A tool box for a climate neutral housing sector: Climate Goals

Anna Hornykewycz* Jakob Kapeller† Jan David Weber‡ Bernhard Schütz§
Lukas Cserjan¶

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1 Defining relative reduction goals

Reduction goals are typically defined relative to a certain base year and set relative reduction targets for specific periods (for the *German case* the base year is 1990, whereas targets are defined for milestones in 2030, 2040 and 2050). Specifically, we formulate our climate goal estiamtes on the basis of the Federal Climate Change Act (KSG). [1]

In doing so, we also adjust for current emissions to rescale targets to more accurately reflect contemporary needs for emission reduction. In this version, we use recent data to account for current emissions (see here for more details); however, extrapolating the trend from 1990 onwards would give very similar results.

```
emissions_buildings_1990 = 210
goal_2030 = -(emissions_buildings_1990-67)/emissions_buildings_1990
goal_2040 = -0.88
goal_2050 = -1.00
emissions_buildings_2023 = 102

target_2030 = emissions_buildings_1990 * (1 + goal_2030)
target_2040 = emissions_buildings_1990 * (1 + goal_2040)
target_2050 = emissions_buildings_1990 * (1 + goal_2050)

global_targetsinpercent <- c(0,
                      1 - target_2030 / emissions_buildings_2023,
                      1 - target_2040 / emissions_buildings_2023,
                      1 - target_2050 / emissions_buildings_2023)
```

2 Extrapolation between targets

In this section we linearly extrapolate targets to generate an exhaustive time-series.

*Institute for Comprehensive Analysis of the Economy (ICAE), Johannes Kepler University, Linz, Austria
†Institute for Socio-Economics, University of Duisburg-Essen, Germany and Institute for Comprehensive Analysis of the Economy (ICAE), Johannes Kepler University, Linz, Austria
‡Institute for Socio-Economics, University of Duisburg-Essen, Germany
§Vienna Institute for International Economic Comparisions (wiiw) and Institute for Socio-Economics, University of Duisburg-Essen, Germany
¶Institute for Comprehensive Analysis of the Economy (ICAE), Johannes Kepler University, Linz, Austria
[1] We use Appendix I to construct the goal for 2030, while basing the goals for 2040 and 2050 on Appendix II.

```r
start_year = 2023
end_year = 2050

target_1 = 2030
target_2 = 2040
target_3 = end_year

globalscenario <- matrix(NA, end_year-start_year+1, 2)
for (i in start_year:end_year) {
  if (i <= target_1) {
    globalscenario[i-start_year+1, ] <- c(i, (global_targetsinpercent[2] -
                                    global_targetsinpercent[1]) /
                                    (target_1 - start_year) * (i - start_year))
  } else if (i <= target_2) {
    globalscenario[i-start_year+1, ] <- c(i, global_targetsinpercent[2] +
                                    (global_targetsinpercent[3] -
                                     global_targetsinpercent[2]) /
                                     (target_2 - target_1) * (i - target_1))
  } else if (i <= target_3) {
    globalscenario[i-start_year+1, ] <- c(i, global_targetsinpercent[3] +
                                    (global_targetsinpercent[4] -
                                     global_targetsinpercent[3]) /
                                     (target_3 - target_2) * (i - target_2))
  }
}

globalscenario <- as.data.frame(globalscenario)
colnames(globalscenario) <- c("year", "rel_saving")
globalscenario$rel_reduction <- 1 - globalscenario$rel_saving
```

3 Exporting the generated time series for further processing.

For file management, we make use of the `here`-package. PLease make sure to install this package and verify, whether the correct path is obtained.

```r
library(here)
here::here()
write.csv(globalscenario,
          here::here("Intermediate_Results/global_buildings_climate_goals2040.csv"),
          row.names = FALSE)
```