

E-SPAS: An Energy Education Program at Primary Schools

INBEE Case-study

Name: E-SPAS

Brief project description: E-SPAS (“Energie **S**paren **A**n **S**chulen”) is an **energy education program** at Emden’s primary schools. The program’s objective is to **raise awareness about energy efficiency** (EE) and to convey practical know-how about energy saving in households. The project is carried out in the form of specific courses at different school grades. During these courses, instructors not only create an understanding of how to save energy but an emotional connection and the feeling that saving energy is the right thing to do among the school children. The intellectual leadership and implementation of this project is in the hands of the **local ecology centre** (“Ökowerk”), which works as a non-profit association. Potential benefits of the project are a reduction in local energy demand by triggering changes in behavioural patterns of school children and their parents, a decrease in GHG emissions, and potentially a slight alleviation of municipal budgets. The case also reveals benefits of EE that are not considered by the IEA-categories, such as local coordination and network building, general education, and environmental awareness.

Location: E-SPAS is implemented in **Emden**, a small harbour-city with approx. 50,000 habitants, located in a windy rural area in north-western Germany. This city’s economy is marked by the shipping industry, a big car manufacturing site of one of Germany’s leading car producers, and increasingly, by the wind energy industry. In the last decades, Emden’s economy has experienced a **structural transformation** from a historically strong shipbuilding sector towards the **wind energy** sector. Today, major on- and offshore wind businesses are settled in the harbour area of the city. A **local public utility** (“Stadtwerke Emden”) is responsible for most of the local energy supply and the public transportation system in Emden. From the late 1980s onwards the public utility company started to experiment with renewable energy and EE. In the early 1990s, it constructed its first wind farm on the outskirts of the city and launched EE campaigns towards the local population. Today, Emden is considered a **pioneering city in Northern Germany’s energy transition** (Klagge and Brocke 2012; Mattes, Huber and Koehrsen 2015). The city has set the climate goal to cut 50 % of its CO₂ emissions until 2020, as compared to its levels in 1990 (Stadt Emden 2010).



IN-BEE project: Case Study

Aims:

The joint objectives for the project partners are:

- a) creating general awareness and knowledge about energy and its relationship with climate change in the local community,
- b) transmitting techniques to reduce energy consumption,
- c) altering attitudes towards energy and energy consumption behaviour
- d) (in the long run, reducing the overall energy consumption of Emden's households and thereby decreasing GHG emissions).

Aim d) is not mentioned by the project partners and is an interpretation of the author of this study.

Date of operation: 2009-ongoing

Visual material:



Project Partners:

E-SPAS is a **collaborative project** undertaken by the local ecology centre (Ökowerk), the public utility (Stadtwerke Emden), the municipality (Stadt Emden), and Emden's primary schools. Its implementation in the schools is undertaken by employees from the ecology centre. Depending on the concrete needs, up to ten employees work in the project at the same time. With regards to the daily work in the project and the concrete content of the project, the municipal administration and the public utility remain in a rather remote position: their contribution basically consists of financing the project and supporting it organisationally – when necessary.

Organisation	Role of Organisation in Project
Ökowerk Emden (Ecology Centre Emden)	Leadership of the project, development and implementation of the course program.
Stadt Emden (Municipality Emden)	Financing and administrative/political support
Stadtwerke Emden (Public Utility Emden)	Financing; in some cases, providing material and human resources for undertaking the courses at the primary schools.
Emden's ten local primary schools	Providing infrastructure and teaching hours at the schools.

Links:

<http://www.oekowerk-emden.de/e-spas.html>

https://stadtwerke-emden.de/fileadmin/media/dokumente/fuerdich/biuns/2011/swe_biuns_02_2011.pdf

Author: Jens Koehrsen, Honrary Research Associate at the Environmental Change Institute/University of Oxford; Assistant Professor at Centre for Religion, Economy, and Politics/University of Basel

Detailed Case Description

E-SPAS is an **energy education program for school children at Emden's primary schools**. The local ecology centre (Ökowerk) which is leading the project has conceptualised the courses for this program. Its educational approach stresses an **experimental and corporal form of learning**. The objective is not only to produce an intellectual comprehension of environmental problems but also to create an emotional attachment and commitment to sustainability.

Context: Germany's "Energiewende" and Emden's urban transition

Emden's energy transition is embedded in the context of Germany's "**Energiewende**" (energy transition). The national program to reform the energy system involves a nuclear phase-out until 2022, and aims for 55-60% of renewables in electricity production until 2035, and until 2050, a 50% reduction of energy consumption, as compared to 2008 (Beveridge and Kern 2013; Buchan 2012; The Federal Government 2015). In this context, particularly the **national feed-in-tariffs** have been an important instrument to boost the proportion of renewables: renewables represent more than 25% of Germany's gross electricity production today. Their expansion involves a **decentralization of the energy system**, increasingly relying on local energy production and supply (The Federal Government 2014). This development contrasts the centralization efforts in the 1990s when Germany's government promoted the liberalization of the energy system and many municipalities sold their municipal utilities (Stadtwerke) to the four big players (ENBW, E.ON, Vattenfall, and RWE). The more recent "Energiewende", in contrast, has led to the "re-emergence" of municipal utilities and local energy production (Becker, Beveridge and Naumann 2015).

The municipality of Emden resisted the temptation to sell its **public utility** ("Stadtwerke Emden"). Instead, in the early 1990s, it decided that the public utility should become a **sustainable energy service provider**. Since then, the public utility has strongly invested in wind energy and directed **energy efficiency campaigns** towards Emden's population (among them E-SPAS). Given its strong engagement, the public utility has become the leading actor in the local energy transition. Nevertheless, apart from the *Stadtwerke*, numerous other local actors are involved in Emden's energy transition, such as, for instance, banks, politicians, wind mill manufacturers, renewable energy planning offices, business intermediaries, citizen initiatives, various departments from the local university of applied sciences, and the municipal administration. Given the size of the city, these actors are often aware of their activities and **closely collaborate in joint projects**. Also E-SPAS is an example of a project that is based on the collaboration of several actors in Emden's energy transition.

Project History and Background

E-SPAS is not the first energy related project that is implemented in Emden's schools. **Two previous energy transition related projects** are at the origin of the current project. Both projects were conducted by the municipal administration and the public utility. As their feelings about the impact of these projects were mixed, they finally abandoned them. The first project taught and incentivised facility managers of local schools to save energy, while the second project launched a competition between schools rewarding the school that saved the most energy in a year. The latter project was perceived as unfair given that only the school with the highest energy saving rate won the award, while the efforts of the other schools were unacknowledged. Furthermore, the other schools, given their infrastructure (e.g. windows can only be opened halfway), often had less chances of winning

the award. Thus, the city administration and public utility considered initiating a new project and inquired at the ecology centre about its interest. Subsequently, the ecology centre developed a project proposal in close contact with directors and teachers from various local schools. In contrast to the previous projects, E-SPAS did **not focus on measurable impacts** in the school buildings' energy consumption, but concentrated on conveying a comprehensive educational approach to alter the mentality and behaviour of the school children and their parents. The concept persuaded the city administration and public utility companies, who gave their approval. The project **started in 2009** and, today, is implemented in the ten primary schools in Emden.

Detailed Description of the Course Program

The program is implemented in the form of **interactive courses** at different grades. Pupils have at least **six contacts** with the program: the project carries out three courses in the second grade, two in the third grade, and one in the fourth grade. Each of the courses has a specific purpose and involves a particular teaching strategy.

School Grade	Content	Objective
Second grade (age 6-7)	Theatre play with puppets	Creating awareness for EE
Second grade	Different stations with interactive experiments	Learning techniques of how to improve EE in households
Second grade	“Sick tree”: identifying and solving problems of the tree	Repetition and strengthening of the central techniques learned during the second visit
Third grade (age 7-8)	More complex experiments with central catchphrases at each station	Learning of additional approaches to improve EE
Third grade	Game which ends with passing through the “door of EE”	Repetition and strengthening of central techniques to improve EE and “initiation ritual”
Fourth grade (8-9)	Family fest with children and their parents, (re-)engaging in some of the previous exercises	Children strengthen their knowledge and transmit techniques to improve EE to their parents

Table 1: Courses of the E-SPAS program

The program **starts with a theatre play** that introduces three puppets – a goose, a pig, and Toni Elektroni (an imaginary figure that saves energy) – which will be the “Emotionsträger” (figures of emotional attachment) during project and sensitise the children for the problem of EE. At the end of the play, it becomes clear that the puppets have a problem: they waste too much energy and are unable to solve this problem on their own. They wonder who could help them and the school children who form the audience shout: “We can do that!” After the play, the children receive signature cards with photos from the puppets. They often put these cards into their pen and pencil case where their parents might find them and become curious about what they have done in school, hopefully establishing contact between the project and the household.

The **second course** consists of experiments: eight stations are built up in the classroom. Each of them entails a specific task and conveys know-how about saving energy at home. As small groups of two to

four children pass through each station, they are attended by one employee from the project staff. At one station, for instance, children prepare to drink a tea with a project employee. The employee boils water and suddenly realizes that he has boiled too much water. While drinking the tea, the group wonders what they could do with the water. The employee tells the children to ask their parents how much they fill the kettle and explains that they can save around fifty Euros each month by filling it appropriately; he then hands fifty Euros of game money over to them. Back at home, parents may ask them how they received the game money, again providing a potential contact between school and home life.

The **third course** consolidates the previously learned lessons. The picture of a sick tree is shown to the school children. Employees, together with the children, speculate possible reasons for the sickness and what they could potentially do for its recovery. The children attribute different puzzle pieces to each of the tree's problem areas. Correctly attributed puzzle pieces help the tree to recover. In this way, the children can apply and consolidate the knowledge that they have acquired in the previous course.

The **fourth course** takes place in year three and entails new and more complex experiments. Again several stations are built up in the classroom and small groups of pupils pass through each of them. Each experiment ends with a short catch phrase that summarizes its core lesson. After this, the **fifth course** consists of a parlour game in which the whole class takes part. The objective is to reach the gate of "energy savers". To reach this door, a number of problems have to be solved. These problems are related to the knowledge that the children have acquired during the last two years. In this way, all children repeat the central lessons and finally pass in a kind of initiation ritual through the "gate of energy savers."

The **last session** of the project takes place in the form of family festival at the site of the ecology centre. Its objective is not only to celebrate the end of the education program, but to directly integrate the parents into the learning process. The children guide their parents through some of the exercises from the previous courses and explain to them how they can save energy. This learning event is framed by an informal atmosphere, ending with a barbecue.

Assessment

E-SPAS can be conceived of as an energy saving "boot camp" for children that seeks to shape (future) energy consumers and household owners. Moreover, the project integrates the parental household and aims to alter the household's energy consumption by re-educating parents through their children, as children are encouraged to question the behaviour of their parents based on their new know-how about EE. As shown by Boudet et al. (2016), energy education programmes for children can have a high impact on the energy saving behaviour of children and their parents.

However, the **overall impact** of E-SPAS on the local community is hard to estimate, as there are no evaluations. The project's **resistance to quantitative measurement** is perhaps one of its unique characteristics: initiators of the project at the ecology centre even made it clear from the beginning to their project partners that they did not want the quality of their project assessed along the lines of quantifiable energy savings.

Nevertheless, the project information at the homepage of the ecology centre discloses some information about the quantity of school children reached by the courses: each year the project carries out 150 hours of tuition taught to approx. 800 school children in the 10 primary schools in Emden (Ökowerk Emden 2016). According to information from a project employee, by 2016, **2888**

children had been through the program and a total of **1216 hours of tuition** were taught. Based on the project and additional activities at the schools, four of the participating primary schools have received the award “eco-school in Europe” (“Umweltschule in Europa”).

This information, however, does not reveal to what extent the project alters the energy consumption in households or encourages children to question their parents behaviour. One project member mentioned in an interview that they had received calls from “angry” parents who joked about the fact that their children would now control the kettle and the stand-by mode of the television at home. The ironic criticism of the project illustrates its impact in the parental households. Another example of the project’s impact is a local bank, where employees had been inspired by their children – who had been in touch with project – to implement energy-related projects in the bank. They decided to install a more efficient light system and to rent the “energy bicycle” from the ecology centre for a publicity campaign. Accordingly, the program’s impact is not limited to private households but can also reach the workplace, and from there, in a **multiplier effect**, again other individuals. As such, the education program spurs the confrontation with “energy” in the city.

Challenges of the project concern the **lack of evaluations** and its long-term financing. External evaluations of the project that could provide information about its impact, strengths, and weaknesses as well as its potential for further development have not been carried out. Nevertheless, internal meetings taking place each spring allow for internal evaluation of the project and further development of its contents. As such, the theatrical play has been fully revised, based on comments from project partners. Moreover, project employees stated that they are worried about the **potential reduction of financial resources** (i.e. due to financial problems of a big producer based in Emden, the municipality’s tax revenue is decreasing and the municipality has to revise its spending). At the same time, the interviewed project partners appeared to be highly satisfied with the outcomes of the project and were thinking about expanding to include Emden’s secondary schools. Furthermore, E-SPAS has become a pioneering energy education program in the region: other municipalities have inquired about the ecology centre about E-SPAS, as they are interested in implementing similar projects in their districts.

Funding

The **yearly** costs are **approx. 100,000 €**. The ecology receives approx. 80,000 from the **public utility and the municipality** to conduct the project, the remaining 20,000€ are indirect costs funded by the **land Niedersachsen** (e.g. teaching hours undertaken by teachers that are employed in the project, but paid by the federal land).

Multiple benefits

Given that the project did not seek for measurable immediate quantitative impacts (e.g. on energy consumption), there are **no evaluations** of the project and it is difficult to assess its multiple benefits alongside the IEA categories.

IEA categories	Acknowledged in evaluations	Estimated impact (estimations by author)
Energy savings	No	Highly probable, but numerical estimations are impossible.
GHG savings	No	Highly probable, but numerical estimations are

		impossible.
Energy security	No	Potentially, in the long run, by reducing individual energy demand in Emden.
Energy delivery	No	No
Energy prices	No	No
Macro-economic impact	No	No
Industrial productivity	No	No
Poverty alleviation	No	Probably small impact, by reducing energy bills
Health and well-being	No	Potentially, as children also learn techniques to avoid mould in houses
Employment	No	Very small impact, by creating new employment within the project.
Local air pollution	No	No
Resource management	No	??
Public budgets	No	Yes, the municipality potentially saves money by reducing energy costs in school buildings.
Disposable income	No	Yes, in terms of reduced energy bills.
Asset value	No	No.

The most obvious benefits of the E-SPAS are the potential **reduction of energy consumption** and **GHG emissions**. Despite pursuing these goals, these benefits are underemphasised by the project partners in press statements. Apart from the benefits mentioned in the IEA categories, online information about the project stresses as additional benefits the **general educational impact** on the children through the “lived science” teaching (e.g. children learn under what circumstances mould evolves, how central heating works, alternatives of energy production) and that children develop the **ability to question their own behaviour** and the behaviour of others (e.g. parents) (Ökowerk Emden 2016). Questioning the behaviour of parents and the energy infrastructure of the household (“Why do we not have energy efficient lighting? Why do we not use an efficient heating?”¹), is believed to have an effect on the EE in Emden’s households. A project employee further highlighted that the project furthers the children’s ability to solve problems in groups and that children understand that their behaviour has (environmental) consequences: the project would thereby contribute towards **socialising “responsible citizens”**. Apart from stressing the educational impact on the children, press releases and project employees also underpin the **educational development of teachers** who participate in the program.

Also **creating general awareness** about energy and its relationship with climate change in the local community forms a benefit that is underpinned by informants in interviews and online information (Stadtwerke Emden 2011).

Other benefits concern the **network of local actors**, coordination and **governance** of local energy transitions, and the potential of spill overs. The German “Energiewende” is a vague project that is open to interpretation for actors at the local level: urban energy transitions can concern multifarious changes in the energy system (cf. Beveridge and Kern 2013; Fuchs and Hinderer 2014: 4).

¹ Stadtwerke Emden 2011

Collaborative projects allow actors from different backgrounds (politics, municipal) who are engaged in the urban energy transition of Emden to **create social networks** and to come to terms with what the local “energy transition” is and should be. In this case, the ET is not only interpreted as concerning changing technology but also about changing people’s attitudes and behaviour, and encouraging the questioning of existing behaviour. Moreover, sufficiently visible projects such as E-SPAS constitute **beacons** in a vague energy transition, as they establish a predominant narrative of the local energy transition. Along this perspective other actors can orient their behaviour (e.g. the local bank). Additionally, E-SPAS generate **spill overs**: other local actors feel encouraged to implement their own environmental projects, as in the above case of the local bank.

Moreover, municipal administration and Emden’s leading politicians who support the project appear to have an interest in publicity from the project, **branding Emden** with this and other projects as a **pioneering city in the “Energiewende.”** This strategy has attracted major windmill businesses to Emden. Finally, project partners seek to generate individual benefits: for instance, the public utility regards its EE programs as an opportunity to improve its image and enhance the **loyalty of its customers.**

NON-IEA categories	Acknowledged in evaluations	Estimated impact (estimations by author)
Environmental Awareness	No	Contributes to increasing environmental awareness in the community
Education	No	Improvement of children’s knowledge about energy and the environment, their problem solving capacities, and their capacities to question behaviour. Contributes to educational development of teachers.
Network-Building	No	Networking and coordination among actors involved in local energy transition from different areas of the city: citizens, city administration, education system, business sector.
Customer Loyalty and Economic Outlook	No	At the business level: commitment of clients, customer-loyalty, improved economic prospects
Spill-Overs	No	Others feel encouraged by the program to implement additional environmental projects in the city
Beacon-Function	No	Establishment of predominant perspectives on local energy transition along which other actors can orientate their transition activities.
Municipal branding	No	Branding of Emden as pioneering city in the “Energiewende” allows for attracting investment

Results / Benefits delivered:

Beneficiaries are primarily (a) the **school children** who learn problem solving techniques and improve their know-how about energy and (b) the **parental household** in which EE measures may lead to the reduction of energy bills. Moreover, the program allows the **public utility** to further establish itself in

the community as the pioneering actor in the region’s energy transition and an energy provider who is interested in customers’ satisfaction (“lowering of energy bills”). In this way, the project may strengthen the customers’ loyalty and improve the economic outlook of the utility in the long run. But also the ecology centre and municipality will benefit from the positive publicity of the project. Moreover, the **municipality** has an interest in the potential energy savings in the schools, as these may alleviate the public budget. For the local **ecology centre**, the project contributes to its financial stability and popularity in the city while the **participating schools** can apply more easily for the award, “eco-school in Europe.”

Methods

The study of E-SPAS forms part of a more encompassing research project about Emden’s energy transition. The objective of the study was to draw a relatively encompassing picture of the urban energy transition by analysing the different activities of actors from heterogeneous social sectors (e.g. politics, research, industry, civil society) and their relationships (e.g. collaboration, competition). The research for this was based on **a qualitative methodology** and was comprised of three steps: 1) general research about the region and contacting potential interviewees, 2) conducting interviews, 3) interview analysis.

1) First, relevant **information about the city** and local actors involved in the energy transition was gathered. A database about relevant actors was created from which the most relevant were selected as potential interview partners. In most cases, the first contact was established by sending a short email to **potential interviewees** including some general information about the project. In other cases, the contact was established directly with a phone call.

2) In total, **37 semi-structured interviews** were conducted. The table shows an overview of the sample by classifying the interviewees along different sectors. Interviews were generally conducted in the offices of the interview partners and usually lasted around 90 minutes. Interview questions addressed the activities of the interviewee’s organization in the

Sector	Number of Interviews
Politics	3
City Administration	3
Science	3
Industry	8
Finance	2
Civil society/Religion	10
Intermediaries	8
Total	37

local energy transition and its relationships with other local actors.

3) The audio recordings of the interviews were transcribed for the following analysis, which was undertaken by using the **qualitative data analysis** software MaxQDA. Paragraphs of the interview material were marked with specific codes according to their content. As such, the coded material could be analysed and compared with reference to particular topics; for instance, the interaction of specific actors or the role of a specific actor in the local energy transition.

The chosen methodology faces **limitations** for the analysis of the multiple benefits of EE. As it employed a qualitative methodology, it did not collect quantitative data. Given that there are no evaluations of the project, **quantitative data about the impact of E-SPAS is missing**. The qualitative interviews provide descriptive information about the content and organisation of the project, but

few «objective» assessments about its wider impact. In one case, an impact on an organisation that is not immediately related to the project could be established. However, it is not clear to what extent this case is representative of the project's impact. In total, the potential multiple benefits of the project can only be estimated.

Analysis

The case is embedded in the *specific context of the German "Energiewende"* EE (Beveridge and Kern 2013; Buchan 2012) which has spurred numerous local initiatives towards transforming the energy system (cf. (Blanchet 2015); (Mattes 2015 #1891); Schönberger 2013; Späth and Rohracher 2010; Späth and Rohracher 2015). Besides the national context, the *specific local context* positively contributes to E-SPAS: the local energy provider's interest in improving EE, support for the energy transition within the municipal administration and among local politicians, and a local ecology centre with trained school teachers.

The E-SPAS case reveals *multiple benefits of EE* that are not considered by the IEA-categories such as local coordination, network building, education, and environmental awareness. Moreover, the project may contribute to the dissemination of pro-environmental moral values and worldviews, a role that is often attributed to religious actors (Koehrsen 2015).

Interestingly, project partners hardly stress the most palpable benefits of E-SPAS in press communication – the reduction of energy consumption and GHG emissions. Instead, communication centres on the educational benefits. This may be related to the fact that the rhetoric around urban transitions often stress the *strengthening of the local community*, but to a lesser degree the (global) environmental benefits (cf. Busch and McCormick 2014; Fuchs and Hinderer 2014): benefits beyond improving EE and climate change mitigation seem to be important for promoting projects related to energy transitions. Accordingly, when designing EE-projects, framing them in such a way that the multiple benefits for the local community – beyond the (global) environmental impact – become evident, may be crucial for leveraging local support.

In more general terms, the case study indicates *difficulties in defining what counts as a co-benefit of energy efficiency*. Apart from the perspective of the researcher, this appears to depend on the specific socio-geographic context (e.g. presence of a shared and positively connoted vision of an "Energiewende") and the perspective of the given local actors, as these may tend to define the "benefits" along their individual interests.

References

Becker, Sören, Ross Beveridge, and Matthias Naumann. 2015. "Remunicipalization in German Cities: Contesting Neo-Liberalism and Reimagining Urban Governance?" *Space and Polity* 19(1):76–90.

Beveridge, Ross and Kristine Kern. 2013. "Energiewende in Germany: Background, Developments and Future Challenges, the." *Renewable Energy L. & Pol'y Rev.* :3.

Blanchet, Thomas. 2015. "Struggle over Energy Transition in Berlin: How Do Grassroots Initiatives Affect Local Energy Policy-Making?" *Energy Policy* 78:246–54.

IN-BEE project: Case Study

Boudet, Hilary, Nicole M. Ardoin, June Flora, K. C. Armel, Manisha Desai, and Thomas N. Robinson. 2016. "Effects of a Behaviour Change Intervention for Girl Scouts on Child and Parent Energy-Saving Behaviours." *Nature Energy* 1(8):16091.

Buchan, David. 2012. *The Energiewende-Germany's Gamble*: Oxford Institute for Energy Studies Oxford, UK.

Busch, Henner and Kes McCormick. 2014. "Local Power: Exploring the Motivations of Mayors and Key Success Factors for Local Municipalities to Go 100% Renewable Energy." *Energy, Sustainability and Society* 4(1):1–15.

Fuchs, Gerhard and Nele Hinderer. 2014. "Situative Governance and Energy Transitions in a Spatial Context: Case Studies from Germany." *Energy, Sustainability and Society* 4(1):16.

Klagge, B. and T. Brocke. 2012. "Decentralized Electricity Generation from Renewable Sources as a Chance for Local Economic Development: a Qualitative Study of Two Pioneer Regions in Germany." *Energy, Sustainability and Society* 2(5):2–9.

Koehrsen, Jens. 2015. "Does Religion Promote Environmental Sustainability? - Exploring the Role of Religion in Local Energy Transitions." *Social Compass* 62(3):296–310.

Mattes, Jannika, Andreas Huber, and Jens Koehrsen. 2015. "Energy Transitions in Small-Scale Regions – What We Can Learn from a Regional Innovation Systems Perspective." *Energy Policy* 78:255–64.

Ökowerk Emden. 2016. "E-SPAS." Retrieved Jun. 30, 2016 (<http://www.oekowerk-emden.de/e-spas.html>).

Schönberger, Philipp. 2013. "Municipalities as Key Actors of German Renewable Energy Governance: An Analysis of Opportunities, Obstacles, and Multi-Level Influences." Retrieved 31.09.2013 (<http://wupperinst.org/en/publications/details/wi/a/s/ad/2056/>).

Späth, Philipp and Harald Rohrer. 2010. "'Energy Regions': the Transformative Power of Regional Discourses on Socio-Technical Futures: Special Section on Innovation and Sustainability Transitions." *Research Policy* 39(4):449–58.

Späth, Philipp and Harald Rohrer. 2015. "Conflicting Strategies Towards Sustainable Heating at an Urban Junction of Heat Infrastructure and Building Standards." *Energy Policy* 78:273–80.

Stadt Emden. 2010. "Integriertes Kommunales Klimaschutzkonzept." Retrieved Sep. 20, 2014 (https://www.emden.de/fileadmin/media/stadtemden/PDF/FB_300/FD_362/Energie_Klima/klimaschutzkonzept_gesamt_endversion.pdf).

Stadtwerke Emden. 2011. "E-SPAS. Energie sparen an Schulen." Retrieved Jun. 30, 2016 (https://stadtwerke-emden.de/fileadmin/media/dokumente/fuerdich/biuns/2011/swe_biuns_02_2011.pdf).

The Federal Government. 2014. "Energiewende: Anteil Erneuerbarer Energien wächst weiter." Retrieved Aug. 27, 2016 (<http://www.bundesregierung.de/Content/DE/Artikel/2014/01/2014-01-13-bdew-energiebilanz-2013.html>).

IN-BEE project: Case Study

The Federal Government. 2015. "Energiewende: Maßnahmen im Überblick." Retrieved Sep. 18, 2015 (<http://www.bundesregierung.de/Content/DE/StatischeSeiten/Breg/Energiekonzept/0-Buehne/ma%C3%9Fnahmen-im-ueberblick.html;jsessionid=384458BD8066B80D628516114515E39C.s4t1>).