ZNES
ZENTRUM FÜR NACHHALTIGE ENERGIESYSTEME
HOCHSCHULE | EUROPA-UNIVERSITÄT FLENSBURG

REINER LEMOINE INSTITUT

OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

oemof
['ø:mɔf]

# Using the oemof cosmos to create feed-in time series – de 21

## oemof – a community project to make energy modelling transparent and shareable

Uwe Krien

10. Mai 2017, oemof user meeting 2017

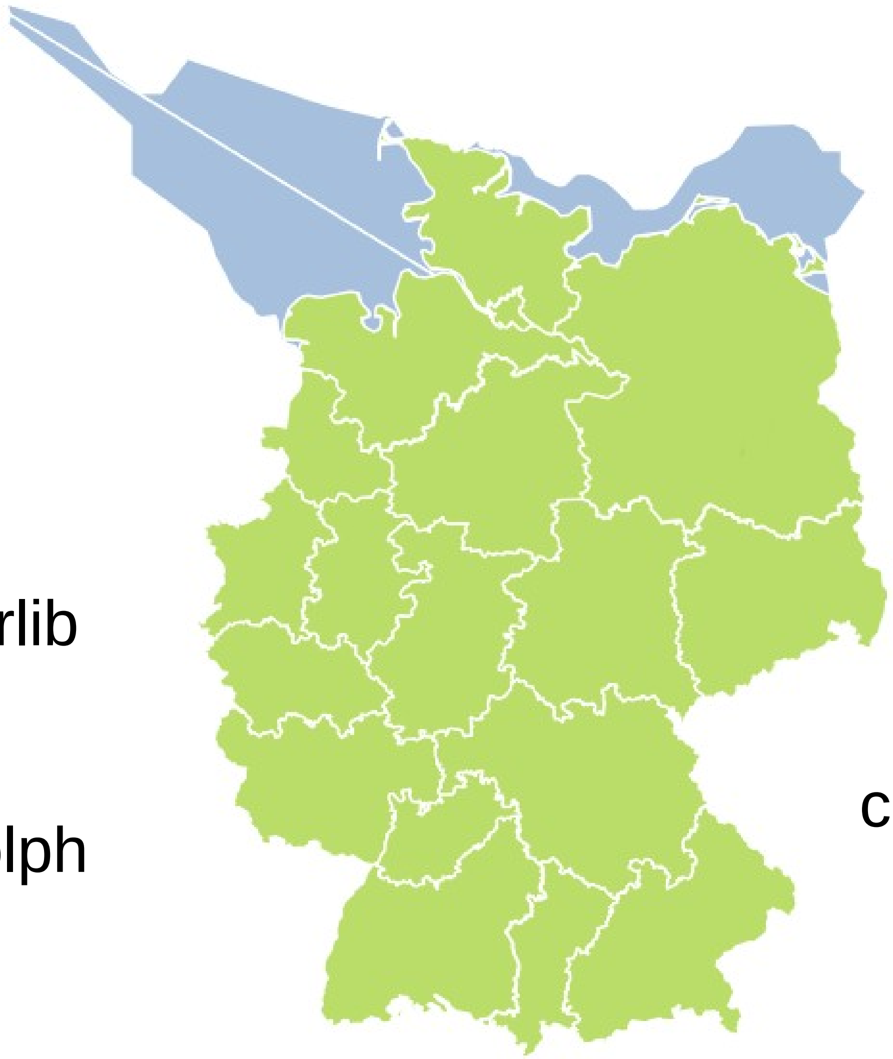
# de21– python as connector

pvlib

demandlib

windpowerlib

oemof.solph



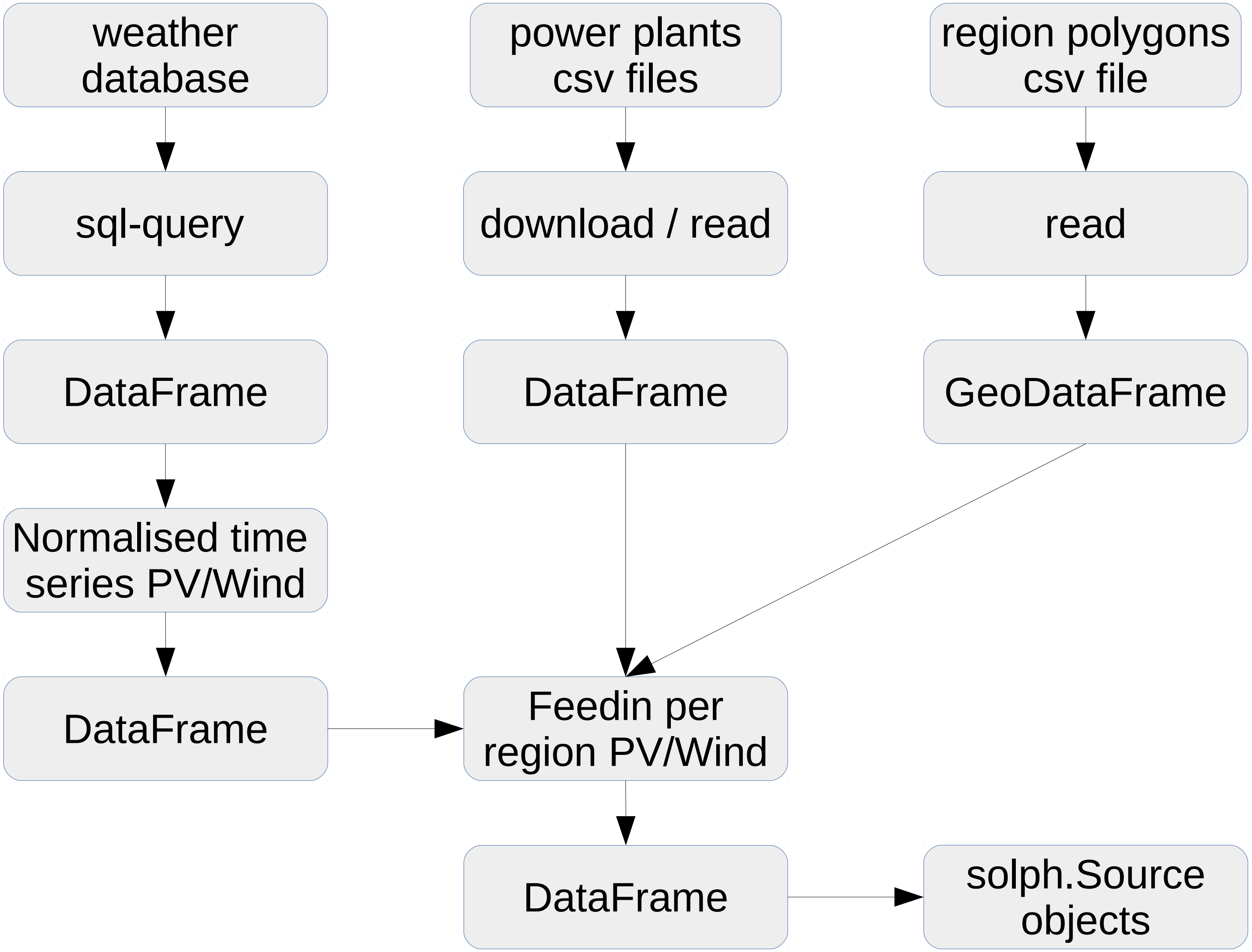
weather data

open power data

open energy db

csv-scenario

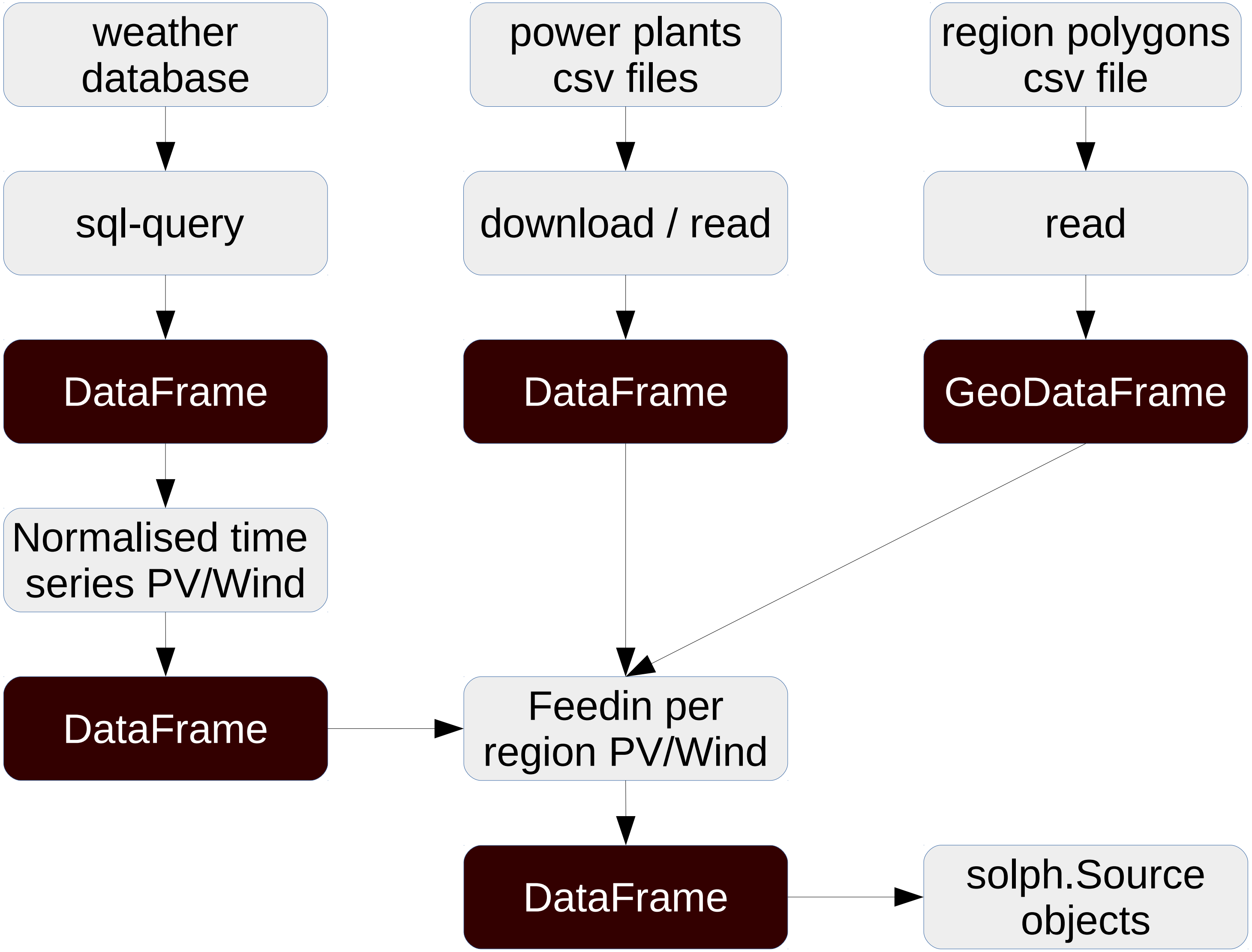
# de21 – solph.Source object from open data



# de21 – using python

- Database
  - SQLAlchemy
  - Psycopg
- Downloads
  - Requests
- GIS operations
  - Shapely
  - Postgis (see database)
  - GeoPandas
  - PyQGIS
- Input/output
  - pandas

# de21 – solph.Source object from open data



# de21 – pandas.DataFrame

- CSV: `read_csv, to_csv`
- JSON: `read_json,  to_json`
- HTML: `read_html, to_html`
- HDF5 : `read_hdf, to_hdf`
- Clipboard: `read_clipboard, to_clipboard`
- MS Excel: `read_excel, to_excel`
- Python Pickle: `read_pickle, to_pickle`
- SQL: `read_sql, to_sql`
- Google Big Query: `read_gbq, to_gbq`

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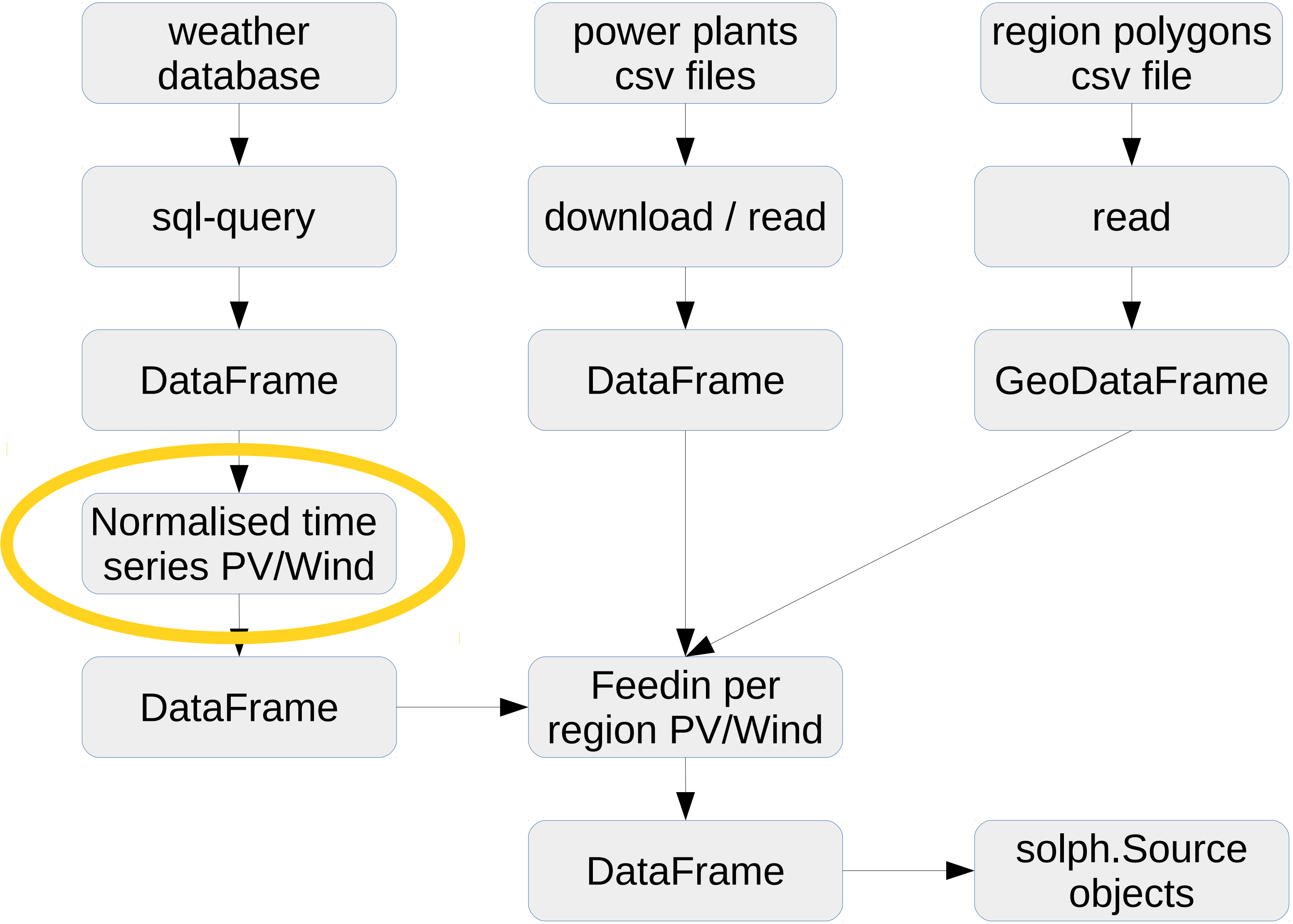
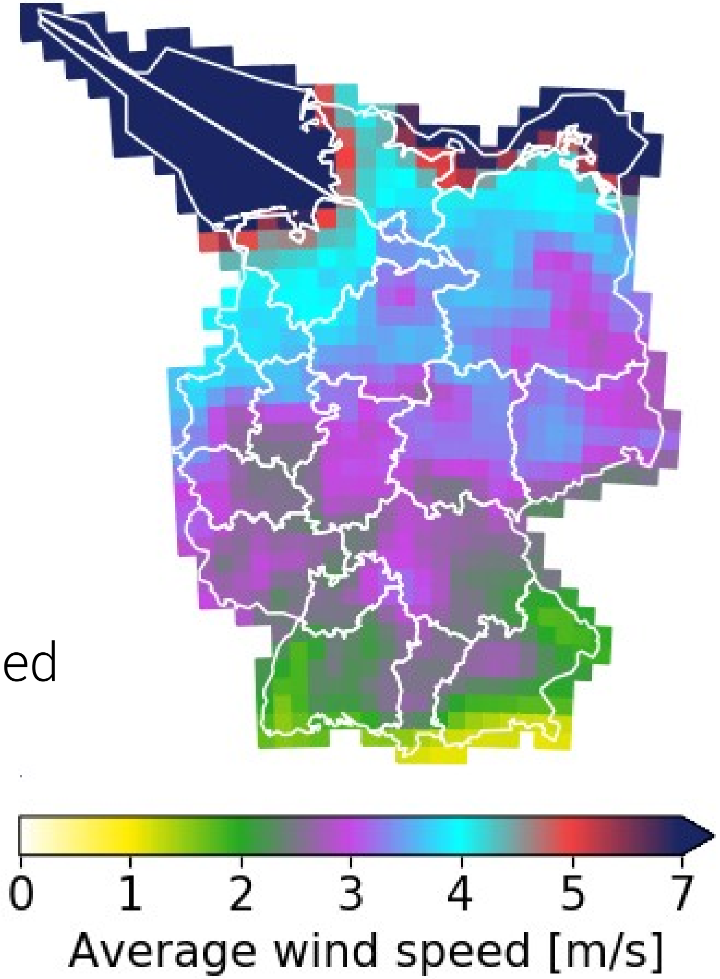


# de21 – feedinlin (windpowerlib, pvlib)

- pvlib
  - surface azimuth
  - surface tilt
  - module type

- windpowerlib
  - selection by average wind speed
  - type of turbine
  - hub height
  - diameter of rotor



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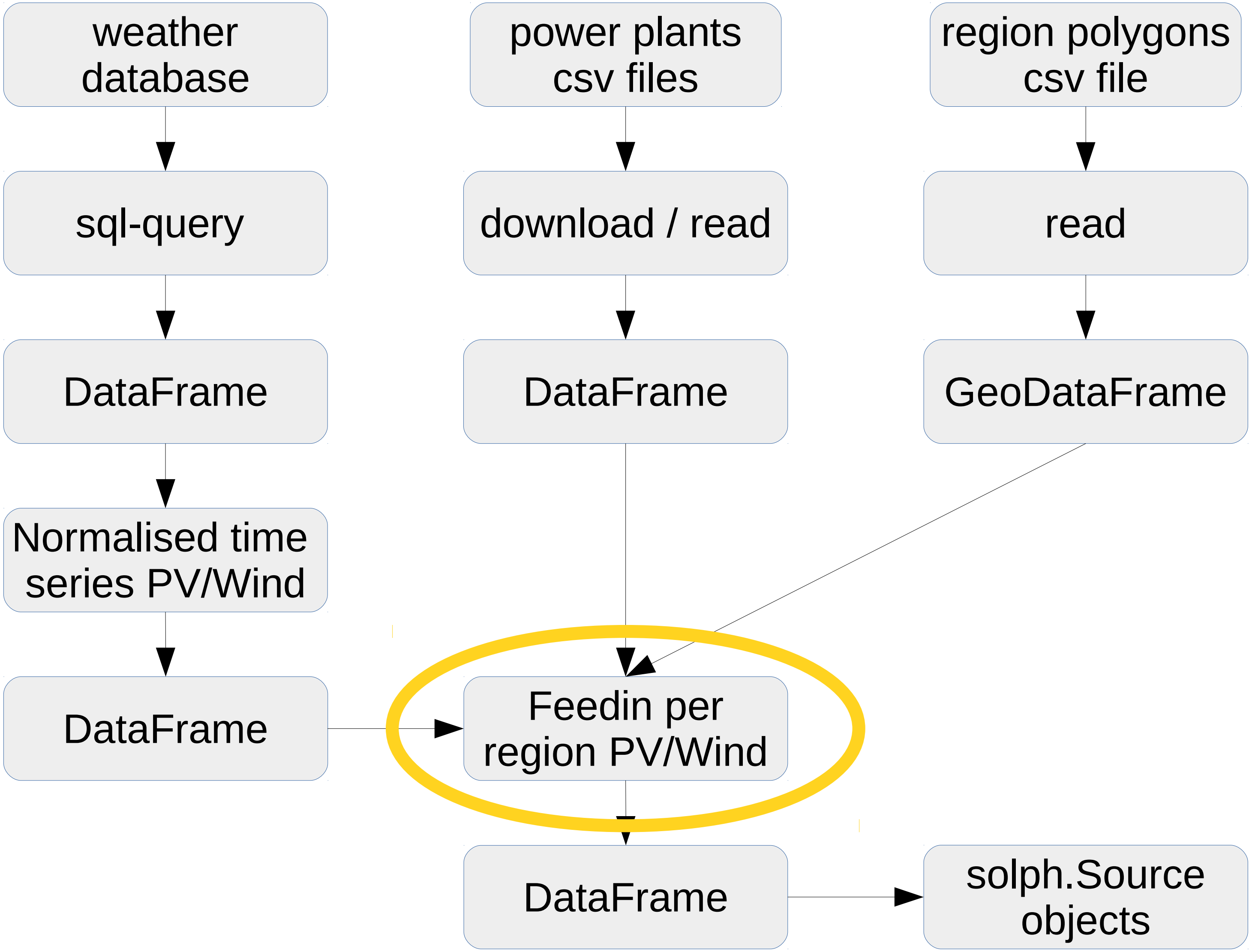
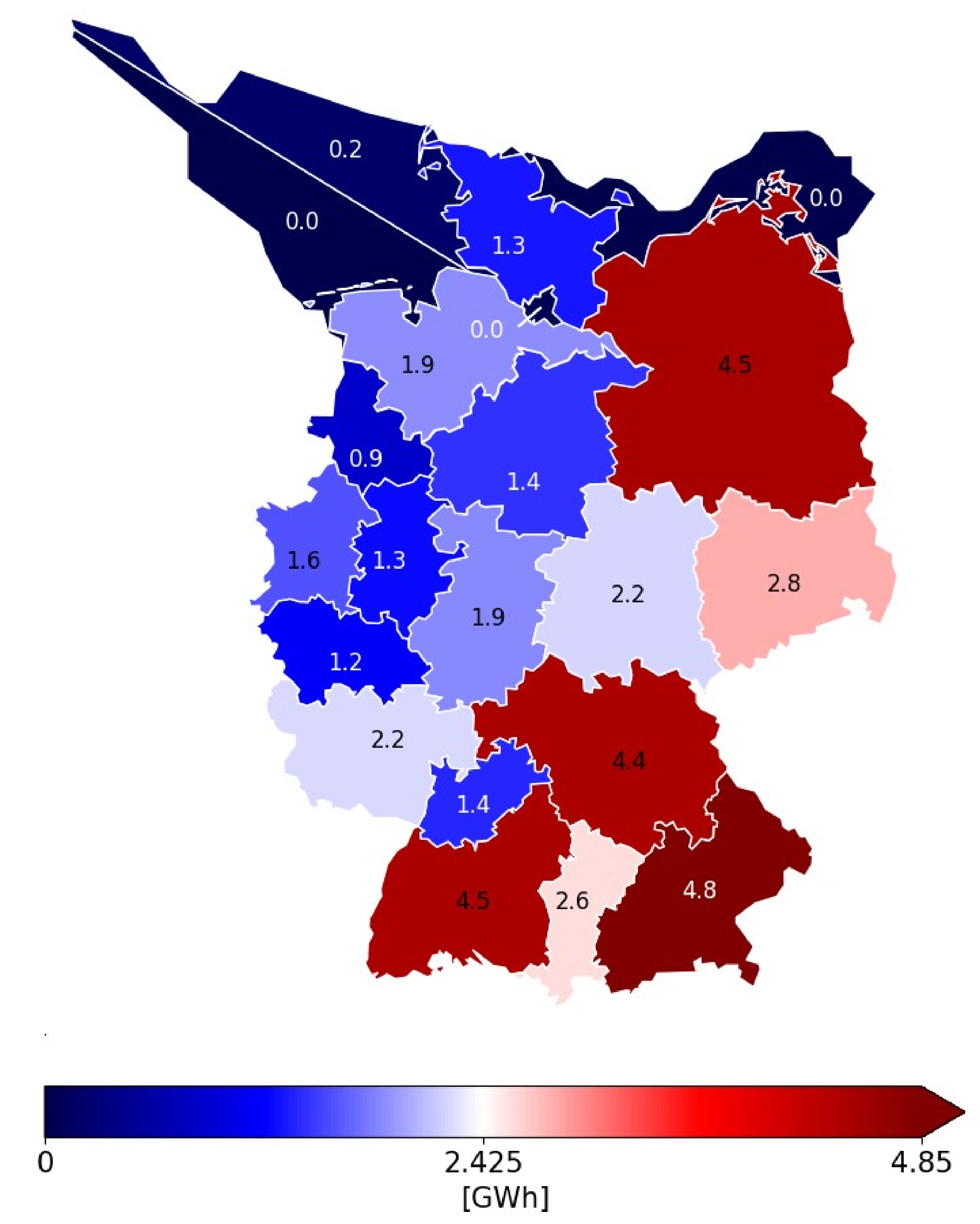


# de21


0.2
0.0
1.3
0.0
0.0
1.9
4.5
0.9
1.4
1.6
1.3
1.9
2.2
2.8
1.2
2.2
4.4
1.4
4.5
2.6
4.8
0
2.425
4.85
[GWh]

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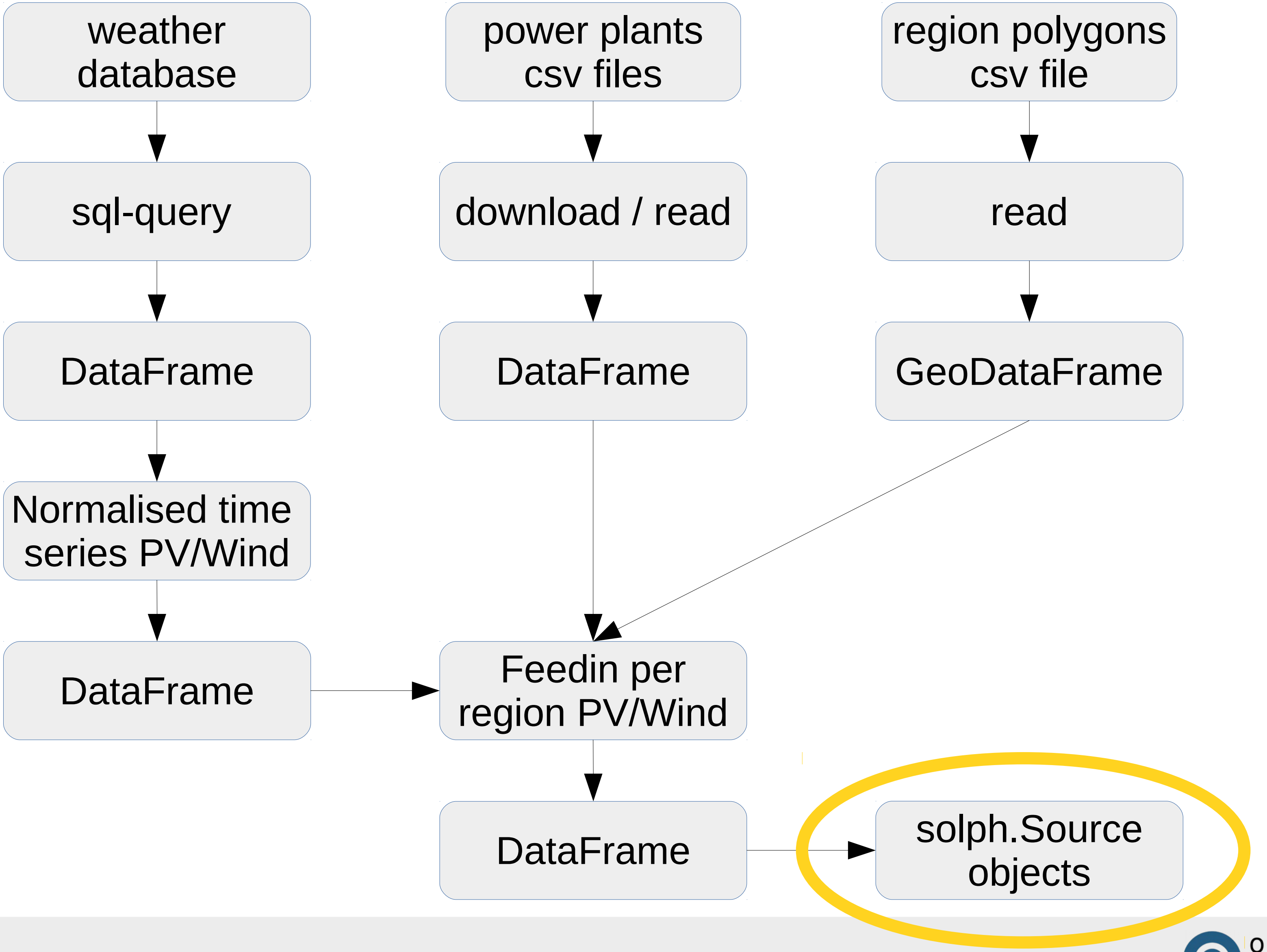

# de21 – solph.Source object from open data

```
feedin = pandas.read_csv('feedin_de21.csv')
capacity = pandas.read_csv('re_capacities_de21.csv')

regions = ['de01', 'de02', ...]
pp_types = ['pv', 'wind']

for region in regions:
    for pp_type in pp_types:

        name = region + '_' + pp_type
        time_series = feedin[(pp_type, reg)]
        capacity = capacities[(pp_type, reg)]

        solph.Source(label=name, outputs={bus_elec: solph.Flow(
            actual_value=time_series, nominal_value=capacity, fixed=True)})
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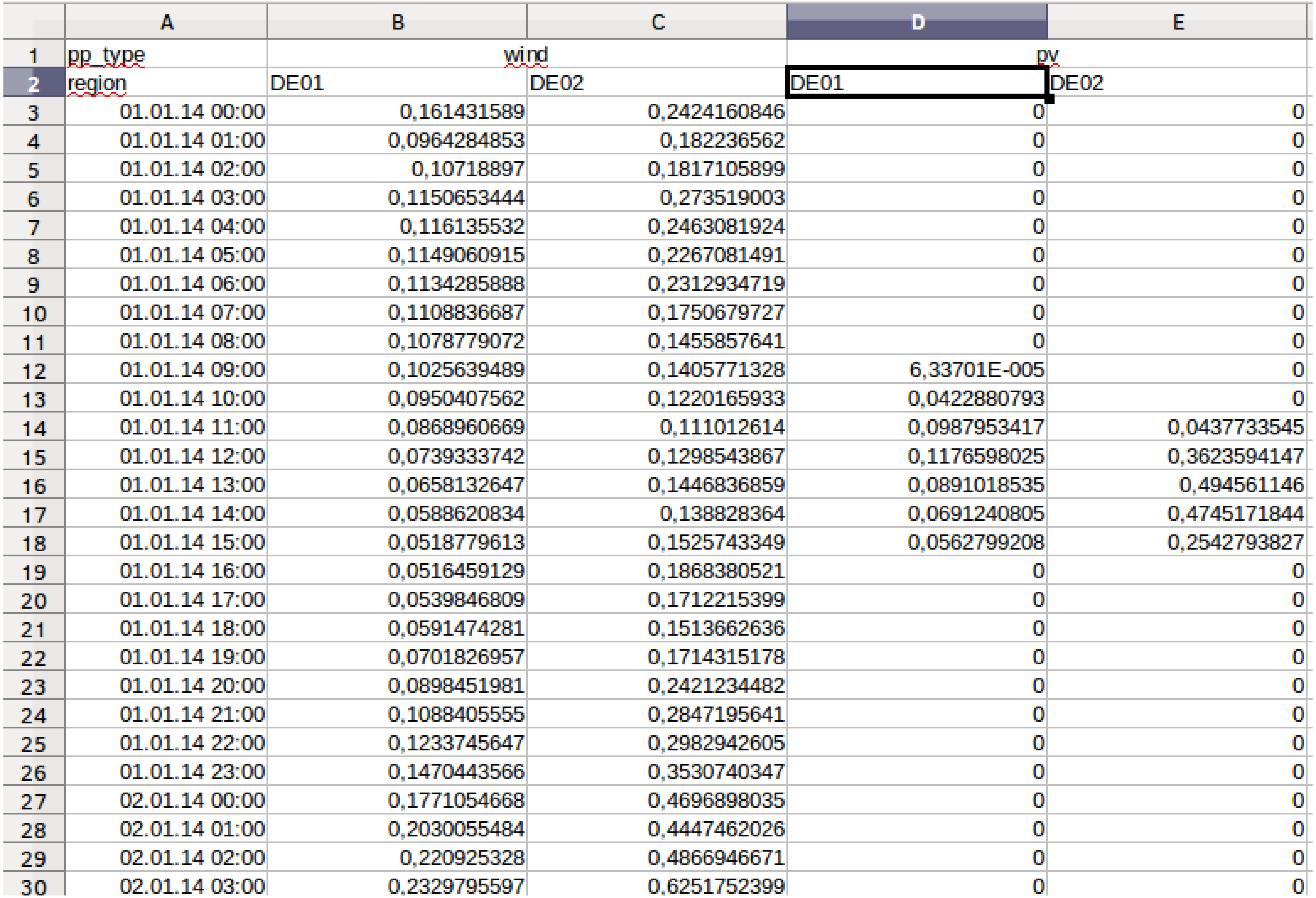
# de21 – `feedin_21.csv` (libreoffice)



|  | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | pp_type | wind |  | pv |  |
| 2 | region | DE01 | DE02 | DE01 | DE02 |
| 3 | 01.01.14 00:00 | 0,161431589 | 0,2424160846 | 0 | 0 |
| 4 | 01.01.14 01:00 | 0,0964284853 | 0,182236562 | 0 | 0 |
| 5 | 01.01.14 02:00 | 0,10718897 | 0,1817105899 | 0 | 0 |
| 6 | 01.01.14 03:00 | 0,1150653444 | 0,273519003 | 0 | 0 |
| 7 | 01.01.14 04:00 | 0,116135532 | 0,2463081924 | 0 | 0 |
| 8 | 01.01.14 05:00 | 0,1149060915 | 0,2267081491 | 0 | 0 |
| 9 | 01.01.14 06:00 | 0,1134285888 | 0,2312934719 | 0 | 0 |
| 10 | 01.01.14 07:00 | 0,1108836687 | 0,1750679727 | 0 | 0 |
| 11 | 01.01.14 08:00 | 0,1078779072 | 0,1455857641 | 0 | 0 |
| 12 | 01.01.14 09:00 | 0,1025639489 | 0,1405771328 | 6,33701E-005 | 0 |
| 13 | 01.01.14 10:00 | 0,0950407562 | 0,1220165933 | 0,0422880793 | 0 |
| 14 | 01.01.14 11:00 | 0,0868960669 | 0,111012614 | 0,0987953417 | 0,0437733545 |
| 15 | 01.01.14 12:00 | 0,0739333742 | 0,1298543867 | 0,1176598025 | 0,3623594147 |
| 16 | 01.01.14 13:00 | 0,0658132647 | 0,1446836859 | 0,0891018535 | 0,494561146 |
| 17 | 01.01.14 14:00 | 0,0588620834 | 0,138828364 | 0,0691240805 | 0,4745171844 |
| 18 | 01.01.14 15:00 | 0,0518779613 | 0,1525743349 | 0,0562799208 | 0,2542793827 |
| 19 | 01.01.14 16:00 | 0,0516459129 | 0,1868380521 | 0 | 0 |
| 20 | 01.01.14 17:00 | 0,0539846809 | 0,1712215399 | 0 | 0 |
| 21 | 01.01.14 18:00 | 0,0591474281 | 0,1513662636 | 0 | 0 |
| 22 | 01.01.14 19:00 | 0,0701826957 | 0,1714315178 | 0 | 0 |
| 23 | 01.01.14 20:00 | 0,0898451981 | 0,2421234482 | 0 | 0 |
| 24 | 01.01.14 21:00 | 0,1088405555 | 0,2847195641 | 0 | 0 |
| 25 | 01.01.14 22:00 | 0,1233745647 | 0,2982942605 | 0 | 0 |
| 26 | 01.01.14 23:00 | 0,1470443566 | 0,3530740347 | 0 | 0 |
| 27 | 02.01.14 00:00 | 0,1771054668 | 0,4696898035 | 0 | 0 |
| 28 | 02.01.14 01:00 | 0,2030055484 | 0,4447462026 | 0 | 0 |
| 29 | 02.01.14 02:00 | 0,220925328 | 0,4866946671 | 0 | 0 |
| 30 | 02.01.14 03:00 | 0,2329795597 | 0,6251752399 | 0 | 0 |

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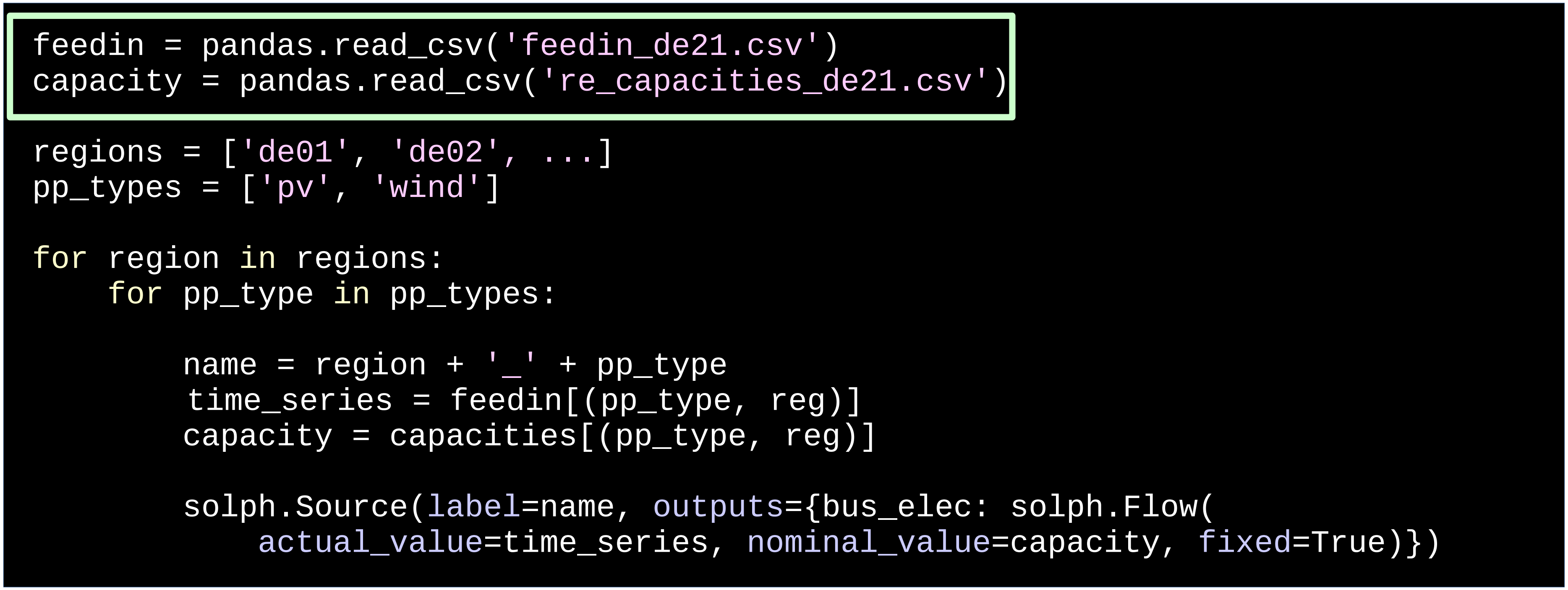

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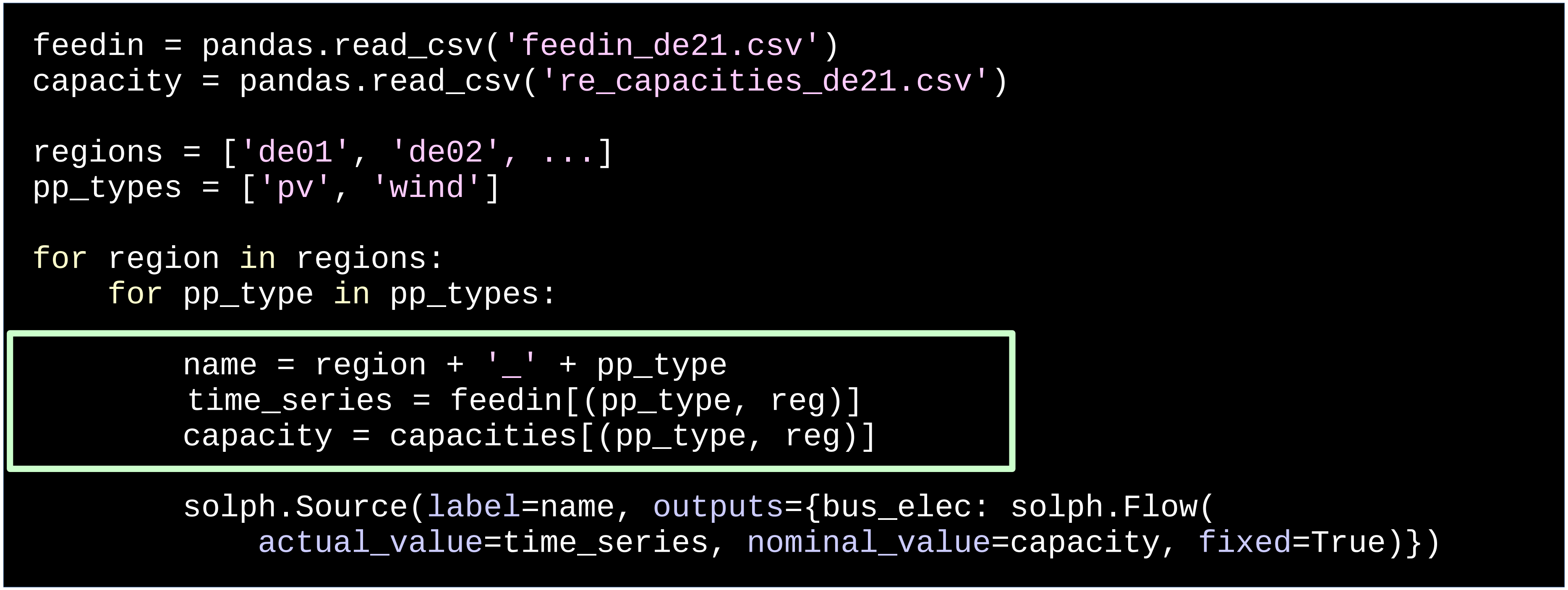

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# de21 – solph csv file from open data

```
de21 = solph.Scenario(path='scenarios', name='cool_scenario')
de21.create_tables()

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pp_types = ['pv', 'wind']

for region in regions:
    for pp_type in pp_types:
        name = region + '_' + pp_type
        time_series = feedin[(pp_type, reg)]
        capacity = capacities[(pp_type, reg)]
        target = region + '_bus_el'
        idx = ('Source', name, name, target)
        cols = ['nominal_value', 'actual_value', 'fixed']
        values = [capacity, 'seq', 1]
        de21.add_parameters(idx, cols, values)

        idx = ['Source', name, name, target, 'actual_value']
        de21.add_sequences(idx, time_series)
de21.write_tables()
```

# Using the oemof cosmos – de21

- pandas for i/o conversions
- different python packages to fetch/process data
- windpowerlib / pvlib / feedinlib
- creating solph objects by looping DataFrames

Any questions?