example-output

December 30, 2023

[1]:
```
"""
main Module
===========

Main module of the `WasteAndMaterialFootprint` tool.

This script serves as the entry point for the `WasteAndMaterialFootprint` tool.␣
 ↪It orchestrates the overall process, including the setup and execution of␣
 ↪various subprocesses like database explosion, material and waste searches,␣
 ↪and the editing of exchanges.

The script supports both single and multiple project/database modes, as well as␣
 ↪the option to use multiprocessing. It also facilitates the use of the␣
 ↪premise module to generate future scenario databases.

Customisation:
--------------
- Project and database names, and other settings can be edited in `config/
 ↪user_settings.py`.
- Waste search query terms can be customised in `config/queries_waste.py`.
- The list of materials can be modified in `config/queries_materials.py`.

Usage:
------
To use the default settings, run the script with `python main.py`.
Arguments can be provided to change project/database names or to delete the␣
 ↪project before running.

"""



#  0. Imports and configuration

# Import standard modules
import os
import sys
from time import sleep
```

```
from datetime import datetime
from multiprocessing import Pool, cpu_count
from pathlib import Path
import bw2data as bd


# not necessary (but fun), so in a try/except block
try:
    import cowsay
    import logging

    logging.getLogger("playsound").setLevel(logging.ERROR)
    from playsound import playsound
except ImportError:
    pass

# If running on a cluster, get the number of CPUs available
num_cpus = int(
    os.environ.get(
        "SLURM_CPUS_PER_TASK", os.environ.get("SLURM_JOB_CPUS_PER_NODE",␣
 ↪cpu_count())
    )
)

script_dir = os.path.dirname(os.path.abspath(__file__))
sys.path.insert(0, script_dir)
# # Set the working directory to the location of this script
# os.chdir(script_dir)
# sys.path.insert(0, str(cwd))

# # Add the config dir to the Python path
# dir_config = cwd / "config"

# sys.path.insert(0, str(dir_config))

# import custom modules (from root dir)
from ExchangeEditor import ExchangeEditor
from ExplodeDatabase import ExplodeDatabase
from FutureScenarios import MakeFutureScenarios
from MakeCustomDatabase import dbExcel2BW, dbWriteExcel
from MethodEditor import AddMethods
from SearchMaterial import SearchMaterial
from SearchWaste import SearchWaste
from VerifyDatabase import VerifyDatabase

# import configuration from config/user_settings.py
from config.user_settings import (
```

```
    custom_bw2_dir,
    db_wmf_name,
    delete_wmf_project,
    dir_logs,
    dir_tmp,
    dir_config,
    generate_args_list,
    project_base,
    project_premise,
    project_wmf,
    use_multiprocessing,
    use_premise,
    use_wmf,
    do_search,
    do_methods,
    do_edit,
    single_database,
)

# Check from the settings if a custom datadir is declared
if custom_bw2_dir:
    os.environ["BRIGHTWAY2_DIR"] = custom_bw2_dir


# 1. DEFINE MAIN FUNCTION: WasteAndMaterialFootprint()
def run():
    """
    Main function serving as the wrapper for the WasteAndMaterialFootprint tool.

    This function coordinates the various components of the tool, including:
        creating future scenario databases,
        setting up and processing each database for waste and material␣
 ↪footprinting,
        and combining results into a custom database.
        adding LCIA methods to the project for each of the waste/material flows.

    The function supports various modes of operation based on the settings in␣
 ↪`config/user_settings.py`.
    Specifications for material and waste searches can be customised in␣
 ↪`queries_materials`.
    """
    print(
        f"""
    {80*'='}
    {80*'~'}
    {'** Starting the WasteAndMaterialFootprint tool **'.center(80, ' ')}
    {80*'~'}
```

```
    {80*'='}
    """
    )
    # create future scenario databases
    if use_premise:
        MakeFutureScenarios()

    assert use_wmf, "use_wmf is False, so WasteAndMaterialFootprint will not␣
↪run"

    start_time = datetime.now()
    args_list = generate_args_list(single_database=single_database)
    total_databases = len(args_list)
    all_databases = list(set(bd.databases) - {"biosphere3"})

    print(
        f"\nStarting WasteAndMaterialFootprint for {total_databases}/
↪{len(all_databases)} databases in project {project_base}\n{'-'*50}"
    )
    for arg in args_list:
        print(f"\t{arg['db_name']}")

    # Make new project, delete previous project if you want to start over, or␣
↪use existing project
    bd.projects.purge_deleted_directories()
    if project_wmf in bd.projects and delete_wmf_project:
        print(f"\n* Deleting previous project {project_wmf}")
        bd.projects.delete_project(project_wmf, True)
        bd.projects.purge_deleted_directories()

    if project_wmf in bd.projects:
        print(f"* WasteAndMaterial project already exists: {project_wmf}")
        bd.projects.set_current(project_wmf)

    if project_wmf not in bd.projects:
        print(
            f"\n* Project {project_base} will be copied to a new project:␣
↪{project_wmf}"
        )
        bd.projects.set_current(project_base)
        bd.projects.copy_project(project_wmf)
        bd.projects.set_current(project_wmf)

    # 1.1 Run the initial steps for each database in the project
    def process_db_setup(args, db_number, total_databases):
        """
        Process initial setup for a given database within the project.
```

```
        This function is responsible for setting up each database by running␣
↪the ExplodeAndSearch process.
        It handles any exceptions during the process and logs errors.

        :param dict args: Arguments containing database and project settings.
        :param int db_number: The current database number in the processing␣
↪sequence.
        :param int total_databases: Total number of databases to be processed.
        :return: int: Returns 1 if successful, 0 if an error occurred.
        """
        print(f'\n{"-"*80}')
        try:
            print(
                f"\n** Pre-processing database ({db_number+1}/
↪{total_databases}): {args['db_name']}**\n"
            )
            print(args)
            if do_search:
                ExplodeAndSearch(args)
            print(f'\n{"-"*80}')
            return 1  # successfully processed
        except Exception as e:
            print(
                f"\n{'@'*50}\n\tError pre-processing database {args['db_name']}!
↪ \n\n\t{e}\n{'@'*50}\n"
            )
            print(f'\n{"-"*80}')
            return 0  # error occurred

    results = []
    if use_multiprocessing:
        with Pool(processes=num_cpus) as pool:
            for db_number, arg in enumerate(args_list):
                pool.apply_async(
                    process_db_setup,
                    (arg, db_number, total_databases),
                    callback=results.append,
                )

    else:
        for db_number, arg in enumerate(args_list):
            result = process_db_setup(arg, db_number, total_databases)
            results.append(result)

    successful_count = sum(results)
```

```
    end_time = datetime.now()
    duration = end_time - start_time

    if do_methods:
        #  1.2 MakeCustomDatabase.py: Make the custom database from the combined search results
        dbWriteExcel()
        dbExcel2BW()
        #  1.3 MethodEditor.py: adds LCIA methods to the project for each of the waste/material flows
        AddMethods()

    print(
        f"""
    {80*'-'}
    *** Preprocessing completed ***

    \t Total databases:          {total_databases}
    \t Successfully processed:   {successful_count}
    \t Duration:                 {str(duration).split('.')[0]} (h:m:s)
    {80*'-'}

    """
    )

    def process_db(args, db_number, total_databases):
        """
        Process the database by editing exchanges

        :param dict args: Arguments containing database and project settings.
        :param int db_number: The current database number in the processing sequence.
        :param int total_databases: Total number of databases to be processed.

        :return: int: Returns 1 if successful, 0 if an error occurred.
        """
        print(f'\n{"-"*80}')
        try:
            print(
                f"\n** Processing database ({db_number}/{total_databases}): {args['db_name']}**"
            )
            print("Arguments:")
            print(args)
            if do_edit:
                EditExchanges(args)
            print(f'{"-"*80}\n')
```

```
            return 1  # successfully processed
        except Exception as e:
            print(
                f"\n{'@'*50}\n\tError processing database {args['db_name']}!␣
↪\n\n\t{e}\n{'@'*50}\n"
            )
            print(f'{"-"*80}\n')
            return 0  # error occurred

    results = []
    db_number = 0
    if use_multiprocessing:
        with Pool(processes=num_cpus) as pool:
            for arg in args_list:
                pool.apply_async(
                    process_db,
                    (arg, db_number, total_databases),
                    callback=results.append,
                )

    else:
        for args in args_list:
            db_number += 1
            result = process_db(args, db_number, total_databases)
            results.append(result)

    successful_count = sum(results)

    end_time = datetime.now()
    duration = end_time - start_time

    # 1.4 VerifyDatabase.py: Verify the database
    print(f'\n{"-"*80}')
    print("\t*** Verifying all databases in the project **")
    for arg in args_list:
        db_name = arg["db_name"]
        VerifyDatabase(project_wmf, db_name)
        print(f'\n{"-"*80}\n')

    try:
        playsound(script_dir.parents[1] / "misc/success.mp3")
    except:
        pass

    print(
        f"""
    {80 * '~'}
```

```
    {80 * '='}
    {'WasteAndMaterialFootprint Completed'.center(80, ' ')}
    {'~' * 80}

    Project:                    {project_wmf}
    Total Databases:            {total_databases}
    Successfully Processed:     {successful_count}
    Duration:                   {str(duration).split('.')[0]} (h:m:s)

    {'=' * 80}
    {'~' * 80}
    """
    )

    sleep(1)

    try:

        def animate_cowsay(message, delay=0.2):
            cow = cowsay.get_output_string("cow", message)
            for line in cow.split("\n"):
                print(line.center(80, " "))
                sleep(delay)
            playsound(script_dir.parents[1] / "misc/moo.mp3")

        message = "\nLet's mooooooo\n some LCA!\n"
        animate_cowsay(message)
    except:
        pass

    print(f'\n{"-"*80}\n')
    print(f'\n{"~"*80}\n')
    print(f'\n{"="*80}\n')


def ExplodeAndSearch(args):
    """
    Exploding the database into separate exchanges, searching for waste and
    material flows, and processing these results.

    This includes:
        - ExplodeDatabase.py
        - SearchWaste.py
        - SearchMaterial.py

    :param args: Dictionary containing database and project settings.
    :returns: None
```

```
    """

    project_wmf = args["project_wmf"]
    db_name = args["db_name"]

    print(
        f"\n{'='*100}\n\t Starting WasteAndMaterialFootprint for␣
↪{db_name}\n{'='*100}"
    )

    # 1.2 Explode the database into separate exchanges
    existing_file = dir_tmp / (db_name + "_exploded.pickle")
    if os.path.isfile(existing_file):
        print(f"\n* Existing exploded database found: {existing_file}")
        print("\n* Existing data will be reused for the current run")
    else:
        ExplodeDatabase(db_name)

    # 1.3 Search the exploded database for waste and material flows
    SearchWaste(db_name)
    SearchMaterial(db_name, project_wmf)

    return None


def EditExchanges(args):
    """
    Edit exchanges in the database.

    This function adds waste and material flows to the activities and verifies␣
↪the database.

    :param args: Dictionary containing database and project settings.
    :returns: None
    """

    db_name = args["db_name"]
    start = datetime.now()
    # Add waste and material flows to the activities, check that it worked

    ExchangeEditor(project_wmf, db_name, db_wmf_name)
    exit_code = VerifyDatabase(project_wmf, db_name)

    if exit_code == 0:
        print("** Database verified successfully! **\n")
    else:
        print("** Error occurred during verification! **")
```

```
        print(f"\t Look in the logfile for details. exit_code = {exit_code}\n")

    # Final message and log
    duration = datetime.now() - start
    print(f"{'='*90}")
    print(
        f"\t*** Finished WasteAndMaterialFootprint for {db_name}␣
 ↪***\n\t\t\tDuration: {str(duration).split('.')[0]} (h:m:s)"
    )
    print("\t*** Woah woah wee waa, great success!! ***")
    print(f"{'='*90}")

    with open(f"{dir_logs / 'main_log.txt'}", "a") as log:
        log.write(
            datetime.now().strftime("%Y-%m-%d")
            + "\t Duration:"
            + str(duration).split(".")[0]
            + " "
            + db_name
            + "\n"
        )

    return None


# 2. RUN MAIN FUNCTION
if __name__ == "__main__":
    run()
```

```
Using environment variable BRIGHTWAY2_DIR for data directory:
/home/stew/brightway2data

================================================================================
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
                    ** Starting the WasteAndMaterialFootprint tool **
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
================================================================================

*** Starting FutureScenarios.py ***
        Using premise version (1, 8, 2, 'dev3')
Deleted existing project SSP-cutoff_test
Created new project SSP-cutoff_test from default

** Using: ecoinvent-3.9.1-cutoff**


 ** Processing scenario set 1 of 2, batch size 2 **
```

```
//////////////////// EXTRACTING SOURCE DATABASE ////////////////////
Cannot find cached database. Will create one now for next time…
Getting activity data

100%|      | 21238/21238 [00:00<00:00, 70870.17it/s]

Adding exchange data to activities

100%|      | 674593/674593 [00:19<00:00, 34835.68it/s]

Filling out exchange data

100%|      | 21238/21238 [00:01<00:00, 12262.49it/s]

Set missing location of datasets to global scope.
Set missing location of production exchanges to scope of dataset.
Correct missing location of technosphere exchanges.
Correct missing flow categories for biosphere exchanges
Remove empty exchanges.
Done!

////////////////// IMPORTING DEFAULT INVENTORIES //////////////////
Cannot find cached inventories. Will create them now for next time…
Importing default inventories…

Extracted 1 worksheets in 0.13 seconds
Migrating to 3.8 first
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Extracted 1 worksheets in 0.02 seconds
Migrating to 3.8 first
Applying strategy: migrate_datasets
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Applying strategy: migrate_datasets
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Extracted 1 worksheets in 0.01 seconds
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Applying strategy: migrate_datasets
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Extracted 1 worksheets in 0.01 seconds
Extracted 1 worksheets in 0.02 seconds
```

```
Migrating to 3.8 first
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
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Extracted 1 worksheets in 0.01 seconds
Extracted 7 worksheets in 0.03 seconds
Migrating to 3.8 first
Applying strategy: migrate_datasets
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Migrating to 3.8 first
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Migrating to 3.8 first
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
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Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
The following datasets to import already exist in the source database. They will
not be imported
+--------------------------------+--------------------------------+----------+--
-----------+
|              Name              |       Reference product        | Location |
File    |
+--------------------------------+--------------------------------+----------+--
```

```
-----------+
| fluorspar production, 97% puri |     fluorspar, 97% purity      |   GLO    |
lci-PV.xlsx |
| metallization paste production | metallization paste, back side |   RER    |
lci-PV.xlsx |
| metallization paste production | metallization paste, back side |   RER    |
lci-PV.xlsx |
| metallization paste production | metallization paste, front sid |   RER    |
lci-PV.xlsx |
| photovoltaic module production | photovoltaic module, building- |   RER    |
lci-PV.xlsx |
| photovoltaic module production | photovoltaic module, building- |   RER    |
lci-PV.xlsx |
| photovoltaic mounting system p | photovoltaic mounting system,  |   RER    |
lci-PV.xlsx |
| photovoltaic mounting system p | photovoltaic mounting system,  |   RER    |
lci-PV.xlsx |
| photovoltaic mounting system p | photovoltaic mounting system,  |   RER    |
lci-PV.xlsx |
| photovoltaic panel factory con |   photovoltaic panel factory   |   GLO    |
lci-PV.xlsx |
|  polyvinylfluoride production  |       polyvinylfluoride        |    US    |
lci-PV.xlsx |
| polyvinylfluoride production,  | polyvinylfluoride, dispersion  |    US    |
lci-PV.xlsx |
| polyvinylfluoride, film produc |    polyvinylfluoride, film     |    US    |
lci-PV.xlsx |
| silicon production, metallurgi |  silicon, metallurgical grade  |    NO    |
lci-PV.xlsx |
|   vinyl fluoride production    |         vinyl fluoride         |    US    |
lci-PV.xlsx |
|   wafer factory construction   |         wafer factory          |    DE    |
lci-PV.xlsx |
+--------------------------------+--------------------------------+----------+--
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Extracted 1 worksheets in 0.02 seconds
Extracted 1 worksheets in 0.02 seconds
Extracted 1 worksheets in 0.02 seconds
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Migrating to 3.8 first
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Applying strategy: migrate_datasets
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Applying strategy: migrate_exchanges
The following datasets to import already exist in the source database. They will
not be imported
+--------------------------------+--------------------------------+----------+--
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|              Name              |       Reference product        | Location |
File              |
+--------------------------------+--------------------------------+----------+--
------------------------------+
| carbon dioxide, captured at ce | carbon dioxide, captured and r |   RER    |
lci-synfuels-from-methanol-fro |
+--------------------------------+--------------------------------+----------+--
------------------------------+
Extracted 1 worksheets in 0.02 seconds
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Applying strategy: migrate_exchanges
The following datasets to import already exist in the source database. They will
not be imported
+--------------------------------+----------------------+----------+------------
--------------------+
|              Name              |  Reference product   | Location |
File              |
+--------------------------------+----------------------+----------+------------
--------------------+
| methanol distillation, hydroge |  methanol, purified  |   RER    | lci-
synfuels-from-methanol-fro |
| methanol synthesis, hydrogen f | methanol, unpurified |   RER    | lci-
synfuels-from-methanol-fro |
+--------------------------------+----------------------+----------+------------
--------------------+
```

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Extracted 1 worksheets in 0.01 seconds
Migrating to 3.8 first
Applying strategy: migrate_datasets
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Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Extracted 5 worksheets in 0.67 seconds
Migrating to 3.8 first
Applying strategy: migrate_datasets
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Applying strategy: migrate_datasets
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Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Extracted 1 worksheets in 0.01 seconds
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Migrating to 3.8 first
Applying strategy: migrate_datasets
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Applying strategy: migrate_exchanges
Extracted 1 worksheets in 0.03 seconds
Extracted 1 worksheets in 0.01 seconds
Extracted 2 worksheets in 0.01 seconds
Migrating to 3.8 first
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
```

```
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Extracted 1 worksheets in 0.02 seconds
Extracted 1 worksheets in 0.02 seconds
Extracted 1 worksheets in 0.01 seconds
Extracted 1 worksheets in 0.04 seconds
Extracted 1 worksheets in 0.02 seconds
Extracted 1 worksheets in 0.01 seconds
Migrating to 3.8 first
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Data cached. It is advised to restart your workflow at this point.
This allows premise to use the cached data instead, which results in
a faster workflow.
Done!

////////////////////// EXTRACTING IAM DATA ////////////////////////
Done!
`update_all()` will skip the following steps:
update_two_wheelers(), update_cars(), and update_buses()
If you want to update these steps, please run them separately afterwards.
Extracted 1 worksheets in 5.47 seconds
Extracted 1 worksheets in 5.47 seconds
Migrating to 3.8 first
Applying strategy: migrate_datasets
Migrating to 3.8 first
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Vehicle fleet data is not available beyond 2050. Hence, 2050 is used as fleet
year.
Vehicle fleet data is not available beyond 2050. Hence, 2050 is used as fleet
year.
Anomalies found: check the change report.
Done!
Done!
Error: "not all values found in index 'year'. Try setting the `method` keyword
argument (example: method='nearest')."
```

```
Write new database(s) to Brightway.
Running all checks…
Running all checks…
Warning: No valid output stream.
Title: Writing activities to SQLite3 database:
  Started: 12/30/2023 11:14:16
  Finished: 12/30/2023 11:14:40
  Total time elapsed: 00:00:24
  CPU %: 87.90
  Memory %: 29.08
Created database: ecoinvent_cutoff_3.9_remind_SSP2-Base_2065
Warning: No valid output stream.
Title: Writing activities to SQLite3 database:
  Started: 12/30/2023 11:15:43
  Finished: 12/30/2023 11:16:04
  Total time elapsed: 00:00:21
  CPU %: 99.00
  Memory %: 29.72
Created database: ecoinvent_cutoff_3.9_remind_SSP2-Base_2100
Generate scenario report.
Report saved under /home/stew/code/gh/WasteAndMaterialFootprint/data/premise/exp
ort/scenario_report.
Generate change report.
Report saved under /home/stew/code/gh/WasteAndMaterialFootprint/data/premise.

 ** Processing scenario set 2 of 2, batch size 2 **

//////////////////// EXTRACTING SOURCE DATABASE ////////////////////
Done!

////////////////// IMPORTING DEFAULT INVENTORIES //////////////////
Done!

/////////////////////// EXTRACTING IAM DATA ///////////////////////
Done!
`update_all()` will skip the following steps:
update_two_wheelers(), update_cars(), and update_buses()
If you want to update these steps, please run them separately afterwards.
Extracted 1 worksheets in 6.32 seconds
Migrating to 3.8 first
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Extracted 1 worksheets in 6.18 seconds
Migrating to 3.8 first
```

```
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Applying strategy: migrate_datasets
Applying strategy: migrate_exchanges
Vehicle fleet data is not available beyond 2050. Hence, 2050 is used as fleet
year.
Vehicle fleet data is not available beyond 2050. Hence, 2050 is used as fleet
year.
Anomalies found: check the change report.
Done!
Done!
Error: "not all values found in index 'year'. Try setting the `method` keyword
argument (example: method='nearest')."
Write new database(s) to Brightway.
Running all checks…
Running all checks…
Warning: No valid output stream.
Title: Writing activities to SQLite3 database:
  Started: 12/30/2023 11:23:11
  Finished: 12/30/2023 11:23:40
  Total time elapsed: 00:00:29
  CPU %: 94.90
  Memory %: 30.09
Created database: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065
Warning: No valid output stream.
Title: Writing activities to SQLite3 database:
  Started: 12/30/2023 11:24:55
  Finished: 12/30/2023 11:25:22
  Total time elapsed: 00:00:26
  CPU %: 98.70
  Memory %: 31.00
Created database: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100
Generate scenario report.
Report saved under /home/stew/code/gh/WasteAndMaterialFootprint/data/premise/exp
ort/scenario_report.
Generate change report.
Report saved under /home/stew/code/gh/WasteAndMaterialFootprint/data/premise.
Adding ('IPCC 2021', 'climate change', 'GWP 20a, incl. H')
Applying strategy: csv_restore_tuples
Applying strategy: csv_numerize
Applying strategy: csv_drop_unknown
Applying strategy: set_biosphere_type
Applying strategy: drop_unspecified_subcategories
Applying strategy: link_iterable_by_fields
Applying strategy: drop_falsey_uncertainty_fields_but_keep_zeros
Applying strategy: convert_uncertainty_types_to_integers
```

```
Applied 8 strategies in 0.07 seconds
Wrote 1 LCIA methods with 248 characterization factors
Adding ('IPCC 2021', 'climate change', 'GWP 100a, incl. H and bio CO2')
Applying strategy: csv_restore_tuples
Applying strategy: csv_numerize
Applying strategy: csv_drop_unknown
Applying strategy: set_biosphere_type
Applying strategy: drop_unspecified_subcategories
Applying strategy: link_iterable_by_fields
Applying strategy: drop_falsey_uncertainty_fields_but_keep_zeros
Applying strategy: convert_uncertainty_types_to_integers
Applied 8 strategies in 0.07 seconds
Wrote 1 LCIA methods with 255 characterization factors
Adding ('IPCC 2021', 'climate change', 'GWP 20a, incl. H and bio CO2')
Applying strategy: csv_restore_tuples
Applying strategy: csv_numerize
Applying strategy: csv_drop_unknown
Applying strategy: set_biosphere_type
Applying strategy: drop_unspecified_subcategories
Applying strategy: link_iterable_by_fields
Applying strategy: drop_falsey_uncertainty_fields_but_keep_zeros
Applying strategy: convert_uncertainty_types_to_integers
Applied 8 strategies in 0.07 seconds
Wrote 1 LCIA methods with 255 characterization factors
Adding ('IPCC 2021', 'climate change', 'GWP 100a, incl. H')
Applying strategy: csv_restore_tuples
Applying strategy: csv_numerize
Applying strategy: csv_drop_unknown
Applying strategy: set_biosphere_type
Applying strategy: drop_unspecified_subcategories
Applying strategy: link_iterable_by_fields
Applying strategy: drop_falsey_uncertainty_fields_but_keep_zeros
Applying strategy: convert_uncertainty_types_to_integers
Applied 8 strategies in 0.07 seconds
Wrote 1 LCIA methods with 248 characterization factors
***** Done! *****

Starting WasteAndMaterialFootprint for 5/5 databases in project SSP-cutoff_test
-------------------------------------------------
        ecoinvent-3.9.1-cutoff
        ecoinvent_cutoff_3.9_remind_SSP2-Base_2065
        ecoinvent_cutoff_3.9_remind_SSP2-Base_2100
        ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065
        ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100

* Project SSP-cutoff_test will be copied to a new project: WMFootprint-SSP-
cutoff_test
```

```
--------------------------------------------------------------------------------

** Pre-processing database (1/5): ecoinvent-3.9.1-cutoff**

{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent-3.9.1-cutoff', 'db_wmf_name':
'WasteAndMaterialFootprint'}

================================================================================
====================
         Starting WasteAndMaterialFootprint for ecoinvent-3.9.1-cutoff
================================================================================
====================

*** Starting ExplodeDatabase ***
ExplodeDatabase uses wurst to open a bw2 database, explodes the exchanges for
each process, and then returns a pickle file with a DataFrame list of all
activities

** db: ecoinvent-3.9.1-cutoff, in project: WMFootprint-SSP-cutoff_test will be
processed

** Opening the sausage…
Getting activity data
100%|      | 21238/21238 [00:00<00:00, 191491.58it/s]
Adding exchange data to activities
100%|      | 674593/674593 [00:30<00:00, 21777.78it/s]
Filling out exchange data
100%|      | 21238/21238 [00:01<00:00, 14409.99it/s]


*** Extracting activities from db…

*** Exploding exchanges from activities…

*** Pickling…

 Pickle is: 51 MB

*** The sausage <ecoinvent-3.9.1-cutoff> was exploded and pickled. Rejoice!

*** Starting SearchWaste ***
*** Loading pickle to dataframe ***
*** Searching for waste exchanges ***
        WasteFootprint_digestion        | kilogram              |      4
        WasteFootprint_composting       | kilogram              |     26
```

```
        WasteFootprint_open burning     | kilogram             |    535
        WasteFootprint_incineration     | kilogram             |   1897
        WasteFootprint_recycling        | kilogram             |    129
        WasteFootprint_landfill         | kilogram             |   1430
        WasteFootprint_hazardous        | kilogram             |   1842
        WasteFootprint_carbon dioxide   | kilogram             |      0
        WasteFootprint_total            | kilogram             |  28883
        WasteFootprint_digestion        | cubic meter          |     16
        WasteFootprint_composting       | cubic meter          |      0
        WasteFootprint_open burning     | cubic meter          |      0
        WasteFootprint_incineration     | cubic meter          |      2
        WasteFootprint_recycling        | cubic meter          |      0
        WasteFootprint_landfill         | cubic meter          |      2
        WasteFootprint_hazardous        | cubic meter          |    423
        WasteFootprint_carbon dioxide   | cubic meter          |      0
        WasteFootprint_total            | cubic meter          |   3976
*** Finished searching for waste exchanges ***

*** Starting SearchMaterial ***
*** Loading pickle to dataframe ***

*** Loading activities
from database: ecoinvent-3.9.1-cutoff
in project: WMFootprint-SSP-cutoff_test

** Materials (59) | (activity, group)
        ('market for aluminium', 'aluminium')
        ('market for antimony', 'antimony')
        ('market for bauxite', 'bauxite')
        ('market for beryllium', 'beryllium')
        ('market for bismuth', 'bismuth')
        ('market for cadmium', 'cadmium')
        ('market for calcium borates', 'borates')
        ('market for cement', 'cement')
        ('market for cerium', 'cerium')
        ('market for chromium', 'chromium')
        ('market for coal', 'coal')
        ('market for cobalt', 'cobalt')
        ('market for coke', 'coke')
        ('market for copper', 'copper')
        ('market for dysprosium', 'dysprosium')
        ('market for erbium', 'erbium')
        ('market for europium', 'europium')
        ('market for electricity,', 'electricity')
        ('market for ferroniobium,', 'niobium')
        ('market for fluorspar,', 'fluorspar')
        ('market for gadolinium', 'gadolinium')
        ('market for gallium', 'gallium')
```

```
        ('market for gold', 'gold')
        ('market for graphite', 'graphite')
        ('market for hafnium', 'hafnium')
        ('market for helium', 'helium')
        ('market for holmium', 'holmium')
        ('market for hydrogen,', 'hydrogen')
        ('market for indium', 'indium')
        ('market for latex', 'latex')
        ('market for lithium', 'lithium')
        ('market for magnesium', 'magnesium')
        ('market for natural gas,', 'natural gas')
        ('market for nickel', 'nickel')
        ('market for palladium', 'palladium')
        ('market for petroleum', 'petroleum')
        ('market for phosphate', 'phosphate rock')
        ('market for platinum', 'platinum')
        ('market for rare earth', 'rare earth')
        ('market for rhodium', 'rhodium')
        ('market for sand', 'sand')
        ('market for selenium', 'selenium')
        ('market for scandium', 'scandium')
        ('market for silicon', 'silicon')
        ('market for silver', 'silver')
        ('market for sodium borates', 'borates')
        ('market for strontium', 'strontium')
        ('market for tantalum', 'tantalum')
        ('market for tellurium', 'tellurium')
        ('market for tin', 'tin')
        ('market for titanium', 'titanium')
        ('market for uranium', 'uranium')
        ('market for tungsten', 'tungsten')
        ('market for vanadium', 'vanadium')
        ('market for vegetable oil,', 'vegetable oil')
        ('market for tap water', 'water')
        ('market for water,', 'water')
        ('market for zinc', 'zinc')
        ('market for zirconium', 'zirconium')

* 1038 material markets were found:
                                                    name material_group  \
89                     market for aluminium alloy, AlLi      aluminium
1023                  market for aluminium alloy, AlMg3      aluminium
80    market for aluminium alloy, metal matrix compo…      aluminium
239   market for aluminium around steel bi-metal str…      aluminium
496   market for aluminium around steel bi-metal wir…      aluminium
…                                                   …              …
757                                market for zinc slag           zinc
476                            market for zinc sulfide           zinc
```

```
281                          market for zirconium oxide      zirconium
93           market for zirconium sponge, nuclear-grade      zirconium
107                  market for zirconium tetrachloride      zirconium

     location
89         GLO
1023       GLO
80         GLO
239        GLO
496        GLO
…        …
757        GLO
476        GLO
281        GLO
93         GLO
107        GLO

[1038 rows x 3 columns]

* Extracting classifications…


Saved activities list to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t-3.9.1-cutoff/material_activities.csv

*** Searching for material exchanges in ecoinvent-3.9.1-cutoff ***

*** Loading pickle to dataframe ***

There were 50387 matching exchanges found in ecoinvent-3.9.1-cutoff

Saved material exchanges to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t-3.9.1-cutoff/material_exchanges.csv

*** Grouping material exchanges by material group

          1822 : aluminium
            26 : antimony
            24 : bauxite
             1 : beryllium
            15 : borates
            17 : cadmium
          2575 : cement
             2 : cerium
           410 : chromium
           146 : coal
```

```
  166 : cobalt
   68 : coke
  915 : copper
    1 : dysprosium
23823 : electricity
    1 : erbium
    1 : europium
   22 : fluorspar
    1 : gadolinium
    3 : gallium
   10 : gold
   30 : graphite
   43 : helium
    1 : holmium
  377 : hydrogen
   13 : indium
   49 : latex
   43 : lithium
  250 : magnesium
 5804 : natural gas
  342 : nickel
   22 : palladium
  503 : petroleum
  207 : phosphate rock
  164 : platinum
   37 : rare earth
   11 : rhodium
  553 : sand
    1 : scandium
    9 : selenium
  358 : silicon
   46 : silver
   27 : strontium
    3 : tantalum
    2 : tellurium
  103 : tin
  454 : titanium
    5 : tungsten
  136 : uranium
   34 : vegetable oil
10145 : water
  557 : zinc
    9 : zirconium
```

```
** Pre-processing database (2/5): ecoinvent_cutoff_3.9_remind_SSP2-Base_2065**

{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent_cutoff_3.9_remind_SSP2-Base_2065',
'db_wmf_name': 'WasteAndMaterialFootprint'}

================================================================================
====================
         Starting WasteAndMaterialFootprint for
ecoinvent_cutoff_3.9_remind_SSP2-Base_2065
================================================================================
====================

*** Starting ExplodeDatabase ***
ExplodeDatabase uses wurst to open a bw2 database, explodes the exchanges for
each process, and then returns a pickle file with a DataFrame list of all
activities

** db: ecoinvent_cutoff_3.9_remind_SSP2-Base_2065, in project: WMFootprint-SSP-
cutoff_test will be processed

** Opening the sausage…
Getting activity data
100%|      | 22433/22433 [00:00<00:00, 205081.15it/s]
Adding exchange data to activities
100%|      | 692676/692676 [00:17<00:00, 39089.13it/s]
Filling out exchange data
100%|      | 22433/22433 [00:01<00:00, 13914.56it/s]


*** Extracting activities from db…

*** Exploding exchanges from activities…

*** Pickling…

 Pickle is: 52 MB

*** The sausage <ecoinvent_cutoff_3.9_remind_SSP2-Base_2065> was exploded and
pickled. Rejoice!

*** Starting SearchWaste ***
*** Loading pickle to dataframe ***
*** Searching for waste exchanges ***
        WasteFootprint_digestion        | kilogram              |      4
        WasteFootprint_composting       | kilogram              |     26
```

```
        WasteFootprint_open burning     | kilogram             |    535
        WasteFootprint_incineration     | kilogram             |   2171
        WasteFootprint_recycling        | kilogram             |    137
        WasteFootprint_landfill         | kilogram             |   1530
        WasteFootprint_hazardous        | kilogram             |   1928
        WasteFootprint_carbon dioxide   | kilogram             |    119
        WasteFootprint_total            | kilogram             |  29524
        WasteFootprint_digestion        | cubic meter          |     16
        WasteFootprint_composting       | cubic meter          |      0
        WasteFootprint_open burning     | cubic meter          |      0
        WasteFootprint_incineration     | cubic meter          |      2
        WasteFootprint_recycling        | cubic meter          |      0
        WasteFootprint_landfill         | cubic meter          |      2
        WasteFootprint_hazardous        | cubic meter          |    437
        WasteFootprint_carbon dioxide   | cubic meter          |      0
        WasteFootprint_total            | cubic meter          |   4360
*** Finished searching for waste exchanges ***

*** Starting SearchMaterial ***
*** Loading pickle to dataframe ***

*** Loading activities
from database: ecoinvent_cutoff_3.9_remind_SSP2-Base_2065
in project: WMFootprint-SSP-cutoff_test

** Materials (59) | (activity, group)
        ('market for aluminium', 'aluminium')
        ('market for antimony', 'antimony')
        ('market for bauxite', 'bauxite')
        ('market for beryllium', 'beryllium')
        ('market for bismuth', 'bismuth')
        ('market for cadmium', 'cadmium')
        ('market for calcium borates', 'borates')
        ('market for cement', 'cement')
        ('market for cerium', 'cerium')
        ('market for chromium', 'chromium')
        ('market for coal', 'coal')
        ('market for cobalt', 'cobalt')
        ('market for coke', 'coke')
        ('market for copper', 'copper')
        ('market for dysprosium', 'dysprosium')
        ('market for erbium', 'erbium')
        ('market for europium', 'europium')
        ('market for electricity,', 'electricity')
        ('market for ferroniobium,', 'niobium')
        ('market for fluorspar,', 'fluorspar')
        ('market for gadolinium', 'gadolinium')
        ('market for gallium', 'gallium')
```

```
        ('market for gold', 'gold')
        ('market for graphite', 'graphite')
        ('market for hafnium', 'hafnium')
        ('market for helium', 'helium')
        ('market for holmium', 'holmium')
        ('market for hydrogen,', 'hydrogen')
        ('market for indium', 'indium')
        ('market for latex', 'latex')
        ('market for lithium', 'lithium')
        ('market for magnesium', 'magnesium')
        ('market for natural gas,', 'natural gas')
        ('market for nickel', 'nickel')
        ('market for palladium', 'palladium')
        ('market for petroleum', 'petroleum')
        ('market for phosphate', 'phosphate rock')
        ('market for platinum', 'platinum')
        ('market for rare earth', 'rare earth')
        ('market for rhodium', 'rhodium')
        ('market for sand', 'sand')
        ('market for selenium', 'selenium')
        ('market for scandium', 'scandium')
        ('market for silicon', 'silicon')
        ('market for silver', 'silver')
        ('market for sodium borates', 'borates')
        ('market for strontium', 'strontium')
        ('market for tantalum', 'tantalum')
        ('market for tellurium', 'tellurium')
        ('market for tin', 'tin')
        ('market for titanium', 'titanium')
        ('market for uranium', 'uranium')
        ('market for tungsten', 'tungsten')
        ('market for vanadium', 'vanadium')
        ('market for vegetable oil,', 'vegetable oil')
        ('market for tap water', 'water')
        ('market for water,', 'water')
        ('market for zinc', 'zinc')
        ('market for zirconium', 'zirconium')

* 1041 material markets were found:
                                                  name material_group location
416                   market for aluminium alloy, AlLi      aluminium      GLO
201                  market for aluminium alloy, AlMg3      aluminium      GLO
28   market for aluminium alloy, metal matrix compo…      aluminium      GLO
944  market for aluminium around steel bi-metal str…      aluminium      GLO
61   market for aluminium around steel bi-metal wir…      aluminium      GLO
..                                                 …            …      …
193                              market for zinc slag           zinc      GLO
815                            market for zinc sulfide           zinc      GLO
```

```
983                          market for zirconium oxide      zirconium      GLO
811         market for zirconium sponge, nuclear-grade      zirconium      GLO
356                 market for zirconium tetrachloride      zirconium      GLO

[1041 rows x 3 columns]

* Extracting classifications…

        Error for activity: market for lithium carbonate, battery grade,
classification: nan
                Inferring from reference product base: "lithium carbonate", from
reference product "lithium carbonate, battery grade"
        Error for activity: market for lithium hydroxide, battery grade,
classification: nan
                Inferring from reference product base: "lithium hydroxide", from
reference product "lithium hydroxide, battery grade"
        Error for activity: market for graphite, battery grade, classification:
nan
                Inferring from reference product base: "graphite", from
reference product "graphite, battery grade"

Saved activities list to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t_cutoff_3.9_remind_SSP2-Base_2065/material_activities.csv

*** Searching for material exchanges in
ecoinvent_cutoff_3.9_remind_SSP2-Base_2065 ***

*** Loading pickle to dataframe ***

There were 51396 matching exchanges found in
ecoinvent_cutoff_3.9_remind_SSP2-Base_2065

Saved material exchanges to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t_cutoff_3.9_remind_SSP2-Base_2065/material_exchanges.csv

*** Grouping material exchanges by material group

          1925 : aluminium
            26 : antimony
            24 : bauxite
             1 : beryllium
            15 : borates
            17 : cadmium
          2598 : cement
             3 : cerium
           425 : chromium
```

```
  146 : coal
  166 : cobalt
   71 : coke
 1064 : copper
    1 : dysprosium
24074 : electricity
    1 : erbium
    1 : europium
   22 : fluorspar
    1 : gadolinium
    4 : gallium
   10 : gold
   33 : graphite
   46 : helium
    1 : holmium
  389 : hydrogen
   13 : indium
   50 : latex
   52 : lithium
  264 : magnesium
 5825 : natural gas
  369 : nickel
   23 : palladium
  503 : petroleum
  207 : phosphate rock
  170 : platinum
   37 : rare earth
   11 : rhodium
  560 : sand
    1 : scandium
    9 : selenium
  364 : silicon
   50 : silver
   28 : strontium
    3 : tantalum
    2 : tellurium
  111 : tin
  457 : titanium
    5 : tungsten
  140 : uranium
   37 : vegetable oil
10438 : water
  592 : zinc
   11 : zirconium
```

```
** Pre-processing database (3/5): ecoinvent_cutoff_3.9_remind_SSP2-Base_2100**

{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent_cutoff_3.9_remind_SSP2-Base_2100',
'db_wmf_name': 'WasteAndMaterialFootprint'}

================================================================================
====================
         Starting WasteAndMaterialFootprint for
ecoinvent_cutoff_3.9_remind_SSP2-Base_2100
================================================================================
====================

*** Starting ExplodeDatabase ***
ExplodeDatabase uses wurst to open a bw2 database, explodes the exchanges for
each process, and then returns a pickle file with a DataFrame list of all
activities

** db: ecoinvent_cutoff_3.9_remind_SSP2-Base_2100, in project: WMFootprint-SSP-
cutoff_test will be processed

** Opening the sausage…
Getting activity data
100%|      | 22433/22433 [00:00<00:00, 220707.79it/s]
Adding exchange data to activities
100%|      | 692676/692676 [00:19<00:00, 35421.58it/s]
Filling out exchange data
100%|      | 22433/22433 [00:01<00:00, 14697.41it/s]


*** Extracting activities from db…

*** Exploding exchanges from activities…

*** Pickling…

 Pickle is: 52 MB

*** The sausage <ecoinvent_cutoff_3.9_remind_SSP2-Base_2100> was exploded and
pickled. Rejoice!

*** Starting SearchWaste ***
*** Loading pickle to dataframe ***
*** Searching for waste exchanges ***
        WasteFootprint_digestion        | kilogram              |      4
```

```
        WasteFootprint_composting       | kilogram             |     26
        WasteFootprint_open burning     | kilogram             |    535
        WasteFootprint_incineration     | kilogram             |   2171
        WasteFootprint_recycling        | kilogram             |    137
        WasteFootprint_landfill         | kilogram             |   1530
        WasteFootprint_hazardous        | kilogram             |   1928
        WasteFootprint_carbon dioxide   | kilogram             |    119
        WasteFootprint_total            | kilogram             |  29524
        WasteFootprint_digestion        | cubic meter          |     16
        WasteFootprint_composting       | cubic meter          |      0
        WasteFootprint_open burning     | cubic meter          |      0
        WasteFootprint_incineration     | cubic meter          |      2
        WasteFootprint_recycling        | cubic meter          |      0
        WasteFootprint_landfill         | cubic meter          |      2
        WasteFootprint_hazardous        | cubic meter          |    437
        WasteFootprint_carbon dioxide   | cubic meter          |      0
        WasteFootprint_total            | cubic meter          |   4360
*** Finished searching for waste exchanges ***

*** Starting SearchMaterial ***
*** Loading pickle to dataframe ***

*** Loading activities
from database: ecoinvent_cutoff_3.9_remind_SSP2-Base_2100
in project: WMFootprint-SSP-cutoff_test

** Materials (59) | (activity, group)
        ('market for aluminium', 'aluminium')
        ('market for antimony', 'antimony')
        ('market for bauxite', 'bauxite')
        ('market for beryllium', 'beryllium')
        ('market for bismuth', 'bismuth')
        ('market for cadmium', 'cadmium')
        ('market for calcium borates', 'borates')
        ('market for cement', 'cement')
        ('market for cerium', 'cerium')
        ('market for chromium', 'chromium')
        ('market for coal', 'coal')
        ('market for cobalt', 'cobalt')
        ('market for coke', 'coke')
        ('market for copper', 'copper')
        ('market for dysprosium', 'dysprosium')
        ('market for erbium', 'erbium')
        ('market for europium', 'europium')
        ('market for electricity,', 'electricity')
        ('market for ferroniobium,', 'niobium')
        ('market for fluorspar,', 'fluorspar')
        ('market for gadolinium', 'gadolinium')
```

```
        ('market for gallium', 'gallium')
        ('market for gold', 'gold')
        ('market for graphite', 'graphite')
        ('market for hafnium', 'hafnium')
        ('market for helium', 'helium')
        ('market for holmium', 'holmium')
        ('market for hydrogen,', 'hydrogen')
        ('market for indium', 'indium')
        ('market for latex', 'latex')
        ('market for lithium', 'lithium')
        ('market for magnesium', 'magnesium')
        ('market for natural gas,', 'natural gas')
        ('market for nickel', 'nickel')
        ('market for palladium', 'palladium')
        ('market for petroleum', 'petroleum')
        ('market for phosphate', 'phosphate rock')
        ('market for platinum', 'platinum')
        ('market for rare earth', 'rare earth')
        ('market for rhodium', 'rhodium')
        ('market for sand', 'sand')
        ('market for selenium', 'selenium')
        ('market for scandium', 'scandium')
        ('market for silicon', 'silicon')
        ('market for silver', 'silver')
        ('market for sodium borates', 'borates')
        ('market for strontium', 'strontium')
        ('market for tantalum', 'tantalum')
        ('market for tellurium', 'tellurium')
        ('market for tin', 'tin')
        ('market for titanium', 'titanium')
        ('market for uranium', 'uranium')
        ('market for tungsten', 'tungsten')
        ('market for vanadium', 'vanadium')
        ('market for vegetable oil,', 'vegetable oil')
        ('market for tap water', 'water')
        ('market for water,', 'water')
        ('market for zinc', 'zinc')
        ('market for zirconium', 'zirconium')

* 1041 material markets were found:
                                                 name material_group location
523                   market for aluminium alloy, AlLi      aluminium      GLO
219                  market for aluminium alloy, AlMg3      aluminium      GLO
729  market for aluminium alloy, metal matrix compo…      aluminium      GLO
907  market for aluminium around steel bi-metal str…      aluminium      GLO
656  market for aluminium around steel bi-metal wir…      aluminium      GLO
..                                                 …            …      …
200                              market for zinc slag           zinc      GLO
```

```
879                           market for zinc sulfide           zinc      GLO
373                         market for zirconium oxide      zirconium      GLO
166         market for zirconium sponge, nuclear-grade      zirconium      GLO
273                  market for zirconium tetrachloride      zirconium      GLO

[1041 rows x 3 columns]

* Extracting classifications…

        Error for activity: market for graphite, battery grade, classification:
nan
                Inferring from reference product base: "graphite", from
reference product "graphite, battery grade"
        Error for activity: market for lithium hydroxide, battery grade,
classification: nan
                Inferring from reference product base: "lithium hydroxide", from
reference product "lithium hydroxide, battery grade"
        Error for activity: market for lithium carbonate, battery grade,
classification: nan
                Inferring from reference product base: "lithium carbonate", from
reference product "lithium carbonate, battery grade"

Saved activities list to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t_cutoff_3.9_remind_SSP2-Base_2100/material_activities.csv

*** Searching for material exchanges in
ecoinvent_cutoff_3.9_remind_SSP2-Base_2100 ***

*** Loading pickle to dataframe ***

There were 51396 matching exchanges found in
ecoinvent_cutoff_3.9_remind_SSP2-Base_2100

Saved material exchanges to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t_cutoff_3.9_remind_SSP2-Base_2100/material_exchanges.csv

*** Grouping material exchanges by material group

          1925 : aluminium
            26 : antimony
            24 : bauxite
             1 : beryllium
            15 : borates
            17 : cadmium
          2598 : cement
             3 : cerium
```

```
  425 : chromium
  146 : coal
  166 : cobalt
   71 : coke
 1064 : copper
    1 : dysprosium
24074 : electricity
    1 : erbium
    1 : europium
   22 : fluorspar
    1 : gadolinium
    4 : gallium
   10 : gold
   33 : graphite
   46 : helium
    1 : holmium
  389 : hydrogen
   13 : indium
   50 : latex
   52 : lithium
  264 : magnesium
 5825 : natural gas
  369 : nickel
   23 : palladium
  503 : petroleum
  207 : phosphate rock
  170 : platinum
   37 : rare earth
   11 : rhodium
  560 : sand
    1 : scandium
    9 : selenium
  364 : silicon
   50 : silver
   28 : strontium
    3 : tantalum
    2 : tellurium
  111 : tin
  457 : titanium
    5 : tungsten
  140 : uranium
   37 : vegetable oil
10438 : water
  592 : zinc
   11 : zirconium
```

```
--------------------------------------------------------------------------------

** Pre-processing database (4/5):
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065**

{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065',
'db_wmf_name': 'WasteAndMaterialFootprint'}

================================================================================
====================
         Starting WasteAndMaterialFootprint for
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065
================================================================================
====================

*** Starting ExplodeDatabase ***
ExplodeDatabase uses wurst to open a bw2 database, explodes the exchanges for
each process, and then returns a pickle file with a DataFrame list of all
activities

** db: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065, in project: WMFootprint-
SSP-cutoff_test will be processed

** Opening the sausage…
Getting activity data
100%|      | 22433/22433 [00:00<00:00, 28568.53it/s]
Adding exchange data to activities
100%|      | 692676/692676 [00:22<00:00, 30689.12it/s]
Filling out exchange data
100%|      | 22433/22433 [00:01<00:00, 13019.77it/s]


*** Extracting activities from db…

*** Exploding exchanges from activities…

*** Pickling…

 Pickle is: 52 MB

*** The sausage <ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065> was exploded
and pickled. Rejoice!

*** Starting SearchWaste ***
*** Loading pickle to dataframe ***
```

```
*** Searching for waste exchanges ***
        WasteFootprint_digestion        | kilogram             |      4
        WasteFootprint_composting       | kilogram             |     26
        WasteFootprint_open burning     | kilogram             |    535
        WasteFootprint_incineration     | kilogram             |   2171
        WasteFootprint_recycling        | kilogram             |    137
        WasteFootprint_landfill         | kilogram             |   1530
        WasteFootprint_hazardous        | kilogram             |   1928
        WasteFootprint_carbon dioxide   | kilogram             |    119
        WasteFootprint_total            | kilogram             |  29524
        WasteFootprint_digestion        | cubic meter          |     16
        WasteFootprint_composting       | cubic meter          |      0
        WasteFootprint_open burning     | cubic meter          |      0
        WasteFootprint_incineration     | cubic meter          |      2
        WasteFootprint_recycling        | cubic meter          |      0
        WasteFootprint_landfill         | cubic meter          |      2
        WasteFootprint_hazardous        | cubic meter          |    437
        WasteFootprint_carbon dioxide   | cubic meter          |      0
        WasteFootprint_total            | cubic meter          |   4360
*** Finished searching for waste exchanges ***

*** Starting SearchMaterial ***
*** Loading pickle to dataframe ***

*** Loading activities
from database: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065
in project: WMFootprint-SSP-cutoff_test

** Materials (59) | (activity, group)
        ('market for aluminium', 'aluminium')
        ('market for antimony', 'antimony')
        ('market for bauxite', 'bauxite')
        ('market for beryllium', 'beryllium')
        ('market for bismuth', 'bismuth')
        ('market for cadmium', 'cadmium')
        ('market for calcium borates', 'borates')
        ('market for cement', 'cement')
        ('market for cerium', 'cerium')
        ('market for chromium', 'chromium')
        ('market for coal', 'coal')
        ('market for cobalt', 'cobalt')
        ('market for coke', 'coke')
        ('market for copper', 'copper')
        ('market for dysprosium', 'dysprosium')
        ('market for erbium', 'erbium')
        ('market for europium', 'europium')
        ('market for electricity,', 'electricity')
        ('market for ferroniobium,', 'niobium')
```

```
        ('market for fluorspar,', 'fluorspar')
        ('market for gadolinium', 'gadolinium')
        ('market for gallium', 'gallium')
        ('market for gold', 'gold')
        ('market for graphite', 'graphite')
        ('market for hafnium', 'hafnium')
        ('market for helium', 'helium')
        ('market for holmium', 'holmium')
        ('market for hydrogen,', 'hydrogen')
        ('market for indium', 'indium')
        ('market for latex', 'latex')
        ('market for lithium', 'lithium')
        ('market for magnesium', 'magnesium')
        ('market for natural gas,', 'natural gas')
        ('market for nickel', 'nickel')
        ('market for palladium', 'palladium')
        ('market for petroleum', 'petroleum')
        ('market for phosphate', 'phosphate rock')
        ('market for platinum', 'platinum')
        ('market for rare earth', 'rare earth')
        ('market for rhodium', 'rhodium')
        ('market for sand', 'sand')
        ('market for selenium', 'selenium')
        ('market for scandium', 'scandium')
        ('market for silicon', 'silicon')
        ('market for silver', 'silver')
        ('market for sodium borates', 'borates')
        ('market for strontium', 'strontium')
        ('market for tantalum', 'tantalum')
        ('market for tellurium', 'tellurium')
        ('market for tin', 'tin')
        ('market for titanium', 'titanium')
        ('market for uranium', 'uranium')
        ('market for tungsten', 'tungsten')
        ('market for vanadium', 'vanadium')
        ('market for vegetable oil,', 'vegetable oil')
        ('market for tap water', 'water')
        ('market for water,', 'water')
        ('market for zinc', 'zinc')
        ('market for zirconium', 'zirconium')

* 1041 material markets were found:
                                                    name material_group  \
830                    market for aluminium alloy, AlLi      aluminium
608                   market for aluminium alloy, AlMg3      aluminium
850   market for aluminium alloy, metal matrix compo…      aluminium
1009  market for aluminium around steel bi-metal str…      aluminium
73    market for aluminium around steel bi-metal wir…      aluminium
```

```
…                                                    …            …
218                              market for zinc slag           zinc
282                            market for zinc sulfide           zinc
571                          market for zirconium oxide      zirconium
537          market for zirconium sponge, nuclear-grade      zirconium
168                  market for zirconium tetrachloride      zirconium

     location
830       GLO
608       GLO
850       GLO
1009      GLO
73        GLO
…         …
218       GLO
282       GLO
571       GLO
537       GLO
168       GLO

[1041 rows x 3 columns]

* Extracting classifications…

        Error for activity: market for graphite, battery grade, classification:
nan
                Inferring from reference product base: "graphite", from
reference product "graphite, battery grade"
        Error for activity: market for lithium hydroxide, battery grade,
classification: nan
                Inferring from reference product base: "lithium hydroxide", from
reference product "lithium hydroxide, battery grade"
        Error for activity: market for lithium carbonate, battery grade,
classification: nan
                Inferring from reference product base: "lithium carbonate", from
reference product "lithium carbonate, battery grade"

Saved activities list to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t_cutoff_3.9_remind_SSP2-PkBudg500_2065/material_activities.csv

*** Searching for material exchanges in
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065 ***

*** Loading pickle to dataframe ***

There were 51396 matching exchanges found in
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065
```

```
Saved material exchanges to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t_cutoff_3.9_remind_SSP2-PkBudg500_2065/material_exchanges.csv

*** Grouping material exchanges by material group

          1925 : aluminium
            26 : antimony
            24 : bauxite
             1 : beryllium
            15 : borates
            17 : cadmium
          2598 : cement
             3 : cerium
           425 : chromium
           146 : coal
           166 : cobalt
            71 : coke
          1064 : copper
             1 : dysprosium
         24074 : electricity
             1 : erbium
             1 : europium
            22 : fluorspar
             1 : gadolinium
             4 : gallium
            10 : gold
            33 : graphite
            46 : helium
             1 : holmium
           389 : hydrogen
            13 : indium
            50 : latex
            52 : lithium
           264 : magnesium
          5825 : natural gas
           369 : nickel
            23 : palladium
           503 : petroleum
           207 : phosphate rock
           170 : platinum
            37 : rare earth
            11 : rhodium
           560 : sand
             1 : scandium
             9 : selenium
           364 : silicon
```

```
            50 : silver
            28 : strontium
             3 : tantalum
             2 : tellurium
           111 : tin
           457 : titanium
             5 : tungsten
           140 : uranium
            37 : vegetable oil
         10438 : water
           592 : zinc
            11 : zirconium

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** Pre-processing database (5/5):
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100**

{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100',
'db_wmf_name': 'WasteAndMaterialFootprint'}

================================================================================
====================
         Starting WasteAndMaterialFootprint for
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100
================================================================================
====================

*** Starting ExplodeDatabase ***
ExplodeDatabase uses wurst to open a bw2 database, explodes the exchanges for
each process, and then returns a pickle file with a DataFrame list of all
activities

** db: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100, in project: WMFootprint-
SSP-cutoff_test will be processed

** Opening the sausage…
Getting activity data

100%|      | 22433/22433 [00:00<00:00, 169095.50it/s]

Adding exchange data to activities

100%|      | 692676/692676 [00:23<00:00, 29821.18it/s]

Filling out exchange data
```

```
100%|      | 22433/22433 [00:01<00:00, 14191.14it/s]

*** Extracting activities from db…

*** Exploding exchanges from activities…

*** Pickling…

 Pickle is: 52 MB

*** The sausage <ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100> was exploded
and pickled. Rejoice!

*** Starting SearchWaste ***
*** Loading pickle to dataframe ***
*** Searching for waste exchanges ***
        WasteFootprint_digestion        | kilogram             |      4
        WasteFootprint_composting       | kilogram             |     26
        WasteFootprint_open burning     | kilogram             |    535
        WasteFootprint_incineration     | kilogram             |   2171
        WasteFootprint_recycling        | kilogram             |    137
        WasteFootprint_landfill         | kilogram             |   1530
        WasteFootprint_hazardous        | kilogram             |   1928
        WasteFootprint_carbon dioxide   | kilogram             |    119
        WasteFootprint_total            | kilogram             |  29524
        WasteFootprint_digestion        | cubic meter          |     16
        WasteFootprint_composting       | cubic meter          |      0
        WasteFootprint_open burning     | cubic meter          |      0
        WasteFootprint_incineration     | cubic meter          |      2
        WasteFootprint_recycling        | cubic meter          |      0
        WasteFootprint_landfill         | cubic meter          |      2
        WasteFootprint_hazardous        | cubic meter          |    437
        WasteFootprint_carbon dioxide   | cubic meter          |      0
        WasteFootprint_total            | cubic meter          |   4360
*** Finished searching for waste exchanges ***

*** Starting SearchMaterial ***
*** Loading pickle to dataframe ***

*** Loading activities
from database: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100
in project: WMFootprint-SSP-cutoff_test

** Materials (59) | (activity, group)
        ('market for aluminium', 'aluminium')
        ('market for antimony', 'antimony')
        ('market for bauxite', 'bauxite')
```

```
('market for beryllium', 'beryllium')
('market for bismuth', 'bismuth')
('market for cadmium', 'cadmium')
('market for calcium borates', 'borates')
('market for cement', 'cement')
('market for cerium', 'cerium')
('market for chromium', 'chromium')
('market for coal', 'coal')
('market for cobalt', 'cobalt')
('market for coke', 'coke')
('market for copper', 'copper')
('market for dysprosium', 'dysprosium')
('market for erbium', 'erbium')
('market for europium', 'europium')
('market for electricity,', 'electricity')
('market for ferroniobium,', 'niobium')
('market for fluorspar,', 'fluorspar')
('market for gadolinium', 'gadolinium')
('market for gallium', 'gallium')
('market for gold', 'gold')
('market for graphite', 'graphite')
('market for hafnium', 'hafnium')
('market for helium', 'helium')
('market for holmium', 'holmium')
('market for hydrogen,', 'hydrogen')
('market for indium', 'indium')
('market for latex', 'latex')
('market for lithium', 'lithium')
('market for magnesium', 'magnesium')
('market for natural gas,', 'natural gas')
('market for nickel', 'nickel')
('market for palladium', 'palladium')
('market for petroleum', 'petroleum')
('market for phosphate', 'phosphate rock')
('market for platinum', 'platinum')
('market for rare earth', 'rare earth')
('market for rhodium', 'rhodium')
('market for sand', 'sand')
('market for selenium', 'selenium')
('market for scandium', 'scandium')
('market for silicon', 'silicon')
('market for silver', 'silver')
('market for sodium borates', 'borates')
('market for strontium', 'strontium')
('market for tantalum', 'tantalum')
('market for tellurium', 'tellurium')
('market for tin', 'tin')
('market for titanium', 'titanium')
```

```
        ('market for uranium', 'uranium')
        ('market for tungsten', 'tungsten')
        ('market for vanadium', 'vanadium')
        ('market for vegetable oil,', 'vegetable oil')
        ('market for tap water', 'water')
        ('market for water,', 'water')
        ('market for zinc', 'zinc')
        ('market for zirconium', 'zirconium')

* 1041 material markets were found:
                                                  name material_group location
232                   market for aluminium alloy, AlLi      aluminium      GLO
898                  market for aluminium alloy, AlMg3      aluminium      GLO
873  market for aluminium alloy, metal matrix compo…      aluminium      GLO
757  market for aluminium around steel bi-metal str…      aluminium      GLO
0    market for aluminium around steel bi-metal wir…      aluminium      GLO
..                                                 …            …      …
673                              market for zinc slag           zinc      GLO
91                             market for zinc sulfide           zinc      GLO
864                          market for zirconium oxide      zirconium      GLO
468         market for zirconium sponge, nuclear-grade      zirconium      GLO
941                 market for zirconium tetrachloride      zirconium      GLO

[1041 rows x 3 columns]

* Extracting classifications…

        Error for activity: market for lithium carbonate, battery grade,
classification: nan
                Inferring from reference product base: "lithium carbonate", from
reference product "lithium carbonate, battery grade"
        Error for activity: market for graphite, battery grade, classification:
nan
                Inferring from reference product base: "graphite", from
reference product "graphite, battery grade"
        Error for activity: market for lithium hydroxide, battery grade,
classification: nan
                Inferring from reference product base: "lithium hydroxide", from
reference product "lithium hydroxide, battery grade"

Saved activities list to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t_cutoff_3.9_remind_SSP2-PkBudg500_2100/material_activities.csv

*** Searching for material exchanges in
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100 ***

*** Loading pickle to dataframe ***
```

```
There were 51396 matching exchanges found in
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100

Saved material exchanges to csv:
/home/stew/code/gh/WasteAndMaterialFootprint/data/SearchMaterialResults/ecoinven
t_cutoff_3.9_remind_SSP2-PkBudg500_2100/material_exchanges.csv

*** Grouping material exchanges by material group

          1925 : aluminium
            26 : antimony
            24 : bauxite
             1 : beryllium
            15 : borates
            17 : cadmium
          2598 : cement
             3 : cerium
           425 : chromium
           146 : coal
           166 : cobalt
            71 : coke
          1064 : copper
             1 : dysprosium
         24074 : electricity
             1 : erbium
             1 : europium
            22 : fluorspar
             1 : gadolinium
             4 : gallium
            10 : gold
            33 : graphite
            46 : helium
             1 : holmium
           389 : hydrogen
            13 : indium
            50 : latex
            52 : lithium
           264 : magnesium
          5825 : natural gas
           369 : nickel
            23 : palladium
           503 : petroleum
           207 : phosphate rock
           170 : platinum
            37 : rare earth
            11 : rhodium
           560 : sand
```

```
    1 : scandium
    9 : selenium
  364 : silicon
   50 : silver
   28 : strontium
    3 : tantalum
    2 : tellurium
  111 : tin
  457 : titanium
    5 : tungsten
  140 : uranium
   37 : vegetable oil
10438 : water
  592 : zinc
   11 : zirconium

--------------------------------------------------------------------------------


*** Writing custom database file: WasteAndMaterialFootprint


*** Appending to existing custom database file: WasteAndMaterialFootprint

        Appending: MaterialFootprint_aluminium
        Appending: MaterialFootprint_antimony
        Appending: MaterialFootprint_bauxite
        Appending: MaterialFootprint_beryllium
        Appending: MaterialFootprint_borates
        Appending: MaterialFootprint_cadmium
        Appending: MaterialFootprint_cement
        Appending: MaterialFootprint_cerium
        Appending: MaterialFootprint_chromium
        Appending: MaterialFootprint_coal
        Appending: MaterialFootprint_cobalt
        Appending: MaterialFootprint_coke
        Appending: MaterialFootprint_copper
        Appending: MaterialFootprint_dysprosium
        Appending: MaterialFootprint_electricity
        Appending: MaterialFootprint_erbium
        Appending: MaterialFootprint_europium
        Appending: MaterialFootprint_fluorspar
        Appending: MaterialFootprint_gadolinium
        Appending: MaterialFootprint_gallium
        Appending: MaterialFootprint_gold
        Appending: MaterialFootprint_graphite
        Appending: MaterialFootprint_helium
```

```
        Appending: MaterialFootprint_holmium
        Appending: MaterialFootprint_hydrogen
        Appending: MaterialFootprint_indium
        Appending: MaterialFootprint_latex
        Appending: MaterialFootprint_lithium
        Appending: MaterialFootprint_magnesium
        Appending: MaterialFootprint_natural gas
        Appending: MaterialFootprint_nickel
        Appending: MaterialFootprint_palladium
        Appending: MaterialFootprint_petroleum
        Appending: MaterialFootprint_phosphate rock
        Appending: MaterialFootprint_platinum
        Appending: MaterialFootprint_rare earth
        Appending: MaterialFootprint_rhodium
        Appending: MaterialFootprint_sand
        Appending: MaterialFootprint_scandium
        Appending: MaterialFootprint_selenium
        Appending: MaterialFootprint_silicon
        Appending: MaterialFootprint_silver
        Appending: MaterialFootprint_strontium
        Appending: MaterialFootprint_tantalum
        Appending: MaterialFootprint_tellurium
        Appending: MaterialFootprint_tin
        Appending: MaterialFootprint_titanium
        Appending: MaterialFootprint_tungsten
        Appending: MaterialFootprint_uranium
        Appending: MaterialFootprint_vegetable oil
        Appending: MaterialFootprint_water
        Appending: MaterialFootprint_zinc
        Appending: MaterialFootprint_zirconium
        Appending: WasteFootprint_carbondioxide-kilogram
        Appending: WasteFootprint_composting-kilogram
        Appending: WasteFootprint_digestion-cubicmeter
        Appending: WasteFootprint_digestion-kilogram
        Appending: WasteFootprint_hazardous-cubicmeter
        Appending: WasteFootprint_hazardous-kilogram
        Appending: WasteFootprint_incineration-cubicmeter
        Appending: WasteFootprint_incineration-kilogram
        Appending: WasteFootprint_landfill-cubicmeter
        Appending: WasteFootprint_landfill-kilogram
        Appending: WasteFootprint_openburning-kilogram
        Appending: WasteFootprint_recycling-kilogram
        Appending: WasteFootprint_total-cubicmeter
        Appending: WasteFootprint_total-kilogram

** Added 67 entries to the xlsx for the custom waste and material database:
       WasteAndMaterialFootprint
```

```
** Importing the custom database WasteAndMaterialFootprint**
         to the brightway2 project: WMFootprint-SSP-cutoff_test

** Running BW2io ExcelImporter **

Extracted 1 worksheets in 0.01 seconds
Applying strategy: csv_restore_tuples
Applying strategy: csv_restore_booleans
Applying strategy: csv_numerize
Applying strategy: csv_drop_unknown
Applying strategy: csv_add_missing_exchanges_section
Applying strategy: normalize_units
Applying strategy: normalize_biosphere_categories
Applying strategy: normalize_biosphere_names
Applying strategy: strip_biosphere_exc_locations
Applying strategy: set_code_by_activity_hash
Applying strategy: link_iterable_by_fields
Applying strategy: assign_only_product_as_production
Applying strategy: link_technosphere_by_activity_hash
Applying strategy: drop_falsey_uncertainty_fields_but_keep_zeros
Applying strategy: convert_uncertainty_types_to_integers
Applying strategy: convert_activity_parameters_to_list
Applied 16 strategies in 3.88 seconds
67 datasets
0 exchanges
0 unlinked exchanges

Warning: No valid output stream.
Title: Writing activities to SQLite3 database:
  Started: 12/30/2023 11:31:14
  Finished: 12/30/2023 11:31:14
  Total time elapsed: 00:00:00
  CPU %: 0.00
  Memory %: 35.15
Created database: WasteAndMaterialFootprint

** Database metadata **
format: Excel
depends: []
backend: sqlite
number: 67
modified: 2023-12-30T11:31:14.732004
searchable: True
processed: 2023-12-30T11:31:14.925335

*** Great success! ***

*** Running AddMethods() ***
```

```
        ('WasteAndMaterialFootprint', 'Demand: Aluminium', 'Aluminium')
        ('WasteAndMaterialFootprint', 'Demand: Antimony', 'Antimony')
        ('WasteAndMaterialFootprint', 'Demand: Bauxite', 'Bauxite')
        ('WasteAndMaterialFootprint', 'Demand: Beryllium', 'Beryllium')
        ('WasteAndMaterialFootprint', 'Demand: Borates', 'Borates')
        ('WasteAndMaterialFootprint', 'Demand: Cadmium', 'Cadmium')
        ('WasteAndMaterialFootprint', 'Demand: Cement', 'Cement')
        ('WasteAndMaterialFootprint', 'Demand: Cerium', 'Cerium')
        ('WasteAndMaterialFootprint', 'Demand: Chromium', 'Chromium')
        ('WasteAndMaterialFootprint', 'Demand: Coal', 'Coal')
        ('WasteAndMaterialFootprint', 'Demand: Cobalt', 'Cobalt')
        ('WasteAndMaterialFootprint', 'Demand: Coke', 'Coke')
        ('WasteAndMaterialFootprint', 'Demand: Copper', 'Copper')
        ('WasteAndMaterialFootprint', 'Demand: Dysprosium', 'Dysprosium')
        ('WasteAndMaterialFootprint', 'Demand: Electricity', 'Electricity')
        ('WasteAndMaterialFootprint', 'Demand: Erbium', 'Erbium')
        ('WasteAndMaterialFootprint', 'Demand: Europium', 'Europium')
        ('WasteAndMaterialFootprint', 'Demand: Fluorspar', 'Fluorspar')
        ('WasteAndMaterialFootprint', 'Demand: Gadolinium', 'Gadolinium')
        ('WasteAndMaterialFootprint', 'Demand: Gallium', 'Gallium')
        ('WasteAndMaterialFootprint', 'Demand: Gold', 'Gold')
        ('WasteAndMaterialFootprint', 'Demand: Graphite', 'Graphite')
        ('WasteAndMaterialFootprint', 'Demand: Helium', 'Helium')
        ('WasteAndMaterialFootprint', 'Demand: Holmium', 'Holmium')
        ('WasteAndMaterialFootprint', 'Demand: Hydrogen', 'Hydrogen')
        ('WasteAndMaterialFootprint', 'Demand: Indium', 'Indium')
        ('WasteAndMaterialFootprint', 'Demand: Latex', 'Latex')
        ('WasteAndMaterialFootprint', 'Demand: Lithium', 'Lithium')
        ('WasteAndMaterialFootprint', 'Demand: Magnesium', 'Magnesium')
        ('WasteAndMaterialFootprint', 'Demand: Natural gas', 'Natural gas')
        ('WasteAndMaterialFootprint', 'Demand: Nickel', 'Nickel')
        ('WasteAndMaterialFootprint', 'Demand: Palladium', 'Palladium')
        ('WasteAndMaterialFootprint', 'Demand: Petroleum', 'Petroleum')
        ('WasteAndMaterialFootprint', 'Demand: Phosphate rock', 'Phosphate
rock')
        ('WasteAndMaterialFootprint', 'Demand: Platinum', 'Platinum')
        ('WasteAndMaterialFootprint', 'Demand: Rare earth', 'Rare earth')
        ('WasteAndMaterialFootprint', 'Demand: Rhodium', 'Rhodium')
        ('WasteAndMaterialFootprint', 'Demand: Sand', 'Sand')
        ('WasteAndMaterialFootprint', 'Demand: Scandium', 'Scandium')
        ('WasteAndMaterialFootprint', 'Demand: Selenium', 'Selenium')
        ('WasteAndMaterialFootprint', 'Demand: Silicon', 'Silicon')
        ('WasteAndMaterialFootprint', 'Demand: Silver', 'Silver')
        ('WasteAndMaterialFootprint', 'Demand: Strontium', 'Strontium')
        ('WasteAndMaterialFootprint', 'Demand: Tantalum', 'Tantalum')
        ('WasteAndMaterialFootprint', 'Demand: Tellurium', 'Tellurium')
        ('WasteAndMaterialFootprint', 'Demand: Tin', 'Tin')
```

```
        ('WasteAndMaterialFootprint', 'Demand: Titanium', 'Titanium')
        ('WasteAndMaterialFootprint', 'Demand: Tungsten', 'Tungsten')
        ('WasteAndMaterialFootprint', 'Demand: Uranium', 'Uranium')
        ('WasteAndMaterialFootprint', 'Demand: Vegetable oil', 'Vegetable oil')
        ('WasteAndMaterialFootprint', 'Demand: Water', 'Water')
        ('WasteAndMaterialFootprint', 'Demand: Zinc', 'Zinc')
        ('WasteAndMaterialFootprint', 'Demand: Zirconium', 'Zirconium')
        ('WasteAndMaterialFootprint', 'Waste: Carbondioxide combined',
'Carbondioxide (kg)')
        ('WasteAndMaterialFootprint', 'Waste: Composting combined', 'Composting
(kg)')
        ('WasteAndMaterialFootprint', 'Waste: Digestion combined', 'Digestion
(m3)')
        ('WasteAndMaterialFootprint', 'Waste: Digestion combined', 'Digestion
(kg)')
        ('WasteAndMaterialFootprint', 'Waste: Hazardous combined', 'Hazardous
(m3)')
        ('WasteAndMaterialFootprint', 'Waste: Hazardous combined', 'Hazardous
(kg)')
        ('WasteAndMaterialFootprint', 'Waste: Incineration combined',
'Incineration (m3)')
        ('WasteAndMaterialFootprint', 'Waste: Incineration combined',
'Incineration (kg)')
        ('WasteAndMaterialFootprint', 'Waste: Landfill combined', 'Landfill
(m3)')
        ('WasteAndMaterialFootprint', 'Waste: Landfill combined', 'Landfill
(kg)')
        ('WasteAndMaterialFootprint', 'Waste: Openburning combined',
'Openburning (kg)')
        ('WasteAndMaterialFootprint', 'Waste: Recycling combined', 'Recycling
(kg)')
        ('WasteAndMaterialFootprint', 'Waste: Total combined', 'Total (m3)')
        ('WasteAndMaterialFootprint', 'Waste: Total combined', 'Total (kg)')

*** Added 67  new methods ***

------------------------------------------------------------------------------
    *** Preprocessing completed ***

        Total databases:          5
        Successfully processed:   5
        Duration:                 0:04:16 (h:m:s)
------------------------------------------------------------------------------



------------------------------------------------------------------------------
```

```
** Processing database (1/5): ecoinvent-3.9.1-cutoff**
Arguments:
{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent-3.9.1-cutoff', 'db_wmf_name':
'WasteAndMaterialFootprint'}


*** ExchangeEditor() is running for ecoinvent-3.9.1-cutoff ***

* Appending waste and material exchanges in WasteAndMaterialFootprint


 -  1/66 : MaterialFootprint_aluminium                |
                | 100.0% | Progress:  1822 of 1822  |
Elapsed: 00:23 | Remaining: 00:00
 -  2/66 : MaterialFootprint_antimony                 |
                | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 -  3/66 : MaterialFootprint_bauxite                  |
                | 100.0% | Progress:    24 of 24    |
Elapsed: 00:00 | Remaining: 00:00
 -  4/66 : MaterialFootprint_beryllium                |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 -  5/66 : MaterialFootprint_borates                  |
                | 100.0% | Progress:    15 of 15    |
Elapsed: 00:00 | Remaining: 00:00
 -  6/66 : MaterialFootprint_cadmium                  |
                | 100.0% | Progress:    17 of 17    |
Elapsed: 00:00 | Remaining: 00:00
 -  7/66 : MaterialFootprint_cement                   |
                | 100.0% | Progress:  2575 of 2575  |
Elapsed: 00:28 | Remaining: 00:00
 -  8/66 : MaterialFootprint_cerium                   |
                | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 -  9/66 : MaterialFootprint_chromium                 |
                | 100.0% | Progress:   410 of 410   |
Elapsed: 00:04 | Remaining: 00:00
 - 10/66 : MaterialFootprint_coal                     |
                | 100.0% | Progress:   146 of 146   |
Elapsed: 00:01 | Remaining: 00:00
 - 11/66 : MaterialFootprint_cobalt                   |
                | 100.0% | Progress:   166 of 166   |
Elapsed: 00:01 | Remaining: 00:00
 - 12/66 : MaterialFootprint_coke                     |
                | 100.0% | Progress:    68 of 68    |
Elapsed: 00:00 | Remaining: 00:00
```

```
 - 13/66 : MaterialFootprint_copper                    |
                | 100.0% | Progress:   915 of 915    |
Elapsed: 00:10 | Remaining: 00:00
 - 14/66 : MaterialFootprint_dysprosium                |
                | 100.0% | Progress:     1 of 1      |
Elapsed: 00:00 | Remaining: 00:00
 - 15/66 : MaterialFootprint_electricity               |
                | 100.0% | Progress: 23823 of 23823 |
Elapsed: 04:16 | Remaining: 00:00
 - 16/66 : MaterialFootprint_erbium                    |
                | 100.0% | Progress:     1 of 1      |
Elapsed: 00:00 | Remaining: 00:00
 - 17/66 : MaterialFootprint_europium                  |
                | 100.0% | Progress:     1 of 1      |
Elapsed: 00:00 | Remaining: 00:00
 - 18/66 : MaterialFootprint_fluorspar                 |
                | 100.0% | Progress:    22 of 22     |
Elapsed: 00:00 | Remaining: 00:00
 - 19/66 : MaterialFootprint_gadolinium                |
                | 100.0% | Progress:     1 of 1      |
Elapsed: 00:00 | Remaining: 00:00
 - 20/66 : MaterialFootprint_gallium                   |
                | 100.0% | Progress:     3 of 3      |
Elapsed: 00:00 | Remaining: 00:00
 - 21/66 : MaterialFootprint_gold                      |
                | 100.0% | Progress:    10 of 10     |
Elapsed: 00:00 | Remaining: 00:00
 - 22/66 : MaterialFootprint_graphite                  |
                | 100.0% | Progress:    30 of 30     |
Elapsed: 00:00 | Remaining: 00:00
 - 23/66 : MaterialFootprint_helium                    |
                | 100.0% | Progress:    43 of 43     |
Elapsed: 00:00 | Remaining: 00:00
 - 24/66 : MaterialFootprint_holmium                   |
                | 100.0% | Progress:     1 of 1      |
Elapsed: 00:00 | Remaining: 00:00
 - 25/66 : MaterialFootprint_hydrogen                  |
                | 100.0% | Progress:   377 of 377    |
Elapsed: 00:04 | Remaining: 00:00
 - 26/66 : MaterialFootprint_indium                    |
                | 100.0% | Progress:    13 of 13     |
Elapsed: 00:00 | Remaining: 00:00
 - 27/66 : MaterialFootprint_latex                     |
                | 100.0% | Progress:    49 of 49     |
Elapsed: 00:00 | Remaining: 00:00
 - 28/66 : MaterialFootprint_lithium                   |
                | 100.0% | Progress:    43 of 43     |
Elapsed: 00:00 | Remaining: 00:00
```

```
 - 29/66 : MaterialFootprint_magnesium                |
                | 100.0% | Progress:   250 of 250   |
Elapsed: 00:02 | Remaining: 00:00
 - 30/66 : MaterialFootprint_natural gas              |
                | 100.0% | Progress:  5804 of 5804  |
Elapsed: 01:02 | Remaining: 00:00
 - 31/66 : MaterialFootprint_nickel                   |
                | 100.0% | Progress:   342 of 342   |
Elapsed: 00:03 | Remaining: 00:00
 - 32/66 : MaterialFootprint_palladium                |
                | 100.0% | Progress:    22 of 22    |
Elapsed: 00:00 | Remaining: 00:00
 - 33/66 : MaterialFootprint_petroleum                |
                | 100.0% | Progress:   503 of 503   |
Elapsed: 00:05 | Remaining: 00:00
 - 34/66 : MaterialFootprint_phosphate rock           |
                | 100.0% | Progress:   207 of 207   |
Elapsed: 00:02 | Remaining: 00:00
 - 35/66 : MaterialFootprint_platinum                 |
                | 100.0% | Progress:   164 of 164   |
Elapsed: 00:01 | Remaining: 00:00
 - 36/66 : MaterialFootprint_rare earth               |
                | 100.0% | Progress:    37 of 37    |
Elapsed: 00:00 | Remaining: 00:00
 - 37/66 : MaterialFootprint_rhodium                  |
                | 100.0% | Progress:    11 of 11    |
Elapsed: 00:00 | Remaining: 00:00
 - 38/66 : MaterialFootprint_sand                     |
                | 100.0% | Progress:   553 of 553   |
Elapsed: 00:05 | Remaining: 00:00
 - 39/66 : MaterialFootprint_scandium                 |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 40/66 : MaterialFootprint_selenium                 |
                | 100.0% | Progress:     9 of 9     |
Elapsed: 00:00 | Remaining: 00:00
 - 41/66 : MaterialFootprint_silicon                  |
                | 100.0% | Progress:   358 of 358   |
Elapsed: 00:03 | Remaining: 00:00
 - 42/66 : MaterialFootprint_silver                   |
                | 100.0% | Progress:    46 of 46    |
Elapsed: 00:00 | Remaining: 00:00
 - 43/66 : MaterialFootprint_strontium                |
                | 100.0% | Progress:    27 of 27    |
Elapsed: 00:00 | Remaining: 00:00
 - 44/66 : MaterialFootprint_tantalum                 |
                | 100.0% | Progress:     3 of 3     |
Elapsed: 00:00 | Remaining: 00:00
```

```
 - 45/66 : MaterialFootprint_tellurium                |
                 | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 46/66 : MaterialFootprint_tin                      |
                 | 100.0% | Progress:   103 of 103   |
Elapsed: 00:01 | Remaining: 00:00
 - 47/66 : MaterialFootprint_titanium                 |
                 | 100.0% | Progress:   454 of 454   |
Elapsed: 00:04 | Remaining: 00:00
 - 48/66 : MaterialFootprint_tungsten                 |
                 | 100.0% | Progress:     5 of 5     |
Elapsed: 00:00 | Remaining: 00:00
 - 49/66 : MaterialFootprint_uranium                  |
                 | 100.0% | Progress:   136 of 136   |
Elapsed: 00:01 | Remaining: 00:00
 - 50/66 : MaterialFootprint_vegetable oil            |
                 | 100.0% | Progress:    34 of 34    |
Elapsed: 00:00 | Remaining: 00:00
 - 51/66 : MaterialFootprint_water                    |
                 | 100.0% | Progress: 10145 of 10145 |
Elapsed: 02:15 | Remaining: 00:00
 - 52/66 : MaterialFootprint_zinc                     |
                 | 100.0% | Progress:   557 of 557   |
Elapsed: 00:09 | Remaining: 00:00
 - 53/66 : MaterialFootprint_zirconium                |
                 | 100.0% | Progress:     9 of 9     |
Elapsed: 00:00 | Remaining: 00:00
 - 54/66 : WasteFootprint_composting-kilogram         |
                 | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 - 55/66 : WasteFootprint_digestion-cubicmeter        |
                 | 100.0% | Progress:    16 of 16    |
Elapsed: 00:00 | Remaining: 00:00
 - 56/66 : WasteFootprint_digestion-kilogram          |
                 | 100.0% | Progress:     4 of 4     |
Elapsed: 00:00 | Remaining: 00:00
 - 57/66 : WasteFootprint_hazardous-cubicmeter        |
                 | 100.0% | Progress:   423 of 423   |
Elapsed: 00:06 | Remaining: 00:00
 - 58/66 : WasteFootprint_hazardous-kilogram          |
                 | 100.0% | Progress:  1842 of 1842  |
Elapsed: 00:29 | Remaining: 00:00
 - 59/66 : WasteFootprint_incineration-cubicmeter     |
                 | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 60/66 : WasteFootprint_incineration-kilogram       |
                 | 100.0% | Progress:  1897 of 1897  |
Elapsed: 00:30 | Remaining: 00:00
```

```
 - 61/66 : WasteFootprint_landfill-cubicmeter         |
                | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 62/66 : WasteFootprint_landfill-kilogram           |
                | 100.0% | Progress:  1430 of 1430  |
Elapsed: 00:22 | Remaining: 00:00
 - 63/66 : WasteFootprint_openburning-kilogram        |
                | 100.0% | Progress:   535 of 535   |
Elapsed: 00:08 | Remaining: 00:00
 - 64/66 : WasteFootprint_recycling-kilogram          |
                | 100.0% | Progress:   129 of 129   |
Elapsed: 00:02 | Remaining: 00:00
 - 65/66 : WasteFootprint_total-cubicmeter            |
                | 100.0% | Progress:  3976 of 3976  |
Elapsed: 01:03 | Remaining: 00:00
 - 66/66 : WasteFootprint_total-kilogram              |
                | 100.0% | Progress: 28883 of 28883 |
Elapsed: 07:45 | Remaining: 00:00

********************************************************************************
********************

*** ExchangeEditor() completed for ecoinvent-3.9.1-cutoff in 0:20:08 (h:m:s) ***

********************************************************************************
********************

** Verifying database ecoinvent-3.9.1-cutoff in project WMFootprint-SSP-
cutoff_test **

        Score: 4.66e-11
        Method: Indium
        Activity: electricity production, photovoltaic, 3kWp slanted-roof
installation, single-Si, laminated, integrated
        Database: ecoinvent-3.9.1-cutoff

** Database verified successfully! **

================================================================================
==========
        *** Finished WasteAndMaterialFootprint for ecoinvent-3.9.1-cutoff ***
                        Duration: 0:20:27 (h:m:s)
        *** Woah woah wee waa, great success!! ***
================================================================================
==========
--------------------------------------------------------------------------------
```

```
--------------------------------------------------------------------------------

** Processing database (2/5): ecoinvent_cutoff_3.9_remind_SSP2-Base_2065**
Arguments:
{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent_cutoff_3.9_remind_SSP2-Base_2065',
'db_wmf_name': 'WasteAndMaterialFootprint'}


*** ExchangeEditor() is running for ecoinvent_cutoff_3.9_remind_SSP2-Base_2065
***

* Appending waste and material exchanges in WasteAndMaterialFootprint


 -  1/67 : MaterialFootprint_aluminium                |
                | 100.0% | Progress:  1925 of 1925  |
Elapsed: 00:32 | Remaining: 00:00
 -  2/67 : MaterialFootprint_antimony                 |
                | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 -  3/67 : MaterialFootprint_bauxite                  |
                | 100.0% | Progress:    24 of 24    |
Elapsed: 00:00 | Remaining: 00:00
 -  4/67 : MaterialFootprint_beryllium                |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 -  5/67 : MaterialFootprint_borates                  |
                | 100.0% | Progress:    15 of 15    |
Elapsed: 00:00 | Remaining: 00:00
 -  6/67 : MaterialFootprint_cadmium                  |
                | 100.0% | Progress:    17 of 17    |
Elapsed: 00:00 | Remaining: 00:00
 -  7/67 : MaterialFootprint_cement                   |
                | 100.0% | Progress:  2598 of 2598  |
Elapsed: 00:29 | Remaining: 00:00
 -  8/67 : MaterialFootprint_cerium                   |
                | 100.0% | Progress:     3 of 3     |
Elapsed: 00:00 | Remaining: 00:00
 -  9/67 : MaterialFootprint_chromium                 |
                | 100.0% | Progress:   425 of 425   |
Elapsed: 00:04 | Remaining: 00:00
 - 10/67 : MaterialFootprint_coal                     |
                | 100.0% | Progress:   146 of 146   |
Elapsed: 00:01 | Remaining: 00:00
 - 11/67 : MaterialFootprint_cobalt                   |
                | 100.0% | Progress:   166 of 166   |
Elapsed: 00:01 | Remaining: 00:00
```

```
 - 12/67 : MaterialFootprint_coke                    |
                | 100.0% | Progress:    71 of 71    |
Elapsed: 00:00 | Remaining: 00:00
 - 13/67 : MaterialFootprint_copper                  |
                | 100.0% | Progress:  1064 of 1064  |
Elapsed: 00:16 | Remaining: 00:00
 - 14/67 : MaterialFootprint_dysprosium              |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 15/67 : MaterialFootprint_electricity             |
                | 100.0% | Progress: 24074 of 24074 |
Elapsed: 06:29 | Remaining: 00:00
 - 16/67 : MaterialFootprint_erbium                  |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 17/67 : MaterialFootprint_europium                |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 18/67 : MaterialFootprint_fluorspar               |
                | 100.0% | Progress:    22 of 22    |
Elapsed: 00:00 | Remaining: 00:00
 - 19/67 : MaterialFootprint_gadolinium              |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 20/67 : MaterialFootprint_gallium                 |
                | 100.0% | Progress:     4 of 4     |
Elapsed: 00:00 | Remaining: 00:00
 - 21/67 : MaterialFootprint_gold                    |
                | 100.0% | Progress:    10 of 10    |
Elapsed: 00:00 | Remaining: 00:00
 - 22/67 : MaterialFootprint_graphite                |
                | 100.0% | Progress:    33 of 33    |
Elapsed: 00:00 | Remaining: 00:00
 - 23/67 : MaterialFootprint_helium                  |
                | 100.0% | Progress:    46 of 46    |
Elapsed: 00:00 | Remaining: 00:00
 - 24/67 : MaterialFootprint_holmium                 |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 25/67 : MaterialFootprint_hydrogen                |
                | 100.0% | Progress:   389 of 389   |
Elapsed: 00:06 | Remaining: 00:00
 - 26/67 : MaterialFootprint_indium                  |
                | 100.0% | Progress:    13 of 13    |
Elapsed: 00:00 | Remaining: 00:00
 - 27/67 : MaterialFootprint_latex                   |
                | 100.0% | Progress:    50 of 50    |
Elapsed: 00:00 | Remaining: 00:00
```

```
 - 28/67 : MaterialFootprint_lithium                  |
                | 100.0% | Progress:    52 of 52    |
Elapsed: 00:00 | Remaining: 00:00
 - 29/67 : MaterialFootprint_magnesium                |
                | 100.0% | Progress:   264 of 264   |
Elapsed: 00:04 | Remaining: 00:00
 - 30/67 : MaterialFootprint_natural gas              |
                | 100.0% | Progress:  5825 of 5825  |
Elapsed: 01:34 | Remaining: 00:00
 - 31/67 : MaterialFootprint_nickel                   |
                | 100.0% | Progress:   369 of 369   |
Elapsed: 00:05 | Remaining: 00:00
 - 32/67 : MaterialFootprint_palladium                |
                | 100.0% | Progress:    23 of 23    |
Elapsed: 00:00 | Remaining: 00:00
 - 33/67 : MaterialFootprint_petroleum                |
                | 100.0% | Progress:   503 of 503   |
Elapsed: 00:08 | Remaining: 00:00
 - 34/67 : MaterialFootprint_phosphate rock           |
                | 100.0% | Progress:   207 of 207   |
Elapsed: 00:03 | Remaining: 00:00
 - 35/67 : MaterialFootprint_platinum                 |
                | 100.0% | Progress:   170 of 170   |
Elapsed: 00:02 | Remaining: 00:00
 - 36/67 : MaterialFootprint_rare earth               |
                | 100.0% | Progress:    37 of 37    |
Elapsed: 00:00 | Remaining: 00:00
 - 37/67 : MaterialFootprint_rhodium                  |
                | 100.0% | Progress:    11 of 11    |
Elapsed: 00:00 | Remaining: 00:00
 - 38/67 : MaterialFootprint_sand                     |
                | 100.0% | Progress:   560 of 560   |
Elapsed: 00:08 | Remaining: 00:00
 - 39/67 : MaterialFootprint_scandium                 |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 40/67 : MaterialFootprint_selenium                 |
                | 100.0% | Progress:     9 of 9     |
Elapsed: 00:00 | Remaining: 00:00
 - 41/67 : MaterialFootprint_silicon                  |
                | 100.0% | Progress:   364 of 364   |
Elapsed: 00:05 | Remaining: 00:00
 - 42/67 : MaterialFootprint_silver                   |
                | 100.0% | Progress:    50 of 50    |
Elapsed: 00:00 | Remaining: 00:00
 - 43/67 : MaterialFootprint_strontium                |
                | 100.0% | Progress:    28 of 28    |
Elapsed: 00:00 | Remaining: 00:00
```

```
 - 44/67 : MaterialFootprint_tantalum                 |
                | 100.0% | Progress:     3 of 3     |
Elapsed: 00:00 | Remaining: 00:00
 - 45/67 : MaterialFootprint_tellurium                |
                | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 46/67 : MaterialFootprint_tin                      |
                | 100.0% | Progress:   111 of 111   |
Elapsed: 00:01 | Remaining: 00:00
 - 47/67 : MaterialFootprint_titanium                 |
                | 100.0% | Progress:   457 of 457   |
Elapsed: 00:07 | Remaining: 00:00
 - 48/67 : MaterialFootprint_tungsten                 |
                | 100.0% | Progress:     5 of 5     |
Elapsed: 00:00 | Remaining: 00:00
 - 49/67 : MaterialFootprint_uranium                  |
                | 100.0% | Progress:   140 of 140   |
Elapsed: 00:02 | Remaining: 00:00
 - 50/67 : MaterialFootprint_vegetable oil            |
                | 100.0% | Progress:    37 of 37    |
Elapsed: 00:00 | Remaining: 00:00
 - 51/67 : MaterialFootprint_water                    |
                | 100.0% | Progress: 10438 of 10438 |
Elapsed: 02:48 | Remaining: 00:00
 - 52/67 : MaterialFootprint_zinc                     |
                | 100.0% | Progress:   592 of 592   |
Elapsed: 00:09 | Remaining: 00:00
 - 53/67 : MaterialFootprint_zirconium                |
                | 100.0% | Progress:    11 of 11    |
Elapsed: 00:00 | Remaining: 00:00
 - 54/67 : WasteFootprint_carbondioxide-kilogram      |
                | 100.0% | Progress:   119 of 119   |
Elapsed: 00:01 | Remaining: 00:00
 - 55/67 : WasteFootprint_composting-kilogram         |
                | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 - 56/67 : WasteFootprint_digestion-cubicmeter        |
                | 100.0% | Progress:    16 of 16    |
Elapsed: 00:00 | Remaining: 00:00
 - 57/67 : WasteFootprint_digestion-kilogram          |
                | 100.0% | Progress:     4 of 4     |
Elapsed: 00:00 | Remaining: 00:00
 - 58/67 : WasteFootprint_hazardous-cubicmeter        |
                | 100.0% | Progress:   437 of 437   |
Elapsed: 00:07 | Remaining: 00:00
 - 59/67 : WasteFootprint_hazardous-kilogram          |
                | 100.0% | Progress:  1928 of 1928  |
Elapsed: 00:30 | Remaining: 00:00
```

```
 - 60/67 : WasteFootprint_incineration-cubicmeter     |
                 | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 61/67 : WasteFootprint_incineration-kilogram       |
                 | 100.0% | Progress:  2171 of 2171  |
Elapsed: 00:35 | Remaining: 00:00
 - 62/67 : WasteFootprint_landfill-cubicmeter         |
                 | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 63/67 : WasteFootprint_landfill-kilogram           |
                 | 100.0% | Progress:  1530 of 1530  |
Elapsed: 00:24 | Remaining: 00:00
 - 64/67 : WasteFootprint_openburning-kilogram        |
                 | 100.0% | Progress:   535 of 535   |
Elapsed: 00:08 | Remaining: 00:00
 - 65/67 : WasteFootprint_recycling-kilogram          |
                 | 100.0% | Progress:   137 of 137   |
Elapsed: 00:02 | Remaining: 00:00
 - 66/67 : WasteFootprint_total-cubicmeter            |
                 | 100.0% | Progress:  4360 of 4360  |
Elapsed: 01:10 | Remaining: 00:00
 - 67/67 : WasteFootprint_total-kilogram              |
                 | 100.0% | Progress: 29524 of 29524 |
Elapsed: 07:59 | Remaining: 00:00

********************************************************************************
********************

*** ExchangeEditor() completed for ecoinvent_cutoff_3.9_remind_SSP2-Base_2065 in
0:24:35 (h:m:s) ***

********************************************************************************
********************

** Verifying database ecoinvent_cutoff_3.9_remind_SSP2-Base_2065 in project
WMFootprint-SSP-cutoff_test **

        Score: 6.89e-01
        Method: Silver
        Activity: market for oil power plant, 500MW
        Database: ecoinvent_cutoff_3.9_remind_SSP2-Base_2065

** Database verified successfully! **

================================================================================
==========
        *** Finished WasteAndMaterialFootprint for
ecoinvent_cutoff_3.9_remind_SSP2-Base_2065 ***
```

```
                        Duration: 0:24:54 (h:m:s)
        *** Woah woah wee waa, great success!! ***
================================================================================
==========
--------------------------------------------------------------------------------


--------------------------------------------------------------------------------

** Processing database (3/5): ecoinvent_cutoff_3.9_remind_SSP2-Base_2100**
Arguments:
{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent_cutoff_3.9_remind_SSP2-Base_2100',
'db_wmf_name': 'WasteAndMaterialFootprint'}


*** ExchangeEditor() is running for ecoinvent_cutoff_3.9_remind_SSP2-Base_2100
***

* Appending waste and material exchanges in WasteAndMaterialFootprint

 -  1/67 : MaterialFootprint_aluminium                |
                | 100.0% | Progress:  1925 of 1925  |
Elapsed: 00:34 | Remaining: 00:00
 -  2/67 : MaterialFootprint_antimony                 |
                | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 -  3/67 : MaterialFootprint_bauxite                  |
                | 100.0% | Progress:    24 of 24    |
Elapsed: 00:00 | Remaining: 00:00
 -  4/67 : MaterialFootprint_beryllium                |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 -  5/67 : MaterialFootprint_borates                  |
                | 100.0% | Progress:    15 of 15    |
Elapsed: 00:00 | Remaining: 00:00
 -  6/67 : MaterialFootprint_cadmium                  |
                | 100.0% | Progress:    17 of 17    |
Elapsed: 00:00 | Remaining: 00:00
 -  7/67 : MaterialFootprint_cement                   |
                | 100.0% | Progress:  2598 of 2598  |
Elapsed: 00:29 | Remaining: 00:00
 -  8/67 : MaterialFootprint_cerium                   |
                | 100.0% | Progress:     3 of 3     |
Elapsed: 00:00 | Remaining: 00:00
 -  9/67 : MaterialFootprint_chromium                 |
                | 100.0% | Progress:   425 of 425   |
```

```
Elapsed: 00:04 | Remaining: 00:00
 - 10/67 : MaterialFootprint_coal                    |
                | 100.0% | Progress:   146 of 146   |
Elapsed: 00:01 | Remaining: 00:00
 - 11/67 : MaterialFootprint_cobalt                  |
                | 100.0% | Progress:   166 of 166   |
Elapsed: 00:01 | Remaining: 00:00
 - 12/67 : MaterialFootprint_coke                    |
                | 100.0% | Progress:    71 of 71    |
Elapsed: 00:00 | Remaining: 00:00
 - 13/67 : MaterialFootprint_copper                  |
                | 100.0% | Progress:  1064 of 1064  |
Elapsed: 00:11 | Remaining: 00:00
 - 14/67 : MaterialFootprint_dysprosium              |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 15/67 : MaterialFootprint_electricity             |
                | 100.0% | Progress: 24074 of 24074 |
Elapsed: 05:35 | Remaining: 00:00
 - 16/67 : MaterialFootprint_erbium                  |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 17/67 : MaterialFootprint_europium                |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 18/67 : MaterialFootprint_fluorspar               |
                | 100.0% | Progress:    22 of 22    |
Elapsed: 00:00 | Remaining: 00:00
 - 19/67 : MaterialFootprint_gadolinium              |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 20/67 : MaterialFootprint_gallium                 |
                | 100.0% | Progress:     4 of 4     |
Elapsed: 00:00 | Remaining: 00:00
 - 21/67 : MaterialFootprint_gold                    |
                | 100.0% | Progress:    10 of 10    |
Elapsed: 00:00 | Remaining: 00:00
 - 22/67 : MaterialFootprint_graphite                |
                | 100.0% | Progress:    33 of 33    |
Elapsed: 00:00 | Remaining: 00:00
 - 23/67 : MaterialFootprint_helium                  |
                | 100.0% | Progress:    46 of 46    |
Elapsed: 00:00 | Remaining: 00:00
 - 24/67 : MaterialFootprint_holmium                 |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 25/67 : MaterialFootprint_hydrogen                |
                | 100.0% | Progress:   389 of 389   |
```

```
Elapsed: 00:06 | Remaining: 00:00
 - 26/67 : MaterialFootprint_indium                    |
                | 100.0% | Progress:    13 of 13    |
Elapsed: 00:00 | Remaining: 00:00
 - 27/67 : MaterialFootprint_latex                     |
                | 100.0% | Progress:    50 of 50    |
Elapsed: 00:00 | Remaining: 00:00
 - 28/67 : MaterialFootprint_lithium                   |
                | 100.0% | Progress:    52 of 52    |
Elapsed: 00:00 | Remaining: 00:00
 - 29/67 : MaterialFootprint_magnesium                 |
                | 100.0% | Progress:   264 of 264   |
Elapsed: 00:04 | Remaining: 00:00
 - 30/67 : MaterialFootprint_natural gas               |
                | 100.0% | Progress:  5825 of 5825  |
Elapsed: 01:33 | Remaining: 00:00
 - 31/67 : MaterialFootprint_nickel                    |
                | 100.0% | Progress:   369 of 369   |
Elapsed: 00:05 | Remaining: 00:00
 - 32/67 : MaterialFootprint_palladium                 |
                | 100.0% | Progress:    23 of 23    |
Elapsed: 00:00 | Remaining: 00:00
 - 33/67 : MaterialFootprint_petroleum                 |
                | 100.0% | Progress:   503 of 503   |
Elapsed: 00:08 | Remaining: 00:00
 - 34/67 : MaterialFootprint_phosphate rock            |
                | 100.0% | Progress:   207 of 207   |
Elapsed: 00:03 | Remaining: 00:00
 - 35/67 : MaterialFootprint_platinum                  |
                | 100.0% | Progress:   170 of 170   |
Elapsed: 00:02 | Remaining: 00:00
 - 36/67 : MaterialFootprint_rare earth                |
                | 100.0% | Progress:    37 of 37    |
Elapsed: 00:00 | Remaining: 00:00
 - 37/67 : MaterialFootprint_rhodium                   |
                | 100.0% | Progress:    11 of 11    |
Elapsed: 00:00 | Remaining: 00:00
 - 38/67 : MaterialFootprint_sand                      |
                | 100.0% | Progress:   560 of 560   |
Elapsed: 00:08 | Remaining: 00:00
 - 39/67 : MaterialFootprint_scandium                  |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 40/67 : MaterialFootprint_selenium                  |
                | 100.0% | Progress:     9 of 9     |
Elapsed: 00:00 | Remaining: 00:00
 - 41/67 : MaterialFootprint_silicon                   |
                | 100.0% | Progress:   364 of 364   |
```

```
Elapsed: 00:05 | Remaining: 00:00
 - 42/67 : MaterialFootprint_silver                    |
                 | 100.0% | Progress:    50 of 50    |
Elapsed: 00:00 | Remaining: 00:00
 - 43/67 : MaterialFootprint_strontium                 |
                 | 100.0% | Progress:    28 of 28    |
Elapsed: 00:00 | Remaining: 00:00
 - 44/67 : MaterialFootprint_tantalum                  |
                 | 100.0% | Progress:     3 of 3     |
Elapsed: 00:00 | Remaining: 00:00
 - 45/67 : MaterialFootprint_tellurium                 |
                 | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 46/67 : MaterialFootprint_tin                       |
                 | 100.0% | Progress:   111 of 111   |
Elapsed: 00:01 | Remaining: 00:00
 - 47/67 : MaterialFootprint_titanium                  |
                 | 100.0% | Progress:   457 of 457   |
Elapsed: 00:07 | Remaining: 00:00
 - 48/67 : MaterialFootprint_tungsten                  |
                 | 100.0% | Progress:     5 of 5     |
Elapsed: 00:00 | Remaining: 00:00
 - 49/67 : MaterialFootprint_uranium                   |
                 | 100.0% | Progress:   140 of 140   |
Elapsed: 00:02 | Remaining: 00:00
 - 50/67 : MaterialFootprint_vegetable oil             |
                 | 100.0% | Progress:    37 of 37    |
Elapsed: 00:00 | Remaining: 00:00
 - 51/67 : MaterialFootprint_water                     |
                 | 100.0% | Progress: 10438 of 10438 |
Elapsed: 02:47 | Remaining: 00:00
 - 52/67 : MaterialFootprint_zinc                      |
                 | 100.0% | Progress:   592 of 592   |
Elapsed: 00:09 | Remaining: 00:00
 - 53/67 : MaterialFootprint_zirconium                 |
                 | 100.0% | Progress:    11 of 11    |
Elapsed: 00:00 | Remaining: 00:00
 - 54/67 : WasteFootprint_carbondioxide-kilogram       |
                 | 100.0% | Progress:   119 of 119   |
Elapsed: 00:01 | Remaining: 00:00
 - 55/67 : WasteFootprint_composting-kilogram          |
                 | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 - 56/67 : WasteFootprint_digestion-cubicmeter         |
                 | 100.0% | Progress:    16 of 16    |
Elapsed: 00:00 | Remaining: 00:00
 - 57/67 : WasteFootprint_digestion-kilogram           |
                 | 100.0% | Progress:     4 of 4     |
```

```
Elapsed: 00:00 | Remaining: 00:00
 - 58/67 : WasteFootprint_hazardous-cubicmeter        |
                 | 100.0% | Progress:   437 of 437   |
Elapsed: 00:07 | Remaining: 00:00
 - 59/67 : WasteFootprint_hazardous-kilogram          |
                 | 100.0% | Progress:  1928 of 1928  |
Elapsed: 00:30 | Remaining: 00:00
 - 60/67 : WasteFootprint_incineration-cubicmeter     |
                 | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 61/67 : WasteFootprint_incineration-kilogram       |
                 | 100.0% | Progress:  2171 of 2171  |
Elapsed: 00:34 | Remaining: 00:00
 - 62/67 : WasteFootprint_landfill-cubicmeter         |
                 | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 63/67 : WasteFootprint_landfill-kilogram           |
                 | 100.0% | Progress:  1530 of 1530  |
Elapsed: 00:24 | Remaining: 00:00
 - 64/67 : WasteFootprint_openburning-kilogram        |
                 | 100.0% | Progress:   535 of 535   |
Elapsed: 00:08 | Remaining: 00:00
 - 65/67 : WasteFootprint_recycling-kilogram          |
                 | 100.0% | Progress:   137 of 137   |
Elapsed: 00:02 | Remaining: 00:00
 - 66/67 : WasteFootprint_total-cubicmeter            |
                 | 100.0% | Progress:  4360 of 4360  |
Elapsed: 01:10 | Remaining: 00:00
 - 67/67 : WasteFootprint_total-kilogram              |
                 | 100.0% | Progress: 29524 of 29524 |
Elapsed: 07:56 | Remaining: 00:00

********************************************************************************
********************

*** ExchangeEditor() completed for ecoinvent_cutoff_3.9_remind_SSP2-Base_2100 in
0:23:34 (h:m:s) ***

********************************************************************************
********************

** Verifying database ecoinvent_cutoff_3.9_remind_SSP2-Base_2100 in project
WMFootprint-SSP-cutoff_test **

        Score: 5.39e-02
        Method: Total (kg)
        Activity: magnesium sulfate production
        Database: ecoinvent_cutoff_3.9_remind_SSP2-Base_2100
```

```
** Database verified successfully! **

================================================================================
==========
        *** Finished WasteAndMaterialFootprint for
ecoinvent_cutoff_3.9_remind_SSP2-Base_2100 ***
                        Duration: 0:23:53 (h:m:s)
        *** Woah woah wee waa, great success!! ***
================================================================================
==========
--------------------------------------------------------------------------------


--------------------------------------------------------------------------------

** Processing database (4/5): ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065**
Arguments:
{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065',
'db_wmf_name': 'WasteAndMaterialFootprint'}


*** ExchangeEditor() is running for
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065 ***

* Appending waste and material exchanges in WasteAndMaterialFootprint

 -  1/67 : MaterialFootprint_aluminium                |
                | 100.0% | Progress:  1925 of 1925  |
Elapsed: 00:33 | Remaining: 00:00
 -  2/67 : MaterialFootprint_antimony                 |
                | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 -  3/67 : MaterialFootprint_bauxite                  |
                | 100.0% | Progress:    24 of 24    |
Elapsed: 00:00 | Remaining: 00:00
 -  4/67 : MaterialFootprint_beryllium                |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 -  5/67 : MaterialFootprint_borates                  |
                | 100.0% | Progress:    15 of 15    |
Elapsed: 00:00 | Remaining: 00:00
 -  6/67 : MaterialFootprint_cadmium                  |
                | 100.0% | Progress:    17 of 17    |
Elapsed: 00:00 | Remaining: 00:00
 -  7/67 : MaterialFootprint_cement                   |
```

```
                | 100.0% | Progress:  2598 of 2598  |
Elapsed: 00:29 | Remaining: 00:00
 -  8/67 : MaterialFootprint_cerium                   |
                | 100.0% | Progress:     3 of 3     |
Elapsed: 00:00 | Remaining: 00:00
 -  9/67 : MaterialFootprint_chromium                 |
                | 100.0% | Progress:   425 of 425   |
Elapsed: 00:04 | Remaining: 00:00
 - 10/67 : MaterialFootprint_coal                     |
                | 100.0% | Progress:   146 of 146   |
Elapsed: 00:01 | Remaining: 00:00
 - 11/67 : MaterialFootprint_cobalt                   |
                | 100.0% | Progress:   166 of 166   |
Elapsed: 00:01 | Remaining: 00:00
 - 12/67 : MaterialFootprint_coke                     |
                | 100.0% | Progress:    71 of 71    |
Elapsed: 00:00 | Remaining: 00:00
 - 13/67 : MaterialFootprint_copper                   |
                | 100.0% | Progress:  1064 of 1064  |
Elapsed: 00:11 | Remaining: 00:00
 - 14/67 : MaterialFootprint_dysprosium               |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 15/67 : MaterialFootprint_electricity              |
                | 100.0% | Progress: 24074 of 24074 |
Elapsed: 05:23 | Remaining: 00:00
 - 16/67 : MaterialFootprint_erbium                   |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 17/67 : MaterialFootprint_europium                 |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 18/67 : MaterialFootprint_fluorspar                |
                | 100.0% | Progress:    22 of 22    |
Elapsed: 00:00 | Remaining: 00:00
 - 19/67 : MaterialFootprint_gadolinium               |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 20/67 : MaterialFootprint_gallium                  |
                | 100.0% | Progress:     4 of 4     |
Elapsed: 00:00 | Remaining: 00:00
 - 21/67 : MaterialFootprint_gold                     |
                | 100.0% | Progress:    10 of 10    |
Elapsed: 00:00 | Remaining: 00:00
 - 22/67 : MaterialFootprint_graphite                 |
                | 100.0% | Progress:    33 of 33    |
Elapsed: 00:00 | Remaining: 00:00
 - 23/67 : MaterialFootprint_helium                   |
```

```
                | 100.0% | Progress:    46 of 46    |
Elapsed: 00:00 | Remaining: 00:00
 - 24/67 : MaterialFootprint_holmium                  |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 25/67 : MaterialFootprint_hydrogen                 |
                | 100.0% | Progress:   389 of 389   |
Elapsed: 00:06 | Remaining: 00:00
 - 26/67 : MaterialFootprint_indium                   |
                | 100.0% | Progress:    13 of 13    |
Elapsed: 00:00 | Remaining: 00:00
 - 27/67 : MaterialFootprint_latex                    |
                | 100.0% | Progress:    50 of 50    |
Elapsed: 00:00 | Remaining: 00:00
 - 28/67 : MaterialFootprint_lithium                  |
                | 100.0% | Progress:    52 of 52    |
Elapsed: 00:00 | Remaining: 00:00
 - 29/67 : MaterialFootprint_magnesium                |
                | 100.0% | Progress:   264 of 264   |
Elapsed: 00:04 | Remaining: 00:00
 - 30/67 : MaterialFootprint_natural gas              |
                | 100.0% | Progress:  5825 of 5825  |
Elapsed: 01:33 | Remaining: 00:00
 - 31/67 : MaterialFootprint_nickel                   |
                | 100.0% | Progress:   369 of 369   |
Elapsed: 00:05 | Remaining: 00:00
 - 32/67 : MaterialFootprint_palladium                |
                | 100.0% | Progress:    23 of 23    |
Elapsed: 00:00 | Remaining: 00:00
 - 33/67 : MaterialFootprint_petroleum                |
                | 100.0% | Progress:   503 of 503   |
Elapsed: 00:08 | Remaining: 00:00
 - 34/67 : MaterialFootprint_phosphate rock           |
                | 100.0% | Progress:   207 of 207   |
Elapsed: 00:03 | Remaining: 00:00
 - 35/67 : MaterialFootprint_platinum                 |
                | 100.0% | Progress:   170 of 170   |
Elapsed: 00:02 | Remaining: 00:00
 - 36/67 : MaterialFootprint_rare earth               |
                | 100.0% | Progress:    37 of 37    |
Elapsed: 00:00 | Remaining: 00:00
 - 37/67 : MaterialFootprint_rhodium                  |
                | 100.0% | Progress:    11 of 11    |
Elapsed: 00:00 | Remaining: 00:00
 - 38/67 : MaterialFootprint_sand                     |
                | 100.0% | Progress:   560 of 560   |
Elapsed: 00:08 | Remaining: 00:00
 - 39/67 : MaterialFootprint_scandium                 |
```

```
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 40/67 : MaterialFootprint_selenium                 |
                | 100.0% | Progress:     9 of 9     |
Elapsed: 00:00 | Remaining: 00:00
 - 41/67 : MaterialFootprint_silicon                  |
                | 100.0% | Progress:   364 of 364   |
Elapsed: 00:05 | Remaining: 00:00
 - 42/67 : MaterialFootprint_silver                   |
                | 100.0% | Progress:    50 of 50    |
Elapsed: 00:00 | Remaining: 00:00
 - 43/67 : MaterialFootprint_strontium                |
                | 100.0% | Progress:    28 of 28    |
Elapsed: 00:00 | Remaining: 00:00
 - 44/67 : MaterialFootprint_tantalum                 |
                | 100.0% | Progress:     3 of 3     |
Elapsed: 00:00 | Remaining: 00:00
 - 45/67 : MaterialFootprint_tellurium                |
                | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 46/67 : MaterialFootprint_tin                      |
                | 100.0% | Progress:   111 of 111   |
Elapsed: 00:01 | Remaining: 00:00
 - 47/67 : MaterialFootprint_titanium                 |
                | 100.0% | Progress:   457 of 457   |
Elapsed: 00:07 | Remaining: 00:00
 - 48/67 : MaterialFootprint_tungsten                 |
                | 100.0% | Progress:     5 of 5     |
Elapsed: 00:00 | Remaining: 00:00
 - 49/67 : MaterialFootprint_uranium                  |
                | 100.0% | Progress:   140 of 140   |
Elapsed: 00:02 | Remaining: 00:00
 - 50/67 : MaterialFootprint_vegetable oil            |
                | 100.0% | Progress:    37 of 37    |
Elapsed: 00:00 | Remaining: 00:00
 - 51/67 : MaterialFootprint_water                    |
                | 100.0% | Progress: 10438 of 10438 |
Elapsed: 02:48 | Remaining: 00:00
 - 52/67 : MaterialFootprint_zinc                     |
                | 100.0% | Progress:   592 of 592   |
Elapsed: 00:09 | Remaining: 00:00
 - 53/67 : MaterialFootprint_zirconium                |
                | 100.0% | Progress:    11 of 11    |
Elapsed: 00:00 | Remaining: 00:00
 - 54/67 : WasteFootprint_carbondioxide-kilogram      |
                | 100.0% | Progress:   119 of 119   |
Elapsed: 00:01 | Remaining: 00:00
 - 55/67 : WasteFootprint_composting-kilogram         |
```

```
                | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 - 56/67 : WasteFootprint_digestion-cubicmeter        |
                | 100.0% | Progress:    16 of 16    |
Elapsed: 00:00 | Remaining: 00:00
 - 57/67 : WasteFootprint_digestion-kilogram          |
                | 100.0% | Progress:     4 of 4     |
Elapsed: 00:00 | Remaining: 00:00
 - 58/67 : WasteFootprint_hazardous-cubicmeter        |
                | 100.0% | Progress:   437 of 437   |
Elapsed: 00:07 | Remaining: 00:00
 - 59/67 : WasteFootprint_hazardous-kilogram          |
                | 100.0% | Progress:  1928 of 1928  |
Elapsed: 00:30 | Remaining: 00:00
 - 60/67 : WasteFootprint_incineration-cubicmeter     |
                | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 61/67 : WasteFootprint_incineration-kilogram       |
                | 100.0% | Progress:  2171 of 2171  |
Elapsed: 00:35 | Remaining: 00:00
 - 62/67 : WasteFootprint_landfill-cubicmeter         |
                | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 63/67 : WasteFootprint_landfill-kilogram           |
                | 100.0% | Progress:  1530 of 1530  |
Elapsed: 00:24 | Remaining: 00:00
 - 64/67 : WasteFootprint_openburning-kilogram        |
                | 100.0% | Progress:   535 of 535   |
Elapsed: 00:08 | Remaining: 00:00
 - 65/67 : WasteFootprint_recycling-kilogram          |
                | 100.0% | Progress:   137 of 137   |
Elapsed: 00:02 | Remaining: 00:00
 - 66/67 : WasteFootprint_total-cubicmeter            |
                | 100.0% | Progress:  4360 of 4360  |
Elapsed: 01:10 | Remaining: 00:00
 - 67/67 : WasteFootprint_total-kilogram              |
                | 100.0% | Progress: 29524 of 29524 |
Elapsed: 07:57 | Remaining: 00:00

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*** ExchangeEditor() completed for
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065 in 0:23:23 (h:m:s) ***

********************************************************************************
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```

```
** Verifying database ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065 in project
WMFootprint-SSP-cutoff_test **

        Score: 4.74e-13
        Method: Landfill (m3)
        Activity: manganese concentrate production
        Database: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065

** Database verified successfully! **

================================================================================
==========
        *** Finished WasteAndMaterialFootprint for
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065 ***
                        Duration: 0:23:43 (h:m:s)
        *** Woah woah wee waa, great success!! ***
================================================================================
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** Processing database (5/5): ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100**
Arguments:
{'project_base': 'SSP-cutoff_test', 'project_wmf': 'WMFootprint-SSP-
cutoff_test', 'db_name': 'ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100',
'db_wmf_name': 'WasteAndMaterialFootprint'}


*** ExchangeEditor() is running for
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100 ***

* Appending waste and material exchanges in WasteAndMaterialFootprint


 -  1/67 : MaterialFootprint_aluminium                |
                 | 100.0% | Progress:  1925 of 1925  |
Elapsed: 00:30 | Remaining: 00:00
 -  2/67 : MaterialFootprint_antimony                 |
                 | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 -  3/67 : MaterialFootprint_bauxite                  |
                 | 100.0% | Progress:    24 of 24    |
Elapsed: 00:00 | Remaining: 00:00
 -  4/67 : MaterialFootprint_beryllium                |
                 | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
```

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 -  5/67 : MaterialFootprint_borates                  |
                | 100.0% | Progress:    15 of 15    |
Elapsed: 00:00 | Remaining: 00:00
 -  6/67 : MaterialFootprint_cadmium                  |
                | 100.0% | Progress:    17 of 17    |
Elapsed: 00:00 | Remaining: 00:00
 -  7/67 : MaterialFootprint_cement                   |
                | 100.0% | Progress:  2598 of 2598  |
Elapsed: 00:29 | Remaining: 00:00
 -  8/67 : MaterialFootprint_cerium                   |
                | 100.0% | Progress:     3 of 3     |
Elapsed: 00:00 | Remaining: 00:00
 -  9/67 : MaterialFootprint_chromium                 |
                | 100.0% | Progress:   425 of 425   |
Elapsed: 00:04 | Remaining: 00:00
 - 10/67 : MaterialFootprint_coal                     |
                | 100.0% | Progress:   146 of 146   |
Elapsed: 00:01 | Remaining: 00:00
 - 11/67 : MaterialFootprint_cobalt                   |
                | 100.0% | Progress:   166 of 166   |
Elapsed: 00:01 | Remaining: 00:00
 - 12/67 : MaterialFootprint_coke                     |
                | 100.0% | Progress:    71 of 71    |
Elapsed: 00:00 | Remaining: 00:00
 - 13/67 : MaterialFootprint_copper                   |
                | 100.0% | Progress:  1064 of 1064  |
Elapsed: 00:11 | Remaining: 00:00
 - 14/67 : MaterialFootprint_dysprosium               |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 15/67 : MaterialFootprint_electricity              |
                | 100.0% | Progress: 24074 of 24074 |
Elapsed: 05:30 | Remaining: 00:00
 - 16/67 : MaterialFootprint_erbium                   |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 17/67 : MaterialFootprint_europium                 |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 18/67 : MaterialFootprint_fluorspar                |
                | 100.0% | Progress:    22 of 22    |
Elapsed: 00:00 | Remaining: 00:00
 - 19/67 : MaterialFootprint_gadolinium               |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 20/67 : MaterialFootprint_gallium                  |
                | 100.0% | Progress:     4 of 4     |
Elapsed: 00:00 | Remaining: 00:00
```

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 - 21/67 : MaterialFootprint_gold                    |
                | 100.0% | Progress:    10 of 10    |
Elapsed: 00:00 | Remaining: 00:00
 - 22/67 : MaterialFootprint_graphite                |
                | 100.0% | Progress:    33 of 33    |
Elapsed: 00:00 | Remaining: 00:00
 - 23/67 : MaterialFootprint_helium                  |
                | 100.0% | Progress:    46 of 46    |
Elapsed: 00:00 | Remaining: 00:00
 - 24/67 : MaterialFootprint_holmium                 |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 25/67 : MaterialFootprint_hydrogen                |
                | 100.0% | Progress:   389 of 389   |
Elapsed: 00:06 | Remaining: 00:00
 - 26/67 : MaterialFootprint_indium                  |
                | 100.0% | Progress:    13 of 13    |
Elapsed: 00:00 | Remaining: 00:00
 - 27/67 : MaterialFootprint_latex                   |
                | 100.0% | Progress:    50 of 50    |
Elapsed: 00:00 | Remaining: 00:00
 - 28/67 : MaterialFootprint_lithium                 |
                | 100.0% | Progress:    52 of 52    |
Elapsed: 00:00 | Remaining: 00:00
 - 29/67 : MaterialFootprint_magnesium               |
                | 100.0% | Progress:   264 of 264   |
Elapsed: 00:04 | Remaining: 00:00
 - 30/67 : MaterialFootprint_natural gas             |
                | 100.0% | Progress:  5825 of 5825  |
Elapsed: 01:35 | Remaining: 00:00
 - 31/67 : MaterialFootprint_nickel                  |
                | 100.0% | Progress:   369 of 369   |
Elapsed: 00:05 | Remaining: 00:00
 - 32/67 : MaterialFootprint_palladium               |
                | 100.0% | Progress:    23 of 23    |
Elapsed: 00:00 | Remaining: 00:00
 - 33/67 : MaterialFootprint_petroleum               |
                | 100.0% | Progress:   503 of 503   |
Elapsed: 00:08 | Remaining: 00:00
 - 34/67 : MaterialFootprint_phosphate rock          |
                | 100.0% | Progress:   207 of 207   |
Elapsed: 00:03 | Remaining: 00:00
 - 35/67 : MaterialFootprint_platinum                |
                | 100.0% | Progress:   170 of 170   |
Elapsed: 00:02 | Remaining: 00:00
 - 36/67 : MaterialFootprint_rare earth              |
                | 100.0% | Progress:    37 of 37    |
Elapsed: 00:00 | Remaining: 00:00
```

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 - 37/67 : MaterialFootprint_rhodium                  |
                | 100.0% | Progress:    11 of 11    |
Elapsed: 00:00 | Remaining: 00:00
 - 38/67 : MaterialFootprint_sand                     |
                | 100.0% | Progress:   560 of 560   |
Elapsed: 00:09 | Remaining: 00:00
 - 39/67 : MaterialFootprint_scandium                 |
                | 100.0% | Progress:     1 of 1     |
Elapsed: 00:00 | Remaining: 00:00
 - 40/67 : MaterialFootprint_selenium                 |
                | 100.0% | Progress:     9 of 9     |
Elapsed: 00:00 | Remaining: 00:00
 - 41/67 : MaterialFootprint_silicon                  |
                | 100.0% | Progress:   364 of 364   |
Elapsed: 00:06 | Remaining: 00:00
 - 42/67 : MaterialFootprint_silver                   |
                | 100.0% | Progress:    50 of 50    |
Elapsed: 00:00 | Remaining: 00:00
 - 43/67 : MaterialFootprint_strontium                |
                | 100.0% | Progress:    28 of 28    |
Elapsed: 00:00 | Remaining: 00:00
 - 44/67 : MaterialFootprint_tantalum                 |
                | 100.0% | Progress:     3 of 3     |
Elapsed: 00:00 | Remaining: 00:00
 - 45/67 : MaterialFootprint_tellurium                |
                | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 46/67 : MaterialFootprint_tin                      |
                | 100.0% | Progress:   111 of 111   |
Elapsed: 00:01 | Remaining: 00:00
 - 47/67 : MaterialFootprint_titanium                 |
                | 100.0% | Progress:   457 of 457   |
Elapsed: 00:07 | Remaining: 00:00
 - 48/67 : MaterialFootprint_tungsten                 |
                | 100.0% | Progress:     5 of 5     |
Elapsed: 00:00 | Remaining: 00:00
 - 49/67 : MaterialFootprint_uranium                  |
                | 100.0% | Progress:   140 of 140   |
Elapsed: 00:02 | Remaining: 00:00
 - 50/67 : MaterialFootprint_vegetable oil            |
                | 100.0% | Progress:    37 of 37    |
Elapsed: 00:00 | Remaining: 00:00
 - 51/67 : MaterialFootprint_water                    |
                | 100.0% | Progress: 10438 of 10438 |
Elapsed: 02:49 | Remaining: 00:00
 - 52/67 : MaterialFootprint_zinc                     |
                | 100.0% | Progress:   592 of 592   |
Elapsed: 00:09 | Remaining: 00:00
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 - 53/67 : MaterialFootprint_zirconium                |
                 | 100.0% | Progress:    11 of 11    |
Elapsed: 00:00 | Remaining: 00:00
 - 54/67 : WasteFootprint_carbondioxide-kilogram      |
                 | 100.0% | Progress:   119 of 119   |
Elapsed: 00:01 | Remaining: 00:00
 - 55/67 : WasteFootprint_composting-kilogram         |
                 | 100.0% | Progress:    26 of 26    |
Elapsed: 00:00 | Remaining: 00:00
 - 56/67 : WasteFootprint_digestion-cubicmeter        |
                 | 100.0% | Progress:    16 of 16    |
Elapsed: 00:00 | Remaining: 00:00
 - 57/67 : WasteFootprint_digestion-kilogram          |
                 | 100.0% | Progress:     4 of 4     |
Elapsed: 00:00 | Remaining: 00:00
 - 58/67 : WasteFootprint_hazardous-cubicmeter        |
                 | 100.0% | Progress:   437 of 437   |
Elapsed: 00:07 | Remaining: 00:00
 - 59/67 : WasteFootprint_hazardous-kilogram          |
                 | 100.0% | Progress:  1928 of 1928  |
Elapsed: 00:32 | Remaining: 00:00
 - 60/67 : WasteFootprint_incineration-cubicmeter     |
                 | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 61/67 : WasteFootprint_incineration-kilogram       |
                 | 100.0% | Progress:  2171 of 2171  |
Elapsed: 00:36 | Remaining: 00:00
 - 62/67 : WasteFootprint_landfill-cubicmeter         |
                 | 100.0% | Progress:     2 of 2     |
Elapsed: 00:00 | Remaining: 00:00
 - 63/67 : WasteFootprint_landfill-kilogram           |
                 | 100.0% | Progress:  1530 of 1530  |
Elapsed: 00:25 | Remaining: 00:00
 - 64/67 : WasteFootprint_openburning-kilogram        |
                 | 100.0% | Progress:   535 of 535   |
Elapsed: 00:08 | Remaining: 00:00
 - 65/67 : WasteFootprint_recycling-kilogram          |
                 | 100.0% | Progress:   137 of 137   |
Elapsed: 00:02 | Remaining: 00:00
 - 66/67 : WasteFootprint_total-cubicmeter            |
                 | 100.0% | Progress:  4360 of 4360  |
Elapsed: 01:12 | Remaining: 00:00
 - 67/67 : WasteFootprint_total-kilogram              |
                 | 100.0% | Progress: 29524 of 29524 |
Elapsed: 07:57 | Remaining: 00:00

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```
*** ExchangeEditor() completed for
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100 in 0:23:38 (h:m:s) ***

**************************************************************************
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** Verifying database ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100 in project
WMFootprint-SSP-cutoff_test **

        Score: 6.92e-10
        Method: Indium
        Activity: market for inorganic phosphorus fertiliser, as P2O5
        Database: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100

** Database verified successfully! **

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        *** Finished WasteAndMaterialFootprint for
ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100 ***
                        Duration: 0:23:58 (h:m:s)
        *** Woah woah wee waa, great success!! ***
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        *** Verifying all databases in the project **

** Verifying database ecoinvent-3.9.1-cutoff in project WMFootprint-SSP-
cutoff_test **

        Score: 1.81e-01
        Method: Cement
        Activity: market for sawlog and veneer log, softwood, debarked, measured
as solid wood
        Database: ecoinvent-3.9.1-cutoff


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** Verifying database ecoinvent_cutoff_3.9_remind_SSP2-Base_2065 in project
WMFootprint-SSP-cutoff_test **

        Score: 3.20e-04
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        Method: Indium
        Activity: metal coating facility construction
        Database: ecoinvent_cutoff_3.9_remind_SSP2-Base_2065


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** Verifying database ecoinvent_cutoff_3.9_remind_SSP2-Base_2100 in project
WMFootprint-SSP-cutoff_test **

        Score: 2.31e-06
        Method: Fluorspar
        Activity: market for tinplate scrap, sorted
        Database: ecoinvent_cutoff_3.9_remind_SSP2-Base_2100


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** Verifying database ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065 in project
WMFootprint-SSP-cutoff_test **

        Score: 0.00e+00
        Method: Chromium
        Activity: treatment of sewage sludge, 70% water, WWT, WW from hard
fibreboard production, municipal incineration
        Database: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065

        Score: 1.84e-04
        Method: Silicon
        Activity: chromium steel turning, primarily roughing, computer numerical
controlled
        Database: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2065


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** Verifying database ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100 in project
WMFootprint-SSP-cutoff_test **

        Score: 2.82e+02
        Method: Electricity
        Activity: market for sawnwood, azobe, dried (u=15%), planed
        Database: ecoinvent_cutoff_3.9_remind_SSP2-PkBudg500_2100
```

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================================================================================
                          WasteAndMaterialFootprint Completed
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    Project:                   WMFootprint-SSP-cutoff_test
    Total Databases:           5
    Successfully Processed:    5
    Duration:                  2:01:32 (h:m:s)

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                                | Let's moooooo |
                                | some LCA!     |
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