Integration of the German energy transition in the EU-context

Anna Ernst (Ed.)

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1. Preface

Prof. Jürgen-Friedrich Hake, Head of the Institute of Energy and Climate Research – Systems Analysis and Technology Evaluation (IEK-STE)

The reduction targets of carbon dioxide emissions are set on EU and national level. However the transition process towards such a low carbon society is characterised by a high degree of uncertainty and complexity. Thus possible strategies and measures need to be able to adjust to uncertain changes, overcome stagnations due to conflicts and foster innovations. The most important prerequisite to accomplish effective and efficient measures towards a low carbon society is to produce robust knowledge. The production of robust and applicable knowledge is based on an interdisciplinary approach that considers the multi-dimensional and vale-based concept of sustainability. Meaning that the integration of the different knowledge types system knowledge, target knowledge and transformations knowledge is a core challenge of developing sustainable solution. In this manner the Institute of Energy and Climate Research – Systems Analysis and Technology Evaluation (IEK-STE) operationalises and investigates social and political principles and objectives in terms of their importance for future energy systems and the associated transformation process. The R&Dialogue project contributed to this aim in testing a new approach of knowledge co-production and fostering the dialogue between science and civil society.

So far many studies have analysed the technological and economic advantages, disadvantages and obstacles of different strategies and measures towards a low carbon society. However the integration of social issues such as the acceptance of technologies or change in actors' constellations has not been included. Especially the case of the energy transformation (e.g. Energiewende) in Germany demonstrates very clearly that the social dimension of this complex process has a vast impact on the implementation of technologies, measures and strategies.

The society in Germany is well educated with a prosperous economy, which mark a good starting point for a transformation process towards a low carbon society: In principle, the technological, financial and societal capacity exists to manage necessary changes. However there are still challenges to overcome. One such challenge is that the constitution of society evolved over the past decades and demands more and more participatory rights to decision making. Especially the ongoing energy transformation has shown that without inclusive and transparent decision making processes the success of the transformation is endangered.

Therefore analysing future energy systems means taking the social and political values and objectives into account to better understand possible roadmaps and instruments to achieve a transformation. One main shortcoming of the past years to achieve better decision making was the interaction between science and society to jointly develop strategies. R&Dialogue addresses these shortcomings in two ways: The initiated dialogue process by IEK-STE identified questions and challenges that need to be tackled to transit towards a low carbon society. At the same time IEK-STE tested a new method to produce robust and applicable knowledge.

2. Introduction

This documentary of the final R&Dialogue event in North Rhine-Westphalia addresses the topic of ‘Integration of the German energy transition in the EU-context’. In addition it will give a brief summary about the findings and outputs of the dialogue process that took place between March 2014 and September 2014. At first a brief introduction about the issue at hand - a low carbon society- and also about the R&Dialogue project is given. The second chapter provides a short overview of the main outputs of the dialogue project: the discussion and vision paper. Chapter three is the actual documentary of the final event in February 2015 and summarises the key note speeches held in addition to the main points of discussion between the participating experts. The final chapter will give a summary about the lessons we learned in the past two years and indicates further challenges that need to be tackled to improve dialogue between science and civil society.

2.1 Topic Introduction: A Society with Low Carbon Emissions

The Fifth Assessment Report of Working Group III of the Intergovernmental Panel on Climate Change (IPCC) published in April 2014 showed that ‘recent changes in climate have caused impacts on natural and human systems on all continents and across the oceans’ (IPCC, 2014). The report also indicates how reduction of emissions and creation of sinks for greenhouse gases with the human possibilities can be accomplished: different technological measures and behavioural changes could limit the increase in average global temperature to two degrees Celsius since industrialisation. However this requires profound institutional and technological changes in order to achieve the required reduction of greenhouse gas (GHG) emissions by 70 percent compared to 2010 by 2050. The development towards a low-carbon society is therefore needed to avoid negative impacts on both environmental and human systems.

According to the German Advisory Council on Global Change (WGBU[1]) a Great Transformation is needed to address these challenges (WBGU, 2011). This Great Transformation is a non-linear process and the result ‘of interlinked dynamics occurring at different time scales, which then, in their compounded form, create a certain direction of the transition’(Leggewie & Messner, 2012). Aiming to foster a transition to decarbonise our economy and society means to improve the co-operation between various actors and institutions globally.

[1] The German federal government set up WBGU as an independent, scientific advisory body in 1992 in the run-up to the Rio Earth Summit.

At present the failing and insufficient climate negotiations between nation states indicate that national short-term interests prevent the development of joint strategies towards a low carbon society. This is especially crucial because ‘actors constellations with sufficient power, resources and creativity prepared to welcome innovations and reforms in order to overcome established barriers, can be drivers of change’ (Leggewie & Messner, 2012). Furthermore, even though no concept or experiences exists to give reasons for decisions, scientific expertise is available to better understand future developments and develop strategies accordingly. Consequently, improved cooperation and communication between science and civil society is required to decarbonise the society.

2.2 Short description of R&Dialogue Project

In the context of the project R&Dialogue, funded under the European Union’s 7th Framework Programme for Research (FP7), the Institute of Energy and Climate Research – Systems Analysis and Technology Evaluation (IEK-STE) at the Forschungszentrum Jülich organised a dialogue on the subject of a society with low carbon dioxide emissions in North Rhine-Westphalia. The project objective was to improve the dialogue between civil society and science in this sphere of activity, and to identify concrete questions for both groups to work on. Our partners in France, Spain, Portugal, Scotland, Norway, the Netherlands, Italy, the Czech Republic and Greece have each carried out their own series of dialogues.

We considered it more conducive to the success of R&Dialogue to organize the dialogue in North Rhine-Westphalia than on the federal level. In terms of energy policy, Germany is a highly heterogeneous country. Energy is a so-called ‘matter under concurrent legislative powers’, i.e. energy policy falls within the jurisdiction of the Länder (federal states) as long as the federal level does not legislate. In practice it means that the federal level has indeed legislated and the Länder have to implement this legislation but they often do so in an uncoordinated way. We have chosen NRW because NRW is one of the most interesting and diverse Länder in terms of energy production and energy technology. It is fourth largest and most densely populated Land in Germany and it is responsible for about one third of Germany’s overall GHG emissions. It generates almost one third of Germany’s overall power demand and 10percent of Germany’s renewable energy supply. Also, 25percent of Germany’s end energy and industrial energy are consumed here. NRW’s economy is characterized by the presence of highly energy intensive industries. Energy and energy technology production comprise both conventional (mainly lignite, coal and methane as well as the respective plants) and renewable/LC (wind, solar, PV, hydro/coal mine methane) technologies. So energy and electricity are of particular importance for the economic and thus social prosperity in NRW, and they cover a wide range of resources and uses.

The integral part of the dialogue was a series of talks in which senior-ranking stakeholders from the energy sector in North Rhine-Westphalia (NRW) discussed a society with low carbon dioxide emissions. The IEK-STE staff organized and structured the events. They created the space for the dialogue but did not exercise any influence on its content.

Prior to the start of the series of talks, interviews were conducted with 43 experts on the subject of a low carbon society. On the basis of these interviews, themes were identified to be addressed as topics for discussion in the subsequent series of talks. These themes were presented to the experts and the most important four were determined by means of a voting procedure. In this manner, the four areas of 'acceptance', 'participation', 'application of science' and 'opportunities and challenges in North Rhine-Westphalia' were identified. The series of dialogues began in March 2014 with an inaugural event and ended in September 2014. The dialogue series produced a discussion and vision paper on the topic of a low carbon society.[2]

The R&Dialogue project in North Rhine-Westphalia ended with a final event on February 3rd 2015. At the Forschungszentrum Jülich we discussed the integration of the German energy transition in the EU-context with experts from different European countries. The aim of this event was to create a deliberative forum for exchanging perspectives on the German (NRW) energy transition, building cross-border networks, identifying areas of cooperation and mutual learning.

References

IPCC 2014: 'Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change'. Cambridge, United Kingdom and New York, NY, USA.

Leggewie, C. & Messner, D. 2012: 'The low-carbon transformation—A social science perspective'. Journal of Renewable and Sustainable Energy, 4:4**,** 041404.

WBGU 2011: 'World in Transition A Social Contract for Sustainability'. Berlin.

[2] A short summary is given in the next chapter. For the full paper see http://www.rndialogue.eu/papers.php

3. R&Dialogue: short summary of outputs

Discussion Paper

The Discussion Paper begins by outlining challenges, possible approaches, and the objectives of the participants, identified as issues to be addressed for the transition to a low carbon society. The Discussion Paper also detects questions that remain open and which represent sources of disagreement. It illuminates the current challenges in the progression towards a low carbon society as seen from the perspective of the stakeholders directly involved. Therefore, it is characterised by current events and by the contribution from the respective stakeholders participating. The document is consequently to be regarded as a possible point of departure that supplies indications and suggestions for further steps that can be taken. Some general conclusions are:

> Against the background of the aims of the climate protection law of the German state of North Rhine-Westphalia[3], the necessity for measures to reduce greenhouse gases was acknowledged by all participants present in the dialogue series. There was disagreement, however, about the speed with which these measures must actually be implemented. Although the influence of regional climate mitigation measures, through which carbon dioxide emissions are reduced, appear small on the global scale, there was agreement that Germany, and NRW in particular, could assume a pioneering role: If the industrial nation of Germany could succeed in carrying out a transformation process, particularly in its energy sector, this could inspire other countries to follow suit.
>
> From one perspective, the society was seen by the experts involved as the driver of climate mitigation politics. From a counter perspective, the criticism was offered that the population at large does not understand the magnitude of what awaits them. This was offered as a reason for why the consensus within society about which measures would lead to a low carbon society could not simply be reached in the future.
>
> The inclusion and the participation of different stakeholders (citizens, associations, companies, etc.) was seen by participants as an important corner stone for a low carbon society. The desire for more democracy by means of participation would be driven by the lack of trust in current politics and the economy and also by the higher educational level and the improved access to information. From this, there would be a resulting necessity

[3] More information on the climate mitigation law in NRW: http://www.umwelt.nrw.de/klima-energie/klimaschutz-in-nrw/klimaschutzgesetz/

to use the new methods and structures to involve the population in the transformation process.

The principal demand, which was repeatedly cited at different meetings, was identified as the need to initiate a higher-ranking dialogue that should lead towards a broad public agreement on clear visions for the transformation to a society with low carbon dioxide emissions. This could be initiated and authorised by the federal government. Similar processes were perceived to be necessary at the levels of the Länder, regions and local communities, in order to support a stabilisation of the expectations that are being placed on the energy transition.

Vision paper

The vision paper presents options of how a low carbon society can look like in 2044, from the perspective of the stakeholders involved. The basis for this was the round of talks conducted on September 4th 2014, at which the first partial aspects of future visions were collected. The vision presented here is intended to reflect the participants' core concepts of objectives and thereby show the basic orientation that guides their proposed actions. Some essential parts of the common vision are:

In the year 2044, with the aid of dialogue processes, a low-carbon dioxide society had been achieved, and one that is characterised by a comfortable standard of living. The three key points of the energy economy's triangle of targets had been met: the security of supply, the financial viability, and the environmental compatibility. The measures for the reduction of carbon dioxide in North Rhine-Westphalia are embedded in international agreements. Long-term and predictable determining conditions and rules of conduct for the roll-out of renewable energy sources and for the conversion of the energy infrastructure had been set by the political system. Renewable and conventional energy sources are integrated into the system. The stability of the system and of the grid is safeguarded. In addition, the energy transition is a holistic process that also contributes to solutions for other (global) problems (alleviating poverty and unemployment).

Regional dialogue processes of the past and present have enabled the participation of everyone in the transformation process, and they continue to do so. The costs and the advantages that result from the reduction of carbon dioxide emissions are known to all. The larger part of humanity is also aware of how much carbon dioxide its own actions actually cause. These aspects had become the topics of dialogue processes. The results of the dialogue processes and their implementation by those politically responsible led, and continue to lead, to a fair distribution of the costs and benefits within the society. Trust in dialogue processes and in political courses of action has significantly grown and a culture of "open dialogue on the energy transition" has taken root. North Rhine-Westphalia is still an important industrial centre, and a structural change has occurred. By virtue of the well-designed transformation process, opportunities could be exploited and larger negative effects have not materialised. The industry of North Rhine-Westphalia has achieved an important contribution to the reduction of greenhouse gas emissions. As a consequence there is affluence in all layers of society, even though consumption and patterns of behaviour have altered when compared to the year 2014.

4. Final event

4.1 Introduction

After several of months of dialogue with experts in North Rhine-Westphalia about the challenges of a low carbon society, we wanted to extend the dialogue process and include other European experts to deliberate on what we have learned so far. At present the discussion about the energy transition is only focused on national issues. But to successfully implement sustainable energy strategies, cooperation with other European countries is essential. Therefore on February 3rd 2015 the final event of the R&Dialogue project in North Rhine-Westphalia addressed the topic of the integration of the German energy transition in the EU-context. The aim of the event at the Forschungszentrum Jülich was to give room for exchanging perspectives on the German energy transition, building cross-border networks, identifying areas of cooperation and mutual learning. About 50 experts from Germany and other European countries attended the event to learn from each other.

The event started in the morning with five key-speakers to give a first overview on the different perspectives on the energy transition. Dr. Gianfranco Guidati, Program Manager Future Technology, Alstom (Switzerland) AG started with his presentation about ‘Modelling the lowest-cost route to decarbonising European power’. Views on the German Energy transition from a Portuguese perspective presented Antonio Mano, Directorate of Studies and Equipment Engineering, Consultant, Energias de Portugal (EDP). Dr. Christoph Neitzel, Consultant of EU and international committees at the Specialist Agency of Renewable Resources (FNR) then spoke about ‘The role of bioenergy in the European energy transition’. Dr.ir. Emile Chappin assistant professor at Delft University of Technology and senior research fellow at Wuppertal Institute for Climate, Environment and Energy presented his thoughts on the German Energy transition from a Dutch perspective. The method ‘Design Thinking as Messy Deliberation’ was introduced just before the lunch break by Prof. Dr. Steven Ney, Professor of Policy Science and Social Entrepreneurship at Jacobs University Bremen and Senior Fellow at the Hasso-Plattner-Institute.

To be able to have in depth discussions the participants split into three groups after lunch to discuss the topics of: ‘Different national energy transition pathways: a problem?’; ‘European harmonisation of support schemes for renewables?’ and ‘What role for dialogue and participation towards a European energy transition?’. This chapter gives the short summary of the presentations held at the final event. Further, the three discussion groups of the afternoon were summarized and the most important findings are documented.

4.2 Modelling the lowest-cost route to decarbonising European power

Dr. Gianfranco Guidati, Program Manager Future Technology, Alstom (Switzerland) AG

Any energy supply system has to follow the same three objectives:

- Safety & reliability: including both the short-term stability of the system as well as the long-term security of supply
- Affordability: Minimize cost of electricity or energy.
- Sustainability: Minimize the use of non-renewable resources, such as fossil fuels.

The challenge for the energy transition as envisaged by Germany and other European states lays in the fact that these objectives are generally contradicting each other. A very reliable system will require extra installation capacity which will increase the costs. Reducing the use of fossil fuels requires the installation of renewable capacity which will again increase costs. Even safety and sustainability are in contradiction; the first requiring thermal plants to operate and emit carbon dioxide even if enough renewable electricity would be available (see Figure 1).

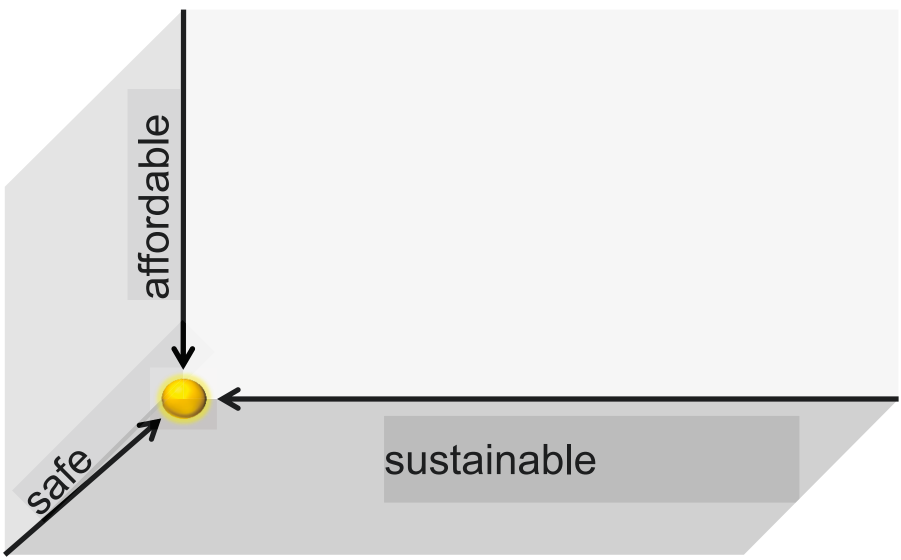


Figure 1: How we want an Energy System?

Such conflicting objectives can be visualized using a Pareto frontier (see Figure 2). This line represents the limit that can be reached with the best technology available at a given time. Any point on the Pareto frontier is better than any other in at least one respect. A more expensive solution is more sustainable, on the other hand a less sustainable is cheaper, etc. The Pareto frontier is not an abstract concept; it can be calculated as is shown on two examples.

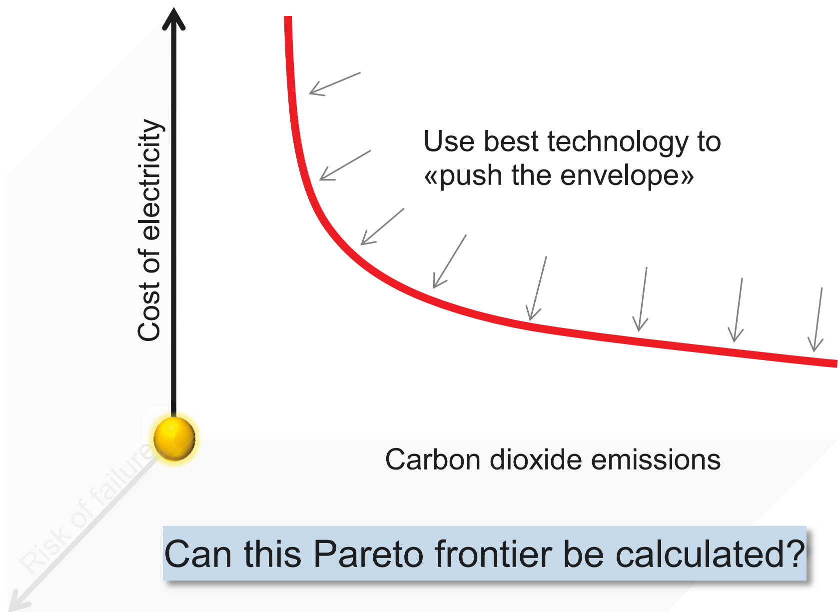


Figure 2: Conflicting Objectives: The Pareto Frontier

The first example is a full model of the European electricity system as developed by NTNU in Norway[4]. It uses historic demand and weather data and includes all power generation technologies (fossil, nuclear, renewable, carbon capture and storage - CCS). The model solves a coupled optimization problem, (1) an optimal dispatch with ten 48-hour blocks per year, and (2) an optimal investment trajectory from 2010 to 2050. The objective is to minimize the levelized cost of electricity (see Figure 3).

[4] http://www.ntnu.no/documents/7414984/221367681/Skar,%20CenSES+%C3%A5rskonferanse+2013.pdf/cbfbc4e6-9d1c-4451-91ed-43169bb8f4f4

- Developed within the ZEP (Zero Emission Platform)
- Modeling done at NTNU in Norway
  - Historic demand and wheather data
  - Includes all technologies (fossil, nuclear, renewable, carbon capture and storage - CCS)
  - Optimizes investment trajectory from 2010 to 2050

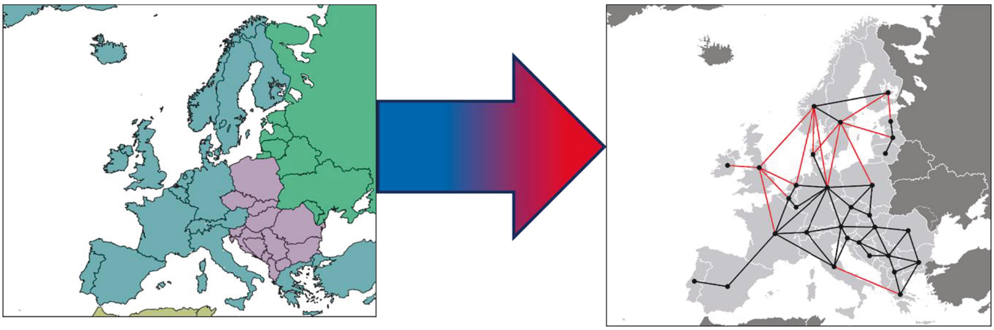


Figure 3: Model of the Electricity System in Europe

These simulations were done within the Zero Emission Platform (ZEP), using various assumptions on limits for Photovoltaics and onshore wind, and PV prices (see Figure 4). The results are published on ZEPs website[5].

- Constraints on PV deployment
  - Scaled on available land area
  - Assume coverage of 0.15% surface area of all European countries
  - Total of 1000 GW for Europe (calibrated on 70 GW for Germany)
- Constraints on onshore wind deployment
  - Scaled on available land area
  - Assume coverage of 5% of agricultural land (roughly 50%) for all European countries
  - Total of 850 GW for Europe (calibrated on 60 GW for Germany)
- Costs for photovoltaics in 2050
  - Conservative 1000 €/kW
  - Aggressive 200 €/kW

Figure 4: Definition of Scenarios

[5] http://www.zeroemissionsplatform.eu/library/publication/240-me2.html and http://www.zeroemissionsplatform.eu/library/publication/253-zepccsinelectricity.html

A typical example is shown in Figure 5. The normalized cost of electricity is plotted vs. the specific carbon dioxide emissions. The different dots along the curves represent the different years from 2010 to 2050. It can be seen that the availability of CCS leads to the lowest cost. Higher costs have to be expected when CCS is not available and electricity is mostly de-carbonized by PV and wind. This cost increase can be reduced by using electricity storage.

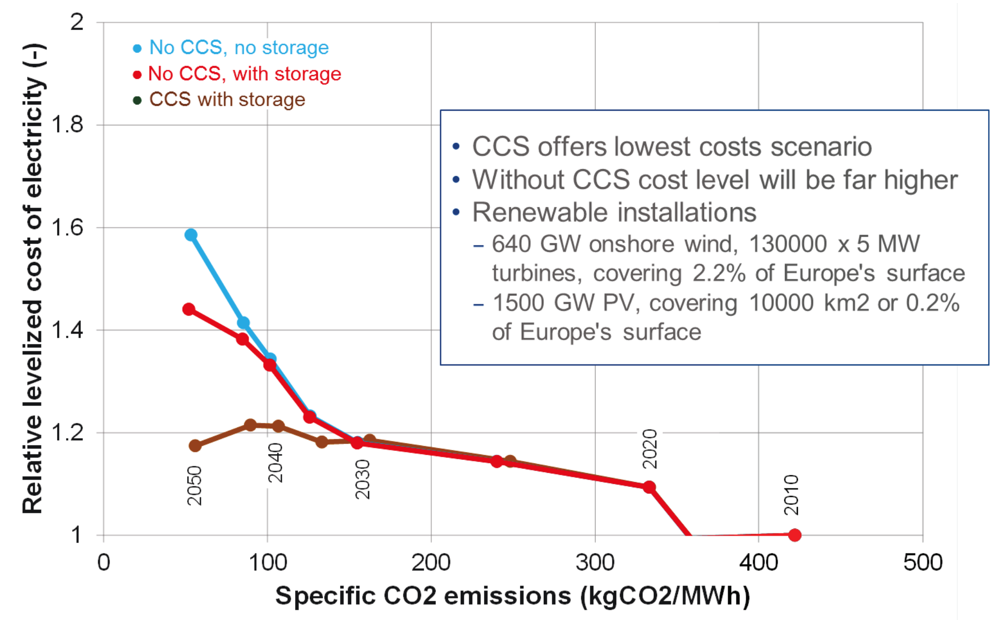


Figure 5: Scenario (6), Low PV Cost of 200 €/kW in 2050, no Limits on Onshore Wind/ PV

The results of the modelling can be evaluated to show the investment waves for the CCS and non-CCS scenarios (see Figure 6). From 2010 to 2030 an emission reduction is mostly achieved by building new, high-efficient gas turbine combined cycle plants. From 2030 to 2050 the investment path bifurcates, one being dominated by CCS the other by renewables, mostly PV.

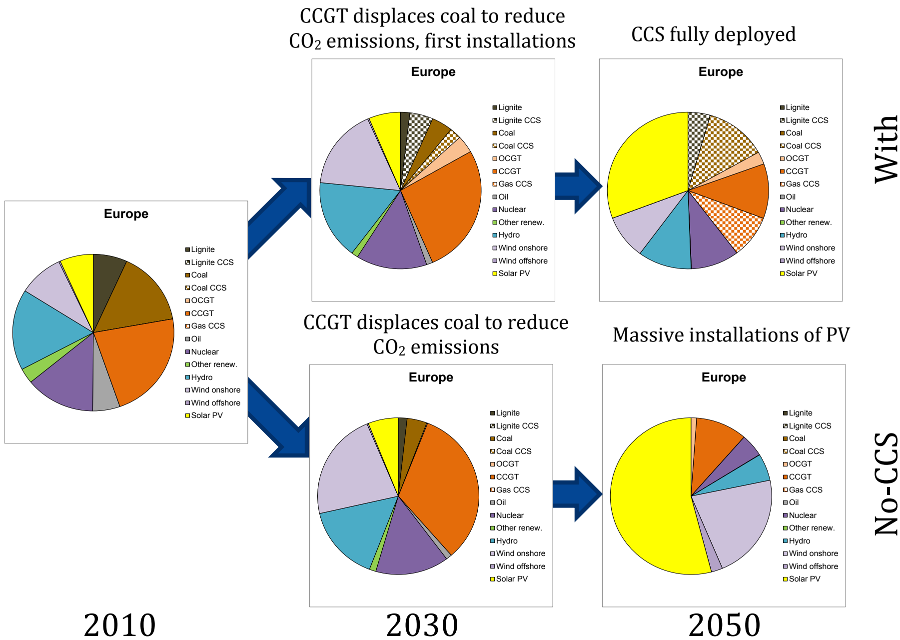


Figure 6: Scenario (6) Technology Waves

Figure 7 summarizes the results of different scenarios that show a possible increase of electricity generation costs by 20-50% in case CCS is not an available option.

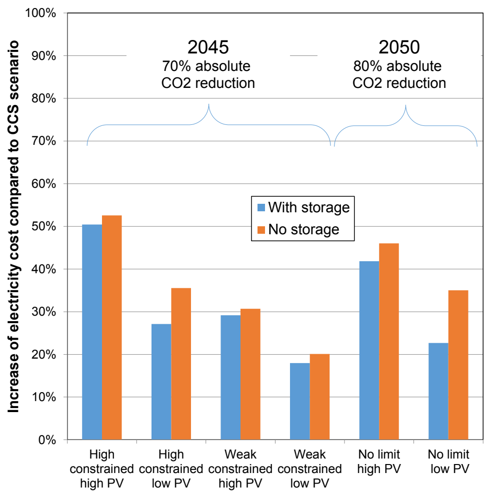


Figure 7: Summary of Simulations

- CCS always lowers the cost of reducing absolute CO_2 emissions by 80% in 2050
- Without CCS the cost of electricity in 2050 will be 20 – 50% higher
- Electricity storage helps to limit this increase

The second example of a Pareto frontier focuses on the value of electricity storage within a much simpler system that consists of renewable generation, electricity storage and a consumer. Again, the costs will generally increase for reducing carbon dioxide emissions, i.e. increasing installation of PV and wind. This becomes even stronger when curtailment occurs, i.e. when too much electricity is generated at some times while there is not enough at others. Once curtailment becomes too large, it becomes economically wise to invest in electricity storage, in order to transfer this "useless" electricity to times when there is a lack. The change of the Pareto frontier is different for different types of storage (hourly or seasonal).

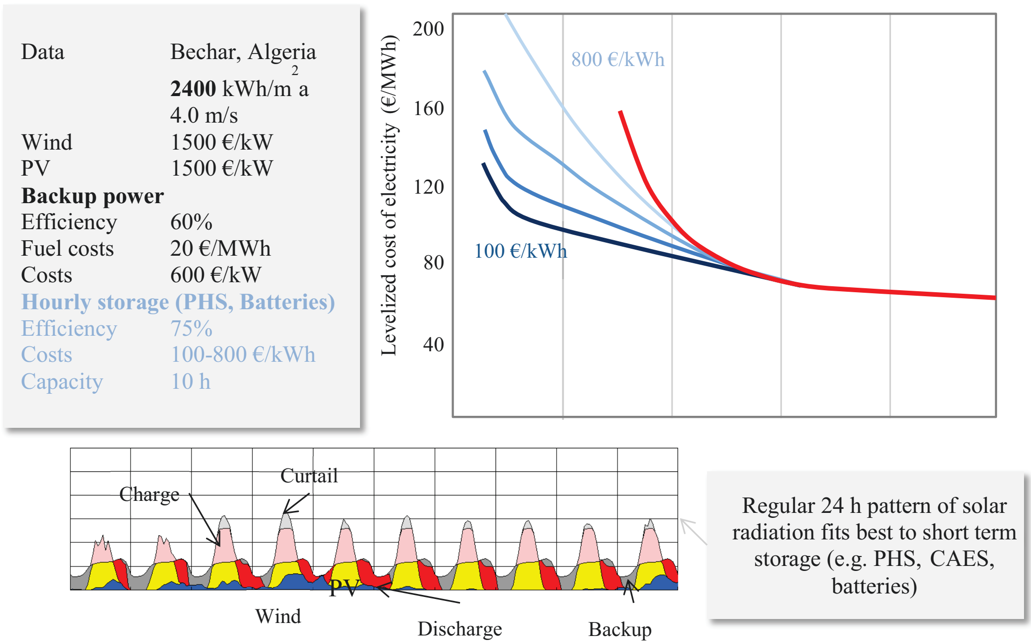


Figure 8: Solar dominated Scenario (Northern Africa)

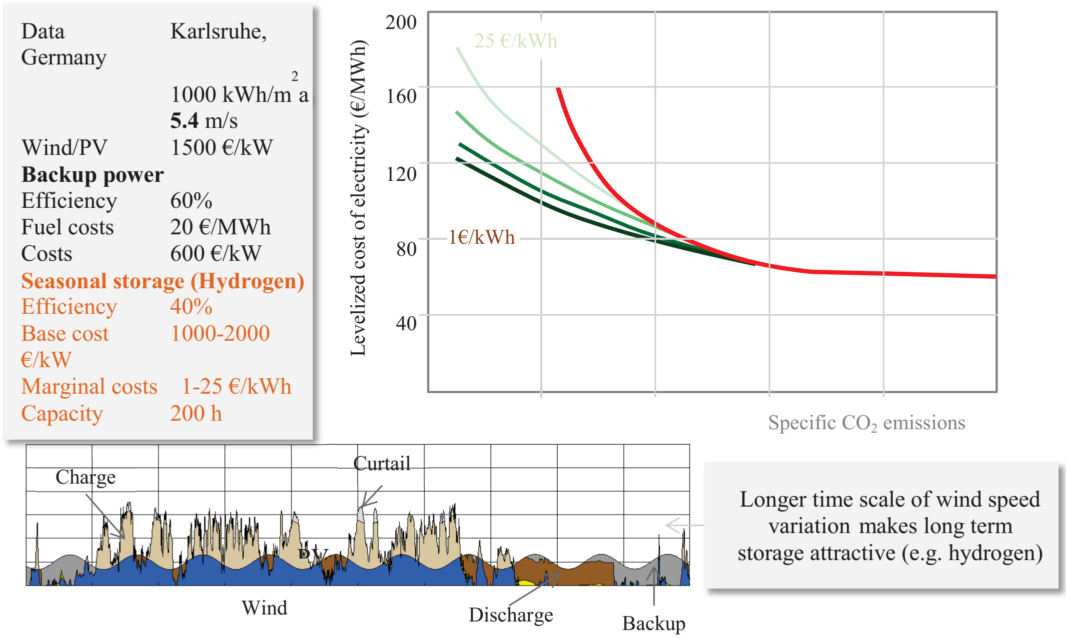


Figure 9: Wind dominated Scenario: Germany

Figure 8 and 9 show examples of Pareto frontiers, which were calculated for a solar and wind dominated scenario, respectively. The first exhibits a regular daily pattern that favours short term storage such as batteries. The second has the longer periods of wind generation and is better suited for longer term storage such as hydrogen.

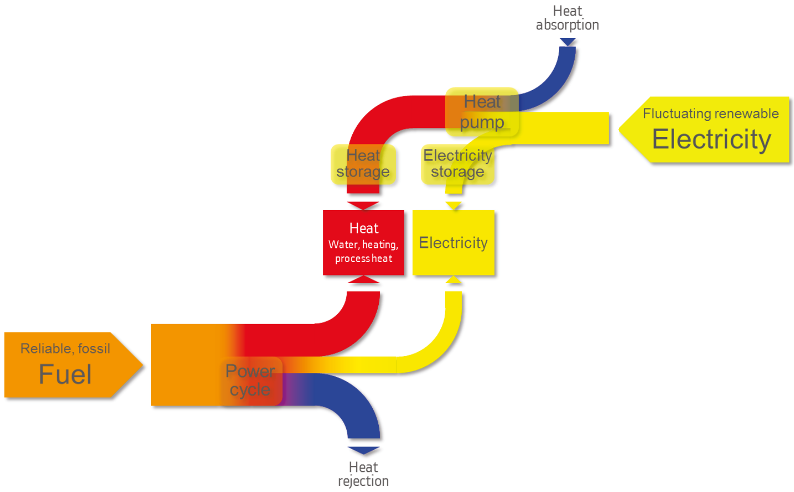


Figure 10: Energy is more than Electricity

Finally an outlook is given that goes beyond the electricity system that usually dominates the discussion on the energy transition (see Figure 10 and 11). Electricity is an important but not the only form of energy that is used. The others are low-grade (heating, warm water) and high grade (industrial processes) heat, as well as transportation fuels. Any serious effort to decarbonize an energy system has to tackle these fields, as well. This can be achieved by an electrification of the heat and transport sector, via heat pumps, electrolysers or batteries. The interesting aspect is that this transformation of one energy form (electrical) into another (thermal or chemical) enables storage options (thermal energy storage, tanks or caverns), that are generally cheaper than pure electricity storage.

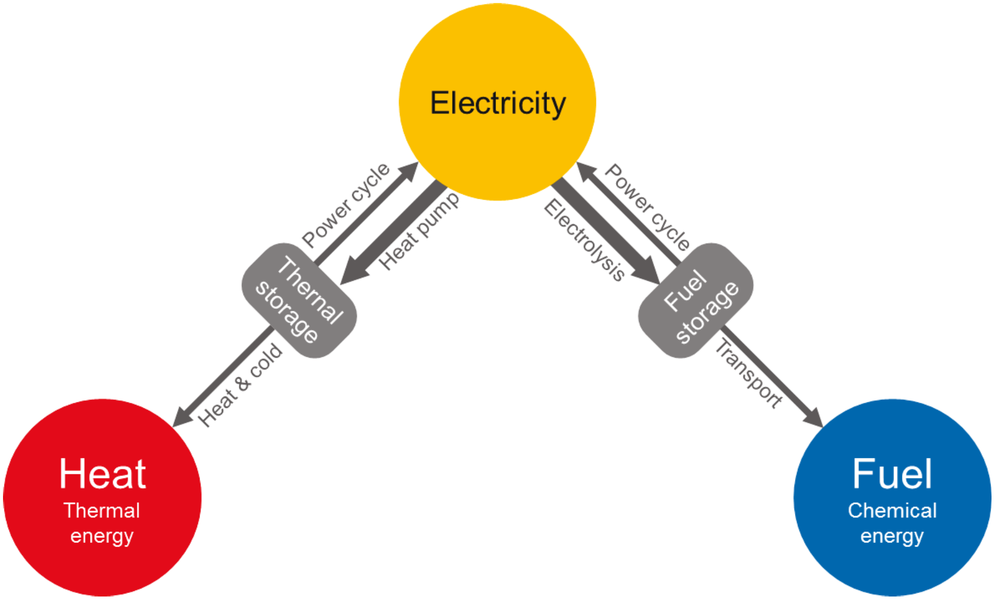
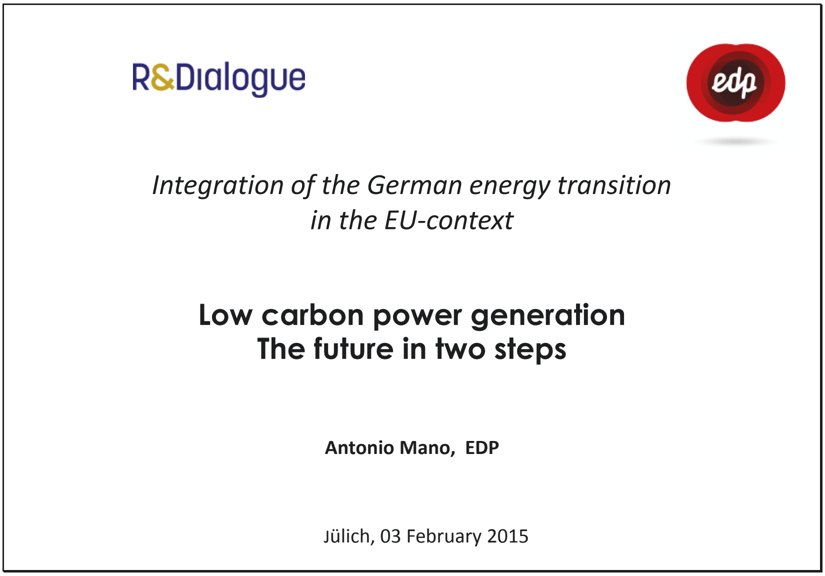


Figure 11: The Future is not only in producing Electricity, it is in managing it!

A successful energy transition that considers all three objectives mentioned at the beginning must therefore be based on a holistic approach that considers all energy forms that are required.

4.3 Low carbon power generation: The future in two steps

Antonio Mano, Energias de Portugal (EDP)



Power generation business development: **Driving framework**

Policy

- ✓ **Drives the regulation which sets the business oportunities and rules:**
  - ✓ Carbon emissions reduction (environment)
  - ✓ Lower dependency (higher security)
  - ✓ Affordability (economic competitiveness)

Economy

- ✓ **Drives investment decisions of utilities**

Lower GHG emissions

- ✓ **Sets renewable sources targets & CO2 caps (ETS)**

R&Dialogue Event
Jülich, 03 February 2015

First step to the future

Lower GHG emissions

- ✓ **Sets renewable sources targets & CO2 caps (ETS)**

Ex. : **EU** Energy climate targets 2020, 2030, 2050

R&Dialogue Event
Jülich, 03 February 2015
3

Energy systems in EU are changing …

KEY DRIVERS IN EU

- Environmental concerns (combat climate change)
- Increase energy security
- Strengthen competitiveness

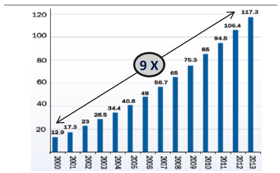
MAIN COMMITMENTS AND TARGETS

- (2007) "20-20-20" targets by 2020
- 2030 Framework:
  - Reduce GHG by 40%
  - Increase RE share to at least 27%
  - Increase grid interconnection to 15%
  - Increase energy efficiency by 30%
- 2050 Roadmap

SELECTED LEGISLATION

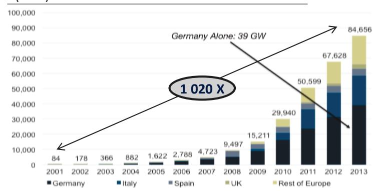
- (2009) Climate and energy package:
  - Reform of the EU Emissions Trading System
  - National targets for non-EU ETS emissions (Effort Sharing Decision)
  - National renewable energy targets (RE Directive)
  - Legal framework for carbon capture and storage (CCS Dir)
- (2011) Energy Efficiency Plan and EF Directive

Cumulative EU Wind Installations, 2000-2013
(GW)



Source: EWEA - Wind in power: 2013 European Statistics - February 2014

Cumulative EU PV Installations, 2001-2013
(MW)



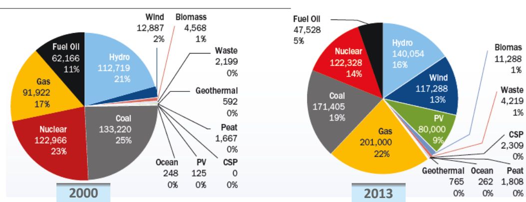
Source: EnBW

Wind and Solar Power have experienced huge growth between 2000 and 2013:

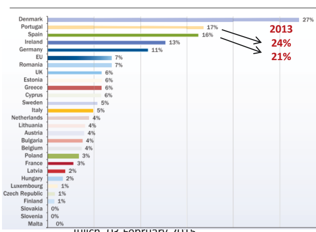
- The Wind Power installed in Europe reached **117 GW in 2013**, of which **4,7 GW in Portugal** and **23 GW in Spain**.
- The Solar PV in Europe reached almost **85 GW in 2013**, of which **282 MW in Portugal** and **4,4 GW in Spain**.

Power mix and share of renewables are changing …

Power Mix in EU, 2000 and 2013 [MW / %]



Wind Share in total consumption in EU, 2010 [%]

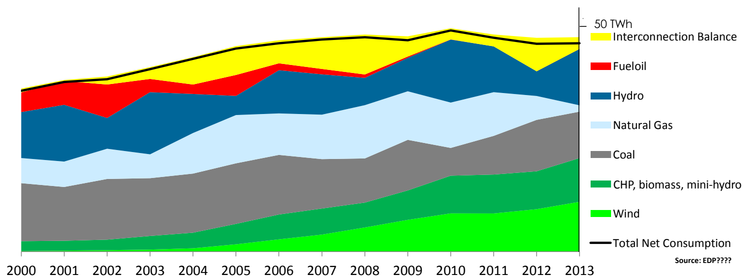


- **63%** of total installed capacity in EU, during 2013, was achieved through **Wind and Solar**.
- Wind power's share of total installed power capacity has increased five times since 2000; from 2.4% in 2000 to 13% in 2013.
- Over the same period, renewable capacity increased by 61% from **24.5% of total power capacity in 2000 to 39.6% in 2013**.
- In addition to the high installed capacity, the share of renewables in total consumption has been increasing in recent years.

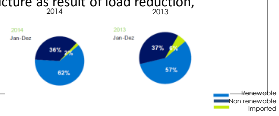
Source: EWEA - Wind in power: 2013 European Statistics - February 2014

Similar radical transformation in the electricity generation occurred in Portugal since 2000

Historical Generation structure
(TWh)



- The Natural Gas Technology has almost disappeared from the generation structure as result of load reduction, renewables contribution and excess capacity installed in the system;
- Strong growth of renewables sources, specially the wind generation;
- Fuel oil technology disappearance in 2010.



R&Dialogue Event
Jülich, 03 February 2015

6 6

Consequences of high shares of renewable energy

- ✓ **Operation Flexibility requirements**
- ✓ "No more" **base load**
- ✓ **Lower load factors** (lower utilisation) (excess of capacity ?)
- ✓ **Decreasing price** of energy in **gross market** (lower spreads)
- ✓ **Decreased profitability of conventional PG**
- ✓ No technology is profitable to invest on new assets for the gross market (LCOE > market price)
- ✓ **No willingness to invest in new capacity, unless huge guarantees & prices (Ex: Nuclear, CCS)**

R&Dialogue Event
Jülich, 03 February 2015

7

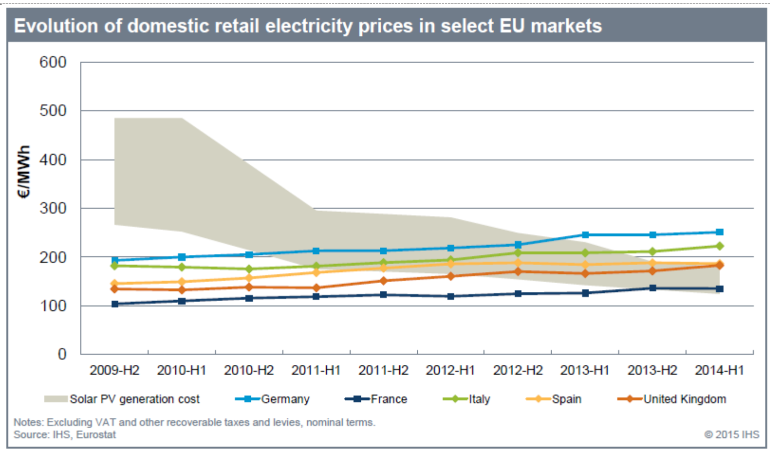
Second step to the future

A new profitable market is **emerging**:

- The **retail market of prosumers**

- Price level > 20c€/kWh
- while **gross market** average price: 5c€ /kWh
- Competitiveness of distributed generation is being reached for PV technology. (with storage will follow soon)

The economics for PV self-generation have improved a lot between 2009 and 2014



Conclusion

Distributed Generation is expected to grow and replace an increasing part of the generated conventional power which will suffer from lower price level of

Thanks for the interest

4.4 The role of bioenergy in the European energy transition

Dr. Christoph Neitzel, European and International Cooperation, Agency for Renewable Resources (FNR)6

Introduction

This article briefly summarises some of the major statements from the presentation "The role of bioenergy in the European energy transition" held on February 3rd, 2015 in Jülich. Although the emphasis of this article is on a European perspective, the German case is frequently used for exemplification. The article will start with a brief overview of the relevant European policy framework, highlights the role of bioenergy in the European energy mix, provides a few insights regarding the socio-economic impact of bioenergy, and concludes with a challenging outlook for this sector.

Policy framework

The EU's policy framework for bioenergy is mainly based on the Europe 2020[7] strategy for smart, sustainable and inclusive growth. The strategy is focused on five ambitious goals including one goal for climate and energy. Climate change and energy sustainability is divided into three sub-goals, known as the triple 20-targets: i) 20 percent reduction of greenhouse gas (GHG) emissions compared to 1990, ii) 20 percent of energy from renewables, and iii) 20 percent increase in energy efficiency of primary energy use. These targets are flanked by various EU supporting measures, such as technology road-mapping (e.g. the EIBI[8] 'European Industrial Bioenergy Initiative' under the SET-Plan[9] 'Strategic Energy Technology Plan', which prioritizes and facilitates first-of-a-kind demonstration of innovative clean energy technologies in Europe), policy-making (e.g. the RED[10] 'Renewable Energy Directive', which establishes an overall policy

[6] The Agency for Renewable Resources (FNR) was founded in 1993 and currently employs more than 80 people. The main task of FNR as a single funding agency is to manage the funding program "Renewable Resources" on behalf of the Federal Ministry of Food and Agriculture" (BMEL). Specific tasks are the support of research, development and demonstration projects in the field of material and energetic use of renewable resources, the provision of information and advice through public relation activities, and international and EU activities. The target groups are commercial enterprises, small and medium-sized enterprises, private and public research institutions, universities, authorities and consumers amongst others.

[7] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF; retrieved January 2015

[8] http://www.biofuelstp.eu/eibi.html; retrieved January 2015

[9] http://setis.ec.europa.eu/about-setis/set-plan-governance; retrieved January 2015

[10] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&from=EN; retrieved January 2015

for the production and promotion of energy from renewable sources in the EU) and funding activities (e.g. the research framework program HORIZON 2020[11] for supporting the EU's Innovation Union by also funding R&D projects in the realm of bioenergy).

Role of bioenergy in the energy mix

The role of renewable sources[12] in the energy mix varies considerably among countries in the world. For example, the share of energy from renewable sources in gross final energy consumption[13] in an OECD-EU comparison from 2011[14] shows that the EU-28 is apparently not a forerunner with an overall share of 13 percent. Countries such as Iceland (72%), Norway (64%), New Zealand (32%), Chile (29%), Canada (24%), Switzerland (24%) and Turkey (13%) are well ahead.

However, the EU-28's share of energy from renewable sources in gross final energy consumption has grown strongly from 8.3 percent in 2004 to 14.1 percent in 2012[15]. This has been promoted by the RED from 2009 onwards, in particular through the legally binding target of 20 percent renewable energy in the energy mix by 2020. This target is translated into country-specific targets that are formulated in national action plans. These action plans are designed to plot a pathway for the development of renewable energies in each Member State. While the EU as a whole is on track to meet its 2020 targets, some Member States need to make additional efforts to meet their national targets. Among the EU Member States, the highest share of renewables in gross final energy consumption in 2012 was recorded in Sweden (51%), while Latvia, Finland and Austria reported each more than 30 percent from renewables. The targets for the Netherlands and the United Kingdom require them to increase their share of renewables in final energy consumption by at least 10 percent. By contrast, Denmark, Sweden, Bulgaria and Estonia had already surpassed their targets for 2020. In this European picture, Germany is with more than 10 percent on the lower end of the scale and did not reach their individual target yet.[16]

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[11] http://ec.europa.eu/programmes/horizon2020/; retrieved January 2015
[12] Renewable energy sources are sources that renew themselves naturally; e.g. biomass, solar, wind, and hydro.
[13] Final energy consumption is the total energy consumed by end users; e.g. households, industry and agriculture.
[14] http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_from_renewable_sources; retrieved January 2015
[15] http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_from_renewable_sources; retrieved January 2015
[16] http://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics; retrieved January 2015

The role of bioenergy[17] in the energy mix is influenced, among others, by the rapid expansion of other energy technologies. For example, in the EU-28 the share of renewable energy for final consumption from solid renewables (including wood and renewable waste) decreased from 60 percent in 1990 to 42 percent in 2013, although their share increased in absolute terms by 73 percent[18], highlighting its important role especially in the heating sector. In Germany, the total final energy consumption reached about 2,590 TWh in 2013 with more than 13 percent renewable energy sources, including 7.6 percent from biomass, which means that more than 60 percent is attributable to bioenergy[19]. In the case of renewable electricity production it is likewise observed that the share of biomass between 2000 (34.1 TWh, 8.2 %) and 2012 (149.4 TWh, 19.5 %) did not increase in absolute and relative terms at the same rate in the EU[20]. In 2012, significant (in absolute figures) amounts of electricity were produced from biomass in Germany (17 TWh), Finland (11 TWh), Sweden (12.2 TWh), Poland (9.5 TWh) and the United Kingdom (9.3 TWh), and from biogas in Germany (27.2 TWh), the United Kingdom (5.9 TWh) and Italy (4.6 TWh)[21.] In the case of renewable sources for gross final energy consumption in the transport sector, the EU-28 had a five percent share in 2011[22]. In 2012, high amounts (in absolute figures) of transport fuel were produced in the form of bioethanol in Germany (9.4 TWh), France (4.8 TWh), the United Kingdom (4.5 TWh), Sweden (2.3 TWh) and Spain (2.3 TWh), and in the form of biodiesel in France (26.4 TWh), Germany (25.5 TWh), Spain (22.1 TWh), Italy (14.7 TWh), Poland (7.8 TWh) and the United Kingdom (5.8 TWh) [23.]

Socio-Economic Impact

In 2012, a sales volume of almost 130 billion € was generated from renewable energy in the EU-27. Compared to 2011 the industry had recorded a significant decline (turnover 2011: 141 billion

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[17] Biomass is the feedstock source for the direct and indirect production of bioenergy. Main examples are biofuel (gasoline) from plant waste, biodiesel from waste oil, biogas from sewage/manure/organic household waste/plant crops, bio-heat from wood, and bio-electricity from wood.

[18] http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_from_renewable_sources; retrieved May 2015

[19] https://mediathek.fnr.de/grafiken/daten-und-fakten/bioenergie/anteil-erneuerbarer-energien-am-endenergieverbrauch.html; retrieved January 2015

[20] http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6; retrieved January 2015

[21] http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6; retrieved January 2015

[22] http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_from_renewable_sources; retrieved January 2015

[23] http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6; retrieved January 2015

€). According to the EurObserv'ER24, this downward trend is attributed to the investment uncertainty as a result of the financial crisis and the performance of photovoltaics. In terms of the sales volume, the biomass sector ranked third place after wind and solar. At the national level, Germany is the highest revenue country and has a share of total sales volume in the EU with over 26 percent followed by Italy (11.1%) and France (8.7%).[25]

Germany's total turnover with renewable energy sources in 2014 was around 14.1 billion € where biomass for electricity and heat constituted almost 50 percent and biomass for fuels approximately additional 20 percent[26]. Due to the growing number of installations, revenues from the operation of renewable energy plants increased since 2000 steadily. These revenues strengthen the economy sustainably, as they occur continuously over the entire lifespan of a plant, mostly 20 years, and continue to grow with each additional installation.[27]

According to an estimate of IRENA28, approximately 6.5 million people were worldwide either directly or indirectly employed in the renewable energy sector in 2013. A total of approximately 1.2 million jobs were determined by the EurObserv'ER[29] in the European renewable energy sector in 2012. Nearly three-quarters of the jobs are in the sectors wind, solid biomass and photovoltaic. The biomass sector (282,095 jobs) is ranked second after the wind sector (303,445 jobs) and followed by the photovoltaic industry (252,570 jobs). The jobs in the renewable energy sector are unequally distributed over the EU countries: 76 percent of the jobs are concentrated in

[24] Observatoire des énergies renouvelables (Observ'ER): The state of renewable energies in Europe, 13th EurObserv'ER report, Edition 2013, www.eurobserv-er.org; cited in http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6

[25] http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6; retrieved January 2015

[26] https://mediathek.fnr.de/grafiken/daten-und-fakten/bioenergie/umsatz-mit-bioenergie.html; retrieved January 2015

[27] http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6; retrieved January 2015

[28] International Renewable Energy Agency (IRENA): Renewable Energy and Jobs – Annual Review 2014, May 2014, www.irena.org; cited in http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6

[29] Observatoire des énergies renouvelables (Observ'ER): The state of renewable energies in Europe, 13th EurObserv'ER report, Edition 2013, www.eurobserv-er.org; cited in http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6

seven countries. However, while jobs were lost in Germany, Italy, Spain, Denmark and the United Kingdom, an increase was recorded in almost all other EU countries[30.31]

In Germany the employment nearly doubled between 2004 (160,500) and 2012 (399,800) in the renewable energy sector. Renewable energy from biomass ranked second after wind energy and followed by solar energy. But according to initial estimates[32], the number of employees has decreased in 2013 to 371,400. Decline was most pronounced in the photovoltaic industry, followed by a minor decrease from 137,800 (2012) to 126,400 (2013) in the bioenergy sector. In contrast wind energy increased employment by almost 16,000 jobs. However, the last performed review[33] on a net basis came to the conclusion that an ambitious expansion of renewable energies in Germany in almost all scenarios analyzed result in a net increase of employment compared to an energy supply that largely waives the option of renewable energy.[34]

Challenging outlook

Bioenergy challenges are varied and touch up on policy, economic, environmental and social aspects. In the case of policy, the 'new' EU's 2030 framework for climate and energy35 raises the question whether the triple targets (40 percent reduction of GHG emissions, 27 percent of energy from renewables, and 27 percent increase in energy efficiency) are ambitious enough. Only the 40 percent GHG emission reduction is binding and there is no separate target for the transport sector. This reservation is also reflected at the Member State level where the progress

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[30] Observatoire des énergies renouvelables (Observ'ER): The state of renewable energies in Europe, 13th EurObserv'ER report, Edition 2013, www.eurobserv-er.org; cited in http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6

[31] http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6; retrieved January 2015

[32] O'Sullivan, M .(DLR); Edler, D .(DIW); Bickel, P .(ZSW); Lehr, U .(GWS); Peter, F .; Sakowski, F .(Prognos): *Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2013 – eine erste Abschätzung*, Stand Mai 2014, Im Auftrag des BMWi, http://bmwi.de/BMWi/Redaktion/PDF/B/bericht-zur-bruttobeschaeftigung-durch-erneuerbare-energien-jahr-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf; cited in http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6

[33] Lehr, U .; Lutz, C .(GWS); Edler, D .(DIW); O'Sullivan, M .; Nienhaus, K .; Nitsch, J .; Simon, S .(DLR); Breitschopf, B .(FhG-ISI); Bickel, P .; Ottmüller, M .(ZSW): *Kurz- und langfristige Auswirkungen des Ausbaus der erneuerbaren Energien auf den deutschen Arbeitsmarkt.* Forschungsvorhaben im Auftrag des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit (BMU), Februar 2011; cited in http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6

[34] http://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/erneuerbare-energien-in-zahlen.pdf?__blob=publicationFile&v=6; retrieved January 2015

[35] http://ec.europa.eu/clima/policies/2030/index_en.htm; retrieved January 2015

of and active support for the achievement of the 2020 targets is stuttering. For example Germany, as the alleged forerunner of the energy transition, recently amended its well-known Renewable Energy Sources Act (EEG) 2014 in a way that the future development of bioenergy for electricity production got significantly limited. Furthermore, it can be observed that in Germany in the case of heating production the Renewable Energy Heating Act (EEWärmeG) didn't provide sufficient impetus to the market uptake of bioenergy and consumption levels are stagnating instead.

From an economic perspective, the bioenergy sector faces relatively high operating expenses (OPEX) for energy production compared to other renewables and conventional sources. For instance, costs for substrates incur continuously for bioenergy production, while the input factors wind and sun are available for free. In this regard bioenergy is only of advantage compared to other renewable energies, if attributes such as storage and flexible accessibility play a key role in considerations. In the past Germany remunerated these aspects with its incentive scheme. However, since incentives are continuously cut down, an economic operation of, for example, new biogas plants and wood heating plants in its present form is hardly possible. Only small manure and biowaste fermentation plants still receive relatively high support and allow economical operation. All other bioenergy solutions must develop new concepts without public support schemes. In this respect, energy generation from biomass requires further technical developments, improved efficiency, adequate framework conditions, rising prices for conventional energy sources and new business models or combinations of these factors in order to play a role in the future.

Although bioenergy is deemed renewable, it is obvious that there are environmental limits. An uncontrolled increase of bioenergy use would create additional land-use competition. This competition may, for example, provoke and affect land-use change (LUC), indirect land-use change (ILUC), water quantity/quality, soil quality, and biodiversity. However, it is necessary to equally acknowledge that the forecasted population growth to nine billion people by the year 2020 and the planned paradigm shift from a fossil-based to a bio-based economy in Germany[36,] and Europe[37] as a whole, will increase the demand for all four "F's" of a growing bioeconomy: food, feed, fibre and fuel. That means that Europe has an allocation problem of scarce resources and has to find balanced, sustainable and smart solutions to deal with it. In the case of bioenergy this means i) comply with the primacy of food security, ii) comply with the already existing sustaina-

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36 http://www.bmel.de/SharedDocs/Downloads/EN/Publications/NatPolicyStrategyBioeconomy.pdf?__blob=publicationFile; retrieved January 2015

37 http://ec.europa.eu/research/bioeconomy/pdf/official-strategy_en.pdf; retrieved January 2015

bility criteria under the RED, and iii) identify biomass sources that reduce the environmental impact and ideally improve production practices. Examples for the latter would be a focus on bio-waste/-residues (e.g. from forestry, agriculture, livestock and food industry), integrated food-energy systems[38] (e.g. catch crops and inter-cropping systems) and blue growth options (e.g. micro and macro algae). However, at least in Germany the potential for a 2050 energy scenario[39] with a significant role of bioenergy in the energy mix is there, if consumption is reduced significantly in parallel. Germany can build its consumption on a minimum of two solid pillars: forestry and agriculture. Germany's forest area covers approximately one-third of the national territory (11.4 million hectare) and the latest forest inventory showed that the timber stock is growing[40]. Similarly the agriculture potential of Germany is considerably high with around 16.7 million hectares, where in 2014 the area for energy use was limited to 12.4 percent of the total area (see Figure 12)[41].

[38] http://www.fao.org/energy/78517/en/; retrieved April 2015
[39] https://www.ffe.de/fachtagung2013/download/FfE-Fachtagung_2013_Vortrag_Dr_Schillings.pdf
[40] www.bundeswaldinventur.de; retrieved January 2015
[41] https://mediathek.fnr.de/grafiken/daten-und-fakten/anbau/anbauflache-fur-nachwachsende-rohstoffe-2013-grafik.html; retrieved May 2015

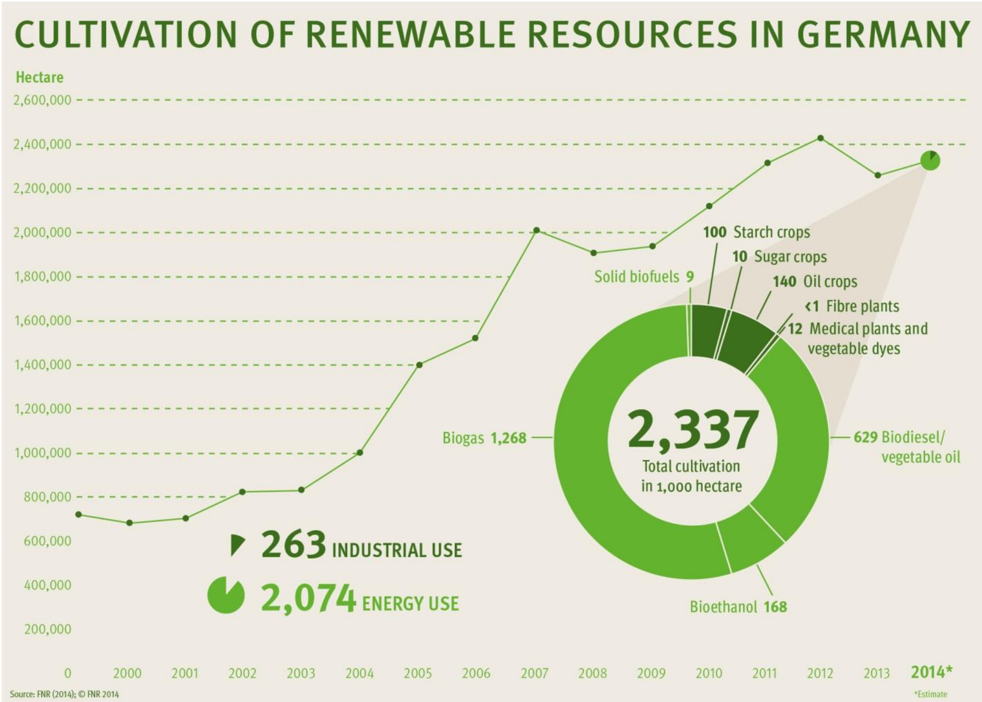


Figure 12: Cultivation of Renewable Resources in Germany[42]

The social dimension is related to the decreasing public acceptance, in particular of biofuels. This perception is mainly influenced by the public discussion around environmental considerations as mentioned before. However, a critical review of the complete picture, catchword ‘growing bioeconomy’ and alternative concepts for energy security, catchword ‘Energiewende’, is missing. If society is willing to forgo the business as usual option this preference must be stated on an informed basis and concepts must be developed under a holistic contemplation of Europe’s situation.

Conclusion

The provided information and aforementioned challenges and advocacy arguments make no claim to be complete but they indicate that there are considerable arguments in favor of a bioenergy future, which directly relate to three of the five ambitious goals in the Europe 2020 strategy:

[42] Source: https://mediathek.fnr.de/grafiken/daten-und-fakten/anbauflache-fur-nachwachsende-rohstoffe-2013-grafik.html

employment, innovation, and climate & energy. It has been shown that bioenergy is a strong support for rural development since existing jobs in the primary sector are secured and new jobs got created in the tertiary sector. This ‘rural renaissance’ is also a result of a boost in innovation and development over the last 20 years, which made Germany a European leader in biogas/methane production and led to a share of more than two-thirds of bioenergy in renewable energy for heating in Germany. In terms of energy security the contribution of bioenergy is positive as well through the fostered decentralized energy production, the flexible multi-functionality (heat, electricity, fuel) and the reduced dependency from fossil and nuclear energy.

However, the varied critics in the public debate also point out that there is a need for action. On the policy side the implementation of favorable political and legal frameworks is needed, which should be evidence and science-based. A first step could be an equal level playing-field where external costs of conventional energy carriers are included in market prices.

On the socio-ecological dimension it is necessary to consider sustainability aspects in all four sectors of a growing bioeconomy. Currently, bioenergy is on the forefront of self-commitment and government regulations. It does not show the whole picture if only bioenergy is blamed for LUC around the world while population growth is the real challenge. In particular the desirable increase of living standards requires massive area increases for feed production in order to satisfy beef consumption. In this regard it is equally necessary to inform objectively and improve PR activities for raising more public awareness.

Related to the technology axis a lot of progress has been made but there is still room for improvement along the whole value chain. On the feedstock side developments are needed regarding alternative substrates that reduce land use competition. Among the examples are bio-waste, straw, integration of energy crops in rotation cycles, and higher area efficiency. The increasing use of residual matter and waste materials is of particular interest since they are still considered as no regret options. Furthermore, process optimization (e.g. process control and substrate pre-treatment) has still some potential as well. In this regard, raising efficiency in production and use of bioenergy is still possible. An immense advantage compared to other renewable energy sources is that bioenergy production is flexible and demand-driven. There is a considerable potential for the combination of bioenergy with fluctuating renewables such as solar thermal heating. The possibility of new organizational and business models is there and already existent through approaches such as bioenergy/renewable energy villages/regions.

In sum, the future of bioenergy, in particular for electricity generation and transport, is currently strongly questioned. In this for many operators critical situation a discussion is needed concerning the allocation of the existing biomass potential in the most meaningful way and the creation of long-term conditions for reliable development. In this context, the important role of bioenergy in the renewable energy mix must be considered. It is necessary to acknowledge that without bioenergy – at least as long-term bridging technology – the energy transition is hard to achieve, if the use of conventional energy carriers shall really expire.

4.5 Die Energiewende: A 'Delft' perspective

Dr.ir. Emile Chappin, Assistant Professor, Energy & Industry Section, Faculty of Technology, Policy and Management, Delft University of Technology, Delft

In this talk I discussed three main messages:

1. The Energiewende forces us to consider new questions, new approaches, and new tools
2. The complexity of modern infrastructures forces us to look at interactions across time scales, across sectors and across levels, and, therefore, at technology and at actors
3. The Energiewende advocates the search for and exploration of policies that are able to shape the actors and technologies in our energy systems in such a way that they are robust against the myriad of uncertainties.

Climate policy and uncertainty

The only climate policy on the EU level is the EU emissions trading scheme, which functions but has only achieved emission reductions because of the economic crisis, which turned out to lead to the first decline in electricity demand since World War 2. In addition, it is helped by national renewables policies, which amongst others is the core driver behind the Energiewende. However, in the European Union's Emission Trading System – (EU ETS) you could argue that subsidizing local reduction means subsidizing emissions elsewhere.

The EU ETS is assumed to become a driver for the energy transition, but because abatement needs investment and technology development, this is very slow. Our modelling work shows that long abatement and price swings are very not unlikely and very expensive (Chappin 2011, Chappin et al., 2010). Indeed, we see in reality that price signal on the carbon market has proven to be hard to get right and the currently proposed reparations may well prove unsuccessful (Richstein et al., 2013; Richstein et al., 2014).

The scope can't even be limited to the EU. A 652 million euro brand new and relatively clean gas fired power plant in the Netherlands not running amongst others because of an overcapacity of coal, low coal prices do to shale gas, an immense infeed of German solar and wind power. Global developments have a dominant influence on local return on investment. How to foresee such things how to avoid them or correct undesired effects?

This illustrates the fundamental complexities of Energiewende, and how everything is interconnected: EU energy policy cannot be seen separately from climate policy, nor from local climate and energy policies. These are the new questions of today.

Energiewende and actors

Energiewende has been successful in terms of a 'Stromwende' (electricity transition), but a lot of other abatements that are economically viable have not been adopted. Less attention goes to why that is the case and how it can be solved. It requires not only technological change, but we also have to acknowledge that behavioural change is needed. For instance in lighting, which accounts for ~4 TWh/year in the Netherlands, the incandescent technology has not improved for 100 years, and despite the fact that many alternatives are available, they have long not been adopted because of the habits of consumers, perceptions on how saving lamps perform etc. The EU ban on bulbs is an effective measure and the need for such a ban shows how difficult it is to change how consumers make decisions (Chappin & Afman, 2013). Even stronger, lighting is becoming more of a fashionable item, so consumers don't choose the desired options and buy more lamps.

The Delft approach

In Delft, at the faculty of Technology, Policy and Management, we develop and explore new methodologies and tools to deal with these fundamental complexities. Can we find out what are the mechanisms that together make the system as a whole behave in the way we see in reality? Can we explore how to shape possible future trajectories, acknowledging that we face fundamental uncertainties that we have to consider multiple levels of analysis, that many different hard-to-capture actors are involved and that we have to look at various time scales? This translates into new types of questions, and leads to the need for new approaches.

We start from a good understanding of the technical systems, the infrastructure networks, the core components, we taking an engineering attitude, not ignoring the systems in place, an attitude to build stuff, develop models, make explicit assumptions to approaching system-level questions that open the black box of the 'societal context', taking a socio-technical perspective on infrastructure systems.

We work on a variety of modelling techniques, such as agent-based modelling, which models actors as individual agents who make autonomous decisions. For instance, energy producers decide to invest in power plant or consumer agents decide to renovate, purchases light bulbs.

Agents make decisions based on the others: they interact through the market and through social networks. Investment decisions are based on expected power prices, which are affected by past investments. Therefore, the decisions together determine system-wide developments

System-level questions we work on

Let's discuss a few of the ongoing questions that we currently work on.

1) What are cross-border effects of energy/climate policies?

This requires taking into account interacting policies within and across borders. For instance, does the minimum carbon dioxide price in the UK sponsor the need for carbon dioxide reduction in the Netherlands? What is the effect of German renewable energy penetration on Dutch electricity prices and need for flexibility? Security of supply: How to design a capacity mechanism in the Netherlands?

It requires considering the technology (power generating technologies, networks, dispatch, ramp rates, weather, etc.) and the social/institutional (ETS, day ahead electricity markets, fuel markets, regulation, investment, etc.).

2) What can be the role of energy storage?

How can storage help to provide the needed flexibility in the electricity system, matching demand and supply; affordable, reliable & clean? How does this relate to demand response: possibilities with electric vehicles? What is needed to make this a reality? What are the effects of high German RES penetration rate on Dutch business case for storage?

It requires technology (potential, short-term variations, incl. predictability, developments in generation capacity, operation, etc.) and the social/institutional (institutional design, possible business cases, investment strategies, market structures, operation, etc.).

3) How to improve the energy renovation rate in buildings?

The renovation rate is low, how can the huge potential and economically viable renovation be materialized? What is needed to make the energy label function better?

It requires technology (development technologies, smart grid/smart meters, smart devices, etc.) and the social/institutional (housing market, social networks, social structures, structuring of lifestyles, etc.)

Research results – improving the EU ETS and feeding the dialogue

With the agent-based model called EMLab-Generation[43] we simulate the North West European electricity markets and the ETS. In the model we represent the power sector in two zones, Great Britain (GB) on the one hand and Central Western Europe (CWE, consisting of Belgium, France, Germany, Luxemburg and The Netherlands) on the other. We model the interconnector between the two markets and have various power companies as agents investing in power generators based on their own forecasted net present value (NPV). They are faced with the emissions trading scheme, with an optional price floor in one or both countries, a price ceiling and tax. In addition subsidized renewables follow the targets in place.

Results from EMLab-Generation show the weaknesses of the EU ETS and help us to improve it. It illustrates that a carbon auction reserve price does not lower welfare, but lowers the price volatility for carbon, that a national price floor for carbon lowers consumer cost in other countries, that a price ceiling for carbon does not lead to an overshoot of emissions and that the proposed market stability reserve may cause more price volatility instead of resolving it.

We also work on serious gaming. We feed the dialogue with an electricity market game (see http://emg.tudelft.nl), where players form electricity companies, operate the electricity market, invest in assets. Players experience a variety of uncertainties, such as fuel prices, outages and policy changes. Involvement by means of the game leads to deeper understanding of the complexities of the system (Chappin, 2011; De Vries & Chappin, 2010).

References

Chappin, E. J. L.; Dijkema, G. P. J.; Vries, L. J. d. 2010: Carbon policies: Do they deliver in the long run?'. In P. Sioshansi, ed.: 'Carbon Constrained: Future of Electricity'. Elsevier, pp. 31-56.

Chappin, E. J. L. 2011: 'Simulating Energy Transitions'. PhD thesis, Delft University of Technology.

Chappin, E. J. L. & Afman, M. R. 2013: 'An agent-based model of transitions in consumer lighting: Policy impacts from the E.U. phase-out of incandescents'. Environmental Innovation and Societal Transitions 7, 16-36.

[43] see http://emlab.tudelft.nl

De Vries, L. J. & Chappin, E. J. L. 2010: ‘Power play: simulating the interrelations between an electricity market and a CO_2 market in an on-line game’. In '33st IAEE International Conference, The Future of Energy: Global Challenges, Diverse Solutions'. IAEE, InterContintental Rio Hotel, Rio de Janeiro, Brazil.

Richstein, J. C.; Chappin, E. J. L.; de Vries, L. J. 2014: 'Cross-border electricity market effects due to price caps in an emission trading system: An agent-based approach'. Energy Policy 71, 139-158.

Richstein, J. C.; Chappin, E. J. L.; de Vries, L. J. 2015 (accepted): 'The Market (In-)Stability Reserve for EU Carbon Emission Trading: Why it may fail and how to improve it'. Utilities Policy.

4.6 Design Thinking as Messy Deliberation

Prof. Dr. Steven Ney, Professor of Policy Science and Social Entrepreneurship, Jacobs University Bremen and Senior Fellow, Hasso-Plattner-Institut

Low Carbon R&Dialogue - Design Thinking Workshops

On two separate weekends (20th and 21st of September and the 18th and 19th of October 2014), 17 people from different backgrounds took part in a design thinking exercise. The workshops, which form part an EU-funded project seeking to improve low carbon dialogue across Europe[44], aimed to develop innovations or ideas that could make a tangible contribution towards a low-carbon future for Scotland.

What is Design Thinking?

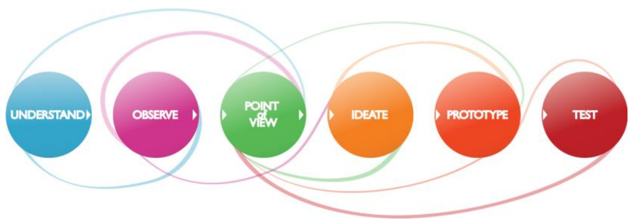
While the term “design thinking” or “d-thinking” has been in currency for some time now (c.f. Buchanan, 1992), the specific ‘flavour’ of design thinking used for this workshop has emerged in its present form from Stanford University in the last decade. Here, about 20 years ago, Terry Winograd (a professor of computer science at Stanford), Larry Leifer (a professor of mechanical engineering at Stanford) and David Kelley (founder of the IDEO design studio in Silicon Valley and also professor at Stanford) started putting together a practical process for team-based innovation. Drawing on a wide range of thought, theories and practices -- well beyond their own three home disciplines -- the three assembled a practical and highly effective toolbox for generating innovative solutions to real-life problems. When Hasso Plattner, one of the founding partners of SAP, first encountered d-thinking at Stanford, he was so impressed that he sponsored both the D-School at Stanford as well as establishing a School of Design-Thinking as part of the HPI Institute for Software System Research in Potsdam. Since then, d-thinking has rapidly evolved as a tool for solving complex and uncertain issues, such as climate change.

Essentially, design thinking provides a framework and the tools for leveraging the epistemic diversity of transdisciplinary teams. It combines a range of methods and approaches from the qualitative social sciences (such as participant observation and qualitative research) and engineering and design (such as rapid prototyping and testing). These tools are applied in the context of team-building and team-cohesion exercises. In this way, design thinking allows teams to

[44] www.rndialogue.eu

effectively pool individual talents and targeting these capacities to complex and uncertain — or 'wicked' — problems people face.

D-thinking consists of three basic elements. First, d-thinking requires diverse and transdisciplinary teams. Typically, teams consist of about 5-8 individuals from as backgrounds as divergent as engineering, architecture, social science, art and design. Second, d-thinking requires a variable workspace that can be adapted to the needs of the team as well as the requirements of the challenge at hand. Last, the d-thinking process (depicted below) provides an iterative design process. This process is radically output-oriented and revolves around the needs of users. Teams are not only encouraged to understand and empathise with users but also to design, prototype and test actual solutions. The aim of the process is to create prototypes of potential solutions rapidly (within a couple of hours) and then test these invariably imperfect solutions with users to obtain material for further (re)design). The process enables teams to embrace anything that contributes to meeting user needs and put aside anything that distracts from solving design challenges.



The Design Thinking process

Source: www.dschool.stanford.edu/groups/k12

The R&Dialogue Workshops

In preparation for the workshops, three members of the R&Dialogue team at the University of Edinburgh – Emily Creamer, Carly Maynard and Nathan Bower-Bir – attended a bespoke introductory course to design-thinking and team coaching at the D-Forge Bremen[45] in early September. This workshop provided both theoretical and practical introduction to the design thinking process as well as a brief overview of the tools to enable the coaching of diverse teams.

[45] http://www.jacobs-university.de/shss/research/d-forge

In the two weeks preceding the first workshop, the coaching team – the three members of the R&Dialogue research group and Steven Ney (Jacobs University Bremen) – designed the programme for the two weekends. The plan was to begin the process by asking the participants to formulate a collaborative, general vision of a low carbon Scotland, including the barriers and opportunities that they anticipated would arise in pursuing this ambition. Then, after exposing the participants to the design-thinking method, teams of participants would work together on real-life problems in need of low-carbon solutions. The workshops would end with an overall reflection of the process with respect to the more general visions of a low-carbon future for Scotland that had been formulated on the first day. The participant teams were put together by the coaching team in a way intended to maximise diversity and transdisciplinarity.

Weekend 1: Low-carbon visioning and introduction to Design Thinking

The aims of the first weekend were twofold. First, the coaching team sought to elicit visions for potential low carbon futures for Scotland. Second, the workshop was to expose and acquaint participants with the design thinking approach.

The three teams spent the first day developing low-carbon visions for Scotland. In order to do this effectively, the coaching team provided adequate spatial (by creating team spaces as depicted in the photo below) and ideational (in terms of specific team exercises) contexts for the teams to get to know each other. Here, members of each needed to find out about each other and find a name that reflects the characteristics of the team. The team names that emerged were “Out of the Bubble”, “Collabo-Change” and “Rapid”.

By interviewing members of the other teams, each team then explored the perceptions and views on climate change and vision for a low-carbon Scotland that were held by the different people in the room. On the basis of the insights from this ‘research’, each team developed a low-carbon vision for Scotland by imagining that Scotland is a hotel. The teams were asked what type of hotel Scotland should become if it were to embark on a low-carbon trajectory.

The last task for each team was to draft their set of *design principles*. The teams were told that the design principles should not be solutions; rather, design principles should provide a guide for designing these solutions. As such, they can embody aspirations, values and goals, even if they are contradictory. By the way of an example, the coaching team Google's design principles were presented (e.g. "Delight the eye without distracting the mind").

Out of the Bubble formulated the following principles

- Thrive within our means!
- Think about tomorrow today!
- Lower carbon, increase prosperity!
- Can everyone do this forever?
- Use past knowledge to innovate future design!
- Can everyone understand this? Citizen buy-in.
- Needs of the many, not wants of the few.

Collabo-Change devised the following design principles:

- Encourage don't chastise (Carrot not stick)!
- Educate to motivate!
- Collaboration through competition.
- Innovate don't stagnate!

The design principles to emerge from *Rapid*:

- Everyone has to give something back to the community.
- Work together but celebrate individual strength!
- Living within environmental limits but still being free!
- A society where low carbon is a norm.
- Personal tradable carbon allowances for all.

The second day exposed participants to the process and methods of design thinking. Here, the coaching team relied on three "fast forwards". These are short exercises that rapidly take participants through an entire design thinking cycle (see Figure 1). In this way, the participants experience the process as a whole while being able to explore specific mind-sets, methods and principles (such as user-centric thinking, needs research, ideation and rapid prototyping). In addition, these exercises are aimed at generating something that David Kelley calls "creative confidence": they demonstrate to individuals who may not feel creative, that creativity and design are, to a large extent, accessible skills. The three 'fast forward exercises' were the Wallet Exercise, the Dream Holiday Exercise and Whose Life is It?

In sum, the first weekend covered the following:

- Participants got to know one another in terms of their design teams;
- Teams formulated a vision of a low carbon future for Scotland;
- Teams drafted design principles to guide future actions in bringing about a low carbon future for Scotland;
- The participants were introduced to the theory and mindsets of the Design Thinking approach
- Participants learned the methods of the design thinking approach (observe, synthesis, ideation and prototyping);
- The participants were exposed to methods and approaches used for small design teams;

Weekend 2: Designing low-carbon solutions for Scotland

The second workshop aimed to develop low carbon solutions for real issues facing citizens in Scotland. The coaching team developed three distinct design challenges for the teams:

> *'Design a fulfilling, low-carbon holiday experience for young professionals'* (Collabo-Change)
>
> *'Design a convenient, low-carbon food-shopping experience for families'* (Out of the Bubble)
>
> *'How can we reduce car use among the over 60s without reducing mobility?'* (Rapid)

The challenges were selected to address areas in which changes in individual behaviour could have some of the most significant impacts. In Scotland, individuals and households account for 70percent of Scotland's consumption-related emissions, 29percent of this is related to transport (particularly car use and flying), and 21percent is related to food. Therefore, we designed challenges which addressed these issues. For design thinking, it is important to identify a specific user group that the solution is aimed at, and, in order to give further breadth and diversity to the process, we selected a different categories of 'users' (young professional, families, and the over-60s) for each challenge.

On the first day, the teams reframed the design challenge, researched user needs and synthesised this data into a design stance. On the basis of this data, each team developed a persona to reflect the insights about user needs:

<u>Out-of-the Bubble's Persona:</u> Jenny McDonald is a 38-year old lawyer in the housing and property business. She is married with two children, a 10-year-old boy and a 13-year-old girl, and enjoyed a recent family holiday in Portugal. She is relatively affluent and aligns herself with Conservative politics. She has a typical British, upper-middle-class lifestyle, with hobbies including horse-riding, golf, and baking.

Point-of-View: "Jenny, a busy professional mum, needs a socially rewarding and socially mindful food supply experience because she is too far removed from the consequences of her food."

<u>Collabo-Change's Persona:</u> Ewen Randall, a 27 year-old single sales manager at Lidl, is a bit of a lad. Despite his somewhat unhappy relationship with his estranged father, he gets on well enough with his mother, stepfather and step-sister without, however, being particularly close to them. When not at work, Ewen is either in the gym or socialising (mostly in the pub but occasionally at sports events or concerts) with his three best mates Byron, Jack and Connor. He enjoys playing and viewing sports – particularly golf and football – as well as taking part in pub quizzes. While on the whole Ewen does not mind his daily routine, he needs to get away once in a while. Especially when the rain, the traffic (which makes getting around in the car a nightmare) and what seems to Ewen like a never-ending stream of tourists through Edinburgh get a little too much. Ideally, he would head out to Las Vegas with his mates.

Point-of-view: "Ewen, a 27 year old lad, needs an adventure with his three best friends but lacks awareness of inspiring, creative, affordable or sustainable holiday options."

<u>Rapid's Persona:</u> Alastair Blair, 67 years old, retired from dentistry two years ago. Since then, he has been enjoying his retirement by taking it easy. Together with the occasional visit to the children and grandchildren, Alastair's leisure pursuits – walking the dog, a spot of golf and walking – are unspectacular but keep him and his wife fit and busy. While Alastair is not one to flaunt the wealth he has accumulated over the years, he does like high-quality and reliable goods and services. Once he finds something he likes and that works for him, Alastair sticks with it. This is why his raincoat is a Barbour. And why would anyone who can afford to not drive a S-Class Mercedes? Alastair gets very annoyed at cyclists who openly break the law. He hates waiting and finds the bus lanes that slow him down in his car very irritating indeed. Increasingly, he finds it difficult to understand what it is that young people are about these days. This too is a source of irritation for Alastair.

Point-of-View: "Alastair, a retired 67-year-old dentist, needs a way to enjoy his retirement because, despite his wealth, he wants to do the right thing and give something back."

On the basis of these so-called design stances, the teams set about developing ideas for solving their persona's problems. During ideation, the aim is to generate as many ideas as possible in a very limited amount of time. In order to help the teams, they are encouraged to formulate questions (so called "How might we…" and "How to…" questions) specific to their persona and its point of view. The ideation process itself relies on a range of brainstorming methods (such as reverse brainstorming, body storming, constraints, see http://dschool.stanford.edu/use-our-methods/) as well as brainstorming rules (see box below). These methods and rules are designed to ensure that teams not only avoid obvious ideas (by getting them out of the way at an early stage of the brainstorming process) but also, and more importantly, that they leverage the diversity of the team. At the end of the brainstorming period, the teams were asked to cluster the ideas and vote for the two ideas that they wanted to take on into the prototyping phase.

During the prototyping phase, each team created a so-called "low resolution" prototype of their idea. The teams were urged by the coaches to fashion the prototypes so that testers could interact with these prototypes and experience the solution (or an aspect of the solution). The coaching team had invited three people to test the solutions and provide feedback to the teams. Each tester spent 5 minutes with each team experiencing the solution and providing critical feedback. The teams were encouraged to iterate their ideas and solutions in the light of the feedback.

The three innovations that emerged from this process were "Food Matters", "Lad Swap" and a "Local Volunteer Coordinator Agency", detailed below.

i) **'Food Matters'** (*Out of the Bubble*)

In order to help Jenny become more aware of the consequences of her food choices, the *Out of the Bubble* team designed the 'Food Matters' website. The aim of the site is to provide the type of information about food supply that enables Jenny to make sustainable food choices. To do this, the website would allow food suppliers to offer their goods along with information relating to the sustainability of the food. This would include nutritional and health related information, farming and processing methods, or the distance of the supplier from Jenny's location. By providing the greenhouse gas costs of the food on offer from each supplier, in terms of "food miles", the website empowers Jenny to make GHG efficient choices. This cost would include the production of the food, as well as transport to the supplier and from the supplier to Jenny's location. An interactive map helps visualise this information and, more importantly, guides Jenny to the food of her choice.

In addition to this core information and enlightening function, Jenny can find a number of other useful features at the "Food Matters" website. Customised to Jenny's needs, "Food Matter" provides timely information on offers, suppliers and events in the East Lothian region. The community of users of "Food Matters" will generate much of this information. Other features include recipes, foodie chats, food-related 'how-to' videos, links to other regional food-related networks (e.g. Fife Diet), as well as an events calendar.

ii) **'Lad Swap: the new lads' escape'** (*Collabo-Change*)

This idea aims to give Ewen an adventurous holiday with the lads but without leaving a huge environmental and social footprint. The idea consists of two basic elements. The first part is about the travel to and from the holiday destination. Instead of using low cost air carriers for both legs of the journey, the "New Lad Escape" idea suggests that one leg of the journey take place in an alternative, less carbon intensive mode of transport. For destinations in southern Europe, for example, the first leg of the journey could take place in a cruise ship. This journey would be part of the experience offering Ewen and his friends the type of relaxation and entertainment they enjoy.

The second aspect of the concept centres on the idea of making travel such as "Air BnB" or "couch surfing" accessible to Ewen and his friends. This, then, is the "Lad Swap": Ewen and his friends, using a website or smart-phone app, will have arranged a swap with local lads at the holiday destination. Ewen and his friends will be housed and hosted by locals who will introduce them to local entertainment as well as local customs. The 'locals', in turn, will visit Ewen and his friends in Edinburgh.

iii) **Local Volunteer Coordinator** (*Rapid)*

Since Alastair needs help in finding ways to give something back to the community, the *Rapid* team devised a volunteer coordinator service. The key idea is that many people are not sure what volunteering they could do and may be a little intimidated by the process and responsibility volunteering might bring with it. By having a paid local government official to assist potential volunteers find suitable placements this problem is overcome. The volunteer coordinator would know of local opportunities and know how to match up people to a suitable context. Based on a thorough personal consultation with Alastair, the staff of the service would devise a programme of local voluntary work tailored to the specific skills, interests and capabilities of Alastair. Alastair has a meeting with the volunteer coordinator and it turns out that he would like to take tame animals (cats, dogs, guinea pigs, etc.) into the local hospital for those who would welcome this (e.g. would find it comforting, a distraction from their illness, etc.). Being an accomplished gardener, Alastair also volunteers to help manage the gardens of several infirm elderly persons who are not physically able to do any gardening.

Alastair wants to make his presence visible so he helps design an electric tricycle vehicle in which he can take the animals to the hospital. He is so happy with the trike that he also uses it to transport his golf clubs and gardening equipment around. He also helps raise funds to support community volunteering from his connections at the Golf Club, local BMA group and the Rotary Club.

Conclusion:

In sum, the participants achieved the following on the second workshop weekend:

- The teams reflected on and reframed the design challenges;
- Teams drafted and put to action a strategy for observing real users in their relevant contexts;
- Teams used this data to devise a persona and a unique design stance;
- Teams developed new ideas for responding to the design challenges based on their design stance;
- Teams built low resolution prototypes of their designs, tested these with users and used the feedback to iterate their designs
- The teams devised potential business models to implement their innovations.

The Low Carbon R&Dialogue Design Thinking Workshops served two purposes. First, the workshops aimed at facilitating experts and lay citizens to design solutions that can contribute to a low carbon future for Scotland. Taking a user-centred and empathy-based design approach, these small teams of experts and lay citizens developed, tested and iterated three different solutions: the “Lad Swap”, the “Food Matters” website and the “Local Volunteer Coordinator Agency”. As we have seen, each of these solutions addresses a specific aspect of sustainability. Second, the workshop series also sought to equip participants (as well as the University of Edinburgh personnel) with a set of methods and tools for introducing user-centred and empathy-based methods for problem-solving in their institutional contexts. Over the two weekends, the participants were exposed to methods for organising and directing small teams, critical reframing, user research, design-oriented data analysis and synthesis. What is more, participants explored key design thinking mindsets by applying methods and techniques such as rapid prototyping to real-life problems.

References

Buchanan, R. 1992: ‘Wicked Problems in Design Thinking’. Design issues: 5-21.

4.7 Discussion group: Different national energy transition pathways: a problem?

The documentation of the discussion group 'Different National Energy Transition Pathways: A Problem?' starts with a brief introduction. The discussion was structured by two sub questions: 'Should Europe have a REAL common energy policy?' and 'Do we need to harmonise measures and incentives for a transition to low-carbon energy / economy across Europe?'. The group was moderated by Vít Hladík, Research Coordinator Environmental & Geo-Energy Technologies at the Czech Geological Survey.

Introduction

Since the Lisbon Treaty established in 2007 energy policy as a primary legislation on European Union (EU) level, the amount of control capabilities and joint regulation measures increased (Fischer, 2011). Especially due to events such as the Russian cut of gas exports to Europe in 2008 due to failed negotiations with the Ukraine, or the development of the oil price, the EU decided on common measures to secure energy supply. Furthermore, the 'Energy Roadmap 2050' was adopted by the European Commission in October 2011 and 'explores the challenges posed by delivering the EU's decarbonisation objective while at the same time ensuring security of energy supply and competitiveness' (European Commission 2011). The aim of the European Roadmap is to create a long-term framework, which helps to integrate national and local policies in a European dimension to lower transition costs and foster more effective policies. However the power to decide on national energy strategies remains with the 28 EU member states, which result in different and sometimes conflicting national energy transition pathways. For example: The industrial policy role of nuclear energy in France and the labour and social political importance of coal mining in Poland are in contrast to decisions in Germany to phase out nuclear power and immense expansion of renewable energies in particular in Denmark.

The issue of different national energy transition pathways was discussed along two sub questions: 'Should Europe have a REAL common energy policy?' and 'Do we need to harmonise measures and incentives for transition to low-carbon energy / economy across Europe?'

Discussion

Should Europe have a REAL common energy policy?

First of all, the definition of a common energy policy was not clear and needs to be defined clearly to be the subject of discussion. What would a common European energy consist of? It was stated that at the moment it seems to be impossible to decide on one energy mix, because the priorities and abilities of the countries differ enormously. That's why a common energy strategy should rather focus on reducing carbon dioxide emissions and letting the member states decide on specific strategies and measures.

Even the participants could not agree on what technologies are needed to reach the carbon reduction targets. Some argued that a carbon free society needs nuclear energy because the energy demand cannot be covert by renewables. Furthermore, renewables are characterized by being fluctuating due to their dependence on the sun and wind, a characteristic that creates challenges for the grid system and a demand for flexible backup capacity. Another point was added about the future composition of electricity systems: It was argued that not all the base load would be needed in the future. In Czech Republic it is controversially debated how much base load will be required in the future: Some say less base load will be necessary but some quite strong opinions argue that as much as now or even more base load will be needed. The view that renewable energy sources cannot provide the needed backup capacity without storage was considered as quite strong in the Czech Republic.

Others countered that renewable energies are not the only energy source that has problematic aspects, which need to be handled. As an example nuclear power was given: Recent examples in the EU show that it is financially risky to build nuclear power plants and without subsidies it is not worthwhile. Additionally, the construction phase often lasts longer than planned and thus leading to uncertainty of the availability of nuclear energy. The energy market and the financial situation do not produce conditions to invest in huge energy infrastructure projects such as nuclear power plants. Hinkley Point C nuclear power station in the UK was referred to as an example that it is not possible to build nuclear plants without subsidies. Especially if the energy prices decrease, electricity from nuclear power plants will become more expensive. In the same line of argument lignite as a resource of energy was also not seen as part of the energy mix, because the source is declining and causing most of the carbon dioxide emissions. Therefore, a pan-European debate on a common energy strategy needs to cover the question which options really exist and which are feasible. Demand side management, storage and a system in which renewables can really work should also be elaborated and solutions developed.

It was argued that, as a prerequisite to implement a common energy policy, member states would have to give up a part of their sovereignty and authorise the EU with more decision making power (national independence of energy supply; definition of energy mix). It was doubted by some participants that the EU member states are willing to give up sovereignty. The different priorities of the nation states based on their individual cultural, economic and environmental framework condition lead to the questions: How much power and responsibilities shall and can be transferred to EU level? If the EU receives more decision making power which body is going to take the decisions: Parliament or council? Is it going to be majority decisions or are veto powers allowed? For instance how to decide on the percentages of renewables on EU level? What if a country does not accept decisions taken on EU level?

Some participants argued that certain forms of common EU policies are already implemented (e.g., European Emission Trading System - ETS) and EU policy is affecting national policies. Other discussants responded that the ETS is on the one hand an example of common energy policy but on the other hand it does not function properly. It was stated that if Germany shuts down coal power plants to reach its carbon dioxide reduction targets more ETS-certificates would be available. This would cause the carbon dioxide price to decline. It was even suggested that the amount of emissions that Germany reduces by shutting down coal power plants would be emitted elsewhere and consequently overall there would be no reduction of carbon dioxide. Therefore, some concluded that a common European energy policy is needed to manage such interdependencies.

Furthermore, it was added that a proper grid system needs to be established with well-functioning interconnections between the member states. Germany's targets are to reduce 25 percent of energy consumption, which implies energy import of 20 percent. If everybody else (France, Poland, Italy etc.) does the same and relies on energy imports, an imbalance would be created. A long-term concept is missing whose function would be to analyse all national energy needs and generate a concept with regulates imbalances and interdependencies. That's why it was contended, it is fine that Germany has a specific concept, but it would create dilemmas if other countries have the same concept. In this sense it was concluded by some that individual national strategies are not problematic as long as they fit in the overall system.

Do we need to harmonise measures and incentives for a transition to low-carbon energy / economy across Europe?

The participants agreed that distorted energy prices exist due to different subsidies. Related to the question what energy mix the participants see feasible for a low carbon society (see question one) the solutions to this challenge were differently estimated. It was agreed that the power companies do not invest in huge energy infrastructure projects: At present the energy market does not provide the security of the return of investment. This was named as a reason why the construction of new blocks of a power plant in the Czech Republic was postponed. The question was raised, if the guarantee of return of investment must come from the state or if other tools or institutions could provide the necessary framework conditions, too.

Cooperation was seen by most participants as the key to address these challenges. It was argued that it is already a topic of debate to change form the old system in which renewables have been subsidised to a new system in which renewables are integrated into a real market. The decision of the EU in 2013 to change the system towards reality of the power market can be seen as a first step.

It was argued that Germany is not running out of coal too soon and thus the requirement of taking other steps was not considered as urgent by some participants. Since coal will be accessible for a long time, resource scarcity of coal was not estimated as a driver to phase out of fossil fuels. Furthermore, it was criticised that harmonising the strategies throughout Europe, when it comes to specific strategic options based on decisions on European level, appear unfeasible due to different access to resources and also different economic preconditions. All of those issues have to be considered.

ETS was named by some participants as a very good subject for cooperation: ETS is in place but still the price of the full cost of producing energy is not paid. At present only the price for extracting the energy is covered but not the externalities, which means that carbon pollution is almost free. The ETS was considered as a good approach which is not sufficiently functioning. It was suggested that the parameters of this market need to be reconsidered to establish more realistic prices. Australia was named as an example of having a carbon market, even though the country lacks a general engagement in climate mitigation. Much more cooperation is needed to reform the ETS successfully.

Others argued that improvement of the ETS-system could result also in new application of energy technologies: If a higher carbon price would be stablished brand new gas power plants could be build and economically run. At the moment there is no space for gas plants in the market. It was pointed out that here are branches of industry that have to pay carbon taxes and others who are excluded. This was named as a reason for obstacles to change the ETS: some favour a lower carbon price, are satisfied with how it is and oppose a reform and others lobby for the opposite.

Another subject for cooperation lays in the field of energy in the transport sector. Electricity is the focus, but there are also other cooperate policies as transport and fuel use in this field. For instance housing and transport is increasing in France and so is the energy demand in this field. European housing policy was considered by some participants as strange but transport policy as reasonable. It was claimed that especially energy demand in the transport sector needs to be included. As example electricity cars were mentioned, which might store renewable energy. Even though it seems that the people are not yet ready to act accordingly and the technology is still immature to use on larger scale, the electric cars were thought of as a promising device for the transition process.

Others give cause for concern by explicating that covering 25 percent of consumption with electricity cars is problematic, because this increases electricity demand. Others doubted this and argued: If energy was produced on windy and sunny days charging a car could even be cost-free. This argument was countered that people need their car in the morning to go to work and therefore charge it overnight.

Lessons learned: Are the different national energy transition pathways a problem, or rather an advantage?

In general the participants named both advantages and disadvantages as already discussed in the context of the two previous sub questions. No clear response can be given to answer the question but the participants identified a few issues and challenges that need to be addressed to improve European energy policy.

As an argument for different strategies it was debated that harmonising the different national energy strategies to specific measures seems quite impossible. But some participants suggested that a system similar to the economic market could be able to function. This idea is based on establishing common objectives, which enable more trade and make them more complementary in a way that trade improves. The advantages would be to allow for cross-border trade to guarantee security of supply. Further it was contested that the energy market functions also as a regulator and is a driver of the transition process. This view is based on the argument that it is not the states who make the decision to invest but companies decide on what they spend money and infest in. Therefore, the development of a certain energy resource depends on the investment of businesses. Multinational companies exist already who are able to invest and are important drivers for the transition process. But investments in energy infrastructures are missing due to insufficient frameworks to invest.

The questions whether diversity is it a problem or a benefit was contrarily answered: On the one hand different energy pathways may lead to contradicting developments and less reduction of carbon emissions. But on the other hand it was argued that energy imports may become a problem and if countries have a similar import based energy concept this may lead to a strong overall vulnerability. That's why it was concluded that different pathways are ok as long as they fit the overall concept / strategy and cooperation between the countries is necessary, due to interdependencies for instance energy prices and grid stability across borders. Some participants gave cause for serious concern that such an overall agreed concept was missing and it would be quite difficult to establish one. Other participants argued that examples of how an overall agreed concept can be developed are the 2030 goals.

The example of the Czech Republic shows, that national governments are already troubled with developing national strategies. Several attempts have already been undertaken to develop a national transition plan but were cancelled with change of governments. At the moment the Czech Republic relies to 60 percent on fossil fuels and a discussion is going how to cover the declining source of coal. It is debated if the whole current production capacity in total needs to be replaced or if less energy needed in the future? These questions have not been answered on national scale therefore it seems even more challenging to find solutions for these problems on European level.

Still, the participants agreed that cross border cooperation and a common framework is needed to face current challenges. For instance, the German energy transition is creating problems in neighbouring countries. These interdependencies have not been considered before. Therefore, it was argued that more cooperation is needed. Issues such as energy price and the grids need to be governed or regulated across borders. Consequently methods and tools need to be developed to handle these issues.

It was agreed that how common energy policy works at the moment it is not sufficiently addressing joint challenges. The management of a constantly increasing demand, the development of demand side management, the integration of renewable energy and how to improve electricity storage and efficiency are a few issues that need to be discussed on European level. But how to approach these challenges was controversially discussed: a market based approach and a regulatory approach were suggested from different participants.

References:

Fischer, S. 2011: ‘Auf den Weg einer gemeinsamen Energiepolitik’. Nomos Verlagsgesellschaft, Baden-Baden.

European Commission 2011: ‚Energy Roadmap 2050‘. Brussels.

4.8 Discussion group: European harmonisation of support schemes for renewables?

Summarised and recorded by Dr. Andrea Fischer-Hotzel

The documentation of the discussion group 'Harmonization of support schemes for RES' starts with a brief summary of the moderator's introductory remarks. Then, the four main conclusions drawn by the participants will be presented, each followed by a summary of the relevant parts of the discussion. The group was moderated by Susanne Nies, head of the unit 'Energy policy and generation of the European business association 'Union of the Electricity Industry' (EURELECTRIC).

Introductory remarks

The topic of state support for renewable energy sources (RES) development was introduced by giving a brief overview of the current situation throughout Europe and its historical development. It was explained that the EU 20-20-20 objectives as set in 2008[46] had sparked off the development of RES throughout Europe. Since then, support schemes had rapidly spread in the member states, mostly operating with feed-in tariffs (FIT) but also with feed-in premiums (FIP) and green certificates. They often had, however, turned out to be too costly, which in some cases had led to retroactive change, frustrating the investment climate. In 2014, the European Council had defined RES targets for 2030, comprising 40 percent of carbon dioxide reduction, 27 percent of RES in energy production on an EU-wide scale and an increase in energy efficiency by 30 percent compared to 2005.[47] With its 27 percent of RES, the 2030 framework set an EU Wide binding target for the first time.

In line with Art 194 of the Lisbon Treaty and the RES Directive from 2009 (2009/28/EC), the technologies chosen as well as their respective share in energy production varied from member state to member state, largely consisting of photovoltaic (PV), wind and biomass. Even though the RES Directive included cooperation mechanisms for RES development in practice it mostly remained a national issue. The state aid reform of 2014 had introduced new EU regulations for national support schemes but with a transitory period for existing ones. In general, FITs would

[46] In 2008 the Council of the European Union adopted a set of legislation setting climate and energy targets for 2020, the so '2020 climate and energy package'. The targets included 20% reduction of greenhouse gas emissions from 1990 levels, a 20% share of RES in energy consumption and a 20% increase of energy efficiencies, also compared to 1990, see http://ec.europa.eu/clima/policies/package/documentation_en.htm.

[47] 2030 Energy Strategy, COM(2014)15

largely be replaced by FIPs and a certain competition through tendering and other market-based tools would be introduced into the current schemes.

Historically, it was remarked, support for power generation technologies had varied considerably. The development of oil-based technologies had enjoyed no support while gas technologies had in order to increase their competitiveness. Nuclear energy had been supported by governments because at the time of introduction utilities had been state-owned. 1998 had marked a break because the energy sector then had become liberalized. In terms of conventional energy production technologies, many EU member states today still subsidized coal, and the UK also still supported nuclear energy.

Discussion

Conclusion 1: Immature technologies need subsidizing

It was pointed out that subsidies were necessary in capital intensive sectors and for stimulating innovation in novel and superior technologies. The example was given that without subsidies in the form of feed-in tariffs, the wind sector would not have developed and neither would have nuclear energy.

However, the discussants also pointed out that support schemes should be designed in a way not to foreclose alternative technological developments as was currently the case. As soon as technologies were competitive on the free market subsidies should be stopped. Wind energy and PV, it was argued, were now mature and no longer needed to be subsidized.

The subsidization of RES turned out to be a contested issue, triggering a debate on the German Energiewende. One discussant criticized that under certain weather conditions RES produced so much cheap electricity that the one from conventional power plants became uncompetitive. Other discussants countered that this was the main purpose of the existing RES subsidization, if not of the German Energiewende as such. This statement was in turn considered provocative because it was argued that there was no societal agreement on what the goal of the Energiewende was, whether it was a goal in itself, whether greenhouse gas (GHG) reduction and climate change mitigation or energy supply security should be achieved, or whether new industrial champions should be created. The discussants then agreed that support schemes needed to be transparent when it came to the definition of clear societal goals of technology support.

The question was then raised who should identify technologies that were worth supporting, politicians or the market. One of the discussants responded that experts could easily assess different technologies available, their states of maturity and their potentials.

Although there was agreement that immature technologies should be supported it was also argued that from the perspective of the security of energy supply fossil fuels, too, should be subsidized. One discussant stressed that despite the development of RES Europe was dependent on fossil fuels to cover its energy demand and would remain so in the foreseeable future. Decreasing import dependency by subsidizing indigenous coal was a desirable goal and it would also have positive employment effects.

This position provoked immediate protest from other discussants, who argued that coal was not a precious resource that could only be found in one country, such as lithium in Bolivia, but was instead internationally tradable. There was no reason therefore to subsidize less competitive European coal. Such a protectionist stance ignored the basic principle of free trade that it increased the wealth of all partners due to locally varying production costs.

To this, one discussant responded that energy had always been a power resource for which not only economic but also strategic concerns applied. Energy was a core component of a country's power. For this reason, a perfect energy world market had never emerged.

It was then replied that with other one-time strategic sectors changes of mentality had already taken place. Home-grown food had for a long time been of strategic importance but was now an internationally tradable commodity. Due to liquefied natural gas (LNG) technology, a similar development could be observed in the gas sector with the emergence of a unified North-West European gas market. Just as food, energy, too, would sooner or later become a tradable commodity.

It was generally acknowledged that coal technology should be subsidized because it was still needed as a back-up. Countries that heavily relied on coal such as Poland would not be able to phase it out soon so there should be support to modernize coal-fired power plants there. At this point, one discussant countered that coal-fired power plants should be modernized all over Europe but that there currently were no political or economic incentives to do so. Efficiency increases were necessary, however, because the European energy demand would have to be covered to a large extent by fossil fuels for a long time to come.

Conclusion 2: Support schemes need to be elaborate, transparent and dynamic. They have to internalize system costs, and auto-consumption should be excepted

The discussion then proceeded to the question how support schemes should be designed. Concerning this question it was argued that subsidies should be granted in a transparent bidding process that would allow for competition among different actors. If the process was transparent and the actors concerned could better understand why some technologies got subsidized and others not funding decisions would have more legitimacy.

It was also called for fair distribution among bidding countries, maybe according to the number of people living there, to avoid concentration of European subsidies in individual countries. The competition on the internal market made fair distribution of subsidies among countries necessary.

Then the discussion turned to the way that subsidies are distributed in practice. It was argued that on the national level the distribution usually was a result of a complex bargaining process driven by vested interests. If subsidies were distributed on the European level, the process would become even more complex.

After that the questions were raised how to deal with dynamic technology development in the sense that support schemes could react to efficiency improvement and be phased out, and how to deal with system costs caused by grid-connected technologies. After all, such novel technologies had the capacity to affect the whole system when they became mature and made investment in additional grid capacities necessary. It was suggested that limits for immature technologies could be defined so that if they constituted more than 20percent of capacity they should be considered mature and no longer be supported.

Alternatively, it was suggested different approaches of allocating subsidies should be taken for large-scale technologies, such as big power plants, and small-scale or decentralized ones, such as most RES. Decentralized technologies, starting from a certain support level, could show in application which one was the most efficient, and then subsidies would be adjusted. This approach was taken, e.g., in Germany, where it had turned out that onshore wind and solar were cheapest. Larger technologies with nearly no application needed a different approach.

Very small installations should be exempted from state support at all, especially those designed for auto-consumption. Here, even a fee for using the grid would be justified because all small installations taken together could have a huge share in grid capacities, and the grid needed to be maintained and possibly expanded.

Conclusion 3: Advantages of RES support are increased security of supply, easier storage, increased international competitiveness and sustainability, strengthening of the EU's position globally, and the creation of markets and business opportunities

It was discussed whether the recently agreed EU goal of 27 percent RES share in the energy system would make a harmonization of support schemes necessary and what the advantages of harmonization would be. One supportive argument was brought forward that innovation was the result of research and that research was always done internationally. Therefore support schemes should go beyond the national level.

Discussants then raised the point that harmonization would lead to more cost efficiency. They illustrated it with the example of current offshore wind farms that would not always produce electricity for the country closest to them but for the operating country. In addition, countries would become more aware of the systemic impact of their national policies.

Subsequently, the advantages of harmonization for the security of supply were discussed. Here again it was pointed out that security of supply on the European level was different from and probably counterproductive for the national level. The example of the Netherlands was cited, where legal provisions stated that in case of emergency the grid would disconnect. In that case, due to systemic effects, the security of supply of one country determined the security of supply of all other countries. In this context, it was also explained that the development of storage technology could be promoted better in an interconnected European grid, partly because imbalances could better be handled.

In the context of grid and storage development, harmonization would create business opportunities and markets. If a technology worked only in a small country or region, it would not attract much international investment. If it worked European-wide, it would. It was also mentioned a number of times but not dwelled upon that Europe's political power on a global scale was dependent on the harmonization of the energy sector.

It was then argued that in order to achieve an internal energy market, which was desired on the European level, not only harmonization of state aid for the energy sector but also a change of design from energy only to capacity markets would be necessary. Unbundling was considered a necessary condition for it. Even though this point was not dwelled upon it was generally considered important by the participants.

Conclusion 4: It is unclear how to get to harmonized support schemes. Crises might be used as windows of opportunity. Indirect ways could be storage development and the design of the energy market

The discussion turned to the question what the disadvantages of harmonized support schemes would be. It was argued that under the current European decision making system harmonization would be difficult to achieve. The decision making system was considered too clumsy. More leadership would be necessary. At this point, one of the discussants countered that a centralized political system was not the goal of the European project. The preservation of national identities, languages and cultures was a success in itself. A stronger identification with the European idea was necessary but not at the price of centralization. To this, another discussant replied that during the recent banking crisis, decisions were indeed taken without much consultation, to everyone's satisfaction. It was then conceded that strong executive decision-making might work sometimes however in the medium-term might disenchant people with politics. Also, throughout the EU people were still thinking regionally, especially in terms of energy security, and not European, as would be necessary for more harmonization.

In addition, legal frameworks for investment were different in the individual EU countries, e.g. in the case of unbundling of grid operators. It was recommended that unbundling result in the possibility to exchange energy across borders but also in minimization of financial risks for investors. The examples of Spain, Italy and the Czech Republic were cited, who introduced a tax after unbundling, which alienated investors and affected the investment climate in Europe negatively.

On the other hand, it was pointed out that national and European goals might be conflicting. The example was given that from a European perspective it would be advantageous to install solar panels in Southern Spain, where because of the high number of sun hours the return of investment (ROI) would be significantly higher than in Northern Europe. From a Spanish perspective, however, additional PV installations would mean that coal-fired power plants would have to shut down, leaving miners unemployed.

It was argued, however, that in other sectors, harmonization had been achieved despite similar obstacles as in energy. With food, it was stressed once more, an outright mentality change could be observed, it was now no longer considered a strategic resource. Roaming tariffs for mobile phones were cited as a success story from Brussels-led harmonization. In other sectors, too, innovation was policy and not industry-driven, e.g. in the automobile industry with government policies and European norms for fuels and efficiency.

It was argued that windows of opportunity should have to be sought actively to promote harmonization. One such window could be the transformation of grids that RES would make necessary anyway. This way, private companies would become front runners of harmonization. Here, the example of the Dutch companies Gasunie and Tennet to cooperate in Germany in order to establish a joint Dutch-German infrastructure for gas and electricity was cited. However, it was also observed that in other countries, private companies were not interested in or actively obstructing cross-border cooperation.

Greece was cited as an example how crises might constitute windows of opportunity for harmonized energy policy. The Greek government wanted to change conditions for repaying international debt while at the same time Greek households struggled to pay their heat and electricity bills. So creditors, it was suggested, could stop installing RES in their own countries, install PV panels on Greek residential houses instead, subtract it from the debt and should this way still be able to honour the European 27 percent RES target.

At the end of the discussion one discussant remarked that concerning energy governance the Lisbon Treaty was to a certain degree contradictory. On the one hand Article 194 called for solidarity among the member states and on the other hand it left member states to decide on their national energy mix. The question was raised but not answered whether the Treaty would have to be changed as a prerequisite for harmonization.

4.9 Discussion group: What role for dialogue and participation towards a European energy transition?

The documentation of the discussion group 'What role for dialogue and participation towards a European energy transition?' gives first with a short introduction about deliberative methods. Issues such as the need for a European dialogue, characteristics of the European energy transition, the exchange of existing dialogue practices and preconditions for dialogue were discussed. The group was moderated by Anna Ernst, member of R&Dialogue and researcher at Forschungszentrum Jülich.

Introduction

The European energy transition will affect many livelihoods and consequently many interests must be considered. The decisions to be taken will affect many people who should be included in the decision making process towards a low carbon society. Furthermore, the successful implementation of measures and strategies depends on those who will apply them. Meanwhile, the decision making process will take place under uncertainty because the future outcomes of the development of environmental as well as social and political framework conditions are unknown.

Deliberative methods such as dialogue and participation are discussed to help overcome or tackle these challenges. Deliberative methods differ from the usual voting system, which aggregates preferences and leads to a majority decision, by creating a platform for discussion where participants listen to and argue different views and might even transform their preferences. The core of the approach is learning from each other and developing a consensus. Some scientists but also practitioners, policy makers etc. presume that deliberative methods can create acceptance, better informed decisions, transparency, inclusion, and avoid conflicts etc. On the other hand, however, deliberative methods are also criticized to lead to the dominance of a particular view, prolong decision making and raise expenses or even lead to frustration and greater conflicts.

There is no easy answer to the question of using more or less dialogue and participation in deciding on matters concerning the energy transition. Both positive and negative examples and experiences with deliberative methods have already been made. Some important characteristics need to be considered and kept in mind while discussing what role dialogue and participation can take. The form of a deliberative method needs to match the aim and circumstances (target group etc.): one way communication, consultation, participation, dialogue, cooperation etc. Therefore participation and dialogue can take very different shapes and have different effects on the transition process. It is important to differentiate between outcome (real impact of strategies or measures) and output (decision or agreement on measures or strategies etc.). It is especially crucial to consider who is involved and who wants to be involved.

Discussion

At first the meaning of the discussion group question ‘What role for dialogue and participation towards a European energy transition?’ was discussed. The role of dialogue towards a European transition is not only limited to public participation processes on the European level. It also includes dialogue processes of certain stakeholder groups or between member states to foster the energy transition. Already, transition processes are taking place and energy is debated everywhere, that is why it is difficult to define a single European energy transition. At the moment the European energy transition is characterized by national and regional transition strategies which differ and even seem to contradict each other.

The participants of the discussion group had different opinions about how the energy transition in Europe should be governed. Some argued that general decisions should be made by the policy makers in order to set targets. The specific strategies and measures to reach these targets should be left to the nation state, regional or local level. Others argued that the EU agreed on climate mitigation targets but not all countries act accordingly. The example of Poland was given, which leaks appropriate climate mitigation measures and activities. In this sense it seemed to be necessary to intensify the dialogues on the European level which should lead to an improved implementation of targets.

Furthermore, the need of a European energy transition was questioned and asked why Germany does not just lead the way? It was argued that Chancellor Merkel wants Germany to become the technological leader. Leadership in this sense would mean an open method of cooperation. As a pioneer Germany would resemble a blueprint from which others could learn and adjust to their situation. This could be a driver to foster an energy transition towards a low carbon society in other European countries, too, so that the coordination between the European countries becomes redundant. Others raised objections by pointing out the interconnections between the countries: the energy systems of the national states do not stop at the national borders and consequently cooperation between the countries is necessary. At present, these cross boarder connections seem to be forgotten by the German decision makers. Problems and challenges that, for instance, the Dutch people face could have been avoided if the coordination between the countries would have been better. Therefore, dialogue and cooperation between neighbouring countries is needed in order to better understand interdependencies and improve decision making.

Tools and mechanisms must be developed to improve a fairer distribution of benefits and costs. For instance, not all regions are similarly able to produce energy due to varying access to natural resources or different landscapes (mountains, ocean etc.). Therefore, dialogue should generate an improved cooperation that makes sure that all regions and countries can contribute from the transition process.

Everyone is talking about energy at differently levels or within different contexts. That's why it was predicated that dialogues about energy already exist. This societal debate needs to be analysed to understand what exists already and to identify disconnections of dialogue processes and how to overcome them. Further this would indicate what form of and with who dialogue or participation is needed on EU-level to foster the energy transition.

It was suggested to rephrase the question: Should we have a European energy transition? It was recommended that before deciding on developing strategies in a deliberative way it needs to be discussed if the European Union is capable of having common energy strategies and measures to lower carbon dioxide emissions. Furthermore, it does not make sense to ask the people about the European energy transition if there is no institution to implement the decisions. Within the 2004 process to ratify the 'Treaty establishing a Constitution for Europe' the underlining question was not correctly asked to the people. It was asked 'Do you want this constitution?' instead of 'Do you want a constitution?'. Maybe the answer meant that the people refused the proposed constitution but do not in general object to a constitution. That is why it was suggested to let the people vote if they want to have a constitution and if they do, start working on a constitution.

Examples of participation approaches

Switzerland has a plebiscite democracy and thus decided by referendum to phase out nuclear power. This means that in 10 or 20 years the decision lays with the people to really execute it. The plebiscite democracy in Switzerland is an essential part of their culture and thus based on experience. The general public will not decide on the details but rather on the fundamental direction based on a relatively short abstract on what to decide on. Beforehand, the issue will be politically debated. Normally 50 percent of the population votes and most of the time the Swiss people accept the decision. This is a unique situation in Switzerland because the Swiss population has grown up this way and established a culture of direct democracy which is quite different from the other political systems in Europe. In the case of Switzerland plebiscite democracy is working, but the participants reasoned that the established culture of debate and voting is the key factor.

The case of Switzerland raised a debate on what can be learned from the Swiss approach and what can be used for a European dialogue. It was argued that Switzerland is rather small with eight million citizens compared to Europe which would mean to organize a dialogue between approximately 500 million people. On the other hand, four different languages are spoken in Switzerland and thus it is a positive example that multiple languages do not hinder dialogue.

Some uttered causes for concern by saying that even if you ask a question phrased in the same way in every country you may not get comparable answers because the understanding of the question would differ from country to country. The 'World Value Survey' by Ronald Inglehart was named as an example to overcome this problem. It was assessed to be rather a technical issue which can be dealt with.

Furthermore, it was argued that there are limits to the application of deliberative approaches: In certain cases policy should lead the way because decisions taken in a direct democracy approach may lead to strong path dependencies. This means that it would need a long time to improve or correct a plebiscite decision once taken even if circumstances and perceptions change and better options and strategies are apparent. For instance, the decision in 2011 by the German government to phase out nuclear power sooner and to almost imminently shout down old nuclear power plants would not have been possible in a plebiscite democracy. Furthermore, some participants were rather sceptical if plebiscites create a dialogue. Plebiscites cannot be considered as deliberative democracy because they aggregate preferences by voting. Most of the time plebiscites are characterized by a yes-or-no-vote or at least the question to decide on must be answered with simple responses. Otherwise the amount and complexity of responses would not add up to a clear decision. However, there are issues and problems to be solved that need more differentiated answers than 'yes' or 'no'. Plebiscite approaches in Germany were given as an example, which sometimes occur within planning and decision making processes of renewable energy power plants. Most of the time plebiscites are applied when a conflict has already occurred and a decision must be made. This does not solve the conflict nevertheless ends the debate. The dialogue becomes a competition of two parties to get most of the votes instead of a learning process to find a common solution. It was also added that from a business perspective it is necessary to get coherent answers to questions to be able to invest and act.

One participant reported on a dialogue forum on retirement pensions. Pensions are thought of as complicated to understand but people are informed about it because it affects their lives. The citizens involved were able to participate with substantial knowledge and complemented the knowledge of the invited experts in the field. A learning process was established due to different knowledge types. It was concluded that everybody is an expert in energy or at least in that part of life that means something to him or her. Scientists and civil society organization could facilitate deliberative democracy by providing information what people are experts in and develop questions that are of interested for the people to discuss and work on rather than telling them what they need to know or need to learn. In order to give even more decision making power to the citizens, it was also suggested, that they should be included in the agenda setting and in the framing of the questions which should be elaborated within deliberative processes.

Lessons learned: Preconditions for dialogue

It is important to define the issue to be discussed and the possibilities to influence decision making at the beginning. To create an honest, transparent and inclusive dialogue, everyone must be familiar with the goals and also the boundaries of involvement. Otherwise it may lead to expectations which cannot be met and thus frustration and even conflicts may rise because participants might get the impression that they have been used instead of respectfully included. Furthermore, the aim of the dialogue process needs to be practical and usable to make it valuable. The tool must fit the aim but also needs to match the cultural background and other framework conditions.

To decide who to involve, a stakeholder analysis about possible effects of the decision and who may be affected or has an interest, could serve as a guideline. The identified people or institutions should be included and invited to take part in the dialogue.

It is important to frame the question or issue for the dialogue as precisely as possible. It must represent something that people care about. They do care about energy; it is a part of their life. Therefore they should not be approached by asking: Have you ever thought about energy? That was considered as a wrong question. Rather it must be more specifically related to their livelihoods.

Another decision must be made by the initiators and organizers of the dialogue on when to involve the public or stakeholders. Some argued that it is quicker if politicians take a decision and include the people within the implementation to decide what in detail should be done. This could enhance the acceptance. Others argued that this could also generate the opposite: people feel excluded and overruled and thus start to protest against this unjust decision. It may take longer to decide if the public or stakeholders are involved from the beginning, but the more the citizens are involved, the better it is; and some added the more natural the results would be. The solutions would better fit the regional or local circumstances because people know best what can be implemented in their specific setting. This was regarded by some as more appropriate and justifiable than someone from the EU deciding what locals should do.

It is essential to build trust between the dialogue partners. The dialogue partners must trust each other. It was articulated that in some countries citizens do not trust their government to actually act according to the citizens' vote. Furthermore, European institutions are also criticized to be lacking transparency, openness and being detached from the citizens. Building trust is consequently a fundamental requirement for a dialogue.

The attitudes of participants in a dialogue need to be characterized by the willingness to cooperate and acceptance of the outcome even though it may not be what oneself has supported. The acceptance of the outcome depends on the perception of the dialogue process as honest, open and transparent. Otherwise it could lead to conflicts. Furthermore, interests shape the input from participants to a dialogue or participation process. Therefore, people who are participating must be transparent in their interests.

To motivate people to engage in a dialogue process the relevance to their daily lives must be shown. However, experts always talk about what people need without really knowing what they need. This was seen as an obstacle that needs to be overcome. It is necessary to show the benefits of participating and even applying strategies and measures. That is why it is crucial to explore how to interest people to get involved. It was suggested, that the awareness of citizens may be focused on local or regional issues and less on what is happening in Italy or Greece. It was argued that people have a specific and personal interest which does not necessarily match with problems and challenges on EU level. Others suggested that dialogues on local or regional level could be 'upgraded' to a higher level. In general, it would improve European decision making if the needs and interests of the people in Poland, Czech Republic etc. were understood by European institutions.

Another precondition for dialogue is to convert complex data and information into images and stories, which are easily understood by everyone. To better show the influence of the energy transition on the livelihoods of everyone, different futures could be envisioned to make the impacts comprehensible. Such images and stories already exist but most of the time they are not profoundly done and politically exploited. Technology firms for instance can create visions of what they can do but they also use it to highlight certain pathways which they think are feasible. An option to overcome this bias would be to involve citizens and different stakeholders who together with companies develop visions of possible futures.

Open questions

What needs to be discussed on European level? Is there a topic or a question that needs to be discussed by everyone?

How can trust between EU institutions and citizens be built? Would an improved dialogue or participation be a solution? And if yes: how?

It seems that many people think that nation states, government institutions and municipalities create and organize dialogue and participation platforms. Why cannot citizens, organization companies do that? Some claimed, it is a civic duty to push the transition process on and thus everyone should engage and even foster dialogue processes.

5. Lessons learned and outlook

Improved knowledge co-production to address wicked problems is seen as a driver towards a low carbon society: 'The imminent transition must gain momentum on the basis of the scientific findings and knowledge regarding the risks of continuation along the resource-intensive development path based on fossil fuels, and shaped by policy-making to avoid the historical norm of a change in direction in response to crises and shocks' (Leggewie & Messner, 2012). The R&Dialogue process in North Rhine-Westphalia and also the final event in February 2015 with experts from different European countries, aimed at tackling this issue. The dialogue process has shown that the risk perceptions of the impacts of climate change on environmental and human systems have led to common agreement that strategies towards a low carbon society are necessary. However, how the existing measures and strategies in place to decarbonise were assessed could not be agreed on by the various experts. R&Dialogue fostered the transition process by applying and testing dialogue methods and communication strategies to create a better understanding of current challenges. Over the past two years we have learned how to dialogue about a low carbon society and what role science can play in decision making processes.

The aim of R&Dialogue was to improve the dialogue between civil society and science about a low carbon society and to identify concrete questions for both groups of actors to work on. We were able to create an environment of mutual learning between the involved experts. Studies have shown that such an accomplishment is challenged by lack of trust, lack of problem awareness or insufficient problem framing and unbalanced problem ownership (Lang et al., 2012). To address these challenges we have developed a procedure that consisted of three process phases and different dialogue methods.

The first process phase was dedicated to get to know experts in the field of energy in North Rhine-Westphalia and interview them about current challenges towards a low carbon society. This 5 month period facilitated to build trust and identify dialogue themes that resembled pressing problems of the energy transition. The second process phase and actual dialogue phase contributed immensely from the first phase, because the fundamental preconditions of dialogue were established: trust and creating an impact that motivated the experts to come. Furthermore, we tested different dialogue methods to develop consensus between the participants. The third project phase is currently ongoing and evaluates the dialogue process. We send out an online questionnaire to the involved stakeholders to analyse the perception and the impact of the dialogue. The evaluation is based on the criteria empowerment, fairness, legitimacy, transparency, efficiency, effectiveness and network building.

Findings

Deliberative methods ‘provide policy and decision makers with much richer data on stakeholders knowledge, views and values, offer[…] opportunities to more fully explore and express people thoughts and ideas, allow[…] the time to develop options and priorities’ (Dorfmann et al., 2012). We have experienced, that a dialogue should be face to face to generate all the benefits, even though it is more expensive than virtual meetings. Communication between meetings, via e-mail, telephone or internet platforms is a necessary supplement. Face to face meetings avoid misunderstandings, controversies can be dealt with eminently and especially it is much easier to make new acquaintances. Establishing dialogue processes to generate improved knowledge and creating trustworthy relationship between the participants, is still challenging.

We applied and tested the dialogue methods 'World Café', 'Future Workshop', 'Dynamic Facilitation' and 'Dragon Dreaming’. Our aim was to establish mutual learning between the participants and identify methods that foster the exchange between experts from science and civil society. Most dialogue methods so far are constructed for different target groups such as general public, employees in a company and professionals with similar backgrounds. Due to the various background and interest of our group of participants it was necessary to modify the chosen dialogue methods to have enough room for exchange. Further the participants decided on the character of the output of the dialogue process and also gave feedback on how to structure the meetings. Accordingly to their wishes we organised the meetings and developed the discussion and vision paper. Due to this flexible approach and being able to adjust accordingly the character of the dialogue process, we were able to establish a mutual learning process.

Based on this experience we agree with Sykes et al. that good dialogic practices between science and civil society are classified by not ‘simply to (re)legitimize ‘lay knowledge’ or ‘lay values’ through deliberative processes. Such a framing itself would reinforce an unproductive separation between science and the public’ (Sykes et al., 2013). However a dialogue aiming at reconfiguring the relationship between science and civil society seems to be essential for knowledge coproduction. Thus the real outcome of such dialogue is not building consensus but rather to contribute to decision making by identifying questions and issues that need to be addressed for a successful transformation process towards a low-carbon society.

Outlook

We have identified gabs in research but also in everyday practices that need to be addressed to foster the transition process towards a low carbon society. To foster the transition process towards sustainable energy system more intense dialogue and cooperation processes across borders are necessary in Europe. However what dialogue methods and what role science may play are neither sufficiently elaborated nor applied.

A democratic gap has been identified, which is characterised by the 'lack of European public sphere, […] the ineffective communication between Brussels and national level […] and by the basic inability of citizens to directly influence and participate in the work of the European institutions' (Tanasescu, 2013) Furthermore, one discussion group (chapter 4.9) has shown that deliberative methods may contribute to improved European energy policy but to what extend and how needs still to be elaborated. What role for dialogue and participation towards a European energy transition?

In the past two years we experienced a dialogue between science and civil society. Several studies show that more and more scientist integrate non-scientist into their analysis (Brandt et al., 2013). However, the limits and benefits of knowledge co-production are not evaluated and controversially discussed. Questions such as on what level or scale are collaboration between science and civil society needed and possible need to be further examined. At the moment most transdisciplinary research projects take place on local or regional scale. What topics and issues can be addressed with methods of knowledge co-production? It is assumed that certain scientific research fields such as fundamental natural sciences may not be gaining from joint activities with lay people. Also the fundamental question of the degree of involvement of external or non-academic experts needs to be elaborated. This issue tackles the question of how much sovereignty of science can be shared with lay people, who might be biased and hinder critical scientific analysis.

References

Brandt, P.; Ernst, A.; Gralla, F.; Luedeeritz, C.; Lang, D. J.; Newig, J.; Reinert, F.; Abson D. J.; von Wehrden, H. 2013: 'A review of transdisciplinary research in sustainability science'. Ecolgical Economics, 92: 1-15

Dorfmann, P.; Prikken, I.; Burall, S. 2012: 'Future national energy mix scenarios: public engagement processes in the EU and elsewhere'. European Economic and Social Committee (EESC), London.

Lang, D. J.; Wiek, A.; Bergmann, M.; Stauffacher, M.; Martens, P.; Moll, P.; Swilling, M.; Thomas, C. J. 2012: ‘Transdisciplinary research in sustainability science: practice, principles, and challenges’. Sustainability Science 7: 25-43.

Leggewie, C. & Messner, D. 2012: 'The low-carbon transformation—A social science perspective'. Journal of Renewable and Sustainable Energy, 4:4**,** 041404.

Sykes,K.; Macnaghten, P. 2013: ‘Responsible Innovation – Opening up Dialogue and Debate’. In: Owen, R.; Bessant, J.; Heintz, M. (eds.): ‘Responsible Innovation’. John Wiley & Sons.

Tanasescu, I. 2013: ‘Involving the public?’. In: Jordan, A. & Adelle, C. (eds.): , Environmental Policy in the EU: Actors, institutions and processes‘. Routledge, Oxon: 326-345

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