Energy Digitalisation & Bird & Bird

Energy 4.0 – An Overview

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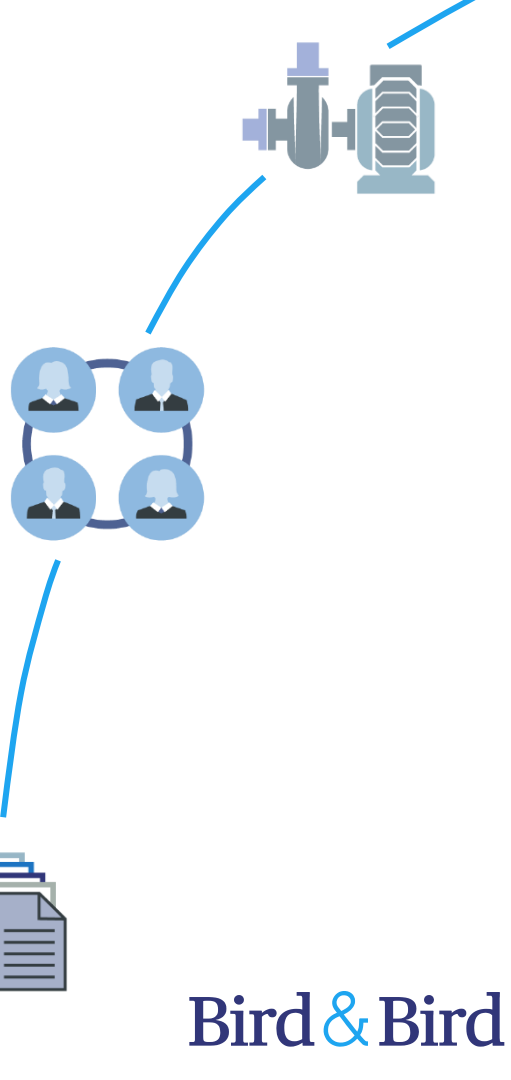


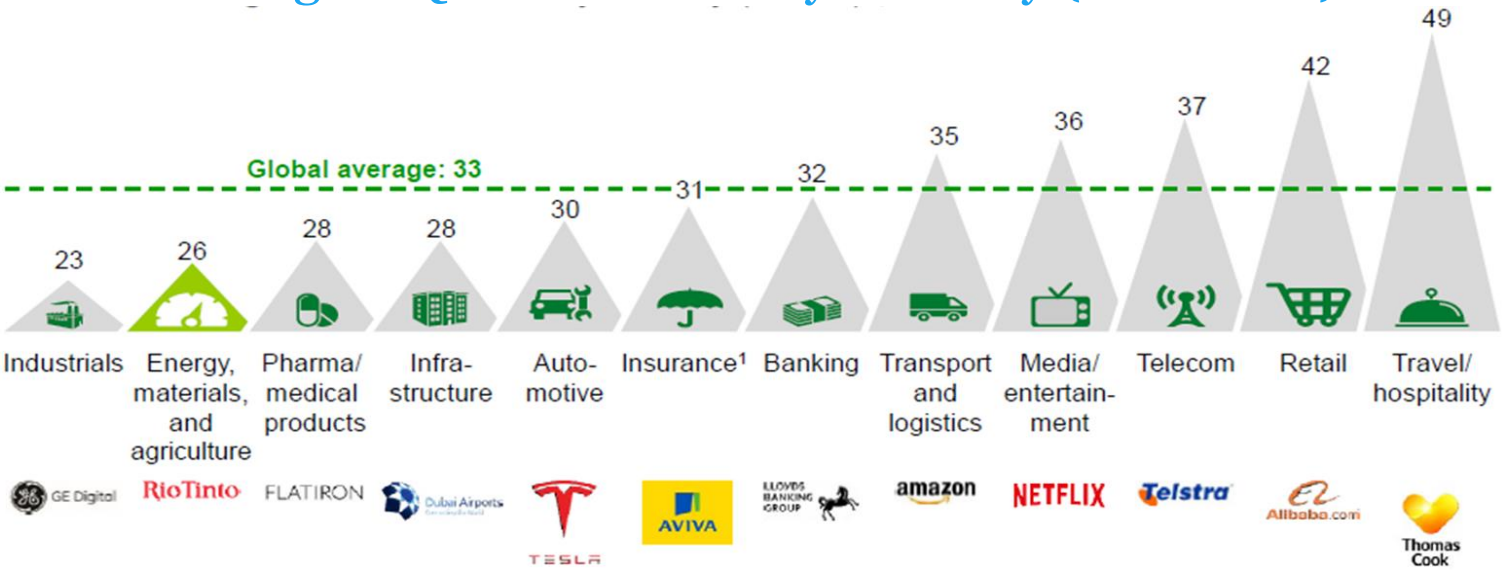
Bird & Bird

1. Introduction

1. Introduction

Where are we?

Distribution of Digital Quotient Score by Industry (out of 100)



[1] Includes P&C and Life; [2] The McKinsey Digital Quotient is a proprietary tool used to assess companies across 18 management practices, which have measured the digital readiness of 200+ companies

SOURCE: McKinsey Digital Quotient™

1. Introduction

Where are we?

Digitisation. Digitization. Digitalisation. Digitalization

- Regardless of spelling, it's everywhere
- Digitalisation is a rapidly expanding topic in the energy sector
- Digitalisation of the energy sector has arrived in corporate reality
  - But not yet fully in the energy sector's legal departments
- Potentially disruptive as well as beneficial interaction of digitalisation and energy sector
  - With unique Bird & Bird expertise

1. Introduction

Where are we?

Energy 4.0 Business Models

- Digitalisation of the energy industry will be a key driver of future change
- Huge investment needs (> EUR 1 trillion in energy sector)
- New, smarter technology everywhere
  - Generation, transmission, distribution, storage, consumption, trading, retail, services
- ICT sector experience with quickly changing, disruptive technology
- All Energy 4.0 business models involve substantial ICT element
  - Can and should build upon ICT technical, commercial and legal experience
  - Must be open to questioning conventional energy wisdom
- Challenge for energy companies: ICT as inspiration and/or driver, not subordinate service provider

1. Introduction

Where's Germany?

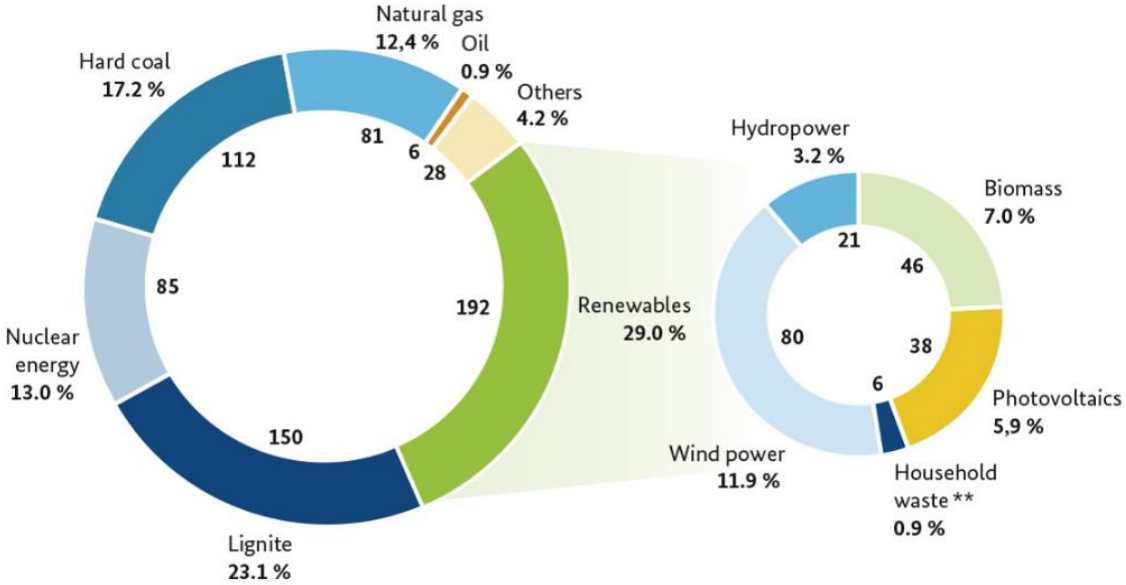
Physics and Political Desire Make Energy 4.0 Vitally Important

- 2013: "The internet is new territory for us all Neuland" (Chancellor Merkel)
- 2018: "We want to develop our country into strong digital country in all areas" and "In the energy sector we want to set the framework in such a way that the Energiewende will become a driver of energy efficiency, mondernisation, innovation and digitalisation in the power, heat, agriculture and traffic sectors, without endangering the international competitiveness of Germany as a location for industry (Coalition Agreement CDU/CSU/SPD)

1. Introduction

Where's Germany?

Gross Power Production 2016

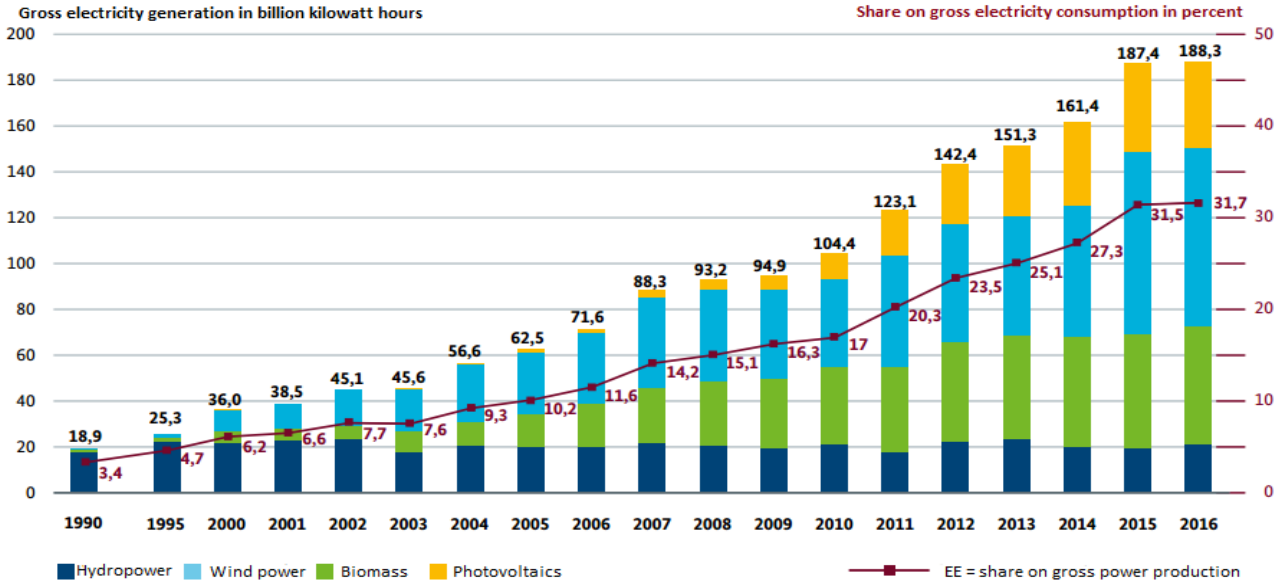


Source: Federal Ministry for Economic Affairs and Energy, Gross power production in Germany 2016, status March 2017 (last visit on 10.05.2017)

1. Introduction

Where's Germany?

Development of Electricity Generation from Renewable Energy Sources

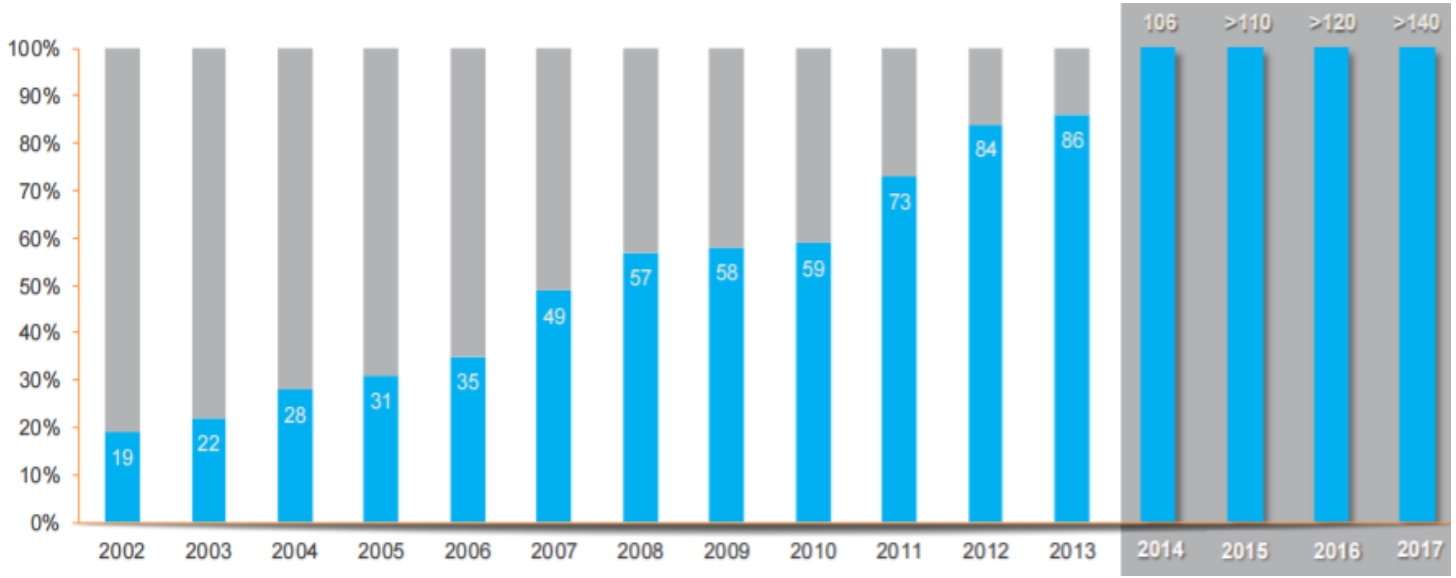


Source: Federal Ministry for Economic Affairs and Energy, Erneuerbare Energien 2016 , status April 2017, page 2 (last visit on 10.05.2017)

1. Introduction

Where's Germany?

More Than 100% Renewables already Reality in Regions

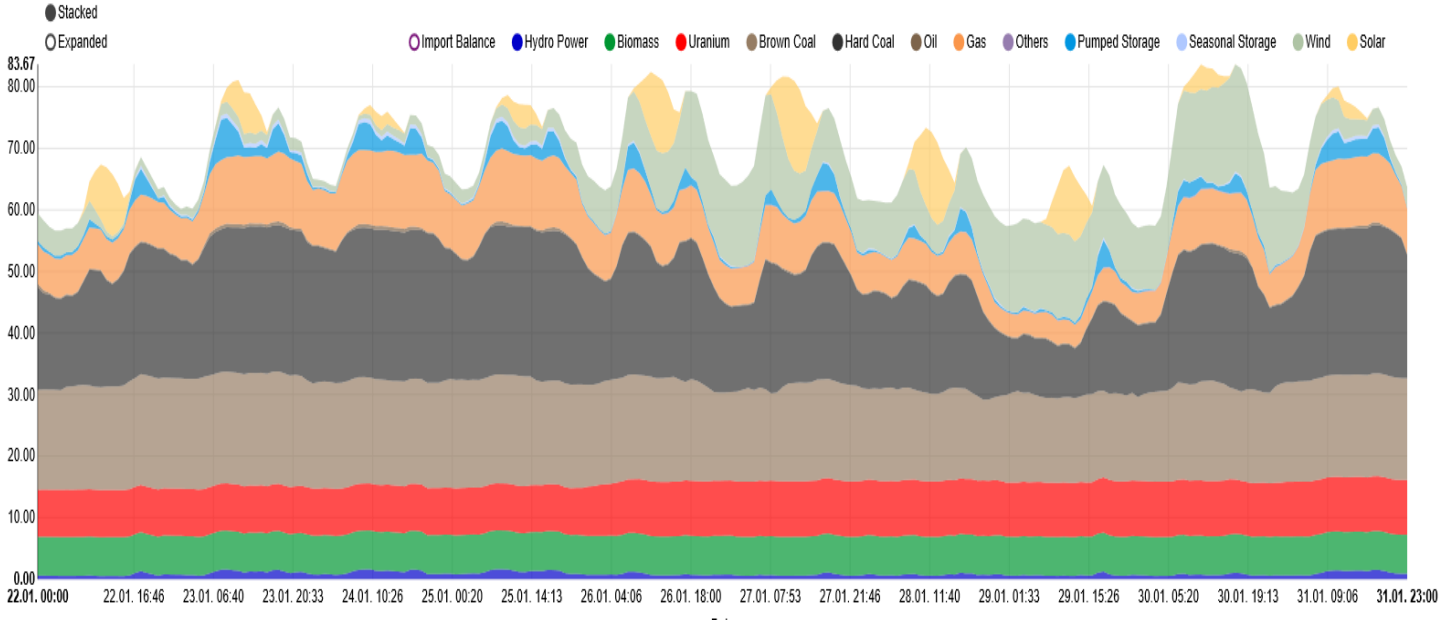


Source: WEMAG, Batteriespeicherprojekte der WEMAG AG (last visit on 31.05.2017)

1. Introduction

Where's Germany?

German Power Production 21 to 31 January 2017

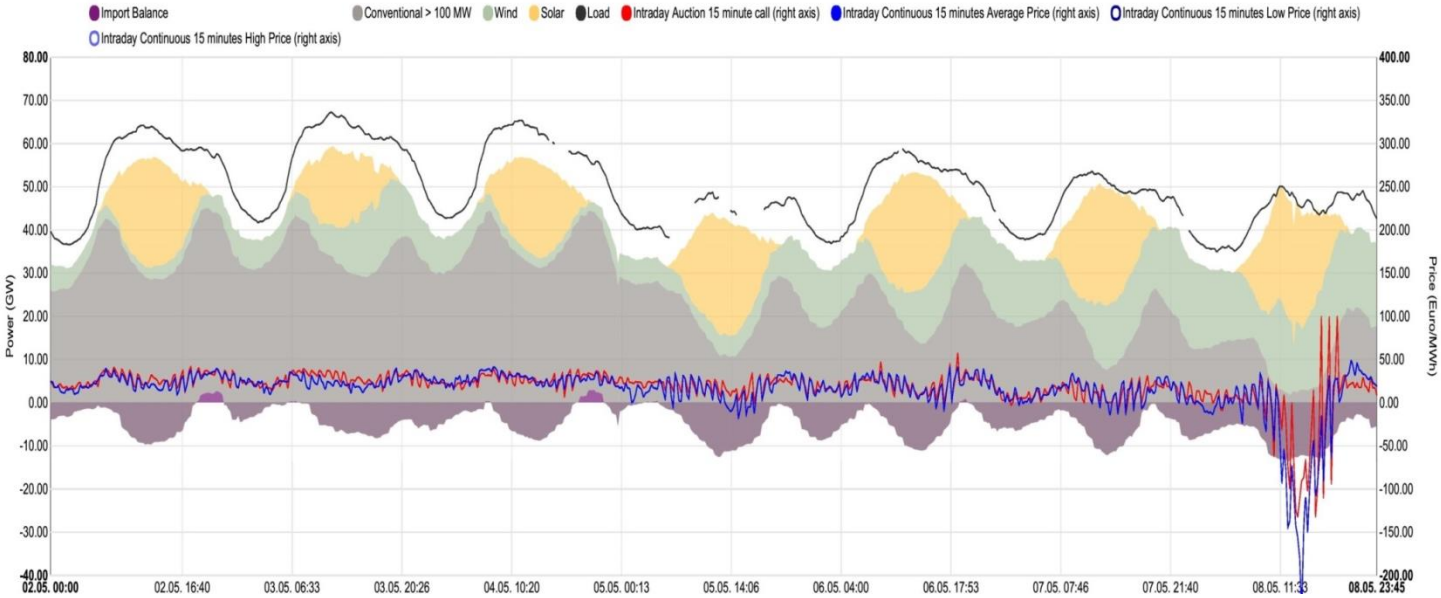


Source: WEMAG, Batteriespeicherprojekte der WEMAG AG (last visit on 31.05.2017)

1. Introduction

Where's Germany?

German Electricity Production and Spot Prices 2016 Week 18

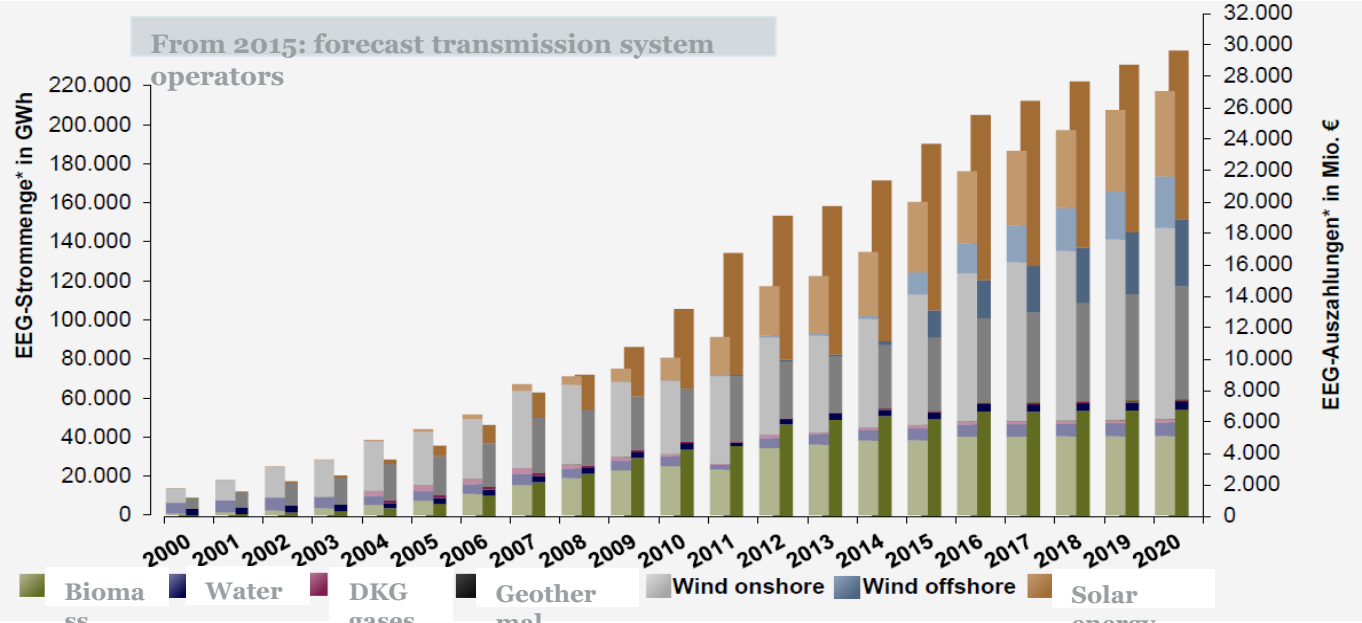


Source: Fraunhofer ISE Energy Charts, Electricity production in Germany week 36/2016 (last visit on 06.10.2017)

1. Introduction

Where's Germany?

EEG quantities and EEG payments 2000 - 2020

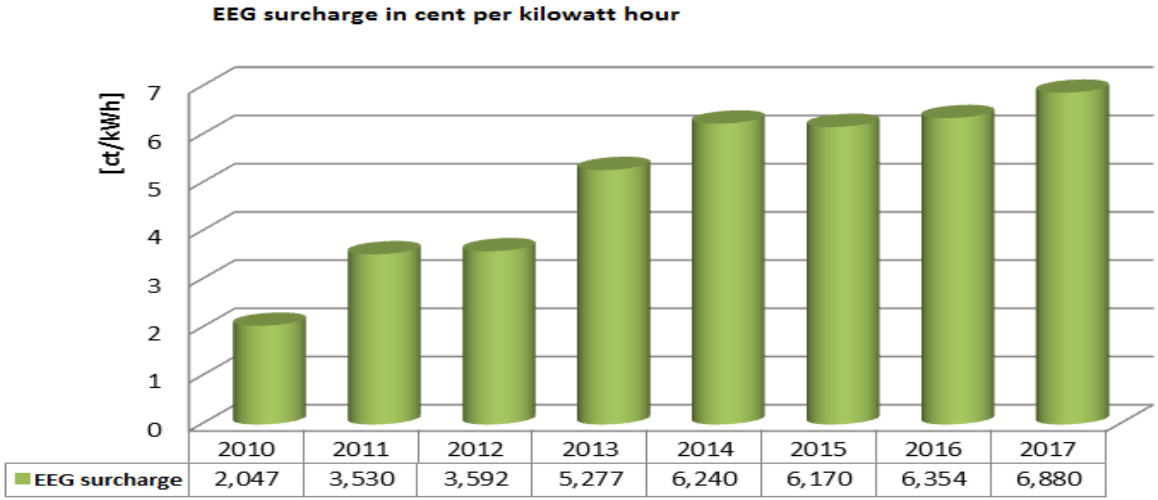


Source: Bundesverband der Energie- und Wasserwirtschaft e.V., Erneuerbare Energien und das EEG: Zahlen, Fakten, Grafiken (2015), status February 2016 , page 72 (last visit on 06.10..2017)

1. Introduction

Where's Germany?

- EEG surcharge 2017 amounts to 6.880 ct/kWh
- EUR 22,586,130,079 /81.8 million inhabitants (2016) = EUR 276/year/per person
- 3,500h*6.880 ct/kWh = EUR 241/ year/per standard 3 person household

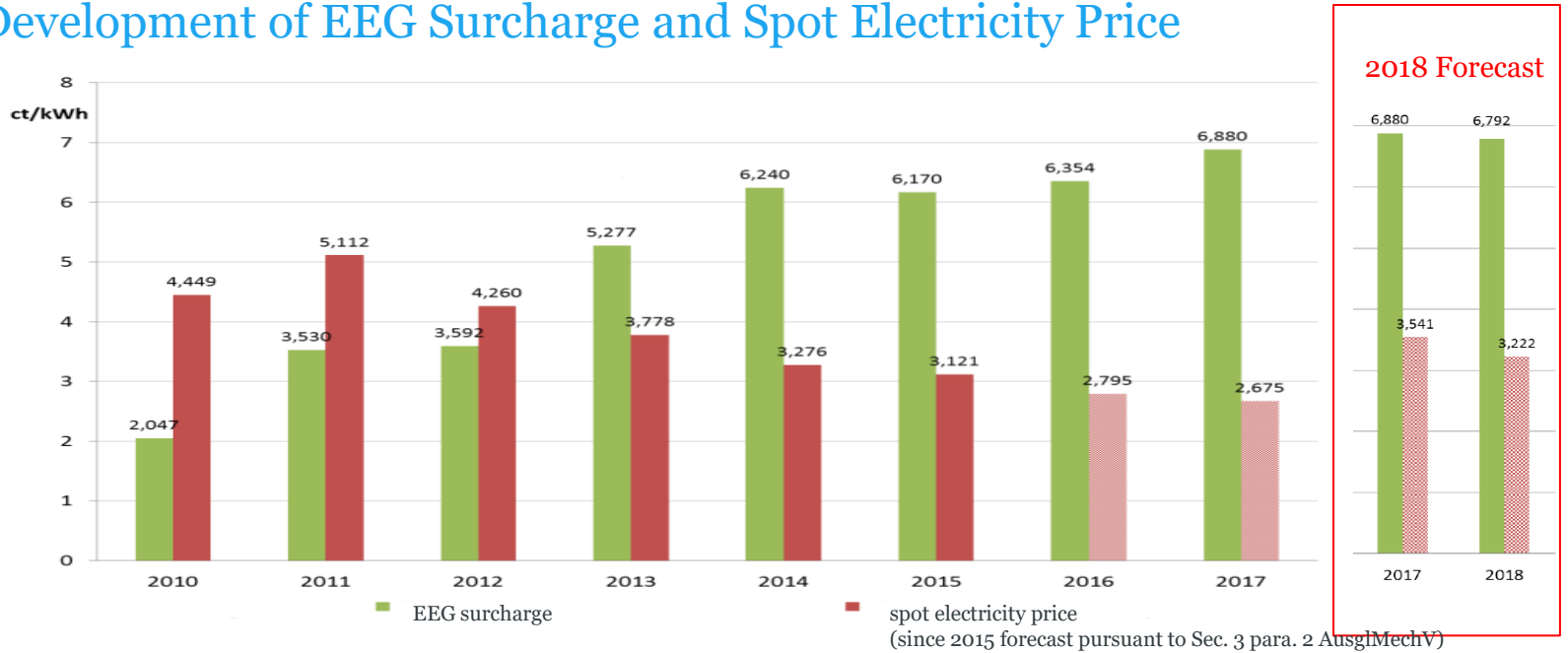


Source: Netztransparenz, EEG surcharge in cent per kilowatt hour (last visit on 15.05.2017)

1. Introduction

Where's Germany?

Development of EEG Surcharge and Spot Electricity Price



Source: Netztransparenz, Prognose der EEG-Umlage nach AusglMechV, status October 2016, page 20, (last visit on 26.05.2017)

1. Introduction

Where's Germany?

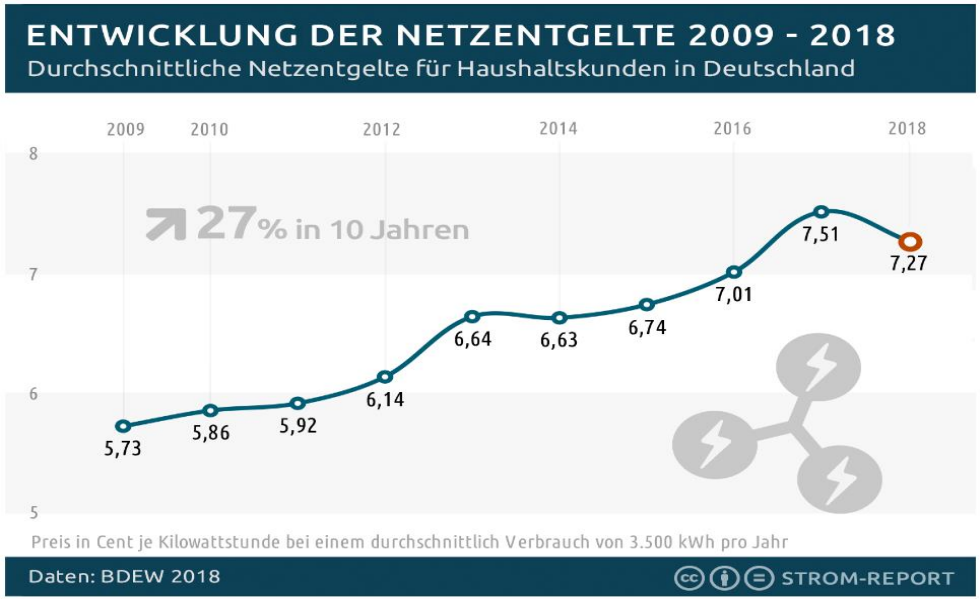
Cost Efficiency of EEG CO2 Reductions?

- Renewable energy lead to 119 million tons of CO2 reduction in 2016 (UBA)
- Net EEG payments in 2016 EUR 23.7 billion (Netztransparenz)
  - EUR 199/ton CO2 reduction using renewable energy
- Market Price EU Emission Allowance 13.12.2017: EUR 7.09/ton (EEX)

1. Introduction

Where's Germany?

Development Average Household Grid Fees 2009-2018

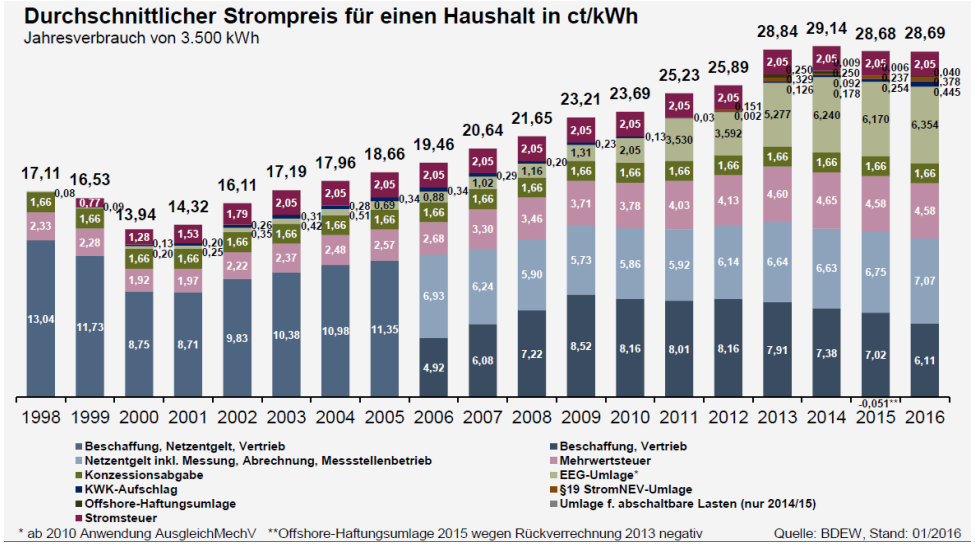


Source: Strom Report (last visit on 28.02..2018)

1. Introduction

Where's Germany?

- Average electricity price of a three-person household in ct/kWh
- Annual consumption of 3.500 kWh



Source: Bundesverband der Energie- und Wasserwirtschaft e.V., Erneuerbare Energien und das EEG: Zahlen, Fakten, Grafiken (2016), status February 2016, page 56 (last visit on 06.10.2017)

1. Energy 4.0

2. Energy 4.0

Introduction

Digitisation. Digitization. Digitalisation. Digitalization

- Digitisation is expanding topic in the energy sector
  - Not only electricity
  - Also gas, heat and utilities in general
- Digitisation of energy sector has arrived in corporate reality
- Digitisation has a habit of developing faster than "traditional industry progress"
  - Companies and regulators need to identify chances and risks for innovation, and implement solutions
  - Need for everyone to be quicker
- Legal framework on European and national level is constantly amended to keep up with technological development
  - With lots of implementation questions to resolve in practice
  - Digitisation in rather unfamiliar to many energy lawyers

2. Energy 4.0

Introduction

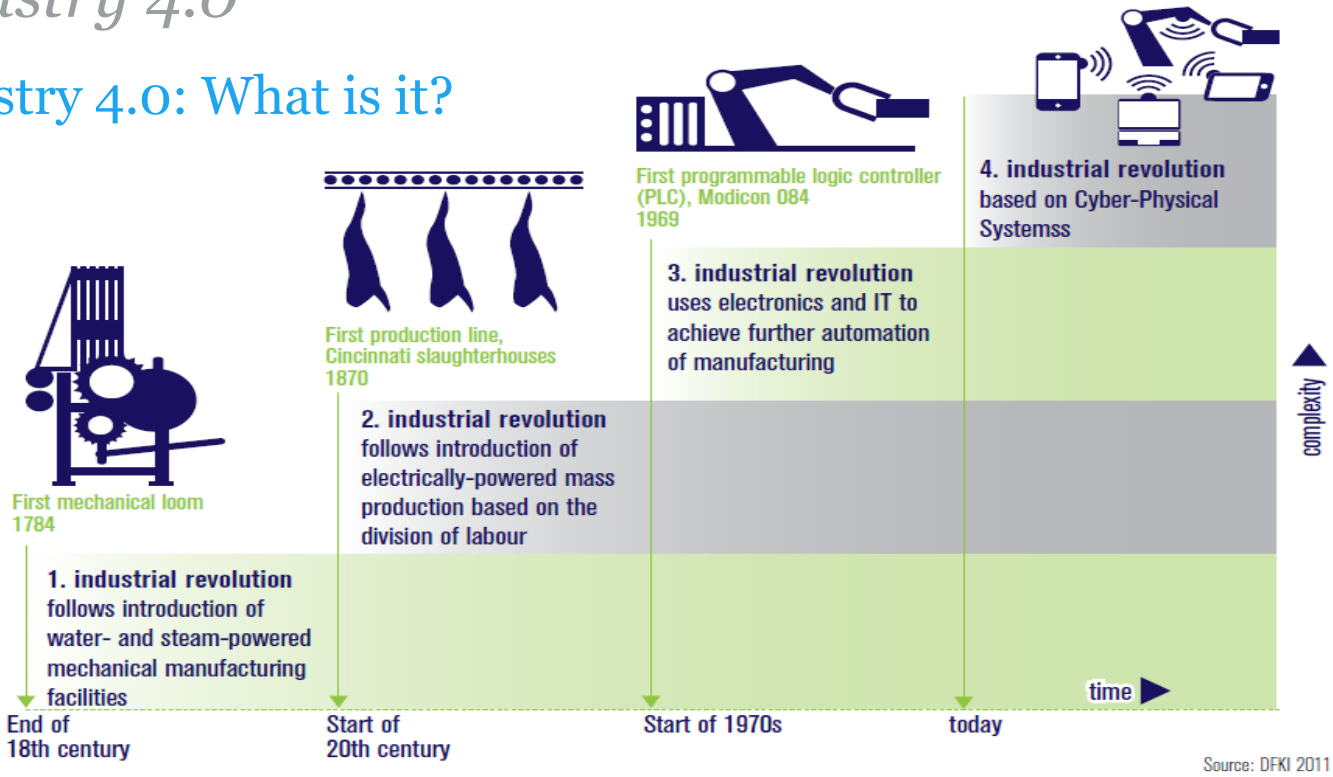
Increasing Importance of Digitisation

- Tallinn Digital Summit held on 29 September 2017
- EU heads of state or governments discussed technological transformation and digitalisation of jobs, industries, education and welfare systems
  - Planning for digital innovation with the aim of keeping Europe ahead of the technological curve while becoming a digital leader globally
  - Considering a longer term timeframe up to 2025
  - Focusing on essential topics of building a digital future for Europe: trust, security, e-government, industry, society and the economy
- Long list of energy related declarations

2. Energy 4.0

Industry 4.0

Industry 4.0: What is it?



Source: Forschungsunion, Final report of the Industrie 4.0 Working Group, page 13 (last visit on 31.05.2017)

2. Energy 4.0

Introduction

From Industry 4.0 to Energy 4.0

- Industry in general has recognised that we are at the beginning of a revolution that is fundamentally changing the way we live, work, and relate to one another
- Energy has been key to all industrial revolution so far
- The energy industry may not have fully realised how much the current industrial revolution will be transforming the energy industry
  - At a time when the energy industry is struggling with the Energiewende
  - At a time when other industries are already in the process of realising what potential and what risks are associated with Industry 4.0

2. Energy 4.0

Details

What is Energy 4.0?

- Is has become an official buzzword of German politics
- Energy Digitalisation: The next big thing after renewables
- Why?
  - ➢ Physical energy world is changing at an unprecedented speed
    - Intermittent renewables
    - Nuclear phase-out
    - Other phase-outs? Lignite, hard coal, oil, gas?
    - New transmission and distribution grids
    - Storage
- Commercial energy world is changing at an unprecedented speed
  - Unbundling, trading, many new players, new products, etc.
- Vastly increased and increasing collection and flow of data

2. Energy 4.0

Details

Key Elements of Energy 4.0

- Cyber-physical systems: System composed of physical entities and controlled or monitored by computer-based algorithms
  - More than 1.6 million decentralised power generators in Germany
  - Millions and millions of consumers
  - Generations must always exactly match consumption
- The energy industry is becoming one big and highly complex cyber-physical system
- Consequence: The energy industry is likely to be seriously affected by all Industry 4.0 developments, with Energy 4.0 in turn materially influencing Industry 4.0

2. Energy 4.0

Details

Energy 4.0 - It is already happening!

- Which current energy developments have nothing or little to do with sensor-based communication-enabled autonomous systems?
  - Generation?
  - Transmission and distribution?
  - Trading?
  - Retail?
  - Consumption?

2. Energy 4.0

Details

Energy 4.0 - It is already happening!

- Which hot Tech & Comms subject has nothing or little to do with energy?
  - Cloud computing?
  - Big data?
  - IT and data security?
  - Smart everything?
  - Internet of things?
  - Outsourcing?
  - Standardisation?
  - Data protection?

2. Energy 4.0

Details

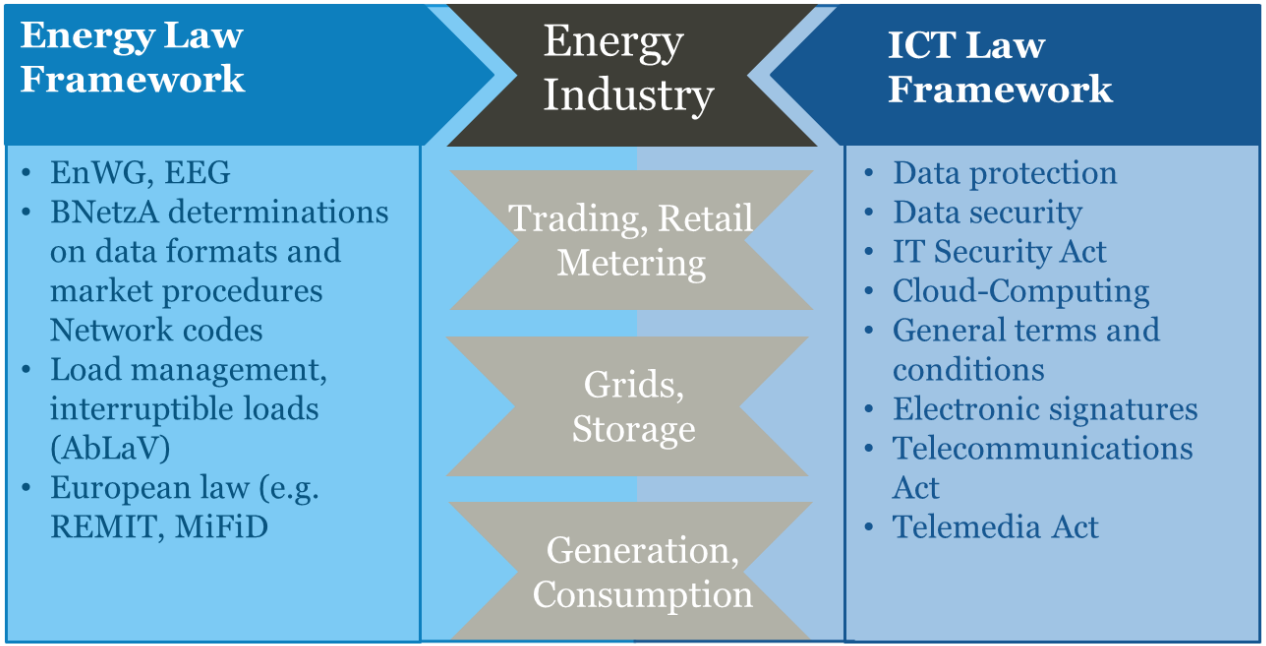
Energy 4.0 Business Models?

- Missing basis for business models
  - Technical: "It's never going to work"
  - Regulatory: "Our regulatory framework does not allow this"
  - Commercial: "It's impossible to make money with this"
- Lack of vision
  - Google: "Stupid idea to think that you can make money with a free internet search engine"
  - Amazon: "I have a great local bookstore – don't need an internet one"
  - Twitter: "You cannot say anything meaningful with 140 characters"
  - Apple: "I already have a great mobile phone"

2. Energy 4.0

Details

Energy 4.0 Business Models: Convergence



2. Energy 4.0

Details

Key Energy 4.0 Subjects

- Digitisation of the energy turnaround is much broader than the "Digitisation of the Energy Turnaround Act"
- Plethora of additional subjects traditionally associated more with ICT than with energy, e.g.
  - Data ownership
  - Protection of intellectual property
  - Outsourcing
  - E-commerce
  - Liability for product and system failure

2. Energy 4.0

Smart Metering

EU Third Energy Package

Member States are required to ensure implementation of smart meters

- Implementation may be subject to a long-term cost-benefit analysis
- Where cost-benefit analysis is positive, at least 80% of consumers shall be equipped with smart meters by 2020
- Subject to the cost-benefit analysis Member States shall prepare a timetable with a target of up to 10 years for the implementation of smart meters
- EU Commission proposal on 30 November 2016 that all consumers should be entitled to request a smart meter from their suppliers
  - Consumers shall reap benefits of progressive digitalisation of the energy market
  - Consumers shall be able to access dynamic electricity price contracts

2. Energy 4.0

Smart Metering

Deployment of Smart Meters in the EU - 2014 Commission report on deployment of smart metering

- Close to 200 million smart meters for electricity will be rolled out in the EU by 2020
- This represents a potential investment of €45 billion
- By 2020, it is expected that almost 72% of European consumers will have a smart meter for electricity
- Costs of installing a smart meter in the EU is on average between €200 and €250
- On average, smart meters provide savings of €309 for electricity per metering point (distributed amongst consumers, suppliers, distribution system operators, etc.) as well as an average energy saving of 3%
- But: "Traditional" cost/benefit approach
  - Business models in the digital world are somewhat different

2. Energy 4.0

Smart Metering

Differences in the Member States

- Overall successful rollout of smart meters depends on criteria largely decided by Member States, including
  - Regulatory arrangements
  - Extent to which systems will be technically and commercially interoperable
  - Data privacy and security
- No EU-wide consensus yet on the minimum range of operations required by smart meters

2. Energy 4.0

Smart Metering

German Smart Meters Operation Act

- Key Element of the "Digitisation of the Energy Turnaround Act"

- Entered into force on 2 September 2016
- Specifies roles of different players and technological minimum requirements for the use of smart meters
- Specifies role and certification requirements for the Smart-Meter-Gateway-Administrator
- Provides for admissible data communication to ensure data protection and data security
- Provides for the operation of meters and their equipment

2. Energy 4.0

Smart Metering

Phased rollout for smart meters for electricity

- Consumers with annual electricity consumption of over 10,000 kWh
  - Rollout has started in 2017
- Consumers with annual electricity consumption between 6,000 – 10,000 kWh
  - Rollout begins 2020
- Consumers with annual electricity consumption below 6,000 kWh
  - Smart meters optional
  - Have to be equipped with modern metering equipment
- Consumers have to be equipped with smart meters or modern metering equipment until 2032 at the latest

2. Energy 4.0

Smart Metering

Practical difficulties

- Many implementation questions are still unanswered in practice, e.g.
  - How does outsourcing affect certification requirements for the Smart-Meter-Gateway-Administrator?
  - What are technological requirements for already installed modern metering equipment which does not fulfil the new requirements for smart meters yet?
  - What are technological requirements for visualizing relevant energy data?
- Revision of European legal framework for smart meters as part of Winter Package

2. Energy 4.0

Smart Metering

European General Data Protection Regulation (GDPR)

- Key indirect energy digitisation example
- In force since 24 May 2016
- Applies from 25 May 2018
- Leads to material changes to existing data protection regimes in the EU
- Stricter requirements in several areas
- For example regarding data breaches, documentation of compliance and handling of data subject/consumer rights
- Affected entities required to examine their operation procedures and processes ("Gap Analysis")
- Affected entities required to amend operation procedures and processes if necessary to ensure compliance
- In cases of noncompliance: Fines up to 4% of the global turnover

2. Energy 4.0

Smart Metering

Hot Compliance Topic!

- Data protection as a fast growing legal area attracts more and more attention of consumers, press and public in Europe
  - More than any other compliance topic
- Major reputational risk for companies
  - Negative effect on sales
  - Consumers becoming more and more privacy sensitive (privacy as the "critical pitch")
- Authorities, press and public focus on major B2C brands

2. Energy 4.0

Smart Metering

European NIS Directive

- Another indirect digitisation example
- Directive on Security of Network and Information Systems = NIS Directive
- Entered into force on 8 August 2016
- Member States required to transpose Directive by 9 May 2018
- Aims to ensure a high common level of security of network and information systems within the EU

2. Energy 4.0

Smart Metering

Scope of NIS Directive

- Creation of a computer security incident response team network (CSIRT network) to promote swift and effective operational cooperation
- Set up of a Cooperation Group to support and facilitate strategic cooperation and the exchange of information among Member States
- Establishment of security and notification requirements for operators of essential services and for digital service providers
- Operators of essential services and digital service providers can apply stricter security measures than set out in the Directive

2. Energy 4.0

Smart Metering

German IT-Security Act

- Act on Increasing the Security of Information Technology Systems
- In force since 25 July 2015
- Applies to providers of online services, telecommunication companies as well as to operators of critical infrastructure
- Operators of critical infrastructure energy plants have to ensure adequate protection against threats to telecommunications and data processing systems
  - Security of those systems needs to be checked regularly (every 2 years)

2. Energy 4.0

Smart Metering

German Critical Infrastructure Regulation

- Implements IT-Security Act
- In force since 3 May 2016
- Establishes reporting obligations for significant IT-security incidents
  - Applies to operators of critical infrastructure in the energy sector as well as in the IT, telecommunications, food and water sectors
  - Amendment from 30 June 2017 extends reporting obligations to finance, insurance, health, transportation and traffic sectors

2. Energy 4.0

Smart Metering

German IT-Security Catalogue

- Available since August 2016
- Contributes to establishing adequate protection against threats to critical infrastructure energy information and communication systems
- Establishes an information security management system
- Provides for certification by an independent and authorized authority
- Further practice will show whether the catalogue can contribute to an adequate protection as planned

2. Energy 4.0

Smart Metering

No Smart Energy Without Telecom Infrastructure (TI)

- Numerous generating plants, storage facilities, smart meter and electric vehicles have to be integrated into the smart grid
- Smart energy systems will massively use TI connections for parallel communication of data
  - Overloads of communication channels?
- Current communication networks are mainly designed for medium or average loads
- Existing TI needs to be expanded or upgraded to manage parallel or additional data loads

2. Energy 4.0

Smart Metering

Challenges of TI expansion or upgrade

- Requirements for smart energy TI depend on
  - Local availability of existing TI in different regions
  - Technological availability of existing TI (e.g. due to technical restrictions)
  - Sufficient broadband availability for different uses of smart technologies (e.g. smart meter gateways)
  - Security characteristics of different types of TI
- Costs for expanding or upgrading TI have to be divided between affected parties

2. Energy 4.0

Smart Metering

Amending Legal and Regulatory Framework

- Amendments to the legal and regulatory framework are necessary to support an efficient development of reliable smart energy TI
- Regulation of telecom resources which are essential for the energy transition (frequencies, right of way, etc.)
- Regulation of use and access for operators and users of TI (e.g. competitive access for services)
- Practical effects of network neutrality requirements on existing laws have to be taken into account
- Practical effects and possible contradictions to existing and future data protection laws have to be assessed (on European and national levels)

2. Energy 4.0

EU Winter Package

Digitalisation is coming. Also in Energy-Union

- On 30 November 2016 the European Commission presented its so called “Winter Package”, official title, "Clean Energy for all Europeans"
- Digitalisation is not a key element of the Winter Package, but digitalisation is part of the various legislative proposals of the package (Smart Meter, Smart Home, Smart Market, Smart Grid)
- The package includes 8 different legislative proposals:
  - Energy Performance in Buildings, Renewable Energy, Energy Efficiency, Governance, Electricity Market Design (the Electricity Regulation, Electricity Directive, and Risk-Preparedness Regulation), Rules for the regulator ACER
  - As of November 2018 political agreement has been reached on the first four of the eight files

2. Energy 4.0

EU Winter Package

Energy Performance in Buildings Directive

- Political agreement reached - final approval on 17 April 2018 by European Parliament
- Digitalisation content – Smart Homes/Smart Buildings:
  - Encourages the use of information and communication technology (ICT) and smart technologies to ensure buildings operate efficiently for example by introducing automation and control systems
  - Supports the rollout of the infrastructure for e-mobility in all buildings (although to a lesser extent than in the Commission's proposal)
  - Introduces a "smart readiness indicator" which will measure the buildings' capacity to use new technologies and electronic systems to adapt to the needs of the consumer, optimise its operation and interact with the grid

2. Energy 4.0

EU Winter Package

Electricity Directive

- Political agreement pending
- Digitalisation Content – Smart Meters (Chapter III of the proposed Directive):
  - Smart meter rollout is subject to economic assessment
  - Where roll-out of smart meters is assessed positively, at least 80 % of final customers shall be equipped with smart meters within 8 years from the date of their positive assessment or by 2020 for those Member States that have initiated deployment before entering into force of this Directive
  - Even in case of negative assessment every consumer shall be entitled to request a smart meter equipped with a minimum set of functionalities

6. Q & A

Thank you & Bird & Bird

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