GLOBAL INDICATOR OF CLIMATE CHANGE ADAPTATION IN CATALONIA

GIA 2018

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Catalan Office for Climate Change

Author

Catalan Office for Climate Change (OCCC)

Cover images:

Photo 1: Sant Pol de Mar

Photo 2: Aerial view of A-26 dual carriageway (Source: Government of Catalonia)

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TABLE OF CONTENTS

1. INTRODUCTION

The Catalan Strategy for Adapting to Climate Change 2013-2020 (ESCACC), written by the Catalan Office for Climate Change (OCCC) and approved by the Government of Catalonia in November 2012, represented a step forward in becoming less vulnerable to the impacts of climate change. Among the measures that the ESCACC determines to reduce the vulnerability of the region and of the socioeconomic systems, a monitoring and indicator system was established on the measures to adapt to climate change impacts with the aim of evaluating whether or not they have developed favourably.

This is the reason why the OCCC drafted the document Global Indicator of Climate Change Adaptation in Catalonia in November 2014 where, for the first time, a global indicator of adaptation was established so that the evolution of Catalonia's adaptive capacity to the impacts of climate change could be monitored. The conclusions drawn in this document include: "*These indicators should be reviewed every five or ten years based on new information available (in order to include more aspects in the synthetic indicator)*". Now, it is worth noting that at the well-attended conference, held on 6 February 2015 at the Colet Museum in Barcelona, for the presentation and debate on all the work done on the indicator, a wide range of improvement suggestions were made, such as the creation of sectorial indicators of adaptation.

Since then, four significant milestones have also been reached in Catalonia on the public adaptation policy. Arranged from earliest to latest, they are:

1. The publication of the Third Report on Climate Change in Catalonia in September 2016.
2. The publication of the document Monitoring and Assessment of the Catalan Strategy for Adapting to Climate Change 2013-2020 (ESCACC) to report on the status of adaptation to the impacts of climate change in Catalonia or, in other words, the degree of implementation of the ESCACC. This document was approved by the Interdepartmental Commission on Climate Change (CICC) in its session number 7 of 13 February 2017. Later, on 7 March, the Government of Catalonia was notified of this approval.
3. The publication in the Official Gazette of the Government of Catalonia (DOGC) of Law 16/2017 of 1 August, on Climate Change, approved by the Parliament of Catalonia on 27 July 2017.
4. The completion of the project Life MEDACC, Adapting the Mediterranean to Climate Change (June 2013-June 2018), coordinated by the OCCC, whose noteworthy results include the writing of a manual for applying adaptation assessment indicators to agriculture, water management and forestry management in the three case study basins of the project (Muga, Segre and Ter).

These milestones have entailed increased knowledge on adaptation in Catalonia, the verification that the impacts of climate change are a reality and the regulatory integration of adaptation in sectorial public policies. At the OCCC, it is believed that these items—along with progress in several adaptation tools at municipal and supra-municipal levels developed by district councils, the metropolitan area and the provincial councils—were complete and valuable enough to move on to reviewing the Global Indicator of Adaptation.

Consequently, over the course of 2018, the OCCC undertook a twofold task:

- Redefine the global indicator of adaptation to the impacts of climate change using the aforesaid milestones and, in parallel, obtain sectorial sub-indicators of adaptation: the redefinition of the indicator entailed increasing the number of indicators from 29 to 42
- Extension of the time series of the indicators, so that the values of the indicators analysed would correspond to a timeline ending in 2014[1]

[1] In the previous study, the time series finished in 2011.

2. METHODOLOGY

Starting with an initial proposal of more than 50 indicators, those that did not present enough variability are discarded, either because the information is not annual, because the indicator is only qualitative or because there are not enough observations. The table below lists the indicators selected by sector, where the 13 new indicators since the 2014 study are highlighted in yellow. There has been a significant increase in indicators for the agriculture and forestry sectors, an indicator included on biodiversity, on logistics and insurance in mobility and transport, and on energy certification of housing in urban planning.

Table 1: Name and definition of indicators included in the analysis

Sector and code	**Definition**
Agriculture and livestock	
pa1	Ratio of forest versus agricultural area (dimensionless)
pa2	Dryland agricultural area compared to total farming area (%)
pa3	Area of organic production (ha)
pa4	Organic livestock farms (no.)
pa5	Percentage of farms with livestock insensitive to climate change (%)
Biodiversity	
pd1	Indicator of climate connectivity in bird populations
Water management	
pga1	Household use in decline (l/inhab./day): Catalonia
pga2	Household use in decline (l/inhab./day): Metropolitan Area of Barcelona
Forest management	
pgf1	Area with forest management instrument in force (PTGMF/PSGF) on private properties (ha)
pgf2	Area of cutting carried out on private properties managed under PTGMF/PSGF (ha)
pgf3	Timber harvesting for firewood and biomass (t)
pgf4	Area burned per fire (ha/fire)
pgf5	Heads of sheep and goats (no.)
pgf6	Cork production (t)
pgf7	Primary energy consumption from forests and agriculture (ktoe)
Industry, services and trade	
pi1	Water consumption of the industrial and service sectors (m^3)
pi2	Final energy consumption of the industrial and service sectors (ktoe)

Sector and code	Definition
pi3	GHG emissions from the industrial sector (thousands of t of CO_{2eq})
pi4	Imports of oil extraction and refining, coal (millions of euros)
Mobility and transport infrastructure	
pt1	Bus and coach transport: urban and interurban (millions of journeys)
pt2	Rail transport: Rodalies (commuter), Regionals, Avant, FGC, tram and metro (millions of journeys)
pt3	Share of rail freight transport (%)
pt4	Energy consumed by transport (ktoe)
pt5	GHG emissions from transport (kt CO_{2eq})
pt6	Empty road operations (%)
pt7	Electricity and renewable energy versus total energy consumed by transport (%)
pt8	Insurance policies for extraordinary risks of civil engineering: roads, motorways, bridges, ports, dams… (no.)
Health	
ps1	At-risk-of-poverty rate: after social transfers (%)
ps2	Green area per inhabitant in the city of Barcelona (m^2/inhabitant)
ps3	Catalan Air Quality Index ICQA (% Satisfactory + Excellent)
ps4	Maximum value of ozone immissions ($\mu g/m^3$)
Energy sector	
pe1	Consumption of electricity obtained from renewable sources (%)
pe2	Primary energy intensity: Energy content of GDP (toe/€million in 2010)
pe3	Primary energy consumption per capita (toe/person)
pe4	Percentage of renewable energies in primary energy production (%)
Tourism	
ptu1	Total overnight stays in hotel establishments (% third quarter/total)
ptu2	Foreign business travellers in relation to total foreign tourists (%)
ptu3	Snow cannons at ski resorts (no.)
Urban planning and housing [2]	
pu1	Volume of water billed in the household sector (thousands of m^3)
pu2	Final energy consumption of the household sector (ktoe)
pu3	GHG emissions from the residential sector (thousands of t of CO_{2eq})
pu4	A and B certified new builds in relation to total energy certified new builds

Details on the 42 indicators used can be viewed in Appendix 1. The information has been structured into individual data sheets with the following sections:

[2] The number is the order assigned to each indicator using the list of pre-selected indicators.

1. **Sector indicator –**name of the indicator.
2. **Methodology –** explanation of the methodology used by the information source to obtain the numerical data.
3. **Data –** numerical values of the indicator by year (table).
4. **Source –**information source.
5. **Graphic representation –** of the data.
6. **Desired trend of the adaptation –** description of the direction the indicator must take in order to achieve a more effective adaptation, i.e. whether it should increase or decrease. This is a way of explaining how to interpret the indicator and its evolution.
7. **Relevance of the indicator –** justification of why this indicator is useful. It also explains how the data should be interpreted.

Like the 2014 study, data were analysed by analysing the principal components, which is one of the techniques included in the factorial analysis family. The objective of factorial analysis is to analyse the structure of interrelations between a number of variables (indicators, in our case) and to define common sizes, this producing a lower dimensional space. In particular, the principal component analysis reduces the dimensionality of the data matrix in order to obtain a lower number of new variables and principal components with these characteristics:

- The principal components are linear combinations of the original variables.
- The principal components are not correlated with each other.
- The number of principal components must be small (so that the analysis is effective) and sufficient (to absorb most of the information on the original variables). There are several criteria to determine the number of factors to incorporate. In particular, one of the most widely used criteria is to keep factors that have a value greater than one or factors that, accrued, explain more than 70% of the total variance.

Thus, the first component (or factor) is calculated as a linear combination of the original variables that retains the maximum amount of total variance. In calculating the second component (or factor), the same procedure is performed (linear combination of the original variables to retain the maximum amount of total variance of the part not included in the first). And so on consecutively. Interpreting the components (or factors) is easy in theory, but it tends to be quite difficult in practice. Each variable (indicator) has a relative contribution to each factor. This contribution expresses the correlation between this variable and the factor. A high relative contribution of the variable indicates that there is a strong correlation between this variable and the factor. In other words, it means that this variable is important for the interpretation of the factor. This contribution can be positive or negative, depending on whether that variable increases or reduces the value of the factor.

In order to standardize the information, the values of all the variables are converted to values between 0 and 1. Using the statistical program Stata, two factors are obtained, both with values greater than 1 (see next chapter). In the cases in which the correlation of the original indicators with each of the factors is contrary to the desired trend, the sign of this correlation has been changed: if the desired trend is positive, the correlation result of the indicator value has to be positive. Since the value used for the indicator is always positive because it is normalised between 0 and 1, the key lies in the correlation:

- If the correlation is positive, the result is moving in the desired direction; otherwise this product must be multiplied by -1.
- If the desired trend is negative, it must be multiplied by -1 if the correlation is positive.

Table 2 summarises the contribution of each indicator to each of the two factors:

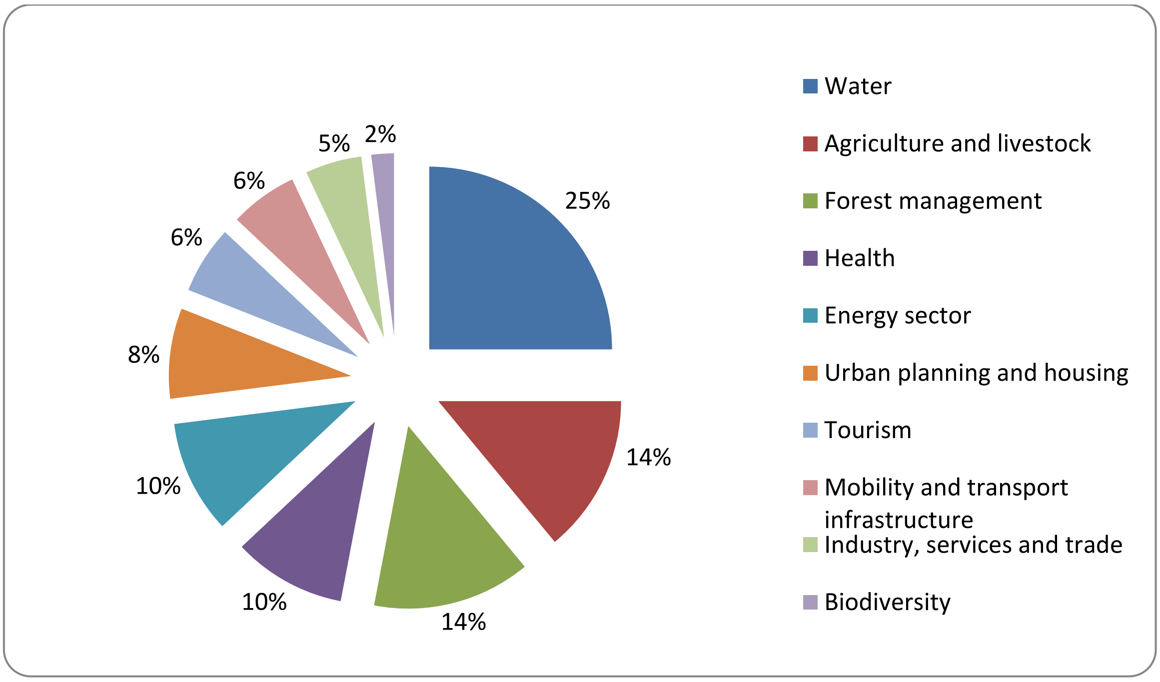
Table 2: Contribution of each indicator to factors 1 and 2

Indicator	f1	f2
pa1	0.8161	-0.5274
pa2	-0.9181	0.3441
pa3	0.976	0.1322
pa4	0.9632	0.1904
pa5	0.573	0.2844
pd1	-0.2478	-0.1847
pga1	-0.9796	0.0745
pga2	-0.9445	0.3096
pgf1	0.9713	-0.149
pgf2	-0.2263	-0.3785
pgf3	0.7778	0.5078
pgf4	0.1349	0.3723
pgf5	-0.9604	0.2338
pgf6	0.5728	0.2701
pgf7	0.9473	0.2557
pi1	-0.9727	0.0464
pi2	-0.9713	0.0546
pi3	-0.941	0.2347
pi4	0.5478	-0.3354
pt1	-0.3544	-0.6227
pt2	0.3575	-0.712
pt3	0.3937	0.3119
pt4	-0.8809	-0.3386
pt5	-0.927	-0.1632
pt6	-0.9158	-0.2765
pt7	0.7474	-0.2551
pt8	0.614	0.6038
ps1	0.7572	0.1713
ps2	0.9574	0.1127
ps3	0.8329	0.2824
ps4	-0.7014	0.1675
pe1	0.95	0.0605
pe2	-0.7842	0.3764
pe3	-0.9581	0.0877

Indicator	f1	f2
pe4	0.9209	-0.1725
ptu1	0.3202	-0.1246
ptu2	-0.7497	0.5424
ptu3	0.9325	-0.3419
pu1	-0.9439	-0.0207
pu2	-0.7008	-0.5051
pu3	-0.6371	-0.4629
pu4	0.7267	-0.2955

To avoid overweighting the sectors with a greater number of indicators, the weights of each of the 10 sectors are assigned according to the degree of exposure and sensitivity to the impacts of climate change, based on the results of the ESCACC monitoring and assessment work. Thus, Figure 1 shows the weighting for each of the sectors analysed:

Figure 1: Weighting by sector



The weighted value is then multiplied by the indicator's contribution to the factor and by the value (between 0 and 1, or normalised) of the indicator during the selected time period (years). By performing this calculation for both factors and for the years 2005, 2011 and 2014 (the last year for which there are values for each indicator), the results of the indicators are obtained.

3. RESULTS

3.1. Significance of the sectors

In the 2014 study, two factors were obtained that explained 100% of the variability of the original information. The first factor explained 61% of the variability and the second factor 39%. The significance of the two factors was interpreted by: the first factor evaluated the use of resources—basically water and energy—while the second factor evaluated environmental quality—primarily atmospheric emissions.

In the present 2018 study, both factors explain 73%[3] of the variability of the original information. The first factor explains 62% of the variability and the second factor 11%. Proceeding in the same way as in 2014 for determining the significance of the factors, the indicators that have a high contribution to each of the factors have been highlighted: the values less than -0.8 or greater than 0.8 are considered to have a high contribution (highlighted in blue). With regard to factor 2, it is noted that the correlation of the indicators is much weaker, with none greater than 0.8 in absolute value and only 3 with a value less than -0.6 or greater than 0.6 (highlighted in orange).

Table 3: Relative contribution of each indicator

Indicator	f1	f2
pa1	0.8161	-0.5274
pa2	-0.9181	0.3441
pa3	0.976	0.1322
pa4	0.9632	0.1904
pa5	0.573	0.2844
pd1	-0.2478	-0.1847
pga1	-0.9796	0.0745
pga2	-0.9445	0.3096
pgf1	0.9713	-0.149
pgf2	-0.2263	-0.3785
pgf3	0.7778	0.5078
pgf4	0.1349	0.3723
pgf5	-0.9604	0.2338
pgf6	0.5728	0.2701
pgf7	0.9473	*0.2557*

[3] Even though a lower percentage of variance is accounted for in GIA 2018 than in GIA 2014, it is worth noting that in 2018 there is much more variability, as 13 more indicators than in 2014 were studied, as well as including an indicator in a new sector (biodiversity). Furthermore, there are more standardised variance units in GIA 2018 (34 in 2018 compared to 12 in 2014). Consequently, it is believed that GIA 2018 is more robust (indeed, it explains more than double the original information in absolute terms).

Indicator	f1	f2
pi1	-0.9727	*0.0464*
pi2	-0.9713	*0.0546*
pi3	-0.941	*0.2347*
pi4	0.5478	-0.3354
pt1	-0.3544	-0.6227
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pu4	0.7267	-0.2955

Of the 22 indicators that correlate most with factor 1, eight are related to energy consumption, seven with land consumption/use and five with water consumption. In other words, **factor 1 is determined by eco-efficiency, understood as how we use resources (water, energy and land)**. In the 2014 study, factor 1 was also determined by the use of resources, even though land consumption/uses were not included.

3.2. Values of the Global Indicator of Adaptation

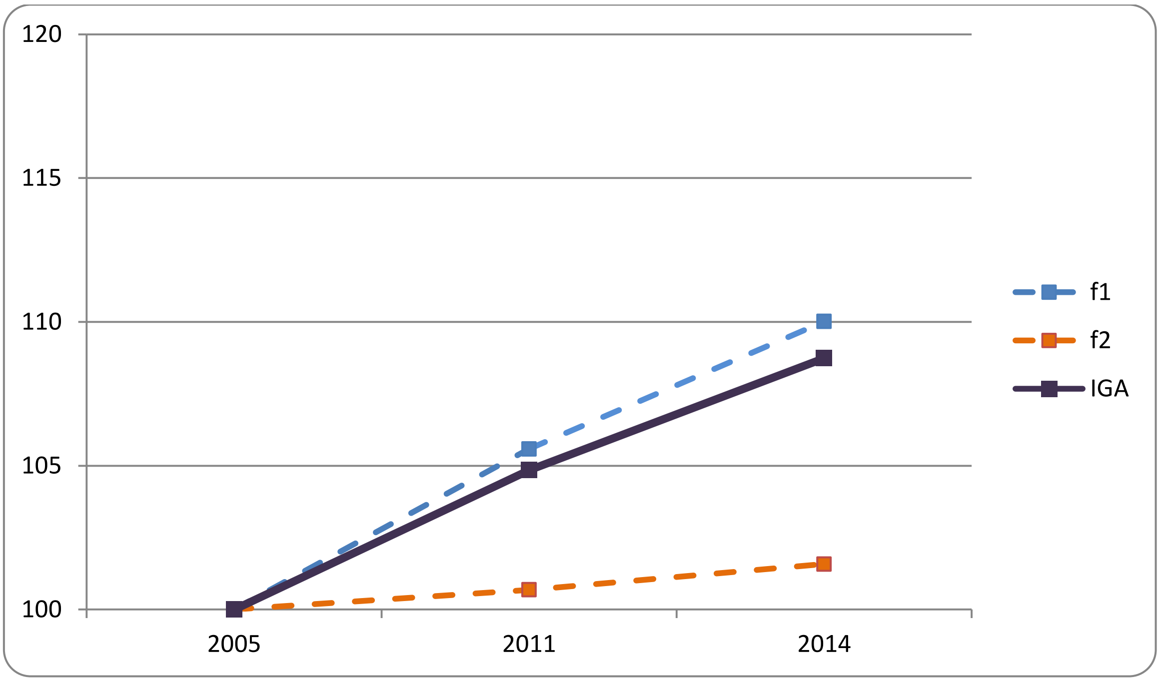
While in 2014 the results of the global indicator of adaptation (GIA) were expressed in values between 0 and 1, the present 2018 study expresses them out of 100. This is because the most important aspect an indicator tells us is not its value in a specific year, but its evolution over time. Take, for example, the Consumer Price Index (CPI): almost no-one remembers its value last year, but most people know its variation, or whether it has increased or—rarely—

decreased. That is why the GIA results are expressed in accordance with Table 4 and Figure 2.

Table 4: Values of the Global Indicator of Adaptation (GIA) for the years 2005, 2011 and 2014 (base value 100)

2005			2011			2014		
F1	**F2**	**GIA**	**F1**	**F2**	**GIA**	**F1**	**F2**	**GIA**
100	100	100	105.584	100.681	104.845	110.010	101.579	108.740

Figure 2: Evolution of the Global Indicator of Adaptation (GIA)



As can be seen, both factors show a rising trend (2005, base 100). **For factor 1, this growth is considerable**, while growth is much less for factor 2. Bearing in mind the evolution of the values of both factors, **the GIA grew 8.74% during the 2005-2014 period**.

The same methodology was applied in the GIA defined in 2014 to be able to compare it to the 2018 GIA, and it can be seen that most of the differences in the evolution of the values can be explained by including the 13 new indicators (see Appendix 2 for more details).

3.3. Sectorial sub-indicators of adaptation

The same methodology used for the global indicator was applied—except with regard to weighting—in the nine sectorial sub-indicators.[4] Results point to a greater dispersion with regard to those obtained with the Global Indicator of Adaptation, given that for the GIA the different behaviours between the sectors are balanced out.

It is worth noting that the results obtained with the sectorial sub-indicators are more dependent on the distorting effect of the economic crisis, due to the number of sub-indicators used for each sector and the need to have longer time series in order to obtain more accurate trends.

[4] Given that biodiversity only has a single indicator, it has been excluded from the results.

4. CONCLUSIONS

- The revision of the Global Indicator of Adaptation for 2018 provides us with a much richer and more diverse indicator because it integrates 42 sectorial indicators, 13 more than in the 2014 study.
- The expression of the GIA out of 100 (reference year, 2005) allows a moderately positive evolution to be observed in adapting to the impacts of climate change over the course of the last 10 years: the GIA grew 8.74% during the 2005-2014 period, in line with the start and deployment of adaptation measures and actions throughout Catalonia.
- The wealth and diversity of this indicator also translates to the weight contribution of the indicators with regard to the factors that comprise them. Thus, factor 1, determined by eco-efficiency defined as the use made of resources (water, energy and land) explains a full 62% of the variability and, further, the correlation values of the indicators are robust. However, in factor 2 the correlation values are much weaker and only explain 11% of the variability.
- It is factor 1 that points to a clearly positive evolution, which is a major finding. In the context of our country, the adaptation to the impacts of climate change must be based on preventing rural depopulation and the abandonment of crops and pastures, preventing the loss of extensive livestock farming, lack of forest management and the waste of water and energy.
- The GIA was progressively constructed as the knowledge and actions for adapting to climate change were expanded and developed. Therefore, each update of the GIA makes the indicator richer, more diverse and more robust than the previous version.
- A periodic revision of the Global Indicator of Adaptation must be performed every five to ten years by updating the historic series and adding any new information available, for example, the introduction of more biodiversity indicators or new sectors like fishing. And, in parallel, by further refining the methodology to determine sectorial sub-indicators of adaptation.
- The next update will determine the degree to which the period analysed (2005-2014)—beset by a deep economic crisis—has ended up distorting the evolution of the indicators most closely linked to emissions in the timeline studied in this project.

5. APPENDICES

5.1. Appendix 1: List and data sheets of the 42 indicators

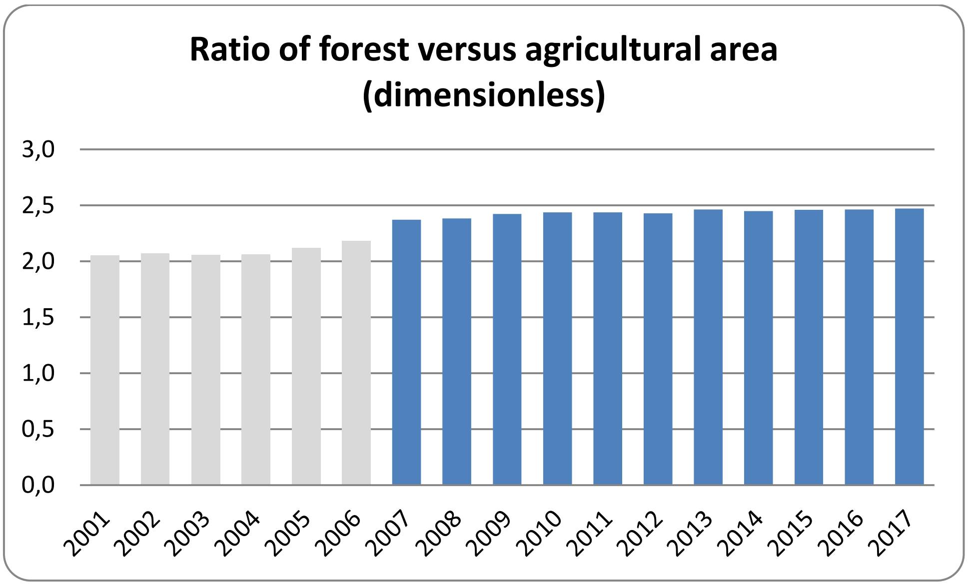
Ratio of forest versus agricultural area (dimensionless) – pa1

Methodology: The ratio is established between the total types of forestry areas (forest, scrubland and others) and the total agricultural area (dryland and irrigated) in Catalonia.

	Forest area (ha)			Crops (ha)		
	Forests	Scrubland	Others	Dryland	Irrigated	**pa1**
2001	912,818	478,136	511,902	661,200	266,112	**2.1**
2002	914,195	476,018	509,933	658,951	259,850	**2.1**
2003	915,046	476,763	503,839	663,877	258,113	**2.1**
2004	937,784	472,514	490,208	660,149	261,768	**2.1**
2005	995,121	495,612	454,472	655,961	261,071	**2.1**
2006	1,052,985	507,632	419,969	644,451	263,141	**2.2**
2007	1,231,006	648,144	158,887	597,537	261,207	**2.4**
2008	1,246,866	650,611	146,869	595,398	262,253	**2.4**
2009	1,251,872	647,450	151,258	586,014	260,595	**2.4**
2010	1,251,832	650,319	149,683	579,440	262,402	**2.4**
2011	1,267,757	651,137	129,553	577,290	263,013	**2.4**
2012	1,269,357	656,267	124,285	579,355	264,308	**2.4**
2013	1,137,800	698,403	224,577	570,876	265,860	**2.5**
2014	1,121,387	714,772	217,308	570,830	267,280	**2.5**
2015	1,118,963	716,273	219,285	568,917	265,834	**2.5**
2016	1,119,486	715,777	219,727	563,946	270,213	**2.5**
2017	1,119,161	715,352	220,261	562,319	268,662	**2.5**

Note: Starting in 2007 the data are not strictly comparable to those from previous years due to the introduction of methodological improvements.

Source: Statistical Institute of Catalonia (IDESCAT). Data published in the years 2001-2006 (highlighted) are not comparable due to differences in the methodology used.



Note: Starting in 2007 the data are not strictly comparable to those from previous years due to the introduction of methodological improvements.

Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: This ratio can be considered an indirect indicator of adaptation to climate change with respect to water consumption. An increase in forest area would mean increased water consumption and, thus, a decrease in the water resources available downstream from the headland and riverbank forest.

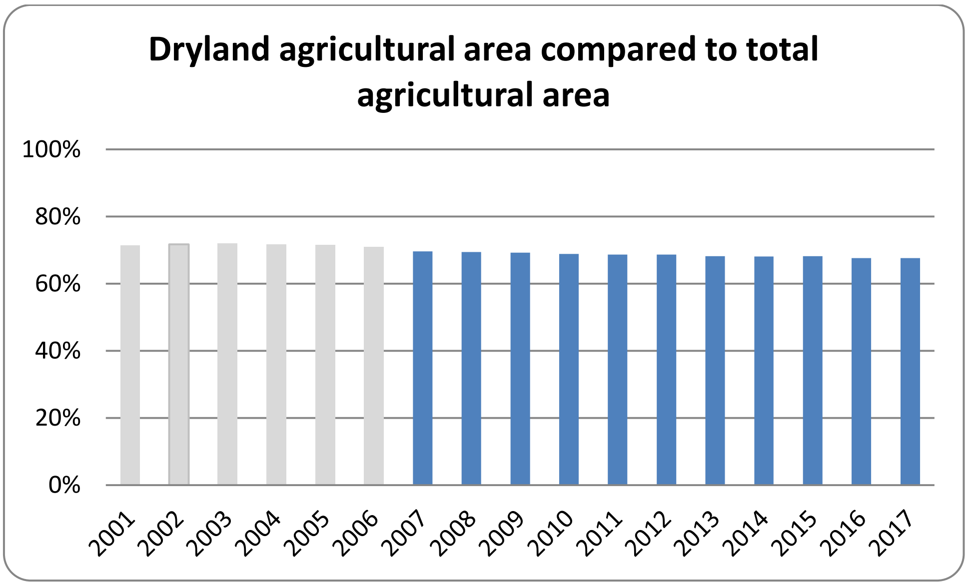
Dryland agricultural area compared to total agricultural area (%) – pa2

Methodology: The ratio between dryland area and total utilised agricultural area (UAA).

	Dryland (ha)	Total (ha)	pa2
2001	661,200	927,312	**71.3%**
2002	658,951	918,801	**71.7%**
2003	663,877	921,990	**72.0%**
2004	660,149	921,917	**71.6%**
2005	655,961	917,032	**71.5%**
2006	644,451	907,592	**71.0%**
2007	597,537	858,744	**69.6%**
2008	595,398	857,651	**69.4%**
2009	586,014	846,609	**69.2%**
2010	579,440	841,842	**68.8%**
2011	577,290	840,303	**68.7%**
2012	579,355	843,663	**68.7%**
2013	570,876	836,736	**68.2%**
2014	570,830	838,110	**68.1%**
2015	568,917	834,751	**68.2%**
2016	563,946	834,159	**67.6%**
2017	562,319	830,981	**67.7%**

Note: Starting in 2007 the data are not strictly comparable to those from previous years due to the introduction of methodological improvements.

Source: Statistical Institute of Catalonia (IDESCAT). Data published in the years 2001-2006 (highlighted) are not comparable due to differences in the methodology used.



Note: Starting in 2007 the data are not strictly comparable to those from previous years due to the introduction of methodological improvements.

Desired trend of the adaptation: An increase in the indicator.

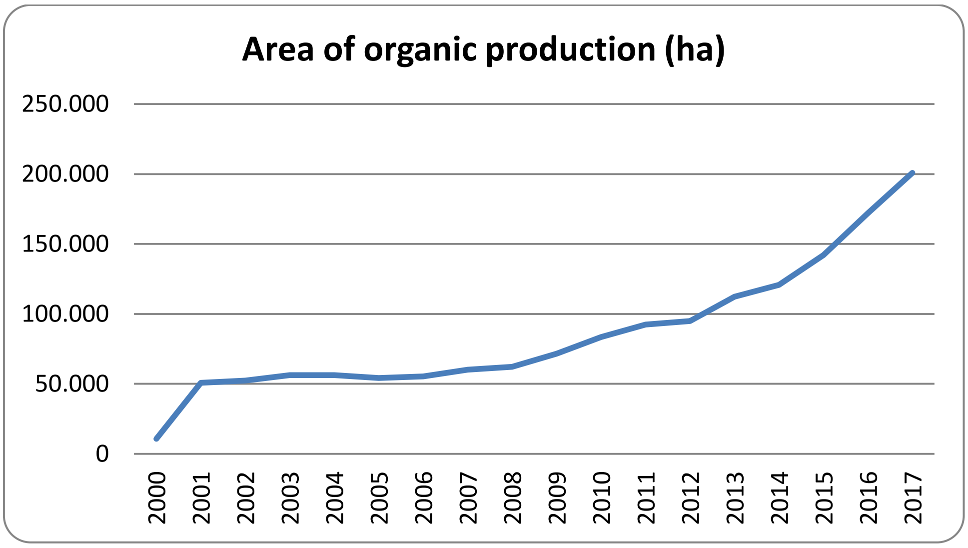
Relevance of the indicator: The dryland area is compared to total utilised agricultural area (UAA) as an indicator that reflects the water needs of the crops.

Area of organic production (ha) – pa3

Methodology: Area of organic production 2000-2017.

	pa3
2000	**10,827**
2001	**50,788**
2002	**52,346**
2003	**56,211**
2004	**56,386**
2005	**54,189**
2006	**55,355**
2007	**60,095**
2008	**62,331**
2009	**71,513**
2010	**83,506**
2011	**92,435**
2012	**94,972**
2013	**112,408**
2014	**120,865**
2015	**142,024**
2016	**171,937**
2017	**200,750**

Source: Catalan Council of Organic Production (CCPAE).



Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: Organic production is highly focused on improving and maintaining the fertility and quality of the soil. There are several fundamental organic practices that support them, which also provide considerable benefits for climate change adaptation.

Organic farms generally have a larger diversity of species and they also tend to grow locally adapted varieties. This improves the resilience of the agro-ecosystems when facing adverse climate conditions, such as extreme weather events. Studies show that under extreme drought conditions, organic systems produce more than conventional systems, as the movement of water through the soil to the water table is 15-20% greater and, therefore, there greater groundwater recharge. Water capture and retention capacity in organically managed soils is up to 100% greater than in conventional soils. In summary, organic production systems are more resilient to changing climate conditions, such as droughts and extreme rainfall[5].

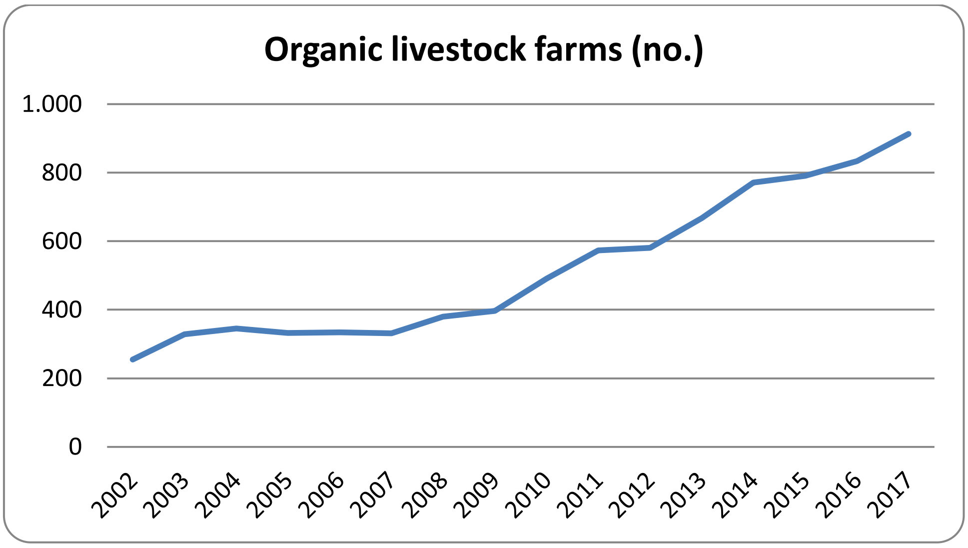
[5] Organic Farming, Climate Change Mitigation and Beyond. Reducing the Environmental Impacts of EU Agriculture (2017)

Organic livestock farms (no.) – pa4

Methodology: Number of organic livestock farms 2000-2017.

	pa4
2002	**255**
2003	**328**
2004	**345**
2005	**332**
2006	**334**
2007	**331**
2008	**380**
2009	**397**
2010	**491**
2011	**573**
2012	**581**
2013	**667**
2014	**771**
2015	**791**
2016	**834**
2017	**913**

Source: Catalan Council of Organic Production (CCPAE).



Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: Organic livestock production involves less intensive use of the land and resources compared to conventional livestock production.

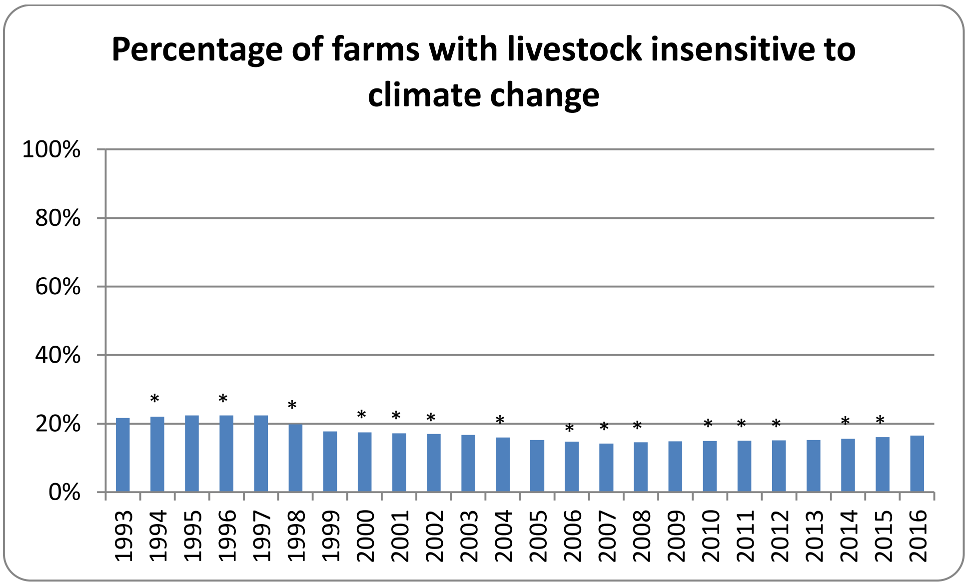
Percentage of farms with livestock insensitive to climate change (%) – pa5

Methodology: The ratio between the total farms with livestock insensitive to climate change (cattle, sheep, goats and horses) and total livestock farms. Given that annual data are not available, the data for some years have been estimated (in yellow).

	Cattle LU	Sheep LU	Goat LU	Horse LU	∑LU cattle, sheep, goat, horse	LU totals	pa5
1993	345,950	87,432	4,902	9,545	447,829	2,066,562	**21.7%**
1994	359,422	86,736	4,773	9,356	460,286	2,089,088	**22.0%**
1995	372,894	86,040	4,643	9,166	472,743	2,111,614	**22.4%**
1996	380,215	88,624	4,874	11,174	484,886	2,165,226	**22.4%**
1997	387,535	91,207	5,105	13,181	497,028	2,218,838	**22.4%**
1998	387,830	89,145	6,172	12,494	495,640	2,503,657	**19.8%**
1999	388,125	87,082	7,238	11,806	494,251	2,788,476	**17.7%**
2000	378,721	83,079	7,304	11,426	480,529	2,750,785	**17.5%**
2001	369,316	79,077	7,370	11,045	466,808	2,713,093	**17.2%**
2002	359,912	75,074	7,436	10,665	453,086	2,675,402	**16.9%**
2003	350,507	71,071	7,502	10,284	439,364	2,637,710	**16.7%**
2004	331,741	69,901	7,508	10,446	419,596	2,629,928	**16.0%**
2005	312,975	68,731	7,514	10,607	399,827	2,622,145	**15.2%**
2006	300,637	65,440	7,466	11,655	385,198	2,614,492	**14.7%**
2007	288,298	62,149	7,418	12,703	370,568	2,606,839	**14.2%**
2008	305,972	61,079	7,297	14,093	388,440	2,672,557	**14.5%**
2009	323,646	60,008	7,175	15,482	406,311	2,738,275	**14.8%**
2010	324,299	59,502	7,160	15,640	406,601	2,724,516	**14.9%**
2011	324,952	58,996	7,145	15,798	406,890	2,710,757	**15.0%**
2012	325,605	58,489	7,130	15,955	407,180	2,696,997	**15.1%**
2013	326,258	57,983	7,115	16,113	407,469	2,683,238	**15.2%**
2014	332,295	58,646	7,169	16,337	414,448	2,652,627	**15.6%**
2015	338,333	59,310	7,224	16,561	421,427	2,622,016	**16.1%**
2016	344,370	59,973	7,278	16,785	428,406	2,591,405	**16.5%**

Note: Estimated values highlighted in yellow.

Source: Statistical Institute of Catalonia (IDESCAT): Agricultural Census (1999 and 2009), Farm Structure Survey (1993, 1995, 1997, 2003, 2005 and 2007) and Farm Structure Survey by the Spanish National Statistics Institute (INE) (2013 and 2016).



* Estimated values.

Desired trend of the adaptation: An increase in the indicator.

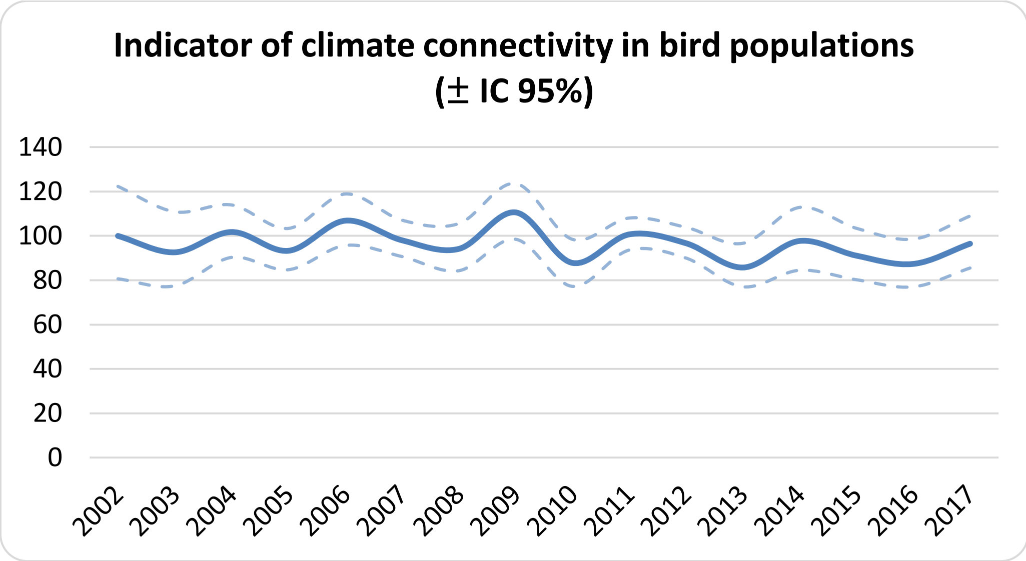
Relevance of the indicator: Farms with livestock insensitive to climate change will be better adapted.

Indicator of climate connectivity in bird populations – pd1

Methodology: This multispecific indicator was constructed following the methodology of Gregory et al. (2009). In summary, an indicator was created of the climate connectivity in birds using population indices for each year of the period under study and indices on climate connectivity. The connectivity index allows us to classify the species into two broad groups: 1) the species for which the index has positive values, which are those that, in a climate change scenario, are assumed to have better interconnected populations and which we have deemed as Climate Connectivity species (+), and 2) the species for which the index has negative values, which are those that, in a climate change scenario, are assumed to have more poorly connected populations, so they have been classified as Climate Connectivity species (-). A general trend was calculated for each group that is the geometric average of all the trends weighted by the climate connectivity index for each of them. Finally, the annual value of the indicator of climate connectivity was calculated by producing the quotient of the two sub-indicators, that of climate connectivity (+) and climate connectivity (-) and the confidence interval was calculated using a bootstrapping process based on 10,000 repetitions of the indicator with a random selection of the species used for each iteration.

	pb1
2002	**100.0**
2003	**92.6**
2004	**101.8**
2005	**93.3**
2006	**106.9**
2007	**98.0**
2008	**94.1**
2009	**110.6**
2010	**87.8**
2011	**100.7**
2012	**96.7**
2013	**85.7**
2014	**97.7**
2015	**91.1**
2016	**87.4**
2017	**96.5**

Source: The Catalan Ornithological Institute (ICO).



Desired trend of the adaptation: For the indicator to not decrease.

Relevance of the indicator: The indicator of climate connectivity has remained extremely stable during the period under study. Therefore, and for now, it would not appear that connectivity is limiting birds from adapting to climate change. There are two interpretive hypotheses: a) Good connectivity in the distribution areas of birds in Catalonia could offset the effects that climate change causes among the populations; b) The indicator does not reflect temporary changes because they are not occurring (at this time) due to being masked by the effect of other global change factors.

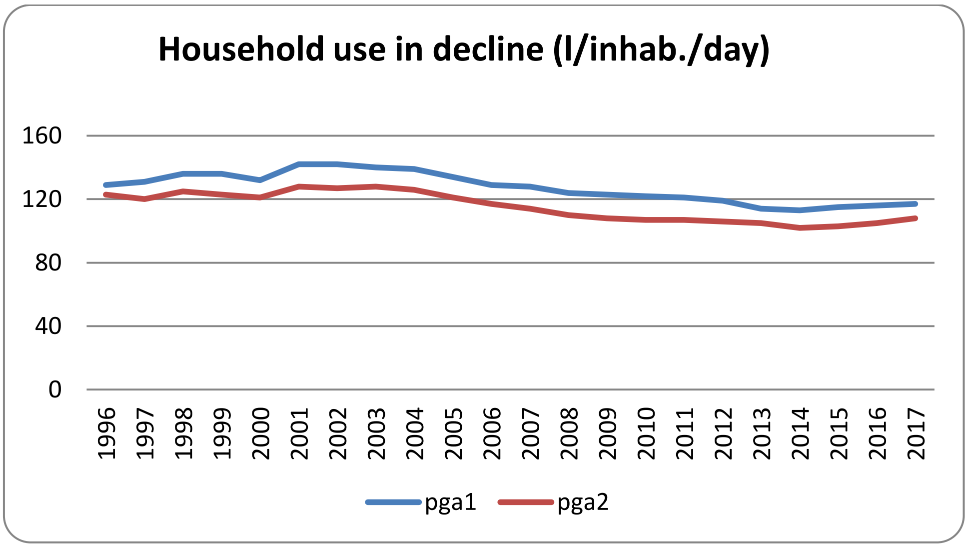
This study leans toward the second interpretive hypothesis. Previous studies in Catalonia reveal that, as a whole, the populations of open-habitat species show a global negative trend due to growing rural abandonment, while forest species' populations are increasing due to natural plant growth. Therefore, it is necessary to remain alert in the future to the changes in connectivity as a possible reason for population changes.

Household use in decline (l/inhab./day): Catalonia – pga1
Household use in decline (l/inhab./day): Metropolitan Area of Barcelona – pga2

Methodology: The data are drawn from statements made to the Catalan Water Agency by water supply companies, industrial users and other economic activities.

	pga1	pga2
1996	**129**	**123**
1997	**131**	**120**
1998	**136**	**125**
1999	**136**	**123**
2000	**132**	**121**
2001	**142**	**128**
2002	**142**	**127**
2003	**140**	**128**
2004	**139**	**126**
2005	**134**	**121**
2006	**129**	**117**
2007	**128**	**114**
2008	**124**	**110**
2009	**123**	**108**
2010	**122**	**107**
2011	**121**	**107**
2012	**119**	**106**
2013	**114**	**105**
2014	**113**	**102**
2015	**115**	**103**
2016	**116**	**105**
2017	**117**	**108**

Source: Catalan Water Agency (ACA).



Desired trend of the adaptation: For the indicator to decrease and remain stable.

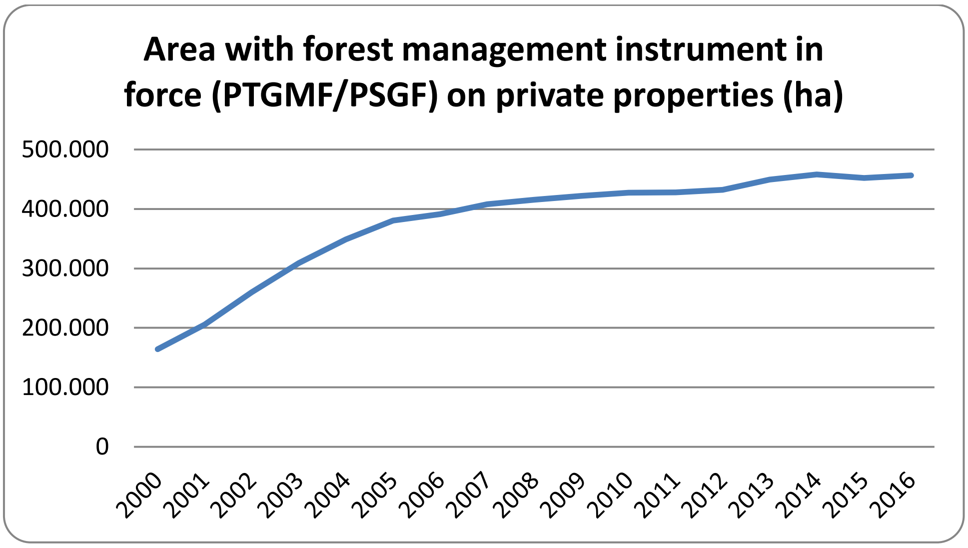
Relevance of the indicator: This is a direct indicator both of the efficiency of water use in our homes (less consumption for equal or greater comfort), and effective savings. Thus, the evolution of household use in decline indicates a cumulative reduction with regard to historic maximums of 15% that, expressed in terms of volume, is equal to some 120 hm^3 or, in other words, double the volume of water that can be stored in the Boadella-Darnius reservoir (60 hm^3).

Area with forest management instrument in force (PTGMF/PSGF) on private properties (ha) – pgf1

Methodology: The data refer to forest area (in ha) of private properties with a Forest Management Instrument, differentiating between: 1) Simple Forest Management Plan (PSGF), an instrument to manage forest properties with an area less than 25 hectares; and 2) Technical Plan for Forest Management and Improvement (PTGMF), for forest properties with an area to manage that is greater than or equal to 25 hectares.

	PTGMF	PSGF	**pgf1**
2000	164,114		**164,114**
2001	205,511		**205,511**
2002	259,989		**259,989**
2003	309,024		**309,024**
2004	348,521	255	**348,776**
2005	379,112	1,322	**380,434**
2006	389,527	2,062	**391,589**
2007	405,641	2,324	**407,965**
2008	413,248	2,567	**415,815**
2009	419,340	2,762	**422,101**
2010	424,459	3,154	**427,613**
2011	424,327	3,452	**427,779**
2012	428,408	3,941	**432,349**
2013	444,896	4,743	**449,639**
2014	452,476	5,529	**458,005**
2015	446,205	6,074	**452,279**
2016	450,158	6,313	**456,471**

Source: Environmental data for Catalonia 2017.



Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: The aim of management instruments is to enable and improve the management of forest properties, maximising yields in goods and/or services in the framework of sustainable management.

The concepts of sustainability, multifunctionality and social perception of forests have been established as basic aspects in forest management. The capacity of natural heritage to produce biodiversity acts as a reserve for the genetic variability of flora and fauna and their natural evolution. Forests play an important role in replenishing aquifers and improving water quality, favouring its infiltration into the soil, preventing erosion and decreasing flooding by reducing surface runoff. Furthermore, forests provide materials and products that the economy needs, such as timber and cork for industries, biomass as a renewable energy source, grassland as the mainstay of livestock, and other resources including wild mushrooms, pine nuts, truffles and more, as well as the increase of recreational, leisure, scientific and educational uses, among others.

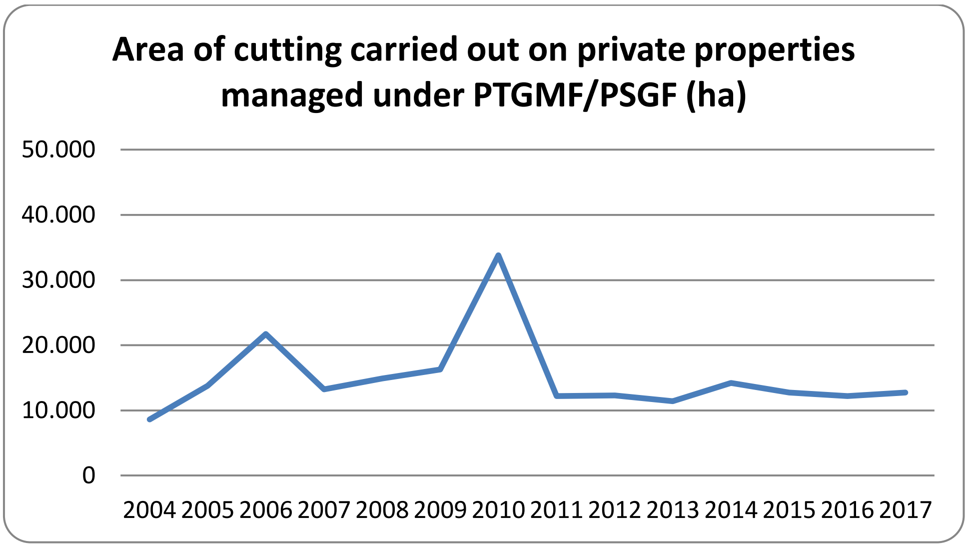
Nonetheless, it must be borne in mind that this indicator directly shows the degree of forest planning, but it does not reveal its effectiveness (whether the planning is being implemented or not).

Area of cutting carried out on private properties managed under PTGMF/PSGF (ha) – pgf2

Methodology: The data refer to the area where authorised uses on privately owned lands have been carried out. They include direct use cutting and extraordinary works: improved clearing, use of firewood for own consumption, preparatory cutting, removal cutting, seed cutting, final cutting, selective cutting, clearcutting, sanitary cutting, cutting dead vegetation and cutting vegetation affected by fire, wind, drought, snow or hail.

	pgf2
2004	**8,615**
2005	**13,763**
2006	**21,719**
2007	**13,246**
2008	**14,881**
2009	**16,262**
2010	**33,802**
2011	**12,184**
2012	**12,305**
2013	**11,415**
2014	**14,206**
2015	**12,728**
2016	**12,217**
2017	**12,760**

Source: Forest Ownership Centre (CPF). Ministry of Agriculture, Livestock, Fisheries and Food of Catalonia.



Desired trend of the adaptation: To increase to values close to the planned managed area to be executed for the year in question. Furthermore, it would be desirable if this value remained somewhat stable.

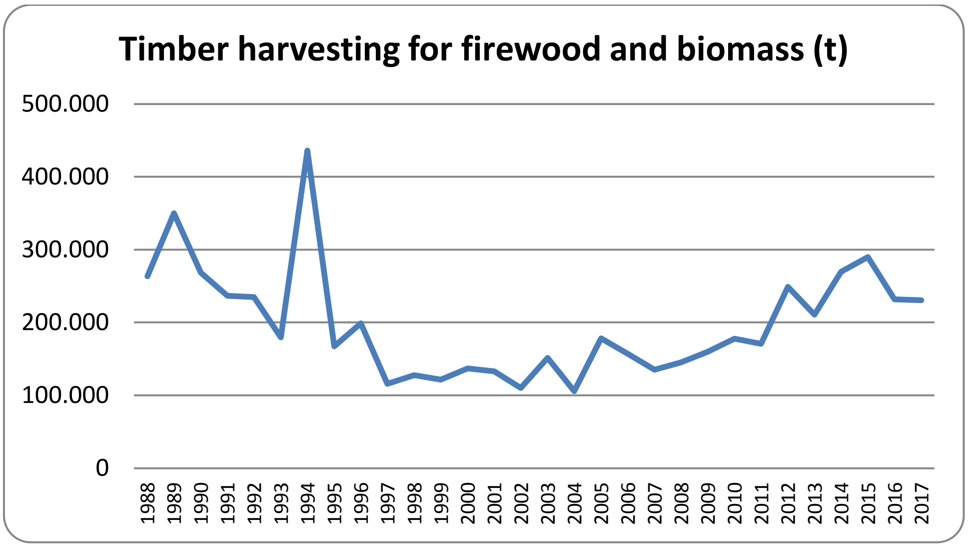
Relevance of the indicator: High values indicate the good condition of use of the forest's productive function. Low values are indicators of the abandonment of this function.

Timber harvesting for firewood and biomass (t) – pgf3

Methodology: Forest timber harvesting encompasses all operations consisting of partial preparation, extraction and transportation of wood and firewood obtained from cutting carried out in a forest mass, under appropriate planning.

	Conifers	Holm oaks and oaks	Other hardwood	Shrubs and bushes	**pgf3**
1988	141,594	104,144	17,652	-	**263,390**
1989	173,171	147,792	29,198	-	**350,161**
1990	86,801	154,043	27,574	-	**268,418**
1991	69,800	141,626	25,126	-	**236,552**
1992	60,308	148,030	26,378	14	**234,730**
1993	46,873	110,264	22,274	28	**179,439**
1994	294,041	112,914	29,070	-	**436,025**
1995	36,025	95,262	35,624	151	**167,062**
1996	51,603	101,610	44,990	558	**198,761**
1997	38,340	46,389	30,991	-	**115,720**
1998	63,172	42,165	20,739	1,532	**127,608**
1999	37,103	61,350	22,662	226	**121,341**
2000	51,203	64,147	21,359	78	**136,787**
2001	38,506	64,653	29,950	17	**133,126**
2002	23,351	66,908	19,564	245	**110,068**
2003	30,646	85,589	35,103	164	**151,502**
2004	19,524	61,832	23,847	330	**105,533**
2005	22,974	116,029	38,840	514	**178,357**
2006	31,707	100,418	25,004	196	**157,325**
2007	26,919	81,030	26,735	406	**135,090**
2008	20,633	80,507	43,166	875	**145,181**
2009	24,836	105,658	29,326	53	**159,873**
2010	22,281	101,829	53,740	-	**177,850**
2011	31,842	89,921	48,945	83	**170,791**
2012	50,280	169,414	29,382	45	**249,121**
2013	48,942	129,338	32,303	9	**210,592**
2014	80,364	130,557	58,727	80	**269,728**
2015	105,161	138,288	46,321	-	**289,770**
2016	55,845	126,665	49,549	-	**232,059**
2017	47,116	122,574	60,752	-	**230,442**

Source: Catalan Forest Observatory (OFC) / Directorate-General for Forest Ecosystems and Environmental Management, Ministry of Agriculture, Livestock, Fisheries and Food.



Desired trend of the adaptation: To increase to sustainable values. The target value of the General Forest Policy Plan 2014-2024 is for it to increase 50% during this period.

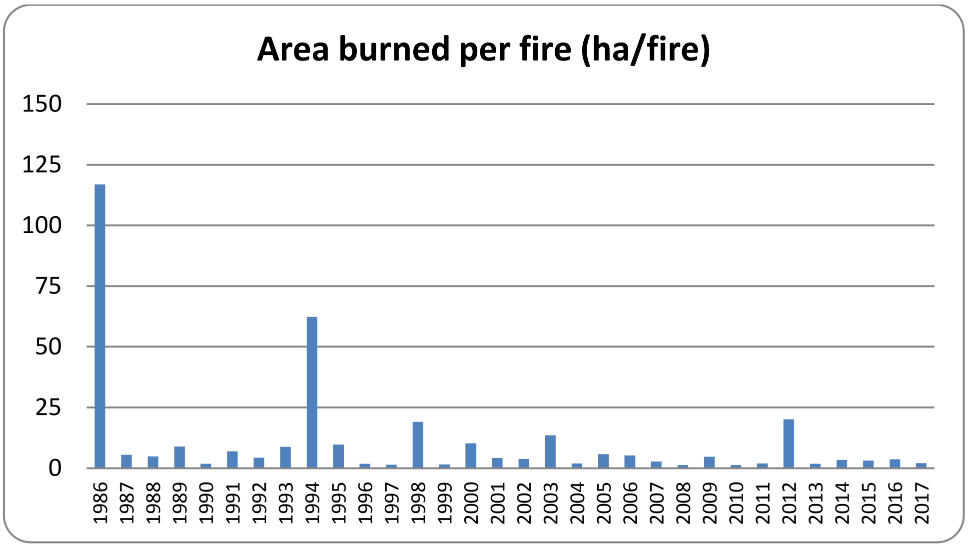
Relevance of the indicator: High values indicate the good condition of the use of the forest's productive function. Low values are indicators of the abandonment of this function.

Area burned per fire (ha/fire) – pgf4

Methodology: The information on forest fires corresponds to the total affected area.

	pgf4
1986	**116.9**
1987	**5.5**
1988	**4.8**
1989	**9.0**
1990	**1.8**
1991	**6.9**
1992	**4.3**
1993	**8.8**
1994	**62.3**
1995	**9.7**
1996	**1.8**
1997	**1.4**
1998	**19.1**
1999	**1.5**
2000	**10.2**
2001	**4.2**
2002	**3.8**
2003	**13.5**
2004	**1.9**
2005	**5.8**
2006	**5.2**
2007	**2.8**
2008	**1.3**
2009	**4.6**
2010	**1.3**
2011	**1.9**
2012	**20.1**
2013	**1.8**
2014	**3.4**
2015	**3.1**
2016	**3.6**
2017	**2.1**

Source: Catalan Forest Observatory (OFC) / Forest Fire Prevention Service, Ministry of Agriculture, Livestock, Fisheries and Food.



Desired trend of the adaptation: A decrease in the indicator.

Relevance of the indicator: The best prepared forests will be those that do not become large fires after a fire has started.

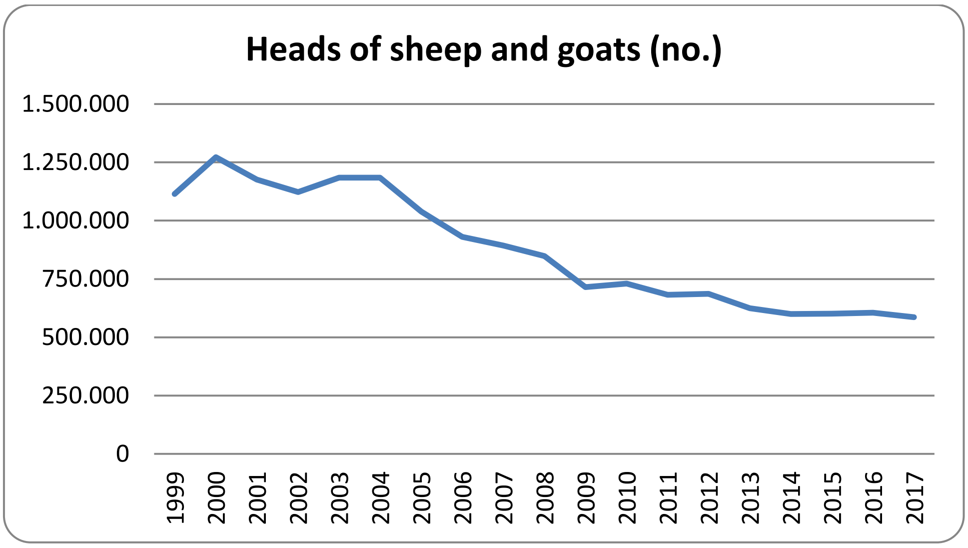
Heads of sheep and goats (no.) – pgf5

Methodology: The European Union establishes that member states perform annual livestock surveys to determine the number of heads of animals and their structuring into age groups and production statuses. For sheep and goats, a single annual survey is established to be done jointly for both species during the month of November. The population scope includes all sheep and goat farms located in Catalonia and registered as active in the Farm Register of the Ministry of Agriculture, Livestock, Fisheries and Food of Catalonia.

In Catalonia, the body responsible for the management, execution, review and dissemination of the survey results of actual heads of livestock is the Ministry of Agriculture, Livestock, Fisheries and Food of Catalonia. This statistical operation must be done pursuant to the common rules established by the Ministry of Agriculture, Fisheries and Food of Spain for all autonomous communities.

	Sheep	Goats	**pgf5**
1999	1,046,635	67,168	**1,113,803**
2000	1,174,532	97,592	**1,272,124**
2001	1,098,913	77,778	**1,176,691**
2002	1,043,820	78,246	**1,122,066**
2003	1,108,099	76,437	**1,184,536**
2004	1,108,099	76,437	**1,184,536**
2005	947,360	90,844	**1,038,204**
2006	865,720	64,873	**930,593**
2007	811,651	81,735	**893,386**
2008	748,841	99,074	**847,915**
2009	633,232	81,590	**714,822**
2010	638,804	91,023	**729,827**
2011	607,886	74,684	**682,570**
2012	610,474	75,896	**686,370**
2013	548,819	76,111	**624,930**
2014	533,594	65,856	**599,450**
2015	530,792	70,486	**601,278**
2016	533,289	71,517	**604,806**
2017	514,101	72,315	**586,416**

Source: Statistical Institute of Catalonia (IDESCAT) / Ministry of Agriculture, Livestock, Fisheries and Food.



Desired trend of the adaptation: For the indicator to increase sustainably.

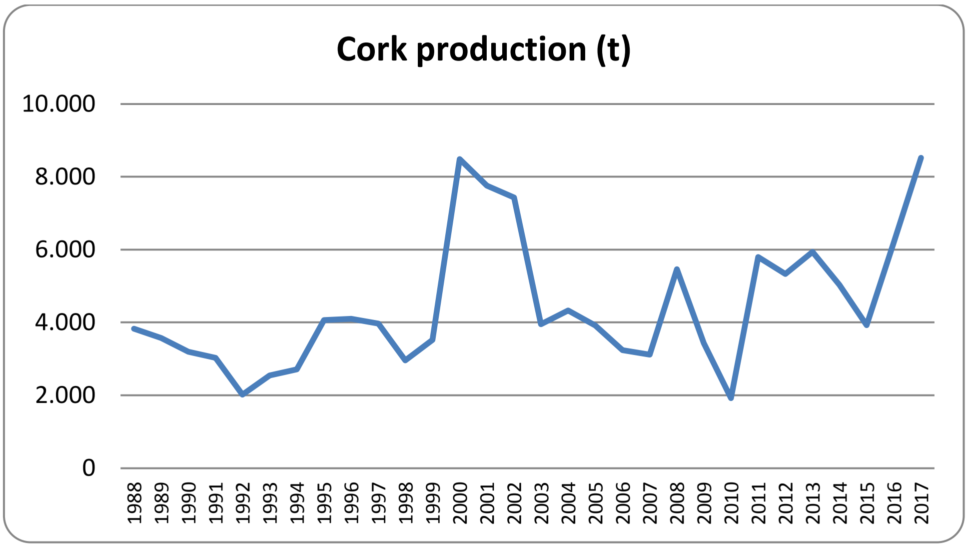
Relevance of the indicator: Although a large part of extensive livestock farming in Catalonia belongs to the cattle subsector, as official data do not distinguish between intensive and extensive cattle farming, this assessment had to be limited to the subsectors that clearly correspond to extensive livestock farming (IEEEP, 2010). These subsectors are sheep and goats (and horses). The data incorporate unavoidable inaccuracies, given that stabled animals are included on these farms, although they are few.

Cork production (t) – pgf6

Methodology: Forests with cork production (*Quercus suber*) were considered, regardless of whether or not they are operational.

	pgf6
1988	**3,830**
1989	**3,574**
1990	**3,199**
1991	**3,032**
1992	**2,021**
1993	**2,544**
1994	**2,709**
1995	**4,070**
1996	**4,103**
1997	**3,973**
1998	**2,962**
1999	**3,522**
2000	**8,489**
2001	**7,759**
2002	**7,432**
2003	**3,955**
2004	**4,331**
2005	**3,917**
2006	**3,236**
2007	**3,116**
2008	**5,463**
2009	**3,432**
2010	**1,919**
2011	**5,798**
2012	**5,336**
2013	**5,940**
2014	**5,033**
2015	**3,925**
2016	**6,200**
2017	**8,523**

Source: Catalan Forest Observatory (OFC) / Directorate-General for Forest Ecosystems and Environmental Management, Ministry of Agriculture, Livestock, Fisheries and Food of Catalonia.



Desired trend of the adaptation: An increase in the indicator. The target value set out in the General Forest Policy Plan 2014-2024 is for cork production to increase by 40% during its term.

Relevance of the indicator: High values indicate the good condition of use of the forest's productive function. Low values are indicators of the abandonment of this function.

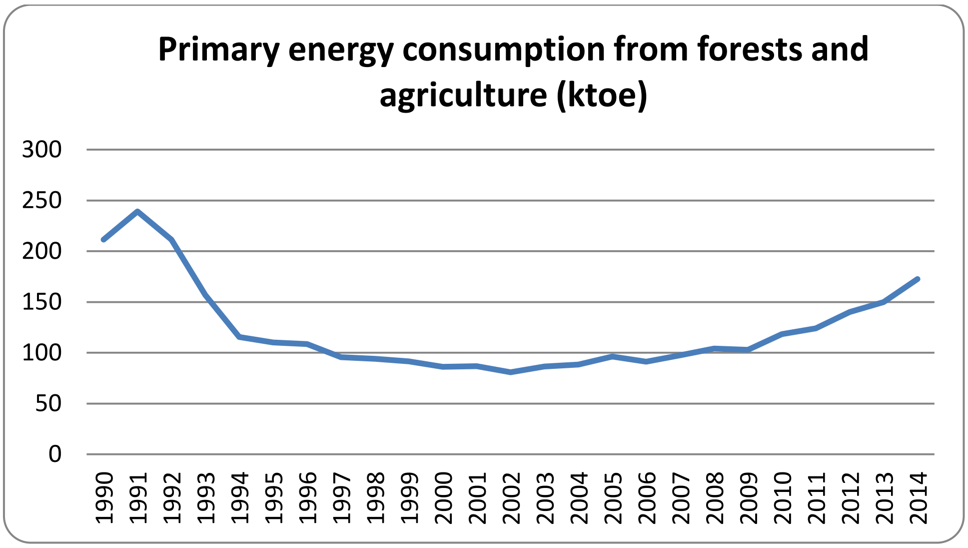
Primary energy consumption from forests and agriculture (ktoe) – pgf7

Methodology: Wood biomass that is used for energy purposes can have diverse origins:

- Forest biomass from forest improvement and cleaning works, as well as wood generated in the treatments and harvesting of the forest masses.
- Biomass generated in the agricultural sector, from agricultural, woody and herbaceous crops, both from tree pruning and the harvest and collection of end products.
- Biomass generated in industrial activities linked to the forestry and agricultural sectors (wood chips, sawdust, reclaimed wood, nut shells, etc.).
- Energy crops: Biomass production sector using crops of plant species specifically intended for production for energy purposes.

	pgf7
1990	**211.5**
1991	**239.3**
1992	**211.6**
1993	**156.7**
1994	**115.6**
1995	**110.2**
1996	**108.5**
1997	**95.7**
1998	**94.0**
1999	**91.6**
2000	**86.1**
2001	**86.9**
2002	**80.7**
2003	**86.4**
2004	**88.3**
2005	**96.3**
2006	**91.2**
2007	**97.6**
2008	**104.2**
2009	**102.8**
2010	**118.5**
2011	**124.2**
2012	**140.1**
2013	**149.9**
2014	**172.8**

Source: Catalan Energy Institute (ICAEN).



Desired trend of the adaptation: An increase in the indicator.

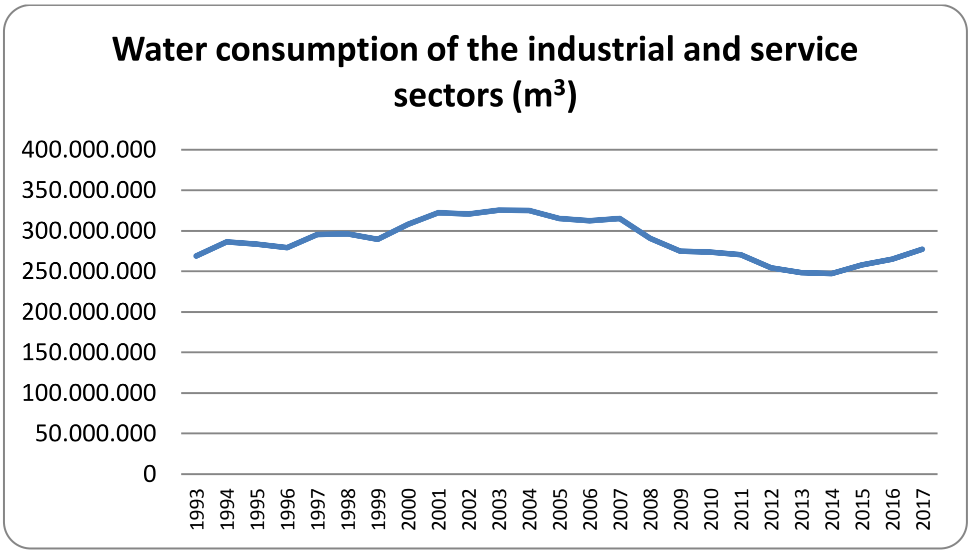
Relevance of the indicator: The Catalan Energy and Climate Change Plan 2012-2020 foresees an increase in the production of energy from forest and agriculture biomass in the coming years, until reaching 16% of primary energy consumption from renewable energy sources in Catalonia (631.9 ktoe by the year 2020). This would mean that forest and agriculture biomass would become the second renewable energy source in the total consumption of primary energy.

Water consumption of the industrial and service sectors (m^3) – pi1

Methodology: The data are drawn from statements made to the Catalan Water Agency by water supply companies, industrial users and other economic activities. Consumption by uses, which includes water from supply networks and own sources.

	pi1
1993	**268,970,680**
1994	**286,333,913**
1995	**283,593,685**
1996	**279,417,917**
1997	**295,447,642**
1998	**296,182,057**
1999	**289,455,548**
2000	**307,947,839**
2001	**322,230,511**
2002	**320,917,493**
2003	**325,675,090**
2004	**324,900,303**
2005	**315,143,721**
2006	**312,315,960**
2007	**315,273,448**
2008	**290,619,076**
2009	**274,771,220**
2010	**273,570,835**
2011	**270,439,046**
2012	**254,252,791**
2013	**248,487,681**
2014	**247,446,535**
2015	**257,828,366**
2016	**264,993,504**
2017	**277,103,297**

Source: Study of volumes of water supplied and collected in Catalonia by the Catalan Water Agency (2017).



Desired trend of the adaptation: A decrease in the indicator.

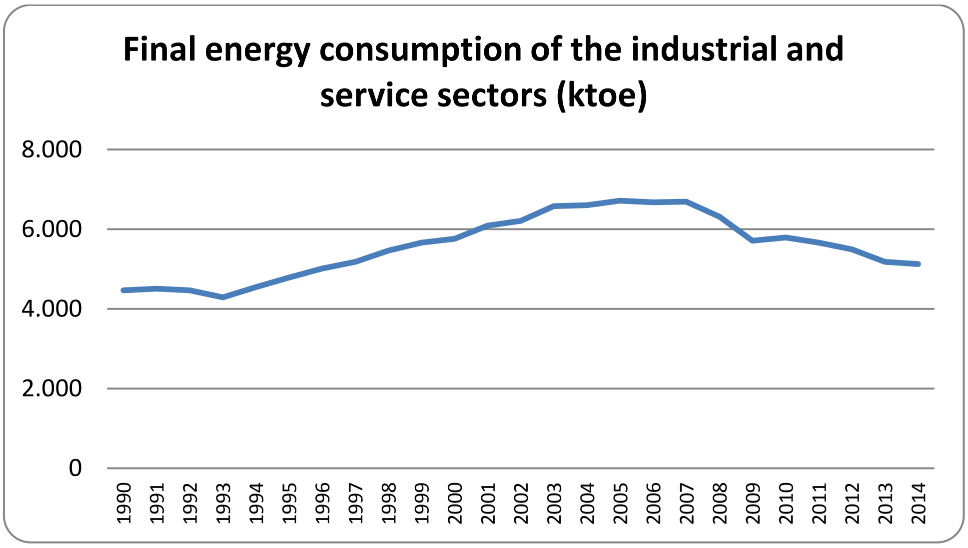
Relevance of the indicator: Being more efficient in resource use will allow the industrial and service sector to be more resilient to the foreseen impacts of lower water availability and will increase the sector's adaptive capacity.

Final energy consumption of the industrial and service sectors (ktoe) – pi2

Methodology: Defined in the Catalan Energy and Climate Change Plan 2012-2020.

	pi2
1990	**4,467.1**
1991	**4,503.0**
1992	**4,465.6**
1993	**4,286.3**
1994	**4,542.7**
1995	**4,790.1**
1996	**5,009.1**
1997	**5,181.5**
1998	**5,459.1**
1999	**5,661.0**
2000	**5,756.3**
2001	**6,093.3**
2002	**6,210.2**
2003	**6,576.2**
2004	**6,605.9**
2005	**6,715.5**
2006	**6,672.7**
2007	**6,691.0**
2008	**6,313.2**
2009	**5,708.4**
2010	**5,794.3**
2011	**5,664.0**
2012	**5,498.5**
2013	**5,179.0**
2014	**5,125.0**

Source: Energy Balance in Catalonia 2014 by the Catalan Energy Institute (ICAEN).



Desired trend of the adaptation: A decrease in the indicator.

Relevance of the indicator: Being more efficient in the use of resources will allow the industrial and service sector to increase its adaptive capacity in order to be more resilient to the foreseen impacts of increased energy demand or economic difficulties in the face of rising energy prices.

GHG emissions from the industrial sector (thousands of t of CO_{2eq}) – pi3

Methodology: The National Greenhouse Gas Inventory for the period 1990-2016 (2018 version) from the Ministry of Agriculture and Fisheries, Food and the Environment (MAPAMA), broken down by autonomous communities, as well as data from the Catalan Office for Climate Change (OCCC) and the Catalan Ministry of Territory and Sustainability (DTES) on the emissions trading scheme.

	pi3
1990	**14,833**
1991	**15,061**
1992	**15,564**
1993	**15,538**
1994	**17,964**
1995	**21,877**
1996	**20,879**
1997	**21,180**
1998	**21,112**
1999	**23,139**
2000	**24,454**
2001	**21,369**
2002	**19,263**
2003	**21,877**
2004	**21,543**
2005	**22,060**
2006	**19,788**
2007	**20,356**
2008	**18,349**
2009	**15,870**
2010	**16,725**
2011	**15,897**
2012	**15,621**
2013	**14,565**
2014	**14,677**
2015	**13,705**
2016	**13,925**

Source: Catalan Office for Climate Change (OCCC). Ministry of Territory and Sustainability.

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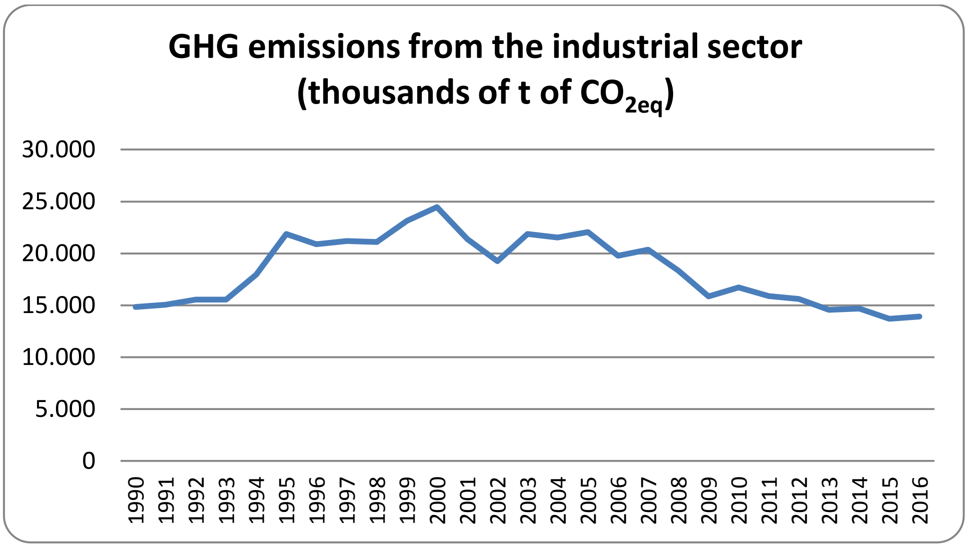


Desired trend of the adaptation: A decrease in the indicator.

Relevance of the indicator: Achieving a transition towards a more diversified, decentralised and low-carbon energy model will be a key factor for the successful adaptation of the sector.

Imports of oil extraction and refining, coal (millions of euros) – pi4

Methodology: The Statistical Institute of Catalonia (IDESCAT) generates these statistics from the most relevant information taken from data on imports with third countries, using the Single Administrative Document (SAD) and intra-community entries based on the Intrastat declaration.

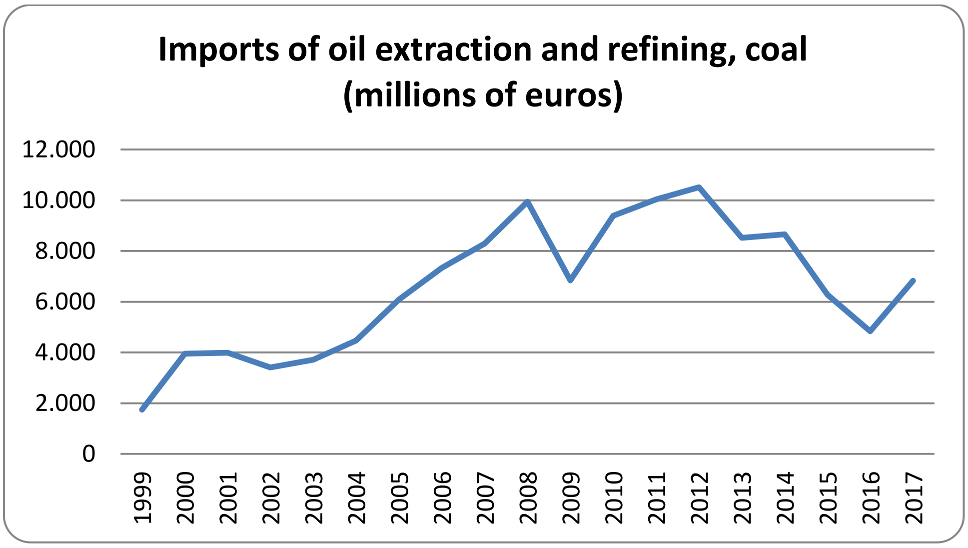
Intrastat can be considered as a permanent and direct data collection system from companies, with the aim of guaranteeing that statistics on the exchanges of goods between member states are compiled through a statistical declaration, via consignors and consignees.

The branches of activity are obtained from the following divisions of the Catalan Classification of Economic Activities (CCAE-2009):

- 05+06+09+19 Energy products; oil extraction and refining.

	pi4
1999	**1,742**
2000	**3,955**
2001	**3,995**
2002	**3,408**
2003	**3,718**
2004	**4,470**
2005	**6,091**
2006	**7,333**
2007	**8,289**
2008	**9,949**
2009	**6,840**
2010	**9,391**
2011	**10,030**
2012	**10,518**
2013	**8,523**
2014	**8,663**
2015	**6,273**
2016	**4,835**
2017	**6,831**

Source: Statistical Institute of Catalonia (IDESCAT) / State Tax Administration Agency.



Desired trend of the adaptation: A decrease in the indicator.

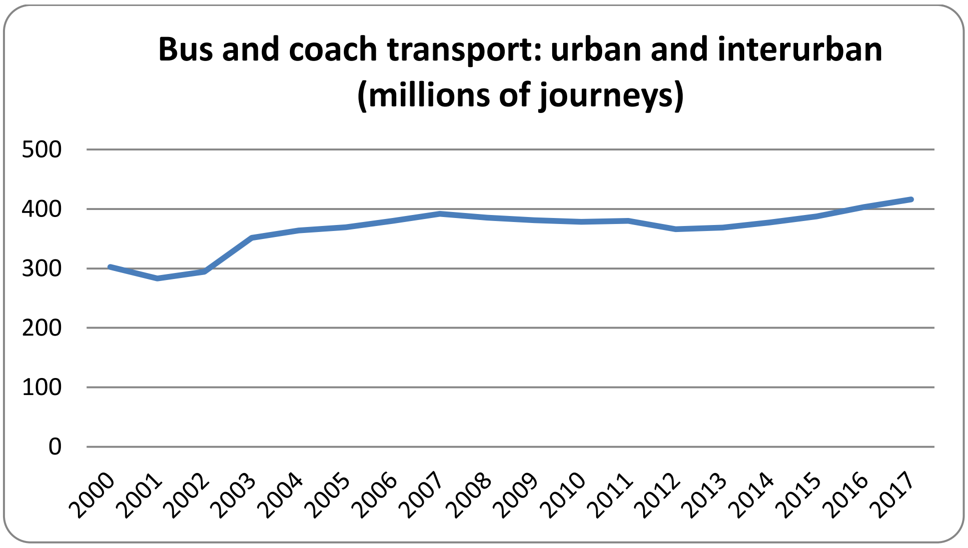
Relevance of the indicator: In order to make the transition towards a more diversified, decentralised and low-carbon energy model, it is necessary to reduce fossil fuel imports.

Bus and coach transport: urban and interurban (millions of journeys) – pt1

Methodology: Data was compiled on regular passenger transport in Catalonia (Transport de Barcelona, MAB buses, DGTM interurban coaches, AMTU urban buses, Girona, Lleida, Tarragona and Reus). The Ministry of Territory and Sustainability obtained these figures directly from the companies authorised to provide these services.

	pt1
2000	**302.3**
2001	**283.2**
2002	**294.5**
2003	**351.3**
2004	**363.7**
2005	**369.2**
2006	**380.0**
2007	**391.9**
2008	**385.4**
2009	**381.1**
2010	**378.4**
2011	**380.0**
2012	**366.0**
2013	**369.0**
2014	**377.6**
2015	**387.8**
2016	**403.3**
2017	**416.4**

Source: Public transport figures in Catalonia, 2017 edition, Ministry of Territory and Sustainability.



Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: In order to achieve the effective transition towards a low-carbon model that is resilient to the impacts of climate change, it is necessary to steadily increase the share of bus transport as a more sustainable mode than fossil fuel-intensive road transport.

Rail transport: Rodalies (commuter), Regionals, Avant, FGC, tram and metro (millions of journeys) – pt2

Methodology: Data provided by railway operators. The data show millions of journeys made with the following modes of transport: Rodalies de Catalunya (commuter rail), regional trains, Avant, Ferrocarrils de la Generalitat de Catalunya, tram and metro.

	pt2
2000	**465.4**
2001	**486.8**
2002	**520.4**
2003	**528.2**
2004	**551.6**
2005	**567.7**
2006	**582.7**
2007	**595.0**
2008	**606.7**
2009	**587.2**
2010	**599.8**
2011	**611.8**
2012	**589.7**
2013	**585.7**
2014	**593.7**
2015	**607.7**
2016	**608.8**
2017	**626.9**

Source: Public Transport Figures in Catalonia 2017. Ministry of Territory and Sustainability.

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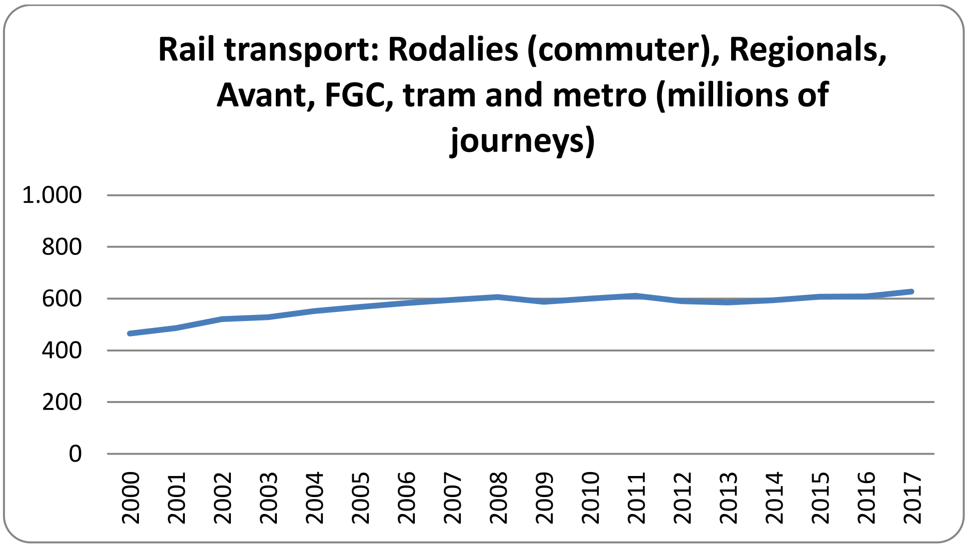


Desired trend of the adaptation: An increase in the indicator.

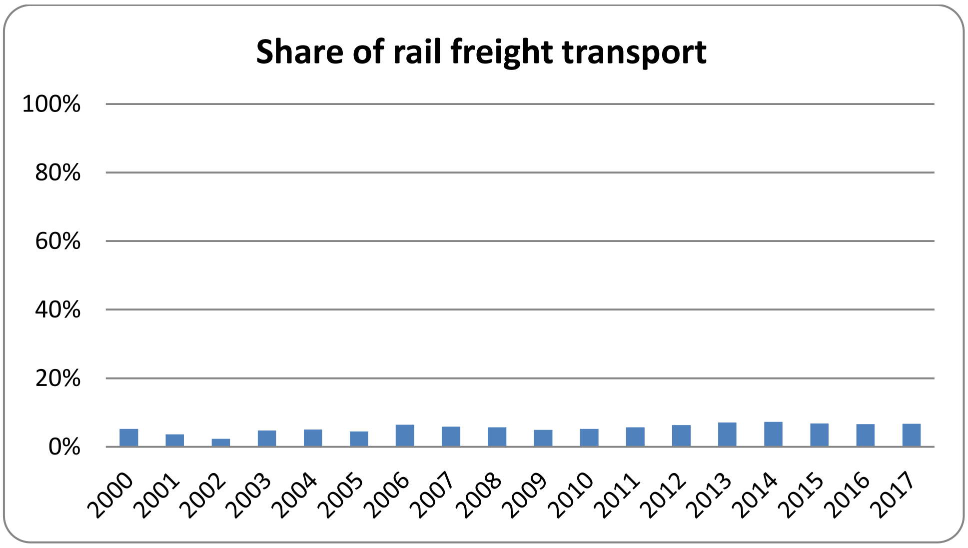
Relevance of the indicator: In order to achieve the effective transition towards a low-carbon model that is resilient to the impacts of climate change, it is necessary to steadily increase the share of rail transport as a more sustainable mode than fossil-fuel intensive road transport.

Share of rail freight transport (%) – pt3

Methodology: This indicator is based on rail freight transport data from RENFE (RENFE, 2018), FCG (FGC, 2018) and Private Operators (Private Operators, 2018), and road freight transport data from the Directorate-General of Infrastructure, Transport and Sea (DGITM, 2018) and the extended Permanent Survey of Road Freight Transport (EPTMC) (Ministry of Development, 2018).

	pt3
2000	**5.2%**
2001	**3.6%**
2002	**2.3%**
2003	**4.7%**
2004	**5.1%**
2005	**4.4%**
2006	**6.4%**
2007	**5.9%**
2008	**5.7%**
2009	**4.9%**
2010	**5.2%**
2011	**5.7%**
2012	**6.3%**
2013	**7.1%**
2014	**7.3%**
2015	**6.8%**
2016	**6.6%**
2017	**6.7%**

Source: Indicators of Competitiveness of the Catalan Logistics System. Logistics Observatory.



Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: The current shares of the level of implementation of rail freight transport represent very low values with considerable scope for improvement.

The degree of implementation of rail freight transport in Catalonia, in addition to being a key factor for the competitiveness of the Catalan economy, undoubtedly determines the level of dependence on using fossil fuels for freight transport in Catalonia.

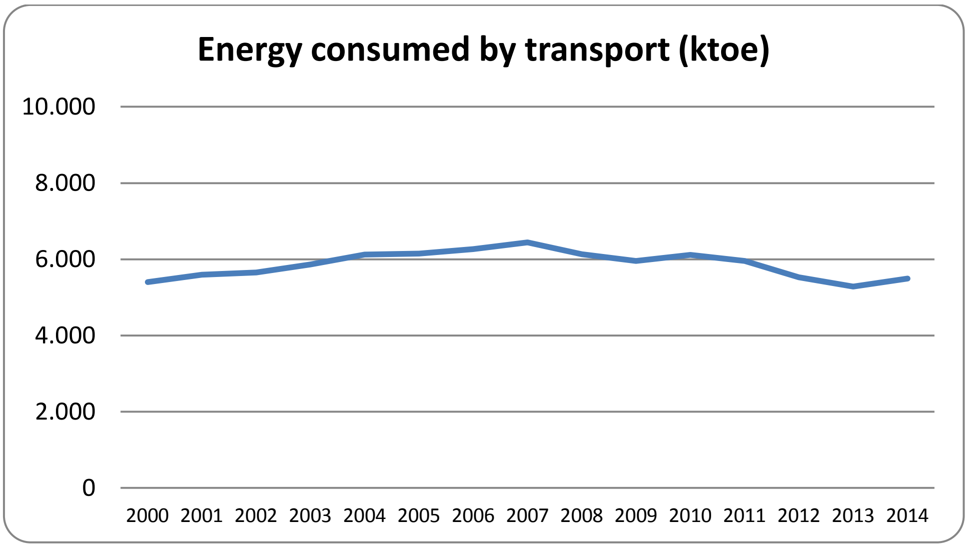
An improvement in public policies that would increase the rail freight transport share would be an important step in adapting to climate change.

Energy consumed by transport (ktoe) – pt4

Methodology: Defined in the Catalan Energy and Climate Change Plan 2012-2020.

	pt4
2000	**5,404.9**
2001	**5,596.4**
2002	**5,654.8**
2003	**5,860.6**
2004	**6,121.2**
2005	**6,147.6**
2006	**6,262.7**
2007	**6,446.9**
2008	**6,135.7**
2009	**5,959.3**
2010	**6,117.7**
2011	**5,957.6**
2012	**5,525.2**
2013	**5,288.5**
2014	**5,492.9**

Source: Energy Balance in Catalonia 2014. Catalan Energy Institute (ICAEN).



Desired trend of the adaptation: A decrease in the indicator.

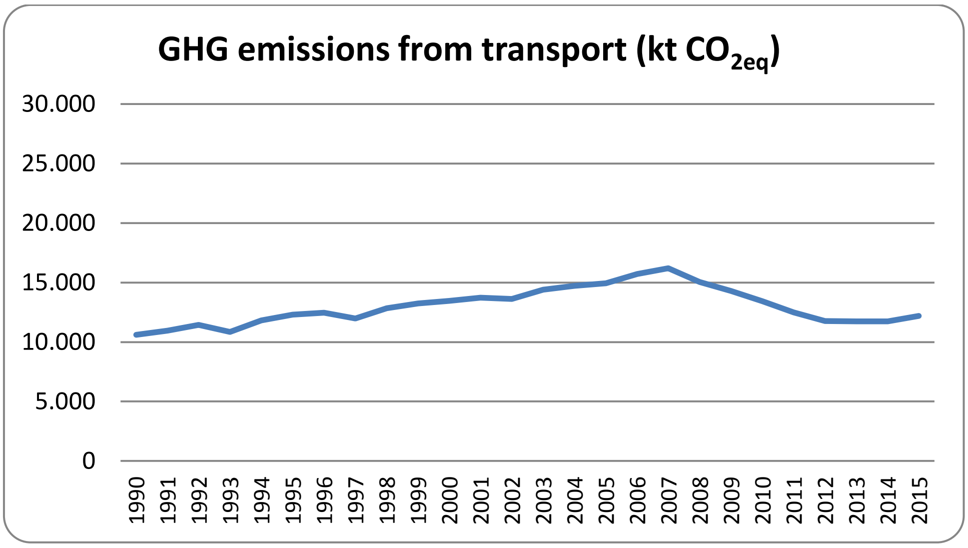
Relevance of the indicator: In order to obtain a more diversified, decentralised, low-carbon and environmentally friendly energy model, a reduction in the dependence of transport on fossil fuels is essential.

GHG emissions from transport (kt CO_{2eq}) – pt5

Methodology: The National Greenhouse Gas Inventory for the period 1990-2016 (2018 version) from the Ministry of Agriculture and Fisheries, Food and the Environment (MAPAMA), broken down by autonomous communities, as well as data from the Catalan Office for Climate Change (OCCC) from the Ministry of Territory and Sustainability (DTES) on the emissions trading scheme.

	pt5
1990	**10,610**
1991	**10,960**
1992	**11,453**
1993	**10,858**
1994	**11,805**
1995	**12,308**
1996	**12,452**
1997	**11,971**
1998	**12,845**
1999	**13,231**
2000	**13,467**
2001	**13,737**
2002	**13,612**
2003	**14,391**
2004	**14,714**
2005	**14,945**
2006	**15,720**
2007	**16,212**
2008	**15,053**
2009	**14,279**
2010	**13,433**
2011	**12,494**
2012	**11,775**
2013	**11,739**
2014	**11,744**
2015	**12,198**
2016	**12,598**

Source: Catalan Office for Climate Change (OCCC). Ministry of Territory and Sustainability.



Desired trend of the adaptation: A decrease in the indicator.

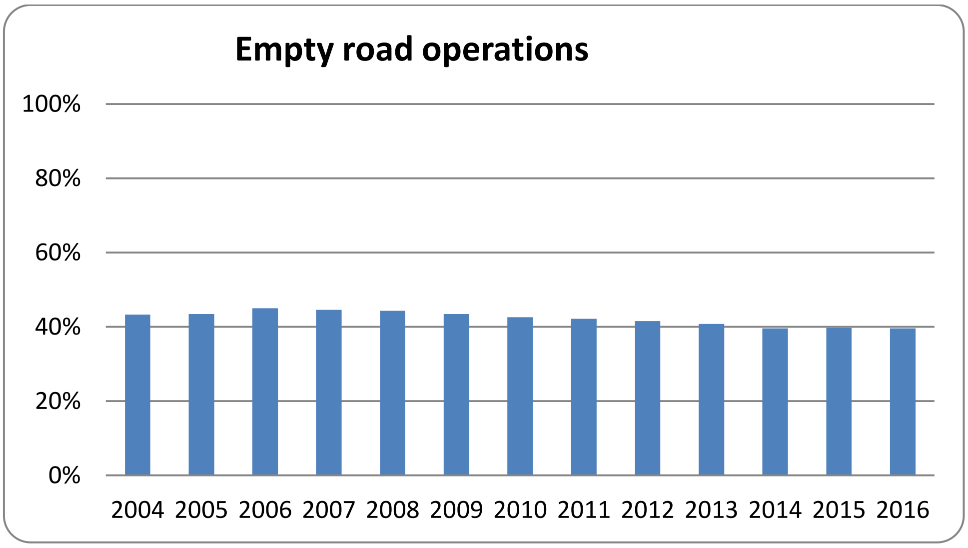
Relevance of the indicator: Achieving a transition towards a more energy-diverse and low-carbon transport model is essential for an effective adaptation to climate change. Emissions associated with this sector must continue to decrease.

Empty road operations (%) – pt6

Methodology: Based on data from the Ministry of Development, 2018, the number of road transport operations for vehicles with Spanish registration plates were counted, obtaining the number of empty operations in intra-regional transport (intra-municipal and inter-municipal) and inter-regional transport (between Catalonia and all other autonomous communities) and international transport (between Catalonia and other countries). This number was divided by the total number of operations, which includes empty operations and laden operations.

	pt6
2004	**43.3%**
2005	**43.5%**
2006	**45.0%**
2007	**44.6%**
2008	**44.3%**
2009	**43.5%**
2010	**42.6%**
2011	**42.2%**
2012	**41.6%**
2013	**40.8%**
2014	**39.6%**
2015	**39.8%**
2016	**39.6%**

Source: Indicators of Competitiveness of the Catalan Logistics System. Logistics Observatory.



Desired trend of the adaptation: A decrease in the indicator.

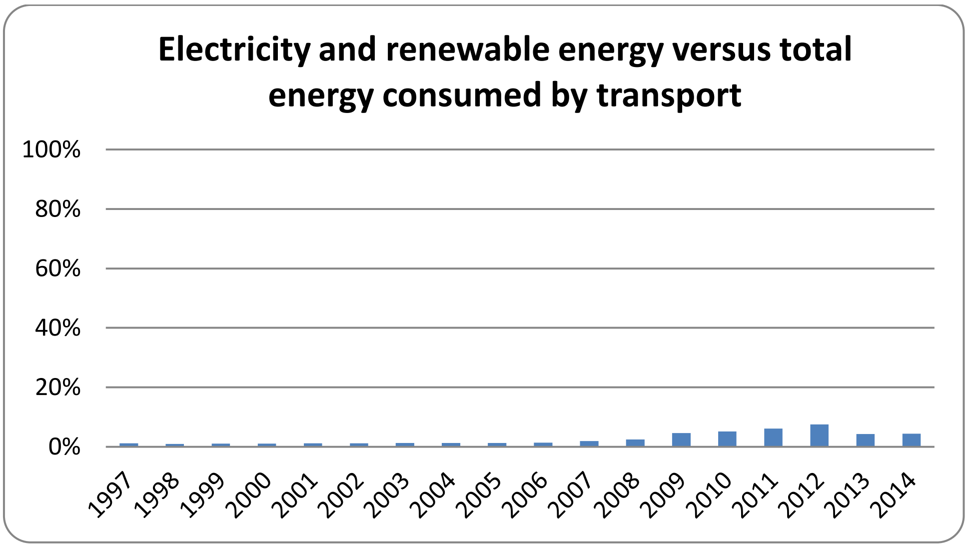
Relevance of the indicator: Increased road transport efficiency and a decrease in empty journeys would mean savings in fossil fuels and, therefore, in CO_2 emissions, improved competitiveness and a good sign of efficiency in the use of resources.

Electricity and renewable energy versus total energy consumed by transport (%) – pt7

Methodology: Defined in the Catalan Energy and Climate Change Plan 2012-2020.

	pt7
1997	**1.2%**
1998	**1.0%**
1999	**1.1%**
2000	**1.0%**
2001	**1.1%**
2002	**1.1%**
2003	**1.3%**
2004	**1.3%**
2005	**1.3%**
2006	**1.4%**
2007	**1.9%**
2008	**2.4%**
2009	**4.6%**
2010	**5.1%**
2011	**6.1%**
2012	**7.6%**
2013	**4.2%**
2014	**4.3%**

Source: Energy Balance of Catalonia 2014. Catalan Energy Institute (ICAEN).



Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: In order to obtain a more diversified, decentralised, low-carbon and environmentally friendly energy model, a reduction in the dependence of transport on fossil fuels is essential, moving towards a more sustainable model.

More significant implementation shares are needed to favour the energy transition of the transport sector towards a more electrified model with mass use of renewable energies.

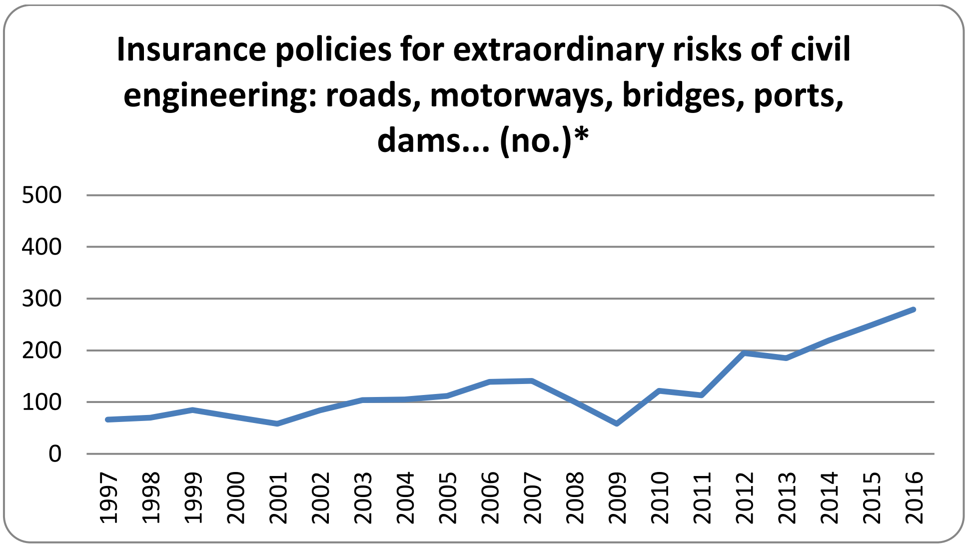
Insurance policies for extraordinary risks of civil engineering: roads, motorways, bridges, ports, dams... (no.) – pt8

Methodology: Statistics from the Insurance Compensation Consortium (data for the whole of Spain).

	pt7*
1997	**66**
1998	**70**
1999	**85**
2000	**71**
2001	**58**
2002	**84**
2003	**104**
2004	**105**
2005	**112**
2006	**139**
2007	**141**
2008	**101**
2009	**58**
2010	**122**
2011	**113**
2012	**195**
2013	**185**
2014	**219**
2015	**249**
2016	**279**

* Data for the whole of Spain

Source: Statistics on Extraordinary Risks, series 1971-2017. Insurance Compensation Consortium.



* Data for the whole of Spain.

Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: The evolution of compensation in the insurance sector is undoubtedly an extremely appropriate indicator for assessing the sector's degree of adaptation to the impact on civil engineering works of damage caused by flooding and extreme weather events.

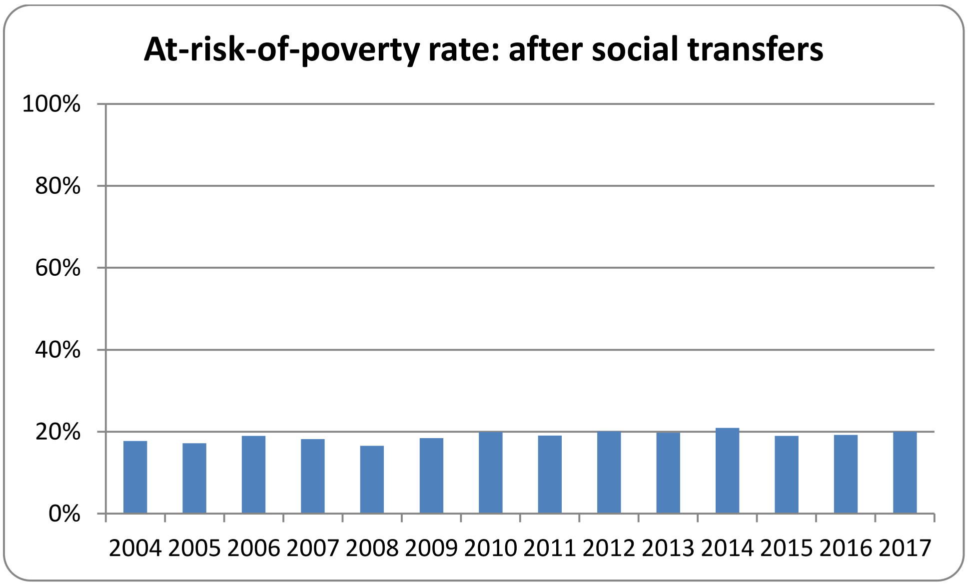
At-risk-of-poverty rate: after social transfers (%) – ps1

Methodology: The poverty threshold is defined as the minimum level of income necessary to have an adequate standard of living. It is set at 60% of the median net income per consumption unit of all persons in a society. The median is the value that, after ordering all individuals from lowest to highest income, half will be below and half will be above this value. In the results for Catalonia presented by the Statistical Institute of Catalonia (IDESCAT), the threshold that was calculated on the income distribution of the Catalan population was used.

The at-risk-of-poverty rate includes income from social transfers (pensions, unemployment benefits, social assistance and family protection). This ensures that the effort made by the social protection system to reduce the risk of poverty is taken into account.

	ps1
2004	**17.7%**
2005	**17.2%**
2006	**19.0%**
2007	**18.2%**
2008	**16.6%**
2009	**18.4%**
2010	**19.9%**
2011	**19.1%**
2012	**20.1%**
2013	**19.8%**
2014	**20.9%**
2015	**19.0%**
2016	**19.2%**
2017	**20.0%**

Source: Statistical Institute of Catalonia (IDESCAT) and EUROSTAT.



Desired trend of the adaptation: A decrease in the indicator.

Relevance of the indicator: The population below the poverty threshold is more vulnerable to the impacts of climate change.

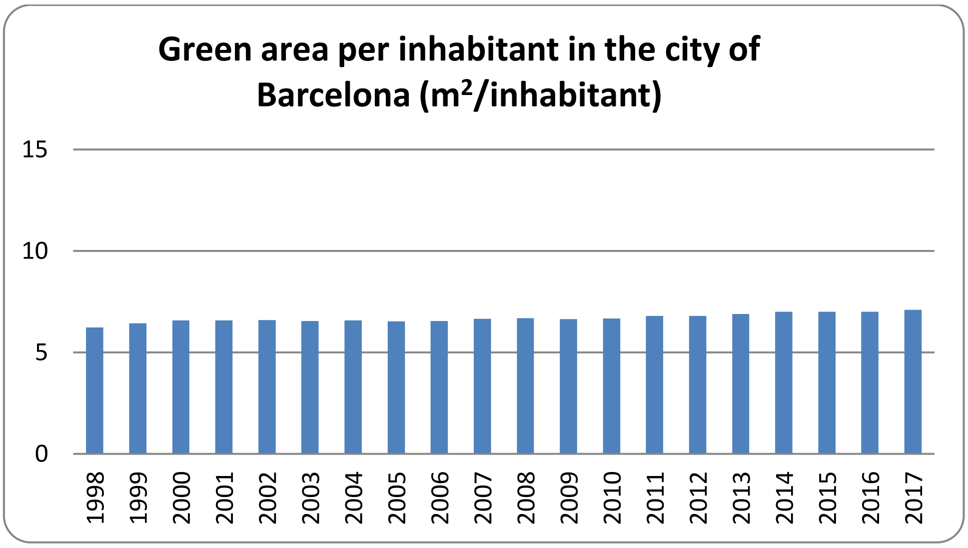
Green area per inhabitant in the city of Barcelona (m^2/inhabitant) – ps2

Methodology: In calculating the green area in the city of Barcelona, the area of Collserola Park was not taken into account (which is included in the Barcelona City Council's Green and Biodiversity Plan).

	ps2
1998	**6.2**
1999	**6.4**
2000	**6.6**
2001	**6.6**
2002	**6.6**
2003	**6.5**
2004	**6.6**
2005	**6.5**
2006	**6.6**
2007	**6.7**
2008	**6.7**
2009	**6.6**
2010	**6.7**
2011	**6.8**
2012	**6.8**
2013	**6.9**
2014	**7.0**
2015	**7.0**
2016	**7.0**
2017	**7.1**

* Does not include Collserola Park.

Source: By the authors using the Barcelona City Council's Green and Biodiversity Plan.



* Does not include Collserola Park.

Desired trend of the adaptation: An increase towards the $15m^2$/inhabitant target (recommended by the World Health Organisation).

Relevance of the indicator: Green areas play an extremely important role in reducing the urban heat island effect.

Catalan Air Quality Index ICQA (% Satisfactory + Excellent) – ps3

Methodology: In Catalonia, air quality monitoring is carried out by the Air Pollution Monitoring and Forecast Network (XVPCA), which includes stations that measure the concentration of the main atmospheric pollutants in the air.

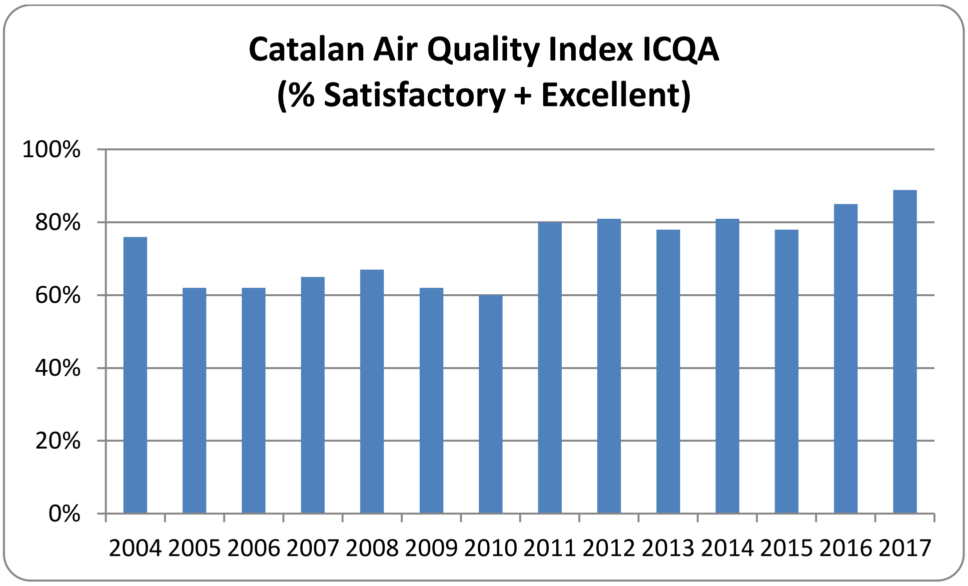
The Catalan Air Quality Index (ICQA) is an indicative indicator of air quality for the general public. It is calculated from XVPCA data, taking into account the immission levels of carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3) and particulate matter (PM10).

The ICQA is calculated based on the concentration of each pollutant. The ICQA is not an average, but instead the lowest air quality value is chosen, which becomes the ICQA for that day.

Air quality is defined based on the numerical value of the ICQA. The higher the ICQA, the higher the air quality.

	ps3
2004	**76%**
2005	**62%**
2006	**62%**
2007	**65%**
2008	**67%**
2009	**62%**
2010	**60%**
2011	**80%**
2012	**81%**
2013	**78%**
2014	**81%**
2015	**78%**
2016	**85%**
2017	**89%**

Source: Air Pollution Monitoring and Forecast Network (XVPCA). Directorate-General of Environmental Quality and Climate Change. Ministry of Territory and Sustainability.



Desired trend of the adaptation: An increase in the indicator.

Relevance of the indication: Air pollution and climate change are different problems, although they are inextricably linked. With heat, the harmful effects of pollution increase because certain toxic elements are more volatile and because their oxidising capacity increases.

Areas with worse air quality, subject to the same rises in average temperature or in the frequency or intensity of heat waves, have more harmful effects on human health than other areas with better air quality. Therefore, actions designed to reduce local pollution sources are excellent measures for adapting to climate change.

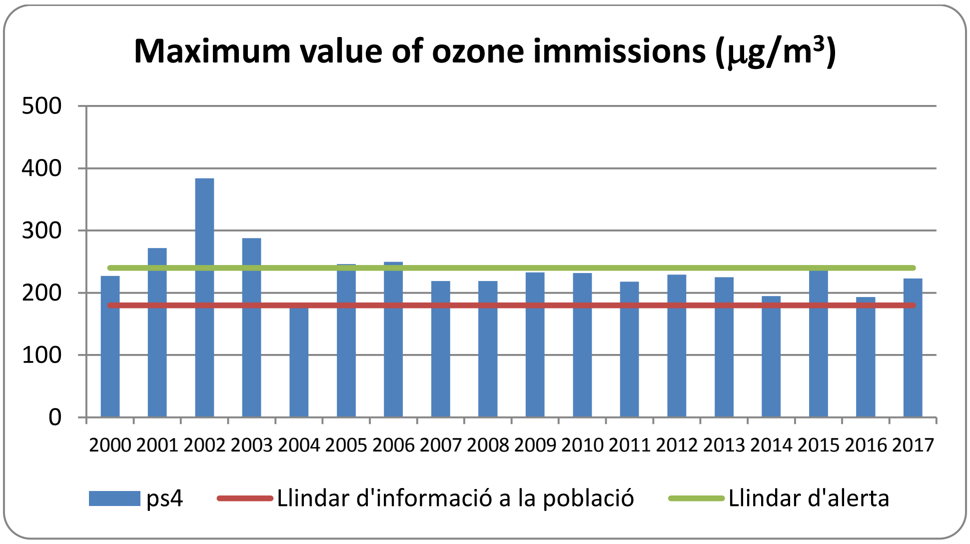
Maximum value of ozone immissions (μg/m³) – ps4

Methodology: The immission levels (presence) of ozone in the troposphere are analysed. The maximum hourly values are calculated.

	ps4
2000	**227**
2001	**272**
2002	**384**
2003	**288**
2004	**180**
2005	**246**
2006	**250**
2007	**219**
2008	**219**
2009	**233**
2010	**232**
2011	**218**
2012	**229**
2013	**225**
2014	**195**
2015	**237**
2016	**193**
2017	**223**

Maximum hourly averages	
Public information threshold	**180 μg/m³**
Alert threshold	**240 μg/m³**

Source: Statistical Institute of Catalonia (IDESCAT) / Directorate-General of Environmental Quality and Climate Change. Ministry of Territory and Sustainability.



Desired trend of the adaptation: A reduction to levels below the public information threshold.

Relevance of the information: The ozone concentration in a particular location is dependent on temperature, but also on solar radiation and, in particular, the concentration of certain precursors, such as nitrogen oxide, a gas generated by human activity (e.g. transport) in significant amounts. Our capacity to limit the concentration of these precursors and, therefore, the anthropogenic sources that emit them, will be a determining factor in reducing the vulnerability of the population.

Consumption of electricity obtained from renewable sources (%) – pe1

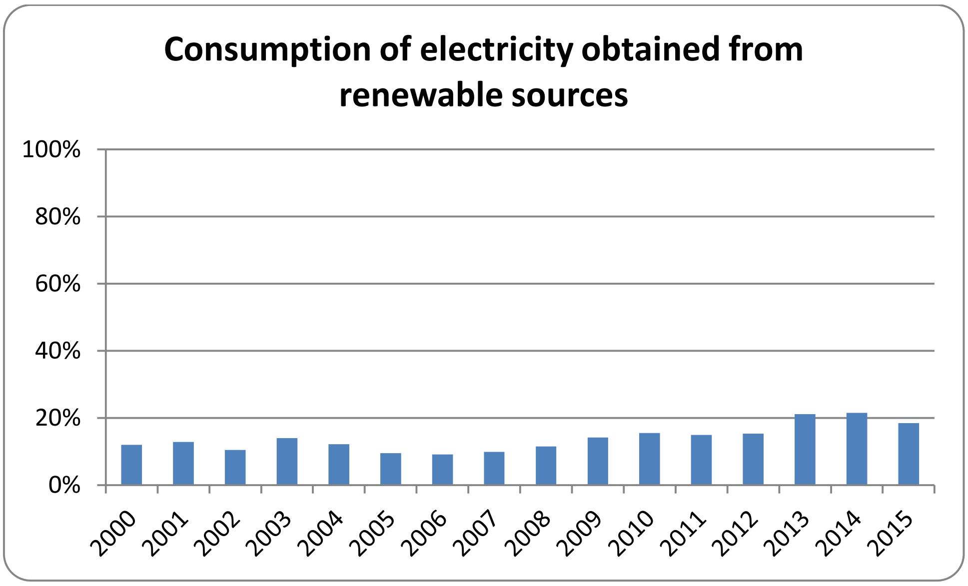
Methodology: This indicator is the ratio between the electricity produced from renewable energy sources and the total national electricity consumption for a given year.

The electricity produced from renewable energy sources includes electricity generated from hydroelectric plants (excluding pumping), wind, solar, geothermal and biomass power, and waste plants. Electricity from biomass power and waste plants includes electricity generated from burning wood and wood waste and other renewable solid waste (straw, black liquor), from the incineration of municipal solid waste, biogas (from landfill, wastewater treatment plants and farms, etc.) and from liquid biofuels.

The total national electricity consumption comprises the total gross national generation from all forms of energy (including self-produced), plus electricity imports minus electricity exports.

	pe1
2000	**12.0%**
2001	**12.8%**
2002	**10.4%**
2003	**14.0%**
2004	**12.2%**
2005	**9.5%**
2006	**9.1%**
2007	**9.9%**
2008	**11.5%**
2009	**14.2%**
2010	**15.5%**
2011	**14.9%**
2012	**15.3%**
2013	**21.1%**
2014	**21.5%**
2015	**18.4%**

Source: Catalan Energy Institute (ICAEN) and EUROSTAT.



Desired trend of the adaptation: An increase in the indicator.

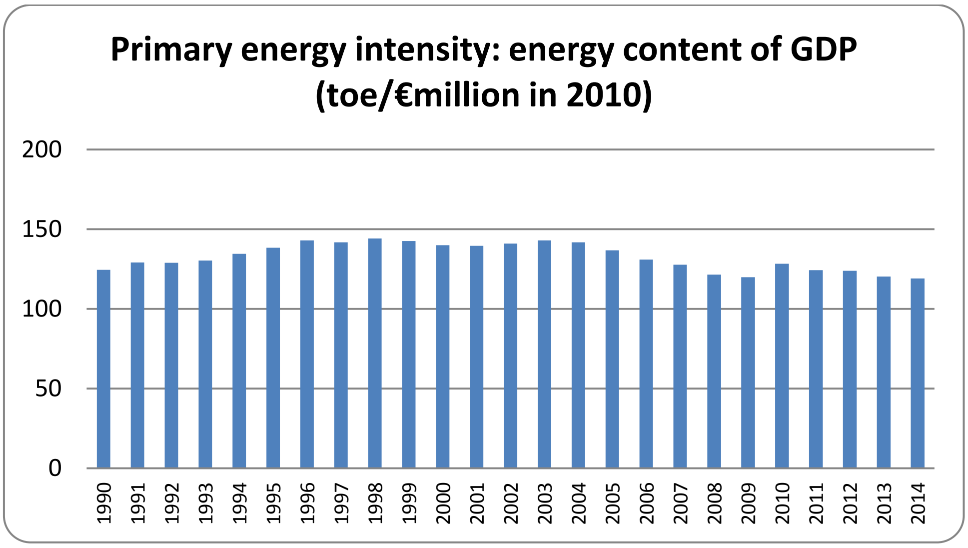
Relevance of the indicator: This is a really important indicator if a diversified and low-carbon energy model, consistent with the strategic objectives of the European Union on energy and climate, is to be achieved.

Primary energy intensity: energy content of GDP (toe/€million in 2010) – pe2

Methodology: According to Catalan Energy Institute (ICAEN) data.

	pe2
1990	**124.6**
1991	**129.2**
1992	**128.9**
1993	**130.4**
1994	**134.5**
1995	**138.5**
1996	**143.0**
1997	**141.8**
1998	**144.3**
1999	**142.7**
2000	**139.9**
2001	**139.6**
2002	**141.0**
2003	**143.1**
2004	**141.8**
2005	**136.8**
2006	**130.9**
2007	**127.8**
2008	**121.5**
2009	**119.8**
2010	**128.3**
2011	**124.3**
2012	**124.0**
2013	**120.3**
2014	**119.1**

Source: Catalan Energy Institute (ICAEN).



Desired trend of the adaptation: A decrease in the indicator.

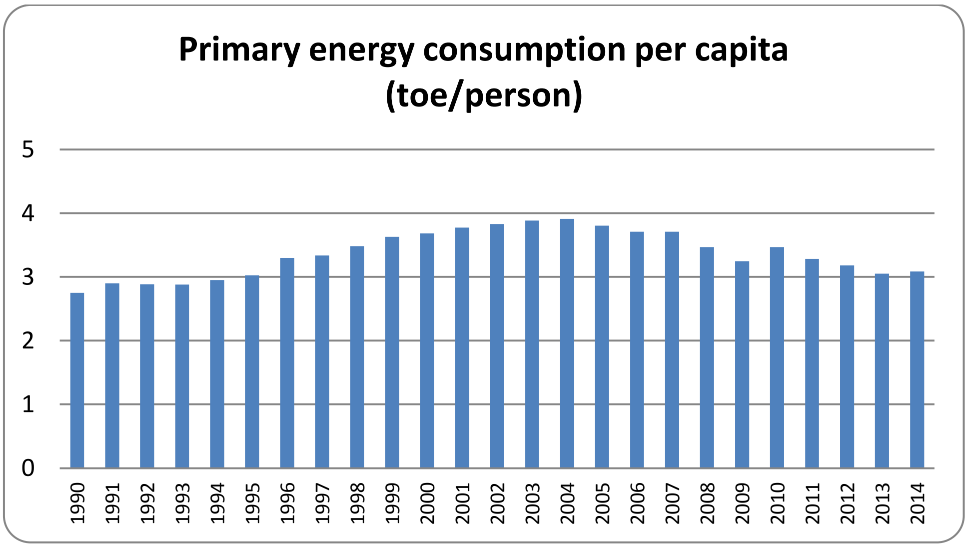
Relevance of the indicator: Achieving a significant percentage of improvement in the area of energy efficiency and energy saving will make the sector more resilient and less vulnerable to the impacts of climate change.

Primary energy consumption per capita (toe/person) – pe3

Methodology: Defined in the Catalan Energy and Climate Change Plan 2013-2020.

	pe3
1990	**2.8**
1991	**2.9**
1992	**2.9**
1993	**2.9**
1994	**3.0**
1995	**3.0**
1996	**3.3**
1997	**3.3**
1998	**3.5**
1999	**3.6**
2000	**3.7**
2001	**3.8**
2002	**3.8**
2003	**3.9**
2004	**3.9**
2005	**3.8**
2006	**3.7**
2007	**3.7**
2008	**3.5**
2009	**3.3**
2010	**3.5**
2011	**3.3**
2012	**3.2**
2013	**3.1**
2014	**3.1**

Source: Energy Balance in Catalonia. Catalan Energy Institute (ICAEN).



Desired trend of the adaptation: A decrease in the indicator.

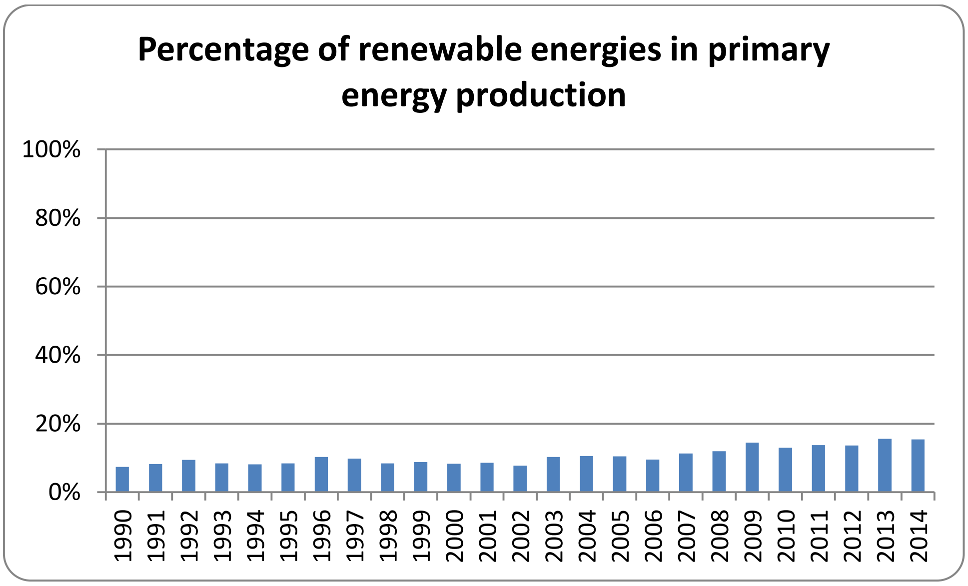
Relevance of the indicator: This is a really important indicator if an energy efficient, diversified and low-carbon energy model, consistent with the strategic objectives of the European Union on energy and climate, is to be achieved.

Percentage of renewable energies in primary energy production (%) – pe4

Methodology: According to Catalan Energy Institute (ICAEN) data.

	pe4
1990	**7.4%**
1991	**8.2%**
1992	**9.4%**
1993	**8.4%**
1994	**8.1%**
1995	**8.4%**
1996	**10.3%**
1997	**9.8%**
1998	**8.4%**
1999	**8.8%**
2000	**8.3%**
2001	**8.6%**
2002	**7.7%**
2003	**10.3%**
2004	**10.5%**
2005	**10.4%**
2006	**9.5%**
2007	**11.3%**
2008	**11.9%**
2009	**14.5%**
2010	**13.0%**
2011	**13.7%**
2012	**13.6%**
2013	**15.6%**
2014	**15.4%**

Source: Energy Balance in Catalonia. Catalan Energy Institute (ICAEN).



Desired trend of the adaptation: An increase in the indicator.

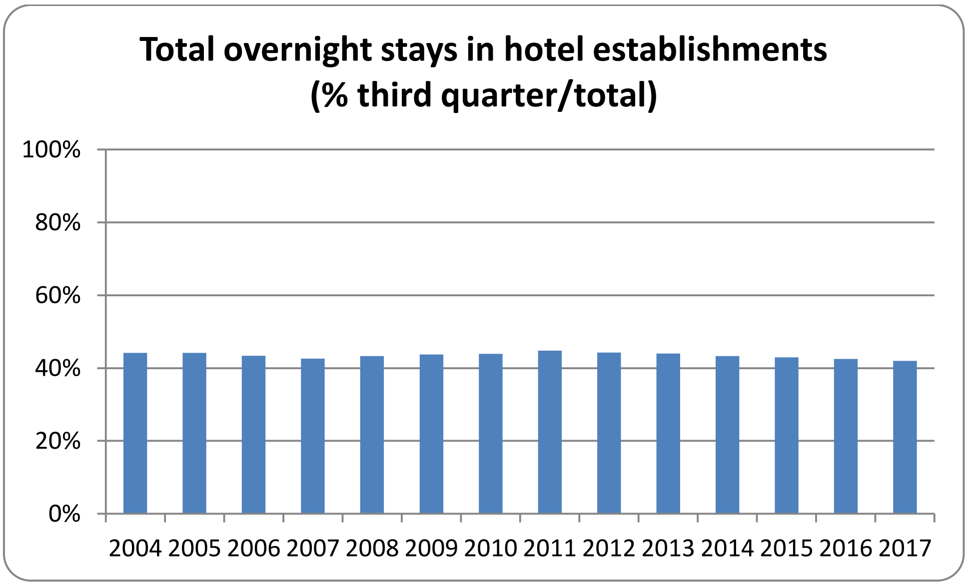
Relevance of the indicator: This is a really important indicator if a diversified and low-carbon energy model, consistent with the strategic objectives of the European Union on energy and climate, is to be achieved.

Total overnight stays in hotel establishments (% third quarter/total) – ptu1

Methodology: Data on overnight stays in hotel establishments in Catalonia. The percentage is calculated corresponding to the third quarter.

	ptu1
2004	**44.2%**
2005	**44.2%**
2006	**43.4%**
2007	**42.6%**
2008	**43.3%**
2009	**43.8%**
2010	**44.0%**
2011	**44.8%**
2012	**44.2%**
2013	**44.0%**
2014	**43.3%**
2015	**42.9%**
2016	**42.5%**
2017	**42.0%**

Source: Statistical Institute of Catalonia (IDESCAT).



Desired trend of the adaptation: A decrease in the indicator.

Relevance of the indicator: More than 40% of the annual overnight stays are concentrated in the third quarter of the year (July, August, September). Furthermore, other sectors such as agriculture also have the highest demand for water resources in the same quarter.

Therefore, reducing the percentage of overnight stays during the third quarter of the year means, as a measure of tourism deseasonalization, a good measure of adaptation to climate change in the tourism sector.

Foreign business travellers in relation to total foreign tourists (%) – ptu2

Methodology: The purpose of foreign tourists' travel is classified into: leisure/holidays, professional reasons, and others, a category that also includes tourists travelling for personal reasons (family, health and shopping).

Until the third quarter of 2015, the Spanish Tourism Institute was responsible for creating Statistics on Tourist Movements on Borders (Frontur) and the Tourist Expenditure Survey (Egatur). From the fourth quarter of 2015, the organisation responsible for these operations has been the Spanish National Statistics Institute.

	Total	Professional reasons	**ptu2**
2004	13,170.4	1,813.2	**13.8%**
2005	14,662.0	1,909.4	**13.0%**
2006	15,809.5	1,790.5	**11.3%**
2007	15,892.4	1,677.5	**10.6%**
2008	15,026.9	1,493.4	**9.9%**
2009	13,597.0	1,194.7	**8.8%**
2010	14,206.6	1,448.3	**10.2%**
2011	14,969.4	1,397.9	**9.3%**
2012	15,553.6	1,440.7	**9.3%**
2013	16,638.4	1,670.4	**10.0%**
2014	18,311.8	1,670.8	**9.1%**
2015	19,260.6	2,049.0	**10.6%**
2016	18,139.2	1,682.6	**9.3%**
2017	19,118.4	1,524.1	**8.0%**

Source: Statistical Institute of Catalonia (IDESCAT).

Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: Tourism for professional reasons (unlike sun and beach or snow tourism) is not climate dependent and, therefore, is a measure of diversification for the sector. For this reason, the increase in business tourism is a good measure of adaptation to climate change.

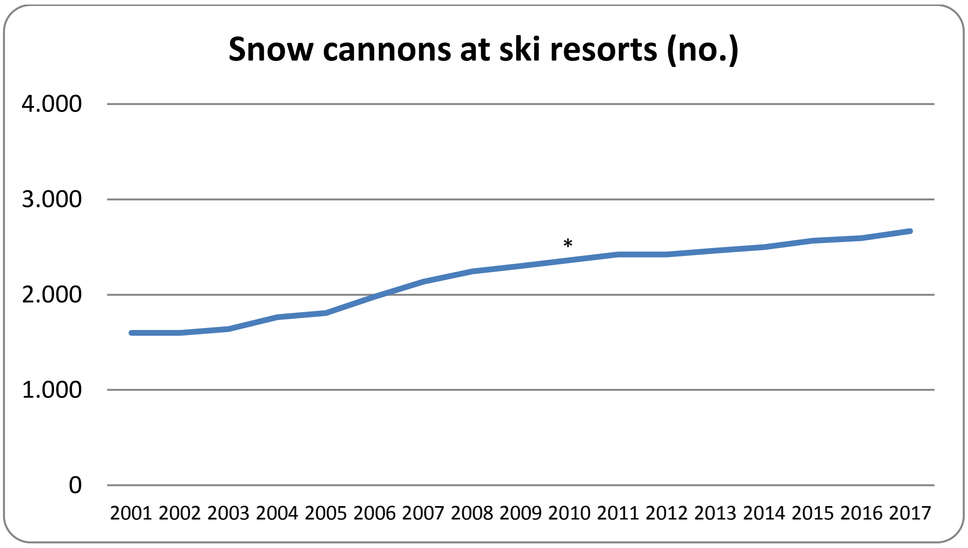
Snow cannons at ski resorts (no.) – ptu3

Methodology: Data drafted by IDESCAT based on information from the Employment and Production Model Observatory and the Catalan Ministry of Labour, Social Affairs and Families. In order to analyse the evolution, an estimated value was assigned to 2010 (highlighted in yellow) due to the lack of data for that year.

	ptu3
2001	**1,600**
2002	**1,600**
2003	**1,638**
2004	**1,764**
2005	**1,806**
2006	**1,979**
2007	**2,136**
2008	**2,244**
2009	**2,300**
2010	**2,361**
2011	**2,422**
2012	**2,422**
2013	**2,461**
2014	**2,500**
2015	**2,567**
2016	**2,592**
2017	**2,666**

Note: Estimated value highlighted in yellow.

Source: Statistical Institute of Catalonia (IDESCAT).



* Estimated value.

Desired trend of the adaptation: A decrease in the indicator.

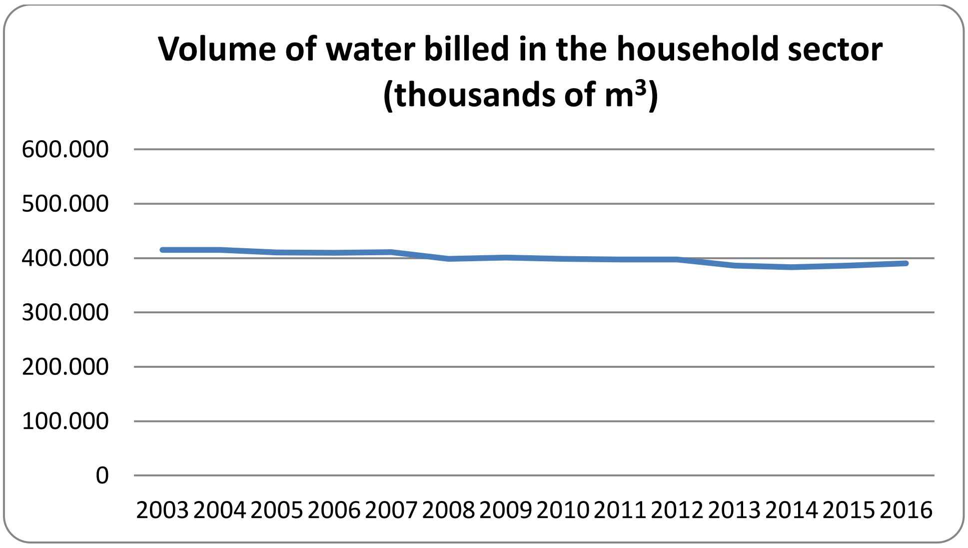
Relevance of the indicator: The production of artificial snow is a common practice in Catalan ski resorts, but it is classified as a poor adaptation to climate change, as it requires high water and energy resources, and has a great impact on mountain ecosystems. Ski resorts that are dependent on the use of snow cannons must diversify their activities to include mountain resorts.

Volume of water billed in the household sector (thousands of m^3) – pu1

Methodology: The methodology is established in the Catalan River Basin District Management Plan.

	pu1
2003	**415.179**
2004	**415.337**
2005	**410.370**
2006	**410.081**
2007	**410.941**
2008	**398.654**
2009	**400.917**
2010	**398.545**
2011	**397.496**
2012	**397.524**
2013	**386.369**
2014	**383.370**
2015	**386.473**
2016	**390.173**

Source: Catalan Water Agency (ACA): Official economic and socioeconomic data, environmental control data, data from supra-municipal bodies on supply.



Desired trend of the adaptation: A decrease in the indicator.

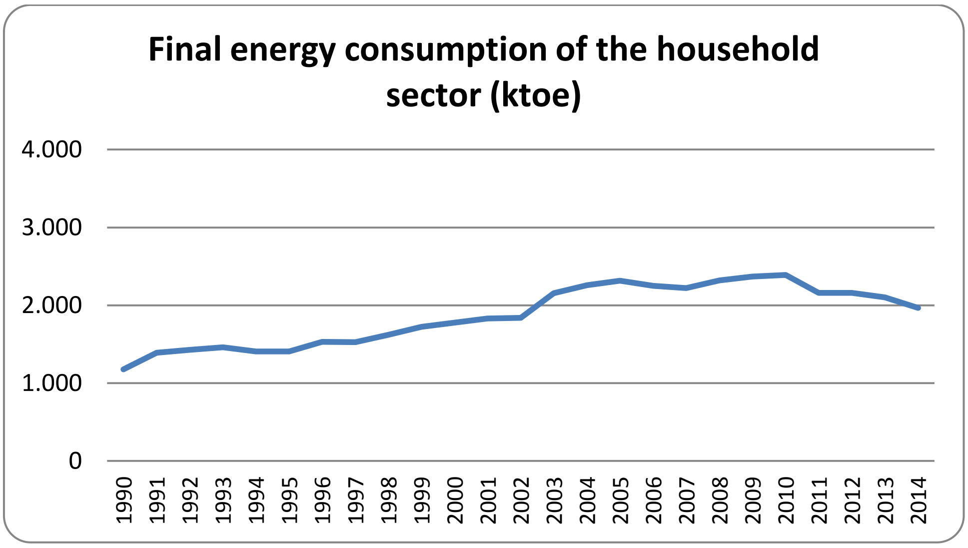
Relevance of the indicator: This is a good indicator for the sector, since greater savings and efficiency will make urban areas more resilient to the anticipated impacts of climate change (a reduction and greater competition for resources).

Final energy consumption of the household sector (ktoe) – pu2

Methodology: The methodology is established in the Catalan Energy and Climate Change Plan 2013-2020.

	pu2
1990	**1,177.8**
1991	**1,389.2**
1992	**1,429.0**
1993	**1,460.4**
1994	**1,405.6**
1995	**1,407.0**
1996	**1,530.7**
1997	**1,525.8**
1998	**1,621.4**
1999	**1,724.3**
2000	**1,778.8**
2001	**1,832.7**
2002	**1,838.1**
2003	**2,155.8**
2004	**2,260.5**
2005	**2,314.4**
2006	**2,248.5**
2007	**2,219.9**
2008	**2,318.4**
2009	**2,370.6**
2010	**2,391.3**
2011	**2,161.7**
2012	**2,159.6**
2013	**2,102.7**
2014	**1,964.6**

Source: Catalan Energy and Climate Change Plan 2013-2020.



Desired trend of the adaptation: A decrease in the indicator.

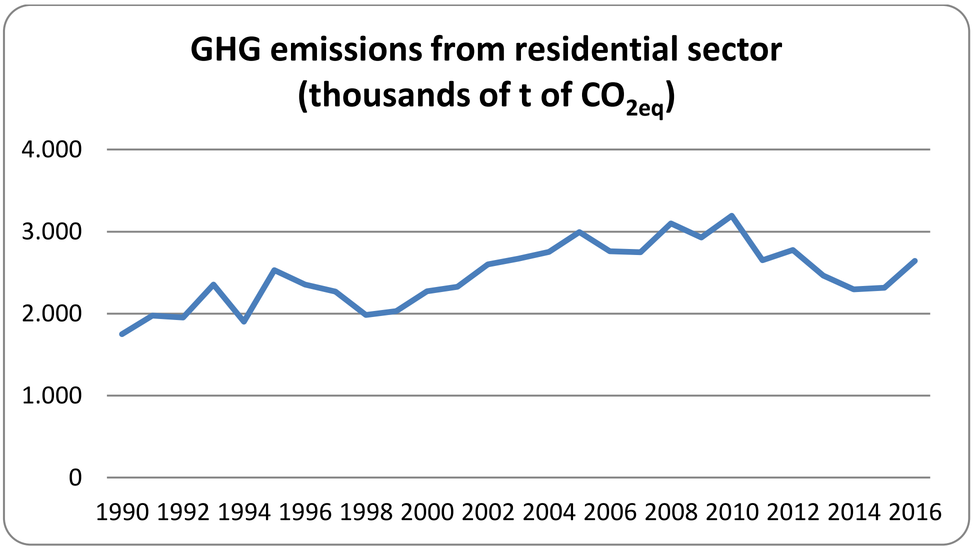
Relevance of the indicator: Indicator that can provide an idea of the importance of saving energy in the home and moving towards a more sustainable energy model, both of which are key issues in adaptation to climate change impacts.

GHG emissions from residential sector (thousands of t of CO_{2eq}) – pu3

Methodology: The National Greenhouse Gas Inventory for the period 1990-2016 (2018 version) from the Ministry of Agriculture and Fisheries, Food and Environment (MAPAMA), broken down by autonomous communities, as well as data from the Catalan Office for Climate Change (OCCC) in the Catalan Ministry of Territory and Sustainability (DTES) on the emissions trading scheme.

	pu3
1990	**1,749**
1991	**1,977**
1992	**1,951**
1993	**2,353**
1994	**1,902**
1995	**2,529**
1996	**2,354**
1997	**2,270**
1998	**1,985**
1999	**2,032**
2000	**2,273**
2001	**2,328**
2002	**2,600**
2003	**2,671**
2004	**2,753**
2005	**2,995**
2006	**2,762**
2007	**2,750**
2008	**3,102**
2009	**2,929**
2010	**3,195**
2011	**2,650**
2012	**2,778**
2013	**2,465**
2014	**2,295**
2015	**2,317**
2016	**2,643**

Source: Catalan Office for Climate Change (OCCC). Ministry of Territory and Sustainability.



Desired trend of the adaptation: A decrease in the indicator.

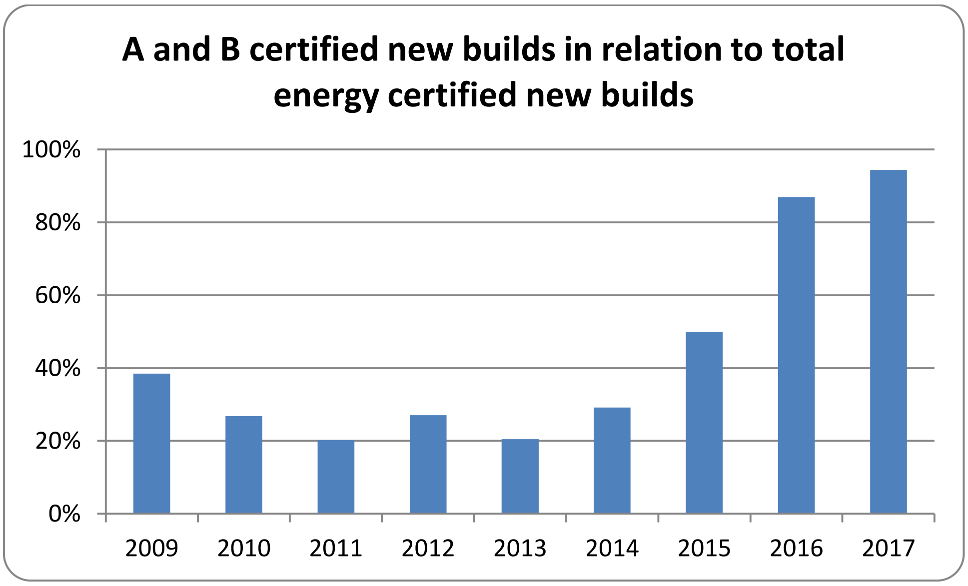
Relevance of the indicator: This indicator shows the residential sector's contribution to greenhouse gas emissions. In order to move towards a low-carbon society that is more resilient to and prepared for the impacts of climate change, the residential sector must aim to make savings in resource usage and to reduce GHG emissions from fossil fuels.

A and B certified new builds in relation to total energy certified new builds (%) – pu4

Methodology: Established by the Catalan Energy Institute (ICAEN) pursuant to the register of certified properties in Catalonia.

	pu4
2009	**38.5%**
2010	**26.8%**
2011	**20.2%**
2012	**27.1%**
2013	**20.5%**
2014	**29.1%**
2015	**50.0%**
2016	**86.9%**
2017	**94.4%**

Source: Energy efficiency certification of buildings. Catalan Energy Institute (ICAEN).



Desired trend of the adaptation: An increase in the indicator.

Relevance of the indicator: This indicator shows the residential sector's contribution in terms of energy saving and efficiency. In order to move towards a low-carbon society that is more resilient to and prepared for the impacts of climate change, the residential sector must aim to make savings in resource usage and to reduce GHG emissions from fossil fuels.

5.2. Appendix 2: Comparison of results with the previous global indicator of adaptation (GIA)

Table 5 compares the values of this new global indicator of adaptation (GIA) in relation to the indicator defined in 2014. As you can see, the values and evolution of factor 2 are almost identical. However, the evolution of factor 1 is just the opposite. Statistically, this may have three explanations (non-exclusive):

1) First, the new indicator uses 42 indicators, 13 more than the indicator defined in 2014. Therefore, a possible explanation is that these 13 new indicators (particularly those related to resource consumption) behave differently to those that were previously introduced.
2) A second complementary explanation is that now the correlations between the indicators and factor 1 are new: It is possible that these new correlations, compared to the previous ones, have benefited the factors with a more positive behaviour from 2005 to 2014.
3) Finally, the weights given to each sector has also changed slightly, which may benefit the sectors or natural systems with a more positive behaviour; this explanation can only be complementary to either of the previous two.

Table 5: Values of global indicators of adaptation to climate change 2014 and 2018

GIA	F1 (2005)	F1 (2011)	F1 (2014)	F2 (2005)	F2 (2011)	F2(2014)
GIA 2018	100	105.58	110.01	100	100.68	101.58
GIA 2014	100	98.16	97.46	100	98.63	99.41

In order to determine which of the three explanations carries more weight from a statistical point of view, a small exercise can be carried out to try to explain the differences in the evolution of the two indicators with regard to factor 1, which is where the differences are greatest (see Table 6 below). Comparing the values of this evolution, we find that the evolution of GIA 2018 is 7.42 points more positive in 2011 than in 2005 and 5.13 points more positive in 2014 compared to 2011. Using the weights of the sectors used in 2014, this difference would be even more positive (0.98 more in 2011 and 1.47 more in 2014). Applying the correlations of the indicator from 2014 only explains a small part of these differences (-0.82 in 2011 and -1.13 in 2014). Therefore, most of the differences remain unexplained because they are due to the new indicators introduced in 2018.

Table 6: Disaggregation of the differences between GIA 2018 and GIA 2014

GIA	F1 (2005)	F1 (2011)	2011-2005	F1 (2014)	2014-2011
GIA 2018	100	105.58	5.58	110.01	4.43
GIA 2014	100	98.16	-1.84	97.46	-0.70
GIA 2018-GIA 2014			7.42		5.13
With 2014 weights			8.40		6.60
Difference with weights			0.98		1.47
With 2014 correlations			6.60		4.00
Difference with correlations			-0.82		-1.13