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This file describes the data and code for "(Mis)allocation of Renewable Energy Sources" by Stefan Lamp and Mario Samano.

A. Data availability:

Since the original data have been collected from a large variety of sources and some data are proprietary (see article and online appendix for details), we only provide the final cleaned datasets used in the analysis in .dta format. This readme file provides additional information on the data sources. We include all Stata .do files that produce the results presented in the paper and online appendix (OA). The user must group the files into two folders according to the description in dataverse. Before running the .do files with the main analysis, change the directory to the desired location on your computer in "/programs/0_master.do".

Details on each data source in subfolder "data"

- Production data by technology at TSO level (15-minute data resolution) provided from ENTSO-E (https://transparency.entsoe.eu). These data also include information on fuel cost in EUR / MWh, electricity production, and their respective emission factors (see data section in the main paper).

Datafile: `entsoe.dta`

- Data on load, production, and day-ahead market prices (hourly resolution) in Germany provided by Open Power System Data, OPSD (https://open-power-system-data.org)

Datafile: `load_production.dta`

- Data on ancillary services (secondary reserves, minute reserves, TSO balance, and balancing prices) provided by REGELLEISTUNG (https://www.regelleistung.net), combined with information on load, data on renewable generation and renewable forecasts (15-minute resolution) and day-ahead market prices (hourly resolution).

Datafile: `data_15min.dta`

- Data on supply in North and South region (TenneT). These data combine information from a variety of sources: data on plant outages from fossil plants (ENTSO-E), information on the geo-location of individual fossil-fuel power plants (OPSD), nameplate capacity of conventional power plants (OPSD) and solar plants (NETZTRANSPARENZ, https://www.netztransparenz.de/EEG/Anlagenstammdaten).

Datafile: `supply_capacity_TenneT.dta`

- Data on total solar PV production in Bavaria (South region). These data can be obtained from the corresponding TSO's website: https://www.tennet.eu/electricity-market/transparency-pages/transparency-germany/network-figures/actual-and-forecast-solar-energy-feed-in/bayern/

Datafile: `Tennet_solar_South.dta`

- List of conventional power plants (OPSD) merged to TSOs based on county information (NUTS-3 regions). Data also includes information on installed capacity of residential solar (NETZTRANSPARENZ) and building stocks (Regional Statistical Database, https://www.regionalstatistik.de/genesis/online/logon)

Datafile: `county_TSO_covar_powerplants.dta`

B. Computational requirements:

Data construction: last run January 2020
Main analysis: last run July 2021
Code last run on MacBook Pro (13-inch, M1, 2020) with STATA 17.

Reallocation algorithms may take several days to run as iterative allocation for different specifications (SCC and robustness). It is therefore highly recommended to separate the main analysis from the robustness checks and to run one SCC value at a time. Work can be parallelized on different STATA sessions / computers.

C. Description of programs / code:

0_master.do
Sets main paths, defines "globals" for reallocation algorithm and runs analysis.

Specify "PATH" in line 13 and run auxiliary files before executing main reallocation algorithms. These files will generate additional ".dta" files.

AUXILARY FILES
1_AS_regression.do
Runs regressions to obtain marginal impact of changes in solar PV production on ancillary service costs. File also creates load clusters and Figures B.1 and B.2, as well as Tables B.1 to B.5 in the Online appendix (OA).

1_Lambdas_v1.do
Obtains the marginal cost of electricity generation, marginal emissions, and ancillary service costs by TSO. Input for Table 1 (marginal benefits) and Figure 3 in the main text. Tables A.1 and D.1 in the OA. The program directory includes several versions of this file "1_Lambdas_XXX" to account for co-pollutants as well as robustness regarding a unique (Germany-wide) dispatch.

3_Supply_Demand_splitTenneT.do
Prepares data for the reallocation exercise with North and South region and runs regressions on capacity imbalance. Generates Table 2 in the main text, Figures A.2 and D.6 as well as Table D.3 in the OA.

MAIN REALLOCATION ALGORITHM

2_ini_reallcoation_main.do

Determines different levels of the SCC for main reallocation algorithm of residential solar (2_PVoutput_analysis3_10KW_V3.do) as well as the robustness checks regarding solar radiation ranking (robust1) and Germany-wide dispatch (robust2). File also runs reallocation algorithm including co-pollutants (2_PVoutput_analysis3_10KW_v4_lpollution.do) and generates Figures 4 and 5 of the main paper as well as Figure D.4 in the OA.

3_PVoutput_analysis_all_splitTenneTdeltaK.do

Main reallocation algorithm for all solar capacity considering transmission from North to South region. Generates Figure 7 and Figure D.7 in the OA.