TASK OPEN :Renewables Capacities : Installed / Lifetime /Depp

26 Mart 2020 Perşembe 11:38

Fuelcell deppreciation ve CCGT ve GT installed

Main Resources:

1. Smard:
   - Powerplant Maps and Lists
   Content: Search is possible according to : Company, Area, Nominal Capacity, Commissoning year, State, Network Operator, Control Area and Energy Resource

2. Marktstammdatenregister
   Registered Generation Units
   https://www.marktstammdatenregister.de/MaStR/Einheit/Einheiten/ErweiterteOeffentlicheEinheitenuebersicht

3. EEG 2017 Presentation

4. Kraftwerkliste bundesagentur

5. Zeitreihen zur Entwicklung der erneuerbaren Energien in Deutschland -Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat) (Stand: Februar 2020)
6. LEVELIZED COST OF ELECTRICITY RENEWABLE ENERGY TECHNOLOGIES March 2018 FRAUNHOFER INSTITUTE for Solar Energy Systems
7. Die vorliegende dena-Leitstudie Integrierte Energiewende- Deutsche Energie-Agentur GmbH (dena)-07/18

8. BDEW-Kraftwerkspark in Deutschland Aktueller Kraftwerkspark, Stromerzeugungsanlagen im Bau und in Planung, absehbare Stilllegungen konventioneller Kraftwerke Berlin, 27. April 2018

9. Studie IndWEDe - Industrialisierung der Wasserelektrolyse in Deutschland: Chancen, und Herausforderungen, für nachhaltigen Wasserstoff für Verkehr, Strom und Wärme

10. Hydrogen from eRenewable power IRENA
11. DOE Fuelcell

General Capacities [1] 04.2020

Monday, April 20, 2020 12:00 AM

Installed generation capacity
- ●: Other conventional: **7,592 MW**
- ●: Hydro pumped storage: **9,422 MW**
- ●: Fossil gas: **31,712 MW**
- ●: Fossil hard coal: **22,458 MW**
- ●: Fossil brown coal: **21,067 MW**
- ●: Nuclear: **8,114 MW**
- ●: Other renewable: **523 MW**
- ●: Photovoltaics: **46,471 MW**
- ●: Wind onshore: **53,405 MW**
- ●: Wind offshore: **7,709 MW**
- ●: Hydropower: **5,256 MW**
- ●: Biomass: **7,855 MW**

Capacities:
For PV, Onshore/Ofshore Wind ,Hydropower, Geothermie, Biomass,Biogas I will use [5]

For rest I will use [2]

Installed Renewables according to commissioning date

Onshorewind:

<=2005:
- 3,441.60 MW [1]
- 6,972.751 MW [4]
- 18,248 MW [5]
- 22,300 MW[2]

2005< , >=2015:

- 9,396.207 MW [4]
- 23,049 MW [5]

>2015

Biomass explanation:
Info https://www.unendlich-viel-energie.de/erneuerbare-energie/strom-aus-biomasse

Biomass= solid, liquid,gas

Solid:

Liquid:

Gasbiomass -----> biogas:
Large power plants (up to 20 megawatts, MW) are referred to as thermal power plants. In the somewhat smaller output range (often up to approx. 500 kilowatts, kW output), combined heat and power plants (CHP) are used. A special technology are combined heat and power plants, in which heat or cold, e.g. is generated for air

23,049 MW [5]

>2015

36,256 [4]
12,108[5]

Offshore Wind:

Biomass:
Solid: 1637 [5]
Liquid: 231 [5]
Gas: 7051 [5]
Biomass and Biogass represented seperately
Biomass includes solid and liquid
Biogas includes: Biogas* + Biomethan *+ Klärgas** +Deponiegas
*ab 2013 inklusive Leistung mit dem Ziel der Flexibilisierung der Stromerzeugung aus Biomasse
**bis 2014 auf Grundlage der Stromerzeugung nach energieträgerspezifischen Volllaststunden berechnet, ab 2015 Netto-Zubau gemäß BNetzA-Registerdaten, ab 2018 gemäß StBA

Geothermie
48MW [5]

Geothermal well :
Calculated with efficiency of Geothermie 48/0.14 MW =343MW

Hydropower:
Lauf- und Speicherwasserkraftwerke sowie Pumpspeicherkraftwerke mit natürlichem Zufluss
5595 MW [5]

- Hydropoweri da 3 ayri gruba böldüm cunku depp 50 yil ve 5500MW in 4000 i 1990 öncesinden kalma
- Burada net bi weri olmadigi icin sanki 2030 da 2000MW 2040 da 2000 MW 2050de 800 MW tekrar invest edilmesi gerekiyormus gibi modelledim.
- Ama kapacity upi sabit almayi planliyorum

ERGAS:
2020:31,712 [1]
2000: 20,452 [8]
2005: 21,255 [8]
2010: 25,721 [8]
2015: 28, 359 [8]
2017: 29,789 [8]
GT:

CCGT:

Kernenergie:
8,114 (2020) [1]

Braunkohle:
21,067 (2020)[1]
21,033 (2017) [8]
20,050 (2000) [8]

Steinkohle:
22,458 (2020) [1]
25,341[2017] [8]
30,123(2000)[8]

Lifetime:

Large power plants (up to 20 megawatts, MW) are referred to as thermal power plants. In the somewhat smaller output range (often up to approx. 500 kilowatts, kW output), combined heat and power plants (CHP) are used. A special technology are combined heat and power plants, in which heat or cold, e.g. is generated for air conditioning.

Klärgas : sevage CHP
Sewage gas is to be distinguished from agricultural biogas production. In comparison, sewage gas supplies only a fraction of the electricity generation. Around 1,000 sewage treatment plants use the resulting sewage gas to generate electricity and heat in CHP plants. Even if energy is only used in every tenth plant, a significantly higher proportion of the biogenic residue sewage sludge is recorded. Among the 1,000 plants with sewage gas CHP plants are the largest sewage treatment plants in Germany, which often alone cover disposal for hundreds of thousands of residents. The majority of the smaller plants have no use of sewage gas for energy, but are increasingly discovering them as an attractive source of energy for self-supply in view of rising electricity and heating costs. In 2013, a total of 240 MW CHP plants were installed at the sewage treatment plants (2012: 236 MW). Electricity generation rose slightly to 1.4 billion kWh (2012: 1.3 billion kWh).

Deponiegas:
By contrast, electricity generation from landfill gas is declining slightly. Landfill gas is created from biogenic waste that was previously filled in landfills. The high-energy landfill gas is converted into electricity and heat in CHP plants. At the existing landfill sites, the landfill gas reserves are now gradually running out. Practically no other biogenic waste is deposited. The installed capacity of the landfill gas CHP plant therefore decreased to 110 MW in 2013 (2012: 118 MW). Electricity generation was now only 0.47 billion kWh (2012: 0.54 billion kWh).

	PV rooftop small (5-15 kWp)	PV rooftop large (100-1000 kWp)	PV utility-scale (> 2 MWp)	Wind onshore	Wind offshore	Biogas	Brown coal	Hard coal	CCGT	GT
Lifetime [in years]	25	25	25	25	25	30	40	40	30	30
Share of debt	80%	80%	80%	80%	70%	80%	60%	60%	60%	60%
Share of equity	20%	20%	20%	20%	30%	20%	40%	40%	40%	40%
Interest rate on debt	3.5%	3.5%	3.5%	4.0%	5.5%	4.0%	5.5%	5.5%	5.5%	5.5%
Return on equity	5.0%	6.5%	6.5%	7.0%	10.0%	8.0%	11.0%	11.0%	10.0%	10.0%
WACC nominal	3.8%	4.1%	4.1%	4.6%	6.9%	4.8%	7.7%	7.7%	7.3%	7.3%
WACC real	1.8%	2.1%	2.1%	2.5%	4.8%	2.7%	5.6%	5.6%	5.2%	5.2%
OPEX fix [EUR/kW]	2.5% of CAPEX	2.5% of CAPEX	2.5% of CAPEX	30	100	4.0% of CAPEX	36	32	22	20
OPEX var [EUR/kWh]	0	0	0	0.005	0.005	0	0.005	0.005	0.004	0.003
Degradation	0.0025	0.0025	0.0025	0	0	0	0	0	0	0

Table 2: Input parameter for LCOE calculation. The real WACC is calculated with an inflation rate of 2%.

Biogas:
30 [6]
30[7]
20
Biogas 20 is modelled because it has 30 y lifetime and 3500 MW was already installed in 2010

Biomass:
30[7]

Lignite:
40 [6]
45[7]

Hard Coal:
40 [6]
45[7]

CCGT:
30 [6]
30[7]

GT:
30 [6]

Geothermie:
30 [7]

Hydropower:
100 [7]

Electrolyser:
Alcali:
Lebensdauer 2020 a 20 [7]
Lebensdauer 2050 a 29 [7]
20 [9]

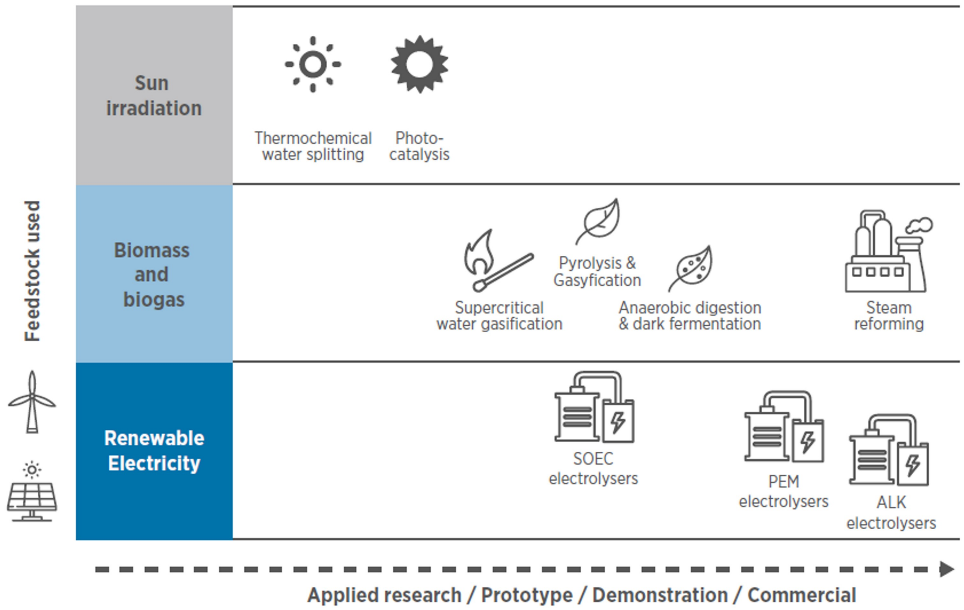
PEM:
Lebensdauer 2020 a 11[7]
Lebensdauer 2050 a 16[7]

SOEC:
Lebensdauer 2020 a 11[7]
Lebensdauer 2050 a 16[7]

Electrolysers:

[10]

Figure 6: Renewable hydrogen production pathways and current levels of maturity



Notes: ALK = alkaline; PEM = proton exchange membrane; SOEC = solid oxide electrolyser cell.
Source: Based on FCH JU (2015), Study on Hydrogen from Renewable Resources in the EU.

Table 1: Techno-economic characteristics of ALK and PEM electrolysers (2017, 2025)

Technology		ALK		PEM	
	Unit	2017	2025	2017	2025
Efficiency	kWh of electricity/ kg of H_2	51	49	58	52
Efficiency (LHV)	%	65	68	57	64
Lifetime stack	Operating hours	80 000 h	90 000 h	40 000 h	50 000 h
CAPEX – total system cost (incl. power supply and installation costs)	EUR/kW	750	480	1 200	700
OPEX	% of initial CAPEX/year	2 %	2 %	2 %	2 %
CAPEX – stack replacement	EUR/kW	340	215	420	210
Typical output pressure*	Bar	Atmospheric	15	30	60
System lifetime	Years	20		20	

Alkaline (ALK) electrolysers have been used by industry for nearly a century.

Proton exchange membrane (PEM) electrolysers are commercially available today and are rapidly gaining market traction as, among other factors, they are more flexible and tend to have a smaller footprint.

Solid oxide electrolysers
hold the potential of improved energy efficiency but are still in the development phase and, unlike ALK and PEM, work at high temperatures (FCH JU, 2017a; FCH JU, 2014).

The lifetime of an ALK electrolyser is currently twice as long, and is expected to remain significantly longer for the next decade.

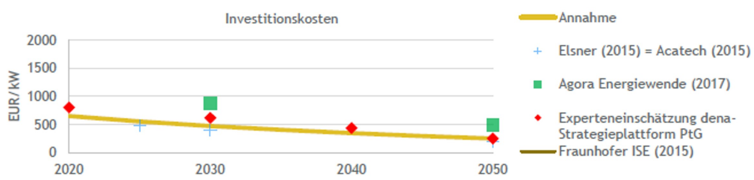
[9]
Polymer-Elektrolyt-Membran-Elektrolyse (PEMEL)

- Alkalische Elektrolyse (AEL)
- Hochtemperatur-Elektrolyse (HTEL) ---------(SOEC)

[7]

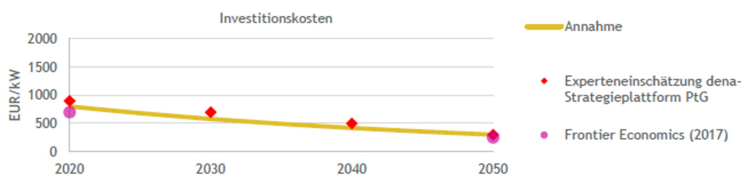
TABELLE 29: PTX-TECHNOLOGIEN

Elektrolyseur Alkali

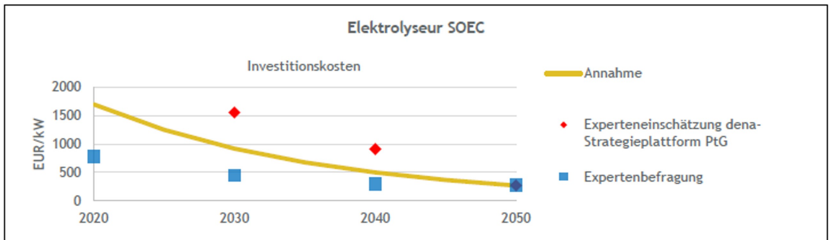


Größe	Einheit	Wert	Quellen
Kosten 2020 (Basisszenarien)	EUR/kW	650	ewi ER&S Kraftwerksdatenbank (2018), Literaturrecherche (siehe Abbildung für Quellen Investitionskosten), Expertenbefragung
Kosten 2050 (Basisszenarien)	EUR/kW	250	
Kosten 2020 (Sensitivität PtX)	EUR/kW	650	
Kosten 2050 (Sensitivität PtX)	EUR/kW	500	
Kostenreduktion	%	62	
Lebensdauer 2020	a	20	
Lebensdauer 2050	a	29	
Wirkungsgrad 2020	%	82	
Wirkungsgrad 2050	%	84	
FOM-Kosten 2020	EUR/kW	26	
FOM-Kosten 2050	EUR/kW	10	
Kalk. Zins	%	10,5	Expertenbefragung

Elektrolyseur PEM



Kosten 2020 (Basisszenarien)	EUR/kW	800	ewi ER&S Kraftwerksdatenbank (2018), Literaturrecherche (siehe Abbildung für Quellen Investitionskosten), Expertenbefragung
Kosten 2050 (Basisszenarien)	EUR/kW	300	
Kosten 2020 (Sensitivität PtX)	EUR/kW	800	
Kosten 2050 (Sensitivität PtX)	EUR/kW	600	
Kostenreduktion	%	62	
Lebensdauer 2020	a	11	
Lebensdauer 2050	a	16	
Wirkungsgrad 2020	%	82	
Wirkungsgrad 2050	%	84	
FOM-Kosten 2020	EUR/kW	14	
FOM-Kosten 2050	EUR/kW	5	
Kalk. Zins	%	10,5	Expertenbefragung



Kosten 2020 (Basisszenarien)	EUR/kW	1700	ewi ER&S Kraftwerksdatenbank (2018), Literaturrecherche (siehe Abbildung für Quellen Investitionskosten), Expertenbefragung
Kosten 2050 (Basisszenarien)	EUR/kW	270	
Kosten 2020 (Sensitivität PtX)	EUR/kW	1700	
Kosten 2050 (Sensitivität PtX)	EUR/kW	540	
Kostenreduktion	%	84	
Lebensdauer 2020	a	11	
Lebensdauer 2050	a	16	
Wirkungsgrad 2020	%	87	
Wirkungsgrad 2050	%	95	
FOM-Kosten 2020	EUR/kW	68	
FOM-Kosten 2050	EUR/kW	10,8	
Kalk. Zins	%	10,5	Expertenbefragung

FUELCELL : doa fuelcell factsheet

Fuel Cell Type	Operating Temperature	System Output	Efficiency	Applications
Alkaline (AFC)	90–100°C 194–212°F	10kW–100kW	60–70% electric	• Military • Space
Phosphoric Acid (PAFC)	150–200°C 302–392°F	50kW–1MW (250kW module typical)	80–85% overall with combined heat and power (CHP) (36–42% electric)	• Distributed generation
Polymer Electrolyte Membrane or Proton Exchange Membrane (PEM)*	50–100°C 122–212°F	<250kW	50–60% electric	• Back-up power • Portable power • Small distributed generation • Transportation
Molten Carbonate (MCFC)	600–700°C 1112–1292°F	<1MW (250kW module typical)	85% overall with CHP (60% electric)	• Electric utility • Large distributed generation
Solid Oxide (SOFC)	650–1000°C 1202–1832°F	5kW–3 MW	85% overall with CHP (60% electric)	• Auxiliary power • Electric utility • Large distributed generation

Source: Argonne National Laboratory

**Direct Methanol Fuel Cells (DMFC) are a subset of PEMFCs typically used for small portable power applications with a size range of about a subwatt to 100W and operating at 60–90°C.*

Brenstoftzelle lebensdauer PEM 40,000 betriebsstunden
Brenstofzelle SOFC 100,000 betriebsstunden