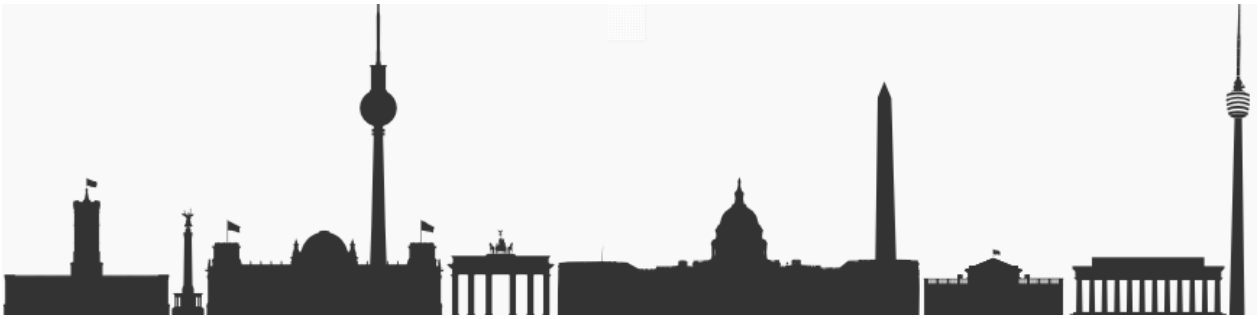
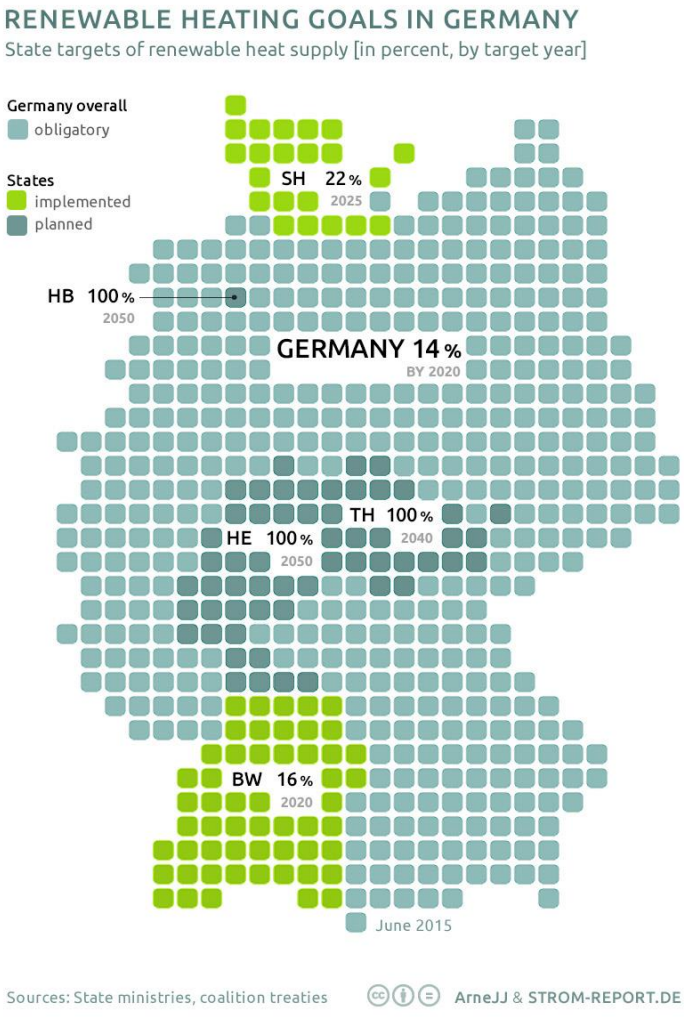


Sticks and Carrots:
Germany's Approach to Renewable Heating

A snapshot overview by Arne Jungjohann & Natascha Spörle



About the Authors:

Arne Jungjohann is a political scientist, energy analyst, and editor for the Energiewende's central Twitter platform @EnergiewendeGER. He lives in Stuttgart, Germany.

Natascha Spörle studied Sustainable Development and European Studies in Germany and the Netherlands. Currently living in Berlin, her interests cover issues of environmental governance and governance of natural resources.

The authors would like to thank Alexander Franke for comments.

Published by Arne Jungjohann
Stuttgart, Berlin, June 2015

Authors: Arne Jungjohann, Natascha Spörle
Layout: Natascha Spörle
Cover image: STROM-REPORT (www.strom-report.de)

Contact:
Arne Jungjohann
Strohberg 38
70180 Stuttgart
Germany
Phone: 0049-711-93596255
Email: JJ@arnejungjohann.de
Twitter: @arnejungjohann
www.arnejungjohann.de/en/

Sticks and carrots: Germany's approach to renewable heating

Germany's *Energiewende* and its achievements have been widely discussed over the last years. The focus of these discussions often lies on the phase-out of nuclear power and the shift to renewables in the power sector. Indeed, Germany has successfully increased the share of electricity generated from renewable sources from 6 percent in 2000 to almost 28 percent in 2014. This comparably aggressive deployment drove down soft and hardware costs, especially of photovoltaics and wind power. Under current estimates the government is on track to reach its target of 40 to 45 percent renewables in gross electricity consumption by 2025. Beyond that the Renewable Energy Sources Act (EEG, 2014) sets further targets of 55 to 60 percent by 2035, and at least 80 percent by 2050.

However, the *Energiewende* and its goals expand beyond the power sector. To reach its economy-wide climate targets (in comparison to 1990: minus 40 percent greenhouse gas emissions by 2020, and at least minus 80 percent by 2050), the government aims to cut energy use and also to increase renewables in the heat and transport sector. By 2020, renewables should provide 14 percent to the heat supply. In 2014, however, a modest 9.9 percent of heat stemmed from renewable sources in Germany. This figure has not changed much over the last years. In comparison to the recent success in electricity generation, the heating sector lags behind in renewables deployment (see Figure 1).

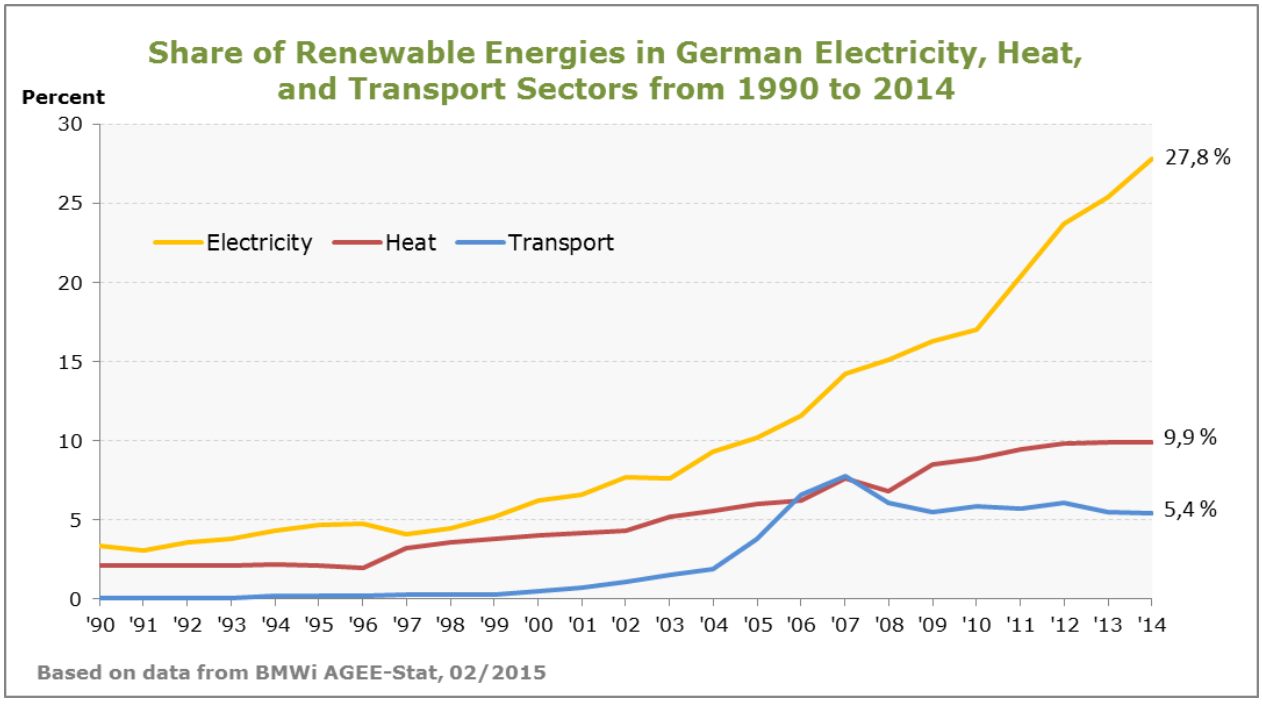


Figure 1: Share of renewables in German energy market (Source: own figure based on AGEE-Stat, 2015)

Like many other countries, Germany uses more energy for heating needs than for electricity generation. In 2013 the heat sector accounted for 56 percent of Germany's total energy consumption (BMWi, 2015a), and for around 45 percent of energy-related greenhouse gases (PWC, 2015). The greatest potential to reduce heat demand is wide refurbishment of the existing building stock. Substituting dominantly imported fossil fuels with renewable heating sources – and in particular, the switch to domestic renewables – will increase energy security and lower greenhouse gas emissions. In summary, the heat sector is a sleeping giant in terms of deploying technologies, tapping cost reduction potentials of renewable sources, and reducing greenhouse gas emissions.

So if the heat sector is highly relevant for reaching the climate target because of its emission reduction potentials, why was Germany so far not able to expand renewables aggressively in the heat sector, especially in comparison to the success of the power sector? Why did the deployment of renewable heating technologies stagnate over the past five years? What are the obstacles that need to be overcome?

One answer to these questions can certainly be delivered by the legislative framework. Therefore, this paper reviews Germany's renewable heating policies. For lack of space we deliberately choose not to address efficiency policies while recognizing that these will have to play a prominent role to reduce energy consumption and emissions of the heat sector. We first provide an overview of the national policy framework; second, we present examples of regional approaches by two German *Länder* (states); and third, the paper places Germany's policy framework into the EU context. Based on reviewing these three governance levels we draw conclusions and provide an outlook on the perspectives of Germany's renewable heating sector.

Germany's renewable heating market

In 2014, an equivalent of 130.9 billion kWh of heat consumption was generated from renewable sources. The most important single source for renewable heating in Germany is biomass (86 percent), followed by geo-thermal (8 percent), and solar thermal (5 percent) (BMWi, 2015b). Within biomass solid fuels such as waste wood, sludge, and wood are the most relevant (Figure 2, dark green).

Germany's wood pellet market of around 2.4 million tons per year is used solely for heating purposes. Pellets are supplied through domestic production. Other EU member states, such as the United Kingdom, Belgium, and the Netherlands are using wood pellets to a larger extent for co-firing in thermal power plants and import most pellets from the United States and other countries (Morris, 2015).

In the early 2000s, a steady growth of the renewable heat sector can be observed. From 2000 to 2007, the generation of renewable heat increased by 74 percent. This

increase was largely the result of a higher deployment of renewable heating installations, driven by the government's market incentive program (see p. 6). Since 2010, however, growth slowed down considerably and has basically flattened over the past years.

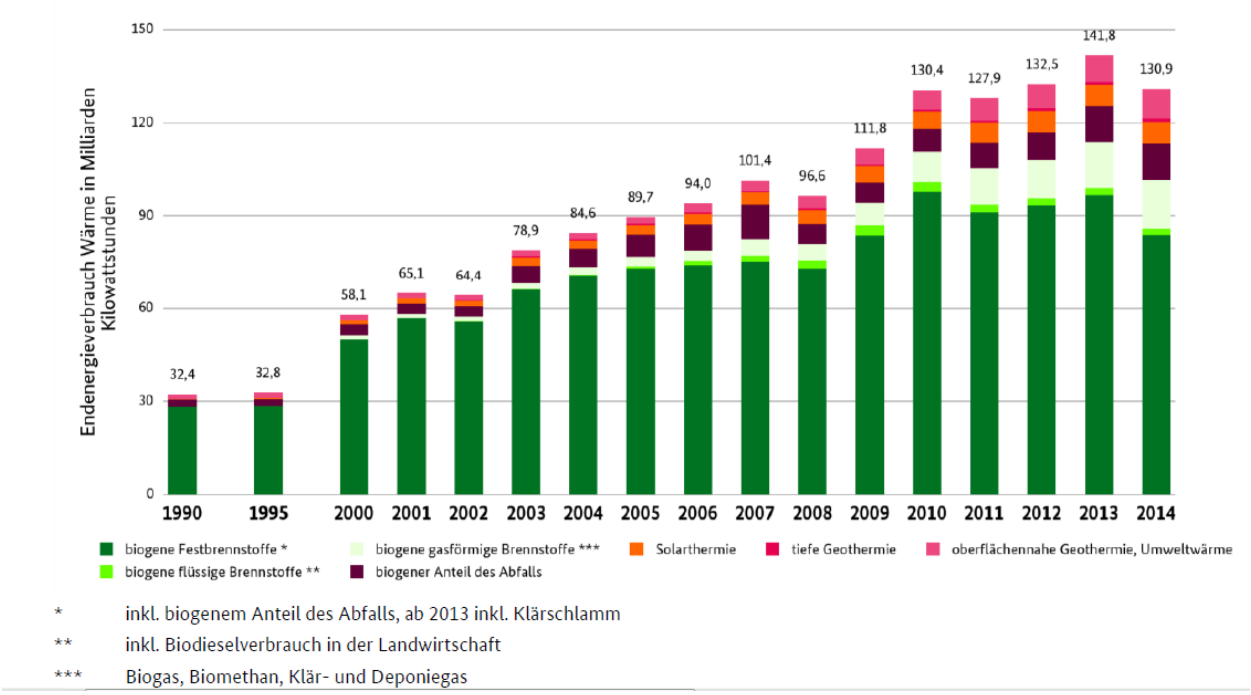


Figure 2: Development of heat consumption from renewable sources in Germany (Source: BMWi, 2015b)

Similarly, the German solar thermal sector has been stagnating. Even though it is still the biggest in Europe, it encountered setbacks in 2013. With only 1 Mio m² of new installations, the market has slipped back to 2005 levels and has more than halved since the record year of 2008 (see Figure 3 below). By 2013, the total area covered roughly 11.9 GWth (17.5 Mio m²). The drop in installations since 2011 reveals that the sector is facing difficulties.

While we are focusing on the legislative framework to explain the problems in the renewable heating sector, there are also well accepted structural hurdles. Germany, with a relatively big rental sector (iner, 2015), faces a typical user-investor dilemma in the existing building stock. House owners have to invest in renewable heating technologies but renters directly benefit. This is a structural challenge for the heating sector in comparison to the electricity sector. However, it delivers no adequate explanation to the described stagnation in the heating sector over the past five years. The next sections therefore focus on relevant policy on federal, state, and EU level to investigate the legislative context.

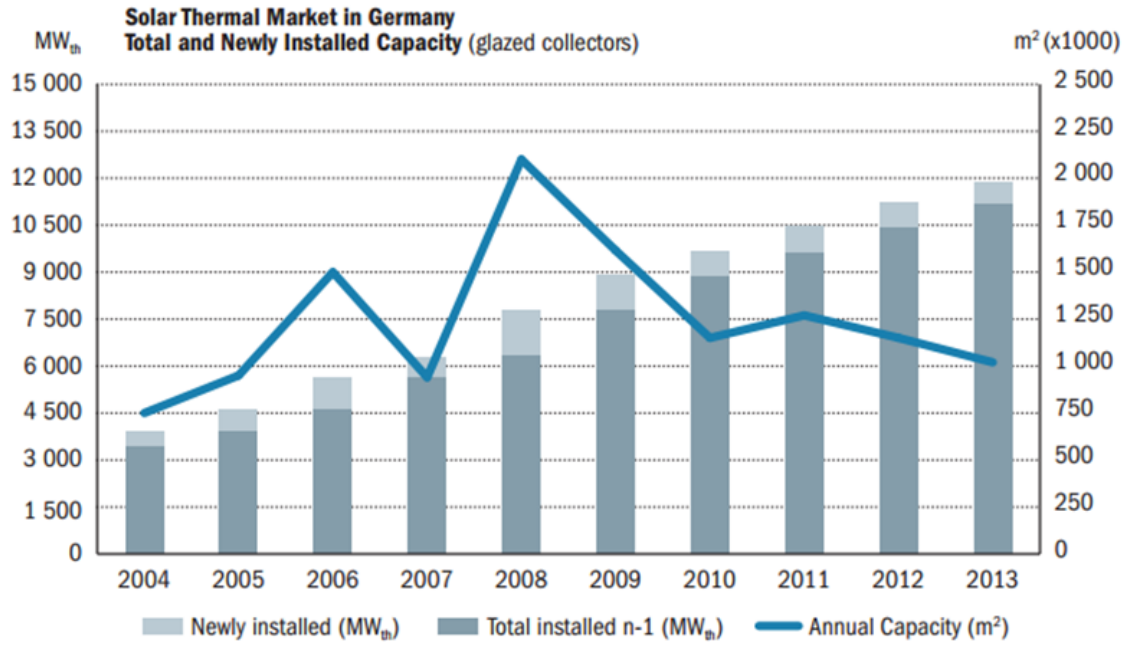


Figure 3: Solar thermal market in Germany (Source: ESTIF, 2014)

Federal policy framework for renewable heating

To increase the share of renewable heating in Germany, there are a number of initiatives on multiple levels in place. Critics argue that despite these efforts, Germany lacks a comprehensive long-term oriented heating policy (HIR, 2015). Nevertheless, two policies on federal level can be considered crucial. While the Market Incentive Program supports the installation of renewables in the existing building stock, the Renewable Energy Heating Law addresses the use of renewables in newly constructed buildings. Together they are the 'sticks and carrots' of Germany's renewable heating approach:

- In 1999, the **Market Incentive Program** (*Markt-Anreiz-Programm*, MAP) was launched to facilitate investments in renewable heating. It is based on two pillars: First, it encourages homeowners and small businesses to invest in renewable heating sources like solar-thermal, geo-thermal, or wood-chip heating technologies by issuing a grant. Second, it provides low-interest loans through the German Development Bank (KfW), particularly for big commercial actors who might invest in process heating systems, power-and-heat generation based on biomass, or local district heating (BMWi, 2015c). In contrast to the later introduced renewable heat law, the MAP is directed at the existing building stock. Until around 2005, the program successfully triggered new investments in the sector (see figure 2 above). Starting in 2006, however, the program suffered from substantial funding cuts which undermined investor certainty (see Figure 4 below).

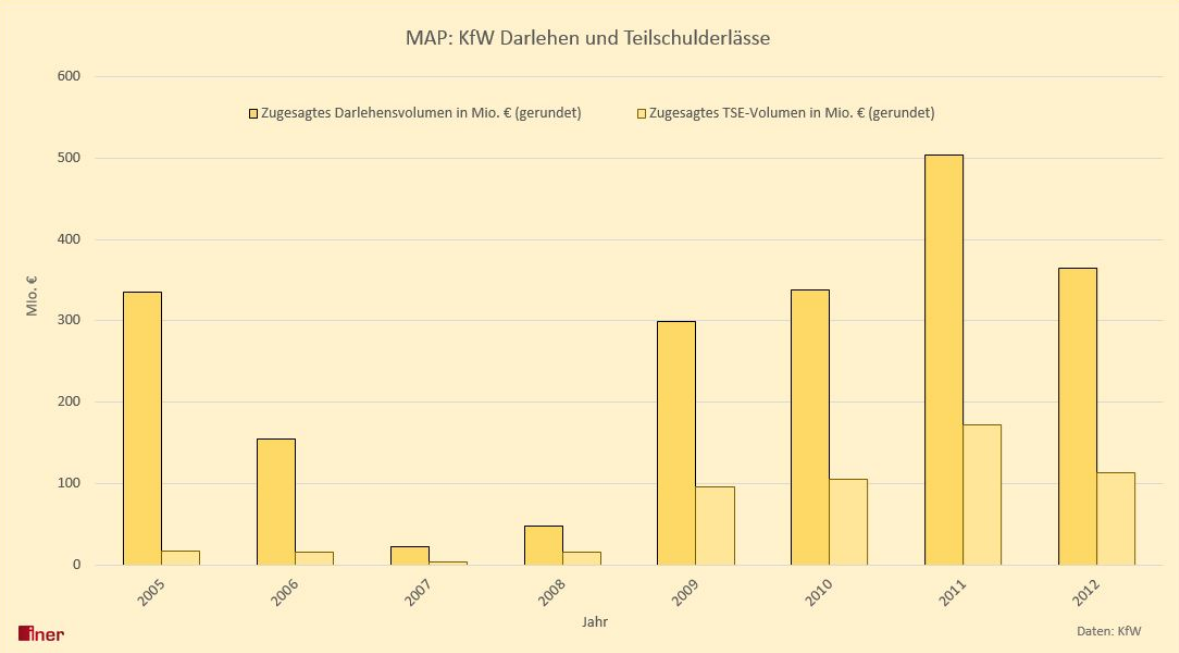


Figure 4: Funding through KfW loans (dark yellow) and partial remissions of debts (light yellow) (Source: iner, 2014)

Furthermore, the guidelines which technology could be funded and by how much changed very often – 13 times over the last 16 years. From 1999 to 2006, a total of 512 million Euro were granted through the MAP. In 2007 and 2008, however, the program basically collapsed. In 2009, coinciding with the introduction of the EEWärmeG (see below), the MAP was announced to be considerably extended; and thus, the program was revitalized despite the fact that funds were temporarily blocked in 2010 because of the financial crisis (iner, 2014).

Overall, the program and concomitantly the sector suffered from uncertainties in the mid-2000s. The newly revised MAP (BMWi, 2015c) is supposed to deliver higher certainty. It came into force on 1 April 2015, includes higher support levels for individual technologies, and has an annual volume of 300 million Euros. The German Solar Association expects substantial incentives for new solar thermal investments (BSW, 2015). Despite the improved conditions, the government's own *Energiewende* monitoring commission recommends to move towards a more comprehensive approach to renewable heating which relies less on financial support through the federal budget (Expertenkommission, 2014).

- In 2009, the **Renewable Energy Heating Act** (EEWärmeG, 2011) came into force. It was one of 14 legislative measures of the *Integrated Energy and Climate Programme* which was initiated by the federal government in 2007 (BMU, 2007). For the first time it specified a national target of a 14 percent

share of renewable heat by 2020, as well as the obligation to use renewable heating and cooling for all newly constructed buildings that exceed 50 m². The revision of the legislation in 2011 explicitly reiterated this obligation for public buildings, hinting at the responsibility of the public sector to serve as a role model.

The EEWärmeG, however, does not require a 100 percent share of renewable heating but introduces quota for different technologies based on investment and fuel costs. For instance, solar-thermal technologies have to provide at least 15 percent of the demanded heat, while biomass or geo-thermal appliances have to cover 50 percent of the required heat in the building. The use of waste heat, combined heat and power, district heating, or improved energy efficiency may serve as compensating measures instead.

In addition to deployment incentives, the federal government supports research on renewable heating technologies. In 2014, 42 million Euros were made available for research in renewable heating and cooling technologies (see table 1 below). This is around 5 percent of the total federal energy research budget of 819 million Euros. Deep geothermics and solarthermics receive by far the greatest amount of funds. In particular deep geothermics is seen as a crucial technology to deliver a continuous flow of energy. The research focus lies on finding methods that can help to identify suitable sites for geothermal bores; to increase the acceptance of geothermics; and to reduce the costs of the technology (BMWi, 2015e). The reduction of costs is also the main focus for research on solarthermics (BMWi, 2015f).

Funded technology	Amount of funding in Euro
Deep Geothermics	15.55 million
Solarthermics	9.25 million
EnEff:City District Heating	3.75 million
EnEff:City Combined Heat and Power	2.65 million
Low temperature solarthermics	6.36 million
Solar cooling	1.02 million
Heat pumps (for industry)	2.58 million
Heat exchangers (for industry)	1.13 million
Solar process heating (for industry)	0.1 million
	42.39 million

Table 1: Federal research funds in 2014 for different heat technologies in Germany (Source: own table based on BMWi, 2015d).

State examples: Baden-Württemberg and Schleswig-Holstein

In Germany's federalism, the central government, the states (*Länder*), and the municipalities have different tasks, and partially competing areas of responsibilities ruled by a complex system of checks and balances. On energy and particular renewable energy policy, regional differences become apparent. So far only two of the sixteen German states – Baden-Württemberg and Schleswig-Holstein – have passed state heating targets in addition to the federal goal. Three more states (Bremen, Hesse, Thuringia) have announced to pass a heating target (see cover image). To illustrate the exemplary role of Baden-Württemberg and Schleswig-Holstein, this section takes a closer look at the two states' renewable heating agendas.

- On renewable heating the state of **Baden-Württemberg** is a front-runner – both in deployment as well as policy design. The state in Germany's Southwest adopted its own *Energiewende* strategy with mid- and long-term targets and a focus on dialogue with citizens. The goals are to cut overall energy consumption in half by 2050, to increase the share of renewables in electricity generation to 80 percent, and to cut CO_2 emissions by 90 percent (BW, 2015a). The state government emphasizes that without energy savings and more renewables in the heating sector (which accounts for about 30 percent of the state's CO_2 emissions) Baden-Württemberg would miss its climate target (BW, 2015b).

  Besides legislation on refurbishments and efficiency measurements (BW, 2015c), the state has implemented its own renewable heating law (EWärmeG) already in 2007, aiming to increase the share of renewable heat from 8 to 16 percent in 2020 (BW, 2015b). The state law, which was passed two years ahead of the national law by a center-right coalition, introduced the mandatory requirement for homeowners to include renewable energy as part of heating supply of new residential buildings, and when retrofitting. Baden-Württemberg therefore served as an example for the federal level and other states (iner, 2015).

  In March 2015, the state legislature passed an adapted version of the EWärmeG to come into force in July. The new EWärmeG is supposed to be more flexible, open to new technologies, and encompass non-residential buildings, which did not fall under the previous regulation (BW, 2015d). The adapted law more explicitly addresses the existing building stock and obliges owners to include renewable heating energy technologies when a heating system is modernized. The requirement can also be met by investing in efficiency retrofits instead. Homeowners find financial support through the federal Market Incentive Program (see above). In addition, the state bank of Baden-Württemberg offers loans of up to 50,000 Euros with low interest rates (L-Bank, 2015).

  The impact of the programs in Baden-Württemberg are yet to be assessed. A decreasing rate of retrofits in the existing building stock indicates that some

homeowners postpone retrofitting to avoid the obligation (Lamprecht & Czakainski, 2014). Yet on the other hand, the programs seem well accepted and clearly served as an example for federal legislation.

- Like Baden-Württemberg and most other *Länder*, Germany's most Northern state **Schleswig-Holstein** pursues its own *Energiewende* state strategy. Until 2025, the state aims to increase the share of renewables in gross electricity generation to 300 (three hundred) percent of the state's consumption (SH, 2015b) – exporting the surplus to its neighbors. In its energy infrastructure Schleswig-Holstein focuses on a fundamental change by establishing and expanding local and district heating networks (SH, 2015a). Denmark, bordering in the north, serves as an example for this strategy.

  The focus on heat networks is based on two premises: first, energy efficient retrofits of individual houses alone will not suffice and considerable investments in heating technologies will be necessary; and second, heat networks offer cost advantages and render technological benefits. They are cost efficient because the costs for single house owners are reduced which encourages refurbishments in general, and for rentals in particular. In turn, renters can benefit from the reduced and relatively stable prices for heating; and even the providers can profit because of greater density of connectivity in a district (SH, 2014a). The benefit of heat networks from a technological perspective is their high flexibility in being compatible with a number of different renewable sources.

  Similar to the federal goal, Schleswig-Holstein aims to reach 14 percent renewable heating by 2020. Additionally, the state government set a 22 percent state goal for 2025 (SH, 2014b). The strategy sets out municipalities to be the main actors in driving the transition. To support municipalities in this task, the Energy and Climate Protection Initiative (EKI) of Schleswig-Holstein guarantees consultation services and advice for funding possibilities (BMUB, 2015). Furthermore, the state invests in efficiency technologies including combined heat and power (CHP) (based on natural gas, coal or biogas), solar-thermal heating, geo-thermal heating, power to gas (e.g., from excess wind energy), or the use of wastewater heat. In particular, power-to-heat is considered the future of the heat market among leading researchers (IWES, 2015).

  A focus on a range of different technologies is integral to the strategy of Schleswig-Holstein in order to reap the benefits of the flexibility of heat networks. The diversification of technologies aims to ensure stable prices and security of supply. The state's vast renewable electricity resources add another possible source for heating. On sunny, windy days, large amounts of surplus electricity at lowest marginal costs will be available. As heating grids can function as storage, new technologies like power-to-gas become economically more feasible. Schleswig-Holstein's vast surplus in renewable electricity could result in the state

becoming a technology hot spot in creating spill-over effects from the power to the heat sector.

Different social and economic structures can partly explain the diverging approaches of the two states. Schleswig-Holstein is an economically less potent and also more rural state. In contrast, Baden-Württemberg is economically one of Germany's strongest regions with a thriving manufacturing and equipment industry. Baden-Württemberg is thus able to involve residents and home owners to a wider degree, while Schleswig-Holstein invests in centralized technologies involving municipalities. In addition, the geographical location of the two states could induce the use of different renewable sources. Baden-Württemberg has favorable sun conditions, making it a better spot than most other areas in Germany to use solar thermal as a heating technology. As a rural and coastal state, Schleswig-Holstein has better access to biomass and especially wind power. Denmark in the North serves as a success case to follow. The two state examples highlight that there is no one-fit-all-solution for renewable heating technology and policy.

EU Policy Framework

Being a member state of the European Union, German federal and state policy is embedded and shaped by EU legislation. Overall, the EU pursues its 20-20-20 targets by 2020, aiming for (1) a 20 percent reduction of EU wide greenhouse-gas-emissions; (2) a share of 20 percent renewable energy overall; and (3) a 20 percent energy consumption savings in comparison to the business-as-usual path. By 2013, the EU has made good progress to meet these targets (EEA, 2014). To achieve the overall EU targets, member states have committed to individual national targets.

In 2014, the European Council agreed on new targets for 2030 (EC, 2014a): (1) a 40 percent reduction of greenhouse gas emissions; (2) a 27 percent share of renewable energy consumption; and (3) improving energy efficiency by 27 percent. When and how these goals will come into force depends on the further legislative progress of the 2030 energy package, including the advancement of the *Energy Union* (EC, 2015).

With regard to renewable heating the decisive EU legislative acts are the Renewable Energies Directive (OJ, 2009), the Energy Performance of Buildings Directive (OJ, 2010), and the Energy Efficiency Directive (EED) (OJ, 2012). The Renewable Energies Directive broadly specifies the use of renewables, and for instance calls for a greater role of municipalities. The EED obliges member states to serve as a role model by annually making at least three percent energy efficient renovations while newly purchased buildings must be energy efficient. Furthermore, key policies must be identified in order to stimulate renovations. The Energy Performance of Buildings Directive requires member states to provide financial incentives for building energy

efficiency, to enforce minimum standards for the energy performance of buildings, and to ensure by 2020 that new constructions are zero energy buildings.

Germany's EEWärmeG and the MAP already meet the obligation under the listed directives (EC, 2014b). The federal law has been passed before European legislation came into force, and Baden-Württemberg had implemented a state law even before. The first steps towards renewable heating were thus taken on the regional level; yet, the above mentioned directives certainly generate new impulses to improve the support for renewable heat. We expect the legislation of EU 2030 goals to trigger discussions in Germany about a mid-term goal for renewable heating beyond 2020.

Conclusions

1. **With the current sticks-and-carrots programs, Germany's renewable heating market is set to grow in the short-term.** While the sticks have stayed the same, the bucket of carrots was refilled in 2015. The upgrade of the Market Incentive Program, which is to deliver greater funding security, is expected to trigger new investments in the building stock. Therefore, Germany will move closer to meeting its renewable heating target of 14 percent by 2020. Nevertheless, it is questionable whether these efforts are enough in the long-term. This depends very much on the political will and possible budget constraints. Previous years have shown difficulties to provide steady funding for the Market Incentive Program, creating uncertainty among investors. In comparison, investment conditions for renewables in the power sector are more stable. This might explain the considerably greater success of the *Energiewende* in the power sector. The current federal policy is not adequate to tap the full potential of renewable energy in the heating sector.
2. **For the mid-term, we expect further improvement of the federal policy framework for renewable heating technologies, backed by impulses from the EU.** The German government's comprehensive energy and climate approach already has provided a favorable policy framework for renewable heating technologies. After all, the Renewable Heating Act was only implemented as part of the *Integrated Energy and Climate Programme* as an overall climate strategy. The goal of the expansion of renewable heating technologies is to bring down emissions of the heat sector. In addition, the advancement of the EU's 2030 energy package will eventually result in more efforts by EU member states such as Germany to advance renewable heating technologies, including setting targets beyond 2020. From the domestic *Energiewende* discourse pressure will grow on the German government to develop a more comprehensive approach for renewable heating. Such an approach could integrate efficiency, system technology, urban planning and social aspects (HIR, 2015). The biggest potential is seen in expanding heat

networks as it opens the door for a variety of renewable sources and offers synergies between the power and the heat sector. The federal level could support municipalities in developing urban heating and cooling maps to identify local heating sinks and sources (Expertenkommission, 2014). For these reasons, we expect an improved federal policy framework for renewable heating technologies in the mid-term.

3. **There is no *one-fit-all-solution* for renewable heating policies.** German states serve as examples for a variety of policy and technological approaches on renewable heating. As a frontrunner, Baden-Württemberg introduced legislation on renewable heating well before federal or European laws were passed. Likewise, Schleswig-Holstein shows the functionality of focusing on municipalities and district planning. Germany and its federal structures therefore showcase the need to adapt the use of technologies towards local and regional structures. The policy framework needs to be designed accordingly.

Sources

[AGEE-Stat] Arbeitsgruppe Erneuerbare Energien-Statistik (2015). Zeitreihen zur Entwicklung der erneuerbaren Energien in Deutschland. BMWi, Berlin.

[BMU] Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2007). The Integrated Energy and Climate Programme of the German Government. http://www.bmub.bund.de/fileadmin/bmu-import/files/english/pdf/application/pdf/hintergrund_meseberg_en.pdf, 22 May 2015.

[BMUB] Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (2015). EKI Energie- und Klimaschutzinitiative Schleswig Holstein. https://www.klimaschutz.de/de/zielgruppen/kommunen/foerderung/eki-energie-und-klimaschutzinitiative-schleswig-holstein, 22 May 2015.

[BMWi] Bundesministerium für Wirtschaft und Energie (2015a). Energiestatistiken 2013. https://www.bmwi.de/BMWi/Redaktion/PDF/E/energiestatistiken-energiegewinnung-energieverbrauch,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf, 22 May 2015.

[BMWi] Bundesministerium für Wirtschaft und Energie (2015b). Erneuerbare Energien im Jahr 2014. Erste Daten zur Entwicklung der erneuerbaren Energien in Deutschland auf Grundlage der Angaben der Arbeitsgruppe Erneuerbare Energien Statistik. BMWi, Berlin.

[BMWi] Bundesministerium für Wirtschaft und Energie (2015c). Marktanreizprogramm. http://www.erneuerbare-energien.de/EE/Navigation/DE/Foerderung/Beratung_und_Foerderung/Marktanreizprogramm/marktanreizprogramm.html, 22 May 2015.

[BMWi] Bundesministerium für Wirtschaft und Energie (2015d). Bundesbericht Energieforschung 2015. Forschungsförderung für die Energiewende. BMWi, Berlin.

[BMWi] Bundesministerium für Wirtschaft und Energie (2015e). Tiefe Geothermie. http://www.erneuerbare-energien.de/EE/Redaktion/DE/Standardartikel/foerdergebiete_geothermie.html, 22 May 2015.

[BMWi] Bundesministerium für Wirtschaft und Energie (2015f). Niedertemperatur-Solarthermie. http://www.erneuerbare-energien.de/EE/Redaktion/DE/Standardartikel/foerdergebiete_solarthermie.html, 23 May 2015.

[BSW] Bundesverband Solarwirtschaft (2015). Dank neuem Marktanreizprogramm gute Aussichten für Solarwärme. http://www.solarwirtschaft.de/presse/pressemeldungen/pressemeldungen-im-detail/news/dank-neuem-marktanreizprogramm-gute-aussichten-fuer-solarwaerme.html, 22 May 2015.

[BW] Energiewende Baden-Württemberg (2015a). Die Ziele der Landesregierung. 7 X Klimaschutz. http://energiewende.baden-wuerttemberg.de/de/wissen/unsere-ziele-50-80-90/unsere-kernziele/, 22 May 2015.

[BW] Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg (2015b). Erneuerbare-Wärme-Gesetz BW für Bestandsgebäude. https://um.baden-wuerttemberg.de/de/energie/energieeffizienz/erneuerbare-waerme-gesetz-bw/, 22 May 2015.

[BW] Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg (2015c). Pressemitteilung April 2015, Nr. 52/2015. BW ist Land der Gebäudesanierer.

[BW] Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg (2015d). Gesetz zur Novellierung des Erneuerbaren-Wärme-Gesetzes. https://um.baden-wuerttemberg.de/de/energie/energieeffizienz/erneuerbare-waerme-gesetz-bw/ewaermeg-novelle/, 22 May 2015.

[EC] European Commission (2014a). EU leaders agree 2030 climate and energy goals. http://ec.europa.eu/clima/news/articles/news_2014102401_en.htm, 23 May 2015.

[EC] European Commission (2014b). Communication from the Government of the Federal Republic of Germany to the Commission of the European Union of 16 April 2014. Report on the long-term strategy for mobilizing investment in the renovation of the national building stock. https://ec.europa.eu/energy/sites/ener/files/documents/2014_article4_en_germany.pdf, 23 May 2015.

[EC] European Commission (2015). Energy Union. http://ec.europa.eu/priorities/energy-union/index_en.htm, 23 May 2015.

[EEA] European Environmental Agency (2014). Trends and projections in Europe 2014. Tracking progress towards Europe's climate and energy targets for 2020. Publications Office of the European Union, Luxembourg.

[EEG] Erneuerbare-Energien-Gesetz (2014). Gesetz für den Ausbau erneuerbarer Energien vom 21. Juli 2014 (BGBI. I S. 1066), das zuletzt durch den Artikel 1 des Gesetzes vom 22. Dezember 2014 (BGBI. I S. 2406) geändert worden ist.

[EEWärmeG] Erneuerbare-Energien-Wärmegesetz (2011) Erneuerbare-Energien-Wärmegesetz vom 7. August 2008 (BGBI. I S. 1658), das zuletzt durch Artikel 2 Absatz 68 des Gesetzes vom 22. Dezember 2011 (BGBI. I S. 3044) geändert worden ist.

[ESTIF] European Solar Thermal Industry Federation (2014). Solar Thermal Markets in Europe. Trends and Market Statistics 2013. Brussels. http://www.estif.org/fileadmin/estif/content/market_data/downloads/solar_thermal_markets2013_v01.pdf, 22 May 2015.

[EWärmeG] Gesetz zur Nutzung erneuerbarer Wärmeenergie in Baden-Württemberg (2015). Gesetz vom 17. März 2015. GBl Nr. 5, S. 151-160.

Expertenkommission (2014). Stellungnahme zum ersten Fortschrittsbericht der Bundesregierung für das Berichtsjahr 2013. Monitoring-Prozess „Energie der Zukunft". http://www.ecologic.eu/sites/files/publication/2014/ewk_stellungnahme_2014.pdf, 1 June 2015.

[HIR] Hamburg Institut Research gGmbH (2015). Fernwärme 3.0. Strategien für eine zukunftsorientierte Fernwärmepolitik. http://www.gruene-bundestag.de/fileadmin/media/gruenebundestag_de/themen_az/energie/150310_HHI-Studie-Fernwaerme.pdf, 1 June 2015.

[iner] Institut für nachhaltige Energie- und Ressourcennutzung (2014). Marktanreizprogramm. http://ee-waerme-info.i-ner.de/index.php?title=Marktanreizprogramm, 22 May 2015.

[iner] Institut für nachhaltige Energie- und Ressourcennutzung (2015). Renewable Energy Sources for domestic heating in Germany. http://ee-waerme-info.i-ner.de/images/1/13/Broschuere_EE-Waerme.pdf, 22 May 2015.

[IWES] Fraunhofer-Institut für Windenergie und Energiesystemtechnik (2015). Klimaschutz-ziele nur mit Wärme durch Strom aus erneuerbaren Energien erreichbar. Agentur für Erneuerbare Energien. http://www.unendlich-viel-energie.de/themen/waerme/klimaschutzziele-nur-mit-waermedurch-strom-aus-erneuerbaren-energien-erreichbar, 1 June 2015.

Lamprecht, F., & Czakainsi, M. (2014). Energiewende im Wärmemarkt. *Energiewirtschaftliche Tagesfragen, 64*(3), pp. 21–25.

[L-Bank] Staatsbank für Baden-Württemberg (2015). Wohnen mit Zukunft: Erneuerbare Energien. https://www.l-bank.de/lbank/inhalt/nav/foerderungen-und-finanzierungen/alle-foerderangebote/wf-wirtschaftsfoerderung/wohnen-mit-zukunft-erneuerbare-energien.xml?ceid=101170, 22 May 2015.

Morris, Craig (2015). Germany is not burning US forests. http://energytransition.de/2015/03/germany-is-not-burning-us-forests/, 22 May 2015.

[OJ] Official Journal of the European Union (2009). Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. L 140/16.

[OJ] Official Journal of the European Union (2010). Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast). L 153/13.

[OJ] Official Journal of the European Union (2012). Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. L 315/1.

[PtJ] Projektträger Jülich (2015). Forschungsförderung für die Energiewende: BMWi veröffentlicht Bundesbericht Energieforschung und Jahresbericht „Innovation durch Forschung". https://www.ptj.de/news/bundesbericht-energieforschung-2015, 22 May 2015.

[PWC] PricewaterhouseCoopers (2015). Energiewende-Outlooks: Kurzstudie Wärme. http://www.pwc.de/de_DE/de/energiewende/assets/pwc-ewo-kurzstudie-waerme-2015.pdf, 22 May 2015.

[SH] Schleswig-Holstein (2014a). Die Energiewende im Wärmesektor – Chancen für Kommunen. Ministerium für Energiewende, Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein. hansedruck und Verlag-GmbH & Co KG, Kiel.

[SH] Schleswig-Holstein (2014b). Energie- und Klimaschutzgesetz Schleswig-Holstein – Eckpunkte und Zeitplanung. Drucksache 18/2580, December 17, 2014.

[SH] Schleswig-Holstein (2015a). Energiewende. Ausbau der Wärmenetze. http://www.schleswig-holstein.de/Energie/DE/Waerme/Waermenetze/waermenetze_node.html, 22 May 2015.

[SH] Schleswig-Holstein (2015b). Energiewende – Erneuerbare Energien ausbauen. http://www.schleswig-holstein.de/DE/Schwerpunkte/Energiewende/energiewende_node.html;jsessionid=3F1DF5A9E64B4BBB06CD706843F67600, 22 May 2015.