The PRIMAP-hist national historical emissions time series (1750-2022) (v2.5, updated October 2023) - detailed CHANGELOG

1 Content

The v2.5 release updates mainly country reported data and extends the time series by one year to 2022. New and updated input data sources are UNFCCC data for AnnexI and non-AnnexI data, EI data (Energy Institute (2023)), and cement process emissions data (Andrew (2023)). F-gas data are now included from EDGAR v7.0.

2 Notes

- This document just lists the major sources of changes per country for 2021 and 1990-2021. If you want to investigate country changes for other years and / or in more detail check out the file *changes_PRIMAP-hist_v2.5_final_nr_to_PRIMAP-hist_v2.4.2_nr.xlsx* which contains information for more years and all sectors and gases.
- All changes are compared to the last published version v2.4.2. For comparisons (just in numbers) with the 2022 pre-COP version (v2.4) check out the *changes_PRIMAP-hist_v2.5_final_nr_to_PRIMAP-hist_v2.4_nr.xlsx* document that can show the differences per country, sector, and gas.
- To understand the information in this document please read the data description first to get an overview over the gases, sectors and input data sources.
- For differences between the CR and TP scenario consult the file *changes_PRIMAP-hist_v2.5_final_nr_CR_to_TP.xlsx*.
- Comparisons are mostly carried out on the level of CO_2, CH_4, N_2O and f-gases as a group. However, often changes for HFCs, PFCs, SF_6, and NF_3 are very different.

3 Changes in data sources and preprocessing

- Data source updates
  - **CRF** has been updated to the 2023 submissions (closes issues #64, #65)
  - **UNFCCC data for non-AnnexI countries** have been combined from different sources (DI interface and BURs / NCs / NIRs read from pdf / xlsx). Several new and older reports have been included (closes issues #66, #67). We refer to this source as *UNFCCCALL*. New (and older) BURs / NIRs / NCs have been added for the countries listed below. The years covered are added in parentheses. Often not all years have a full inventory thus downscaling is needed to make the data usable for PRIMAP-hist. For some submissions individual years or time series have to be removed due to errors or inconsistencies with other data sources. For more information see Section Individual country information below.
    - **Afghanistan:** BUR1 (1990-2017)

* **Albania:** NC4 (2009-2019), combined with data from the UNFCCC DI portal
* **Andorra:** BUR4 (1990, 1995, 2000, 2005, 2010-2019), combined with data from older BURs
* **Armenia:** BUR3 (2017), combined with data from the UNFCCC DI portal
* **Antigua and Barbuda:** BUR1 (2015), NC3 (2006), combined with data from the UNFCCC DI portal
* **Azerbaijan:** NC4 (1990, 1995, 2000, 2005, 2010-2016)
* **Benin:** BUR1 (1990, 1995, 2000, 2005, 2010-2014, 2015)
* **Bangladesh:** NC3 (2012), combined with data from the UNFCCC DI portal
* **Bahrain:** NC3 (2007), combined with data from the UNFCCC DI portal
* **Bahamas:** BUR1 (2001-2018)
* **Belize:** BUR1 (2012, 2015, 2017), combined with data from the UNFCCC DI portal
* **Bolivia:** NC3 (2006, 2008), combined with data from the UNFCCC DI portal
* **Brunei Darussalam:** NC2 (2010-2014)
* **Bhutan:** BUR1 (1994-2020), combined with data from the UNFCCC DI portal
* **Botswana:** NC3 (2014), combined with data from the UNFCCC DI portal
* **Chile:** BUR5 (1990-2018)
* **Cook Islands:** NC3 (2007-2014), combined with data from the UNFCCC DI portal
* **Cape Verde:** NC3 (1995, 2000, 2005, 2010)
* **Costa Rica:** NIR (1990, 1996, 2000, 2005, 2010, 2012-2017)
* **Cuba:** BUR1 (2016), NC3 (2010, 2012, 2014), combined with data from the UNFCCC DI portal
* **Djibouti:** NC3 (2010), combined with data from the UNFCCC DI portal
* **Dominican Republic:** BUR1 (2015), combined with data from the UNFCCC DI portal
* **Ecuador:** NIR (1994, 2000, 2006, 2010, 2012, 2014, 2016, 2018), combined with data from the UNFCCC DI portal
* **Egypt:** BUR1 (2015), combined with data from the UNFCCC DI portal
* **Eritrea:** BUR1 (2018), combined with data from the UNFCCC DI portal
* **Fiji:** NC3 (2006-2011), combined with data from the UNFCCC DI portal
* **Gabon:** NIR to BUR1 (1994, 2000, 2005, 2010-2017)
* **Georgia:** NC4 (1990-2017), combined with data from the UNFCCC DI portal
* **Ghana:** NIR5 (1990-2018)
* **Gambia:** NC3 (2010), combined with data from the UNFCCC DI portal
* **Grenada:** NC2 (2000-2014), combined with data from the UNFCCC DI portal
* **Guatemala:** NC3 (1990, 1994, 2000, 2005, 2010, 2014, 2016), combined with data from the UNFCCC DI portal
* **Honduras:** BUR1 (2005, 2015), combined with data from the UNFCCC DI portal
* **Indonesia:** BUR3 (2019), combined with data from BUR 1 and 2 and the UNFCCC DI portal
* **India:** BUR3 (2011-2015), combined with data from the UNFCCC DI portal
* **Iran:** NC3 (2010), combined with data from the UNFCCC DI portal
* **Israel:** BUR2 (1996-2020), combined with data from the UNFCCC DI portal
* **Jordania:** NC4 (2017), combined with data from the UNFCCC DI portal
* **Kyrgyzstan:** BUR1 and NIR (1990-2018)
* **Cambodia:** BUR1 (1994-2016)
* **Kuwait:** NC2 (2000), combined with data from the UNFCCC DI portal
* **Lao People's Democratic Republic:** BUR1 (2014), combined with data from the UNFCCC DI portal
* **Lebanon:** BUR4 (2018), NC4 (2019), combined with data from the UNFCCC DI portal
* **Saint Lucia:** BUR1 (2000, 2005, 2010, 2014-2018), combined with data from UNFCCC DI portal
* **Lesotho:** BUR1 (2011-2017), NC3 (2005-2010), combined with data from the UNFCCC DI portal
* **Morocco:** BUR3 (2010, 2012, 2014, 2016, 2018)
* **Republic of Moldova:** NC5 (1990-2020)
* **North Macedonia:** NIR4 (1990, 2000, 2014-2019), BUR3 (1990, 2000, 2005, 2014-2016), combined with data from BUR2 and the UNFCCC DI portal
* **Montenegro:** NIR to BUR3 (1990-2019)

    - **Mozambique:** New data in the DI interface (2000, 2005, 2010, 2012, 2014, 2016). But sectoral resolution not sufficient for most sectors.
    - **Mauritius:** BUR1 and NIR (2001-2016), NIR (2000)
    - **Malawi:** BUR1 (2010), NC3 (1995-1999)
    - **Malaysia:** BUR4 (1990-2019)
    - **Nigeria:** BUR2 (2000-2017)
    - **Nicaragua:** NC3 (2000, 2005, 2010)
    - **Panama:** BUR2 and NIR (1994-2017)
    - **Papua New Guinea:** NIR to BUR2 (2000, 2005, 2010-2017)
    - **Peru:** BUR3 (2000, 2005, 2010, 2012, 2014, 2016, 2019)
    - **Puerto Rico:** BUR3 (2017), combined with data from the UNFCCC DI portal
    - **Rwanda:** BUR1 (2006-2018)
    - **South Korea:** 2022 inventory (1990-2020)
    - **Saudi Arabia:** NC4 (2016), combined with data from the UNFCCC DI portal
    - **Singapore:** BUR4 (1994, 2000, 2010, 2012, 2014, 2016, 2018)
    - **Sierra Leone:** NC3 (2005, 2007-2010)
    - **El Salvador:** BUR1 (2014), combined with data from the UNFCCC DI portal
    - **Somalia:** BUR1 (2000, 2005, 2010, 2014, 2020)
    - **Serbia:** NC2 (1990, 2000, 2005, 2010-2014)
    - **Sao Tome and Principe:** BUR1 (2012, 2016, 2018), combined with data from the UNFCCC DI portal
    - **Thailand:** BUR4 (2000-2019)
    - **Togo:** BUR2 (2018), combined with data from BUR1 and the UNFCCC DI portal
    - **Tajikistan:** BUR1 (2014), combined with data from the UNFCCC DI portal
    - **Timor Leste:** NC2 (2005-2015)
    - **Trinidad:** and Tobago NC3 (2006-2018)
    - **Tunesia:** NC3 (2010, 2012), combined with data from the UNFCCC DI portal
    - **Uruguay:** BUR2 (1990, 1994, 1998, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014), combined with data from the UNFCCC DI portal
    - **Uzbekistan:** BUR1 (1990, 2000, 2010-2017)
    - **Vanuatu:** NC3 (2007-2015)
    - **Samoa:** NC2 (1994-2007)
    - **Zambia:** BUR1 (1995, 2005, 2010-2016), combined with data from the UNFCCC DI portal
    - **Zimbabwe:** BUR1 (2017), NC4 (1994, 2000, 2006, 2010)

  - **Statistical Review of World Energy 2023** Data published by the Energy Institute for energy CO_2 have been included (closes issue #63). The data replaced the 2022 version (published by BP).
  - **EDGAR v7.0** F-gas data have been included (closes issue #58). The f-gas emissions estimates are very different from older EDGAR versions. For all AnnexI and some non-AnnexI countries country reported data are now used as a basis for EDGAR f-gase emissions. To bring the global bottom up emissions estimates in line with global estimates the remaining emissions (at leasy for HFCs) are split over the remaining countries using their HCFC use as a proxy as HFCs are used to replace HCFCs. This leads to much lower HFC emissions estimates for many AnnexI countries and much higher HFC emissions estimates for a lot of non-AnnexI countries. For more information on the methodology see Olivier (Augst 2022).
  - **Andrew** cement emissions data have been updated to the September 2023 version.
- For some countries sector *3.C.1.a - biomass burning in forest land* was mapped to the agricultural sector until v2.4.2 because mapping was done on all BURs together and not all countries resolved the 3.C.1 subcategories. We now do the mapping on a per country basis and map 3.C.1.a and *3.C.1.d - biomass burning in all other land* to the LULUCF sector where possible.
- We now process the non-numerical flags for some additional BURs which leads to some zero time-series which were NaN before and in consequence filled with data from other sources.
- We remove negative data in EDGAR for CO_2 and CH_4 in category 1.B.1.

4 Changes in PRIMAP-hist source creation

4.1 Methodology changes

No changes

4.2 Data source prioritization

- Replacement with updated version of the data. See Section [Changes in data sources and preprocessing (v2.5)] above.

4.3 Sectors and gases

- Gas basket timeseries with AR5 and AR6 GWPs have been added (closes issue #62)

4.4 Composite source generation methodology

- HFCs show a steep decline in recent years for several AnnexI countries. This has not been modeled by the extrapolation in v2.4.2 and earlier as the period for calculating the trend was too long. We have shortened this period for v2.5 from 15 to 8 years.
- Some further small methodology changes have been implemented to fix issues with extrapolation. See Section [Bug fixes and resolved issues (v2.5)] below.

4.5 Special treatment of individual countries

- Special treatments for Andorra, China, Croatia, The Democratic Republic of the Congo, France, India, Latvia, Namibia, Pakistan, and Saudi Arabia are still in place (see [Special treatment of individual countries (v2.4)]). The special treatment for Iceland has been removed as it is no longer necessary with the new EDGAR f-gas data.
- **Albania:** The existing special treatment for CO_2 in 2.A and 2.C remains in place. Additionally we extrapolate UNFCCCALL data for 1.B.1, CO_2 to cover 1993 - 2022 because scaling EDGAR to UNFCCCALL gives huge emissions. The same is done for 1.B.2, N_2O for 1986-2022
- **Ghana:** We extrapolate UNFCCCALL data for 1.B.2, CO_2 until 2022 because scaling EDGAR to UNFCCCALL gives huge emissions.
- **Jamaika:** We extrapolate EDGAR data for 1.B.1, CH_4 to cover 1965 - 2022 because scaling CEDS to EDGAR gives huge emissions.
- **Jordan:** We extrapolate UNFCCCALL data for 1.B.2, CO_2 to cover 1988 - 2022 because scaling EDGAR to UNFCCCALL gives huge emissions.
- **Latvia:** We have added CO_2 to the fix for 2.C (adding CRF data to EDGAR directly to avoid scaling artifacts)
- **Myanmar:** We remove EDGAR data for CO_2 in 2.B because it has very high fluctuations and is zero for several short periods between non-zero data.
- **Nigeria:** We extrapolate UNFCCCALL data for 2.C, CO_2 for 5 years into the past because scaling CEDS to EDGAR gives huge emissions.
- **Saint Lucia:** We extrapolate EDGAR data for 1.B.1, CH_4 to cover 1965 - 2022 because scaling CEDS to EDGAR gives huge emissions.
- **Saint Vincent and the Grenadines:** We extrapolate EDGAR data for 1.A, CH_4 to cover 1965 - 2022 because scaling CEDS to EDGAR gives huge emissions.
- **Spain:** We extrapolate EDGAR data for 1.B.1, CO_2 until 2022 because scaling CRF to EDGAR gives huge emissions.
- **Vanuatu:** We extrapolate EDGAR data for 1.B.2, CH_4 to cover 1960 - 2022 because CEDS data have very high fluctuations and are not consistent with EDGAR data.

5 Bug fixes and resolved issues

- F-gas baskets were not complete in the old PRIMAP software. A few HFCs were missing in the HFC basket from the f-gas basket additionally NF_3 was missing. This impacted a few countries.
- South Africa: 2014 data in energy CO_2 was very low due to an error and has been removed.

- Category 5 ("other") was missing in CRF data in v2.4.2. Only few countries have reported emissions in this category, however many have reported that there are no emission from the sector. Thus the EDGAR timeseries used have been replaced by 0 leading to lower emissions for several Annex I countries. (closes issue #57).
- The issue with SF_6 timeseries in the TP scenario has been resolved by the new EDGAR data (closes issue #19).
- Sources for negative emissions in non-LULUCF and non-CCS categories have been removed by removing input data and fixing a bug (closes issue #70).
- Sector 1.C emissions (carbon capture and transport) are now included. (closes issue #61)
- All-zero timeseries were sometimes extended and / or interpolated with non-zero data. This has been fixed.
- Sector 1.B.1, N_2O emissions: Extrapolation methods have been changed to fit the short time period covered by EDGAR data for some countries. (advances issue #42)
- The issue of very high extrapolated emissions for some countries in 1.B.1, CH_4 has been fixed by changing the calculation of the trend values used for matching CEDS to the higher priority data sources for 1.B.1. We no longer calculate trend from the years preceding the matching year because these show the steep emissions decline resulting a near zero matching value and consequently a very high initial scaling factor for CEDS. (closes issue #40)
- Fixed a bug leading to missing extrapolation pre 1960/70 for some small countries like Andorra
- Fixed issue with inconsistent UNFCCC reported data for Georgia by including data from the NIR submitted with NC4. (closes issue #55)
- Fixed issue with inconsistent UNFCCC reported data for Palau by removing inconsistent data and data not in line with NC2. (closes issue #54)
- Latvia. A timeseries harmonization problem leading to an emission spike in sector 2.C for CO_2 has been fixed.

6 Known problems

This listing only contains issues that affect several countries. For individual country issues see Section Individual country information below.

- FAO data for synthetic fertilizers do not cover the full period (1961 - 2018) for several countries. In the 2020 release data for some countries were removed leading to changed emission estimates. Some time series start later than 1961, while others have gaps. We currently use the summed "Agricultural Soils" data from the FAO emissions total domain. We plan to use detailed FAO data processing in v2.5 again and solve this issue. (issue #22)
- In v2.2 there was a problem with scaling of historical CO_2 emissions especially for 1.B.2 and the USA. The new scaling algorithm has alleviated this problem, but it is not completely solved. Countries affected are Belize, Morocco, Mexico, Turkey, USA. (issue #34)
- Process emissions from lime production (2.A.2) are currently not included in the third party priority (TP) scenario, as we use Andrew cement data as a proxy for sector 2.A. To include lime process emissions sub-sector resolution of 2.A would have to be introduced. (issue #38)
- EDGAR data for N_2O, 1.B.1 is very limited for some countries, thus extrapolation generates most of the data for those countries. The main problem is Croatia, however it's not relevant on the level of aggregate emissions. (issue #42)
- For some countries some timeseries start later than 1750, so long range historical data (CEDS etc.) are (partly) missing. This issues has been fixed for most cases, but a few remain. (see issue #56)
- For problems that were found after the release of the dataset, please consult the issue tracker github.com/JGuetschow/PRIMAP-hist. If you encounter a problem please add an issue or contact the authors directly.

7 Noteworthy changes

7.1 General changes

- Updates of input data are mostly for country reported sources, thus the changes in the country reported (CR) scenario are higher and affect more sectors than the changes in the third party priority scenario (TP).

- In the third party scenario changes in 2021 are limited to energy CO_2, cement CO_2 and f-gases for most countries. Only for these sectors / gases input data have been updated. Few countries have changes in other sectors, either because bugs with e.g. harmonization of lower priority data sources have been fixed, or because there are no data for a certain sector / gas combination such that country reported data are used. Changes in cumulative emissions are low for most countries except for f-gases where a major change in the methodology used by EDGAR has shifted HFC emissions from AnnexI countries to non-AnnexI countries. BP2022 had a 22% decrease for energy CO_2 emissions in the "other europe" region for 2021. This has been corrected and affects several smaller european countries. Other countries and regions have seen adjustments of 2021 growth rates as well.
- For the country reported priority scenario we distinguish between AnnexI and non-AnnexI countries
  - AnnexI countries have regular reporting requirements leading to good data coverage and mostly only small changes to existing data. As 2021 data was not taken from CRF in v2.4.2 but extended from CRF data for 2020 using growth rates from third party sources like BP, EDGAR 7.0, and Andrew we have changes for 2021 for many countries, sectors, and gases which are mostly below 2%, but for 7 countries in the range of 2%-5% and for 3 countries in the 5%-10% range. Changes for cumulative emissions are small (no country above 2% for M.0.EL KyotoGHG emissions). High changes are common for HFCs as HFC emissions are steeply declining for many AnnexI countries in the last few years. This decline was not modeled by the numerical extrapolation used in v2.4.2 as the period for calculating the trend was significantly longer than the period of emissions decline. We have now shortened the trend period for HFCs to avoid this problem in the future.
  - For many non-AnnexI countries we have included new country reported data. As reporting requirements are lower for non-Annex countries and reports are less frequent and have more methodological freedom, data for the same countries from different reports can have high differences. This not only leads to challenges regarding consistency when combining data from different reports, but also to high changes in emissions between reports for several developing countries. Some developing countries report in a very structured way and data are similarly structured and consistent among reports as AnnexI country data. But for many other countries we have very high changes for several gases and sectors for both 2021 and cumulative emissions. As f-gases are often not included in country reports the changes in EDGAR f-gas data also play a role for the country reported scenario.

7.2 Countries by level of changes

All countries listed below are covered in detail in the Individual country information section. The lists are automatically generated.

7.2.1 Relative changes for 2021 (%) from v2.4.2_final to v2.5_final in the country reported priority scenario.

- **2% - 5%:** Armenia (2.4%), Belgium (-3.5%), Benin (4.1%), Belize (2.3%), Barbados (-4.1%), Brunei Darussalam (-4.8%), Canada (-2.2%), Congo, The Democratic Republic of the (2.7%), Costa Rica (-4.3%), Spain (-2.6%), Estonia (-2.3%), France (-2.7%), Guinea (2.4%), Haiti (-2.3%), Israel (3.3%), Jamaica (-4.8%), Kazakhstan (-3.7%), Cambodia (-4.5%), Lao People's Democratic Republic (3.8%), Liechtenstein (-3.0%), Lesotho (3.9%), Monaco (-3.2%), Madagascar (2.8%), Mozambique (-3.2%), Mauritania (-2.9%), Malawi (4.2%), Malaysia (3.5%), Nicaragua (-2.4%), Norway (-4.5%), Pakistan (2.5%), Peru (2.3%), Paraguay (2.1%), Sudan (2.2%), Senegal (4.8%), Slovakia (-2.6%), Viet Nam (2.5%),
- **5% - 10%:** Aruba (-9.0%), Anguilla (-9.4%), ANT (-9.5%), Azerbaijan (9.3%), Burundi (7.4%), Bulgaria (-8.2%), Bolivia, Plurinational State of (-9.4%), Chile (5.8%), Côte d'Ivoire (6.7%), Cameroon (9.2%), Cabo Verde (-8.2%), Cyprus (-5.9%), Dominica (-6.2%), Egypt (7.5%), Georgia (8.0%), Ghana (-5.7%), Gambia (5.4%), Iran, Islamic Republic of (7.0%), Iraq (-5.1%), Jordan (5.2%), Libya (5.8%), Saint Lucia (8.0%), LDC (5.4%), Mexico (7.8%), Nigeria (-7.6%), Panama (5.4%), Romania (-6.3%), Saudi Arabia (7.5%), Singapore (-6.7%), Sweden (8.8%), Syrian Arab Republic (9.5%), Turks and Caicos Islands (-9.1%), Tajikistan (-8.8%), Uzbekistan (-8.1%), Saint Vincent and the Grenadines (-8.4%), Virgin Islands, British (-9.0%),
- **10% - 25%:** United Arab Emirates (16.0%), Antigua and Barbuda (14.8%), Bangladesh (16.1%), Bahamas (22.0%), Bosnia and Herzegovina (12.9%), Djibouti (-25.0%), Ecuador (-16.7%), Eritrea

(10.8%), Guatemala (-11.9%), Honduras (19.2%), Kyrgyzstan (-15.4%), Saint Kitts and Nevis (-11.3%), Lebanon (24.8%), Moldova, Republic of (-20.9%), North Macedonia (-18.5%), Malta (18.4%), Montenegro (16.5%), Namibia (-13.0%), Papua New Guinea (-24.8%), Korea, Democratic People's Republic of (-10.7%), Rwanda (18.7%), Somalia (15.9%), Serbia (10.1%), Sao Tome and Principe (11.2%), Thailand (-12.4%), Trinidad and Tobago (-18.8%), Tunisia (10.7%), Vanuatu (-12.3%), Yemen (14.4%), Zambia (-12.5%), Zimbabwe (21.3%),

- **25% - 50%:** Albania (27.4%), Bahrain (-36.3%), Bhutan (-25.9%), Cuba (31.6%), Dominican Republic (25.5%), Fiji (27.8%), Grenada (38.9%), Kuwait (-33.1%), Mauritius (-31.5%), Palau (-29.6%), Solomon Islands (41.4%), Sierra Leone (44.7%),
- **50% - 100%:** Afghanistan (57.5%), Central African Republic (90.1%), Gabon (-66.2%), Togo (90.8%),
- **> 100%:**

7.2.2 Relative changes for 1990-2021 (%) from v2.4.2_final to v2.5_final in the country reported priority scenario.

- **2% - 5%:** United Arab Emirates (4.8%), Azerbaijan (-2.8%), Burundi (2.9%), Benin (2.5%), Belize (2.8%), Brunei Darussalam (-2.5%), Botswana (-2.5%), Central African Republic (2.5%), Côte d'Ivoire (3.2%), Cameroon (3.1%), Cabo Verde (-3.2%), Egypt (4.9%), Gambia (3.5%), Iran, Islamic Republic of (3.4%), Jordan (2.9%), Kazakhstan (3.8%), Saint Kitts and Nevis (-2.0%), Saint Lucia (-4.6%), LDC (2.5%), Macao (-3.3%), Madagascar (3.6%), Peru (-2.5%), Korea, Democratic People's Republic of (-2.8%), Senegal (2.1%), Syrian Arab Republic (2.2%), Tunisia (4.2%), Uruguay (-3.0%), South Africa (3.1%),
- **5% - 10%:** Albania (7.6%), Andorra (-9.0%), AOSIS (-6.5%), Bosnia and Herzegovina (-5.4%), Costa Rica (-5.8%), Eritrea (8.5%), Guatemala (-8.2%), Honduras (5.3%), Lebanon (5.1%), Lesotho (-6.6%), Moldova, Republic of (-7.8%), Mozambique (-5.2%), Mauritania (-8.4%), El Salvador (6.3%), Tajikistan (7.6%), Uzbekistan (-6.9%), Yemen (5.8%),
- **10% - 25%:** Antigua and Barbuda (21.5%), Bangladesh (14.1%), Bahamas (18.5%), Bolivia, Plurinational State of (-12.3%), Bhutan (-24.1%), Cuba (11.8%), Dominican Republic (11.1%), Ecuador (-11.6%), Ghana (11.7%), Grenada (20.9%), Kyrgyzstan (-14.5%), North Macedonia (-12.5%), Nicaragua (-12.2%), Palau (-22.4%), Papua New Guinea (-23.0%), Singapore (-12.7%), Somalia (12.7%), Chad (16.8%), Togo (23.2%), Thailand (-15.1%), Trinidad and Tobago (-24.9%), Vanuatu (-11.1%), Samoa (-10.6%), Zimbabwe (-12.9%),
- **25% - 50%:** Afghanistan (33.8%), Bahrain (-40.9%), Djibouti (-28.5%), Kuwait (-38.7%), Mauritius (-28.3%), Namibia (-28.4%), Nigeria (-27.2%), Solomon Islands (39.0%), Sierra Leone (35.3%), Zambia (-30.0%),
- **50% - 100%:** Gabon (-73.5%),
- **> 100%:**

7.2.3 Relative changes for 2021 (%) from v2.4.2_final to v2.5_final in the third party priority scenario.

- **2% - 5%:** Afghanistan (2.6%), ANNEXI (-3.9%), Argentina (3.7%), Burundi (4.0%), Belgium (-2.5%), Benin (4.1%), Bahrain (2.7%), Belarus (-2.0%), Brunei Darussalam (-4.8%), Botswana (3.4%), Central African Republic (2.1%), Canada (-4.9%), Congo, The Democratic Republic of the (3.4%), Costa Rica (2.7%), Cyprus (-3.3%), Czechia (-4.1%), Djibouti (4.6%), Denmark (-2.7%), Egypt (4.4%), Estonia (-3.2%), EU27BX (-3.8%), Gabon (4.8%), Guinea (2.4%), Honduras (4.9%), Hungary (-2.7%), Iceland (-2.6%), Israel (-3.5%), Kyrgyzstan (2.3%), Cambodia (2.4%), Morocco (2.1%), Moldova, Republic of (3.0%), Madagascar (2.8%), North Macedonia (4.5%), Mauritania (4.2%), Malawi (4.2%), Malaysia (4.6%), Nigeria (3.1%), Nicaragua (2.4%), Pakistan (2.5%), Saudi Arabia (4.1%), Sudan (2.2%), Senegal (4.8%), Sierra Leone (4.5%), El Salvador (3.9%), Serbia (-3.5%), Sao Tome and Principe (3.4%), Slovakia (-4.7%), Trinidad and Tobago (3.6%), UMBRELLA (-4.2%), United States (-2.9%), Viet Nam (4.7%), Samoa (4.4%), Zimbabwe (4.5%),
- **5% - 10%:** Aruba (-9.0%), Anguilla (-9.4%), ANT (-9.5%), Armenia (-6.1%), Azerbaijan (5.7%), Bulgaria (-5.8%), Bahamas (-7.9%), Belize (7.1%), Barbados (-5.1%), Switzerland (-5.9%), Chile (8.8%), Côte d'Ivoire (6.7%), Cameroon (9.2%), Cuba (-6.0%), Dominica (-6.5%), Fiji (5.7%), Iraq (-5.1%), Jamaica (-7.6%), Jordan (7.2%), Lao People's Democratic Republic (9.6%), Lebanon (5.2%), Libya (5.8%), Lithuania (-10.0%), Monaco (-7.6%), Netherlands (7.3%), Panama (6.8%), Poland (-8.7%), Russian Federation (-5.2%), Singapore (7.7%), Somalia (5.2%), Syrian Arab Republic

(9.5%), Turks and Caicos Islands (-9.1%), Togo (6.6%), Thailand (8.3%), Tunisia (8.4%), Saint Vincent and the Grenadines (-9.4%), Virgin Islands, British (-9.0%),
- **10% - 25%:** Albania (15.2%), United Arab Emirates (15.7%), Antigua and Barbuda (-11.1%), Austria (-23.2%), Bosnia and Herzegovina (12.4%), Georgia (14.8%), Greece (-14.5%), Japan (-10.7%), Saint Kitts and Nevis (-11.3%), Liechtenstein (-12.3%), Latvia (-18.7%), Malta (12.4%), Montenegro (-15.9%), Mauritius (21.2%), Korea, Democratic People's Republic of (-10.7%), Yemen (15.2%),
- **25% - 50%:** Bolivia, Plurinational State of (-48.2%), Grenada (25.3%), Portugal (-38.1%),
- **50% - 100%:**
- **> 100%:**

7.2.4 Relative changes for 1990-2021 (%) from v2.4.2_final to v2.5_final in the third party priority scenario.

- **2% - 5%:** Andorra (2.2%), United Arab Emirates (4.6%), Armenia (-4.5%), Antigua and Barbuda (-2.0%), Benin (2.5%), Belize (4.5%), Brunei Darussalam (-2.5%), Switzerland (-2.7%), Côte d'Ivoire (3.2%), Cameroon (3.1%), Denmark (-2.9%), Fiji (2.4%), Georgia (2.0%), Jordan (3.4%), Japan (-4.2%), Saint Kitts and Nevis (-2.0%), Lebanon (3.5%), Liechtenstein (-4.0%), Lithuania (-3.5%), Macao (-3.3%), Mauritania (2.1%), Norway (-2.7%), Panama (2.6%), Poland (-4.0%), Korea, Democratic People's Republic of (-3.1%), Saudi Arabia (3.0%), Senegal (2.1%), Sierra Leone (2.3%), Syrian Arab Republic (2.2%), Togo (3.3%), Thailand (3.1%), Trinidad and Tobago (2.6%), Tunisia (3.0%), Taiwan, Province of China (3.1%), Samoa (2.2%),
- **5% - 10%:** Latvia (-7.5%), Montenegro (-9.1%), Mauritius (7.5%), Netherlands (5.2%), Serbia (-6.3%), Yemen (5.2%),
- **10% - 25%:** Austria (-11.7%), Grenada (12.6%), Portugal (-11.7%), Tajikistan (11.0%),
- **25% - 50%:** Bolivia, Plurinational State of (-39.4%),
- **50% - 100%:**
- **> 100%:**

7.3 Individual country information

Here we assess changes for all countries individually and list the most important changes for individual gases and sectors. Most important means highest impact on total emissions changes in most cases, but we also list some individual country changes that don't affect total emissions much. The change information is organized as follows:

- **country:** *CR: 2021 (%), 1990-2021 (%); TP: 2021 (%), 1990-2021 (%)*

Some Changes usually have the same reason for all countries and we do not mention this for each country: * Changes in the TP scenario for energy CO_2 are from BP/EI if not stated otherwise. * Changes in the TP scenario for cement CO_2 are from Andrew if not stated otherwise. * Changes in the TP scenario for f-gases are from EDGAR if not states otherwise. * For non-AnnexI countries the above defaults are also true in the CR scenario if only 2021 is affected but cumulative emissions have changed only little. * Changes in other sectors are mostly form country reported data updates and only in a few cases from bug fixes or other changes.

The text for individual countries likely contains typos and bad english language. It's just too long to do a language proof read for the full text.

- **Aruba:** *KyotoGHG, M.0.EL: (CR: -9.0%, -0.2%; TP: -9.0%, -0.2%)*;
  - CR: We have no country reported data for Aruba, thus the CR and TP time-series are identical.
  - TP: The only change is from energy CO_2 where the 2021 growth rate in BP/EI has been adjusted.
- **Afghanistan:** *KyotoGHG, M.0.EL: (CR: 57.5%, 33.8%; TP: 2.6%, 1.2%)*;
  - CR: Inclusion of BUR1 has changed emissions in most sectors and gases. The increased 2021 emissions mainly originate from energy CO_2, while many other sectors have changed as well with high contributions from waste and agriculture. Relative changes can be over 200% for some sectors and gases (e.g. energy CO_2). Cumulative emissions have not changed as much, but energy CO_2 has seen an increase of 129%. F-gas emissions are included for the first time.
  - TP: The TP timeseries have changed little both in 2021 and cumulatively with the main contribution from cement CO_2 in 2021 where Andrew data have been adjusted. F-gas emissions

are included for the first time.

- **Angola:** *KyotoGHG, M.0.EL: (CR: -0.3%, 0.1%; TP: -0.3%, 0.1%)*;
  - CR: We have no country reported data for Angola, thus the CR and TP time-series are identical.
  - TP: For 2021 energy CO_2 is lower while cement CO_2 is higher than in v2.4.2. Cumulatively both are slightly lower. F-gases (HFCs) are much higher both for 2021 and cumulatively.
- **Anguilla:** *KyotoGHG, M.0.EL: (CR: -9.4%, -0.1%; TP: -9.4%, -0.1%)*;
  - CR: We have no country reported data for Aruba, thus the CR and TP time-series are identical.
  - TP: Only energy CO_2 has changed due to adjusted emissions for 2021 and to a lower extent earlier years.
- **Albania:** *KyotoGHG, M.0.EL: (CR: 27.4%, 7.6%; TP: 15.2%, 0.4%)*;
  - CR: Data for 2009-2016 have been added from the NIR which underlies BUR1. In consequence timeseries for most sectors and gases have changed. Energy sector emissions are much higher than in v2.4.2 in 2021 and 3.5% higher for cumulative emissions. Emissions in the IPPU sector are 19% lower than in v2.4.2 in 2021 and 37% lower cumulatively. The main source are cement CO_2 emissions where BUR data have replaced Andrew data for 2010-2016. F-gases are lower as country reported data have been included.
  - TP: Energy CO_2 data are much higher for 2021 and 0.8% higher cumulatively. Cement CO_2 is lower for 2021 as Andrew data have been adjusted. The IPPU sector has higher cumulative emissions due to changes in cement CO_2, f-gases and the addition of sector 2.H from BUR1 data.
- **Andorra:** *KyotoGHG, M.0.EL: (CR: -1.0%, -9.0%; TP: -0.8%, 2.2%)*;
  - CR: Data from BUR4 have been added leading to changes in most sectors and gases both in 2021 and cumulatively. The highest 2021 changes in absolute terms are from energy CO_2 (+2.4%) and chemical industry CO_2, which is now zero as zero data from BUR4 have been added, while EDGAR data was used for v2.4.2. Metal industry CO_2 is now zero as well. For cumulative emissions energy CO_2 is 6.9% lower. Many other sectors have changes as well and several now have data and are zero while third party data were used before.
  - TP: No changes except for f-gases
- **Netherlands Antilles:** *KyotoGHG, M.0.EL: (CR: -9.5%, -0.3%; TP: -9.5%, -0.3%)*;
  - CR: We have no country reported data for the Netherlands Antilles, thus the CR and TP time-series are identical.
  - TP: The only change is in energy CO_2 which is 9.7% lower in 2021 and 0.4% lower cumulatively.
  - NOTE: While the Netherlands Antilles no longer exist as a country (but dissolved in 2010), we do not have individual data for all new countries but have to group Bonaire, Sint Eustatius and Saba, Sint Maarten, and Curaçao to the Netherlands Antilles. Aruba has independent data.
- **United Arab Emirates:** *KyotoGHG, M.0.EL: (CR: 16.0%, 4.8%; TP: 15.7%, 4.6%)*;
  - CR: There is no new country reported data so changes are limited to CO_2 from energy and cement as well as f-gases. Changes in energy CO_2 are due to changed growth rates in EI2023 vs BP2022 and changes in cement CO_2 due to changes in Andrew data. F-gas emissions have increased drastically due to the inclusion of EDGAR 7.0 f-gas emissions.
  - TP: In 2021 energy CO_2 emissions are 10% higher than in v2.4.2 while cement CO_2 is 8.5% lower. The impact on cumulative emissions is small. As in the CR time-series f-gas emissions have increased drastically leading to increased cumulative emissions.
- **Argentina:** *KyotoGHG, M.0.EL: (CR: 0.8%, -0.2%; TP: 3.7%, 1.2%)*;
  - CR: Overall changes are very small and limited to energy CO_2 (new EI data) and f-gases (new EDGAR data). For f-gases the changes are high but the impact on overall emissions is small.
  - TP: in 2021 energy CO_2 emissions are slightly higher. The impact in cumulative emissions is negligible. The main change (both for 2021 and cumulatively) comes from the new EDGAR f-gas data which is higher by a factor of 3 in 2021 and 4.7 cumulatively.
- **Armenia:** *KyotoGHG, M.0.EL: (CR: 2.4%, -1.1%; TP: -6.1%, -4.5%)*;
  - CR: 2021 emissions are 2.4% higher than in v2.4.2. Higher emissions come from CH_4, 1.B.2 (new data point from BUR3), cement CO_2 (updated Andrew data), and agricultural N_2O (new data point from BUR3). Emissions from energy CO_2 (BP/EI and new BUR3) and f-gases (new EDGAR data) are lower. As the CH_4 changes are only for the latest years cumulative emissions are lower.
  - TP: The TP time-seres have less changes. F-gases are identical to the CR time-series. Small

emissions increases come from CO_2 in energy and IPPU. Cumulative emissions are lower due to f-gases and slightly lower cement CO_2 emissions.

- **Antarctica:** *KyotoGHG, M.0.EL: (CR: 0.0%, 0.0%; TP: 0.0%, 0.0%)*;
  - CR: We have no country reported data for Antarctica, thus the CR and TP time-series are identical.
  - TP: No changes.
  - NOTE: Antarctica has no permanent inhabitants but just several research stations. Emissions are very low and so is data coverage. The only available data are energy CO_2 data from CDIAC.
- **Antigua and Barbuda:** *KyotoGHG, M.0.EL: (CR: 14.8%, 21.5%; TP: -11.1%, -2.0%)*;
  - CR: Data from BUR1 (2015) and NC3 (2006) have been added and complement data for 1990 and 2000 from the UNFCCC DI interface. Emissions changes in 2021 are mostly from a 22% increase in energy CO_2 (from the country reported data) and the removal of f-gas emission in EDGAR data.
  - TP: Energy CO_2 emissions are significantly lower in 2021 and slightly lower cumulatively. f-gas emissions have been removed as there are nor f-gas emissions for Antigua and Barbuda in EDGAR 7.0
- **Australia:** *KyotoGHG, M.0.EL: (CR: -0.6%, -0.4%; TP: -0.8%, -0.3%)*;
  - CR: Emissions are slightly lower both for 2021 and cumulatively. 2021 emissions changes are in many sectors and due to differences between reported CRF data and our estimates based on third party sources and numerical methods. For cumulative emissions most sectors have only very small changes with the exception of waste N_2O which is 38% lower than in v2.4.2 due to lower CRF data and the "other" sector for all gases where emissions are now zero.
  - TP: Emissions are almost unchanged except for f-gas emissions which are significantly lower.
- **Austria:** *KyotoGHG, M.0.EL: (CR: -0.4%, -0.3%; TP: -23.2%, -11.7%)*;
  - CR: Minor changes to 2021 data, but for the main sectors the 2021 PRIMAP-hist data is consistent with new CRF data.
  - Emissions are almost unchanged except for f-gas emissions which are significantly lower. Energy and cement CO_2 emissions are a 0.4 and 1.3% higher than in v2.4.2.
- **Azerbaijan:** *KyotoGHG, M.0.EL: (CR: 9.3%, -2.8%; TP: 5.7%, 1.2%)*;
  - CR: NC4 data have replaced data from the UNFCCC DI interface. This leads to high changes for several sectors and gases both for 2021 and cumulatively. Several sector-gas combinations are now reported as zero. The highest relative changes come from agricultural CH_4, f-gases, and N_2O.
  - TP: Changes are mostly in energy and cement CO_2 (mostly 2021) and f-gases. There are also some changes for CH_4 from chemical industry (2.B) because country reported data extends EDGAR for this sector - gas combination.
- **Burundi:** *KyotoGHG, M.0.EL: (CR: 7.4%, 2.9%; TP: 4.0%, 1.7%)*;
  - CR: 2021 changes come mostly from f-gases (new EDGAR data). Agricultural N_2O, where we have removed the country reported data as it was incomplete for most years (agricultural soils and savanna burning emissions missing), has also increased. Additional contribution come from energy and cement CO_2 leading to an increase in 2021 emissions of 7.4%. for cumulative emissions the main change are f-gas emissions with small contributions from agricultural N_2O.
  - TP: F-gases are the main source of changes both for 2021 and cumulatively. Energy CO_2 emissions are higher in 2021 and slightly higher cumulatively. cement CO_2 emissions are strongly reduced as there has been a major change in Andrew cement CO_2 emissions.
- **Belgium:** *KyotoGHG, M.0.EL: (CR: -3.5%, -0.4%; TP: -2.5%, -0.7%)*;
  - CR: Main contributions to the changes are HFCs and energy CO_2. HFCs show a steep decline from a peak in the latest years. The extrapolation also takes into account the years before the decline and thus did not model the further decline in 2021 data. Energy CO_2 is lower than estimated in v2.4.2 as growth rates for 2021 in CRF data are slightly smaller than in BP 2022. The "other" category is now read from CRF where it is 0. Changes are mostly limited to 2021 except for the "other" category.
  - TP: 2021 emissions are 2.5% lower than in v2.4.2 because of lower f-gas emissions and lower 2021 growth rates for energy CO_2 in CRF2023 than in BP2022 used in v2.4.2. Cumulative emissions are slightly lower due to the lower f-gas emissions.
- **Benin:** *KyotoGHG, M.0.EL: (CR: 4.1%, 2.5%; TP: 4.1%, 2.5%)*;
  - CR: We have no country reported data for Benin, thus the CR and TP time-series are identical.

  - TP: The majority of the 2021 emissions increase is from the addition of f-gases from EDGAR v7.0. Smaller changes in energy and cement CO_2 are due to adjustments in BP/EI and Andrew data. For changes in cumulative emissions only f-gases play a role.
- **Burkina Faso:** *KyotoGHG, M.0.EL: (CR: 0.2%, 0.4%; TP: 1.6%, 0.7%)*;
  - CR: 2021 emissions are almost unchanged. F-gas emissions and cement CO_2 are higher due to new EDGAR data and an update in Andrew data for the last years. Cumulative emissions are lower as we have removed inconsistent 2007 data-points from the UNFCCCDI data impacting IPPU and waste emissions. The consistency issues mentioned in issue #53 are still present.
  - TP: EDGAR v7.0 provides third party f-gas emissions for Burkina Faso for the first time. These are higher than country reported emissions leading to an increase in f-gas and KyotoGHG emissions. Energy CO_2 is a bit lower in 2021 and a bit higher cumulatively. cement CO_2 is 38% higher in 2021 and 9% higher cumulatively (from higher emission in the last years). F-gas emissions were added from EDGAR v7.0
- **Bangladesh:** *KyotoGHG, M.0.EL: (CR: 16.1%, 14.1%; TP: 0.8%, 0.5%)*;
  - CR: Data for 2012 have been added from NC3 leading to changes for many sectors and gases. Most prominent changes are energy CO_2, waste CH_4, and agricultural N_2O (both for 2021 and cumulatively). Livestock N_2O (3.A) uses country reported data for the first time as there were not enough data before adding NC3. F-gas data are included for the first time (from EDGAR 7.0).
  - TP: 2021 changes are limited to f-gases and small changes CO_2 from energy and cement. For cumulative emissions only f-gases play a role.
- **Bulgaria:** *KyotoGHG, M.0.EL: (CR: -8.2%, -1.9%; TP: -5.8%, -1.2%)*;
  - CR: Changes come almost exclusively from f-gases where emissions estimates have been reduced drastically from CRF2022 to CRF2023. Smaller contributions from agricultural N_2O, the energy sector, and the "other" sector where CRF replaces EDGAR data. Changes from f-gases and the "other" sector are over a longer period of time.
  - TP: Changes come almost exclusively from f-gases where EDGAR v7.0 emissions are much lower than the old EDGAR version extended with CRF2022 which was used in v2.4.2.
- **Bahrain:** *KyotoGHG, M.0.EL: (CR: -36.3%, -40.9%; TP: 2.7%, 1.2%)*;
  - CR: Data from NC3 (2007) have been added and combined with data for 1994, 2000 from UNFCCC DI. While for several sectors and gases we still have insufficient country reported data, some sectors / gases now use country reported data which impact especially fugitive CH_4 emissions from oil and gas (1.B.2) which is now over 95% lower than in v2.4.2 where EDGAR data were used. Other noteworthy changes are the addition of HFCs from EDGAR and lower energy CO_2 (-2.8% in 2021, -4.4% cumulatively) and cement CO_2 emissions (-65% in 2021, -17% cumulatively).
  - TP: The main contributions to changes in 2021 emissions are lower cement CO_2 emissions and much higher f-gas emissions. For cumulative emissions f-gases are the only major source of changes.
- **Bahamas:** *KyotoGHG, M.0.EL: (CR: 22.0%, 18.5%; TP: -7.9%, -0.3%)*;
  - CR: Data for 2001-2018 have been added from BUR1 (all years before 2018 are downscaled from main sectors using 2018 sector shares). Relative changes are especially high for agricultural and fugitive emissions, however, total emissions changes in 2021 and cumulatively are dominated by energy CO_2 where BUR1 data are higher than CDIAC2022 that was used before.
  - TP: The only relevant change is that energy CO_2 is lower in 2021 and slightly lower cumulatively because BP/EI growth rates have been updated.
- **Bosnia and Herzegovina:** *KyotoGHG, M.0.EL: (CR: 12.9%, -5.4%; TP: 12.4%, 0.4%)*;
  - CR: We have downscaled the UNFCCC DI data where sectoral and gas resolution was not sufficient for PRIMAP-hist for all years. For 2021 emissions are higher, mainly from higher energy CO_2 emissions (BP2022 showed a steep emissions decrease, while EI2023 shows only a small decrease) partly offset by lower f-gas emissions (due to the removal of HFC emissions in EDGAR v7.0). Cumulative emissions are lower, mainly due to lower agricultural emissions and CO_2 from metal industry.
  - TP: The main change in 2021 emissions is energy CO_2 for the same reason as in the CR time-series. F-gas emissions are identical to the CR time-series. Cumulative emissions are slightly higher than in v2.4.2 because the increased energy CO_2 emissions for the last few years outweigh the lower f-gas emissions where the differences in earlier years are also much smaller than for 2021.

- **Belarus:** *KyotoGHG, M.0.EL: (CR: 1.9%, -0.4%; TP: -2.0%, -0.7%)*;
  - CR: The main contributions come from the energy sector (fugitive CH_4, ff CO_2) and the agricultural (livestock) sector where CRF data has been adjusted from the 2022 to the 2023 releases (2020 values). These adjustments also affect other sectors (IPPU, waste). The "other" category is now read from CRF where it is 0. Changes are mostly limited to 2021 except for the "other" category.
  - TP: F-gas emissions are about 80-90% lower than in v2.4.2 both in 2021 and cumulatively. There are neither HFC nor PFC emissions for Belarus in EDGAR v7.0 data, only SF_6. Thus CRF2023 is used in the third party priority scenario as well. As EDGAR uses CRF data it is unclear why there are not f-gas data present. However, using CRF is consistent with the EDGAR data for the other AnnexI countries. No other noteworthy changes.
- **Belize:** *KyotoGHG, M.0.EL: (CR: 2.3%, 2.8%; TP: 7.1%, 4.5%)*;
  - CR: We have added data from BUR1 (2012, 2015, 2017) which are combined with data from the UNFCCC DI interface (which does not cover all sectors though). The main changes for 2021 are 90% lower waste CH_4 emissions and 30% higher energy CO_2 emissions which lead to similar changes in absolute terms. F-gas emissions have been added from country reported data. for cumulative emissions the changes are similar.
  - TP: Changes in 2021 are only in energy CO_2 and f-gases (which have been added from BUR1). For cumulative emissions the only significant change are f-gas emissions.
- **Bolivia, Plurinational State of:** *KyotoGHG, M.0.EL: (CR: -9.4%, -12.3%; TP: -48.2%, -39.4%)*;
  - CR: Data for 2006 and 2008 have been added from NC3. This leads to changes in several sectors and gases. Most prominent are higher emissions in agricultural CH_4 and energy CO_2 and lower f-gas emissions. As country reported f-gas emissions for Bolivia are very high the reduction in f-gas emissions leads to an overall emissions decrease both for 2021 and cumulatively. It is worth noting that the new f-gas data points are lower, but in the same order of magnitude than the older data which was often considered questionable (see issue #2).
  - TP: the main reason for the strongly decreased emissions are f-gases. F-gas emissions are now included in EDGAR v7.0 and much lower than the very high country reported emissions. Energy CO_2 emissions are higher in 2021 and slightly lower cumulatively, but the total emissions change is less than 1% of the f-gases emissions change.
- **Brazil:** *KyotoGHG, M.0.EL: (CR: 0.8%, 0.1%; TP: 1.1%, -0.1%)*;
  - CR: No new country reported data was added. We have high relative differences for SF_6 and PFCs (from EDGAR 7.0), but small absolute values. Highest absolute contribution form energy CO_2, but small in relative terms. Also a small change in cement CO_2. Changes in cumulative emissions are very small.
  - TP: in 2021 emissions from energy CO_2 are higher and f-gas emissions are much higher. In the f-gas emissions HFCs are much higher and PFCs much lower than in v2.4.2. The new EDGAR data is now based on country reported data and almost identical to the data from the UNFCCC DI interface (likely from BUR4). Cumulatively we have lower f-gas emissions and a small contribution from energy CO_2 leading to a slight reduction in overall emissions.
- **Barbados:** *KyotoGHG, M.0.EL: (CR: -4.1%, 0.0%; TP: -5.1%, 0.1%)*;
  - CR: We have no new usable country reported data for Barbados as the data from NC2 which is available from the UNFCCC DI interface lacks gas resolution (some gas resolved time series are available in NC2 but not in the UNFCCC portal). NC1 data are not consistent with NC2 and can not be used for downscaling NC2 data. The only changes to 2021 emissions are a 9.7% decrease in energy CO_2 emissions and a 50% increase in cement CO_2. Cumulative emissions have only very small changes.
  - TP: The changes are similar to the CR scenario changes.
- **Brunei Darussalam:** *KyotoGHG, M.0.EL: (CR: -4.8%, -2.5%; TP: -4.8%, -2.5%)*;
  - CR: We have no country reported data for Brunei Darussalam, thus the CR and TP time-series are identical.
  - TP: The main source of changes both for 2021 and cumulatively is that f-gas emissions are lower in EDGAR v7.0. Energy CO_2 emissions are also slightly lower.
- **Bhutan:** *KyotoGHG, M.0.EL: (CR: -25.9%, -24.1%; TP: 0.2%, 1.6%)*;
  - CR: We have added data from BUR1 for 1994-2020. 2015 data is taken from the UNFCCC DI portal and used to downscale the main sector KyotoGHG timeseries from BUR1 to the necessary categorical and gas level. 2021 and cumulative emissions have changed for most sectors and gases. With a few exceptions emissions are lower than in v2.4.2 both for 2021

and cumulatively. The highest changes are in the energy sector where fugitive emissions are over 95% lower and combustion based emissions are over 40% lower in 2021 and 19% lower cumulatively.
  - TP: Emissions changes are limited to cement CO_2 (-3.5% in 2021, +19% cumulatively), emission from chemical industry (added for country reported data) and waste N_2O (added from country reported data). This leads to a slight increase in 2021 emissions and a 1.6% increase in cumulative emissions.
- **Botswana:** *KyotoGHG, M.0.EL: (CR: 0.5%, -2.5%; TP: 3.4%, 0.9%)*;
  - CR: Data for 2014 have been added from NC3. Energy CO_2 emissions in 2021 are slightly higher and f-gas emissions have been added from EDGAR. Fugitive CH_4 emissions are 52% lower in 2021 and 38% lower cumulatively. For 2021 this offsets most of the increases from f-gases and energy CO_2. For cumulative emissions energy CO_2 is 4.1% lower leading to an overall emission reduction. The energy CO_2 emissions changes are caused by a combination of country reported data and changes in the BP/EI data.
  - TP: The main change are added f-gas emissions. In 2021 we also have a 1.6% increase in energy CO_2.
- **Central African Republic:** *KyotoGHG, M.0.EL: (CR: 90.1%, 2.5%; TP: 2.1%, 0.7%)*;
  - CR: We have removed DI data as they only cover a few years and show a steep emissions decline which is not in line with NC3. Changes come mostly from the agricultural sector. CR and TP time-series are now identical.
  - TP: Energy CO_2 emissions are slightly reduced in 2021. The main impact however, is from the new EDGAR f-gas data.
- **Canada:** *KyotoGHG, M.0.EL: (CR: -2.2%, -1.3%; TP: -4.9%, -1.5%)*;
  - CR: Adjustment for 2021 in CH_4, 1.B.2, Adjustment for 2021, CO_2, 2.B, 2.C, 2.D, M.AG.ELV. Major change for N_2O, 1.A for all years (new CRF data). Smaller (relative) change for CO_2, 1.A for all years (new CRF data). Minor adjustment for N_2O, 3.A. Waste sector CRF data has changed for all years especially for CH_4.
  - TP: For 2021 energy CO_2 emissions are 2.9% lower than in v2.4.2 while cement CO_2 emissions are 2.6% higher (from BP/EI and Andrew data). F-gas emissions are much lower both for 2021 and cumulatively.
- **Switzerland:** *KyotoGHG, M.0.EL: (CR: 1.5%, 1.0%; TP: -5.9%, -2.7%)*;
  - CR: For 2021 energy CO_2 emissions and waste N_2O emissions have increased while IPPU f-gas and N_2O emissions as well as agricultural N_2O have decreased. changes in agricultural and waste N_2O emissions are due to adjusted CRF data. IPPU fgases and N_2O are due to extrapolation not modeling the actual development. The change in energy CO_2 is due to a lower 2021 growth rate in BP2022 compared to CRF2023. Cumulative emissions changes are driven by increased waste N_2O emissions which are partly offset by reduced "other" N_2O emissions.
  - TP: The main source for changes in 2020 and cumulatively are lower f-gas emissions. Other changes are 2% higher cement CO_2 emissions in 2021 and the addition of CH_4 in the "other" sector from CRF.
- **Chile:** *KyotoGHG, M.0.EL: (CR: 5.8%, -1.5%; TP: 8.8%, 1.4%)*;
  - CR: New BUR data leads to changes in several sectors. Highest absolute change is in energy CO_2 (7.8%) due to adjustment of 2021 data in EI data. Further changes come from waste CH_4 (from BUR5), CO_2 in 2.B (from BUR5) and f-gases (from BUR5) and other sectors with smaller contributions. Relative changes are high for some sectors. Changes in cumulative emissions are in the same sectors but generally smaller. An exception is CO_2 for IPPU where reduced emissions in 2.B leading to an overall reduction of 23%.
  - TP: Main 2021 changes in the TP time-series are from f-gases (new EDGAR data are orders of magnitude higher than EDGAR v4.2) and energy CO_2 where the 2021 growth rate in BP/EI data has been increased leading to higher 2021 emissions. For changes in cumulative emissions only f-gases play a role.
- **China:** *KyotoGHG, M.0.EL: (CR: 1.5%, 1.8%; TP: 1.8%, 0.4%)*;
  - CR: Changes mostly in Energy CO_2 and f-gases. Changes are higher (2.2% for energy CO_2) but partly cancel each other. F-gas emission changes come from new EDGAR data that shows an intermediate steep decline in emissions which was not modeled by the extrapolation used before. For cumulative emissions the lower f-gas emissions are compensated by higher CH_4 emissions and higher agricultural N_2O. Changes in country reported data from the DI interface

come from an additional datapoint (2005) we have added through downscaling of higher level sector data.
  - TP: 2021 changes are similar to CR for energy CO_2 but differ for f-gases. CH_4 and N_2O are almost unchanged. For cumulative emissions f-gases and energy CO_2 are higher.
- **Côte d'Ivoire:** *KyotoGHG, M.0.EL: (CR: 6.7%, 3.2%; TP: 6.7%, 3.2%)*;
  - CR: We have no country reported data for Côte d'Ivoire, thus the CR and TP time-series are identical.
  - TP: F-gas emissions have been added from EDGAR 7.0 leading to higher overall emissions for 2021 and cumulatively. Energy CO_2 is slightly lower in 2021 than in v2.4.2.
  - NOTE: BUR1 is not completely read. See UNFCCC_no-AnnexI_data issue #77.
- **Cameroon:** *KyotoGHG, M.0.EL: (CR: 9.2%, 3.1%; TP: 9.2%, 3.1%)*;
  - CR: We have no country reported data for Cameroon, thus the CR and TP time-series are identical.
  - TP: HFC emissions have been added from EDGAR 7.0 leading to higher overall emissions for 2021 and cumulatively. Energy CO_2 is 4% lower in 2021 than in v2.4.2 and cement CO_2 is 39% higher because of adjusted growth rates in Andrew data. For cumulative emissions only f-gases play a noteworthy role.
- **Congo, The Democratic Republic of the:** *KyotoGHG, M.0.EL: (CR: 2.7%, 1.1%; TP: 3.4%, 1.5%)*;
  - CR: We have no country reported data for The Democratic Republic of the Congo, thus the CR and TP time-series are identical.
  - TP: F-gas emissions from EDGAR 7.0 are much higher, leading to higher overall emissions for 2021 and cumulatively. Energy CO_2 is 4% lower in 2021 than in v2.4.2 and cement CO_2 is 22% higher because of adjusted growth rates in Andrew data. For cumulative emissions only f-gases play a noteworthy role.
- **Congo:** *KyotoGHG, M.0.EL: (CR: 1.0%, 0.5%; TP: 1.0%, 0.5%)*;
  - CR: We have no country reported data for Congo, thus the CR and TP time-series are identical.
  - TP: F-gas emissions have been added from EDGAR 7.0 leading to higher overall emissions for 2021 and cumulatively. Energy CO_2 is 4% lower in 2021 than in v2.4.2 and cement CO_2 is 9.6% higher because of adjusted growth rates in Andrew data. For cumulative emissions only f-gases play a noteworthy role.
- **Cook Islands:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.3%; TP: -0.2%, -0.3%)*;
  - CR: We have no country reported data for Cook Islands, thus the CR and TP time-series are identical.
  - TP: No changes except for slightly lower energy CO_2 emissions.
- **Colombia:** *KyotoGHG, M.0.EL: (CR: -0.3%, -0.4%; TP: 1.5%, 0.8%)*;
  - CR: Agricultural CH_4, N_2O have small adjustments over several years (from M.AG.ELV where in previous versions category 3.C.1.a - biomass burning in forest land was included by mistake (we treat it as a LULUCF category)). EI2023 energy CO_2 data differs from BP2022 leading to differences in energy CO_2 data also in the CR scenario.
  - TP: F-gas emissions from EDGAR 7.0 are much higher leading to higher overall emissions for 2021 and cumulatively. Energy CO_2 is 1.2% lower in 2021 than in v2.4.2. For cumulative emissions changes are similar but smaller.
- **Comoros:** *KyotoGHG, M.0.EL: (CR: -0.1%, -0.1%; TP: -0.1%, -0.1%)*;
  - CR: We have no country reported data for Comoros, thus the CR and TP time-series are identical.
  - TP: No changes except for the removal of f-gas emissions (not contained in EDGAR v7.0)
- **Cabo Verde:** *KyotoGHG, M.0.EL: (CR: -8.2%, -3.2%; TP: 0.3%, 0.4%)*;
  - CR: Data from NC3 have been added (1995, 2000, 2005, 2010). This leads to changes in most sectors and gases mostly with lower emissions. The highest contributions come from the energy sector and the waste sector. Agricultural emissions are higher for CH_4 and lower for N_2O. F-gases are newly included.
  - TP: The only noteworthy change is the addition of f-gas emissions.
- **Costa Rica:** *KyotoGHG, M.0.EL: (CR: -4.3%, -5.8%; TP: 2.7%, 1.1%)*;
  - CR: Data from the latest NIR have been added covering 1990, 1996, 2000, 2005, 2010, 2012-2017 and replacing the data from the UNFCCC DI interface. This leads to changes for almost all sectors and gases. The highest 2021 contributions come from a 77% reduction in agricultural N_2O and a 14% increase in energy CO_2. Agricultural CH_4 has decreased as well while f-gas

emissions are higher than in v2.4.2. Cumulatively the changes are similar, but the emissions increases are less pronounced such that total emissions decreased more than for 2021.
  - TP: changes are smaller than in the CR time series and amount to an overall increase in emissions. Emissions in Energy CO_2 and from f-gases have increased while cement CO_2 emissions are much lower than in v2.4.2. Waste CO_2 emissions have been added. Emissions changes in 2021 are higher than cumulatively, but the affected sectors are the same.
- **Cuba:** *KyotoGHG, M.0.EL: (CR: 31.6%, 11.8%; TP: -6.0%, -0.2%)*;
  - CR: Data from BUR1 (2016) and NC3 (2010, 2012, 2014) have been added and combined with data from the UNFCCC DI interface including downscaling of M.0.EL KyotoGHG emissions to individual sectors and gases for some years. This has changed both 2021 and cumulative emissions for most sectors and gases (except f-gases). The highest contribution in 2021 comes from fugitive CH_4 which has high emissions and a steep increase in 2021 (from EDGAR). Energy CO_2, waste CH_4, and agricultural N_2O also contribute to increased 2021 emissions. Relative changes are much higher in agricultural N_2O and waste CH_4 than in energy CO_2. CO_2 from the IPPU sector is lower than in v2.4.2. cumulative emissions have increased as well, but to a lesser extent. Contributions from all sectors are smaller, but especially so from fugitive CH_4.
  - TP: 2021 emissions are lower mainly due to decreased energy CO_2 emissions. F-gas emissions have high relative changes but a small contribution to overall emissions. Cumulative emissions are slightly lower due to the decreased energy CO_2 emissions.
- **Cyprus:** *KyotoGHG, M.0.EL: (CR: -5.9%, -1.2%; TP: -3.3%, -1.0%)*;
  - CR: Energy CO_2 has beend adjusted for 2020 in CRF. 2021 data are also lower. N_2O, M.AG.ELV is much lower in CRF2023 than in CRF2022 for all years. Several other sectors have changes as well, cumulative (1990-2021) KyotoGHG M.0.EL are 1.2% lower than in v2.4.2.
  - TP: 2021 emissions from energy CO_2 show a slight decrease. F-gases are over 30% lower both in 2021 an cumulatively.
- **Czechia:** *KyotoGHG, M.0.EL: (CR: -0.5%, -0.3%; TP: -4.1%, -0.7%)*;
  - CR: Changes in 2021 effectively come from N_2O in "other". 2021 CO_2 emissions for energy and IPPU have small changes as well which cancel in the totals. Other sectors have only small contributions to absolute emissions changes. The "other" sector changes affect the whole time series while other changes are mostly limited to 2021.
  - TP: The main sources of changes are f-gases which are almost 50% lower in 2021 and over 30% lower cumulatively and energy CO_2 emissions which have been reduced by 1.2% in 2021. Contriubtions from other sectors are negligible.
- **Germany:** *KyotoGHG, M.0.EL: (CR: -0.3%, -0.5%; TP: -0.5%, -0.6%)*;
  - CR: Sector and gas specific changes are higher than overall changes as they partly cancel. The highest absolute change in 2021 is from energy CO_2, however it's a small relative change. As CRF data has changed for several sectors and years between the 2022 and 2023 submissions we have changes in several sectors for several years.
  - TP: The main sources of changes are f-gases which are over 50% lower in 2021 and over 30% lower cumulatively and energy CO_2 emissions which have been increased by 2.2% in 2021 but don't play a major role for cumulative emissions changes. Contributions from other sectors are negligible.
- **Djibouti:** *KyotoGHG, M.0.EL: (CR: -25.0%, -28.5%; TP: 4.6%, 0.3%)*;
  - CR: Data for 2010 have been added from NC3 extending the DI data for 1994, 2000. This has changed emissions estimates in many sectors. Agricultural emissions are lower both cumulatively and in 2021 while CO_2 from energy and cement have increased in 2021 with little impact on cumulative emissions.
  - TP: The only changes are in CO_2 from energy and cement where 2021 emissions are higher and cumulative emissions are slightly higher.
- **Dominica:** *KyotoGHG, M.0.EL: (CR: -6.2%, -0.9%; TP: -6.5%, -0.3%)*;
  - CR: We have downscaled data from the UNFCCC DI interface making more data usable for PRIMAP-hist. The impact on
  - TP: Energy CO_2 data for 2021 are 10% lower than in v2.4.2 also slightly affecting cumulative emissions. F-gas emissions have been removed from EDGAR and are now much lower (using country reported data). However, the absolute emissions contribution is very small.
- **Denmark:** *KyotoGHG, M.0.EL: (CR: 1.1%, 0.3%; TP: -2.7%, -2.9%)*;
  - CR: 2021 changes originate mostly from livestock CH_4 and affect the whole timeseries as CRF

data has changed for all years. N_2O in "other" has also an effect for all years. Other sectors only have small contributions (but sometimes larger relative changes in 2021).
  - TP: The main sources of changes are f-gases which are over 80% lower in 2021 and over 70% lower cumulatively and energy CO_2 emissions which have been increased by 2.9% in 2021 but don't play a major role for cumulative emissions changes. Contributions from other sectors are negligible.
- **Dominican Republic:** *KyotoGHG, M.0.EL: (CR: 25.5%, 11.1%; TP: -0.5%, 1.6%)*;
  - CR: Data for 2015 have been added from BUR1 to complement DI data. The most important change for 2021 and cumulative emissions is an increase in energy CO_2 emissions (62% in 2021, 20% cumulatively). Further changes come from cement CO_2 (+50% in 2021, +15% cumulatively), the addition of f-gases from EDGAR, an reduction in agricultural N_2O (-81% in 2021, -26% cumulatively) which comes mostly from livestock. Livestock CH_4 emissions are lower as well.
  - TP: In 2021 10% lower emissions from energy CO_2 are offset by the introduction of f-gas emissions (from EDGAR 7.0) leading to small changes in aggregate emissions. For cumulative emissions energy CO_2 plays a smaller role and in consequence aggregate emissions are higher than in v2.4.2.
  - NOTE: Country reported data looks inconsistent: CH_4 in 1.B.2 much higher in 2015 but reported like that. Waste emissions have high fluctuations, but we keep the data until further investigation. CO_2 emissions in IPPU other than cement are only reported in NC2/1, not in NC3 and BUR1. N_2O in 1.A has high fluctuations, but we keep the data until further investigation. The same is true for sectors 3.A and 4.
- **Algeria:** *KyotoGHG, M.0.EL: (CR: 1.9%, 0.2%; TP: 1.9%, 0.2%)*;
  - CR: As we have no usable country reported data for Algeria the CR and TP time-series are identical.
  - TP: lower emissions in 2.A, CO_2 due to new Cement emissions data. Energy CO_2 is higher due to new BP/EI data. F-gas emissions have also changed as new EDGAR data are included.
- **Ecuador:** *KyotoGHG, M.0.EL: (CR: -16.7%, -11.6%; TP: 1.2%, 0.3%)*;
  - CR: Data for 8 years reaching from 1994 to 2018 have been added from the latest NIR. DI data are used to add IPPU (until 2012 only). This changes emissions for almost all sectors and gases both for 2021 and cumulatively. The highest absolute changes are in fugitive CH_4 where emissions are much lower (-90%) and energy CO_2 where emissions are 9% lower in 2021 and 2% lower cumulatively. Agricultural emissions are higher than in v2.4.2 both for 2021 and cumulatively, while waste emissions are much lower.
  - TP: In 2021 the main changes are from increased energy CO_2 emissions and increased f-gas emissions. Cement CO_2 emissions are 14% lower than in v2.4.2. Cumulatively small changes in energy and cement CO_2 cancel and 220% higher f-gas emissions dominate the changes (which are small compared to total emissions).
- **Egypt:** *KyotoGHG, M.0.EL: (CR: 7.5%, 4.9%; TP: 4.4%, 1.3%)*;
  - CR: 2015 data have been added from BUR1 impacting emissions in several sectors, especially fossil CO_2, fugitive CH_4, agricultural N_2O, and f-gases, but also other sectors. The changes affect several years.
  - TP: In 2021 cement CO_2 emissions are higher than in v2.4.2 due to updated 2021 data in the Andrew dataset. F-gas emissions are much higher due to the new EDGAR data. for cumulative emissions only f-gases play a role.
- **Eritrea:** *KyotoGHG, M.0.EL: (CR: 10.8%, 8.5%; TP: -0.0%, -0.0%)*;
  - CR: Data for 2018 have been added from BUR1 changing emissions for 2021 and cumulatively for many sectors and gases. The highest absolute change is in CH_4 from livestock (+23% in 2021, +16% cumulatively). Waste CH_4 emissions are lower, while CO_2 emissions from energy and cement are higher. N_2O emissions are unchanged.
  - TP: Overall 2021 emissions have negligible changes as higher emissions in energy CO_2 and much lower emissions in cement CO_2 cancel. The changes in cumulative emissions are small, except for the relative change in cement CO_2 (-13%, coming from higher changes in the latest years).
- **Spain:** *KyotoGHG, M.0.EL: (CR: -2.6%, -1.7%; TP: -0.9%, 0.4%)*;
  - CR: The main contribution to lower 2021 emissions comes from agriculture where CRF2023 is lower than CRF2022 with the highest contribution coming from N_2O in M.AG.ELV. CO_2 emissions in sectors 1 and 2 are also lower than in v2.4.2. which is mostly due to other sources

used for 2021 data (CRF instead of BP/EDGAR). Changes in agricultural emissions affect all years.
  - TP: F-gases are over 15% lower in 2020, but over 19% higher cumulatively. A bug has been fixed for 1.B.1, CH_4 removing negative emissions (see issue (#70)[https://github.com/JGuetschow/PRIMAP-hist/issues/70])).
- **Estonia:** *KyotoGHG, M.0.EL: (CR: -2.3%, -0.7%; TP: -3.2%, 0.2%)*;
  - CR: CRF data for 1.A, CH_4 is much lower in 2023 than in the 2022 submission. This affects all years. In 2021 there is an additional small change from energy CO_2. N_2O in "other" affects all years.
  - TP: The main change in 2021 emissions are reduced energy CO_2 emissions (-4.6%) which are partly offset by higher f-gas emissions (+110%). For cumulative emissions the changes in CO_2 are just -0.1% and thus f-gases (+174%) play the mayor role for changes in cumulative emissions.
- **Ethiopia:** *KyotoGHG, M.0.EL: (CR: 0.4%, -0.2%; TP: 0.2%, 0.0%)*;
  - CR: DI data for 1990-1994 have been added by downscaling them from main sectors and aggregate KyotoGHG to the sectoral and gas resolution needed fro PRIMAP-hist. 2021 energy CO_2 emissions are higher than in v2.4.2 (from BP/EI) while cement CO_2 is lower (from Andrew) and f-gas emissions have been removed as they are not included in EDGAR v7.0. Cumulative emissions have changes especially before 1994 where downscaled data have been added which are lower than the growth rate based data used before.
  - TP: 2021 emissions changes are similar to the CR time series. Cumulative emissions have not changed much except for the removal of f-gas data which is offset by a small increase in energy CO_2 emissions.
- **Finland:** *KyotoGHG, M.0.EL: (CR: -1.8%, -0.7%; TP: -1.9%, 0.0%)*;
  - CR: Changes for all years are dominated by "other" N_2O and agricultural N_2O (excluding livestock). for 2021 CO_2 in energy and IPPU (extrapolation in 2.C) plays a larger role. HFCs emissions play a role in 2021 as well where the steep decline in 2021 was not modeled by extrapolation.
  - TP: 2021 emissions are 1.9% lower than in v2.4.2, mainly because of lower energy CO_2 emissions with a smaller contribution from reduced f-gas emissions. Cumulative emissions have only small changes. f-gases are 12% higher than in v2.4.2.
- **Fiji:** *KyotoGHG, M.0.EL: (CR: 27.8%, 0.3%; TP: 5.7%, 2.4%)*;
  - CR: Data for 2006-2011 have been added from NC3 and combined with data for 1994 and 2004 from the DI interface. In consequence data have changed for all time series covered by country reported emissions. The most important change for 2021 is a 52% increase in energy CO_2 (39% cumulatively). F-gas emissions have bee added from EDGAR. CH_4 emissions from agriculture and waste are lower. Agricultural N_2O emissions are higher in the livestock sector but lower for other agricultural emissions.
  - TP: The main change in both 2021 and cumulative emissions is the addition of f-gases.
- **France:** *KyotoGHG, M.0.EL: (CR: -2.7%, -1.6%; TP: -2.0%, -0.0%)*;
  - CR: The main contribution is from agricultural N_2O (excluding livestock) where CRF data is much (over 30%) lower than in the 2022 submission for all years. Other agricultural emissions have been adjusted as well (livestock emissions upwards). HFCs are much lower in v2.5 for 2021 as the steep decline has not been modeled by extrapolation. CO_2 emissions in sector 2.G have been reduced by over 90% in CRF data for 2021 and cumulatively.
  - TP: The main sources of changes in 2021 are f-gases which are 43% lower in 2021. Further contributions come from slightly increased energy CO_2 emissions and increased cement CO_2 emissions. CO_2 emissions in sector 2.G have the same reductions as in the CR scenario as there is no third party data for CO_2 in that sector. Cumulative emissions are almost identical. Higher f-gas (1.2%) and cement CO_2 (2.4%) emissions are offset by the reduced CO_2 emissions in 2.G. Contributions from other sectors are negligible.
- **Micronesia, Federated States of:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.2%; TP: -0.2%, -0.2%)*;
  - CR: We have no country reported data for Federated States of Micronesia, thus the CR and TP time-series are identical.
  - TP: Emissions have not changed except for a slight decrease in energy CO_2 (2021 and cumulatively).
- **Gabon:** *KyotoGHG, M.0.EL: (CR: -66.2%, -73.5%; TP: 4.8%, 1.6%)*;
  - CR: We have added data for 1994, 2000, 2005, and 2010-2017 from the NIR which underlies

BUR1. This changes emissions in all sectors and gases with country reported data. NIR data are mostly significantly lower than third party data sources. The highest contribution to the reduced emissions is from fugitive CH_4 which is reduced by 88%in 2021 and 91% cumulatively. Waste CH_4 and N_2O are reduced by over 99% both for 2021 and cumulatively, however, the absolute contribution is much smaller than from fugitive CH_4. The very low waste emissions seem unlikely as waste CO_2 is actually much higher than third party data. However, we could not find an obvious error in the inventory so we keep the data until we find evidence that is is incorrect. F-gas emissions are higher than in v2.4.2 but lower than the EDGAR 7.0 data used for the TP time-series.
  - TP: The main source for higher emissions are the new f-gas data from EDGAR 7.0. Energy CO_2 emissions are 2.2% lower in 2021 and slightly lower cumulatively.
- **United Kingdom:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.1%; TP: -1.4%, -0.6%)*;
  - CR: In 2021 increases in agricultural emissions and energy CO_2 are offset by decreased emissions from CO_2 and f-gases in the IPPU sectors. For IPPU and energy CO_2 the changes are due to different growth rates in the sources used. Agricultural N_2O emissions have changed in CRF for all years. Cumulative emissions are slightly lower because of lower "other" N_2O emissions which are partly offset by slightly higher energy CO_2 emissions and agricultural emissions.
  - TP: The main sources of changes are f-gases which are 39% lower in 2021 and 26% lower cumulatively. Further contributions in 2021 come from slightly increased energy CO_2 emissions and increased cement CO_2 emissions. For cumulative emissions only f-gases play a role.
- **Georgia:** *KyotoGHG, M.0.EL: (CR: 8.0%, -0.8%; TP: 14.8%, 2.0%)*;
  - CR: Data from NC4 (1990-2017) have been added replacing the UNFCCC DI data for all sectors but IPPU where NC4 marks some data as "confidential". The main change in 2021 is an increase of 27% in energy CO_2 emissions due to adjusted growth rates in BP/EI data. Further contributions in 2021 come from lower IPPU CO_2 data (-8.8%, from cement and chemical industry) and lower f-gas data. the change in cumulative emissions is small and due to several factors partly canceling each other. Most prominent are lower fugitive CH_4 emissions (14%), lower CO_2 emissions from chemical industry (43%), higher agricultural emissions (11%), and higher energy CO_2 emissions (2.7%). Inclusion of NC4 data closes issue #61.
  - TP: The main sources of changes are energy CO_2 emissions (+27% in 2021) and f-gases which are over 1500% higher in 2021 and cumulatively. For cumulative emissions only f-gases play a role.
- **Ghana:** *KyotoGHG, M.0.EL: (CR: -5.7%, 11.7%; TP: -0.6%, -1.3%)*;
  - CR: Data from the NIR underlying BUR3 replaced UNFCCC DI data. Main sector (gas resolved) time series have been downscaled to the resolution needed fro PRIMAP-hist. As the DI data are not consistent with BUR3 data they could not be used as downscaling key. The peaks visible in energy CO_2 data are reported in the NIR and not a processing error. Emissions have changed in for most sectors and gases both for 2021 and cumulatively.
  - TP: In 2021 a 98% decrease in cement CO_2 emissions (from Andrew data) is mostly offset by a 7100% increase in f-gase missions from new EDGAR data. cumulatively the decrease in cement emissions is similar while the f-gas increase is smaller leading to a 1.3% reduction in KyotoGHG M.0.EL emissions.
  - INFO: The peaks in UNFCCC data come from NIR to BUR3. They actually come from flaring but we currently only have the total energy time-series (1). Flaring data are available in the NIR to BUR3. See UNFCCC_no-AnnexI_data issue #78.
- **Guinea:** *KyotoGHG, M.0.EL: (CR: 2.4%, 1.4%; TP: 2.4%, 1.4%)*;
  - CR: We have no country reported data for Guinea, thus the CR and TP time-series are identical.
  - TP: The main change is that f-gas emissions have been added.
- **Gambia:** *KyotoGHG, M.0.EL: (CR: 5.4%, 3.5%; TP: -0.1%, 0.0%)*;
  - CR: We have added data for 2010 from NC3. The main sources of change for 2021 and cumulative emissions are emissions from fossil fuel combustion especially CH_4, but also N_2O and CO_2. While in 2021 all gases show increases, cumulative emissions are lower for CO_2 and higher for N_2O and CH_4.
  - TP: Changes are small and only in energy CO_2.
- **Guinea-Bissau:** *KyotoGHG, M.0.EL: (CR: -0.0%, 0.0%; TP: -0.0%, 0.0%)*;
  - CR: We have no country reported data for Guinea-Bissau, thus the CR and TP time-series are identical.

  - TP: Changes are small and only in energy CO_2.
- **Equatorial Guinea:** *KyotoGHG, M.0.EL: (CR: -0.3%, 0.5%; TP: -0.3%, 0.5%)*;
  - CR: We have no country reported data for Equatorial Guinea, thus the CR and TP time-series are identical.
  - TP: energy CO_2 emissions are 4% lower in 2021 and slightly lower cumulatively. In 2021 they are offset by added f-gas emissions. Cumulatively the f-gas emissions lead to a slight increase in KyotoGHG emissions.
- **Greece:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.2%; TP: -14.5%, -1.8%)*;
  - CR: Sector and gas specific changes are higher than overall changes as they partly cancel. Energy CO_2 is 2.8% higher than estimated in v2.4.2 because the growth rate in BP2022 was lower than it is in CRF2023 (and EI2023). F-gases are lower in v2.5 as the steep decline was not modeled in v2.4.2. Changes before 2021 are very small and mainly come from "other" N_2O.
  - TP: In 2021 there are two major changes: energy CO_2 emissions are 24% lower than in v2.4.2 because of an adjustment in BP/EI data for 2017 which is the last year of the CDAIC2022 time-series. This strongly influences the matching of the time-series such that 2021 emissions change significantly despite very small changes in BP/EI data itself for 2021. Cumulatively the effect is smaller and emissions are reduced by 3.1%. F-gas emissions are 74% higher in 2021 and 13% higher cumulatively. Cement CO_2 is 6% higher in 2021 but the influence on total emissions is negligible.
- **Grenada:** *KyotoGHG, M.0.EL: (CR: 38.9%, 20.9%; TP: 25.3%, 12.6%)*;
  - CR: We have added data for 2000-2006 and 2008-2014 from NC2. 2007 data are not used because they are inconsistent with the other years and third party data. Data for years without a full inventory are downscaled to the necessary category and gas level. Data from the UNFCCC DI interface are used for 1994 (without agriculture and waste because these are inconsistent with data for the other years). The main change in 2021 and cumulative emissions is the addition of f-gas data. A further contribution comes from higher energy CO_2 emissions. Changes in other sectors and gases play a smaller role.
  - TP: The main source of changes for the TP time series is the addition of f-gas data. Additionally energy CO_2 emissions are 10% lower in 2021 and slightly lower cumulatively.
- **Guatemala:** *KyotoGHG, M.0.EL: (CR: -11.9%, -8.2%; TP: -1.6%, -1.7%)*;
  - CR: Data from NC3 for 1990, 1994, 2000, 2005, 2010, 2014, and 2016 have been added. The highest changes in absolute terms are from lower agricultural N_2O emissions (-57% in 2021, -28% cumulatively, from M.AG.ELV). Emissions from energy CO_2 are 23% higher in 2021 and 9.3% higher cumulatively resulting in an absolute contribution similar to agricultural N_2O - just with the opposite sign. F-gas emissions are lower than in v2.4.2 and so are agricultural and waste CH_4. Contributions form other sectors and gases are smaller.
  - TP: F-gas emissions are over 80% lower for 2021 and cumulatively because of the new EDGAR data. Energy CO_2 emissions are 5.2% higher in 2021 and 0.9% cumulatively. Cement CO_2 emissions are smaller both for 2021 and cumulatively.
  - Note: The country reported data have high fluctuations but are consistent with the data reported in NC3.
- **Guyana:** *KyotoGHG, M.0.EL: (CR: 1.1%, -0.1%; TP: 1.0%, -0.1%)*;
  - CR: No new country reported data were included. Changes to 2021 emissions mainly come from, increased energy CO_2 and to a smaller extent from cement CO_2. Changes in cumulative emissions are very small.
  - TP: Changes in the TP time-series are similar to changes in the CR time-series.
- **Hong Kong:** *KyotoGHG, M.0.EL: (CR: -1.2%, -0.5%; TP: -1.2%, -0.5%)*;
  - CR: We have no country reported data for Hong Kong, thus the CR and TP time-series are identical.
  - TP: The main source for changes in 2021 emissions are f-gas emissions estimates which have been reduced by 66%. Further contributions come from reduced cement CO_2 emissions and a slight increase in energy CO_2 emissions. For cumulative emissions only f-gases play a role.
- **Honduras:** *KyotoGHG, M.0.EL: (CR: 19.2%, 5.3%; TP: 4.9%, 1.7%)*;
  - CR: Data for 2005 and 2015 have been added from BUR1 and are combined with data for 1995 and 2000 from UNFCCCC DI. However, the data are not consistent for all sectors and thus only some sectors use country reported data. The main source of changes are higher waste CH_4 emissions (+156% in 2021 and +40% cumulatively). F-gas emissions have been added

and energy CO_2 emissions are 5.2% higher in 2021 and 1% higher cumulatively. Other sectors contribute less to total emissions changes.
  - TP: Higher 2021 emissions are caused by a 5.2% increase in energy CO_2 and the addition of f-gas emissions. Cement CO_2 emissions are 10% lower than in v2.4.2 but contribute only little to total emissions changes. For cumulative emissions f-gases are the main factor with some increase in energy CO_2 contributing to the total changes as well.
- **Croatia:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.2%; TP: 0.0%, 0.9%)*;
  - CR: Only small changes. CH_4, 1.B.2 was very low in 2.4.2, now higher. For the agricultural sector and sector 5 ("other") several years have changed data.
  - TP: 2021 emissions totals are practically unchanged from v2.4.2 because a 1.9% decrease in energy CO_2 amounts to the same emissions as the 124% increase in f-gas emissions. For cumulative emissions only f-gases play a noteworthy role leading to an increase in total emissions.
- **Haiti:** *KyotoGHG, M.0.EL: (CR: -2.3%, -0.0%; TP: -1.9%, -0.0%)*;
  - CR: No new country reported data have been added. Changes in 2021 emissions are dominated by a 9.7% decrease in energy CO_2. Cement CO_2 emissions are 50% higher than in v2.4.2, but the influence on total emissions is small compared to energy CO_2.
  - TP: Changes are almost identical to changes in the CR time-series.
  - NOTE: The UNFCCC DI time-series are short and have high variability. As it's unclear from which submissions the data in the DI interface are taken the time-series might be combined from different inconsistent submissions.
- **Hungary:** *KyotoGHG, M.0.EL: (CR: 0.1%, -0.5%; TP: -2.7%, -1.8%)*;
  - CR: In 2021 small changes from different sectors cancel (energy CO_2, f-gases, "other" N_2O). For other years "other" N_2O, fugitive CH_4, and energy CO_2 lead to small emissions reductions.
  - TP: The main source for changes in 2021 and cumulatively are the new f-gas emissions from EDGAR v7.0 which are 50% lower in 2021 and 56% cumulatively. Energy CO_2 is 0.9% higher in 2021 and almost unchanged cumulatively. Cement CO_2 is 8% higher in 2021 but plays only a minor role for total emissions.
- **Indonesia:** *KyotoGHG, M.0.EL: (CR: 0.8%, -1.7%; TP: -0.2%, 0.5%)*;
  - CR: Now combined country reported data from DI interface and BURs 1-3 are used. This affects several sectors and gases mostly for years before 2016. Highest absolute changes in 2021 are in energy CO_2 while highest relative changes are in f-gas emissions. A small known bug is that the sum of categories 1.X does not add up to 1 for CH_4 in UNFCCC data. This comes from downscaling where downscaled subsector data is inconsistent with higher level data. This will be fixed in a future release.
  - TP: Highest absolute changes in 2021 are in energy CO_2 while highest relative changes are in f-gas emissions. For cumulative emissions f-gases are responsible for the majority of the changes. Cement CO_2 is lower both for 2021 (5%) and cumulatively (0.5%). changes in other sectors don't play a role for total emissions.
- **India:** *KyotoGHG, M.0.EL: (CR: -1.4%, -1.1%; TP: -0.4%, 0.2%)*;
  - CR: Main contribution to emissions changes is energy CO_2 where EI2023 data have lower growth rates than BP2022 post 2020. F-gases especially PFCs contribute to lower 2020 emissions because EDGAR growth rates are lower than the extrapolation used in v2.4.2. CH_4 emissions for 2.H have been added. EI data show a steep increase in energy CO_2 emissions in 2022. Lower emissions in IPPU before 2000 because very high first UNFCCC data point in 1994 in 2.C have been removed.
  - TP: total emissions have not changed much, but individual sector and gas changes are higher. Energy CO_2 emissions are 1.9% lower than in v2.4.2 while f-gas emissions are 82% higher and CH_4 in sector 2.H has been added. These increases offset more than half of the CO_2 decreases. For cumulative emissions the changes come from the same sectors but are smaller.
- **Ireland:** *KyotoGHG, M.0.EL: (CR: 1.4%, -0.3%; TP: -1.8%, -1.7%)*;
  - CR: for HFCs the extrapolated value for 2021 in v2.4.2 is higher than CRF 2023 data. Agricultural CH_4 emissions are higher than in v2.4.2 for all years. Agricultural CO_2 has a steep increase in 2021, but the time-series has high fluctuations for all years covered by CRF data. Agricultural N_2O is lower than in CRF2022 which leads to a very small impact of agricultural emissions changes on total emission before 2021 (CH_4 and N_2O cancel). N_2O from the "other" sector is responsible for the slight reduction in overall emissions.
  - TP: The reason for lower 2021 and cumulative emissions are the new f-gas emissions data

from EDGAR 7.0 which lead to 75% lower f-gas emissions in 2021 than in v2.4.2 and 60% lower emissions cumulatively. CO_2 from energy and from cement is higher in 2021 dampening the impact of f-gas emissions changes. For cumulative emissions changes only f-gases play a significant role.

- **Iran, Islamic Republic of:** *KyotoGHG, M.0.EL: (CR: 7.0%, 3.4%; TP: 1.7%, 0.9%)*;
  - CR: With the combination of data from the UNFCCC DI interface for 1994 and 2000 with data from NC3 for 2010 we can use country reported data for Iran for the first time. Emissions estimates for most sectors and gases have changed for the whole time period. Changes in the TP time series are limited to f-gases.
  - TP: the highest absolute and relative changes are from f-gases which have increased drastically (1200% in 2021 and 270% cumulatively) due to the addition of HFC emissions to EDGAR data. Changes in other sectors (CO_2 from energy, cement) are below 0.5%.
- **Iraq:** *KyotoGHG, M.0.EL: (CR: -5.1%, -0.7%; TP: -5.1%, -0.7%)*;
  - CR: We have no country reported data for Iraq, thus the CR and TP time-series are identical.
  - TP: The main cause for changes in 2021 emissions are 15% lower energy CO_2 emissions. The reason for this change is that BP/EI emissions for 2017 and years before and after have changed which impacts matching of BP/EI data to CDIAC. Cement CO_2 emission are over 90% higher than in v2.4.2 because of adjusted data from the Andrew dataset. HFCs have been added and increase f-gas emissions. For cumulative emissions the CO_2 changes are much smaller and f-gas changes are also smaller leading to smaller total changes.
- **Iceland:** *KyotoGHG, M.0.EL: (CR: -0.4%, -0.2%; TP: -2.6%, 0.0%)*;
  - CR: Total emissions have not changed much. For 2021 increases in energy CO_2, f-gases and other sectors cancel with lower CO_2 emissions in metal industry (which is a major sector in Iceland) and agricultural N_2O. These changes partly come from differences between emissions estimates based on CRF2022, and numerical extrapolations and third party growth rates used in v2.4.2 to emissions in CRF2023 and partly from differences between CRF2022 and CRF2023. Changes in cumulative emissions are mostly due to changes in agricultural data from CRF2022 to CRF 2023.
  - TP: Total emissions in 2021 are lower because of lower f-gas emissions (36%) and lower energy CO_2 emissions (3%). Cumulatively emissions changes cancel out and individual changes are small except for higher HFC emissions which cancel with lower SF_6 and PFC emissions.
- **Israel:** *KyotoGHG, M.0.EL: (CR: 3.3%, -0.5%; TP: -3.5%, -1.7%)*;
  - CR: The main impact on 2021 emissions changes is energy CO_2 where new data from BUR2 has been added that replaced growth rates from BP2022. Similar changes occur in several other sectors. For f-gases, agricultural CH_4, and IPPU N_2O (and other sectors to a smaller extent) changes affect several years and change cumulative emissions.
  - TP: The main impact on total emissions are the new EDGAR f-gas data which are 33% lower in 2021 and 38% lower cumulatively. In 2021 0.6% lower energy CO_2 emissions and 21% higher cement CO_2 emissions play a role while they are negligible for changes in cumulative emissions.
- **Italy:** *KyotoGHG, M.0.EL: (CR: 0.8%, -0.1%; TP: -1.1%, 0.4%)*;
  - CR: In v2.4.2 2021 data for fugitive CH_4 was extrapolated from 2020 and earlier. This trend showed a steep decline leading to a low 2021 value which was not confirmed in CRF2023 data. Thus 2021 fugitive CH_4 emissions are significantly higher in v2.5. Energy CO_2 emissions have risen more in 2021 (according to CRF2023) than estimated by BP2022 data. The increased emission in the energy sector have partly been offset by lower emissions in the agricultural sector and from f-gases. Over a longer period f-gas emissions are higher than in v2.4.2 (from changed CRF data), while "other" N_2O is lower leading to a small overall decrease in emissions. Other sectors have small changes that cancel out.
  - TP: In 2021 f-gas emissions are reduced by 31% vs v2.4.2. This is partly offset by a 1% increase for energy CO_2, and a 12% increase in cement CO_2 but total emissions are lower than in v2.4.2. cumulatively f-gas emissions are actually 12% higher (because of high pre-2000 emissions not present in earlier EDGAR versions) leading to increase in total emissions.
- **Jamaica:** *KyotoGHG, M.0.EL: (CR: -4.8%, 1.2%; TP: -7.6%, -0.1%)*;
  - CR: No new country reported data have been added. The main source of changes is that energy CO_2 emissions are 9.7% lower in 2021 and 2.5% higher cumulatively. F-gas emissions are almost 30% lower but only contribute a little to total emissions. We also have a change in pre-1990 emissions where we have fixed a problem with extrapolation leading to very high emissions in 1.B.1 for CH_4.

  - TP: Changes in energy CO_2 in 2021 are similar to the CR scenario, cumulatively energy CO_2 is 0.3% lower than in v2.4.2. F-gases are higher in 2021 and cumulatively.
- **Jordan:** *KyotoGHG, M.0.EL: (CR: 5.2%, 2.9%; TP: 7.2%, 3.4%)*;
  - CR: Data for 2017 have been added from NC4. We have also removed some data points from the UNFCCC DI data as they are inconsistent with the other data in the time-series (waste for 1994, agriculture for 1994, 2000). This changed emissions estimates for most sectors and gases for 2021 and cumulatively. The most important increased emissions estimates in 2021 are 330% higher f-gas emissions, 250% higher fugitive CH_4 emissions (from 1.B.2. 1.B.1 is actually 0 in CR data), 35% higher agricultural N_2O, 21% higher agricultural CH_4, and 2950% higher CO_2 from metal industry (2.C). Emissions estimates for energy CO_2 (-1.5%) and cement CO_2 (-36%) are lower. For cumulative emissions the most important changes are in f-gases (+195%), agriculture (+25%), fugitive CH_4 (+98%), and CO_2 from metal industry (+2450%).
  - TP: For 2021 f-gas emissions estimates based on the new EDGAR data have increased by 610% (526% for cumulative emissions). For 2021 the only other noteworthy change is the reduction of cement CO_2 by 26% (-3.5% cumulatively). For cumulative emissions we also have higher fugitive CH_4 emissions.
- **Japan:** *KyotoGHG, M.0.EL: (CR: -0.4%, -0.1%; TP: -10.7%, -4.2%)*;
  - CR: Lower emissions in 2021 come from waste (adjustment in CRF, for CH_4 for all years) and energy CO_2 (which is very small relative to sector emissions (0.25%)). Cumulative emissions are slightly lower with contribution from all sectors.
  - TP: F-gas emissions have been reduced by 86% in 2021 and 68% cumulatively. For 2021 a 1.2% increase in energy CO_2 emissions plays a role while for cumulative emissions all changes except f-gases are negligible.
- **Kazakhstan:** *KyotoGHG, M.0.EL: (CR: -3.7%, 3.8%; TP: -0.8%, -0.5%)*;
  - CR: Emissions in CRF data have changed for most sectors, gases and years between the 2022 and 2023 submissions leading to changes in both 2021 and cumulative emissions. The highest relative changes are in the waste sector and fugitive emissions. The highest absolute contribution is from energy CO_2.
  - TP: For 2021 the main contributions come from lower energy CO_2 emissions (0.9%) and lower cement CO_2 emissions (14%). F-gas emissions are 26% higher. For cumulative emissions cement CO_2 plays a negligible role and the changes come from energy CO_2 and f-gases.
- **Kenya:** *KyotoGHG, M.0.EL: (CR: 1.1%, 0.1%; TP: 2.0%, 0.6%)*;
  - CR: No new country reported data have been added. The main source of changes is that energy CO_2 emissions are 5.9% higher in 2021 and 0.5% higher cumulatively. F-gas emissions are 22% higher but only contribute a little to total emissions.
  - TP: In 2021 emissions from energy CO_2 are 5.9% higher and emissions from cement CO_2 29%. Cumulatively only cement CO_2 plays a role. F-gas emissions have high relative changes but don't play a role for total emissions.
- **Kyrgyzstan:** *KyotoGHG, M.0.EL: (CR: -15.4%, -14.5%; TP: 2.3%, 0.1%)*;
  - CR: We replaced UNFCCC DI data by data from BUR1 and NIR1. This has changed emissions estimates for all sectors and gases. For most sectors emissions are now lower than in v2.4.2. In 2021 only cement CO_2 and agricultural N_2O are higher. For cumulative emissions only CH_4 from fossil fuel combustion, fugitive CO_2, CO_2 from cement and metal industry, and agricultural N_2O are higher than in v2.4.2.
  - TP: 2021 emissions are 2.3% higher due to increased CO_2 emissions from energy and cement.
  - NOTE: F-gas emissions from BUR1/NIR1 are currently missing. See UNFCCC_non-AnnexI_data issue #79.
- **Cambodia:** *KyotoGHG, M.0.EL: (CR: -4.5%, 0.5%; TP: 2.4%, 0.5%)*;
  - CR: Data for 1994-2016 have been added from BUR1. Data coverage for f-gases has some gaps. The sectoral resolution of the data is not sufficient for all sectors, thus changes are limited to the sectors where the country reported data are used. The highest absolute change is from a reduction in cement CO_2 of over 40% both for 2021 and cumulatively. Further changes come from waste CH_4 (over 20% reduction) and energy CO_2 (3.2% reduction in 2021, 4.1% increase in cumulative emissions). f-gases have been added.
  - TP: The main changes in 2021 are and increase in cement CO_2 and the addition of f-gas data. For cumulative emissions changes the new f-gas data and 0.6% reduction in energy CO_2 play a role.
- **Kiribati:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.3%; TP: -0.2%, -0.2%)*;

  - CR: Emissions are basically unchanged.
  - TP: Emissions are basically unchanged.
- **Saint Kitts and Nevis:** *KyotoGHG, M.0.EL: (CR: -11.3%, -2.0%; TP: -11.3%, -2.0%)*;
  - CR: We have no country reported data for Saint Kitts and Nevis, thus the CR and TP time-series are identical.
  - TP: In 2021 energy CO_2 emissions are 9.7% lower than in v2.4.2. F-gas emissions have been removed completely as they are no longer contained in EDGAR data. For cumulative emissions energy CO_2 has a reduction of 0.4%.
- **Korea, Republic of:** *KyotoGHG, M.0.EL: (CR: -0.9%, -0.6%; TP: 1.8%, 0.5%)*;
  - CR: New inventory data has been included adding 2020 and changing emissions for some sectors also in other years. F-gases data for AR4 GWPs have changed because they are only reported as aggregate HFCs and aggregate PFCs in SAR GWPs and we have updated the default conversion factors between the GWPs.
  - TP: The main change for 2021 and cumulative emissions comes from much higher HFC emissions in EDGAR data after 2005.
- **Kuwait:** *KyotoGHG, M.0.EL: (CR: -33.1%, -38.7%; TP: -0.4%, 1.8%)*;
  - CR: New data for 2000 have been included from NC2. Together with data for 1994 and 2016 from the UNFCCC DI interface this enables the use of country reported data for some sectors and gases. This lowers emissions estimates especially in the energy sector. CH_4 emissions are over 95% lower while CO_2 emissions are roughly 30% lower than in v2.4.2. Waste CH_4 emissions are reduced by roughly 75% and also lead to a strong decrease in overall emissions which is alleviated by strongly increased f-gas emissions.
  - TP: Total emissions changes are small for 2021 as a 12% reduction in energy CO_2 is canceled out by a 366% increase in f-gas emissions. For cumulative emissions the increase in f-gases is roughly three times the reduction in energy CO_2 and total emission increase.
- **Lao People's Democratic Republic:** *KyotoGHG, M.0.EL: (CR: 3.8%, -0.6%; TP: 9.6%, 0.5%)*;
  - CR: We have added data for 2014 from BUR1 which is combined with data for 1990, 2000 from the UNFCCC DI interface. However, the data don't cover all sectors. The highest absolute change in 2021 is from cement CO_2 where Andrew data has increased by 168% (no country reported data used). Energy CO_2 emissions are 7.5% lower in 2021 offsetting part of the increase from cement. Other contributions are lower energy CH_4 and waste CH_4 emissions and higher energy N_2O emissions. For cumulative emissions the increase in cement CO_2 plays a small role, while an increase in agricultural CH_4 is added to the factors impacting aggregate emissions.
  - TP: For 2021 the main source of change is cement CO_2 (identical to CR timeseries). Cumulatively lower energy CO_2 emissions also play a role.
  - NOTE: Waste CH_4 has high fluctuation. In NC1 solid waste disposal has high emissions, in BUR1 wastewater treatment and discharge. In NC2 bot sectors have lower emissions (keep data as is)
- **Lebanon:** *KyotoGHG, M.0.EL: (CR: 24.8%, 5.1%; TP: 5.2%, 3.5%)*;
  - CR: We have added data for 2019 from NC4 and for 2018 from BUR4. These are combined with data for 1994, 2000, and 2011-2013 from the UNFCCC DI interface. However, f-gas emissions are taken from EDGAR because reporting in UNFCCC data is insufficient. for 2021 emissions a 34% increase in energy CO_2 and the addition of f-gas emissions are the dominating factors. Waste CH_4 and (-39%) and cement CO_2 (-65%) are lower than in v2.4.2. For cumulative emissions relative changes are much lower and the main factors are f-gases and increased energy CO_2 (4.2%). Waste CH_4 (-9.4%) and cement CO_2 (-7.9%) are lower.
  - TP: Noteworthy 2021 changes are limited to f-gases and cement CO_2. For cumulative emissions the impact of f-gases is much higher than the reduction in cement CO_2.
- **Liberia:** *KyotoGHG, M.0.EL: (CR: 0.4%, -0.6%; TP: 0.4%, -0.6%)*;
  - CR: We have no country reported data for Liberia, thus the CR and TP time-series are identical.
  - TP: F-gas emissions have been removed from EDGAR data and PRIMAP-hist. cement CO_2 emissions are 30% higher than in v2.4.2 in 2021 and 7.3% higher cumulatively. Energy CO_2 is 0.5% lower in 2021 and slightly higher cumulatively. No other sectors have changes.
- **Libya:** *KyotoGHG, M.0.EL: (CR: 5.8%, 1.3%; TP: 5.8%, 1.3%)*;
  - CR: We have no country reported data for Libya, thus the CR and TP time-series are identical.
  - TP: The higher 2021 emissions are based in a 4% increase in energy CO_2 and a 379% increase

in f-gas emissions. Cumulative emissions changes are due to higher f-gas emissions.

- **Saint Lucia:** *KyotoGHG, M.0.EL: (CR: 8.0%, -4.6%; TP: -0.6%, -0.8%)*;
  - CR: We have added data from BUR1 for several year sin the period 2000-2018. Data for years earlier than 2018 are downscaled from M.0.EL KyotoGHG timeseries to the detail needed for PRIMAP-hist. The main change for 2021 are increased f-gas emissions. Further changes are 2.3% higher energy CO_2 emissions, 12% decreased waste CH_4 emissions, a 33% decrease in agricultural N_2O and many smaller contributions (in absolute emissions) from other sectors and gases. The change in cumulative emissions is dominated by lower waste CH_4 and agricultural N_2O, alleviated by higher f-gas emissions.
  - TP: In 2021 the only changes are 9.7% lower energy CO_2 emissions and 33% higher f-gas emissions. Cumulatively both energy CO_2 and f-gases show lower emissions.
- **Liechtenstein:** *KyotoGHG, M.0.EL: (CR: -3.0%, -0.5%; TP: -12.3%, -4.0%)*;
  - CR: The main sources for changes in 2021 are a 1.7% reduction in energy CO_2, and a 19% reduction in f-gas emissions (because the extrapolation did not model the decline in 2021). N_2O from the "other" sectors is now 0 which also reduces emissions. Other sectors contribute smaller changes. For cumulative emissions "other" N_2O is the main source of changes.
  - TP: F-gas emissions are 77% lower in 2021 and 64% lower cumulatively due to the new EDGAR data. No other changes.
- **Sri Lanka:** *KyotoGHG, M.0.EL: (CR: 1.5%, 0.6%; TP: 1.5%, 0.6%)*;
  - CR: We have no country reported data for Sri Lanka, thus the CR and TP time-series are identical.
  - TP: Changes in 2021 emissions are due to the addition of f-gas data from EDGAR and 0.5% higher energy CO_2 emissions. Cement CO_2 emissions are 0.5% lower but don't contribute significantly to total emissions. Cumulatively 0.2% higher energy CO_2 emissions cancel with 3.4% lower cement CO_2 emissions leaving the added f-gas emissions to increase total emissions. 2022 emissions show a steep decline from 2021 because of a steep decline in energy CO_2 emissions in EI2023.
- **Lesotho:** *KyotoGHG, M.0.EL: (CR: 3.9%, -6.6%; TP: 1.4%, 0.2%)*;
  - CR: Data for 2005-2017 have been added from NC3 and BUR1. Many sectors and gases have changes both for 2021 and cumulative emissions. In 2021 the main impacts are higher energy CH_4 emissions and lower energy CO_2 emissions. Agricultural emissions are lower for CH_4 and higher for N_2O. Waste emissions are higher. Cumulative emissions are lower because of a 24% reduction in energy CO_2 which is partly offset by higher agricultural N_2O (33%) and higher energy CH_4 (28%). F-gases have been added from BUR1 but don't play a role for cumulative emissions.
  - TP: Emissions have only changed little. Energy CO_2 is 1.6% higher in 2021 and f-gases have been added. Cumulative emissions have increased slightly due to energy CO_2 ans f-gases.
  - NOTE: Data for 3.A, N_2O seem inconsistent (NC3 is much higher than DI and BUR1). Waste N_2O has the opposite effect. We have double checked the data and found that they are consistent with the reports. We keep the data unless we find an error in the reports.
- **Lithuania:** *KyotoGHG, M.0.EL: (CR: -1.9%, -0.8%; TP: -10.0%, -3.5%)*;
  - CR: The main contributions to lower emissions in 2021 are from CO_2 in 2.B (CRF is lower starting in 2005) and f-gases (extrapolation in v2.4.2). For cumulative emissions only 2.B CO_2 plays a role.
  - TP: Over 95% of the changes in 2021 and cumulative emissions are due to reduced EDGAR f-gas emissions. Energy CO_2 is slightly higher and cement CO_2 is 14% higher in 2021 and slightly higher cumulatively.
- **Luxembourg:** *KyotoGHG, M.0.EL: (CR: -0.1%, -1.0%; TP: 1.7%, -0.5%)*;
  - CR: Some changes in CRF data especially for the agricultural and waste sectors change emissions for all years. Energy CO_2 data for 2021 adjusted. CO_2 from cement production in 2021 lower in CRF then estimated in v2.4.2. Cumulative emissions lower because of N_2O in "other" sector and agriculture excluding livestock.
  - TP: For 2021 energy CO_2 emissions are 4.7% higher while f-gas emissions are 70% lower and cement CO_2 is 12% lower than in v2.4.2. For cumulative emissions the main impact is from lower f-gas emissions.
- **Latvia:** *KyotoGHG, M.0.EL: (CR: -0.8%, -0.6%; TP: -18.7%, -7.5%)*;
  - CR: The largest contribution to changes is from N_2O in the "other" sector. For f-gases 2021 value is below estimate in v2.4.2. For cumulative 1990-2021 emissions only "other" N_2O plays

a role.
  - TP: For 2021 f-gas emissions are 88% lower and metal industry CO_2 has been reduced by 100% due to a change in extrapolation methodology (if a time series is 0 at it's last data point is is extrapolated with 0). Other sectors play only a small role.
  - NOTE: A timeseries harmonization problem leading to an emission spike in sector 2.C for CO_2 has neem fixed.
- **Macao:** *KyotoGHG, M.0.EL: (CR: -0.2%, -3.3%; TP: -0.2%, -3.3%)*;
  - CR: We have no country reported data for Macao, thus the CR and TP time-series are identical.
  - TP: The only 2021 change is a slight reduction in energy CO_2. Cumulative emissions have changed more because cement CO_2 is now zero for all years.
- **Morocco:** *KyotoGHG, M.0.EL: (CR: 1.2%, 1.2%; TP: 2.1%, 0.7%)*;
  - CR: Almost no differences in 2021 data (small difference from energy CO_2). Cumulative emissions have changed for several sectors as in 2.4.2 the UNFCCCDI data was harmonized to BUR3 while we don't use it in v2.5 as we reassessed it and found it to be too inconsistent to combine under our new approach where country reported data is not harmonized but combined directly. The highest relative change is in the waste sector.
  - TP: The main change in 2021 and cumulatively is that f-gases are much higher from increased HFC emissions in EDGAR. In 2021 we also have an 0.8% increase in energy CO_2 and a 2.2% increase in cement CO_2. For cumulative emissions the change in energy CO_2 is negligible while cement CO_2 emissions are 1.1% lower.
- **Monaco:** *KyotoGHG, M.0.EL: (CR: -3.2%, -1.3%; TP: -7.6%, -0.6%)*;
  - CR: Country reported data has changed in most sectors and gases for 2021 with the highest contribution from lower f-gas emissions. Energy CO_2 emissions are 0.4% higher while "other" N_2O emissions are now 0. For cumulative emissions the main source of changes are "other" N_2O emissions with smaller contributions from CO_2 in 2.D and energy CO_2. 2.D is a small sector but relative reductions are over 80% both for 2021 and cumulatively due to updated CRF data.
  - TP: The only relevant change are lower f-gas emissions.
- **Moldova, Republic of:** *KyotoGHG, M.0.EL: (CR: -20.9%, -7.8%; TP: 3.0%, 0.7%)*;
  - CR: Data from NC5 (1990-2019) have replaced data from the UNFCCC DI interface. For 2021 We have high changes in almost all sectors. The highest absolute change is from a 23% reduction energy CO_2, followed by a 34% reduction in agricultural N_2O. For cumulative emissions changes come from the same sectors but are generally smaller in relative (and absolute) terms.
  - TP: In 2021 much higher f-gas emissions and a 1.7% increase in energy CO_2 are the main factors for higher emissions. For cumulative emissions the relative change in energy CO_2 is smaller (0.2%). Cement CO_2 is decreased by 5.8% in 2021 and 0.5% cumulatively.
- **Madagascar:** *KyotoGHG, M.0.EL: (CR: 2.8%, 3.6%; TP: 2.8%, 0.9%)*;
  - CR: We have no new country reported data for Madagascar, but made some data usable through downscaling. For 2021 the main sources of changes are increases in f-gases of over 4000% and a 5.9% increase in energy CO_2. Cement CO_2 is 35% lower than in v2.4.2.
  - TP: In 2021 much higher f-gas emissions and a 5.9% increase in energy CO_2 are the main factors for higher emissions. For cumulative emissions the relative change in energy CO_2 is smaller (0.6%). Cement CO_2 is decreased by 35% in 2021 and 8.2% cumulatively.
  - NOTE: CH_4 data for M.AG.ELV is inconsistent between NCs 1 and 2 and NC3. The difference comes from rice cultivation. It is not immediately clear which change in accounting causes the difference, further reading of the reports is needed. We remove data from NCs 1 and 2 (1994, 2000). We also have to remove field burning of agricultural residues and Prescribed burning of savannas as they are summed with rice cultivation in PRIMAP-hist.
- **Maldives:** *KyotoGHG, M.0.EL: (CR: 0.0%, 0.0%; TP: 0.0%, 0.0%)*;
  - CR: We have no new country reported data for the Maldives.
  - TP: No changes.
- **Mexico:** *KyotoGHG, M.0.EL: (CR: 7.8%, 0.6%; TP: 1.8%, -1.6%)*;
  - CR: 2021 emissions are much higher because of increased energy CO_2 and f-gas emissions. For energy CO_2 the reason are adjusted growth rates in EI2023 (compared to BP2022). HFC emissions are higher because some HFC species were not included in the HFCs sum in v2.4.2 and earlier. Cumulative emissions are slightly higher due to the increased f-gas emissions and the higher energy CO_2 emissions in 2020 and 2021. CH_4 emissions in M.AG.ELV are lower

because of per country processing of agricultural and LULUCF data enabling a more detailed mapping of biomass burning emissions to agriculture and LULUCF.
  - TP: The main contribution to higher 2021 emissions comes from a 14% increase in energy CO_2 emissions (see CR). F-gas emissions are over 60% lower in 2021 and cumulatively (from new EDGAR data). For cumulative emissions the increase in energy CO_2 is smaller (0.7%) and therefore lower f-gas emissions dominate the changes in total emissions.
- **Marshall Islands:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.2%; TP: -0.2%, -0.3%)*;
  - CR: We have no new country reported data for the Marshall Islands. The only change in emissions is a 0.2% reduction in energy CO_2 for 2021 (-0.4% cumulatively).
  - TP: The only change in emissions is a 0.2% reduction in energy CO_2 for 2021 (-0.3% cumulatively).
- **North Macedonia:** *KyotoGHG, M.0.EL: (CR: -18.5%, -12.5%; TP: 4.5%, 1.5%)*;
  - CR: We have added data from NIR4 and BUR3 (f-gases only) which is combined with data from BUR2 and the UNFCCCDI interface (where data are consistent). The most prominent change in 2021 is a 80% reduction in waste CH_4 where the new data are much lower than the UNFCCC DI data. CO_2 emissions from energy (-2.5%) are also lower while agricultural N_2O emissions are higher (114%). For cumulative emissions the changes are in the same sectors but except for waste CH_4 less pronounced.
  - TP: The main change for 2021 and cumulative emissions is a strong increase inf-gas emissions, especially HFCs. In 2021 we also have a 1.8% decrease in energy CO_2 and a 5.3% increase in cement CO_2.
- **Mali:** *KyotoGHG, M.0.EL: (CR: 1.0%, 0.5%; TP: 1.7%, 0.7%)*;
  - CR: We have no new country reported data for Mali.
  - TP: The main source of changes for 2021 is the addition of f-gases from EDGAR 7.0 and a 80% increase in cement CO_2 from changed Andrew data. energy CO_2 has a reduction of 0.4%. For cumulative emissions f-gases also play the largest role while the contribution from cement CO_2 is smaller than for 2021.
- **Malta:** *KyotoGHG, M.0.EL: (CR: 18.4%, 0.3%; TP: 12.4%, -1.5%)*;
  - CR: in 2021 energy CO_2 emissions are much higher than estimated in v2.4.2 because BP2022 emissions for 2021 are much lower than CRF (and EI2023). F-gas emissions are lower than estimated in v2.4.2 (extrapolation) while waste emissions are a bit higher (CRF adjusted). The effect on cumulative emissions is small as changes are mostly limited to 2021.
  - TP: For 2021 the main change is a 27% increase in energy CO_2 emissions because of adjusted BP/EI growth rates. F-gas emissions are lower in 2021 and cumulatively. for cumulative emissions the changes in energy CO_2 are small and thus the lower f-gas emissions dominate changes in total emissions.
- **Myanmar:** *KyotoGHG, M.0.EL: (CR: 0.9%, 0.1%; TP: -0.2%, -0.2%)*;
  - CR: We have no new country reported data for Myanmar, but we have made IPPU CO_2 data available for PRIMAP-hist by downscaling it to the necessary categorical level. In consequence the main changes are in the IPPU sector where cement emissions are 16% higher in 2021, chemical industry emissions 100% lower and metal industry emissions almost 400% higher. f-gas emissions are 38% higher as well but here the reason is that EDGAR growth rates used to extend the country reported data have changed. Changes in cumulative emissions are in the same sectors and of similar relative magnitude except for f-gases where relative changes are only 8.9%.
  - TP: Emissions changes in the TP time-series are also mostly in the IPPU sector. However, metal industry emissions are unchanged and cement CO_2 emissions are reduced by 13% for 2021 instead of an increase.
- **Montenegro:** *KyotoGHG, M.0.EL: (CR: 16.5%, -1.7%; TP: -15.9%, -9.1%)*;
  - CR: Data from the NIR underlying BUR3 have been corrected at a few places. The main change for 2021 is from a 38% increase in energy CO_2 due to corrected growth rates in BP/EI data. IPPU emissions are generally lower as they are now included as 0 in the country reported data while they were missing earlier and supplemented from EDGAR for some subsectors. Cumulative emissions changes are small as the high energy CO_2 changes are limited to 2021.
  - TP: We also have high 2021 changes in energy CO_2 (+27%) but reduction in f-gases of 96% for 2021 leading to a decrase in total 2021 emissions. For cumulative emissions the lower f-gas emissions are the main factor. Cement CO_2 emissions are now non-zero and reduce the emissions decrease.

  - NOTE: Data from BUR3 will be checked in detail again to make sure all errors in the reorting tables are found. See UNFCCC_no-AnnexI_data issue #80.
- **Mongolia:** *KyotoGHG, M.0.EL: (CR: 0.3%, -0.1%; TP: 0.1%, -0.2%)*;
  - CR: We have no new country reported data, but enables use of more data from BUR1 in PRIMAP-hist by downscaling it to the necessary categorical level. The main changes in 2021 are a 50% increase in f-gas emissions, an 18% increase in cement CO_2, and an 0.2% decrease in energy CO_2. For cumulative emissions the main impacts are an 0.4% decrease in energy CO_2, a 2.2% increase in fugitive CH_4, and a 24% increase in f-gas emissions.
  - TP: Emissions changes are similar to the CR scenario but limited to f-gases, energy CO_2 and cement CO_2.
- **Mozambique:** *KyotoGHG, M.0.EL: (CR: -3.2%, -5.2%; TP: 0.4%, -0.2%)*;
  - CR: CR data are available for the main sectors and gases now, but this is only sufficient for the waste sector and f-gases. All other time-series are identical to the TP scenario. The inclusion of CR data for waste has reduced waste emissions estimates for all years and CH_4 and N_2O. Waste CO_2 has been added. F-gas emissions are 148% higher in 2021 and 275% higher cumulatively, because the country reported data are much higher than EDGAR data.. CO_2 from energy and cement has increased due to changes in BP/EI and Andrew data. All changes are valid for 2021 and cumulative emissions.
  - TP: CO_2 from energy and cement has increased due to changes in BP/EI and Andrew data for 2021 and cumulative emissions. F-gas emissions are lower as EDGAR 7.0 data are lower than earlier versions.
- **Mauritania:** *KyotoGHG, M.0.EL: (CR: -2.9%, -8.4%; TP: 4.2%, 2.1%)*;
  - CR: We have now new country reported data, however, we have included the non-numerical information from BUR2 and translated this into all-zero time-series where appropriate. This leads to lower emissions in fugitive CH_4 which is the main change both for 2021 and cumulative emissions. Further changes come from energy CO_2 (-0.3% in 2021, +0.5% cumulatively), agricultural N_2O is lower for cumulative emissions as gaps in the BUR2 timseries are no longer filled using growth rates from the much lower BUR1 emissions time-series, where the harmonization amplified fluctuation in BUR1 data.
  - TP: The changes in 2021 and cumulatively are almost completely due to an increase in f-gas emissions by over 4500%.
- **Mauritius:** *KyotoGHG, M.0.EL: (CR: -31.5%, -28.3%; TP: 21.2%, 7.5%)*;
  - CR: country reported data from different submissions has been added and replaces data from the UNFCCC DI interface. Gaps between years with full inventories are filled with downscaled national total time-series. Data have changed for most sectors and gases both for 2021 and cumulative emissions. The highest changes come from reduced waste CH_4 emissions (-65% in 2021, -55% cumulatively) and f-gases (-68% in 2021, -70% cumulatively). Further changes come from energy CO_2 (-8.3% in 2021, -7% cumulatively), and smaller contributions from many other sectors. N_2O emissions from chemical industry are no longer contained as they are neither present in the new country reported data nor in EDGAR.
  - TP: The main change for 2021 is that f-gas emissions are over 2100% higher than in v2.4.2. (from new EDGAR data). N_2O emissions from chemical industry are no longer contained as they are neither present in the new country reported data nor in EDGAR. Cumulative f-gas emissions are 755% higher than in v2.4.2.
- **Malawi:** *KyotoGHG, M.0.EL: (CR: 4.2%, 1.4%; TP: 4.2%, 1.4%)*;
  - CR: We don't have sufficient country reported data, therefore the CR and TP time-series are identical.
  - TP: Energy CO_2 data are higher in 2021 and slightly higher cumulatively as BP/EI data have changed. Cement CO_2 has changed as well and here the changes are highest in the 2000s. Cumulative cement CO_2 has decreased while 2021 emissions have increased.
- **Malaysia:** *KyotoGHG, M.0.EL: (CR: 3.5%, -0.5%; TP: 4.6%, 0.0%)*;
  - CR: New BUR data covering 1990-2019 has introduced data changes in several sectors. Most prominent are an increase in energy CO_2 and a decrease in fugitive CH_4 in recent years. The increase in energy CO_2 is due to higher growth rates for 2020 and 2021 in EI2023 compared to BP2022 and higher fugitive CO_2 emissions in BUR4 compared to BUR3. The decreased fugitive CH_4 is for recent years only and due to an earlier decrease in emissions in BUR4 compared to EDGAR 7.0 which was used to extrapolate BUR3. CO_2 emissions in 2.D are now zero because in BUR4 they are reported as 0.

  - TP: For 2021 the dominant change is a 7% increase in energy CO_2 emissions. Cement CO_2 emissions are 16% lower than in v2.4.2. F-gases are 22% higher in 2021. for cumulative emissions the changes are much smaller. Increased energy CO_2 emissions (0.4%) cancel with decreased cement CO_2 emissions (-8.9%). While HFC emissions are higher, total cumulative f-gas emissions are quite similar to v2.4.2.
- **Namibia:** *KyotoGHG, M.0.EL: (CR: -13.0%, -28.4%; TP: 1.1%, 0.1%)*;
  - CR: 2021 and cumulative emissions are much lower for CH_4 and N_2O because category 3.C.1.a (biomass burning in forest land) is no longer mapped to the agricultural sector but to the LULUCF sector. Fugitive CH_4 emissions are now zero as we process the non-numerical flags for BURs now (where possible). F-gases have been updated due to a change in default GWP conversion factors for gas baskets.
  - TP: Changes are small and caused by updated growth rates for energy and cement CO_2 as well as changed f-gas emissions.
- **Niger:** *KyotoGHG, M.0.EL: (CR: 1.4%, 1.0%; TP: 1.1%, 0.7%)*;
  - CR: We have no new country reported data for Niger. The most prominent change for 2021 and cumulative emissions is the addition of f-gases from the new EDGAR data. In 2021 there is a
  - TP: Changes are similar to the changes in the CR scenario.
- **Nigeria:** *KyotoGHG, M.0.EL: (CR: -7.6%, -27.2%; TP: 3.1%, 1.1%)*;
  - CR: Inclusion of BUR2 has changed emissions in several sectors and gases. For CH_4, fugitive, waste, and agricultural emissions are much lower than in v2.4.2. For CO_2 combustion related emissions are higher while fugitive emissions are lower. N_2O emissions from waste are higher while agricultural N_2O is lower than in PRIMAP-hist v2.4.2. F-gases are not contained in BUR but also changed due to new EDGAR data. Waste CO_2 data have been added. These changes apply to both 2021 and cumulative emissions.
  - TP: The main change for 2021 is that f-gas emissions are over 700% higher than in v2.4.2. (from new EDGAR data). Cement CO_2 emissions are 28% higher while energy CO_2 is 0.3% lower. Cumulative f-gas emissions are 560% higher than in v2.4.2. Cement CO_2 is 3.7% higher cumulatively. Waste CO_2 data have been added.
- **Nicaragua:** *KyotoGHG, M.0.EL: (CR: -2.4%, -12.2%; TP: 2.4%, 0.7%)*;
  - CR: Data for 2000, 2005, and 2010 have been added from NC3. Emissions have changed for most sectors and gases for 2021 and cumulatively. The highest contributions to 2021 changes are from lower waste CH_4 emissions (-76%), higher agricultural CH_4 (+15%), and lower agricultural N_2O (-15%). Cement CO_2 is 60% lower than in v2.4.2. f-gases have been added. Changes in cumulative emissions are from the same sectors.
  - TP: For 2021 we have higher emissio ns from a 5.2% increase in energy CO_2 and the addition of f-gas emissions (from EDGAR). for cumulative emissions changes are from the same sectors but smaller in relative and absolute values.
- **Niue:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.3%; TP: -0.2%, -0.2%)*;
  - CR: no changes except for slightly lower energy CO_2 emissions (from BP/EI) both for 2021 and cumulatively.
  - TP: no changes except for slightly lower energy CO_2 emissions (from BP/EI) both for 2021 and cumulatively.
- **Netherlands:** *KyotoGHG, M.0.EL: (CR: -0.0%, 0.3%; TP: 7.3%, 5.2%)*;
  - CR: In v2.4.2 cement CO_2 emissions where based on CRF and Andrew cement data growth rates. Andrew cement data is zero for the Netherlands in the latest years. CRF data for 2.A is non-zero and thus emissions in v2.5 based on CRF are much higher than in v2.4.2. This might be because 2.A does not only contain cement production emissions, but also process emission from other mineral industry sectors (e.g. lime). In cumulative emissions slightly higher energy CO_2 and waste (from CRF) emissions almost cancel with lower "other N_2O".
  - TP: The main change in 2021 and cumulative emissions are much higher f-gas emissions (300% in 2021 and 170% cumulatively). Energy CO_2 emissions are 1.5% lower in 2021 and 0.2% lower cumulatively. Other changes don't contribute significantly to changes in total emissions.
- **Norway:** *KyotoGHG, M.0.EL: (CR: -4.5%, -1.3%; TP: 0.2%, -2.7%)*;
  - CR: Emissions are lower than in v2.4.2 because of lower energy CO_2 and IPPU (mostly 2.D) CO_2 emissions. For cumulative emissions the changed CRF emissions lead to the differences, for 2021 there is an additional effect of extrapolation, especially in 1.A where BP2022 (ans EI2023) show increasing emissions for 2021, while CRF shows decreasing emissions leading to

lower emissions in PRIMAP-hist v2.5.
  - TP: Changes in 2021 are very small, because individual sector changes are small and partly cancel each other. the highest individual change is from f-gases with +37%. Energy CO_2 contributes slightly less with a relative reduction of 0.7%. Cement CO_2 is slightly reduced by 0.4%. For cumulative emissions f-gases are reduced by 46% which translates to a much higher absolute emissions change than for 2021 as Norway's f-gas emissions are declining. Other sectors don't play a role for cumulative emissions.
- **Nepal:** *KyotoGHG, M.0.EL: (CR: -0.7%, -0.1%; TP: -0.7%, -0.1%)*;
  - CR: We have no country reported data for Nepal, thus the CR and TP time-series are identical.
  - TP: The main source for changes in 2021 are reduced cement CO_2 emissions (-8.7%). Energy CO_2 is slightly reduced (-0.2%). Cumulative emissions are almost unchanged. The main factor is a 0.6% reduction for energy CO_2.
- **Nauru:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.3%; TP: -0.2%, -0.2%)*;
  - CR: The only change is a slight reduction in energy CO_2 (-0.2% for 2021, -0.3% for cumulative emissions)
  - TP: The only change is a 0.2% reduction for energy CO_2 both for 2021 and cumulative emissions.
- **New Zealand:** *KyotoGHG, M.0.EL: (CR: -2.0%, -1.5%; TP: -0.4%, -0.2%)*;
  - CR: Lower 2021 emissions come mainly from lower agricultural emissions which have been adjusted in CRF data. CRF data for other sectors has also been adjusted with lower relative changes bur for sectors like energy CO_2 they still play a role for overall emissions. Cumulative emissions have decreased due to the decreased agricultural emissions and decreased "other" N_2O.
  - TP: Overall changes are small as contributions from different sectors partly cancel. Energy CO_2 emissions are 1.2% higher (combustion related emissions are 1.8% higher while fugitive emissions are 16% lower) than v2.4.2, while f-gases are 25% lower contributing a higher absolute emissions reduction. for cumulative emissions the changes in energy CO_2 are small and thus the f-gas reductions determine the changes in total emissions.
- **Oman:** *KyotoGHG, M.0.EL: (CR: 1.2%, 0.5%; TP: -1.6%, 0.2%)*;
  - CR: The main changes in 2021 come from energy CO_2 and cement CO_2. While energy CO_2 is lower, cement CO_2 is higher. Together with reduces f-gas emissions (from EDGAR v7.0) total emissions are reduced by 0.3%. For cumulative emissions energy CO_2 plays a small role as changes are only for recent years (from BP/EI). The slightly increased cement CO_2 emissions (from Andrew) and decreased f-gas emissions almost cancel and thus aggregate cumulative emissions are nearly unchanged.
  - TP: The increase in cement CO_2 is smaller as overall cement CO_2 emissions levels are lower than in the CR scenario and thus the impact of the changed growth rates for the last years is smaller. reductions on energy CO_2 are slightly higher. Total emissions decrease by 2.6% for 2021 and 0.2% cumulatively.
  - NOTE: PRIMAP-hist lists emissions in N_2O (from EDGAR), sector 2.G. According to officials from Oman there are no N_2O emissions in the IPPU sector. We will thus replace the data by zero in future PRIMAP-hist versions (issue #74).
- **Pakistan:** *KyotoGHG, M.0.EL: (CR: 2.5%, 0.7%; TP: 2.5%, 0.7%)*;
  - CR: There is no usable country reported data, thus the CR time-series equal the TP time-series
  - TP: The main changes come from energy CO_2 where EI2023 data differs slightly from BP2022 for the latest years and f-gases where EDGAR v7.0 replaces older EDGAR data. cumulative changes are small as energy CO_2 changes are limited to the latest years.
- **Panama:** *KyotoGHG, M.0.EL: (CR: 5.4%, 1.3%; TP: 6.8%, 2.6%)*;
  - CR: We have added data fro 1994-2017 from BUR2 and the underlying NIR. Full inventories are not present for all years. Data for other years are downsclaed from M.0.EL KyotoGHG time-series using the gas and sector shares of the full inventories. Most sectors and gases have changes vs. v2.4.2. the highest absolute contributions come from the addition of f-gases and increased energy CO_2 emissions (4.5% in 2021, 3.7% cumulatively.). CH_4 emissions have increased (in 2021 waste and agriculture, cumulatively only agriculture), while agricultural N_2O is lower.
  - TP: The highest contribution to total emissions changes comes from the addition of f-gases. for 2021 increased (5.2%) energy CO_2 emissions also play a major role, while the change in cumulative energy CO_2 is just 1%.

- **Peru:** *KyotoGHG, M.0.EL: (CR: 2.3%, -2.5%; TP: -0.3%, -0.3%)*;
  - CR: Inclusion of BUR3 data has changed emissions for almost all sectors and gases, both for 2021 and cumulative emissions. Totals change little because higher emissions in fugitive CH_4 are offset by lower emissions in IPPU, waste, and agriculture.
  - The highest contribution to 2021 emissions changes comes from 2.3% lower energy CO_2 emissions. This decrease is offset by a 22% increase in cement CO_2. F-gas emissions are 15% lower than inv2.4.2. For cumulative emissions f-gases deliver the highest share in changes followed by energy CO_2 reductions. Cement CO_2 only plays a small role for cumulative emissions.
- **Philippines:** *KyotoGHG, M.0.EL: (CR: -1.3%, -1.6%; TP: -1.3%, -1.6%)*;
  - CR: We have no country reported data for the Philippines, thus the CR time series are identical to the TP time series.
  - TP: Changes in 2021 are limited to energy CO_2 and cement CO_2. In both cases the changes come from updated input data (BP2022 -> EI2023 for energy CO_2 and Andrew2022v2 -> Andrew 2023v1 for cement CO_2). HFCs have been added, but total f-gas emissions change little as SF_6 emissions are much lower.
- **Palau:** *KyotoGHG, M.0.EL: (CR: -29.6%, -22.4%; TP: -0.4%, 0.1%)*;
  - CR: We have no new country reported data but removed some data points from the UNFCCC DI data. Waste emissions data are internally inconsistent and have been removed. Data for 1995-1999 only covered few sectors and we could not verify the source for the data, thus we removed it as well. The main emissions change comes from the removal of 1995-1999 data for agricultural CH_4 which was very high and not in line with data for other years and from third party sources. The data removals close issue #54.
  - TP: Changes in the third party scenario are small. Agricultural CH_4 is over 20% higher but the impact on total emissions is small and further reduced by a slight reduction in energy CO_2.
- **Papua New Guinea:** *KyotoGHG, M.0.EL: (CR: -24.8%, -23.0%; TP: -1.2%, -0.8%)*;
  - CR: Country reported data is included for the first time. The NIR to BUR2 provides data for 2000, 2005, and 2010-2017. Aggregate emissions are much lower than in v2.4.2 both for 2021 and cumulatively. The main source of differences is agricultural N_2O. Agricultural CH_4 is lower as well while energy CH_4 is lower in 2021 but higher cumulatively. Energy CO_2 is higher both in 2021 and cumulatively. F-gas emissions are now zero as EDGAR 7.0 does not contain f-gas emissions for Papua New Guinea.
  - TP: The only major change is the removal of f-gas emissions data. Energy CO_2 emissions change very little for 2021 and cumulatively.
- **Poland:** *KyotoGHG, M.0.EL: (CR: -1.6%, -1.8%; TP: -8.7%, -4.0%)*;
  - CR: Waste emissions are much lower for all years than in v2.4.2 because CRF data has changed. "other" N_2O is lower as well. CO_2 from 2.D (Non-energy products from fuels and solvent use) has also been adjusted in CRF2023 for all years. In 2021 we additionally have higher emissions from energy CO_2, partly offset by lower fugitive emissions (all due to discrepancies between extrapolated data and CRF2023).
  - TP: The dominating factor both for 2021 and cumulative emissions is a reduction in f-gas emissions by 93% in 2021 and 85% cumulatively. In 2021 there is alsoa n 0.2% increase ine nergy CO_2 and a 1.7% reduction in cement CO_2.
- **Korea, Democratic People's Republic of:** *KyotoGHG, M.0.EL: (CR: -10.7%, -2.8%; TP: -10.7%, -3.1%)*;
  - CR: No new country reported data for North Korea have been added. The main change for both 2021 and cumulative emissions is a reduction in f-gas emissions (-68% in 2021, -75% cumulatively) which comes from reduced HFC data in EDGAR 7.0. Cement CO_2 emissions have been reduced by 8.3% in 2021 contributing to reduced 2021 emissions. For cumulative emissions only f-gases play a noteworthy role.
  - TP: changes for the TP timse-series are very similar to the CR time-series changes.
- **Portugal:** *KyotoGHG, M.0.EL: (CR: -1.1%, -0.5%; TP: -38.1%, -11.7%)*;
  - CR: Overall changes in 2021 are small. Reductions in IPPU (f-gases, CO_2), agriculture and "other" are partly offset by slightly higher energy CO_2 emissions (where decreased combustion emissions partly offset increased fugitive emissions. Fugitive emissions were very low in v2.4.2 due to extrapolation). Changes to cumulative emissions are low and dominated by lower "other" N_2O emissions and decreased IPPU emissions.
  - TP: F-emissions in EDGAR are much lower for Portugal in v7.0 (now in line with CRF).

This leads to lower cumulative emissions and much lower 2021 emissions. 2021 emissions for energy CO_2 and cement CO_2 are also lower but the influence on KyotoGHG emissions is small compared to f-gases.

- **Paraguay:** *KyotoGHG, M.0.EL: (CR: 2.1%, 0.6%; TP: 1.5%, 0.5%)*;
  - CR: No new country reported data have been added, only 2017 emissions are now directly taken from BUR3 instead of the UNFCCC DI interface. The main change for 2021 and cumulative emissions is the addition of HFC data from EDGAR. Smaller contribution for 2021 come from a 2.4% increase in energy CO_2 and a 11% increase in cement CO_2. For cumulative emissions energy CO_2 is 0.3% lower while cement CO_2 is 1.9% higher than in v2.4.2.
  - TP: changes in the TP time-series are similar to th CR changes, except for cement CO_2 which is 27% lower in 2021 and 6.5% lower cumulatively.
- **Qatar:** *KyotoGHG, M.0.EL: (CR: 1.5%, 0.9%; TP: 1.5%, 0.9%)*;
  - CR: We have no country reported data for Qatar, thus the CR and TP time-series are identical.
  - TP: The most important changes for Qatar are the addition of f-gas emissions from EDGAR and an 0.5% reduction in energy CO_2 (0.1% cumulatively). Changes in cement CO_2 are small.
- **Romania:** *KyotoGHG, M.0.EL: (CR: -6.3%, 0.1%; TP: 0.6%, 1.0%)*;
  - CR: Changes in 2021 emissions mainly come from the energy sector where both combustion CO_2 (sector 1.A) and fugitive CH_4 (1.B) are lower than in v2.4.2. Fugitive emissions are lower because EDGAR 7.0 showed a strong increase in emission in 2021 which is not reflected in CRF data that is used in v2.5. For CO_2 the 2021 growth rate of BP2022 (used in v2.4.2) is higher than the growth rate in CRF2023 which is used in v2.5. Further contribution to 2021 emissions changes come from Agricultural CH_4 and "other" N_2O. Changes in cumulative emissions are small. Slightly increased energy CO_2 emissions are partly offset by reduced "other" N_2O emissions.
  - TP: changes in total emissions are smallfor 2021 because higher f-gas emissions (+123%) cancel with lower energy CO_2 emissions (-2.1%). for cumulative emissions the main factor are the f-gas emssions.
- **Russian Federation:** *KyotoGHG, M.0.EL: (CR: -1.9%, -0.1%; TP: -5.2%, -1.7%)*;
  - CR: The main change in 2021 emissions comes from energy CO_2 emissions which are smaller than in v2.4.2 because the 2021 growth rate of BP2022 (used in v2.4.2) is higher than the growth rate in CRF2023 which is used in v2.5. CH_4 emissions in 2021 are higher than in v2.4.2. Several other sectors have changes in 2021 emissions mostly because of different growth rates of CRF2023 data vs. sources used in v2.4.2 to extrapolate CRF2022. Agricultural CH_4 has changed in CRF data for all years. N_2O from the "other" sector is reduced for all years. CO_2 emissions from chemical industry (2.B) are higher for all years after 2000. In cumulative emissions lower emission from "other" N_2O and the energy sector are partly offset by the higher emissions in 2.B and the agricultural sector leading to very small changes in cumulative KyotoGHG emissions.
  - TP: Total emissions are 5.2% lower in 2021. The vast majority of reduced emissions comes from a 75% reduction in f-gas emissions. A smaller contribution comes from an 0.5% reduction in energy CO_2. For cumulative emissions the f-gas reductions are smaller and the contribution of other sectors is very small.
- **Rwanda:** *KyotoGHG, M.0.EL: (CR: 18.7%, 1.6%; TP: -0.6%, -1.0%)*;
  - CR: We have added data from BUR1 covering 2006-2018 where all years before 2018 need downscaling to reach the gas and categorical detail necessary for PRIMAP-hist. Emissions for almost all sectors and gases have changed. Individual sector growth rates have to be taken with care as they are equal to M.0.EL KyotoGHG growth rates because no other information is available. the highest contributions to 2021 changes come from higher agricultural CH_4, lower waste CH_4, lower agricultural N_2O, and higher energy CO_2. For cumulative emissions the same sectors contribute most to the aggregate emissions changes.
  - TP: The main factor for changes both in 2021 and cumulative emissions are reduced f-gas emissions. CO_2 emissions from energy and cement are 5.9% and 59% higher in 2021 and slighty higher cumulatively.
- **Saudi Arabia:** *KyotoGHG, M.0.EL: (CR: 7.5%, -0.6%; TP: 4.1%, 3.0%)*;
  - CR: Inclusion of data from NC4 (mostly but not only for 2016) has changed emissions for most sectors and gases with the highest reduction in fugitive CH_4 where country reported data is much lower than EDGAR data that was used in v2.4.2. Energy CO_2 emissions are higher in the latest years than estimated in v2.4.2. Emissions in all IPPU subsectors have changed, especially

for CO_2. While different changes almost cancel in 2021, cumulative 1990-2021 emissions are 4.9% lower in PRIMAP-hist v2.5 than in v2.4.2.
  - TP: F-gas emissions are over 6000% higher in 2021 and cumulatively. In 2021 the higher emissions are partly offset by 4.2% lower energy CO_2 emissions. For cumulative emissions the share of f-gases is smaller than for 2021 emissions and thus the influence is smaller. Changes in energy CO_2 are also smaller (-0.7%)
- **Sudan:** *KyotoGHG, M.0.EL: (CR: 2.2%, 0.6%; TP: 2.2%, 0.6%)*;
  - CR: We have no country reported data for Sudan, thus the CR and TP time-series are identical.
  - TP: The only changes are increased emissions from energy CO_2 (5.8% in 20221, 0.6% cumulatively), and the addition of f-gas emissions.
- **Senegal:** *KyotoGHG, M.0.EL: (CR: 4.8%, 2.1%; TP: 4.8%, 2.1%)*;
  - CR: We have no country reported data for Senegal, thus the CR and TP time-series are identical.
  - TP: The main changes are the addition of f-gas emissions. For 2021 higher cement CO_2 emissions (+8.3%) also play a role. Energy CO_2 emissions have small changes (-0.4% in 20221, 0.1% cumulatively) and the influence on total emissions is small as well.
- **Singapore:** *KyotoGHG, M.0.EL: (CR: -6.7%, -12.7%; TP: 7.7%, 1.3%)*;
  - CR: Data from BUR have replaced BUR3 data used in v2.4.2. However, data in BUR4 is identical to BUR3 for all years contained in BUR3. We also make additional data available by downscaling IPPU data and fugitive emissions to the subsectoral resolution needed for PRIMAP-hist. In 2021 we have 8.3% higher emissions in energy CO_2 because the new country reported data are higher in 2018 than the BP based extrapolation in v2.4.2. CO_2 emissions from chemical industry are 96% lower than in v2.4.2. The reason for this extreme change is that country reported data are much lower than EDGAR data. F-gases are almost 60% higher in 2021 among other things because SF_6 can now be taken from country reported data which is much higher than the EDGAR data used before. For cumulative emissions the main factor are much lower emissions from chemical industry for CO_2 and N_2O.
  - TP: The main change both for 2021 and cumulative emissions is a strong increase in f-gas emissions. New EDGAR data are much higher than older EDGAR versions. Some smaller contributions come from energy CO_2 and some IPPU subsectors that use country reported data due to alack of data in third party sources.
- **Saint Helena, Ascension and Tristan da Cunha:** *KyotoGHG, M.0.EL: (CR: 0.0%, 0.0%; TP: 0.0%, 0.0%)*;
  - CR: We have no country reported data for Saint Helena, Ascension and Tristan da Cunha, thus the CR and TP time-series are identical.
  - TP: No changes
- **Solomon Islands:** *KyotoGHG, M.0.EL: (CR: 41.4%, 39.0%; TP: -0.1%, -0.2%)*;
  - CR: We have not added any new sources for country reported data, but we downscale aggregate KyotoGHG data for 2005 and 2010 using 2000 gas shares to make the data usable in PRIMAP-hist. The main change is a 150% increase in waste CH_4 (180% cumulatively) as country reported data are higher than EDGAR. Further much smaller contribution come from agricultural CH_4, energy CO_2 and other sectors (with even smaller contributions).
  - TP: The TP time-series are almost unchanged with a very small reduction in energy CO_2.
- **Sierra Leone:** *KyotoGHG, M.0.EL: (CR: 44.7%, 35.3%; TP: 4.5%, 2.3%)*;
  - CR: New data from NC3 have been included. However, energy related emissions are wrong and are much too high. The cause seems to be in unit conversion and / or emissions factors. We have thus excluded NC3 energy related emissions from use in PRIMAP-hist. The most prominent change in both 2021 and cumulative emissions is an increase in waste CH_4 of over 250% because countrz reported data are higher than EDGAR. Waste CO_2 has been added while waste N_2O is lower than in v2.4.2. Agricultural CH_4 emissions are lower now.
  - TP: The main change both for 2021 and cumulative emissions is the addition of waste CO_2 emissions. F-gas emissions have been removed as they are no longer contained in EDGAR data.
- **El Salvador:** *KyotoGHG, M.0.EL: (CR: 1.9%, 6.3%; TP: 3.9%, 0.6%)*;
  - CR: We have added data for 2014 from BUR1 which is combined with data for 1994 and 2005 from the UNFCCC DI interface. Emissions for several sectors and gases have changed. The most important 2021 changes are 7.7% higher energy CO_2 emissions and 61% lower agricultural N_2O emissions. F-gas emissions are 64% higher. Other sectors contribute smaller amounts to

total emissions changes. for cumulative emissions the main factor are higher agricultural N_2O emissions, while waste CH_4 emissions are lower. Other sectors give smaller contributions.
  - TP: In 2021 energy CO_2 is 5.2% higher and is the main contribution to higher total emissions. f-gas emissions are also higher (identical to CR time-series). Cement CO_2 is 9.3% lower but the contribution to total emissions is smaller than from f-gases and energy CO_2. Changes to cumulative emissions are smaller. The contributing sectors are the same.
- **San Marino:** *KyotoGHG, M.0.EL: (CR: -1.6%, 0.4%; TP: -1.6%, 0.4%)*;
  - CR: We have no country reported data for San Marino, thus the CR and TP time-series are identical.
  - TP: The only change is in f-gas emissions. 23% decrease in 2021 and a 14% increase in cumulative emissions.
- **Somalia:** *KyotoGHG, M.0.EL: (CR: 15.9%, 12.7%; TP: 5.2%, 1.9%)*;
  - CR: We have added data for 2000, 2005, 2010, 2014 and for some sectors 2020 from BUR1. Emissions estimates have changed for many sectors and gases. The highest contribution comes from agricultural CH_4 with 33% increase in 2021 and cumulatively (from livestock). Agricultural N_2O which comes mostly from agriculture excluding livestock is 33% lower than in v2.4.2 (2021 and cumulative). In 2021 was te CH_4 emissions are 55% lower (60% cumulatively), energy CO_2 263% higher (155% cumulatively), and f-gas emissions are several thousand % higher bot in 2021 and cumulatively. Except for the f-gases these changes com e from the new country reported data (f-gases from EDGAR).
  - TP: The main change is in f-gases (identical to CR scenario). Energy CO_2 data are 5.9% higher in 2021 which contributes little to total emissions changes.
- **Serbia:** *KyotoGHG, M.0.EL: (CR: 10.1%, -0.9%; TP: -3.5%, -6.3%)*;
  - CR: Data from NC2 replaced BUR1 data. The highest absolute change in 2021 is from energy CO_2 and due to changed growth rates in BP/EI data (+46%). It is partly offset by a 06% reduction in f-gases. Contributions from other sectors are much smaller. for cumulative emissions the changes are smaller and the f-gas reductions are higher than the increases in energy CO_2.
  - TP: As in the CR scenario the main changes are from energy CO_2 and f-gases. Most other sectors are unchanged.
- **South Sudan:** *KyotoGHG, M.0.EL: (CR: 0.8%, 0.3%; TP: 0.8%, 0.3%)*;
  - CR: We have no country reported data for South Sudan, thus the CR and TP time-series are identical.
  - TP: The only changes in emissions are higher energy CO_2 (5.5% in 2021, 0.4% in cumulative emissions) and the addition of f-gas emissions from EDGAR 7.0.
- **Sao Tome and Principe:** *KyotoGHG, M.0.EL: (CR: 11.2%, -1.2%; TP: 3.4%, 1.5%)*;
  - CR: We have added data for 2012, 2016, and 2018 from BUR1 which is combined with data for 1998 and 2005 from the UNFCCC DI portal. Emissions have changed for most sectors and gases (a lot of sectors and gases had no data and have zero emissions now). In 2021, the highest contribution comes from energy CO_2 where emissions have increase 23%. Waste CH_4 emissions are decreased by 44% while f-gas emissions have been added. Other sectors contribute less to total changes. For cumulative emissions the reduction in waste CH_4 (-58%) is the main factor followed by increased agricultural N_2O (+113%) a 5.4% increase in energy CO_2.
  - TP: The main change in the TP scenario is the addition of f-gas data. Energy CO_2 emissions are reduced by 4% in 2021 and 0.2% cumulatively. There are no other changes.
- **Suriname:** *KyotoGHG, M.0.EL: (CR: 1.8%, -1.5%; TP: 1.8%, -1.5%)*;
  - CR: We have no country reported data for Suriname, thus the CR and TP time-series are identical.
  - TP: in 2021 the only changes are 2.4% higher energy CO_2 and 67% higher cement CO_2. The absolute contribution from energy CO_2 is 10 times the contribution from cement. For cumulative emissions CO_2 changes are very small, but a 50% reduction in f-gas emissions leads to lower total emissions.
- **Slovakia:** *KyotoGHG, M.0.EL: (CR: -2.6%, -0.4%; TP: -4.7%, -1.0%)*;
  - CR: The main contribution to lower 2021 emissions is energy CO_2 where the CRF2023 growth rate for 2021 is a bit lower than the BP2022 growth rate used in v2.4.2. Further contributions come from N_2O in agriculture (CRF growth rate differs from EDGAR) and "other" (CRF instead of EDGAR) and CO_2 in IPPU subsectors (again from different growth rates in CRF

and EDGAR). Cumulative changes are small and mainly from "other" N_2O.
  - TP: The main change for 2021 is a 67% reduction in f-gas emissions. A further contribution to lower emissions comes from 1.9% lower energy CO_2 emissions. Other changes are negligible. For cumulative emissions f-gas changes are lower in absolute terms (and a bit lower relatively: -55%), while changes in energy CO_2 are very small.
- **Slovenia:** *KyotoGHG, M.0.EL: (CR: 1.2%, -0.4%; TP: -0.2%, 0.1%)*;
  - CR: The main source of increased 2021 emissions is energy CO_2, where BP2022 showed a decline in emissions for 2021 while CRF2023 (end EI2023) shows increasing emissions. In IPPU 2021 emissions have been reduced in 2.C (CO_2), 2.G (N_2O) and for f-gases, mostly because the extrapolation did not model the fluctuations in the data. For cumulative emissions the main source of changes is "other" N_2O (which also plays a small role in 2021).
  - TP: The main changes for 2021 are a 51% reduction in f-gas emissions which is offset almost completely by a 3.9% increase in energy CO_2 emissions. Other changes are negligible. For cumulative emissions changes are very small.
- **Sweden:** *KyotoGHG, M.0.EL: (CR: 8.8%, -0.3%; TP: -1.7%, -1.4%)*;
  - CR: Sweden has relatively high changes in 2021 which come mainly from energy CO_2. The reason is that BP2022 showed a decline in emissions for 2021, while CRF shows an increase. Thus 2021 emissions in v2.5 are higher than in v.2.4.2. CO_2 in IPPU has also changed because for several subsector CRF data has been adjusted and / or high fluctuations were not modeled by extrapolation. Agricultural emissions have changed as well mainly from lower N_2O in M.AG.ELV (from lower emissions in CRF2023). cumulative emissions are slightly lower tan in v2.4.2 because of adjusted CRF data for agricultural N_2O and CO_2 from chemical industry (2.B).
  - TP: The main change for 2021 is a 48% reduction in f-gas emissions. A further but much smaller contribution to lower emissions comes from 0.3% lower energy CO_2 emissions. Other changes are negligible. For cumulative emissions f-gas changes are similar, while changes in energy CO_2 are very small.
- **Eswatini:** *KyotoGHG, M.0.EL: (CR: 0.6%, 0.0%; TP: 0.6%, 0.0%)*;
  - CR: We have no country reported data for Eswatini, thus the CR and TP time-series are identical.
  - TP: the only change is a 1.6% increase in energy CO_2 in 2021.
- **Seychelles:** *KyotoGHG, M.0.EL: (CR: 0.0%, 0.0%; TP: 0.0%, 0.0%)*;
  - CR: We have no country reported data for Seychelles, thus the CR and TP time-series are identical.
  - TP: No changes
- **Syrian Arab Republic:** *KyotoGHG, M.0.EL: (CR: 9.5%, 2.2%; TP: 9.5%, 2.2%)*;
  - CR: We have no country reported data for Syrian Arab Republic, thus the CR and TP time-series are identical.
  - TP: The main change is the addition of f-gas emissions. In 2021 there is also an 0.4% increase in energy CO_2 and a 14% increase in cement CO_2, however, these together contribute less than 1/10th of total changes.
- **Turks and Caicos Islands:** *KyotoGHG, M.0.EL: (CR: -9.1%, -0.5%; TP: -9.1%, -0.5%)*;
  - CR: We have no country reported data for Turks and Caicos Islands, thus the CR and TP time-series are identical.
  - TP: The only change in 2021 is a 9.7% decrease in energy CO_2.
- **Chad:** *KyotoGHG, M.0.EL: (CR: 0.5%, 16.8%; TP: 0.6%, 0.4%)*;
  - CR: We have downscaled energy CO_2 and agricultural CH_4 and N_2O from the UNFCCC DI portal to make it usable in PRIMAP-hist. We have removed M.AG.ELV N_2O emissions for 1993 due to inconsistencies with data for other years. This results in changed emissions for the agricultural sector and energy CO_2, mostly for cumulative emissions. In 2021 the highest impact on total emissions changes is from the addition of f-gases from EDGAR. Energy CO_2 emissions are 24% lower. For cumulative emissions the highest changes are a 26% increase in agricultural N_2O and a 12% increase in agricultural CH_4. Energy CO_2 emissions are 25% lower than in v2.4.2.
  - TP: The main change for 2021 is the addition of f-gas emissions. Smaller changes come from a 4% reduction in energy CO_2 and a 22% increase in cement CO_2. For cumulative emissions changes only f-gases are relevant.
- **Togo:** *KyotoGHG, M.0.EL: (CR: 90.8%, 23.2%; TP: 6.6%, 3.3%)*;

  - CR: 2018 data from BUR2 have been included. The BUR2 data for 2018 are significantly higher than the 2015 data from BUR1 and consistency is not clear. We keep both data-sources because removing BUR1 would leave us with a single year which we cannot use while keeping only BUR1 would discard the newest data (see also issue #73). Emissions estimates for 2021 are much higher than in v2.4.2 (+91%). The main contribution is N_2O from agriculture without livestock which is a major sector for Togo and has a 210% increase in 2021 emissions. Agricultural CH_4 emissions are higher as well. while energy CO_2 emissions are 45% lower. F-gas emissions have been added from EDGAR
  - TP: The main source for changes in 2021 and cumulative emissions is cement CO_2 where Andrew data has been adjusted slightly for the last few years. Other changes in energy CO_2 and agricultural CO_2.
- **Thailand:** *KyotoGHG, M.0.EL: (CR: -12.4%, -15.1%; TP: 8.3%, 3.1%)*;
  - CR: BUR4 has been included and downscaled to the sector and gas level needed for PRIMAP-hist. For most sectors and gases this included country reported data for the first time leading to different emissions estimates for most sectors and gases. Overall 2021 emissions are 12.5% lower than in v2.4.2 with the main contributions coming from energy CO_2, waste (CH_4, N_2O), and agriculture. F-gases have been added from BUR4 while cement CO_2 emissions are lower. For cumulative emissions the situation is similar.
  - TP: The main change is the addition of f-gas emissions from EDGAR. In 2021 there is also an 0.3% increase in energy CO_2. However, the contribution to total changes is small. For cumulative emissions the situation is similar.
- **Tajikistan:** *KyotoGHG, M.0.EL: (CR: -8.8%, 7.6%; TP: 0.9%, 11.0%)*;
  - CR: We have added data for 2014 from BUR1. The main reason for the lower 2021 emissions is that the last data point in non-livestock agricultural N_2O emissions is much lower than the other country reported datapoints and together with extrapolation leads to very low 2021 emissions in the sector. Additional data in BUR1 shows that BUR1 emissions estimates for earlier years are consistent with this data point and not consistent with the older country reported data. However, the data in BUR1 lacks the necessary categorical and gas detail for use in PRIMAP-hist and downscaling is complicated due to the availability of both gas detail without sector detail and sector details without gas detail. Agricultural CH_4 emissions are higher than in v2.4.2 while fugitive CH_4 is lower. Energy and cement CO_2 emissions are higher. The low N_2O emissions are only for the last years, thus cumulative emissions are less affected. As cumulative f-gas emissions are much higher (from EDGAR), cumulative total emissions are actually higher than in v2.4.2.

  - TP: Total emissions changes in 2021 are low because different factors partly cancel. The highest contributions comes from a 400% increase in f-gas emissions. CO_2 in total has small changes as a 1.7% increase in energy CO_2 cancels with a 4.3% decrease in cement CO_2. For cumulative emissions the relative change in f-gas emissions is smaller, but the absolute values higher. other sectors don't play a noteworthy role for total emissions changes.
- **Tokelau:** *KyotoGHG, M.0.EL: (CR: 0.0%, 0.0%; TP: 0.0%, 0.0%)*;
  - CR: We have no country reported data for Tokelau, thus the CR and TP time-series are identical.
  - TP: No changes
- **Turkmenistan:** *KyotoGHG, M.0.EL: (CR: -0.3%, -0.1%; TP: 0.2%, 0.0%)*;
  - CR: We have no new country reported data for Turkmenistan. For 2021 a 47% in reduction in cement CO_2 (from Andrew data) is partly offset by a 1.1 increase in energy CO_2. F-gases are 18% lower, but play only a smaller role in total emissions changes. For cumulative emissions the changes come from the same sectors but are smaller. f-gases play a larger role than in 2021.
  - TP: Changes are similar to the CR scenario, however, energy CO_2 has a higher impact in term sof absolute emissions resulting in an overall emissions increase for 2021.
- **Timor-Leste:** *KyotoGHG, M.0.EL: (CR: 0.0%, 0.0%; TP: 0.0%, 0.0%)*;
  - CR: We have no country reported data for Timor-Leste, thus the CR and TP time-series are identical.
  - TP: No changes
- **Tonga:** *KyotoGHG, M.0.EL: (CR: -0.1%, -0.2%; TP: -0.1%, -0.2%)*;
  - CR: No new country reported data have been added for Tonga. The only change is an 0.2%

decrease in energy CO_2 in 2021 (-0.4% cumulatively).
  - TP: Same as in the CR scenario.
- **Trinidad and Tobago:** *KyotoGHG, M.0.EL: (CR: -18.8%, -24.9%; TP: 3.6%, 2.6%)*;
  - CR: We have added data from NC3 for 2006-2018. Some sectors need downscaling for the years before 2018. The agricultural sector misses the necessary details for all years. The highest contribution to changes in 2021 comes from a 61% reduction in energy CO_2. The reason is that country reported data are much lower than CDIAC data used in the TP scenario. CO_2 from chemical industry are 45% higher also because of the NC3 data. There are changes in several other sectors and gases but their contributions to total emissions are smaller. For cumulative emissions the changes are similar.
  - TP: The main contributions to higher total emissions come from the addition of f-gas emissions (from EDGAR) and the addition of chemical industry emissions (from NC3). A 2.9% reduction in energy CO_2 emissions reduces the increase in total emissions. For cumulative emissions the changes come from the same sectors but are smaller except for chemical industry N_2O which is similar.
- **Tunisia:** *KyotoGHG, M.0.EL: (CR: 10.7%, 4.2%; TP: 8.4%, 3.0%)*;
  - CR: We have added data from NC3 for 2010 and 2012 which are combined with data from the UNFCCC DI portal for 1994 and 2000. the main changes however, come from third party data: energy CO_2 is 7.9% higher in 2021 partly due to changed growth rates in BP/EI data. F-gas emissions have been added from EDGAR. Cement CO_2 data are 32% higher in 2021 because Andrew data has changed (there is no sufficient country reported data for cement CO_2). For cumulative emissions the main changes are 4.5% higher energy CO_2 emissions, 22% lower waste CH_4 emissions, 20% higher cement CO_2 emissions and the addition of f-gases.
  - TP: Changes are similar to the changes in the CR scenario. Energy CO_2 changes are smaller (+4% in 2021, 0.1% cumulatively), f-gases and cement CO_2 are identical. Changes are limited to energy and cement CO_2 and f-gases.
- **Turkey:** *KyotoGHG, M.0.EL: (CR: -0.1%, -0.3%; TP: -0.5%, -1.7%)*;
  - CR: 2021 emissions have changed little for KyotoGHG, however there are changes for individual sectors and gases which cancel out. Energy and cement CO_2 emissions have increased while emissions estimates for the agricultural, waste and "other" sectors have decreased. For cumulative emissions only the "other" sector plays a role.
  - TP: The main sources of changed total 2021 missions are 64% lower f-gas emissions and 2.3% higher energy CO_2 emissions. For cumulative emissions the changes in energy CO_2 are small (0.2%) and f-gas changes make are the main factor for total emissions changes.
- **Tuvalu:** *KyotoGHG, M.0.EL: (CR: -0.1%, -0.2%; TP: -0.1%, -0.2%)*;
  - CR: We have no country reported data for Tuvalu, thus the CR and TP time-series are identical.
  - TP: The only change are slightly reduced energy CO_2 emissions (-0.2% in 2021, -0.3% cumulatively).
- **Taiwan, Province of China:** *KyotoGHG, M.0.EL: (CR: 0.6%, 0.2%; TP: 0.7%, 3.1%)*;
  - CR: no new country reported data. Only very small changes in energy CO_2 due to adjustments in EI2023 vs BP2022. F-gas emissions have changed for 2021 and also cumulatively. This is due to the removal of NF_3 from EDGAR which causes differences in the extrapolation of country reported data to the past. N_2O emissions in 2.E are included for the first time. As only Taiwan reports them they were not processed in PRIMAP-hist before.
  - TP: Energy CO_2 emissions are slightly higher in 2021 and almost unchanged cumulatively. F-gas emissions are lower in 2021, because NF_3 emissions have been removed from EDGAR and country reported NF_3 is much lower. HFCs are higher for all years leading to higher cumulative emissions. N_2O in 2.E is included for the first time as in the CR time-series.
- **Tanzania, United Republic of:** *KyotoGHG, M.0.EL: (CR: -0.0%, -0.0%; TP: -0.0%, -0.0%)*;
  - CR: We have no country reported data for the United Republic of Tanzania, thus the CR and TP time-series are identical.
  - TP: The only change are slightly reduced cement CO_2 emissions (-0.2% in 2021).
- **Uganda:** *KyotoGHG, M.0.EL: (CR: 0.1%, -0.0%; TP: 0.1%, -0.0%)*;
  - CR: We have no country reported data for Uganda, thus the CR and TP time-series are identical.
  - TP: The only change are changed cement CO_2 emissions (+8% in 2021, -0.6% cumulatively).
- **Ukraine:** *KyotoGHG, M.0.EL: (CR: -0.2%, -0.2%; TP: -0.2%, -0.1%)*;

  - CR: While aggregate changes in 2021 are small several sectors have changed. decreased emissions from fugitive CH_4 have been offset by increase energy CO_2 and agricultural N_2O. CRF data itself has not changed (except for waste) thus the changes come from different growth rates of sources used for 2021 in v2.4.2 (BP2022, Andrew2022v2, EDGAR v7.0) to the CRF2023 growth rates used in v2.5. For cumulative emissions there are no larger changes and the slight decrease is driven by lower emissions in "other" N_2O.
  - TP: Changes to total emissions are small and mainly come from reduced f-gas emissions and a slight reduction in energy CO_2.
- **Uruguay:** *KyotoGHG, M.0.EL: (CR: 0.7%, -3.0%; TP: 0.0%, -0.2%)*;
  - CR: We have added data for several years from BUR2. However, the last year with data available, 2019, comes from the UNFCCC DI portal and has already been included in v2.4.2. Thus 2021 emissions have not changed for many sectors. energy CO_2 is 2% higher, cement CO_2 22% higher, and f-gases 13% higher. Cumulative emissions have changed for more sectors. The main factors are lower agricultural N_2O emissions (-9.4% in M.AG.ELV) and lower agricultural CH_4 emissions (-1.1% in livestock). Contributions from many other sectors are smaller.
  - TP: Total emissions are basically unchanged. In 2021, f-gas emissions are 57% lower while energy CO_2 emissions are 2.4% higher and cement CO_2 emissions are 22% higher. higher and lower emissions cancel and lead to (almost) unchanged total 2021 emissions. Cumulatively energy CO_2 is slightly lower, cement 1% higher and f-gases 48% lower leading to slightly lower total emissions.
- **United States:** *KyotoGHG, M.0.EL: (CR: 1.7%, 0.3%; TP: -2.9%, -1.7%)*;
  - CR: The main sources for changes in 2021 emissions are energy CO_2 and fugitive CH_4. Energy CO_2 changes cone from a slightly higher 2021 growth rate in CRF2023 than BP2022. For fugitive CH_4 EDGAR 7.0 has steep decline in 2021 which is not present in CRF2023 and thus emissions in v2.5 are higher than in v2.4.2. In the IPPU sector changes differ by subsector and gas and are caused by discrepancies between extrapolated data and CRF2023 and changes in CRF data. Agricultural N_2O is higher in CRF2023 than in CRF2022 and SF_6 and NF_3 data have been adjusted as well impacting cumulative emissions. A further impact on cumulative emissions comes from fugitive CH_4 which has been adjusted in CRF data as well.
  - TP: The main factors for 2021 emissions are a 56% reduction in f-gas emissions which is only partly offset by a 1.4% increase in energy CO_2. For cumulative emissions the influence of energy CO_2 is small.
- **Uzbekistan:** *KyotoGHG, M.0.EL: (CR: -8.1%, -6.9%; TP: 1.0%, -0.7%)*;
  - CR: Data from BUR1 have been included, DI data have been removed. Data for most sectors and gases have changed with the highest reduction in fugitive CH_4 (both for 2021 and cumulative emissions). Emissions from agriculture and energy CO_2 are higher while waste and IPPU emissions are lower than in v2.4.2.
  - TP: A 4.7% increase in energy CO_2 and a 32% increase in cement CO_2 are partly offset by a 96% reduction in f-gas emissions (from new EDGAR data). For cumulative emissions energy and cement CO_2 play a smaller role and the reduced f-gas emissions dominate the total changes.
- **Holy See (Vatican City State):** *KyotoGHG, M.0.EL: (CR: -1.6%, 0.5%; TP: -1.6%, 0.5%)*;
  - CR: We have no country reported data for Vatican City State, thus the CR and TP time-series are identical.
  - TP: F-gases have been reduced by 26% in 2021 and 17% cumulatively. no other changes.
- **Saint Vincent and the Grenadines:** *KyotoGHG, M.0.EL: (CR: -8.4%, -1.1%; TP: -9.4%, -1.3%)*;
  - CR: We have no new country reported data for Saint Vincent and the Grenadines. Changes are limited to energy CO_2 (-9.7% in 2021, -0.4% cumulatively) and the removal of f-gases as they are not contained in EDGAR 7.0.
  - TP: Changes in 2021 and cumulative (smaller) for energy CO_2 (from BP/EI) and f-gases which are not present in EDGAR v7.0 while they were present in EDGAR v2.4.2.
- **Venezuela, Bolivarian Republic of:** *KyotoGHG, M.0.EL: (CR: 1.3%, 0.3%; TP: 1.3%, 0.3%)*;
  - CR: We have no country reported data for Venezuela, thus the CR and TP time-series are identical.
  - TP: F-gas emissions have increased by 130% for 2021 and 48% cumulatively. Lower energy CO_2 emissions (-1.7% in 2021, -0.2% cumulatively) and lower cement CO_2 emissions (-44% in 2021 and -4.7% cumulatively) reduce the f-gas induced increase in emissions estimates.

- **Virgin Islands, British:** *KyotoGHG, M.0.EL: (CR: -9.0%, -0.3%; TP: -9.0%, -0.3%)*;
  - CR: We have no country reported data for British Virgin Islands, thus the CR and TP time-series are identical.
  - TP: Energy CO_2 emissions have been reduced by 9.7% in 2021 and 0.4% cumulatively. no other changes.
- **Viet Nam:** *KyotoGHG, M.0.EL: (CR: 2.5%, -1.8%; TP: 4.7%, 1.6%)*;
  - CR: No new country reported data has been added. Changes to 2021 data are limited to CO_2 from energy and cement. Energy CO_2 changes are small because of small adjustments to growth rates in EI2023 vs BP2022. Cement CO_2 growth rates in Andrew data have been increased strongly for 2020 and 2021 leading to much higher cement CO_2 emissions in v2.5 vs v2.4.2.
  - TP: Emissions estimates have increased due to added f-gas emissions, increased cement CO_2 emissions (+14% in 2021 and +3.1% cumulatively) and to a lesser extent increased energy CO_2 emissions (0.9% in 2021 and 0.4% cumulatively).
- **Vanuatu:** *KyotoGHG, M.0.EL: (CR: -12.3%, -11.1%; TP: -0.1%, -0.1%)*;
  - CR: We have added data for 2007 - 2015 from NC3. Data for most sectors and gases have changed. The most important change for total emissions is that N_2O emissions from agriculture without livestock are now 0. Waste CH_4 has been reduced by 62% while CH_4 and N_2O from livestock have increased. Changes to CO_2 emissions are smaller.
  - TP: The only change is a 0.2% reduction in energy CO_2.
- **Samoa:** *KyotoGHG, M.0.EL: (CR: -0.2%, -10.6%; TP: 4.4%, 2.2%)*;
  - CR: We have added country reported data for 1994 - 2007 from NC2. The main changes for 2021 are 44% higher agricultural N_2O emissions, 6.6% lower energy CO_2 emissions, 23% lower agricultural CH_4 emissions, and the addition of f-gas emissions (from NC2). many other sectors have changes as well. For cumulative emissions the main change is a 33% reduction in agricultural CH_4, followed by 5.1% reduction in energy CO_2 and a 21% increase in agricultural N_2O.
  - TP: The main change is the addition of f-gas emissions from NC2.
- **Yemen:** *KyotoGHG, M.0.EL: (CR: 14.4%, 5.8%; TP: 15.2%, 5.2%)*;
  - CR: We have no new country reported data for Yemen. The main factor for increased emissions is the addition of f-gases from EDGAR. Changes in energy CO_2 and cement CO_2 play a minor role.
  - TP: The changes are similar to the changes in the CR scenario.
- **South Africa:** *KyotoGHG, M.0.EL: (CR: 1.2%, 3.1%; TP: 2.0%, 0.7%)*;
  - CR: No new country reported data sources have been added, however for f-gases the 2017 data was missing in v2.4.2 and has now been added. 2021 data changes are dominated by these updated f-gas emissions. For cumulative emissions the influence of f-gases is smaller and the main change come from fixing energy CO_2 emissions where an erroneous data point in 2014 has been removed.
  - TP: The main change are updated and much higher f-gas emissions from EDGAR 7.0. Other changes are small.
- **Zambia:** *KyotoGHG, M.0.EL: (CR: -12.5%, -30.0%; TP: 1.1%, 1.6%)*;
  - CR: We have added data for several years in the period 1995 - 2016 from BUR1 and combined them with data fro 2000 from the UNFCCC DI portal. for all years except 2000 and 2016 downscaling of M.0.EL, KyotoGHG time-series is needed. Emissions for almost all sectors and gases have changed. for 2021 the highest changes come from energy CO_2 (+71%), agricultural N_2O (-61%), waste CH_4 (-91%), agricultural CH_4 (+22%), and cement CO_2 (+168%). For cumulative emissions the main factors are lower agricultural emissions especially from N_2O, but also from CH_4. Emissions in agriculture without livestock are 57% lower while livestock emission are 76% higher than in v2.4.2. Other important changes are 84% lower waste CH_4 emissions, 33% higher energy CO_2 emissions, 124% higher cement CO_2 emissions and f-gas emissions which have increased by over 100.000% (the discrepancy between the increase in cumulative emissions and 2021 decrease come from f-gas emissions dropping to zero in 2020).
  - TP: The main 2021 changes in the TP scenario are a 5.9% increase in energy CO_2 and a 10% increase in cement CO_2. For cumulative emissions increased f-gas emissions are the main factor with smaller contributions from energy CO_2 and cement CO_2.
- **Zimbabwe:** *KyotoGHG, M.0.EL: (CR: 21.3%, -12.9%; TP: 4.5%, 1.3%)*;
  - CR: We have added data for several years from BUR1. The aggregate KyoyoGHG time-series

are downscaled using detailed data for 2016 (BUR1) and 2010 (UNFCCC DI). The new data have changed emissions for most sectors and gases. The highest change comes from CH_4 from fossil fuels combustion (1.A) where 2021 emissions in v2.4.2 we very low while they are now higher than in third party sources. In agricultural CH_4 lower livestock emission cancel with higher non-livestock emissions. N_2O emissions are higher for energy and non-livestock agriculture. F-gases have been added from country reported data. For cumulative emissions the main change is 36% lower energy CO_2. CH_4 emissions are higher from agriculture and energy. N_2O emissions are lower with non-livestock agriculture as the main cause.

– TP: 2021 emissions for energy CO_2 have increased while 2021 emissions for cement CO_2 have decreased. Both changes are due to changes in BP/EI data and Andrew data. F-gases have been added from EDGAR. Cumulative emissions have only little changes as only the last years have changed.

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