Towards Climate Neutrality in Berlin
or: how to make Berlin Paris-compliant

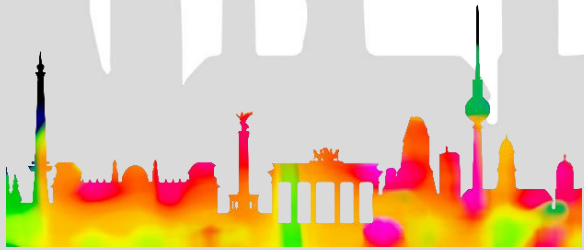
Prof. Dr. Bernd Hirschl

Institute for Ecological Economy Research
Institut für ökologische Wirtschaftsforschung IÖW, Berlin,

and
Brandenburg University of Technology Cottbus-Senftenberg (Lusatia)

Climate Advisory Council of Berlin (Chair)

Lead author of several energy and climate policy studies
for the city of Berlin



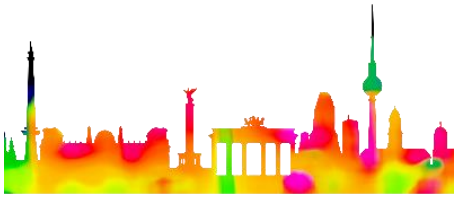
24th REFORM-Meeting 2020,
Raitenhaslach, 27.08.2020

i ö w
INSTITUT FÜR ÖKOLOGISCHE
WIRTSCHAFTSFORSCHUNG

Short CV of Bernd Hirschl
Prof. Dr. phil. Dipl-Ing-Oec.

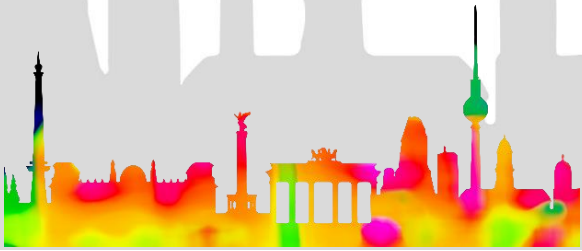
- **Institute for Ecological Economy Research**, Berlin, Germany (limited company, non-profit)
  Institut für ökologische Wirtschaftsforschung IÖW GmbH, gemeinnützig
  - Head of Department Sustainable Energy and Climate Protection
    - analysis, development and assessment of innovations, markets and political instruments and strategies in the fields of climate & energy
  - IÖW: Pioneer in sustainability research, founded in 1985, doing inter- and transdisciplinary research and political consulting in various fields of sustainable economy, non profit
    - see www.ioew.de
- **Brandenburg University of Technology Cottbus-Senftenberg** (Lusatia)
  - Head of department Management of Regional Energy Systems
    - see https://www.b-tu.de/fg-energieversorgungsstrukturen (only in German)
- **Actual functions (selection)**
  - Chair of the Climate Advisory Council of Berlin
  - Head of several strategic projects for & with the city of Berlin, i.a.
    - Ongoing: Feasibility-Study “How to make Berlin Paris-compliant”,
    - Ongoing: Development of a heating strategy for the City of Berlin
    - Ongoing: 2016-2021: Research-Project: Urban heat transformation – the case of Berlin
    - 2014-15: Development of the "Berlin Energy and Climate Protection Programme"
    - 2012-14: Feasibility Study "Climate Neutral Berlin 2050"
  - Active Member of the Initiative “Energy Systems of the Future” of the German Academies of Sciences

Outline



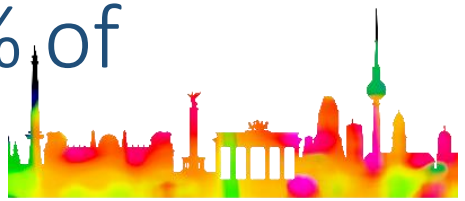
- Introduction: Cities count!
- Status quo in Berlin
  - Energy consumption and production
  - CO2 development and (current) targets
- Future Scenarios for Berlin
- Political strategy and instruments
- Climate neutrality reloaded (the Paris-update)
- Challenges and possible solutions
- Actual developments in Berlin

Introduction
Global CO_2-neutrality: Cities count!



i ö w
INSTITUT FÜR ÖKOLOGISCHE WIRTSCHAFTSFORSCHUNG

Cities already account for over 70% of anthropogenic greenhouse gases



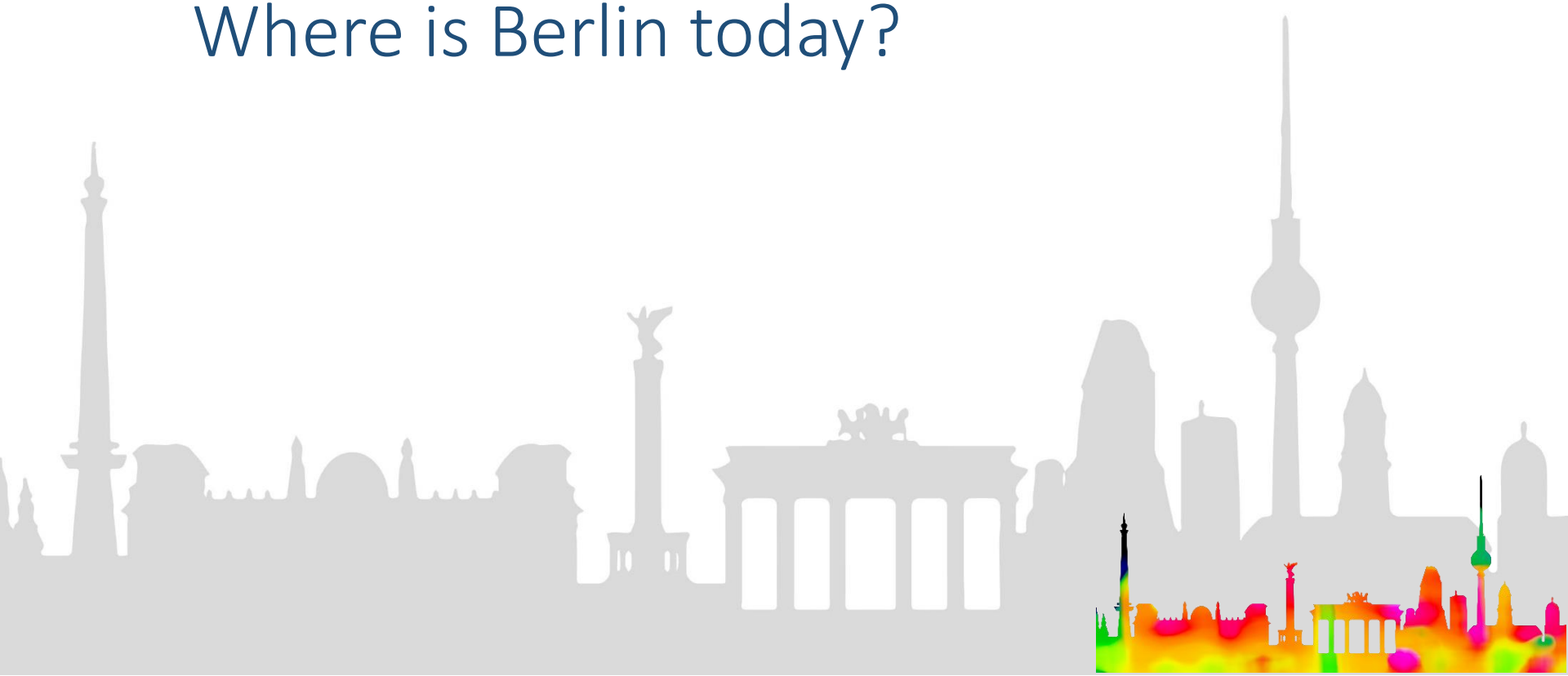
CO2-emissions (in millions of tons per year) selected cities and countries (2010)

City	CO_2-emissions
Tokyo	65,9
New York City	54,3
Moscow	44,6
London	43.4
Bangkok	42,7
Rotterdam	29,6
Paris	24,6
Berlin	**20,7**
Hamburg	16,9
Delhi	15,4
Warsaw	10,7
Amsterdam	5,0
Stockholm	2,9
Copenhagen	2,5
Potsdam	0,87
Eberswalde	0,23

Country	CO_2-emissions
Austria	66,9
Bangladesh	56,1
Bulgaria	44,7
Ireland	40.0
Switzerland	39,0
Angola	30,4
Tunisia	25,9
Croatia	**20,9**
Bolivia	15,5
Slovenia	15,3
Luxembourg	10,8
Paraguay	5,0
Mozambique	2,9
Bahamas	2,5
French-Polynesia	0,9
Central African Republic	0,26

Source: Reusswig et al. 2014, data based on CDP (2012) and UNFCCC (2015).

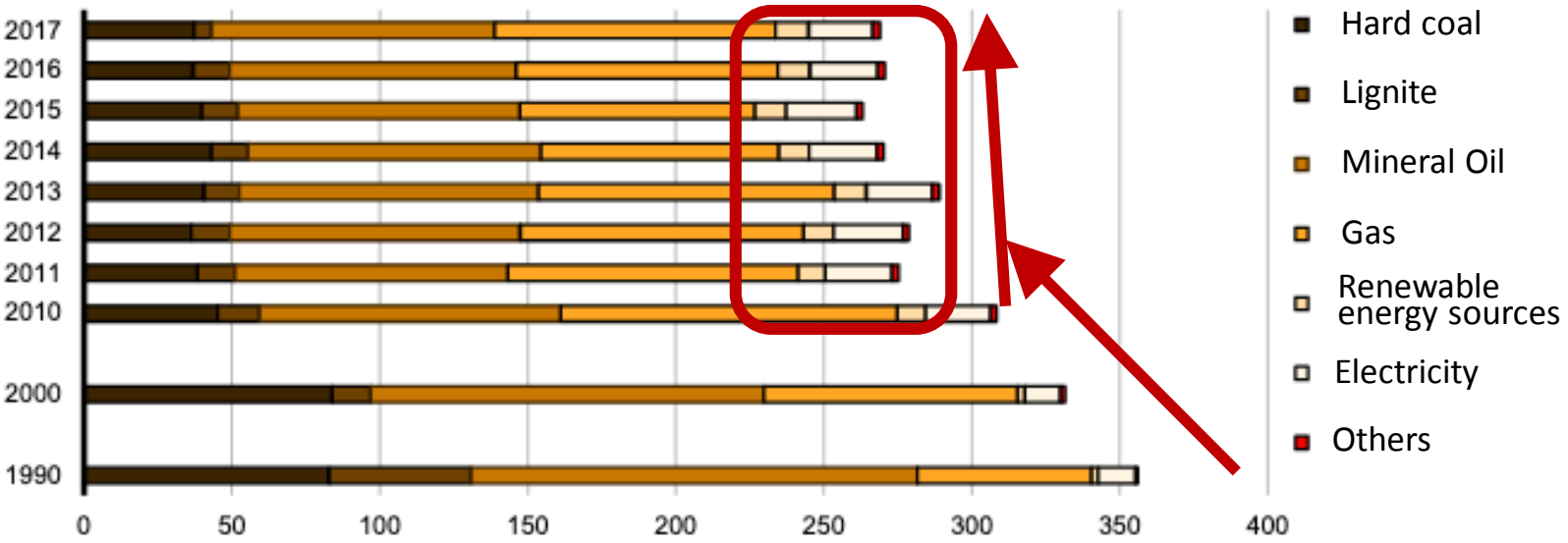
Status quo:
Where is Berlin today?



i|ö|w
INSTITUT FÜR ÖKOLOGISCHE
WIRTSCHAFTSFORSCHUNG

Primary energy consumption

Primary energy consumption by energy source in Berlin from 1990 to 2017 (in PJ)

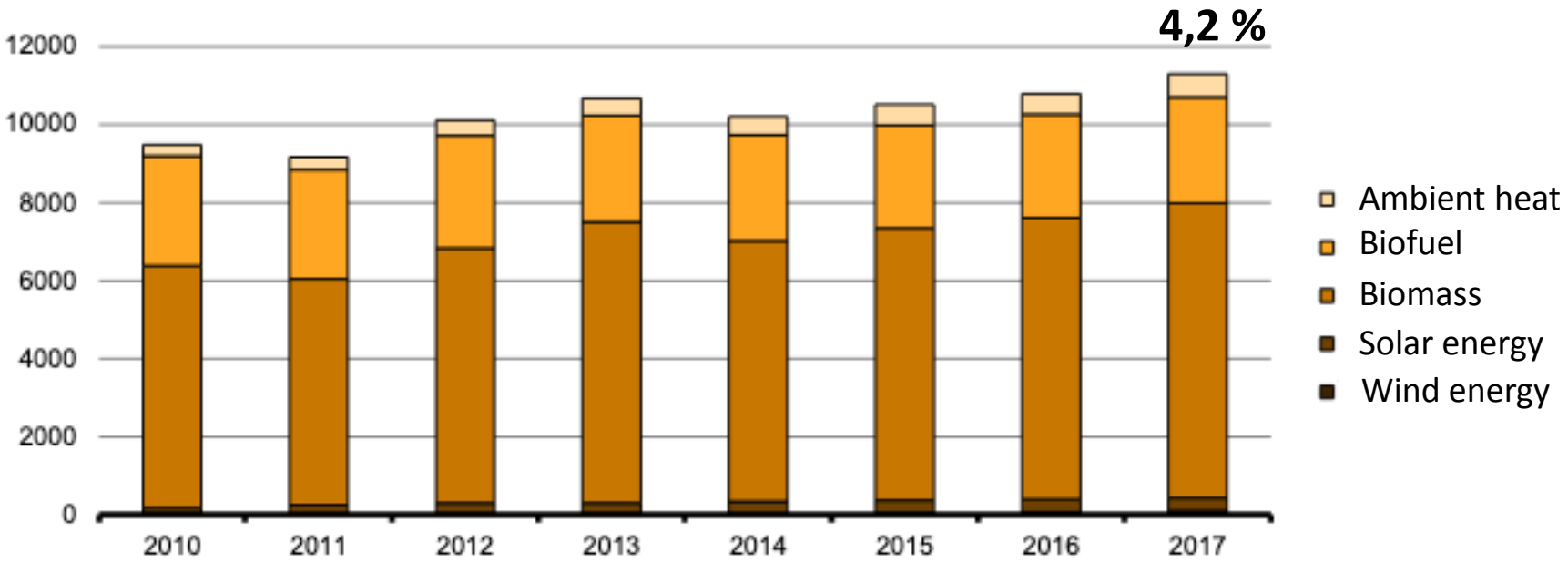


Source: Based on Statistical Office for Berlin-Brandenburg 2019: 12.

- decline from the 1990s: mainly caused by deindustrialisation, renovation of buildings and increase in efficiency of (fossil) power plants since the German reunification
- … has turned into stagnation in recent years due to weak climate policy in Germany and Berlin – and rising population and economic growth (GDP)

Primary energy consumption of renewable energies

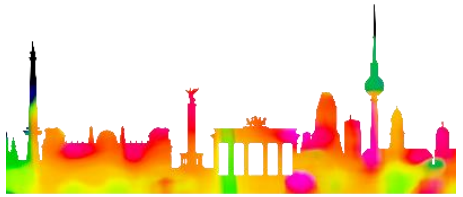
Primary energy consumption of renewable energies in Berlin from 2010-2017 (TJ)



Source: Based on Statistical Office for Berlin-Brandenburg 2019: 12.

- Endogenous Potential for renewable energies is much higher (Hirschl et al. 2015: about 60%) - but very likely lower than in comparison to cities such as Helsinki, Stockholm or Copenhagen

Low emission level (per capita) - high importance of buildings



- As a service sector region with little (energy-intensive) industry, Berlin has low per capita emissions

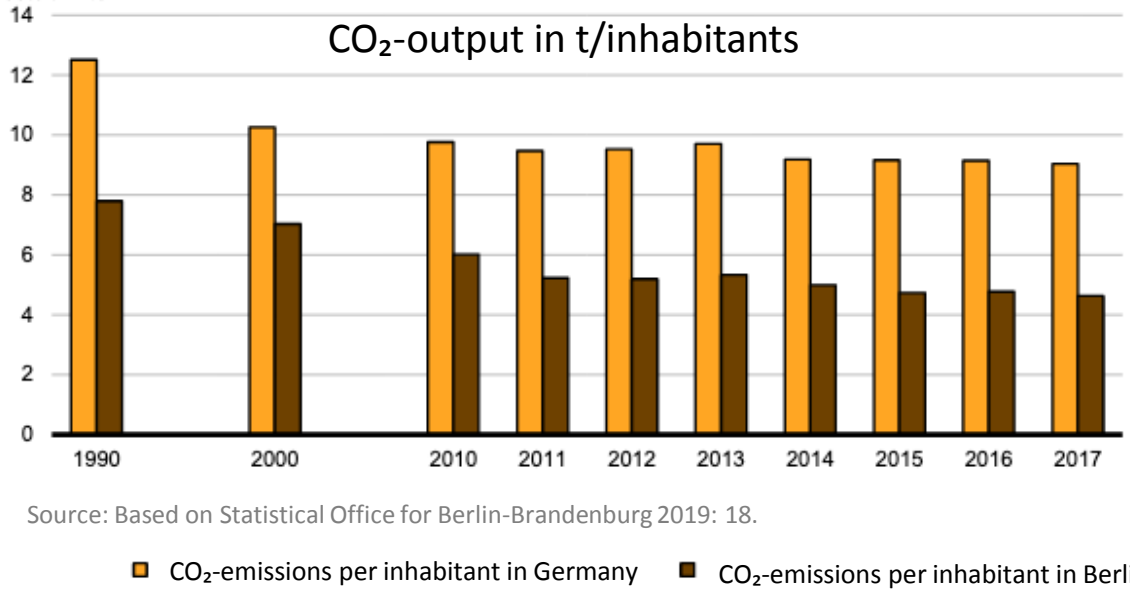
Main areas/sectors as share of final energy consumption (2012)

- 59% buildings
- 12% economy
- 5% households and consumption
- 25% traffic

Deviation from 100% due to rounding up or down

Source: Hirschl/Harnisch 2016: 5

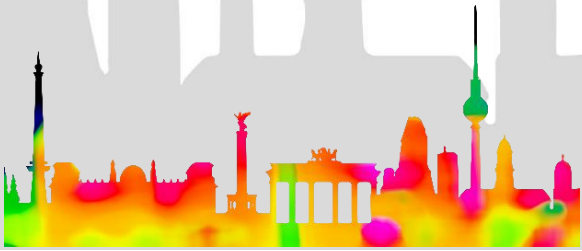
Development of per capita CO_2-emissions (production-based accounting)



Source: Based on Statistical Office for Berlin-Brandenburg 2019: 18.

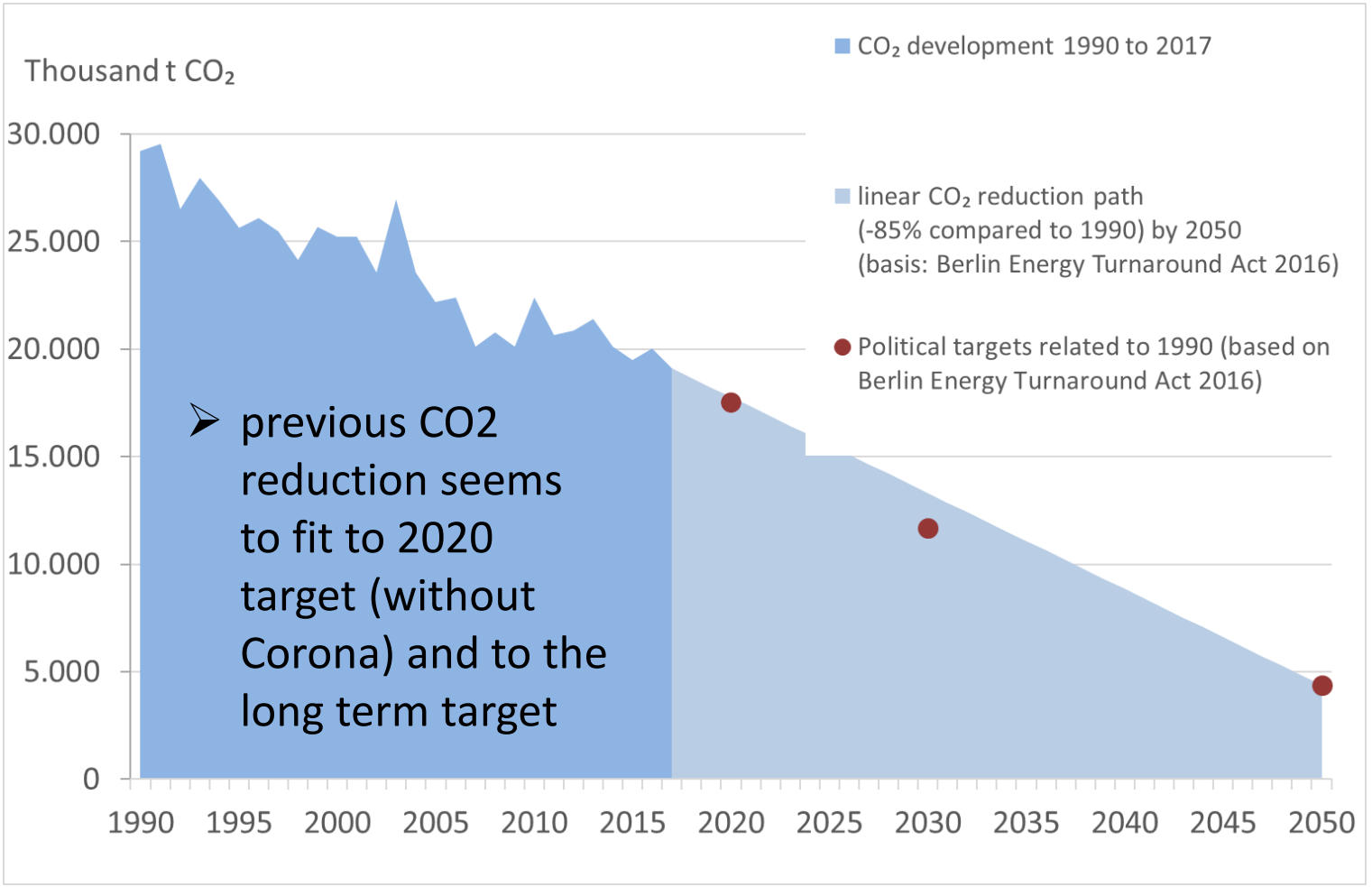
- Note: another accounting method (e.g. CO2-footprint) would show higher CO2-emissions …

From the past to the future – CO_2-development and targets



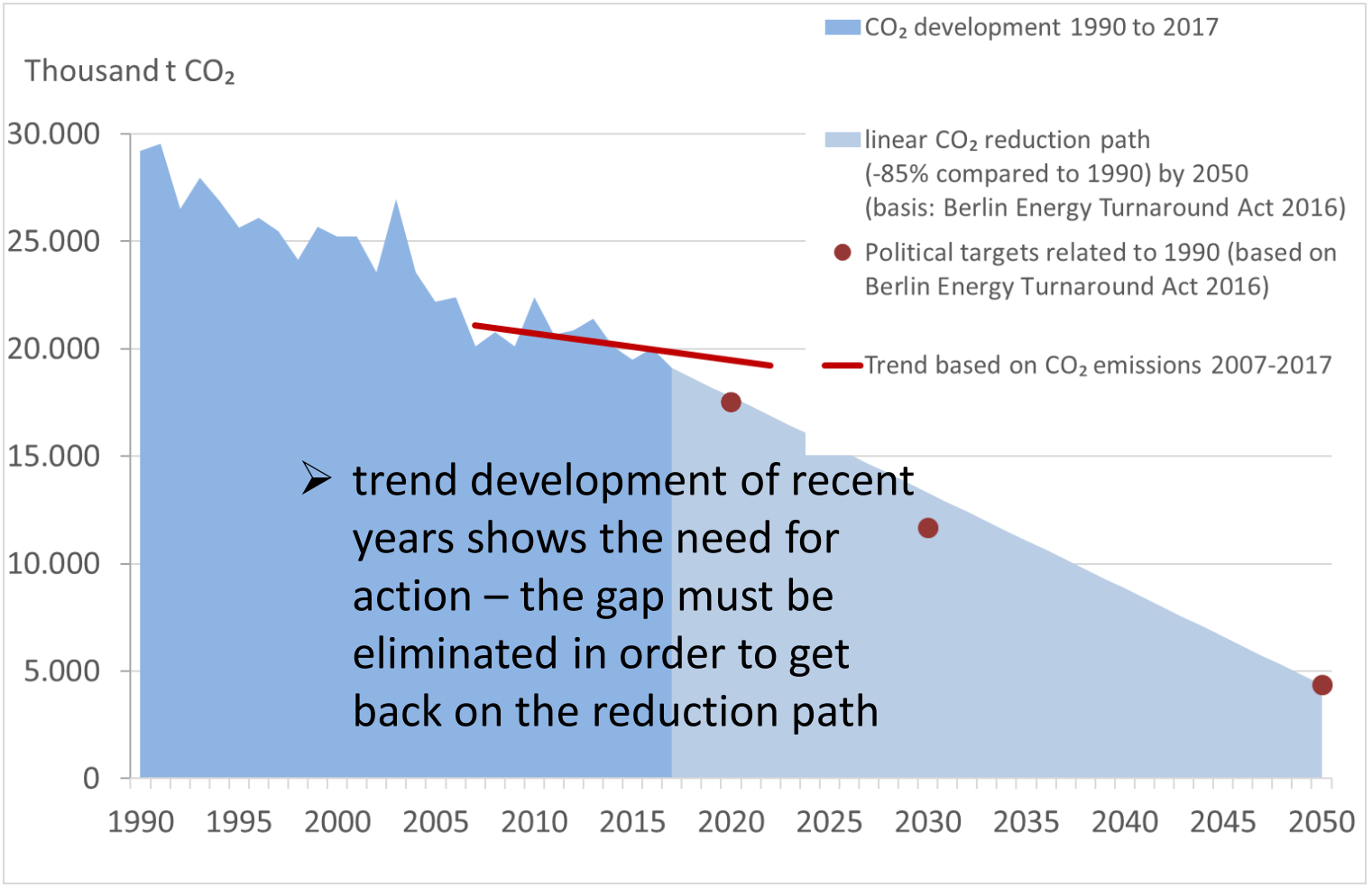
i ö w
INSTITUT FÜR ÖKOLOGISCHE WIRTSCHAFTSFORSCHUNG

Previous CO_2-development and current political targets



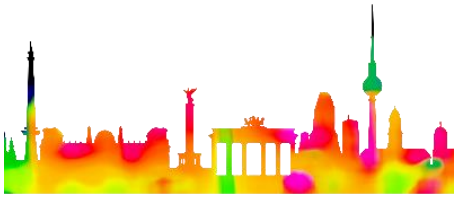
Source: Own graph, data based on Statistical Office for Berlin-Brandenburg (consumption-based accounting).

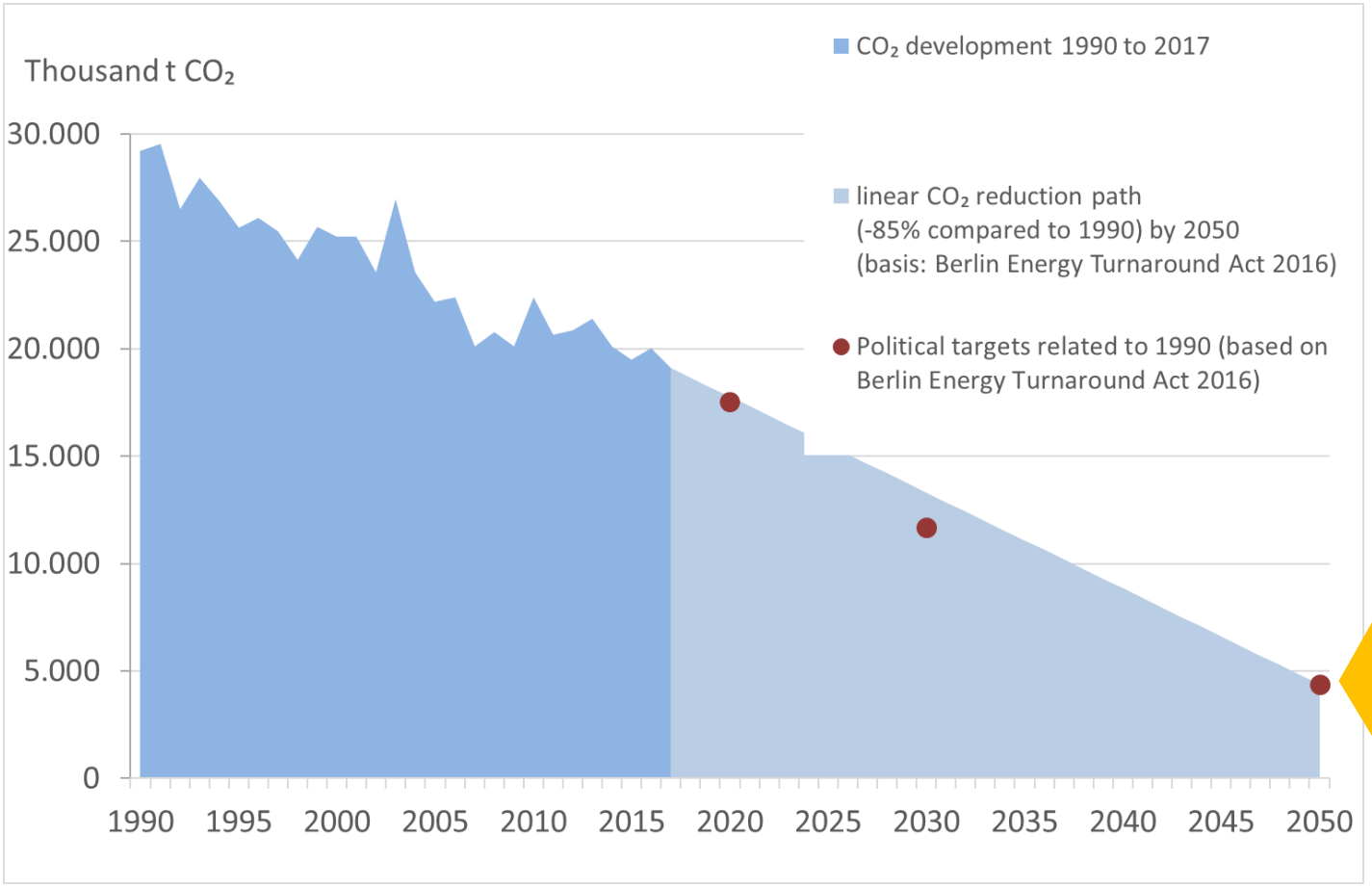
Previous CO_2-development, trend and political targets



Source: Own graph, data based on Statistical Office for Berlin-Brandenburg (consumption-based accounting).

Previous CO_2-development and current political targets



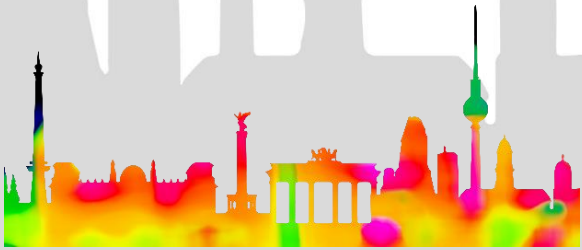


Current 2050-target:
4,4 Mill. t CO2 = -85% (comp. to 1990)

derived from a 2°-CO2-budget (max. 2 t CO2 per capita) [WBGU 2009]

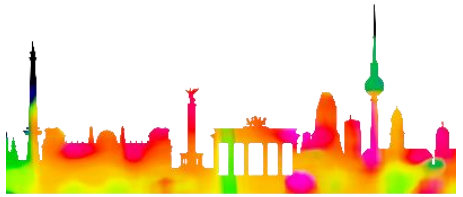
Source: Own graph, data based on Statistical Office for Berlin-Brandenburg (consumption-based accounting).

Scenarios
(developed 2015, before Paris)

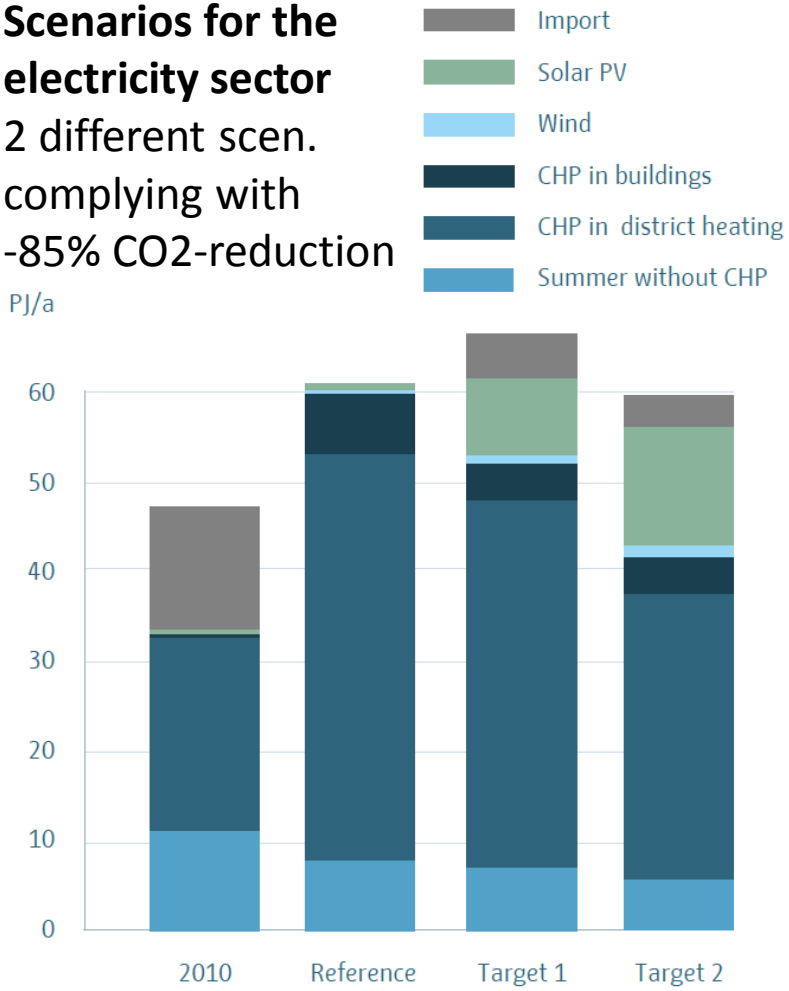


INSTITUT FÜR ÖKOLOGISCHE WIRTSCHAFTSFORSCHUNG

How to reach -85% CO_2-emission reduction targets in Berlin



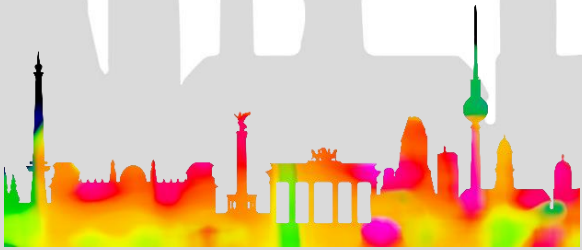
Scenarios for the electricity sector
2 different scen. complying with -85% CO2-reduction



Source: Reusswig et al. 2014.

- Solar-potential: up to 25% of electricity
- Combined heat & power plants (CHP)
  - in the future only gas – first natural, then green gas – no more coal
  - (flexible) back-up-technology for the stability of the electricity system
  - in cities with higher heat demand (district heating)
- Massive reduction of oil usage
  - in transport sector up to 20%
  - in buildings sector up to zero
- Heating transition
  - Building renovation and massive change to heat pump systems, usage of PtX

Political strategy and instruments



INSTITUT FÜR ÖKOLOGISCHE WIRTSCHAFTSFORSCHUNG

Political strategy and instruments in Berlin – an overview

- The city of **Berlin** is a **federal state** (one of 16) of Germany
- In **2011**, the first **"climate neutrality target"** was already determined by federal government of Berlin consisting out of **Social Democrats** and **Conservatives**
- **Since 2016** the government consist of **Social Democrats, the Greens and the Left**
  - adopted the Energy Turnaround Act (EWG) and
  - the Energy and Climate Protection Programme (BEK)
  - is currently planning to tighten the rules
- Up to now: **mainly "soft law"** like promotion & incentives, hardly "hard law" like obligations

Instruments for promoting climate protection

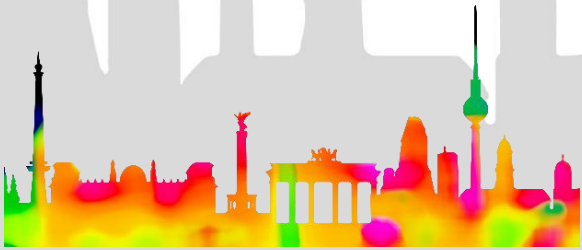
Source: Hirschl/Harnisch 2016: 8

Energy and Climate Policy in Berlin – main elements

- 2016: The **Energy Turnaround Act** defines a legally binding framework for climate protection with a focus on public authorities to serve as a role model and the announcement of a programme, no sectoral targets
  - Current long-term target: -85% reduction of CO_2-emissions in 2050
  - update to -95% is within the political debate, also sectoral goals
- 2018: The **Berlin Energy and Climate Programme 2030** defines about 100 measures to bring carbon emission reduction on track
  - constantly monitored
  - not all measures are currently implemented
- 2019: **coal (based power and heat generation) phase-out by 2030**
  - As agreed with the main company (Vattenfall), phase-out to be integrated within the E T Act (in Germany: coal phase-out by 2038)
- 2019: "**Masterplan Solarcity Berlin**"
  - bundle of measures to increase the implementation of solar technologies
- 2019: Proclamation of **Climate Emergency in Berlin** (as first federal state in Germany)
  - Additional measures besides the existing Programme in the political debate for 2020/21

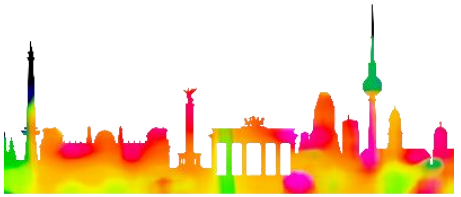
Source: Senate Department for the Environment, Transport and Climate Protection n.d..a

Climate Neutrality reloaded
- new targets
- new challenges and possible solutions



INSTITUT FÜR ÖKOLOGISCHE WIRTSCHAFTSFORSCHUNG

Paris Agreement implies increased targets

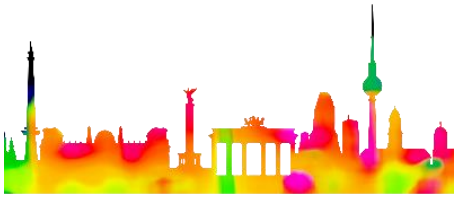


- **Central aim** of Paris Agreement

  *"is to strengthen the global response to the threat of climate change by keeping a **global temperature rise** this century **well below 2 degrees Celsius** above pre-industrial levels and to pursue efforts to limit the temperature increase even further **to 1.5 degrees** Celsius"* (UN 2015)

- **IPCC special report** "Global warming of 1.5°C" (2018) identifies a new range of CO_2-bugets left to reach climate neutrality (greenhouse gas neutrality)
- But: Currently, no method has yet been established for an equitable distribution of globally permitted emissions across nation states, regions, cities, municipalities, sectors etc.
  - Different approaches: with/without consideration of historical emissions or emission reductions, emissions per capita, …

Paris Agreement implies increased targets



- **Possible CO_2-budget ranges for Berlin**
  - from **approx. 100 Mt CO_2** ..... up to **300Mt CO_2**

calculation based on	calculation based on
1.5 degree	1.75 degree
(50% probability)	(67% probability)
current emission levels	population

- Following the current political target or the associated reduction path, Berlin will not be able to achieve either the 1.5 degree or the 1.75 degree target – regardless of the calculation method

➢ Berlin has to increase its efforts to reduce greenhouse gas emissions – starting from today and reaching net zero earlier than calculated

➢ How can that be achieved?

Source: Own calculation based on IPCC 2018 and German Advisory Council on the Environment (SRU) 2020.

Challenges and possible solutions (selection)

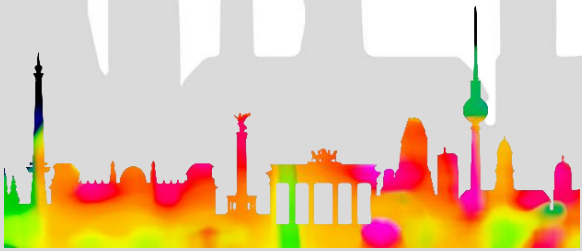
- **Stagnation of the building renovation rate – massive increase is needed**
  - target conflict with social dimension: actual Berlin law to limit rental increases („Berliner Mietendeckel”), cost allocation and acceptability problems have to be addressed
  - ➢ Solution approach: Obligations for (energy-related) renovations AND at the same time attractive support programmes
- **Solar energy: from insufficient to dynamic expansion**
  - ➢ Solution approach: Reduce approval obstacles; enforce the pioneer role of the public sector; solar systems obligatory at least for new buildings and non-residential buildings; consulting and communication offensive, promote innovative integrated solutions (e.g. solar roof tiles)
- **Heat Pumps for the heating transition: use more geothermal energy sources**
  - ... as they are (much) more efficient as air source heat pumps
  - But: in Berlin conflicts with drinking water protection (entirely obtained from groundwater)
  - ➢ Solution approach: Pilot projects and diffusion strategies for all relevant applications: Heat from waste water and river water, ground water usage for closed/open systems etc.

Challenges and possible solutions (selection)

- **E-Mobility, public transport and cycle traffic**
  - Development of E-fueling-station- or hub-concepts
  - shifting urban space from car based to pedestrians, cyclists and public transport
  - …
- **Consulting, training and education offensive** in all areas
- …
- …
- Dealing with
  - **compensation measures**
    - in regional surroundings / metropolitan area, also (inter)national
  - and **carbon dioxide removal (CDR) technologies**
    - to reach netto negative emission balance

… seems to be necessary to reach greenhouse gas neutrality in large cities

Climate Neutrality reloaded - current (political) developments in Berlin



INSTITUT FÜR ÖKOLOGISCHE WIRTSCHAFTSFORSCHUNG

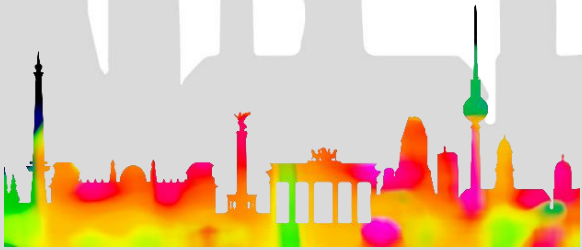
Recent developments

- Amendment of energy turnanround act and new climate related political measures in political process (2021)
  - IÖW leads consulting study
- Development of a heat strategy for Berlin (2021)
  - IÖW leads consulting study
- Berlin civil society
  - Still a lot of active movements pro climate policy
  - Foundation of a new one-topic political party for the climate
  - Preparation of referendum for a citizens climate council
- New European and national legislation (from Green Deal to national climate protection law and measures)
  - Could improve the situation for climate protection in general – but impact on cities is yet unclear
- Corona: (no) showstopper for climate protection?

Thank you for your attention!

Bernd Hirschl

Institute for Ecological Economy Research, Berlin
and
Brandenburg University of Technology Cottbus-Senftenberg



| i | ö | w
INSTITUT FÜR ÖKOLOGISCHE
WIRTSCHAFTSFORSCHUNG

Literature

Amt für Statistik Berlin-Brandenburg (2019): Statistischer Bericht E IV 4 – j / 17. Energie- und CO_2-Bilanz in Berlin 2017. Available at: https://www.statistik-berlin-brandenburg.de/publikationen/stat_berichte/2019/SB_E04-04-00_2017j01_BE.pdf (accessed on 15 August 2020).

CDP (Carbon Disclosure Project) (2012): Measurement for Management. CDP Cities 2012. Global Project. London. Available at: https://www.c40.org/researches/cdp-c40-2012-global-report (accessed at 20 August 2020).

German Advisory Council on the Environment (2020): Using the CO_2 budget to meet the Paris climate targets. Environmental Report 2020, Chapter 2. Available at: https://www.umweltrat.de/SharedDocs/Downloads/EN/01_Environmental_Reports/2020_08_environmental_report_chapter_02.pdf?__blob=publicationFile&v=5 (accessed on 17 August 2020).

Hirschl, B./Harnisch, R. (2016): Climate-Neutral Berlin 2050. Recommendations for a Berlin Energy and Climate Protection Programme (BEK). Available at: https://www.berlin.de/sen/uvk/_assets/klimaschutz/publikationen/broschuere_bek_en.pdf (accessed on 15 August 2020).

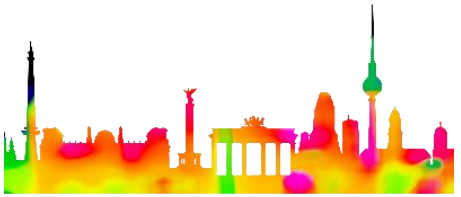
IPCC (2018): Global Warming f 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Available at: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf (accessed at 20 August 2020).

Reusswig, F./Hirschl, B./Lass, W./Becker, C./Bölling, L./Clausen, W./Haag, L./Hamann, H./Heiduk, P./Hendzlik,M./Henze, A./Hollandt,F./Hunsicker, F./Lange, C./ Meyer-Ohlendorf, L./Neumann, A./Rupp, J./Schiefelbein, S./Schwarz, U./Weyer, G./Wieler, U. (2014): Machbarkeitsstudie Klimaneutrales Berlin 2050, Berlin. Available at: http://www.berlin.de/sen/uvk/_assets/klimaschutz/klimachutz-in-der-umsetzung/das-berliner-energie-und-klimschutzprogramm-bek/machbarkeitsstudie_berlin2050_hauptbericht.pdf (accessed on 15 August 2020).

Senatsverwaltung für Umwelt, Verkehr und Klimaschutz (2017): Erstes Gesetz zur Änderung des Berliner Energiewendegesetzes, in: Gesetz- und Verordnungsblatt für Berlin, 73.Jahrgang Nr.29. Available at: https://www.berlin.de/sen/justiz/service/gesetze-und-verordnungen/2017/ausgabe-nr-29-vom-7-11-2017-s-541-556.pdf (accessed on 15 August 2020).

Senate Department for the Environment, Transport and Climate Protection (2019): BEK 2030. Berlin Energy and Climate Protection Programme 2030. Available at: https://www.berlin.de/sen/uvk/_assets/klimaschutz/publikationen/bek2030_broschuere_en.pdf (accessed on 15 August 2020).

Literature



Senate Department for the Environment, Transport and Climate Protection (2019): Monitoringbericht zur Umsetzung des Berliner Energie- und Klimaschutzprogramms (BEK 2030). Berichtsjahr 2019. Available at: https://www.berlin.de/sen/uvk/_assets/klimaschutz/klimaschutz-in-der-umsetzung/das-berliner-energie-und-klimaschutzprogramm-bek/bek_monitoringbericht_2019.pdf (accessed on 15 August 2020).

Senate Department for the Environment, Transport and Climate Protection (n.d a): Climate-Neutral Berlin 2050. Available at: https://www.berlin.de/sen/uvk/en/climate-protection/climate-neutral-berlin-2050/ (accessed at 15 August 2020).

Senate Department for the Environment, Transport and Climate Protection (n.d. b): Berlin´s phase-out of coal. Available at: https://www.berlin.de/sen/uvk/en/climate-protection/berlin-s-phase-out-of-coal/ (Available at 15 August 2020).

Senate Department for the Environment, Transport and Climate Protection (n.d. c): Climate Emergency in Berlin. Available at: https://www.berlin.de/sen/uvk/en/climate-protection/climate-emergency-in-berlin/ (accessed at 15 August 2020).

Senate Department for Economics, Energy and Public Enterprises (n.d.): Masterplan Solarcity. Available at: https://www.berlin.de/sen/energie/energie/erneuerbare-energien/masterplan-solarcity/ (accessed at 15 August 2020).

United Nations Framework Convention on Climate Change (2015): Paris Agreement. Available at: https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf (accessed at 17 August 2020).