



MAPPING GERMANY'S ENERGY R&D EXPENDITURES TO THE IEA CLASSIFICATION

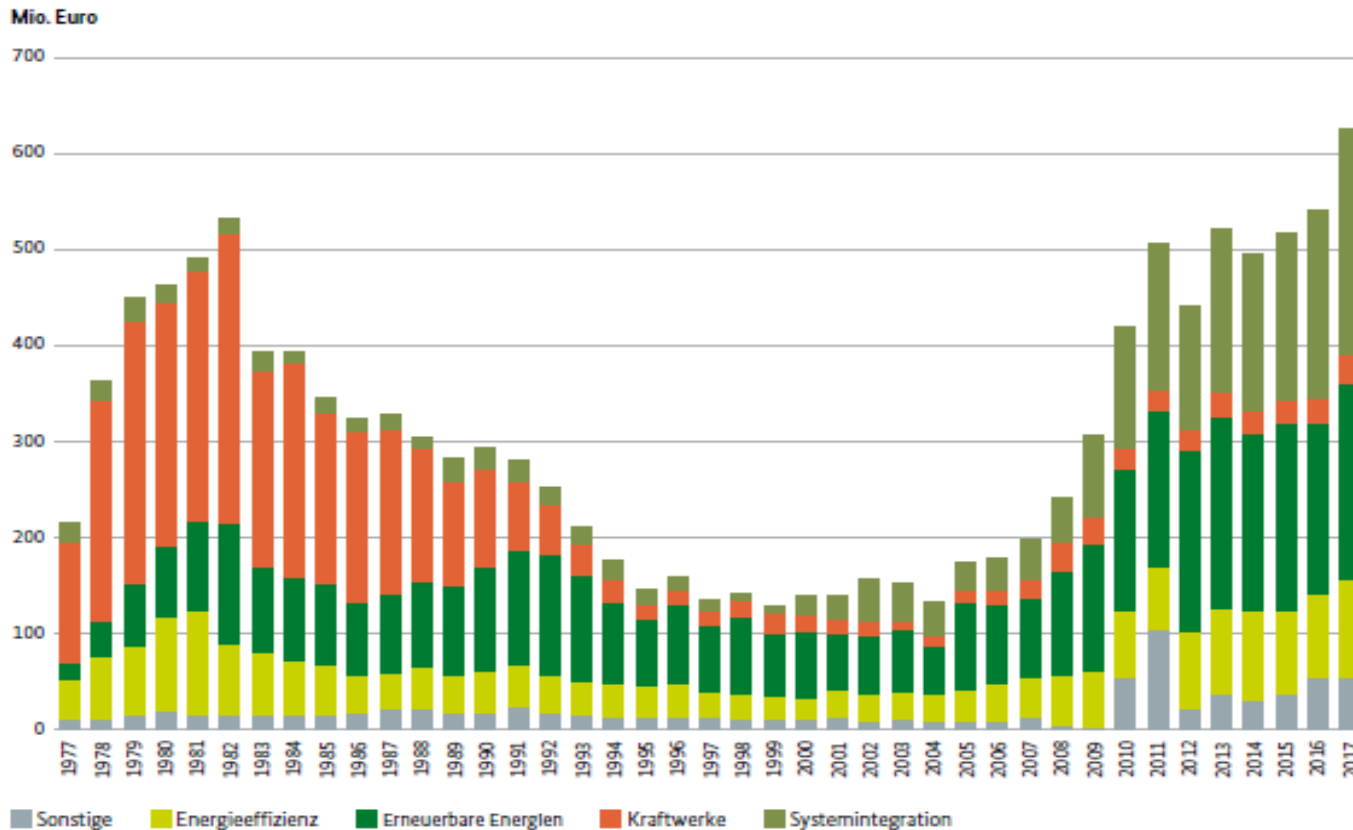
Dr. Johannes Tambornino
Head of Energy Strategies and Systems Analysis
Project Management Jülich

ENERGY RESEARCH PROGRAMMES (EFP) IN GERMANY



- Funding Energy Research in Germany by the Federal Government since 1977
- Strategic Element of Germany's Energy Politics
- Enabling and supporting technological Innovations
- Supporting Germanys goals towards economical development and climate change
- Strengthen export of innovations in the energy sector

PROJECT FUNDING FOR NON-NUCLEAR ENERGY RESEARCH IN GERMANY (ADJUSTED FOR INFLATION – BASE YEAR 2010)



7.EFP

2018-2022:

6,4 bn €;

45% more than

2013-2017

CONTENT OF THE 7TH ENERGY RESEARCH PROGRAMME – NON-NUCLEAR ENERGY RESEARCH

> **Cross cutting**

- > Energy Systems Analysis
- > Digitalization
- > Ressource Efficiency
- > CO2-Technologies
- > Socioeconomic Research
- > Material Science

> **Energy Efficiency**

- > Smart Cities and Buildings
- > Industry, Trades and Services
- > Mobility

> **Systems Integration**

- > Power (and Gas) Grids
- > Storage
- > Sectorcoupling

> **Power Generation**

- > Photovoltaics
- > Wind Energy
- > Biomass
- > Geothermal Energy
- > Hydropower
- > Thermal Power Plants

COMPARISON WITH PREVIOUS ENERGY RESEARCH PROGRAMMES

- Stronger focus on
 - Intelligent Coupling of different sectors (Industry, mobility, heating, gas, hydrogen, ...)
 - Digitalization
 - Clean Energy Transition of the whole energy system
- Exploring new paths towards deployment
 - Including Start-ups in Energy Research
 - Living Labs
 - Research Networks: Bringing together expertise from different fields

MONITORING R&D EXPENDITURES ON A NATIONAL LEVEL (I)

- Classification of different expenditures
 - Project funding: Funding given by different funding agencies for a specified project for a limited amount of time (typically 3 years), granted to universities, research institutes *and the public sector* according with EU-regulations (→ rather easy to monitor)
 - Institutional funding: Funding given to universities and research institutes on a perpetual basis to conduct research in a certain area (→ more difficult to monitor)
 - Private R&D investments: Investments by the private sector for R&D (→ hard to monitor) ...independent bi-annual survey

MONITORING R&D EXPENDITURES ON A NATIONAL LEVEL (II)

- > Different funding agencies
 - > On a national level:
 - > Federal Ministry of Economic Affairs and Energy (→ applied energy research)
 - > Federal Ministry Education and Research (→ basic energy research)
 - > Federal Ministry of Food and Agriculture (→ biomass)
 - > Federal Ministry of Transport and Digital Infrastructure (→ mobility)
 - > Other Federal Ministries (→ related programmes)
 - > On a state level:
 - > Different State Ministries (depending on state)

WHAT DO WE MONITOR?

- > Energy research conducted within the energy research programme of the federal government
 - > Project funding by
 - > Federal Ministry of Economic Affairs and Energy
 - > Federal Ministry of Education and Research
 - > Federal Ministry of Food and Agriculture
 - > Institutional Funding (partially)
 - > Federal funding given to the institutes of the Helmholtz Society
- > [Federal Government on Energy Research](#) published yearly
- > www.enargus.de Energy Research Database (see projects there!)

WHAT IS **NOT** INCLUDED IN OUR MONITORING?

- Project funding by the states
 - Additional survey but only accompanying the official statistics and with longer time lapse (2 years)
- Institutional funding by the states
 - Institutional budgets of universities that (partially) conduct energy research
- Institutional fundings other than Helmholtz society
 - Max Planck, Fraunhofer, Leibnitz, ...
- Accompanying programmes
 - Mobility, Digital Infrastructure, Material Research, ...
- Private sector R&D expenditure

HOW DO WE MONITOR?

➤ Classification system for the 7th energy research programme

Funding topic	Disbursements in € million					
	2014	2015	2016	2017	2018	2019
Project funding¹						
Energy transition in the consumption sectors	115.89	112.04	108.08	137.28	156.04	193.92
Energy generation	198.95	209.86	191.67	244.49	212.36	255.36
System integration: Grids, storage, sector coupling	95.22	113.30	119.79	144.44	127.15	127.11
Cross-system research topics of the energy transition	34.29	44.49	71.01	86.12	92.22	78.31
Nuclear safety research	43.29	45.74	45.73	47.13	47.48	48.98
Institutional funding (Helmholtz Association) ²	331.60	348.69	362.81	379.63	393.75	410.29
Accompanying measures (e.g. project managers, international aspects, research networks, research communication)	28.14	34.72	35.03	28.20	25.76	34.47
total	847.39	908.85	934.12	1,067.28	1,054.75	1,148.42

- Technological classification scheme
- Differs from the IEA classification
- Problem: finding an appropriate map

Table 2 | Disbursements of project funding in the area of “energy transition in the consumption sectors”

Funding topic	Disbursements in € million								Number of projects		Total funding in € million
	2012	2013	2014	2015	2016	2017	2018	2019	Ongoing in 2019	Newly approved in 2019	
Energy transition in buildings and neighbourhoods	47.52	60.11	66.11	61.85	58.21	65.38	78.63	93.51	911	207	117.23
Energy-optimised and climate-neutral buildings	25.83	31.82	36.55	35.64	32.00	36.57	39.78	50.24	507	122	60.58
Energy-optimised and climate-neutral neighbourhoods	12.23	15.16	15.78	14.30	16.82	20.30	30.02	35.57	301	69	49.01
Thermal energy storage	2.38	4.15	6.51	7.33	5.75	4.84	5.33	4.65	54	2	0.43
Supply of heat and cold	7.08	8.99	7.27	4.59	3.64	3.67	3.51	3.06	49	14	7.21
Other	–	–	–	–	–	–	–	–	–	–	–
Energy transition in industry, commerce, trade and services	31.58	39.69	37.17	37.39	36.00	57.12	60.92	66.20	715	230	96.21
Waste heat use	4.37	4.21	3.88	4.98	4.03	2.78	1.26	0.55	15	5	1.70
Chemical process technology	5.23	7.30	7.13	7.49	9.11	12.83	12.83	11.22	128	34	10.72
Iron, steel and non-ferrous metals	1.81	1.77	0.98	0.97	0.86	1.09	2.07	3.56	54	6	1.15
Circular economy	–	0.05	0.34	0.32	0.12	0.03	–	–	–	–	–
Manufacturing technology	10.93	15.93	17.13	15.82	11.09	14.82	17.49	23.19	228	70	28.35
High-temperature superconductivity	2.81	3.10	2.37	0.53	0.62	1.18	1.15	1.07	4	3	1.98
Industrial motors	–	–	–	–	–	–	–	–	–	–	–
Digitisation in industry	0.44	0.65	0.70	0.74	1.07	1.59	1.69	1.61	11	–	–
Material and resource efficiency	0.09	0.06	0.07	0.09	0.01	0.18	0.28	0.49	7	–	–
Process heat	2.02	3.41	3.29	4.14	5.65	8.15	8.58	9.45	96	27	12.73
Water treatment	–	–	0.04	0.18	0.35	0.72	0.58	0.57	10	–	–
Flexible industrial processes	–	–	–	–	–	10.70	12.54	10.80	106	50	26.08
Other	3.89	3.22	1.24	2.12	3.07	3.03	2.44	3.67	56	35	13.51
Energy transition in the transport sector	14.22	17.83	12.61	12.80	13.87	14.78	16.49	34.21	273	72	38.51
Battery technology for mobile applications	14.22	17.83	12.61	12.80	13.87	14.28	15.63	17.06	146	18	12.35
Synthetic fuels	–	–	–	–	–	0.50	0.86	17.15	122	49	24.51
Charging infrastructure and systems integration	–	–	–	–	–	–	–	–	5	5	1.66
Other	–	–	–	–	–	–	–	–	–	–	–
Total	93.33	117.63	115.89	112.04	108.08	137.28	156.04	193.92	1,899	509	251.94

APPROACH: MAPPING NATIONAL STATISTICS TO THE IEA CLASSIFICATION?

- We use a *fine grained* technological classification system to mark each individual project (roughly 300 categories) → „Leistungsplansystematik“
- We defined a consistent map to uniquely map each fine grained category in the „Leistungsplansystematik“ to
 1. Our National Energy Statistics according to the 7th enegy research programme
 2. The IEA Survey

➤ Example

41	EA4440	Energieoptimierte Gebäude - Neue Materialien und Komponenten	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	1212 Building design				
42	EA4450	Energieoptimierte Gebäude - Digitale Werkzeuge	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	1221 Building energy management systems (incl. smart meters) and efficient internet and cor				
43	EB2010	Solkollektoren	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	311 Solar heating and cooling				
44	EB2011	Kollektorkonzepte, Kollektorentwicklung	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	311 Solar heating and cooling				
45	EB2012	Optimierung Fertigungsprozesse	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	311 Solar heating and cooling				
46	EB2013	Werkstofftechnologien	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	311 Solar heating and cooling				
47	EB2014	Gebäudeintegration und kombinierte Nutzung	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	311 Solar heating and cooling				
48	EB2020	Wärmespeicher	1 Gebäude und Quartiere	Thermische Energiespeicher	1239 Unallocated appliances and other residential/commercial				
49	EB2021	Optimierte Wärmespeicher	1 Gebäude und Quartiere	Thermische Energiespeicher	1239 Unallocated appliances and other residential/commercial				
50	EB2022	Speicherkonzepte für Solaraktivhäuser	1 Gebäude und Quartiere	Thermische Energiespeicher	1239 Unallocated appliances and other residential/commercial				
51	EB2023	Neue Speicher hoher Energiedichte	1 Gebäude und Quartiere	Thermische Energiespeicher	1239 Unallocated appliances and other residential/commercial				
52	EB2024	Saisonale Wärmespeicherung in Wärmenetzen	1 Gebäude und Quartiere	Versorgung mit Wärme und Kälte	1239 Unallocated appliances and other residential/commercial				
53	EB2030	Systemtechnik solares Heizen und WW- Bereitung für Großanlagen	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Quart	311 Solar heating and cooling				
54	EB2031	Solares Heizen, Solaraktivgebäude	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	311 Solar heating and cooling				
55	EB2032	Planungstools, Regelungs- und Hydraulikkonzepte, Wärmetransport	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	129 Unallocated residential and commercial buildings, appliances and equipment				
56	EB2033	Monitoring, Funktionskontrolle und Ertragsbewertung	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	1211 Building envelope technologies				
57	EB2040	Solare Kühlung	1 Gebäude und Quartiere	Versorgung mit Wärme und Kälte	311 Solar heating and cooling				
58	EB2041	Komponenten für solarthermisch angetriebene Kälteprozesse	1 Gebäude und Quartiere	Versorgung mit Wärme und Kälte	311 Solar heating and cooling				
59	EB2042	Systemtechnik solare Kühlung	1 Gebäude und Quartiere	Versorgung mit Wärme und Kälte	311 Solar heating and cooling				
60	EB2043	Monitoring von Pilot- und Demoanlagen	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	122 Building operations and efficient building equipment				
61	EB2060	Begleitforschung, Messprogramme	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	122 Building operations and efficient building equipment				
62	EB2070	Pilot- und Demoanlagen	1 Gebäude und Quartiere	Energieoptimierte und klimaneutrale Gebä	1211 Building envelope technologies				
63	EB2080	Wärmeinfrastruktur	1 Gebäude und Quartiere	Versorgung mit Wärme und Kälte	1223 Heating, cooling and ventilation technologies				
64	EB2081	Wärmenetze 4.0	1 Gebäude und Quartiere	Versorgung mit Wärme und Kälte	1223 Heating, cooling and ventilation technologies				
65	EA3201	Energiesparende Industrieverfahren - Wärmetauscher	2 Industrie und Gewerbe	Abwärmenutzung	119 Unallocated industry				
66	EA3202	Energiesparende Industrieverfahren - Wärmepumpen, Kältetechnik, Kältemitte	2 Industrie und Gewerbe	Prozesswärme	119 Unallocated industry				
67	EA3203	Energiesparende Industrieverfahren - Wärmetransformatoren/ORC-Anlagen/Th	2 Industrie und Gewerbe	Abwärmenutzung	119 Unallocated industry				

ADVANTAGES AND REMAINING PROBLEMS

- Starting with a very fine grained technological classification scheme allows for different mappings onto final statistics
- **Reproducibility:** Since the statistics can be traced back to individual projects, long time reproducibility is assured
- Compared to our old approach (mapping on a high level, sometimes estimating percentages): **higher validity**
- **Open issues:** Sometimes categories in the IEA-survey do not really fit
→ a significant amount of expenditures still in „**Unallocated**“

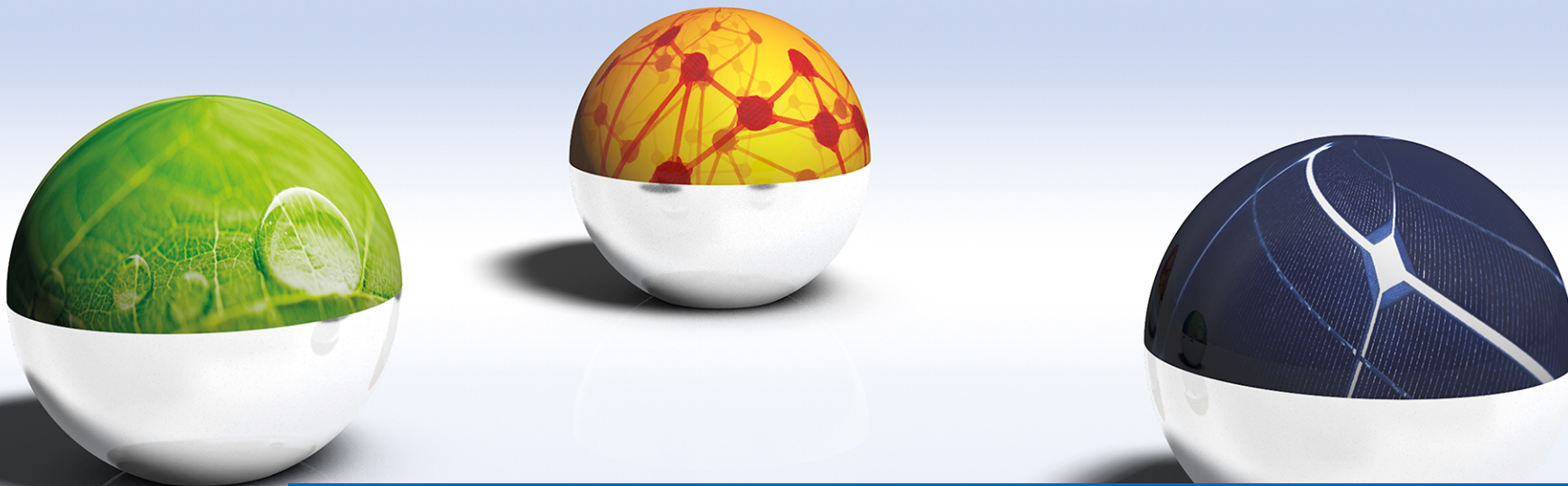
QUESTIONS?

Feel free to get in touch with me and the members of our energy funding data team for questions or further discussions.

Dr. Johannes Tambornino

Head of Energy Strategies and Systems
Analysis
Project Management Jülich
j.tambornino@fz-juelich.de
Tel.: +49-2461-61-8619





Picture credits front page:

3D Assembly: Project Management Jülich, Forschungszentrum Jülich GmbH;

Pictures: IvanMikhaylov/iStock/Thinkstock, palau83/iStock/Thinkstock, PN_Photo/iStock/Thinkstock