

SUPPLEMENTARY MATERIAL: FULLY REFERENCED DATA TABLES

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S 1 Spain

S 1.1 Representative organisations

Traditionally, Spanish governments have been formed either by a socialist or a centre-right parliamentary majority. When the socialists or the centre-right party did not get an absolute majority, they tended to get support from centre-right regional/nationalist parties in Catalonia and the Basque Country instead of looking for national allies. The traditional differences in energy policy are consistent with the government-centred/market logic divide, with the socialists pushing for more public intervention while the centre-right advocated for privatisation and liberalisation. However, after the financial crisis, a new political party (Podemos) emerged representing the populist left. The results of the 2015 elections were so fragmented that elections were repeated in 2016. The centre-right obtained a relative majority in Parliament, but was expelled from the government in 2018 by an ensemble of opposition parties forged among the left and nationalist parties. More recently, the Andalucía regional elections saw the rise of the populist right represented by VOX. This has changed the Spanish political system from bipolarity to fragmentation. Furthermore, the Catalan crisis has made it more difficult for separatist parties to support any national party, making parliamentary alliances more and more complex, with several parties involved in the bargaining process. General elections were held in April 2019, and sitting Prime Minister Sanchez was called by the King to form a government, but so far (August 2019), no new government coalition has been formed and the prospects are uncertain.

Table 1: Parties currently (April 2019) represented in the Spanish national parliament.

Party	Spanish general election 2019	Seats
Partido Socialista Obrero Español	28.7%	123
PP	16.7%	66
C's	15.9%	57
Unidas Podemos	11.1%	33
VOX	10.3%	24
ERC-SOBIRANISTES	3.9%	15
eN Comú Podem	2.4%	7
JxCAT	1.9%	7
PNV	1.5%	6

<i>EH Bildu</i>	1.0%	4
<i>En Comun</i>	0.9%	2
<i>Compromis</i>	0.7%	1
<i>CC-PNC</i>	0.5%	2
<i>Navarra Suma</i>	0.4%	2
<i>PRC</i>	0.2%	1

This section describes and quantifies three different energy policy pathways for the Spanish energy transition: the dominant government-centred pathway represented by *PSOE* as expressed in government strategies and the draft NECP, a market-centred minority pathway represented by the *PP*, and a grassroots minority pathway represented by *Unidas Podemos*. Although these parties are not the only ones with explicit energy visions, these three span the entire energy transition policy space – and are the currently largest ones, with the highest probability of government power in the near term. Further, PP, PSOE and Unidas Podemos have prepared law proposals allowing for better specification and quantification of their pathways (Ministerio para la Transición Ecológica, 2018; Partido Popular, 2018; Unidas Podemos, 2018).

Each of the three decarbonisation pathways can include elements that would theoretically fall within other two decarbonisation pathways. For instance, the new socialist government's Climate Change and Energy Transition Law proposal includes bidding and other market mechanisms, but on the whole, it tends to assume energy transition requires tough, mandatory measures, like phase-outs, deadlines, bans and ambitious targets. In a similar manner, Unidas Podemos sets the most ambitious decarbonisation targets, argues for state (and local) intervention, but its key differentiating factor lies in the grassroots-centred logic, focused on the small-scale and local action, seeking decarbonisation through decentralisation of the energy system. Finally, the Popular Party self-stated market-centred logic is based on carbon pricing and letting the market identify the most cost-efficient way to meet energy and climate targets.

S 1.2 Dominant pathway: state-centred (PSOE)

Table 2: Quantification of the Spanish state-centred dominant policy pathway as described by currently valid policies of the Partido Socialista Obrero Español and its government

ES: Dominant	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	283 Mt CO ₂ eq (EEA, 2018)	327 MtCO ₂ eq (II) (NECP Spain, 2019) Pag 34	227 Mt CO ₂ eq 21% (GHG-1990) (II) (NECP Spain, 2019) Pag 34	(V)	≥90% (GHG-1990) (II) (NECP Spain, 2019) Pag 34
ETS sector reduction targets	229 Mt CO ₂ eq (European annual emission allocation)	219 Mt CO ₂ eq (European annual emission allocation) (I) (2013/162/EU)	60% (GHG-2005) (II) (NECP Spain, 2019) Pag 36	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	10% (GHG-2005) (2009/406/EC)	38% (GHG-2005) (II) (NECP Spain, 2019) Pag 36	(V)	(V)
GHG reduction targets (electricity sector)	(V)	63.5 Mt CO ₂ eq 4% (GHG 1990) (II) (NECP Spain, 2019) Pag 34	19.7 Mt CO ₂ eq (II); 70% (GHG 1990) (NECP Spain, 2019) Pag 34	(V)	(V)
Renewables targets (energy; % of final energy consumption)	(V)	20% (I) (European Union, 2009)	42% (II) (NECP Spain, 2019)	(V)	100% (II) (NECP Spain, 2019) Pag 167
Renewables targets (electricity; % of final energy consumption)	39% 108 TWh 49 GW (EUROSTAT, 2018)	40% (II) (NECP Spain, 2019) Pag 174	>74% (II) (NECP Spain, 2019) Pag 174	(V)	100% (II) (NECP Spain, 2019) Pag 35
Intermittent renewables	57 TWh; 28 GW (EUROSTAT, 2018)	36.4 GW; 75.7 TWh (II) (NECP Spain, 2019)	87.1 GW; 182.5 TWh (II) (NECP Spain, 2019)	≥ 2030	≥ 2040
Wind onshore	49 TWh; 23 GW (EUROSTAT, 2018)	60.5 TWh; 28.0 GW(II)(NECP Spain, 2019) Pag 174	116.1 TWh; 50.3 GW (II)(NECP Spain, 2019) Pag 174	(V)	(V)
Wind offshore	included above	included above	included above	(V)	(V)
Solar PV	8 TWh; 5 GW (EUROSTAT, 2018)	15.1 TWh; 8.4 GW (II)(NECP Spain, 2019) Pag 174	66.4 TWh; 36.9 GW (II) (NECP Spain, 2019) Pag 174	> 2030	> 2030
Dispatchable renewables	51 TWh; 21 GW (EUROSTAT, 2018)	24.0 GW; 42.8 TWh (including hydro pumping) (II) (NECP Spain, 2019)	33.8 GW; 72.3 TWh (including hydro pumping) (II) (NECP Spain, 2019)	≥ 2030	≥ 2040
Biomass	5 TWh; 1 GW (EUROSTAT, 2018)	5.3 TWh; 1.6 GW(II) (NECP Spain, 2019) Pag 171 and 174	13.2 TWh; 2.4 GW (II) (NECP Spain, 2019) Pag 171 and 174	(V)	(V)

ES: Dominant	2016	2020	2030	2040	2050
Hydro (without pumping)	40 TWh; 14 GW (EUROSTAT, 2018)	28.3 TWh; 14.1 GW (II) (NECP Spain, 2019) Pag 171 and 174	29 TWh;14.6 GW (II) (NECP Spain, 2019) Pag 171 and 174	(V)	(V)
CSP	6 TWh; 2 GW (EUROSTAT, 2018)	5 TWh, 2.3 GW (II) (NECP Spain, 2019) Pag 171 and 174	22.6 TWh,7.3 GW (II) (NECP Spain, 2019) Pag 171 and 174	≥ 2030	≥ 2040
Other renewables	1 TWh (EUROSTAT, 2018)	0 (II) (NECP Spain, 2019) Pag 171 and 174	0.3 TWh, 0.1 GW (II) (NECP Spain, 2019) Pag 171 and 174	(V)	(V)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)		(V)	(V)	(V)	(V)
Statistical transfer of renewables (cooperation)		(V)	(V)	(V)	(V)
Explicit trade of CSP or hydropower		(V)	(V)	(V)	(V)
Nuclear	59 TWh; 7 GW (EUROSTAT, 2018)	57.7 TWh; 7.4 GW (II) (NECP Spain, 2019) Pag 171 and 174	24.8 TWh; 3.2 GW (II) (NECP Spain, 2019) Pag 171 and 174	0 (II) (NECP Spain, 2019) Pag 171	0 (II) (NECP Spain, 2019) Pag 171 and 174
Fossil fuels	108 TWh; 48 GW (EUROSTAT, 2018)	112 TWh; 45.1 GW (II) (NECP Spain, 2019) Pag 171 and 174	55 TWh;32.5 GW (II) (NECP Spain, 2019) Pag 171 and 174	(V)	0 (II) (NECP Spain, 2019) Pag 35
CCS	0	0 (NECP Spain, 2019) Pag 171 and 174	0 (NECP Spain, 2019) Pag 171 and 174	(V)	(V)
Lignite	0 TWh (EUROSTAT, 2018)	0	0	0	0
Hard coal	36 TWh (EUROSTAT, 2018)	47.2 TWh; 10.5 GW (II) (NECP Spain, 2019) Pag 171 and 174	0 TWh; 0-1.3 GW (II)(NECP Spain, 2019) Pag 171 and 174		0(II)(NECP Spain, 2019) Pag 35
Gas	54 TWh (EUROSTAT, 2018)	56.8 TWh; 31.2 GW (II) (NECP Spain, 2019) Pag 171 and 174	50.5 TWh 30.2 GW (II)(NECP Spain, 2019) Pag 171 and 174	(V)	0 (II)(NECP Spain, 2019) Pag 35

ES: Dominant	2016	2020	2030	2040	2050
Petroleum	16 TWh (EUROSTAT, 2018)	7.4 TWh; 3.4 GW (II)(NECP Spain, 2019) Pag 171 and 174	4.7 TWh;2.3 GW (II)(NECP Spain, 2019) Pag 171 and 174	(V)	0 (II)(NECP Spain, 2019) Pag 35
Other non-renewables	1 TWh (EUROSTAT, 2018)	0.7 TWh (II) (NECP Spain, 2019) Pag 174	1.5 TWh (II) (NECP Spain, 2019) Pag 174	(V)	0 (II) (NECP Spain, 2019) Pag 35
Storage	(V)	(V)	(V)	(V)	(V)
Battery	(V)	(V)	2.5 GW (II) (NECP Spain, 2019) Pag 42	(V)	(V)
Pumped Hydropower	3.3 GW (2015) (II) (NECP Spain, 2019) Pag 171	3.3 GW (II) (NECP Spain, 2019) Pag 171	6.8 GW(II) (NECP Spain, 2019) Pag 171	(V)	(V)
Other storage	(V)	(V)	(V)	(V)	(V)
Cross-border interconnection NTC	2750 MW (France) 2800 MW (Portugal) 800 MW (Morocco) (II) (NECP Spain, 2019)Pag 187	2900 MW (France) 3500 MW (Portugal) 800 MW (Morocco) (II) (NECP Spain, 2019) Pag 187	8000 MW (France) 4300 MW (Portugal) (II)(NECP Spain, 2019)Pag 1871200 MW (Morocco)(IV) (Montel, 2019)	=2030(V)	=2040(V)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	(V)	(V)	(V)	(V)
Heating with electricity (energy supplied by heat pumps) COP>3	4.1 TWh (II)(NECP Spain, 2019) Pag 167	7.6 TWh (II) (NECP Spain, 2019) Pag 167	47.4 TWh (II) (NECP Spain, 2019) Pag 167	(V)	(V)
Total cooling demand incl. non-electric cooling	(V)	(V)	< 2018 (II) (Ministerio para la Transición Ecológica, 2018)	(V)	(V)
Cooling with electricity	(V)	(V)	< 2018 (II) (Ministerio para la Transición Ecológica, 2018)	(V)	(V)

ES: Dominant	2016	2020	2030	2040	2050
Electric mobility	6.6 TWh (II) (NECP Spain, 2019) Pag 180	4.9 TWh (II) (NECP Spain, 2019) Pag 180	20.7 TWh; 5 million EV (II)(NECP Spain, 2019) Pag 180	>> 2030 (II) Ban on ICE sales (Ministerio para la Transición Ecológica, 2018)	>> 2030 (II) Ban on ICE circulation (Ministerio para la Transición Ecológica, 2018)
EV chargers	4974 (2017) (Spöttle <i>et al.</i> , 2018)	> 2017 (II) (Ministerio para la Transición Ecológica, 2018)	>>2020 (II) (Ministerio para la Transición Ecológica, 2018)	>> 2030 (II) (Ministerio para la Transición Ecológica, 2018)	>> 2040 (II) (Ministerio para la Transición Ecológica, 2018)
Gross electricity consumption	275 TWh (EUROSTAT, 2018)	267 TWh (II) (NECP Spain, 2019) Pag 174	284 TWh (II) (NECP Spain, 2019) Pag 174	(V)	(V)
Final energy consumption	983 TWh (2015) (II) (NECP Spain, 2019) Pag 214	1035 TWh (II) (NECP Spain, 2019) Pag 214	922TWh (II) (NECP Spain, 2019) Pag 214	(V)	(V)

S 1.3 Minority pathway: grassroot-centred (Podemos)

Table 3: Quantification of the Spanish grassroots-centred minority policy pathway as described by Podemos.

ES: Grassroots	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	283 Mt CO2eq (EEA, 2018)	(V)	35% (1990) (III) (Unidas Podemos, 2018)	70% (1990) (III) (Unidas Podemos, 2018)	95% (1990) (III) (Unidas Podemos, 2018)
ETS sector reduction targets	229 Mt CO2eq (European annual emission allocation)(EU/2017/1471, 2017)	219 Mt CO2eq (European annual emission allocation) (EU/2017/1471, 2017)	(V)	(V)	(V)
Non-ETS sectors emission reduction targets		10% (GHG-2005) (406/2009/EC, 2009) (I)	26% (GHG-2005) (I) (EU/2018/842, 2018)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(V)	(V)	(V)	(V)
Renewables targets (energy; % of final energy consumption)	(V)	20% (I) (European Union, 2009)	45% (III) (Unidas Podemos, 2018)	60% (III) (Unidas Podemos, 2018)	100% (III) (Unidas Podemos, 2018)
Renewables targets (electricity; % of final energy consumption)	39%; 108 TWh; 49 GW(Eurostat, 2018)	> 2016 (V)	80% (III) (Unidas Podemos, 2018)	(V)	100% (by 2045) (III) (Unidas Podemos, 2018)
Intermittent renewables	57 TWh; 28 GW(Eurostat, 2018)	> 2016 (III) (Unidas Podemos, 2018)	> 2020 (III) (Unidas Podemos, 2018)	> 2030 (III) (Unidas Podemos, 2018)	> 2040 (III) (Unidas Podemos, 2018)
Wind onshore	49 TWh; 23 GW (Eurostat, 2018)	> 2016 (III) (Unidas Podemos, 2018)	> 2020 (III) (Unidas Podemos, 2018)	> 2030 (III) (Unidas Podemos, 2018)	> 2040 (III) (Unidas Podemos, 2018)
Wind offshore	included above	= 2016 (III) (Unidas Podemos, 2018)	= 2016 (III) (Unidas Podemos, 2018)	= 2016 (III) (Unidas Podemos, 2018)	= 2016 (III) (Unidas Podemos, 2018)
Solar PV	8 TWh; 5 GW (Eurostat, 2018)	>> 2016 (mainly decentralised) (III) (Unidas Podemos, 2018)	>> 2020 (mainly decentralised) (III) (Unidas Podemos, 2018)	>> 2030 (mainly decentralised) (III) (Unidas Podemos, 2018)	>> 2040 (mainly decentralised) (III) (Unidas Podemos, 2018)
Dispatchable renewables	51 TWh; 21 GW (Eurostat, 2018)	> 2016 (III) (Unidas Podemos, 2018)	> 2020 (III) (Unidas Podemos, 2018)	> 2030 (III) (Unidas Podemos, 2018)	> 2040 (III) (Unidas Podemos, 2018)

ES: Grassroots	2016	2020	2030	2040	2050
Biomass	5 TWh; 1 GW (Eurostat, 2018)	> 2016 (III) (Unidas Podemos, 2018)	> 2020 (III) (Unidas Podemos, 2018)	> 2030 (III) (Unidas Podemos, 2018)	> 2040 (III) (Unidas Podemos, 2018)
Hydro	40 TWh; 14 GW (Eurostat, 2018)	> 2016 (III) (Unidas Podemos, 2018)	> 2020 (III) (Unidas Podemos, 2018)	> 2030 (III) (Unidas Podemos, 2018)	> 2040 (III) (Unidas Podemos, 2018)
CSP	6 TWh; 2.3 GW (Eurostat, 2018)	> 2016 (III) (Unidas Podemos, 2018)	> 2020 (III) (Unidas Podemos, 2018)	> 2030 (III) (Unidas Podemos, 2018)	> 2040 (III) (Unidas Podemos, 2018)
Other renewables	1 TWh (Eurostat, 2018)	(V)	(V)	(V)	(V)
Traded renewables	As little as possible	As little as possible	As little as possible	As little as possible	As little as possible
Physical import of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Statistical transfer of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Explicit trade of CSP or hydropower	(V)	(V)	(V)	(V)	(V)
Nuclear	59 TWh; 7 GW (Eurostat, 2018)	Phase-out as licences expire: Almaraz I, II, Vandellós II (2020); Ascó I, II, Cofrentes (2021); Trillo (2024) (III) (Unidas Podemos, 2018)	0 (by 2025) (III) (Unidas Podemos, 2018)	0 (III) (Unidas Podemos, 2018)	0 (III) (Unidas Podemos, 2018)
Fossil fuels	108 TWh; 48 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)
CCS	0	(V)	(V)	(V)	(V)
Lignite	0 TWh (Eurostat, 2018)	<< 2016 (III) (Unidas Podemos, 2018)	0 (by 2025) (III) (Unidas Podemos, 2018)	0 (III) (Unidas Podemos, 2018)	0 (III) (Unidas Podemos, 2018)
Hard coal	36 TWh (Eurostat, 2018)	<< 2016 (III) (Unidas Podemos, 2018)	0 (by 2025) (III) (Unidas Podemos, 2018)	0 (III) (Unidas Podemos, 2018)	0 (III) (Unidas Podemos, 2018)
Gas	54 TWh (Eurostat, 2018)	< 2016 (III) (Unidas Podemos, 2018)	< 2020 (III) (Unidas Podemos, 2018)	< 2030 (III) (Unidas Podemos, 2018)	< 2040 (III) (Unidas Podemos, 2018)

ES: Grassroots	2016	2020	2030	2040	2050
Petroleum	16 TWh (Eurostat, 2018)	< 2016 (III) (Unidas Podemos, 2018)	< 2020 (III) (Unidas Podemos, 2018)	< 2030 (III) (Unidas Podemos, 2018)	0 (III) (Unidas Podemos, 2018)
Other non-renewables	1 TWh (Eurostat, 2018)	≥ 2016 (Waste) (III) (Unidas Podemos, 2018)	≥ 2020 (III) (Unidas Podemos, 2018)	(V)	(V)
Storage	(V)	(V)	(V)	(V)	(V)
Battery	(V)	> 2016 (III) (Unidas Podemos, 2018)	> 2020 (III) (Unidas Podemos, 2018)	> 2030 (III) (Unidas Podemos, 2018)	> 2040 (III) (Unidas Podemos, 2018)
Pumped Hydropower	(V)	(V)	(V)	(V)	(V)
Other storage	(V)	> 2016 (III) (Unidas Podemos, 2018)	> 2020 (III) (Unidas Podemos, 2018)	> 2030 (III) (Unidas Podemos, 2018)	> 2040 (III) (Unidas Podemos, 2018)
Cross-border interconnection NTC	(V)	≥ 10% of installed capacity (III) (Unidas Podemos, 2018)	≥ 15% of installed capacity (III) (Unidas Podemos, 2018)	= 2030 (III) (Unidas Podemos, 2018)	= 2040 (III) (Unidas Podemos, 2018)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	(V)	(V)	(V)	(V)
Heating with electricity		Same as dominant	Same as dominant	(V)	(V)
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity		Same as dominant	Same as dominant		
Electric mobility		3% of new vehicles are EV (by 2020) , 25% EV (by 2025) (III) (Unidas Podemos, 2018) 4.9 TWh (same as dominant)	70% (EV) (III) (Unidas Podemos, 2018) 16.8 TWh *(20% less than dominant)	100% (EV) (III) (Unidas Podemos, 2018)(same as dominant)	
EV chargers		>> 2016 (III) (Unidas Podemos, 2018)	> 2020 (III) (Unidas Podemos, 2018)	> 2030 (III) (Unidas Podemos, 2018)	≥ 2040 (III) (Unidas Podemos, 2018)
Gross electricity consumption	275 TWh (Eurostat, 2018)	267 TWh (same as dominant)	280 TWh**	(V)	(V)

ES: Grassroots	2016	2020	2030	2040	2050
Final energy consumption	983 TWh	1035 TWh (same as dominant)	927 TWh***	***	(V)

* 3% of new vehicles as electric vehicles in 2020, 25% in 2025 and 70% in 2030 lead to a cumulative EV fleet of around 4.2 million vehicles, 19% less than in the dominant pathway.

** Same as dominant but slightly lower electrification of transport leads to slightly lower electricity demand

*** 40% reduction in primary energy demand vs 39.6% in dominant and 3% more of renewables in final energy (2030) 45% primary energy demand reduction compared to reference scenario (2040).

S 1.4 Minority pathway: market-centred (Partido Popular)

Table 4: Quantification of the Spanish market-centred minority policy pathway as described by Partido Popular.

ES: Market	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	283 Mt CO ₂ eq (EEA, 2018)	10% (GHG-2005) (III) (Partido Popular, 2018)	Non-ETS 26% (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	80% (III) (Partido Popular, 2018)
ETS sector reduction targets	229 Mt Mt CO ₂ eq (European annual emission allocation) (I) (EU/2017/1471, 2017)	219 Mt Mt CO ₂ eq (European annual emission allocation) (I) (EU/2017/1471, 2017)	(V)	(V)	(V)
Non-ETS sectors emission reduction targets		10% (GHG-2005) (406/2009/EC, 2009) (I)	26% (GHG-2005) (I) (EU/2018/842, 2018)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(V)	(V)	(V)	(V)
Renewables targets (energy; % of final energy consumption)	(V)	20% (I) (European Union, 2009)	> 2020 (III) (Partido Popular, 2018)	(V)	(V)
Renewables targets (electricity; % of final energy consumption)	39%; 108 TWh; 49 GW (Eurostat, 2018)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Intermittent renewables	57 TWh; 28 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)
Wind onshore	49 TWh; 23 GW (Eurostat, 2018)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Wind offshore	included above	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Solar PV	8 TWh; 5 GW (Eurostat, 2018)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Dispatchable renewables	51 TWh; 21 GW (Eurostat, 2018)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Biomass	5 TWh; 1 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)

ES: Market	2016	2020	2030	2040	2050
Hydro	40 TWh; 14 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)
CSP	6 TWh; 2.3 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)
Other renewables	1 TWh (Eurostat, 2018)	(V)	(V)	(V)	(V)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Statistical transfer of renewables (cooperation)	(V)	≥ 2016 (III) (Partido Popular, 2018)			
Explicit trade of CSP or hydropower	(V)	(V)	(V)	(V)	(V)
Nuclear	59 TWh 7 GW (Eurostat, 2018)	= 2016 (IV) (Sociedad Nuclear Española, 2015; Público, 2018)	= 2016 (IV) (Sociedad Nuclear Española, 2015; Público, 2018)	= 2016 (IV) (Sociedad Nuclear Española, 2015; Público, 2018)	= 2016 (IV) (Sociedad Nuclear Española, 2015; Público, 2018)
Fossil fuels	108 TWh; 48 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)
CCS	0	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Lignite	0 TWh (Eurostat, 2018)	≤ 2016 (IV) (La Nueva Crónica, 2018)	≤ 2016 (IV) (La Nueva Crónica, 2018)	(V)	(V)
Hard coal	36 TWh (Eurostat, 2018)	≤ 2016 (IV) (La Nueva Crónica, 2018)	≤ 2016 (IV) (La Nueva Crónica, 2018)	(V)	(V)
Gas	54 TWh (Eurostat, 2018)	≥ 2016 (III) (Popular, 2016)			
Petroleum	16 TWh (Eurostat, 2018)	(V)	(V)	(V)	(V)
Other non-renewables	1 TWh (Eurostat, 2018)	(V)	(V)	(V)	(V)
Storage	(V)	(V)	(V)	(V)	(V)

ES: Market	2016	2020	2030	2040	2050
Battery	(V)	> 2016 (Partido Popular, 2018)	> 2020 (Partido Popular, 2018)	> 2030 (Partido Popular, 2018)	> 2040 (Partido Popular, 2018)
Pumped Hydropower	(V)	> 2016 (Partido Popular, 2018)	> 2020 (Partido Popular, 2018)	> 2030 (Partido Popular, 2018)	> 2040 (Partido Popular, 2018)
Other storage	(V)	(V)	(V)	(V)	(V)
Cross-border interconnection NTC	(V)	≥ 10% of installed capacity	≥ 15% of installed capacity (III) (Partido Popular, 2018)	≥ 2030 (III) (Partido Popular, 2018)	≥ 2030 (III) (Partido Popular, 2018)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	(V)	(V)	(V)	(V)
Heating with electricity		Same as dominant	Less than dominant*	(V)	(V)
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity		Same as dominant	Less than dominant*	(V)	(V)
Electric mobility	480 ktoe	Same as dominant	Less than dominant*	(V)	(V)
EV chargers		> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Gross electricity consumption	275 TWh (Eurostat, 2018)	270 TWh; Same as dominant	279 TWh**Lower than dominant	(V)	(V)
Final energy consumption	983 TWh	1035 TWh Same as dominant	987 TWh***	(V)	(V)
ES: Market	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	283 Mt CO ₂ eq (EEA, 2018)	10% (GHG-2005) (III) (Partido Popular, 2018)	Non-ETS 26% (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	80% (III) (Partido Popular, 2018)
ETS sector reduction targets	229 Mt Mt CO ₂ eq (European annual emission allocation)(EU/2017/1471, 2017)	219 Mt Mt CO ₂ eq (European annual emission allocation)(EU/2017/1471, 2017)	(V)	(V)	(V)
Non-ETS sectors emission reduction targets		10% (GHG-2005) (406/2009/EC, 2009) (I)	26% (GHG-2005) (I) (EU/2018/842, 2018)	(V)	(V)

ES: Market	2016	2020	2030	2040	2050
GHG reduction targets (electricity sector)	(V)	(V)	(V)	(V)	(V)
Renewables targets (energy; % of final energy consumption)	(V)	20% (I) (European Union, 2009)	> 2020 (III) (Partido Popular, 2018)	(V)	(V)
Renewables targets (electricity; % of final energy consumption)	39%; 108 TWh; 49 GW(Eurostat, 2018)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Intermittent renewables	57 TWh; 28 GW(Eurostat, 2018)	(V)	(V)	(V)	(V)
Wind onshore	49 TWh; 23 GW (Eurostat, 2018)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Wind offshore	included above	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Solar PV	8 TWh; 5 GW (Eurostat, 2018)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Dispatchable renewables	51 TWh; 21 GW (Eurostat, 2018)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Biomass	5 TWh; 1 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)
Hydro	40 TWh; 14 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)
CSP	6 TWh; 2.3 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)
Other renewables	1 TWh (Eurostat, 2018)	(V)	(V)	(V)	(V)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Statistical transfer of renewables (cooperation)	(V)	≥ 2016 (III) (Partido Popular, 2018)			

ES: Market	2016	2020	2030	2040	2050
Explicit trade of CSP or hydropower	(V)	(V)	(V)	(V)	(V)
Nuclear	59 TWh 7 GW (Eurostat, 2018)	= 2016 (IV) (Sociedad Nuclear Española, 2015; Público, 2018)	= 2016 (IV) (Sociedad Nuclear Española, 2015; Público, 2018)	= 2016 (IV) (Sociedad Nuclear Española, 2015; Público, 2018)	= 2016 (IV) (Sociedad Nuclear Española, 2015; Público, 2018)
Fossil fuels	108 TWh; 48 GW (Eurostat, 2018)	(V)	(V)	(V)	(V)
CCS	0	> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Lignite	0 TWh (Eurostat, 2018)	≤ 2016 (IV) (La Nueva Crónica, 2018)	≤ 2016 (IV) (La Nueva Crónica, 2018)	(V)	(V)
Hard coal	36 TWh (Eurostat, 2018)	≤ 2016 (IV) (La Nueva Crónica, 2018)	≤ 2016 (IV) (La Nueva Crónica, 2018)	(V)	(V)
Gas	54 TWh (Eurostat, 2018)	≥ 2016 (III) (Popular, 2016)			
Petroleum	16 TWh (Eurostat, 2018)	(V)	(V)	(V)	(V)
Other non-renewables	1 TWh (Eurostat, 2018)	(V)	(V)	(V)	(V)
Storage	(V)	(V)	(V)	(V)	(V)
Battery	(V)	> 2016 (Partido Popular, 2018)	> 2020 (Partido Popular, 2018)	> 2030 (Partido Popular, 2018)	> 2040 (Partido Popular, 2018)
Pumped Hydropower	(V)	> 2016 (Partido Popular, 2018)	> 2020 (Partido Popular, 2018)	> 2030 (Partido Popular, 2018)	> 2040 (Partido Popular, 2018)
Other storage	(V)	(V)	(V)	(V)	(V)
Cross-border interconnection NTC	(V)	≥ 10% of installed capacity	≥ 15% of installed capacity (III) (Partido Popular, 2018)	≥ 2030 (III) (Partido Popular, 2018)	2030 (III) (Partido Popular, 2018)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	(V)	(V)	(V)	(V)
Heating with electricity		Same as dominant	Less than dominant*	(V)	(V)

ES: Market	2016	2020	2030	2040	2050
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity		Same as dominant	Less than dominant*	(V)	(V)
Electric mobility		Same as dominant	Less than dominant*	(V)	(V)
EV chargers		> 2016 (III) (Partido Popular, 2018)	> 2020 (III) (Partido Popular, 2018)	> 2030 (III) (Partido Popular, 2018)	> 2040 (III) (Partido Popular, 2018)
Gross electricity consumption	275 TWh (Eurostat, 2018)	270 TWh; Same as dominant	279 TWh**Lower than dominant	(V)	(V)
Final energy consumption	983 TWh	1035 TWh Same as dominant	987 TWh***	(V)	(V)

*No specific policies addressing the electrification of other sectors. No specific EV promotion policies.

** Lower than the dominant due to lower electrification of end use sectors. Taken as the trend scenario of the NECP.

*** calculated using a 32.5% reduction of primary energy from the reference scenario and a factor to convert PE to FE higher than in the dominant due to the reduced penetration of renewable energies (32% vs 42% in the dominant)

S 2 France

S 2.1 Representative organisations

French policy has traditionally been defined by two large parties, the Socialists and the conservative UMP (and its predecessor parties). The last years have been marked by large political shifts, which have greatly diminished the old parties, and in particular the Socialist party, and given rise to two new strong parties in parliament, the liberal *En Marche* of President Macron, and the right-wing *Rassemblement National*.

France is governed by the National Assembly (Parliament), the Senate (Representation of the Territorial Collectivities) and the President. The President is elected directly and powerful, and can, for example, appoint the Prime minister or dissolve the government.

A dominant issue in French energy policy has been and remains nuclear power, which supplies about $\frac{3}{4}$ of the French electricity. Most French political parties are more or less pro-nuclear power, and although some seek to reduce its role and diversify the power supply, few parties want to abandon it completely.

In general, France is seeking a leadership role in the fight against climate change and energy transition. As such, it has been active in promoting renewable electricity and energy policies, especially internationally. Nationally, the role of renewable energies is highlighted, yet given the large share of CO₂-neutral nuclear energy, this is not an extremely urgent topic.

Currently, 8 parties are represented in the national assembly (see Table 5). The current President Emmanuel Macron is supported by the liberal parties *La République En Marche* and the *Mouvement démocrate*. Measured in number of seats, they have a majority in the National Assembly.

Table 5: Parties currently (November 2018) represented in the French national parliament.

Party	National Assembly election 2017
<i>La République En Marche</i>	28.2%
<i>Les Républicains</i>	15.8%

<i>La France Insoumise</i>	11.0%
<i>Parti Socialiste</i>	7.4%
<i>Mouvement democrat</i>	4.1%
<i>Union des democrats et independants</i>	3.0%

As President Macron and the new government have not yet implemented any significant changes to the French energy policy, the dominant pathway here is the one decided and implanted by the previous President, the socialist Hollande. This is a state-centred pathway, focused on diversifying the French power supply by reducing the dominance of nuclear and scaling up renewables in a controlled manner through strong state policies. The 2019 French draft NECP strongly builds on this dominant pathway and the Macron government introduces only minor amendments: the French energy policy as described in that dominant pathway has its origin with the Hollande government and is executed without major changes by the Macron government.

For the minority pathways, we identified two parties with energy strategies representative for the remaining two corners of Foxon's triangle. We base the grassroots-centred minority pathway of the energy policy position of the Green party *Europe Écologie – Les Verts* (EELV). This strategy foresees the phase-out of nuclear power by 2030 and the expansion of mainly decentralised renewables to compensate the lost capacity, triggered by carbon prices and feed-in tariffs. We base the market-centred pathway on the position of the liberal party *En Marche*, which foresees a moderately fast transition of the energy system triggered by carbon taxes and a ban on internal combustion engine cars.

In addition, we also include the strategy of the right-wing *Rassemblement National* (previously Front National), which rejects climate change mitigation as a valid policy aim and instead puts French energy autonomy at the top of its energy agenda, to be achieved by strong centralised policies (making it in essence a state-centred pathway, but without the perceived need for an energy transition to a carbon-neutral future). The consequence is an isolated French electricity system strongly dominated by nuclear power, but also with renewables, as the only large domestic French energy resource.

S 2.2 Dominant pathway: state-centred (Hollande and Macron governments)

Table 6: Quantification of the French state-centred dominant policy pathway as described by currently valid policies of both (first) the Parti Socialiste and (then) En Marche and their respective governments.

FR: Dominant	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	421 Mt CO _{2eq} (EEA, 2018)	-20% (GHG-1990) (Grenelle I Law, 2009; Grenelle II Law, 2010)	-40% (GHG-1990) (ETL, 2015; French Republic, 2018)	(V)	-75% (GHG-1990) / Max. 140 Mt CO _{2eq} (ETL, 2015; French Republic Prime Minister's Office, 2012; Grenelle I Law, 2009; Grenelle II Law, 2010)
ETS sector reduction targets	393 Mt CO _{2eq} (European annual emission allocation)	355 Mt CO _{2eq} (European annual emission allocation) (2013/162/EU)	(V)	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	14% (GHG-2005) (2009/406/EC)	37% (GHG-2005) (I) (2018/842)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(V)	(V)	(V)	(V)
Renewables targets (energy; % of final energy consumption)	(V)	23% (Grenelle I Law, 2009; Grenelle II Law, 2010) 71-78 GW by 2023); 150-167 TWh by 2023 (MEP, 2016)	34% (NECP FR, 2019)	(V)	(V)
Renewables targets (electricity; % of final energy consumption)	18%; 102 TWh; 40 GW (EUROSTAT, 2018)	(V)	40% (French Republic, 2018; Ministry of Ecological and Solidary Transition, 2017)	Close to but below 50% (Viennot, 2015)	50% (Viennot, 2015)
Intermittent renewables	30 TWh; 19 GW (EUROSTAT, 2018)	(V)	(V)	(V)	(V)

FR: Dominant	2016	2020	2030	2040	2050
Wind onshore	21 TWh; 11 GW (EUROSTAT , 2018)	(V)	4-to-1 ratio (wind onshore to PV) (Ministry of Ecological and Solidary Transition, 2018)	4-to-1 ratio (wind onshore to PV) (Ministry of Ecological and Solidary Transition, 2018)	4-to-1 ratio (wind onshore to PV) (Ministry of Ecological and Solidary Transition, 2018)
Wind offshore	included above	(V)	(V)	(V)	(V)
Solar PV	8 TWh; 7 GW (EUROSTAT , 2018)	(V)	4-to-1 ratio (wind onshore to PV) (Ministry of Ecological and Solidary Transition, 2018)	4-to-1 ratio (wind onshore to PV) (Ministry of Ecological and Solidary Transition, 2018)	4-to-1 ratio (wind onshore to PV) (Ministry of Ecological and Solidary Transition, 2018)
Dispatchable renewables	73 TWh; 21 GW (EUROSTAT , 2018)	≥ 2020 (2023) (ADEME, 2016)	≥ 2023 (ADEME, 2016)	≥ 2030 (ADEME, 2016)	≥ 2040 (ADEME, 2016)
Biomass	5 TWh; 1 GW (EUROSTAT , 2018)	≥ 2020 (2023) (ADEME, 2016)	≥ 2023 (ADEME, 2016)	≥ 2030 (ADEME, 2016)	≥ 2040 (ADEME, 2016)
Hydro	65 TWh; 18 GW (EUROSTAT , 2018)	≥ 2016 (2023) (TWh); =2016 (GW) (ADEME, 2016)	≥ 2016 (2023) (TWh); =2016 (GW) (ADEME, 2016)	≥ 2016 (2023) (TWh); =2016 (GW) (ADEME, 2016)	≥ 2016 (2023) (TWh); =2016 (GW) (ADEME, 2016)
CSP	0 TWh; 0 GW (EUROSTAT , 2018)	(V)	(V)	(V)	0.4 GW (II) (ADEME, 2016)
Other renewables	3 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Statistical transfer of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Explicit trade of CSP or hydropower	(V)	(V)	(V)	(V)	(V)
Nuclear	403 TWh; 63 GW (EUROSTAT , 2018)	(V)	By 2025: 50% of mix; 63.2 GW (AFP, 2017; ETL, 2015; MEP, 2016)	= 2030 (AFP, 2017; ETL, 2015; MEP, 2016)	= 2030 (AFP, 2017; ETL, 2015; MEP, 2016)
Fossil fuels	51 TWh; 23 GW (EUROSTAT , 2018)	(V)	-30% (GW-2012) (ETL, 2015; French Republic, 2018; MEP, 2016)	(V)	(V)

FR: Dominant	2016	2020	2030	2040	2050
CCS	0	(V)	(V)	(V)	(V)
Lignite	0 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Hard coal	8 TWh (EUROSTAT , 2018)	By 2023 - 37% (GW- 2012) (MEP, 2016)	(V)	(V)	(V)
Gas	37 TWh (EUROSTAT , 2018)	By 2023 - 15.8% (GW- 2012) (MEP, 2016)	(V)	(V)	(V)
Petroleum	2 TWh (EUROSTAT , 2018)	By 2023: - 22.4% (GW- 2012) (MEP, 2016)	(V)	(V)	(V)
Other non-renewables	3 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Storage		(V)	(V)	(V)	(V)
Battery	(V)	(V)	(V)	(V)	Technologica lly unspecified direct storage interweekly and interdaily => 2016 (II) (ADEME, 2016)
Pumped Hydropower	(V)	= 2016 (ADEME, 2016)	= 2016 (ADEME, 2016)	= 2016 (ADEME, 2016)	= 2016 (ADEME, 2016)
Other storage	(V)	(V)	(V)	(V)	200 TWh (Power-to- gas) (II) 10- 46 TWh (Gas-to- power) (II) (ADEME, 2016, 2018)
Cross-border interconnection NTC	(V)	≥ 2016 (Ministry of Ecological and Solidary Transition, 2016)	≥ 15% of yearly power production (Ministry of Ecological and Solidary Transition, 2016)	= 2030 (Ministry of Ecological and Solidary Transition, 2016)	= 2030 (Ministry of Ecological and Solidary Transition, 2016)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	By 2023: +50% (TWh- 2014) (MEP, 2016)	Growth rate of heating and cooling by RETs: +1%/year between 2020 and 2030 (NECP FR, 2019)	(V)	(V)

FR: Dominant	2016	2020	2030	2040	2050
Heating with electricity	(V)	(V)	38% (RES-E) (Ministry of Ecological and Solidary Transition, 2017)	(V)	(V)
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity	(V)	(V)	(V)	(V)	(V)
Electric mobility	(V)	By 2023: 2.4 million EV (MEP, 2016)	4 million EV (MEP, 2016)	Ban on new ICE (Le Monde, 2017)	(V)
EV chargers	(V)	(V)	7 million Chargers (MEP, 2016)	(V)	(V)
Gross electricity consumption	556 TWh (EUROSTAT, 2018)	(V)	-20% (2012) (II) (French Republic, 2018)	(V)	420 TWh (II) (French Republic, 2018)
Final energy consumption	(V)	1528 TWh (NECP FR, 2019)	1368 TWh (EU target applied to France in the NECP) (NECP FR, 2019)	<1368 TWh (NECP FR, 2019)	<<1368 TWh (NECP FR, 2019)

S 2.3 Minority pathway: outside the energy logics framework (Rassemblement National)

Table 7: Quantification of the French minority policy pathway (outside the transition logics framework) as described by Rassemblement National.

FR: Outside logic	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	421 Mt CO ₂ eq (EEA, 2018)	(V)	(V)	(V)	(V)
ETS sector reduction targets	393 Mt CO ₂ eq (European annual emission allocation)		(V)	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	14% (GHG-2005) (2009/406/EC)	37% (GHG-2005) (I) (2018/842)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(V)	(V)	(V)	(V)
Renewables targets (energy; % of final energy consumption)	(V)	(V)	(V)	(V)	(V)
Renewables targets (electricity; % of final energy consumption)	18%; 102 TWh; 40 GW (EUROSTAT, 2018)	(V)	(V)	(V)	All that is not covered by nuclear power. Applies to solar and biomass (III) (Dupin, 2017)
Intermittent renewables	30 TWh; 19 GW (EUROSTAT, 2018)	(V)	(V)	(V)	(V)
Wind onshore	21 TWh; 11 GW (EUROSTAT, 2018)	= 2018 (III) (Durox, 2018; Odoul, 2018)	= 2018 (III) (Durox, 2018; Odoul, 2018)	= 2018 (III) (Durox, 2018; Odoul, 2018)	= 2018 (III) (Durox, 2018; Odoul, 2018)
Wind offshore	included above	= 2018 (III) (Durox, 2018; Odoul, 2018)			
Solar PV	8 TWh; 7 GW (EUROSTAT, 2018)	= 2018 (III) (Dupin, 2017; Rassemblement National, 2017)	= 2018 (III) (Dupin, 2017; Rassemblement National, 2017)	> 2030 (III) (Dupin, 2017; Rassemblement National, 2017)	> 2040 (III) (Dupin, 2017; Rassemblement National, 2017)
Dispatchable renewables	73 TWh; 21 GW (EUROSTAT, 2018)	(V)	(V)	(V)	(V)
Biomass	5 TWh; 1 GW (EUROSTAT, 2018)	(V)	= 2018 (III) (Dupin, 2017; Rassemblement National, 2017)	> 2030 (III) (Dupin, 2017; Rassemblement National, 2017)	> 2040 (III) (Dupin, 2017; Rassemblement National, 2017)
Hydro	65 TWh; 18 GW (EUROSTAT, 2018)	= 2018 (III) (Aliot, 2018; Coativy, 2018)	= 2018 (III) (Aliot, 2018; Coativy, 2018)	= 2018 (III) (Aliot, 2018; Coativy, 2018)	= 2018 (III) (Aliot, 2018; Coativy, 2018)

FR: Outside logic	2016	2020	2030	2040	2050
CSP	0 TWh; 0 GW (EUROSTAT , 2018)	0 (Joffre, 2017)	0 (Joffre, 2017)	0 (Joffre, 2017)	0 (Joffre, 2017)
Other renewables	3 TWh (EUROSTAT , 2018)	0 (Joffre, 2017)	0 (Joffre, 2017)	0 (Joffre, 2017)	0 (Joffre, 2017)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	0 (III) (Brezet, 2017b)			
Statistical transfer of renewables (cooperation)	(V)	0 (III) (Brezet, 2017b)			
Explicit trade of CSP or hydropower	(V)	0 (Joffre, 2017)	0 (Joffre, 2017)	0 (Joffre, 2017)	0 (Joffre, 2017)
Nuclear	403 TWh; 63 GW (EUROSTAT , 2018)	75% of mix (III) (Astier, 2017; Brezet, 2017b; Dupin, 2017)	75% of mix (III) (Astier, 2017; Brezet, 2017b; Dupin, 2017)	75% of mix (III) (Astier, 2017; Brezet, 2017b; Dupin, 2017)	75% of mix (III) (Astier, 2017; Brezet, 2017b; Dupin, 2017)
Fossil fuels	51 TWh; 23 GW (EUROSTAT , 2018)	(V)	(V)	By 2035: - 50% (FE-2017) (III) (Barroux, 2016)	0 (III) (Joffre, 2017)
CCS	0	(V)	(V)	(V)	(V)
Lignite	0 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	0 (III) (Joffre, 2017)
Hard coal	8 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	0 (III) (Joffre, 2017)
Gas	37 TWh (EUROSTAT , 2018)	(V)	(V)	-50% (ref. 2018) (III) (Joffre, 2017)	0 (III) (Joffre, 2017)
Petroleum	2 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	0 (III) (Joffre, 2017)
Other non-renewables	3 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Storage		(V)	(V)	(V)	(V)
Battery	(V)	(V)	(V)	(V)	(V)
Pumped Hydropower	(V)	(V)	(V)	(V)	(V)
Other storage	(V)	(V)	(V)	> 2016 (III) (hydrogen for mobility) (Brezet, 2017b)	> 2040 (III) (hydrogen for mobility) (Brezet, 2017b)
Cross-border interconnection NTC	(V)	(V)	= 2016 (III) (Brezet, 2017b)	= 2016 (III) (Brezet, 2017b)	= 2016 (III) (Brezet, 2017b)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	(V)	(V)	(V)	(V)
Heating with electricity	(V)	(V)	(V)	(V)	(V)

FR: Outside logic	2016	2020	2030	2040	2050
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity	(V)	(V)	(V)	(V)	(V)
Electric mobility	(V)	0 EV (Astier, 2017)			
EV chargers	(V)	(V)	(V)	(V)	(V)
Gross electricity consumption	556 TWh (EUROSTAT, 2018)	(V)	(V)	(V)	(V)
Final energy consumption	(V)	(V)	(V)	(V)	(V)

S 2.4 Minority pathway: grassroot-centred (Europe Écologie – Les Verts)

Table 8: Quantification of the French grassroot-centred minority policy pathway as described by Europe Écologie – Les Verts.

FR: Grassroots	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	421 Mt CO _{2eq} (EEA, 2018)	-30% (GHG-1990) (III) (EELV, 2012, 2018c)	-40% (GHG-1990) (III) (EELV, 2012, 2018c)	(V)	-85% (GHG-1990) (III) (EELV, 2012, 2018c)
ETS sector reduction targets	393 Mt CO _{2eq} q (European annual emission allocation)	355 Mt CO _{2eq} (European annual emission allocation) (2013/162/EU)	(V)	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	14% (GHG-2005) (2009/406/EC)	37% (GHG-2005) (I) (2018/842)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(V)	(V)	(V)	(V)
Renewables targets (energy; % of final energy consumption)	(V)	(V)	(V)	(V)	(V)
Renewables targets (electricity; % of final energy consumption)	18%; 102 TWh; 40 GW (EUROSTAT, 2018)	40% of mix; 175 TWh (III) (EELV, 2012, 2018a)	(V)	(V)	100% (III) (EELV, 2012, 2018a)
Intermittent renewables	30 TWh; 19 GW (EUROSTAT, 2018)	(V)	(V)	(V)	(V)
Wind onshore	21 TWh; 11 GW (EUROSTAT, 2018)	10-60 TWh (incl. offshore) / 14% (III) (EELV, 2012, 2018a)	≥ 2020 (III) (EELV, 2012, 2018a)	≥ 2030 (III) (EELV, 2012, 2018a)	≥ 2040 (III) (EELV, 2012, 2018a)
Wind offshore	included above	≥ 2016 (III) (EELV, 2012, 2018a)	≥ 2020(III) (EELV, 2012, 2018a)	≥ 2030 (III) (EELV, 2012, 2018a)	≥ 2040 (III) (EELV, 2012, 2018a)
Solar PV	8 TWh; 7 GW (EUROSTAT, 2018)	25 TWh (6%) (mainly decentral) (III) (EELV, 2012, 2018a)	≥ 2020 (mainly decentral) (III) (EELV, 2012, 2018a)	≥ 2030 (mainly decentral) (III) (EELV, 2012, 2018a)	≥ 2040 (mainly decentral) (III) (EELV, 2012, 2018a)
Dispatchable renewables	73 TWh; 21 GW (EUROSTAT, 2018)	(V)	(V)	(V)	(V)
Biomass	5 TWh; 1 GW (EUROSTAT, 2018)	4.5% (III) (EELV, 2012, 2018a)	≥ 2020 (III) (EELV, 2012, 2018a)	≥ 2020 (III) (EELV, 2012, 2018a)	≥ 2020 (III) (EELV, 2012, 2018a)
Hydro	65 TWh; 18 GW (EUROSTAT, 2018)	70 TWh (16% of mix) (III) (EELV, 2012, 2018a)	= 2020 (III) (EELV, 2012, 2018a)	= 2020 (III) (EELV, 2012, 2018a)	= 2020 (III) (EELV, 2012, 2018a)

FR: Grassroots	2016	2020	2030	2040	2050
CSP	0 TWh; 0 GW (EUROSTAT , 2018)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)
Other renewables	3 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Statistical transfer of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Explicit trade of CSP or hydropower	(V)	(V)	(V)	(V)	(V)
Nuclear	403 TWh; 63 GW (EUROSTAT , 2018)	40% (III) (EELV, 2012, 2018a)	0 by 2032 (III) (EELV, 2012)	0 (III) (EELV, 2012)	0 (III) (EELV, 2012)
Fossil fuels	51 TWh; 23 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
CCS	0	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)
Lignite	0 TWh (EUROSTAT , 2018)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)
Hard coal	8 TWh (EUROSTAT , 2018)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)
Gas	37 TWh (EUROSTAT , 2018)	20% of mix (combined cycle) (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)
Petroleum	2 TWh (EUROSTAT , 2018)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)	0 (III) (EELV, 2018a)
Other non-renewables	3 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Storage		(V)	(V)	(V)	(V)
Battery	(V)	> 2016 (decentralised) (III) (EELV, 2018a)	> 2020 (decentralised) (III) (EELV, 2018a)	> 2030 (decentralised) (III) (EELV, 2018a)	> 2040 (III) (decentralised) (EELV, 2018a)
Pumped Hydropower	(V)	≥ 2016 (III) (EELV, 2018a)	≥ 2016 (III) (EELV, 2018a)	≥ 2016 (III) (EELV, 2018a)	≥ 2016 (III) (EELV, 2018a)
Other storage	(V)	> 2016(III) (EELV, 2018a)	> 2020 (III) (EELV, 2018a)	> 2030 (III) (EELV, 2018a)	> 2040 (III) (EELV, 2018a)

FR: Grassroots	2016	2020	2030	2040	2050
Cross-border interconnection NTC	(V)	≥ 2016 (III) (AFP & Sciences et Avenir, 2018; EELV, 2018c)	≥ 2020 (III) (AFP & Sciences et Avenir, 2018; EELV, 2018c)	≥ 2030 (III) (AFP & Sciences et Avenir, 2018; EELV, 2018c)	≥ 2040 (III) (AFP & Sciences et Avenir, 2018; EELV, 2018c)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	(V)	(V)	(V)	(V)
Heating with electricity	(V)	40% RES (III)) (EELV, 2018a)	≥ 2020 (III) (EELV, 2018a)	≥ 2030 (III) (EELV, 2018a)	≥ 2040 (III) (EELV, 2018a)
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity	(V)	(V)	(V)	(V)	(V)
Electric mobility	(V)	By 2025: -20% (GHG-1990) (III) (mainly e-mobility and reduced demand) (EELV, 2018b)	-45% (GHG-1990) (III) (mainly e-mobility and reduced demand) (EELV, 2018b)	(V)	(V)
EV chargers	(V)	(V)	(V)	(V)	(V)
Gross electricity consumption	556 TWh (EUROSTAT, 2018)	-15% (2009) (III) (EELV, 2012, 2018c)	< 2020 (III) (EELV, 2012, 2018c)	< 2030 (III) (EELV, 2012, 2018c)	-50% (2009) 360 TWh (III) (EELV, 2012, 2018c)
Final energy consumption	(V)	(V)	(V)	(V)	(V)

S 2.5 Minority pathway: market-centred (La République en Marche)

Table 9: Quantification of the French market-centred minority policy pathway as described by La République en Marche.

FR: Market-centred	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	421 Mt CO ₂ eq (EEA, 2018)	(V)	-40% (GHG-1990) (III) (De Ravignan, 2018)	(V)	-75% (GHG-1990) Max. 140 million tons CO ₂ eq (III) (De Ravignan, 2018; En Marche, 2017)
ETS sector reduction targets	393 Mt CO ₂ eq (European annual emission allocation)	355 Mt CO ₂ eq (European annual emission allocation) (2013/162/EU)	(V)	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	14% (GHG-2005)(2009/406/EC)	37% (GHG-2005) (I) (2018/842)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(V)	(V)	(V)	(V)
Renewables targets (energy; % of final energy consumption)	(V)	(V)	32% (III) (Energie Plus, 2017)	(V)	(V)
Renewables targets (electricity; % of final energy consumption)	18%; 102 TWh; 40 GW (EUROSTAT, 2018)	(V)	40% (III) (Qualit-EnR, 2017)	(V)	(V)
Intermittent renewables	30 TWh; 19 GW (EUROSTAT, 2018)	By 2022: +26 GW / + 32 TWh (III) (En Marche, 2017)	≥ 2020 (III) (En Marche, 2017, 2018)	≥ 2030 (III) (En Marche, 2017, 2018)	≥ 2040 (III) (En Marche, 2017, 2018)
Wind onshore	21 TWh; 11 GW (EUROSTAT, 2018)	By 2022: +100% (2018) (III) (Energie Plus, 2017)	≥ 2020 (III) (En Marche, 2017, 2018)	≥ 2030 (III) (En Marche, 2017, 2018)	≥ 2040 (III) (En Marche, 2017, 2018)
Wind offshore	included above	(V)	(V)	(V)	(V)
Solar PV	8 TWh; 7 GW (EUROSTAT, 2018)	By 2022: +100% (2018) (III) (Energie Plus, 2017)	≥ 2020 (III) (En Marche, 2017, 2018)	≥ 2030 (III) (En Marche, 2017, 2018)	≥ 2040 (III) (En Marche, 2017, 2018)
Dispatchable renewables	73 TWh; 21 GW (EUROSTAT, 2018)	> 2017 (III) (En Marche, 2017, 2018)	> 2020 (III) (En Marche, 2017, 2018)	> 2030 (III) (En Marche, 2017, 2018)	> 2040 (III) (En Marche, 2017, 2018)
Biomass	5 TWh; 1 GW (EUROSTAT, 2018)	(V)	(V)	(V)	(V)

FR: Market-centred	2016	2020	2030	2040	2050
Hydro	65 TWh; 18 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
CSP	0 TWh; 0 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Other renewables	3 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Statistical transfer of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Explicit trade of CSP or hydropower	(V)	(V)	(V)	(V)	(V)
Nuclear	403 TWh; 63 GW (EUROSTAT , 2018)	(V)	By 2025: 50% of electricity mix (III) (Energie Plus, 2017; Qualit-EnR, 2017)	= 2025 (III) (Energie Plus, 2017; Qualit-EnR, 2017)	= 2025 (III) (Energie Plus, 2017; Qualit-EnR, 2017)
Fossil fuels	51 TWh; 23 GW (EUROSTAT , 2018)	(V)	Min. -30% (2012) (III) (En Marche, 2017)	(V)	(V)
CCS	0	By 2023: 0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)
Lignite	0 TWh (EUROSTAT , 2018)	By 2023: 0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)
Hard coal	8 TWh (EUROSTAT , 2018)	By 2023: 0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)
Gas	37 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Petroleum	2 TWh (EUROSTAT , 2018)	By 2023: 0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)	0 (III) (En Marche, 2017)
Other non-renewables	3 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Storage		≥ 2016 (En Marche, 2017, 2018)	≥ 2020 (En Marche, 2017, 2018)	≥ 2030 (En Marche, 2017, 2018)	≥ 2040 (En Marche, 2017, 2018)
Battery	(V)	(V)	(V)	(V)	(V)
Pumped Hydropower	(V)	(V)	(V)	(V)	(V)
Other storage	(V)	(V)	(V)	(V)	(V)

FR: Market-centred	2016	2020	2030	2040	2050
Cross-border interconnection NTC	(V)	\geq 2016 (III) (En Marche, 2017)	\geq 2020 (III) (En Marche, 2017)	\geq 2030 (III) (En Marche, 2017)	\geq 2040 (III) (En Marche, 2017)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	By 2022: 1 million buildings insulated (III) (Brezet, 2017a; Qualit-EnR, 2017)	(V)	(V)	(V)
Heating with electricity	(V)	(V)	(V)	(V)	(V)
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity	(V)	(V)	(V)	(V)	(V)
Electric mobility	(V)	By 2023: 2.4 million EVs (III) (Brezet, 2017a; En Marche, 2017)	4 million EVs (III) (Brezet, 2017a; En Marche, 2017)	Ban on sale of any ICE vehicle (En Marche, 2017)	(V)
EV chargers	(V)	(V)	7 million chargers (III) (Brezet, 2017a)	(V)	(V)
Gross electricity consumption	556 TWh (EUROSTAT, 2018)	(V)	(V)	(V)	(V)
Final energy consumption	(V)	(V)	(V)	(V)	(V)

S 3 Germany

S 3.1 Representative organisations

Traditionally, German Politics have been shaped by shifting majorities of its two major parties, the conservative *Christian Democratic Party of Germany* (CDU and CSU) and the *Social Democratic Party of Germany* (SPD). Either party formed coalitions with the German liberal party the *Free Democratic Party* (FDP). Together CDU/CSU, SPD, FDP have shaped the German electricity system that was highly centralised and divided between four large utilities and built on large scale fossil fuel and nuclear power stations. This stable regime was interrupted when the first coalition between SPD and the Greens (Bündnis 90/Die Grünen) came into power in 1998. With its origins in the anti-nuclear movement, the Greens pushed for a nuclear phase-out and to replace the declining nuclear capacity with renewables, a policy program that later became known as *Energiewende*. In the 2000s, the parliamentary landscape has evolved so that today six parties are represented in the *Bundestag*. This diversity has, however, failed to produce larger diversity in government coalitions, but instead lead to a higher incidence of *grand coalitions* of CDU/CSU and SPD.

Since 2013, Germany has been governed by a coalition of the two largest parties of CDU/CSU and SPD, both of which are invested in the status-quo of the German energy system. These parties have a majority in the parliament (see Table 10) and form the current government (together with CSU). Consequently, we use the currently valid policies of their ministries, party programs of SPD and CDU/CSU, and the government coalition agreements to inform the dominant pathway. This continuity is also reflected in the German draft NECP, which is a continuation of past plans, but also includes references to ongoing – but not yet finished – legislative and stakeholder processes to phase out coal power and change the mobility sector to a carbon-neutral one.

Table 10: Result of the 2017 German federal elections (Bundeswahlleiter, 2017).

Party	German federal elections 2017
Christlich Demokratische Union Deutschlands (CDU)	26.8 %

Sozialdemokratische Partei Deutschlands (SPD)	20.5 %
Alternative für Deutschland (AfD)	12.6 %
Freie Demokratische Partei (FDP)	10.7 %
Die Linke	9.2 %
Bündnis 90/GRÜNE	8.9 %
Christlich-Soziale Union in Bayern (CSU)	6.2 %
Others	5.0 %

We base the market-centred minority pathway on the position of the liberal party, FDP. The main reason is that the party is strongly advocating for market-based mechanisms and aims to dismantle all technology-specific support, and subsidies in general. It expresses its position in policy proposals and has a well-developed energy policy position from the time when it was in government from 2009-2013. The FDP's policy aims fits well with the logic of a market-centred europeanisation of German energy policy.

The Green party developed out of the peace movement and a civil-society movement against nuclear power. Empowerment and democratic participation are still at the heart of the Green position, although the party also support higher carbon prices and other market-based mechanisms and favours strong government involvement in reducing fossil and nuclear power generation. This focus on empowering citizens and cooperatives to consume their own energy and to make their own energy decisions is at the core of the grassroots logic, and is strong in the Green party position as well. Moreover, the party has precise and elaborate positions on most of the variables that we investigate, resulting in an ambitious vision for complete decarbonisation to achieve Germanys full contribution towards the Paris agreements 1.5-degree goal.

The decision to leave out the other two parties in the German Bundestag has several reasons. The Left party (*Die Linke*) does not have an elaborate energy policy strategy, but mainly aims to ensure distributional fairness of existing policies, i.e. that people with low income are not excluded from energy

consumption through decarbonisation policies. The Alternative for Germany (*AfD*) on the other hand does not support the goal of decarbonisation at all and often question the existence of anthropogenic climate change in general. They also argue for cheap electricity prices, through continued use of fossil fuels and giving up decarbonisation policies all together, but do not have a detailed vision expressed in written documents. Hence, we do not include any of these parties in our analysis.

S 3.2 Dominant pathway: state-centred (Christian Democrats/Social Democrats)

Table 11: Quantification of the German state-centred dominant policy pathway as described by currently valid policies of the current and previous Christian Democrat/Social Democrat government.

DE: Dominant	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	894 Mt CO _{2eq} (EEA, 2018)	40% (GHG-1990) (II) (BMUB, 2016)	55-56% (GHG-1990) (II) (BMUB, 2016) <562 Mt CO ₂ (NECP DE, 2018)	>70% (GHG-1990) (II) (BMUB, 2016) <375 Mt CO ₂ (III) (NECP DE, 2018)	80-95% (GHG-1990) (II) (BMUB, 2016) 263-62.5 Mt CO ₂ (III) (NECP DE, 2018)
ETS sector reduction targets	474 Mt CO _{2eq} (European annual emission allocation)	431 Mt CO _{2eq} (European annual emission allocation) (2013/162/EU)	EU: 43 % (2005)	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	14% (GHG-2005) (2009/406/EC)	38% (GHG-2005) (I) (2018/842)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(V)	61-62% (GHG-1990) (II) (BMUB, 2016)	(V)	100% (GHG-1990) (II) (BMUB, 2016)
Renewables targets (energy; % of final energy consumption)	(V)	18% (II) (BMW & BMU, 2010; CDU/CSU/SPD, 2018)	30% (II) (BMW & BMU, 2010)	45% (II) (BMW & BMU, 2010)	60% (II) (BMW & BMU, 2010)
Renewables targets (electricity; % of final energy consumption)	30%; 194 TWh; 108 GW (EUROSTAT, 2018)	By 2025: 40-45% (I) (EEG, 2017, §1)	65% (III) (NECP DE, 2018) (CDUCSUSPD, 2018-Koalitionsvertrag) 360-400 TWh (III) (NECP DE, 2018)	>65% (I) (EEG, 2017, §1)	>80% (I) (EEG, 2017, §1)
Intermittent renewables	117 TWh; 90 GW (EUROSTAT, 2018)	(V)	180-220 GW (III) (NECP DE, 2018)	(V)	(V)

DE: Dominant	2016	2020	2030	2040	2050
Wind onshore	79 TWh; 50 GW (EUROSTAT , 2018)	+2.8 GW per year (I) (2017-19) (EEG, 2017, §4.1a); +2.9 GW per year (I) (EEG, 2017, §4.1b)	+2.9GW per year 74-85.5GW (BNA, 2018)	≥74-85.5GW	≥74-85.5GW
Wind offshore	included above	6.5 GW(I) (EEG, 2017, §4.1b)	15 GW(I) (EEG, 2017, §4.1b)	≥17-20 GW	≥17-20 GW
Solar PV	38 TWh; 41 GW (EUROSTAT , 2018)	+2.8 GW per year (I) (EEG, 2017, §4.1a)	72.9GW-104.5GW	≥72.9GW-104.5GW	≥72.9GW-104.5GW
Dispatchable renewables	77 TWh; 18 GW (EUROSTAT , 2018)	(V)	14.9 GW (III) (BNA, 2018)	(V)	(V)
Biomass	45 TWh; 7 GW (EUROSTAT , 2018)	+150 MW per year (2017-19) (EEG, 2017, §4.4a); +200 MW per year (2020-2022) (EEG, 2017, §4.4b)	6.0 GW (BNA, 2018)	=6.0 GW	=6.0 GW
Hydro	26 TWh; 5 GW (EUROSTAT , 2018)	(V)	5.6 GW (BNA, 2018)	=5.6GW	=5.6 GW
CSP	0 TWh; 0 GW (EUROSTAT , 2018)	=0 (IV)	=0 (IV)	=0 (IV)	=0 (IV)
Other renewables	6 TWh (EUROSTAT , 2018)	(V)	1.3 GW	=1.3 GW	=1.3 GW
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	Up to 5% of auction volume available to foreign bidders (EEG, 2017, §5)	≥2020 (V)	≥2020 (V)	≥2020 (V)
Statistical transfer of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Explicit trade of CSP or hydropower	(V)	(V)	(V)	(V)	(V)

DE: Dominant	2016	2020	2030	2040	2050
Nuclear	85 TWh; 11GW (EUROSTAT , 2018)	31.12.19 Philippensburg 2 (I) (AtG, 2017, §7)	31.12.2021: Grohnde, Grundremmin gen C, Brokdorf 31.12.2022: Isar 2, Emsland, Neckarwesthe im 2 By 2023: 0 GW (I) (AtG, 2017, §7)	0 (I) (AtG, 2017, §1)	0 (I) (AtG, 2017, §1)
Fossil fuels	371 TWh; 96GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
CCS	0	0 (I) (KSpG, 2012, §2)	0 (I) (KSpG, 2012, §2)	0 (I) (KSpG, 2012, §2)	0 (I) (KSpG, 2012, §2)
Lignite	150 TWh (EUROSTAT , 2018)	(V)	(V).	By 2038: 0 (II) (KWSB, 2019)	(V).
Hard coal	112 TWh (EUROSTAT , 2018)	(V)	(V)	By 2038: 0 (II) (KWSB, 2019)	(V)
Gas	94 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Petroleum	5 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Other non-renewables	10 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Storage	(V)	(V)	(V)	(V)	(V)
Battery	(V)	(V)	8-12.5 GW (IV) (BNA, 2018)	(V)	(V)
Pumped Hydropower	(V)	(V)	11.6 GW (IV) (BNA, 2018)	(V)	(V)
Other storage	(V)	(V)	1-3 GW (IV) (Power-to- Gas) (BNA, 2018)	(V)	(V)
Cross-border interconnection NTC		≥ 10% of yearly power production (II) (2015/82/CO M, 2015)	≥ 15% of yearly power production (II) (2018/2001/E C)	(V)	(V)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)

DE: Dominant	2016	2020	2030	2040	2050
Total heating demand incl. non-electric heating	(V)	-20% (TWh-2008) 2% renovation rate (II) (BMWi & BMU, 2010)	681-766 TWh (2453-2757 PJ) (III) (NECP DE, 2018) -67-66% (GHG-1990) (II) (BMUB, 2016)	546 -685 TWh (1966-2465 PJ) (III) (NECP DE, 2018)	444-623 TWh (1597-2243 PJ) (III) (NECP DE, 2018) -80% (TWh-2008)-(II) (BMWi, 2015)
Heating with electricity	(V)	14% RES-H (I) (EEWärmeG, 2008)	1.1-4.1 million heat pumps (IV) (BNA, 2017, p22) 27% RES-H (III) (NECP DE, 2018)	> 2030	> 2040 - 100% (GHG-1990) (II) (BMWi, 2015)
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity	(V)	(V)	(V)	(V)	(V)
Electric mobility	(V)	All transport: -10% (PE-2005) (II) (BMWi & BMU, 2010)	-42-40% (GHG-1990) (II) (BMUB, 2016); 1-6 million EV (IV) (BNA, 2017, p22) Double number of train passengers (2018) (CDU/CSU/S PD, 2018); 14% RES-T (III) (NECP DE, 2018)	(V)	All transport: -40% (PE-2005)(II) (BMWi & BMU, 2010)
EV chargers	(V)	+100,000 Charging points (III) (CDU/CSU/S PD, 2018)	>2020 (V)	>2030 (V)	>2040 (V)
Gross electricity consumption	596.9 TWh (AGEE, 2018)	557.19 TWh (equals -10% (2008)) (NAPE, 2014)+ new demand from Sector coupling(NA PE, 2014)(NAPE, 2014)	554-615TWh (NECP DE, 2018) (BNA, 2018)	<2030	464.3 TWh (equals -25% (2008)) (NAPE, 2014)+ new demand from Sector coupling
Final energy consumption	(V)	(V)	(V)	(V)	(V)

S 3.3 Minority pathway: grassroot-centred (Bündnis 90/Die Grünen)

Table 12: Quantification of the German grassroot-centred minority policy pathway as described by Bündnis 90/Die Grünen.

DE: Grassroot	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	894 Mt CO ₂ eq (EEA, 2018)	(V)	>55% (IV) (GHG-1990) (Bündnis 90/Die Grünen, 2018)		> 95% (IV) (GHG-1990) (Bündnis 90/Die Grünen, 2018)
ETS sector reduction targets	474 Mt CO ₂ eq (European annual emission allocation)	431 Mt CO ₂ eq (European annual emission allocation) (2013/162/E U)	(V)	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	14% (GHG-2005) (I) (2009/406/EC)	38% (GHG-2005) (I) (2018/842)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(V)	100% (III) (Bündnis 90/Die Grünen, 2016)	100% (III) (Bündnis 90/Die Grünen, 2016)	100% (III) (Bündnis 90/Die Grünen, 2016)
Renewables targets (energy; % of final energy consumption)	(V)	(V)	(V)	(V)	(V)
Renewables targets (electricity; % of final energy consumption)	30%; 194 TWh; 108 GW (EUROSTAT , 2018)	+100% (2013) (IV) (Bündnis 90/Die Grünen, 2013)	100% (IV) (Bündnis 90/Die Grünen, 2016, 2018)	100% (IV)	100% (IV)
Intermittent renewables	117 TWh; 90 GW (EUROSTAT , 2018)	>> 2016 (V)	>> 2020 (V)	> 2030 (V)	(V)
Wind onshore	79 TWh; 50 GW (EUROSTAT , 2018)	≥ +5 GW per year (IV) (Bündnis 90/Die Grünen, 2019b)	≥ +5 GW per year (IV) (Bündnis 90/Die Grünen, 2019b)	(V)	(V)
Wind offshore	included above	6-8 GW (Kabel, 2018)	20 GW in 2030 and 30 GW in 2035 (Kabel, 2018)	(V)	(V)
Solar PV	38 TWh; 41 GW (EUROSTAT , 2018)	≥ +5 GW per year (mainly decentral) (IV)(Bündnis 90/Die Grünen, 2019b)	≥ +5 GW per year (mainly decentral) (IV) (Bündnis 90/Die Grünen, 2019b)	(V)	(V)

DE: Grassroot	2016	2020	2030	2040	2050
Dispatchable renewables	77 TWh; 18 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Biomass	45 TWh; 7 GW (EUROSTAT , 2018)	≥ 2016 (IV) (sustainable) (Bündnis 90/Die Grünen, 2011); 25% (Biomass with mini-CHP) (Bündnis 90/Die Grünen, 2013)	≥ 2020 (IV) (sustainable) (Bündnis 90/Die Grünen, 2011); ≥ z2020 (Biomass with mini-CHP) (IV) (Bündnis 90/Die Grünen, 2013)	≥ 2030 (IV) it (sustainable) (Bündnis 90/Die Grünen, 2011); ≥ 2030 (Biomass with mini-CHP) (IV) (Bündnis 90/Die Grünen, 2013)	≥ 2040 (V) it (sustainable) (Bündnis 90/Die Grünen, 2011); ≥ 2040 (Biomass with mini-CHP) (IV) (Bündnis 90/Die Grünen, 2013)
Hydro	26 TWh; 5 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
CSP	0 TWh; 0 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Other renewables	6 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	≥ 2016 (IV) As local as possible (Bündnis 90/Die Grünen, 2013)	≥ 2016 (IV) As local as possible (Bündnis 90/Die Grünen, 2013)	(V) ≥ 2016 (IV) As local as possible (Bündnis 90/Die Grünen, 2013)	≥ 2016 (IV) As local as possible (Bündnis 90/Die Grünen, 2013)
Statistical transfer of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Explicit trade of CSP or hydropower	(V)	Trade hydropower from Scandinavia and the Alps (III) (Bündnis 90/Die Grünen, 2013)	Trade hydropower from Scandinavia and the Alps (III) (Bündnis 90/Die Grünen, 2013)	Trade hydropower from Scandinavia and the Alps (III) (Bündnis 90/Die Grünen, 2013)	Trade hydropower from Scandinavia and the Alps (III) (Bündnis 90/Die Grünen, 2013)
Nuclear	85 TWh; 11GW (EUROSTAT , 2018)	(V)	In 2023: 0 (I) (AtG, 2017)	0 (I) (AtG, 2017)	0 (I) (AtG, 2017)
Fossil fuels	371 TWh; 96GW (EUROSTAT , 2018)	(V)	0 (III) (Bündnis 90/Die Grünen, 2010)	0 (III) (Bündnis 90/Die Grünen, 2010)	0 (III) (Bündnis 90/Die Grünen, 2010)

DE: Grassroot	2016	2020	2030	2040	2050
CCS	0	0 (III) (Bündnis 90/Die Grünen, 2009)	0 (III) (Bündnis 90/Die Grünen, 2009)	0 (III) (Bündnis 90/Die Grünen, 2009))	0 (III) (Bündnis 90/Die Grünen, 2009))
Lignite	150 TWh (EUROSTAT , 2018)	By 2022: at least -3 GW (2017) (III) (Bündnis 90/Die Grünen, 2019a)	0 (III) (Bündnis 90/Die Grünen, 2010)	0 (III) (Bündnis 90/Die Grünen, 2010)	0 (III) (Bündnis 90/Die Grünen, 2010)
Hard coal	112 TWh (EUROSTAT , 2018)	By 2022: at least -4 GW (2017) (III) (Bündnis 90/Die Grünen, 2019a)	0 (III) (Bündnis 90/Die Grünen, 2010)	0 (III) (Bündnis 90/Die Grünen, 2010)	0 (III) (Bündnis 90/Die Grünen, 2010)
Gas	94 TWh (EUROSTAT , 2018)	(V); 25% (Decentralise d mini-CHP with gas) (III) CHP electricity (Bündnis 90/Die Grünen, 2013)	0 (III) (Bündnis 90/Die Grünen, 2010); Micro CHP only with renewable gas (Bündnis 90/Die Grünen, 2013)	0 (III) (Bündnis 90/Die Grünen, 2010)	0 (III) (Bündnis 90/Die Grünen, 2010)
Petroleum	5 TWh (EUROSTAT , 2018)	< 2016 (V)	0	0	0
Other non-renewables	10 TWh (EUROSTAT , 2018)	< 2016 (V)	0	0	0
Storage	(V)	(V)	(V)	(V)	(V)
Battery	(V)	100,000 batteries (decentralised) (IV) (Bündnis 90/Die Grünen, 2016)	>> 2020 (V)	> 2030 (V)	(V)
Pumped Hydropower	(V)	(V)	(V)	(V)	(V)
Other storage	(V)	Emphasis on Power to gas (Wind gas) (Sterner <i>et al.</i> , 2015) & Power to Heat (Bündnis 90/Die Grünen, 2010)	>> 2020 (V)	> 2030 (V)	(V)

DE: Grassroot	2016	2020	2030	2040	2050
Cross-border interconnection NTC	(V)	Less additions than dominant pathway (Bündnis 90/Die Grünen, 2013) Super-Smart grid (Grünen, 2011)	Sustainable cross-border connection (no import of nuclear electricity) (Bündnis 90/Die Grünen, 2013)	(V)	(V)
Electrification of additional sectors	(V)	> 2016 (V)	> 2020 (V)	> 2030 (V)	> 2040 (V)
Total heating demand incl. non-electric heating	(V)	<< 2016 (III) (Bündnis 90/Die Grünen, 2017a)	<< 2020 (III) (Bündnis 90/Die Grünen, 2017a)	<< 2030 (III) (Bündnis 90/Die Grünen, 2017a)	<< 2040 (III) (Bündnis 90/Die Grünen, 2017a)
Heating with electricity	(V)	25% RES-H (III) (Bündnis 90/Die Grünen, 2013)	(V)	-100% (GHG-1990) (III) (Bündnis 90/Die Grünen, 2013)	(V)
Total cooling demand incl. non-electric cooling	(V)	<< 2016 (III) (Bündnis 90/Die Grünen, 2017a)	<< 2020 (III) (Bündnis 90/Die Grünen, 2017a)	<< 2030 (III) (Bündnis 90/Die Grünen, 2017a)	<< 2040 (III) (Bündnis 90/Die Grünen, 2017a)
Cooling with electricity	(V)	< 2016 (III) (Bündnis 90/Die Grünen, 2017a)	<< 2020 (III) (Bündnis 90/Die Grünen, 2017a)	< 2030 (III) (Bündnis 90/Die Grünen, 2017a)	< 2040 (III) (Bündnis 90/Die Grünen, 2017a)
Electric mobility	(V)	>> 2016 (IV) (Kühn & Özdemir, 2019)	>> 2020 (IV) (Kühn & Özdemir, 2019) Ban on new ICE vehicles (IV) (Bündnis 90/Die Grünen, 2017b)	>> 2030 (V) (Bündnis 90/Die Grünen, 2017b)	> 2040(V)
EV chargers	(V)	>> 2016 (IV) (Kühn & Özdemir, 2019)	>> 2020 (IV) (Kühn & Özdemir, 2019)	> 2030 (V)	> 2040 (V)
Gross electricity consumption	649 TWh (EUROSTAT, 2018)	(V)	(V)	(V)	(V)
Final energy consumption	(V)	(V)	(V)	(V)	50% (PE-2017) (Bündnis 90/Die Grünen, 2017a)

S 3.4 Minority pathway: market-centred (Freie Demokratische Partei)

Table 13: Quantification of the German market-centred minority policy pathway as described by the Freie Demokratische Partei.

DE: Market	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	894 Mt CO _{2eq} (EEA, 2018)	(V)	40% (GHG-1990) (IV) (FDP, 2017b)	(V)	80% (GHG-1990) (IV) (or EU-Goals if higher) (FDP, 2017b)
ETS sector reduction targets	474 Mt CO _{2eq} (European emission allocation)	Mt CO _{2eq} (European emission allocation) (2013/162/EU)	(V)	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	14% (GHG-2005) (2009/406/EC)	38% (GHG-2005) (I) (2018/842)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)
Renewables targets (energy; % of final energy consumption)	(V)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)
Renewables targets (electricity; % of final energy consumption)	30% 194 TWh 108 GW (EUROSTAT, 2018)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)
Intermittent renewables	117 TWh; 90 GW (EUROSTAT, 2018)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)	(IV) No sector-specific goals (FDP, 2017a)
Wind onshore	79 TWh; 50 GW (EUROSTAT, 2018)	< less expansion than dominant: strict regulation to reduce available areas (10x height) (FDP, 2017a)	(V) No technology specific goals (FDP, 2017a)	(V) No technology specific goals. (FDP, 2017a)	(V) No technology specific goals. (FDP, 2017a)
Wind offshore	included above	(V) No technology specific goals. (FDP, 2017a)	(V) No technology specific goals. (FDP, 2017a)	(V) No technology specific goals. (FDP, 2017a)	(V) No technology specific goals. (FDP, 2017a)
Solar PV	38 TWh; 41 GW (EUROSTAT, 2018)	(V) No technology specific goals. (FDP, 2017a)	(V) No technology specific goals. (FDP, 2017a)	(V) No technology specific goals. (FDP, 2017a)	(V) No technology specific goals. (FDP, 2017a)

DE: Market	2016	2020	2030	2040	2050
Dispatchable renewables	77 TWh; 18 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Biomass	45 TWh; 7 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Hydro	26 TWh; 5 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
CSP	0 TWh; 0 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Other renewables	6 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	> 2016 (IV) (FDP, 2017a)	> 2020 (IV) (FDP, 2017a)	> 2030 (IV) (FDP, 2017a)	> 2040 (IV) (FDP, 2017a)
Statistical transfer of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Explicit trade of CSP or hydropower	(V)	in favour of DESERTEC (IV) (FDP, 2013)	(V)	(V)	(V)
Nuclear	85 TWh; 11 GW (EUROSTAT , 2018)	(V)	By 2023: 0 (I) (AtG, 2017; FDP, 2017a)	By 2023: 0 (I) (AtG, 2017) (FDP, 2017a)	By 2023: 0 (I) (AtG, 2017) (FDP, 2017a)
Fossil fuels	371 TWh; 96 GW (EUROSTAT , 2018)	(V)	(V)	(V)	>0 (III) (FDP, 2017a)
CCS	0	(V)	(V)	(V)	(V)
Lignite	150 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	> 0 (III) (FDP NRW, 2016)
Hard coal	112 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Gas	94 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Petroleum	5 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Other non-renewables	10 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Storage	(V)	(V)	(V)	(V)	(V)
Battery	(V)	(V)	(V)	(V)	(V)
Pumped Hydropower	(V)	(V)	(V)	(V)	(V)
Other storage	(V)	(V)	(V)	(V)	(V)
Cross-border interconnection NTC	(V)	> 2016 (IV) (FDP, 2017a)	> 2020 (IV) (FDP, 2017a)	> 2030 (IV) (FDP, 2017a)	> 2040 (IV) (FDP, 2017a)

DE: Market	2016	2020	2030	2040	2050
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	(V)	(V)	(V)	(V)
Heating with electricity	(V)	(V)	(V)	(V)	(V)
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity	(V)	(V)	(V)	(V)	(V)
Electric mobility	(V)	(V)	(V)	(V)	(V)
EV chargers	(V)	(V)	(V)	(V)	(V)
Gross electricity consumption	649 TWh (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
Final energy consumption	(V)	(V)	(V)	(V)	(V)

S 4 Italy

S 4.1 Representative organisations

Italy has a broad spectrum of parties with different perspectives on energy policy. In the parliament and the senate, majorities usually follow a pattern centre-right or centre-left. After five years with a centre-left parliament and senate, the general elections of 2018 saw the emergence of the catch-all and protest-party *Movimento Cinque Stelle* (M5S). This disrupted the usual change pattern between left and right governments with a new governing alliance between the M5S and the right-wing party *Lega*.

Table 14: Main parties (>3%) currently represented in the Italian parliament (2018; Source: Italian Ministry of the Interior).

Party	Senate election 2018
<i>Movimento Cinque Stelle</i>	32.2%
<i>Partito Democratico</i>	19.1%
<i>Lega</i>	17.6%
<i>Forza Italia</i>	14.4%
<i>Fratelli D'Italia</i>	4.3%
<i>Liberi e Uguali</i>	3.3%

In this deliverable, we describe the pathways for the parties with an explicit energy and climate strategy following one of the ideal-typical logics described above. The dominant pathway is based on the Italian draft NECP (NECP IT, 2018), which is very similar to the Democratic Party's Energy Strategy 2017 (SEN, 2017), with a few elements of bottom-up development, such as decentralised PV and self-consumption added (inserted by the sitting M5S-led government); hence, we attribute the dominant pathway to the previous government (until 2018), led by PD. The M5S, which is currently (August 2019) the strongest party in the parliament and leading the government (see Table 14), has a very explicit energy vision, based on decentralisation and citizen control. As M5S has not yet been able to implement this vision in actual energy policies, we position this pathway as a grassroot minority pathway. The government coalition partner of M5S, *Lega*, has a similar but less explicit energy position, and is not included here. *Forza Italia* may (and have been in the past) be part of a future government coalition, but it has no distinct, well-described energy policy position, and we do not include its strategy here.

S 4.2 Dominant pathway: state-centred (Partito Democratico)

Table 15: Quantification of the Italian state-centred dominant policy pathway as described by currently valid policies of the Gentiloni government of the Partito Democratico.

IT: Dominant	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	397 Mt CO _{2eq} (EEA, 2018)	(V)	(V)	< 2030 (II) (SEN, 2017)	-100% (III) (1990) (NECP IT, 2018)
ETS sector reduction targets	311 Mt CO _{2eq} (European annual emission allocation)	299 Mt CO _{2eq} (European annual emission allocation) (I) (2013/162/EU)	57% (GHG-2005) (II) (SEN, 2017)	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	13% (GHG-2005) (I) (2009/406/EC)	33% (GHG-2005) (II) (SEN, 2017)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	(V)	(V)	(V)	(V)
Renewables targets (energy; % of final energy consumption)	(V)	17% (I) (D.Lgs. 3 March 2011 n.28, 2011)	>30% (III) (NECP IT, 2018)	> 2030 (II) (RSE, 2018)	>> 2030 (II) (RSE, 2018)
Renewables targets (electricity; % of final energy consumption)	38% 110 TWh 52 GW (EUROSTAT, 2018)	(V)	55.4% (III) (187 TWh) (NECP IT, 2018)	> 2030 (II) (SEN, 2017)	>> 2030 (II) (SEN, 2017)
Intermittent renewables	40 TWh; 29 GW (EUROSTAT, 2018)	(V)	68.4 GW (III) (NECP IT, 2018)	(V)	(V)
Wind onshore	18 TWh; 9 GW (EUROSTAT, 2018)	18 TWh (II) (RSE, 2018)	38 TWh (II) (RSE, 2018); 17.5 GW (III) (NECP IT, 2018)	> 2030 (II) (SEN, 2017)	> 2040 (II) (SEN, 2017)
Wind offshore	included above	0 TWh (II) (RSE, 2018)	2 TWh (II) (RSE, 2018); 900 MW (III) (NECP IT, 2018)	(V)	(V)
Solar PV	22 TWh; 19 GW (EUROSTAT, 2018)	27 TWh (II) (SEN, 2017)	69 TWh (mainly decentral) (II) (RSE, 2018); 50 GW (III) (NECP IT, 2018)	> 2030 (II) (SEN, 2017)	>> 2030 (II) (SEN, 2017)
Dispatchable renewables	70 TWh; 24 GW (EUROSTAT, 2018)	(V)	24.8 GW (V)	≥ 2030 (V)	≥ 2030 (V)

IT: Dominant	2016	2020	2030	2040	2050
Biomass	17 TWh; 2 GW (EUROSTAT , 2018)	16 TWh (II) (SEN, 2017)	15 TWh (II) (RSE, 2018); 3.7 GW (III) (NECP IT, 2018)	= 2030 (V)	= 2030 (V)
Hydro	44 TWh; 15 GW (EUROSTAT , 2018)	49 TWh (II) (SEN, 2017)	50 TWh (II) (RSE, 2018); 19.2 GW (III) (NECP IT, 2018)	> 2030 (V)	> 2030 (V)
CSP	0 TWh; 0 GW (EUROSTAT , 2018)	0 TWh (II) (RSE, 2018)	3 TWh (II) (RSE, 2018); 880 MW (III) (NECP IT, 2018)	≥ 2030 (V)	≥ 2030 (V)
Other renewables	9 TWh (EUROSTAT , 2018); 815 MW (NECP IT, 2018)	7 TWh (Geothermal) (II) (SEN, 2017)	7 TWh (II) (RSE, 2018); 950 MW (Geothermal) (III) (NECP IT, 2018)	= 2030 (V)	= 2030 (V)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)	(V)	> 2016 (I) (D.Lgs. 3 March 2011 n.28, 2011)	> 2016 (I) (D.Lgs. 3 March 2011 n.28, 2011)	> 2016 (I) (D.Lgs. 3 March 2011 n.28, 2011)	> 2016 (I) (D.Lgs. 3 March 2011 n.28, 2011)
Statistical transfer of renewables (cooperation)	(V)	(V)	(V)	(V)	(V)
Explicit trade of CSP or hydropower	(V)	(V)	(V)	(V)	(V)
Nuclear	0 TWh; 0 GW (EUROSTAT , 2018)	0 (II) (RSE, 2018)	0 (II) (RSE, 2018)	0 (II) (RSE, 2018)	0 (II) (RSE, 2018)
Fossil fuels	180 TWh; 62 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
CCS	0	0 (II) (RSE, 2018)	0 (II) (RSE, 2018)	0 (II) (RSE, 2018)	0 (II) (RSE, 2018)
Lignite	0 TWh (EUROSTAT , 2018)	0 (II) (RSE, 2018)	0 (II) (RSE, 2018)	0 (II) (RSE, 2018)	0 (II) (RSE, 2018)
Hard coal	36 TWh (EUROSTAT , 2018)	37 TWh (II) (RSE, 2018)	By 2026: 0 TWh (III) (NECP IT, 2018)	0 (II) (SEN, 2017)	0 (II) (SEN, 2017)
Gas	129 TWh (EUROSTAT , 2018)	117 TWh (II) (RSE, 2018)	118 TWh (II) (SEN, 2017)	< 2030 (II) (SEN, 2017)	<< 2030 (II) (SEN, 2017)
Petroleum	10 TWh (EUROSTAT , 2018)	2 TWh (II) RSE2017	2 TWh (II) (SEN, 2017)	0 (II) (SEN, 2017)	0 (II) (SEN, 2017)
Other non-renewables	5 TWh (EUROSTAT , 2018)	2 TWh (Waste) (II) (RSE, 2018)	2 TWh (Waste) (II) (RSE, 2018)	(V)	(V)
Storage	(V)	(V)	(V)	(V)	(V)
Battery	(V)	(V)	(V)	(V)	(V)

IT: Dominant	2016	2020	2030	2040	2050
Pumped Hydropower	(V)	> 2016 (II) (SEN, 2017)	> 2016 (II) (SEN, 2017)	> 2016 (II) (SEN, 2017)	> 2016 (II) (SEN, 2017)
Other storage	(V)	(V)	(V)	(V)	(V)
Cross-border interconnection NTC	(V)	= in 2018 (I) (D.Lgs. 3 March 2011 n.28, 2011)	≥ 2020 (II) (SEN, 2017)	≥ 2020 (II) (SEN, 2017)	≥ 2020 (II) (SEN, 2017)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)
Total heating demand incl. non-electric heating	(V)	< 2016 (I) (D.Lgs.4 July 2014 n. 102)	< 2020 (V)	< 2030 (V)	< 2040 (V)
Heating with electricity	(V)	1.18 TWh (II) (RSE, 2018)	1.39 TWh (II) (RSE, 2018)	1.51 TWh (II) (RSE, 2018)	1.74 TWh (II) (RSE, 2018)
Total cooling demand incl. non-electric cooling	(V)	< 2016 (I) (D.Lgs.4 July 2014 n. 102)	< 2020 (V)	< 2030 (V)	< 2040 (V)
Cooling with electricity	(V)	1.84 TWh (II) (RSE, 2018)	2.31 TWh (II) (RSE, 2018)	2.76 TWh (II) (RSE, 2018)	3.22 TWh (II) (RSE, 2018)
Electric mobility	(V)	> 2016 (II) (SEN, 2017)	6 Mio EV (of which 1.6 Mio BEV) (III) (NECP IT, 2018)	> 2030 (V)	>> 2030 (V)
EV chargers	(V)	(V)	(V)	(V)	(V)
Gross electricity consumption	290 TWh (EUROSTAT , 2018)	294 TWh (III) (NECP IT, 2018)	337.3 TWh (III) (NECP IT, 2018)	> for 2030 (II) (SEN, 2017)	> 350 TWh (II) (SEN, 2017)
Final energy consumption	(V)	1353.7 TWh (III) (NECP IT, 2018)	1207.2 TWh (III) (NECP IT, 2018)	(V)	(V)

S 4.3 Minority pathway: grassroot-centred (Movimento Cinque Stelle)

Table 16: Quantification of the Italian grassroots-centred minority policy pathway as described by Movimento Cinque Stelle (in the government coalition since 2018).

IT: Grassroots	2016	2020	2030	2040	2050
GHG reduction targets (economy-wide)	397 Mt CO ₂ eq (EEA, 2018)	(V)	(V)	(V)	(V)
ETS sector reduction targets	311 Mt CO ₂ eq (European annual emission allocation) (2013/162/EU)	299 Mt CO ₂ eq (European annual emission allocation) (2013/162/EU)	(V)	(V)	(V)
Non-ETS sectors emission reduction targets	(V)	13% (GHG-2005) (I) (2009/406/EC)	33% (GHG-2005) (I) (2018/842)	(V)	(V)
GHG reduction targets (electricity sector)	(V)	> 2016 (III) (M5S, 2017)	> 2020 (III) (M5S, 2017)	>> 2020 (III) (M5S, 2017)1	100% (III) (M5S, 2017)
Renewables targets (energy; % of final energy consumption)	(V)	17% (I) (D.Lgs. 3 March 2011 n.28, 2011)	(V)	(V)	(V)
Renewables targets (electricity; % of final energy consumption)	38% 110 TWh 52 GW (EUROSTAT, 2018)	> 2016 (III) (M5S, 2017)	>> 2016 (III) (M5S, 2017)	>> 2016 (III) (M5S, 2017)	100% (III) (M5S, 2017)
Intermittent renewables	40 TWh; 29 GW (EUROSTAT, 2018)	(V)	(V)	(V)	(V)
Wind onshore	18 TWh; 9 GW (EUROSTAT, 2018)	8.96 GW; +3.4% per year from 2021 to 2050 (III) (M5S, 2017)	+3.4% per year (III) (M5S, 2017)	+3.4% per year (III) (M5S, 2017)	≥ 45 TWh (III) (M5S, 2017)
Wind offshore	included above	(V)	(V)	(V)	(V)
Solar PV	22 TWh; 19 GW (EUROSTAT, 2018)	20.06 GW; +9.3% per year from 2021 to 2050, (mainly decentral) (III) (M5S, 2017)	+9.3% per year (mainly decentral) (III) (M5S, 2017)	+9.3% per year (mainly decentral) (III) (M5S, 2017)	73% of the power mix, 420 TWh (III) (M5S, 2017)
Dispatchable renewables	70 TWh; 24 GW (EUROSTAT, 2018)	(V)	(V)	(V)	(V)
Biomass	17 TWh; 2 GW (EUROSTAT, 2018)	23 GWh (III) (M5S, 2017)	+0.8% per year from 2021 to 2050 (III) (M5S, 2017)	+0.8% per year (III) (M5S, 2017)	30 TWh (III) (M5S, 2017)

IT: Grassroots	2016	2020	2030	2040	2050
Hydro	44 TWh; 15 GW (EUROSTAT , 2018)	= 2016 (III) (M5S, 2017)	+1% per year from 2021 to 2050 (III) (M5S, 2017)	+1% per year (III) (M5S, 2017)	+70 TWh (2017) (III) (M5S, 2017)2
CSP	0 TWh; 0 GW (EUROSTAT , 2018)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)
Other renewables	9 TWh (EUROSTAT , 2018)	7 TWh (Geothermal) (III) (M5S, 2017)	8 TWh (Geothermal) (III) (M5S, 2017)	8-12 TWh (Geothermal) (III) (M5S, 2017)	12 TWh (Geothermal) (III) (M5S, 2017)
Traded renewables	(V)	(V)	(V)	(V)	(V)
Physical import of renewables (cooperation)		(V)	(V)	(V)	(V)
Statistical transfer of renewables (cooperation)		(V)	(V)	(V)	0 (III) (M5S, 2017)0
Explicit trade of CSP or hydropower		(V)	(V)	(V)	(V)
Nuclear	0 TWh; 0 GW (EUROSTAT , 2018)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)
Fossil fuels	180 TWh; 62 GW (EUROSTAT , 2018)	(V)	(V)	(V)	(V)
CCS	0	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)
Lignite	0 TWh (EUROSTAT , 2018)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)
Hard coal	36 TWh (EUROSTAT , 2018)	43 TWh (III) (M5S, 2017)	0 TWh (III) (M5S, 2017)	0 TWh (III) (M5S, 2017)	0 TWh (III) (M5S, 2017)
Gas	129 TWh (EUROSTAT , 2018)	94 TWh (III) (M5S, 2017)	110 TWh (III) (M5S, 2017)	<< 2030 (III) (M5S, 2017)	0 TWh(III) (M5S, 2017)
Petroleum	10 TWh (EUROSTAT , 2018)	2% of total electricity prod. (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)
Other non-renewables	5 TWh (EUROSTAT , 2018)	3 TWh (Waste) (III) (M5S, 2017)	0 (Waste) (III) (M5S, 2017)	0 (Waste) (III) (M5S, 2017)	0 (Waste) (III) (M5S, 2017)
Storage	(V)	(V)	(V)	(V)	(V)
Battery	(V)	= 2016 (III) (M5S, 2017)	> 2020 (III) (M5S, 2017)	> 2020 (III) (M5S, 2017)	> 2020 (III) (M5S, 2017)
Pumped Hydropower	(V)	≤ 2016 (III) (M5S, 2017)	≤ 2016 (III) (M5S, 2017)	≤ 2016 (III) (M5S, 2017)	≤ 2016 (III) (M5S, 2017)
Other storage	(V)	(V)	(V)	(V)	(V)
Cross-border interconnection NTC	(V)	> 2016 (I) (D.Lgs. 3 March 2011 n.28, 2011)	~ 2020 (III) (M5S, 2017)	~ 2020 (III) (M5S, 2017)	~ 2020 (III) (M5S, 2017)
Electrification of additional sectors	(V)	(V)	(V)	(V)	(V)

IT: Grassroots	2016	2020	2030	2040	2050
Total heating demand incl. non-electric heating	(V)	< 2016 (I) (D.Lgs.4 July 2014 n. 102); 1035 TWh (III) (M5S, 2017)	791 TWh (III) (M5S, 2017)	547 TWh (III) (M5S, 2017)	279 TWh (III) (M5S, 2017)
Heating with electricity	(V)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)	0 (III) (M5S, 2017)
Total cooling demand incl. non-electric cooling	(V)	(V)	(V)	(V)	(V)
Cooling with electricity	(V)	(V)	(V)	(V)	(V)
Electric mobility	(V)	2% (III) (M5S, 2017)	> 2020 (III) (M5S, 2017)	>> 2030 (III) (M5S, 2017)	90% (III) (M5S, 2017)
EV chargers	(V)	(V)	(V)	(V)	(V)
Gross electricity consumption	290 TWh (EUROSTAT, 2018)	285 TWh (III) (M5S, 2017)	385 TWh (III) (M5S, 2017)	485 TWh (III) (M5S, 2017)	580 TWh (III) (M5S, 2017)
Final energy consumption	(V)	(V)	(V)	(V)	(V)

S 5 References to the supplementary material

- 2009/406/EC Effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020, in: <http://data.europa.eu/eli/dec/2009/406/oj>.
- 2013/162/EU Annual emission allocations for the period from 2017 to 2020, in: *ELI*: <http://data.europa.eu/eli/dec/2017/1471/oj>
- 2015/82/COM (2015). *Energy Union Package. Achieving the 10% electricity interconnection target Making Europe's electricity grid fit for 2020.*
- 2018/842 Binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, in: <http://data.europa.eu/eli/reg/2018/842/oj>.
- 2018/2001/EC On the promotion of the use of energy from renewable sources, in.
- ADEME (2016). *A 100% renewable electricity mix? Analysis and optimisation.* Angers.
- ADEME (2018). *A 100% renewable gas mix in 2050?* Angers.
- AFP (2017). France: la baisse à 50% du nucléaire repoussée, colère contre Hulot. from <https://www.publicsenat.fr/article/politique/france-la-baisse-a-50-du-nucleaire-repousse-colere-contre-hulot-79536>.
- AFP & Sciences et Avenir (2018). *Energies renouvelables : Jadot (EELV) propose 100 milliards d'euros par an pour l'Europe.*
- AGEE (2018). *Energy Consumption in Germany in 2017.* Berlin, Working Group on Energy Balances (Energy Balances Group).
- Aliot, L. (2018). Faisons barrage à la mainmise sur notre énergie hydraulique ! , from <https://www.rassemblementnational.fr/communiques/faisons-barrage-a-la-mainmise-sur-notre-energie-hydraulique/>.
- Astier, M. (2017). *Le programme Environnement de Marine Le Pen : pour les voitures et pour le nucléaire.*
- AtG (2017). *ATG "Atomgesetz in der Fassung der Bekanntmachung vom 15. Juli 1985 (BGBl. I S. 1565), das zuletzt durch Artikel 2 Absatz 2 des Gesetzes vom 20. Juli 2017 (BGBl. I S. 2808) geändert worden ist".* Bonn, Bundesministeriums der Justiz und für Verbraucherschutz.
- Barroux, R. (2016). *Ecologie : Marine Le Pen repeint le vert en bleu-blanc-rouge.*
- BMUB (2016). *Climate Action Plan 2050 - Principles and goals of the German government's climate policy.* Berlin, Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety.
- BMWi (2015). *Energy Efficiency Strategy for BuildingsMethods for achieving a virtually climate-neutral building stock.* Berlin, Federal Ministry for Economic Affairs and Energy (BMWi).
- BMWi and BMU (2010). *Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply,* Federal Ministry of Economics and Technology (BMWi) & Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).
- BNA (2017). *Bedarfsermittlung 2017-2030 Bestätigung Netzentwicklungsplan Strom.* Bonn, Bundesnetzagentur.
- BNA (2018). *Genehmigung des Szenariorahmens 2019-2030.* Bonn, Bundesnetzagentur.
- Brezet, G. (2017a). *Energie: les plans d'investissement d'Emmanuel Macron.*
- Brezet, G. (2017b). *Marine Le Pen et Nicolas Dupont-Aignan : nucléaire, thorium et isolation.*
- Bundeswahlleiter (2017). *2017 Bundestag Election: final result - Press release no. 34/17 of October 12, 2017.* Berlin, https://www.bundeswahlleiter.de/info/presse/mitteilungen/bundestagswahl-2017/34_17_endgueltigesergebnis.html.
- Bündnis 90/Die Grünen (2009). *Klare Regelungen für CCS-Technik – Vorrang für erneuerbare Energien: Positionspapier zur CCS (Carbon Capture und Storage) Technologie.* Berlin Deutscher Bundestag, Fraktionsbeschluss 3. März 2009.
- Bündnis 90/Die Grünen (2010). *Energiekonzept 2050: sicher erneuerbar.* Berlin, Bündnis 90/Die Grünen, Bundestagsfraktion.
- Bündnis 90/Die Grünen (2011). *Stoffliche und energetische Nutzung von Biomasse.* Berlin, Bündnis 90/Die Grünen Bundestagsfraktion.

- Bündnis 90/Die Grünen (2013). *Fraktionsbeschluss - Die Energiewende weiterdenken*. Weimar, Bündnis 90/Die Grünen Bundestagsfraktion.
- Bündnis 90/Die Grünen (2016). *Fraktionsbeschluss - Grün für Bürgerenergie*. Berlin, Bündnis 90/Die Grünen Bundestagsfraktion.
- Bündnis 90/Die Grünen (2017a). *Antrag - Klimaschutz stärken – Energiesparen verbindlich machen*. Berlin, Deutscher Bundestag, Drucksache 18/12095.
- Bündnis 90/Die Grünen (2017b). *Fraktionsbeschluss - Grünes Wirtschaften für mehr Lebensqualität - Eckpunkte für eine ökologische Modernisierung der Wirtschaft*. Berlin, Bündnis 90/Die Grünen Bundestagsfraktion.
- Bündnis 90/Die Grünen (2018). *Wirksames Klimaschutzgesetz vorlegen – Maßnahmen und Regelungen für alle Sektoren*. Berlin, Deutscher Bundestag Drucksache 19/6103.
- Bündnis 90/Die Grünen (2019a). *Entwurf eines Ersten Gesetzes zur Beendigung des Betriebs von Kohlekraftwerken zur Stromerzeugung (Kohlekraftwerk-Sofortmaßnahme-Gesetz)*. Berlin, Deutscher Bundestag Drucksache 19/9920.
- Bündnis 90/Die Grünen (2019b). *Klimaschutz: Was jetzt zu tun ist - Sofortprogramm für den Sommer 2019*. Berlin, Web: https://www.gruene-bundestag.de/fileadmin/media/gruenebundestag_de/themen_az/klimaschutz/pdf/190628_Klimaschutz-Sofortprogramm-Sommer-2019.pdf.
- CDU/CSU/SPD (2018). Ein neuer Aufbruch für Europa - Eine neue Dynamik für Deutschland -Ein neuer Zusammenhalt für unser Land - Koalitionsvertrag zwischen CDU, CSU und SPD - Entwurf in der Version vom 7.2. 2018, in: (Ed.). Berlin, CDU/CSU/SPD.
- Coatify, M. (2018). Après la SNCF, Macron brade notre parc hydroélectrique, joyau de notre indépendance énergétique. from <https://murielcoatify.fr/2018/04/11/apres-la-sncf-macron-brade-notre-parc-hydroelectrique-joyau-de-notre-independance-energetique/>.
- D.Lgs.4 July 2014 n. 102 *Attuazione della direttiva 2009/28/CE sulla promozione dell'uso dell'energia da fonti rinnovabili, recante modifica e successive abrogazione delle direttive 2001/77/CE e 2003/30/CE*. Rome, Gazz. Uff. 13 gennaio 2017, no 10.
- D.Lgs. 3 March 2011 n.28 (2011). *Attuazione della direttiva 2009/28/CE sulla promozione dell'uso dell'energia da fonti rinnovabili, recante modifica e successive abrogazione delle direttive 2001/77/CE e 2003/30/CE*, Gazz. Uff. 28 marzo 2011, n. 71 S.O.
- De Ravignan, A. (2018). Climat : Macron en marche arrière. from <https://www.alternatives-economiques.fr/climat-macron-marche-arriere/00085896>.
- Dupin, L. (2017). *Présidentielle 2017 : Emmanuel Macron Et Marine Le Pen Proposent Deux Énergies Différentes Pour La France*.
- Durox, A. (2018). Non aux éoliennes à la Croix-en-Brie. from <https://rassemblement-national77.fr/2018/09/non-aux-eoliennes-a-la-croix-en-brie/>.
- EEA (2018). Air pollutants by source sector (source: EEA) (env_air_emis) in: <https://ec.europa.eu/eurostat/web/environment/air-emissions-inventories/database>.
- EEG (2017). *Gesetz für den Ausbau erneuerbarer Energien (Erneuerbare-Energien-Gesetz - EEG 2017)*. Berlin, Bundestag.
- EELV (2012). *La transition énergétique : comment?*
- EELV (2018a). Développement des énergies renouvelables : comment ? , from <http://energie.eelv.fr/la-transition-energetique/comment/developpement-des-energies-renouvelables-comment/>.
- EELV (2018b). Émissions CO2 : des objectifs ambitieux pour des voitures moins polluantes. from <https://europeecologie.eu/emissions-co2-des-objectifs-ambitieux-pour-des-voitures-propres>.
- EELV (2018c). *Programmation pluriannuelle de l'énergie. Les écologistes dénoncent un débat tronqué et rappellent la pertinence de leurs propositions : sobriété, énergies renouvelables, sortie du nucléaire*.
- EEWärmeG (2008). *Erneuerbare-Energien-Wärmegesetz vom 7. August 2008*. Berlin, Bundestag.
- En Marche (2017). Le programme d'Emmanuel Macron pour l'environnement et la transition écologique. from <https://en-marche.fr/emmanuel-macron/le-programme/environnement-et-transition-ecologique>.
- En Marche (2018). Qui peut encore croire que nous ne faisons rien pour l'environnement ? , from <https://en-marche.fr/articles/actualites/ce-que-nous-faisons-pour-l-environnement>.
- Energie Plus (2017). *Transition energetique le programme de M. Macron*.

- ETL (2015). *Loi relative à la transition énergétique pour la croissance verte* ("energy transition law"). **2015-992.**
- EUROSTAT, 2018. *Generation [TWH]: Supply, transformation and consumption of electricity - annual data [nrg_105a] and Capacities [GW]: Infrastructure - electricity - annual data [nrg_113a]*, Luxembourg, doi:
- FDP (2013). *Bürgerprogramm 2013 - Damit Deutschland stark bleibt. Nur mit uns.* Berlin, Freie Demokratische Partei Bundesgeschäftsstelle.
- FDP (2017a). *Denken wir neu. Das Programm der Freien Demokraten zur Bundestagswahl 2017: "Schauen wir nicht länger zu".* Berlin, FDP-Bundesgeschäftsstelle.
- FDP (2017b). *Ergänzende Beschlüsse zum Wahlprogramm.* Berlin, Bundesvorstand der FDP.
- FDP NRW (2016). *Verlässliche Rahmenbedingungen für das Rheinische Revier – auf vorzeitigen Braunkohleausstieg und Verkleinerung des Tagebaus Garzweiler II verzichten.* Düsseldorf, FDP Landtagsfraktion Nordrhein-Westfalen.
- French Republic (2018). *Comment accélérer la transition énergétique? Avis sur la mise en œuvre de la loi relative à la transition énergétique pour la croissance verte.* Paris.
- French Republic Prime Minister's Office (2012). *Pathways 2020-2050. Towards a low-carbon economy in France.* Paris. **46.**
- Grenelle I Law (2009). *Programmation relative à la mise en œuvre du Grenelle de l'environnement.* **2009-967.**
- Grenelle II Law (2010). *Engagement national pour l'environnement.* **2010-788.**
- Grünen, B. D. (2011). *Stromnetze 2020plus - jetzt in die Energiezukunft investieren* Berlin, Bündnis 90/Die Grünen Bundestagsfraktion.
- Joffre, A. (2017). *Les énergies renouvelables permettent de produire de l'électricité à un coût aujourd'hui très compétitif.*
- Kabel, N. (2018). Schleswig-Holstein will zusätzlichen Offshore-Ausbau. Retrieved 2019.01.12, from https://www.schleswig-holstein.de/DE/Landesregierung/V/Presse/PI/2018/0118/180123_Offshore.html.
- KSpG (2012). *Gesetz zur Demonstration und Anwendung von Technologien zur Abscheidung, zum Transport und zur dauerhaften Speicherung von Kohlendioxid,* Bundesgesetzblatt Jahrgang 2012 Teil I Nr. 38, ausgegeben zu Bonn am 23. August 2012. available online: <https://www.bmwi.de/Redaktion/DE/Downloads/Gesetz/gesetzesentwurf-ccs-08-2012.html>.
- Kühn, S. and C. Özdemir (2019). *Zehn-Punkte-Plan: Elektromobilität auf die Überholspur bringen.* Berlin, Bundestagsfraktion Bündnis 90/Die Grünen [Online]: https://www.gruene-bundestag.de/fileadmin/media/gruenebundestag_de/themen_az/mobilitaet/pdf/190620_Zehn-Punkte-Plan_Elektromobilitaet_Kuehn_Oezdemir.pdf.
- KWSB (2019). *Kommission „Wachstum, Strukturwandel und Beschäftigung“ - Abschlussbericht.* Berlin, BMWi [Online]: https://www.bmwi.de/Redaktion/DE/Downloads/A/abschlussbericht-kommission-wachstum-strukturwandel-und-beschaeftigung.pdf?__blob=publicationFile&v=4.
- Le Monde (2017). *Nicolas Hulot : « Nous visons la fin de la vente des voitures à essence et diesel d'ici à 2040 ».*
- M5S (2017). *Programma energia 2016-17, v1.4.* Rome, Movimento cinque stelle.
- MEP (2016). *Programmation pluriannuelle de l'énergie ("multiannual energy plan").* **2016-1442.**
- Ministry of Ecological and Solidary Transition (2016). Interconnexions électriques – manuel des procédures. from <https://www.ecologique-solidaire.gouv.fr/interconnexions-electriques-manuel-des-procedures>.
- Ministry of Ecological and Solidary Transition (2017). *Towards 32% renewable energy in 2030. French public policies for renewables.* Paris.
- Ministry of Ecological and Solidary Transition (2018). Présentation des technologies relatives à la filière solaire. from <https://www.ecologique-solidaire.gouv.fr/solaire>.
- NAPE (2014). *Making more out of energy - National Action Plan on Energy Efficiency.* Berlin, Federal Ministry for Economic Affairs and Energy.
- NECP DE (2018). *Germany's Draft Integrated National Energy and Climate Plan - Courtesy Translation in English.* Brussels, Translation Services of the European Commission.
- NECP FR (2019). *Plan national intégré énergie-climat de la France.*

- NECP IT (2018). *Italy: Draft integrated national energy and climate plan - Courtesy Translation in English Provided by the Translation Services of the European Commission*. Rom, Ministry of Economic Development, Ministry of the Environment and Land and Sea Protection and Ministry of Infrastructure and Transport.
- Odoul, J. (2018). Pour un Rassemblement National contre l'installation des éoliennes. from <https://www.rassemblementnational.fr/communiques/pour-un-rassemblement-national-contre-linstallation-des-eoliennes/>.
- Qualit-EnR (2017). *Quel est le programme énergétique du nouveau Président de la République?*
- Rassemblement National (2017). *144 Engagements Présidentiels*.
- RSE (2018). *Scenari di sviluppo dei sistemi elettroenergetici*, Ricerca sistema energetico (RSE).
- SEN (2017). *Strategia Energetica Nazionale*. Rome, Ministerio dello sviluppo economico, Ministerio dell'ambiente della tutela del territorio del mare.
- Sterner, M., M. Thema, F. Eckert, T. Lenck and P. Götz (2015). *Bedeutung und Notwendigkeit von Windgas für die Energiewende in Deutschland*. Berlin, Forschungsstelle Energienetze und Energiespeicher (FENES) OTH Regensburg, Energy Brainpool, Studie im Auftrag von Greenpeace Energy.
- Viennot, M. (2015). Loi de transition énergétique: un réel changement sur le nucléaire? , from https://www.francetvinfo.fr/economie/loi-de-transition-energetique-un-reel-changement-sur-le-nucleaire_1701063.html.