 Oct. 2015).

change must also be made to the system of network charges, which creates price signals regarding the usefulness to the system. Another step towards implementing the mechanism of producer-consumer communities would be to introduce direct selling for green electricity.<sup>36</sup> Furthermore, citizens and businesses should be equipped with knowledge that will allow them to actively participate in the energy transition.<sup>37</sup>

In addition, when it comes to energy-intensive businesses, regulatory obstacles should be removed that currently prevent flexible loads from having equal and easier access (demand-side management) to the balancing market.<sup>38</sup> **To this end, the state of Berlin should help implement an appropriate revision of the imbalance energy regulation (*Ausgleichsenergieregelung*) at the federal level.**

## 3.2 Storage

Berlin's energy supply system is becoming greener, more flexible and more decentralised. Alongside bringing flexibility to demand and production, using storage technologies is another way of decoupling electricity production and energy consumption, of maintaining network stability and security of supply, and of reducing the extent of network expansion necessary to handle a supply increasingly fed by unstable energy sources. The decision on establishing the Study Commission ascribes an important function to storage when it comes to the matter of future interdependencies between the electricity and heat sector.<sup>39</sup>

### 3.2.1 Storage in the electricity market

Power-to-gas, power-to-liquid and power-to-chemicals processes allow electricity generated from renewables to be converted into gas, methanol and potentially other forms of energy so that it is available as needed, regardless of when it was produced. All of these technologies can be used for both the transmission network and the distribution network.

Assessments regarding the mid-term prospects for the various types of storage in Berlin differ among the scientific community and among the experts heard as part of the Study Commission's work.

In the mid-term, a lack of storage facilities will not be an obstacle to expanding renewable energy production. Expanding the network and exploiting the scope for flexibility in consumption and production is, for now, the most cost-effective solution for managing an increasing amount of energy from renewables being fed into the electricity network. In the long term, to achieve the goal of generating 100 percent of its power from renewable sources, Germany as a whole must increase the number of electricity storage facilities that have a

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<sup>36</sup> See A. II. 1. 1.3.1 Photovoltaics, p. 20 ff.

<sup>37</sup> Section A. IV. Institutions, participation and processes, p. 76 ff., explains which institution or institutions perform these tasks.

<sup>38</sup> Cf. Connect Energy Economics (final report of a study on behalf of Agora Energiewende), *Aktionsplan Lastmanagement* (Action plan for demand-side management), 2015; available (in German) at: [http://www.agora-energiawende.de/fileadmin/Projekte/2014/aktionsplan-lastmanagement/Agora\\_Aktionsplan\\_Lastmanagement\\_web.pdf](http://www.agora-energiawende.de/fileadmin/Projekte/2014/aktionsplan-lastmanagement/Agora_Aktionsplan_Lastmanagement_web.pdf) (last accessed on 30 Oct. 2015).

<sup>39</sup> Cf. *Einsetzungsbeschluss der Enquete-Kommission „Neue Energie für Berlin“* (Decision on establishing the Study Commission on New Energy for Berlin), Berlin House of Representatives printed paper 17/1632, p. 2.

discharge capacity equal to a large share of current production from conventional sources. In the short to medium term, storage capacities in the form of battery-based decentralised short-term storage systems are most likely to be economically viable – particularly in connection with PV systems to increase self-consumption of electricity. If operated appropriately, battery systems for PV technology can make a major contribution to easing the burden on the electricity networks.<sup>40</sup> Looking further into the future, there will be a need for long-term storage facilities with the same discharge capacity as the short-term options – although the long-term facilities will need to be capable of storing around two orders of magnitude (a factor of 100) more energy.<sup>41</sup>

In the case of standardised nationwide storage (measured by consumption), rough preliminary estimates show that Berlin would have to provide storage facilities with up to three gigawatts (GW) of discharge capacity, divided fairly evenly between short-term and long-term storage facilities. Depending on the technology, the short-term storage capacities would cost between €0.5 billion and €1.5 billion. Berlin would also require long-term storage facilities with around one terawatt-hour of capacity that could deliver electricity at a cost of between €0.15 and €0.30 per kilowatt-hour.<sup>42</sup> However, these cost estimates ignore the leaps forward in innovation and downward in price that are predicted for the storage-technology sector (via, for instance, Tesla and its mass production operations) and that are already taking place in the computer and mobile phone market.

### 3.2.2 Storage in the heat market

The electricity sector and the heat sector will increasingly be connected in the future. As a power-to-heat reservoir, the district heating network offers flexibility for the electricity system because it can be used to convert and store excess renewable electricity as heat. The future district heating system could then, via a combination of large-scale heat pumps, CHP plants, heat storage facilities and solar thermal systems, use energy from alternative resources and simultaneously balance out fluctuations.<sup>43</sup> This would also increase the importance of the role that district heating plays in stabilising the energy supply. In the long term, using power-to-gas technology to link the electricity and gas networks at the low and medium-voltage level could usefully complement the function of linking the electricity and district heating networks via power-to-heat technology.<sup>44</sup> Using power-to-gas would therefore change the gas

<sup>40</sup> Cf. Fraunhofer ISE, *Speicherstudie 2013* (Storage Study 2013), p. 6; available (in German) at: <http://www.ise.fraunhofer.de/de/veroeffentlichungen/veroeffentlichungen-pdf-dateien/studien-und-konzeptpapiere/speicherstudie-2013.pdf> (last accessed on 30 Oct. 2015).

<sup>41</sup> Cf. Energie Forschungszentrum Niedersachsen (Energy Research Centre of Lower Saxony, on behalf of the German Federal Ministry for Economic Affairs and Energy), *Studie Eignung von Speichertechnologien zum Erhalt der Systemsicherheit* (Study on the ability of storage technologies to maintain system security), 2013, p. 33; available (in German) at: <http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/Studien/eignung-von-speichertechnologien-zum-erhalt-der-systemsicherheit> (last accessed on 30 Oct. 2015).

<sup>42</sup> Cf. Ludwig-Bölkow-Systemtechnik GmbH (on behalf of the German Renewable Energy Federation e. V.), *Analyse der Kosten Erneuerbarer Gase* (Cost analysis of renewable gases), 2013, p. 18 and 20; available (in German) at: [http://www.lbst.de/download/2014/20131217\\_BEE-PST\\_LBST\\_Studie\\_EEGase.pdf](http://www.lbst.de/download/2014/20131217_BEE-PST_LBST_Studie_EEGase.pdf) (last accessed on 30 Oct. 2015).

<sup>43</sup> Cf. the statements by Ms Neumann-Cosel / BürgerEnergie Berlin eG, EnKoEnergie transcript 17/4, p. 3 ff. and 39 ff.

<sup>44</sup> Cf. study by the German Technical and Scientific Association for Gas and Water (DVGW): *Nutzen von Smart-Grid-Konzepten unter Berücksichtigung der Power-to-Gas-Technologie*, (Using smart grid concepts that include power-to-gas technology), 2014; *greenfacts* 1/2014, Heike Gruber's interview with Heinrich Busch and Professor Markus Zdrallek; written statement by the DVGW of 24 March 2015.

network's role in the future if the process was not to be primarily used in centralised power plants. Rather than losing significance because of declining capacity utilisation, the gas network would then become an important source of storage.

On the basis of the statements above, we can conclude that the infrastructural conditions mean that power-to-gas and power-to-heat systems could, in principle, very well be set up in Berlin. Furthermore, the heat that escapes during power-to-gas processes (methanisation) could be used, which would significantly increase the efficiency of the processes. It would, however, be necessary to clarify whether any – and if so, which – locations in and around Berlin are suitable for optimally storing energy and feeding it back into the networks when it is needed. At the same time, no final assessment has yet been made about whether the power-to-gas systems should mainly be located in places where the excess electricity occurs, or in Berlin.

### 3.2.3 Required action

**The state of Berlin should play a part in organising the legal, economic and research-policy frameworks in a way that enables the development of storage facilities that include power-to-gas or power-to-heat technologies.** The Berlin Senate in particular can work through the Bundesrat to help improve the possible applications for storage systems and to boost their profitability for innovative businesses. In order to make the storage technologies profitable, Berlin must campaign at the federal level for the necessary legal amendments, e.g. the abolition of end-user charges (EEG surcharge, CHP Act surcharge, network access charges).<sup>45</sup> The measures must be organised so as to favour an efficient and cost-effective storage infrastructure.

Storage facilities should have equal access to the balancing market. In addition, Berlin can play an important role as a business location for firms that develop storage technologies (e.g. Younicos).<sup>46</sup> When it comes to feeding (back) into the network, ensuring network stability, and transporting and storing electricity, it is above all the relevant network operators (electricity, gas, district heating) that must find the best solutions at the entrepreneurial level.<sup>47</sup>

As they increasingly take over from Berlin's conventional power plants, renewable producers will also have to fulfil tasks that help keep the system stable.<sup>48</sup> However, regulatory interventions or special incentive systems could be necessary here because operating combined production and storage systems in a way that keeps the network stable could be less profitable for operators than opting for conventional operation that optimises self-consumption. Since the dissemination of these types of batteries depends heavily on PV expansion, **Berlin should campaign at the federal level for conditions that will secure a permanently high level of PV expansion and simultaneously ensure that PV storage systems are operated in a way that keeps the network stable.**

<sup>45</sup> Cf. the statements by Prof. Staiß (ZSW), EnKoEnergie transcript 17/15, p. 30.

<sup>46</sup> Cf. the statements by Ms Sen Yzer (Senate Department for Economics, Technology and Research) EnKoEnergie transcript 17/3, p. 5.

<sup>47</sup> Cf. written statement by the Berlin Energy Agency GmbH of 24 March 2015, p. 13.

<sup>48</sup> Cf. Energie Forschungszentrum Niedersachsen (Energy Research Centre of Lower Saxony, on behalf of the German Federal Ministry for Economic Affairs and Energy), *Eignung von Speichertechnologien zum Erhalt der Systemsicherheit* (The ability of storage technologies to maintain system security), 2013, p. 33; available (in German) at:

<http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/Studien/eignung-von-speichertechnologien-zum-erhalt-der-systemsicherheit> (last accessed on 30 Oct. 2015).

**Energy strategy plans for identifying the best locations for power-to-heat or power-to-gas should be developed** as part of increased, improved and optimised collaboration and coordination between the individual network operators and businesses, and the relevant senate departments and – insofar as Brandenburg is affected – ministerial departments or their interfaces. The development of the energy strategy plans should be coordinated with the senate department office responsible for planning network expansion in the state of Berlin and with the offices in the senate and ministerial departments of the affected states (Berlin and Brandenburg) as regards the transmission network.

### 3.3 Intelligent metering and control systems

With the help of better demand-side and feed-in management, regional and local smart grids can play an important part in energy policy by networking and controlling electricity production and consumption. Smart metering systems (a combination of smart metres and devices that can communicate with the smart grids – so-called “smart meter gateways”) allow network operators to precisely coordinate the timing of production, network load, and consumption on a largely automated basis. In line with the key points contained in the federal government’s Smart Grids package of ordinances, these metering systems should gradually become binding from 2017 for medium and large-scale consumers (annual consumption starting at 6,000 kWh) and producers (renewable energy systems and CHP plants with a capacity of at least seven kilowatts). There is most potential for optimisation among large-scale consumers and producers. Large-scale consumers that use demand-side management can significantly reduce their average procurement costs. Large-scale producers that use feed-in management can significantly increase their average earnings. However, the potential that exists among small-scale consumers and producers should not be underestimated. Although the costs for smart metering systems are in many cases higher than the savings potential for these types of consumers/producers, significantly cheaper smart meters (that have no communication systems) can help small-scale consumers and producers to keep better track of their own electricity consumption and production and, via the tariff structure, to bring them into line with the requirements of the energy transition. Efforts should therefore be made to ensure that these meters become more widespread. However, for all levels of consumption and production, the questions of financing and data protection still need to be clarified and settled fully and in a socially just way in the federal government’s still-to-be-agreed Smart Grids package of ordinances.

In terms of consumer protection, efforts must be made to ensure that the use of smart metering and control systems that steer the consumption and feed-in behaviour of consumers and producers do not create any undue financial burdens for these network users. Operating these types of smart systems (which ultimately make automated decisions about purchasing and selling electrical energy) raises the question of who they are serving and who is at an economic advantage or disadvantage because of their actions. For instance, a smart system can be programmed to either support network stability or optimise self-consumption. Network users who behave in a way that helps stabilise the network must not be financially disadvantaged in the process. The best way to ensure that this does not happen is to stipulate open standards and allow network users to use smart metering and control systems from an open market for these types of systems – similar to the way in which telecommunications users can generally connect modems and telephones of their choosing to the telecommunications network, or use mobile phones of their choosing. A network user’s decision to use a system programmed to help stabilise the network should come about via

appropriate financial incentives, rather than by pressure from network operators or electricity suppliers.

### 3.4 Transparency in infrastructure investments

High energy and connection densities mean that network charges for household customers in Berlin are low. However, the fees for business customers without power metering are higher than the average in structurally similar networks in other large German cities.<sup>49</sup> At the same time, Berlin has – also compared to non-city states in the west of the country with low network charges – a high connection density (number of connections per square kilometre). This implies that the current charges, as set by the German Federal Network Agency (BNetzA), are too high in Berlin.

One reason for this could be the regulation by the BNetzA, which has neither sufficient human resources nor finances to efficiently control the monopolies. Another could be that – because of the legal conditions granted to it – the BNetzA only carries out checks every five years (base year). This allows network operators to report high costs for operation during the base year, which will then be used as the benchmark for the entire regulatory period. Companies can inflate the breakdown of their costs because, for instance, they have flexibility in dating their invoices and their procurement of services, and in whether they classify outgoings as expenditure or investments in their accounts. Also, although grid companies might be separate entities from a legal perspective, they often function within a network of service relationships with other companies belonging to the corporation, which can be used to inflate costs.

A review should be carried out to identify the opportunities for energy-transition-friendly investments in network infrastructure that might emerge from funds being freed up in this way. To create the necessary transparency, **the Study Commission calls on current network operator Vattenfall to publish in full the annual reports of Vattenfall Europe Netzservice GmbH for the years 2006 to 2011.**<sup>50</sup>

**Furthermore, the Study Commission recommends that the Berlin Senate should campaign at the federal level for the BNetzA to be strengthened in terms of its legal foundations and human resources so that it can efficiently fulfil its task of monitoring the network monopolies.**

### 3.5 Network expansion planning, and coordinated or integrated network operation

The Study Commission's interim report<sup>51</sup> discussed a number of possibilities for more efficiently and effectively coordinating and implementing the energy transition and the climate-policy goals in the state of Berlin. One of them proposed introducing integrated network operation for the electricity, gas and/or district heating networks, or establishing a

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<sup>49</sup> Cf. the analysis by Agora Energiewende, *Netzentgelte in Deutschland* (Network charges in Germany), [http://agora-energiewende.de/fileadmin/downloads/publikationen/Analysen/Netzentgelte\\_in\\_Deutschland/Agora\\_Netzentgelte\\_web.pdf](http://agora-energiewende.de/fileadmin/downloads/publikationen/Analysen/Netzentgelte_in_Deutschland/Agora_Netzentgelte_web.pdf) (last accessed on 30 Oct. 2015).

<sup>50</sup> The annual reports of Vattenfall Europe Netzservice GmbH have been published in full since 2012. See: <https://www.bundesanzeiger.de/ebanzwww/wexsservlet> (last accessed on 30 Oct. 2015).

<sup>51</sup> Berlin House of Representatives printed paper 17/2100.

municipal operator for road-bound infrastructure (Berlin Infrastructure). In the case of the latter, it would be a matter of jointly managing, in the future, all network infrastructure in the public road space – i.e. the energy networks, water and sewage systems, road-bound track systems, and possibly public lighting and charging stations for electric vehicles.

As part of the Study Commission's work, eight experts and parties to be heard made oral or written statements regarding their views on the integrated operation of the energy networks. Six of these experts stressed the advantages of integrated network operation.<sup>52</sup> The arguments in favour of jointly managing the energy networks in particular included the following: As well as bringing advantages in terms of cost, joint management offers scope for faster and better customer service (for new connections: customer service and package solutions from a single source). It will make it possible to leverage synergies, for instance via better and more efficient coordination of building and planning measures, and better coordination of emergency measures. The interplay between the gas, electricity and district heating networks will become increasingly important in the future. Excess electricity from renewable energies will be converted into heat via power-to-heat processes and then used in the heat networks, or be converted via power-to-gas processes into a form that can be stored for longer. Furthermore, declining heat consumption because of progress in refurbishing buildings will eventually raise the question of whether the parallel installation of heat and gas networks still makes sense. However, if the gas and district heating networks were operated jointly, or if the competition between gas and district heating were to be removed by avoiding parallel installation, an effective price control would be needed.

The Study Commission believes that an integrated operation of the electricity, gas and district heating networks could boost the effectiveness and efficiency of the coordination and implementation of the energy transition and climate-policy goals in the state of Berlin. Integrating all road-bound infrastructure could amplify this positive effect even further.

Seeing as all the associated effects have yet to be sufficiently examined, no such decision should be made in Berlin until a review has been carried out on the basis of existing experiences to establish the degree to which synergies and other advantages over simple coordinated management and the removal of competition between gas and district heating actually exist and what the environmental impact of the latter would be.

In any event, to make the most of synergies and other advantages, the collaboration and coordination between the individual network operators and companies, as well as with the relevant offices in the state of Berlin must be strengthened and improved. The state of Berlin should create conditions that are conducive to this.

The Study Commission also believes that efforts should be made to use synergies and increase the economic efficiency for network-expansion planning by strengthening, improving and optimising collaboration and coordination between the states of Berlin and Brandenburg and the network operators in Berlin and Brandenburg.

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<sup>52</sup> Cf. the oral statements of the following people heard by the Study Commission: Dr Rendez (Stromnetz Berlin GmbH), EnKoEnergie transcript 17/4; Mr Hatakka (Vattenfall GmbH), EnKoEnergie transcript 17/9; Mr Maaß (Hamburg Institut Consulting GmbH), EnKoEnergie transcript 17/8; Prof. Strunz (Technische Universität Berlin), EnKoEnergie transcript 17/15; Mr Heine (Stromnetze Hamburg GmbH), EnKoEnergie transcript 17/15; Mr Dinger (Alliander AG), EnKoEnergie transcript 17/18 and Mr Neldner (Landesbetrieb Berlin Energie) EnKoEnergie transcript 17/4; and the written statement by Prof. Zdrallek (Bergische Universität Wuppertal) of 23 March 2015.

### III. Heat and interdependencies

#### 1. Introduction

For a metropolis like Berlin, the heat supply is at the heart of efforts to optimise the energy sector in order to achieve ambitious climate goals. This is where we can expect the largest contribution to achieving the goals. The key tasks here involve making energy usage more efficient, transforming production and using and distributing energy in a smart way.

**To achieve this, Berlin needs strategic heat planning**, i.e. an expert plan that will be continually updated and make it possible, at the state and local levels, to investigate and realise the potential for generating heat in a way that is as cost-effective, safe and climate-friendly as possible and that gives priority to local and long-distance district heating, especially in densely populated areas.

**The heat and cooling supply for Berlin's buildings must make a significant contribution** in order for the Berlin Senate's 2050 climate goal to be achieved. This is clear from the mere fact that the building sector is currently responsible for 47 percent of carbon emissions. The feasibility study *Climate-Neutral Berlin 2050*<sup>53</sup> calculated a reference scenario to show how the restructuring of the heat supply could develop up to 2050.

- Ongoing building refurbishments will mean that, despite further population growth, overall heat consumption will drop by almost a third (to 105,350 terajoules per year) and the share of crude oil will be reduced to zero.
- Gas and combined-heat-and-power (CHP) district heating will take the lion's share of the heat supply, each accounting for around 45 percent, and the share of renewable energies will increase significantly in both gas and district heating.
- The use of excess wind and solar electricity to directly generate heat or to produce gas for meeting heat demand, including the use of power-to-heat and in future also power-to-gas technologies, will increase in importance, while solar thermal technology and biomass will stagnate at a low level.

So even the reference scenario assumes major changes to the structure and level of the heat supply. However, these changes lag far behind what is needed from a climate-policy perspective. Only under the conditions set out in the feasibility study's target scenarios will the heat sector make the necessary contribution. This involves a decline in final energy consumption of nearly 50 percent in target scenario 1 and almost 60 percent in target scenario 2. But even this will not be enough on its own; the structure of the energy sources used must also be changed so as to favour emission-free renewable energies. In the target scenarios, their share of final consumption must increase from around just two percent today to 52 percent (target scenario 1) and 57 percent (target scenario 2). This covers both the direct and indirect consumption (via use for electricity and district heating) of renewable energies.

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<sup>53</sup> Available (in German) at:

[http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/studie\\_klimaneutrales\\_berlin/download/Machbarkeitsstudie\\_Berlin2050\\_Hauptbericht.pdf](http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/studie_klimaneutrales_berlin/download/Machbarkeitsstudie_Berlin2050_Hauptbericht.pdf) (last accessed on 30 Oct. 2015).

Of all domains, the building sector will continue to be the largest consumer by far in the future, accounting for roughly 50 percent of total final energy consumption (including transport). It will be followed by transport (which was not part of the Study Commission's inquiry mandate), businesses and, much further behind, private households (without space heating, cooling or warm water supply). This prominent role again confirms how important the city's heat supply is in terms of energy and climate policy. **Without a heat transition, there can be no energy transition in Berlin.**

## 2. Urgent need for energy and climate policy action

It is clear that the structural change needed for the target scenarios will not come about by the "free play of forces". Differing interests among the diverse actors, and differences in economic conditions between the various energy sources could both hamper the outlined "ideal route" for a climate-neutral heat supply in Berlin. Therefore, the Study Commission believes that there is substantial need for policy action in order to advance the fundamental restructuring of the heat supply in large sections of the city, and to significantly accelerate energy-efficient refurbishments of the building stock and the replacement of outdated, inefficient heating systems. For this to happen, the state and federal levels must make fundamental strategic policy decisions. The organisational structures must also be improved so that energy-optimised supply structures that serve the climate goals can be established.

As far as possible, the priorities must be enforced in cooperation with the individual actors involved. However, if it becomes clear that this approach, alongside establishing material incentive systems, is not enough, regulatory measures must also be considered. These include, for instance, establishing priority zones and/or prescribing legal obligations on using renewable energies in existing building stock as well as for new-builds. It is also a matter of **exhausting the opportunities offered by urban land-use planning**. Even as the law currently stands, the Senate and the districts must, when drawing up development plans, review how they can accommodate climate-protection requirements (planning principle in Section 1(a)(5) of the German Building Code, BauGB). Since 2004, the BauGB has stipulated that urban land-use planning must take account of "general climate protection" (second sentence of Section 1(5), BauGB).<sup>54</sup>

In order to fulfil these requirements, intensive use should be made of the scope for corresponding arrangements in the development plans – of the kind that are, for example, possible under Section 9(1)(23) BauGB for structural and technical measures for generating, using or storing electricity, heat or cooling from renewable energies or CHP systems. On this basis, standards for climate-compatible urban land-use planning are possible, for instance via urban and residential structures that reduce traffic, standards for building and energy-saving measures, e.g. concerning the orientation of buildings and heat insulation, and for the use of renewable energies and CHP or even spatial planning for variable ways of generating

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<sup>54</sup> What follows will include excerpts of considerations from the study by Gaßner, Groth, Siederer & Coll: *Erste rechtliche Überlegungen zum regulativen Rahmen verschiedener Handlungsfelder für ein integriertes Energie- und Klimaschutzkonzept für Berlin bis 2050* (First legal considerations on the regulatory framework for various fields of action for an integrated energy and climate concept for Berlin until 2050), quoted from: SenStadtUm/BEK, *Für ein klimaneutrales Berlin. Dokumentation zur ersten Workshopreihe (Teil 2), Handlungsfelder Gebäude, Stadtentwicklung und Verkehr* (For a climate-neutral Berlin: Documentation from the first series of workshops (part 2); Fields of action: Buildings, urban development, and transport), p. 20-21; <https://klimaneutrales.berlin.de/ecm-politik/stadt/de/home/file/fileId/2233> (last accessed on 30 Oct. 2015).

renewable energies and for networks to distribute them. In order to make full use of these opportunities, **the state should, where necessary, issue relevant regulations in line with Section 23 of the Berlin Energy Conservation Act (BEnSpG)<sup>55</sup> or a subsequent regulation, and include these in the development plan.**

**The Study Commission recommends that energy concepts for development plans should be drawn up in the state of Berlin and – if possible – anchored in an urban-development contract in line with Section 11 BauGB.** Since 2011, the BauGB has expressly stated that the following can be the subject matter of contracts: *“in accordance with the goals and purposes pursued with urban-development plans and measures, the installation and use of plants and facilities for the central and decentralised production, distribution, use or storage of electricity, heat or cooling from renewable energies or combined heat and power,”* and *“the requirements for the energetic quality of buildings.”* **The Study Commission recommends revising the existing guidelines for concluding urban-development contracts in Berlin (*Leitlinien für den Abschluss städtebaulicher Verträge in Berlin*) and supplementing them with binding regulations concerning climate protection.**

### **3. District heating / Combined heat and power**

District heating already makes a considerable contribution to the city’s heat supply. It covers around 16 percent of total final energy consumption, and accounts for the second largest share of the heat supply for buildings (around 30 percent), after gas (44 percent). In terms of efficiency, it should above all be stressed that around 80 percent of total district heat generation comes from CHP plants. CHP technology accounts for no less than 62 percent, or about five billion kilowatt-hours (kWh), of the city’s total gross electricity production.

Currently, however, over 90 percent of district heat generation still relies on fossil fuels, which considerably limits its ability to reduce emissions, and in many cases leads to a situation where district heating, which is actually more efficient, has higher carbon emissions than decentralised natural gas systems. The high share of lignite and hard coal (around 40 percent in total) is responsible for this.

In view of the existing fuel-use structure in district heat generation, it is clear that, **in addition to energy efficiency, moving away from lignite and hard coal is a key lever for improving climate protection in Berlin’s heat sector in the short to medium term.** Even in the reference scenario in the feasibility study *Climate-Neutral Berlin 2050*, oil and coal are absent from the heat supply in 2050. Between now and then, we will see an increase in the importance of district and local heating (with a renewable energy share of around a third to 40 percent) generated with natural gas in CHP plants and with temporarily excess wind and solar electricity. Thanks to a considerable reduction in total heat consumption, this would mean that district heating in buildings would, at least in target scenario 1, more or less maintain current production levels until 2050 (it declines in target scenario 2 because of the assumption that heat consumption will drop sharply, by almost 30 percent). In contrast, when it comes to gas consumption in individual heating systems, the reference scenario shows a decline of about 30 percent, while target scenarios 1 and 2 show a drop of 80 to 90 percent (with gas from renewable energies accounting for 18 to 30 percent).

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<sup>55</sup> See footnote 9.

Remarkably, based on its share of the total energy mix used to generate heat, heat produced via CHP becomes increasingly important in all scenarios (its share rises to 44 percent in the reference scenario and to 53 percent in both target scenarios). The “centralised, efficient city” scenario (target scenario 1) relies primarily on centrally produced CHP electricity and district heating, while the “decentralised, cross-linked city” (target scenario 2) focuses on decentralised sub-networks and small-scale CHP systems.

The regional distribution of district heating shows numerous gaps (map 08.01.1 in the Environmental Atlas 2010)<sup>56</sup> in the inner city. We can assume that several areas of Berlin that lie close to the city centre and are densely populated and built-up could already be cost-effectively developed for district heating. Innovative solutions linked to virtual power plants are also conceivable (e.g. Fernheizwerk Neukölln). However, given the high cost of district heating pipes, this would only be feasible if there was a high enough connection rate. In order to judge the cost-effectiveness of district heating, Berlin also needs to establish how much it will cost to maintain the district heating network beyond 2050. At the moment, the specific pipeline costs for district-heating and gas pipeline construction are about the same. However, the cost of the pipes is no longer the deciding factor – in large cities it is primarily a matter of excavation and construction work in challenging urban locations, which occurs to a similar degree in both district-heating and gas pipeline construction. But because electricity lines and gas pipes can – unlike district heating pipes – mostly be laid underground and with no need for open trenches, they are often significantly cheaper than district heating pipes.

In addition, the district heating network must – via corresponding political frameworks if necessary – be operated as efficiently as possible. This means that it must be economically attractive to exploit potential for raising efficiency. In Denmark, for instance, legislative measures are one of the main reasons why district heating suppliers there are much more technologically open to innovation than comparable providers in Germany. Denmark’s innovative edge is reflected in technologies that optimise the efficiency of the systems within the buildings, with the result that, for instance, return temperatures are declining (and heat sales are showing a downward trend).

**Although the district heating network must be consolidated in the short to medium term as part of the energy transition in Berlin, there is no need to expand it on a comprehensive scale. Instead, decentralised sub-networks should be established** in residential areas, districts or individual buildings on the basis of, for instance, solar thermal technology, heat pumps or decentralised CHP. Small-scale CHP systems can continue to run on fossil fuels – mainly natural gas – in the short to medium term. In the long term, they will also have to switch to renewable energy sources so that Berlin can achieve its carbon goals for 2050. Given the shorter investment cycles for decentralised CHP (10 to 15 years), this technology is considerably more flexible in terms of future technological developments than large power plants that have lifetimes spanning several decades.

The Energy Concept 2020 estimates that, over the next five years, decentralised CHP has economic potential for about 2,175 plants with an electrical output of 64 megawatts (MW). The output could be doubled by 2020 compared to today. Since the number of plants has more than doubled since 2009, when the concept was produced, this target could be achieved with the same rate of expansion if the frameworks are improved and investment incentives for

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<sup>56</sup> Cf. [http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/db801\\_05.htm#D3](http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/db801_05.htm#D3) (last accessed on 30 Oct. 2015).

plant operators and/or building owners are maintained. This expansion trajectory has the potential to save around 280,000 tonnes of carbon emissions per year. Its realisation will, however, also depend on whether the federal level sets the right course for the upcoming amendment to Germany's Combined Heat and Power Act.

The most dynamic growth will continue to be in plants with between 15 and 50 kilowatts of electrical output. Plants of this size are well suited for use in typical Berlin housing stock that is either not connected to the district heating network or cannot be connected to it. The Energy Concept 2020 estimates that, by 2020, around 90 percent of small-scale CHP systems will be installed in the housing sector, roughly seven percent in the public sector, and just a small share in the commercial sector. However, the potential cannot be cost-effectively exploited under the current conditions.

**The Study Commission recommends making more intensive use of, above all, suitable public sector properties for decentralised CHP, and replacing outdated and inefficient heating systems in public buildings with modern small-scale CHP systems.** An estimation of potential produced by the Berliner Energieagentur shows that district heating covers about 45 percent of the heating consumption of the some 6,000 public buildings (excluding universities, hospitals and public companies belonging to the state of Berlin) in Berlin. Fifty-five percent could, at least theoretically, be covered by small-scale CHP systems in individual buildings. The investment volume calculated for this area is around €1 billion and could be raised by public and private investors (intracting, energy-saving contracting, systems contracting).<sup>57</sup> This would save up to 1.5 million tonnes of carbon emissions every year.<sup>58</sup>

The state should conduct a feasibility study, down to the individual building level, of the extent to which public properties are suitable for this, and of how far their individual heating needs will facilitate the cost-effective operation of a small-scale CHP system. It should also be taken into account that these publicly owned CHP systems can serve as the core units of small local heating systems, to which surrounding residential buildings can also be connected. This will boost the efficiency of the systems and will make them more cost-effective in the summer because the connection to surrounding buildings will cause hot water consumption to rise overall. Another conceivable option would be to use systems for combined cooling, heat and power (CCHP) – i.e. to connect small-scale CHP systems to absorption chillers. The local heating network should be built up outside of areas with long-distance district heating,

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<sup>57</sup> See Dr Kora Kristof, project manager, *Kommunales Intracting* (Municipal intracting), 1998, p. 1;

1. Contracting: “Contracting is a contractually agreed service provided by a third party – the contractor – for energy consumers as part of an energy saving investment, and generally covers planning, financing and implementation. A contracting agreement can also include maintaining and operating new or refurbished energy systems. Contracting can focus on different aspects of energy services: heat, cooling, light, etc. The investment costs for the contractor are paid back via savings in energy costs that are achieved by using the energy-saving technology. Whether or not a share of the saved energy costs go to the users from the outset can be arranged when drawing up the individual contract; the payback period for the contractor will last longer if the cost savings are to be divided between him/her and the users. Contracting can be divided into systems contracting and savings contracting. Systems contracting is oriented towards financing for efficient energy generation technologies, such as small-scale CHP systems or condensing boilers. It therefore focuses on the sales side. Savings contracting, meanwhile, focuses on the demand side and aims to systematically develop energy savings measures in the conversion of final and useful energy into energy services.”

2. Intracting: Intracting can also be referred to as “internal contracting”. “The starting point is a contracting model (see 1), which, however, is not handled by an external third party, but by one of the public authority's organisational units, which plays the role of the contractor. Source: Kora Kristof (Project Manager, *Kommunales Intracting* (Municipal intracting) 1998, p. 1)

<sup>58</sup> Cf. written statement by the Berliner Energieagentur GmbH of 24 March 2015, p. 4.

although intelligent networking with decentralised heat being fed into the long-distance district heating network or into larger heat storage facilities should be considered.

Expanding decentralised CHP generally goes hand in hand with an overall boost to efficiency and modernisation. This is because, in practice, it is not just a question of installing the small-scale CHP systems themselves; peripheral equipment (boiler, control technology, water heating) is also upgraded. Furthermore, converting to small-scale CHP systems should also involve changing the fuel supply from oil to gas.

When it comes to developing the energy market, smaller generation services (e.g. from decentralised small-scale CHP systems, and batteries used in PV systems and transportation) should be given access to a business model which allows them to benefit from generated power on demand. This will help develop an increasingly flexible energy market. With centralised demand-side management, power-to-heat systems will be able to improve the control of electricity demand for fluctuating renewable supplies from wind and solar electricity.<sup>59</sup>

A heat supply via district heating must be viewed in connection with required cooling and air-conditioning (which will be in greater demand in the summer). Cooling continues to be generated via compressors – and, increasingly, electrically. Here – in the interests of synergetic efficiency optimisation – attempts should be made to make dual use of production capacities (e.g. absorption cooling), networks and storage facilities.

Within CHP funding, care will increasingly have to be taken to ensure that support for CHP electricity does not have any unintentional negative impacts on the market for renewable heat. Electricity-focused funding for CHP must not lead to a situation where competitive renewable heat sources still cannot access the heat networks. Earlier on, we explained that the share of renewable energies in heat must be increased enormously. This goal structurally contradicts ill-thought-through, generous funding for CHP electricity. CHP heat subsidised from the electricity side has an economic advantage over renewable heat and can keep it out of the market, even though a massive expansion of renewable heat appears to make sense for achieving the climate goals. The state of Berlin's CHP strategy and CHP funding should aim to avoid such counterproductive effects in the future.

It is clear that sustainably converting the energy supply structures will require substantial investments, for instance in building new gas-CHP power plants to replace Berlin's remaining lignite and hard coal electricity generation. Within this context, it is absolutely essential that Vattenfall keeps the promises it made to the Senate in the climate protection agreement to invest in new gas-based CHP plants. Vattenfall has already distanced itself from its previous announcement about replacing the lignite power plant in Lichtenberg by 2016. Furthermore, in a hearing by the Study Commission, Vattenfall cast clear doubt on whether it would abide by the agreement it reached with the state of Berlin under which it must, by investing in new gas-and-steam-turbine power plants, replace the lignite power plant by 2020 at the latest.<sup>60</sup> The Study Commission feels that Vattenfall is incorrect in its view that the agreement is not binding in terms of the measures, and that only savings targets were agreed. In fact, there is a binding agreement on numerous concrete investment measures which have so far only been

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<sup>59</sup> See also A. II. 3. Infrastructures, p. 29 ff., in this report.

<sup>60</sup> See the statements by Mr Hatakka, Senior Executive Vice President of Vattenfall GmbH, EnKoEnergie transcript 17/9, p. 2 ff. and 13 ff.

implemented to a small degree. **The Study Commission emphatically advises the state of Berlin to insist that the commitments in its climate protection agreement with Vattenfall are adhered to, and to investigate how measures arranged in climate agreements can be made more binding.**<sup>61</sup>

The Study Commission does not share Vattenfall's opinion that investing in more than one modern gas-fired power plant (300 MW) is unreasonable given the situation on the market today. Reasonableness does not mean that profits must necessarily be made quickly. It is also reasonable when a business that has generated billions in profits for years and years continues to invest even when it is not immediately guaranteed new, high returns. In view of the nuclear phase-out – a further 10 gigawatts (GW) of electrical output will be shut down by 2022 – and Berlin's recommendation to Brandenburg that it should not authorise any further expansion of its opencast lignite mines (Jänschwalde: 3 GW; Schwarze Pumpe: 1.6 GW), more new gas-and-steam-turbine power plants will be needed in the medium term anyway.

**The Study Commission expects Vattenfall to keep its promise and build two new gas-and-steam-turbine power plants that are no less efficient than the Berlin-Mitte power plant. As a follow-up to the Study Commission, we recommend holding a public hearing of Vattenfall in the Berlin House of Representatives, to which the politically responsible Swedish representatives of the company owners should be invited.**

As part of the energy transition, expanding CHP will not only play a key role in protecting the climate in Berlin, but in all major cities in Germany. Nationwide surveys investigating figures for heat consumers suited to CHP show that an enormous amount of untapped potential exists here.<sup>62</sup> The feasibility study *Climate-Neutral Berlin 2050* confirms this for Berlin and believes that a significant increase in the share of CHP heat is necessary for achieving the climate goals. It is likely that ongoing building refurbishments will reduce specific heat demand even further. The lower specific heat demand drops, the less sense parallel installation of district heating and gas networks makes. On the other hand, given the lack of regulation, this parallel structure helps to reduce the monopoly price for district heating. In the case of avoiding parallel installation, therefore, the price of district heating must be regulated.

### *Regulation / District Heating Act*

The Study Commission discussed in depth what opportunities exist for legally and contractually regulating the heat network, including the district heating network. The discussion was founded on points II.5.a and II.6.d of the decision on establishing the Study Commission, according to which clarification was needed on (i) what regulatory requirements exist for the heat networks and (ii) how network access (feed in/transmission) for heat produced by third parties can be regulated in the district heating network. During its

<sup>61</sup> See also A. I. Berlin's role in the energy transition, p. 11 ff. (12) and A. II. 1. 1.2 Fossil-based electricity generation and CHP, p. 17 in this report.

<sup>62</sup> A similar conclusion is reached in the final report on evaluating the CHP Act, produced on behalf of the German Federal Ministry for Economic Affairs and Energy (BMWi) by the Fraunhofer Institute for Manufacturing Technologies and Advanced Materials (IFAM), the Institute for Resource Efficiency and Energy Strategies GmbH (IREES), BHKW-Consult and Prognos AG, of 1 October 2014; available (in German) at: <https://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/Studien/potenzial-und-kosten-nutzen-analyse-zu-den-einsatzmoeglichkeiten-von-kraft-waerme-kopplung,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf> (last accessed on 30 Oct. 2015).

deliberations, the Study Commission unanimously came to the conclusion that a legal assessment by the parliamentary Research Services was required on these issues. The Study Commission therefore requested an expert review of and answers to the following questions.

1. *What options are there for regulating the heat network, including the district heating network, via legal regulations at the state level?*
2. *What options exist for regulating the heat network, including the district heating network, via contractual regulations, e.g. by granting concessions at the state level?*
3. *With regard to questions 1 and 2, please also establish the extent to which opportunities exist for local producers to feed into the network.*

The report that the parliamentary Research Services produced at the request of the Study Commission<sup>63</sup> is limited to a legal review of the scope for legally and contractually regulating feed-in from local producers. The scope for regulating retail prices for local and long-distance district heating was not reviewed. Furthermore, question 3 was only answered to the extent that a review was carried out to establish whether it is legally possible for local producers to feed in. The question of technical scope for feeding in was not addressed in the legal assessment and thus remains unanswered for now.

With regard to question 1, the report finds “*that the state of Berlin currently has legislative powers to regulate district heating being generated by local producers and fed into Berlin's district heating network, as the federal government has made no use of its legislative powers in this respect.*” Since these types of rules are also lacking in other German states, the state of Berlin could play a pioneering role in this context.

With regard to question 2, the parliamentary Research Services refer to the draft of a concession contract for supplying district heating in Stuttgart, the capital of Baden-Württemberg. Section 8(3) of the contract reads as follows: “*The district heating company undertakes to grant everyone non-discriminatory access to the district heating network in the concession area. The district heating company will allow the state and third parties to feed decentralised heat into the district heating network as far as is technically possible. In cases of doubt, the legal provisions for guaranteeing network access and for connection to the general gas supply networks apply accordingly. The district heating company calculates network charges in line with the regulation on gas network charges (Gasnetzgelbverordnung) or any subsequent regulations.*”

Overall, the parliamentary Research Services feel that “the selection criterion and the corresponding concession contract on the feed-in of district heating (from renewable energies) by local producers are permissible.”

**The legal or contractual regulation of the district heating network at the state level thus appears to be possible within the limits set by European and German law. It also seems to make sense, as district heating providers can act more or less as monopolists on the market** because their freedom to act is insufficiently limited by providers of heat from other

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<sup>63</sup> Parliamentary Research Services of the Berlin House of Representatives, *Gutachten zur gesetzlichen und vertraglichen Regulierung des Berliner Fernwärmenetzes auf Landesebene* (Report on legally and contractually regulating Berlin's district heating network at the state level), 6 March 2015.

sources. This finding is also reflected in the opinion of the German Federal Court of Justice, according to which the market for supplying customers with district heating should be considered as an independent, relevant product market and, from a competition perspective, not as part of a general heat market.<sup>64</sup> Judicial practice in many other countries (such as Sweden, Canada, France and Austria) also sees the matter this way.<sup>65</sup>

The reason for this classification as an individual market is because, once consumers have chosen either gas, oil or district heating, they are then tied into being supplied by their chosen heating fuel and, if prices change, they can only switch their fuel if they are willing to accept very high costs. Although the sector inquiry into district heating carried out by the Bundeskartellamt (Germany's competition authority) found that adjacent heating-fuel markets do exert a certain degree of competitive pressure,<sup>66</sup> the extreme differences in prices are indicative of an independent market for district heating. The Bundeskartellamt's inquiry also indicates "*that prices in network areas where district heating is mandatory are on average higher than in other areas where the customer can decide against district heating as a form of heating at the time of the initial connection or (under more difficult conditions) at a later date.*"<sup>67</sup> The latter finding was also confirmed in the hearings that the Study Commission conducted with external experts.

Therefore, in order to convince consumers that switching to district heating would be advantageous, effective consumer protection must be guaranteed in the long term. This requirement is even more pressing when designating priority zones for district heating, as these further diminish the already weak competitive pressure.

Effective consumer protection, which will make consumers more motivated to switch to district heating, can be achieved by regulating the district heating market. There are three main options for doing this:

- 1) Regulating feed-in and/or transmission fees in the Berlin district heating network, either legally within a Berlin heating act, or contractually within a concession contract.
- 2) Regulating the upper limits for district heating retail prices, either legally within a Berlin heating act, or contractually within a concession agreement.
- 3) A (Bundesrat) initiative for strengthening control under competition law of (improperly inflated) retail prices.

While options 2 and 3 set out different models for controlling retail prices, option 1 is only indirectly concerned with retail prices. Its immediate focus is network access fees on the wholesale side. Options 2 and 3 are therefore in principle mutually exclusive. Option 1,

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<sup>64</sup> Federal Court of Justice, judgement of 9 July 2002, Az. KZR 30/00 (*Fernwärme für Börsen*), BGHZ 151, 274; Federal Court of Justice, judgement of 6 April 2011, Az. VIII ZR 66/09, NJW 2011, 2508; Cf. also Bundeskartellamt (2012), *Sektoruntersuchung Fernwärme* (Sector Inquiry District Heating), report pursuant to Section 32e GWB, p. 75 ff. / marginal no. 175 ff.

<sup>65</sup> Cf. Bundeskartellamt (2012), *Sektoruntersuchung Fernwärme* (Sector Inquiry District Heating), report pursuant to Section 32e GWB, p. 76 / marginal no. 177 and footnote 107.

<sup>66</sup> Cf. Bundeskartellamt (2012), *Sektoruntersuchung Fernwärme* (Sector Inquiry District Heating), report pursuant to Section 32e GWB, p. 1 f. / marginal no. 3 and p. 109 ff. / marginal no. 280 ff.

<sup>67</sup> Cf. Bundeskartellamt (2012), *Sektoruntersuchung Fernwärme* (Sector Inquiry District Heating), report pursuant to Section 32e GWB, p. 1 f. / marginal no. 3.

meanwhile, can certainly complement options 2 and 3, and can be implemented in addition to either option 2 or 3.

*Option 1: Regulating network access*

Feed-in and/or transmission fees have long been regulated in other areas of the energy sector (especially electricity and gas) at a national and international level. The form of regulation can vary a great deal, and might include limiting the maximum return on equity, or setting upper limits for prices or revenues. Regulating access to the district heating network in this way, however, only ultimately protects consumers if there actually are a sufficient number of alternative district heating providers who make use of regulated network access and between whom consumers can effectively choose. In principle, this type of access to the district heating network would be legally possible today on the basis of Section 19(2)(4) of Germany's Act Against Restraints of Competition (GWB).<sup>68</sup> The high costs of legally enforcing access rights on the basis of competition law, however, make this legal possibility appear ineffective, not least because the investments for building a power plant for generating district heat by a third party (not by the district heating operator itself) will not be made unless a permanent feed-in or transmission right is legally enforceable. This was why, with the 2005 amendment to the energy industry law, the legislature decided to switch from negotiated network access to officially regulated network access for electricity and gas.

No national and hardly any international experience of regulating network access has been gathered within the district-heating sector.<sup>69</sup> The state of Berlin could therefore play a genuinely pioneering role here. However, the technical hurdles to realising network access should not be underestimated. In its district heating sector inquiry, for instance, the Bundeskartellamt explains that numerous technical problems mean that "the access of third parties to existing networks for the transmission of heat to their own customers will therefore at best remain the exception in future."<sup>70</sup>

Specifically, three types of question need to be answered:

- a) Technical questions, e.g. guarantees for sufficient and continuous heat quality (e.g. flow temperature), must be clarified. However, complex control of heat distribution and storage is also needed, especially if, in addition to heat from decentralised sources, heat from power-to-heat systems is also to be fed into the network. It must be possible to shut feeders down when power-to-heat is deployed – this applies to centralised

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<sup>68</sup> Cf. Körber, Thorsten (2011), *Drittzugang zu Fernwärmenetzen* (Third-party access to district heating networks), Munich.

<sup>69</sup> According to information from the Bundeskartellamt, a survey conducted within the European Competition Network found "that the transmission of district heating by third party heat generators plays practically no role within Europe; in contrast to electricity and gas, there is no special transmission system for district heating, even in regions in which the district heat supply level is much higher than in Germany" (Bundeskartellamt (2012), *Sektoruntersuchung Fernwärme* (Sector Inquiry District Heating), report pursuant to Section 32e GWB, p. 4 / marginal no. 11). After lengthy discussions (Cf., e.g. OECD Green Growth in Stockholm, Sweden, 2013, p. 105), Sweden introduced access to heat networks for third-party providers in August 2014. So far, however, almost no practical experience exists as regards the network access system (Cf., e.g. M. Kimming et al. (2015), Vertical Integration of Local Fuel Producers into Rural District Heating Systems, Energy Policy 78, p. 51–61).

<sup>70</sup> Cf. Bundeskartellamt (2012), *Sektoruntersuchung Fernwärme* (Sector Inquiry District Heating), report pursuant to Section 32e GWB, p. 2 / marginal no. 5.

power plants as well as to decentralised feeders, etc. This must be organised centrally by the operator of the district heating network.

- b) Contractual questions: the technical quality and shutdown capability of decentralised feeders must be clarified above all. The fee for network use must also be determined on a case-by-case basis. This should take into account the fact that district heating networks involve long investment and payback periods. Securing appropriate and fair participation for feeders with short and medium term agreements will mean entering uncharted contractual territory.
- c) Regulatory questions: the cost of establishing a regulatory system (additional work for the relevant authority, plus the risk of legal costs if the regulated providers bring lawsuits).

These questions could be moderated by the Senate and incorporating the expertise of the Bundeskartellamt and the Federal Network Agency, especially seeing as the Federal Network Agency was tasked by the state of Berlin with performing the tasks involved in regulating the electricity and gas networks (when one public authority works for another like this in Germany, it is known as *Organleihe*, “authority on loan”). For climate-policy reasons, care must be taken to ensure that scope for feeding into the grid is above all granted to heat from systems that have a smaller carbon footprint than the heat produced by the universal supplier.

In view of these problems, regulating network access for district heating will not be enough on its own to guarantee effective consumer protection. Regulating network access to district heating networks should therefore be complemented by effective control of the retail prices.

### *Option 2: Regulating retail prices*

Retail prices in the district heating network could be regulated by stipulating – either contractually or legally and starting from a pre-defined price – maximum increases in the prices or returns per customer. The maximum scope for raising district heating prices should be oriented towards the trend in gas prices, since gas is the main alternative heating fuel for many people. If consumers can be given a guarantee that increases in district heating prices will at least not exceed the increases in the gas sector, this will make district heating more attractive to consumers. Checks should be carried out to establish whether the starting price can be set below the current price level in Berlin because the city’s district heating prices should, given low heat production costs, the long-paid-off heating network and high consumer density, lie significantly below the level of those in other cities, but this is not the case.

The advantage of this type of regulation is that it is less complex, thus relatively easy to monitor, and guarantees effective consumer protection. As a result, it will make district heating more attractive to consumers.

Alternatively, a type of regulation could be introduced that, as is the case in the gas and electricity networks, limits revenues. This would involve more monitoring work than price regulation. This alternative should be used if the solution proposed here proves to be unworkable, for instance because of changes to the legal framework.

### *Option 3: Strengthening the control of abusive price practices under competition law*

An alternative to contractually or legally regulating the district heating prices would be to create more robust options for the Bundeskartellamt to intervene. In terms of the networked supply of electricity and gas, Section 29 of the Act Against Restraints of Competition (GWB) sets out a special control of abusive practices, which reverses the burden of proof for providers with a dominant position on the market.

Section 29 of the GWB says the following:

*“An undertaking which is a supplier of electricity or pipeline gas (public utility company) on a market in which it, either alone or together with other public utility companies, has a dominant position is prohibited from abusing such position by*

- 1. demanding fees or other business terms which are less favourable than those of other public utility companies or undertakings in comparable markets, unless the public utility company provides evidence that such deviation is objectively justified, with the reversal of the burden of demonstration and proof only applying in proceedings before the competition authorities, or*
- 2. demanding fees which unreasonably exceed the costs.”*

This provision could be extended to include suppliers of district heating. Compared to option 2, however, option 3 has the disadvantage that (a) unlike with ex-ante price regulation, consumer protection does not automatically occur with ex-post control of abusive practices, but rather only via the specific actions of the competition authorities and (b) changing the GWB in this way will require a successful initiative in the Bundesrat because the state of Berlin cannot make this type of legal amendment.

### *Investment incentives in expanding district heating*

A much-cited concern is that regulating district heating prices could cause operators of the integrated district heating network to hold back on investment. These worries might be justified. While the incentive regulation in the electricity and gas networks does not appear to have this effect (according to an evaluation by the German Institute for Economic Research (DIW Berlin) on behalf of the Federal Network Agency),<sup>71</sup> the electricity network operator at least is a natural monopolist that existing customers cannot avoid and on which new customers are forced to rely. As mentioned above, this only applies to district heating to a limited degree. Since it is economically and legally unacceptable for the incurred costs of district heating to exceed the allowable maximum price, the state of Berlin should, in exceptional cases, be able to adjust the maximum price allowed under the regulations if a district heating provider can demonstrate that the incurred costs would otherwise not be proportional to the prices. In contrast to regulating returns, the burden of proof here lies with the supplier.

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<sup>71</sup> DIW Berlin / DIW Econ GmbH, Study on the network behaviour of electricity and gas network operators as part of the evaluation report in accordance with Section 33(1) ARegV, October 2014; available (in German) at: [http://diw-econ.de/wp-content/uploads/2014/11/GA\\_Investitionsverhalten\\_ARegV1.pdf](http://diw-econ.de/wp-content/uploads/2014/11/GA_Investitionsverhalten_ARegV1.pdf) (last accessed on 30 Oct. 2015).

**In order to make progress on renewing Berlin’s power plants and integrating renewable energies into district heating, the regulation should therefore also include gradually increasing requirements regarding the carbon footprint of the heat transmitted through the district heating network.**

### *Recommendation*

Sustainably reorganising the energy supply structures requires substantial investments, for instance to construct new gas-CHP power plants. **In order to minimise any increase in heating costs and thus guarantee effective consumer protection and encourage people to switch to district heating, the Study Commission recommends regulating the local and long-distance district heating market via a Berlin heating act.** We recommend regulating network access for local producers feeding heat into the network, and the carbon emitted by the heat production and distribution process. We also recommend regulating the retail price by linking the admissible maximum price for local and long-distance district heating to the applicable market price for natural gas in Berlin. The applicable market price is made up of the annual average of one or more liquid trading points, plus the network charge for natural gas customers in Berlin.

## **4. Decentralised heat generation based on fossil fuels**

The city’s heat supply continues to rely almost entirely on fossil fuels. In many parts of Berlin, heating oil still makes up a sizeable share of this at around 20 percent. To protect the climate, this share should be reduced to zero as soon as possible. The emissions stemming from the use of heating oil amount to a staggering 2.4 million metric tons of carbon. If heating oil was replaced in its entirety with natural gas, this would already achieve a reduction in carbon emissions of almost 0.6 million metric tons. **As an effective political measure for replacing oil heaters in the short term, Berlin could offer a “scrapping bonus” for oil heaters on replacement with a climate-friendly heating system. Of course, financial support for such a replacement could also be integrated into a broader scheme.**<sup>72</sup> At the same time, there also needs to be at least sporadic testing of whether the oil heating systems in use still comply with environmental regulations – if they do not, their use must be discontinued in any case.

A medium-term solution on a federal level would be to collect a carbon tax from sectors not subject to emissions trading, such as transport and buildings. This would make it less affordable to use emissions-heavy fuels for heating rather than more climate-friendly alternatives. Berlin should consider an initiative at the Bundesrat (Federal Council) to this end.

For the financing of a possible Berlin energy efficiency fund,<sup>73</sup> it would make sense for the state of Berlin to receive funding from trading in carbon certificates. Instead of a possible carbon tax, this could be supplemented by an expansion of the emissions trading scheme to include sectors such as transport and buildings, which to date have been exempt from this

<sup>72</sup> See also section A. III. 6. 6.1 Energy-efficient refurbishments, p. 56 ff.

<sup>73</sup> For the Berlin energy efficiency fund, see also section A. III. 7. Making energy-efficient refurbishments socially acceptable, p. 62 ff (63/64).

system. Independently of this, the existing emissions trade should be subjected to significant reductions in trading volumes.

Substituting natural gas for heating oil, however, is only an interim solution. Only a complete substitution through the direct or indirect use of renewables via electricity or district heating, ideally in conjunction with a significantly improved efficiency rating, would make it possible for the heating market to contribute decisively to Berlin's climate neutrality. Unfortunately, this is not a practical reality in the short term. A number of innovations are still needed for this to happen, particularly as heating oil is frequently deployed in detached and semi-detached houses in less populated areas.

**It is crucial that Berlin conducts a precise, building-by-building assessment of potential energy transition measures, particularly in terms of improvements in heat generation. On this basis, an action concept for a climate-friendly heat supply should be worked out jointly by the participating businesses and local government.** Such a concept would set out the priorities for the individual supply areas by systematically determining the potential efficiency increases. This may mean that as well as phasing out heating oil due to its big carbon footprint, the gas supply system for heaters and central heating systems may also be discontinued in some residential areas.

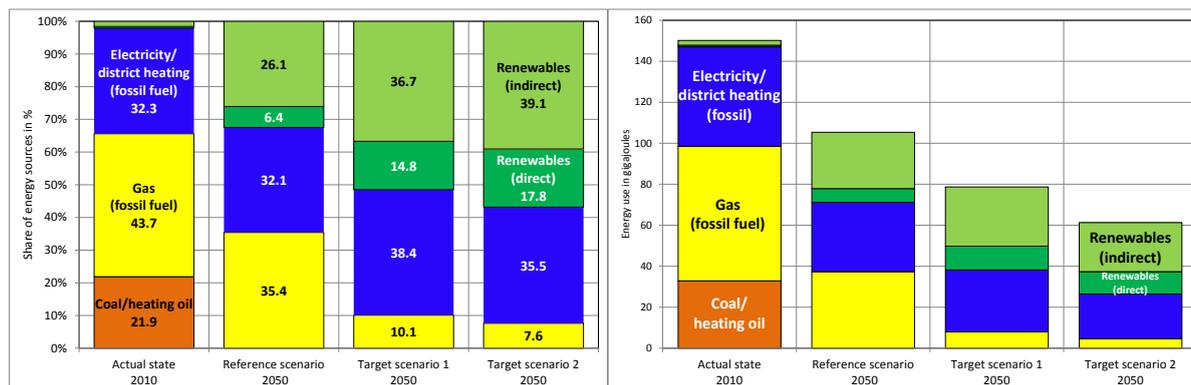
**The Study Commission recommends that detailed concepts on a climate-friendly heat supply should be compiled for major new residential development projects, as well as for existing residential areas with high energy consumption.** In these concepts, fossil fuels are no longer to be utilised directly. Instead, the heat supply of the future will need to embrace renewables both directly and indirectly, which will need to go hand in hand with efficiency improvements.

## **5. Heat from renewables**

The share of renewables in Berlin's heat supply is currently negligible at less than 2 percent. This applies to both directly-used renewables as well as renewables deployed indirectly via electricity and district heating grids. According to the feasibility study *Climate-Neutral Berlin 2050*, even the reference scenario for this is to change significantly by 2050. With an overall drop in end user energy consumption by around 30 percent for heat generation, the share of all renewables combined is set to increase to around one third; the increase is even more pronounced with the two target scenarios, being close to 52 percent for target scenario 1 and around 57 percent for target scenario 2 – while energy consumption will conversely drop by 48 or 59 percent respectively.

## Energy deployment for heat supply

## Structure according to fuel type



In the area of renewable energies, renewables deployed indirectly via electricity and district heating grids will play a much bigger role in the future than directly deployed renewables; in all of the scenarios for 2050, ambient heat is considerably more important than solar thermal energy and biomass energy. In indirect deployment, PV is the most important for electricity generation, whereas urban wind energy is comparatively insignificant. In the scenarios described in the feasibility study, wind energy is primarily deployed in the form of imported electricity.

**The path towards a climate-friendly Berlin will entail not only efficiency increases but also an extensive deployment of renewables.** In the view of the Study Commission, the target scenarios outlined for heat supply in the feasibility study provide suitable starting points in this respect. This applies to both the direct and indirect deployment of renewables.

The indirect deployment in particular will need to become much more significant in the future alongside a considerable reduction in primary energy demand, because otherwise neither local nor district heating will be able to fulfil their designated leading roles in the pursuit of a more climate-friendly heat supply infrastructure. In the short term, the deployment of lignite in the generation of district heat will need to be temporarily replaced with natural gas, but in the long term, district heat generation will need to increasingly rely on renewables. At the same time, however, suitable strategies towards the direct deployment of renewables in the heating market also need to be pursued. This includes not only conventional technologies such as solar thermal and biomass energy but also new technologies for integrating renewables into electricity generation for the heating market. Key facts on several of these technologies will be outlined below.

In order to foster a wide-ranging proliferation of renewables, existing research on the potential of renewables need to be pooled and expanded as needed to address the urban context of Berlin. This will provide guidance for action as well as foundations for the required decision-making processes.

**In order to improve the conditions for integrating renewables into heating networks, the flow temperatures within the heating networks need to be lowered in the long term.** With flow temperatures at their current high levels, PtH (via heat pumps) can only be implemented at very high costs and energy losses; the same is true for the utilisation of industrial waste heat. The reduction of flow temperatures can be instated gradually through the hydraulic

decoupling of individual grid sections, which needs to be accompanied by building-side adjustments in the affected areas (insulation, different heater sizes, transition to panel heating).

## 5.1 Solar thermal energy

So far, there has been little economic incentive to pursue heat generation based on solar thermal energy due to the lack of subsidies. Another reason that this approach has been neglected is that Germany's Renewable Energy Act (EEG)<sup>74</sup> makes it much more profitable to invest in PV systems. It remains to be seen whether the federal market incentive programme in place since 1 April 2015, which provides improved funding conditions for residential and industrial users as well as communal enterprises, will foster growth for renewables in the heating market.

**In the view of the Study Commission, the Berlin Senate should be supporting this growth through corresponding information and promotion campaigns**, particularly in areas that feature large unused roofing surfaces and that are not connected to centralised district heating grids. It should be ensured that property owners are adequately informed about the benefits of solar thermal energy when planning roof renovations. **At the same time, stimuli should be created for the development and implementation of heating concepts that are suited to solar thermal energy systems**, which ideally should also include the potential of solar thermal energy to supply low-temperature process heat.

## 5.2 Biomass / Biogenic waste

The energy gained from biomass offers an interim solution for phasing out coal and oil in the short term until the Berlin state's planned reductions in carbon emissions can be instated through energy efficiency measures, energy savings and the deployment of renewables such as wind, solar and geothermal energy. However, committing to a transitional concept of this nature only makes sense if the deployed biomass is proven to have a positive climate effect, and if its production does not compete directly with the production of human food. Resultantly, the deployment of biomass for energy generation must comply with very high sustainability and social acceptability standards. Biogenic waste and sewage sludge, on the other hand, can potentially make an ongoing contribution to energy generation in Berlin, provided the efficiency and emissions of their deployment can be optimised significantly.<sup>75</sup>

## 5.3 Ambient heat / Geothermal energy

### 5.3.1 Shallow geothermal energy

(Shallow) geothermal energy plays an important role in the renewable heat supply to the city of Berlin. Across the city, the number of geothermal plants has risen from 132 in 2004 to around 2,400 in 2011. Geologically, Berlin is well suited for accessing heating and cooling

<sup>74</sup> Renewable Energy Act (Erneuerbare-Energien-Gesetz, EEG 2014), July 2014 (Federal Law Gazette I p. 1066), last amended by Section 1 of the law from 29 June 2015 (Federal Law Gazette I p. 1010).

<sup>75</sup> The conditions and implementation strategies required for this are outlined in section A. II. 1. 1.3.3 Energy generation from biomass and municipal waste, p. 23 ff. of this report.

flows through the exploitation of shallow geothermal energy. The water-logged sand strata and extensive aquifers of Berlin offer very good conditions for the construction of groundwater circulation systems and borehole heat exchangers. These technologies are well-established already, and geothermal plants have been successfully deployed across Berlin and other parts of Germany for many years. Geothermal energy is particularly well suited for providing cooling. For example, buildings can be cooled by using groundwater as a cooling source; this has a base temperature of around 10 degrees Celsius. The primary energy required for such cooling is only around 5 percent of the primary energy consumed by conventional cooling systems.

Still, there is only slow growth in installed capacity of shallow geothermal energy systems in Berlin. While regulatory incentives (Renewable Energies Heat Act / EEWärmeG,<sup>76</sup> Energy Saving Ordinance / EnEV<sup>77</sup>) do increase demand, they have stimulated significantly less development than the EEG has for electricity generation. The main obstacle is that geothermal systems take 5-10 years to pay for themselves, which makes them unattractive to investors eager for short-term returns. In addition, costly geological analyses and bureaucratic hurdles also have a stifling effect on demand. **The Study Commission recommends instating the following measures in order to create new stimuli for the deployment of geothermal energy production:**

- Development, adoption and ongoing monitoring of a deployment corridor for renewable heating and cooling in Berlin for 2020 and for 2030
- Introduction of minimum standards for the deployment of renewables in providing cooling for new industrial buildings (at least 25 percent)
- Inclusion of geothermal exploitation of Berlin groundwater as a political goal in the relevant laws and ordinances (in conjunction with the protection of drinking water)
- Increase of resources at the relevant authorities for approving geothermal energy plants
- Revision of the approval procedures for groundwater thermal exploitation plants in locations with existing contaminations. Currently, any plants utilising groundwater where there are existing or suspected contaminations are either not approved at all or only if they meet very specific requirements. This usually prevents such plants from being constructed or makes them economically unviable. The Study Commission recommends that such sites be approved on the condition that the geothermal groundwater circulation process is augmented by a groundwater purification stage. Should thermal groundwater exploitation plants become more widespread, this would lead to a significant improvement in groundwater quality. Additionally, Berlin currently has a bore depth restriction of 99.9 metres, a figure that bears no scientific

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<sup>76</sup> Renewable Energies Heat Act (Erneuerbare-Energien-Wärmegesetz, EEWärmeG), 7 August 2008 (Federal Law Gazette I p. 1658), last amended by Section 14 of the law from 21 July 2014 (Federal Law Gazette I p. 1066).

<sup>77</sup> Ordinance on energy-saving thermal insulation and energy-saving installations in buildings (Energy Saving Ordinance - EnEV), 24 July 2007 (Federal Law Gazette I p. 1519), last revised by Section 1 of the ordinance from 18 November 2013 (Federal Law Gazette I p. 3951).

foundation; instead, the bore depth limit should be determined in relation to the depth of the Septarian clay layer that sits above the saline stockwork.

Another potential heat source usable by geothermal heat pumps is to be found in the wastewater flows of the city's central pumping stations. On the assumption that consumers will restrict their local heating systems to relatively low temperatures, this could be a great option for securing local heat supply sources in the relevant areas. In the longer term, it could also be possible to increase the return flow of district heating if district heating temperatures are lowered.

**The Study Commission therefore recommends conducting a study to map out the local potentials, and making the findings publicly available.** This study should include all the major aspects for consideration, i.e., new housing projects with potentially low flow temperatures, development timeline, long-term solutions for wastewater disposal and long-term options for reducing district heating temperatures.

### **5.3.2 Deep geothermal energy**

Deep geothermal energy is a renewable energy source that generates heat independently of weather conditions. While Berlin's geography is not ideal for this, it is nevertheless possible to exploit ground heat from depths of around 5,000 metres. The possibility of feeding this heat into existing heat supply grids makes deep geothermal exploration an attractive option. **The Study Commission recommends running a pilot project over the next four years, and if the results are promising, to then implement a full-scale project.**

## **5.4 Power-to-Heat / Power-to-Gas**

In terms of the indirect types of deployment available for renewables to generate heat, the role of electricity generation from renewables will be crucial. The more that volatile renewables are exploited for electricity generation, the greater an energy surplus there will be at peak times; this can either go to waste, or it can be used for heat generation and/or gas production. In the face of decreasing or even negative electricity prices in the event of electricity overproduction, the excess energy can be converted very cost-efficiently into heat, which can be fed into district heating grids or heat stores (or conversely cooling grids and cold stores). This process is described as "power-to-heat". When electrical energy, which is highly exergetic, is deployed for low-temperature heating, there are inherent exergy losses. One way to prevent these is to produce hydrogen (with or without subsequent methanation), which can be deployed in natural gas grids; the generation of electricity and heat would thus also contribute to the heat supply infrastructure ("power-to-gas"). In terms of technology, both of these processes are entirely feasible; their economic viability is another matter altogether. A significant cost depression (by a factor of around four) would be necessary, particularly for the hydrogen production process. In Berlin like in many other places, there is ongoing research into finding alternatives to the conventional electrolysis method for hydrogen production.

**The share of hydrogen in Berlin's gas grid has decreased from an erstwhile 50 percent down to a mere 2 percent due to a cap imposed by the grid operator. The Study Commission recommends allowing a share of at least 10 percent so that more**

**renewables can indirectly contribute to the gas grid in the short term.** It also recommends conducting tests into how even greater shares of hydrogen would affect safety and material strain. In addition, the grid operator should examine the possibility of creating additional access points across the city's gas grid to feed in hydrogen.

#### **5.4.1 Power-to-Heat**

According to the feasibility study, PtH is set to reach consumption levels of around 7-9 petajoules per year (PJ/a) in the grid-based heating market, making it a major player; this will, of course, also necessitate significant increases in heat storage. The forecast for 2050 is that the overall share of renewables in district heating used for buildings will be at around 30 percent for the reference scenario alone, and at around 35 and 40 percent in the two target scenarios. To a large extent, this would be provided via PtH. In addition, renewables-based electricity generation would also contribute directly to heat provision in the form of supplying power to heating devices. The feasibility study's predicted electricity mix cites a share of around 80 percent for renewables across all of the scenarios. Resultantly, the electricity generated from renewables will contribute significantly to cover heating demand both directly and indirectly.

In this context, however, it should also be noted that it only makes economic and ecological sense to use renewables-based electricity for heating when there is indeed an electricity surplus being produced using renewables. This will need to be regulated legally. Given these conditions, PtH could contribute very considerably towards the integration of renewables into the heating/district heating market.

There are already two projects in Berlin nearing commissioning: district heating provider Fernheizwerk Neukölln (majority shareholder: Vattenfall) with an electrical output of 10 MW, and Blockheizkraftwerks- Träger- und Betreibergesellschaft mbH Berlin (BTB) with an output of 6 MW. Further projects are to follow in step with the proliferation of wind and solar energy generation not only in Berlin but also across Brandenburg. The state of Berlin should strongly advocate for PtH electricity conversion to be based on heat pumps wherever possible.

#### **5.4.2 Power-to-Gas with combustion in efficient heating plants with heat extraction**

Should it become clear that PtG is not only technologically but also economically feasible, a lot of potential could be tapped both for direct gas utilisation within the heating market and in transport, as well as for indirect gas utilisation for electricity and district/local heat generation. In order to keep this option open, the infrastructure necessary for this in Berlin should be planned to accommodate likely PtG progress as it arises. In particular, it would make sense to further expand the gas infrastructure with efficient grids as well as gas-fired heating plants drawing on the established district heating grids. One issue that still needs to be resolved is whether the required conversion processes (electrolysis: methanation) should be instated centrally for feeding into the gas pipeline grid, or locally, such as directly at the power plant sites.

## 5.5 Key levers for the deployment of renewables in Berlin

There is huge potential in Berlin for renewables to be deployed for heat supply. Electricity-powered systems are particularly important in this regard, be it through the deployment of shallow geothermal energy, wastewater or ambient heat via heat pumps, or through indirect deployment methods such as PtH and PtG. However, there is also considerable potential for direct heat utilisation via solar thermal systems – which compete with solar photovoltaics systems for installation space – and via (sustainable) biomass. The Study Commission recommends further research into this, as well as possible pilot projects for the exploitation of deep geothermal energy. To date, most of this potential has remained virtually untapped, which means there are no notable restrictions in place for the available funding means.

Even today, potential Berlin investors can make use of federal funding measures such as the Renewable Energy Act (EEG) or the market incentives and matching subsidies provided by the KfW development bank. The Berlin Senate should give special attention to questions pertaining to the further development of the electricity and heat grids' economic infrastructure, as well as to the institutional requirements involved.<sup>78</sup>

## 6. Heat consumption in old buildings / Energy-efficient refurbishments

A crucial factor in the success of the energy transition in the heat supply sector is the energy-efficient refurbishment of *existing* buildings.<sup>79</sup> In the residential sector alone, there are 316,000 buildings holding close to 1.9 million apartments. If Berlin's existing buildings are to attain anything even close to climate neutrality by 2050, a rough forecast suggests that every year, almost 9,000 residential buildings (the equivalent of around 50,000 apartments) need to be refurbished for greater energy efficiency. The sheer scope of this task is well demonstrated by the fact that the rate of energy-efficient refurbishments in Berlin has been less than 1 percent for the last few years.

The federal-level findings of the BMWi expert commission for monitoring the energy transition also apply to Berlin. However, the developments of the past years have shown that the ambitious goals set out for the building sector simply cannot be met using existing measures such as the Energy Saving Ordinance (EnEV), the CO<sub>2</sub> Building Rehabilitation Programme (in this instance, KfW's "Energy-efficient refurbishments" programme), the Renewable Energies Heat Act (EEWärmeG), the market incentives programme, on-location advice, and a standardised legal tenancy framework for heat supply contracting. While these measures have collectively achieved positive energy savings overall, they are severely underdimensioned in face of the given goals.<sup>80</sup>

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<sup>78</sup> See also section A. IV. Institutions, participation and processes, p. 76 ff.

<sup>79</sup> The statements made on buildings do not essentially distinguish between residential and non-residential buildings, as these are treated the same both by the EU Directive on the Energy Performance of Buildings and by Germany's Energy Saving Ordinance (EnEV).

<sup>80</sup> Cf. expert commission on the "Energie der Zukunft" ("Energy of the Future") monitoring process, statement on the federal government's first progress report for the reporting year of 2013, Berlin, Münster, Stuttgart, November 2014; available here: <http://www.bmwi.de/BMWi/Redaktion/PDF/M-O/monitoringbericht-energie-der-zukunft-stellungnahme-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf> (last accessed on 30 Oct. 2015).

In Berlin, a lot of action is needed to raise energy efficiency within existing buildings. The target values for this need to be identified and implemented in relation to building type and social context. After all, there are still more detached and semi-detached houses (178,705) to be dealt with in Berlin than large apartment buildings (136,762) – which of course bears no relation to the actual distribution of dwellings (around 1.64 million dwellings in apartment buildings versus 0.2 million dwellings in detached and semi-detached houses). Energy services with sufficient coverage need to be offered in either case, matched to the needs and options of the target group in question (landlord/tenant/industrial use etc.). The goal must be to raise the determined energy efficiency potential within the existing buildings sector as comprehensively as possible. In doing so, special attention must be paid to the social acceptability of the instated measures, particularly in terms of affordability.

Even in the area of energy efficiency measures that pay for themselves relatively quickly, there is still a lot of room for improvement in Berlin. For example, the hydronic balancing of a heating system results in heating energy savings of around 7-13 percent. But despite hydronic balancing being compulsory during the installation of new heating systems, only 13.5 of Germany's heating systems have in fact been hydronically balanced. In Berlin, this figure is even lower than the national average at just 11.4 percent.<sup>81</sup>

## 6.1 Energy-efficient refurbishments

The growth experienced so far in the share of (fossil fuel-based) gas heating systems is no longer sustainable from a climate perspective. This is particularly true for the densely built-up inner city areas, where priority should be given to the installation of heating systems connecting to heat supply networks. Nevertheless, natural gas can still be used as an interim solution to replace oil as a heating source in detached dwellings in the outer areas of the city. With increasing building refurbishments and the associated decrease in total heat consumption, this means that the direct deployment of gas to fuel individual heaters will decrease.

The *Climate-Neutral Berlin 2050* feasibility study concludes that if only its reference scenario is implemented, the climate goals set out for 2050 will not be attained. With its two target scenarios, on the other hand, the climate goals can be reached – thanks to a projected increase in building refurbishments to 1.5 or even 2 percent, and also an increase of electricity generated through PtH to a share of 20 percent with a concurrent decrease of natural gas use (24-30 percent of which is to be replaced by renewables). Crucial to this is not only the setting of a binding building refurbishment rate for existing buildings but also of the degree of refurbishment, for example, by setting a target value for average consumption of end user energy per square metre below 50 kWh by 2050.

Independently of the federal German programmes for funding building refurbishments (see above), Berlin should also pursue options of its own. **The existing programmes provided by the Berlin Senate for supporting building refurbishments should be optimised, and sufficient financial resources be made available. This should firstly entail increased funding for innovative solutions, and in view of the capital's socio-economic structure, a**

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<sup>81</sup> co2online gGmbH, Comparison of hydronic balancing in the individual states of Germany – <http://www.co2online.de/energie-sparen/heizenergie-sparen/hydraulischer-abgleich/hydraulischer-abgleich-daten-statistik/media/hydraulischer-abgleich-im-bundeslaendervergleich/> (last accessed on 30 Oct. 2015).

**second priority should be placed on funding socially acceptable solutions for low-income households.** Refurbishments should not lead to rent increases that make dwellings unaffordable for low-income tenants.<sup>82</sup>

Many types of refurbishment are not very effective unless they are implemented professionally and as intended. As a case in point, many of Berlin's buildings contain modern gas condensing boilers but do not make use of their efficient gas-condensing operating mode; similarly, hydronic balancing to match the heating system to requirements is frequently not carried out. The consequences are energy losses, unnecessary costs for tenants, and in the worst case, damage to the fabric of the building. **In order to improve the quality of energy-efficient refurbishments, the Study Commission recommends implementing a certification for registered energy efficiency engineers, and carrying out random inspections.**

An important aspect to consider is that many of Berlin's residential buildings are owned by condominium owners' associations, which frequently poses an obstacle to energy-efficient refurbishments. The levels of financial incentives aimed at sole building owners have very limited appeal to owners' associations. In order to achieve substantial progress in this area, Berlin needs to consider suitable measures, not least because any changes to the German Condominium Act (WEG) – such as altering the voting majority required for energy-efficient refurbishments – is not within the jurisdiction of the individual states. Another relevant factor in this respect is that the majority of existing residential buildings are detached and semi-detached houses. With these, the demographics of the building owners (such as age structure, income strata) crucially determine whether funding measures will provide sufficient incentives for the implementation of energy-efficient refurbishments. Outreach advisory programmes could be very useful in this regard, as in many cases, the biggest obstacle to refurbishment is a lack of awareness of the cost savings it entails.

### *Enforcing compliance with climate protection regulations in the building sector*

The Energy Saving Ordinance (EnEV) prescribes energy efficiency measures for buildings, which pay for themselves over the course of their lifecycle through energy savings. This is why it is in the interest of every building owner to implement the EnEV requirements, both for new-build projects and refurbishments. However, a lack of information and also a lack of enforcement mean that in an estimated 25 percent of cases nationwide these requirements are not implemented – causing unnecessary deadweight losses and worsening Berlin's carbon footprint.

Since 2008, proof of EnEV compliance is no longer tied to the building permission procedure in Berlin. Instead, inspection experts for energy efficiency planning in the building sector now monitor compliance. However, these inspectors only see around a fifth of all new-build projects. For refurbishment projects, they see even less. Proof of the legally-prescribed EnEV compliance is no longer required for any building permits issued in Berlin. Even when a construction project is completed, there are virtually no on-site inspections. According to a survey jointly conducted by the Berlin Chamber of Crafts and the environmental protection association BUND Berlin, the city's building authorities permitted around 600 new-build projects in 2012 for which the EnEV implementing provision required an inspection.

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<sup>82</sup> Also see A. III. 7. Making energy-efficient refurbishments socially acceptable, p. 62 ff.

However, the inspectors only actually looked at around 160 of these. This means that almost three quarters of these new-build projects were not inspected as set out by the regulations. Further adding to this figure are all major refurbishment projects that should also be subjected to inspection.<sup>83</sup>

**The Study Commission supports the efforts of the Senate to enforce implementation of the Energy Saving Ordinance (EnEV) and the Renewable Energies Heat Act (EEWärmeG) through random inspections, and to penalise non-compliance.** For this to happen, proof of EnEV compliance again needs to become part of the document set submitted for building permission. To ensure EnEV compliance, the applicable administrative departments need to be granted additional staff, or otherwise an independent agency needs to be employed for monitoring. The costs of this can be recouped at least in part through the collection of penalty fines. The Study Commission furthermore recommends for the Chamber of Architects and the Chamber of Crafts to provide in-depth information about the new inspections to affected companies and architects, and thus create a greater incentive for them to involve properly qualified inspectors in their construction projects. After all, the goal is for the climate protection regulations to be implemented *before* the random inspections, and also for the state to ensure a fair competitive environment that does not place construction offers with higher costs due to compliance with climate regulations at a disadvantage (but which tenants and landlords alike end up paying dearly through higher operating costs).

The hydronic balancing report, which is mandatory for refurbishments of heating systems, should be presented to the chimney sweeper when commissioning the new heating system. This new requirement, which should be added to the Berlin inspection regulations, is to be pointed out as early as the decommissioning of the legacy heating system. In the case of boilers that are to be replaced through connection to a local or district heating network, mandatory hydronic balancing should similarly be made a prerequisite for decommissioning the boiler. This is because district heating also becomes significantly more efficient through hydronic balancing. Every combustion system is regularly inspected by a chimney sweeper. This inspection, which currently only checks for flue gas loss under full capacity operation, should be augmented by relevant additional checks into the quality and state of the heating system. These include the insulation of heating and hot water pipes in unheated (basement) spaces, and the state of insulation in the topmost ceiling. In the future, the results of these checks should be also be logged in the chimney sweeper's report.

### *Information campaign on energy-efficient refurbishments*

In Berlin, there is presently a very wide range of information sources available on climate protection. A lot of this information, however, is provided by parties with vested interests. Also, there is no overarching coordination of the offers provided, nor specific support for building owners willing to refurbish (as offered in other German cities and states).<sup>84</sup>

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<sup>83</sup> Cf. BUND Berlin/Handwerkskammer Berlin: 5 Point Plan from 12 Mar 2014; also Cf. BUND Berlin from 14 Mar 2015: [http://www.bund-berlin.de/nc/bund\\_berlinde/presse/pressemitteilungen/detail/artikel/berlin-verschlaeft-die-energiewende.html?tx\\_ttnews\[backPid\]=447&cHash=6072f3cb46912319cdafdf26af5f00ce](http://www.bund-berlin.de/nc/bund_berlinde/presse/pressemitteilungen/detail/artikel/berlin-verschlaeft-die-energiewende.html?tx_ttnews[backPid]=447&cHash=6072f3cb46912319cdafdf26af5f00ce) (last accessed on 30 Oct 2015), or the press release of Handwerkskammer Berlin [Chamber of Crafts] from 14 Mar 2015: <https://www.hwk-berlin.de/handwerkspolitik/energie-umwelt/berliner-energiewendegesetz.html> (last accessed on 30 Oct 2015).

<sup>84</sup> Examples: "altBAU plus", Aachen; "Zukunft Altbau", Baden-Württemberg; "proKlima", Hanover.

Particularly the owners of detached and semi-detached houses and of detached apartment buildings still find they do not have a single source of information and advice on everything from the initial survey of refurbishment needs and options through to the monitoring of their implementation, and that also offers individual guidance through the manifold funding opportunities available.

**Overall, Berlin is in need of an information campaign that raises awareness of how energy efficiency can be improved in the city's building stock.** Housing companies, small-scale landlords and tenants need to be addressed and advised precisely according to their requirements so that the refurbishment backlog can be successfully tackled. Providers of modern heating systems, energy suppliers and Berlin's trade professionals would all benefit from providing free, unbiased quotes to prospective customers, but are not independent enough themselves to be perceived as unbiased. **In order to ensure such endeavours remain fully unbiased, it is necessary for the state to assume responsibility, even if the free quotes are in fact predominantly financed by the private sector. The Study Commission recommends that the Berlin Senate should bring together the relevant building-sector service providers with the goal of compiling a suitable range of advisory services,** and to set up a dedicated advice centre where efficient, climate-friendly heating methods and building materials can be demonstrated. These advisory services should be integrated with the existing energy advisory services offered in Berlin,<sup>85</sup> and should be available by calling the public authorities hotline (115). **In order for Berlin's predominant building types to attain the stipulated energy savings by 2050, the Study Commission recommends a concerted effort until around 2020 to systematically encourage local dialogue with property owners as well as tenants, and to implement individual agreements for gradually decreasing energy requirements.**

## **6.2 Renewables for Berlin's building stock**

The Study Commission regards the implementation of climate-neutral heat generation as a crucial factor in creating a climate-neutral Berlin. Here, the top priority must be to refurbish the city's existing buildings to become more energy-efficient. In order for the building stock to become climate-neutral, however, the direct and indirect deployment of fossil fuels needs to be phased out almost entirely. From a technological perspective, this can be achieved if energy requirements are significantly reduced on the one hand, and if the remaining demand is covered by emissions-free renewables on the other. The economic viability of this can be granted by instating the most cost-efficient combination of measures that reduce demand with measures that provide energy more efficiently. **The Study Commission recommends setting clear and quantitative goals and a timeline of milestones also for the heating sector, not least so that progress towards climate neutrality in Berlin's building stock can be checked on a regular basis.**

According to the scenarios cited in the feasibility study, the direct deployment of renewables will increase from just 0.5 percent (in 2010) to only just over 6 percent in 2050 with the reference scenario, and to almost 15 and 18 percent with target scenarios 1 and 2 respectively. Only once the indirect deployment of renewables via the provision of electricity, gas and district heating is included in the equation does the share of renewables increase from just a little over 2 percent to 32 percent (reference), or to 52 or 57 percent (targets). In essence, this

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<sup>85</sup> See also A. II. 2. 2.2 Households and businesses, p. 28 f. of this report.

means that the indirect deployment of renewables is vastly more significant than their direct deployment.

Because of this, the implementation of strategies towards increasing the share of renewables in electricity and local/district heat generation will be crucial. This will, however, not have the desired effect unless there is a concurrent pursuit of strategies for the direct deployment of renewables.

It is for this reason that federal lawmakers have introduced the Renewable Energies Heat Act (EEWärmeG), which has the following purpose: “To facilitate a sustainable development of the energy supply that serves climate protection, decreases the exploitation of fossil-based resources and decreases energy importing dependencies, and that also fosters the further development of technologies for generating heat and cold from renewables.” (EEWärmeG Section 1) As a result of this law, both private and public owners of any new buildings are required to cover a certain proportion of the heat and cooling supply with renewables. For public bodies, the obligation to deploy renewables also extends to existing public buildings undergoing extensive renovations.

The exact proportion of the share of renewables varies depending on the type of renewable being deployed. For example, where solar radiation energy is deployed (this is generated by solar thermal energy plants but not by PV plants), at least 15 percent of the heat and cooling requirements need to be covered using renewables. Where gaseous biomass is deployed, the proportionate share is at least 30 percent; for geothermal and ambient energy, it is at least 50 percent. The obligation to deploy renewables can be circumvented only if defined substitute measures are being instated (such as CHP, or special energy savings methods). Some building categories also have a blanket exemption.

As sensible as the EEWärmeG may be, its effects are limited because outside of the public sector, it only applies to new buildings. There is no obligation for any existing non-public buildings to make use of renewables. With EEWärmeG Section 3 Para. 4, federal law makes it possible for the individual German states to instate their own rules as to how existing public buildings should be leading by example, even if this means deviating from the law’s regulations. Even more importantly, the states are also allowed to individually regulate obligatory use of renewables for existing non-public buildings. The state of Baden-Württemberg, for example, has already made use of this freedom.

**In view of this and also because it is particularly important for Berlin’s building stock to become climate neutral in order for the city to attain its climate goals, the Study Commission recommends that the House of Representatives should similarly make use of EEWärmeG’s flexibility clause and adopt its own state-level regulation stipulating a minimum required proportion of renewable energy use in existing buildings.** As stipulated by the federal regulation, however, there should also be options for alternative ways to fulfil the obligation other than solely through the use of renewables. In contrast to the federal regulation, however, the obligation should also be fulfillable through the indirect deployment of renewables. This consideration is all the more important as the heating sector is predicted to become increasingly dependent on electricity in the long term.

**Beyond the federal regulation, there should furthermore be recognition for a qualified refurbishment roadmap to function as either a full or at least partial measure of fulfilment.** In other words, the regulation does not invariably require specific investments in

renewables or ongoing energy-efficient refurbishments, but simply that residential building owners actively engage with the issue of energy-efficient refurbishments and how to make them economically viable; the timespan for this still needs to be specified. Such a refurbishment roadmap will provide building owners with individually compiled guidelines on how their building can become adequately energy-efficient. The roadmap should include a present-state analysis of the building as well as (at least) two options for refurbishment: one in which all the energy efficiency measures are instated at once, and another in which they are instated in stages. **For such an advisory tool to be used effectively, however, there also need to be binding regulations on the criteria qualifying certified energy advisers and relevant tradespeople to compile a refurbishment roadmap, and also on the range of measures that a qualified refurbishment roadmap is required to cover** (such as roof insulation, external wall insulation, window replacement, heating system replacement, ventilation with heat recovery). Further, it should also be possible for non-residential buildings to be provided with a refurbishment roadmap for partial or complete compliance with EEWärmeG. Moderate funding packages should be made available in order to incentivise the use of refurbishment roadmaps.

In the opinion of the Study Commission, the implementation of measures which the refurbishment roadmap has shown to be economically feasible from an EnEV perspective should be a mandatory requirement, within a timespan to be specified, both with a view to the long-term goal of having a climate-neutral building stock in Berlin (and indeed nationwide), and in working towards the political measures still to be instated for this purpose. In this context, the refurbishment roadmap, in concert with the binding implementation of the associated economically feasible measures, could be regarded as part of a multi-stage model of building refurbishment.

Independently of this, the introduction of EEWärmeG not only prescribes the obligatory use of renewables for new public buildings and major renovations of existing public buildings but also legally defines the funding of systems for deploying renewables within the heating market as a means to attain the goals set out in EEWärmeG Section 13 (“Market incentive programme”).<sup>86</sup>

A crucial consideration with this is that although EEWärmeG Section 15 Para. 1 states that measures cannot be funded if they simply serve to fulfil the obligatory use of renewables, an accumulation of funding is still possible if certain conditions are met; usually, this entails more demanding measures than those legally prescribed. This should also be taken into consideration for existing buildings when the individual states’ regulations on the obligatory use of renewables are formulated. **Additionally, the Study Commission emphatically endorses the special duty and role-model function of public bodies to increase the share of renewables in existing public buildings and properties – this is mentioned throughout EEWärmeG. The Study Commission still sees a pressing need for action in this regard and recommends the setting of specific planning targets for the direct and indirect deployment of renewables in this area.**

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<sup>86</sup> Federal German Ministry for Economic Affairs and Energy, Guidelines on measures for the deployment of renewables in the heating market, 11 March 2015; link: <http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/Foerderbekanntmachungen/marktanreizprogramm-erneuerbare-energien.html> (last accessed on 30 Oct 2015).

## 7. Making energy-efficient refurbishments socially acceptable

As a major urban centre, Berlin is currently having to endure significant rent increases. It seems likely that these will continue over the coming years, given the unceasing population growth predicted for the city. Low-income households frequently cannot afford the new rent levels and have to move to more affordable areas. This trend is frequently exacerbated by hefty rent surcharges to cover energy-efficient refurbishments. Reducing the heating and service costs on top of rent is significant in two ways: If the costs for heating and hot water continue to rise due to developments in the energy market, the trend is reinforced. But if these costs can be capped or even lowered, this will conversely slow the trend towards excessive heating and service costs on top of rent.

Given these overall developments, there is growing urgency surrounding the issue of how the necessary energy-efficient refurbishments of existing buildings can be made affordable even for low-income households. There is no doubt that if the envisioned climate goals are to be reached, Berlin's building owners will need to invest substantially into upgrading their heating systems as well as implementing other energy-efficient refurbishments. Because landlords are able to pass such costs on to the tenants in the form of rent surcharges, rents are set to increase without the accompanying heating and service costs being alleviated accordingly. In order to facilitate easier investment into the energy-efficient refurbishment of buildings, Berlin should make greater use of the wide-ranging federal funding programmes provided through the KfW development bank. These programmes help to stifle rent increases, as the measures funded through them must not be used to justify rent increases. In addition, long-term measures need to be developed that prevent investors from misleadingly claiming their own rent increase goals to be in response to energy-efficient refurbishments, and to include unpermitted measures in their rent increase calculations. Another funding avenue available for integrating renewables is the subsidy programme of the Federal German Office for Economic Affairs and Export Control (BAFA), which is part of the updated market introduction programme for renewables within the heating market.

Based on these observations, the Study Commission has developed an initial recommendation: **The Berlin Senate should instate suitable initiatives for the programmes offered by KfW and BAFA to become more widely known and utilised. Public energy advice in the districts and residential quarters of the city should be expanded for this purpose.** The appointment of climate representatives for the districts has already proven to be a success; this structure should be expanded so that every inhabitant of the city has access to a suitable contact person in their vicinity. Energy suppliers operating in Berlin should similarly be offering independent, non-sales-driven energy advice.

In general, it can be assumed that particularly in the case of buildings that have experienced little refurbishment, simple measures can achieve the most significant decreases in energy consumption, which should help to reduce the excessive heating and service costs of such tenancies. If these simple, highly-efficient measures are implemented as a first step, this will typically result in lowered heating costs.

This cost decrease then creates a buffer zone for further, more in-depth measures that may entail rent rises. By splitting up the process into such distinct stages, the increase of total rent (including heating and service costs) can be lessened, which helps to make it socially acceptable to implement the required refurbishments even in low-income tenancies.

This should be an important consideration in the planning and implementation of refurbishment roadmaps for individual buildings. Where it makes sense in terms of the actual refurbishment process, the first stage should always focus on those measures that can be implemented in a way that will decrease heating and service costs, or at least not increase them.

Of course, this does not change the simple fact that the extent of climate protection needing to be instated to reach the set climate goals cannot be achieved without incurring additional costs. Reconciling climate protection and social acceptability in the building sector will also require the development of wider-ranging societal solutions. In other words, landlords and tenants should not be left to deal with these issues solely by themselves. One way to achieve a better degree of social acceptability would be to introduce a regulation that caps the refurbishment-related increase of rent to an affordable level.

Special preventive measures should be instated for low-income tenancies faced with the prospect of total rent becoming unaffordable due to refurbishments. **Considering that the state of Berlin is home to an above-average share of low-income tenants, the state's own funding programmes for building refurbishment – to be developed in addition to the federal programmes – should therefore focus on a programme specifically intended to support low-income tenancy households.** Given Berlin's tight budget, this type of funding should be conceived of as a supplement to federal-level funding (such as through KfW). As a first step, the Study Commission recommends targeting those energy savings measures in buildings that directly benefit the tenants. Together with the Berlin Investment Bank, the Berlin Senate should introduce a funding programme that specifically fosters low-investment energy savings measures. This should work in tandem with the KfW funding programme for individual measures. In the event that building owners commit themselves to instate refurbishments without increasing the heating and service costs bundled with rent, they should receive increased funding – as is the case with a Hamburg state programme. The state of Berlin could introduce such a programme without any external help. Funding support in the form of subsidies is much more effective at stopping rent increases than measures such as more favourable loans.

**In addition, there is a need for federally-funded programmes that subsidise energy efficiency building refurbishments in such a way that avoids low-income households being forced out of their tenancies as a result of refurbishment. Two models should be examined:**

- A Berlin Energy Efficiency Fund towards the socially acceptable implementation of building refurbishments. This fund would specifically subsidise energy-efficient refurbishments of dwellings rented by low-income tenants. Such a subsidy would be calculated to compensate those measures set out in the refurbishment roadmap that despite their base federal funding would result in significant rent surcharges. In order for the subsidy to be granted, a binding agreement between the landlord, tenant and approval authority would need to be entered. The initial effect of such an agreement would be that the landlord draws on all available funding opportunities on a federal level. If these fail to cover the entirety of costs incurred by the given energy efficiency measure, which would otherwise justify a rent increase, a subsidy is granted to cover the shortfall. In return, the landlord agrees not to increase the rent. Both landlords and tenants can apply for this arrangement. The landlord furthermore agrees to transfer the agreement to any future tenants in the event that the existing tenant moves out. The

Study Commission suggests linking the roll-out of this programme with the identification and announcement of energy-efficient refurbishment zones as this would allow for effective use of the additional advisory and monitoring services involved.

- The introduction of “KfW priority zones” as a new energy efficiency programme for urban renewal. Building owners in targeted neighbourhoods are to be offered significantly improved funding opportunities for refurbishment that are tied to social acceptability criteria. The targeted renewal of individual neighbourhoods facilitates ecologically and economically efficient solutions in cases where multiple adjacent buildings are refurbished concurrently to improve their energy and transport structures. As long as they do not breach data privacy, such combined efforts enable the formation of “micro smart grids”, which as well as meeting their own energy needs can also supply to public grids. The social benefits of this result from these highly favourable loans being tied to social conditions designed to prevent the renewed neighbourhood from being socially restructured.

It is beyond the means of the state of Berlin to finance such a programme on its own. However, there are good arguments for Berlin to strive for such a programme on a federal level. Firstly, building refurbishment is currently one of the most cost-effective climate protection measures, and the energy efficiency of the building stock on a federal scale is still far removed from the envisioned goals. Secondly, the federation could use such a programme as a reference project to stimulate neighbourhood-wide building refurbishments and innovative energy solutions. Thirdly, the federation’s main funding means for instating the energy transition have largely failed to take hold in Berlin so far: Out of the total amount of KfW funding allocated to climate protection, less than 3 percent goes to Berlin; significantly less than 1 percent of the funds from the Renewable Energy Act (EEG) end up in Berlin; and use of the BFA market incentive programme is also well below the 1 percent threshold in Berlin.<sup>87</sup>

Identifying and announcing individual neighbourhoods as locations for energy-efficient refurbishment is one way to reduce negative social repercussions for tenants; another is to introduce restructuring ordinances and to announce social conservation areas (milieu preservation areas) with suitably tested eligibility criteria.<sup>88</sup>

The guidelines on the reasonableness of rent allowances for recipients of transfer payments should include flexibility clauses that make it possible to increase the rent allowance in response to a proven rent increase following energy-efficient refurbishments. This is already the case in North Rhine-Westphalia<sup>89</sup> and Lower Saxony. A “climate bonus” of this nature should also be introduced in Berlin.

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<sup>87</sup> Calculation based on KfW funding report: <https://www.kfw.de/migration/Weiterleitung-zur-Startseite/Startseite/KfW-Konzern/Unternehmen/Zahlen-und-Fakten/KfW-auf-einen-Blick/F%C3%B6rderreport/F%C3%B6rderreport-12-2011.pdf>; calculations based on figures supplied by BDEW; market incentive initiative: [https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/Berichte/evaluierung-marktanreizprogramm.pdf?\\_\\_blob=publicationFile&v=4](https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/Berichte/evaluierung-marktanreizprogramm.pdf?__blob=publicationFile&v=4) (zuletzt abgerufen am 30.10.2015).

<sup>88</sup> The creation of restructuring ordinances and social conservation areas (milieu preservation areas) is facilitated by BauGB Section 172. The completion of municipal energy-efficient refurbishments and the determination of energy-efficient refurbishment zones is set out in BauGB Sections 136 ff.

<sup>89</sup> For the Bielefeld model, see also: <http://www.bgw-bielefeld.de/bielefelder-modell.html> (last accessed on 30 Oct 2015).

**The state of Berlin should endeavour to extend the “Alliance of social housing policy and affordable rent” initiative already agreed upon with the municipal housing associations to include private landlords and their associations.** This stipulates the landlords’ responsibility to complete energy-efficient refurbishments in consideration of the tenants’ socio-economic context, and to apply the required rent surcharges in a socially responsible way; this should be subject to regular monitoring.

At the Bundesrat, Berlin will pursue a reform of tenancy law so that any abuse of the refurbishment rent surcharge stipulated in BGB Section 559 at the expense of tenants can be prevented more effectively. The goal should be that the refurbishment rent surcharge should be lowered significantly, and that it should be corrected to match today’s lowered interest rates. In the regulations for compiling rent indices, the current energy efficiency of the building should be reflected more accurately.

## **8. Heat consumption on state-owned property / Energy-efficient refurbishments**

Despite the Study Commission’s in-depth research, no reliable data could be secured regarding the energy efficiency and related refurbishments of the properties owned by the state of Berlin. The only data found in this respect was sporadic detail information held by the management bodies responsible for the individual properties. The Study Commission regards this as a considerable deficiency, also compared to the data available from other municipalities across Germany.

The state of Berlin needs to set an example in leveraging energy efficiency potentials and further developing gas-fired CHP plants. **This requires defining new-build and refurbishment standards for the state and its enterprises; these need to reach beyond the legal federal minimum requirements and aim for a climate-neutral administration by 2030.** To make this possible, the rate and intensity of public building refurbishment needs to be increased significantly. Refurbishment decisions should be based on consumption data (particularly of the Berlin state’s energy industry agency) that is published in detail.

The Study Commission is aware that due to the necessary advance planning and continued capacity building in administration, any significant increase in the refurbishment rate and intensity of the public building stock can only be gradual. **Nevertheless, the state of Berlin must ensure that its 2016/2017 biennial budget includes all the funding required for refurbishing its public buildings** so that any additional refurbishment requirements can be planned and implemented without delay.

Initially, the most important task is to compile a reliable and comprehensive database on the energy efficiency of all state-owned properties. Any existing data on state-owned properties needs to be pooled with the energy data still to be collected, and all of the data needs to be published. For each building, at least the following information must be shown: type and structure of heating system; level of refurbishment; specific heat consumption per year; etc.

**The Study Commission recommends establishing a central agency as part of the Berlin Senate that would be responsible for fast and thorough data collection and for coordinating the creation and implementation of systematic refurbishment roadmaps for state-owned properties.** These roadmaps need to be based on the goal of attaining a climate-neutral administration by 2030.

It can be assumed that those measures that are carried out in the first step of the refurbishment roadmap are particularly cost-effective thanks to the significant energy savings they provide, and that they will thus contribute greatly to the feasibility of the overall concept within the Berlin budget.

**The Study Commission recommends setting up a state-owned energy service provider tasked with making suitable contracting/intracting offers<sup>90</sup> for all state-owned properties according to the defined refurbishment roadmaps, and implementing the necessary measures.**

The state of Berlin has a lot of catching up to do in terms of its buildings' energy-efficient refurbishment. In the medium to long term, investments into energy-efficient refurbishments pay for themselves through the saved energy costs, and ultimately free up more money in the state budget. At the same time, these types of refurbishment stimulate regional added value. The Senate therefore intends to approach the energy-efficient refurbishments of public buildings in a systematic fashion, and aims to put together a concept for the required refurbishment roadmaps and the creation of an energy management structure for public buildings. The Study Commission welcomes these endeavours, which in the future will make it possible for refurbishment funding to be prioritised for those projects that have the greatest climate protection effects. Because this process will still take several years to be completed, preparations need to be made now for a significant expansion of energy-efficient refurbishments, and a thorough upgrade of public buildings needs to be launched soon. The hearings of the Study Commission have shown that the Senate shares this view. After all, the rate and intensity of public building refurbishment needs to be increased in order to attain Berlin's climate goals, and due to the planning work involved and the capacity building still required for the administration, it can only be carried out gradually. The Study Commission recommends the following concrete steps:

#### *Creating an intracting enterprise*

**A state-owned body should be established to advance the energy-efficient refurbishment of public buildings as a profitable enterprise.** This body would act as an "intractor" (an internal contractor within the council structure) towards public authorities, state-owned enterprises, tertiary education institutions etc.; it would pre-finance the energy efficiency portion of the refurbishment projects (e.g., 25 percent from equity and 75 percent from loans/other finance sources including public funding), and later recoup this outlay through the saved energy costs. Intracting has already been used very successfully in more than 60 municipalities across Germany; in Berlin, Freie Universität has also been taking advantage of this concept. Since 2012, the state of Baden-Württemberg not only runs a "Contracting Campaign" but also a special programme for "Energy Intracting", which is aimed at refurbishing the state's public buildings. In Berlin, intracting should cover not only the energy equipment needed in a building but also the building shell; where necessary, the financing for this can also be supplemented by building cost subsidies or other funding sources. In the medium term, the intracting enterprise should also be given the opportunity to offer its energy efficiency services on the market – this is to serve as an incentive for the enterprise to work as a service provider rather than falling back on bureaucratic structures.

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<sup>90</sup> For more about "intracting" and "contracting", see footnote 57.

### *Financing concept*

The body acting as intractor needs to be 100% state-owned (assignable in-house). It gradually needs to be endowed with its own equity and also with a state credit guarantee, which will enable it to obtain loans for financing the energy efficiency portion of refurbishment projects and new construction projects. Where able to cope with a low return on equity, it can also pursue climate protection investments that are only recouped in the long term.

Because the energy-efficient refurbishment of a building is usually only economically viable if completed in tandem with other, more structural refurbishments, the funding for non-energy-related refurbishments also gradually needs to be increased. To this end, the corresponding pre-construction funds need to be increased as soon as possible. In the future, the energy portion of the refurbishment costs will be financed through the intracting enterprise (e.g., Berliner Stadtwerke), which also mobilises private capital for this. This way, the level of energy-efficient refurbishment can be increased without impacting on the budget. The intracting enterprise should be allocated the necessary funding so that it can cover its own share in financing the energy portions of the refurbishment projects. This will both enable the intractor to boost the refurbishment quality and to lower the funding required from the budget.

### *Implementing models developed by energy saving partnerships*

Close to 30 major energy savings contracting projects covering around 1,300 public buildings have been implemented since the mid-1990s, based on the model of the Berlin Energy Saving Partnership. In Berlin and across Germany, these projects are widely considered best-practice. Energy savings contracting in all its different shapes and guises should therefore be planned, tendered and implemented for energy efficiency building refurbishments just as vigorously as intracting. This is particularly important for those projects that are not suitable for intracting due to e.g. the required investment level, the contract running times, the risk structures, the technology requirements, or special financing requirements including the integration of relevant programmes. The public bodies and their buildings and properties are to be supported by suitable institutions such as the Berlin Energy Agency (BEA) in preparing and overseeing such projects. Contracting services should be awarded by tender. This also requires a new standard agreement for public contracting projects. The state-owned intracting enterprise should be able to submit contracting bids just like any private enterprise.

### *Renewables / Energy production*

Buildings have the potential to be sites for generating considerable amounts of energy. The intracting enterprise should therefore also finance systems for renewable energy generation fitted to state-owned buildings, as long as the investment is viable. Many public buildings have heritage building fronts and other structural elements that are largely unsuitable for conventional heat insulation. For buildings like these, combined concepts should be devised that retain the building's historic and cultural qualities by combining renewable energy generation with the required carbon reductions (e.g., prioritised insulation of the building front, window sills, basement ceilings and top floor ceilings, as well as the installation of heat pumps, geothermal energy systems, small-scale CHP etc. rather than solar power for energy generation).

State-owned buildings outside of the district heating network can also become hubs of local heating networks and supply heat to nearby residential and commercial spaces. This would make it much more feasible to deploy small-scale CHP plants in public buildings, as many public buildings have such a low need for hot water themselves that the installation of CHP only makes sense if they can feed it into a local heating network. State-owned buildings that have access to the district heating network are principally to be connected to these – assuming that the district heating supplier in question is committed to phasing out coal by no later than 2025.

### *Standards*

When it comes to energy-efficient refurbishments, the state of Berlin needs to lead by example. **The Study Commission therefore recommends that the state, its institutions and enterprises should be bound to ambitious standards for sustainable construction and refurbishment that go beyond the legal minimum requirements.** Current research shows that when considered from a lifecycle perspective – which the Berlin public tendering law<sup>91</sup> requires to be part of any feasibility analysis – such standards are not only ecologically but also economically viable. The “Berlin Energy Standard”<sup>92</sup> needs to be linked to standards and criteria that define the environmental compatibility of building materials.<sup>93</sup> It is recommended that prototypical projects are scientifically monitored by research facilities based in the state of Berlin.

The “Berlin Energy Standard”, and especially the specifications it entails, should be updated on the basis of the “Assessment system for sustainable building”<sup>94</sup> **The Study Commission recommends that all new public buildings comply with the passive house or even the energy-plus house standard.** Particularly in terms of ensuring refurbishment quality, it is of vital importance that this set of specifications, currently maintained by the Berlin Administrative Regulation for Procurement and the Environment (VwVBU),<sup>95</sup> is made mandatory for all public facilities and enterprises belonging to the state of Berlin. This way,

<sup>91</sup> Berlin public tendering law (Berliner Ausschreibungs- und Vergabegesetz / BerlAVG), 8 July 2010 (Berlin Law and Ordinance Gazette (GVBl.) p. 399 from 22 July 2010), last changed by the first law amending the BerlAVG, 5 June 2012 (Berlin Law and Ordinance Gazette (GVBl.) p. 159 from 16 June 2012).

<sup>92</sup> *Editors’ note:* The Berlin Energy Standard is a binding planning target for all public sector new-build and major refurbishment projects within the scope of the Senate Administration for Urban Development and the Environment. Where economically viable, the Berlin Energy Standard stipulates 25-30 percent stricter requirements relating to primary energy consumption for new buildings and up to 20 percent for extensive refurbishment measures than the 2009 Energy Savings Ordinance (EnEV). Here, it needs to be ensured that renewables are deployed as much as possible. Cf.

[http://www.stadtentwicklung.berlin.de/bauen/nachhaltiges\\_bauen/de/energieeffizienz/index.shtml](http://www.stadtentwicklung.berlin.de/bauen/nachhaltiges_bauen/de/energieeffizienz/index.shtml) (last accessed on 30 Oct 2015).

<sup>93</sup> See also: Senatsverwaltung für Stadtentwicklung Berlin, *Ökologisches Bauen – Anforderungen an Baumaßnahmen*, 2007; this Senate guideline on ecological construction requirements can be viewed here: <https://www.ibb.de/PortalData/1/Resources/content/download/immo/OekoLeitfadenBlNE.pdf> (last accessed on 30 Oct 2015).

<sup>94</sup> *Editors’ note:* The “Bewertungssystem Nachhaltiges Bauen für Bundesgebäude” (BNB, Assessment system for the sustainable construction of federal buildings) of the Federal German Ministry for the Environment, Nature Conservation, Building and Nuclear Safety is a comprehensive quantitative assessment procedure for office and administrative buildings that supplements the ministry’s “Leitfaden Nachhaltiges Bauen” (Guideline on sustainable construction).

<sup>95</sup> Administrative ordinance for the enactment of environmental protection requirements in the procurement of supply, construction and other services, *Verwaltungsvorschrift Beschaffung und Umwelt (VwVBU, Berlin Administrative Regulation for Procurement and the Environment)* from 23 Oct 2012.

energy efficiency becomes an integral aspect of planning, implementation becomes more straightforward, and goal attainment can be monitored more easily. A clear framework for feasibility calculations needs to be established as part of this, as numerous climate protection projects currently fail because their feasibility calculations pay little heed to the risk of fossil fuel price rises.

Practice has shown that divergences in new-build costs for otherwise identical buildings result less from individual specifications such as energy standards or fire protection requirements than they do from factors such as cost management, selection of materials and planning expertise. **The Study Commission therefore recommends that the state's upcoming construction projects (schools, day-care centres, refugee housing etc.) are organised in such a way that the expertise for these projects is bundled across all of the construction stages.** This way, any mistakes made in building e.g. the first day-care centres will not be repeated for the next construction projects. This approach is also very beneficial for the energy quality of the buildings. For example, the first new school buildings can be constructed and certified according to the sustainability criteria developed by the Association for New Educational Buildings (Bund für Bildungsneubauten); as soon as the first two new school buildings have been certified, the subsequent school buildings can be built without certification – assuming this is done by the same construction company, which by now would have sufficient experience with the specification sets. **In order to reduce the budget's investment allocation and also to ensure the energy quality of the buildings, the Study Commission recommends that even for new buildings, the energy-related share of costs is financed by a creditworthy public enterprise.** For this, the budget needs to include a suitable allocation of equity to the enterprise in question.

#### *Refurbishment roadmaps*

**The Study Commission agrees with the demand of the House of Representatives to introduce an energy management structure for public buildings, and it welcomes the Senate's deliberations of establishing refurbishment roadmaps for public buildings.** Building-specific refurbishment roadmaps also make it possible to sensibly integrate energy-efficient refurbishments with other refurbishment activities, and thus save on costs. **These refurbishment roadmaps should be made publicly accessible;** similarly, any existing roadmaps of this kind should also be made publicly accessible.

In addition, the Study Commission urgently recommends not to wait until the Energy Transition draft legislation's concept for creating refurbishment roadmaps is ready<sup>96</sup> or until an intracting body has been established, but rather to make use of the existing structures to immediately start increasing the refurbishment rate and intensity step by step.

#### *Central monitoring / Transparency*

**The Study Commission calls on the Senate to continue to comprehensively collect and assess the energy data and consumption levels of all public buildings along the same lines**

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<sup>96</sup> Bill on Implementing the Energy Transition and on Promoting Climate Protection in Berlin (Berlin Energy Transition Act / Berliner Energiewendegesetz – EWG Bln), 14 April 2015 – Berlin House of Representatives, printed paper 17/2339; cf. also footnotes 4 and 10.

**as the Berlin state's Energy Industry Agency, dating back to 2008 and covering all the involved approval bodies. This data is to be supplemented by the corresponding data from the approval bodies' register databases – such as street name, property number, gross property size, use and area in square metres – and published as an MS Excel spreadsheet.**

The Study Commission suggests that the standardised central index of all properties owned by the state of Berlin, which is maintained as a database at the Senate Administration for Finances, is extended to include all relevant information on the installed energy systems (energy source, heating type, heating structure), their energy consumption and costs, the level of refurbishment, and the energy certifications.

Generally speaking, the success of energy-efficient refurbishments in public buildings depends on the accurate monitoring of results and how well the envisioned measures are actually implemented. **The Study Commission therefore recommends the introduction of a central monitoring system that ensures regular, binding progress and implementation checks of all measures, including those implemented by the intractor or contractor.** Berlin's individual districts are free to take advantage of the Berlin state's intracting structures; alternatively, they can tender out their energy-efficient refurbishments and associated service requirements themselves, either as a regular public tender or restricted to project-specific private contractors. The building energy data from the project coordinated by the intractor or contractor, as well as that from other sources such as municipal energy management systems, needs to be fed into the central monitoring system via suitable interfaces. **To supplement the central monitoring system, all prototype projects should be accompanied by research projects to provide the necessary scientific support and to further develop the monitoring system.**

## **9. New-build projects (residential and non-residential)**

Compared to existing buildings, the energy consumption of new buildings is much less of an issue. Of course, they still need to be constructed to be as energy-efficient as possible. The EU Building Directive<sup>97</sup> has established a good framework for this to happen. For example, EU Building Directive Article 9 states the following:

*„(1) Member States shall ensure that:*

- a) by 31 December 2020, all new buildings are near zero-energy buildings; and*
- b) after 31 December 2018, new buildings occupied and owned by public authorities are near-zero energy buildings.*

*Member States shall draw up national plans for increasing the number of near-zero energy buildings. These national plans may include targets differentiated according to the category of building.*

- (2) Member States shall furthermore, following the leading example of the public sector, develop policies and take measures such as the setting of targets in order to stimulate the transformation of buildings that are refurbished into near-zero energy buildings,*

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<sup>97</sup> 2010/31/EU Directive of the European Parliament and of the Council of 19 May 2010 on the Energy Performance of Buildings. In: *Official Journal of the European Union* L153/13, 18 June 2010.

*and inform the Commission thereof in their national plans referred to in Paragraph 1.”*

Following the amendment of Germany’s Energy Saving Act (Energieeinsparungsgesetz / EnEG)<sup>98</sup>, Section 2a – “Construction of Near-Zero Energy Buildings” – is in keeping with the EU Building Directive, stating the following:

- „(1) Whoever constructs a building after 31 December 2020 with a purpose that requires either heating or cooling shall construct this building as a near-zero energy building in accordance with the ordinance set out in Paragraph 2. For non-residential new buildings to be owned and utilised by public authorities, the obligation stated in Sentence 1 shall apply from 31 December 2018. A near-zero energy building is a building with very good overall energy efficiency; the building’s energy consumption must be very low, and where possible, covered in the largest part by renewable energies.*
- (2) The Federal German government is given the authority to regulate the requirements placed on the overall energy efficiency of near-zero energy buildings through a legal ordinance approved by the Federal Council; all newly-constructed buildings shall comply with this ordinance.”*

After the second regulation to amend the Energy Saving Ordinance (EnEV) from 18 November 2013, which similarly served to implement the EU Building Directive, Section 1 now states that the ordinance should help to ensure that *“the energy policy goals of the federal government, particularly near-climate-neutrality of existing buildings, are reached by 2050.”* The following is also stated: *“This goal is to be pursued not only using the stipulations of this ordinance but also by other means, such as a building refurbishment campaign, incentives offered by funding policies and a refurbishment roadmap. In the context of the overall energy efficiency requirements for near-zero energy buildings, which are yet to be determined, the federal government will also strive to significantly simplify and consolidate the means by which energy savings and the deployment of renewable energies in buildings are regulated, in order to make it easier to optimise the energy- and economy-related aspects of buildings.”*

**Because the Energy Saving Ordinance – which still needs to be instated on a federal level – is legally binding, Berlin needs to ensure that the ordinance is instated in full compliance with the law, and that this compliance is adequately monitored. This includes ensuring that the building inspection authorities are given sufficient funding and staff.**

In the view of the Study Commission, the state of Berlin should also assume a role model function in the area of new buildings. This applies to, for example, planned school buildings

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<sup>98</sup> Act on the Saving of Energy in Buildings (Energy Saving Act, Energieeinsparungsgesetz – EnEG) in the version announced on 1 September 2005 (Federal Law Gazette I, p. 2684); last changed by the fourth law amending the Energy Saving Act from 4 July 2013, which serves the following purposes: to implement the European Parliament and Council’s 2010/31/EU Directive from 19 May 2010 regarding the overall energy efficiency of buildings (new wording) (OJ L 153 from 18 June 2010, p. 13, OJ L 155 from 22 June 2010, p. 61) and the European Parliament and Council’s 2012/27/EU Directive on energy efficiency from 25 Oct. 2012, to change the 2009/125/EG and 2010/30/EU Directives, and to nullify the 2004/8/EG and 2006/32/EG Directives (OJ L 315 from 14 Nov. 2012, p. 1).

and new housing developments by the state-owned housing associations. **The Study Commission recommends that all public new-build projects are committed to a revised Berlin Energy Standard that makes it mandatory to attain a passive house level of energy efficiency.**

## 10. Interdependencies

When discussing the interdependencies between the electricity and heating sectors, it is important to maintain an overall systemic perspective, with a focus on reconciling the various demand and supply options on offer. The main priority should be to find an optimal balance of reducing heating and electricity demand while ensuring a climate-neutral supply of the same. In this context, the advice of one of the experts heard by the Study Commission seems very sensible, which is that due to the high exergy losses of an efficient electricity system, as little of the generated electricity as possible should be converted in lower energy types such as low-temperature heat (such as for room heaters).<sup>99</sup> This also means that as little electricity as possible should be used to create room heat. From this point of view, any exception is only to be made for heat pumps, as these extract most of their energy from the immediate environment; in this respect, they function much like renewable energy systems.

CHP represents a key interface between the electricity and heating sectors, and it already plays a crucial role in Berlin's energy mix that is set to increase even further. However, CHP will only be able to fulfil this role in terms of the given climate protection goals if its current reliance on predominantly fossil fuels is succeeded by renewable fuel sources in the long term. In the view of the Study Commission, fossil fuel-based CHP is not a feasible option in the long term. What should also be considered with this is that in the future, there will likely be considerably less heat consumption by existing buildings (the "heat sink"), while there will also be less of an electricity sink due to the strong increase of renewables-based electricity generation incompatible with CHP generation methods.

**Because of this, the Study Commission regards it as crucial that a transition strategy is devised to work towards climate-friendly CHP.** Similarly, it will be crucial to overcome the challenging current economic conditions for CHP by adapting the funding system to also accommodate long-term requirements. This will only be possible on a federal level. To this end, Berlin should exert as much influence as it can on the Bundesrat.

### 10.1 On the roles of Power-to-Heat and Power-to-Gas

The deployment of renewables-based electricity from PtH and PtG could be crucial to CHP becoming more climate-friendly in the long term, and also to a more climate-friendly energy supply in general. Out of these two methods, PtH will be focused on more strongly initially, as it is already relatively wide-spread; PtG will be focused on more as a long-term option.

Because heat can be stored more easily and cost-efficiently than electricity over extended periods of time, PtH initially also holds great potential for the heating sector to provide stable and cost-efficient system services of the kind that are needed for accommodating the use of

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<sup>99</sup> Cf. the comments by Mr Maaß (Hamburg Institut Consulting GmbH / Hamburg Institut Research gGmbH), transcript 17/8, p. 3; HIC/HIR/Maaß, statement given during hearing, p. 1.

fluctuating renewables. For the time being, the available electricity storage systems are still not very cost-efficient, which is why it can make economic sense to deploy and store electricity within the heating system. The potential within the heating system for deploying electricity generated from fluctuating renewables should not be overestimated. How this may affect the other ways in which PtH can be deployed remains to be seen.

One of main assessment criteria for PtH (as well as PtG) is its ecological benefit. This very much depends on where the electricity is sourced from. Where the electricity is generated exclusively or mostly from renewables, the ecological benefit is obvious. However, both now and in the foreseeable future, electricity generation will continue to rely significantly on fossil fuels. Accordingly, PtH and PtG cannot be regarded as ecologically beneficial per se. Even today, however, PtH is able to contribute significantly to making CHP electricity generation more flexible in the context of the growing use of renewable energy sources. Examples for this include PtH plants for directly providing heat to hot water stores, as well as large-scale heat pumps for local and district heating systems and for industrial process heat. The efficiency of these PtH uses should be increased in the future by deploying the generated electricity to power heat pumps. Thanks to the high performance coefficients of heat pumps, the heat yield per consumed kilowatt hour of electricity can be increased four- to sixfold. The required heat can be extracted e.g. from the ground (shallow geothermal energy), waste water (such as in Oslo's sewage treatment plants), or surface waters (particularly from canals).

In contrast to PtH systems, PtG systems are less efficient overall and still require a lot of investment. Because of this, they are currently not an economically feasible option. According to an expert heard by the Study Commission,<sup>100</sup> the deployment of PtG in the long term will therefore only be viable once electricity overproduction reaches a level where grid expansion, load management and PtH are pushed to their limits. Although Vattenfall points out that there is a lot of potential in PtG, it also claims that it can only be deployed efficiently and on a large scale when electricity generation is based on well over 50 percent renewables.<sup>101</sup>

## 10.2 On the role of intelligent power plants

Intelligent, i.e. virtual power plants centrally control the local generation of electricity and heat to increase the intake capacity for fluctuating electricity. Resultantly, they can contribute significantly to the integration of renewables into the energy supply grid. Due to the possibility of deploying available technologies, the low cost of energy storage in the shape of heat, and the high potential offered by the market for decentralised heating, virtual power plants are a great way of instating climate protection particularly in urban areas. The possibility to involve a large number of contributing parties is similarly advantageous. In this respect, the city of Berlin could set a great example. The biggest obstacle to overcome here is the pricing of electricity and balancing energy, which currently makes it uneconomical in the private sector to fit local generation systems with central controllers. A municipal body such as Berliner Stadtwerke could fill this gap and fit medium-size generation systems with this type of control. It should be noted, however, that virtual power plants heavily rely on an economy of scale – the more local generation systems are connected, the more effective they become. A municipal participant in such a scenario would therefore also need to be able to

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<sup>100</sup> Cf. the comments by Mr Maaß (Hamburg Institut Consulting GmbH / Hamburg Institut Research gGmbH) in: transcript 17/8, p. 8; HIC/HIR/Maaß, statement given during hearing, p. 7

<sup>101</sup> Cf. written statement by Vattenfall GmbH / Vattenfall Europe Wärme AG: “Interdependencies Between the Electricity and Heating Sectors”, October 2014.

integrate large-size plants from outside of the city area into the virtual power plant. This would require the legal framework of the Berliner Stadtwerke to be modified.

### 10.3 Demand-side management

The targeted control of electricity consumption, also known as demand-side management, is an essential building block towards integrating large amounts of wind and solar energy into the electricity grid. In contrast to electricity storage, grid expansion and the construction of highly flexible power plants, this is a comparatively affordable measure to implement. Demand-side management becomes even more effective when it is used to bridge gaps between the electricity and heating sectors, for example, in conjunction with virtual power plants or heat storage systems. Companies employing demand-side management can significantly reduce their average energy procurement prices. This is because their electricity consumption is at a peak when the electricity prices are low, and conversely they cut back consumption when the prices on the electricity market are high. However, there are currently still too many obstacles for this to happen more widely, and the state of Berlin should strive to remove these in order to make the electricity grid more flexible overall:

- Industrial consumers should no longer be penalised by additional network charges when they change their consumption levels in response to pronounced changes in electricity price.
- Electricity vendors should meet their customers' electricity requirements more accurately. If they fail to do so, they should be the ones who pay for the balancing energy needed to compensate for so-called balance group deviations. Measures such as these help to bolster active demand-side management within the increasingly important intraday electricity market.
- Flexible electricity consumers should be granted easier access to the balancing market. To this end, the balancing market should feature daily offers, and balancing products should be offered by the hour. To date, tenders for balancing power are mostly on a weekly basis and for a minimum of several hours. Resultantly, flexible electricity consumers – as well as renewable energy systems – are largely excluded from feeding balancing power into the grid.

According to a study by Agora Energiewende,<sup>102</sup> consistent demand-side management can cut the electricity market's peak prices by up to 50 percent, as well as helping to reduce the number of times wind and solar energy systems have to be curtailed.

Berlin would benefit greatly from there being fewer obstacles to intelligent demand-side management; as a "Smart City", it could also contribute to the German energy transition by acting as an energy sink. The "My Energy for My City" initiative of Berlin<sup>103</sup> is currently producing some very innovative ideas for demand-side management. However, these can only

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<sup>102</sup> [http://www.agora-energiewende.de/fileadmin/Projekte/2012/Lastmanagement-als-Beitrag-zur-Versorgungssicherheit/Agora\\_Studie\\_Lastmanagement\\_Sueddeutschland\\_Zwischenergebnisse\\_web.pdf](http://www.agora-energiewende.de/fileadmin/Projekte/2012/Lastmanagement-als-Beitrag-zur-Versorgungssicherheit/Agora_Studie_Lastmanagement_Sueddeutschland_Zwischenergebnisse_web.pdf) (last accessed on 30 Oct. 2015).

<sup>103</sup> More information on the initiative available (in German) at: <http://www.meine-energie-fuer-meine-stadt.de/> (last accessed on 30 Oct. 2015)

be implemented if the participating enterprises are also able to benefit financially from drawing more wind and solar energy at peak times – instead of being penalised with higher network charges for drawing higher peak loads.

**The Study Commission suggests that the state of Berlin launches an initiative at the Bundesrat to address this. Should it be unrealistic for the cited obstacles to be comprehensively removed at this point, the Study Commission recommends experimental clauses for cities as a short-term solution;** these will enable the cities and their network operators to structure network charges for renewable energy peaks more flexibly where this does not require any additional network expansion.

## IV. Institutions, participation and processes

### 1. A generations-long task: Elements of a new institutional framework for Berlin's energy transition

The goal of turning Berlin into a climate-neutral city by 2050 and switching the city's entire energy supply to renewables as a part of this process also requires taking a new institutional approach. We need to cut Berlin's carbon emissions by at least 85 percent over 1990 levels (25 million tonnes per year) in the next 35 years, i.e. within the span of about one generation. With carbon emissions currently at 18.8 million tonnes per year (2012), that means a reduction of at least 79 percent to bring emissions below 4 million tonnes per year. And, with Berlin's GDP growing by 2 percent per year (which corresponds to a doubling in 35 years), its carbon emissions are also increasing, so they need to be cut by a substantially higher percentage still. As shifting Berlin's energy supply so that the city becomes climate neutral by 2050 will not be completed within the space of the next five years, future governments will also need to work towards these long-term goals. The energy transition is a generations-long task and that poses big challenges for our political system. The Study Commission therefore recommends setting the basic course for the transition and making the necessary structural decisions in the current and the next legislative term. The Berlin state government needs to get the city's major actors and civil society groups (chambers of commerce and industry, trade unions, citizens' initiatives, non-profit organisations, associations, businesses) on board to make the energy transition happen.

In this process, Berlin can tap into key resources: Firstly, there is cross-party consensus on the goal of becoming climate neutral so both the government and the opposition are basically following the same objective. This ensures the basic policy continuity necessary for such a generations-long project to succeed. Secondly, many people living in Berlin are interested and actively involved in Berlin's energy transition. This has been clearly demonstrated by the energy referendum<sup>104</sup> and public participation in the current process of drawing up Berlin's Energy and Climate Protection Programme (BEK)<sup>105</sup> as well as by the work of this Study Commission. Thirdly, many actors in Berlin are already working intensively on the energy transition, in the administration (e.g. Berlin's Energy Saving Partnerships,<sup>106</sup> network

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<sup>104</sup> *Editors' note:* The Berlin Energy Table (Berliner Energietisch) is an alliance initiated by a number of organisations and individuals in 2012 to run a referendum campaign for the remunicipalisation of Berlin's energy supply. After successfully petitioning for a referendum, Berlin's citizens voted on a draft law for a democratically controlled, ecologically sustainable and socially just energy supply in Berlin (EnergieVG: Entwurf eines Gesetzes für die demokratische, ökologische und soziale Energieversorgung in Berlin) on 3 November 2013 aimed at remunicipalising Berlin's electricity network and founding a municipal utility. The referendum failed due to an insufficient voter turnout of 24.1 percent, falling just short of the necessary quorum of 25 percent of all eligible voters. More information available (in German) at: <http://www.berliner-energietisch.net/> (last accessed on 30 October 2015).

<sup>105</sup> *Editors' note:* As a project of the Berlin Senate, the BEK (Berliner Energie- und Klimaschutzprogramm) is a key instrument for drawing up energy and climate policy measures for Berlin and for outlining strategies related to the following fields of action: energy supply, buildings and urban development, industry, private households and consumption, and transport. Public participation is also part of the policy process. More information available (in German) at: [http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/bek\\_berlin/](http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/bek_berlin/) and <https://klimaneutrales.berlin.de/stadt/de/home> (last accessed on 30 October 2015).

<sup>106</sup> *Editors' note:* The Energy Saving Partnership is a model for efficient energy contracting in the public sector developed by the Berliner Energieagentur (BEA) and commissioned by the Berlin Senate Department for Urban Development (now called the Senate Department for Urban Development and the Environment). The model is designed to realise the potential for energy savings by making buildings more energy efficient. More information

management by Berliner Netzwerke),<sup>107</sup> in industry (e.g. Berlin-Brandenburg Energy Technology Cluster,<sup>108</sup> activities in the Climate Alliance,<sup>109</sup> energy efficiency initiatives),<sup>110</sup> and in associations (e.g. annual environmental festival with cyclist rally, local environmental protection schemes). Fourthly, technical progress is propelling the energy transition forwards: wind and solar energy have become low-cost technologies in a very short space of time and further cost reductions are on the horizon. Costs have also been cut substantially in electricity storage in the last three years. This means that excess supplies of electricity generated through wind and solar power can be stored at reasonable cost and this will also help achieve a breakthrough for electromobility. Furthermore, new materials are being tested as a low-cost option for building insulation. Many innovative businesses have clustered in Berlin to deploy and demonstrate use of their products. In this way Berlin's energy transition is also a great opportunity economically for the city. Berlin is, above all, an appealing location for start-ups, which are developing many products that connect digital technologies with the energy transition.

Despite having all of these resources, the energy transition still lacks the firm institutional basis it needs as a key project that spans generations. **To meet the challenge of maintaining a consistent political orientation for a number of legislative terms, the Study Commission believes that the following institutional restructuring is necessary:**

1. **Passing an energy transition law:** Enacting an energy transition law with a clear mandate for the Senate and the administration would be an important and necessary step in permanently institutionalising the task of climate protection in Berlin. It should definitely be adopted in the current legislative term, if possible with cross-party consensus. This law could then form the cross-party framework for the generations-long task of completing the energy transition in the next 35 years. The Study Commission welcomes the draft law presented by the Senate Department for Urban Development and

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available at: <http://www.berliner-e-agentur.de/en/consulting-information/energy-saving-partnerships-berlin> (last accessed on 30 October 2015).

<sup>107</sup> *Editors' note:* Berliner Netzwerke is a network of businesses from various industries working together on energy efficiency and renewable energy issues. Its activities are orchestrated by the Berliner Energieagentur. The network is funded equally by the Berlin Senate Department for Economic Affairs, Technology and Research and the Federal Ministry for Economic Affairs and Energy. More information available at: <http://www.berliner-e-agentur.de/en/consulting-information/berliner-netzwerke> and (in German) <http://www.berliner-netzwerk-e.de/startseite> (last accessed on 30 October 2015).

<sup>108</sup> *Editors' note:* The states of Berlin and Brandenburg set up the Energy Technology Cluster in January 2011 to support and advance interstate innovation processes in the emerging field of energy technology. More information available at: <http://www.energietechnik-bb.de/en/home> (last accessed on 30 October 2015).

<sup>109</sup> *Editors' note:* In October 2008, 13 businesses agreed to implement concrete climate projects and publicly signed the declaration of accession to the Climate Alliance Berlin. Berlin's governing mayor signed the declaration of accession for the state of Berlin. More information available (in German) at: <http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/aktiv/vereinbarung/klimabuendnis/index.shtml> (last accessed on 30 October 2015).

<sup>110</sup> *Editors' note:* The project EnergieEffizienz-Tisch Berlin plus was founded in February 2013 under the auspices of the Berlin Chamber of Commerce and Industry. The participating businesses have set themselves the goal of cutting their current energy needs by increasing their energy efficiency. The project is organised by the Modell Hohenlohe network. More information available (in German) at: [http://www.modell-hohenlohe.de/effizienztaische/energieeffizienz/\\_EnergieEffizienz-Tisch-Berlin-plus\\_309.html](http://www.modell-hohenlohe.de/effizienztaische/energieeffizienz/_EnergieEffizienz-Tisch-Berlin-plus_309.html) (last accessed on 30 October 2015).

the Environment as a first step.<sup>111</sup> However, the draft law only calls for a voluntary agreement with the public sector. This voluntary agreement must be made binding. Further binding and measurable goals and corresponding measures need to follow. Concerning the institutional set-up, Berlin's individual energy and climate plans should be scheduled so as to be presented by the Senate no later than twelve months after a new government has been formed, and should set out the measures to be implemented in the current legislative term by the Senate and the city's districts based on the interim and long-term goals. These should also be enshrined in law to ensure both that the measures are concrete and measurable and that a sufficiently consistent approach is taken throughout the legislative terms.

- 2. Passing a heat law:** Adoption of a heat law with clear stipulations for cutting energy used for heating in Berlin's buildings, for expanding the production of heat from renewable energy sources and for regulating district heating networks. The latter deals with third-party access to such networks and the reduction of specific carbon emissions from district heating. Berlin's specific social conditions need to be taken into account throughout this process, particularly in view of the tense situation on the property market and the associated steadily rising rents, although this must not lead to cutbacks in the climate goals.
- 3. Creating an Energy Transition Steering Committee:** A steering committee for the energy transition should be set up at the Senate Chancellery to bring together the most important actors from industry; associations; environmental, tenant and consumer protection organisations; trade unions; and the science and research sectors. It should convene the central actors at least once every six months to discuss progress in implementation and new activities and to keep the public abreast of these developments. The steering committee will also need an administrative office for energy and climate protection in the Senate Chancellery to coordinate its activities, to balance interests in cases of conflicting interests and problems – within the administration (Senate and districts) and among policymakers and actors – that are critical to Berlin's energy transition and, lastly, to review the implementation of measures. This will give the energy transition the attention and the recognition that it deserves in its role as a generations-long task.
- 4. Pooling responsibilities for the energy transition in one Senate department:** Given that the energy transition is a generations-long task, it can only succeed if it is better structured and organised within the administration than it has been so far. Setting up a unit dedicated to climate protection and energy in the Senate Department for Urban Development and the Environment in the current legislative term would be an important step in this direction. Responsibilities related to the energy transition should in general be pooled permanently in a separate Senate department, analogous to the new organisational structure on the federal level. These responsibilities include in particular the fields of energy, climate protection, energy-relevant construction activity and the municipal utilities. This new Senate department should also have energy or energy transition in its

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<sup>111</sup> Bill on Implementing the Energy Transition and on Promoting Climate Protection in Berlin (EWG Bln: Energiewendegesetz Berlin) of 14 April 2015 – Berlin House of Representatives printed paper 17/2339; see also footnotes 4 and 10.

name. It should work in close coordination with all departments on the state and district level, who will all still be obliged to actively work towards making the energy transition happen in their respective areas of responsibility.

Based on the Study Commission's recommendations from the other sections of this report, the Senate Department for Energy could be assigned the following responsibilities:<sup>112</sup>

- Heat planning: Drawing up a strategic heat plan for the state of Berlin, including a precise, building-specific analysis of potential heat generation in Berlin; implementation of this heat plan in densely populated areas in particular, giving preference to local and district heating; ensuring needs-based network expansion planning while avoiding non-needs-based parallel installation of district heating and gas networks; designation of priority zones.
- Making the public sector a role model: Laying down ambitious regulations on sustainable modernisation and construction that exceed the minimum legal requirements; binding regulations that require all new public-sector construction projects to meet a revised Berlin Energy Standard (with a general passive house standard); implementing the special obligation of the public sector to act as a role model (as stated repeatedly in the Renewable Energies Heat Act)<sup>113</sup> by increasing the proportion of renewable energy used in its current properties; action needed: setting goals for the direct and indirect use of renewable energy sources in this area; centralised monitoring for a regular and binding progress and implementation review of public refurbishment measures; successive conversion to LED lighting or equally efficient systems in the public sector.
- Implementing legislation, regulations and voluntary agreements on climate protection: Implementation of the Berlin Energy Transition Act (EWG Bln)<sup>114</sup> through the preparation, enforcement and monitoring of the BEK;<sup>115</sup> monitoring the implementation of the Energy Saving Ordinance (EnEV)<sup>116</sup> and the Renewable Energies Heat Act (EEWärmeG) by performing at least random checks and sanctioning non-compliance; reducing barriers to the expansion of renewable energies; further developing voluntary climate agreements into a more efficient instrument; and promoting the implementation of and compliance with agreements.
- Coal phase-out: Implementation of Berlin's phase-out of lignite by 2020 at the latest<sup>117</sup> and the complete phase-out of coal-generated electricity and heating by 2030; the state of Berlin, and particularly the Senate Department for Energy, should work

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<sup>112</sup> See also table in the appendix to this section.

<sup>113</sup> Renewable Energies Heat Act (Erneuerbare-Energien-Wärmegesetz, EEWärmeG:) of 7 August 2008 (Federal Law Gazette I, p.1658), most recently amended by Section 14 of the Act of 21 July 2014 (Federal Law Gazette I, p. 1066).

<sup>114</sup> Cf. footnotes 4 and 10.

<sup>115</sup> Cf. footnote 105.

<sup>116</sup> Ordinance on energy-efficient insulation and building services in buildings (EnEV: Energieeinsparverordnung) of 24 July 2007 (Federal Law Gazette I, p.1519), last amended by Article 1 of the Ordinance of 18 November 2013 (Federal Gazette I, p.3951).

<sup>117</sup> In accordance with the climate agreement between the state of Berlin and Vattenfall; available (in German) at: <http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/aktiv/vereinbarung/vattenfall/> (last accessed on 30 October 2015).

towards Vattenfall not selling its lignite division in the Lausitz region but accompanying the structural change in the region and phasing out lignite mining and use by 2030.<sup>118</sup>

**5. Setting up an Energy Transition Agency:** An adequately staffed Energy Transition Agency would give the city a strong new body to serve as a central contact and implementation point for the major actors of Berlin's energy transition. In contrast to the Berliner Energieagentur, the Energy Transition Agency should be publicly owned, be bound to the goals of the Energy Transition Act and its action plans, and not have any business operations of its own. Rather, in its role of managing Berlin's energy transition, it should assume the following responsibilities:

- Operationalise the stipulations set out in the Energy Transition Act and other relevant legislation in conjunction with further specifications from the department and the agreements reached by the Energy Transition Steering Committee.
- Plan, structure, initiate, coordinate, manage, supervise, monitor and review the adopted implementation processes, under the guiding principles of increased decentralisation, subsidiarity and participation.
- Initiate and support research, development, investment and personnel development processes to generate value added, skilled and competitive jobs, and products and services of national and international interest; particular attention needs to be paid to consumer protection issues throughout this whole process.

The Energy Transition Agency should in particular work together with Berlin's industry and science sectors and their institutions and be supported by them (e.g. by seconding personnel) in order to make the energy transition a success factor in the creation of regional value added and the implementation of regional structural change. The agency should be financed by the budget of the Senate Department for Energy and should also be reviewed by this body.

Based on the Study Commission's recommendations in other sections of this report, the Energy Transition Agency could be assigned the following responsibilities:<sup>119</sup>

- Collection and – to the extent that data protection laws allow – publication of energy data: Aggregating and publishing available data, collecting new energy data for all state-owned properties (for each individual building and with the following minimum information: type and structure of heating, state of refurbishment, specific heat consumption per year, record of all the building's energy certificates); swift data collection by mid-2016; centralised public monitoring of relevant biomass flows (material flow management).
- Energy consulting: the Energy Transition Agency will serve as a guide in energy consulting, steering consumers and businesses to the most suitable advisory service;

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<sup>118</sup> For a chronological view of the lignite and coal phase-out scenario presented by the Study Commission, see also section A. II. 1. 1.2. Fossil-based electricity generation and CHP, p. 17 of this report.

<sup>119</sup> See also the table in the appendix to this section.

development and implementation of the energy conservation campaign: “Berlin saves itself a power plant”; awareness campaign: “Potential to increase energy efficiency in Berlin’s building stock”.

- Development and lead implementation of the “Solar Capital Berlin” master plan including the establishment of a research cluster, accelerating the implementation of innovative flagship projects and pilot schemes, for instance by involving Berlin’s universities, non-university research institutes and private companies; make energy generation on particularly large public roof spaces – including those on U-Bahn and S-Bahn (underground and suburban train) stations – a top priority; goal: by 2020 use 80 percent of all suitable roof spaces of the state of Berlin for energy generation and, by 2025, 100 percent.

**6. Making networks future proof:** The infrastructure – i.e. the electricity, gas and district heating networks – will be of critical importance to the energy transition:

- The electricity networks will become more important in the course of the energy transition, serving as a platform for not just the decentralised electricity generation and consumption by increasingly assertive prosumers,<sup>120</sup> but also for new application areas such as electromobility and the heat market. They must be developed into smart grids that can efficiently manage electricity generation (in centralised and decentralised plants), electricity procurement, demand-side management and storage control while also providing the infrastructure for electromobility and electricity-based heating.
- According to what we know today, district heating will become more important on the heat market on our road to becoming climate neutral by 2050. District heating networks must become renewable heat networks, i.e. be heated to an increasing degree by bioenergy, geothermal energy, solar thermal energy and high-capacity heat pumps that are linked to the electricity system via highly flexible CHP (combined heat-and-power) plants, heat accumulators and power-to-heat facilities, and intelligently manage dropping demand as the scale of energy-efficiency refurbishments increases.
- The gas network is an important part of Berlin’s current energy infrastructure. Whether it will remain so in the long term will only become clear further into the energy transition. On the one hand, the gas network is an important infrastructure for centralised and decentralised CHP plants, biogas plants and, in the future, perhaps for feed-in using power-to-gas conversion technology. On the other hand, in the course of increasing refurbishment of buildings in Berlin, the city’s gas needs are set to decline considerably over the next decades. In the target scenarios of the feasibility study *Climate-Neutral Berlin 2050*, the proportion of households supplied directly by the gas network is projected to drop by between 70 and 73 percent. Total gas consumption may temporarily increase as power plants switch fuels following the phase-out of coal-fired electricity generation dictated by climate policy. The total consumption of gas will nonetheless decline from around 2030.

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<sup>120</sup> *Editors’ note:* “Prosumers” are consumers that are also producers, or producers that are also consumers. The term is a mix of the words “producer” and “consumer”.

Energy networks are monopolies, the operation of which is awarded for a period of time. The state must make use of these limited periods to exert its influence over the current direction of energy and climate policy. The district heating network is presently in limited competition (particularly for grid connections) with the gas network. In the longer term, after extensive energy-efficient refurbishments, it must be evaluated to determine whether it makes economic sense to operate a parallel infrastructure of gas and district heating and whether there are possibly alternative solutions for ensuring that consumers still have a choice (competition).

The question of whether this infrastructure should be owned by the state of Berlin or not is currently a subject of broad public debate in which many citizens are getting involved. Independently of the ownership structure, the city's future energy supplier must be oriented towards the goal of 100 percent renewable energy and be measured by its progress towards this goal. The options open to the state of Berlin regarding the question of ownership are the following:

- a) Transfer the networks to public ownership, whereby the orientation of the enterprise towards the energy transition goals of the state of Berlin must be anchored in its statute and its management bound to them.
- b) Leave the networks (and the connected power plants) in private ownership, while at the same time regulating the use of infrastructure in a targeted way (such as with legislation on district heating oriented towards climate protection), a rigorous interpretation of the relevant planning law, rigorous administrative action and the negotiation of voluntary agreements with the respective companies.
- c) A mix between these two approaches is also possible. The state could aim to acquire a majority or qualified minority stake in the respective networks, in combination with the regulation of and contractual agreements with the respective network companies.

The upcoming concessions for the operation of Berlin's electricity and gas networks must be awarded in accordance with criteria defined by the Energy Industry Act. The concession contracts have both expired already but a new concession has not yet been awarded in either case. The state of Berlin has itself applied to operate and take over both networks and, at the same time, has opened up the option of taking over the networks in cooperation with a private bidder. In the case of district heating, the network is not awarded in a concession procedure but rather, until the end of 2014, the district heating contract was tied to the electricity concession contract. The question of whether the state of Berlin is entitled to acquire the district heating networks once that contract expires, is currently under review by the courts. To lend more weight to the right of municipalities to manage their own affairs as anchored in Germany's Basic Law and to reduce legal uncertainties, the Study Commission urges the Senate to call for clearer legal regulations in the German Bundesrat, including the option of awarding concessions to in-house bidders.

*For more information on a federal regulation on awarding concessions to in-house bidders, see the dissenting opinion of the CDU parliamentary group and Prof. Haucap on page 96.*

The consortium agreement between the companies Engie (formerly GDF Suez) and Vattenfall basically eliminates the competition between the gas and district heating networks at grid connection. The planned consortium will be in control not only of district heating but also of more than 60 percent of GASAG. This would also cancel out the advantages for Berlin's citizens of having competition between the gas and district heating networks.

Alongside remunicipalisation or finding a cooperative solution in the award of concessions, the state of Berlin could also negotiate directly with the network owners on the acquisition of shares in the network companies or their parent companies. Negotiations to this end are taking place. The policy space of the state of Berlin in this area is restricted both by the legal parameters of awarding concessions and by the primarily economic interests of its negotiating partners, i.e. the current network owners or their parent companies.

A remunicipalisation of the networks entails both opportunities and risks:

- On the one hand, remunicipalised energy networks would give the state of Berlin more influence over business policies and greater scope to align these policies with its energy, economic, social and democratic policy goals. While private network operators are primarily focused on generating high returns on their investments and operations, profits from network operation in the case of remunicipalisation would remain in the public sector and could be used to make investments in the networks, to expand ecological energy production, to prevent energy poverty, to decarbonise the transport sector (public transport network or electromobility) or to pursue other goals. The experience of other cities shows that private operators often fail to make investments that are in the public interest but not that profitable.<sup>121</sup> Remunicipalisation also ensures that the legislator has energy data that can be used to improve political governance. Public ownership also enables increased transparency and greater democratic participation. It would also facilitate the development of integrated network operation and the profits from network operation could be used to achieve Berlin's energy policy goals.
- On the other hand, remunicipalisation also harbours risks. A major financial risk is that the purchase price could be higher than the actual value of the networks. This risk is particularly high for the gas and district heating networks that could lose value in the face of a rigorous climate policy and can only be taken over on a profitable basis if such a climate policy is factored into the purchase price. Customers and taxpayers also stand to lose out financially through general mismanagement and inefficient operational management. The incentive regulation of the Energy Industry Act sanctions inefficient network operation by capping returns. Network ownership and operation would also give rise to conflicting interests between the state of Berlin's economic and climate policy, for example, when decisions on climate policy lead to a drop in the revenues of gas and/or district heating network operators. This is particularly relevant in the case of Berlin's district heating network as the coal-fired power plants are closely connected to the district heating network on account of their

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<sup>121</sup> For example, Mr Heine (Stromnetz Hamburg GmbH), in the hearing during the Study Commission's 15th meeting on 25 March 2015, bemoaned the inadequate investments in network infrastructure made by the previous private owner in upgrading Hamburg's network infrastructure. Overall, 500 of the 30,000 kilometres of cable need to be renewed every year. In the last few years not even 50 kilometres of cable had been renewed per year. Cf. statements by Mr Heine in EnKoEnergie transcript 17/15, p. 34.

CHP electricity generation. If the district heating network is remunicipalised, the Berlin state also stands to become the operator of coal-fired power plants that will definitely need to be shut down to reach our climate policy goals.<sup>122</sup>

In view of the fast pace of change on the energy market, it is desirable from a regulatory policy perspective that there is not one single company that feeds the most electricity into the network, that has the most electricity customers, and that (partly) controls the electricity network monopoly. The Study Commission therefore recommends the Berlin state to remunicipalise the electricity network. The electricity network is monopolistic in character, has a central role to play in Berlin's energy transition and offers a realistic and practical way for the people of Berlin to take an active part in their city's energy transition (through e.g. the participation of citizens and cooperatives).

The gas network is also a natural monopoly and will continue to be an important component of Berlin's energy supply and therefore part of the public infrastructure for the foreseeable future. Alongside the risks that the future holds for the gas network as a consequence of a decreasing demand for heat, there are also a range of opportunities that could make the gas network a key element in the energy transition. Restructuring the network away from the pure distribution of gas and towards the storage of renewable gas would be an important step in this direction. This restructuring process can be managed in a more proactive way under state-owned operation than it could under private-sector operation. For this reason and to be able to exploit the advantages of integrated network operation (as described in section II "Electricity and infrastructures"),<sup>123</sup> the Study Commission also recommends the complete remunicipalisation of the gas network. A major prerequisite for remunicipalisation here is that the purchase price of the gas network must not exceed the returns that the network can expect to reap under the rigorous and ongoing climate policy that is needed to make Berlin climate neutral by 2050. A remunicipalisation of the gas network should ensure that the current synergies produced through the partial operation of large sections of the Brandenburg gas network are maintained.

*For more information on the remunicipalisation of the electricity and gas networks, see the dissenting opinion of the CDU parliamentary group and Prof. Haucap from page 96 onwards.*

The energy transition will entail the restructuring of district heating in Berlin so as to increase renewable heat generation and to facilitate third-party feed-in in the district heating network. At present the technical requirements for third-party feed-in are, for the most part, only in place to a very limited extent. A private network operator that is also the owner of the power plants will not be economically motivated to meet these

<sup>122</sup> For example, the acquisition of STEAG AG initiated in 2011 and completed in full in 2014 by various Ruhr-area municipal utilities carried high financial risk (purchase price €1.2 billion, mainly loan-financed), as the coal-fired power plants belonging to the STEAG Group are set to depreciate substantially in value as the result of a rigorous climate policy. STEAG and the municipal utilities owners were among the fiercest opponents of the, in climate terms, very positive proposal made by the Federal Minister for Economic Affairs and Energy in March 2015 with respect to introducing a climate contribution for the German electricity industry in order to reach Germany's 2020 climate goal.

<sup>123</sup> See section A. II. 3. 3.5 Network expansion planning and coordinated or integrated network operation, p. 34 f. of this report.

requirements. The Study Commission recommends regulating the district heating network as expanded upon in section III “Heating and interdependencies”. The Study Commission also recommends the state of Berlin to carefully review whether, and on what terms and conditions, a takeover of the Berlin district heating network would be expedient. In case of remunicipalisation, the calculation of the returns of the district heating network would have to factor in that the heat supply needs to be steadily decarbonised (lignite phase-out by 2020, hard-coal phase-out by 2030, gas phase-out by 2050).

Concrete ecological, economic, social and democratic policy goals need to be defined in advance of remunicipalisation. Clear criteria need to be established for determining if such a move would be good for the public sector – in terms of the purchase price, the corporate structure and the state of Berlin’s goals. If the state of Berlin decides to remunicipalise one or more of the networks in part or in full, it must ensure that the remunicipalised companies are aligned with state’s energy transition goals. Should the state of Berlin participate in the district heating networks, a short-term phase-out of the use of lignite and hard coal needs to be agreed upon. In case of remunicipalisation, the networks should be operated as transparently as possible and with the greatest possible involvement of the public. An appropriate option for the people of Berlin to get involved is a cooperative participation in the corresponding network company. Participation in the financial risk will also give the citizens involved participation rights and monitoring rights in the network company. The Study Commission recommends that the Berlin House of Representatives should set up its own monitoring body for Berlin’s remunicipalised energy companies, e.g. a sub-committee on participation management and monitoring.

7. **Making municipal utilities fit for the future:** The further expansion of the Berliner Stadtwerke is a central prerequisite for making the energy transition happen. Municipal utilities can support and help shape Berlin’s energy transition on many levels. They are also well suited for public participation and for citizen-friendly practices, e.g. through extensive advisory board rights and a socially responsible operating and energy policy. Berlin needs a new kind of municipal utility – a 100 percent state-owned municipal utility whose central task is climate protection. Its tasks could range from investments in renewable generation (e.g. CHP plants and solar panels in *Mieterstrommodelle*) through innovative sales models to a wide spectrum of energy services (e.g. energy efficiency measures, energy concepts for public buildings, intracting, individual district supply concepts, support of socially responsible building refurbishment, energy efficiency consulting).

The Berlin water utility, the Berliner Wasserbetriebe (BWB), sees three different options: the *Beschlussmodel* (model that adheres to the decision made by the Berlin House of Representatives regarding business areas and excludes the option of selling non-self-produced electricity), the modified *Beschlussmodel* (sale of non-self-produced electricity for a transitional period) and the Berlin model (open sales).<sup>124</sup> The *Beschlussmodel* is regarded as not economically viable in the short to medium term as the number of possible customers is dependent on expanding its energy production capacities and is therefore extremely limited at the beginning. Calculations point to a market share of only

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<sup>124</sup> For further details on the individual models, see the statements by representatives of the BWB, EnKoEnergie transcript 17/2, p. 6 ff.

1 percent by 2020. The main difference between the Berlin model and the two *Beschlussmodelle* is that the Berlin model authorises the sale of electricity produced by third parties and not just self-produced electricity from solar and wind power. There is no legal basis for this model as yet on the state level.

The information of the Study Commission clearly shows that the Berliner Stadtwerke, currently the subsidiary of BWB, is falling short of requirements due to the legal restrictions imposed upon it. To meet the objectives set out above, the Study Commission therefore recommends expanding the mandate of the municipal utilities on the basis of the Berlin model and making the necessary legal amendments.

*For more information on expanding the mandate of the Berliner Stadtwerke, see the dissenting opinion of the CDU parliamentary party and Prof. Haucap from page 97 onwards.*

The Study Commission recommends developing the Berliner Stadtwerke into a powerful company that, based on the recommendations of the Study Commission in the other sections of this report, is assigned the following core responsibilities:

- **Energy efficiency:** Set-up and deployment of a competence team to step up the systematic harnessing of energy savings and energy efficiency potential in Berlin's public sector (public infrastructure, companies with public holdings, public sector property) resulting in the creation of a city-wide showcase network of decentralised energy self-production and self-supply (e.g. solar panels, small-scale CHP units, geothermal energy units, biogas units, small vertical wind turbines). To optimise the future work of the Berliner Stadtwerke, a "Competence Centre Energy Efficiency" should be set up based on the same model as the "Competence Centre Water" in order to drive forward specific innovative processes through research and development.
- **Electricity:** New construction of a high-efficiency waste-to-energy plant to turn the sewage sludge of Berlin into energy in cooperation with the BWB; implementation of a strategy for the efficient use of the material and energy in biogenic residual waste and for the extensive climate-neutral use of biomass generated in the state of Berlin; CHP plants and solar panels in *Mieterstrommodelle*; use of large public roofing space – also underground and commuter rail station roof space – for solar electricity generation with the target of using all suitable roof space for this purpose by 2025; set-up and operation of wind power plants on the outskirts of Berlin and Berlin-owned land in Brandenburg.
- **Heat:** Establish and develop an intracting subsidiary, possibly together with state-owned property company Berliner Immobilienmanagement GmbH and municipal housing companies, to drive forward the energy-efficient refurbishment of the public building stock; set up an energy management system for all public buildings; compile and implement systematic refurbishment action plans for all state-owned properties; draw up detailed concepts for an environmentally friendly supply of heating for all medium and large new housing development projects and neighbourhoods; conduct a feasibility study down to each individual building to determine to what extent decentralised CHP could be an option for public properties and whether their

individual heating needs allow for the economically viable operation of a small-scale combined-heat-and-power (CHP) unit.

- Demand-side management / flexibilisation: Set-up of a high-capacity virtual power plant; turn state-owned properties into core units of decentralised local heating networks; increase the use of CHP plants in Berlin as balancing and back-up power plants; synergistic efficiency optimisation, i.e. using production, network and storage capacities also for cooling and air-conditioning.

To enable the Berliner Stadtwerke to expand rapidly, the Study Commission recommends that the Stadtwerke focus on the tasks that will have the greatest positive impact on climate protection. Existing state resources in the field of renewable energies and energy efficiency should be pooled in the Berliner Stadtwerke. It should be given the task of supporting and coordinating the expansion of renewable energy initiatives and energy efficiency programmes in state-owned companies as well. A coordinated demand-side management by the Berliner Stadtwerke should also be aimed for. The Berliner Stadtwerke should additionally start up trading and electricity sales activities, which, among other benefits, will help to build up a customer base and contacts for the brokering of energy services.

- 8. Encouraging public participation:** Of fundamental importance for a successful, low-carbon energy transition in Berlin is the real involvement of local citizens and local civil society. By involving the public, the opinions, expectations and ideas of all affected citizens will feed in to final decision-making and implementation processes. The principle of public participation builds on the public's willingness to contribute their knowledge, skills and enthusiasm to the making of sound decisions.

Involving the public in decision-making ensures that government action takes into account the needs and concerns of citizens. As citizens know their community best, it is of vital importance to include the public in the development of economically viable, socially just and environmentally friendly solutions for Berlin's energy transition.

Public participation brings with it numerous advantages. Public participation is an integral element of democratic processes. Involving the public also raises awareness for the reasoning behind the energy transition and enables citizens to take ownership of the energy transition. Citizens can put forward new and innovative ideas that can be taken into consideration in decision-making. Open decision-making processes that address the views of all different social groups often lead to more stable and sustainable decisions. Achieving social consensus on goals usually leads to fewer conflicts in the selection of instruments to achieve these goals.

Transparency and openness in decision-making processes increases the legitimacy and acceptance of political decisions and political programmes. Involving interested citizens early on makes it less likely that projects encounter opposition further down the road.

Berlin's efforts to become a climate-neutral city have already included different forms of public participation. Many public events were held in the course of the feasibility study *Climate-Neutral Berlin 2050*. There was online participation and a "city dialogue"

in connection with Berlin's Energy and Climate Protection Programme (BEK).<sup>125</sup> Information is available online for all relevant areas (energy supply, buildings and urban development, industry, private households and consumption, transport).

The Study Commission has made many of its consultations open to the public and, to the extent permissible to it within the greatly limited options under its rules of procedure,<sup>126</sup> has invited representatives from industry, civil society, science and the community to get involved in the process. Through this process, the Study Commission has managed to build up a solid understanding of the need for the energy transition and the associated challenges and costs, as well as of the options that can be proposed to policymakers.

Public participation must be an ongoing process. It also requires consumer protection organisations and other associations for engaging in communications with their members and the media for reaching a broad public, as well as companies that kick-start innovations, make products and sell them. Participatory information and discussion processes in the form of public events and online forums should be continued.

To minimise acceptance problems and conflicts associated with possible network expansion and the introduction of new technologies, instruments such as customer advisory boards or an energy network advisory board with all stakeholders<sup>127</sup> should be used to set policy priorities and define priorities for network operators. These instruments would enable a customer-oriented perspective and create the necessary transparency and trust. These aspects should be taken into account in the criteria for network concession award procedures. A further measure to increase acceptance are the producer-consumer communities already mentioned in section II "Electricity and infrastructures" that enable citizens to grasp the logic behind and the necessity of expanding networks and introducing new technologies.

As well as involving local civil society by having societal representatives on the Energy Transition Steering Committee and on (customer) advisory boards and also promoting financial participation, the Study Commission also recommends establishing a structural basis for participatory processes.

Furthermore, a culture of participation needs to flourish in Berlin. This includes the imparting of participation competencies and methodologies and the willingness to create participatory framework conditions for citizens as well as overcoming the fears associated with citizen involvement in municipal departments and public authorities.

Berlin needs a customised participatory concept. Starting points for such a concept can be found in the examples set by the state of Baden-Württemberg, the cities of Heidelberg, Bonn, Leipzig and Mannheim and the Austrian state of Vorarlberg. The following aspects are key:

- Quality guidelines and guiding principles for public participation.

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<sup>125</sup> Cf. footnote 105.

<sup>126</sup> The Rules of Procedure of the Berlin House of Representatives (GO Abghs: Geschäftsordnung des Abgeordnetenhauses), in its currently applicable version, stipulates that Study Commission meetings are generally not open to the public (Cf. first sentence of Sec. 24(5) of GO Abghs).

<sup>127</sup> This term encompasses all internal and external groups of persons that are directly or indirectly affected by current or future business operations.

- Robust framework conditions for public participation, e.g. by anchoring participatory procedures in the municipal code and/or the state constitution.
- Specialised offices and representatives for public participation charged with supporting the participatory processes, reflecting upon and analysing these processes and initiating learning activities; with organising coaching and consulting for the relevant public authorities, parliamentarians, etc.; with facilitating the sharing of experience and ideas among experts in the different sectors of public administration (on the municipal and state levels) and with monitoring the participatory processes.

The Study Commission recommends the state of Berlin to carefully evaluate how public participation can be effectively coordinated and vertically integrated on the district and state levels, building on existing structures such as *Quartiersräte* (neighbourhood councils) and district coordinators, as well as the experience gained from programmes such as the refurbishment scheme ServiceStadt Berlin 2016,<sup>128</sup> specific individual processes and feedback from the “Handbuch Partizipation” (Manual on Participation)<sup>129</sup> (Senate Department for Urban Development and the Environment). A possible starting point is the analysis of the participation procedure for the Tempelhofer Feld.<sup>130</sup>

- 9. Launching an education and training campaign around the energy transition:** The energy transition can only be successful if it is anchored within a general societal consensus and if the implications and changes that the energy transition will bring are widely accepted among citizens, the craft trades, training institutions and other public and private-sector actors. For this reason, it is essential that all parts of the public education system address climate change and other environmental problems related to energy consumption and initiate a training campaign in the relevant sectors. The energy transition will impact all current economic and social activities, including the provision of electricity, heating and ventilation of residential and commercial buildings, the transport of people and goods, the waste industry and all business activities. The citizens of Berlin need to not only be aware of these necessary but fundamental changes, but also involved in developing solutions and be given the capacity to implement these solutions. Current efforts should therefore be maintained and intensified. This will require strong partnerships with schools, extracurricular establishments and universities for the purpose of advancing energy and environmental education. Sustainable development also needs to

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<sup>128</sup> *Editors' note:* The refurbishment programme ServiceStadt Berlin 2016 is an instrument aimed at further developing administrative capacities. The programme funds projects within departments throughout the state to promote more transparent, efficient and participatory work procedures. More information available (in German) at: <https://www.berlin.de/sen/inneres/moderne-verwaltung/servicestadtberlin/auftrag/artikel.23588.php> (last accessed on 30 Oct. 2015).

<sup>129</sup> *Editors' note:* The Manual on Participation is a guideline for supporting and conducting participatory processes, addressed primarily to public administration employees. More information available (in German) at: [http://www.stadtentwicklung.berlin.de/soziale\\_stadt/partizipation/de/handbuch.shtml](http://www.stadtentwicklung.berlin.de/soziale_stadt/partizipation/de/handbuch.shtml) (last accessed on 30 Oct. 2015).

<sup>130</sup> *Editors' note:* The citizens' initiative 100 % Tempelhofer Feld ran a referendum campaign in 2012 to prevent the development of the Tempelhofer Feld site. The draft law to maintain the Tempelhofer Feld (THFG: Entwurf des Gesetzes zur Bewahrung des Tempelhofer Feldes) was approved by popular referendum on 25 May 2014 and the Tempelhofer Feld Act (THFG) entered into force in June 2014. The Senate Department for Urban Development and the Environment is currently conducting a public participation project aimed at preparing a development and maintenance plan (EPP: Entwicklungs- und Pflegeplan). More information available (in German) at: <http://www.thf100.de/start.html> and [http://www.stadtentwicklung.berlin.de/umwelt/stadtgruen/tempelhofer\\_feld/](http://www.stadtentwicklung.berlin.de/umwelt/stadtgruen/tempelhofer_feld/) (last accessed on 30 Oct. 2015).

be firmly anchored in the new framework curriculum for Berlin schools as an interdisciplinary subject. The structures and networks of diverse educational institutions (both schools and extracurricular establishments) on sustainable development that are already in place should be further supported and expanded. The Study Commission recommends the preparation of a concrete and action-oriented plan for the education sector as a building block in Berlin's sustainability strategy. The Study Commission further recommends setting up an environmental mentoring programme in Berlin schools that involves all the relevant bodies.

- 10. Using the potential of art and culture for the energy transition:** Artists and cultural practitioners can encourage the public to address the consequences of climate change through their work methods, art works and cultural productions. They can use artistic means to visualise the ecological consequences of global warming and the attendant dramatic changes in the environment. There are many opportunities in cultural education, in particular, to promote the artistic expression of climate change in projects with children and young adults in schools and nurseries.

What is lacking is a structured process that brings artists and climate protagonists together for a progressive exchange of ideas and experiences, thereby raising the profile of climate protection in the cultural sector. The Study Commission recommends initiating a dialogue on climate change and the energy transition between artists in Berlin and the main institutions and initiatives addressing climate change. To kick this process off, the Senate Department of Urban Development and the Environment is called upon to consult with the Council for the Arts to decide on the best way to raise awareness of climate change within Berlin's population (e.g. festival, climate change event series, art prize) and to carry out the awareness-raising measure in 2016.

- 11. Regulating the takeover of employees:** The institutional restructuring process in Berlin to create a basis for the energy transition as a generations-long project spanning multiple legislative terms will, depending on the model selected, bring about varying institutional changes, but in all cases these changes will presumably be far reaching and will also affect ownership structures. What will change, in particular, is the organisation and integration of the electricity, gas and district heating networks, and with it the operating units of these networks and their service providers, which will assume corresponding responsibilities.

This process of change must also introduce, at any early stage, binding regulations on the takeover of employees by the new operating units and legal entities. All employees of the affected companies must be provided legal certainty as to their professional future. This is not only to give them a solid planning basis and prospects for their personal future, but also because the energy transition will need to call on the extensive energy-sector expertise of these employees in Berlin and so this expertise must be maintained as far as possible. Regulated employment conditions and a secure career outlook are necessary for this to succeed.

The Study Commission proposes that the Senate pledges, in a declaration of intent, to ensure that employee interests are given reasonable consideration in all institutional and ownership changes that prove necessary in the course of restructuring Berlin's energy

industry. The collective energy wage agreements that apply to the federal state of Berlin are the basis for this point. The Senate's declaration of intent will be especially important for operating units and companies in case of total or partial remunicipalisation.

- 12. Making Berlin the divestment capital:**<sup>131</sup> A climate-neutral Berlin also means stopping investments in companies whose business model runs counter to the climate neutrality goal, both now and in the future. Excluded from investments should be, in particular, companies that extract, process or distribute gas from unconventional deposits, oil or coal. The state of Berlin also has financial assets, including state pension reserves. Some of these state assets are invested in shares of companies whose business model is based on fossil fuels, or in funds that hold shares of such companies. Cities such as San Francisco (United States), Oxford (England) and Boxtel (Netherlands) have addressed this contradiction, and Münster (Germany) will do so soon. The Study Commission recommends that the Senate should take the necessary steps to make Berlin the world's first divestment capital. This should include pledging to withdraw assets from corporations whose business model runs counter to the climate neutrality goal in the space of the next five years and ruling out such investments in the future by adopting corresponding investment guidelines.
- 13. Mobilising additional financing for Berlin's energy transition:** The energy transition is a broadly based investment programme in Berlin's energy infrastructure. The state of Berlin must aim to mobilise as much additional investment for the energy transition as possible – both new investments from the private sector and additional state investment in renewable energies and energy efficiency. As with every investment, the energy transition, too, will need sufficient financial resources, not just in the case of a possible remunicipalisation but also for the tasks that the state still has to tackle. Alongside guarantees, tens of millions in equity will need to be made available from the Berlin budget, especially for the further expansion of the Berliner Stadtwerke. Furthermore, the new Energy Transition Agency and the Energy Transition Steering Committee, which is to be overseen by Berlin's governing mayor, will also need adequate resources if they are to create the necessary momentum within local civil society. It is already clear at this point that more will have to be invested in the energy transition than planned so far. The state should not delay additional investments until the structures recommended by the Study Commission have been established, but should start parallel investment projects under the present structures. The necessary planning processes involved mean that investments can only be increased incrementally. For example, the energy efficient refurbishment of public buildings can only be commenced once pre-construction planning has been completed. The Study Commission therefore recommends substantially increasing the funds for pre-construction planning starting with the biennial budget 2016/2017. Additionally, a new budget item for "energy transition investments" should be added and allocated sufficient funds.

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<sup>131</sup> Divestment means releasing capital tied up in longer-term assets by selling these assets

***Appendix to section A. IV. Institutions, participation and processes***

The previous sections outlined many measures that need to be given an institutional basis under Berlin's energy transition. The following is a list of these measures together with a proposed institutional assignment:

<b>No.</b>	<b>Measures and Tasks</b>	<b>Institution</b>
1.	Provision of the necessary funds to refurbish public buildings (starting with the biennial budget 2016/2017).	Berlin House of Representatives
2.	Strategic heat plan for the state of Berlin, including a precise, building-specific survey of potential for the energy transition and for Berlin's heat production in particular.	Energy Transition Agency
3.	Implementation of the strategic heat plan, giving preference to local and district heating, particularly in densely populated areas.	Senate Energy Dept. / Energy Transition Steering Committee
4.	Aggregation and publication of available data (Senate Dept. for Finance) and the newly collected energy data for all state-owned properties (with at least the following information for each individual building: type and structure of heating, consumption data [electricity, gas, district heating, oil, solid fuels], state of refurbishment, specific heat consumption per year, record of all the building's energy certificates); creation of interfaces to other established energy management systems and the instruction and coordination of district energy representatives and other energy representatives; swift data collection by mid-2016.	Energy Transition Agency / Senate Energy Dept.
5.	Binding regulations stipulating ambitious standards for sustainable refurbishment and construction for the public sector (including its institutions and companies) that exceed the minimum legal requirements.	Senate Energy Dept.
6.	Binding regulations that require all new-build public-sector projects to meet a revised Berlin Energy Standard (with a general passive house standard).	Senate Energy Dept.
7.	Implementation of the special obligation of the public sector to act as a role model (as stated repeatedly in the Renewable Energies Heat Act [EEWärmeG]) and increasing its proportion of renewable energy consumption; action needed: setting targets for the direct and indirect use of renewable energy sources in this area.	Senate Energy Dept.

8.	<p>“Solar Capital Berlin” master plan:</p> <ul style="list-style-type: none"> <li>- Setting up a research cluster.</li> <li>- Accelerating the implementation of innovative flagship projects and pilot schemes, for instance by involving Berlin’s universities, non-university research institutes and private companies.</li> <li>- Make energy generation on particularly large public roof spaces – including those on U-Bahn and S-Bahn (underground and suburban train) stations – a top priority; target: by 2020 use 80 percent of all suitable roof spaces of the state of Berlin for energy generation and, by 2025, 100 percent.</li> </ul>	Energy Transition Steering Committee / Energy Transition Agency
9.	Monitor implementation of the Energy Saving Ordinance (EnEV) and Renewable Energies Heat Act (EEWärmeG) by performing at least random checks and sanctioning non-compliance.	Senate Energy Dept.
10.	Centralised monitoring to regularly and bindingly review progress in and implementation of public refurbishment measures (including those implemented via intracting or contracting).	Senate Energy Dept.
11.	Centralised public monitoring of relevant biomass flows (material flow management).	Energy Transition Agency
12.	Successive conversion to LED lighting or equally efficient systems in the public sector.	Senate Energy Dept.
13.	<p>Reducing the barriers to the expansion of renewable energies, e.g. by:</p> <ul style="list-style-type: none"> <li>- Providing incentives for the application of geothermal energy generation (e.g. developing and monitoring a deployment corridor, amending the authorisation for the operation of groundwater circulation systems, etc.) and a study to assess its local potential.</li> <li>- Conducting a study on innovative technologies and assessing the potential of wind power (e.g. use of high-altitude wind, small wind turbines).</li> </ul>	Senate Energy Dept.
14.	Climate agreements: Promoting compliance and implementation; demanding submission of a plan for phasing out coal-fired electricity generation by 2030 at the latest.	Energy Transition Steering Committee / Energy Transition
15.	Phase-out plan for lignite: The state of Berlin should work towards Vattenfall not selling its lignite division in the Lausitz region but accompanying the structural change in the region and phasing out lignite mining and use by 2030 at the	Energy Transition Steering Committee / Vattenfall
16.	Biomass electricity sustainability regulation (BioSt-NachV): Stepping up the verification obligations on the federal level and the sustainability agreements on the state level.	House of Reps. / Senate and Federal Initiative

17.	Link together renewable energy production in Brandenburg with that in Berlin; prerequisite: revision of the regional development plan to make reaching the climate goals a top priority.	Senate Chancellery – Energy and Climate Protection Office
18.	Needs-based network expansion planning; avoidance of non-needs-based parallel installation of district heating and gas networks.	Energy Transition Steering Committee
19.	Energy conservation campaign: “Berlin saves itself a power plant”.	Energy Transition Agency
20.	Information campaign: “Potential for increasing energy efficiency in Berlin’s building stock”.	Energy Transition Agency
21.	State-wide installation of a network of electric vehicle charging stations.	Energy Transition Steering Committee / Industry
22.	Energy savings advisory services: Berlin needs a platform to guide consumers and businesses to the appropriate advisory service.	Energy Transition Agency
23.	Review the guidelines for concluding urban development contracts in Berlin and add binding climate regulations.	Senate Dept. of Urban Dev.
24.	Exploiting potential of urban development planning: - Implementation of building and energy saving measures, e.g. orientation of buildings, insulation and use of renewable energies and CHP, and spatial planning for varying types of renewable energy production. - The state must make use of its policy space as per Section 23 of the Berlin Energy Conservation Act (BEnSpG) and pass appropriate regulations where expedient and include these in the development plan.	Senate Dept. of Urban Dev.
25.	Definition of priority zones (gas/district heating).	Senate Dept. for Urban Dev.
26.	Obtaining energy from the surrounding area: The state of Berlin should follow the Federal Environmental Office’s recommendations for energy procurement so as to contribute to the energy transition in this area as well.	Senate Dept. for Finance
27.	Using the flexibility clause in Renewable Energies Heat Act (EEWärmeG) to adopt a state-wide regulation stipulating a minimum required proportion of renewable energy use in Berlin’s building stock.	Senate Dept. for Energy / Berlin House of Reps.
28.	Regulating third-party network access, the reduction of specific carbon emissions, and retail prices for local and district heating networks in a Berlin heat law.	Senate Dept. for Energy / House of Reps.

29.	Structuring energy-efficient refurbishment in a socially acceptable way, e.g. introducing flexibility clauses on the reasonableness of rent allowances for recipients of transfer payments in case of energy-efficient refurbishment; providing targeted support of low-investment savings measures that benefit tenants; increasing funding for refurbishment that does not increase total rents; raising awareness of KfW and BAFA programmes, expanding the “Alliance of social housing policy and affordable rent” (Bündnis für soziale Wohnungspolitik und bezahlbare Mieten) to include private landlords and private landlord associations.	Senate Dept. for Urban Dev. / IBB
30.	Amending the legal basis for the Berliner Stadtwerke so as to expand its mandate.	House of Reps.
31.	New construction of a highly-efficient waste-to-heat plant that generates energy from sewage sludge in Berlin.	Berliner Stadtwerke
32.	Implementation of a strategy for the efficient climate-neutral use of biogenic residual waste to generate energy and recycle materials from the biomass produced in the state of Berlin.	Berliner Stadtwerke
33.	Development and promotion of <i>Mieterstrommodelle</i> (power is generated on/in a building and sold directly to its tenants), use of medium and large public space for solar electricity production, set-up and operation of wind turbines.	Berliner Stadtwerke
34.	Establishing and developing an intracting company to accelerate the energy efficient refurbishment of the public building stock.	Berliner Stadtwerke
35.	Setting up an energy management system for all public buildings and compiling and implementing systematic action plans for the refurbishment of all state-owned properties.	Berliner Stadtwerke
36.	Drawing up detailed concepts for an environmentally friendly supply of heating for all medium and large new housing development projects and neighbourhoods.	Berliner Stadtwerke
37.	Conducting a building-specific feasibility study to determine to what extent state-owned properties are suitable for the installation of decentralised CHP plants and, possibly, for becoming core units of decentralised local heating networks.	Berliner Stadtwerke
38.	Setting up a high-capacity virtual power plant; use of CHP plants in Berlin to balance out peaks and troughs in demand; synergetic efficiency optimisation.	Berliner Stadtwerke

## **2. Dissenting opinions**

### **2.1 Dissenting opinion of the CDU parliamentary group and Prof. Haucap on regulating the option of awarding concessions to in-house bidders**

In September 2015 the Federal Ministry for Economic Affairs and Energy presented an initial working version of a ministerial draft law to amend the Energy Industry Act (EnWG). In this draft, the ministry endorses and maintains the narrow policy space given to municipalities in the award of concessions. The guiding principle for concession awards, as stated in Section 1 of the Energy Industry Act, remains achieving “the most secure, low-cost, consumer-friendly, efficient and environmentally friendly cabled public supply of electricity and gas, increasingly from renewable energy sources.” Therefore, awarding concessions to in-house bidders is still not provided for in federal legislation.

This follows the legal position of the Federal Court of Justice, which, in its landmark ruling of 17 December 2013 (Ref. KZR 65/12 and 66/12), ruled that awarding concessions to in-house bidders is not permissible under current law. Having the option of awarding concessions to in-house bidders – also in ongoing concession award procedures – endangers the legal certainty of the call for tender as this would overextend the rights of municipalities to self-governance and lead to a one-sided interpretation of the required principle of non-discriminatory and fair competition (also between private and public bidders).

Alongside excluding private bidders from the conventional energy industry, awarding concessions to in-house bidders would also exclude citizen cooperatives from participating. Therefore, such a practice also runs counter to the Study Commission’s objective of increasing public participation.

In the opinion of the Berlin CDU parliamentary group, a course of action that adheres to the currently applicable legislation and the latest assessment of the Federal Ministry for Economic Affairs affords the most legal certainty. Therefore, it recommends abstaining from making a one-sided amendment to current federal legislation on awarding concessions to in-house bidders.

### **2.2 Dissenting opinion of the CDU parliamentary group and Prof. Haucap on a remunicipalisation of the electricity and gas networks**

In the opinion of the Berlin CDU parliamentary group, specific goals for ecological, economic, social and democratic policies need to be defined before a decision is made regarding possible remunicipalisation. There needs to be clarity as to the terms and conditions under which such an involvement by the public sector would be beneficial – in terms of the purchase price, the corporate structure and the state’s objectives. In preparatory talks, consensus was reached among representatives of all parliamentary groups and experts on this point.

The Study Commission’s decisions on the electricity and gas network concessions which were, in part, passed by a narrow majority, fall short of fulfilling these objectives and, instead, indiscriminately call for the full acquisition of both energy networks.

The Study Commission has neither provided a description of the objectives nor given the required definition of specific goals for ecological, economic, social and democratic policies. Rather, a dogmatic approach is taken, based purely on state intervention. There are nonetheless many other lines of argumentation that need to be considered to obtain a balanced and critical picture of remunicipalisation: no risk-free profits but large investments; risks for taxpayers if losses are incurred; the state of Berlin's lack of specialist expertise and management expertise; lack of control over falling energy prices; high purchase prices for the networks that will strain the public budget and a number of other factors.

The Berlin CDU parliamentary group does not rule out a participation of the state of Berlin in Berlin's gas and electricity utilities and in their network companies. The Senate is conducting a competitive dialogue on possible participation with energy partners. A strategic participation of the state of Berlin in the networks and in the area of energy management must, however, involve an innovation drive to strengthen Berlin's position as an energy location.

Cooperative solutions can be considered in a tendering procedure and can be selected with legal certainty if the bid is sufficiently good. This applies both to the gas network (a final cooperative bid has been submitted) and to the electricity network (cooperative bid is expected). It is, however, not absolutely necessary for the state of Berlin to take over the business management or hold the majority in the company to reach its energy policy goals.

The outcome of a strictly regulated tendering procedure must not be decided by a pure political motivation to achieve a specific result. A commitment to full remunicipalisation would put further legal pressure on the tendering procedures. It might give the impression that the outcome of what should be a fair, transparent and non-discriminatory procedure has already been decided upon in advance. In view of these considerations and to reduce the risk of legal action against the state, the Study Commission should refrain from making recommendations to the Berlin House of Representatives to achieve a certain political outcome of the tendering procedures, given that the House of Representatives has to confirm the outcome of these procedures.

### **2.3 Dissenting opinion of the CDU parliamentary group and Prof. Haucap on expanding the mandate of the Berliner Stadtwerke**

With the resolution of the Berlin House of Representatives of 24 October 2013 on the "Principles for the integrated energy service provider to be founded as a subsidiary of BWB" (Grundsätze eines neu zu gründenden integrierten Energiedienstleisters als Tochtergesellschaft der BWB), and the ensuing amendment of the Berlin Companies Act (BerlBG: Berliner Betriebe-Gesetz), the foundation and operational mandate of a municipal utility was adopted by parliament and enshrined in law. The model that has been decided upon (*Beschlussmodell*) does not permit the municipal utility to engage in electricity trading.

In the opinion of the CDU parliamentary group, the municipal utility has considerable potential, alongside selling the renewable energy it produces, in activities related to energy efficiency and energy conservation. Amending the *Beschlussmodell* to a so-called "Berlin model" (under which electricity trading is permitted) is not required to tap this potential. Electricity trading does not bring any direct advantages in terms of energy policy to the municipal utility, but instead harbours a number of business risks. The energy transition is increasing the volatility of prices on the electricity markets, which, in turn, makes electricity

trading a high-risk activity. There are already numerous providers of electricity in Berlin so the people of Berlin already have a very wide selection in comparison to other federal states in Germany. Consequently, one more provider owned by the state of Berlin will have a limited impact on consumer behaviour and on competition in the overall market.

Furthermore, in the opinion of the CDU parliamentary group, electricity trading will not promote the further development of renewable energies in Berlin. The danger is rather that if the municipal utility focuses on senseless and high-risk trading operations, it will neglect making the investments necessary to further develop renewable energies.

For these reasons, the Berlin House of Representatives was right to oppose trading on the electricity exchange by a state-owned municipal utility in its resolutions of 24 October 2013. The CDU parliamentary group believes that it is wiser not to change the legal basis of a company repeatedly within a short space of time. The Berliner Stadtwerke should rather take up operations within the legal framework of the *Beschlussmodell*, which the Berlin House of Representatives adopted in a majority vote.

## **B. Procedure**

### **I. Decision on establishing the Study Commission**

At the joint request of all parliamentary groups (SPD, CD U, Alliance 90/The Greens, the Left Party and the Pirate Party) of 2 April 2014,<sup>132</sup> the Berlin House of Representatives set up the Study Commission on New Energy for Berlin – The Future of Energy-Sector Structures<sup>133</sup> and passed the following resolution on this Study Commission in its 47th session of the 17th legislative term, on 8 May 2014:<sup>134</sup>

#### **“Establishment of a Study Commission on New Energy for Berlin”**

##### **I**

A Study Commission on New Energy for Berlin – The Future of Energy-Sector Structures shall be set up as per Section 24 of the Rules of Procedure of the Berlin House of Representatives.

The Study Commission is tasked with investigating the future of energy-sector structures in the state of Berlin with a view to reaching the state’s energy policy goals and in light of current developments such as the energy transition.

The Study Commission shall investigate in particular the economic and technical challenges on the horizon for key utility facilities (e.g. electricity network, gas network, district heating network and centralised electricity and heat generation plants) and how public and private electricity and heat consumers can be supported in cutting consumption and increasing energy efficiency.

The Study Commission shall also clarify whether, to reach its energy policy goals, it would be advantageous and/or necessary for the state of Berlin to take up commercial activities on the municipal level, or whether it should work towards cooperative structures with other actors. It shall also identify which instruments can be used to incorporate other private energy-sector actors in the state’s energy-policy strategy and to mobilise private investment in the energy sector.

##### **II**

The Berlin House of Representatives tasks the Study Commission, taking into account the reports and concepts that have been compiled or commissioned by the Senate departments, to work on the following set of issues and topics:

1. In its first three meetings, the Study Commission shall inform itself of the Senate’s energy policy goals and activities, also by calling on, among others, the Environment

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<sup>132</sup> Berlin House of Representatives, printed paper 17/1570.

<sup>133</sup> Referred to in the following as “New Energy for Berlin”.

<sup>134</sup> Berlin House of Representatives, printed paper 17/1632; see also the decision to extend the Study Commission’s timeline of 14 April 2015 – Berlin House of Representatives, printed paper 17/2213 – the provision in section III of the original establishing decision was amended so as to move the submission date for the final report forward to autumn 2015.

Senator for input on specialist issues and the Finance Senator for input on participation-related issues.

The Study Commission shall further inform itself on the results of both concession award procedures for electricity and gas, as soon as these become available, and shall discuss the potential energy-policy, economic and social impacts of these results.

2. Economic and technical challenges for Berlin's energy supply, in particular:
  - a. the role of metropolises in the energy transition;
  - b. a stock-taking of Berlin's power plants (large-scale power plants) including the Ruhleben waste-to-energy plant and a review of their development prospects;
  - c. challenges in the further development of Berlin's electricity network infrastructure.
3. Influence of the electricity generation plants and distribution systems located around Berlin – in particular wind turbines, solar power systems and lignite-powered electricity generation – on Berlin's energy supply, how this influence is likely to develop in the future and what options are open to the state of Berlin to shape this development through joint regional planning.
4. Economic and technical challenges for heat supply in Berlin, in particular:
  - a. a stock-taking of the heat sector and the preparation of possible development scenarios for reaching the Senate's goal of making Berlin's building stock climate neutral;
  - b. a review of the development prospects for the district and local heating networks with consideration of the connected heat generation plants as well as the gas network and its connected CHP and small-scale combustion plants;
  - c. challenges regarding the current energy efficiency of the public and private building stock;
  - d. potential for using renewable energies and energy from residual materials for Berlin's heat sector.
5. Interdependencies of the electricity and the heat sectors, in particular:
  - a. central regulation of decentralised electricity and/or heat producers ("intelligent power plants"), and possible new technical concepts such as the storage of excess electricity in the form of gas (power-to-gas) or heat (power-to-heat) and their possible application in a metropolis such as Berlin;
  - b. investigating whether and to what extent a single network company for Berlin's electricity and heat networks would be beneficial.
6. Clarifying which of the requirements identified under Nos. 1 to 5 can be most effectively and efficiently implemented by which available actors and what regulatory amendments the state of Berlin needs to undertake in this context. The Study Commission shall further clarify what commercial activities the state of Berlin should sensibly undertake, such as the already established Berliner Stadtwerke, to supplement private-sector activities. The Study Commission should take into consideration, above all, the outcomes of the two concession award procedures for electricity and gas and any changes this will have on the ownership structure of Berlin's energy supply systems and companies. The Study Commission should in particular answer the following specific questions:
  - a. What as yet untapped but economically viable potential is there for a climate-friendly energy supply for Berlin and how can this potential best be exploited?

- b. How can the energy-efficient refurbishment of Berlin's public building stock be structured to enable a climate-neutral operation of the buildings in the long term?
- c. How can the energy-efficient refurbishment of Berlin's private-sector building stock be structured to enable a climate-neutral operation of these buildings in the long term? What requirements need to be set for new housing complex developments in order to reach the state's energy policy goals?
- d. What influence can the state exert on the supply of district heating and how can the state best apply this influence? What options for third-party access to the district heating network (Ruhleben waste-to-energy plant, deep geothermal energy) are possible and useful in terms of energy policy? Is supplementary regulation by the legislator necessary for the further development of Berlin's heat supply (e.g. a state-wide heat act)?
- e. How and with the help of which actors should decentralised CHP be expanded in Berlin and how can the state exert influence on this process?
- f. What structures should be established to best interconnect the state-owned actors in the energy sector? How can cooperation among all energy-sector actors in Berlin be improved?
- g. How, from the perspective of the state of Berlin, should the funding structures for the heat sector at the federal level be further developed?

### **III**

The Study commission shall submit to the Berlin House of Representatives an interim report on the set of topics outlined under Nos. 2 to 6 and possibly on the set of topics outlined under No. 1, while also working towards including concrete proposals for implementation in this report. The final report shall be submitted in summer 2015.

Each parliamentary group shall receive flat-rate reimbursement for personnel resources working for the Study Commission as per Section 8(6) of the Parliamentary Group Act (Fraktionsgesetz). This amounts to up to €24,000 per year for the duration of the Study Commission's work; Section 10(1) of the Parliamentary Group Act shall apply analogously.

### **IV**

The Study Commission shall be composed of 16 members, eleven of whom shall be members of the Berlin House of Representatives. The members of the Study Commission shall be appointed jointly by the parliamentary groups as per Section 24(3) of the Rules of Procedure of the Berlin House of Representatives.

## **II. Composition and staffing of the Study Commission**

### **1. Members**

As stipulated in the establishing decision, the Study Commission on New Energy for Berlin was composed of 16 members: eleven members of the Berlin House of Representatives and five experts who were not members of the House of Representatives.

#### **1.1 Members of the Berlin House of Representatives**

The following members of the Berlin House of Representatives were selected as members and deputy members of the Study Commission:

##### **Members**

##### **Deputy members**

##### **SPD parliamentary group**

Daniel Buchholz (spokesman)  
Nikolaus Karsten  
Irene Köhne  
Jörg Stroedter (chairman)

Franziska Becker  
Burgunde Grosse  
Ülker Radziwill  
Torsten Schneider

##### **CDU parliamentary group**

Danny Freymark  
Dr Michael Garmer (spokesman)  
Claudio Jupe

Matthias Brauner  
Heiko Melzer  
Sven Rissmann

##### **Alliance 90/The Greens parliamentary group**

Silke Gebel  
Michael Schäfer (spokesman)

Nicole Ludwig  
Andreas Otto

##### **The Left Party parliamentary group**

Harald Wolf (spokesman)

Dr Klaus Lederer

##### **Pirate Party parliamentary group**

Pavel Mayer (spokesman)

Simon Kowalewski

## 1.2 Experts

The following experts, who were not members of the Berlin House of Representatives, were selected as members or as their personal deputies of the Study Commission:

### Members

#### **Dr Patrick Graichen**

(Executive Director, Agora Energiewende)

#### **Prof. Justus Haucap**

(Director, Düsseldorf Institute for Competition Economics / Heinrich Heine University Düsseldorf)

#### **Dr Reinhard Klopffleisch**

(Department Head of Energy Supply and Waste Management Policy and European Policy, ver.di)

#### **Prof. Miranda Schreurs**

(Director, Environmental Policy Research Centre, Free University of Berlin)

#### **Dr Stefan Taschner**

(Spokesman, Berliner Energietisch)

### Personal deputies

#### **Dr Barbara Praetorius**

(Deputy Executive Director, Agora Energiewende)

#### **Prof. Dieter Flämig**

(Management, Main INFRANEU Association)

#### **Clivia Conrad**

(Director of the National Water Industry Working Group, ver.di)

#### **Dr Hans-Joachim Ziesing**

(Managing Director, Working Group on Energy Balances)

#### **Dr Christine Kühnel**

(Chairman of the Board, BUND [Friends of the Earth Germany], Berlin)

## 2. Staff of the parliamentary groups

The following staff of the parliamentary groups supported the work of the Study Commission:

### **SPD parliamentary group**

Doris Jagodzinski

### **CDU parliamentary group**

Jan-Arne Seewald (up to June 2014)

Fritz Kluchert (since June 2014)

### **Alliance 90/The Greens parliamentary group**

Dr Tobias Jentsch

### **The Left Party parliamentary group**

Malte Krückels (up to November 2014)

Andreas Fuhs (since December 2014)

### **Pirate Party parliamentary group**

Dr Karolina Jankowska (since August 2014)

### **3. Parliamentary administration**

The Plenary Assembly and Committee Services (Directorate III) of the Berlin House of Representatives assisted the Study Commission with its work by providing operational, organisational and substantive support.

The following staff members supported the office of the Study Commission:

Commission advisor:	Nina Hufen
Research assistant:	Anna Kahlert (since August 2014)
Office managers:	Stefan Bernhardt Antje Sehne

The Plenary and Committee Transcript Division, under the responsibility of editor Barbara Oehler, prepared verbatim and summary records.

### **III. Working procedure of the Study Commission**

The Study Commission held its inaugural meeting on 21 May 2014 and elected Jörg Stroedter MP (SPD) as chairman, Pavel Mayer MP (Pirate Party) as deputy chairman, Silke Gebel MP (Alliance 90/The Greens) as secretary and Danny Freyremark MP (CDU) as deputy secretary.

The Study Commission convened a total of 23 times, with the final meeting held on 7 October 2015. In accordance with the first clause of the first sentence of Section 24(5) of the Rules of Procedure of the Berlin House of Representatives (GO Abghs), the Study Commission's meetings were not generally open to the public.<sup>135</sup> Eight of the nine consultations conducted by the Study Commission were open to the public in accordance with the second clause of the first sentence of Sec. 24(5) of the Rules of Procedure.

#### **1. First work phase (1st–13th meeting)**

During the first phase of its work, the Study Commission proceeded as follows:

##### **1.1 Information from the Senate**

The Study Commission first informed itself of the energy policy goals and activities of the Senate. For this purpose the Senator for Urban Development and the Environment, the Senator for Finance and the Senator for Economic Affairs, Technology and Research were invited to individual meetings. They reported to the Study Commission's members and answered their questions. The first phase of the Study Commission's work therefore involved analysing the present situation in light of the state of Berlin's energy policy. Furthermore, at the request of the Study Commission, the State Secretary for Transport and the Environment regularly attended the Study Commission's meetings and answered questions from the Commission's members.

##### **1.2 Hearings and written statements**

During the first phase of its work, the Study Commission held six hearings to which it invited experts on specific energy-related technical and political issues as well as key actors in the energy sector. The Study Commission also obtained written statements from experts. The information gathered through these hearings and the statements of Senate representatives gave the Study Commission insights into the questions set out in the establishing decision. The Study Commission held an extensive discussion in the follow-up to each hearing and statement in order to form opinions on the information received.

##### **1.3 Analysis and summary for the interim report**

The information obtained in the hearings, statements and the reports of the Senate departments was then analysed extensively. In a first step, the key information was

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<sup>135</sup> See also Section 4 "Openness to the public" of the Rules of Procedure for the Study Commission on New Energy for Berlin – decision of 21 May 2014.

summarised. The Study Commission's members evaluated this information to draw preliminary conclusions and set out possible options for the state of Berlin's future energy policy and for the Commission's further work. The experts sitting on the Study Commission took the leading role in writing individual sections for the interim report, which were then presented to the Commission and discussed.

The final vote on the interim report was held in the 12th meeting of the Study Commission on 28 January 2015. The interim report was adopted unanimously and subsequently presented to the parliament in its 60th session on 19 February 2015.<sup>136</sup>

## **2. Second work phase (14th–23rd meeting)**

Building on the first phase of its work and the findings set out in the interim report, the Study Commission proceeded as follows in the second phase of its work:

### **2.1 Identification of open questions and formation of working groups**

Following the completion of the interim report, the Study Commission first identified the questions set out in the establishing decision that had not yet been addressed,<sup>137</sup> which were then allocated to the three topics areas of Heat and Interdependencies, Electricity and Infrastructures, and Institutions. In its 13th meeting, the Study Commission also adopted a resolution setting up three working groups to address the questions remaining in each respective area and to write the corresponding section of the final report.

In accordance with the decision, the working groups of the Study Commission each had a core team comprised of between two to four expert members and two MP members of the Commission. These were as follows:

#### **Working Group 1 –**

##### **Heat and Interdependencies**

Irene Köhne MP (SPD)  
Michael Schäfer MP (Alliance 90/The Greens)  
Prof. Justus Haucap  
Dr Reinhard Klopffleisch

#### **Working Group 2 –**

##### **Electricity and Infrastructures**

Dr Michael Garmer MP (CDU)  
Pavel Mayer MP (Pirate Party)  
Dr Christine Kühnel  
Dr Stefan Taschner

#### **Working Group 3 – Institutions**

Nikolaus Karsten MP (SPD)  
Harald Wolf MP (The Left Party)  
Prof. Dieter Flämig  
Dr Patrick Graichen  
Dr Hans-Joachim Ziesing  
Prof. Miranda Schreurs

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<sup>136</sup> Berlin House of Representatives, printed paper 17/2100.

<sup>137</sup> See non-public annex 3 to the EnKo official record (17/13 non-public).

All other members of the Study Commission including the staff of the parliamentary groups were invited to participate in the working groups' meetings.

The first task of the working groups was to make preparations for the remaining meetings of the Study Commission, which consisted of recommending experts for the hearings and compiling topic-specific lists of questions.<sup>138</sup> The other main task of the working groups was to draw up a draft of the corresponding section of the final report.<sup>139</sup> To accomplish this, the findings made so far and the information collected was discussed in regular meetings, at which other studies and reports were also reviewed and analysed. Working Group 3 also met with two invited experts to obtain further information.

## **2.2 Hearings and written statements**

Based on the recommendations given by the working groups, the Study Commission invited various experts to take part in the hearings held during its 14th, 15th and 18th meetings, or to submit written statements on the topic areas of Heat and Interdependencies, Electricity and Infrastructures, and Institutions. In its 16th, 17th and 19th meetings, the Study Commission evaluated its findings from the hearings and the written statements. Each working group prepared a discussion paper on its respective topic for these evaluation meetings.

## **2.3 Compilation and coordination of the final report**

Following the evaluation meetings, the working groups were requested to rework the draft text according to the feedback from the Study Commission and to prepare a final version for the vote on the final report. The working groups held further meetings to accomplish this task. The draft sections prepared by the working groups on this basis were then consulted on in depth and voted on in the 21st, 22nd and 23rd meetings of the Study Commission. Three dissenting opinions were submitted regarding section A. IV. Institutions, participation and processes. In its 23rd meeting, the Study Commission voted unanimously in favour of the final report while taking into consideration the dissenting opinions. The Study Commission submitted its final report to the parliament in its 71st session on 12 November 2015.

## **3. External meeting**

On 24 June 2015, in the Brandenburg town of Großräschen, a joint meeting was held with the Brandenburg state parliament's Committee for Economic Affairs and Energy and its Committee for Infrastructure and Agriculture; the Berlin House of Representative's Committee on Urban Development and the Environment and its Committee on Economic Affairs, Research and Technology; and the Study Commission on New Energy for Berlin. The topic of the meeting was the future of lignite opencast mining in the Lausitz region, and

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<sup>138</sup> See also the following section B. III. 2.2 Hearings and written statements, p.107.

<sup>139</sup> See also section B. III. 2.3 Compilation and coordination of the final report, p.107.

included a joint tour of the region. Statements were heard by representatives of the Berlin Senate, the parliament and municipalities of the state of Brandenburg, and various experts.<sup>140</sup>

#### **4. Press and public relations**

The Study Commission held two press conferences, on 28 January 2015 and 7 October 2015, to inform representatives of the press of its work. The Study Commission also held two public panel discussions, on 18 February 2015 and 11 November 2015.

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<sup>140</sup> Among those invited were the president of the Brandenburg State Office for Mining, Geology and Natural Resources, a representative of BUND e.V., a representative of Grüne Liga e.V., the mayor of the town of Welzow, the chairwoman of the Welzow City Council's Committee for the Environment, Public Order and Security, the CEO of Vattenfall Europe Mining and Generation, the chairman of the Central Works Council of Vattenfall Europe Mining, the managing director of the Cottbus Chamber of Commerce and Industry, the regional head of the mining, chemical and energy trade union IG BCE and the managing director of the Proschim group of companies.

## **C. Appendices**

### **I. List of abbreviations**

<b>AG</b>	joint-stock company
<b>BAFA</b>	Federal Office for Economic Affairs and Export Control
<b>BauGB</b>	Federal Building Code
<b>BDEW</b>	German Association of Energy and Water Industries
<b>BEA</b>	Berlin Energy Agency
<b>BEK</b>	Berlin Energy and Climate Protection Programme
<b>BEnSpG</b>	Berlin Energy Conservation Act
<b>BerlAVG</b>	Berlin Public Tender and Procurement Act
<b>BerIBG</b>	Berlin Companies Act
	Biomass electricity sustainability ordinance
<b>BMWi</b>	Federal Ministry for Economic Affairs and Energy
<b>BNB</b>	Sustainable Construction Assessment System for Federal Buildings
<b>BNetzA</b>	Federal Network Agency
<b>BSR</b>	Berlin's public waste management utility
<b>BTU C-S</b>	Brandenburg University of Technology Cottbus-Senftenberg
<b>BUND</b>	Friends of the Earth Germany
<b>BWB</b>	Berlin water utility company
<b>BWE</b>	German Wind Energy Association
<b>CCHP</b>	Combined cooling, heat and power
<b>CCS</b>	Carbon Capture and Storage
<b>CHP</b>	Combined heat and power
<b>CO<sub>2</sub></b>	carbon dioxide
<b>Ct/kWh</b>	cent per kilowatt hour
<b>dena</b>	German Energy Agency
<b>DVGW</b>	German Technical and Scientific Association for Gas and Water
<b>DWV</b>	German Hydrogen and Fuel Cell Association
<b>ed.</b>	editor
<b>EEG</b>	Renewable Energy Sources Act
<b>EEWärmeG</b>	Renewable Energy Heat Act
<b>EnEG</b>	Act on the Saving of Energy in Buildings (Energy Saving Act)
<b>EnEV</b>	Energy Saving Ordinance
<b>EnWG</b>	Energy Industry Act

<b>EWG Bln</b>	Bill on Implementing the Energy Transition and on Promoting Climate Protection in Berlin (Berlin Energy Transition Act)
<b>e.V.</b>	registered association
<b>GASAG</b>	Berlin public limited gas company
<b>GmbH</b>	Limited liability company
<b>GO Abghs</b>	Rules of Procedure of the Berlin House of Representatives
<b>GVBl.</b>	Gazette of Laws and Ordinances
<b>GW</b>	gigawatt
<b>GWB</b>	Act against Restraints of Competition
<b>GWh</b>	gigawatt-hour
<b>GWh/a</b>	gigawatt-hours per year
<b>HIC</b>	Hamburg Institut Consulting GmbH
<b>HIR</b>	Hamburg Institut Research gGmbH
<b>IBB</b>	Investitionsbank Berlin (Berlin Investment Bank)
<b>ICT</b>	Information and communications technology
<b>IFAM</b>	Fraunhofer Institute for Manufacturing Technology and Advanced Materials
<b>IHK</b>	Chamber of Commerce and Industry of Berlin
<b>IÖW</b>	Institute for Ecological Economy Research
<b>IREES</b>	Institute for Resource Efficiency and Energy Strategies
<b>KfW</b>	Reconstruction Loan Corporation (development bank)
<b>kW</b>	kilowatt
<b>kWh</b>	kilowatt-hour
<b>KWKG</b>	Act on Combined Heat and Power Generation (Combined Heat and Power Act)
<b>kWp</b>	Kilowatt peak
<b>LEP B-B</b>	State Development Plan Berlin-Brandenburg
<b>MW</b>	megawatt
<b>MWh</b>	megawatt-hour
<b>OJ</b>	Official Journal of the European Union
<b>PIK</b>	Potsdam Institute for Climate Impact Research
<b>PJ</b>	petajoule
<b>PJ/a</b>	petajoule per year
<b>PtG</b>	Power-to gas
<b>PtH</b>	Power-to-Heat
<b>PV</b>	photovoltaics

<b>REEG</b>	Regional energy-efficiency cooperatives oriented towards the common good
<b>Sen. Dept. Fin.</b>	Senate Department for Finance
<b>Sen. Dept. Urban Dev.</b>	Senate Department for Urban Development and the Environment
<b>Sen. Dept. Econ.</b>	Senate Department for Economics, Technology and Research
<b>Tech. Res.</b>	
<b>TU</b>	Technische Universität Berlin
<b>TWh</b>	terawatt-hours
<b>VwVBU</b>	Berlin Senate administrative regulation on applying environmental-protection requirements to the procurement of deliveries, construction works, and services
<b>WEG</b>	German Condominium Act
<b>ZSW</b>	Centre for Solar Energy and Hydrogen Research Baden-Württemberg

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### **III. List of transcripts**

Non-public transcript of the second meeting of the Study Commission in the 17th electoral term (17/2, non-public), 4 June 2014.

Non-public transcript of the third meeting of the Study Commission in the 17th electoral term (17/3, non-public), 18 June 2014.

Transcript of the fourth meeting of the Study Commission in the 17th electoral term (17/4), 2 July 2014.

Transcript of the fifth meeting of the Study Commission in the 17th electoral term (17/5), 17 September 2014.

Transcript of the non-public section of the fifth meeting of the Study Commission in the 17th electoral term (17/5, non-public), 17 September 2014.

Transcript of the sixth meeting of the Study Commission in the 17th electoral term (17/6), 1 October 2014.

Transcript of the eighth meeting of the Study Commission in the 17th electoral term (17/8), 12 November 2014.

Transcript of the ninth meeting of the Study Commission in the 17th electoral term (17/9), 26 November 2014.

Annex 3 to the official record of the 13th meeting of the Study Commission in the 17th electoral term (17/13), 18 February 2015.

Transcript of the 14th meeting of the Study Commission in the 17th electoral term (17/14), 11 March 2015.

Transcript of the 15th meeting of the Study Commission in the 17th electoral term (17/15), 25 March 2015.

Transcript of the 18th meeting of the Study Commission in the 17th electoral term (17/18), 27 May 2015.

#### **IV. List of presentations and statements**

**50Hertz Transmission GmbH:** Written statement as part of the hearing in the 15th meeting, held on 25 March 2015.

**50Hertz Transmission GmbH:** Written statement on the list of questions from the Pirate Party parliamentary group to the parties to be heard at the fifth meeting, held on 17 September 2014.

**50Hertz Transmission GmbH:** *Stellungnahme zur Anhörung* (Statement on the hearing); written statement on the hearing in the fifth meeting, held on 17 September 2014.

**Alliander AG:** *Analyse der Netznutzungsentgelte und Implikationen für Berlin* (Analysis of the network access charges and implications for Berlin); statement of 23 September 2015 to the Study Commission following the hearing in the 18th meeting, held on 27 May 2015.

**Alliander AG:** Written statement as part of the hearing in the 18th meeting, held on 27 May 2015.

**Berlin Energie:** *Rechtliche Fragen im Zwischenbericht der Enquete-Kommission betreffend Einrichtung einer einheitlichen Netzgesellschaft* (Legal issues in the Study Commission's interim report regarding the establishment of a unified grid company); letter to the Study Commission dated 21 September 2015.

**Berliner Energieagentur:** *Enquetekommission „Neue Energie für Berlin“ Antworten der Berliner Energieagentur zum Fragenkatalog zur Anhörung am 25.03.2015* (Replies of the Berliner Energieagentur to the list of questions at the hearing on 25 March 2015); written statement as part of the hearing in the 15th meeting, held on 25 March 2015.

**Berliner Stadtreinigung (BSR):** *Fragen der Enquete-Kommission ‚Neue Energie für Berlin‘ an die BSR* (Questions from the Study Commission to the BSR); written statement on the fourth meeting, held on 2 July 2014.

**Berliner Wasserbetriebe:** *Berliner Stadtwerke – Aktueller Stand* (Berliner Stadtwerke municipal utilities – current status); presentation as part of the hearing in the second meeting, held on 4 June 2014.

**BLS Energieplan GmbH / Lange:** Presentation as part of the hearing in the sixth meeting, held on 1 October 2014.

**German Association of Energy and Water Industries e.V.:** *Stellungnahme zu Tagesordnungspunkt 1 der 18. Sitzung der Enquete-Kommission „Neue Energie für Berlin“ am 27. Mai 2015* (Statement on Item 1 at the 18th meeting of the Study Commission); written statement as part of the hearing in the 18th meeting, held on 27 May 2015.

**German Wind Energy Association e.V., Berlin-Brandenburg branch (BWE Berlin-Brandenburg):** written statement on the fifth meeting, held on 17 September 2014.

**BürgerEnergie Berlin eG:** *Wirtschaftliche und technische Herausforderungen der Stromversorgung in Berlin – Herausforderungen für die Entwicklung der Berliner Stromnetzinfrasturktur* (Economic and technical challenges of Berlin's electricity supply – Challenges in the development of Berlin's electricity network infrastructure); written statement on the hearing in the fourth meeting, held on 2 July 2014.

**German Technical and Scientific Association for Gas and Water e.V. (DVGW):** *Standpunkt: Power-to-Gas* (Position on: Power-To-Gas); written statement on the eighth meeting, held on 12 November 2014.

**German Technical and Scientific Association for Gas and Water:** written statement as part of the hearing at the 15th meeting, held on 25 March 2015.

**German Hydrogen and Fuel Cell Association e.V.:** *Fragenkatalog zur Anhörung im Rahmen der 15. Sitzung am 25. März 2015 Thema „Strom und Infrastrukturen“* (List of questions on the hearing as part of the 15th meeting on “Electricity and infrastructures”, held on 25 March 2015); written statement as part of the hearing in the 15th meeting, held on 25 March 2015.

**Diwald:** *Keine Energiewende ohne Wasserstoff “Power to Gas” Strom-Kraftstoff-Management* (No energy transition without hydrogen power-to-gas electricity and fuel management); presentation as part of the hearing in the 15th meeting, held on 25 March 2015.

**Energiewirtschaftsstelle:** *Vorstellung der Energiewirtschaftsstelle* (Introducing the Energiewirtschaftsstelle energy management unit); presentation as part of the hearing in the 14th meeting, held on 11 March 2015.

**Joint Spatial Planning Department Berlin / Schirmer, P.:** *Enquete-Kommission „Neue Energie für Berlin – Zukunft der energiewirtschaftlichen Strukturen* (Study Commission New Energy for Berlin – The Future of Energy-Sector Structures); presentation as part of the hearing in the fifth meeting, held on 17 September 2014.

**Hamburg Institut Consulting GmbH (HIC) & Research gGmbH (HIR) / Maaß, C.:** written statement on the hearing in the eighth meeting, held on 12 November 2014.

**Hirschl, Prof.:** *Statement zur 5. Sitzung der Enquete-Kommission „Neue Energie für Berlin“ – Themenschwerpunkt Stromversorgung* (Statement on the fifth meeting of the Study Commission – main topic: electricity supply); presentation as part of the hearing in the fifth meeting, held on 17 September 2014.

**Hoffmann-Kallen:** *Masterplan Stadt und Region Hannover – Institutionelle Organisation der Energiewende* (Master plan for the city and region of Hanover – Institutional organisation of the energy transition); presentation as part of the hearing in the 18th meeting, held on 27 May 2015.

**Chamber of Industry and Commerce Berlin:** Written statement as part of the hearing during the 18th meeting, held on 27 May 2015.

**Ministry for Economic Affairs and Energy of the State of Brandenburg:** Written statement on the list of questions from the Pirate Party parliamentary group to the experts at the fifth meeting, held on 17 September 2014.

**Mono, Dr:** *Stellungnahme für die 15. Sitzung der Enquête-Kommission „Neue Energie für Berlin“* (Statement on the 15th meeting of the Study Commission); written statement as part of the hearing in the 15th meeting, held on 25 March 2015.

**Pirate Party parliamentary group:** *Fragen der Piratenfraktion für die 5. Sitzung der Enquete-Kommission „Neue Energie für Berlin“ am 17.9.2014* (Questions from the Pirate Party parliamentary group for the fifth meeting of the Study Commission on 17 September 2014); written list of questions to the parties to be heard at the fifth meeting (Prof. Bernd Hirschl, Prof. Joachim Twele, 50Hertz Transmission, the Joint Spatial Planning Department and the Ministry for Economic Affairs and Energy of the state of Brandenburg), held on 17 September 2014.

**Richter:** *Bürgerbeteiligung für die Energiewende in Berlin* (Public participation in the energy transition in Berlin); written statement as part of the hearing in the 18th meeting, held on 27 May 2015.

**Senator for Environment, Construction and Transport of the City of Bremen / Bremer Energie Institut:** *Übertragung des Erneuerbare-Energien-Wärmegesetzes (EEWärmeG) auf den Gebäudebestand im Land Bremen – Untersuchung der Handlungsoptionen und Einsparpotenziale* (Applying the Renewable Energy Heat Act to the building stock in the state of Bremen – Investigation of the options for action and energy saving potentials); expert opinion on the eighth meeting, held on 12 November 2014.

**Senator for Environment, Construction and Transport of the City of Bremen / Bremer Energie Institut:** *Übertragung des Erneuerbare-Energien-Wärmegesetzes (EEWärmeG) auf den Gebäudebestand im Land Bremen – Untersuchung zur Wirtschaftlichkeit der Erfüllungsmaßnahmen* (Applying the Renewable Energy Heat Act to the building stock in the state of Bremen – Investigation of the cost-effectiveness of the fulfilment criteria); expert opinion on the eighth meeting, held on 12 November 2014.

**Senator for Environment, Construction and Transport of the City of Bremen:** *Bremisches Klimaschutz- und Energiegesetz (BremKEG)* (Bremen climate protection and energy act); letter of 26 February 2015 to the Study Commission on the eighth meeting, held on 12 November 2014.

**Senate Department for Finance:** Letter of 14 October 2014 to the Study Commission.

**Senate Department for Finance:** Letter of 7 November 2014 to the Study Commission.

**Senate Department for Urban Development and the Environment:** *Beantwortung der Fragen aus der 14. Sitzung der Enquete-Kommission am 11. März* (Reply to the questions from the 14th meeting of the Study Commission on 11 March); letter of 24 March 2015 to the Study Commission.

**Senate Department for Urban Development and the Environment:** *Beantwortung der Fragen aus der 15. Sitzung der Enquete-Kommission am 25. März 2015* (Reply to the questions from the 15th meeting of the Study Commission on 25 March 2015); written reply of 22 April 2015 to the Study Commission.

**Senate Department for Urban Development and the Environment:** *Geltung der Endschaftsklausel des Stromkonzessionsvertrages für das Wärmenetz der Vattenfall Europe Wärme AG* (The validity of the termination clause of the electricity concession agreement for the Vattenfall Europe Wärme heat network); letter of 9 March 2015 to the Study Commission; statement on the questions at the 13th meeting, held on 18 February 2015.

**Senate Department for Urban Development and the Environment:** *Informationen zum Stand der energetischen Gebäudesanierung im Land Berlin und den diesbezüglich genutzten politischen Instrumenten* (Information on the status of energy-efficient building refurbishments in the state of Berlin and the policy instruments used in this regard); written reply of 19 March 2015 to the Study Commission.

**Senate Department for Urban Development and the Environment:** Letter of 29 September 2014 to the Study Commission.

**Senate Department for Urban Development and the Environment:** Letter of 21 October 2014 to the Study Commission.

**Senate Department for Economics, Technology and Research:** *Energiepolitische Ziele und Aktivitäten des Senats – Zusammenfassung von Frau Senatorin Cornelia Yzer* (The Senate's energy policy goals and activities – A summary by Senator Cornelia Yzer); presentation as part of the hearing in the third meeting, held on 18 June 2014.

**Staiß, Prof.:** *Energiespeicherung* (Energy storage); presentation as part of the hearing in the 15th meeting, held on 25 March 2015.

**Stromnetz Berlin GmbH:** *Antworten der Stromnetz Berlin GmbH auf die Fragen im Verlauf der Anhörung der Enquete-Kommission ‚Neue Energie für Berlin‘ vom 2.7.2014* (Replies from Stromnetz Berlin GmbH to the questions raised during the hearing on 2 July 2014); written statement following the hearing in the fourth meeting, held on 2 July 2014.

**Stromnetz Berlin GmbH:** *Expertenbeitrag der Stromnetz Berlin GmbH im Rahmen der Anhörung der Enquete-Kommission „Neue Energie für Berlin“* (Expert contribution from Stromnetz Berlin GmbH during the Study Commission hearing); written statement on the hearing in the fourth meeting, held on 2 July 2014.

**Stromnetz Hamburg GmbH:** Presentation as part of the hearing in the 15th meeting, held on 25 March 2015.

**Strunz, Prof.:** *Systemintegration – Bedeutung für Berlin und die Energiewende* (System integration – what it means for Berlin and the energy transition); presentation as part of the hearing in the 15th meeting, held on 25 March 2015.

**Twele, Prof.:** Written statement on the hearing in the fifth meeting, held on 17 September 2014.

**Vattenfall Europe Mining AG:** Written statement on the fifth meeting, held on 17 September 2014.

**Vattenfall GmbH / Vattenfall Europe Wärme AG:** *Interdependenzen von Strom- und Wärmesektor* (Interdependencies between the electricity and heat sector); written statement on the ninth meeting, held on 26 November 2014.

**Vattenfall:** *Beantwortung der Fragen von Herrn Abg. Karsten (SPD)* (Reply to the questions from Member of the German Bundestag Mr Karsten, SPD); letter of 23 September 2015 to the Study Commission.

**Vattenfall GmbH:** Letter of 11 December 2014 to the Study Commission; written reply to questions from the members of the Commission.

**Vattenfall Wärme AG:** *Wirtschaftliche und technische Herausforderungen der Stromversorgung in Berlin* (Economic and technical challenges of Berlin's electricity supply); presentation as part of the hearing in the fifth meeting, held on 17 September 2014.

**Verband Berlin-Brandenburgischer Wohnungsunternehmen e.V.:** *„Neue Energie für Berlin“ – Thema „Wärme und Interdependenzen“* (New Energy for Berlin – on the topic of Heat and interdependencies); written statement as part of the hearing in the 14th meeting, held on 11 March 2015.

**Verband kommunaler Unternehmen e.V.:** Written statement as part of the hearing in the 18th meeting, held on 27 May 2015.

**Parliamentary Research Services of the Berlin House of Representatives:** *Gutachten zur gesetzlichen und vertraglichen Regulierung des Berliner Fernwärmenetzes auf Landesebene* (Expert opinion on the legal and contractual regulation of the Berlin district heating network at the state level); expert opinion on behalf of the President of the House of Representatives following a request from the Study Commission made on 6 March 2015.

**Zdrallek, Prof.:** Written statement as part of the hearing in the 15th meeting, held on 25 March 2015.

**V. Overview of hearings held**

<b>Name</b>	<b>Meeting</b>	<b>Topic</b>
Mr Simon (Berliner Wasserbetriebe)	2nd meeting, 4 June 2014	Berliner Stadtwerke
Mr Bruckmann (Berliner Wasserbetriebe)	2nd meeting, 4 June 2014	Berliner Stadtwerke
Mr Natz (Berliner Wasserbetriebe)	2nd meeting, 4 June 2014	Berliner Stadtwerke
Senator Müller (Sen. Dept. Urban Dev.)	2nd meeting, 4 June 2014	The Senate's energy policy goals and activities
Senator Yzer (Sen. Dept. Econ. Tech. Res.)	3rd meeting, 18 June 2014	The Senate's energy policy goals and activities
Senator Dr Nußbaum (Sen. Dept. Fin.)	3rd meeting, 18 June 2014	The Senate's energy policy goals and activities
Ms Neumann-Cosel (BürgerEnergie Berlin)	4th meeting, 2 July 2014	Economic and technical challenges of Berlin's electricity supply
Mr Gaßner (BürgerEnergie Berlin)	4th meeting, 2 July 2014	Economic and technical challenges of Berlin's electricity supply
Mr Neldner (Landesbetrieb Berlin Energie)	4th meeting, 2 July 2014	Economic and technical challenges of Berlin's electricity supply
Dr Schnauß (Vattenfall Europe Wärme)	4th meeting, 2 July 2014	Economic and technical challenges of Berlin's electricity supply
Dr Rendez (Stromnetz Berlin)	4th meeting, 2 July 2014	Economic and technical challenges of Berlin's electricity supply
Dr Landeck (Stromnetz Berlin)	4th meeting, 2 July 2014	Economic and technical challenges of Berlin's electricity supply

Name	Meeting	Topic
Prof. Hirschl (Institute for Ecological Economy Research)	5th meeting, 17 Sept. 2014	Economic and technical challenges of Berlin's electricity supply  Influence of the electricity generation and distribution systems situated around Berlin
Prof. Twele HTW Berlin University of Applied Sciences	5th meeting, 17 Sept. 2014	Influence of the electricity generation and distribution systems situated around Berlin
Mr Feix (50Hertz Transmission)	5th meeting, 17 Sept. 2014	Influence of the electricity generation and distribution systems situated around Berlin
Dr Enneper (Ministry for Economic Affairs and Energy of the state of Brandenburg)	5th meeting, 17 Sept. 2014	Influence of the electricity generation and distribution systems situated around Berlin
Mr Schirmer (Joint Spatial Planning Department Berlin- Brandenburg)	5th meeting, 17 Sept. 2014	Influence of the electricity generation and distribution systems situated around Berlin
Mr Geißler (Berliner Energieagentur)	6th meeting, 1 Oct. 2014	Economic and technical challenges of Berlin's heat supply
Mr Lange (BLS Energieplan)	6th meeting, 1 Oct. 2014	Economic and technical challenges of Berlin's heat supply
Mr Maaß Hamburg Institut Consulting (HIC) and Research (HIR)	8th meeting, 12 Nov. 2014	Interdependencies between the electricity and heat sector

Name	Meeting	Topic
Mr Hatakka (Vattenfall)	9th meeting, 26 Nov. 2014	Interdependencies between the electricity and heat sector
Herr Jung (Vattenfall)	9th meeting, 26 Nov. 2014	Interdependencies between the electricity and heat sector
Mr Sieberg (Nature And Biodiversity Conservation Union Germany)	14th meeting, 11 Mar. 2015	Heat and interdependencies
Mr Lemiss (Berliner Immobilien)	14th meeting, 11 Mar. 2015	Heat and interdependencies
Ms Wenk (Da.Vi.D. GmbH, Energiewirtschaftsstelle Berlin)	14th meeting, 11 Mar. 2015	Heat and interdependencies
Mr Diwald (German Hydrogen and Fuel Cell Association)	15th meeting, 25 Mar. 2015	Electricity and infrastructures
Mr Heine (Stromnetz Hamburg)	15th meeting, 25 Mar. 2015	Electricity and infrastructures
Prof. Strunz (Technische Universität Berlin)	15th meeting, 25 Mar. 2015	Electricity and infrastructures
Prof. Staiß (Centre for Solar Energy and Hydrogen Research Baden- Württemberg ZSW)	15th meeting, 25 Mar. 2015	Electricity and infrastructures
Mr Dinger (Alliander)	18th meeting, 27 May 2015	Institutions
Ms Richter (Institute of Advanced Sustainability Studies, Joint project “DEMOENERGY – The Transformation of the Energy System as the Engine for Democratic Innovations”)	18th meeting, 27 May 2015	Institutions

<b>Name</b>	<b>Meeting</b>	<b>Topic</b>
Ms Hoffmann-Kallen (Climate Protection Unit of the City of Hannover)	18th meeting, 27 May 2015	Institutions
Senator Dr Kollatz-Ahnen (Sen. Dept. Fin.)	18th meeting, 27 May 2015	Institutions