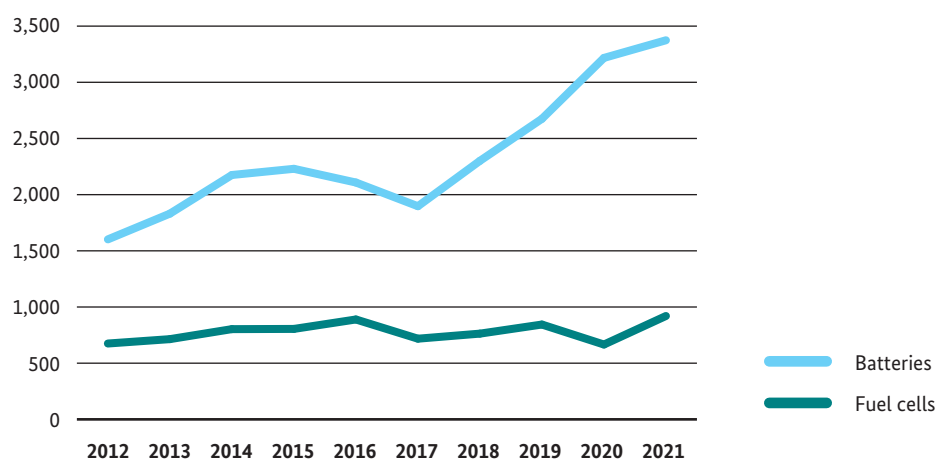


## Development of patent applications effective in Germany<sup>1)</sup>

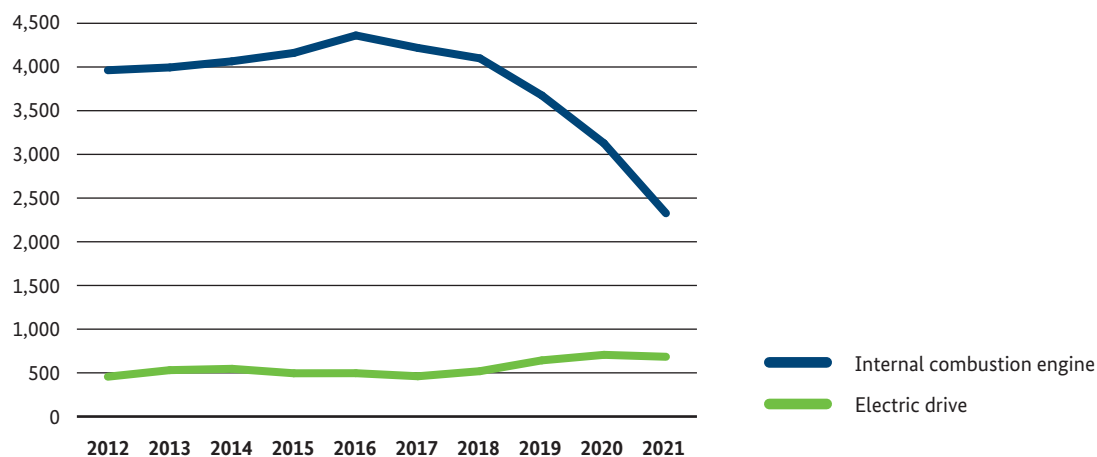
### Batteries, fuel cells

Fields of technology <sup>2), 3)</sup>	Year of publication									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Batteries <sup>4)</sup>	1,602	1,831	2,175	2,230	2,108	1,897	2,301	2,675	3,217	3,374
Fuel cells <sup>5)</sup>	675	714	803	805	889	718	763	844	666	920



### Electric drive and internal combustion engine

Fields of technology <sup>2), 6)</sup>	Year of publication									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Electric drive <sup>7)</sup>	456	531	546	495	496	461	519	643	706	684
Internal combustion engine <sup>8)</sup>	3,963	3,995	4,065	4,161	4,361	4,218	4,099	3,674	3,127	2,326



<sup>1)</sup> Applications published by the DPMA and the EPO avoiding double counts.

<sup>2)</sup> IPC classes valid at the time of retrieval counted proportionately. Without claim to completeness.

<sup>3)</sup> Results do not refer exclusively to automotive uses.

<sup>4)</sup> H01M 2, H01M 4/02, H01M 4/04, H01M 4/13 to H01M 4/84, H01M 10, H01M 50.

<sup>5)</sup> H01M 4/86 to H01M 4/98, H01M 8.

<sup>6)</sup> Results not related to automotive drive technologies may be included.

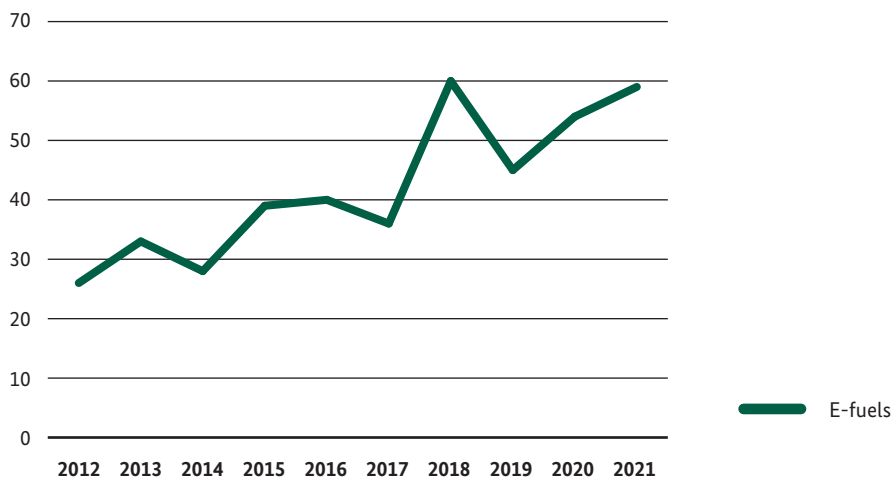
<sup>7)</sup> B60K 1, B60L 7/12, B60L 7/14, B60L 8, B60L 11, B60L 15/00 to B60L 15/38, B60L 50, B60L 58.

<sup>8)</sup> F01N 3, F01N 5, F01N 9, F01N 11, F02B, F02D, F02F, F02M, F02N, F02P, F16C 3/18, F16C 3/20, F16F 15/24, F16F 15/31.

## Development of patent applications effective in Germany<sup>1)</sup>

### E-fuels

Fields of technology <sup>2)</sup>	Year of publication									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
E-fuels <sup>3)</sup>	26	33	28	39	40	36	60	45	54	59



<sup>1)</sup> Applications published by the DPMA and the EPO avoiding double counts.

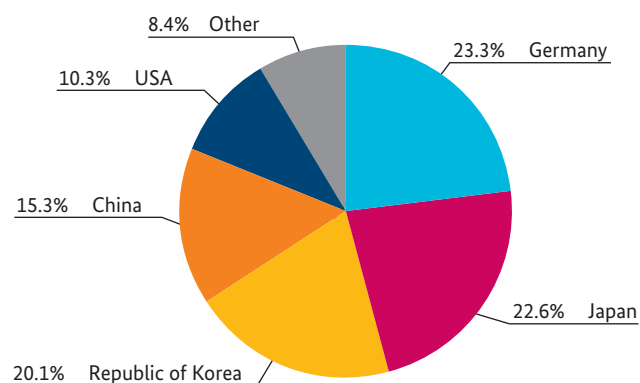
<sup>2)</sup> IPC classes valid at the time of retrieval counted proportionately. Without claim to completeness. Results may also include other chemical processes.

<sup>3)</sup> C25B 1/00, C25B 1/02, C25B 1/04, C25B 1/55, C25B 3/00, C25B 3/03, C25B 3/21, C25B 3/25, C25B 3/26, C25B 9/50, C25B 11/087.

## Patent applications effective in Germany<sup>1)</sup> by country (residence or principal place of business of the first applicant)

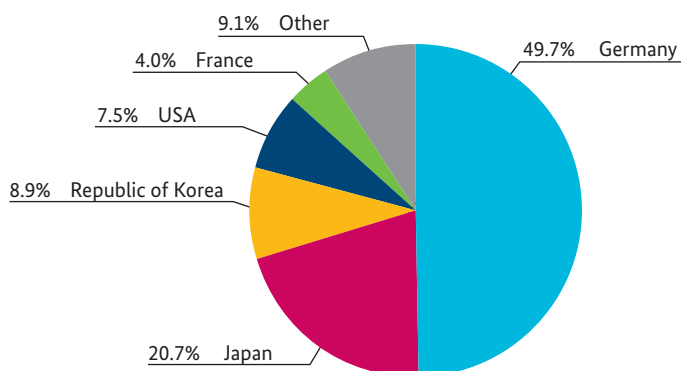
### Batteries

Country	Publication in 2021		
	Number	Percentage	Change compared to 2020
Germany	787	23.3%	-7.3%
Japan	763	22.6%	+13.9%
Republic of Korea	677	20.1%	-13.0%
China	515	15.3%	+59.3%
USA	347	10.3%	+10.7%
Other	285	8.4%	+0.9%
<b>Total<sup>2)</sup></b>	<b>3,374</b>	<b>100%</b>	<b>+4.9%</b>



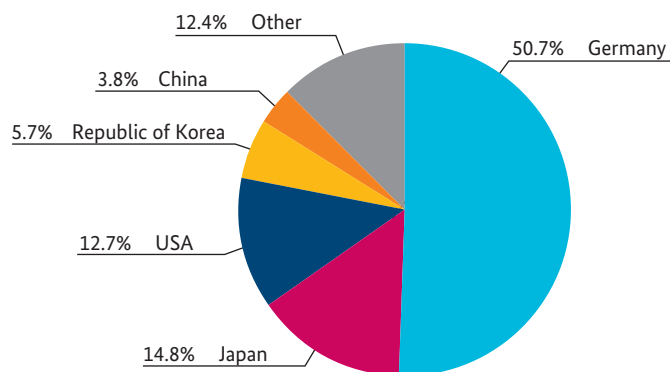
### Fuel cells

Country	Publication in 2021		
	Number	Percentage	Change compared to 2020
Germany	457	49.7%	+89.8%
Japan	190	20.7%	-4.3%
Republic of Korea	82	8.9%	+49.7%
USA	69	7.5%	-3.0%
France	37	4.0%	+48.4%
Other	84	9.1%	+11.0%
<b>Total<sup>2)</sup></b>	<b>920</b>	<b>100%</b>	<b>+38.0%</b>



### Electric drive

Country	Publication in 2021		
	Number	Percentage	Change compared to 2020
Germany	347	50.7%	-4.9%
Japan	101	14.8%	-12.4%
USA	87	12.7%	-0.7%
Republic of Korea	39	5.7%	+36.1%
China	26	3.8%	-17.9%
Other	85	12.4%	+8.2%
<b>Total<sup>2)</sup></b>	<b>684</b>	<b>100%</b>	<b>-3.1%</b>



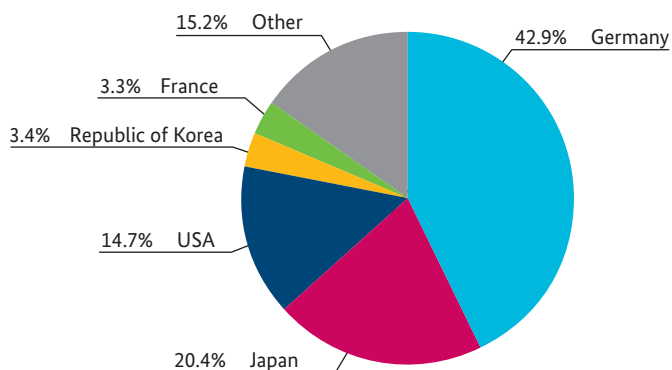
<sup>1)</sup> Applications published by the DPMA and the EPO avoiding double counts.

<sup>2)</sup> Due to rounding differences, summed values may deviate from the total number.

## Patent applications effective in Germany<sup>1)</sup> by country (residence or principal place of business of the first applicant)

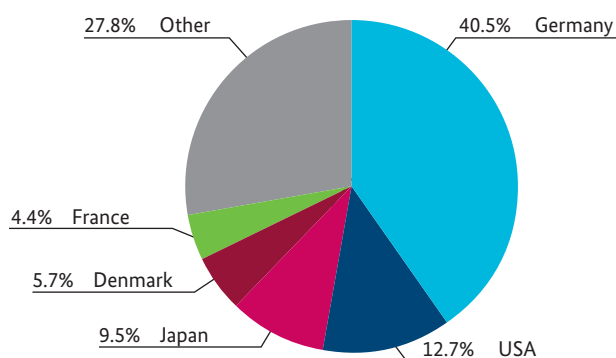
### Internal combustion engine

Country	Publication in 2021		
	Number	Percentage	Change compared to 2020
Germany	998	42.9%	-28.9%
Japan	475	20.4%	-30.2%
USA	343	14.7%	-31.3%
Republic of Korea	79	3.4%	-35.2%
France	77	3.3%	+4.0%
Other	353	15.2%	+1.8%
<b>Total<sup>2)</sup></b>	<b>2,326</b>	<b>100%</b>	<b>-25.6%</b>



### E-fuels

Country	Publication years 2019 to 2021	
	Number	Percentage
Germany	64	40.5%
USA	20	12.7%
Japan	15	9.5%
Denmark	9	5.7%
France	7	4.4%
Other	44	27.8%
<b>Total<sup>2)</sup></b>	<b>158</b>	<b>100%</b>



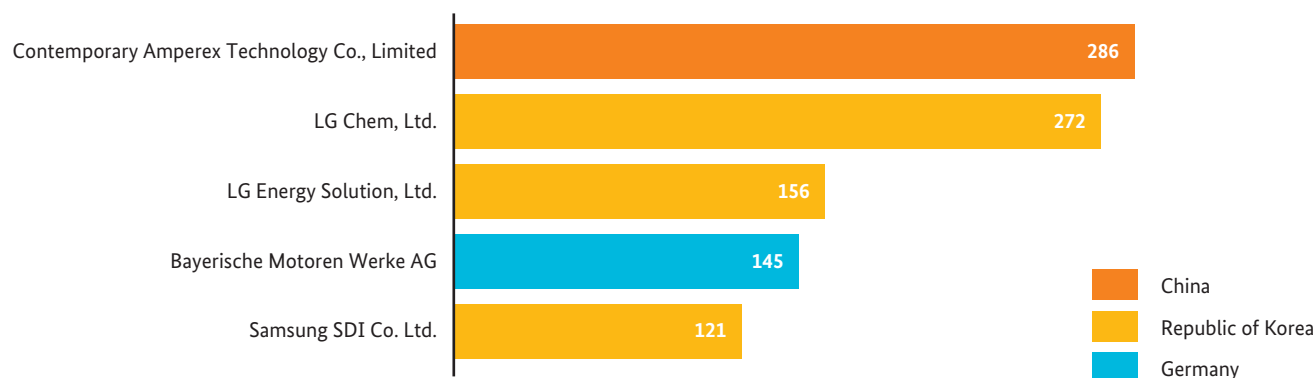
<sup>1)</sup> Applications published by the DPMA and the EPO avoiding double counts.

<sup>2)</sup> Due to rounding differences, summed values may deviate from the total number.

## Patent applications effective in Germany<sup>1)</sup>: TOP 5 applicants 2021

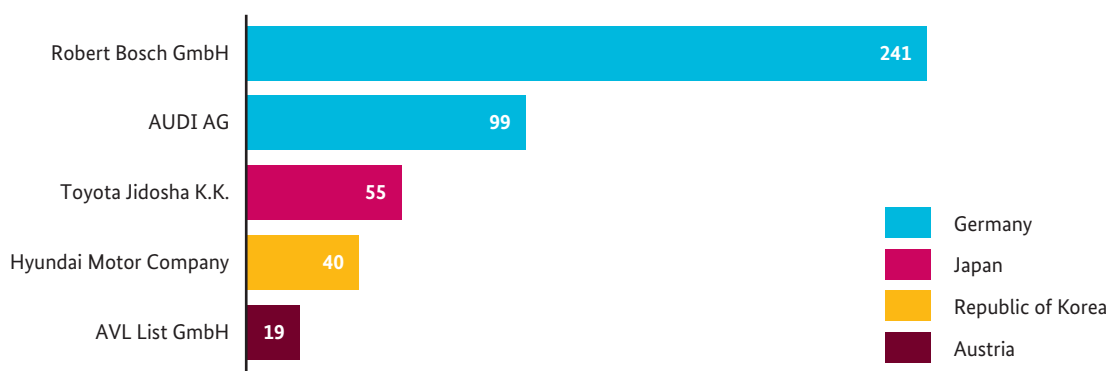
### Batteries

Rank	Applicant <sup>2)</sup>	Principal place of business	Applications
1	Contemporary Amperex Technology Co., Limited	CN	286
2	LG Chem, Ltd.	KR	272
3	LG Energy Solution, Ltd.	KR	156
4	Bayerische Motoren Werke AG	DE	145
5	Samsung SDI Co. Ltd.	KR	121



### Fuel cells

Rank	Applicant <sup>2)</sup>	Principal place of business	Applications
1	Robert Bosch GmbH	DE	241
2	AUDI AG	DE	99
3	Toyota Jidosha K.K.	JP	55
4	Hyundai Motor Company	KR	40
5	AVL List GmbH	AT	19



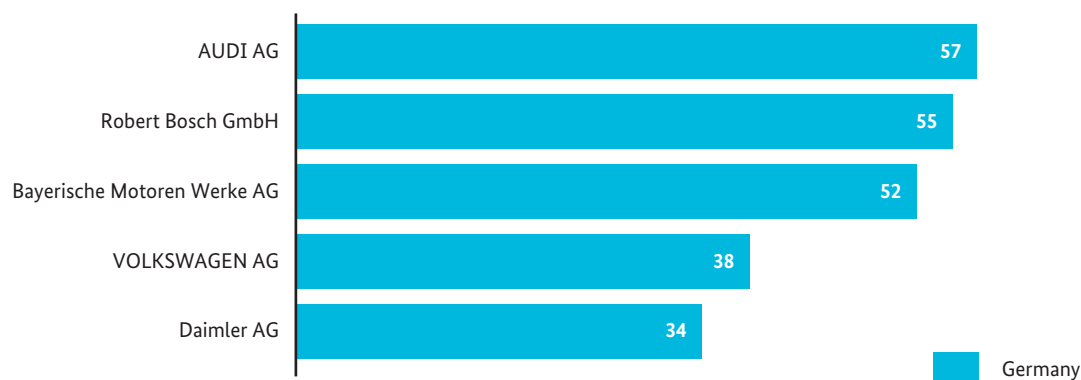
<sup>1)</sup> Applications published by the DPMA and the EPO avoiding double counts.

<sup>2)</sup> Applicant indicated first; without considering possible intra-group affiliations.

## Patent applications effective in Germany<sup>1)</sup>: TOP 5 applicants 2021

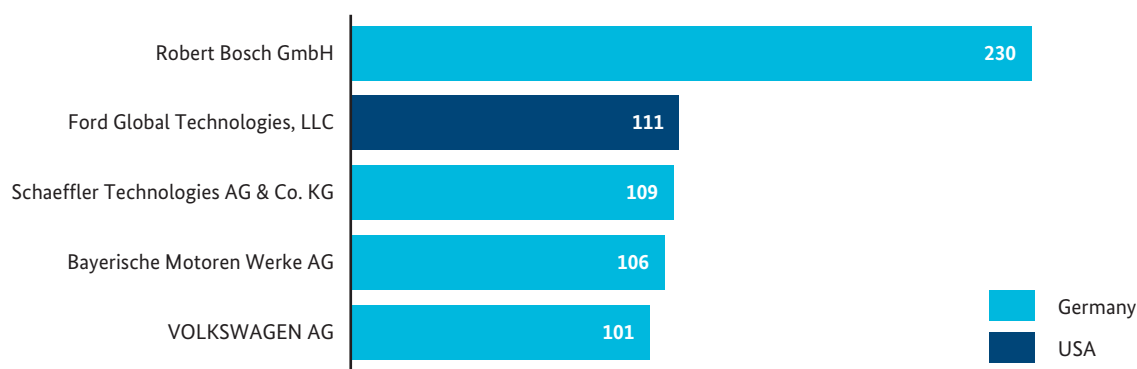
### Electric drive

Rank	Applicant <sup>2)</sup>	Principal place of business	Applications
1	AUDI AG	DE	57
2	Robert Bosch GmbH	DE	55
3	Bayerische Motoren Werke AG	DE	52
4	VOLKSWAGEN AG	DE	38
5	Daimler AG	DE	34



### Internal combustion engines

Rank	Applicant <sup>2)</sup>	Principal place of business	Applications
1	Robert Bosch GmbH	DE	230
2	Ford Global Technologies, LLC	US	111
3	Schaeffler Technologies AG & Co. KG	DE	109
4	Bayerische Motoren Werke AG	DE	106
5	VOLKSWAGEN AG	DE	101



<sup>1)</sup> Applications published by the DPMA and the EPO avoiding double counts.

<sup>2)</sup> Applicant indicated first; without considering possible intra-group affiliations.