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Report

The socio-economic impacts of renewable energy in EU regions

Strengthening local benefits of renewable energy deployment

Case studies

Institute for European Environmental Policy

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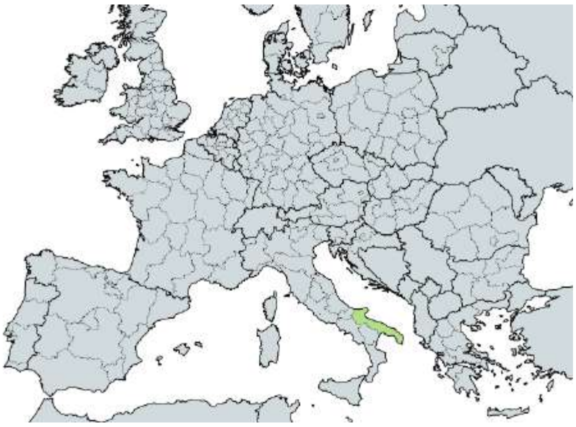
Apulia

1. APULIA (PUGLIA), ITALY

*This case study was authored by **Chiara Montanini** and **Andrea Barbabella** from Fondazione per lo sviluppo sostenibile (Sustainable Development Foundation).*



GDP per capita	€18,842 (2019)
Population	3,926,931 (2020)
Population density	200/km^2
Unemployment rate	14.1% (2020)
People at risk of poverty or social exclusion	37.4%
Share of renewable energy (% of gross final energy consumption)	16.5%
Total installed RES capacity	5,750 MW (2019)
Employment in RES	0.5% (direct & indirect)

1.1 National context

1.1.1 Socio-economic development

Italy is the third biggest economy in the EU27[1], with a GDP of 1,480 billion €$_{2010}$ in 2020, after Germany (2,836 billion €$_{2010}$) and France (2,062 billion €$_{2010}$)and before Spain (1,058 billion €$_{2010}$), and is **second only to Germany in industrial production**. **Italy ranks 11th among the EU27 countries in terms of GDP per capita**[2], with a level of 26,640 €$_{2010}$ in 2020, just below the EU27 average (26,230 €$_{2010}$). Italy's GDP growth was already very slow even before Covid-19, and **in 2020 Italy was the second-most hit country from Covid-19 in EU in terms of GDP** (-8.9% with respect to 2019), after Spain (-10.9%). As a result, Italy has now entered an economic recession (-8.2% of GDP between 2010 and 2020), and the same figures appear when looking **at GDP per capita, with Italy showing the sharpest reduction** (-8.5% between 2010 and 2020), while EU27 average shows an increase of 6.8%.

[1] Gross domestic product at market prices, Chain linked volumes (2010), Eurostat (last update 19.05.2021)

[2] Gross domestic product at market prices, Chain linked volumes (2010) euro per capita, Eurostat (last update 20.05.2021).

When looking at income inequalities, the latest figures from 2019 show **Italy ranking 22nd among the EU27 in terms of Gini coefficient**[3]. **Income inequality conditions have worsened in the last 10 years in Italy** (+3.1%), while the EU27 registers a stagnation (+0.3%).

Italy has the 3rd highest unemployment rate[4] **among the EU27** (after Greece and Spain), reaching 9.2% (and 2.3 million unemployed people) in 2020, against an EU27 average of 7.1%. **Unemployment has also dramatically risen in the last 10 years**, with a 21% increase in absolute terms and a 10% increase in unemployment rate.

As for **education**[5], in 2020 the population share that attained at least an upper-secondary level in **Italy (62.9%) remains well below the EU27 average** (79.2%), ranking as the third-worst share after Portugal and Malta. The recent trend, however, has been more positive for Italy (+12% from 2011 to 2020) than for the EU27 average (+8%).

Latest figures from 2019 show that **the expectancy of a healthy life**[6] **in Italy is among the top 5 countries in EU27**, with 68.3 years at birth, against an EU27 average of 64.6. The 10-year trend is more positive for Italy (+9% between 2010 and 2020) than for EU27 average (+6%).

1.1.2 Extent of renewable energy deployment nationally

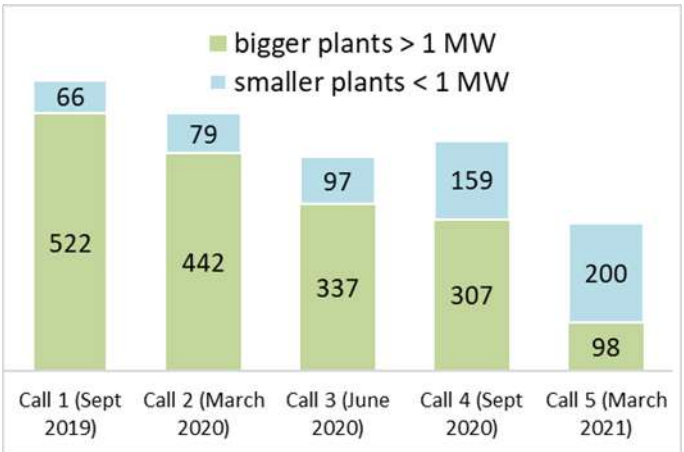
Italy's renewable share (RES share) of total final energy consumption was 18.2% in 2019, **among the highest in the EU27 biggest economies** (just after Spain, with 18.4%), although lower than the EU27 average (19.7%). The main drivers of Italy's renewables performance are: **hydropower**, which historically is a main electricity source (around 15% of total domestic generation); **PV**, whose growth in Italy has been very notable thanks to high resource availability and massive incentives that financed the market between 2005 and 2013 (which led Italy to hold for many years the record for highest PV share in electricity demand in the world); **geothermal energy**, both for electricity and heat, for which Italy holds by far the largest availability in Europe (and ranks 8th in the world for

[3] Gini coefficient of equivalised disposable income, scale from 1 to 100, Eurostat-SILC (last update 19.05.2021)
[4] Unemployment by sex and age, thousand persons and percentage of active population from 15 to 74 years, Eurostat (last update 13.04.2021)
[5] Upper secondary, post-secondary non-tertiary and tertiary education (levels 3-8), percentage of total population between 25 and 64 years old, Eurostat (last update 21.04.2021)
[6] Healthy life years in absolute value at birth, years, Eurostat (last update 11.03.2021)

installed capacity); and **bioenergy**, which today represents 12% of heating/cooling consumption (in line with the EU average) and around half of total RES consumption in Italy.

However, **deployment in the renewables sector has been limited in the recent years**, with the RES share increasing by 6.4% in Italy between 2014 and 2019, against an EU27 average of +12.9% and substantial growth (between 13% and 20%) across all of the EU's other biggest economies[7]. As for renewables in electricity, Italy went from installing 5 GW/year on average between 2009 and 2014[8], to less than 1 GW/year between 2014 and 2019. The reasons behind this critical slowdown are, on one hand, related to the **sharp cut of supporting schemes**. On the other hand, **bureaucracy and permitting procedures** have become more and more unbearable for operators and are hampering the deployment of new renewable power plants in Italy. In the electric sector, results from the long-awaited, new supporting scheme[9] (so-called "DM FER"), launched in July 2019, have confirmed the issue: as of May 2021, auctions have been increasingly avoided by operators and only 2.3 GW have been allocated, out of a total of 4.5 GW capacity offered (both for new and renewed plants). In the last auction, only 12% of all available capacity was allocated.

Figure 1: Total allocated capacity (GW) from DM FER across the first 5 auctions



[7] SHort Assessment of Renewable Energy Sources, Summary results (2019), Eurostat (last update 02.04.2021)

[8] Dati Statistici sull'Energia elettrica (2019), Terna

[9] Decreto 4 luglio 2019 del Ministero per lo sviluppo economico "Incentivazione dell'energia elettrica prodotta dagli impianti eolici on shore , solari fotovoltaici, idroelettrici e a gas residuati dei processi di depurazione".

Source: GSE

With regard to bioenergy, regulatory constraints have been introduced and incentives have decreased in recent years, due to associated negative impacts on air quality. This is also because the Po Valley (Pianura Padana), one of the most relevant hotspots for air quality in the EU, is located in Northern Italy. In 2020 the European Court of Justice ruled that the Italian state was violating the EU Air Quality Directive (Directive 2008/50/EC) in the area, in particular for exceeding PM10 limits, whose main cause is local biomass combustion to produce bioenergy – according to the Italian Institute for Environmental Protection and Research (ISPRA). The role of modern bioenergy in the Italian energy transition continues to be a matter of broad discussion among all state and non-state actors (including civil society, local governments, bioenergy industry, environmental associations, etc.).

Current policy plans and targets are set at national level by the NECP, which will have to be revised in light of the new EU Fit-for-55% package. The current Italian NECP identifies a 30% RES share target for overall final energy consumption, including a 55% RES share in the electricity sector (+3,7 GW/year) by 2030. As is well known, both targets will have to increase to comply with the new 55% emissions reduction target, and this process might translate for Italy into a 40% overall RES target, and 65-70% RES-E target (+7 GW/year) by 2030, according to recent studies[10]. Sectoral experts agree[11] that Italy's renewable energy growth is falling far behind the necessary deployment trends, mostly because of permitting and bureaucracy, and if the issue is not addressed properly, Italy will reach its revised 2030 energy targets in 2085.

1.1.3 Overview of the political governance structures

Energy governance in Italy is fairly complex. After the 2001 Constitutional reform[12], energy has formally become a matter of shared competence between central government and the regions. Central government maintains a certain level of supremacy, given the EU policy framework and the many interpreting judgements in the past 20 years. However, most of relevant decisions are actually made at regional level, including regional planning (through the Regional Energy and Environment Plans), and permitting processes for all small- and medium-

[10] Italy Climate Report (2020), Italy for Climate - Fondazione per lo sviluppo sostenibile

[11] Il disegno del sistema autorizzativo per decarbonizzare e rilanciare gli investimenti (2021), Elettricità Futura e Althesys

[12] Legge costituzionale 18 ottobre 2001 n.3, "Modifiche al titolo V della parte seconda della Costituzione"

scale energy plants (since only the big plants are of national interest, and therefore of national competence).

Until a few months ago, the Ministry for Economic Development (MISE) held the main competences concerning the energy sector, such as: planning and permitting of energy infrastructure, energy security, monitoring, and management of renewables incentives. MISE is thus responsible for coordinating and implementing the Italian NECP. On several energy matters, such as regulation of energy incentives, MISE works in strict cooperation with the Ministry of Environment (but also with others involved, such as the Ministry for Culture or Ministry for Agriculture Policy and Forestry). This is because the Ministry of Environment is in charge of climate policy, including international agreements, management of EU-ETS revenues, etc. Earlier in 2021, the new Government formed a new “Super” Ministry, the Ministry for Ecological Transition (MITE), also in light of implementing the National Recovery and Resilience Plan (PNRR). MITE now holds all competences from the former Ministry of Environment plus competences on most energy matters (previously held by MISE). As a result, climate and energy matters are all unified in a single Ministry.

The authority in charge of supporting the deployment of renewables in Italy is GSE (Gestore dei Servizi Energetici), previously owned by MISE and now by MITE. In 2020, GSE provided 15.2 billion euros of funding to the renewable sector, of which 11.9 went to RES in the electricity sector. Funding is not provided through regions but is delivered directly to the beneficiary actor who owns the renewable plant. Regions might also provide their own public incentives through dedicated mechanisms, however regional funding in Italy remains very low compared to national funding.

1.2 Region's socio-economic development and renewable enrgy deployment

1.2.1 Regional context

Apulia is located in the south-east of Italy, with a population of around 3,926,931 (2020) people, including 1.6 million families and a population density of 200 people per square kilometre. **Apulia's regional GDP was 73,064 M€$_{2015}$ in 2019. The region ranks 9th in Italy and is the third largest economy in the Mezzogiorno (i.e., in southern Italy), after Campania and Sicily. In the last 10 years regional GDP has been stagnating (+0.9% between 2009 and 2019)**, showing a trend worse than the national average (+2.5%). Before the Covid-19 pandemic, about 254 thousand companies were located in the Region, employing almost 750 thousand people (these figures only refer to private actors). The main economic sectors in terms of employed people are the commercial sector (30% of workers), manufacturing industry (16%) and tourism (10%). Apulia is one of the most attractive summer destinations in Italy and tourism is becoming an increasing source for local GDP.[13] Agriculture is also a very relevant sector in the regional economy, with Apulia registering the highest labour unit numbers in Italy (around 140 thousand units) and the second highest (after Lombardy) added value from the sector (around 3 billion euros)[14].

[13] Dati statistici per il territorio Regione Puglia (2020), Istat - Ufficio territoriale per le Marche, l'Abruzzo e la Puglia

[14] Risultati economici delle aziende agricole (2015), Istat

1.2.2 Socio-economic development

GDP per capita in Apulia was 18,842 €$_{2015}$ in 2019 and is much lower (-36%) than the national average, placing the region in the third last position (after Sicily and Calabria). In the last 10 years, GDP per capita has shown a better performance (+3.1% between 2009 and 2019) than the Italian average (+1.7%), **even though the performance is more likely attributable to demographic trends;** in the same period, resident population in Apulia decreased by 3%, in sharp contrast with the national trend (+0.1%), although in line with the average trend in the whole Mezzogiorno area (-2.7%).

The latest figures from Eurostat[15] show that the share of people at risk of poverty or social exclusion in Apulia is 37.4%, which is significantly higher than the national average (25.6%). Concerning the Gini coefficient, in 2018 the regional indicator (33) appears slightly lower than the national average (33.4), leading Apulia to rank 6th among all Italian regions. The 10-year trend, however, shows that the indicator is slightly worsening in the region, just like at national level. According to Istat[16], 22.4% of households in Apulia are vulnerable or poor, a much higher share than the national average (11.4%). Also, in terms of household income, the regional level (26,887 € of net income) is significantly lower than the national average (31,641 €).

The latest figures from 2020 register an unemployment rate of 14.1% in Apulia, significantly higher than the national average (9.2%), although better than the Mezzogiorno average (15.9%). The highest unemployment in Apulia is found among the younger generations (34.5% in the age group 15-24), and it decreases as the age group increases – until the lowest rate, which is found in the 55-64 group (7.5%). Difference between male and female trends are in line with the national average, with female unemployment in Apulia (16.7%) being higher than male unemployment (12.5%). In 2010 the unemployment rate in Apulia was 13.5%, thus it increased in the Region by c.a. 0.5% every year since then.

1.2.3 Renewable energy development

With 39,017 thousand tons of CO_2 equivalent (kt CO_2eq), Apulia is the third most emitting region in Italy (after Lombardy and Emilia-Romagna), according

[15] People at risk of poverty or social exclusion by NUTS regions (2019), Eurostat – EU SILC (last update 19.05.2021)

[16] Reddito familiare netto (2019), Istat –Eurostat SILC

to latest official figures from 2017[17]. Since 1990 Apulia has always been among the top three emitting regions in Italy, **however its reduction rates have been higher than the national average**: between 2005 (emissions peak year in Italy) and 2017, Apulia cut its emissions by 35% against a national average of -25%. In terms of GHG emissions per capita, **Apulia also ranks third with 9.6 tCO_2eq per capita in 2017**, after Sardinia (12,1) and Friuli-Venezia Giulia (10), against an Italian average of 7.2 tCO_2eq. In terms of GHG emissions per GDP, in 2017 Apulia emitted 543 tCO_2eq per each million € of GDP produced in the region, which is twice the national average (256 tCO_2eq/M€) and is the second highest carbon intensity in Italy after Sardinia (608). **GHG trends in Apulia are highly affected by two extremely high carbon-intensive facilities which are located in the Region: the notable steel plant in Taranto (formerly named ILVA) and the coal-fired power plant in Brindisi,** with the former being the biggest steel production site in Europe and the latter being among the 10 biggest coal power plants in Europe. Together, these two sites are still responsible for almost a third of all regional GHG emissions (roughly 12 billion tons of CO_2 equivalent), despite the fact that activity has been decreasing in both sites (especially in the power plant, which is scheduled to be closed by 2025).

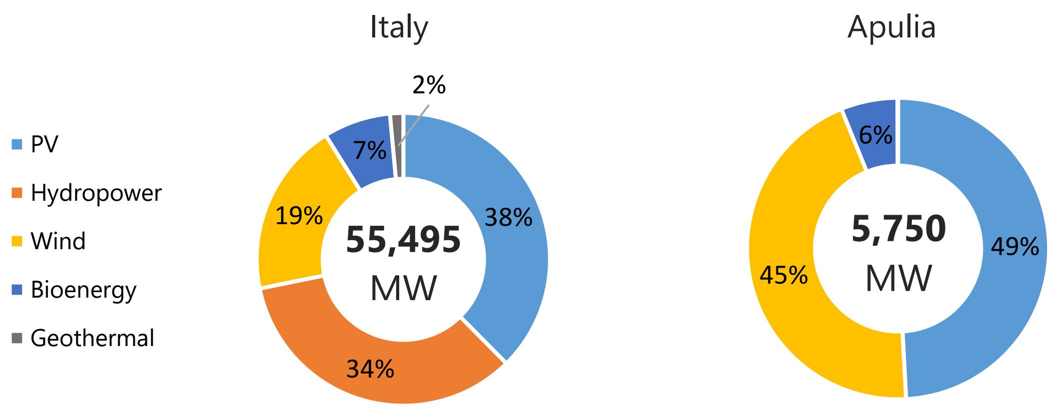
As for renewable energy**, the Apulian RES share (including RES-E and RES-H/C, excluding RES-T) of final energy consumption was 16.5% in 2018** (latest year for official figures)[18], ranking 14th among all Italian regions, just below the national average (16.8%). While RES consumption per capita for heating and cooling is the second-lowest in Italy (only 0.09 toe/per capita), RES-E production per capita in Apulia (0.21 toe/per capita) is just above the Italian average (0.21). **However, in absolute terms, RES-E normalized production[19] in Apulia is the 4th highest in Italy after Lombardy, Trentino-South Tyrol and Piedmont** (all regions from Northern Italy, where hydropower contributes 60-90% to RES-E production). **RES-E production in Apulia already contributes to 50% of regional electricity consumption, while the national average is around 35%**[20].

As of 2019, Apulia has installed 5,750 MW of renewable power plants, largely PV (2.827 MW) and wind (2.571 MW). Three-fourths (4,200 MW) of Apulia's current renewable power plants were installed between 2009 and 2019 (while Italy's average is 53%), and for the majority between 2009 and 2014.

[17] Emissioni di gas a effetto serra totali – territorio regionale (2019), ISPRA
[18] Monitoraggio Regionale (2018), GSE
[19] As of RED II accountability
[20] Own elaboration from GSE

The difference between Italian average trends and RES-E mix (chart below) are explained by the fact that Apulia, like most southern regions in Italy, has a much greater availability of wind and solar energy, and no hydropower sources. As a matter of fact, **Apulia has been a main contributor to the deployment of wind and PV in Italy**.

Figure 2: Renewable energy mix in the electricity sector in 2019



Source: GSE

As for PV, Apulia is the first region in Italy for both installed capacity (13.5% of total national capacity) **and for electricity generation** (3,622 GWh in 2019, 15.3% of total national generation from PV). Three provinces in the region – Lecce, Brindisi and Bari – are driving PV generation and are also the first three provinces in Italy: in 2019, PV generation in Lecce alone was 962 GWh, a performance higher than 8 regions in Italy[21].

In the last 10 years, PV deployment in terms of installed capacity in Apulia has been fairly aligned with national trends. PV underwent exponential growth between 2009 and 2012, when each year the installed capacity tripled the levels from the year before, both in Italy and in Apulia. In 2011 alone, Apulia installed 1,500 MW, 16% of total installed capacity in Italy in that year (9,300 MW). In the following years, new installation trends suddenly almost stopped in Apulia (as well as in Italy), reaching stagnation between 2013 and 2018 (on average +27 MW, i.e. +1%, each year). In 2019, installation figures in Apulia were slightly more positive (+175 MW, i.e. +7% compared to 2018), but they all occurred in one province (a new solar park in Foggia). As a matter of fact, Foggia also hosts the

[21] Solare fotovoltaico – Allegato tabelle provinciali (2019), GSE

biggest solar park in Italy (capacity of 103 MW), which was connected to the grid in June 2020.

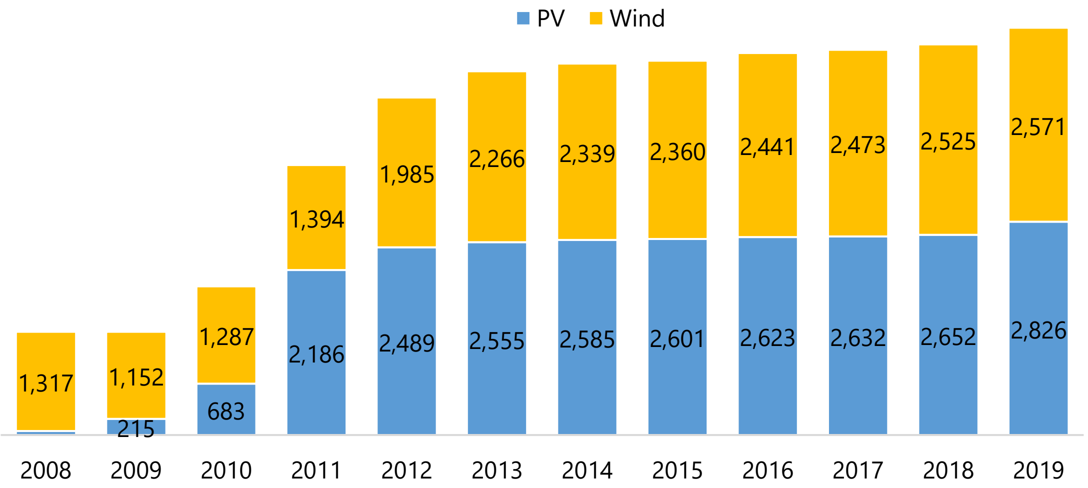
While installations trends are in line with the national context, the same cannot be said concerning the type of deployment of PV in Apulia. **The region holds by far the highest share of grounded PV (75% in 2019, while PV on buildings is limited to 25%) against a national average share of 42%**[22]. Such a share distribution is actually common among southern regions in Italy, which all hold a higher share of grounded PV, while on the contrary PV on buildings is much more prevalent in northern regions. These figures are consistent with the fact that **utility-scale PV is more widespread than small-scale PV in Apulia, where the average size is 55.2 kW**, twice the average at national level, which is 23.7 kW.

As for wind power, Apulia is by far the first region in Italy for both installed capacity (2,572 MW in 2019, 24% of total national capacity) **and electricity generation** (5,236 GWh, 26% of total national generation). On-shore wind availability in Italy is highly concentrated in southern regions, however deployment of wind power in Apulia has been greater than in other southern regions (the second region for wind installed capacity in Italy is Sicilia, with 1,894 MW). Also, within the Apulian region, installed wind capacity is mostly concentrated in one single province, Foggia: with 2,110 MW, thus**, Foggia hosts 80% of total wind power plants in Apulia and 20% at national level**.

Apulia is historically the first wind region in Italy and deployment has not been following a very regular trend compared to the national context. Apulia has been driving wind power growth in Italy, especially between 2012 and 2014, where over half of total national capacity every year was installed in the region. The peak year in Apulia occurred in 2012, when 590 MW (+17%) of new wind capacity was installed, while the peak year for Italy was 2009 (+1,360 MW, +38%). Since 2014, new installation trends have sharply decreased in Apulia, just as they have overall in Italy: from 2014 to 2019, Apulia added on average around 50 MW/year, but only 10-15% of the new total installed capacity in Italy is now located in the region. Also, for wind, power plants are on average bigger in Apulia (2.2 MW) than at national level (1.9 MW).

[22] Solare fotovoltaico – Rapporto statistico (2019), GSE

Figure 3: Total installed capacity (GW) from PV and wind in the region between 2008 and 2019



Source: GSE

As for RES-H/C, deployment is more limited in Apulia and consumption trends appear fairly different from the national average. Only 30% of total RES consumption in Apulia was for heating and cooling in 2018 (against a national share of 52%) and most of RES-H/C consumption is from solid biomass in the residential sector (72%), while heat pumps in Apulia are less significant (17%) than the national average (24%). In addition, deployment of solar thermal energy appears slightly more significant in Apulia than at national level, even though growth remains limited.

The Renewable Energy Directive (RED, Directive 2009/28/EC) assigned to Italy a 2020 target of 17% RES share of total gross final consumption of energy. Italy reached its target already in 2014, and the RES share remains at 18.2% in 2019. **With a Ministerial Decree from MISE (so-called "DM Burden Sharing"[23]), the national RES share target was split across regions in 2012**. A burden sharing analysis was developed by a dedicated governmental research body (RSE, Research on Electric System) based on regional potential for renewable deployment. Just like the national target, regional RES shares are also the ratio between gross final consumption from RES (including RES-E and RES-H/C,

[23] Decreto 11 maggio 2015 del Ministero per lo sviluppo economico di concerto con il Ministero dell'ambiente e della tutela del territorio e del mare e il Ministero delle politiche agricole alimentari e forestali, "Approvazione della metodologia che, nell'ambito del sistema statistico nazionale, è applicata per rilevare i dati necessari a misurare il grado di raggiungimento degli obiettivi regionali, in attuazione dell'articolo 40, comma 5, del decreto legislativo 3 marzo 2011, n. 28."

excluding RES-T) and total gross final consumption of energy in the Region. Based on its regional potentials, Apulia has been assigned a 2020 RES share target of 14.2% (very similar to the national 2020 target, which reduces from 17% to 14.3% when excluding RES-T). Apulia reached its 2020 target already in 2013, the year following the DM Burden Sharing release, and has remained above the target ever since, with latest figures from 2018 registering a 16.5% RES share[24].

The regional Burden Sharing approach has only been applied to the 2020 RES target, thus for 2030 the national framework only includes an overall national RES target, which is 30% (as defined by the current version of the NECP) and will likely be revised upwards when the Fit-for-55% package will be fully designed and enter into force.

No official estimates exist on renewable potential deployment at regional level; however, some unofficial estimates have been elaborated for Apulia. Elettricità Futura[25], which is the main industrial association for operators in the power sector and thus part of national Confindustria, estimates that **overall southern Italy, including Apulia, should double its current RES-E generation by 2030**, in order to contribute to a national RES-E target which is in line with the EU Green Deal (around 70% of total RES-E generation). **According to ANEV[26]**, which is the national association for wind energy operators, **wind growth in Apulia is expected to be more limited and will come mostly from repowering existing power plants**, with capacity expected to increase from current 2.6 GW to 2.9 GW (+13%) in 2030. Such estimates might imply that potential renewable deployment in Apulia in this decade will mostly refer to PV, upon careful consideration of environmental and landscape aspects.

As for the Regional Plan for Energy and the Environment (PEAR, which is the main planning and monitoring tool at regional level), the version currently in force in Apulia traces back to 2007. A new PEAR was drafted in 2015 and it is now under public consultation for all necessary environmental impact assessments, however information on timing and procedure is not available to the public. **Such long and complex bureaucracy, which is a very common issue among Italian regions, does not appear compatible with the fast pace** at which EU and national climate and energy targets and policy are being discussed and

[24] GSE Monitoraggio Regionale 2018
[25] https://www.elettricitafutura.it/
[26] https://www.anev.org/

implemented, leaving the regional planning lagging far behind its current potentials for renewable deployment.

Permitting and bureaucracy for renewable deployment in Italy are highly complex procedures, which involve multiple government bodies (including economic development, environmental protection, landscape protection, conservation of cultural heritage), also at different levels (municipalities, Regions, central government), depending on the specific RES, size and location of the new power plant, as well as on specific regional regulatory frameworks[27].

The Guidelines for RES power plant authorizations[28] were released in 2010 by MISE, in cooperation with the Ministry of Environment and Ministry of Culture, and identify the overall national framework for authorization processes. The Guidelines have been further integrated with indications for power plants that are subject to environmental impacts assessment (VIA) in Regions and Autonomous Provinces[29]. For instance, for wind power plants with a capacity between 60 and 1,000 kW the VIA procedure is managed at regional level only under specific conditions (e.g., if they are located in protected areas or Natura 2000 sites); wind power plants with a capacity between 1 and 30 MW are always subject to VIA at regional level, while for capacity higher than 30 MW the VIA is managed at national level. Concerning PV, the guidelines allow Regions to extend simplified authorization processes also for bigger power plants (up to 1 MW); this simplified authorization is managed by municipalities with a timing of just 30 days. As explained also in section 3.3, this aspect has particularly influenced the deployment of PV in Apulia. Just like most Regions in Italy, the regional government in Apulia is responsible for releasing the overall authorizations (Autorizzazione Unica), while the VIA is managed both at regional and provincial level.

Regarding the ownership/benefit sharing arrangements used for renewable energy, providing specific and quantitative information remain difficult. Only 7% of total installed capacity in 2019 is located in the residential sector (against a national average of 16%) and only 10% in the commercial and services sector (against a national average of 22%). The share of capacity in industry (78%) in the region is much higher than national average (49%). It can thus be concluded that,

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[27] An overview of updated regulatory frameworks in the RES sector is provided by GSE at this link
[28] Linee guida per l'autorizzazione degli impianti alimentati da fonti rinnovabili (2010), Ministero per lo sviluppo economico
[29] Linee guida per la verifica di assoggettabilità a valutazione di impatto ambientale dei progetti di competenza delle Regioni e delle Province Autonome, Ministero per lo sviluppo economico

also in light of the higher-than-average size of power plants in Apulia, that renewable investors in the region are mostly big operators and companies from the energy sector.

1.3 Analysis and conclusions

1.3.1 Key factors analysis

As numbers have shown, Apulia is one of the most relevant regions in Italy with regard to renewable deployment, especially for PV and wind power. A key factor is of course due to the geography of the Region and the very high resource potential. This is particularly true for wind, as many of the windiest areas in Italy are located in the Region, but also for PV, given that Apulia holds a very high solar radiation factor – and thus PV potential.

Besides geography, another key factor that has been driving renewable deployment in Apulia, just like in Italy overall, is related to incentives and supporting schemes, which have been mostly defined at national level. As reported in section 1.2, successive supporting mechanisms have led to different phases of renewable deployment: the great increase that Italy (and Apulia) registered in the early 2010s stopped abruptly after 2014, when new limitations to regulation and funding were introduced, especially for bigger power plants. The current supporting scheme in place, DM FER, was supposed to relaunch PV and wind deployment in Italy but has not been working appropriately (see Chart 1). The underlying reasons mostly concern bureaucracy and administrative aspects, rather than funding. Procedural requirements multiply and timelines often extend for much longer than required by law, with many projects losing competitiveness and many procedures remaining in litigation especially with regional bodies. This situation is evenly spread across regions in Italy; thus, Apulia is no exception.

According to sectoral experts, a main reason lying behind the disfunction of recent support schemes (section 1.2) is two-fold: on one hand, regions are not highly committed to renewable deployment, since they do not have any burden sharing targets for this decade (section 2.3); on the other hand, the Ministry of Culture has been particularly restrictive on renewable deployment for landscape protection reasons, and it is in fact hampering many authorization processes: according to ANEV, a wind capacity as high as 9 GW is currently in litigation (and thus blocked) by the Ministry of Culture.

As a consequence, permitting procedures for bigger wind power projects (which occur at national level) have been taking on average 5 years to complete, against a national law requirement of 2 years[30]. At the moment, also in light of the massive green investments that PNRR has scheduled for the upcoming years, the Italian Government is setting a new law (so-called Decreto Semplificazioni[31]) which aims specifically to simplify bureaucracy and reduce authorization timing. For instance, in order to accelerate the authorization process for PV parks (power plants bigger than 10 MW), this law proposes the VIA to be managed at national level (and not anymore at regional or province level).

With regard to RES-H/C, a dedicated support scheme (so-called Conto termico) promotes renewable deployment (as well as energy efficiency interventions) across governmental bodies and companies. Results so far have been limited, because of knowledge gaps and, most likely, also because of technical difficulties (the procedure actually requires the approval of the whole project). According to GSE, in 2020 only €229 million were spent for this mechanism to support interventions across companies (out of a 700 million € annual available fund), and €74 million were spent across governmental bodies (out of a total €200 million available).

For Apulia specifically, a key factor for the deployment of PV relates to the specific regional application of the national guidelines for renewable deployment (see section 2.3). Apulia has been one of the first Italian regions to extend the simplified procedure to power plants up to 1 MW, thus attracting many investments and fostering the deployment of bigger PV power plants. At the same time, experts believe that this has created some issues in terms of local acceptance of renewable deployment in the Region.

In recent years Apulia has also implemented regional support schemes, starting from a Regional Call[32] that aims to promote energy efficiency and RES uptake, especially among SMEs. This supporting mechanism is of great interest indeed because it addresses SMEs, for which access to incentives in the sector is much

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[30] The study is not available to the public, but results have been presented during this Event

[31] Decreto-legge 31 maggio 2021, n.77, "Governance del Piano nazionale di rilancio e resilienza e prime misure di rafforzamento delle strutture amministrative e di accelerazione e snellimento delle procedure"

[32] Regolamento generale dei regimi di aiuto in esenzione n. 17 del 30 settembre 2014 e s.m. e i. (in attuazione del Regolamento (CE) 651/2014 del 17.06.2014 e s.m. e i.) – Titolo VI - "Aiuti per la tutela dell'ambiente" - Avviso per la presentazione delle istanze di accesso ai sensi dell'articolo 6 del Regolamento e dell'Accordo di finanziamento sottoscritto tra la Regione Puglia e Puglia Sviluppo spa in data 24/07/2014.

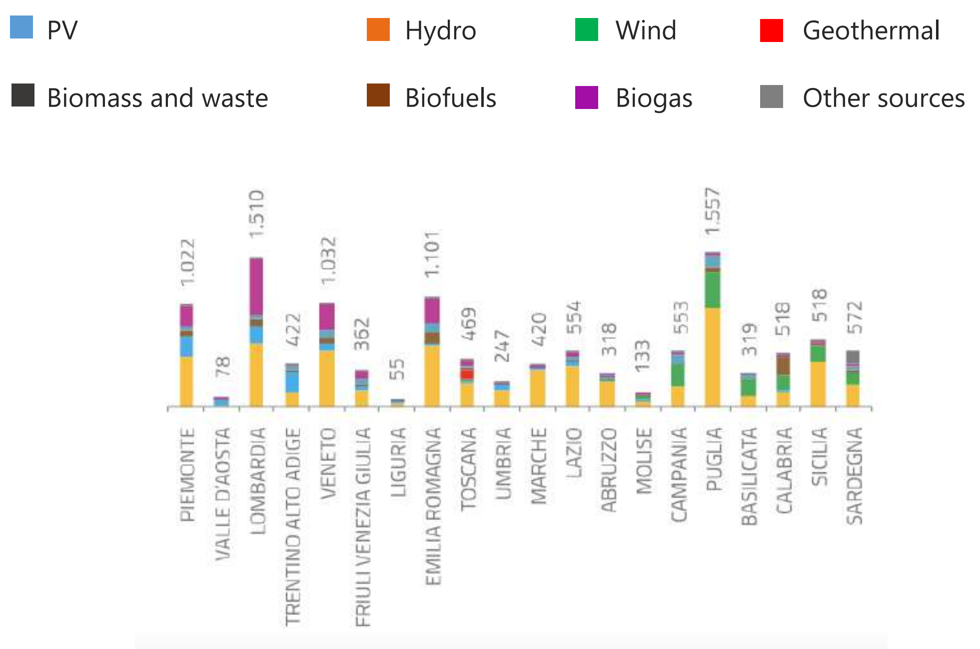
more challenging in Italy, as shown in a recent survey carried out by the Sustainable Development Foundation and CNA (a major association for craftsmanship and SMEs in Italy) [33].

1.3.2 Socio-economic impacts of renewable energy

The latest figures from GSE on socio-economic impacts of renewables in Italian regions refer to 2016 and rank Apulia as the first region for investments in the sector (€350 billion in the year), and the second for O&M expenditures (€390 million in the year, after Lombardy).

It is also worth mentioning that, according to GSE[34], Apulia is the Italian region receiving the highest share of RES-E funds from incentive schemes (the ones that are paid through the A component of the energy bill): out of a total €12 billion funds in Italy, €1.56 billion are paid to power plants located in Apulia, mostly PV but also wind energy (see chart below).

Figure 4: Distribution of RES-E funds paid through the A component of the energy bill in Italy, by source and region (2020)



Source: GSE, Rapporto delle attività 2020

[33] Non senza le PMI (2021), Fondazione per lo sviluppo sostenibile
[34] Rapporto sulle attività (2020), GSE

As for employment figures, which include both direct and indirect jobs in the RES sector, Apulia is the Italian region with the highest number of temporary workers (3,200 Annual Works Units – AWU), while ranking fourth in terms of permanent workers (also 3,200 AWU).

According to a recent study from ANEV, current workers in the wind sector (including direct, indirect and related AWU) amount to 4,500, of which 1,500 are direct AWU. 970 workers are employed in VESTAS production sites (which are located in Taranto), which is the main RES production site in the Region. Potential synergies might be occurring between supply chains from the wind sector and the naval sector (with the latter being a local, traditional supply chain in the region) concerning the production of fiberglass materials.

Apart from exceptional cases, such as the vast Vestas sites, most of RES-related employment in Apulia seems to be located more in other subsectors such as planning and permitting sectors, product assembly, installation, and O&M of power plants. Considering the overall Italian business structure, this means socio-economic impacts in the RES sector mostly affect SMEs. In this regard, it can be said that renewable deployment in Apulia has certainly brought positive impacts to local supply chains and expertise concerning planning, components, installations and O&M.

According to ENEA[35], by means of tax credits, in 2019 Apulia received €1.4 million funds for solar thermal projects and €2.4 million for biomass energy plants[36].

1.3.3 What are the key factors that have determined – or may in the future determine – socio-economic impacts associated with renewable energy deployment?

Socio-economic impacts associated with renewable energy deployment depend, in the first place, on regions' own capacity to promote RES in their territory. Given the technological and geographical features of this sector, economic and employment impacts occur, in fact, mostly at local level. To this end, priority action should focus on removing obstacles to RES growth described in section 3.1, starting with bureaucratic and administrative simplification. At the same time, efforts should be made to promote local entrepreneurship in the sector, especially

[35] Italian Agency for New Technologies, Energy and Sustainable Economic Development, which is in charge to manage tax credits and support schemes for energy efficiency

[36] Rapporto Detrazioni Fiscali (2020), Enea

for components and manufacturing, in order to amplify socio-economic benefits within the Region.

In this context, multiple civil society stakeholders should be primarily involved (alongside governmental bodies), including: industrial associations, both Confindustria (the main one) and the other sector-specific associations (such as Elettricità Futura, ANEV, ANIE[37]); SMEs associations, such as CNA or Confartigianato[38]; Universities, research centres and local districts (such as La Nuova Energia[39]); environmental associations, such as Legambiente and WWF; the main labour unions; and education and training associations for local entrepreneurship.

Apulia has recently launched some initiatives which are potentially very interesting in terms of social inclusion and value sharing, including profit sharing, from RES. However, they are both at a very early stage, thus data are not yet available to evaluate potential impacts and socio-economic benefits.

The first one relates to tackling energy poverty and promoting universal access to clean energy, for which Apulia is currently representing a best practice at the national level. In 2019, in fact, it became the first Italian region to establish by law[40] the so-called “energy income” (reddito energetico), a measure that will provide vulnerable households with small-scale renewable power plants, and thus free and clean energy. The details of how the scheme will work are still being finalised as of 2021. In February 2021, Regional authorities and GSE signed a partnership with the aim to define all necessary technical requirements and procedures to classify both beneficiaries and economic operators who will deliver the measure. The measure will be financed through regional funds, mainly by means of a dedicated revolving fund, which will be financed with the credits generated by selling unused electricity to the national market.

The second initiative refers to promoting renewable energy communities, which involve the aggregation of multiple *prosumers* who share a RES power plant, both in terms of costs and benefits. Apulia has been a pioneering Region in Italy following the approval of a dedicated regional law[41] establishing renewable

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[37] Confindustria’s branch for electronic and electrotechnical industry, including RES. More information at: https://anie.it/
[38] https://www.confartigianato.it/
[39] https://lanuovaenergia.it/
[40] Legge regionale 9 agosto 2019, n. 42 “Istituzione del Reddito energetico regionale”.
[41] Legge regionale del 9 agosto 2019, n. 45 sulla “Promozione dell’istituzione delle comunità energetiche”

energy communities in the Region. The provision also set guidelines to identify criteria for a perspective Protocol of understanding involving municipalities, and the functioning of a regional funding mechanism. As a matter of fact, Apulia's regional law has anticipated the national legislature, which established renewable energy communities just a few months later. Measures to support renewable energy communities at national level include, among the others, a specific funding mechanism which pays an incentive fee of 110 €/MWh[42].

Local ownership and deployment of micro-RES in the residential sector remains relatively low in the region. This could potentially hamper broader economic benefits for the region and could be an avenue to explore in order to enhance the socio-ecnomic benefits regionally.

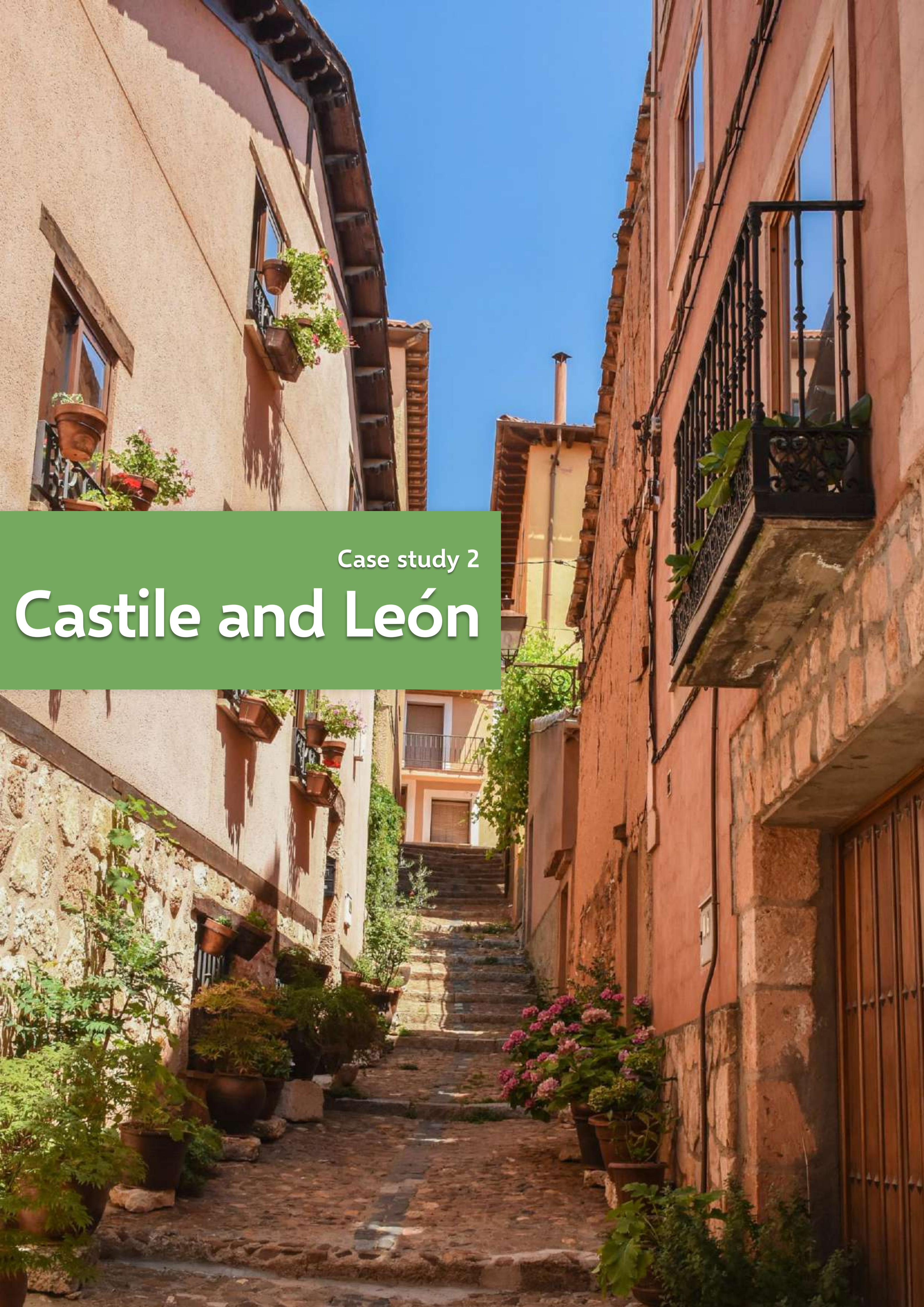
1.3.4 Key conclusions

1. The case study highlights that **the main factor hampering a strong RES growth in the Region today is not about economic costs, but rather about bureaucracy and permitting procedures**, which are becoming unsustainably long and complex – and thus, costly. In Italy, a key role in this issue is played by the Ministry of Culture and linked regional authorities in charge for landscape protection and conservation of cultural heritage, who have been particularly restrictive, rejecting many authorizations requests – including for power plants which are outside landscape protection constraints. Another key role is played by local communities and citizens, who often hamper the deployment of RES because they have been suffering some consequences for past planning and procedural mistakes. There is a need for a broad and dedicated involvement of citizens for them to fully understand the potentialities and urgency of strong – but still socially sustainable – RES deployment in the Region.
2. **Different technologies show different challenges and require different solutions.** Given the context and RES historical deployment, wind power growth in Apulia is mostly about repowering, as many outdated power plants are located in the Region and will need to be repowered in order not to waste the great wind availability of the Region. For PV, instead, deployment efforts will need to be driven both towards

[42] Decreto 16 settembre 2020 del Ministero dello sviluppo economico, "Individuazione della tariffa incentivante per la remunerazione degli impianti a fonti rinnovabili inseriti nelle configurazioni sperimentali di autoconsumo collettivo e comunita' energetiche rinnovabili, in attuazione dell'articolo 42-bis, comma 9, del decreto-legge n. 162/2019, convertito dalla legge n. 8/2020.

small-scale building plants as well as towards large-scale plants (again, not to waste the great solar availability of the Region); for the latter, it will be crucial to support the deployment of large-scale PV power plants also in rural areas by means of a careful regulation, in order to avoid conflicts with primary production and consent complications.

3. **The key role that regions play in the transition towards climate neutrality, including for RES deployment, needs to be made clear and enhanced.** Regions need to work in full harmonization with national governments. In Italy, climate and energy targets are set at the national level but planning occurs at the local level, specifically at the regional level. However, regions do not bear any RES deployment target, not even for emissions reductions and energy efficiency progress. **A new burden sharing scheme would be a solution for a broader and more effective involvement of regions in climate and energy targets.** Ultimately, it is not just a matter of "burden" sharing, but also an occasion for "opportunities" sharing: our case study shows that there is no monitoring and no enhancement of the great local spill overs in terms of jobs and economic growth from the RES sector, despite the great potential of the Region. Apulia, just like many other Regions in Italy, still lacks a local strategy for industrial development in the RES sector, which would be essential to maximize economic and occupational benefits in the Region.



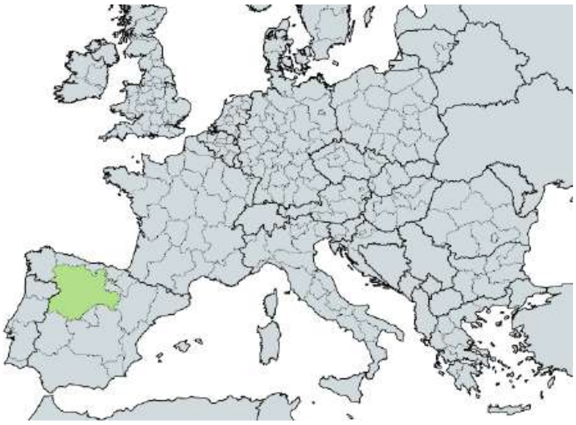
Case study 2

Castile and León

2. CASTILE AND LEÓN (CASTILLA Y LEÓN), SPAIN

This case study was authored by ***Jesús Urios Culiañez*** *from the Institute for European Environmental Policy (IEEP).*

Photo by Héctor J. Rivas on Unsplash



GDP per capita	€24,261 (2020)
Population	2,394,918 (2020)
Population density	26.1/km^2
Unemployment rate	11.82% (2020)
People at risk of poverty or social exclusion	16,7%
Share of renewable energy (% of gross final energy consumption)	N/A
Total installed RES capacity	11,606 (MW) out of 12,197 (MW) (2020)
Employment in RES	1% direct (2020 est)

2.1 Brief overview of the Spanish context

2.1.1 National socio-economic development

The economy of Spain is the fourth biggest in the EU with an estimated size of €1,244,772 million[1] and a real GDP per capita of €25,200[2] in 2019. Despite being a high-income country and showing a remarkable convergence[3] with the EU since its accession in 1986, the country suffers from comparatively high levels of structural unemployment and slightly above average income inequalities with respect to similar countries in the EU.

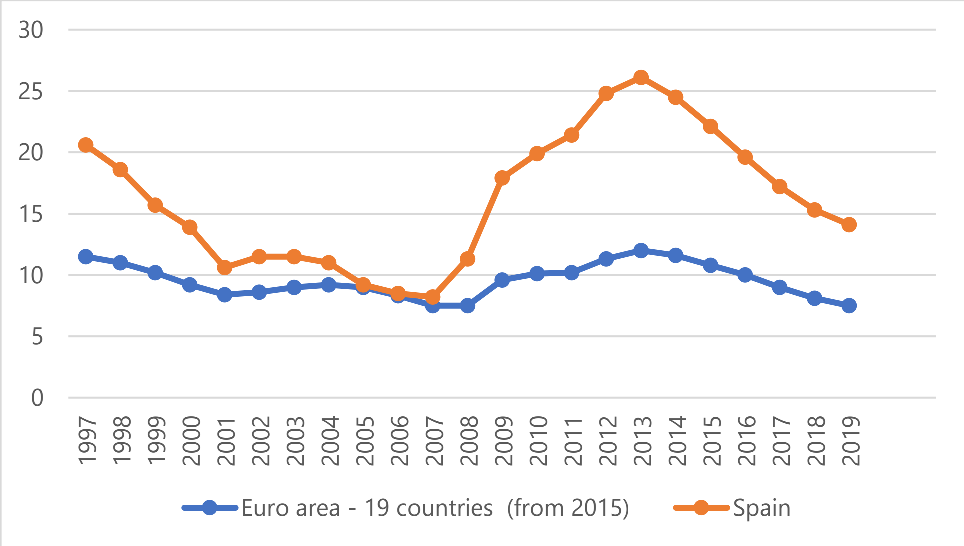
Concerning unemployment, the Spanish economy suffers from high levels of unemployment compared to the Euro area (Figure 5). This is mainly due to the nature of the Spanish economic growth model, based on tourism and construction activities. This has led to the existence of high numbers of short-term contracts and persistent mismatches between supply and demand.

[1] Eurostat (2021) *Gross domestic product at market prices.* Retrieved from https://ec.europa.eu/eurostat/databrowser/view/tec00001/default/table?lang=en

[2] Eurostat (2021) *Real GDP per capita.* Retrieved from https://ec.europa.eu/eurostat/databrowser/view/sdg_08_10/default/table?lang=en

[3] Luis de Guindos (06/09/2018). *Remarks by Luis de Guindos, Vice-President of the European Central Bank, at an event in honour of the 40th anniversary of the Spanish constitution*. Retrieved from https://www.ecb.europa.eu/press/key/date/2018/html/ecb.sp181218.en.html

Figure 5: Unemployment levels in % (1997-2019)

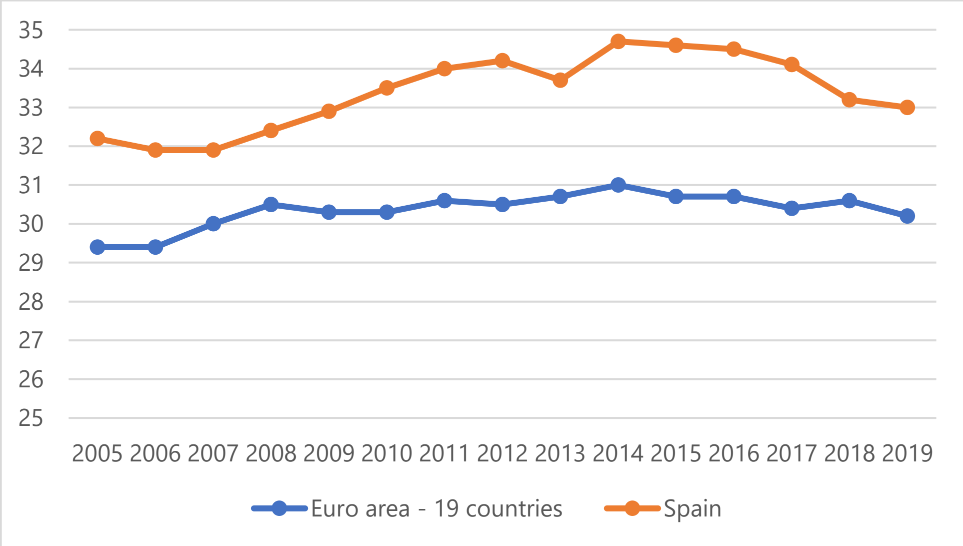


Source: Own elaboration from selected Eurostat[4] figures

Regarding income inequalities, Figure 6 illustrates the Gini coefficient of Spain and comparable countries. Spain performs worse than the EU15 countries consistently, although it converged until 2004. Figure 7 also illustrates the interterritorial inequalities present among different Spanish regions and autonomous cities in terms of GDP per capita to illustrate intra-national inequalities,

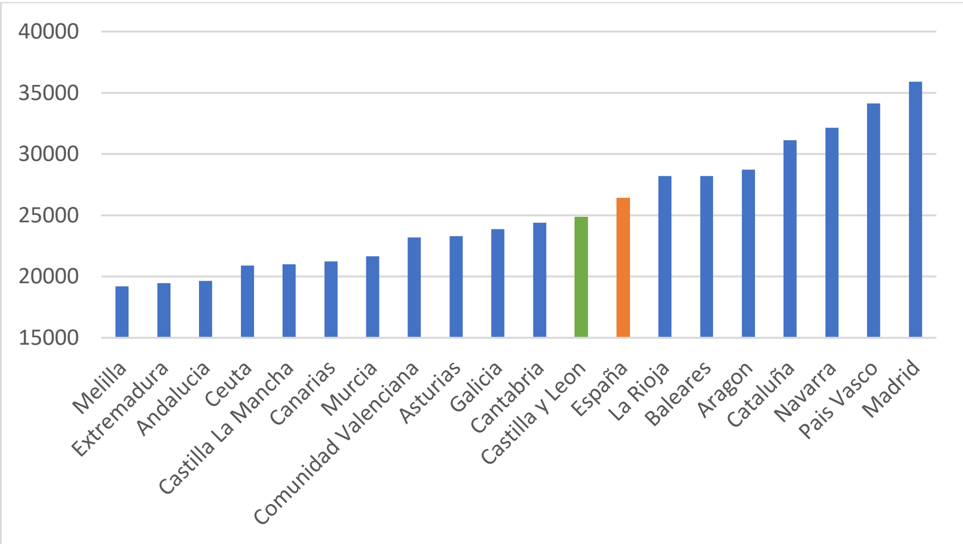
[4] Eurostat (2021) *Unemployment by sex and age.* Retrieved from https://ec.europa.eu/eurostat/databrowser/view/une_rt_m/default/table?lang=en

Figure 6: Gini coefficient of equivalised disposable income EU-SILC survey



Source: Own elaboration from selected Eurostat[5] figures

Figure 7: Regional GDP per capita (2019)



Source: Own elaboration from selected INE[6] figures

[5] Eurostat (2021) *Gini coefficient of equivalised disposable income – EU-SILC survey*. Retrieved from https://ec.europa.eu/eurostat/web/products-datasets/-/ilc_di12

[6] Instituto Nacional de Estadística (2021) *GDP per capita*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736167628&menu=ultiDatos&idp=1254735576581

Population trends

Spain is the fourth most populated country in the EU with 47,351,567 million inhabitants in 2020.[7] However, the country is expected to have weak population growth, in line with other European countries, due to low levels of fertility and ageing population.

The most important demographic trend in Spain is the fact that the population is aging at a considerable rate. In 2019, the percentage of the population above 65 years was 19.5%. This figure is expected to reach 32.7% in 2050.[8] This is partially explained by the above-mentioned low fertility rates and the level of life expectancy at birth: Spanish life expectancy in 2018 was the second highest worldwide at 83 years old, second only to Japan and Switzerland (84)[9], partly due to the existence of strong welfare policies.

Another relevant trend is the population shifts towards the main Spanish cities and coastal areas. For instance, Madrid has grown 73% since 1975 while the province of Soria in Castilla y León has lost 23% of its population. The regions more affected by depopulation are rural areas of the interior and north-west of the Iberian Peninsula, namely Castilla y León, Castilla la Mancha, Asturias, Extremadura and Galicia.[10]

Political dynamics

Spain has not remained isolated from political trends taking place in Europe and elsewhere, although with its own idiosyncrasy. From democratic restoration in 1975 until 2015, Spanish politics were rather bipartisan and stable. The main center-right (PP) and center-left (PSOE) parties reached often solid absolute majorities to form government or simple majorities supported by regional and nationalist parties.

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[7] Instituto Nacional de Estadística (2021) *Population living in Spain*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176951&menu=ultiDatos&idp=1254735572981

[8] European Commission (2020) *The 2021 Ageing Report*. Retrieved from: https://ec.europa.eu/info/sites/info/files/economy-finance/ip142_en.pdf

[9] World Bank (2021). *Life expectancy at birth*. Retrieved from https://data.worldbank.org/indicator/SP.DYN.LE00.IN?locations=OE&most_recent_value_desc=false

[10] Epdata (2021) *La España vacía: despoblación en España, datos y estadísticas*. Retrieved from https://www.epdata.es/datos/despoblacion-espana-datos-estadisticas/282#:~:text=Datos%20actualizados%20el%2025%20de,todas%20las%20zonas%20por%20igual.

However, the effects of the 2007 financial crisis and a series of corruption scandals contributed to the fragmentation of the political landscape and the surge of some political parties on the fringe of populism across the whole political spectrum, as well as regional nationalists and independence movements. This has caused an unprecedented parliamentary fragmentation that has forced political parties to engage in governmental coalitions with the associated dynamics in a country with limited culture of political compromise among parties.

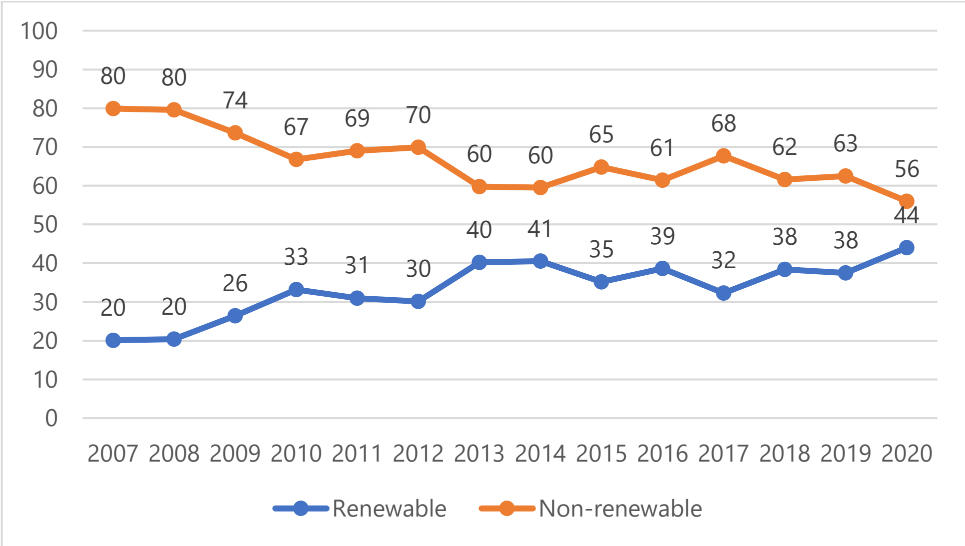
2.1.2 Renewable energy deployment at the national level

Spain has virtually no domestic production of fossil fuel resources, with the exception of limited coal reserves, and it imports almost all the natural gas and oil needed to meet its energy demand. However, despite some progress in greening national generation, non-renewable sources (including fossil fuels and nuclear energy) still held the largest share of generation at 56%, while power from renewable sources accounted for 44% of gross electricity generation in 2020 (Figure 8). Wind generation represented 21.9% and solar PV reached a historic 6.1% of total generation in 2020.[11] Concerning the power generation from renewable energy sources, wind accounted for 55.4% of generation, followed by hydropower (Figure 9). In 2019, Spain also reached 18.4% of renewable energy sources in gross final energy consumption.[12]

[11] Red Eléctrica de España (2019) *El sistema eléctrico español (Avance 2020)*. Retrieved from https://www.ree.es/sites/default/files/publication/2021/03/downloadable/Avance_ISE_2020_1.pdf

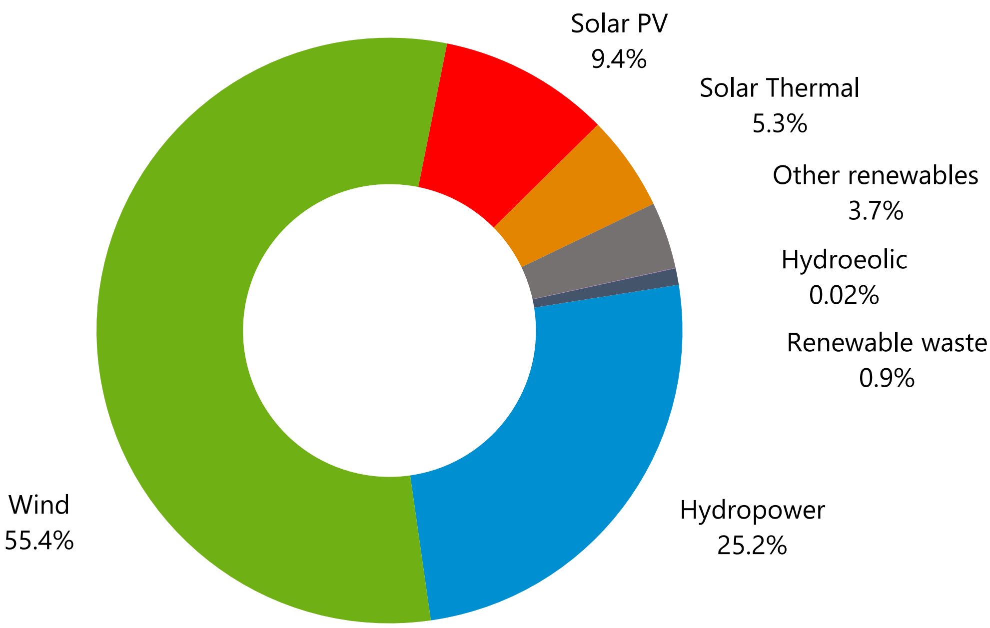
[12] Eurostat (2021) *Renewable energy statistics*. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics

Figure 8: Evolution of national power generation in Spain (2007-2020 in %)



Source: own elaboration from selected REE13 data

Figure 9: Renewable energy power generation structure (2019)



Source: REE[14]

[13] Red Eléctrica de España (2021) *Evolución de la generación renovable y no renovable nacional*. Retrieved from: https://www.ree.es/es/datos/generacion

[14] Red Eléctrica de España (2019) *Las energías renovables en el sistema eléctrico espanol*. Retrieved from https://www.ree.es/es/datos/publicaciones/informe-de-energias-renovables/informe-2019

The need to reduce energy dependence from third countries, the potential for renewable energy production and the efforts needed to comply with international climate mitigation agreements and European law, have led the central government to deliver several strategies concerning the promotion of renewable energy.

Central Government programmes

In the year 2000 the central government approved the 'Plan for the Promotion of Renewable Energy in Spain'[15] with the final objective of achieving at least 12% of primary energy consumption by 2010, based on the European Commission's 1998 White Paper on renewable energy[16] . In 2005, the new government considered that such a plan was not going to deliver its own stated objectives. Hence, the previous plan was replaced by the 'Renewable Energy Plan 2005-2010'[17]. The new plan maintained the 12% objective for the year 2010 but with additional regulatory and financial provisions. Thanks to this legislative framework, renewable energy primary energy consumption grew from 6.3% in 2004 to 13.2% in 2010.

In 2011, a new 'Renewable Energy Programme'[18] was approved with the objective of reaching 20% of final energy consumption from renewable sources by 2020. The plan aimed to fulfill the requirements laid out in the 2009 Renewable Energy Directive[19] in the context of the 2020 Energy and Climate Pack objectives[20].

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[15] Gobierno de España. Ministry for Science and Technology (1999) *Plan de Fomento de las energías renovables en España*. Retrieved from https://www.idae.es/uploads/documentos/documentos_4044_PFER2000-10_1999_1cd4b316.pdf

[16] Communication from the Commission – Energy for the future: renewable sources of energy – White Paper for a Community strategy and action plan (1999) COM/97/0599

[17] Gobierno de España. Ministry for Industry, Tourism and Trade (2005) *Plan de energías renovables en España*. Retrieved from https://energia.gob.es/desarrollo/EnergiaRenovable/Plan/Documents/ResumenPlanEnergiasRenov.pdf

[18] Instituto para la diversificación y Ahorro de la energía (2011) *Plan de energias renovables (2011 – 2020)*. Retrieved from https://www.idae.es/sites/default/files/documentos/publicaciones_idae/documentos_11227_per_2011-2020_def_93c624ab.pdf

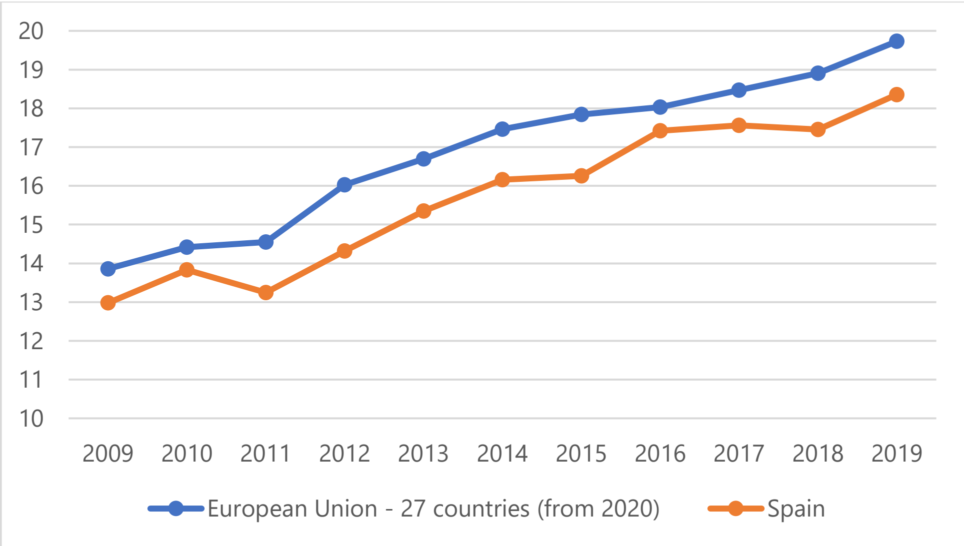
[19] 'Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC' (2009) *Official Journal L140/6*

[20] European Commission (2021) *2020 climate & energy package*. Retrieved from https://ec.europa.eu/clima/policies/strategies/2020_en

Upon expiry of the 2011 plan, the central government approved in 2019 the 'National Integrated Energy and Climate Plan'[21] (NECP) for the period 2021-2030. The new plan was designed to fulfill the legal obligations derived from the legislation agreed in the context of the 2016 'Clean Energy for All Europeans'[22] package. The 2019 Spanish plan goes beyond the EU 2030 objectives and aims to reach 42% of final energy consumption from renewable sources and 74% of renewable energy generation by 2030.

Figure 10 illustrates the results of the mentioned above policies and compares it with the EU.

Figure 10: Share of energy from renewable sources (%)



Source: own elaboration from selected Eurostat[23] data

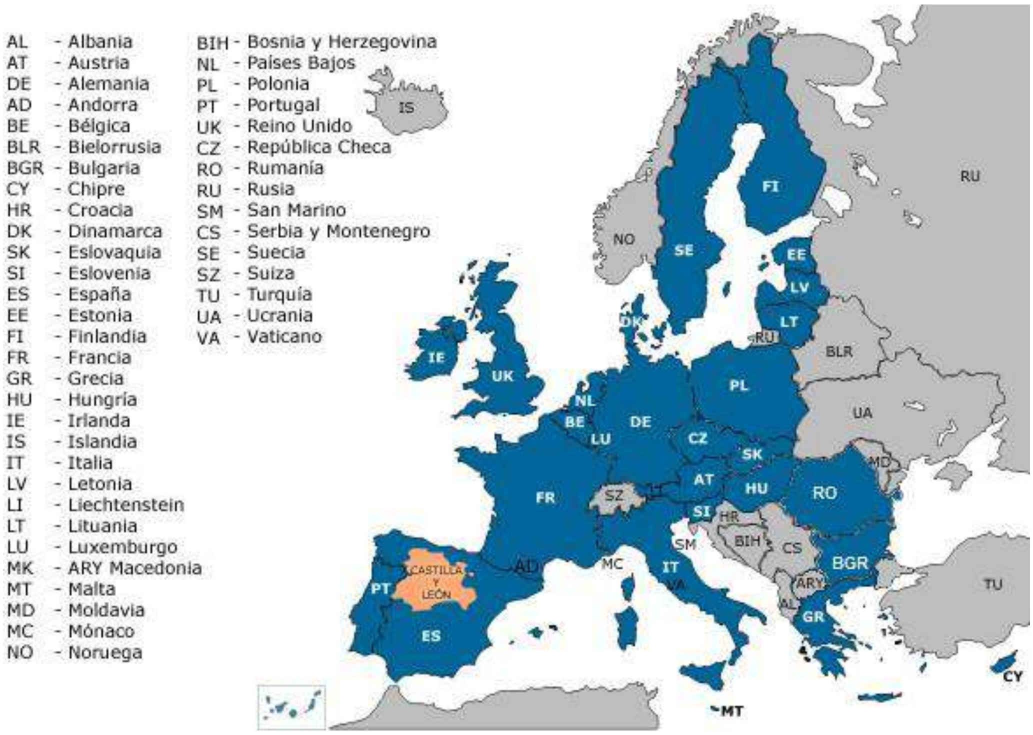
2.2 Detailed overview of Castilla y León

2.2.1 Geography and potential for renewable energy

Castilla y León is one of the 17 regions that form Spain, situated in the northeast of the Iberian Peninsula. With a surface area of 94,225 km², it is the biggest Spanish region and the third biggest region of the EU. The region is made up of 9 provinces (Ávila, Burgos, León, Palencia, Salamanca, Segovia, Soria, Valladolid y

[21] Gobierno de España (2020) *Plan Nacional Integrado de energía y Clima*. Retrieved from https://ec.europa.eu/energy/sites/ener/files/documents/es_final_necp_main_es.pdf
[22] European Commission (2016) *Clean energy for all Europeans package*. Retrieved from https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en
[23] Eurostat (2021) *Share of energy from renewable sources*. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_REN__custom_874796/default/table?lang=en

Zamora) and its capital is Valladolid. It shares border with 9 other Spanish regions and with Portugal, hence it is positioned as a nexus between different regions.[24]



Source: Junta de Castilla y León

The predominant climate in the region is continental Mediterranean climate, characterized by cold winters and hot summers with short spring and autumn periods, although some areas fall within the continental and mountain climates.[25]

Castilla y León has a rather limited rainfall, with an annual average precipitation of 413 mm. Hence, the importance of dams in the region to rationalise the use of water resources, both for supplying the population and for generating hydroelectric power or for agricultural use. Spain is in fact the first country in the EU and the fifth worldwide on number of dams and reservoirs.[26] Castilla y León's orography consists of a vast plain surrounded by mountain ranges with an

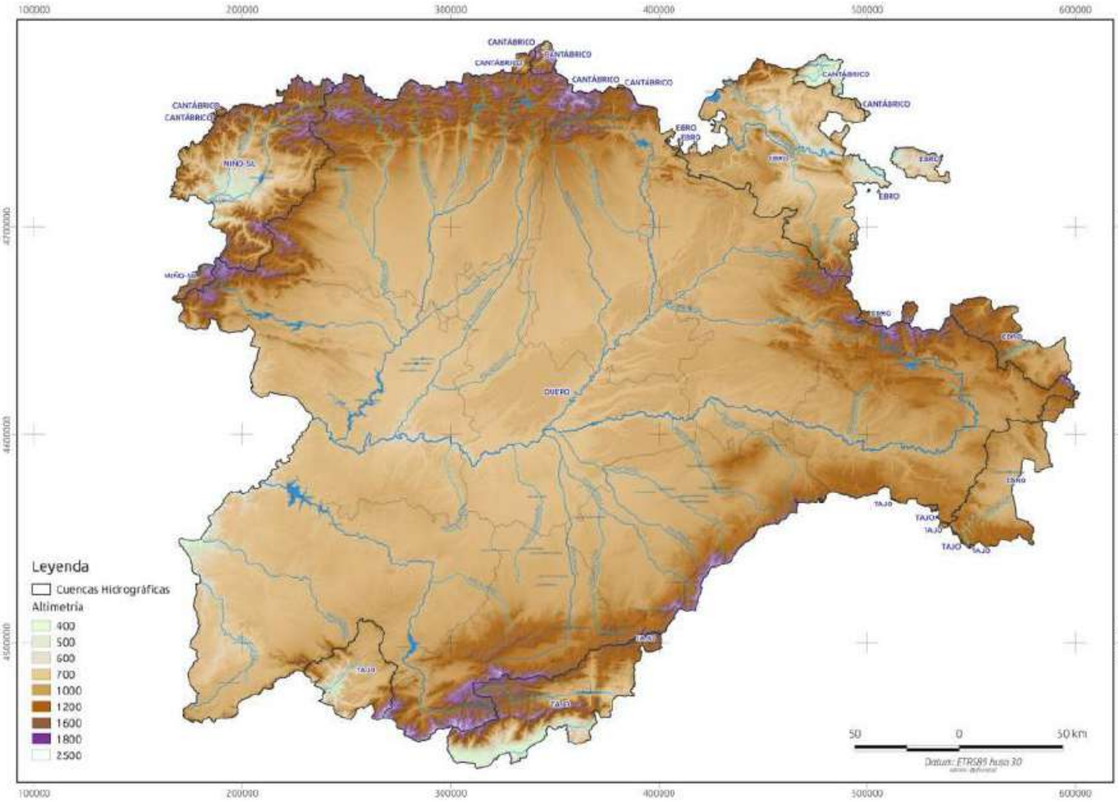
[24] Junta de Castilla y León (2021) *Geography*. Retrieved from: https://conocecastillayleon.jcyl.es/web/es/geografia-poblacion/geografia.html

[25] Junta de Castilla y León (2021) *Climate*. Retrieved from: https://conocecastillayleon.jcyl.es/web/es/geografia-poblacion/clima.html

[26] Morales, F. (2018, September 23) España es el país de la UE que tiene mayor número de embalses. *Diario expansión* https://www.expansion.com/sociedad/2018/09/23/5ba7dedbe2704e51b08b464d.html

average altitude of the region of 830 meters above sea level. The highest point is Torrecerredo mountain, with 2,648 meters high.[27]

Figure 11: Physical map of Castilla y León with altimetry and main rivers



Source: El Pais[28]

Castilla y León has a lot of potential for the deployment of renewable energy due to its geographical conditions. A study from the Joint Research Center (JRC) of the European Commission compared 41 regions across the EU and concluded that Castilla y León has the highest onshore wind potential (228 GW) and the highest potential for ground-mounted solar PV systems (~80 GW) (Figure 9). The region also scores with the highest bioenergy potential from crop residues and from livestock methane (730 MW and 110 MW, respectively) due to its relatively big primary sector. Finally, the region also has the highest sustainable potential

[27] Junta de Castilla y León (2021) *Orography*. Retrieved from: https://conocecastillayleon.jcyl.es/web/es/geografia-poblacion/orografia.html

[28] Martin Barbero, I. (2019, September 4) Mapas de Espana para descargar e imprimir completamente actualizados. *Cinco Días* https://cincodias.elpais.com/cincodias/2019/09/04/lifestyle/1567613643_630278.html

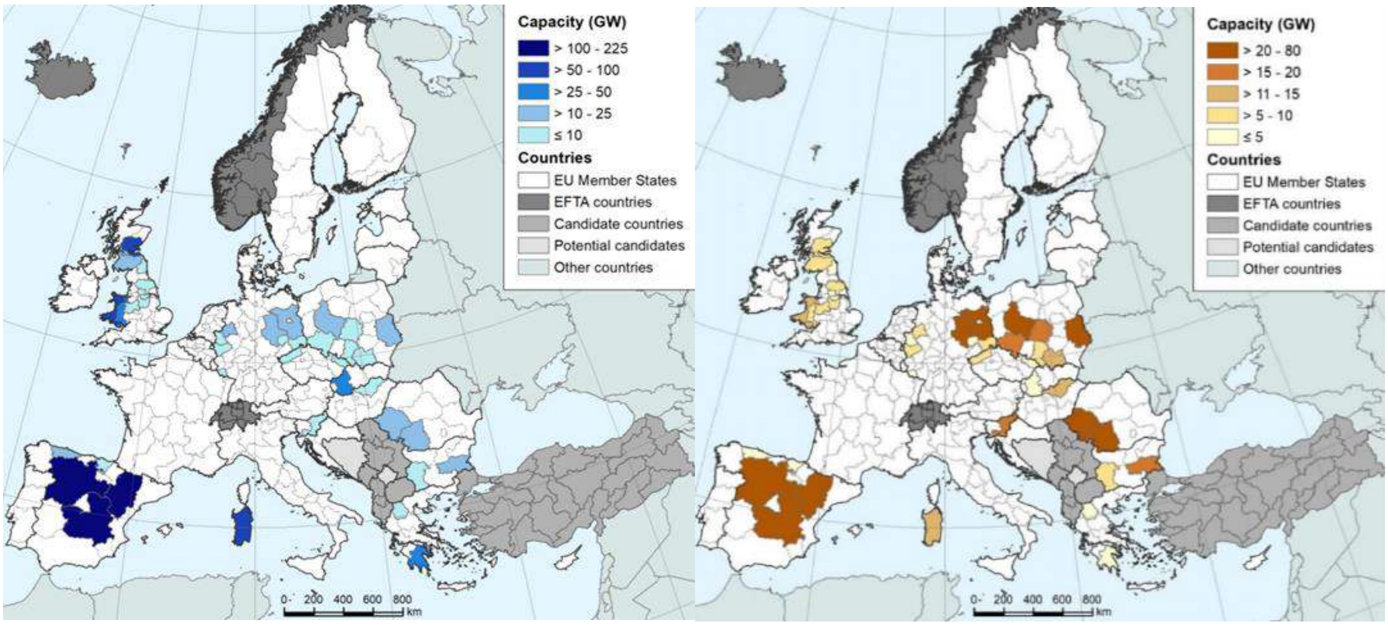
for geothermal energy (500 MW).[29] Indeed, the region is currently far from reaching its highest RE potential as described in the JRC report:

Table 1: Current installation vs potential installation gap (GW)

	2020 installed capacity	Potential (JRC)
Wind	4,39	228
Solar	0,84	80
Bioenergy	0,096	0,84

Source: Own elaboration from JRC and REE data

Figure 12: Onshore wind and grounded-solar PV potential in selected EU regions



Source: JRC

2.2.2 Socio-economic development

Out of the 17 autonomous regions and the 2 autonomous cities, Castilla y León is the 7th biggest regional economy in Spain with a total GDP of €59,794,929

[29] Kapetaki, Z., Ruiz Castello, P., Armani, R., Bodis, K., Fahl, F., Gonzalez Aparicio, I., Jaeger-Waldau, A., Lebedeva, N., Pinedo Pascua, I., Scarlat, N., Taylor, N., Telsnig, T., Uihlein, A., Vazquez Hernandez, C. and Zangheri, P. (2020) *Clean energy technologies in coal regions*. EUR 29895 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-10356-1, doi:10.2760/384605, JRC117938.

million in 2019. In terms of GDP per capita, the region ranks 8th with a value of €24,886[30] per person, below the national average of €25,200 and the EU average of €27,970 per person.[31] There are also remarkable differences in income by province.

Table 2: GDP per capita of Castilla y León by provinces (EUR)

Burgos	29,571
Palencia	27,346
Valladolid	26,901
Soria	26,626
Average	24,261
Segovia	22,212
León	21,579
Salamanca	21,187
Ávila	20,423
Zamora	19,813

Source: INE[32]

The economic structure of the region is one of a developed, service-oriented economy. However, as it can be seen on Table 3, the weight of the primary sector on GDP is twice the size with respect to the rest of Spain and almost 4 times higher than the EU average. The industrial sector of the region is mainly composed of agri-food, car production and construction activities. The region has been a net exporter with a positive trade balance over the past 15 years.

[30] Instituto Nacional de Estadística (2021) *GDP per capita by regions*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736167628&menu=resultados&idp=1254735576581

[31] Eurostat (2021) *Real GDP per capita*. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/sdg_08_10/default/table?lang=en

[32] Instituto Nacional de Estadística (2021) *GDP per capita by provinces*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736167628&menu=resultados&idp=1254735576581

Table 3: GDP composition by sectors (%, 2019)[33]

	Castilla y León	Spain*	EU
Services	68,4	74,2	71
Primary sector	6,6	2,6	1,6
Industry	26	23,2	25,1

Source: JCyL[34] and CIA[35] - *data from 2017

Demographics

Castilla y León had 2,394,918 habitants in 2020 (5.5% over the national census), with a 5.89% of foreign population[36] (compared to an 11.5%[37] average in Spain). The region has one of the lowest population densities in the EU: the region has an average of 26.1 people per km^2, in contrast with the Spanish average (92 people per km^2) and the EU average (177 people per per km^2). Additionally, 44% of the population lives in urban areas,[38] in contrast with the EU average of people living in rural areas (29.1%).[39]

As mentioned in the section above, Castilla y León is one of the Spanish regions most affected by depopulation. Almost 88% of the region's municipalities had less population in 2018 than they had in 1998 and for the period 2000-2018, 6 out of the 9 provinces of Castilla y León lost population. Most emigrants, given its geographical proximity and importance, go to Madrid, followed by the Basque

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[33] Data for Castilla y León is dated from 2019 according to the regional government, while data for the EU and Spain comes from the CIA's database from 2017. The sum of percentages for Castilla y León sums up to 101, while the one for the EU sums 97.7. Both sums should account for 100, as it is expressed in percentage. This is probably due to typos and/or statistical mistakes. However, it gives an overview of the weight of the primary sector in the region with respect to the Spain and the EU.

[34] Junta de Castilla y León (2021) *Información socioeconómica – Mercado laboral*. Retrieved from https://estadistica.jcyl.es/web/es/estadisticas-temas/informacion-socioeconomica.html

[35] CIA (2021) *The World Factbook*. Retrieved from https://www.cia.gov/the-world-factbook/

[36] Junta de Castilla y León (2021) *Estadística – demográficas*. Retrieved from https://estadistica.jcyl.es/web/es/estadisticas-temas/demograficas.html

[37] Instituto Nacional de Estadística (2021) *Foreign population by nationality, provincces, sex and year*. Retrieved from https://www.ine.es/jaxi/Tabla.htm?path=/t20/e245/p08/l0/&file=03005.px&L=0

[38] Epdata op. cit.

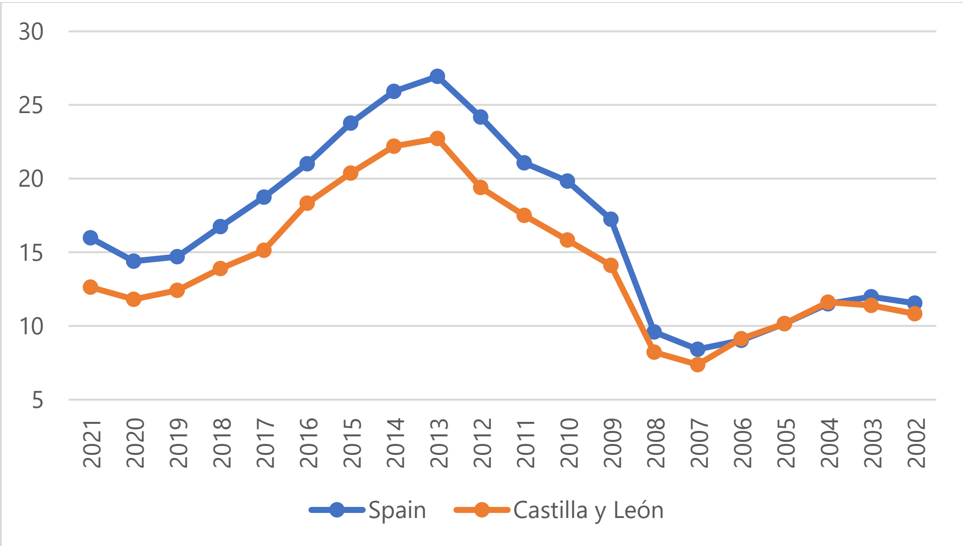
[39] European Commission (2021) *Urban and rural living in the EU*. Retrieved from https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20200207-1

Country.[40] Overall, the region has been losing population since the 1980's.[41] In addition, the region has an aging population: in 2019, the average age in the region was 47.1 years[42] due to the high life expectancy rate and the emigration of young people. The median age in Spain is 44.9 and the EU average is 43.[43]

Labor dynamics

Concerning employment, the region performs better than Spain in terms of unemployment (Figure 13), although still well above the EU average:

Figure 13: Unemployment rate Spain - Castilla y León in % (2002-2021 at the end of Q1)



Source: INE[44]

[40] Epdata op. cit.

[41] Gobierno de España. Ministry for the Ecological Transition and the demographic challenge (2020) The demographic challenge and depopulation in numbers Retrieved from https://www.lamoncloa.gob.es/presidente/actividades/Documents/2020/280220-despoblacion-en-cifras.pdf

[42] Junta de Castilla y León (2019) *Demographic indicators*. Retrieved from https://estadistica.jcyl.es/web/es/estadisticas-temas/indicadores-demograficos.html

[43] Eurostat (2019) *Median age over 43 years in the EU*. Retrieved from https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20191105-1#:~:text=In%202018%2C%20the%20median%20age,was%20recorded%20(37.3%20years).

[44] Instituto Nacional de Estadística (2021) Unemployment rate by age, gender and regions. Retrieved from https://www.ine.es/jaxiT3/Tabla.htm?t=4247

These are some of the key characteristics of the current labor market in Castilla y León[45]:

- According to the Central Business Directory[46], in 2018 there were 161,986 companies in Castilla y León, of which 83.47% had fewer than three employees. Only 57 had more than 500 employees. This is in line with the business structure of Spain, where most businesses are SMEs.

- The total workforce of the region amounted to 1,131,500 people in 2019. There were 1,005,000 employed and 126,500 unemployed. By economic sectors, 6.8 % of the employed worked in agriculture, 17.3 % in industry, 6.4 % in construction and 69.5 % in the service sector. In addition, foreign workers accounted for 7.15 % of the total. Out of these, there were 37,700 employed persons from EU countries and 34,100 from third countries.

- In 2019, 85.5 % of those employed had a full-time contract and 14.5 % had a part-time contract. In addition, 73.54% had a permanent contract and 26.46% had a temporary contract.

- The largest companies located in Castilla y León are: Renault Spain, Grupo Antolin, Michelin Spain Portugal, Iveco Spain, Campofrio Alimentación, Calidad Pascual and Grupo Europac.

- The main trade union of the region (and in Spain) is the Union General de Trabajadores (UGT) with over 65,000 affiliates. The second most relevant trade union is Comisiones Obreras (CCOO). The main business organization is the Confederación de Organizaciones Empresariales de Castilla y León (CECALE).[47] The Estatuto de Autonomia recognizes and encourages what is known as 'social dialogue' between trade unions, business organizations and the public administration. Hence, social dialogue is institutionalized.[48]

[45] EURES (2021) *Information about the labor market of Castilla y León*. Retrieved from https://ec.europa.eu/eures/main.jsp?countryId=ES&acro=lmi&showRegion=true&lang=es&mode=text&regionId=ES4&nuts2Code=%20&nuts3Code=null&catId=440

[46] Instituto Nacional de Estadística (2020) *Companies by regions*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736160707&menu=ultiDatos&idp=1254735576550

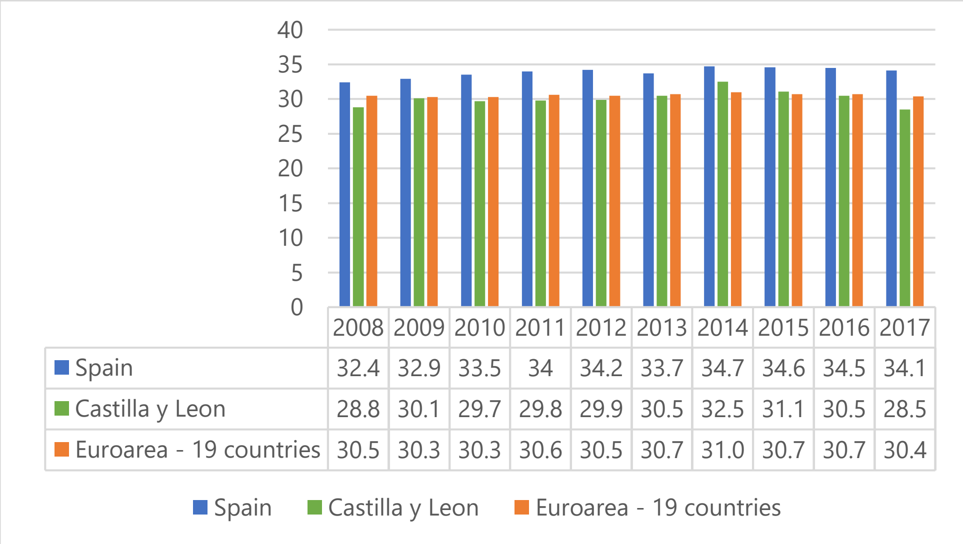
[47] Junta de Castilla y León (2021) *Most relevant labor unions and business organizations in Castilla y León*. Retrieved from https://fafecyl.jcyl.es/web/es/enlaces-interes/organizaciones-empresariales-sindicales-representativas.html

[48] Consejo Económico y Social de Castilla y León (2018) *Annual report – Social dialogue in Castilla y León*. Retrieved from https://www.cescyl.es/es/publicaciones/bases-datos-excel-informe-anual/informe-anual-2018-epigrafes-pdf/capitulo-2-mercado-laboral-castilla-leon-2018/2-3-dialogo-social-castilla-leon

Social inequalities, poverty and rent distribution

The Gini coefficient (Figure 14) has been consistently lower in Castilla y León than in the rest of Spain, indicating a more egalitarian income distribution structure. It can also be observed that throughout the years, the coefficient for Castilla y León in the beginning of the observed period (2008) and towards the end (2017) are very similar. When compared with the Euro area, overall, the region also seems to be more egalitarian.

Figure 14: Gini coefficient evolution (2008-2017)



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Spain	32.4	32.9	33.5	34	34.2	33.7	34.7	34.6	34.5	34.1
Castilla y Leon	28.8	30.1	29.7	29.8	29.9	30.5	32.5	31.1	30.5	28.5
Euroarea - 19 countries	30.5	30.3	30.3	30.6	30.5	30.7	31.0	30.7	30.7	30.4

Source: INE[49]*and Eurostat*

Castilla y León has one of the lowest at-risk-of-poverty rates, reaching 16.7%[50] compared to the 20.7% of Spain. This is also below the EU average in 2017 of 16.9%.[51] There are also other indicators that show a relatively better performance of the region compared to the rest of the country. For instance, in 2019, 7.6% of Spaniards were not able to properly warm their home while in Castilla y León 5.3% could not. In the EU27, the number reached 6.9% in the same year. Also in 2019, 7.8% of Spaniards had difficulties/delays in paying home-related bills (utility bills,

[49] Instituto Nacional de Estadística (2020) *Living conditions survey*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176807&menu=resultados&secc=1254736194793&idp=1254735976608

[50] Eurostat (2021) *People at risk of poverty or social exclusion by NUTS regions*. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/ilc_peps11/default/table?lang=en

[51] Eurostat (2020) *Income poverty statistics*. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Income_poverty_statistics&oldid=440992#At-risk-of-poverty_rate_and_threshold

rent, etc.). In Castilla y León the number represented 5.3% of the population. In Europe, the figure represents 8.1% of the population.[52] [53]

Political context and climate and energy policies

Since democratic restoration in 1975, there has been one government from PSOE and, since 1986, six governments from the main centre-right party (PP).[54] The current government is formed between PP and Ciudadanos (liberal party, Renew in the European Parliament). Politics in the region have been somewhat more stable compared with the rest of the country. Governments have been able to form stable majorities and the role of the emerging parties after 2015 has been rather limited. Most seats are currently largely held by the two traditional parties PP: 29 seats, PSOE: 35 seats, out of 81.

Over the last decade, the government of Castilla y León has developed a series of plans, regulations, and subsidies programs to boost renewable energy deployment in the region. Most of the plans have reached their expiry date and it is likely that these will be renewed in the upcoming years.

- 'Wind power Plan of Castilla y León' had the objective to organise the regional territory for the installation of wind power and to coordinate this with environmental and socio-economic issues in the region.[55]
- 'Solar Plan of Castilla y León' aimed to enhance the solar power sector in the region with three specific action plans: financing installations, businesses and manpower, and institutional diffusion of solar energy.[56]

[52] Eurostat (2021) *EU statistics on income and living conditions (EU-SILC) methodology – economic strain*. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_statistics_on_income_and_living_conditions_(EU-SILC)_methodology_-_economic_strain

[53] Instituto Nacional de Estadística (2020) *Poverty risk survey by regions*. Retrieved from https://www.ine.es/dynt3/inebase/es/index.htm?padre=1928&capsel=1930

[54] Historia Electoral (2021) Elecciones a Cortes de Castilla y León 1983 – 2019. Retrieved from http://www.historiaelectoral.com/acleon.html

[55] Junta de Castilla y León (2021) *The wind power plan of Castilla y León*. Retrieved from https://energia.jcyl.es/web/es/energias-renovables-ordenacion-energetica/plan-eolico-castilla-leon.html

[56] Junta de Castilla y León (2021) *The solar power plan of Castilla y León*. Retrieved from https://energia.jcyl.es/web/es/energias-renovables-ordenacion-energetica/plan-solar-castilla-leon.html

- 'Bioenergy Regional Plan of Castilla y León' established indicative targets for the year 2020.[57]

In addition, back in 2009 the region promoted a set of measures to tackle climate change with the release of the 'Regional Strategy to against Climate Change 2009-2012-2020'[58] focused on CO2 emissions reduction in the context of the Kyoto Protocol.

Regional energy governance

Spain is constitutionally a unitary state but in practice it is a quasi-federal state where regions have a high degree of autonomy. In fact, it is considered one of the most decentralised countries in the world alongside Denmark, Canada, or Germany.[59] All 17 Spanish regions and the 2 autonomous cities have competencies over a wide range of policies such as education, healthcare, internal territorial organisation, environmental protection, etc.

Spanish autonomous regions also have relevant competences concerning the energy sector. The Estatuto de Autonomia[60] of Castilla y León states that the region has the following competences over energy:

- Mining and energy regime, including renewable energy sources
- Industry, in compliance with State regulations for reasons of security, military or health interests and regulations relating to industries subject to mining, hydrocarbon and nuclear energy legislation.
- Installations for the storage, production, distribution and transport of any type of energy, **where they are confined to the territory of the Region and their use does not affect another Region**.

In Spain, the common framework and coordination of energy issues across the whole country is dictated at the national level. Then, it is up to the regions to

[57] Junta de Castilla y León (2021) *The secotral biomass plan of Castilla y León*. Retrieved from https://energia.jcyl.es/web/jcyl/Energia/es/Plantilla100Detalle/1267710822752/Programa/1284151659081/Comunicacion

[58] Junta de Castilla y León (2021) *Climate Change Regional Strategy*. Retrieved from https://medioambiente.jcyl.es/web/jcyl/MedioAmbiente/es/Plantilla100Detalle/1259064156693/Preguntas-Respuestas/1284429650101/Soporte

[59] OECD (2019) OECD *Multi-level governance studies, making decentralization work. A handbook for Policy-Makers.* Retrieved from https://www.oecd-ilibrary.org/sites/53013b71-en/index.html?itemId=/content/component/53013b71-en

[60] Junta de Castilla y León (2021) *Estatuto de Autonomia*. Retrieved from https://www.jcyl.es/web/es/administracionpublica/estatuto-autonomia.html

decide their own energy policy, in accordance with National legislation and when it only affects the region itself. Finally, local authorities have competences over spatial planning. The public body in charge of regional energy issues is the EREN (Ente Publico Regional de la Energia de Castilla y León).[61] The functioning of the energy system at the national level is supervised by the National Commission of Markets and Competition (CNMV)[62] the regulatory body in charge of promoting and ensuring the proper operation of all markets in Spain.

Concerning planning rules and approval processes, the regional government provides instructions on the installation of different energy infrastructures, both renewable and non-renewable and for both businesses and consumers.[63] Overall, several permits issued by the authorities are required (depending on the size of the power installation) and some provinces have tax benefits to promote such investments. The different administrative steps can be done online.

EU Funds for renewable energy deployment

Castilla y León has received EU funds for renewable energy deployment in the region. The European Regional Development Fund (ERDF) provides specific allocations for several thematic areas, including funding for a 'low-carbon economy'.[64] Castilla y León, for the 2015-2020 period, received €22,693,882 (50% from EU Funds and 50% from regional/national funds) for the Objective 4 'Fostering the transition to a low-carbon economy in all sectors', which encompasses both renewable energy deployment and energy efficiency improvements. For renewable energy deployment, the region received € 2,407,170.[65]

The region also received €357,125,579 (€ 233,696,267 from EU funds and € 123,429,312 from national funding) in the context of the ERDF 2007-2013 plan for the region[66] for the 'Transport and Energy' priority, which includes funding for

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[61] Junta de Castilla y León (2021) *EREN*. Retrieved from https://www.jcyl.es/web/jcyl/Portada/es/Plantilla100Directorio/1248366924958/1279887997704/1142233486661/DirectorioPadre
[62] CNMC (2021). *What is the CNMC?* Retrieved from https://www.cnmc.es/en/sobre-la-cnmc/que-es-la-cnmc
[63] Junta de Castilla y León (2021) *Instructions related to energy installations*. Retrieved from https://energia.jcyl.es/web/es/energias-renovables-ordenacion-energetica/instrucciones-materia-energia.html
[64] European Commission (2021) *European Regional Development Fund*. Retrieved from https://ec.europa.eu/regional_policy/en/funding/erdf/
[65] Junta de Castilla y León (2021) *Operative Plan for 2014 - 2020*. Retrieved from https://hacienda.jcyl.es/web/es/fondos-europeos-2014-2020/programas-operativos.html
[66] Junta de Castilla y León (2021) *Operative Plan for 2007 - 2013*. Retrieved from http://www.jcyl.es/web/jcyl/Hacienda/es/Plantilla100/1199779412642/1246993414328/_/_

renewable energy deployment of a value of € 3,446,970. Similarly, the region also received funds for priority number 6.9 of the 2000-2006 ERDF plan for the region, with a value of € 12,490,142 (50% from EU Funds and 50% from regional funds).[67] A substantial decrease in regional funds can be observed for Castilla y León after the 2006 plan due to the 2004 EU accession wave.[68]

Table 4: ERDF funds for renewable energy deployment in Castilla y León (EUR)

	Total (EU + national contributions)	Fund allocation to Energy/Low carbon priorities	Specific allocation for renewable energy
2000 – 2006	5,032,836,105	2,043,022,621*	**12,490,142**
2007 – 2013	818,194,437	357,125,579*	**3,446,970**
2014 – 2020	651,732,622	22,693,882	**2,407,170**

Source: Own elaboration from JCyL data - * this is the allocation to the Transport and Energy theme area. In the 2014-2020 plan, Energy had a differentiated treatment.

2.2.3 Renewable energy deployment in Castilla y León

Castilla y León is the region with the highest share of renewable energy generation in Spain. In 2020, the power generation structure of the region was largely dominated by renewable energy with an 87% of total power generation while only 13% was generated by non-renewable energy sources (Figure 15). The trend continues upwards for 2021. The region had a total installed capacity of 12,197 MW in 2020.[69]

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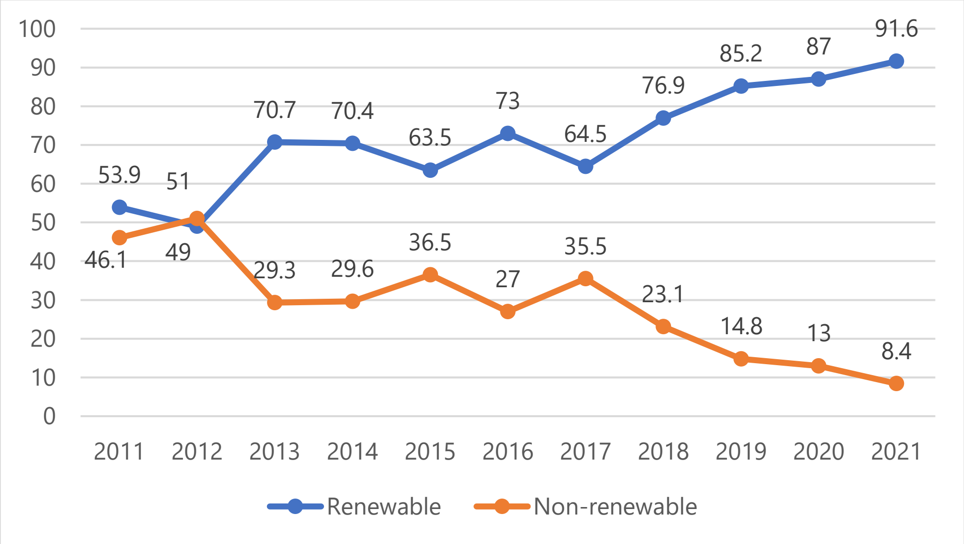
[67] Junta de Castilla y León (2021) *Operative Plan for 2000 - 2006*. Retrieved from https://hacienda.jcyl.es/web/es/fondos-europeos-2000-2006/20002006-programa-operativo-integrado.html

[68] Real Instituto Elcano (2004) *Adapting to a New Funding Relationship with Europe: Spain and Cohesion Policy*. Retrieved from http://www.realinstitutoelcano.org/wps/portal/rielcano_en/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_in/zonas_in/dt53-2004

[69] Red Eléctrica de España (2021) *National energy generation*. Retrieved from https://www.ree.es/en/datos/generation/installed-capacity

Figure 15: Power generation in Castilla y León in % (2011-2021)

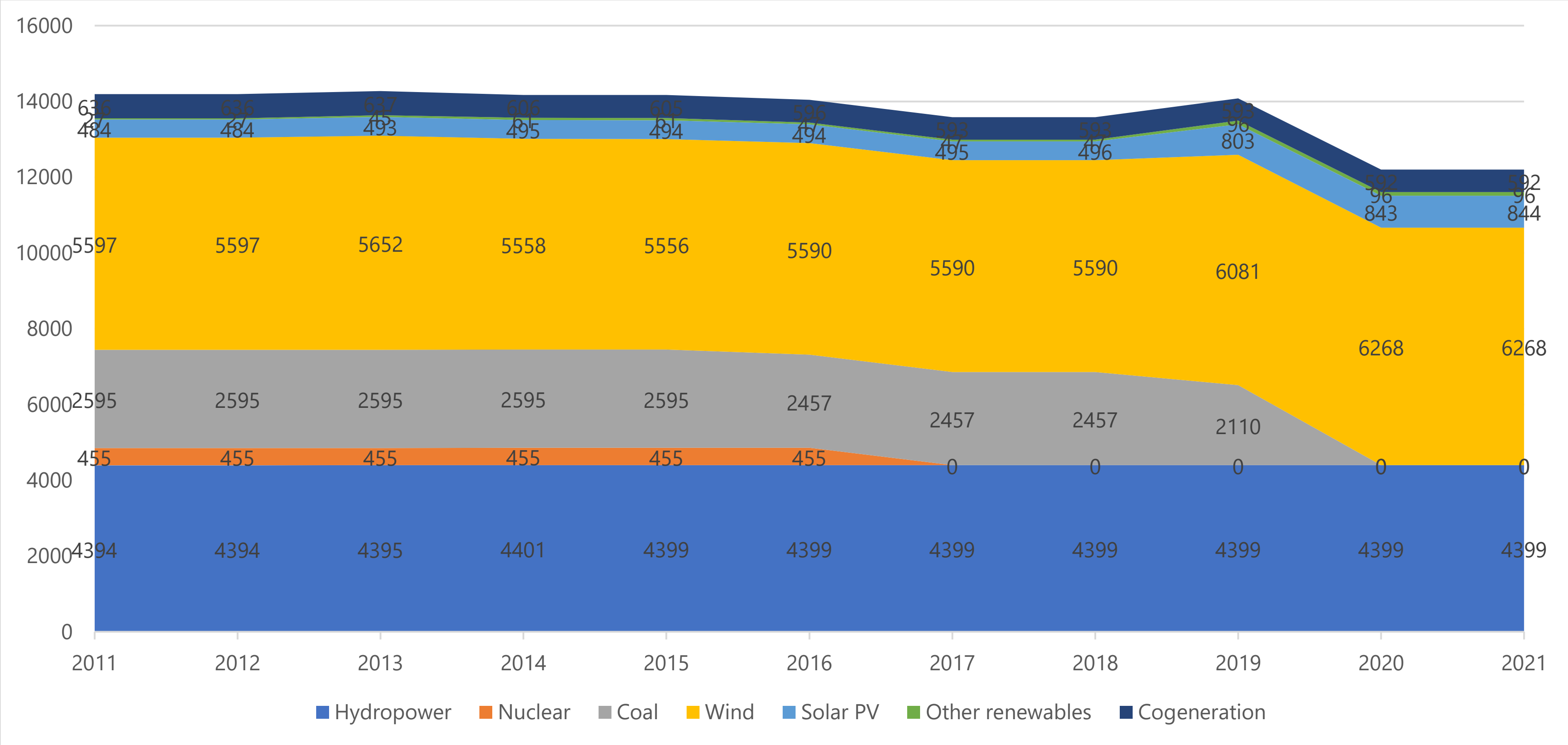


Source: REE[70]

By energy source, during the 2015-2021 period both nuclear and coal production has virtually ended in the region while wind (51%) and solar energy power (7%) have grown. Hydropower has remained stable at 36% of total energy generated (Figure 16).

[70] Red Eléctrica de España (2021) *Evolution of renewable and non-renewable energy generation*. Retrieved from https://www.ree.es/es/datos/generacion/evolucion-renovable-no-renovable

Figure 16: Installed capacity of energy sources in Castilla y León (MW)



Source: REE[1]

[11] Red Eléctrica de España (2021) *National statistical series*. Retrieved from https://www.ree.es/es/datos/publicaciones/series-estadisticas-nacionales

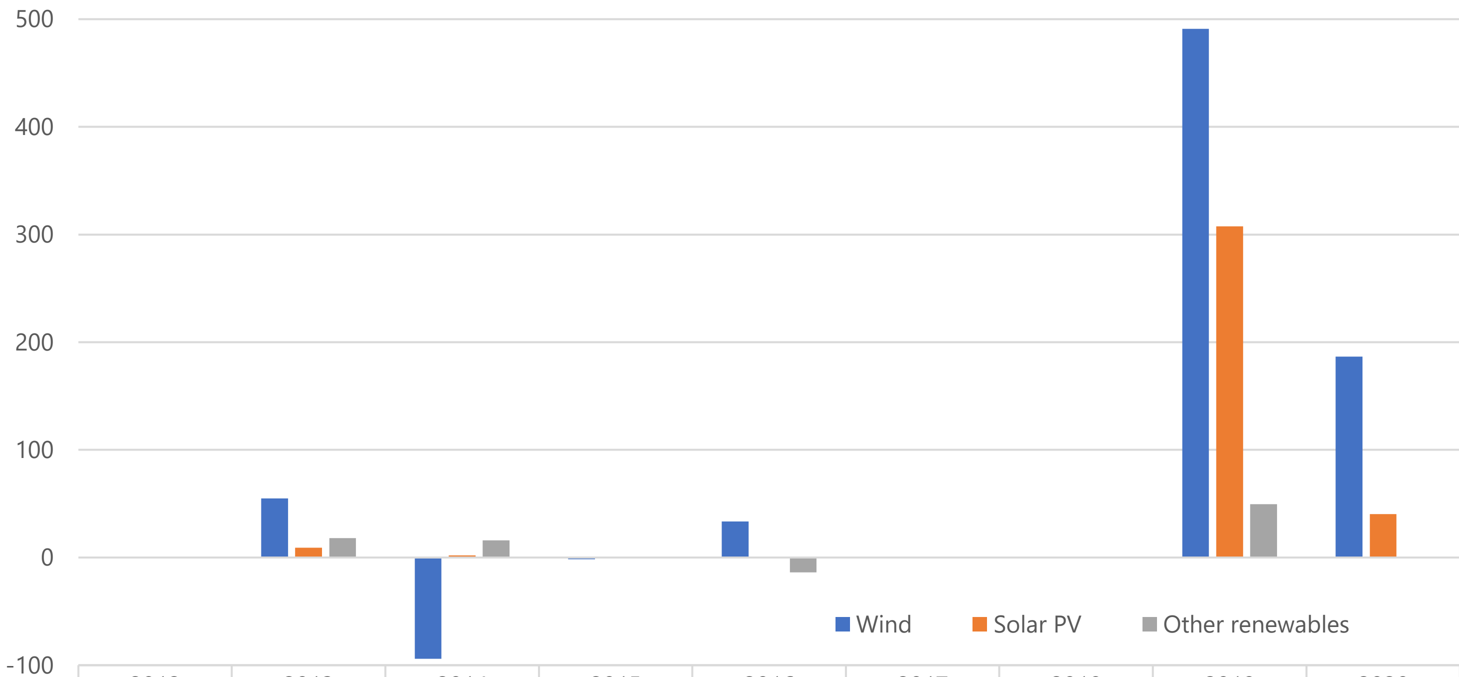
Figure 17 shows the regional year on year changes of installed capacity in MW. The biggest change observed comes from the year 2019. When compared with Figure 18, which shows gross investment flows in the region, the year 2019 also stands out: that year, €1,844 million.

The 2019 investment flow is attributed mainly to a single operation related to the paper industry on one hand, and to investments in renewable energy on the other.[1] During that year important investments in renewable energy were carried out: the region added 862 MW of wind power in 2019 after an investment of €789 million. This represents 43% of total gross investment flows in the region, which will result in a job creation of 2,471 during the construction phase. These investments are expected to have annual income of €2.3 million on property incomes and €20 million for local administrations for taxes on construction activities and €3.5 million on taxes and fees. In addition, the region expects to receive additional €3 million in environmental tax revenues annually on average for the next 20 years.[2]

[1] Valladolid section (2019, November 8) 'Castilla y León lidera la inversión británica en España con 1.648 millones de euros, la mitad del país'. *El Mundo* https://diariodevalladolid.elmundo.es/articulo/castillayleon/castilla-leon-lidera-inversion-britanica-espana-1648-millones-euros-mitad-pais/20191108120027353983.html

[2] Editorial (2019, February 19) 'Castilla y León añadirá 862 MW de eólica hasta 2020 tras invertir 789 millones y crear 2.471 empleos.' *El Periódico de la Energia* https://elperiodicodelaenergia.com/castilla-y-leon-anadira-862-mw-de-eolica-hasta-2020-tras-invertir-789-millones-y-crear-2-471-empleos/

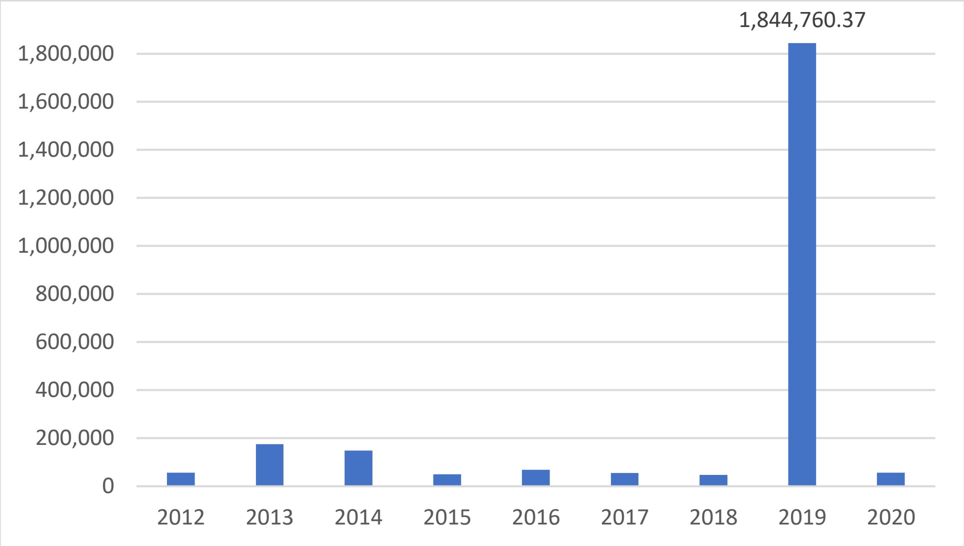
Figure 17: Year-on-year changes on installed capacity for renewable energy in Castilla y León (MW, baseline 2011)



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Wind	0	55	-94	-2	34	0	0	491	187
Solar PV	0	9	2	-1	0	1	1	307	40
Other renewables	0	18	16	0	-14	0	0	50	0

Source: Own elaboration from REE data

Figure 18: Gross Investment Flows in Castilla y León (thousands of euros)



Source: Own elaboration from Ministry of Industry and Trade[116]

Ownership structure

Most of the renewable power capacity, both for wind and solar, consists of medium to large scale installations operated by large energy companies such as Iberdrola, Naturgy, Endesa or EDP. Other ownership modalities, such as cooperative schemes, although with growth projections, still account for a residual amount of total energy generation according to Energética Cooperative, one of the leading cooperative associations in the region.

However, the self-consumption modality (e.g., when the electricity consumed is produced by a, usually small and solar, power installation off the grid) has grown substantially recently. In 2020, almost 65,000 kW of solar power self-consumption installations have been executed in Castilla y León. This represents an 800% increase with respect to 2019. According to Energética Cooperative, the standard profile investing in self-consumption installations has a high-middle income level.

Due to this growth rate, the regional government launched in October 2020 the 'Mesa de Autoconsumo Energético' or 'Energy self-consumption Roundtable'. Its main objective is to promote the self-consumption modality, facilitate administrative procedures, remove barriers and to explore possible incentive measures, such as tax credits. The Roundtable is made up of representatives of the regional government and the private sector. The latter includes energy

[116] Gobierno de España (2021) *Foreign investments*. Retrieved from https://comercio.gob.es/Inversionesexteriores/Paginas/Index.aspx

producers and distributors, installations organizations, as well as energy associations from the different provinces.[117]

In parallel, the government proceeded to reduce the administrative burden for consumers desiring to install by a Decree approved in July 2020[118] modifying the 1999 urban planning law[119]. With this update, citizens no longer need an approved license to install their own power installations. Instead, they only need to submit a declaration of responsibility stating that the installation fulfills all legal obligations. This effectively reduces the administrative burden as well as the time needed to proceed with the installation. Finally, the regional government has a dedicated website on self-consumption, with all requirements, definitions and other relevant information available.[120]

The provincial administrations also have some economic incentives for self-consumption, although it varies among provinces. For instance, in the provinces of Avila, Burgos, Salamanca and Palencia, citizens can enjoy tax reductions on solar self-consumption installations. Meanwhile Leon, Valladolid, Zamora, Soria and Segovia have no incentive programs.[121]

Concerning profitability of self-consumption investments, Castilla y León can be considered a leader within Europe. A study carried out by Otovo took into account the available economic support measures and the available sunlight hours and found out that profitability of self-consumption structures in Castilla y León

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[117] Junta de Castilla y León (2021) Communication: 'La Mesa de Autoconsumo Energético en Castilla y León inicia su trabajo con acciones destinadas a identificar y agilizar los trámites administrativos de las instalaciones, para apoyar el tejido empresarial local y promover el autoconsumo'. Retrieved from https://comunicacion.jcyl.es/web/jcyl/Comunicacion/es/Plantilla100Detalle/1284877983892/NotaPrensa/1285016062572/Comunicacion

[118] 'Decreto-Ley 4/2020, de 18 de junio, de impulso y simplificación de la actividad administrativa para el fomento de la reactivación productiva en Castilla y León. *Official Journal of Castilla y León' (2020) Núm. 122, pág. 18492*

[119] Noticias Jurídicas (2021) *Ley 5/1999, de 8 de abril, de Urbanismo de Castilla y León*. Retrieved from https://noticias.juridicas.com/base_datos/CCAA/cl-l5-1999.html

[120] Junta de Castilla y León (2021) *Self-consumption*. Retrieved from https://energia.jcyl.es/web/es/energias-renovables-ordenacion-energetica/autoconsumo.html

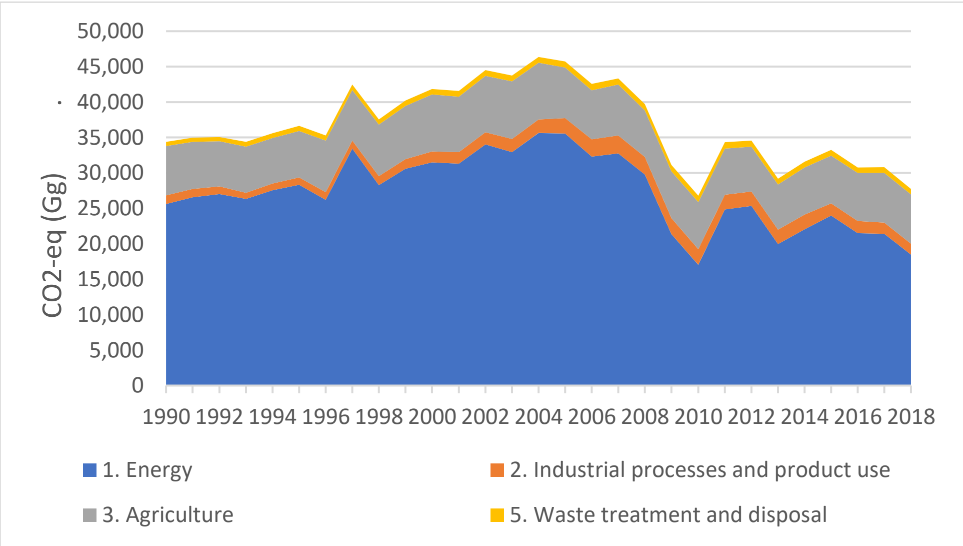
[121] Otovo (2021) *Solar panels for self-consumption in Castilla y León*. Retrieved from https://www.otovo.es/blog/autoconsumo/placas-solares-autoconsumo-castilla-y-leon/#bonificacionesdelicioparaplacassolaresensalamanca

reached 15%,[122] compared with an 8-9% profitability in some of the main European capitals such as Berlin, London and Amsterdam.[123]

Regional GHG emissions

Regional GHG emissions over the last 30 years have decreased from 34,364 tonnes CO2 equivalent (CO2-eq) in 1990 to 27,719 tonnes of CO2-eq in 2018 (Figure 19). The number peaked in 2004, reaching 46,364 tonnes of CO2-eq. This represents a total fall in emissions of 19% for the period 1990-2018. After the 2007 Financial Crisis, a drop in CO2 emissions can be observed due to lower economic activity, followed by a recovery in 2010. However, from 2012 onwards, economic growth and CO2 emissions from energy seem to have somewhat decoupled, as emissions have dropped in parallel to the increase of renewable energy production in the region while regional GDP grew[124], as observed in Figure 15.

Figure 19: Evolution of CO2 equivalent emissions in Castilla y León



Source: JCyL[125]

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[122] Ibid.

[123] Candal, B. (2021, February 24) Castilla y León, entre las regiones europeas lideres en rentabilidad para el autoconsumo. *Energetica21* https://energetica21.com/noticia/castilla-y-leon-entre-las-regiones-europeas-lideres-en-rentabilidad-para-autoconsumo-segun-otovo

[124] Datosmacro.com (2019) GDP of Castilla y León. Retrieved from https://datosmacro.expansion.com/pib/espana-comunidades-autonomas/castilla-leon#:~:text=En%202019%20la%20cifra%20del,PIB%20de%20las%20comunidades%20aut%C3%B3nomas.

[125] Junta de Castilla y León (2020) *Emissions inventory*. Retrieved from https://medioambiente.jcyl.es/web/es/calidad-ambiental/inventario-emisiones.html

2.3 Analysis and conclusions

2.3.1 Key factors determining regional renewable energy development

There seem to be three specific determinant factors in the deployment of renewable energy deployment in Castilla y León:

- the absence of energy generation from non-renewable sources
- the potential for clean energy,
- support from public institutions at the EU, national and regional levels

Lack of fossil fues for energy generation

Castilla y León now has virtually no production of energy from fossil fuel sources. As we have seen in Figure 17, coal and nuclear energy production came to an end during the period 2011- 2020. This is due to the closure of the last nuclear energy plant, Santa María de Garoña plant, located in the province of Burgos after 43 years of functioning due to technical and economic reasons.

In addition, the coal mining industry in the region, which played an important role in the 19th and 20th centuries for Castilla y León (more specifically in the province of Leon), entered into decay at the end of the 20th century, due to lack of profitability of coal mining in Spain and its low quality.[126] Out of the 135 mines the province of Leon had active, only 9 remain active today.[127] In 2020, the last three coal power plants of the region shut down in the provinces of Leon and Palencia.[128]

The absence large amounts of fossil fuel resources in the region and the relatively low levels of economic activity related to fossil fuel extraction and processing, allows the region to switch towards different energy sources more easily than regions heavily linked to fossil fuels. However, some fossil fuel legacy remains: the

[126] LIBRE MERCADO (2012, JUNE 7) EL CARBÓN ESPANOL, UN NEGOCIO RUINOSO DESDE HACE UN SIGLO. *LIBRE MERCADO* HTTPS://WWW.LIBREMERCADO.COM/2012-07-04/EL-CARBON-ESPANOL-UN-NEGOCIO-RUINOSO-DESDE-HACE-UN-SIGLO-1276463068/#:~:TEXT=IMPORTAR%20ES%20M%C3%A1S%20RENTABLE&TEXT=NO%20EN%20VANO%2C%20LOS%209,DE%20TONELADAS%20DE%20RESERVAS%20MUNDIALES.

[127] Carnero, M. (2018, July 16) De las 132 minas que llego a tener Leon solo 15 permanecen en activo. *Diario de Leon*. https://www.diariodeleon.es/articulo/provincia/132-minas-llego-tener-leon-solo-15-permanecen-activo/201807160400001781334.html

[128] Energía de Castilla y León (2021, July 12) Endesa comienza a desmantelar la histórica central térmica de Compostilla, en Cubillos del Sil. *Energía de Castilla y León*. https://energiacastillayleon.com/tag/centrales-termicas/

former direct and indirect jobs linked with the last carbon-fuelled power plants, coal mines in the province of Leon and nuclear plant have not been replaced yet (see section 2.3.2 below). The implementation of effective just transition programs in the region will be key to repurpose and relocate these jobs to other sectors, including the renewable energy sector.

The potential for clean energy generation in the region

The only abundant energy sources in Castilla y León, as illustrated in the JRC report in section 2.4.1, are renewable ones. The region scores high in solar, wind and biomass potential for energy generation. In addition, due to the climate conditions of the region that make it necessary to build dams to retain water, the region also has a remarkable penetration of hydropower.

Institutional support

Since the early 2000's the Spanish central government developed several strategies and a regulatory framework that enabled renewable energy to kick-off. In addition, the regional government also developed its own plans to boost clean energy deployment from different energy sources for consumer's self-consumption, as described before. More importantly, there has been a substantial contribution from EU funds for subsidies for renewable energy installations in the region, as seen in section 2.2.6. Academic literature has confirmed that the existence of subsidies, fiscal incentives and other legislative and non-legislative initiatives has a positive impact in renewable energy deployment.

However, Spain is the country with the lowest rate of implementation of EU Funds: for the period 2014-2020, only 43% of EU funds were implemented to date. This is a major barrier. The main reason for the delays in implementation is due to excessive bureaucratic hurdles.[129] It has to be said that although 1) this report has not analysed in depth the different steps in order to get approval from the regional administration for renewable energy installations, and 2) we lack data on EU funds implementation at the regional level, the regional government does outline clearly the different steps and documents needed in order to be granted a permit.

[129] elEconomista (2021, March 1) España es incapaz de gastar el dinero que recibe de la UE: tiene la peor ejecución, por detrás de Eslovaquia o Rumanía. *elEconomista* https://www.eleconomista.es/economia/noticias/11078468/03/21/Espana-es-el-pais-mas-retrasado-en-la-ejecucion-de-los-fondos-estructurales-del-antiguo-presupuesto-de-la-UE.html

2.3.2 Socio-economic impacts of renewable energy deployment in Castilla y León

Renewable energy deployment has brought several socioeconomic changes in Spain and in the region:

The transition towards clean energies meant the decay of traditional energy sources. In June 2020 the last coal-powered plants were closed in Castilla y León, one located in the province of Leon and another one in the province of Palencia. More specifically, the closure of the coal plants had an estimated effect of 400 direct and 600 indirect jobs loses[130] in the province of Leon and 208 direct jobs in the Province of Palencia[131]. The closure of the Santa María de Garoña nuclear plant in 2013 also translated in a job loss of 700-800 employees.[132]

The different administrations (local, provincial, regional and national) and private companies have already agreed to relocate the workers and repurpose existing installations in order to avoid depopulation of these areas. In the short term, some of the previous employees and other additional ones will work on the decommissioning of the closed power plants. For instance, the nuclear plant will require between 250 and 300 employees.[133] Several areas of the provinces of Leon have raised concerns, since the closing of the coal mines and related industries (including the coal plants) has not been substituted yet by other industrial structures, hence these areas risk further depopulation.

Following the closure of the coal plants, the industry - Iberdrola, Endesa, Naturgy – and the Unions – CCOO and UGT – and central government representatives signed an 'Agreement for a Just Transition' to provide solutions to the workers and municipalities concerned. Among the different measures, the stakeholders have agreed to:[134]

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[130] Energia de Castilla y León op. cit.

[131] Benito Iglesias, J. (2020, July 9) El último negocio del poblado de la térmica. *Diario Palentino* https://www.diariopalentino.es/Noticia/ZDE980B34-EA09-2C14-3B74F9D516FA33DB/202007/El-%C3%BAltimo-negocio-del-poblado-de-la-t%C3%A9rmica

[132] A. C. (2021, March 1) Garoña generará en su desmantelamiento la mitad de empleo. *Diario de Burgos* https://www.diariodeburgos.es/noticia/Z2A184105-FD8B-30F4-AACAAE1EE245AC3C/202102/Garona-generara-en-su-desmantelamiento-la-mitad-de-empleo

[133] Servimedia (2021, March 20) El desmantelamiento de la central nuclear de Garoña requerirá entre 250 y 400 trabajadores. *Expansion* https://www.expansion.com/empresas/energia/2021/03/20/6055c84ae5fdeaa33a8b4655.html

[134] Gobierno de España (2020). *Acuerdo por una transición energética justa para centrales térmicas en cierre: el empleo, la industria y los territorios*. Retrieved from https://www.miteco.gob.es/es/transicion-justa/acuerdoporunatransicionenergeticajustaparacentralestermicasencierrees_tcm30-509582.pdf

- A labor exchange program through the public administrations to re-employ workers in the decommissioning of the plants and in new industrial projects
- Specific measures for workers that will not be needed for the decommissioning works, with special attention to workers above 52 years old.
- A support plan for professional development and training for workers to reorient their careers.

The plans include a participative consultation for its elaboration. The basis of this specific agreement has to be understood in the broad context of the Spanish Just Transition, which under the National Energy and Climate Plans and the Just Transition Strategy[135] will provide technical, legislative and financial support for the coal dependent areas in Spain from governments at all levels.

In Spain, the renewable energy sector grew 15.6% in 2019, after growing 10.7% in 2018, and contributed with € 12,540 million to Spanish GDP. The sector employed 95,089 people and exports related to the sector amounted to €4.273 billion, resulting in a positive balance of €1.186 billion. In addition, renewable energy reduced the market price by €4.365 billion and in terms of energy dependency, renewable energy production resulted in savings of €8.702 billion in fossil fuel imports and €1.017 million in emission rights.[136]

Since Castilla y León was, in 2019, the region with the highest renewable energy power installation with 11,492 MW of the 57,512 MW nationally, that is 20% of the total, we can safely assume the region benefited from these economic benefits measured at the national level.

Already in 2009 (the last year for which reliable figures are available regionally) renewable energy accounted for 15% of industrial Gross Value Added (GVA) of the region. More than 6,027 workers were employed in renewable energy production sector, representing 1.97% of the industrial workers in the region.[137] Since renewable energy generation has increased by 38% for the period 2010 - 2020 (54% to 87% of regional generation), we can make a rough estimate that employment levels in the sector have increased in a similar way. Hence, if in 2009

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[135] Gobierno de España (2021) *Just Transition National Strategy*. Retrieved from https://www.miteco.gob.es/es/transicion-justa/default.aspx

[136] APPA (2019) *Estudio del Impacto Macroeconómico de las energías Renovables en España*. Retrieved from https://www.appa.es/wp-content/uploads/2020/11/Estudio_Impacto_Macroeconomico_Renovables_Espana_2019.pdf

[137] Junta de Castilla y León (2021) *Suministro de la electricidad en Castilla y León*. Retrieved from https://energia.jcyl.es/web/es/biblioteca/suministro-electricidad-castilla-leon.html

there were 6,027 workers in the region in the renewable energy sector, in 2020 the workforce in the sector could potentially amount to 8,317 workers (+38%).[138]

In addition, renewable energy has had a positive effect in the creation of auxiliary industries. For instance, Castilla y León has developed its own industrial base for the production and maintenance of components for wind power plants. In fact, it is the coal transition region with the highest number of such industries. In the region, there are around 25 industrial centers dedicated to wind power-related components.[139]

According to the Joint Research Centre of the European Commission, by 2030 the sector could employ up to 21,379 workers in the renewable energy sector, mostly in the wind energy sector. This makes Castilla y León the region with the highest potential for job creation among the coal transition regions.[140]

However, renewable energy installations employ the bulk of workers during their construction phase, for instance: Endesa is a big energy company building several renewable energy installations in Castilla y León, adding 700 MW to the energy production of the region. The company has calculated that, during the construction phase of such plants between 2023 and 2025, there will be around 2,900 workers employed. Once the construction phase is over, there will only be 55 indefinite workers. This represents only 1.9% of the workers initially employed during the construction phase.[141]

Overall, the Spanish population has historically had a positive attitude towards renewable energy. According to the Spanish Centre for Sociological Research (CIS), in 2007 already 60% of Spaniards considered that renewable energy was an 'efficient and cheap' energy source. In 2020, another barometer showed that investments in renewable energy should be a priority, only behind investments in the healthcare systems and in recycling and waste management activities.[142] In addition, a Eurobarometer from winter 2021 stated that investments in renewable energy should be the top priority for the European Green Deal.[143] Although these trends are focusing on the Spanish society as a

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[138] These are raw calculations and do not take into account other factors, such as innovations in the sector that might lead to a less intensive workforce or synergies due to economies of scale.
[139] CCOO – ISTAS (2020) Las energías renovables en el marco de una transición energética justa en la provincia de Leon. Retrieved from https://istas.net/sites/default/files/2020-09/RenovablesLeon_final.pdf
[140] Kapetaki, Z. op. cit.
[141] CCOO – ISTAS op. cit.
[142] CIS (2020) *Barómetro de Octubre*. Retrieved from http://datos.cis.es/pdf/Es3296marMT_A.pdf
[143] Eurobarometer (2021) *Public Opinion in the European Union*. Retrieved from https://europa.eu/eurobarometer/surveys/detail/2355

whole, it can be extrapolated to the region of Castilla y León, where renewable energy is often seen as an opportunity to modernise the regional economy and tackle depopulation, with the exception of the areas that were dependant on coal or nuclear energy production. More specifically, according to the online magazine 'energias-renovables.com', in those municipalities where wind power installations have been placed, 70% of residents consider them beneficial while only 3% consider them harmful. Depending on the area, between 79% and 91% of citizens considered that the environmental benefits of wind power overcome the possible harmful impacts.[144]

In terms of energy poverty, renewable energy production does not seem to have had an impact. The region has energy poverty at slightly lower than average rates for Spain and the EU as a whole (See: Section 0) according to measures from Eurostat. Continuing energy poverty is linked to a range of factors, such as the age of buildings, the type of family structures, the cost of energy, or the poverty and employment rates. In this case the deployment of renewable energy regionally has not apparently remedied this situation, nor worsened it.

[144] Junta de Castilla y León (2002) *Nuevas ocupaciones profesionales y necesidades de formación ocupacional en relación con las energías renovables*. Retrieved from https://www.yumpu.com/es/document/read/14477640/energias-renovables-en-castilla-y-leon-instituto-de-estudios-del-

2.3.3 Relevant factors that determine socio-economic impacts associated with renewable energy deployment

To support socioeconomic development in the region, it is important to address the root causes of population loss. This requires a combination of policies at the regional, national and EU level.

The main stakeholders in the transition towards a green energy mix have been, and will continue to be, the public administrations, namely the regional government as well as the EU institutions. Private companies, namely big energy companies such as Iberdrola have also been investing in renewable energy installed capacity and will continue to do so. There are some key barriers/issues that must be taken into consideration:

- Enhance the existing supporting frameworks for renewable energy deployment in the form of subsidies, tax deductions and other economic instruments can lead to a dynamization of the economy. How? Jobs associated with renewable energy powerplants often are high-quality and highly-educated jobs. Renewable energy technologies can also boost R&D activities as well as rise the general technology level in the region. In addition, since renewable energy systems are rather decentralised, remote areas once populated can benefit from local energy sources.

- Given the potential for renewable energy generation in the region, and its geographical location with 9 other Spanish regions, including Madrid, and with Portugal, Castilla y León has position itself as an energy exporter as well as an energy nexus. Castilla y León is already net exporter of energy to other regions with more than 10,973,679 MWh exported in 2020. This tendency has been a constant for at least 10 years (data available from 2010). This makes the region the second biggest energy exporter of energy in Spain, second to the region of Extremadura, with 16,339,701 MWh exported in 2020 thanks to its nuclear power plant. As illustrated in figure 3, both Castilla y León and Extremadura are below the Spanish GDP per capita average.[145]

- The continuation of EU funds for renewable energy deployment is also key to make sure investments in this area are done in the region, since these funds are co-financed with other regional and national funds.

- All levels of public administration must ensure clarity and accessibility to consumers and companies alike to the different administrative processes and

[145] Red Eléctrica de Espana (2021) *Electric balance*. Retrieved from https://www.ree.es/es/datos/balance/balance-electrico

tools available for renewable energy installation. In this regard, bureaucratic processes must be simplified and digitalised. This becomes even more relevant with the incoming NextGenerationEU funds.

Interviews conducted

Interview with Santiago Campos from Energetica, an energy cooperative in the region of Castilla y León. Held online via Teams on the 10th of June 2021.

2.3.4 Key conclusions

1. Public support remains one of the biggest enablers for the decarbonisation of the energy systems and the consequent socio-economic benefits. To maximise employment and other socio-economic benefits, both the regional and national governments have to make sure an appropriate legislative framework is put in place in order to:

    a. Eliminate as much as possible administrative burdens that hamper installation of renewable energy systems, both for companies and individuals. The region has recently implemented one such measure to remove the need for individuals to seek prior approval to install micro-RES.

    b. Further incentivize the deployment of renewable energy installations owned at the household level. This is a potentially important modality particularly in this region with excellent solar potential. Recent government coordination on tax incentives and removal of barriers is a good example from this region.

    c. Create an industrial ecosystem that maximizes economic benefits by attracting industries related to renewable energy (e.g., batteries production) that might also contribute to the development of other industries (e.g., chemicals, automotive, AI, etc.)

2. Ensure a Just Transition. The substitution of conventional energy sources (fossil fuels, nuclear) by renewable energy, despite some economic and environmental benefits, can result in a net loss of employment and the depopulation of local areas if not accompanied by supporting policy. Public administrations and other relevant stakeholders (trade unions, business organisations and citizens associations) must work together to ensure these communities can continue to prosper. For this to happen, ambitious re-skilling programs as well as the conversion of former polluting industries into new clean and productive systems are needed. These transitions must also contain participatory mechanisms to involve the local communities alongside

other key stakeholders. A good example is the Just Transitions Guidelines approved in November 2020 between relevant stakeholders with provisions for clean industry conversion, innovation and participation of the local communities for the former coal province of Leon.[146]

3. Given the potential for renewable energy of the region and the geographical position of the region, Castilla y León can become an important exporter of renewable energy. Most importantly, the region shares a border with the Region of Madrid, one of the biggest importers of energy in Spain. By locating renewable energy installations in the region and exporting to other regions, including Portugal, Castilla y León could benefit from additional revenues and employment levels, part of a potential strategy to prevent ongoing depopulation. Studies show that there is significant potential for employment in this region, particularly if it can develop strategic competences in RES technologies.

[146] Gobierno de Espana (2020) Communication: El MITECO, el Gobierno de Castilla y León y la FEMP firman el protocolo para elaborar los Convenios de Transición Justa de tres áreas del norte de la comunidad. Retrieved from https://www.miteco.gob.es/es/prensa/ultimas-noticias/el-miteco-el-gobierno-de-castilla-y-le%C3%B3n-y-la-femp-firman-el-protocolo-para-elaborar-los-convenios-de-transici%C3%B3n-justa-de-tres-%C3%A1reas-del-norte-d/tcm:30-517236

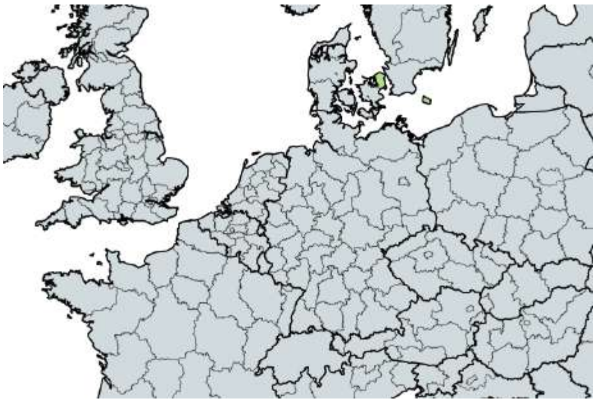
Case study 3

Denmark's Capital Region

3. DENMARK'S CAPITAL REGION (COPENHAGEN), DENMARK

*This case study was authored by **Thorfinn Stainforth** from IEEP.*

Photo by Lasse Jensen on Unsplash



GDP per capita	€51,000 (2018)
Population	1,835,562 (2019)
Population density	720/km^2
Unemployment rate	5,1% (2019)
People at risk of poverty or social exclusion	17.5%
Share of renewable energy (% of gross final energy consumption)	17% (2015)
Total installed RES capacity	3,300 MW (2015)
Employment in RES	0.5% direct (2016)

3.1 A brief overview of the Danish context

3.1.1 Denmark's socio-economic conditions

Denmark is a small country with an open, export dependent economy. Its nominal GDP per capita was 53 470 Euros in 2020, the 3rd highest out of all EU Member States, about 20 000 more than the European average.[147] GDP growth has been solid in recent years, averaging 2.5% between 2014 and 2019.[148] 4.9% of the active population were unemployed prior to the COVID-19 pandemic in January 2020, while the rate has risen to 6.1% as of spring 2021.[149] The country has a relatively low unemployment rate and high and rising labour participation rate. The economy features advanced industry with world-leading firms in pharmaceuticals, maritime shipping, and renewable energy, and a high-tech agricultural sector. Denmark is a net exporter of food, oil, and gas and

[147] Eurostat (2021). Gross domestic product at market prices. Data code: tec00001. URL: https://ec.europa.eu/eurostat/web/products-datasets/-/tec00001. Accessed on: 04.05.2021.

[148] World Bank. (2021) GDP growth (annual %) – Denmark. https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2019&locations=DK&start=2014 Accessed 29 July 2021

[149] Eurostar. (2021) Unemployment by sex and age – monthly data . https://ec.europa.eu/eurostat/databrowser/view/UNE_RT_M__custom_1018178/default/table?lang=en Accessed 29 July 2021

enjoys a comfortable balance of payments surplus but depends on imports of raw materials for the manufacturing sector.

Denmark has relatively low-income inequality (ranking 5th in the EU when measured by Gini-Coefficient)[150] and comparatively high social mobility.[151]

The present Social Democratic government was elected in 2019 and is supported by a number of left-of-centre political parties, but not in a formal coalition. One of the main promises of the new government was to increase climate ambition, with a new overall greenhouse gas reduction target for 2030 of -70% compared to 1990.

According to EU Statistics on Income and Living Conditions, an estimated 2.8 per cent of the Danish population were unable to afford to keep the home adequately warm in 2019, [152] while 3.6 per cent of Danish households reported arrears on utility bills in 2012.[153]

3.1.2 Renewable energy deployment in Denmark

Denmark has a relatively high level of gross final energy consumption from renewable sources at 37.2% in 2019, or 4th highest in the EU.[154] This level has been increasing steadily for many years. The consumption of electricity from renewable sources is high in Denmark at 65% (3rd in the EU). The level for heating and cooling is 48%, or 5th in the EU.

The country has thus significantly outperformed its own renewable energy targets for 2020 set in the 2010 National Renewable Energy Action Plan. (30% overall, 40% heating and cooling, 52% electricity).[155]

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[150] OECD Data. (2021) Income inequality. https://data.oecd.org/inequality/income-inequality.htm Accessed 29 July 2021

[151] OECD. (2018) A Broken Social Elevator? How to Promote Social Mobility. https://www.oecd.org/social/soc/Social-mobility-2018-Overview-MainFindings.pdf

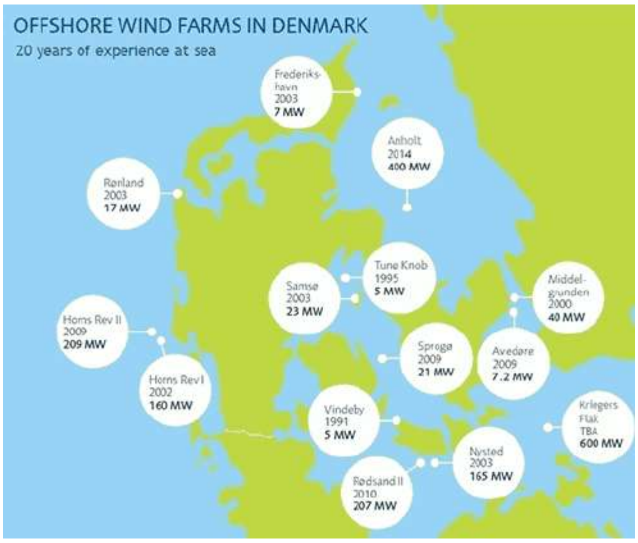
[152] Eurostat. (2021) Can you afford to heat your home? https://ec.europa.eu/eurostat/en/web/products-eurostat-news/-/ddn-20210106-1?redirect=/eurostat/en/news/whats-new Accessed 29 July 2021

[153] Nierop. (2014) Energy poverty in Denmark? https://www.energypoverty.eu/publication/energy-poverty-denmark

[154] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics

[155] European Commission, National renewable energy action plans 2020, https://ec.europa.eu/energy/topics/renewable-energy/national-renewable-energy-action-plans-2020_en?redir=1

Figure 20: Offshore Wind Farms in Denmark 2017[156]



The largest farms are not located in the Capital Region.

Denmark was a pioneer of renewable energy already in the 1970s following the oil crisis, notably in wind energy. It has the highest share of wind in both total primary energy consumption and electricity of any IEA country.[157] 20% of renewable energy is produced by wind (2018). Supported by a flexible domestic power system and a high level of interconnection, Denmark is now widely recognised as a global leader in integrating variable renewable energy while at the same time maintaining a highly reliable and secure electrical-power grid.

Denmark's large-scale use of combined heat and power plants (CHP) with heat storage capacity, and the increasing deployment of wind power, offer good potential for efficient integration of heat and electricity systems.

The largest source of renewable energy in Denmark is bioenergy (64% in 2018), based significantly (ca. 50%) on imported wood chips and pellets (mainly from the Baltic countries, Russia, and the USA, but also other EU countries).[158] Straw, renewable waste, wood waste, and domestic firewood are also significant sources of bioenergy. Recent years have seen a very significant increase in the use of wood based bioenergy, partly

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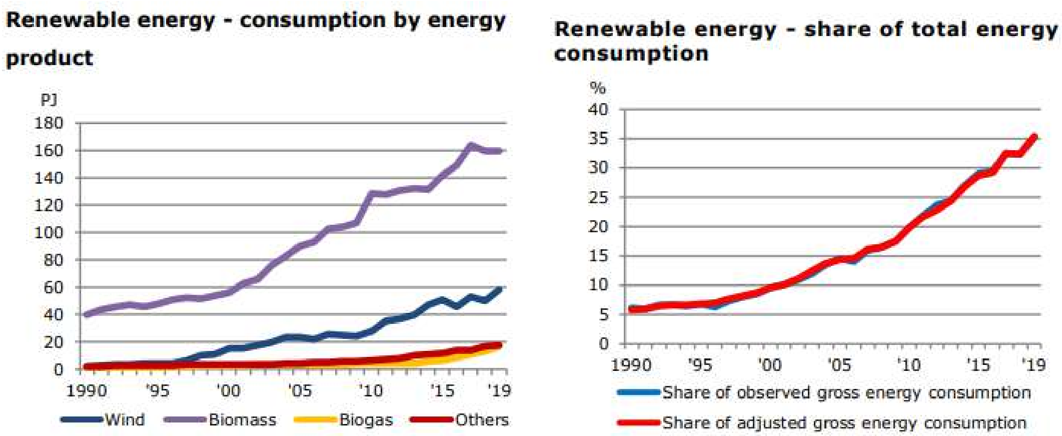
[156] Source: http://energylawgroup.eu/itrfile/_1_/a0dea4f646f5449749afa53390f93296/Danish%20Offshore%20Wind%20Tender%20Model.pdf

[157] International Energy Agency (2021), Country profile, https://www.iea.org/countries/denmark, Access date: 3 June 2021

[158] Danish Energy Agency, Energistatistik 2019, and accompanying detail tables: https://ens.dk/en/our-services/statistics-data-key-figures-and-energy-maps/annual-and-monthly-statistics; Statistics Denmark Foreign Trade statistics, www.statbank.dk/KN8Y

to replace retired coal capacity. Increasing concerns about the sustainability of large-scale biomass use has led to the introduction of voluntary sustainability criteria at national level in 2014 and binding rules in 2020. The Danish Long Term Strategy (LTS) projects that biomass will continue to play a significant role in the country's energy mix, but that its role will stabilise, while other RES such as offshore wind, heat pumps, and solar PV will increase substantially.[159]

Figure 21: National renewable energy consumption



Source: 2019 Energy Statistics, Danish Energy Agency[160]

3.1.3 Political governance structures regarding the deployment of renewable energies in Denmark

Denmark has a tradition of cross-party support for renewable energy deployment through broad energy agreements. The IEA praises this tradition for providing "predictability and continuity in energy policy (thus creating a good environment for investors)."[161]

The current energy agreement has the objective of 100% of electricity and 55% of overall energy consumption to be covered by renewable energy by 2030. In addition, 90% of district heating is to come from non-fossil sources by 2030. This agreement was agreed by most parties in parliament in 2018 under the previous liberal (*Venstre*) led government. These targets are presented in the National Energy and Climate Plan

[159] Danish Government. (2019) Denmark's Long-Term Strategy. https://ec.europa.eu/clima/sites/lts/lts_dk_en.pdf
[160] https://ens.dk/sites/ens.dk/files/Statistik/energystatistics2019_webtilg.pdf
[161] IEA. (2017) Energy Policies of IEA Countries: Denmark, https://www.connaissancedesenergies.org/sites/default/files/pdf-actualites/energypoliciesofieacountriesdenmark2017review.pdf

(NECP) of 2019, but it further outlines that climate plans will be adapted in line with the new -70% overall GHG target for 2030.[162]

The previous energy agreement dating from 2012 targeted 35% renewable energy in gross energy consumption in 2020 and 50% wind power in electricity consumption by 2020. The first target has certainly been achieved, and the second is close to being achieved.

The Danish Ministry of Energy, Utilities and Climate is responsible for national and international policies to mitigate climate change, as well as for energy, national geological surveys, and for meteorology.[163] The ministry consists of the Department itself, the Geological Survey of Denmark and Greenland, the Agency for Data Supply and Efficiency, the Danish Meteorological Institute, the Danish Geodata Agency, the Danish Energy Agency and the associated independent bodies: the Danish Energy Regulatory Authority, Energinet.dk, and the Danish Council on Climate Change.

Wind, solar, biomass, biogas and hydro energy are subsidized. RES used as a fuel is exempted from taxation, while energy taxes are levied on all fossil fuels, that is, oil, natural gas and coal with the exemption of fossil fuels for power production; instead electricity consumed is taxed in order to avoid influencing the costs of exported electricity. [164]

Denmark has had a tradition of community involvement and ownership in renewable energy projects, primarily wind. From 1970s to the mid-1990s, wind turbines were predominantly owned by grassroots actors – individuals and communities in cooperative structures. This feature has become less marked since the year 2000 as projects have increased in size and various other political and institutional pressures have changed. After 2009 the government has tried again to engage communities in ownership of RES projects, partially to improve acceptance of wind projects. The renewable energy law provides an option-to-purchase scheme that gives the local population the right to purchase at least 20% of a new wind energy project, with

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[162] Danish Ministry of Climate, Energy, and Utilities (2019) Denmark's Integrated National Energy and Climate Plan under the REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the Governance of the Energy Union and Climate Action.
https://ec.europa.eu/energy/sites/ener/files/documents/dk_final_necp_main_en.pdf
[163] IEA. (2017)
[164] Rønne, A., & Gerhardt Nielsen, F. (2019). Consumer (Co-)Ownership in Renewables in Denmark. In Energy Transition (pp. 223–244). Springer International Publishing. https://doi.org/10.1007/978-3-319-93518-8_11

residents within 4.5 km having a priority purchase right. However, the provision has been criticised as not providing sufficient possibilities for community ownership.[165]

Most large-scale power plants are owned by Ørsted A/S, formerly DONG Energy A/S. The Danish state holds 50.1%of the shares in Ørsted A/S. Copenhagen and two large municipalities have recently bought large-scale power plants in their cities from the former owner of the Swedish company Vattenfall. In the district heating sector, cooperative and municipal ownership is common. Of the suppliers, 83 per cent are cooperatives with 34 per cent of the total heat supply. Municipalities account for 12 per cent of the suppliers and 58 per cent of the supply. Among the municipalities are the four largest cities in Denmark. Only two per cent of the suppliers are commercially owned with a total supply of 5 per cent.[166]

The Danish Energy Agency (DEA) is responsible for the implementation of policies and measures related to the production, transmission and utilisation of energy, and their impact on climate change. It acts as a one-stop shop regarding offshore energy projects, allocates the necessary permits and co-ordinates consultation processes with other authorities.

Regional and municipal authorities have an important role in the implementation of national energy and climate change policies through regional and municipal plans for urban and industrial development. Municipalities are responsible for planning onshore energy projects (wind power, biomass, biogas and solar PV) and district heating. Many municipalities also own local district heating companies.

3.2 Renewable energy deployment and Denmark's Capital Region's socio-economic development

3.2.1 Denmark's Capital Region's socio-economic conditions

Information drawn from European Commission economic profile of the region unless otherwise stated.

[165] Mey, F., & Diesendorf, M. (2018). Who owns an energy transition? Strategic action fields and community wind energy in Denmark. Energy Research & Social Science, 35, 108–117. https://doi.org/10.1016/j.erss.2017.10.044

[166] Rønne, A., & Gerhardt Nielsen, F. (2019). Consumer (Co-)Ownership in Renewables in Denmark. In Energy Transition (pp. 223–244). Springer International Publishing. https://doi.org/10.1007/978-3-319-93518-8_11

The Capital Region of Denmark (*Region Hovedstaden* in Danish) is one of five administrative regions in Denmark. It is comprised of 29 municipalities, including most of the Copenhagen area and the remote island of Bornholm. However, it does not include all of the functional area of the Greater Copenhagen Metropolitan Area, as some of the southern suburbs are part of the neighbouring region. The island of Bornholm has a significantly different geographical, economic, and social profile than the rest of the region, but is included in the region for administrative reasons. The region was created in 2007 as part of the Danish municipal reform.

It had a population of 1,835,562 people in 2019, corresponding to around 31.61% of the Danish population, and is the most highly educated, innovative and cosmopolitan region in Denmark. The region is geographically the smallest in Denmark, with only 2,560 km^2, or 6% of the Danish area. Population density is 720/km^2. The population has grown significantly over recent decades, and population growth is expected to be strong for the foreseeable future. The region is by far the most urbanised in Denmark, with relatively little agricultural area compared to the Danish average.[167]

In 2018, the region had a gross domestic product (GDP) of €122.2bn (2020). The region therefore generates about 40.6% of the Danish GDP. The strong economic performance in Copenhagen is shown in the high growth in the GDP compared to the rest of the Danish regions. In the period from 2010 to 2018, the GDP increased by 30.9% in the region, compared to a national increase of 23.9% and the increase for EU average being 23.9% (2020). The regional GDP can also be expressed as GDP per capita in purchasing power standards (PPS), 51,000 in 2018, a figure above the national average (39,700) and the EU average (31,000) (2020). The region has been increasing in terms of GDP since 2011, with a value of €93.3bn.

In 2019, 33.3% of the employed people in Denmark were in the Capital region. Here they are distributed mainly in tertiary sector activities (such as in wholesale and retail trade, transport, accommodation and food service activities; and public administration, defence, education, human health and social work activities) with 86.5% of the working population. This number is considerably high, having in mind that the average of people working in tertiary activities in all Denmark is of 79.1%. Therefore, in the secondary sector, the Capital region of Denmark has 12.4% of the population and 0.1% in the primary sector (2020).

With more than 1% decrease in unemployment rate in the period 2009-2019, it is the region that has been the least affected since the onset of the global financial crisis in

[167] Denmark's Capital Region. (2018) FÆLLES STRATEGISK ENERGIPLAN FOR HOVEDSTADSOMRÅDET. https://www.regionh.dk/til-fagfolk/miljoe/en-groennere-region/Energiomstilling/Documents/EPT_F%c3%a6lles-Strategisk-Energiplan_WEB.pdf

2007. In 2019, the Capital Region had an unemployment rate of 5.1%, the lowest in recent years, below the EU average (6.3%) and slightly above the national average (5%) (2020). According to Eurostat, the region has a 17,5% rate of people at risk of poverty or social exclusion (2019).[168]

The innovation performance is strong in the Capital region. The region is home to a number of large and top-performing universities including the University of Copenhagen (the largest university in Northern Europe), the Technical University of Denmark and the Copenhagen Business School. Roughly 60% of all Danes with higher education live in the region.

The region contains municipalities with among the largest intra-municipal household income inequality in the Nordic region as measured by disposable income Gini index, and the level of inequality has been growing over the last decade.[169] The considerable intra-municipality inequality is explained by the very large amount of disposable income (excluding capital) of the highest-earning households (both the top 10% and the top 1%).

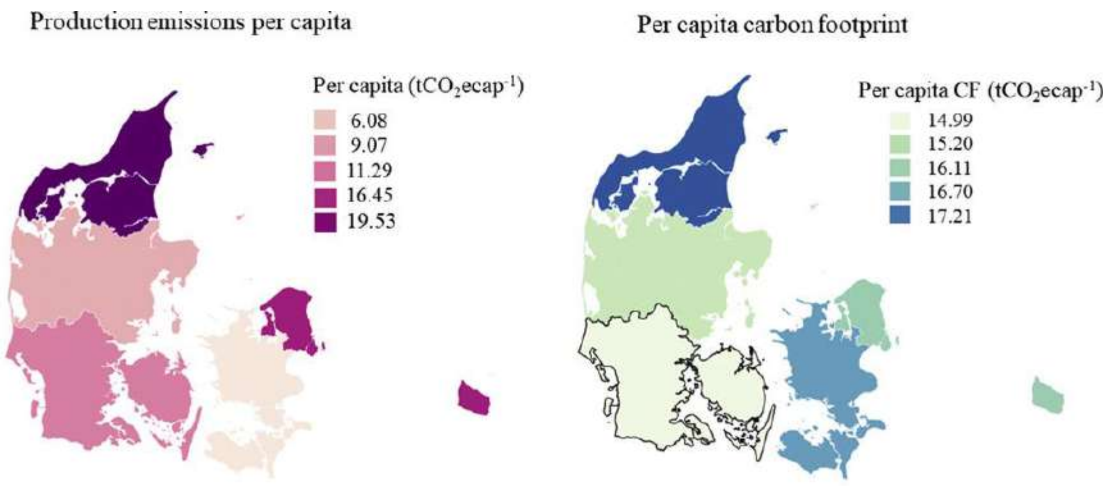
[168] https://ec.europa.eu/eurostat/databrowser/view/ilc_peps11/default/table?lang=en

[169] State of the Nordic Region 2020. (2020). Nordic Council of Ministers. https://doi.org/10.6027/no2020-001

3.2.2 Denmark’s Capital Region: Context for renewable energy

Greenhouse gas emissions and renewable energy deployment in Denmark’s Capital Region

Figure 22: Regional per capita GHG emissions in Denmark



The per capita GHG emissions (t CO_2e) of Denmark’s five regions from a production and consumption perspective in 2011. Darker shades represent relatively high per capita emissions regions while lighter shades represent relatively low per capita emissions regions.

Source: Osei Owusu et al, 2020

Denmark does not track GHG emissions by region. However, there has been some academic work to produce estimates, notably the 2020 article by Osei-Owusu et al.[170] The article produced estimates for both consumption and production-based emissions for Denmark’s five regions based on municipal data from 2011.

Based on this research, Denmark's Capital Region accounts for 41% (28 MtCO2e) and 31% (27 MtCO2e) of Denmark's production and consumption-based emissions respectively. In terms of emissions per capita, this equals just over 16 tCO2e per capita for both measures, significantly higher than the national average of 12.48 tCO2e for production emissions, and slightly above average (15.71 tCO2e) for consumption emissions.

The study highlights that mobility and buildings are the most important sectors for emissions from a production point of view nationally (accounting for more than 60% of emissions), and that the Capital Region accounted for the highest regional shares of these sectors (83% and 25% respectively). Deploying renewable forms of energy for

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[170] Osei-Owusu, A. K., Thomsen, M., Lindahl, J., Javakhishvili, L. N., & Caro, D. (2020). Tracking the carbon emissions of Denmark’s five regions from a producer and consumer perspective. Ecological Economics, 177, 106778. https://doi.org/10.1016/j.ecolecon.2020.106778

heating/cooling and electrification of buildings and transport is thus a very important part of reducing emissions in the Capital Region (and the country as a whole).

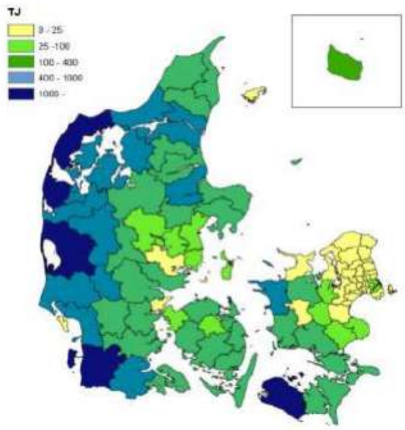
The Capital Region has put together a strategic plan for energy development in the region, in cooperation with all 29 regional municipalities, 10 utilities, and with four additional municipalities in suburban Copenhagen which are functionally a part of the Copenhagen urban area (Greve, Solrød, Køge and Roskilde), but a part of the neighbouring region.[171] The area covered in this plan is referred to as EPT33, and the best figures for energy usage are available for this functional area. The aim of the strategic plan is to move to a fossil-free electricity and heating sector for the area by 2035, as well as fossil-free transport by 2050.

In terms of gross energy consumption (2015), including transport, oil is the largest source of energy at 37%, followed by natural gas (20%), imported electricity (17%), and biomass (16%). Wind and solar made up only a small portion (1%). 17% can thus be considered renewable, of which the vast majority is from biomass. (See below for details on the imported electricity).

During the period 2012-2017, energy consumption for heating seems to be decreasing slightly while electricity consumption and energy consumption for transport has increased. Oil consumption is increasing, natural gas consumption and coal consumption is decreasing, biomass consumption is decreasing slightly and there has been a significant increase in electricity imports to EPT33. The increasing import of electricity is linked to a decrease in local electricity production. However, there has also been an increase in electricity production from both offshore and onshore wind and solar.

[171] Denmark's Capital Region. (2018)

Figure 23: Energy production from land-based wind turbines (2014)[172]



Since 2015 there has been a significant conversion to biomass in district heating and cogeneration, as well as an incipient phasing in of biogas into the natural gas network. This means that large parts of the coal consumption and parts of gas and oil consumption has already been converted to biomass. This conversion is nearing completion for district heating production. During the same period, heat production from waste has increased, probably due to optimization, biomass waste and imports of residual waste. At the same time, the application of gas boilers in the district heating supply increased significantly, particularly at the expense of gas cogeneration.

The net import of electricity is a notable feature of the region. The electricity consumption in EPT33 was almost 9,000 GWh in 2015, while electricity production was around 2,700 GWh, meaning that 70% of electricity was imported. According to the accepted accounting principles, the majority of imported electricity can be considered to be generated from coal. There was an increase in production from wind and sun in the period 2012-2015, and an increase in production from biomass in the period 2015-2017. However, wind energy production capacity in the region continues to represent a marginal amount compared to the national installations, with only 1% of total installations between 2012-16.[173] Electricity production from solar has increased by 471%, but also represents a small fraction of production.

Over half of the heat consumption comes from district heating and about 45% from natural gas. District heating production takes place almost exclusively as cogeneration (80%) and in boiler plants (19%), with a small contribution from surplus heat, solar heat

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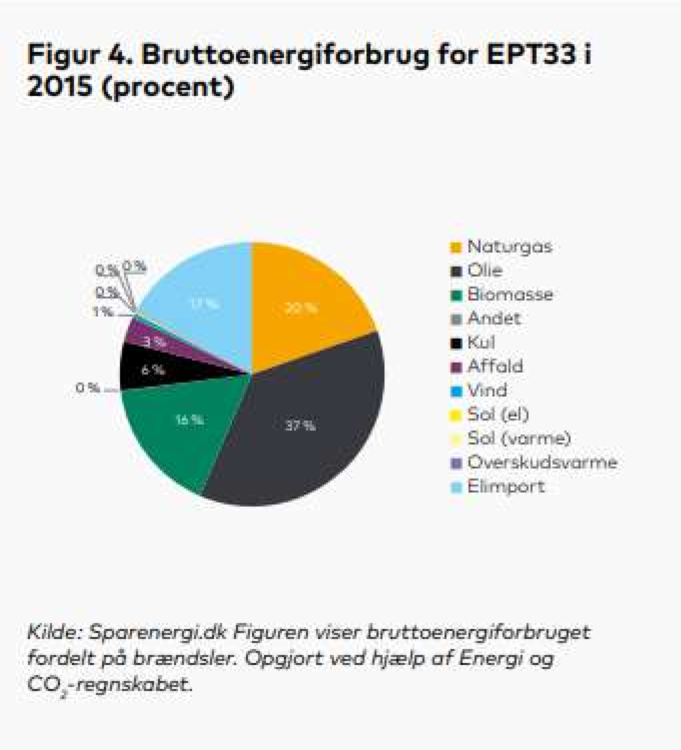
[172] Source: https://www.ea-energianalyse.dk/wp-content/uploads/2021/04/1525_potentialenotat_lokale_vedvarende_energiressourcer.pdf

[173] CONCITO. (2018) Lokal accept og udvikling af vindmølleprojekter: Opsamling på Wind2050-projektet. https://concito.dk/files/dokumenter/artikler/lokal_accept_og_udvikling_af_vindmoelleprojekter_maj2018.pdf

and heat pumps (1%). Looking at the fuels, the largest contribution comes from biomass, followed of coal, natural gas and waste.

Figure 24: Gross energy consumption in EPT33 (Copenhagen region) (2015)



Orange=natural gas; black=oil; green=biomass; grey=other; black=coal; purple=waste; dark blue=wind; dark yellow=solar(electricity); light yellow=solar (heat); violet=excess heat; light blue=imported

In terms of capacity, the region has a total production capacity of 2,569 MW of electricity and 6,402 MW for heating.[174] Using a very rough calculation, about 3300 MW of combined capacity is renewable.[175] Of this, only 295 MW is not biomass.

A 2015 study for the Capital Region found relatively limited potential for renewable energy generation within the region, due primarily to its urban, densely populated character.[176] According to the study the RES potential of the region could cover about 37% of total 2012 energy consumption (including transport). Heating could be 89%

[174] Denmark's Capital Region. (2018)

[175] based on 37% renewable out of heating and electricity, assuming oil is used in transport, and imported electricity is discounted. Oil is also used in heating, and a small percentage of renewable (roughly 6.4% is used in transport, but this is only intended as a rough calclulation.

[176] Ea Energianalyse. (2015). Lokale vedvarende energiressourcer: Potentialevurdering til "Energi på tværs". https://www.ea-energianalyse.dk/wp-content/uploads/2021/04/1525_potentialenotat_lokale_vedvarende_energiressourcer.pdf

covered by RES. The potential of land-based wind and solar is to cover 23% of the region's 2012 electricity needs. The region could thus cover far more of its energy use by renewables, but imports will continue to be a big part of the future energy mix. Nonetheless, the remaining uninstalled potential capacity represents a potentially significant source of jobs in coming years and decades.

Governance structures concerning renewable energy deployment in the Danish Capital Region

Danish regions have limited direct powers in the area of energy policy. However, municipalities have important powers around spatial planning, and the regions can coordinate the plans of municipalities, as is the case in the Capital Region with its regional strategic plan for energy: *Energi på Tværs*, or the broader regional development strategy.[177] As mentioned above, this plan brings together all of the region's municipalities, as well as 4 from suburban Copenhagen outside of the region, and 10 utilities to make a unified energy development plan. The decision was made by the Regional Council and the 29 mayors to set up the strategic energy plan in June 2015, with the goal of fossil-free energy for heating and electricity by 2035, and transport by 2050. The strategic plan allows the individual municipalities to make a coordinated and strategic input to these plans. There is a broader strategic plan, as well as a "Roadmap 2025" with 34 concrete measures to implement the plan toward 2025.[178] The project is managed by an independent organisation, Gate 21. The project's steering group has been composed of seven municipal representatives, seven representatives from utilities, one from Gate 21 and one from the Capital Region.

Municipalities may have their own Strategic Energy Plans, and they have been encouraged and supported to develop them by the Danish Energy Agency since 2012. However, not all have done so. A first generation of municipal heating strategies was established in the 1980s, followed by a second generation of municipal heating strategies in the 1990s to initiate the transition to more eco-friendly energy sources. However, heating planning stagnated after that. Electric energy – except for siting of wind power facilities and general project approvals – has until now not been a planning issue for municipalities. Most energy related planning was done by utilities at the local level, but approved by the municipalities. However, due to lack of coordination and

[177] Denmark's Capital Region. (2020) En region for den næste generation: Regional Udviklingsstrategi 2020-2023. https://www.regionh.dk/til-fagfolk/miljoe/en-groennere-region/Energiomstilling/Documents/RUS_RT_opslag.pdf
[178] Gate 21. (2018) Roadmap 2025. https://www.regionh.dk/til-fagfolk/miljoe/en-groennere-region/Energiomstilling/Documents/EPT_Roadmap-2025_WEB.pdf

passive planning, the national government wanted to move to a more strategic approach in 2012.[179]

The general political consensus around climate action across the mainstream political parties, and the national energy plans setting a direction of travel, means that political leadership has been relatively stable at regional and local level.

3.3 Analysis and conclusions

3.3.1 The socio-economic impacts of renewable energy deployment in Denmark's Capital Region

Overall, Denmark is a strong player in the renewable energy industry, and the green economy more broadly. Early investment into renewable energy technologies, continued R&D in the sector, and ambitious domestic climate goals have played a role in the development of this industry. From 2014 to 2016, the number of "green energy" jobs grew by 6% annually on average nationally. That is six times more than the growth of business in general.[180]

Nationally, 42.6% of all energy sector jobs are in "green energy".[180] This amounted to 31,221 jobs in 2016 when the last national survey was taken, or about 1.4% of all jobs. (3.3% for all energy sector jobs)

Green energy technologies make up an important part of total export value for the country: about 5% of total exports in 2015.[182]

The largest centres of employment are in Jutland where green energy, particularly wind, is a very important employer. According to research by Damvad Analytics, green energy employed 4310 people in the Capital Region in 2016. This constitutes about 14% of the national total, so it is relatively much less important than for the rest of the country, given the area's population makes up about 32% of the national population, 37% of employment, and 41% of GDP.[181] Green energy employment made up less than 1% of regional jobs. However, it is growing more quickly in Greater Copenhagen than

[179] Petersen, J.-P. (2018). The application of municipal renewable energy policies at community level in Denmark: A taxonomy of implementation challenges. Sustainable Cities and Society, 38, 205–218. https://doi.org/10.1016/j.scs.2017.12.029

[180] DAMVAD Analytics. (2018) Energibeskæftigelsen. https://kefm.dk/media/6885/efkm-energibeskaeftigelse-2016.pdf

[181] Erhvervsstyrelsen. (2021) Statistik om regional udvikling. https://regionalt.statistikbank.dk/statbank5a/default.asp?w=1920 (Accessed 21/07/2021)

nationally,[182] and is only a small part of a regional "green economy" industry in the region.[180]

The wind industry employed 4431 people in the Capital Region in 2016 (note: not all of these are officially counted as being in "green energy"). With a turnover of approximately EUR 1.75 billion in the region, this represents about 40% of "green" turnover in the region.[182] Although the industry is primarily based in Jutland, the Greater Copenhagen Region is particularly important for research and development in the industry, with some of the most important research centres located there. Estimates by Damvad Analytics foresee between 4700-8300 new jobs in the region in the wind industry by 2035.

A number of companies active in the field of bioenergy are headquartered in Greater Copenhagen, and looking at the regional distribution of the manufacture of chemical products, which accounts for the vast majority of green revenue in this area, we see that itis located in Greater Copenhagen.[182] However, it is an industry segment that is harder to measure due to its heterogenous nature. 2357 are employed in waste management and recycling, a portion of which is in bioenergy (biomass). 1887 are employed in the manufacture of chemical products, which is likely mostly biofuels related production. It is in Greater Copenhagen that revenue growth for this industry has been strongest in recent years. This is an area of international strength for the country, as R&D is advanced and impactful compared to the OECD average. Estimates by Damvad Analytics foresee between 2100-3300 new jobs in the region in the bioenergy industry by 2035 and between 1500 and 5700 in biofuels.

Full estimates are not available for employment in district heating, but there are at least 617 jobs in this field.[182] Important plants and companies include Avedøre power plant and Burmeister & Wain Scandinavian. Key players within district heating-related consulting such as Cowi and Rambøll are also located in Greater Copenhagen. It is possible that the figures somewhat under-represent total RES employment, as this is a relatively important part of the RES picture in an urban context and in the Copenhagen area.

A number of wind turbine developments are partially community owned, in accordance with the relevant national laws and traditions. For example, the 40MW Middelgrunden cooperative offshore wind farm in Copenhagen harbour is 50% community owned, and 50% owned by HOFOR, the Copenhagen Utility company.[183]

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[182] Damvad Analytics. (2017) Analyse for Gate 21: GRØN VÆKST I DANMARK OG GREATER COPENHAGEN. https://www.gate21.dk/wp-content/uploads/2018/05/Gr%C3%B8n-v%C3%A6kst-i-DK-og-Greater-CPH_DamvadAnalytics.pdf

[183] Middelgrunden Windmill Cooperative, https://www.middelgrunden.dk/middelgrunden-windmill-cooperative/

There are 8650 members of the cooperative. It was built in 2000 and was the largest offshore wind farm in the world at that time.[184]

Estimates by the City of Copenhagen (the municipality, not the region) showed that although the high cost of bioenergy compared to coal could increase energy costs for the municipality, but these would be offset in the long-run by energy efficiency improvements and by income from wind turbines.[185] The city asserts that initially, district heating customers will not notice the added costs since biomass enjoys the benefit of an indirect tax exemption compensating heat producers for rising fuel costs.

3.3.2 Key factors that determine renewable energy deployment and the accompanying socio-economic development in Denmark's Capital Region

Although Denmark as a whole is world leader in the renewable energy industry, and has been a pioneer in this area, Denmark's Capital Region has less renewable capacity, and employs fewer people in this area than the other areas of the country. The vast majority of Danish employment and value added and employment from renewable energy are found in Jutland, particularly the Central-Jutland Region. This is due to the concentration of large wind power firms and their suppliers located there, including large firms such as Vestas and Ørsted.

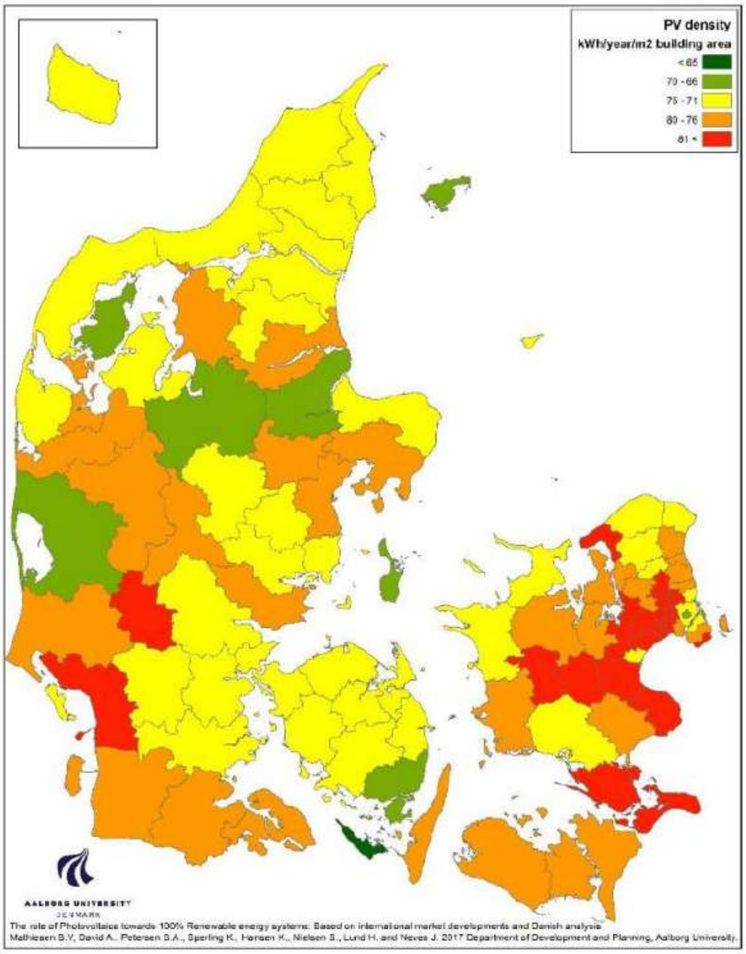
As a relatively densely populated region, it is not as well suited as more rural areas for large scale wind power deployment, and will remain dependent on net imports of renewable energy in the future. However, municipalities in the region do have significant plans to expand wind power in coming years, partially within the region, but also offshore, and in other regions.[186] As a result, the economic effects of this construction will be partially dispersed to other regions.

[184] Hans Christian Sørensen; Lars Kjeld Hansen; Jens H. Mølgaard Larsen. (2002). "Middelgrunden 40 MW offshore wind farm Denmark: Lessons Learned". https://web.archive.org/web/20060820062226/http://www.emu-consult.dk/includes/middelgrunden_munich.pdf Accessed 31 July 2021.

[185] City of Copenhagen. (2012) CPH2025 Climate Plan. pp. 59. https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=983

[186] KBH 2025 klimplan.

Figure 25: Potential PV production calculated per km2



Source: Mathiesen et al, 2017

Denmark as a whole has been making significant progress in terms of renewable energy deployment, and has plans to phase out all coal by 2028, and the Capital Region cannot be viewed in complete isolation from these developments. There are spill-over effects from the large industries in Jutland, mainly in R&D jobs. Projections show significant improvements in local GDP and jobs by 2030 if the national targets are met. Nonetheless, from a purely regional socio-economic development perspective it is not benefitting from RES transition as much as other parts of the country, either in terms of use of RES or in terms of jobs and value added.

However, the urbanized region is better suited to rooftop solar deployment and district heating than the rest of the country. Rooftop solar deployment remains low, but has been increasing recently, as costs have decreased and the technology has improved. Solar is expected to play a significant role in national electricity supply by 2050 (10-

15% of fluctuating RES) according to a study by Aalborg University,[187] indicating the level could be higher in the Capital Region due to population and rooftop density (see map of potential PV production).

District heating is the focus of most renewable energy production and consumption today, but the jobs in this area may be under-counted by the sources available, so it is likely that there is more direct employment than indicated in this report.

The municipality of Copenhagen also has initiatives to ensure that local citizens are able to buy shares in the local windmills, also as stipulated in national legislation. Denmark as a whole has a good history of providing ownership opportunities to citizens through cooperatives and other measures. However, given the relatively small number of windmills in the area this is not likely a major economic factor. In addition, the ownership provisions of the current renewable energy law have been criticized for still being inaccessible to many citizens due to expense, insufficient discount for the closest residents, barriers from the companies implementing the projects, and barriers resulting from attitudes toward the projects (see CONCITO 2018).[188]

It is worth noting that the region does have a concentration of other "green" industries, including in the area of energy and heat efficiency, which employs more people than renewable energy itself, as well as "reducing resource use", and "research into resource and fossil fuel efficiency". In 2019, "green industries" employed over 36,000 people in the region, just under 4% of total regional employment.[189] The region also has a higher level of income from green and renewable industries than it does in terms of direct employment (as a percentage of the national totals). Over 60% of Danish research related jobs in green industries are located in the region.[190] In terms of the Danish green industry as a whole it is still relatively under-represented compared to other regions, in large part because of the major concentration of employment in Central Jutland. However, this is a reflection of the strength of the Danish green sector as a whole rather than a weakness of the region. In absolute terms, the Danish sector is

[187] Mathiesen, B. V., David, A., Petersen, S., Sperling, K., Hansen, K., Nielsen, S., Lund, H., & Neves, J. B. D. (2017). The role of Photovoltaics towards 100% Renewable energy systems: Based on international market developments and Danish analysis. Department of Development and Planning, Aalborg University. https://vbn.aau.dk/ws/portalfiles/portal/266332758/Main_Report_The_role_of_Photovoltaics_towards_100_percent_Renewable_Energy_Systems.pdf

[188] Leer Jørgensen, M., Anker, H. T., & Lassen, J. (2020). Distributive fairness and local acceptance of wind turbines: The role of compensation schemes. Energy Policy, 138, 111294. https://doi.org/10.1016/j.enpol.2020.111294

[189] Based on employment of 926,000 in 2019. Eurostat: https://ec.europa.eu/eurostat/databrowser/view/lfst_r_lfe2emp/default/table?lang=en

[190] Erhvervsstyrelsen, Regional udvikling, https://regionalt.statistikbank.dk/statbank5a/default.asp?w=1920 Accessed 29 July 2021.

larger than in neighbouring Sweden which has a significantly larger population. It is worth highlighting the very significant employment, particularly in the Central Denmark Region, centred around Aarhus, where direct employment in renewable energy accounts for 13.5% of all jobs. This highlights the potential for very significant employment in regions that are able to form an industrial hub centred around renewable energy.

Interviews conducted

The research in this case study was supplemented by an interview with Damvad Analytics on 23 June 2021.

3.3.3 Conclusions

- Employment in the renewable energy industry is relatively low compared to other Danish regions, probably because of the relatively low level of RES deployment, itself a result of the urban, densely populated nature of the region. However, the employment figures available likely undercount the number of jobs due to some jobs in district heating not being fully counted. Rooftop solar is also potentially a good source of jobs in the region in coming years that is so far only in its initial phase of development.

- The region has a relatively high proportion of research related jobs in renewable energy, and many more jobs in other "green industries" (such as related to energy efficiency) possibly as a result of urban agglomeration effects. These are high quality jobs and areas of significant potential employment growth in coming years and are not directly linked to local RES deployment. "Green business" is a particular strength in Denmark as a whole, and the national strength in this area does translate into jobs in in the capital region despite the relatively low level of RES deployment there.

- The regional distribution of jobs and economic activity in Denmark, with a very high concentration of jobs and economic benefits in Jutland, shows the importance of building up RES manufacturing and supply chain capacity for broader employment and economic benefits as well as the first mover advantage in combination with a supportive national policy environment.

- The ownership of renewables in the capital region is mostly in the hands of utility companies and larger corporations, but some large community owned projects have also been present for many years. This partly reflects the reliance on larger biomass facilities in the region, but also the orientation toward larger institutional owners and imperfect system to incentivise local ownership in recent years, despite the strong Danish tradition of community RES ownership.

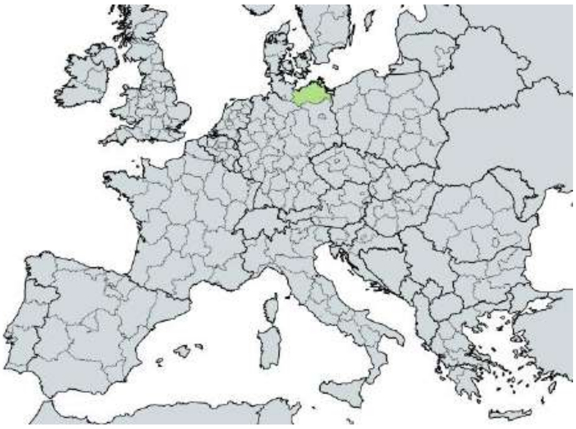
Case study 4

Mecklenburg-Western Pomerania

4. MECKLENBURG-WESTERN POMERANIA (MECKLENBURG-VORPOMMERN), GERMANY

*This case study was authored by **Isabel Haase** from the Ecologic Institute.*

Photo by Matthias Pens on Unsplash



GDP per capita	€28,590 (2020)
Population	1,609,675 (2018)
Population density	69/km^2
Unemployment rate	7.9%
People at risk of poverty or social exclusion	23.2% (Eurostat)
Share of renewable energy (% of gross final energy consumption)	39%
Total installed RES capacity	5,796 MW (2017)
Employment in RES	2.7% (direct & indirect 2016)

4.1 A brief overview of the German context

4.1.1 Germany's socio-economic conditions

Germany is a highly industrialised country with the European Union's biggest economy. Its nominal GDP per capita was 40,120 Euro in 2020, the 8th highest out of all Member States, about 10,000 Euro more than the European average. The German GDP continuously increased in the years between 2010 and 2019, by 1.9% on average[191]. Moreover, only 5.9% of the active population were unemployed in 2020. The share has been continuously declining in the last ten years, with the exception of a slight increase in 2020 due to the COVID-19 pandemic.[192]

Despite the strength of its economy, Germany has a relatively high income inequality (ranking 16th in the EU when measured by Gini coefficient) and comparatively low social mobility. The Programme for International Student Assesment (PISA) study, which evaluates education systems in a variety of countries, found that, in Germany, the influence of the parent's socioeconomic

[191] Eurostat (2021). Gross domestic product at market prices. Data code: tec00001. URL: https://ec.europa.eu/eurostat/web/products-datasets/-/tec00001. Accessed on: 04.05.2021.

[192] Destatis (2020). Arbeitsmarktstatistik der Bundesagentur für Arbeit. Bundesagentur für Arbeit. URL: https://www-genesis.destatis.de/genesis//online?operation=table&code=13211-0001&bypass=true&levelindex=1&levelid=1621320788443#abreadcrumb. Accessed on: 04.05.2021.

background on academic performance is bigger than the surveyed countries' average.[193]

The conservative party Christian Democratic Union (CDU) and the Christian Social Union (CSU) under Chancellor Angela Merkel have governed Germany in varying coalitions since 2005. However, federal elections in autumn 2021 will bring a change in administration, as Angela Merkel will not be running for office again.[194]

4.1.2 Renewable energy deployment in Germany

Germany has a comparatively high share of renewables in its electricity mix: Renewable energies generated 47% of electricity in 2020, the highest individual share of any energy source being wind with 26%[195]. However, at about 19%, the share of renewables in total energy in final energy consumption is considerably lower.[196] There are significant regional disparities: while the North of Germany has a very high share of renewables, especially because of wind energy, the South's share is markedly lower, with its renewable market being dominated by solar, hydro and biomass.[197] This leads to a skewed balance, with the North oftentimes producing high amounts of renewable electricity and the South consuming a large share of it.[198]

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[193] OECD (2018). Programme for international Student Assesment (PISA). Equity in Education: Breaking Down Barriers to Social Mobility – Germany. URL: https://www.oecd.org/pisa/Equity-in-Education-country-note-Germany.pdf.

[194] Le Blond, J.(2018). German chancellor Angela Merkel will not seek re-election in 2021. The Guardian. URL: https://www.theguardian.com/world/2018/oct/29/angela-merkel-wont-seek-re-election-as-cdu-party-leader. Accessed on: 04.05.2021.

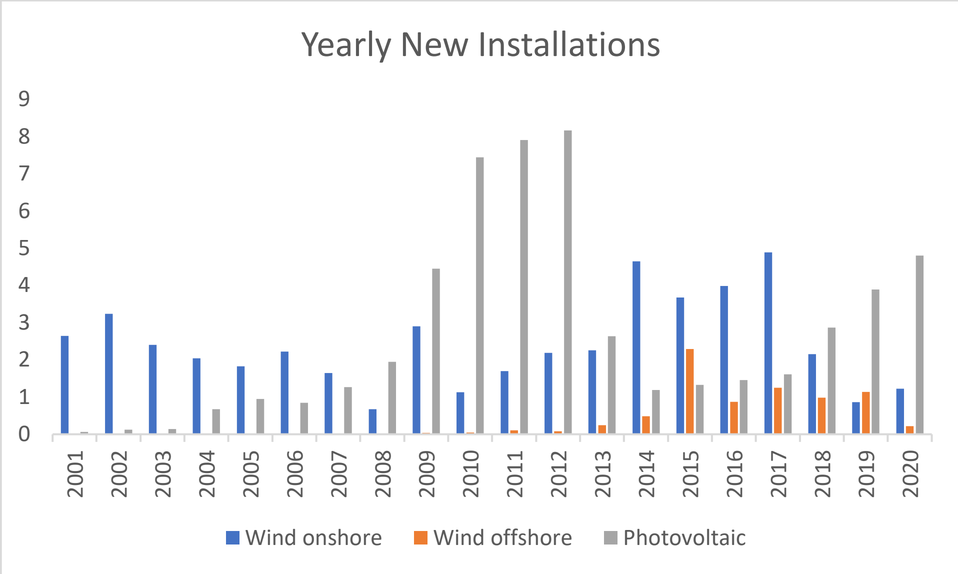
[195] Destatis (2021). Stromerzeugung 2020: 5,9% weniger Strom ins Netz eingespeist als 2019 – Windkraft löst Kohle als wichtigsten Energieträger ab – Anteil der erneuerbaren Energien steigt auf 47%. URL: https://www.destatis.de/DE/Presse/Pressemitteiungen/2021/03/PD21_101_43312.html;jsessionid=4C15A9041BAA721FAF4E7864810BDB8C.live721. Accessed on: 04.05.2021.

[196] Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat) (2021). Entwicklung der erneuerbaren Energien in Deutschland im Jahr 2020. *Bundesministerium für Wirtschaft und Energie*. URL: https://www.erneuerbare-energien.de/EE/Navigation/DE/Service/Erneuerbare_Energien_in_Zahlen/Entwicklung/entwicklung-der-erneuerbaren-energien-in-deutschland.html. Accessed on: 04.05.2021.

[197] Umweltbundesamt (2016). Strommix in Deutschland. URL: https://www.umweltbundesamt.de/bild/strommix-in-deutschland. Accessed on: 04.05.2021.

[198] Gailing, L. (2015). Energiewende als Mehrebenen-Governance. *Nachrichten der ARL*, *45*(2), 7-10. URL: https://shop.arl-net.de/media/direct/pdf/nachrichten/2015-2/NR2-2015_Gailing_S7-10_online.pdf.

Figure 26: Annual renewable energy installations in Germany



Source: Own presentation based on Arbeitsgruppe Erneuerbare Energien (2021)[199]

While the German energy transition ('*Energiewende*') was once role model for its innovativeness and speed, the uptake of renewables has not met expectations, the deployment of wind energy has even stalled (see **Figure**). This is mainly attributed to the change of the incentive structure of the Renewable Energy Act ('*Erneuerbare-Energien-Gesetz EEG'*, original version is from 2000*)*[200] to an auctioning system, which impedes smaller suppliers from participating and puts a de-facto cap on the amount of big-scale renewables that can be deployed;[201] complex licensing procedures, as well as increasing local opposition and lawsuits blocking building permits.[202]

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[199] Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat) (2021). Zeitreihe zur Entwicklung der erneuerbaren Energien in Deutschland. *Bundesministerium für Wirtschaft und Energie*. URL: https://www.erneuerbare-energien.de/EE/Navigation/DE/Service/Erneuerbare_Energien_in_Zahlen/Zeitreihen/zeitreihen.html. Accessed on: 04.05.2021.

[200] Rueter, G. (2019). Dramatischer Einbruch beim Windausbau: Was läuft schief in Deutschland?. *Deutsche Welle.* URL: https://www.dw.com/de/dramatischer-einbruch-beim-windausbau-was-l%C3%A4uft-schief-in-deutschland-eeg-windkraft-erneuerbare/a-49076585. Accessed on: 04.05.2021.

[201] Schade, N. (2021). Der Windkraftausbau stockt massiv. *Tagesschau.* URL: https://www.tagesschau.de/investigativ/swr/deutschland-windkraft-ausbau-101.html. Accessed on: 04.05.2021.

[202] Witsch, K., Stratmann, K.(2019). Ausbau der Windkraft bricht ein – Der Neubau von Windrädern ist im Jahresvergleich um 82% gesunken. Die Branche klagt über Genehmigungsstau und fordert einen Krisengipfel. *Handelsblatt*. URL:

4.1.3 Political governance structures regarding the deployment of renewable energies in Germany

The central legislative instrument for the uptake of renewable energies in electricity is the EEG, which regulates the incentive structure as well as the indicative trajectory for the installation of renewables.[203]

The EEG defines the main policy instruments to regulate and incentivise renewable energy uptake. Those have largely shifted from fixed feed-in-tariffs to auctions, with the most recent amendments of the regulation being in 2017 and 2021. Energy producers wanting to install renewable energy plants (biomass, photovoltaic (PV), wind onshore and offshore) have to participate in auctions in order to be able to connect to the grid and receive a guaranteed support level. Small onshore wind, PV and biomass plants can still receive a feed-in-tariff, if their installed capacity is below a certain threshold value (750 kW for PV, 150 kW for Biomass, 750 kW for wind onshore).[204]

The EEG furthermore sets the target of achieving a share of 65% renewable energies in electricity generation by 2030. Within the EU's Renewable Energy Directive, the target share in gross final energy consumption – i.e. for all energy consumption including transport and heat – was set at 30%. Both targets have been confirmed and elaborated through the country's National Energy and Climate Plan (NECP).[205] Additionally, the Climate Protection Law of 2019 specified CO_2 reduction targets of the energy sector from 61-62% compared to 1990 levels by 2030[206] on the basis of the Climate Protection Programme 2050.[207] In May 2021, however, in the aftermath of a landmark decision by Germany's constitutional court in favour of stronger climate protection, the federal government announced an increase in total emission reduction targets from 55% to 65% by 2030 and a long-term goal to achieve climate neutrality by 2045

https://www.handelsblatt.com/unternehmen/energie/erneuerbare-energien-ausbau-der-windkraft-bricht-dramatisch-ein/24696524.html?ticket=ST-6744000-10FRiQcrZ9F3fFLKdcKf-ap1. Accessed on: 04.05.2021.

[203] Gesetz für den Ausbau erneuerbarer Energien (Erneuerbare-Energien-Gesetz – EEG 2021). (2021). URL: https://www.gesetze-im-internet.de/eeg_2014/BJNR106610014.html.

[204] Gesetz für den Ausbau erneuerbarer Energien (Erneuerbare-Energien-Gesetz – EEG 2021). (2021). URL: https://www.gesetze-im-internet.de/eeg_2014/BJNR106610014.html.

[205] Bundesministerium für Wirtschaft und Energie (2020). Nationaler Energie- und Klimaplan (NECP). URL: https://www.bmwi.de/Redaktion/DE/Textsammlungen/Energie/necp.html.

[206] Bundes-Klimaschutzgesetz (KSG) (2019). URL: https://www.gesetze-im-internet.de/ksg/index.html.

[207] Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (2016). Der Klimaschutzplan 2050 – Die deutsche Klimaschutzlangfriststrategie. URL: https://www.bmu.de/themen/klima-energie/klimaschutz/nationale-klimapolitik/klimaschutzplan-2050/#c8420

instead of 2050.[208] It remains to be seen how this change will affect the specific targets for the energy sector.

The legislative powers in the energy sector are almost exclusively located at federal level, as the energy policy is part of the so-called 'concurrent legislation', meaning federal law has the prerogative over state law. This is especially relevant for the electricity sector, where the parliament at federal level decides on the regulatory framework for both renewables and conventional energy technologies. Nevertheless, federal states also have some competences, mainly in regard to spatial planning, local energy supply, energy efficiency, district heating and heating in general.[209] Thus, federal and state level governance differs. While federal regulation is ubiquitous, federal states focus on spatial factors regarding the installation of renewables, such as nature conservation sites, minimum distance requirements from residential areas and conflict management with residents.[210] It is important to note, however, that the North Sea and Baltic Sea constitute limits to these competencies, as their spatial development plan has been developed on federal level.[211]

Apart from state regulations, federal states have the possibility to influence national policy making through the German Federal Councils ('*Bundesrat*'). This option is limited, however, as the amendments of the EEG only allow for a suspensive veto.[212]

4.2 Mecklenburg-Western Pomerania's socio-economic development and renewable energy deployment

4.2.1 Mecklenburg-Western Pomerania's socio-economic conditions

There are significant regional disparities in Germany. Especially the federal states that formerly belonged to the German Democratic Republic (GDR) are still

[208] Deutsche Welle (2021). Bundesregierung schärft Klimaziele deutlich nach. URL: https://www.dw.com/de/bundesregierung-sch%C3%A4rft-klimaziele-deutlich-nach/a-57439326. Accessed on: 05.05.2021.

[209] Münzner, M. (2014). Energie und Klima Ländersache?. *Rescriptum. (Münchner Studentische Rechtszeitschrift)*, (1), 47. URL: http://www.rescriptum.org/Aufs%C3%A4tze/2014_1_047_Muenzner.pdf.

[210] Gailing, L. (2015). Energiewende als Mehrebenen-Governance. *Nachrichten der ARL*, *45*(2), 7-10. URL: https://shop.arl-net.de/media/direct/pdf/nachrichten/2015-2/NR2-2015_Gailing_S7-10_online.pdf.

[211] Bundesamt für Seeschifffahrt und Hydrographie. Meeresraumplanung. URL: https://www.bsh.de/DE/THEMEN/Offshore/Meeresraumplanung/meeresraumplanung_node.html. Accessed on: 05.05.2021.

[212] Wenz, N. (2021). Die Governance der Energietransformation von Deutschland und Österreich im Vergleich. URL: https://tuprints.ulb.tu-darmstadt.de/11674/1/Dissertation_Wenz.pdf

struggling to bring their economic development up to speed with former West Germany. The average income with equal qualification in the eastern and western parts of the country still differs by 17% [213] and unemployment is generally higher in the eastern part.[214] Low economic opportunity caused a wave of domestic migration from the former GDR into former West Germany afterreunification in 1990. Especially younger people left, leading to the remaining population being considerably older on average. As a consequence, the workforce is smaller than in the West.[215] As Mecklenburg-Western Pomerania is part of the former GDR, it is also part of this dynamic.

Mecklenburg-Western Pomerania is a coastal state in the northeast of Germany, located by the Baltic Sea. Its landscape is characterized by hilly lowlands, a great variety of peatlands and the Mecklenburg Lake District, which makes up a major part of the state. Due to the ecological value of its ecosystems, almost a third of Mecklenburg-Western Pomerania is under some form of nature protection.[216]

At the end of 2019, 1.6 million people lived in Mecklenburg-Western Pomerania in an area of 23,300 km^2, (population density of 69/km^2) making it the least densely populated state in Germany.[217] After the emigration of a big part of its workforce after the reunion with former West Germany, Mecklenburg-Western Pomerania has experience net immigration since 2013. However, the population is still shrinking, as the death rate exceeds the birth rates, an effect that is not compensated for by migration.[218] Hence, an analysis of Mecklenburg-Western Pomeranians' economic conditions found an already noticeable lack of skilled

[213] Lübker, M. (2019). Beschäftigte im Osten verdienen bei gleicher Qualifikation 17% weniger als im Westen – Geringe Tarifbindung wichtiger Grund. URL: https://www.boeckler.de/de/pressemitteilungen-2675-beschaeftigte-im-osten-verdienen-bei-gleicher-qualifikation-17-prozent-weniger-als-im-18622.htm. Accessed on: 05.05.2021.

[214] Destatis (2021). Konjunkturindikatoren – Registrierte Arbeitslose und Arbeitslosenquote nach Gebietsstand. URL: https://www.destatis.de/DE/Themen/Wirtschaft/Konjunkturindikatoren/Lange-Reihen/Arbeitsmarkt/lrarb003ga.html;jsessionid=6B490D9A8EE78CF5FA1197FD2A9F63B4.live742 . Accesses on: 05.05.2021.

[215] Destatis (2019). Koordinierte Bevölkerungsvorausberechnung nach Bundesländern. URL: https://service.destatis.de/laenderpyramiden/. Accessed on: 06.05.2021.

[216] Tourismusverband Mecklenburg-Vorpommern e.V. (2021). Geographische Daten. URL: https://www.tmv.de/geografische-daten/. Accessed on: 06.05.2021.

[217] Destatis (2020). Bundesländer mit Hauptstädten nach Fläche, Bevölkerung und Bevölkerungsdichte am 31.12.2019. URL: https://www.destatis.de/DE/Themen/Laender-Regionen/Regionales/Gemeindeverzeichnis/Administrativ/02-bundeslaender.html. Accessed on: 06.05.2021.

[218] Regierungsportal Mecklenburg-Vorpommern (2021). Daten und Fakten zur demografischen Entwicklung in Mecklenburg-Vorpommern. URL: https://www.regierung-mv.de/Landesregierung/stk/Themen/Demografischer-Wandel/Daten-und-Fakten/. Accessed on: 06.05.2021.

workers is likely to worsen in the future.[219] This was corroborated by another study, which estimated that in the first semester of 2019, 40% of qualified positions could not be filled in; with smaller companies being more affected. The highest percentage was observed in the building sector and manufacturing industries. Overall, the share seems to be stagnating at a high level.[220]

Mecklenburg-Western Pomerania has a comparatively weak economy. With a nominal GDP of 46 million in 2020, it constitutes just 1.4% of Germany's GDP. Its GDP per capita is 28,590 Euro which is more than 10,000 Euro lower than the German average. Correspondingly, unemployment has exceeded the German mean since reunification. However, while around the year 2000 approximately 20% of Mecklenburg-Western Pomeranians were unemployed, this number has significantly dropped, to 7.9% in 2020 [221].

The GDP growth rate also shows a positive trend: Between 2015 and 2020 Mecklenburg-Western Pomerania had the second highest real economic growth of all the federal states, surpassed only by Berlin.[222]

Its relatively weak economy is also reflected in the state's at-risk-of-poverty rate, which is at 19.4%, and thus 3.5 percentage points higher than the German average.[223] Nevertheless, the income inequality is slightly lower than in the rest of Germany, with a Gini coefficient of 0.26 vs. 0.29 for Germany.[224] There is no data available on energy poverty on the state level. However, the percentage of

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[219] Alecke, B. (2014) Sozioökonomische Analyse für das OP EFRE in der Förderperiode 2014 bis 2020 des Landes Mecklenburg-Vorpommern. GEFRA -Gesellschaft für Finanz-und Regionalanalysen. URL: https://www.europa-mv.de/serviceassistent/download?id=1619580.

[220] Glettenberg, M.Arndt, O., Fischer, A., Koll, F., Komendzinski, M.-K., Stader, F. & Spalthoff, F. (2020) Bestandsaufnahme und Fortentwicklung des Gründungsökosystems im Land Mecklenburg-Vorpommern. Prognos. URL: https://www.investorenportal-mv.de/de/aktuelle-broschueren/bestandsaufnahme-und-fortentwicklung-des-gruendungsoekosystems-in-mecklenburg-vorpommern/index.html

[221] Statistische Ämter des Bundes und der Länder (2021). Volkswirtschaftliche Gesamtrechnung der Länder. URL: https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung#alle-ergebnisse. Accessed on: 06.05.2021.

[222] Statistische Ämter des Bundes und der Länder (2021). Volkswirtschaftliche Gesamtrechnung der Länder. URL: https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung#alle-ergebnisse. Accessed on: 06.05.2021.

[223] Statistische Ämter des Bundes und der Länder (2021). Sozialberichterstattung – Einkommensarmut und –verteilung. URL: https://www.statistikportal.de/de/sbe/ergebnisse/einkommensarmut-und-verteilung. Accessed on: 06.05.2021.

[224] Statistische Ämter des Bundes und der Länder (2021). Nachhaltigkeit – Gini-Koeffizient zur Einkommensverteilung. URL: https://www.statistikportal.de/de/nachhaltigkeit/ergebnisse/ziel-10-weniger-ungleichheiten/gini-koeffizient-zur-einkommensverteilung. Accessed on: 06.05.2021.

the population affected by energy poverty in all of Germany is marginal (1.5%), which is why it is likely not a prevalent phenomenon in the region.[225]

The comparison of the economic sectoral division of Germany and Mecklenburg-Western Pomerania shows several differences (see **Figure 1**): the service sector of the northern state is considerably bigger than in the rest of Germany, mainly due to the larger public sector. The share of the manufacturing sector is about 30% smaller than in the rest of Germany, whereas the share of agriculture, fishery and forestry is almost four times higher.[226] Historically, the Mecklenburg-Western Pomeranian economy has been dominated by agriculture; while its economic weight has been declining since reunification, the manufacturing of agricultural products is still very important to the region.[227] Two sectors that stand out are the hospitality sector and the energy supply sector, whose shares are 1.5 times and 2 times higher than in the rest of Germany, respectively. [228]

The structure of its economy is largely dominated by small and medium-sized enterprises; the major part of companies (89.1%) have up to nine employees and only 0.3% have more than 250 employees. However, there is an ever so slight increase in the amount of bigger companies: While only 168 companies with more than 250 employees existed in Mecklenburg-Western Pomeranian in 2008, their number rose to 203 in 2017.[229] Among the bigger enterprises are retail chains, travel companies and energy suppliers, but few industrial enterprises.[230]

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[225] Eurostat (2021). Population unable to keep home adequately warm by poverty status. Data code: [sdg_07_60]. URL: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sdg_07_60&lang=en. Accessed on: 06.05.2021.

[226] Statistische Ämter des Bundes und der Länder (2021). Volkswirtschaftliche Gesamtrechnung der Länder. URL: https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung#alle-ergebnisse. Accessed on: 06.05.2021.

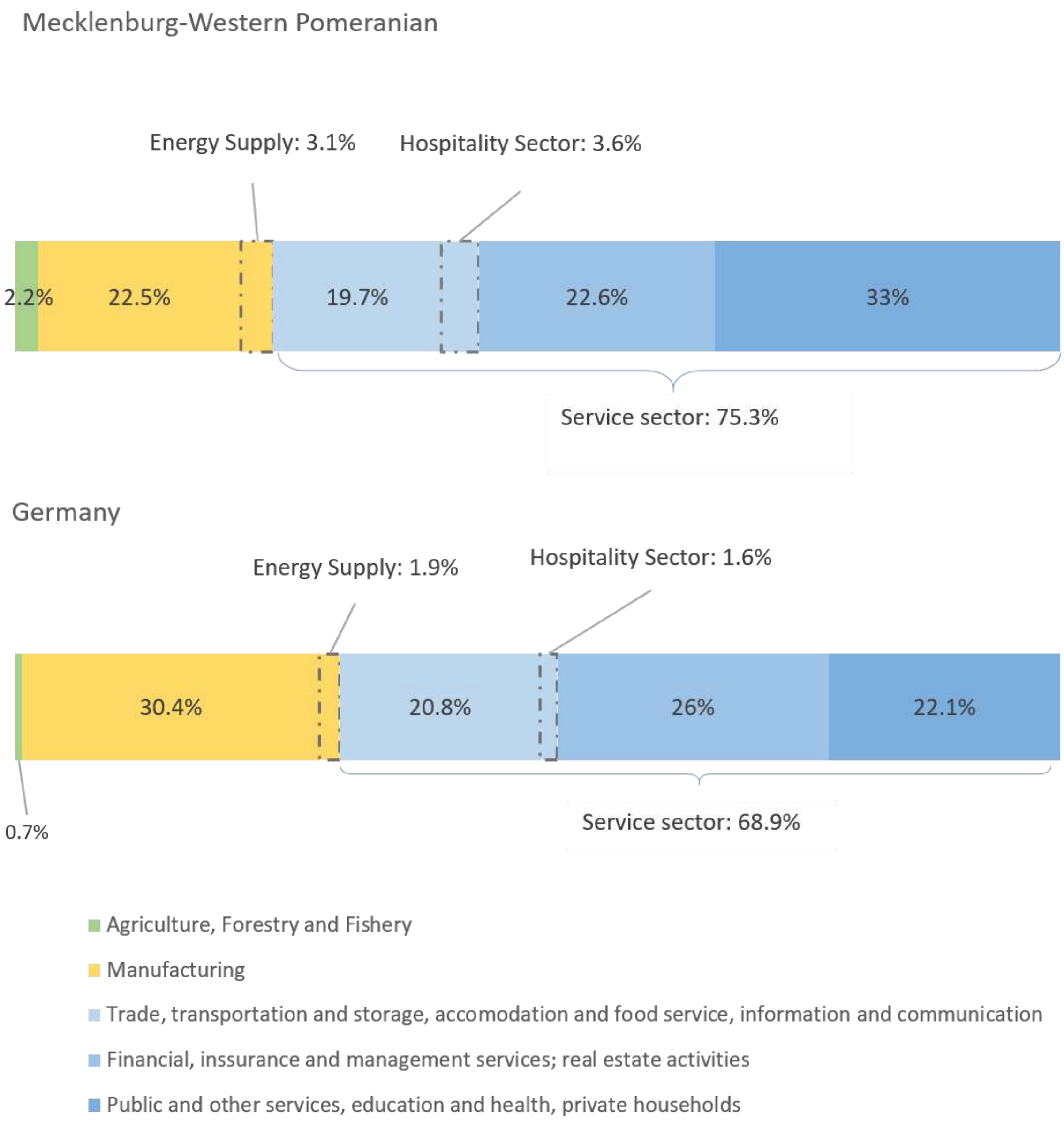
[227] Landeszentrale für politische Bildung Mecklenburg-Vorpommern (2018). Wirtschaft in Mecklenburg-Vorpommern. URL: https://politik-mv.de/2018/08/07/wirtschaft-in-mecklenburg-vorpommern/. Accessed on: 17.05.2021.

[228] Statistische Ämter des Bundes und der Länder (2021). Volkswirtschaftliche Gesamtrechnung der Länder. URL: https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung#alle-ergebnisse. Accessed on: 06.05.2021.

[229] Destatis (2021). Unternehmen (Unternehmesregister-System): Bundesländer, Jahre, Wirtschaftszweige (Abschnitte), Beschäftigungsgrößenklassen. Data code: 52111-0003. URL: https://www-genesis.destatis.de/genesis//online?operation=table&code=52111-0003&bypass=true&levelindex=0&levelid=1621331889208#abreadcrumb. Accessed on: 06.05.2021.

[230] Landeszentrale für politische Bildung Mecklenburg-Vorpommern (2018). Wirtschaft in Mecklenburg-Vorpommern. URL: https://politik-mv.de/2018/08/07/wirtschaft-in-mecklenburg-vorpommern/. Accessed on: 17.05.2021.

Figure 17: Gross value added by sector in Mecklenburg-Western Pomerania and Germany in 2017



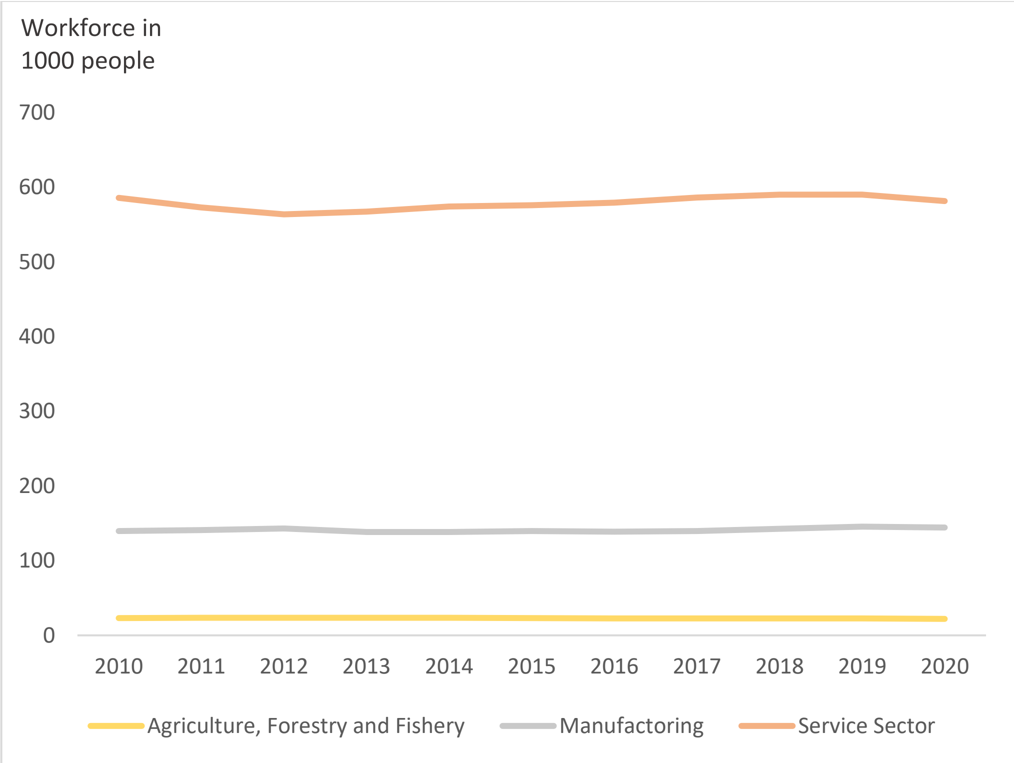
Source: Own presentation, based on data from Federal Statistical offices of the statistical offices of the Länder (2021) [231]

In the distribution of the workforce, there has been relatively little change in the three main areas of the economy between 2010 and 2020 (see **Figure**), The service sector employed the biggest share of the workforce with about 580,000

[231] Statistische Ämter des Bundes und der Länder (2021). Volkswirtschaftliche Gesamtrechnung der Länder. URL: https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung#alle-ergebnisse. Accessed on: 06.05.2021.

people in 2020, while the manufacturing sector employed 145,000 people and the agricultural, fishery and forestry sector about 22,000. The biggest change, in relative terms, happened in the agricultural, fishery and forestry sector, the workforce of which declined by 4.8% between 2010 and 2020. The manufacturing sector increased by 3.5% in the same timeframe, while the service sector declined only slightly by 0.7%. In the growing sectors energy supply and hospitality, the amount of jobs rose between 2010 and 2018 by 18.1% and 4.9%, respectively. [232]

Figure 28: Workforce development by economic sector in Mecklenburg-Western Pomerania



Source: Own presentation, based on data from Federal Statistical offices of the statistical offices of the Länder (2021) [233]

[232] Statistische Ämter des Bundes und der Länder (2021). Volkswirtschaftliche Gesamtrechnung der Länder. URL: https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung#alle-ergebnisse. Accessed on: 06.05.2021.

[233] Statistische Ämter des Bundes und der Länder (2021). Volkswirtschaftliche Gesamtrechnung der Länder. URL: https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung#alle-ergebnisse. Accessed on: 06.05.2021.

4.2.2 Mecklenburg-Western Pomerania: Context for renewable energy

Greenhouse gas emissions and renewable energy deployment in Mecklenburg-Western Pomerania

Mecklenburg-Western Pomerania's greenhouse gas (GHG) emissions amounted to 15 461 kilotons CO_{2e} in 2016 (excl. LULUCF, agriculture and international aviation). Its per capita GHG emissions tend to be lower than the German average by about 13% in 2016. They have declined by 16% compared to 1990 levels.[234]

Complete data on the sectoral split of emissions is not available. However, energy generation and Land Use, Land Use Change and Forestry (LULUCF) stand out: Emissions of primary energy generation made up 10,645 kilotons CO2e in total in 2016, and have, in spite of the high share of renewables in the states' electricity generation, not been declining since 1991. The share of LULUCF in Mecklenburg-Western Pomerania is the second highest of all German states and the state is one of the few, where the sector is emitting and not capturing carbon, with 4 074 kilotons CO_{2e} emissions in 2016.[235]

Mecklenburg-Western Pomerania prides itself on being on the forefront of the energy transition because of its high share of renewables in energy generation.[236] And indeed, its share of renewables in total primary energy demand was 39% in 2016, by far the highest out of all federal states.[237] Additionally, Mecklenburg-Western Pomerania was the state with the second highest increase of renewables in energy generation between 2013 and 2016.[238]

In electricity consumption, the share of renewable energy was at 72%; in gross electricity generation, it was at 173%, both the highest values out of all federal

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[234] Statistische Ämter des Bundes und der Länder (2020). Umweltökonomischee Gesamtrechnung der Länder. URL: https://www.statistikportal.de/de/ugrdl/ergebnisse/gase#alle-ergebnisse. Accessed on: 17.05.2021.

[235] Statistische Ämter des Bundes und der Länder (2020). Umweltökonomischee Gesamtrechnung der Länder. URL: https://www.statistikportal.de/de/ugrdl/ergebnisse/gase#alle-ergebnisse. Accessed on: 17.05.2021.

[236] Landesportal Mecklenburg-Vorpommern (2021). Wirtschaft und Arbeit. URL: https://www.mecklenburg-vorpommern.de/wirtschaft-arbeit. Accessed on: 11.05.2021.

[237] Länderarbeitskreis Energiebelanzen (2021). Energiebilanzen – Primärenergieverbrauch. URL: http://www.lak-energiebilanzen.de/energiebilanzen/. Accessed on: 17.05.2021.

[238] Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

states.[239] Thus, the state has developed into a net electricity exporter. While this is not a recent phenomenon, the extent of exports has increased in over the last few years.[240]

The most relevant electricity source is wind, which constitutes 48.2% of electricity production in 2017 - 39.1% of it onshore and 9.1% offshore. Other renewable energy sources are biomass (15.6%), photovoltaic (8.1%). Non-renewable electricity sources are mainly hard coal (19.6%) and natural gas (7.9%). In comparison, in the heating sector only 21.6% of energy used for heating stems from renewables, the rest of it being primarily natural gas (65.6%) and hard coal (9.5%).[241] Nevertheless, the share of renewable energy in heating is still above the German average.[242]

The amount of renewable energy used has been continuously increasing in the last twenty years (see **Figure**). Nevertheless, the recent development in renewable energies is mirroring the one on the federal level: in Mecklenburg-Western Pomerania, the installation of new onshore wind energy capacity is declining in speed, albeit to a slightly lesser extent than in the rest of Germany. The combined numbers for wind, which are available for more recent years, seem to confirm this trend: while the amount of new installations peaked at 513 MW in 2017, in the years 2018 and 2019 brought only 296 MW and 286 MW of new installations, respectively.[243] Solar energy installation is regaining traction after a slump in the middle of the last decade, whereas the installation of additional biomass capacity has come to a hold (see **Figure**).

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[239] Agentur für erneuerbare Energien (2021). Bundesländer-Übersicht zu Erneuerbaren Energien – Strom.URL: https://www.foederal-erneuerbar.de/uebersicht/kategorie/strom/bundeslaender/BW%7CBY%7CB%7CBB%7CHB%7CHH%7CHE%7CMV%7CNI%7CNRW%7CRLP%7CSL%7CSN%7CST%7CSH%7CTH%7CD. Accessed on: 11.05.2021.

[240] Agentur für erneuerbare Energien (2017). Mecklenburg-Vorpommern - Stromaustauschsaldo. URL: https://www.foederal-erneuerbar.de/landesinfo/bundesland/MV/kategorie/strom/auswahl/737-stromaustauschsaldo/sicht/diagramm/jahr/2017/ordnung/2017/#goto_737. Accessed on: 03.06.2021.

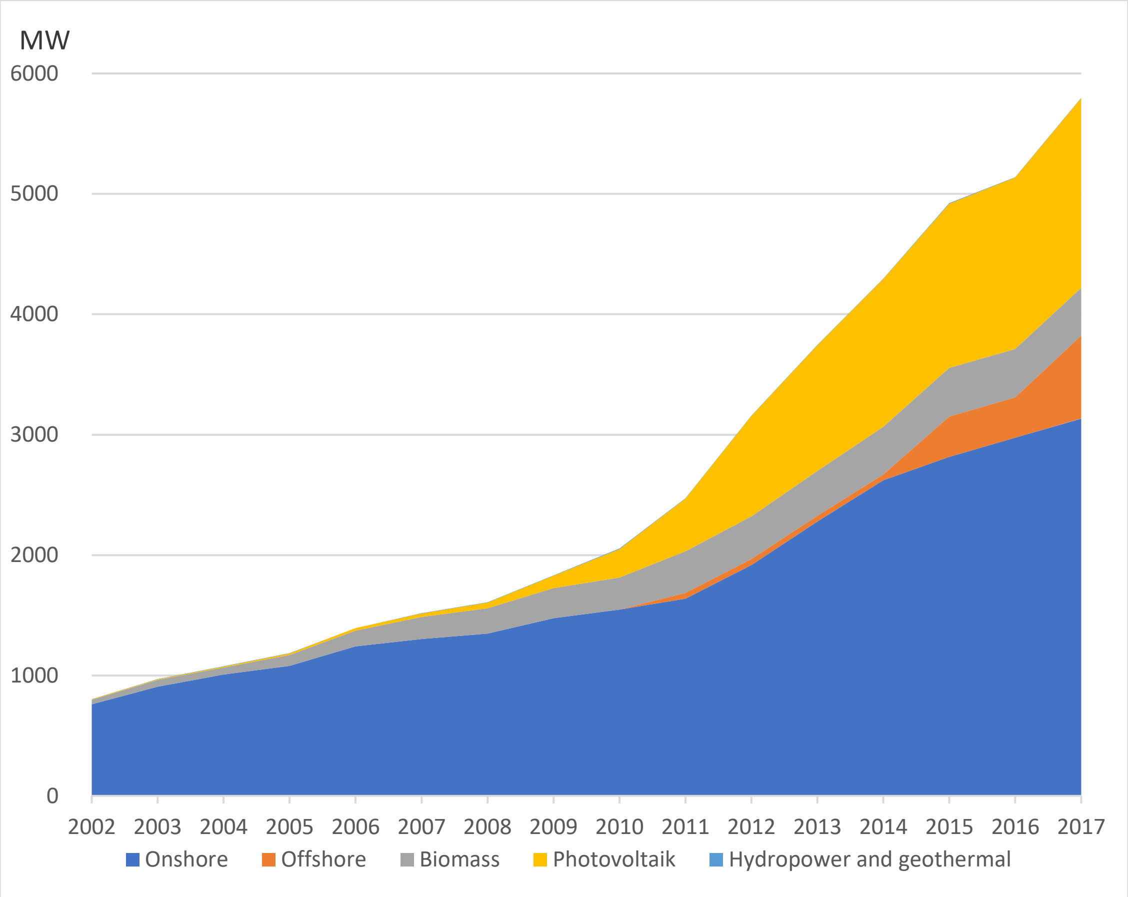
[241] Statistisches Amt Mecklenburg-Vorpommern (2017). Elektrizität- und Wärmeerzeugung in Mecklenburg-Vorpommern. URL: https://www.laiv-mv.de/Statistik/Zahlen-und-Fakten/Gesamtwirtschaft-&-Umwelt/Energie. Accessed on: 11.05.2021.

[242] Umweltbundesamt (2021). Energieverbrach für fossile und erneuerbare Wärme. URL: https://www.umweltbundesamt.de/daten/energie/energieverbrauch-fuer-fossile-erneuerbare-waerme#warmeverbrauch-und-erzeugung-nach-sektoren. Accessed on: 12.05.2021.

[243] Landesamt für innere Verwaltung – Statistisches Amt (2020). Statistisches Jahrbuch 2020 – Kapitel 19: Energie. URL: https://www.laiv-mv.de/Statistik/Ver%C3%B6ffentlichungen/Jahrbuecher/. Accessed on: 07.06.2021.

Deviating from the federal trend, offshore installations have been increasing since the middle of the last decade in the northern states.

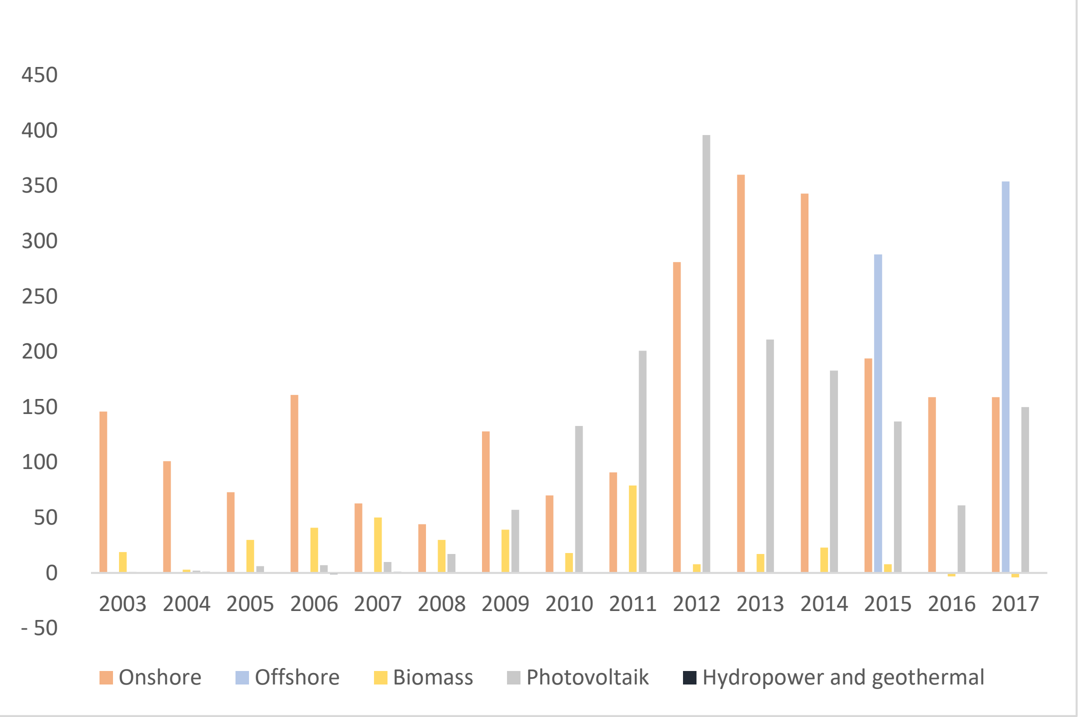
Figure 29: Installed capacity for electricity from renewables in Mecklenburg-Western Pomerania



Source: Own presentation, based on data from the Statistical Office Mecklenburg-Western Pomerania[244]

[244] Statistisches Amt Mecklenburg-Vorpommern (2017). Elektrizität- und Wärmeerzeugung in Mecklenburg-Vorpommern. URL: https://www.laiv-mv.de/Statistik/Zahlen-und-Fakten/Gesamtwirtschaft-&-Umwelt/Energie. Accessed on: 11.05.2021.

Figure 30: Yearly Installed capacity for electricity from renewables in Mecklenburg-Western Pomerania

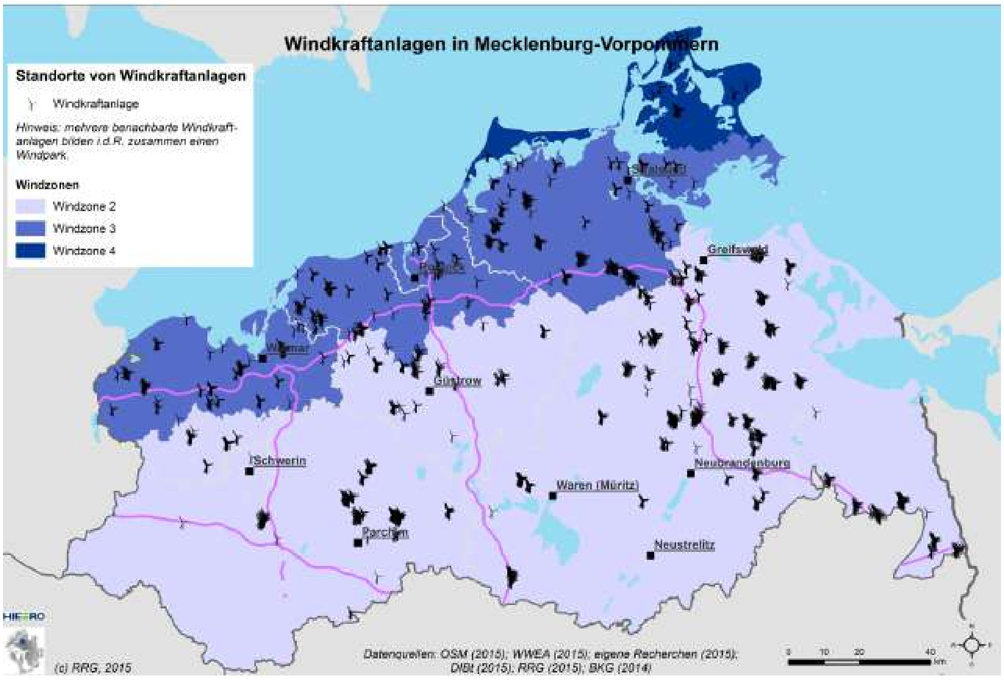


Source: own presentation, based on data from Statistical Office Mecklenburg-Western Pomerania[245]

In terms of spatial distribution,

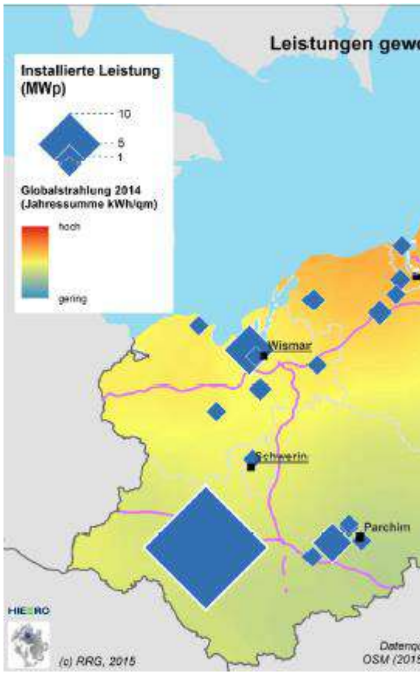
[245] Statistisches Amt Mecklenburg-Vorpommern (2017). Elektrizität- und Wärmeerzeugung in Mecklenburg-Vorpommern. URL: https://www.laiv-mv.de/Statistik/Zahlen-und-Fakten/Gesamtwirtschaft-&-Umwelt/Energie. Accessed on: 11.05.2021.

Figure 31: Wind power plants in Mecklenburg-Western Pomerania



Source: Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015).

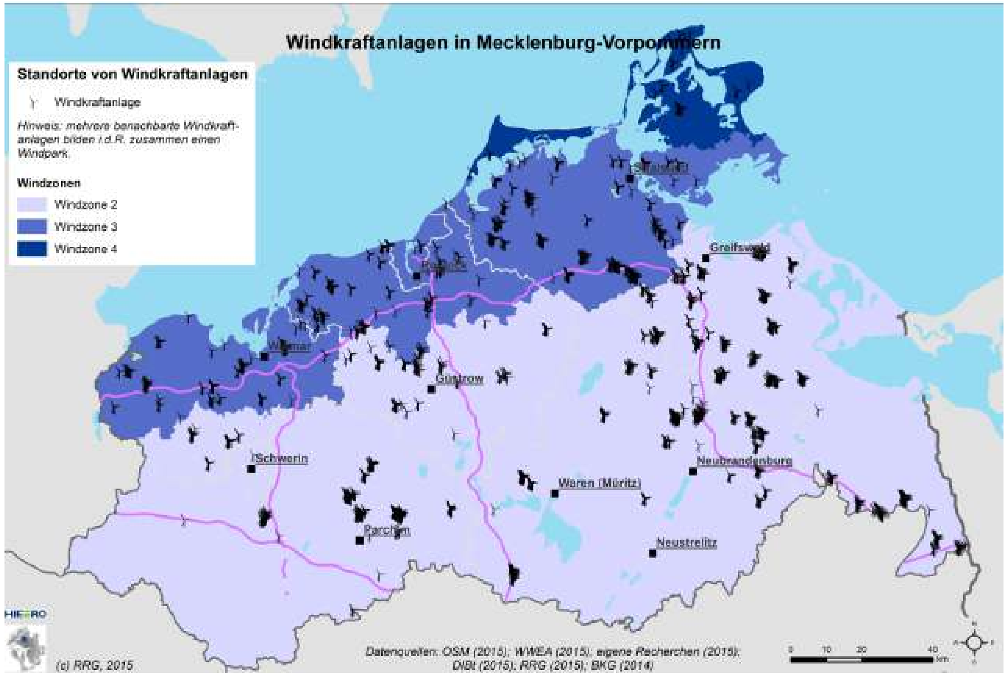
Figure 32: Solar power capac



Source: Lascheweski, L., Peters, M., B

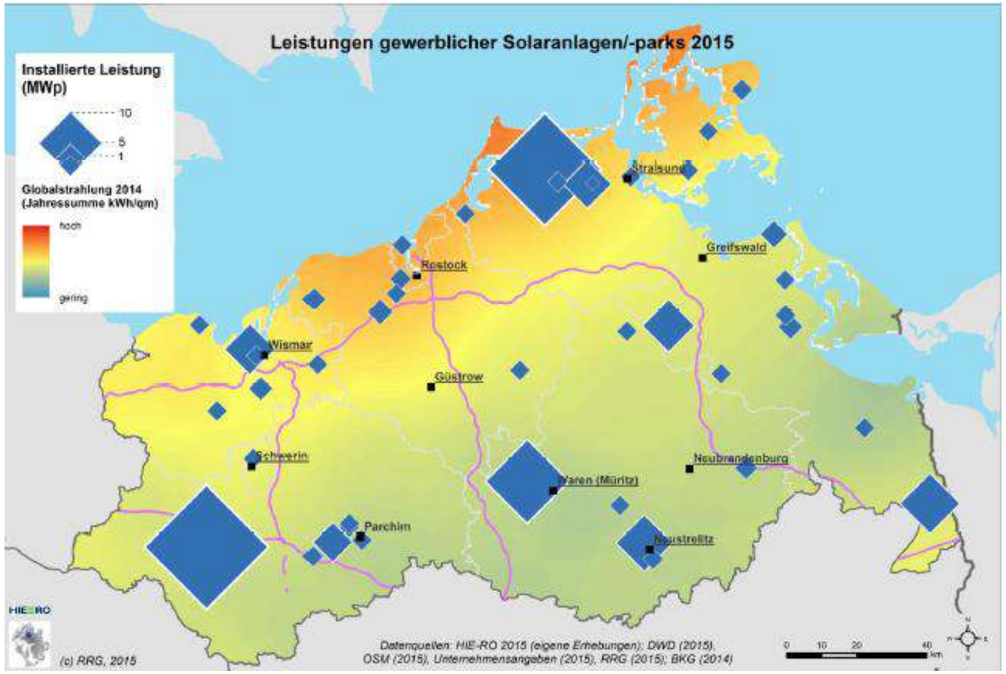
shows that wind power plants tend to cluster on the coast, while solar is more or less evenly distributed (see **Figure**) and biomass centers around bigger settlements (see **Figure**).

Figure 31: Wind power plants in Mecklenburg-Western Pomerania



Source: Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). [246]

Figure 32: Solar power capacity in Mecklenburg-Western Pomerania

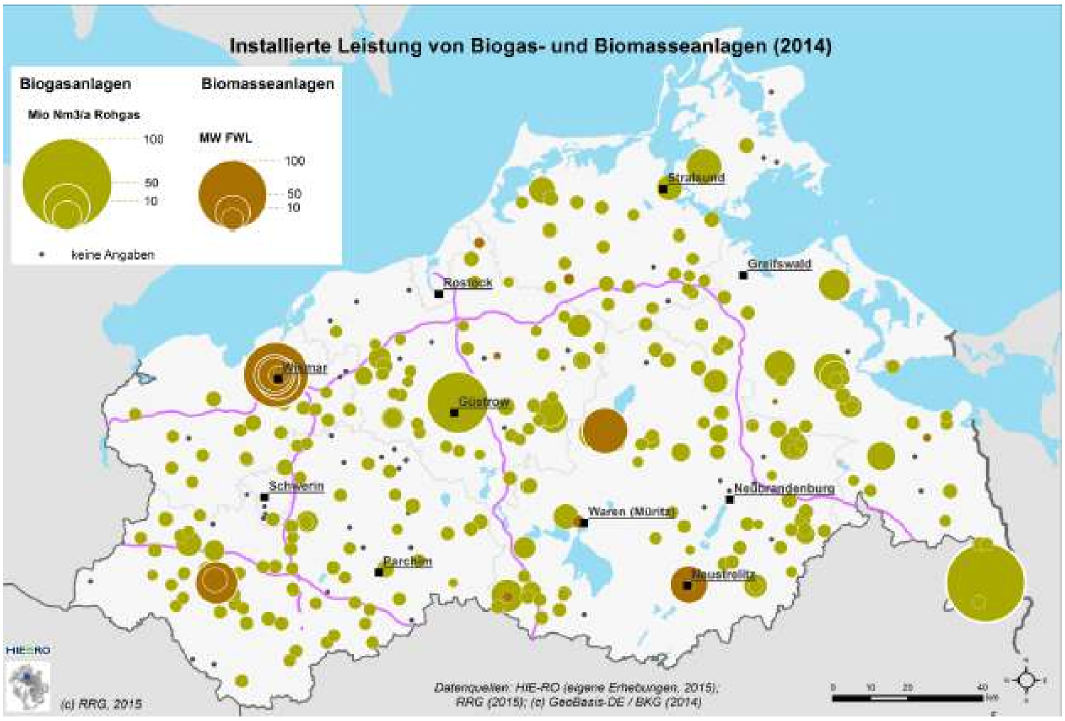


Source: Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). [247]

[246] Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). Wertschöpfung im Sektor der erneuerbaren Energien – Studie zur gesamten Wertschöpfung durch die erneuerbare Energien in Mecklenburg-Vorpommern. Hanseatic Institute for Entrepreneurship and Regional Development an der Universität Rostock. Commissioned by the SPD. URL: http://www.spd-fraktion-mv.de/images/Flyer/Lang_Studie_EE_Bericht_gesamt_FINAL.pdf

[247] Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). Wertschöpfung im Sektor der erneuerbaren Energien – Studie zur gesamten Wertschöpfung durch die erneuerbare Energien in Mecklenburg-Vorpommern. Hanseatic Institute for Entrepreneurship and Regional Development an der Universität Rostock. Commissioned by the SPD. URL: http://www.spd-fraktion-mv.de/images/Flyer/Lang_Studie_EE_Bericht_gesamt_FINAL.pdf

Figure 33: Biomass capacity in Mecklenburg-Western Pomerania



Source: Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). [248]

The most frequently cited study on the potential of renewable energies is the 'Landesatlas für erneuerbare Energien' (2011).[249] It estimates the technical potential of using renewable energy for electricity generation in Mecklenburg-Western Pomerania to be at 8,400 GWh for onshore, 13 600 GWh for offshore (considering the exclusive economic zone), 26 000 GWh for photovoltaic, 14 GWh for hydropower, 2 100 GWh for biogas, 600 GWh for biomass and 400 GWh for sewer and landfill gas. For heat production, the potential is estimated to be 7 500 GWh for geothermal, 5 600 GWh for solar thermal, 1 800 GWh for biogas and 4 100 GWh for biomass.

The authors furthermore point out that crucial for the realization of the potential are not only technical, but also economic and regulatory factors. A study by the German Institute for Economic Research (DIW) found that Mecklenburg-Western Pomerania is

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[248] Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). Wertschöpfung im Sektor der erneuerbaren Energien – Studie zur gesamten Wertschöpfung durch die erneuerbare Energien in Mecklenburg-Vorpommern. Hanseatic Institute for Entrepreneurship and Regional Development an der Universität Rostock. Commissioned by the SPD. URL: http://www.spd-fraktion-mv.de/images/Flyer/Lang_Studie_EE_Bericht_gesamt_FINAL.pdf

[249] Ministerium für Wirtschaft, Arbeit und Tourismus Mecklenburg-Vorpommern (2011). Landesatlas Erneuerbare Energien Mecklenburg-Vorpommern 2011. URL: http://service.mvnet.de/_php/download.php?datei_id=41570.

using 33.2% of its potential in wind electricity generation, but just 5.5% of its photovoltaic potential.[250]

Governance structures for renewable energy deployment in Mecklenburg-Western Pomerania

The state addressed the question of climate change early on; in 1997 it published its first concept for climate protection.[251] There have been three versions of the 'Action Plan Climate Protection' so far, which list climate protection policies, including on energy efficiency and renewable energies.[252]

The most relevant piece of legislation for the uptake of renewable energy is the state's energy concept ('*Landesenergiekonzep*t') of 2015, which underlines the government's ambition of making renewables a key sector of the economy. The aim of the concept is to push the expansion of renewable energy, increase participation in decision making processes as well as economic participation, and safeguard a 'just transition'. The goal is to produce 6.5% of Germany's total energy demand, with the main focus being wind energy, which is supposed to increase to 12 TWh onshore energy generation and 8 TWh offshore generation by 2025. [253] Additionally, Mecklenburg-Western Pomerania joined other states in Northern Germany to pass the 'North German Hydrogen Strategy' *('Norddeutsche Wasserstoffstrategie'*), supporting hydrogen in the region.[254]

The Regional Spatial Development Programmes ('*Regionale Raumentwicklungsprogramme , RREP'*) are key for spatial planning; they set the targets

[250] Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

[251] Umweltbundesamt (2018). Regionale Anpassung in Mecklenburg-Vorpommern. URL: https://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/anpassung-an-den-klimawandel/anpassung-auf-laenderebene/bundesland-mecklenburg-vorpommern. Accessed on: 05.05.2021.

[252] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommern (2020). Aktionsplan Klimaschutz Mecklenburg-Vorpommern – Teil B Klimaschutzaktionen. URL: https://www.regierung-mv.de/serviceassistent/download?id=1621750.

[253] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommern (2015). Energiepolitische Konzeption für Mecklenburg-Vorpommern. URL: https://www.regierung-mv.de/serviceassistent/download?id=156928

[254] Wirtschafts- und Verkehrsministerien der norddeutschen Küstenländer – Bremen, Hamburg, Mecklenburg-Vorpommern, Niedersachsen und Schleswig-Holstein (2019).Norddeutsche Wasserstoffstrategie. URL: https://www.regierung-mv.de/serviceassistent/download?id=156928

for regional development in Mecklenburg-Western Pomerania, including on energy related issues. They are based on the framework set by the States Spatial Development Programme (Landesraumentwicklungsprogramme', LEP M-V).[255] There are four regional plans: Rostock (2020)[256], Westmecklenburg (public participation process for current version still ongoing)[257], Mecklenburg Lake District (process still ongoing)[258] and Vorpommern (process still ongoing).[259] These plans determine, according to the State Planning Act ('Landes*planungsgesetz, LPlG*') and in line with the Building Code ('*Baugesetzbuch, BauGB*'), the possible locations for onshore wind power plants ('*Windeignungsgebiete*'). The permission of municipalities is not necessary. Nevertheless, the municipality can veto individual permission processes, if they do not comply with regulations.[260]

The Mecklenburg-Western Pomeranian government has furthermore expressed its support for the deployment of offshore power plants in the Baltic Sea, which lies in the hand of the federal government. There are currently four offshore wind parks, which pay 30 million Euro of business tax to the state of Mecklenburg-Western Pomeranian. Six more offshore wind parks are planned by 2026.[261]

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[255] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommer (2021). Landesraumentwicklungsprogramm. URL: https://www.regierung-mv.de/Landesregierung/em/Raumordnung/Landesraumentwicklungsprogramm/. Accessed on: 12.05.2021.

[256] Planungsverband Region Rostock (2021). Fortschreibung RREP – Kapitel Energie einschließlich Windenergie. URL: https://www.planungsverband-rostock.de/regionalplanung/fortschreibung-energie/#endfassung_juni_2020. Accessed on: 12.05.2021.

[257] Regionaler Planungsverband Westmecklenburg (2021). Teilfortschreibung des Regionalen Raumentwicklungsprogramms Westmecklenburg, Kapitel Energie. URL: https://www.region-westmecklenburg.de/Regionalplanung/Teilfortschreibung-RREP-WM-2011-Kap-Energie/. Accessed on: 12.05.2021.

[258] Regionaler Planungsverband Mecklenburgische Seenplatte (2021). Teilfortschreibung. URL: https://www.region-seenplatte.de/Regionalplanung/Teilfortschreibung-des-Regionalen-Raumentwicklungsprogrammes/. Accessed on: 12.05.2021.

[259] Regionaler Planungsverband Vorpommern. RREP VP- Zweite Änderung Entwurf 2020. 5. Öffentlichkeitsbeteiligung zu raumbedeutsamen Abwägungsergebnissen gemäß Entwurf 2020 der zweiten Änderung des regionalen Raumentwicklungsprogramms Vorpommern (RREP VP). URL: https://rpv-vorpommern.de/planung/planung-rrep-vp-zweite-aenderung-2020/ Accessed on: 12.05.2021.

[260] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommern (2021). Fragen und Antworten zur Energiewende. URL: https://www.regierung-mv.de/Landesregierung/em/Energie/Fragen-und-Antworten-zur-Energiewende/. Accessed on: 17.05.2021.

[261] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommern (2021). Zehn Jahre „Baltic 1": Offshore-Windstrom von der Ostsee ist Gewinn für Klimaschutz und M-V. URL: https://www.regierung-mv.de/Landesregierung/em/Aktuell/?id=169472&processor=processor.sa.pressemitteilung. Accessed on: 13.05.2021.

In order to increase acceptance of wind energy among the population, the government of Mecklenburg-Western Pomerania passed a 'Citizen and municipality participation law' ('*Bürger- und Gemeindenbeteiligungsgesetz*') in the year 2016. The law determined that investors have to form a limited liability company ('*Gesellschaft mit beschränkter Haftung*'), of which a share of at least 20% has to be offered to direct neighbours of wind power plants (less than 5 km radius).[262] This legislation has been cited as innovative example to promote public ownership. However, it also has been criticized because of the law's bureaucratic implementation, lack of public participation in the policy making and the big time span between the conflict-laden planning phase and the actual pay-out. This lag is also the reason why so far, there has been no case where the law has successfully been applied, according to a study published in 2020. Additionally, there is currently a lawsuit by wind energy companies against this legislation. [263] On the federal level, the most recent amendment of the EEG allows the wind energy producers to pay 0.2 ct/kwh in compensation to affected municipalities.[264] Furthermore, 70% of the business taxes go to the municipality where the wind power plant is placed, and 30% to the municipality where the company is located. [265] However, this only becomes relevant about 8-10 years after the wind power plant is installed, as this is the timeframe when most credits are paid off and the wind mill becomes profitable.[266] This, together with depreciation of assets, transfer of profits, selling of plants and the use of other possibilities of changing the taxation structure, leads to the community receiving less of the share than expected.[267]

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[262] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommern (2016).. URL: http://www.landesrecht-mv.de/jportal/portal/page/bsmvprod.psml?showdoccase=1&st=lr&doc.id=jlr-WindPB%C3%BCGemBGMVrahmen&doc.part=X&doc.origin=bs.

[263] Eichenauer, E. & Gailing, L. (2020). Gute Bedinungen für lokale Wertschöpfung aus Windkraftanlagen – Erfahrungen und Empfehlungen. URL: https://leibniz-irs.de/fileadmin/user_upload/Transferpublikationen/IRS_Dialog_Gute_Bedingungen_Wertschoepfung_Windkraftanlagen.pdf.

[264] Gesetz für den Ausbau erneuerbarer Energien (Erneuerbare-Energien-Gesetz – EEG 2021). (2021). URL: https://www.gesetze-im-internet.de/eeg_2014/BJNR106610014.html.

[265] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommern (2021). Fragen und Antworten zur Energiewende. URL: https://www.regierung-mv.de/Landesregierung/em/Energie/Fragen-und-Antworten-zur-Energiewende/. Accessed on: 17.05.2021.

[266] Witzel, W. (2011). Windkraftprojekte bringen Geld in die kommunale Kasse.URL: http://www.walter-witzel.de/Gewerbe.pdf.

267 Salecki, Dr. Steven; Heinbach, Katharina; Hirschl, Prof. Dr. Bernd; Weidinger, Roman; Schäfer-Stradowsky, Simon; Ott, Ralf; Lehnert, Dr. Wieland; Kliem, Christine; Altrock, Dr. Martin; Umlauf, Dr. Florian; Puffe, Matthias; Seiß, Hannah; Yilmaz, Yasin; Kahle, Lisa (2020). Finanzielle Beteiligung von betroffenen Kommunen bei Planung, Bau und Betrieb von erneuerbaren Energieanlagen (FinBEE). URL: https://www.ioew.de/publikation/finanzielle_beteiligung_von_betroffenen_kommunen_bei_planung_bau_und_betrieb_von_erneuerbaren_energieanlagen_finbee. Accessed on: 07.06.2021.

Mecklenburg-Western Pomerania has been classified as a 'transitional region' by the EU commission (meaning the average income per capita is 75%-90% of the European average) and thus receives EU funding through various founds. One out of five 'priority axes' in the operational program from 2014 to 2020 is CO_2 reduction in all sectors of the economy, including the support of renewable energy deployment. In the period from 2014 to 2020, it received 967 million Euro from the European Regional Development Fund (ERDF), 384 million Euro from the European Social Fund (ESF) and 937 million Euro from the European Agricultural Fund for Rural Development (EAFRD). The ERDF also invests in renewable energy projects, mainly solar and biomass, with a total project volume of about 40 million Euro. Additionally, the ESF funding includes funding for education projects related to energy.[268] The operational programme for the funding period of 2014-2020 states that without the ERDF and the ESF, Mecklenburg-Western Pomeranians BIP would have been 0.3-0.4% lower during the funding period of 2007-2013. However, an ex-ante evaluation of the 'Climate Fund' (an initially planned instrument of the priority axis 'CO_2 reduction in all sectors of the economy') of the ERDF pointed out that the demand for climate financing has been below the German average in the previous funding period. This is attributed to the already existing funding on national level with more favourable conditions as well as the structure of the Mecklenburg-Western Pomeranian economy, which is more heavily based on SMEs. Furthermore, the lack of implementation is not primarily ascribed to lack of financing, but to the lack of technically sound concepts.[269]

This can be partly confirmed by the evaluation of the ERDF's implementation. It showed that out of the targeted 12 MW additional capacity by 2023 for businesses, only 2.9MW have been installed. However, a total of 11.6 MW are expected by the fund's recipients by the end of the funding period. Similarly, for public infrastructure, the target was set at 1 MW until 2023, out of which 0.2 MW have been reached so far, with 0.4 MW expected by recipients. [270]

An overview over the different projects in Mecklenburg-Western Pomerania can be found here.

[268] Das Europaportal Mecklenburg-Vorpommern. Europäischer Fonds für regionale Entwicklung. URL: https://www.europa-mv.de/foerderinstrumente/fonds_mv/efre/. Accessed on: 13.05.2021.
[269] Sauerborn, K., Schulz, C. & Alm, K. (2017). Kurzfassung EndberichtEx-ante Bewertung des Finanzinstruments „Klimaschutz-Darlehensfonds" des EFRE Programms des Landes Mecklenburg-Vorpommern 2014-2020. Ministerium für Energie, Infrastruktur und Landesentwicklung. Taurus Eco Consulting. URL: http://docplayer.org/64251605-Taurus-eco-consulting-gmbh-im-alten-garten-26-d-trier.html. Accessed on: 07.06.2021.
[270] Ministerium für Inneres und Europa Mecklenburg-Vorpommern (2020). Jährlicher Durchführungsbericht im Rahmen des Ziels "Investitionen in Wachstum und Beschäftigung". URL: https://www.europa-mv.de/serviceassistent/download?id=1625896.

4.3 Analysis and conclusions

4.3.1 The socio-economic impacts of renewable energy deployment in Mecklenburg-Western Pomerania

The renewable energy sector is seen as a growth market in Mecklenburg-Western Pomerania; there has been a considerable increase in the sector in the last decade, in terms of amount of companies as well as in terms of created employment. Table 1 gives a short overview over economic indicators that can been found in literature.

Table 5 Economic impacts of the renewable energy sector in Mecklenburg-Western Pomerania – Overview of literature results

	2013	2014	2015	2016	2017	2018
Turnover					3,272 million Euro[271]	
Share of renewables sector BIP		3.6%[272]			7.7%[273]	

[271] Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

[272] Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

[273] Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

Amount of companies	1,037[274]/ 905[275]					1,204[276]
Share of companies					1.9%[277]	
Employees	14,710[278]		14,870[279]			
Share of employees					2.7%[280]	

274 Agentur für erneuerbare Energien (2018). Mecklenburg-Vorpommern – Anzahl der Unternehmen der Erneuerbare- Energien- Branche. URL: https://www.foederal-erneuerbar.de/landesinfo/bundesland/MV/kategorie/unternehmen/auswahl/218-anzahl_der_unternehm/#goto_218. Accessed on: 12.05.2021.

275 Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). Wertschöpfung im Sektor der erneuerbaren Energien – Studie zur gesamten Wertschöpfung durch die erneuerbare Energien in Mecklenburg-Vorpommern. Hanseatic Institute for Entrepreneurship and Regional Development an der Universität Rostock. Commissioned by the SPD. URL: http://www.spd-fraktion-mv.de/images/Flyer/Lang_Studie_EE_Bericht_gesamt_FINAL.pdf

276 Agentur für erneuerbare Energien (2018). Mecklenburg-Vorpommern – Anzahl der Unternehmen der Erneuerbare- Energien- Branche. URL: https://www.foederal-erneuerbar.de/landesinfo/bundesland/MV/kategorie/unternehmen/auswahl/218-anzahl_der_unternehm/#goto_218. Accessed on: 12.05.2021.

277 Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

278 Ulrich, P. & Lehr, U. (2018). Erneuerbar beschäftigt in den Bundesländern – Bericht zur aktualisierten Abschätzung der Bruttobeschäftigung 2016 in den Bundesländern. GWS. Commissioned by the Ministry of Economic Affairs and Energy. https://www.bmwi.de/Redaktion/DE/Publikationen/Studien/erneuerbar-beschaeftigt-in-den-bundeslaendern.pdf?__blob=publicationFile&v=8

279 Ulrich, P. & Lehr, U. (2018). Erneuerbar beschäftigt in den Bundesländern – Bericht zur aktualisierten Abschätzung der Bruttobeschäftigung 2016 in den Bundesländern. GWS. Commissioned by the Ministry of Economic Affairs and Energy. https://www.bmwi.de/Redaktion/DE/Publikationen/Studien/erneuerbar-beschaeftigt-in-den-bundeslaendern.pdf?__blob=publicationFile&v=8

280 Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

Renewable energy companies in Mecklenburg-Western Pomerania constitute 1.9% of all companies, the highest share of all federal states.[281] The Agency for Renewable Energies calculated, based on data from Creditreform[282], that there were 1204 companies in the sector in 2018, a number that rose from 1037 companies in 2015, indicating a significant upwards trend.[283] A study in 2015 found slightly fewer companies, 905, of which 578 were suppliers or service providers. As is typical for the company structure of Mecklenburg-Western Pomerania, by far the biggest share of companies in the renewable sector have less than ten employees. The study furthermore determined that in the wind sector, companies from all parts of the value chain are located in Mecklenburg-Western Pomerania, and the industry is more export-oriented than other sectors in the state.[284]

In contrast, in the biogas sector and solar sector, just parts of the value chain are represented in the state, mainly missing the production steps of planning, installation and maintenance. However, the biogas sector is directly using substrate derived from own agricultural production and the use of residual waste starts to play a more important role.[285] Currently, 200 000 ha of agricultural area are used for biomass, equivalent to a share of 20%.[286]

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[281] Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

[282] Verband der Vereine Creditreform (2021). Firmenwissen. URL: https://www.firmenwissen.de/index.html. Accessed on: 11.05.2021.

[283] Agentur für erneuerbare Energien (2018). Mecklenburg-Vorpommern – Anzahl der Unternehmen der Erneuerbare- Energien- Branche. URL: https://www.foederal-erneuerbar.de/landesinfo/bundesland/MV/kategorie/unternehmen/auswahl/218-anzahl_der_unternehm/#goto_218. Accessed on: 12.05.2021.

[284] Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). Wertschöpfung im Sektor der erneuerbaren Energien – Studie zur gesamten Wertschöpfung durch die erneuerbare Energien in Mecklenburg-Vorpommern. Hanseatic Institute for Entrepreneurship and Regional Development an der Universität Rostock. Commissioned by the SPD. URL: http://www.spd-fraktion-mv.de/images/Flyer/Lang_Studie_EE_Bericht_gesamt_FINAL.pdf

[285] Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). Wertschöpfung im Sektor der erneuerbaren Energien – Studie zur gesamten Wertschöpfung durch die erneuerbare Energien in Mecklenburg-Vorpommern. Hanseatic Institute for Entrepreneurship and Regional Development an der Universität Rostock. Commissioned by the SPD. URL: http://www.spd-fraktion-mv.de/images/Flyer/Lang_Studie_EE_Bericht_gesamt_FINAL.pdf

[286] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommern. (2021). Bioenergie. URL: https://www.regierung-mv.de/Landesregierung/em/Energie/Biomasse/. Accessed on: 07.06.2021.

The renewable energy sector has an impact on employment generation in the state. A study shows that in 2016, 2.7% of Mecklenburg-Western Pomeranian employees can be attributed, directly or indirectly, to the renewable energy sector, which is the second highest share among all the federal states.[287] A study commissioned by the German Ministry for Economic Affairs and Energy found that in total, 14 870 people were employed in the renewable energy sector in the state in 2016, constituting a small increase from 14 710 employees in 2013. More than half of employees were connected to the wind sector (8080), followed by the bio energy sector (5 620), and only a marginal share to the solar sector (960). In relative terms, about 22 out of 1000 people were employed in the renewable energy sector in Mecklenburg-Western Pomerania in 2016, notably more than the German average (8.6), and also more than the mean in the former GDR states (12.6).[288] It is important to note, however, that those numbers do not include the years 2016, during which the reduction in wind power plant deployment in Germany (see chapter 1.2) led to mass layoffs for several big players in the industry.[289] Therefore, it is possible that this would also have an effect in Mecklenburg-Western Pomerania, and limit the economic power of the sector to some extent.

The importance of the renewable energy sector also becomes visible when looking at the share that the renewable energy production has on the whole GDP. According to estimates from the DIW on the basis of data from the Federal Statistical Office[290], measures to enable renewable energy deployment create 3 272 Mio. Euro turnover in Mecklenburg-Western Pomerania, constituting 7.5% of the total GDP. Furthermore,

[287] Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

[288] Ulrich, P. & Lehr, U. (2018). Erneuerbar beschäftigt in den Bundesländern – Bericht zur aktualisierten Abschätzung der Bruttobeschäftigung 2016 in den Bundesländern. GWS. Commissioned by the Ministry of Economic Affairs and Energy. https://www.bmwi.de/Redaktion/DE/Publikationen/Studien/erneuerbar-beschaeftigt-in-den-bundeslaendern.pdf?__blob=publicationFile&v=8

[289] Keilen, A. (2018). Arbeitsplätze in den Wind geschossen. Die Windmesse im norddeutschen Husum wird vom Negativrekord beim Windkraft-Ausbau überschattet. Damit verbunden sind tausendfache Entlassungen. Doch wieso ist der Aufschrei um Arbeitsplätze in der Erneuerbaren-Branche so viel leiser als in der Kohleindustrie?. *klimareporter°*. URL: https://www.klimareporter.de/strom/arbeitsplaetze-in-den-wind-geschossen. Accessed on: 11.05.2021.

[290] Destatis (2019). Wirtschaftsfaktor Umweltschutz 2017: 73.9 Milliarden Euro Umsatz. https://www.destatis.de/DE/Presse/Pressemitteilungen/2019/06/PD19_210_325.html. Accessed on: 05.05.2021.

this share increased between 2014 and 2017 by 4.1 percentage points.[291] A simulation by Ulrich et al. estimated that the energy transition would make the Mecklenburg-Western Pomeranian economy grow 4.5% in 2030 and 6.3% in 2050 in comparison with the baseline scenario.[292] A study by Sievers and Pfaff confirmed that in the state of Mecklenburg-Western Pomerania, the energy transition will have one of the biggest relative positive effects on its economy until 2030, according to their model. They explain this in part by the weaker economy of the state, which leads to the growth through the renewable sector being more impactful, and by the fact that the fossil fuel for electricity generation was never prevalent in the first place, making the costs of the fossil fuel phase-out negligible.[293]

The development of the renewables industry also has effects on other sectors, one example being the shipbuilding sector. Shipbuilding is a traditional craft in Mecklenburg-Western Pomerania, which is why shipyards are a historic driving force for industrialization in the state.[294] This is also relevant for the offshore wind industry: Mecklenburg-Western Pomeranian shipyards have expanded their repertoire to include parts of offshore plants. For instance, the shipyards in Rostock and Wismar started producing platforms. Thus, the turnover of offshore products in ports also expanded greatly the last decade in Mecklenburg-Western Pomerania: according to the state's energy minister, the volume increased from 19,500 tons in 2009 to 1.3 million tons in 2019. He furthermore pointed out that the offshore industry's business tax in the year 2019 amounted to 30.3 million Euro.[295]

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[291] Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

[292] Ulrich, P., Lehr, U., & Lutz, C. (2018). Gesamtwirtschaftliche Effekte der Energiewende in den Bundesländern: Methodische Ansätze und Ergebnisse (No. 2018/05). GWS Research Report. URL: https://www.econstor.eu/bitstream/10419/206680/1/1043733450.pdf.

[293] Sievers, L. & Pfaff, M. (2016). Gesamtwirtschaftliche Nettoeffekte der Energiewende nach Regionen, Wirtschaftszweigen und Einkommensgruppen. Eine modellgestützte Analyse im Rahmen des Projekts „Wirkungen des Ausbaus erneuerbarer Energien (ImpRES)". Commissioned by the Ministry for Economic Affairs and Energy. URL: https://www.iku-innovationspreis.de/impres-wAssets/docs/Sievers_Pfaff_2016_Gesamtwirtschaftliche_Nettoeffekte_der_Energiewende_nach_Regionen_Wirtschaftszweigen_Einkommensgruppen.pdf.

[294] Landeszentrale für politische Bildung Mecklenburg-Vorpommern (2018). Wirtschaft in Mecklenburg-Vorpommern. URL: https://politik-mv.de/2018/08/07/wirtschaft-in-mecklenburg-vorpommern/. Accessed on: 17.05.2021.

[295] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommern (2021). Zehn Jahre „Baltic 1": Offshore-Windstrom von der Ostsee ist Gewinn für Klimaschutz und M-V. URL:

An example of potential negative economic effects of the deployment of renewable energies might be the tourism industry. There are some concerns that the prevalent presence of wind energy plants might negatively affect the attractiveness of tourism destinations. It is difficult to ascertain if these concerns have merit, as scientific research so far is inconclusive. For example, while one survey in the South of Germany found that up to a third of participants would change their destination if feeling disturbed by wind turbines[296] and another one showed that 45% of participants feel disturbed by wind turbines when hiking[297], a study looking at empirical data did not find a decline in tourism as a consequence of wind energy installation.[298] In Mecklenburg-Western Pomerania, there are currently some efforts to combine the sectors, with specific tours and so-called 'wind turbine climbing'.[299]

In summary, the renewable energy sector is an important growth factor for the state, as it creates employment and provides economic impulses. Mainly the wind energy sector is benefitting the region economically, as there are production capacities over the whole value chain present in the state. Furthermore, because fossil-fuel based electricity production was never prominent Mecklenburg-Western Pomerania, there are very few economic losses expected in that regard.

However, it is difficult quantify the impact of to the renewable energy sector on the overall increase of GDP and positive socio-economic development of Mecklenburg-Western Pomerania. Other sectors, such as the hospitality sector, have seen an increase in gross value added as well, which could also have been a factor in the region's economic growth. Furthermore, the development in the wind sector has been volatile in recent years, which could hamper its economic benefits.

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https://www.regierung-mv.de/Landesregierung/em/Aktuell/?id=169472&processor=processor.sa.pressemitteilung. Accessed on: 13.05.2021.

[296] Hecker, A. & Senk-Klumpp, K. & Wiesler, M. (2014). Ergebnisse der Umfrage zum Thema: „Tourismus und Energiewandel in Deutschland am Beispiel Schwarzwald – beeinflusst die Aufstellung von Windkraftanlagen die Entscheidung von Urlaubern. URL: https://docplayer.org/14169012-Ergebnisse-der-umfrage-zum-thema.html. Accessed on: 03.06.2021.

[297] Thiele, F., Steinmark, C. & Quack, H.-D. (2015). Onlineumfrage zur Akzeptanz von Alagen erneuerbarer Energien in der Landschaft. Ostfalia – Hochschule für angewandte Wissenschaften. URL: http://docplayer.org/41171524-Wandern-und-windkraftanlagen-auswertung-einer-langzeit-onlineumfrage-im-zeitraum-2013-bis-2015.html. Accessed on: 04.06.2021.

[298] Renz, K., Fliegenschnee-Jaksch, M. & Moidl, S. (2014). Windkraft und Tourismus – Hintergrundpapier. URL: https://www.nit-kiel.de/wp-content/uploads/2020/07/Tourismuskurzstudie_IG_Windkraft.pdf. Accessed on: 04.06.2021.

[299] Paul, D. & Pfaff, F. (2019). So können Sie auf ein Windrad klettern - Die Energiewende hautnah miterleben: Windkraftanlagen in MV laden Besucher am Wochenende zum Tag der offenen Tür. Diese Orte sind einen Ausflug in windige Höhen wert. URL: https://www.ostsee-zeitung.de/Nachrichten/MV-aktuell/Ein-Mal-auf-eine-Windanlage-in-MV-steigen. Accessed on: 07.05.2021.

4.3.2 Key factors that determine renewable energy deployment and the accompanying socio-economic impacts in Mecklenburg-Western Pomerania

There is technical potential, a strong industry and political will on the state level to support the expansion of renewable energy in Mecklenburg-Western Pomerania. However, sluggish permission procedures and local resistance hamper the expansion of the sector and could do so in the future. Additionally, changes in recent years in federal policies and an increasing shortage of skilled workers might be additional factors that could slow down renewable energy expansion.

The Mecklenburg-Western Pomeranian government, a long standing coalition between social democrats (SPD) and the CDU, has confirmed and reconfirmed their commitment to making renewable energies a key sector in the northern state's economy.[300] However, a strong focus lies on advancing the wind sector, which leads to a lack of political attention on other forms of renewable energy, such as solar or biomass. This could be one of the factors that leads to the sector not realising its full potential. Additionally, the state has reduced its budget for research on renewable energies and system integration to zero, which might lead to missed opportunities in the future. The government has also been critiqued for insufficient reporting on the progress of renewable energy uptake,[301] which could lead to insufficient policy development and a reduction investors' trust.

From the technical side, there still is the hurdle of developing an electricity grid that can transmit the load from the renewable energy producing north, including Mecklenburg-Western Pomerania, to the south, where there is a high electricity demand. The necessary expansion of the grid still requires considerable investment efforts as well as the acceptance of the public, which has shown resistance in the past.[302] A central project in that regard is 'Südlink', which aims to connect both parts

[300] Ministerium für Energie, Infrastruktur und Digitalisierung Mecklenburg-Vorpommern (2015). Energiepolitische Konzeption für Mecklenburg-Vorpommern. URL: https://www.regierung-mv.de/serviceassistent/download?id=156928.

[301] Diekmann, J., Schill W.-P., Püttner, A., Walker, M., Kirrmann, S. & Maier, M. (2019). Politikberatung kompaktVergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2019 – Indikatoren und Ranking. *Deutsches Institut für Wirtschaftsforschung*. URL: https://www.diw.de/de/diw_01.c.698756.de/publikationen/politikberatung_kompakt/2019_0145/vergleich_der_bundeslaender__analyse_der_erfolgsfaktoren_fue___euerbaren_energien_2019__indikatoren_und_ranking__endbericht.html.

[302] ZeitOnline (2019). Netzausbau wird wohl teurer als geplant. Wegen des Ausbaus der erneuerbaren Energien sind laut neuem Netzentwicklungsplan zwei weitere Höchstspannungsleitungen notwendig. Dadurch steigen die Kosten deutlich. URL: https://www.zeit.de/wirtschaft/2019-02/stromerzeugung-erneuerbare-energien-ausbau-stromautobahn-netzentwicklungsplan. Accessed on: 07.05.2021.

of Germany by 2022 and is considered a Project of Common Interest by the European Commission.[303]

The shortage of skilled workers has furthermore been identified as one of the potential barriers for Mecklenburg-Western Pomerania. However, more research is needed to determine to what extent this concerns the renewable energy sector[304] (see also 2.1).

Other factors hampering the deployment of wind energy are in line with those affecting Germany as a whole: the changing incentive structure of the EEG [305] (see 1.3), complex licensing procedures, as well as increasing local opposition.[306]

The question of local support has been considered key in the debate around the slowing down of wind energy deployment. According to a recent survey, most Mecklenburg-Western Pomeranians support the energy transition (86%). However, the share of people indifferent or critical towards the energy transition is among the highest in Germany (14%). Furthermore, the study showed that a significant share of people in Mecklenburg-Western Pomerania would protest against a wind power plant if deemed necessary (45%), a share that is also high in comparison with the rest of Germany and has been increasing since 2017. Nevertheless, only about 3% of people answered that they are currently actively trying to block the installation of a wind power plant.[307] This opposition manifests in a variety of ways, including the creation of a political party, dedicated to combatting the deployment of wind energy called 'Free Horizon' ('*Freier Horizont*'). The party was founded by 40 citizens initiatives in

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[303] European Commission (2017). Commission delegated regulation (EU) 2018/540 of 23 November 2017 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest. URL: https://eur-lex.europa.eu/eli/reg_del/2018/540/oj

[304] Lascheweski, L., Peters, M., Braun, G., Warszycki, P. (2015). Wertschöpfung im Sektor der erneuerbaren Energien – Studie zur gesamten Wertschöpfung durch die erneuerbare Energien in Mecklenburg-Vorpommern. Hanseatic Institute for Entrepreneurship and Regional Development an der Universität Rostock. Commissioned by the SPD. URL: http://www.spd-fraktion-mv.de/images/Flyer/Lang_Studie_EE_Bericht_gesamt_FINAL.pdf

[305] Rueter, G. (2019). Dramatischer Einbruch beim Windausbau: Was läuft schief in Deutschland?. *Deutsche Welle*. URL: https://www.dw.com/de/dramatischer-einbruch-beim-windausbau-was-l%C3%A4uft-schief-in-deutschland-eeg-windkraft-erneuerbare/a-49076585. Accessed on: 04.05.2021.

[306] Witsch, K., Stratmann, K.(2019). Ausbau der Windkraft bricht ein – Der Neubau von Windrädern ist im Jahresvergleich um 82% gesunken. Die Branche klagt über Genehmigungsstau und fordert einen Krisengipfel. *Handelsblatt*. URL: https://www.handelsblatt.com/unternehmen/energie/erneuerbare-energien-ausbau-der-windkraft-bricht-dramatisch-ein/24696524.html?ticket=ST-6744000-10FRiQcrZ9F3fFLKdcKf-ap1. Accessed on: 04.05.2021

[307] Wolf, I. & Tang, M. (2019). Soziales Nachhaltigkeitsbarometer 2019 – Breite Unterstützung für die Energiewende – aber nicht so, wie sie zurzeit gemacht wird. Institute for Advanced Sustainability Studies. URL: https://www.iass-potsdam.de/en/node/7058. Accessed on: 15.05.2021.

2014.[308] Even though the party has received very little public support so far (it obtained 0.8% of votes in the last state elections[309]) it indicates an increasingly active opposition. The main arguments of people opposing wind power plants are the loss of value of real estate, visual disturbance of the landscape, health impacts through shadows and noise as well as nature protection concerns.[310] In Mecklenburg-Western Pomerania, especially the red kite, which is endemic in Germany, is oftentimes cited as being endangered by wind turbines.[311] In general, an unfavourable perception seems to be that nearby communities are burdened by the disadvantages of wind energy, while the advantages, such as income and economic development, benefit external actors.[312]

There are already measures in place to include the public in planning processes and some options for economic involvement (see 2.2.2.). Economic participation is highly favoured as a measure to increase wind energy acceptance in Mecklenburg-Western Pomerania and participatory processes for wind energy permissions are seen as important by the majority of the population (91%). At the same time, most people (82%) do not feel like they have agency in the energy transition. Thus, the expansion of those options might reduce local resistance to the deployment of renewable energy plants. Furthermore, as 64% of Mecklenburg-Western Pomeranians stated that they think the energy transition would burden them financially,[313] it would benefit public approval if the cost of renewable energy deployment would be designed in a way that

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[308] Focus (2014). Energie – Aktionsbündnis „Freier Horizont" gegen Ausbau der Windenergie. URL: https://www.focus.de/regional/mecklenburg-vorpommern/energie-aktionsbuendnis-freier-horizont-gegen-ausbau-der-windenergie_id_4292353.html. Accessed on: 05.05.2021.

[309] Die Landeswahlleiterin Mecklenburg-Vorpommern. Wahl zum Landtag von Mecklenburg-Vorpommern am 4. September 2016. URL: http://service.mvnet.de/wahlen/2016_land/showHtmlContent.php?folder=2016_land&datei=L_WK99.htm.

[310] Ziekow, J., Barth R., Schütte, S. & Ewen, C. (2014). Konfliktdialog bei der Zulassung von Vorhaben der Energiewende – Leitfaden für Behörden. Konfliktdialog bei Windenergieanlagen. Deutsches Forschungsinstitut für öffentliche Verwaltung, Öko-Insitut e.V., team ewen. URL: https://www.bmu.de/fileadmin/Daten_BMU/Pools/Forschungsdatenbank/fkz_3712_13_101_windenergie_bf.pdf.

[311] Beuting, S. (2019). Greifvogel Rotmilan – Artenschutz als vorgeschobenes Argument gegen Windräder?. Deutschlandfunnk. URL: https://www.deutschlandfunk.de/greifvogel-rotmilan-artenschutz-als-vorgeschobenes-argument.697.de.html?dram:article_id=460445. Accessed on: 03.06.2021.

[312] Ziekow, J., Barth R., Schütte, S. & Ewen, C. (2014). Konfliktdialog bei der Zulassung von Vorhaben der Energiewende – Leitfaden für Behörden. Konfliktdialog bei Windenergieanlagen. Deutsches Forschungsinstitut für öffentliche Verwaltung, Öko-Insitut e.V., team ewen. URL: https://www.bmu.de/fileadmin/Daten_BMU/Pools/Forschungsdatenbank/fkz_3712_13_101_windenergie_bf.pdf.

[313] Wolf, I. & Tang, M. (2019). Soziales Nachhaltigkeitsbarometer 2019 – Breite Unterstützung für die Energiewende – aber nicht so, wie sie zurzeit gemacht wird. Institute for Advanced Sustainability Studies. URL: https://www.iass-potsdam.de/en/node/7058. Accessed on: 15.05.2021

minimises costs for low income groups. However, this has to be decided on the federal level, through the levy that is determined by the EEG.

A central tool of resistance are lawsuits against wind power plants. Those are based in a variety of arguments, the main one being the concern that nature protection has not been sufficiently taken into account when planning the wind plant. A survey of industry actors found that 15 out of 111 approved wind energy plants were subject to a lawsuit in Mecklenburg-Western Pomerania in 2019.[314] Central actors in that regard are citizens initiatives, which organize themselves locally, or nature conservation organisations, such as the Nature and Biodiversity Conservation Union Germany (NABU).[315] The survey also found blocked permission procedures to be another important barrier to the deployment of wind energy. The blocking of permissions is caused by military concerns, as is the case for 38 wind power plants waiting for approval in Mecklenburg-Western Pomerania, or rotating radio beacons, which affects 70 wind power plants in the state. This blocking through lawsuits or delayed permissions procedures constitutes a big risk for investors, which is why they might refrain from investing and bidding in auctions.[316]

In summary, there is political will to develop the industry and an already established wind industry in Mecklenburg-Western Pomerania. The sector's relative economic importance is higher than in most other German states, and models predict a positive effect of the energy transition on the state's economy in the next decade. However, the political leadership's strong focus on wind energy leaves some of the potential of other forms of renewable energy, such as solar, untouched.

Generally, increasing public resistance and delayed licensing procedures are hampering the success of renewable energy deployment and might increasingly do so

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[314] Quentin, J. (2019). Hemnisse beim Ausbei der Windenergie in Deutschland - Ergebnisse einer Branchenumfrage zu Klagen gegen Windenergieanlagen sowie zu Genehmigungshemmnissen durch Drehfunkfeuer und militärische Belange der Luftraumnutzung. In cooperation with the German Wind Energy Association (BWE). URL: https://www.wind-energie.de/fileadmin/redaktion/dokumente/pressemitteilungen/2019/20190719_FA_Wind_Branchenumfrage_beklagte_WEA_Hemmnisse_DVOR_und_Militaer.pdf.

[315] NABU (2019). Schlechte Planung, falsche Standorte – Warum der NABE manchmal gegen Windparkpläne klagt. https://www.nabu.de/umwelt-und-ressourcen/energie/erneuerbare-energien-energiewende/windenergie/26913.html. Accessed on: 17.05.2021.

[316] Quentin, J. (2019). Hemnisse beim Ausbei der Windenergie in Deutschland - Ergebnisse einer Branchenumfrage zu Klagen gegen Windenergieanlagen sowie zu Genehmigungshemmnissen durch Drehfunkfeuer und militärische Belange der Luftraumnutzung. In cooperation with the German Wind Energy Association (BWE). URL: https://www.wind-energie.de/fileadmin/redaktion/dokumente/pressemitteilungen/2019/20190719_FA_Wind_Branchenumfrage_beklagte_WEA_Hemmnisse_DVOR_und_Militaer.pdf.

in the future. Additionally, policies at federal level and a shortage of skilled workers due to an aging population might further impede renewable energy deployment.

4.3.3 Key conclusions

- The renewable energy sector has been expanding in Mecklenburg-Western Pomerania during the last decade, albeit at a slowing pace from 2018 onwards. Its relative economic importance is higher than in most other German states, and models predict a positive effect of the energy transition on the state's economy in the next decade.

- Correspondingly, the renewable energy sector has been identified as a growth factor in the region by the Mecklenburg-Western Pomeranian government. Thus, the political leadership especially supports the expansion of onshore and offshore wind energy for the state to become a key electricity producer in Germany. However, while the political focus lies strongly on advancing the wind sector onshore and offshore, Mecklenburg-Western Pomerania does not fully make use of its potential in other renewable sources, especially solar.

- In general, licensing procedures, local resistance and lack of public support are factors that hamper the expansion of the sector and might increasingly do so in the future. Additionally, policies at federal level and a shortage of skilled workers due to an aging population might further impede renewable energy deployment.

- Public acceptance is one key issue, as support in the region is lower in comparison with other states. The perception of not having agency in the energy transition and not reaping its benefits is prevalent in the region. A key tool to mitigate this issue would be to increase local ownership. This is not a new concept – stipulations in Federal and state law already exist to increase public participation, but due to the manner of implementation and a time lag until benefits for the public manifest, they so far have failed to significantly impact local communities.

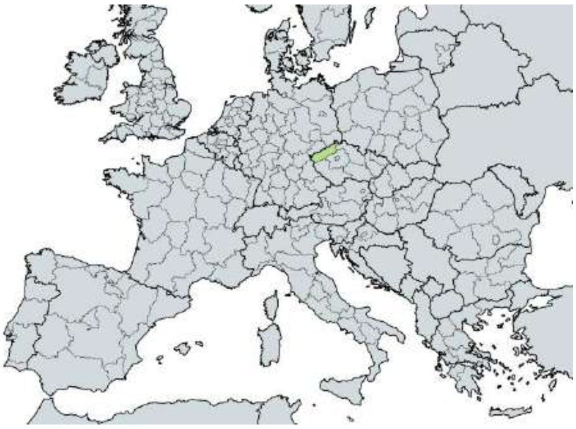
Case study 5

Severozápad

5. NORTHWESTERN CZECH REPUBLIC (SEVEROZÁPAD), CZECH REPUBLIC

*This case study was authored by **Kristina Zindulková** and **Tomáš Jungwirth** from Association for International Affairs (AMO).*

Photo by Leonhard Niederwimmer on Unsplash



GDP per capita	€19,200 (2018)
Population	1,115,629 (2020)
Population density	128/km^2
Unemployment rate	4%
People at risk of poverty or social exclusion	21.5%
Share of renewable energy (% of gross final energy consumption)	N/A
Total installed RES capacity	1,549 (GWh) out of 29,522 (GWh) (2019)
Employment in RES	0.1-0.7% (est)

5.1 National context

5.1.1 Overview of key socio-economic indicators

In 2019, the annual GDP per capita (PPP) in the Czech Republic was 29 510 EUR, nearing the EU-28 average of 32 020 EUR and exceeding even Spain.[1] Notably, Czechia was able to ensure unprecedentedly low unemployment in the past years with its 2.0% rate in 2019 being the lowest of EU-28[2], and overall employment rate of 75.1% among people aged 15-64 being one of the highest in Europe.[3]

[1] Czech Statistical Office, https://www.czso.cz/documents/10180/123503161/370002200801.pdf/ab2797f1-254c-40c4-9440-cb8d02f47a77?version=1.1

[2] Czech Statistical Office, https://www.czso.cz/documents/10180/123503161/370002200326.pdf/f19c21a0-06b1-4709-a92e-bc670d478214?version=1.1

[3] Czech Statistical Office, https://www.czso.cz/documents/10180/123503161/370002200313.pdf/96079e48-2a28-45ec-adee-4184bd9c1c83?version=1.1

According to the OECD, Czechia ranked among member countries with the lowest income inequality (GINI coefficient of 0.249 for 2019) with a trend of slightly decreasing inequality in the past decade.[4] Nevertheless, in other key indicators, Czechia is trailing behind. These include public expenditures on education as a percentage of GDP, which are among the lowest in the EU[5], as well as the percentage of 25-34 year olds with tertiary education (33% as compared to OECD average of 45%).[6]

5.1.2 RES deployment in Czechia

In the Czech energy mix, RES accounts for 16% of gross final energy consumption, surpassing the Czech national target of 13% RES share by 2020. Specifically, RES covers 8% of gross final energy consumption in transport and 23% of gross energy consumption in the heating and cooling sector, the latter dominated by biomass (84% of RES share) followed by heat pumps (8%).

RES generated 10 TWh of electricity in 2019,[7] which corresponds to 14% of gross electricity consumption.[8] Between 2010 and 2019, the electricity generation from RES rose by 59%: most of the change happened between 2010 and 2014, then varied insignificantly. The major boom of solar photovoltaics occured between 2009 and 2011, while the rise of biogas share continued until 2014. The share of wind energy more than doubled by 2019, but still accounts for only 7% of electricity generation from RES.[9]

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[4] OECD, https://data.oecd.org/inequality/income-inequality.htm
[5] Czech Statistical Office, https://www.czso.cz/documents/10180/123503161/370002200701.pdf/07a89be0-117e-414d-a4f5-189c24094d5c?version=1.1
[6] OECD, https://gpseducation.oecd.org/CountryProfile?primaryCountry=CZE&treshold=10&topic=EO
[7] Energy Regulatory Office, https://www.eru.cz/documents/10540/5381883/Rocni_zprava_provoz_ES_2019.pdf/debe8a88-e780-4c44-8336-a0b7bbd189bc
[8] Under the SHARES methodology used by Eurostat, the RES share is 14% in the gross electricity consumption. Ministry of Industry and Trade, https://www.mpo.cz/assets/cz/energetika/statistika/obnovitelne-zdroje-energie/2020/12/Podil-OZE-na-hrube-konecne-spotrebe-energie-2010-2019.pdf;
In gross electricity generation, the RES share stands at 12% due to the high electricity export. Energy Regulatory Office, https://www.eru.cz/documents/10540/5381883/Rocni_zprava_provoz_ES_2019.pdf/debe8a88-e780-4c44-8336-a0b7bbd189bc
[9] Ministry of Industry and Trade, https://www.mpo.cz/assets/cz/energetika/statistika/obnovitelne-zdroje-energie/2020/9/Obnovitelne-zdroje-energie-2019_2.pdf

The boom of solar photovoltaics was caused by the falling prices of solar panels[10] combined with a feed-in tariff regulation for RES set very favourably for the investors with 15-year guaranteed support.[11] Consequently, the 2010 target of 8% RES share in electricity consumption[12] had been met at the cost of considerable state support (tens of billions CZK every year) that shall be paid annually up until 2030. In order to downscale the support, an additional tax on profits from solar electricity was introduced and the regulation was changed in 2010 and 2012.[13] The unfortunate rules for RES support led to a pejorative term 'solar baron' and is the cause of persistent negative public sentiments towards solar energy.

Between 2010 and 2020, the targeted RES share in gross final consumption of energy was set at 13% by Directive 2009/28/EC on renewable energy, accompanied by the binding target of 10% RES share in the transport sector.[14] In response, Czechia published the National Renewable Energy Action Plan for 2020[15]; a stricter version of the original feed-in tariff regulation remains the main support scheme for RES and the fast growth of RES share ceased.[16] The last version of the national plan for RES was approved in 2016 and will be replaced by the NECP after 2021.[17] Moreover, the Czech Government approved the National Action Plan for Clean Mobility (NAP CM) in 2015 and updated it in 2019, based on Directive 2014/94/EU on the deployment of alternative fuels infrastructure.

In the key strategic document for energy policy, the State Energy Policy (SEP), published in 2015, the optimized scenario (not a target)[18] anticipates a 14% RES

[10] Fraunhofer ISE,

[11] Producers had to choose between a fixed feed-in tariff or a premium tariff (green bonus). For biomass cogeneration, only the green bonus applied. Source: Act No. 180/2005 Coll. on the promotion of electricity produced from RES, https://www.zakonyprolidi.cz/cs/2005-180

[12] Directive 2001/77/EC (RES Directive), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02001L0077-20100401

[13] Czech Radio, https://www.irozhlas.cz/zpravy-domov/fotovoltaika-energetika-obnovitelne-zdroje_1912040600_jab; Act No. 165/2012 Coll. on promoted energy sources https://www.zakonyprolidi.cz/cs/2012-165#cast5

[14] Directive 2009/28/EC (RED II), https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32009L0028

[15] National Renewable Energy Action Plans 2020, https://ec.europa.eu/energy/topics/renewable-energy/national-renewable-energy-action-plans-2020_en

[16] Act No. 165/2012 Coll. on promoted energy sources, https://www.zakonyprolidi.cz/cs/2012-165

[17] Czech National Renewable Energy Action Plan, Ministry of Industry and Trade, https://www.mpo.cz/cz/energetika/elektroenergetika/obnovitelne-zdroje/narodni-akcni-plan-pro-obnovitelne-zdroje-energie--169894/

[18] Prognosis under specific assumptions (policy on the EU and national level, electricity consumption, GDP, energy prices and accessibility, ETS prices etc.). SEP, Ministry of Industry and Trade, https://www.mpo.cz/assets/cz/energetika/statni-energeticka-politika/2016/12/Statni-energeticka-koncepce-_2015_.pdf

share among primary energy sources by 2030, 18% in gross electricity generation and a 13% share of biofuels and electricity in final energy consumption in the transport sector.[19]

The most ambitious policy document to date concerning future RES development is the National Energy and Climate Plan of the Czech Republic (NECP), published in 2020 on the basis of the requirements of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action.[20] The Czech Republic proposes a 22% contribution to the European target of 30% RES share in gross final energy consumption by 2030, increasing its national target set for the year 2020 by 9%. It was increased after the assessment by European Commission, though failing to reach the suggested level of 23%.[21] The increase of ambition from 22 to 23% would equal to a significant increase of ambition in the area of electricity production: the NECP goal corresponds to a 33% increase in RES final electricity consumption; the ambition of 23% RES share requires a 87% increase.[22] Altogether, the climate ambition stated in the Czech NECP is assessed as insufficient in a report by Ember.[23] However, it is likely that further development will occur in reaction to the enhanced EU GHG emissions reduction target of at least 55% by 2030.[24]

Broken down into sectors, NECP targets are 17% RES share in electricity consumption, 14% RES share in the transport sector (binding target that has been assigned for all Member States), and 31% RES share in heating and cooling.[25] Among the electricity sources, photovoltaics leads the way with additional 2 TWh of electricity consumption by 2030 compared with 2020 anticipated consumption, followed by wind (additional 1,1 TWh).[26]

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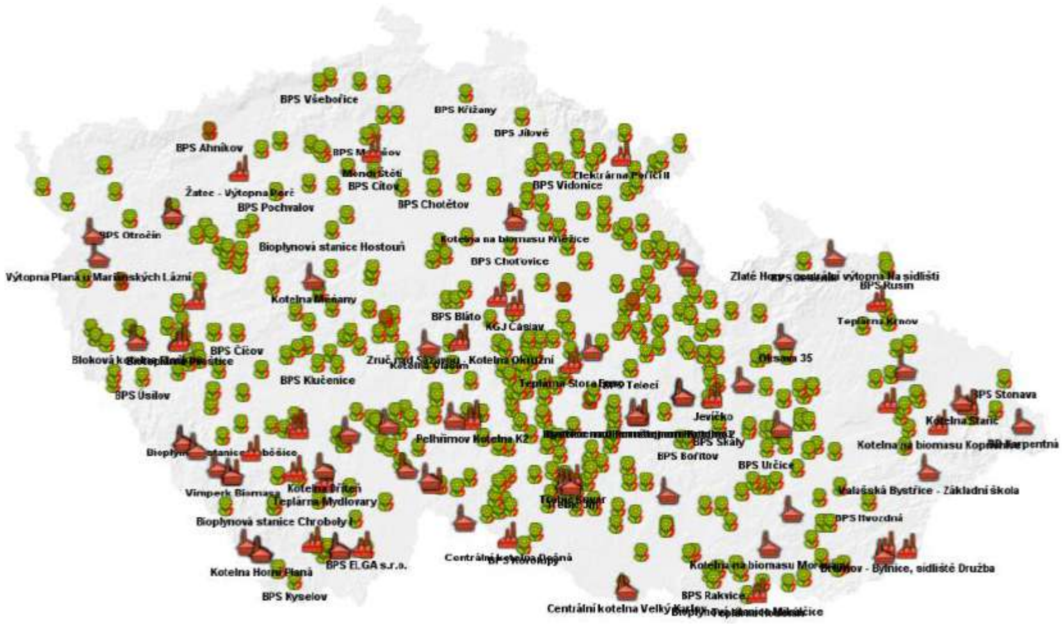
[19] SEP, Ministry of Industry and Trade, https://www.mpo.cz/assets/cz/energetika/statni-energeticka-politika/2016/12/Statni-energeticka-koncepce-_2015_.pdf
[20] NECP, Ministry of Industry and Trade, https://www.mpo.cz/en/energy/strategic-and-conceptual-documents/the-national-energy-and-climate-plan-of-the-czech-republic--252018/
[21] Assessment of the final national energy and climate plan of Czechia, European Commission, https://ec.europa.eu/energy/sites/ener/files/documents/staff_working_document_assessment_necp_czechia.pdf
[22] Analysis of the Czech NECP (actualized), Chamber of RES, https://www.komoraoze.cz/download/pdf/153.pdf
[23] Vision or division? What do National Energy and Climate Plans tell us about the EU power sector in 2030?, Ember, https://ember-climate.org/wp-content/uploads/2020/10/Vision-or-Division-Ember-analysis-of-NECPs.pdf
[24] 2030 climate & energy framework, European Commission, https://ec.europa.eu/clima/policies/strategies/2030_en
[25] Czech NECP
[26] Czech NECP, converted from TJ to TWh

Table 6: CZ electricity generation from renewable energy sources

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Electricity												
Hydro	175.9	181.6	186.4	184.2	187.6	196.1	196.8	197.0	196.0	191.6	192.3	191.5
Wind	18.5	24.7	29.4	31.9	35.6	39.6	41.4	44.8	44.6	47.9	51.3	56.0
Solar	1.1	7.6	52.9	187.6	184.7	174.8	182.5	194.7	183.3	188.6	202.8	198.8
Solid biofuels	100.6	120.1	128.3	144.8	156.3	144.7	171.3	179.8	177.8	190.3	182.4	206.3
All other renewables	24.0	38.9	57.6	87.6	133.7	204.4	229.7	232.0	231.1	236.8	232.8	226.4
Total (RES-E numerator)	320.0	372.9	454.7	636.2	697.9	759.6	821.7	848.2	832.7	855.2	861.5	878.9

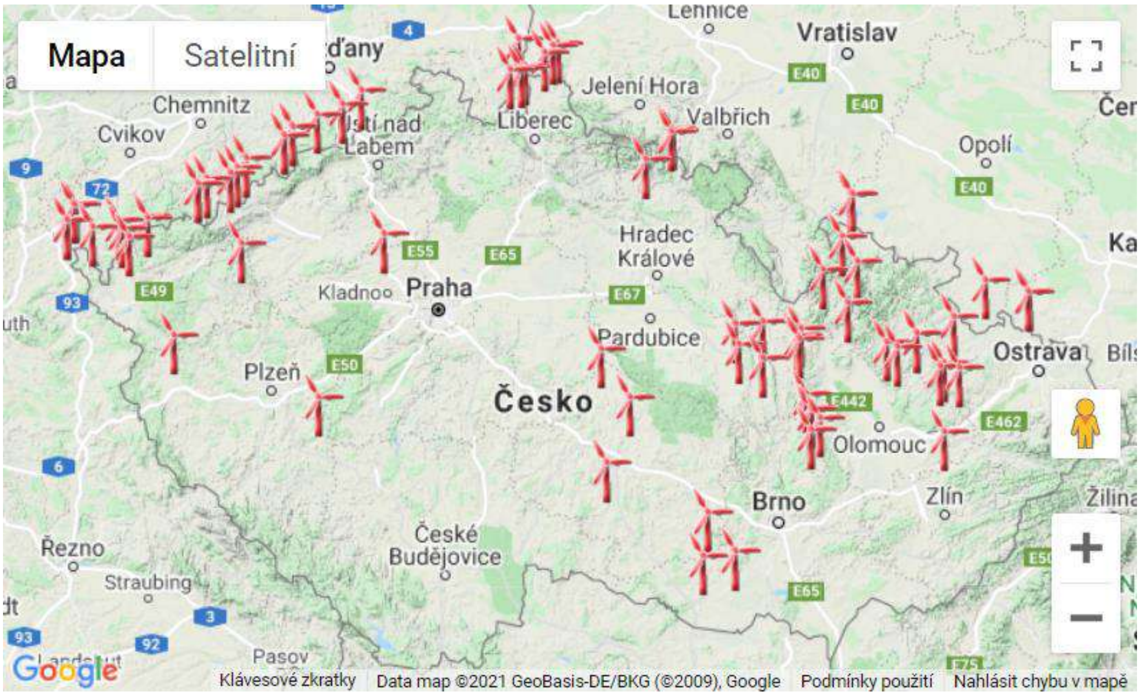
Source: Eurostat SHARES https://ec.europa.eu/eurostat/web/energy/data/shares

Figure 34: Biogas plants (green) and biomass heat plans (red) in Czechia (2021)



Source: Regional Sustainable Energy Policy, https://restep.vumop.cz/

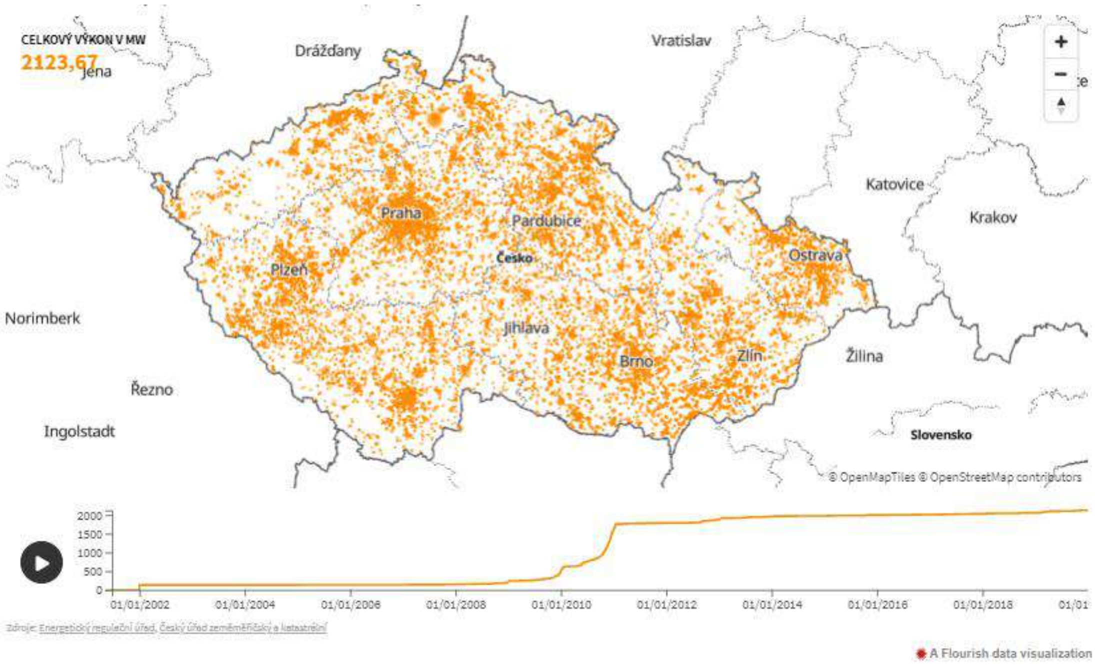
Figure 35: Wind power plants in Czechia



Source: Czech Wind Energy Association, https://csve.cz/cz/aktualni-instalace

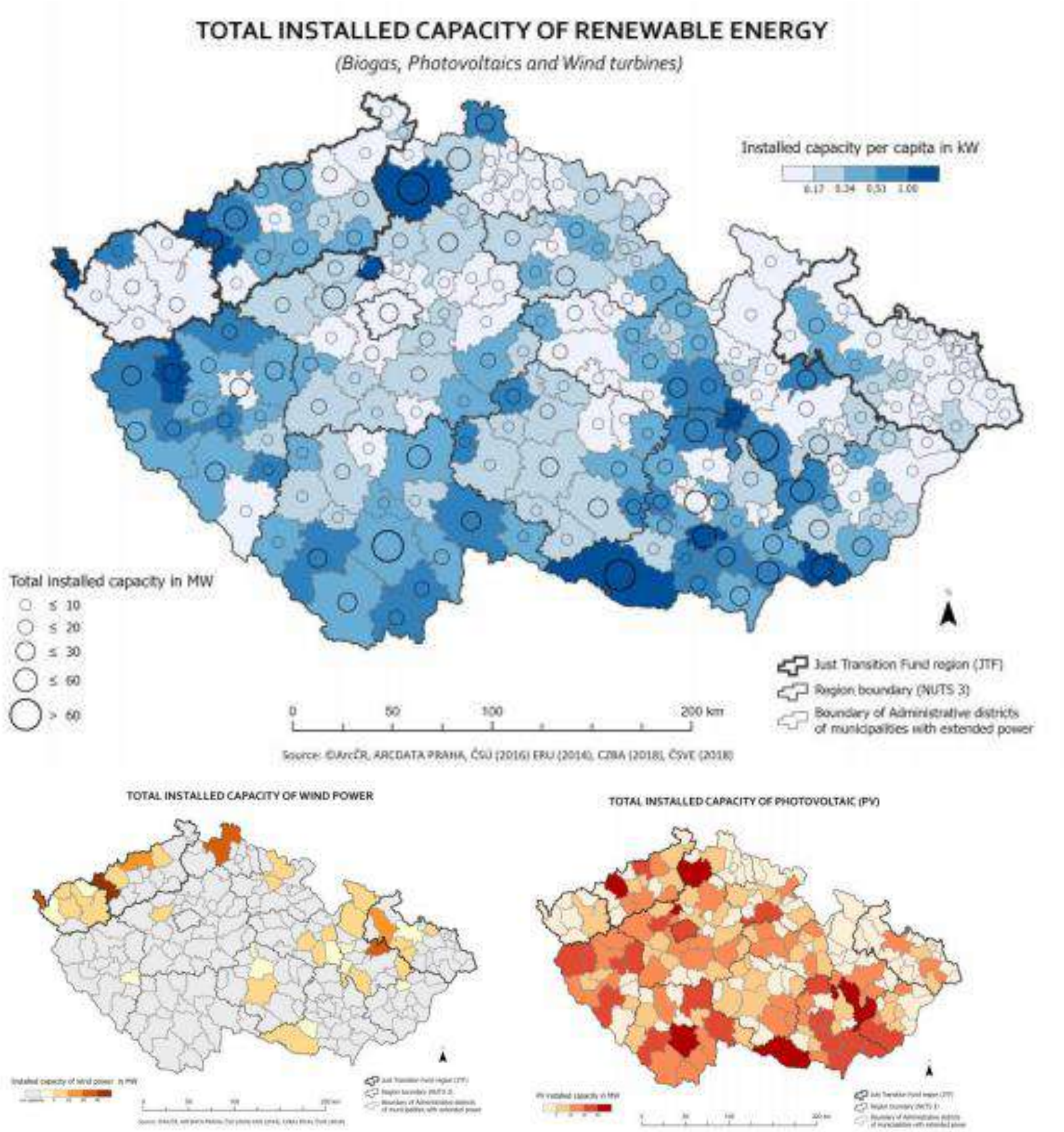
Figure 36: Photovoltaic power plants in Czechia (2019)

(spot size illustrates installed capacity)



Source: Interactive map by the Czech Radio https://www.irozhlas.cz/zpravy-domov/fotovoltaika-energetika-obnovitelne-zdroje_1912040600_jab

Figure 37: Microregional perspective on RES installed capacity (2019)



Source: Frankfurt School of Finance & Management (Support to the preparation of a Territorial Just Transition Plan in Czech Republic)

5.1.3 Overview of relevant political governance structures

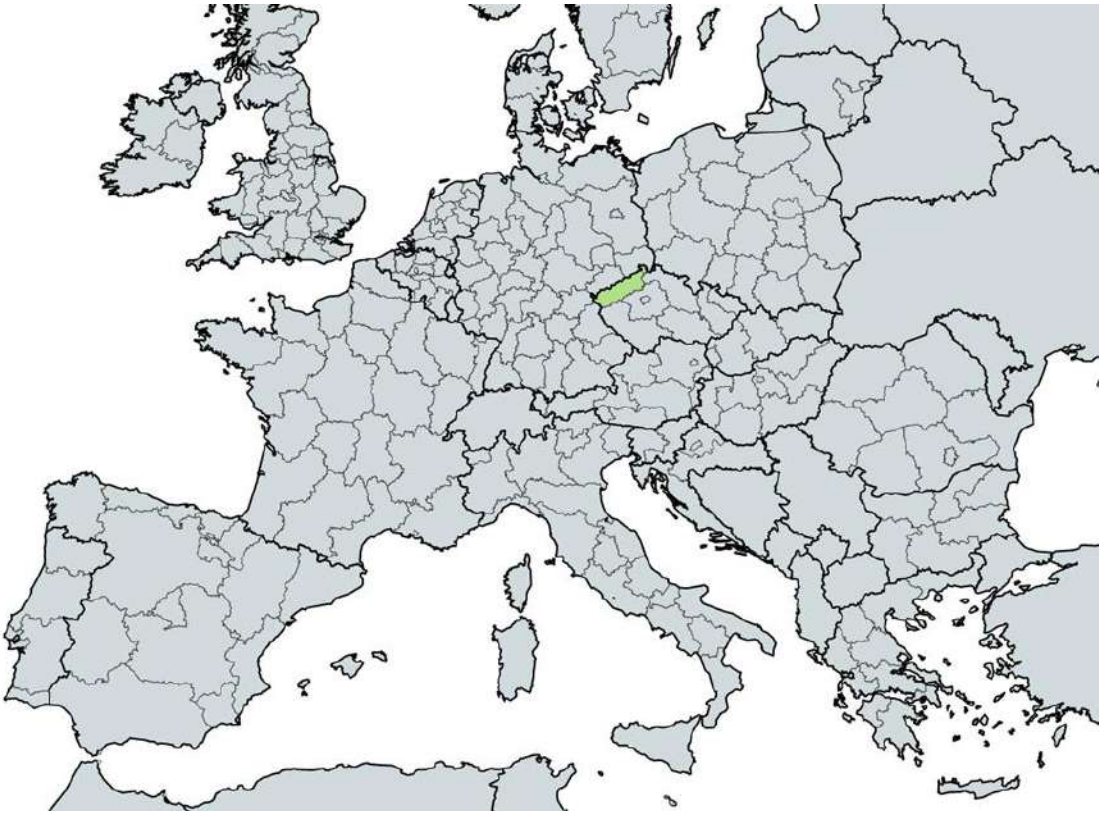
At the level of the central government, energy-related matters are dealt with primarily within the Ministry of Industry and Trade with multiple dedicated departments, comparably large budgets and strong political power. Nevertheless, with the increased prominence of the climate agenda in the EU, the Ministry of the Environment's initially limited role in the topic has also been of a growing importance, which has increased further with the decision assigning it responsibility for setting up and disbursement of the Modernisation Fund, a key financing instrument for the energy transition, as well as the Just Transition Fund.

Historically, the energy sector in Czechia has been a highly centralized one with a prominence of large producers and distributors of power and/or heat. This legacy is still palpable both in terms of governance structures and in mindsets of both stakeholders and the general public. The only real legal obligation that regional governments and administrations (equalling to NUTS III, as NUTS II is just a statistical unit in Czechia) have in the context of energy is the adoption of "Territorial Energy Policies", strategic documents that shall reflect the State Energy Policy and provide an outlook of 25 years with a 5-year evaluation and actualization period.[27] There are no energy departments in the standard administrative setup of regional administrative bodies and the (for the most part, marginal) agenda is dealt with by departments of property and investment. The situation differs somewhat in coal regions in transition which had been setting up advisory bodies dealing with just transition-related matters (see further).

[27] Defined by Act No. 406/2000 Coll., on energy management and specified by government regulation No. 195/2001 Coll, https://www.zakonyprolidi.cz/cs/2000-406

5.2 Detailed assessment

5.2.1 Regional economy, geography, demographics and political context



Location of Severozápad in Europe

As noted above, the NUTS II Severozápad region is composed of two distinct administrative NUTS III units, Ústecký kraj and Karlovarský kraj. Alongside Moravskoslezský kraj, both Ústecký and Karlovarský kraj are considered coal regions in transition, and are eligible for support from the Just Transition Fund.

Both of these are regions historically strongly affected by the mining of lignite in open pits and its combustion in power plants and heat plants, with devastating impacts on the natural environment, public health, and diversification of the local economy. It should be further noted that these regions had been strongly depopulated and uprooted with the mass expulsion of Germans from Czechoslovakia following WWII, leaving behind a negative and lasting legacy.

In 2020 Severozápad had 1 115 629 inhabitants, making it the least populated NUTS II region in Czechia and a population density of 128 people per square kilometer. Out of that, over 820 000 people lived in Ústecký kraj and less than 300 000 people in Karlovarský kraj. Over the past decade, the region had lost over 30 000 inhabitants while in sum, Czechia's population had increased by nearly 200

000. The average age in Severozápad was 42,5 years, equalling the national average.[28]

In most key socio-economic indicators, Ústecký and Karlovarský kraj consistently rank at the very bottom of the Czech Republic (out of the 13 regions + Prague). These include, notably, GDP per capita (with a relative drop post-1989), highest attained level of education of the local population, investments in research and innovation, life expectancy and other health-related indicators (see the graphs below). The region recorded an unemployment rate of 4% in 2020.[29]

Geographically, Karlovarský and Ústecký kraj are characterized particularly by the Ore Mountains range (tallest peak of 1244 m) spanning some 150 km over the northern border with Germany (Saxony). Their foothills host a concentration of cities and towns mostly built around coal mining/energy production/heavy industry (Sokolov, Kadaň, Chomutov, Most, Litvínov, Bílina etc.), with the largest lignite reserves being located and for the most part mined in this region. The local geographic conditions have significant potential for wind energy deployment (along the range) and photovoltaics (on the territory of the former lignite open pits). There are also ongoing discussions about possible pump-up storage use, utilizing the flooded pits left behind by lignite mining.[30]

As for the regional political context, historically, extremist and populist parties have scored well among voters in the region, exploiting among others issues around social exclusion, targeting the Roma population and other minorities. For instance, Ústecký kraj had been presided over by a Communist Party representative between 2012 and 2020 when a new center-right coalition was formed. Similarly, the post-Communists had fared well in Karlovarský kraj, alongside Andrej Babiš's ANO party. A new regional government was formed after difficult negotiations in December 2020, composed of 6 parties so as to put ANO in opposition. The hard-left and populist parties have also traditionally voiced their support for continued lignite mining and fossil-based energy, pointing to the socio-economic realities and presenting themselves as guardians of the working class.

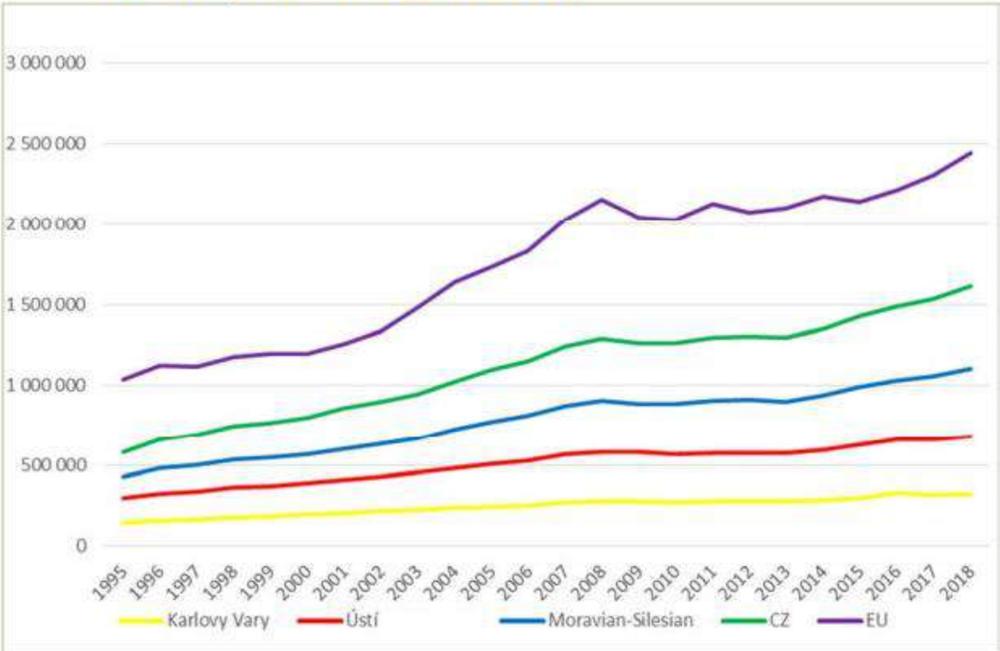
[28] Czech Statistical Office, https://www.czso.cz/documents/10180/20556267/13011001.pdf/fd1f44ef-d931-4ba1-9b59-cf44b82518f5?version=1.0; https://www.czso.cz/documents/10180/121739326/1300722001.pdf/3554a4b2-118f-46ae-9105-8764faa1d6eb?version=1.1

[29] https://ec.europa.eu/eurostat/databrowser/view/tgs00010/default/table?lang=en

[30] Czech Television, https://ct24.ceskatelevize.cz/domaci/2898578-misto-uhli-jezera-voda-mohla-na-severu-cech-vyrobit-podle-havlicka-energii-jako-dva

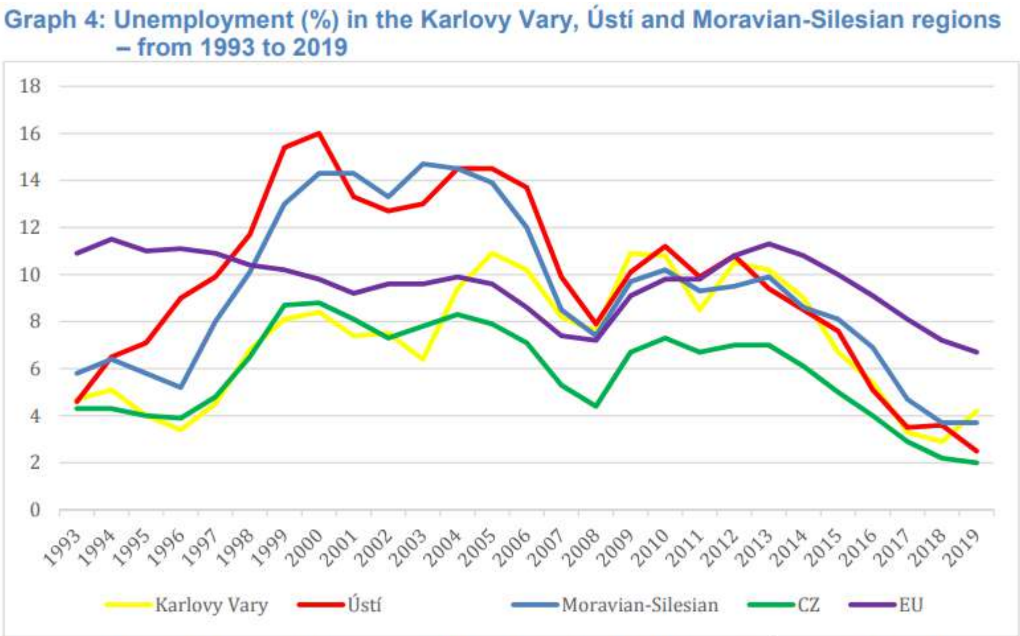
Figure 38: GDP per capita in selected CZ regions as compared to national and EU average

Graph 5: GDP per capita in the Karlovy Vary, Ústí and Moravian-Silesian regions, Czech Republic and the EU in 1995 - 2018



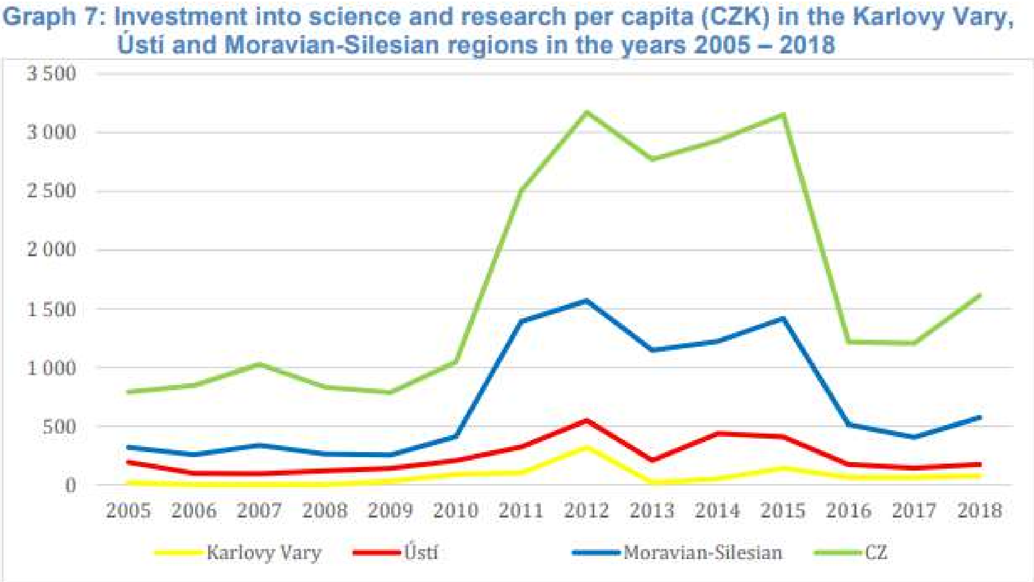
Source: CZSO. (2020). Development of the number of inhabitants in the Czech Republic, Karlovy Vary, Ústí nad Labem and Moravian - Silesian regions in the years 1989 – 2019. Retrieved October 24, 2020, from https://www.czso.cz/, https://data.worldbank.org/. Gross domestic product in Karlovy Vary, Ústí nad Labem and Moravian - Silesian regions in the years 1989 – 2018. Retrieved October 24, 2020, from https://www.czso.cz/

Figure 39: Unemployment in selected CZ regions as compared to national and EU average



Source: CZSO. (2020). Development of unemployment in the Czech Republic, Karlovy Vary, Ústí nad Labem and Moravian-Silesian regions in 1993–2019. Retrieved October 24, 2020, from https://www.czso.cz/, https://data.worldbank.org/indicator/SL.UEM.TOTL.NE.ZS?locations=EU

Figure 40: Investment into science and research per capita in selected CZ regions as compared to national and EU average



Source: https://vdb.czso.cz/vdbvo2/faces/cs/index.jsf?page=vystup%20-objekt&f=TABULKA&pvo=VAV02&z=T&katalog=30851&str=v183

Figure 41: Regional Competitiveness Index per indicator: Severozápad/CZ/EU (2019)

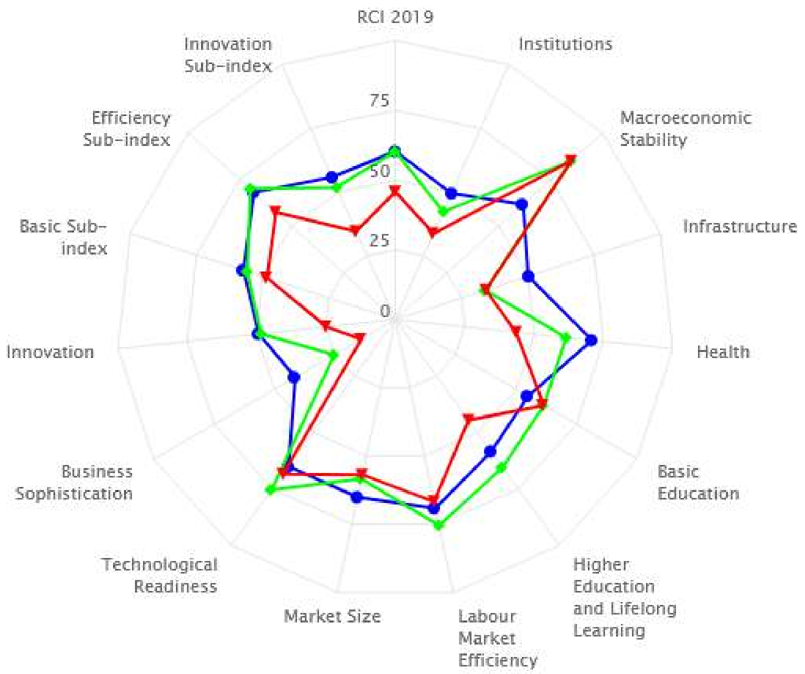


Figure 42: Selected Transition Challenges facing Czech coal regions

Table 2: Situational snapshot of the in the Karlovy Vary, Ústí and Moravian-Silesian regions

CRITERIA	ÚSTÍ	KARLOVY VARY	MORAVIAN-SILESIAN
Economy, entrepreneurship and innovation			
Aging population	Yes	Yes	Yes
Lack of diversification	Yes	Yes	Partially
Innovation	Partially	Partially	Yes
Employment			
Increase of unemployment	No	No	No
Unskilled workers	Yes	Yes	Partially
Sustainable environment			
Air pollution	Partially	Partially	Yes
Contaminated production sites	Partially	Partially	Yes
Negative impact on health	Partially	Partially	Yes
Lack of GHG free energy	Yes	Yes	Yes
Mobility and interconnection			
Lack of Infrastructure and accessibility	Partially	Partially	Partially

➔ Transition Challenges need to be tackled, but also depend on the absorption capacity of the regions

Note: without impact of COVID-19

Source: Frankfurt School of Finance & Management (Support to the preparation of a Territorial Just Transition Plan in Czech Republic)

5.2.2 RES in the Severozápad region

Regional GHG emissions

In the Northwest region, industrial GHG emissions reported under EU ETS in 2016 amounted to 30.4 million tonnes of CO2e, reaching 44% of total Czech ETS emissions in 2016. This equals a decrease of 7.4% between 2010 and 2016.[347] 10 out of 29 biggest Czech emitters under EU ETS are located in this region, producing nearly 29 million tonnes of CO2 equivalent in 2018, indicating that the majority of emissions are produced by a small number of large facilities.[348] This corresponds to a high production of electricity from coal and presence of heavy industry including the chemical industry, an oil refinery, a cement plant and more.

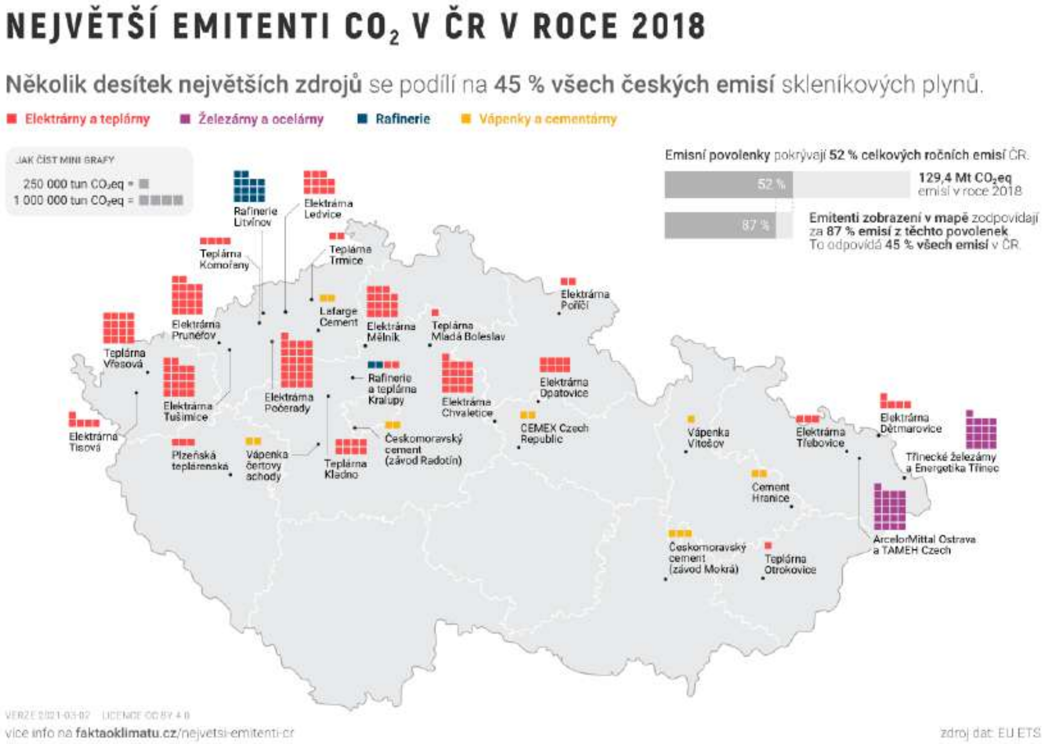
[347] Climate-KIC, https://re-industrialise.climate-kic.org/maps/co2-map/; Mura M et al., Industrial Carbon Emissions Intensity, Ecological Economics, https://www.sciencedirect.com/science/article/pii/S2352340921003309

[348] Apart from that, there are a number of smaller facilities whose emissions have not been included into the figure. Facts on climate change, https://faktaoklimatu.cz/infografiky/nejvetsi-emitenti-cr

Figure 43: Largest industrial GHG emitters in Czechia (2018)

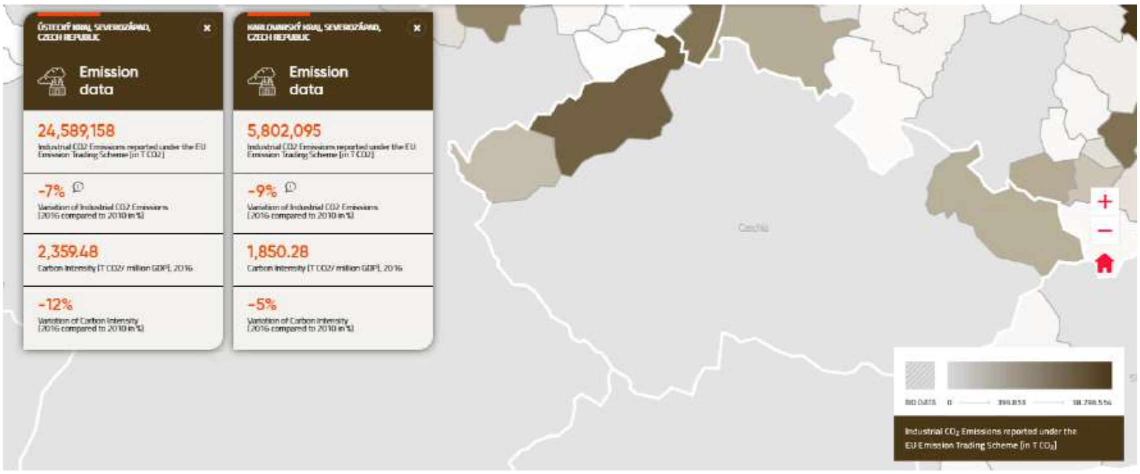
Red: power plants and heat plants; Purple: iron and steel plants; Blue: refineries; Yellow: lime and cement plants. Each square indicates 250 000 tonnes of CO2eq produced by the facility.

(EU ETS covers 52% of total yearly Czech emissions. Facilities captured on the map produce 87% of emissions reported under EU ETS, equalling 45% of total Czech emissions)



Source: Fakta o klimatu/Facts on climate change, https://faktaoklimatu.cz/infografiky/nejvetsi-emitenti-cr

Figure 44: Emission data for Ústecký and Karlovarský kraj (2016)



Source: Climate-KIC, https://re-industrialise.climate-kic.org/maps/co2-map/

RES installations and potential

The Northwest region produces 34% of total Czech electricity (30 TWh in 2019) which illustrates its key position in the Czech energy industry. Its highest share is produced by lignite power plants, and RES sources produce 5.2% of electricity in the region.[349] RES only seems to play a minor role in the Northwest energy mix with an extensive coal energy production, however, in comparison to other regions, the Northwest does not fall behind, producing 14% of total electricity generated from RES.

In 2019, 46% of the Czech installed capacity of wind energy was installed in the Northwest region, while this region accounted for 9% of the total installed capacity of photovoltaics. The level of installed capacity has not changed considerably since 2010. In the case of photovoltaics it even decreased, according to the Czech Energy Regulatory Office.[350]

As for biomass, the data for the installed capacity are not available due to the missing differentiation of combustion sources.[351] The gross electricity production from biomass (solid biomass, biogas and decomposable waste) is 740 GWh of electricity in the Northwest region, that is 15% (2019) of the Czech electricity

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[349] Energy Regulatory Office, https://www.eru.cz/documents/10540/5381883/Rocni_zprava_provoz_ES_2019.pdf/debe8a88-e780-4c44-8336-a0b7bbd189bc

[350] Ibid.

[351] TZB-info, https://vytapeni.tzb-info.cz/vytapime-elektrinou/305-rozdeleni-elektricke-energie

produced from biomass. Solid biomass dominates with 84% of the bioelectricity production.[352]

District heating plays an important role in the heating sector, with 10% of its energy supplied by RES, dominated by biomass (9%). Although the heat pumps and solar heating have a negligible share in the Northwest heating system supplied mainly by coal, compared with other regions, there are 96% of Czech heat pumps and 40% of solar thermal heating in the region, both referring to the district heating.[353]

With regard to individual heating, RES have their role, mainly represented by biomass. As for the deployment of heat pumps, the Northwest region has lower deployment of heat pumps, but in the newly built houses, the installation occurs more frequently than in other Czech regions - while the Czech average is 11% of new houses with heat pump installation, it is 18% in the Northwest.[354]

As for the sub-regional differences, wind energy dominates the RES electricity production in the Northwest region and is relatively evenly deployed on the ridge of the Ore Mountains located on the border with Germany.

Karlovarský region has a low deployment of photovoltaics with a 1% share of local installed capacity (compared with 3% in the Ústecký region) and the highest deployment of wind energy per capita. In the Ústecký region solid biomass dominates with 87% of local bioelectricity production, while in Karlovarský region 86% of electricity production from biomass is produced by biogas.

The potential of RES is assessed by multiple studies differing in ambition and methodology. The Institute of Atmospheric Physics at the Czech Academy of Sciences estimated the wind feasible potential (not to be mistaken with the technical potential) in the Northwest to be 470 MW of installed capacity according to the conservative scenario and 2530 MW in the optimistic scenario,

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[352] Energy Regulatory Office, https://www.eru.cz/documents/10540/5381883/Rocni_zprava_provoz_ES_2019.pdf/debe8a88-e780-4c44-8336-a0b7bbd189bc

[353] Energy Regulatory Office, https://www.eru.cz/documents/10540/5391332/Rocni_zprava_provoz_TS_2019.pdf/a4d8e72d-4f7b-4d02-b464-201bf1648479

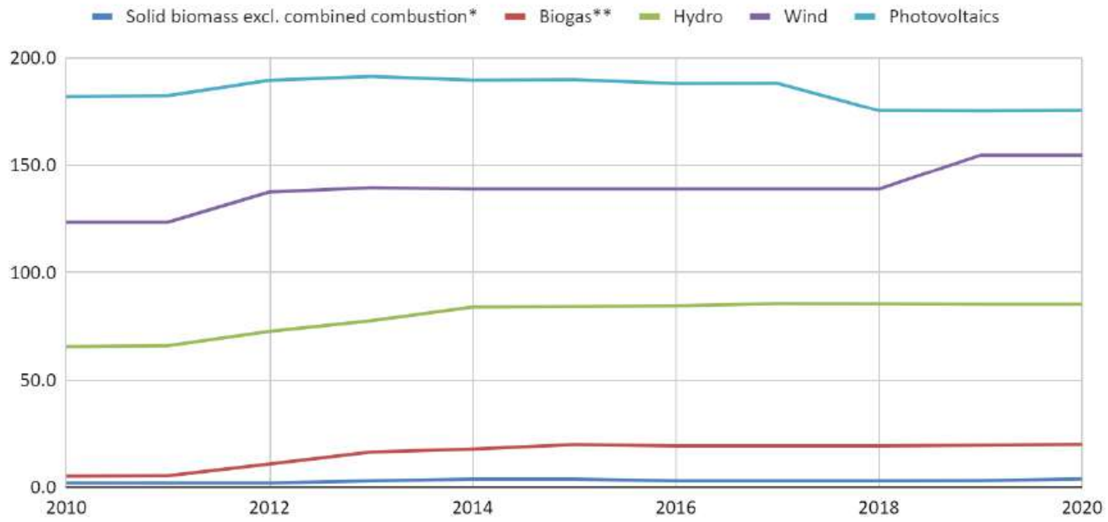
[354] The average is largely reduced by the regions with big cities. Ministry of Industry and Trade, https://www.mpo.cz/assets/cz/energetika/statistika/obnovitelne-zdroje-energie/2019/5/Tepelna-cerpadla-1981-2018-final-verze.pdf

that is between 18%, or 15% respectively of the czech potential wind capacity.[355] The regional potential of solar installations has not yet been assessed.

The potential of RES deployment, its investment needs and job creation in the Northwest region are also analysed in the publication „Clean energy technologies in coal regions" by JRC. The technical potential of installations in the areas of open pit mines is 180 MW of wind energy and 330 MW of solar PV. In total, the technical potential of RES in the Northwest region reaches 40 TWh/year.[356]

[355] The Institute of Atmospheric Physics at the Czech Academy of Sciences, https://www.ufa.cas.cz/DATA/vetrna-energie/Potencial_vetrne_energie_2020.pdf
[356] JRC, https://publications.jrc.ec.europa.eu/repository/handle/JRC117938

Figure 45: RES installed capacity in the Northwest region CR (2010-2020)



Source: Energy Regulatory Office - personal communication

* facilities using biomass only, the biomass used in the facilities burning other solid fuels as well are not included - these are facilities Mondi Štětí, CHP Komořany and CHP Trmice in Ústecký region and CHP Ostrov, Power plant Tisová I. and Heating plant KG Energo s.r.o.

** biogas includes: sewer gas, landfill gas, other biogas

Table 7: RES electricity production in the Northwest region & Czechia

Brutto electricity production (GWh)	Northwest	CZ
	2019	2019
Biomass	741.3	5030.6
...Solid biomass	626.0	2398.7
...Biogas	115.3	2527.1
...Biologically degradable municipal waste	0.0	104.8
Photovoltaic power plants	180.1	2285.9
Hydro including pumped storage plants	315.6	3174.7
Wind power plants	312.0	700.0
RES Total	**1549.0**	**11191.2**
Brutto electricity production from all sources	**29,522.4**	**86,988.7**

Source: Energy Regulatory Office

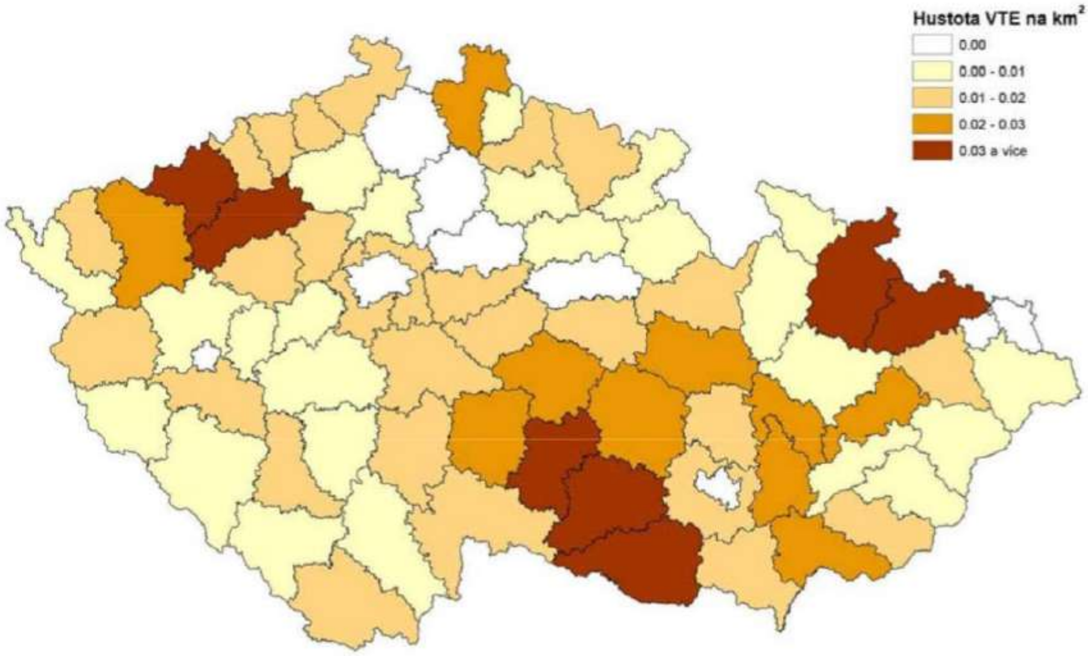
Table 8: Heat supply in district heating

Note that the column „Share of HS in the CR" indicates the regional supply share in the Czech total heat supply (by source), for example, Northwest heat supply accounts for 18% of total Czech heat supply. The column „Share of HS in the NW region" represents the share of different sources in the Northwest heat supply.

Heat supply in district heating (TJ)	2019	2019		Share of HS in the CR (%)	2019		Share of HS in the NW region (%)	2019
	NW	CZ			NW			NW
Total	15752.5	87543.5		Total	18%		Total	(100%)
Biomass (Total)	1442.2	7028.8		Biomass (Total)	21%		Biomass (Total)	9.2%
...Solid biomass	1411	6491		...Solid biomass	22%		...Solid biomass	9.0%
...Biogas	31.2	537.8		...Biogas	6%		...Biogas	0.2%
Electricity	0	13.4		Electricity	0%		Electricity	0%
Heat pump	83.2	86.7		Heat pump	96%		Heat pump	0.5%
Solar heating	0.2	0.5		Solar heating	40%		Solar heating	0%

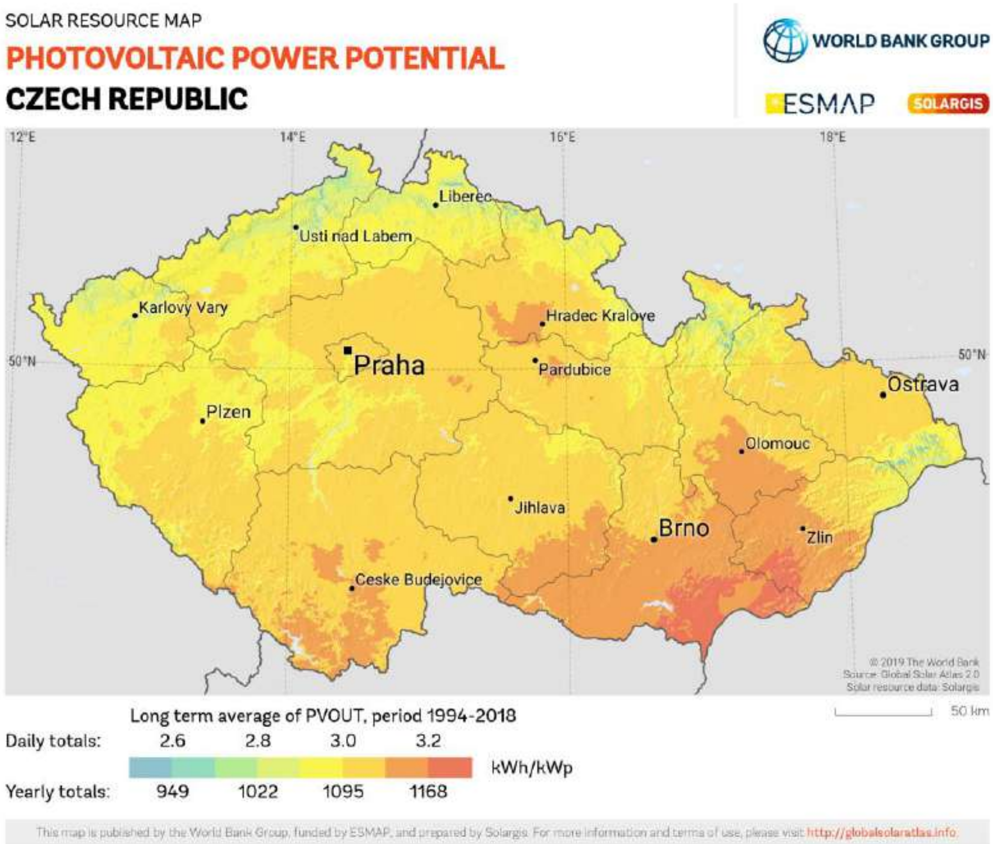
Source: Energy Regulatory Office

Figure 46: Technical potential of wind energy per district (density per km2)



Source: UFA, CZ Academy of Sciences (2012)

Figure 47: Technical potential of photovoltaics in Czechia



Economic impact of RES deployment and ownership structure

The benefits arising from the RES deployment are dependent on the structure of ownership. As for photovoltaics,analysis of the legal structure of operators shows that other entities (such as physical persons etc.) installed the biggest number of photovoltaic facilities, but with regards to the installed capacity, the classical enterprise models (private or public limited company) still own the biggest share of installed capacity in the Czech Republic (around 90%).[357] While the analysis for wind energy is non-existent, it is likely that private ownership dominates here as well.

The character of the biggest Czech wind farm, located in the Ústecký region, illustrates the economics of wind energy: the wind farm Kryštofovy Hamry with 42 MWe capacity is owned by the German company ecoenerg Windkraft GmbH & Co. KG, and uses Enercon's (company also situated in Germany) wind turbines E-82.[358] The wind farm provides a contribution to the municipality where it is located on the order of millions CZK per year, or around a third of the municipality's yearly budget. The plans to expand the wind farm were canceled because of an unstable legal environment that hinders the long-term planning for new RES.[359]

The municipality Jindřichovice in the Karlovarský region, where one of the newest wind farms was built in 2019 (one of 8 facilities built in the Czech Republic after 2014) also receives a similar benefit: the wind farm of 15.4 MW installed capacity provides around 1 million CZK yearly to the local budget.[360]

No factory located in the Northwest is involved in the wind energy value chain; there are 3 in the neighbouring regions (gearbox, nacelle assembly, blades).[361] The major providers of wind energy technology are foreign companies (Enercon, Vestas, etc.). One of the wind farms in Karlovarský region built in 2006 used the technology provided by Czech manufacturer Vítkovice, located in the

[357] Sklenář, Fotovoltaika v České republice v roce 2014, TZB-info, https://oze.tzb-info.cz/fotovoltaika/12162-fotovoltaika-v-ceske-republice-v-roce-2014
[358] Energy Regulatory Office, https://www.eru.cz/legacyerustaticdata/RZ2008/rz/subjekty/21.htm
[359] Czech News Agency, TZB-info, https://oze.tzb-info.cz/124786-nejvetsi-ceska-vetrna-farma-v-krusnych-horach-se-nerozsiri
[360] Czech News Agency, Czech Radio, https://vary.rozhlas.cz/u-jindrichovic-vyrostl-novy-vetrny-park-prvni-po-mnoha-letech-7960829
[361] Clean energy technologies in coal regions, JRC, https://publications.jrc.ec.europa.eu/repository/handle/JRC117938

Moravskoslezský kraj (the other Czech coal region with a concentration of heavy industry, incl. steel).[362]

There are 1800 licenced photovoltaic installations in the Northwest region; 57 of those with capacity exceeding 1 MWe. The biggest installation Alkoun is located in Ústecký region near Chomutov with 12,9 MWe of capacity.[363] Near Chomutov, in the Hrušovany municipality, a small installation of 90 kWe from 2008 is located on the rooftops of publicly owned buildings, having a positive contribution to the local budget.[364] There are 17 enterprises operating with photovoltaics (1 seller, 15 installers, 1 in services) in the Northwest region.[365]

The data on the current employment in the RES energy in the Northwest region are unavailable. According to EurObserv'ER data, RES energy employs 39 000 people (direct and indirect employment[366]), while photovoltaics employs 1 900 people and wind energy 1 300 people in the Czech Republic. Bioenergy production (heat and electricity) employs 21 000 people and biofuels account for 4 100 employees, out of the 39 000.[367]

RES development has a potential for job creation: JRC estimated the number of jobs created by RES-E development in the Northwest under the maximum technology deployment projection of EUCO32.32.3 scenario at around 828 FTE jobs for wind power deployment, 194 FTE jobs for deployment of photovoltaics and 1 305 jobs for bioenergy. JRC assessed the Northwest region as one with restricted decarbonizing employment potential, meaning that "these regions under the EUCO3232.5 scenario do not deploy decarbonized employment to a comparable level of existing coal related levels,"[368] compared with around 10 000 jobs in the coal industry, though other opportunities exist also in other areas of decarbonisation such as energy efficient housing. However, it should be noted that this is estimate is only for direct jobs in the electrical power sector. Information on the match of coal workers and potential employment in RES are not available.

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[362] https://csve.cz/clanky/aktualni-instalace-vte-cr/120
[363] Regional Energy Balances, Ministry of Industry and Trade, https://www.mpo.cz/assets/cz/energetika/statistika/energeticke-bilance/2021/6/UEK-2018.pdf
[364] https://calla.cz/atlas/detail.php?kat=1&id=1755
[365] Clean energy technologies in coal regions, JRC, https://publications.jrc.ec.europa.eu/repository/handle/JRC117938
[366] Direct employment includes renewable equipment manufacturing, renewable plant construction, engineering and management, operation and maintenance, biomass supply and exploitation. Indirect employment refers to secondary activities, such as transport and other services.
[367] 19th annual overview barometer, EurObserv'er, https://www.eurobserv-er.org/category/2019/
[368] Ibid.

Adding to that, a study in the making by WiseEuropa (with direct input from the authors of this paper) concludes that earlier coal phase-out scenarios equate to swifter RES deployment, especially given soaring EU ETS prices. This swifter deployment has a positive impact on employment, creating up to 30,000 more jobs than what will be lost in fossil energy in the coming decade.[369] Presumably, a 10-20% share of those will occur in the Northwest region.

Figure 48: Selected EU stats on job creation in RES development (2020)

Coal mine reclamation

	GW	GWh/y
Wind	0.18	215.5
Solar PV	0.33	327.6

Value chain

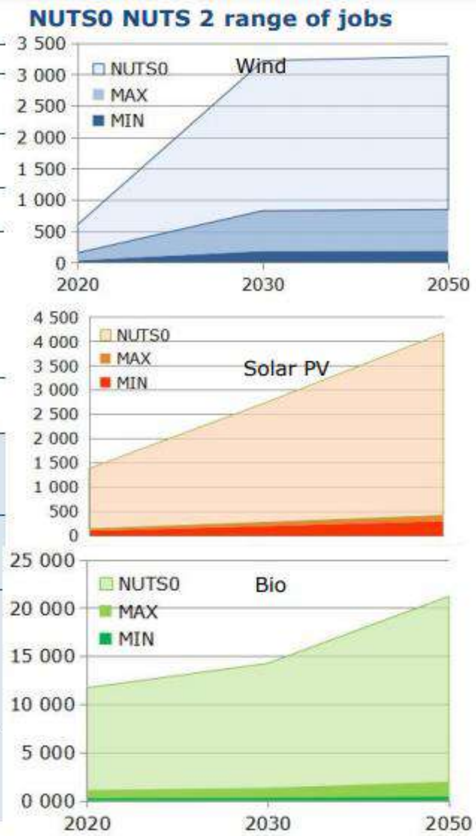
	Facilities	Total
Wind	No factories in region; 3 (gearbox, nacelle assembly, blades) in close-by regions (CZ03, CZ05, DE40)	0
Solar PV	1 (seller); 15 (installer); 1 (services)	17

Clean Energy Production Technologies Investments and Jobs (2030, EUCO3232.5 based MAX technology deployment projection)

	Average CAPEX needs (EUR million)	Job creation potential (FTE)
Wind	795.40	828
Solar PV	62.95	194
Bioenergy	88.40	1305

EUR mil/Job ratio

Wind, 1.29
Solar PV, 0.26
Bio, 0.07



Source: JRC

Figure 49: Employment in renewable energy in Czechia (2018)

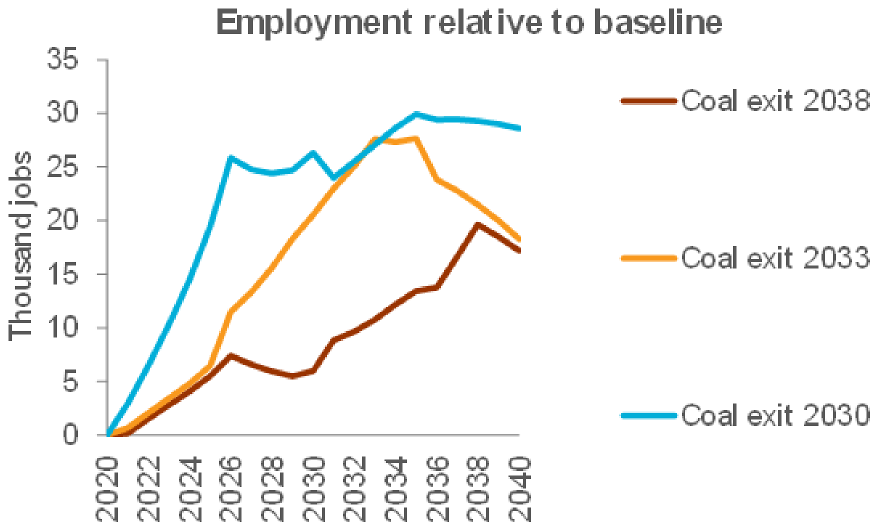
2018 EMPLOYMENT DISTRIBUTION BY SECTOR

	Country total	Biomass	Wind	Biofuels	Heat pumps	PV	Hydro	Biogas	Waste	Solar thermal	Geothermal
Czechia	39 100	16 700	1 300	8 000	5 300	1 900	1 300	4 100	200	200	<100

Source: EurObserv’er

[369] Macroeconomic impacts of early coal phase out in the Czech Republic, WiseEuropa and AMO, upcoming 2021.

Figure 50: Expected impacts of three Czech coal phase-out scenarios on employment (incl. energy bill, high ETS, 2021)



Source: WiseEuropa (upcoming)

5.2.3 Regional energy policy

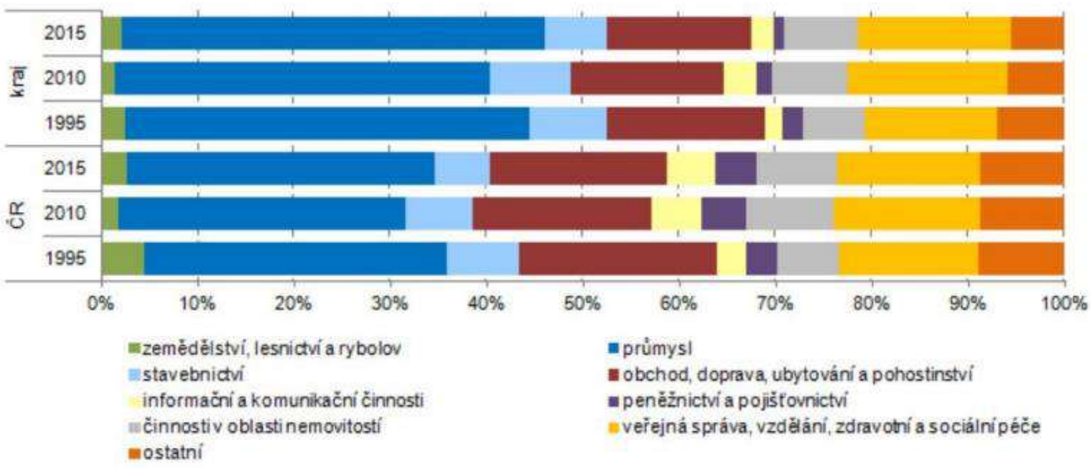
Ústecký krajadopted its updated territorial energy policy in 2020, a complex document envisaging relevant developments up to 2045.[370] The document provides a detailed sectoral assessment of energy production and consumption, but the angle remains rather narrow. With regard to environmental aspects, greater focus is on local pollution by particulate matter than on GHG emissions, whose balance is actually missing altogether. The policy presumes an increasing share of RES in electricity production, identifying particular potential in PV (incl. on brownfields) and biomass plants but also observing that the support for such sources is beyond the competences of regional authorities. As for the potential for new wind installations, which is promising from a technical point of view (tens of MWe), it recalls the barriers that stand in the way including limits set in regional development plans and from ecosystem and species protection. The indicative regional target for RES & energy usage of waste share on primary energy consumption is set at 11% by 2044, showing an extremely limited level of ambition clearly not in line with global, EU and national climate mitigation targets. A specific regional target for GHG emissions reduction is missing.

[370] Territorial Energy Policy, Ústecký kraj, https://www.kr-ustecky.cz/assets/File.ashx?id_org=450018&id_dokumenty=1748687

The updated territorial energy policy of Karlovarský kraj was adopted in 2018, with an outlook to 2042.[371] It follows the same logic as the aforementioned document from Ústí nad Labem with similarly vague targets relevant for climate mitigation. However, it provides a more concrete assessment of RES development in the region, setting the technical and economically viable potential for wind energy, while taking into account the various barriers, at 119 MW (leading to up to 2.5-fold increase in annual power production as compared to baseline). Technical potential of PV at residential, public and commercial buildings has been calculated at 125.3 MW. A summary of tools available for the implementation of a broad set of targets set in the policy offers a useful insight into what regional authorities are entitled (and expected) to do. These include the adoption of territorial development plans, implementation of legislation and strategies in the area of air quality, pollution and waste management, EIA, advisory in the context of available grants or subsidies, collaboration with local NGOs as well as initiating thematic education in schools.

In sum, it appears that the valid territorial energy policies are largely technical documents that neither provide a backbone for an ambitious energy transition, including a swift and scaled deployment of RES, nor are they strongly concerned with GHG emissions and climate mitigation targets. Given their limited competences in the topic, regional authorities are not likely to become key initiators of change.

Figure 51: Value added (btto) per sector: Ústecký kraj vs. CZ

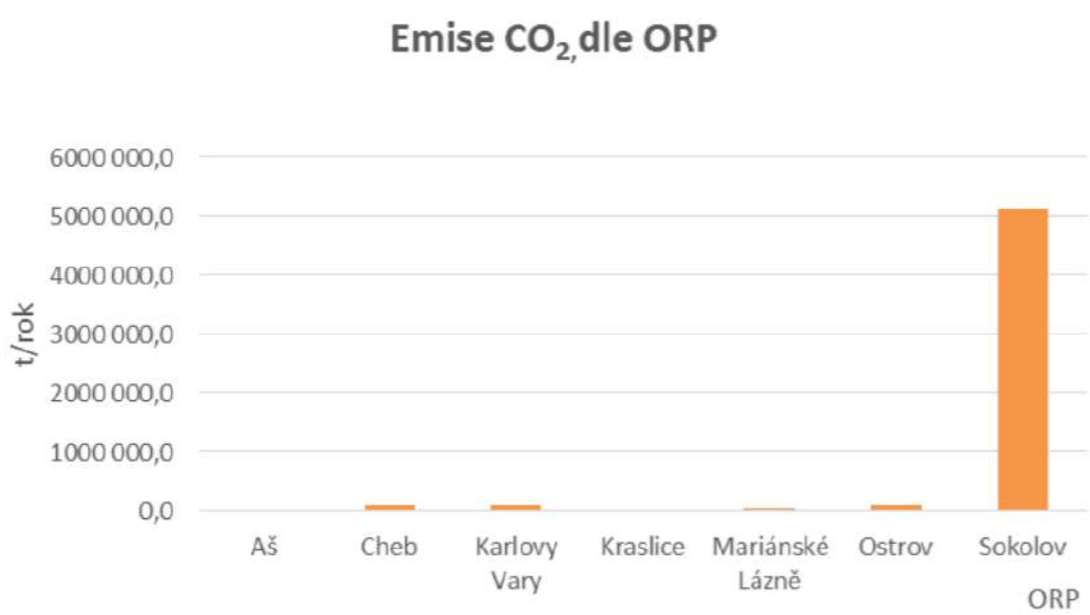


Source: Territorial Energy Policy of Ústecký kraj, data retrieved from CZSO

[371] Territorial Energy Policy, Karlovarský kraj, https://www.kr-karlovarsky.cz/samosprava/dokumenty/Documents/koncepce/OZZ_uzemne_energeticka_koncepce.pdf

Green: agriculture, forestry and fisheries; dark blue: industry; light blue: construction; brown: trade, transport, hospitality; light yellow: information and communications; purple: financial and insurance services; grey: real estate; light orange: public administration, healthcare and social services; dark orange: other

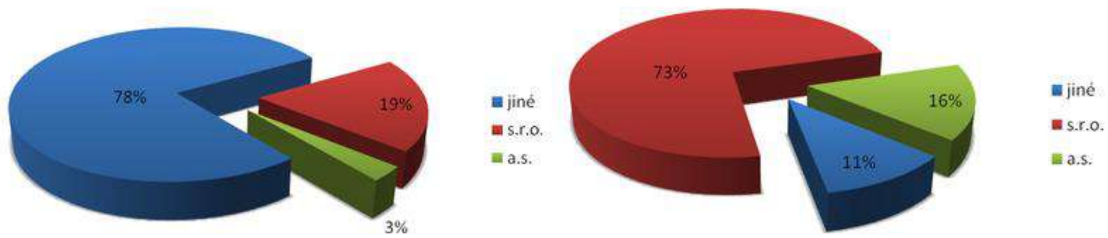
Figure 52: Annual CO2 emissions per district of Karlovarský kraj (2015)



Source: Territorial Energy Policy of Karlovarský kraj

Figure 53: Photovoltaic installation by legal status of licence holders (2013)

1/ Share of individual photovoltaic installations by legal status of licence holders (blue: other, red: s.r.o., green: a.s.); 2/ Share of installed capacity by legal status of licence holders



Graf č. 6 – Procentuální podíl počtu FVE instalací k 8. 5. 2013, dle právní subjektivity držitelů licencí. Zdroj dat: ERÚ

Graf č. 7 – Procentuální podíl instalovaného výkonu FVE k 8. 5. 2013, dle právní subjektivity držitelů licencí. Zdroj dat: ERÚ

5.3 Analysis and conclusion

The deployment of RES in the Northwest region had stagnated in the past 8 years following the quick rise between 2008 and 2012, similarly to the national trend of RES deployment. The latest events, however, indicate that this might change in the near future. The launching of the Modernisation Fund with at least €6bn of funding available for RES development and decarbonisation is a major factor: in the preliminary call for the ModFund, over 8 000 projects registered for the program „New renewable energy sources in energy industry" (RES+) for a sum of €20bn - 78% of the sum of all registered projects.[372] Right now, there is €40m allocated for the photovoltaic projects under 1 MWp and €140m for projects over 1 MWp in the official call.[373] At the same time, the price of solar photovoltaics and wind energy is rapidly decreasing, which is also a major driver for RES deployment.

Geographic factors might hinder the RES deployment at some point due to the limited suitable area for their installation (especially for wind farms), but currently there is still a huge potential to be used. The public is very favorable towards RES deployment in general, however, local installation, especially in the case of wind power plants, may be an issue.[374] Here, the economic impacts might be a turning point for the local approach - with the right legislation, an increase in community energy projects and local production could bring attractive economic benefits.

Also, the rapid rise of allowance price in the EU ETS system accelerates t decarbonisation process, and energy industries are launching their projects in order to stay in the game. For example, Sokolovská uhelná, a major electricity producer in the Karlovarský region, is planning huge photovoltaic projects. The same goes for ČEZ, a public company operating in the CEE.

Notably, these incentives come from the EU level and there is a lack of initiative on the national level. The national decision on coal phase-out was postponed until the end of the year 2021, and the state support for the new RES is insignificant.[375] There are multiple legislative barriers for RES installation, specifically for the deployment of agrivoltaics, accumulation of energy, or roof installations. The regulatory barriers also extend to the installation of new sources, especially wind farms, that might take several years to set up. With the general election coming up in the autumn of 2021, a new legislative cycle will have to

[372] Ministry of the Environment, https://www.mzp.cz/cz/news_20210305-Cesko-je-na-zmenu-energetiky-pripravene-ukazal-obrovsky-zajem-o-Modernizacni-fond-Zacatkem-dubna-odstartuji-prvni-ostre-vyzvy and https://www.mzp.cz/C1257458002F0DC7/cz/news_20210305-Cesko-je-na-zmenu-energetiky-pripravene-ukazal-obrovsky-zajem-o-Modernizacni-fond-Zacatkem-dubna-odstartuji-prvni-ostre-vyzvy/$FILE/predregistracni_vyzva_priloha.pdf

[373] Czech State Environmental Fund, https://www.sfzp.cz/dotace-a-pujcky/modernizacni-fond/vyzvy/

[374] Tomáš Chabada and Jan Krajhanzl, Hnutí DUHA - Friends of the Earth CZ, https://www.hnutiduha.cz/sites/default/files/publikace/2021/01/verejne_mineni_o_oze_2020.pdf

[375] Resolution of the government of the Czech republic of 24 May 2021 No. 481, https://apps.odok.cz/attachment/-/down/IHOAC3DB9Q9K

commence before any reasonable transposition of substantive parts of EU climate/energy legislation can be expected, including RED II.

So far, the socio-economic impacts in the Northwest region have been limited or remain unknown due to the lack of data (see chapters 2.2.3 and 2.3). There is a limited number of enterprises operating in the RES value chain. The RES installations are mostly privately owned, although they bring economic benefits to the municipalities in their proximity. In the future, it is expected thatRES deployment could create as many as 2 500 jobs in the Northwest region. The future economic impacts will be determined by the approach of national as well as regional governments: an active support of the industry going hand-in-hand with the elimination of regulatory barriers might increase the positive economic impacts.

As for the factors most important in determining the socio-economic impacts of RES deployment in the future, the distribution of the Modernisation Fund will play a key role. So far, for the community energy projects, which have the highest potential of maximising the local economic benefits of RES deployment due to being locally owned by households/municipalities/small businesses, the allocation accounts for a mere 1.5% share of the fund (i.e. less than the support allocated for the modernization of public lighting systems). In addition to that, the installation of new RES shall be supported by 38.7% of the fund - 60% of which is designated for the ETS facilities.[376] A further 13.3% of the Fund is allocated to improving energy efficiency and reducing GHG emissions in the ETS facilities and 26% share is dedicated to the modernization of district heating systems (which are generally the ETS facilities) - in this program, coal regions, including the Northwest region, obtained a special allocation given their high utilization of district heating. To sum up, the ETS facilities are the main recipients of support with a 62.5% allocation.[377] The support itself is an economic benefit and it will importantly determine the structure of ownership of new RES installations.

The structure of ownership will then be influenced by the (lack of) political will and capability to eliminate the legislative barriers for RES development, such as legislative barriers for energy storage, community energy or household photovoltaic installations. Enabling a regulatory environment for community projects, especially with participation of municipalities, could help create local resilient and sustainable energy systems.

[376] Czech State Environmental Fund, https://www.sfzp.cz/dokumenty/detail/?id=2344
[377] Czech State Environmental Fund, https://www.sfzp.cz/dotace-a-pujcky/modernizacni-fond/programy/

Furthermore, the extent and character of RES support together with the support of innovation and research will determine the creation of synergies between the local economies and RES deployment. The same RES deployment can have a very different economic impact, depending on the condition of local industry. A functional support has the potential to strengthen the role of local enterprises in the RES value chain. In this sense, stakeholders identify the stability of the economic environment as a key variable in the creation of viable economic models.

In the Northwest specifically, other funds to support the decarbonisation are available and might also bring a stronger RES position in the local economy. For instance, the Just Transition Fund supports the development of clean energy structures where the Modernisation Fund is not sufficient or optimal for support. In the Ústecký region, Green Energy Technologies Centre of UJEP should be supported from the JTF finances as its goal is to expand the existing educational activities and scientific research capacity to educate experts and create a research environment to deal with the implementation of energy transformation in the region.[378] On top of that, support for the energy transition and RES deployment is envisaged from the National Recovery Plan (RRF) and several Operational Programmes.

Finally, RES deployment and its impact will also be conditioned by the approach of key stakeholders: first, these are large energy/utility companies and their willingness to transition and create sustainable projects for revitalisation of the former lignite mines and their utilization for RES deployment or energy storage. Second, the regional governments might develop a leadership role and create the much-needed regional policies (bridge the national and municipal level, ensure support for local projects, create ambitious strategies etc.). Third, the approach of small investors including municipalities and their willingness to initiate the RES installment will be vital.

[378] University of J E Purkyně, Ústí nad Labem, https://www.ujep.cz/cs/29946/ujep-chce-vyznamne-prispet-k-transformaci-usteckeho-kraje-z-uhelneho-na-kreativni

Key conclusions:

- RES deployment has been stagnating for the past 8 years both in the Czech Republic and the Northwest region specifically. The ambition on the national level regarding new RES installations (as set in the NECP and related strategies) is low, however, external incentives (soaring price of EU ETS allowances, Modernization Fund, falling prices of new RES installations) will drive a new wave of RES deployment. The government should enable a smooth transition by removing regulatory barriers for RES deployment and related services, creating a stable environment in the RES sector, and setting ambitious goals and meaningful support for RES, including for local ownership. This will also improve the position of local enterprises in the RES value chain.

- The character of the support together with the legislative environment will determine the main economic beneficiaries of the transition. So far, the rules for distribution of the Modernisation Fund allocate over 60% of the finances to the EU ETS facilities (primarily big coal and heavy industry enterprises), which might hinder a widespread distribution of economic benefits. Apart from channeling the finances more evenly, it is also advisable to eliminate the regulatory barriers for rooftop installations or community energy projects which obstruct the development of smaller RES projects.

- RES deployment in the Northwest region will bring around 2 300 new jobs according to the Joint Research Center of the European Commission. Given that there are around 10 000 jobs in the Northwest coal industry, it is necessary to create other viable economic alternatives outside the energy sector in order to compensate for the expected job losses.

5.4 Annex

Complete table compiled by authors on installed capacity & electricity production in the Northwest region & CZ

5.5 Methodological notes

In order to gain the needed data and information, several relevant stakeholders were addressed (apart from the research conducted through the analysis of available data) with the following questions:

- In what condition is the new RES deployment in the Northwest region (ÚK, KVK)? Are there any synergies of local industries with renewable energy companies/industries in the region? Are there any enterprises that are part of the RES value chain (manufacturing, design, construction etc.)?

- Are the RES facilities owned locally or by external subjects? If they are owned externally, do they provide any benefits (taxes revenues, bonuses etc., similarly to the benefits municipalities close to coal infrastructure get from the coal business) to local communities (municipalities and citizens)?

- In the Northwest, is there a labour force with the relevant skills that could be employed in the local RES deployment and RES value chain. Would a lack of relevant skills or training be a barrier to the industry if it did want to expand regionally?

The responses of approached stakeholders and the individual research indicate the lack of relevant data to assess the current socio-economic impacts of RES deployment in the Northwest region specifically, and the lack of the detailed data in general. The following stakeholders were identified and addressed through mail or personal communication, with the following responses.

- Chamber of RES, response: data not available, provided a publication on the RES socio-economic impacts in general

- Czech Energy Regulatory Office, response: data are not available, provided detailed data on the RES installed capacity between 2010 and 2020

- Guild of Accumulation and Photovoltaics, response: the data not available

- Czech Biomass Association, without response

- Czech Statistical Office, response: provided a general publication on RES and GHG emissions

- Modern Energy Union, response: data not available

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